VME/VXI Engineering Design Guide

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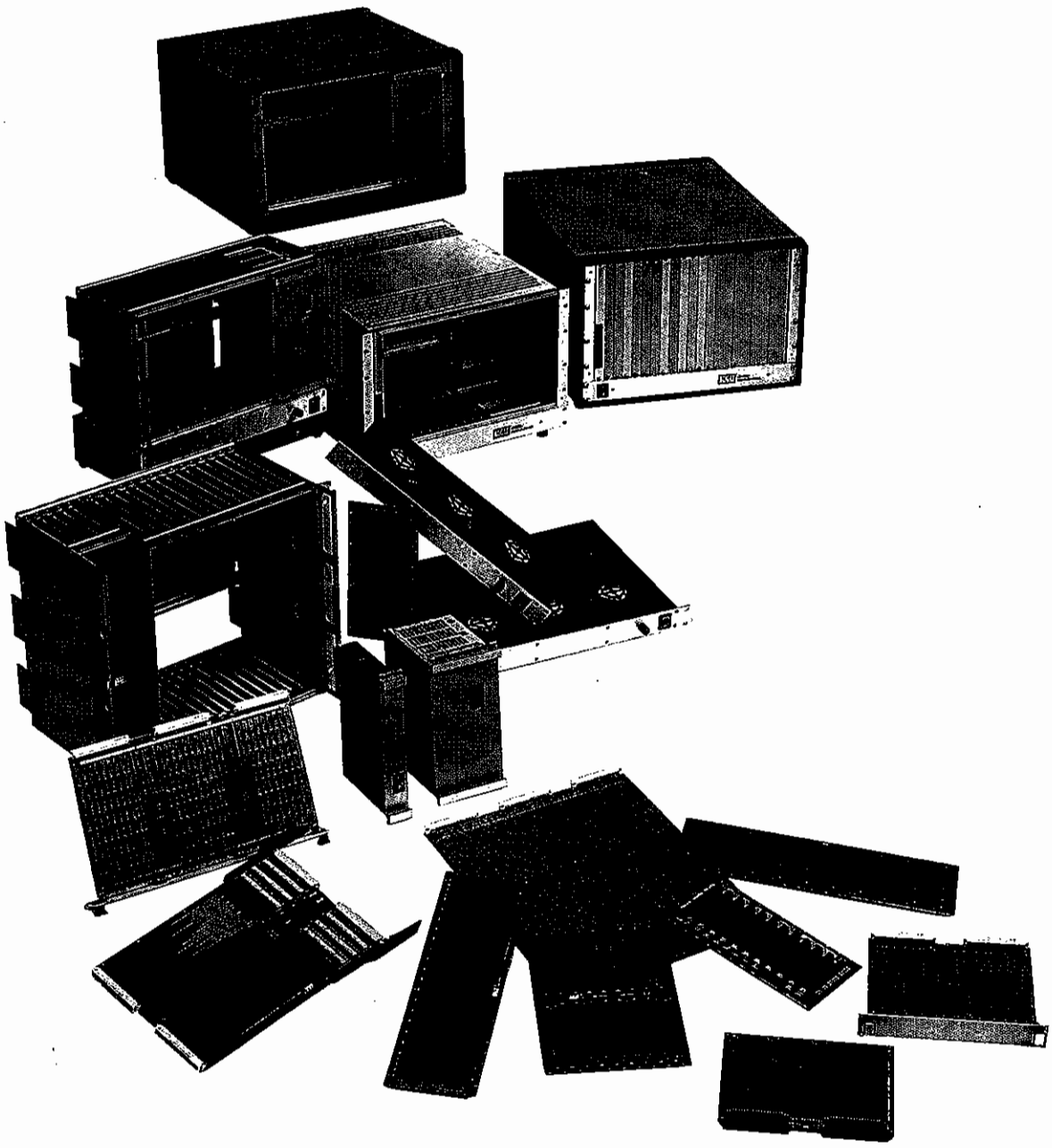

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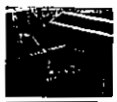
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VME/DIN/VXI Introduction

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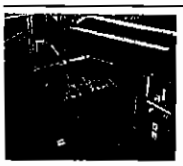

