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Mezzanine Comparison: PC-MIP - M-Modules

Industrial applications are so much diversified that identical solutions are rarely possible. The concept of one-for-all products out of shrink-wrapped cardboard boxes is not usable in industrial, scientific or medical applications. These monopoly-type products are only available for home and business applications. Even in small industrial market segments, like mezzanine cards for VMEbus or CompactPCI, diversity is needed. This will be shown using PC-MIP and M-Modules from MEN (Nuremberg, Germany) as examples. Both mezzanine families were developed by the same company but are defined for different application, manufacturing and price segments.

PC-MIP MODULES

MEN has shown a predecessor model of PC-MIP at Hannover Industrial Fair, April 1997, to selected customers. Encouraged by very favourable reception of this concept it was presented to the members of VSO in July 1997. SBS GreenSpring Modular I/O of Menlo Park, USA had similar ideas. By end of September 1997 both companies had agreed on a joint proposal to VSO. Motorola liked the concept and became a sponsor for this project. Other companies are now also participating in the task group to standardise PC-MIP.

PC-MIP modules are designed to be produced in large quantities using SMD technology. Small production lots are therefore slightly more expensive than those using other production techniques. Some chip types are currently not yet available in SMD technology. An unchanged PCI bus is used as the interface between the carrier and the PC-MIP mezzanine. This guarantees highest flexibility. However, not all functions are needed for simple I/O cards.

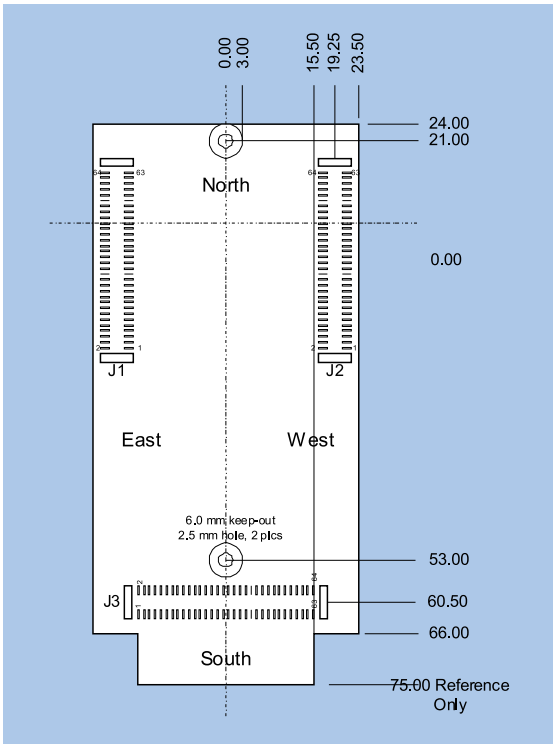

Figure 1. Outside dimensions of PC-MIP (Type I & Type II)

The small area of the PC-MIP module provides for greater flexibility. A VMEbus or CPCI dual EuroCard can hold up to 6 PC-MIPs or 4 M-Modules. But a PC-MIP module can hold SMD ICs on both sides.

PC-MIP modules are best suited for applications, which can utilise existing software (Windows operating systems and applications) from the PC market unchanged. This is especially true for serial communication and all kinds of graphics applications.

