

IEEE Standard for a Common Mezzanine Card (CMC) Family

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Abstract: *The mechanics of a common mezzanine card (CMC) family are defined in this standard. Mezzanine cards, designed to this standard, can be used interchangeably on VME, VME64 and VME64x boards, CompactPCI[®] boards, Multibus[®] I and II boards, desktop computers, portable computers, servers, and other similar types of applications. Mezzanine cards can provide modular front panel I/O, backplane I/O or general function expansion or a combination for host computers. Single, wide mezzanine cards are 75 mm wide by 150 mm deep by 8.2 mm high.*

Keywords: *backplane I/O, bezel, board, card, CompactPCI, face plate, front panel I/O, host computer, I/O, local bus, metric, mezzanine, module, modular I/O, Multibus, PCI, VME, VME64, VME64x, VMEbus*

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Introduction

[This introduction is not part of IEEE Std 1386-2001, IEEE Standard for a Common Mezzanine Card (CMC) Family.]

The primary goal of this standard is to provide the mechanics of a mezzanine card family that can be deployed on a variety of different host computer platforms. These mezzanine cards can be used to provide front panel I/O, rear panel I/O, additional local host functions, or a combination of all three. The mezzanine card's local bus can be PCI, SBus, or other local buses as they are developed in the future. The secondary goal of this standard is to have only one mezzanine card mechanical definition for a specific type of local bus, instead of multiple mechanical implementations as in the past. Multiple mechanical implementations fragment the market and destroy economies of scale for manufacturing, engineering, sales, and marketing. A single mechanical definition builds larger markets with many more unique functions for the multitude of user applications, and at a lower price. Both the suppliers and users win by enjoying the benefits of a larger unified market.

SBus Historical: In 1993 when the effort to develop a mezzanine card standard was started, there seemed to be a market need to shrink the SBus (IEEE 1496) mechanical form factor so that it would fit in a single VME board slot. (SBus cards are 20.32 mm high and take up a second VME slot when attached to a VME host board.) A SBus mezzanine card (SMC) draft child standard was developed and reached the sponsor ballot phase (see Section 1.5 for the definition of child standard). This draft standard, IEEE P1386.2, was titled "Draft Standard Physical and Environmental Layers for SBus: SMC." Due to the overwhelming popularity of the PCI local bus, no market interest developed for the single slot SBus version, SMC. IEEE P1386.2 was dropped as a proposed IEEE standard in the summer of 1996.

Futurebus® Historical: In 1993 most of the core Futurebus+ (IEEE 896.x) standards had been completed. At that time there seemed to be a reasonable market interest in the Futurebus+ architecture. The mechanics of placing mezzanine cards on Futurebus+ modules was included in the core IEEE P1386 Draft 2.0 mechanical definition. Unfortunately, the market for Futurebus+ never developed. During this standard's sponsor ballot phase, it was decided to remove all references to Futurebus+ in both the IEEE P1386 and IEEE P1386.1 draft standards. Since the extended CMC form factor (250 mm deep) version was specified mainly for the Futurebus+ applications, it was also dropped from both IEEE P1386 and IEEE P1386.1. As a result, only two CMC form factors are defined: single width and double width.

CompactPCI® Historical: After the first sponsor ballot in April 1995, a new bus architecture was introduced to the market that rapidly gained large market interest. CompactPCI transformed the PCI local bus into a backplane bus with a maximum of eight slots. CompactPCI board, backplane, and subrack mechanics are the same as VME64x, except for the backplane connectors. All the board and subrack mechanics defined for the VME64x architecture apply directly to CompactPCI. VME64x provides 205 user-defined I/O pins through the backplane, and CompactPCI provides 315 user-defined I/O pins through the backplane. The PCI Industrial Computers Manufacturers Group (PICMG) is responsible for the promotion and maintenance of the CompactPCI specifications.