Chapter 1
Introduction

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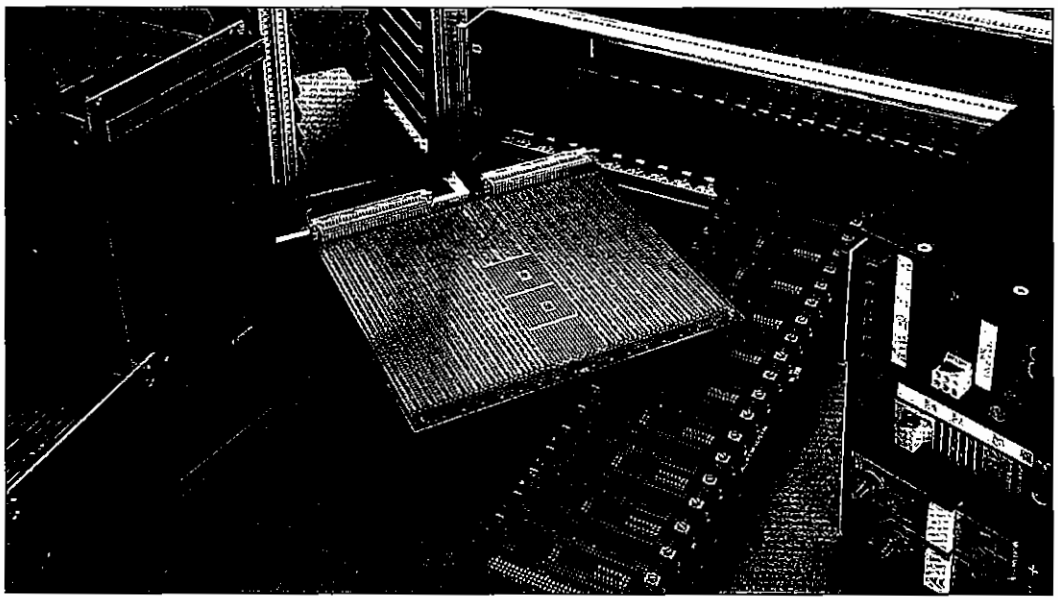
1 VME/DIN/VXI Introduction

Augat's VME/DIN/VXI product line provides an integrated series of electronic packaging and interconnection products based on the VMEbus VXIbus and DIN specifications. The product lines include:

- Backplanes
- Card Cages
- Wire-Wrap Prototype Panels
- Unilayer II Panels
- Multilayer Board Design and Fabrication
- Extender Boards
- Power Supplies/Cooling Units
- Powered Chassis
- SMD and PGA Adaptors

This VME/DIN/VXI Engineering Reference Manual has been prepared to assist a systems engineer or design engineer in the design/specifications stage of projects that require system-level packaging. Every attempt has been made to approach this task from the perspective of the system "as a whole" and to include substantial engineering details.



Augat's VME/DIN Product Line

VME/DIN/VXI Introduction

Why use VMEbus ?

VMEbus and DIN are popular specifications for the design and packaging of electronic systems because they combine the benefits of broad product offerings from multiple suppliers, high performance product characteristics, and the quality of documentation found in a widely-accepted standard. If you are contemplating the use of the VME/DIN standards in your next project, these "commonly highlighted" features and benefits will be important for you to consider.

1. VMEbus provides both a 16-bit data/address architecture, a 32-bit data/address architecture and a 64-bit data/address architecture. This gives you flexibility, and the opportunity to expand your system to obtain greater throughput or to address larger blocks of main memory.

2. VMEbus's interrupt and bus arbitration structure allows multiple processors to share the same bus. Multiprocessing of data combined with the shared resources of a common bus will allow you to increase your system's performance and still preserve the convenience of a single chassis.

3. VMEbus backplane data transfers are non-multiplexed and use asynchronous timing. This facilitates fast data rates and often gives you greater flexibility and a margin for error.

4. The 2-piece DIN connectors used in the VME/DIN products are very rugged and reliable. They enjoy world-wide acceptance in commercial, industrial, and military applications and there are numerous cross-tooled manufacturers.

5. There is an active syndication of manufacturers that support the VMEbus standard. This results in broad and competitive line up of off-the-shelf products to assist you in your system integration.

