

➤ Kontron Solutions@Work

We create digital brains for a more intelligent world

Back to the future

➤ Always up to date with VMEbus control

In the 25 years since its introduction in 1981, VMEbus has proven its worth as an open industry standard for 3U and 6U boards/systems. Some VME solutions from Kontron have been in continuous use for 15-20 years and replacement parts can still be supplied for them today. Alternatively, fully backward compatible parts like the latest Kontron VME CPU VMP3 can be used as upgrades. For example, the Metro in Warsaw still uses basically the same control concept that was first installed 12 years ago. A fundamental advantage of VME is that individual components can have a long service life, despite increases in both performance and the scale of integration of an overall system. Technically, this is made possible by the asynchronous architecture, in which old cards cannot slow down new cards. For this reason, VME is still the first choice for many designs because upgrades are comparatively cost-effective to obtain. If you need greater performance because of extensions, for instance, in many cases it is enough simply to change the CPU. A reference customer for the successful history and future of VME at Kontron is TRUMPF Laser GmbH + Co. KG, Schramberg/ Germany, a company of the TRUMPF Group. With a record turnover of EUR 1.4 billion, the TRUMPF Group is

the leading European vendor of machine tools. TRUMPF is the world market and technology leader in industrial lasers and laser systems.



Figure 1:
TruDisk 6002 laser machine – by TRUMPF

The diode pumped high-performance disk lasers by TRUMPF enable telepresence in superb style: over 500 measurement readings in the lasers can be retrieved remotely. A VMEbus control system by Kontron provides the basis for the necessary data acquisition and laser control in the devices.

The company laid the foundations for the laser devices produced today back in 1988. At that time, it was decided that the control technolo-

gy should be made up of two parts: the first part was a controller developed in-house to handle power supply and the control of the mechanical components. For the second part - collecting all the data generated via the controller and transferring it to the customer's applications - TRUMPF used a VMEbus control from Kontron.

With the controller units they developed themselves, TRUMPF Laser's main objective was to generate as much sensor data as possible from the laser itself, the optics, the cooling system, the power supply and from the interfaces of the devices. Today, with the help of integrated sensors, more than 500 absolute measurement values are continuously recorded. Trumpf has broken away from recording and analyzing digital values: "Using analog values, a problem can not only be localized, but can also be much better assessed in terms of its extent than with simple yes/no responses," emphasized Rainer Thieringer, who heads software development at TRUMPF Laser.

The generated values play an important role when the devices are brought into service in the plant in Schramberg. Using a special software tool (MinTol - minimum tolerance), the technicians restrict the tolerance field of the 500 measurement values by 30 percent. Thieringer: "Every laser device must function optimally under these conditions - and must do so without warnings or error messages." Prior to delivery, the tolerance field is reset to 100 percent, which means that when they are dispatched, every device has a 30-percent safety zone.

Telepresence

The TRUMPF technicians also use the software tool for remote diagnosis at customers' premises in the event a machine has a fault. Right around the clock the specialists can use telepresence in a mat-

ter of seconds via modem, ISDN or the internet, to examine the laser system closely, even while it is in operation at a customer's site.



Figure 2:
Telepresence image - by TRUMPF

Where necessary, the technicians at TRUMPF dial into their customer's system, analyze the error and can adjust it remotely or give repair instructions. Due to reduced repair times, the downtimes are minimized. Expensive on-site service visits are done away with and running costs are reduced.

The VMEbus controller with VMP1 by Kontron plays an important role in rapid and smooth data transfer. This single-board computer in 3U format with PowerPC 8240, 250 MHz continuously collects, manages and filters the data that the company's own controllers generate via the sensors and therefore, as an interface, is used both for the customers' applications and for remote diagnosis. A customer-specific 3U VMEbus carrier card for the laser control and field bus module allows a flexible connection of the control to Profibus, INTERBUS and DeviceNET.

The high level of performance of the VMEbus processor is mainly required for the connection

to the customers' applications. The VME-CPU has to react in a quick and reproducible way on the start signal of CNC and/or PLC via parallel or field bus interfaces. Thieringer: "The customer will not accept it if on a start signal, the laser reacts after 5 ms one time and after 50 ms another time. We need the guaranteed real time capability that the VME system in connection with the real time/multi-tasking operating system OS-9 has provided to date, and which real time Linux will guarantee in future. In the meantime, the migration to real-time Linux has been completed and the hardware has been abstracted. The Linux based operating system environment of the OSADL (Open Source Automation Development Lab) consortium is used.

OSADL follows the concept of an institution organized on a cooperative basis for the development of a Linux based operating system environment for the automation industry. TRUMPF is a founding member of this institution.