Routing of PCI mezzanine cards (PMC) I/O to the rear of CompactPCI boards is defined and controlled by PICMG. Detailed specifications are available on the World Wide Web at the following URL: <http://www.picmg.com>.

Special thanks are due to Dave Moore, original Working Group Technical Editor of IEEE Std 1386-2001, for the generation of the many drafts; to Eike Waltz for the key mechanical designs of the CMC; and to Dave Rios on the connector design. Heinz Horstmeier, Cliff Lupien, Harry Parkinson, Rick Spratt, and Chau Pham are also to be thanked for their contribution to the development of this standard.

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Contents

1.	Overview.....	1
1.1	Scope.....	1
1.2	Purpose.....	1
1.3	General arrangement.....	1
1.4	Theory and operation of usage.....	2
1.5	Parent-child standard	4
1.6	Conformance.....	4
1.7	Dimensions	5
1.8	Coordinate dimensions	5
2.	References.....	5
2.1	Trademarks	6
2.2	Relationship between VME, VMEbus, VME64, VME64x, and CompactPCI	7
3.	Definitions, abbreviations, and terminology.....	7
3.1	Special word usage	7
3.2	Definitions	7
3.3	Abbreviations.....	8
3.4	Dimensional nomenclature height, width, and depth	8
4.	Mezzanine card mechanics	8
4.1	CMC size designations and sizes.....	8
4.2	EMC envelope	9
4.3	CMC dimensions	9
4.4	Voltage keying.....	10
4.5	Connector pads and labeling.....	10
4.6	CMC connector.....	11
4.7	CMC connector assembled on a CMC	11
4.8	CMC component heights	12
4.9	CMC connector and standoff heights	14
4.10	CMC bezel	15
4.11	CMC test dimensions.....	15
4.12	I/O capability	15
4.13	Power consumption and dissipation	16
4.14	Ground connections	18
4.15	Electromagnetic compatibility.....	18
4.16	Shock and vibration	18
4.17	Environmental.....	18
4.18	MTBF.....	19
4.19	ESD design	19
4.20	ESD kit.....	19
5.	Host CMC slot mechanics	19
5.1	Stacking height above the host PCB.....	20
5.2	Host PCB mechanics	20
5.3	Connector pads and labeling.....	22

5.4	CMC connectors	22
5.5	CMC connector assembled on a host.....	24
5.6	Host board side 1 component height.....	25
5.7	Extra shoulder for 13 mm hosts.....	26
5.8	Voltage keying pins	27
5.9	Host front panel or host face plate opening	27
5.10	Filler panels.....	27
5.11	Host test dimensions	30
5.12	I/O capability	32
5.13	Power dissipation	32
5.14	Grounding connections	32
5.15	Electromagnetic compatibility.....	32
5.16	Environmental.....	33
6.	Electrical and logical layers.....	33
6.1	Connector utilization.....	33
6.2	CMC connector pin assignments	33
6.3	Rear I/O mapping.....	33
6.4	BUSMODE signals.....	35

IEEE Standard for a Common Mezzanine Card (CMC) Family

1. Overview

1.1 Scope

This standard defines the mechanics for a common set of slim mezzanine cards that can be used on VME, VME64 and VME64x boards, CompactPCI® boards, Multibus® I and II boards; desktop computers; portable computers; servers; and other similar computer applications. Mezzanine cards based on this standard can be used to provide modular front panel I/O, backplane I/O, or general function expansion for the host computer.

1.2 Purpose

The majority of the popular reduced instruction set computer (RISC) and complex instruction set computer (CISC) microprocessors use the same logical and electrical layer for their high-speed local bus. These same processors are being incorporated onto VME64x boards, CompactPCI boards, Multibus I and II boards, desktop computers, portable computers, servers, and other types of computer systems. There is a large market need for modular I/O and modular local function expansion via slim mezzanine cards mounted parallel above the host computer's board.