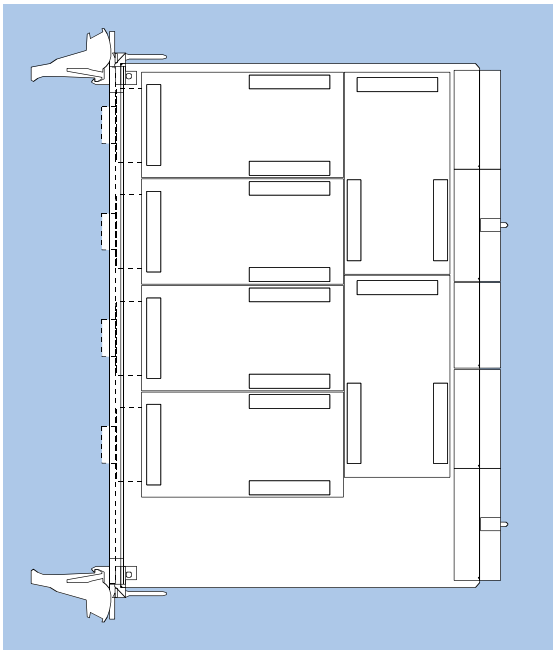

Figure 2. Positioning of 6 PC-MIPs on CPCI, PCI or VME

TECHNICAL DESCRIPTION OF PC-MIP MODULES

Electronics circuits are becoming more integrated every day. So the area needed to implement a certain function becomes smaller which is why PC-MIP modules are as small as business cards. The height of

SMD chips is also very small which means PC-MIP modules can be assembled with ICs on both sides. This doubles the usable space. A feature, which is not available for other mezzanine, types.

The front panel connector concept developed by MEN makes it possible to fulfil European 'CE' requirements. I/O is also available using a connector on the front of the PC-MIP module connecting to the carrier board instead of out through the front panel.

The connectors between the PC-MIP mezzanine and the carrier board are defined in two height variations (8 mm and 10 mm). This allows for different heights of ICs on both sides of the PC-MIP module depending on application and cooling requirements. PC-MIP mezzanines are mounted with two captive screws and two captive bolts. They cannot be lost and they are also used as ejectors for the PC-MIP modules.

An unchanged PCI bus is routed through two 64pin leaf-style SMD connectors at the rear end of the PC-MIP mezzanine. The PCI bus allows for great flexibility of functions. Standard software from PC applications can be used unchanged.

M-MODULES

M-Modules have been available from MEN since 1988. After great success in the market the MUMM association (Manufacturers and Users of M-Modules) was established in 1992. MUMM does the specification work and it has received approval from ANSI for the M-Modules standard (ANSI/VITA 12-1996). MUMM maintains a list of Identification Designations for M-Modules. This guarantees unique identification for every board type making automatic configuration possible.

M-Modules are used as simple but powerful I/O cards for industrial applications. The uncomplicated interface allows for fast development and cost-effective production of modules even in small quantities. It is possible to use low-cost ICs (also rather high chips like DC/DC converters) on the large area. M-Modules are in use for more than 10 years. Know-how and supporting infrastructure are widely available for development and usage of M-Modules.

Table 1 of this article describes a low-level software interface (MDIS) driver in C language. This makes interface programming real easy.

TECHNICAL DESCRIPTION OF M-MODULES

M-Modules are approximately 150 mm long and 53 mm wide. Dual wide modules are also defined in the standard. The electrical interface between an M-Module and its carrier card consists of two or three rows of 20 mating contacts each at the rear end of the module. I/O is available directly at a front panel connector or back onto the carrier card by means of a dual row (2 x 12 contacts) connector. Frequently the outside and the on-board I/O connector use the same pin-out. This is not required by the standard. Front panel connectors are shielded for ESD protection. Coax connectors are also defined in the standard. Even I/O with LED status lights as used on PLCs is available.

M-Module products were designed for harsh industrial environments. Optical isolation and modules for extended temperature ranges are available on demand. M-modules are secured on their carrier boards using four screws. Limit values for operation under shock and vibration conditions are defined. Maximum power consumption is specified to be 10 W. Operation between 0 C and +60 C is required by the standard.

Standard functions like read and write as well as interrupts and DMA operation are available in basic configurations. I/O addressing range is 256 bytes. A SYSCLK signal is available for on-board timing. It is unrelated to the asynchronous M-Module bus. The asynchronous M-Module interface to the carrier board is dynamically adaptable to various different transfer rates. The contents of a 16-byte serial EEPROM are defined to be used for automatic configuration.