6. There are active independent user groups and third-party organizations that support the VMEbus standard. Your training is made simpler by their efforts in trade journals, at trade shows and at user forums.

1 VME/DIN/VXI Introduction

Why use VXIbus?

In July of 1987, five prominent instrument makers disclosed their agreement to support a common architecture and released the first version of the Vme eXtentsion for Instrumentation (VXI) standard. The goal of this group was to define an interface that would enable the manufacturers to assemble test and measurement systems that are smaller, faster, and more flexible than the conventional IEEE 488 GPIB (General Purpose Interface Bus) "rack & stack" systems. Based upon an agreement to fully share information regarding the VXIbus, the VXI Consortium has cooperated to successfully solve both big and small problems. This Consortium was involved not only in defining the text of the spec, but also in assembling, testing, and evaluating VXIbus systems with a variety of different modules and chassis. The net result of their effort is a standard bus architecture that may very well replace the IEEE-488 bus in instrumentation and ATE applications.

VXI combines the speed and space efficiency of VME-like modular instruments with the design simplification and instrument compatibility that GPIB provides. Like the IEEE-488 (GPIB), VXI allows numerous manufacturers to design complementary instruments; however, there is a significant difference between these buses. The GPIB is a cable bus, a typical interconnection for "rack & stack" instruments. VXI is a high speed backplane bus, which, when combined with the Eurocard mechanical format and VME roots, provides some very distinct advantages.

Traditional "rack & stack" instruments connected via cables cannot match the control over signal characteristics and propagation delay that is possible in a well-defined and controlled backplane environment. Tight control over electrical characteristics results in greater flexibility and higher performance communications among instruments.

The Eurocard format allows more compact modules in standard packaging. It is possible to reduce the physical size approximately two to four times over GPIB systems with similar functionality. This ability to downsize a system has earned VXI support in both the commercial/industrial and military/aerospace markets. The modularity reduces costs and optimizes maintainability of the system.

Because VXI is an extension of VME, most VME cards can function in the VXI environment, allowing users access to a multitude of VME cards and software. Consequently, VXI can reduce test program development time from months to days while maintaining compatibility with GPIB. VXI's major additions to VME are largely functional and mechanical.

VME/DIN/VXI Introduction

Why use Augat's VME/DIN and VXI products ?

Augat Interconnection Systems designs, manufactures, and supports a broad line of microcomputer packaging products and prototype services. Augat has a unique combination of skills in electronic packaging engineering, efficient procedures for the utilization of your CAE/CAD databases, and advanced manufacturing technologies. This combination of standard products and technology resources can give you a complete solution to your board-level and system-level packaging needs.

1. Augat's VME/DIN and VXI product lines have hundreds of models from which to choose. You'll find it convenient to deal with a company that has a major commitment to Microcomputer Packaging Standards.

2. Augat's VME/DIN and VXI backplane product lines have many sizes, many different levels of performance, and a broad spectrum of prices. Augat will also custom design and manufacture VME/DIN and VXI backplanes and powered chassis to your specifications.

VMEbus and DIN Backplanes

Series	Description	Layers	Number of Slots
J1/J2/E	Very High Perrformance	6	3-21
J1/E	Very High Performance	6	3-21
J1/H	High Performance	4	3-21
J2	Row B bussed	4	5,9,12,20
J2/E	Row B bussed	2	3-21
J3/E	Unbussed: .8" pitch	2	3-21
J3	Unbussed: .8" pitch	2	5,9,12,20
VG	Unbussed: .6" pitch	2	3,5,6,8,11,13,15,26

VXI bus Backplanes

J1/J2	Very High Performance	12	5,13
J1/J2/ J3	Maximum Performance	12	5, 13

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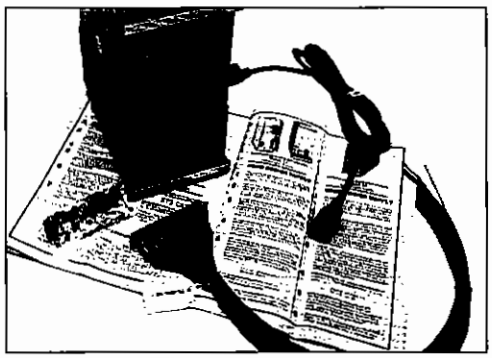
1 VME/DIN/VXI Introduction

3. Augat has more card cage size options than the two sizes specified in the VMEbus standard. There is probably one that is just right for you (see table below).

