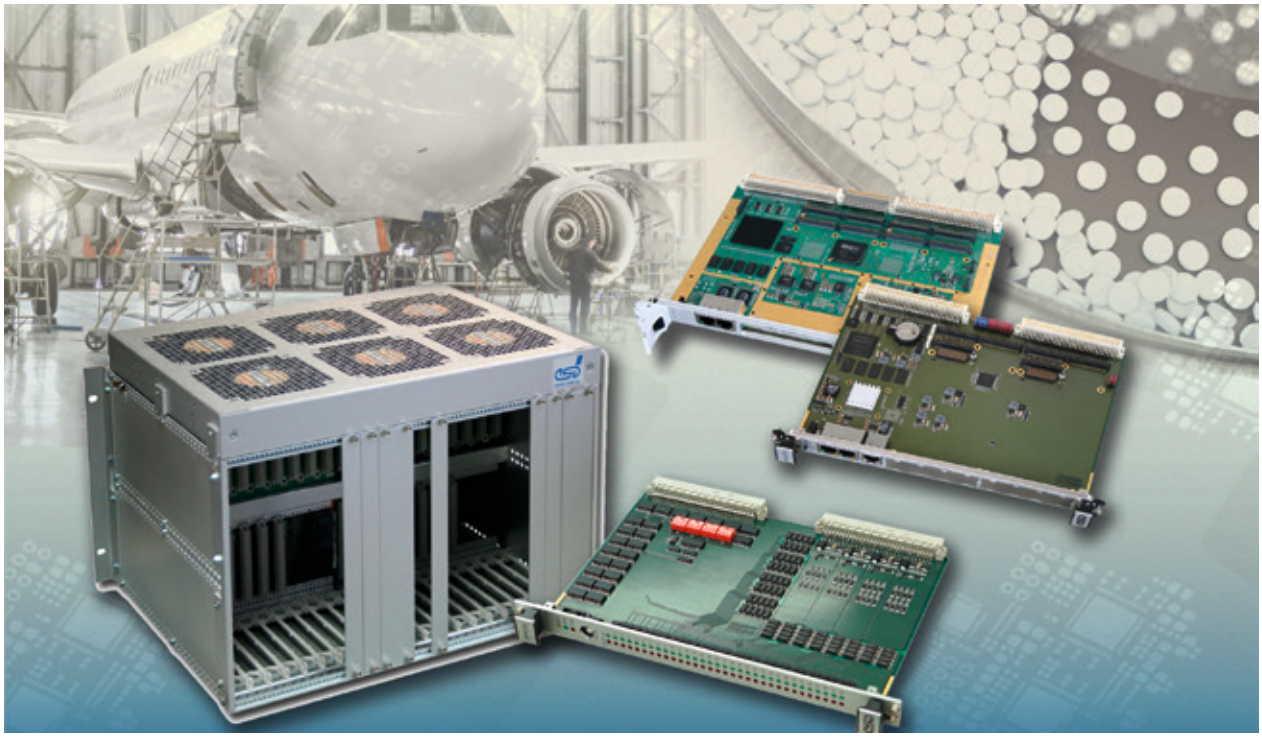

Picture 1: New replacement modules keep existing VMEbus applications technologically up-to-date

VMEbus: Highly stable in demanding Projects

Due to its robustness and real-time capability, the standardized VMEbus technology is still used today in projects with greater demands. To ensure future availability esd electronics develops VME components replacing both its own assemblies as well as those of discontinued third-party products.

In the same year, when the first CD player was launched, the companies Motorola, Mostek, Philips/Signetics and Thomson presented the VMEbus at the trade fair Systems in Munich. That was back in 1981. In those days it was the first license-free and open bus system for industrial and scientific applications. This open and flexible system architecture held out the prospect of many advantages. Even today, computer systems based on the VMEbus technology are used in highly regarded projects such as the International Space Station (ISS) or the European navigation system Galileo. It is also found in projects of industrial control technology as well as in the maritime environment, in medical technology and in military/aerospace applications.