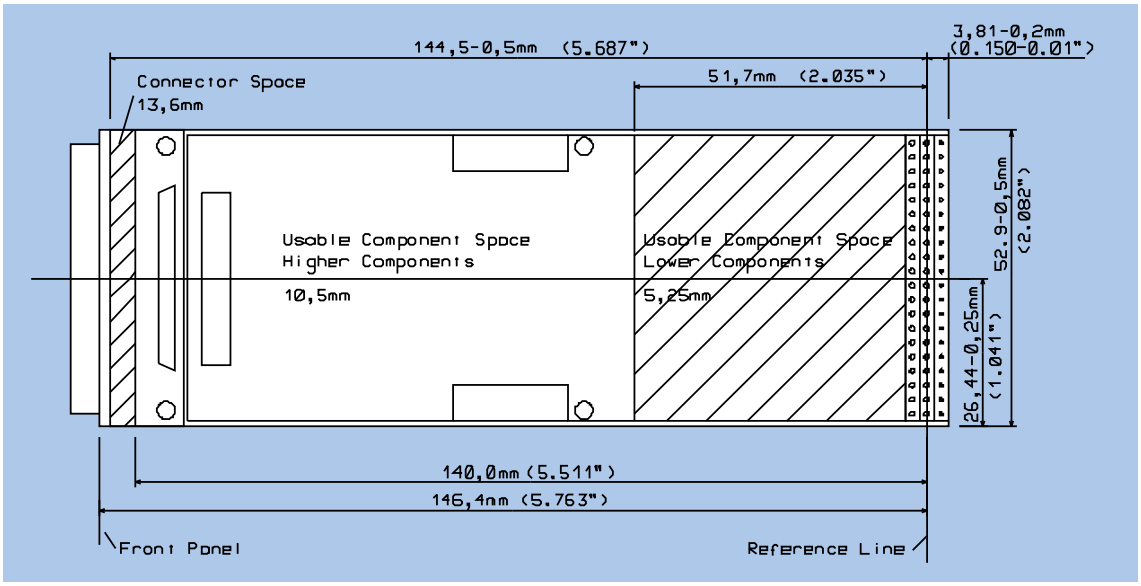

Figure 3. Outside dimensions of M-Module

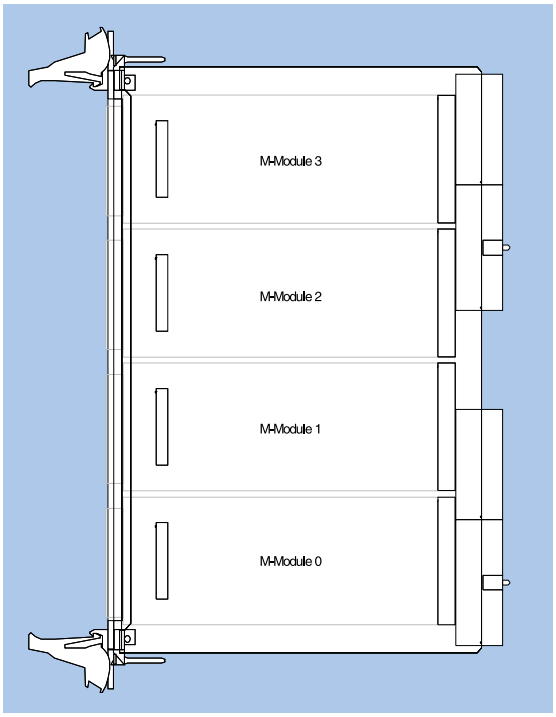

Figure 4. Positioning of 4 M-Modules on CPCI or VME

Three voltages of +5, +12, -12 volts nominal with max. 5% variation up and down are defined by the M-Module standard.

Several modules on a carrier may be directly interconnected using an "Intermodule Connector" (10 pins) which is located about midway along either long side of the M-Module. This link may be used as an intermodule bus or as a point-to-point connection. The carrier board should not have any components located underneath the "Intermodule Connector" on either side of the M-Module to facilitate usage of intermodule cabling.

M-Modules have two zones defined for use with components of different height. From the rear end (next to the interface connector) on a zone of up to 51.7 mm component height is limited to 5.25 mm. The rest of the M-Module (except the connector areas) can accept components up to 10.5 mm in height.

To meet special requirements an extended version of the M-Module standard (MA) has been defined. It includes a wider address bus (from 8 to 24 bit) and a wider data bus (from 8 to 32 bit). Trigger signals for measurement applications and a burst mode have also been added for the MA version which uses the third row of the interface connector.