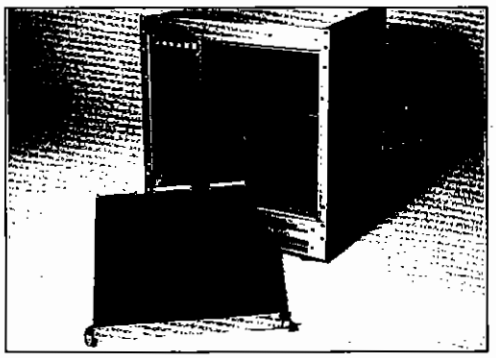
4. Augat's powered chassis combines the best backplane in the VME market with a subrack, power supply and cooling to create a modular system that allows you to effectively start devel -oping a product without being concerned about electromechanical issues.

5. Augat's power supplies have high wattage output capabilities (up to 1200W) and are fully compat - ible with VMEbus and VXI specifications. For your convenience, Augat provides harness as semblies, detail operational instructions, and a complete set of accessories.

Cage Size	Full Width 42HP	Half Width 84HP	'N' Slot 12HP-41HP & 43HP-83HP
3U x 16mm	X	X	X
3U x 220mm	X	X	X
3U x 280mm	X	X	X
6U x 160mm	X	X	X
6U x 220mm	X	X	X
6U x 280mm	X	X	X
9U x 160mm	X	X	X
9U x 220mm	X	X	X
9U x 280mm	X	X	X
9U x 400mm	X	X	X



An Accessory Kit for a 400W Power Supply



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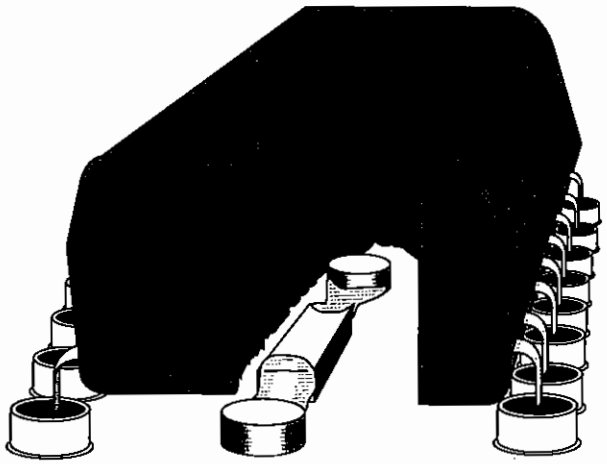
6. There are numerous Wire-Wrap and Unilayer II products to address your prototype or production requirements. Augat's FASTPAK design uses SMD decoupling capacitors that give you a Wire-Wrap board with an inherently low noise characteristic AND a packaging density of .32 square inches per EIC.

7. Qwikturn wiring of Wire-Wrap or Unilayer II panels - directly from your CAE databases - gives you ONE WEEK delivery, without the error and hassle of encoding data manually and handwrapping panels. For applications with volume production, there is Augat's design and fabrication of multilayer boards. It all happens with an integrated database - from your CAE work station, to prototype, to multilayer design, and to volume manufacturing and test.

8. Augat's SMD and PGA adaptors give you an easy way to test and evaluate new IC packages without incurring the risk and inconvenience of new tooling and new assembly processes.

9. Most of Augat's VME/DIN and VXI product lines are stocked by a worldwide network of industrial distributors whose fast delivery and special services are particularly helpful in the early stages of your design.

FASTPAK WireWrap Panels for High Speed and High Density



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1 VME/DIN/VXI Introduction

Terms used in VMEbus and DIN standards

The following terms are used in describing the interconnection and packaging of electronics in the VMEbus and the DIN specifications.

Auto-Bus-Grant Connector (ABG)

A 96-pin DIN connector that provides automatic jumpering between the Bus Grant daisy chain and the bus arbiter when a card is removed from the VMEbus or VXIbus backplane.