The Origins

VME stands for VERSAmodule Eurocard and depicts the backplane bus of a computer. That is where the name VMEbus is derived from – the term VERSAbus is rarely used anymore. The VMEbus system is a modular and robust system architecture in a 19 inch rack. It includes modules in double or single Eurocard format and gas-tight DIN connectors. As a multi-master bus system, it was developed in the early 80s for the Motorola processor family 68000. A few years later, the IEC defined the standard ANSI/IEEE 1014-1987 for the system which included the following essential features having been extended over the years:

- Master/slave architecture with the possibility of multi-master operation

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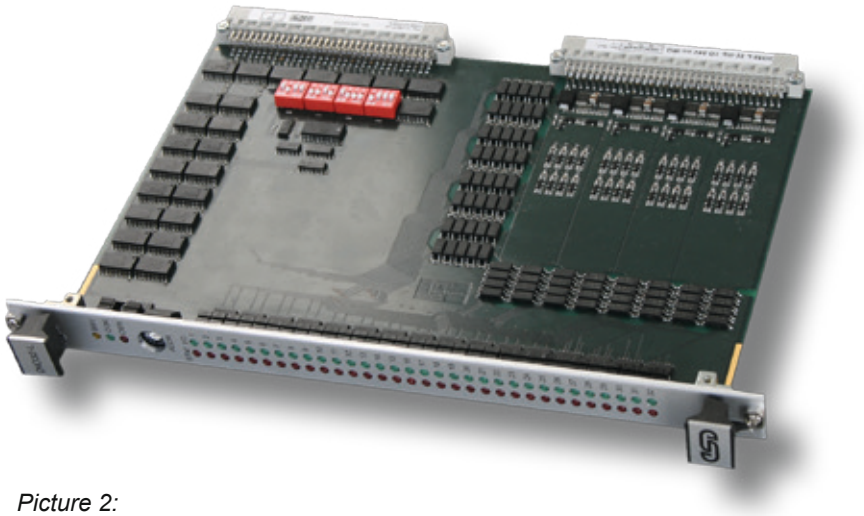
- Asynchronous bus, later extended to include synchronous traffic
- Arbitration methods for bus allocation
- Address width between 16, 32 bits and 64 bits
- Data path width between 8 and 32 bits and in current systems up to 64 bits
- Bandwidth up to 40 Mbyte/s, in newer versions also up to 320 Mbyte/s
- Interrupts with up to seven priorities, daisy chain and interrupt vectors
- Up to 21 plug-in cards can be connected via a backplane

Even though technology is fast-moving, the VMEbus system was able to survive against some hard competition, for example from the Q-Bus, Unibus as well as from Multibus I and II.

Trusted Expertise

Early on, esd electronics recognized the advantages of the VMEbus system and so developed its own industrial computers and boards in 6U format. Accordingly, today the company has more than 30 years of experience in the development of such systems and is a member of the VMEbus International Trading Association VITA.™ The impressive advantages of the VMEbus are still valid today:

- Independence from the microprocessor
- Use of a reliable mechanical standard
- Option of easily increasing the data width to 32 bit and 64 bit
- Freedom of licensing and freely available specification
- Manufacture of compatible products by various independent suppliers



Picture 2:
VME-DIO32: New hardware and software with the same function simplifies replacement in existing systems.

- Use of plug-in cards of different cycle times without clock reduction
- Cost-effective system extensions
- Single-stage interrupt structure for deterministic real-time operation

esd electronics offers industrial CPUs and I/O boards in 6U format for the VMEbus as well as carrier boards such as XMC/PMC for use in VMEbus systems. The company's outstanding strength is the development of VMEbus boards for individual applications according to customer-specific requirements. This includes replacement of components for own products having been discontinued as well as of modules from other manufacturers.

In this way, the reliable operation of systems designed for long-term use can be continued without time-consuming validation processes.

The VMEbus system offers a wide spectrum of applications, and so esd electronics has successfully completed numerous projects, some of which are briefly described below.

SIL-compliant Control System at the Theatre “Schauspielhaus Hannover”

Stage equipment is in close proximity of stagehands and actors, who must trust blindly the technology used at their work. Safety standards have been defined not only to protect people, but also to obtain viable and operative systems.

The company Theatertechnische Systeme TTS from Syke (Germany) has been planning and implementing stage technology systems for more than 40 years. Together with esd electronics, the company developed a SIL-compliant control concept based on VMEbus computers in the late 90s. An approach that is still „state-of-the-art“ today. The control concept is based on a doubled VMEbus master computer and axis computers connected to it, controlling the drives. Enhanced requirements involved the development of CPU cards with a more powerful computer architecture.