STANDARDISATION

Most mezzanines and plug-on board specifications have been standardised through VSO, irrespective of their intended use on VMEbus or other bus carrier cards. VSO is the standardisation organisation of VITA. It is an accredited standardisation committee empow-

PARAMETERS	M-MODULES	PC-MIP
Area (mm x mm)	53 x 150	47 x 90 or 47 x 99
Number of modules/card (6U)	4	6
Mounting on carrier board	4 screws	2 screws (1)
Interface	M-Bus	PCI
Data bus width (bits)	8 , 16, 32	8, 16, 32
Address bus width (bits)	16, 24	32
Interrupt lines	1	4
Transfer rate (MB/s)	100	132
Interface type	simple	multi-function
I/O possibilities	front panel & carrier	front panel & carrier (2)
IC types	all	only SMD
Development time	short	medium
Flexibility	medium	large
Major applications	industry measurement equipment	graphics serial transmission
Technology in use	›10 years	›6 months
Cost	low	medium

Remarks:
(1) Nut and bolt fixed to boards, usable as an ejector mechanism
(2) Front panel I/O only on Type II

Table 1. Comparison criteria

ered by ANSI to create American national standards. Computer busses standardised by ANSI are accepted worldwide as if they were official international standards. It is not usual practice to waste time and money just to get an additional cover page from ISO, IEC or ISO/IEC JTC 1.

M-Modules have officially become an ANSI standard (ANSI/VITA 12-1996) on May 20, 1997. PC-MIP modules were first presented in September 1997. They are now in the process of standardisation through VSO (draft VITA 29) to become an ANSI standard as well. Sponsors are MEN, Motorola and SBS Greenspring with a number of other companies from Europe and the USA actively supporting task group VITA 29 in their standardisation effort.

It is very important that for the first time ever, major companies in their respective segment of the market are jointly proposing right from start a mezzanine board standard. The sponsors are European and US based CPU carrier board and I/O board manufacturers. This should be a guarantee of fast acceptance in the market place.

AVAILABLE PRODUCTS

PC-MIP

At this early stage in PC-MIP technology there is already a graphics mezzanine module (P1 with SMI910 graphics accelerator) available from MEN, Germany. Future releases are planned for interface cards, e.g. SCSI fieldbusses or Ethernet. After that MEN plans to offer intelligent cards using MC860 or DSP processors. When this article appears in print SBS Greenspring should also be selling PC-MIP modules. Both companies have developed carrier boards for CPCI systems and are working on VMEbus carrier boards. The CPCI based carrier board D202 from MEN was designed to accept four modules Type II with front panel I/O and two modules Type I.

M-Module

The printed catalogue from MUMM-or their web page contain information on available M-Modules and supporting products. Currently about 20 manufacturers offer more than 200 different M-Module types and 30 carrier boards for a great variety of industrial applications. A number of other companies have designed additional M-Modules for their own use but do not actively market them.

There are also stand-alone intelligent M-Module systems not using a carrier board. They are linked together and to supervisory computer systems using CAN or some other fieldbus.