Backplane Interface Logic

Each functional module that plugs into the backplane requires backplane interface logic to handle both the logical and the electrical needs of the interface.

Bus Grant Jumpers

Multiprocessor bus arbitration on a VMEbus backplane requires that empty slots do not "open circuit" any of the interrupt priority signals. Bus grant jumpers - small shunts that are manually inserted on Wire-Wrap pins on the back of the backplanes - assure the continuity of these signals.

DIN

The Deutsches Institut fur Normung (DIN) is a German organization that has established many of the mechanical standards employed in the VMEbus specification. These standards are also used worldwide in other "non-VME" applications, such as connector and cabinet specifications.

HP

A horizontal pitch (HP) is a unit of measure that represents a .2" (5,08mm) increment (i.e., 5HP = 1.0"). The HP unit of measure is used in defining the horizontal distance along the DIN card cages. For example, Augat's 400W rackmounted power supply has a width of 24HP (4.8" or 121,92mm), and a typical Unilayer II panel is used with a backplane pitch of 4HP (.8" or 20,32mm).

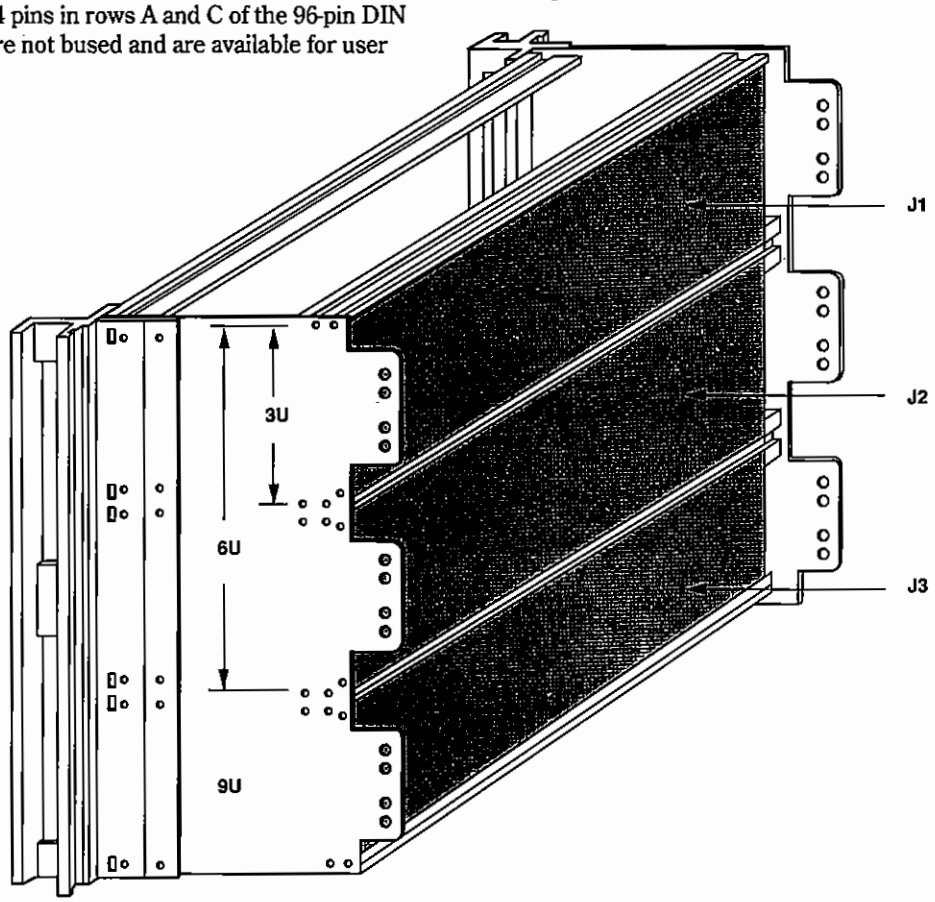
J1, J2, J3 (P1,P2,P3)

The "J" nomenclature is used to signify backplane locations and functions. The "P" nomenclature is used to signify the connectors found on the boards used in a VME/DIN system. The J1 backplane is the main VMEbus backplane and is usually located at the uppermost position on a card cage. All 96 connector pins are bused according to the VMEbus specification. If a system uses only a J1 backplane, it implements a subset of the VMEbus specification. (Only 16 data lines and 24 address lines are available on the J1 backplane due to the limited number of pins on the connector and the non-multiplexed architecture of the VMEbus specification.)