Picture 3: The proven VMEbus system as reliable as ever

These CPU cards with PowerPCs and Ethernet ports, developed by esd electronics, now exchange data via Ethernet rather than CAN as before.

Customized modifications such as these demonstrate how replacement cards can update existing VMEbus systems to the technically required level.

Evaluation of Interferometers

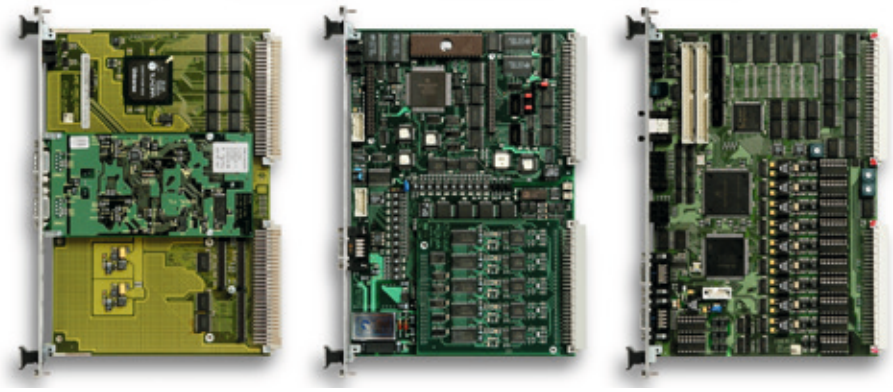
Interferometers are used to measure very small changes in length. The technology is based on the principle of sending light through the instrument via a beam splitter along two different paths. The slightest deviation in the light paths lead to changes in the interference pattern. Laser interferometers are used, among others, to determine with maximum precision the surface quality of lenses, mirrors or metallic bodies. The evaluation of interferometers includes defining the position of the laser. For this purpose, the interferometer transmits signals via the VMEbus to the control computer, which uses these signals to determine the position of the laser.

The company Carl Zeiss has been using the VMEbus computer VME-CPU/T10 and the XMC-CPU/T10 from esd electronics as control computers for about six years. Those in charge appreciate the proven and stable VMEbus system and, due to increased requirements, welcome further developments that lead to high-performance systems of today.

Control and Monitoring of Production Facilities

In pharmaceutical production plants VMEbus systems for control and monitoring have also proven effective. Due to the discontinuation of components esd electronics was assi-

gned by a customer to develop a VME control computer as well as VME I/O boards. With this replacement development, the firmware was adapted in such a way that the customer could use the new boards without



Picture 4: VME boards as a standard product or in customer-specific design.

further system intervention. Thus, the customer was able to produce and sell his system as before. With the VME-CPU/T10 control computer and the VME-DIO32 I/O boards, the customer now has components available with new hardware and firmware still offering the same functionality. This simplifies the exchange of assemblies and offers long-term availability.

Test Systems Aircraft Construction

To test the complex functions of an aircraft during maintenance, Airbus Defence & Space has been building test systems based on VMEbus for more than 20 years. The card from esd electronics in use is the VME-PMC-Caddy/2 carrier board which is equipped with the XMC-CPU/2041 mezzanine card. It is currently being replaced by the Xilinx Zynq® Ultrascale+TM based XMC-CPU/Zulu. Among others, the combination serves to connect industry-relevant bus systems and protocols to the existing test system. Moreover, data acquisition and data preprocessing are supported. The customer benefits from this concept since he can modernize his mezzanine cards step-by-step while keeping the system largely unchanged. In this way, development resources are used efficiently.

Result

Despite its respectable age, the VMEbus system is still in use in many projects today. Discontinued components for this system do not necessarily have to herald a system change. Compatible replacement products can be implemented and are accompanied by the know-how and experience from esd electronics. The company is careful to ensure that hardware and firmware as well as functions remain compatible, which greatly simplifies the replacement of assemblies.
A recent example of this is the VME-DIO32.

With the help of compatible replacement components for esd own products as well as for products from other manufacturers, the VMEbus system remains state-of-the-art without the customer having to decide for an alternative technology. This can drastically reduce the development and validation effort.