This standard defines the mezzanine card mechanics for these types of applications. This mechanical definition is based on IEEE Std 1301.4-1996.¹

1.3 General arrangement

Mezzanine cards are intended to be used where slim parallel-card mounting is required as in embedded single-board computers, desktop computers, portable computers, and servers. Figure 1 illustrates a single-size and a double-size mezzanine card defined by this standard.

Typical single- and double-size common mezzanine cards (CMCs) on VME64x boards are illustrated in Figure 2. Implementation of CMCs on CompactPCI and Multibus II boards is similar to that of 6U VME64x boards except that Multibus II boards are 220 mm deep and CompactPCI boards use a 2 mm connector system. CMCs can also be used on 3U VME64x and CompactPCI boards.

¹Information on references can be found in Clause 2.

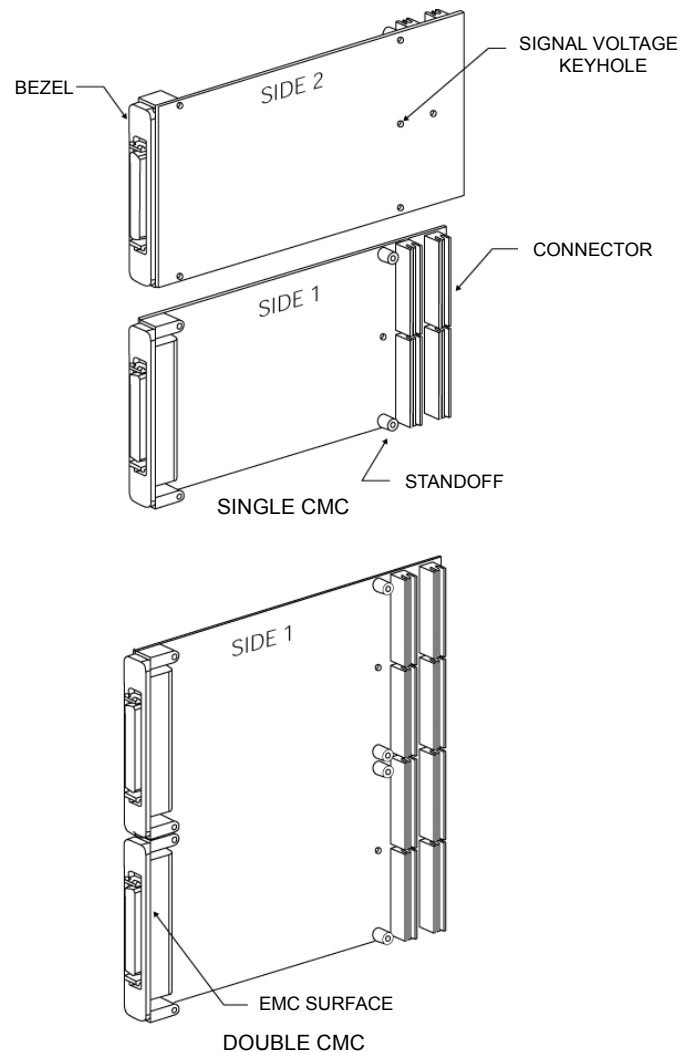


Figure 1—Typical single and double CMC

Multibus I boards do not use front panels. The I/O is via the top edge of the board. Figure 3 illustrates a single CMC and two single CMCs on a Multibus I board.

The size and shape of desktop computers, portable computers, servers, and other similar types of computers vary considerably, depending on specific target markets and associated needs. Figure 4 illustrates how a CMC could be mounted inside a desktop or portable computer host. The I/O panel arrangement would be similar to one already illustrated.