The J2 backplane is the second backplane in a VMEbus system. It is located below the J1 backplane. Only the B row of the 96-pin DIN connector is bused. 24 pins of the B row are bused as additional address and data lines to complete the 32-bit architecture of the VMEbus while the other 8 pins are used for power, ground, and reserved signals.

The other 64 pins in rows A and C of the 96-pin DIN connector are not bused and are available for user I/O. They can also be used for VMX or a VSB bus connection.

The J3 backplane has no VMEbus specification to govern its use. It is typically the third connector location on a board making available for user-defined I/O or power. J3 backplanes may be constructed with Wire-Wrap or etched interconnections.



Backplane Locations on a VMEbus Card Cage

1 VME/DIN/VXI Introduction

Subrack

A subrack is an enclosure that provides mechanical support for boards inserted into a backplane. A subrack may also be used for peripherals or oddshaped components.

U

A "U" is a unit of measure used to define vertical height in a DIN card cage or board. "3U" signifies the use of only one connector, "6U" signifies the use of two connectors, and "9U" signifies the use of three connector locations. (1U = 1.75")

VITA

VITA (VME International Trade Association) is an association of manufacturers that encourages the use of the VMEbus specification, runs trade show promotions for the VMEbus, and is a central clearing house for technical and marketing data. They are located at:

10229 N. Scottsdale Road
Suite E, Scottsdale, Arizona 85252
(602) 951-8866

VME

Versa Module Europa (VME) began as the Versabus specification-originally endorsed by Motorola (USA). The Versabus specification was later changed by Motorola in Munich, West Germany, where many DIN specifications were incorporated.

Working Aperture

The working aperture is the usable width between the inside faces of the left and right side panels of a card cage or subrack. The overall dimensions of a card cage or subrack will be greater than the working aperture to allow for card guide mounting, handling, and other mechanical clearances.

VSB

VME SUBSYSTEM Bus is a local subsystem extension bus which defines the A & C rows of the VME P2 connector. VSB is used to reduce traffic on the main bus in multi-processor VME systems.

VXI

VXI (VME eXtension for Instrumentation) is a standard based on VME which provides additional functions for instrumentation systems in the VME P2 and P3.

VME/DIN Backplanes

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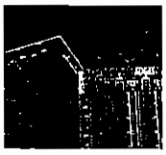

Chapter 2

VME/DIN Backplanes

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VME/DIN Backplanes

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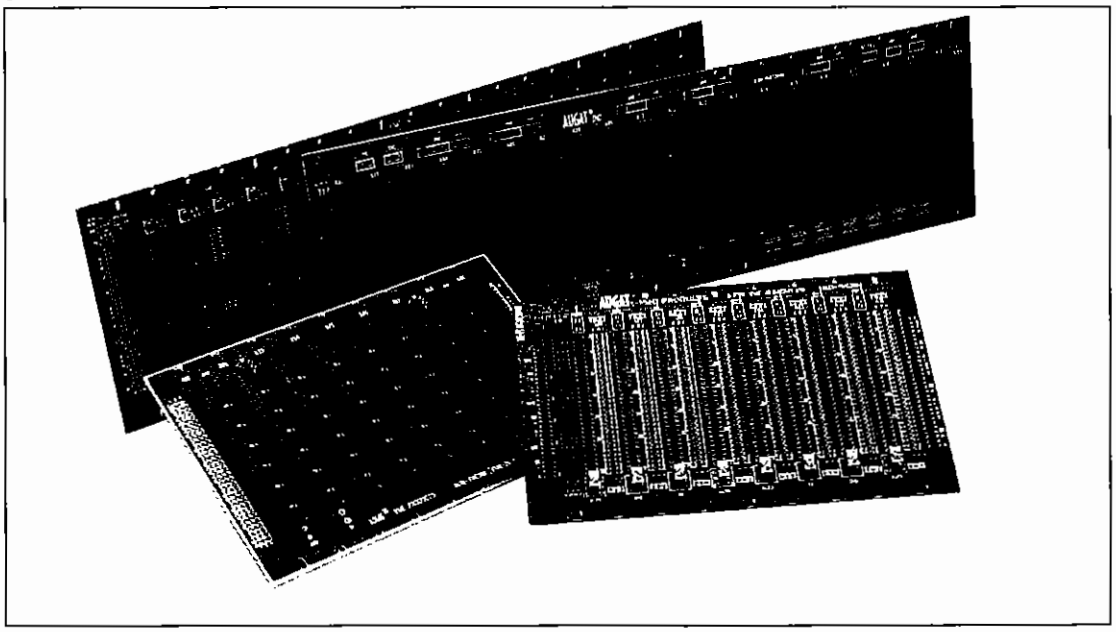
Introduction