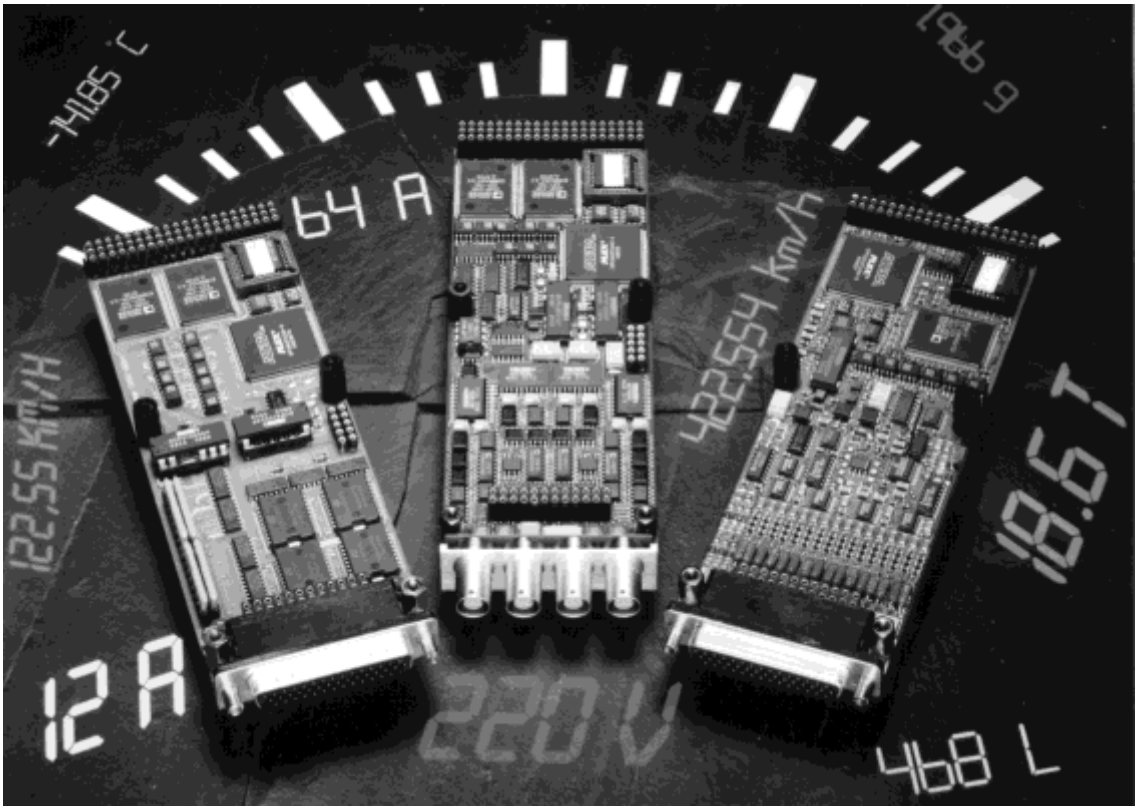

Figure 5. M-Module

FURTHER DEVELOPMENTS

Standardisation of PC-MIP mezzanines is moving along at a rapid pace to get to a stable state. Major changes are not expected. But this is only true after formal balloting results are available from the task group.

MUMM is currently evaluating I/O connectors with more than 24 signal lines since newer types of carrier systems like CPCI or VME64x offer more I/O lines on their connectors. Another project is the introduction of 3.3-volt technology for M-Modules. The main goal is to keep the M-Module interface as simple as possible to be able to produce cost-effective powerful mezzanines in low quantities. ■

ABBREVIATIONS

ANSI	American National Standards Institute
CE	Conform to European standards
CPCI	CompactPCI
DMA	Direct Memory Access
I/O	Input/Output
IC	Integrated Circuit
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
JTC	Joint Technical Committee
LED	Light-Emitting Diode
MA	M-Module Type A
MDIS	MEN Driver Interface System
MUMM	Manufacturers and Users of M-Modules
PC-MIP	PCI, M-Module, IndustryPacks
SMD	Surface-Mount Device
PLC	Programmed Logic Control
SYSCLK	System Clock
U	Unit of height (44,45 mm)
VITA	VMEbus International Trade Association
VSO	VITA Standardisation Organisation

REFERENCES

ANSI	http://www.ansi.org
MEN	http://www.men.de
MUMM	http://www.m-modules.de
PC-MIP	http://www.men.de or http://www.sbs.com
VITA	http://www.vita.com
VSO	http://www.vita.com

Hermann Strass is a consultant for new technologies, including bus architectures (industrial PCI, PMC, USB, VMEbus, Fibre Channel, SCSI, PCMCIA), mass storage technologies and industrial networking (AS-i, Fibre Channel, PROFIBUS, fieldbus USB). As a neutral expert he also organises seminars, conferences and training on these topics. He is an active or corresponding member of more than a dozen standardisation committees, including ANSI, DIN/DKE, ECMA, IEEE and VITA/VSO and Technical Co-ordinator for VITA Europe. Hermann Strass is the author of many technical articles and of books on SCSI, Mass Storage, PCMCIA and CD-ROM.