1.4 Theory and operation of usage

CMCs are designed to be plugged into a slot above the host's printed circuit board (PCB). The host may place low height components under the mezzanine card for additional functionality. The host is to provide one or more slot openings into which the mezzanine cards are plugged. The host slot opening provides mechanical support, as well as EMI shielding. For maximum utilization of component space, the mezzanine

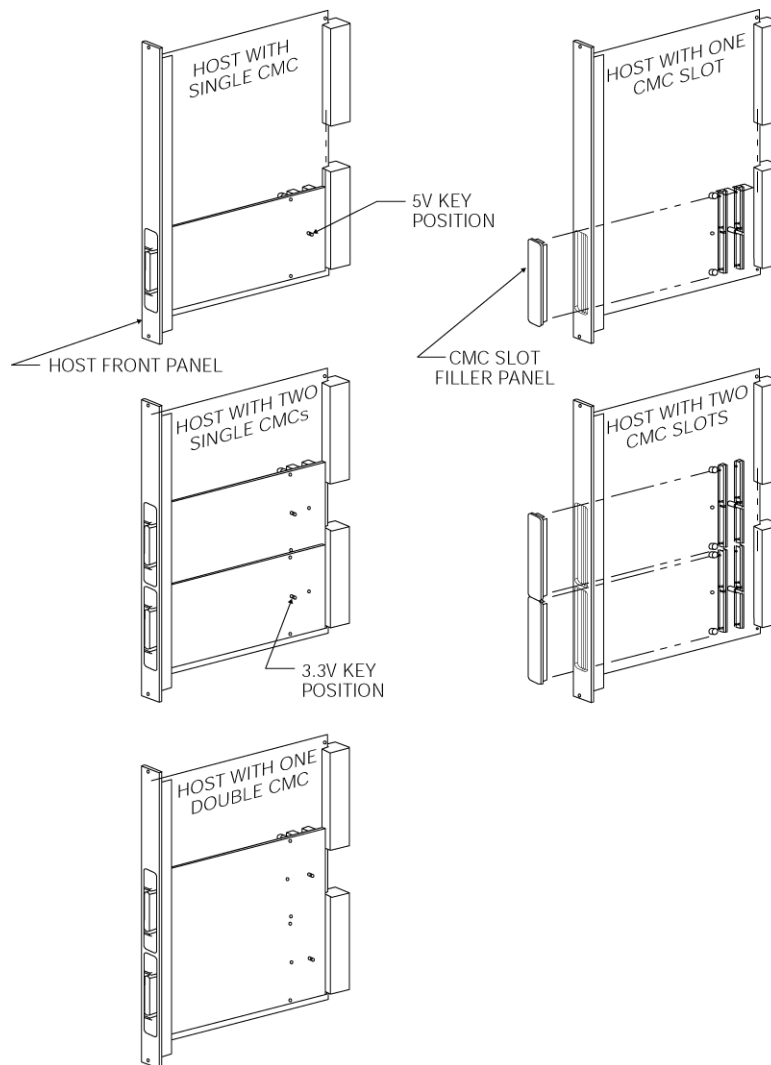


Figure 2—Typical single and double CMC on a 6U VME64x host

card is typically placed such that the major component side of the mezzanine card faces the major component side of the host computer's main board.

The local bus interface to the host computer is provided via one or more connectors between the mezzanine card and the host board. These connectors reside on the rear of the mezzanine card.

The I/O off the mezzanine card can be via the front panel (bezel) or via one or more of the mezzanine card connectors. If the I/O is through the mezzanine card connector, the I/O is generally routed to the host computer's backplane, as is commonly done on VME64x, CompactPCI, and Multibus I and II based computer systems.