For more details, see: www.OSADL.org

The decision to use a VMEbus control was made in 1988 for many different reasons: "On the one hand, we were looking for an open, commercial platform that incorporated different standard components – these include networking components such as field bus or Ethernet connections," explains Thieringer. Scalability also played a crucial role: "When we began 18 years ago, the most innovative product was the VSBC-1 (then made by PEP Modular Computers GmbH, today by Kontron Modular Computers GmbH) with a MC68HC000 (12 MHz). Since then, the throughput of our applications has come ahead in leaps

and bounds: When we went in series, we already needed the VSBC-4 (68302 processor, 10 MHz), we then switched to the VSBC-32 with 68360 CPU (33MHz) and modern FLASH drive technology and today we use the VMP1 with the PowerPC8240 and 250 MHz. We were able to implement all performance leaps without having to modify the software because Kontron had provided us with a Board Support Package (BSP) and the drivers."

According to Thieringer, the special qualities of the VMEbus controller include:

- High reliability
- Scalable throughput
- Safeguarding investments in software through seamless HW/SW upgrades
- Fast interrupt processing unit
- Robust and compact technology
- Ability to supply over the long term



Figure 3: Rainer Thieringer, Manager of Software Development at Trumpf

"For more than 15 years the VMEbus controller has helped TRUMPF to have a stable and reliable controller architecture for their series of laser devices. The changeover to Linux was very easy without having to make significant modificati-

ons to the application software. The switch to RoHS also went without any problems,” says Thieringer.

All functions now available with RoHS compliance
When we changed the VMEbus over to RoHS, 80% of the products we had listed could be successfully switched to RoHS. A few products had to be discontinued such as an old serial interface card with 2X RS232. Nevertheless, 100% of all functional requirements could be switched over to the new RoHS compliant solutions because, for example, many of the interfaces that used to be located on external expansion boards are now integrated on the new CPU boards or on more closely integrated expansion boards that are comparable in terms of price. Kontron even still supplies the 68040/68060-based 3U and 6U VME CPUs in accordance with the new RoHS guidelines so that customers can continue to safeguard their investments in the coming years. In places where, for instance, the DRAM memory was not available with RoHS compatibility, a new layout of the memory submodule was implemented so that form-fit-function compatibility is guaranteed. Kontron therefore continues to offer its customers the entire range of VMEbus-based solutions.

VME-CPU boards: then and now

The VME 3U CPU VMPM68KA introduced by Kontron (previously PEP) in 1985 was fitted with the MC68000 /MC68010 processor 8/10/12 MHz and had 2 sockets each for RAM and ROM, whereby 32 MB ROM or 8/32 KB SRAM, i.e. 64 KB ROM and 64 KB SRAM could be inserted into each socket. A 68000 with 10 MHz could process the quickest commands such as a “MOVE reg,reg” in 4 cycles and reached around 2.5 MIPS. However, due to space restrictions, there was only one RS232 port with 25 Pin DSUB. RSxx ports, DRAM, ROM and Ethernet had to be expanded with additional cards.

The first intelligent 3U VME Ethernet card VLAN with a local 68000 CPU, 256KB each of RAM/ROM and a local RTOS kernel was released in 1988, after more and more Ethernet/IP was required for communication in control systems. Then 68020, 68030, 68040/68060-based VME CPUs with 33 or 66 MHz, 45 or 80 MIPS and up to 64MB DRAM, 1MB SRAM and 4 MB FLASH plus 10 Base 2/5/T and 4 RSxx ports gradually came onto the market.

Today the latest 3U VME assemblies by Kontron VMP3 offers the most up-to-date PowerPC technology with the PMC8540 @660MHz, 1520 MIPS 128MB SDRAM, 1MB SRAM, 16MB on-board FLASH, 1MB NVRAM 2x10/100/1000BaseT, 1x10/100 BaseT as well as a top-performance serial port with the greatest networking capability.



Figure 4 VMP3

Caption: The VMP3 with PowerPC processor, clocked to a maximum of 660 MHz, is remarkable for its outstanding performance (1520 MHz according to Dhrystone 2.1) with low energy consumption.

About Kontron

Kontron is a worldwide leading manufacturer of Embedded Computer Technology and robust mobile solutions. They supply leading OEMs, system integrators and application providers in the most varied market segments such as data and telecommunication, automation technology, metrology and control engineering, transportation, gaming and entertainment, medical and military technology, as well as aeronautical engineering and energy. Our objective is to enable customers to significantly reduce their time-to-market and to provide them with clear competitive advantages with products such as high-performance open computer platforms and systems, single board computers, HMIs and mobile, rugged computers. Kontron employs over 2,300 employees worldwide, with production plants in Europe, North America and the Asia-Pacific region. The company is listed in the German TecDAX 30 under stock exchange code "KBC". Kontron is a member of the Intel® Communications Alliance and therefore receives early access to leading Intel technologies and preferential engineering support. For more detailed information on Kontron, please visit the company website: www.kontron.de

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