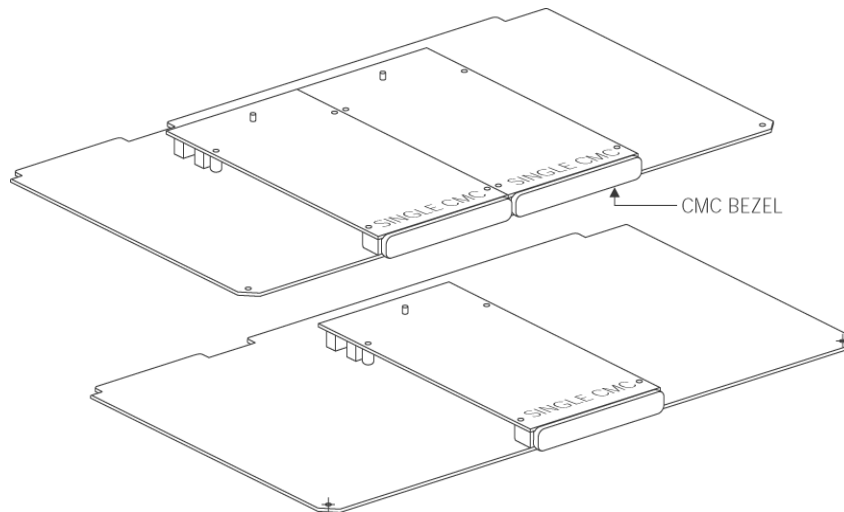


Figure 3—Typical one or two single CMCs on Multibus I host

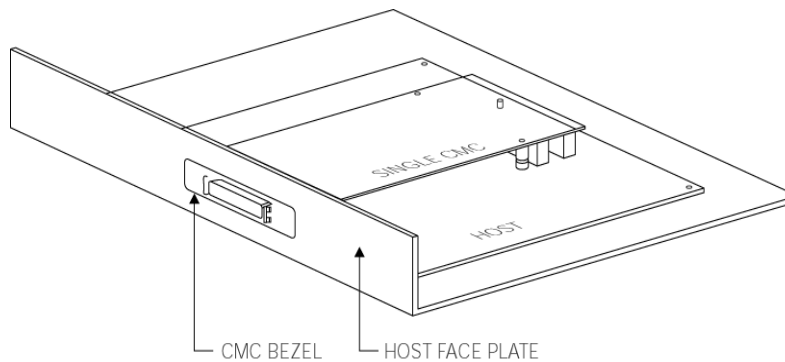


Figure 4—Typical CMC in a desktop or portable computer host

1.5 Parent-child standard

This standard acts as a parent standard to one or more child standards. At the time this standard was developed and approved, one child standard was developed and approved simultaneously, which is the IEEE Std 1386.1-2001. IEEE Std 1386.1-2001 provides the specific connector pin assignment of the PCI local bus, as it is routed onto the mezzanine card. In the future, additional child standards can be developed that use the basic mechanical definition (from this standard), but have different local buses.

Note that IEEE Std 1386.1-2001 references other standards or specifications for the definition of the local bus's logical and electrical layers.

1.6 Conformance

A vendor of mezzanine cards or host computers (or host peripherals) may claim compliance with this standard only when the complete mechanical interface is met.

1.7 Dimensions

All dimensions in this standard are in millimeters (mm) unless otherwise specified. Drawings are not to scale. First-angle projection has been used throughout this standard.

1.8 Coordinate dimensions

The coordinate dimensions define the actual dimensions of a 25 mm metric equipment practice. These actual dimensions are derived from coordination dimensions using the principle of boundary and axis references illustrated in IEEE Std 1301-1991 and IEC 60917-2-1-1993.

Overall dimensions and internal subdivisions are determined by using different increments or mounting pitches (mp1 = 25 mm, mp2 = 5 mm, mp3 = 2.5 mm, mp4 = 0.5 mm, and mp5 = 0.05 mm). These mounting pitches have been used to derive the key dimensions given in this standard. They are also used when extending this standard with additional dimensions (where such extensions are permitted) and when alternative positions of piece parts are described (in such cases, it is obvious that the relationships between involved dimensions shall be maintained).

2. References

The following publications are used in conjunction with this standard. When the following publications are superseded by an approved revision, the revision shall apply.

ANSI/IEEE Std 796-1983, IEEE Standard Microcomputer System Bus.²

ANSI/IEEE Std 1014-1987 IEEE Standard for A Versatile Backplane Bus: VMEbus.³

ANSI/VITA 1-1994 VME64 Standard.⁴

ANSI/VITA 1.1-1997 VME64x Standard.

Bellcore GR-1089-CORE 1999 Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment.⁵

EIA-700 AAAB 1996, 1.0 Millimeter, Two-Part Connectors for Use with Parallel Printed Boards.⁶

EN50082-1-1998 Electromagnetic Compatibility Generic Immunity Standard Part 1: Residential, Commercial and Light Industry.⁷

EN55022-1998 Information Technology Equipment. Limits and Methods of Measurement of Radio Disturbance Characteristics.

²ANSI/IEEE Std 796-1883 has been withdrawn; however, copies can be obtained from the Sales Department, American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

³ANSI/IEEE publications are available from the Institute of Electrical and Electronics Engineers (IEEE), Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-133, USA, (<http://standards.ieee.org/>).

⁴ANSI/VITA publications are available VITA, 78 E. Gelding Drive, #104 Scottsdale, AZ 85260, USA (<http://www.vita.com/>).

⁵Bellcore publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://www.global.ihs.com/>).

⁶EIA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://www.global.ihs.com/>).

⁷EN publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://www.global.ihs.com/>).

EN55024-1989 Information Technology Equipment. Immunity Characteristics. Limits and Methods of Measurement.

ETSI EN300 386-2 1997 Electromagnetic Compatibility and Radio Spectrum Matters (ERM) Telecommunication Network Equipment; Electromagnetic Compatibility (EMC) Requirements; Part 2: Product Family Standard.⁸

FCC Part 15 of the Federal Communication Commission (FCC) Rules.⁹

IEC 60917-2-1-1993, Modular Order for the Development of Mechanical Structures for Electronic Equipment Practices – Part 2: Sectional Specifications Interface Coordination Dimensions for the 25 mm Equipment Practice Section 1.¹⁰

IEC 61587-1:1999 Part 1: Mechanical Structures for Electronic Equipment—Tests for IEC 60917 and IEC 60297—Part 1: Climatic, Mechanical Tests and Safety Aspects for Cabinets, Racks, Subtracks and Chassis.

IEEE Std 1101.1-1998, Mechanical Core Specification for Microcomputers using IEC 603-2 Connectors.¹¹

IEEE Std 1101.10-1996, Specifications for Additional Mechanical Specifications using the IEEE 1101.1 Equipment Practice.

IEEE Std 1156.1-1993, IEEE Standard for Microcomputer Environment Specification for Computer Modules.

IEEE Std 1301-1991 IEEE Standard for a Metric Equipment Practice for Microcomputers-Coordination Document.

IEEE Std 1301.4-1996 IEEE Standard for a Metric Equipment Practice for Microcomputers-Coordination Document for Mezzanine Cards.

IEEE Std 1386.1-2001 IEEE Standard Physical and Environmental Layers for PCI Mezzanine Cards.

PICMG 2.0, R3.0 CompactPCI Core Specification.¹²

ISO/IEC 10861:1994 [ANSI/IEEE Std 1296-1994 Edition] IEEE Standard for a High-Performance Synchronous 32-Bit Bus: MULTIBUS II.

2.1 Trademarks

The following names used within this standard are trademarked:

CompactPCI® and PICMG® are registered trademarks of the PCI Industrial Computers Manufacturers Group.

⁸ETSI EN publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://www.global.ihs.com/>).

⁹FCC rules are available on the World Wide Web from the following URL: <http://www.fcc.gov>.

¹⁰IEC publications are available from the American National Standards Institute, Sales Dept., 11 West 42nd Street, 13th Floor, New York, NY 10036.

¹¹IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

¹²PICMG publications are available from PCI Industrial Computers Manufacturing Group (PICMG), c/o Virtual, Inc., 401 Edgewater Place, Suite 500, Wakefield, MA 01880, USA (<http://www.picmg.com/>).

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2.2 Relationship between VME, VMEbus, VME64, VME64x, and CompactPCI

The original VME specification is specified by IEEE Std 1014-1987. A second generation VME standard was developed that expanded VME to a 64-bit address and data width bus architecture. It was developed by the VITA Standards Organization (VSO) and is called ANSI/VITA 1-1994, VME64 Standard. All of the original IEEE VME standard definition was incorporated in the VME64 standard. A third generation VME standard was developed called ANSI/VITA 1.1-1997, VME64 Extensions (VME64x) Standard. The standard added a variety of additional features, including an expanded 160 pin connector, a center 95 pin 2 mm connector, an EMC U-shaped front panel, ESD protection, +3.3 V & 48 V power, front panel keying, and so on.

All the mechanical features defined in the VME64x standard are utilized in the PICMG 2.0 R3.0. Mechanical placement of the CMCs on VME64x and CompactPCI 3U and 6U boards is exactly the same. The only difference is routing of the CMC's I/O through the rear backplane connectors. CMCs can be used on VME and VME64 boards with flat, front panels. There is less mechanical flex strength in the flat, front panels versus U-shaped front panels. The preference should be to use the U-shaped front panels, in all Eurocard type applications.

The terms *VME* and *VMEbus* mean the same thing and are used interchangeably.

3. Definitions, abbreviations, and terminology

3.1 Special word usage

3.1.1 shall: A key word indicating a mandatory requirement. Designers shall implement such mandatory requirements to ensure interchangeably and to claim conformance with the specification. This key word is used interchangeably with the phrase *is required*.

3.1.2 should: A key word indicating flexibility of choice with a strongly preferred implementation. This key word is used interchangeably with the phrase *is recommended*.

3.1.3 may: A key word indicating flexibility of choice with no implied preference. This key word is used interchangeably with the phrase *is optional*.

3.2 Definitions

3.2.1 coordination dimension: A reference dimension used to coordinate mechanical interfaces. This is not a manufacturing dimension with a tolerance.

3.2.2 mezzanine card: An add-on printed circuit board (PCB), which is mounted parallel to a host computer board. Note that some applications use “module” instead of “board”, although both have the same meaning.

3.2.3 reference plane: A theoretical plane, not having thickness or tolerance, used to separate space.

NOTE—See IEEE Std 1101.1-1998.

3.2.4 true position: Some point on a card's printed circuit board (PCB) that is used by the assembly equipment for the reference positioning of a set of components.

3.3 Abbreviations

The following abbreviations are used extensively in this standard:

CMC	Common Mezzanine Card
H	height nomenclature
I/O	input/output
Jn	Connector receptacle number
mm	millimeter
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
Pn	Connector plug number

3.4 Dimensional nomenclature height, width, and depth

The following is a list identifying abbreviations and a description of height dimensional nomenclature used in this standard:

Nomenclature	Description
H1	CMC side 1 component height
H2	CMC side 2 component height
Hp	CMC plug seating plane height
Hs	CMC standoff height and reference plane height

There are no **width** and **depth** dimensional nomenclatures used in this standard.

4. Mezzanine card mechanics

This clause defines the mechanical dimensions for mezzanine cards. The host mezzanine card slot mechanics are defined in Clause 5.

4.1 CMC size designations and sizes

Two different mezzanine card sizes are defined. These two sizes are listed in Table 1. The designation of each card size is given in the first column.

NOTE—The CMC's envelope boundaries are designed on a grid structure, where the basic increment of the grid is 25 mm. The width increment of CMCs is 75 mm. When two CMCs are placed next to each other, there is a 1 mm gap between each CMC.

The depth of CMCs is 149 mm. Should other mezzanine cards be used in conjunction with one or more CMCs, there will be a 1 mm gap between the edges of two single CMCs.

For a better understanding of this grid structure and how it ties into the international metric measurement systems, please obtain a copy of IEEE Std 1301.4-1996.

Table 1—CMC PWB size designations and dimensions

Designation	Width (mm)	Depth (mm)
Single	74.0	149.0
Double	149.0	149.0