High-speed data transfers and 32-bit architectures have made backplanes a significant component in the design of an overall system.

Augat's VMEbus backplanes have been engineered to provide the right combination of features to make it all happen: characteristic impedance is targeted and controlled, electrical noise is minimized, and power distribution is substantial.

There are many types of VME/DIN backplanes to match your needs. Two models of J1/J2 monolithic backplanes provide two levels of performance. Two models of the J1 backplane give you a broad price/performance range. Two models of the J2 backplane give you the flexibility you'll need for a "user-definable" backplane (such as providing five auxiliary power buses) without sacrificing features like controlled characteristic impedance and minimized crosstalk.

Unbussed backplanes are available with Wire-Wrap tail connectors on .6", .8" or 1.2" pitch. All Augat backplanes are UL approved and qualified to Mil-P-55110D (Type 1,2,3). All backplanes use press-fit, 96 pin DIN connectors which comply with specification 603-2-IEC-C096M. The Augat "Auto-Bus-Grant" Connector is also available.



VME/DIN Backplanes

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Introduction, cont.

Din Connector Specification

Insulator	Glass Filler Polyester UL94VO
Contact:	Copper Alloy - per Federal Specifications QQ-B-750
Plating :	Nickel per QQ-N-290 Gold per Nil-G-45024 Type 1 Tin per Mil-1027 Type 1
Current Rating:	2A per contact
Contact Resistance:	≤20 milliohms
Dielectric withstanding:	≥500 VRMS, 60 Hz at sea level
Insulator resistance:	≥10 megohms after environmental
Temperature rating:	-55C to 120C
Mating force:	3.5 oz. average per contact
Unmating force:	.53 oz. minimum per contact

VMEbus Backplane: J1/J2 M Series

Augat's 21 slot J1/J2 M backplane designed for clock speeds up to 100MHz, provides the electrical characteristics necessary for the most demanding VMEbus designs. Stripline construction minimize crosstalk and controls the characteristic impedance of the signal lines. Meets VMEbus specification D

- Meets VMEbus specification D
- 3 separate signal layers
- Very low crosstalk
- Bus bar
- Active or passive In-board termination

VMEbus Backplane: J1/J2

Monolithic E Series

The J1/J2 E backplane uses a 6 layer microstrip construction and is designed for clock speeds up to 50 MHz. Two voltage and two ground planes provide excellent signal shielding and current distribution, termination resistors are placed inside the first and last connectors for reduced overall length.

- Meets VMEbus specification D
- 5 auxiliary power busses
- Low crosstalk
- 3-21 slots

J1/E Series

The J1/E backplanes use a microstrip design with two voltage planes and two ground planes for added current-carrying capacity. Terminating resistors are placed inside the last connector position to reduce the overall length of the backplanes.

- Meets VMEbus specification D
- 6-layer construction
- In-board termination
- Two voltage/two ground planes
- 3-21 slots

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Introduction, cont.

VMEbus Backplane: J1/H Series

The J1/H backplanes have a economical 4-layer embedded microstrip construction that doesn't compromise performance. The signal routing is the same as the J1/E, but only one voltage and one ground plane are used. Power can be terminated at power cubes or snap-on lugs that are positioned in multiple locations around the circumference of the backplanes.

- 4-layer construction
- On-board termination
- Multiple power terminations
- Meets VME specification B.1

VMEbus Backplane: J2E Series

The J2/E backplanes are used with the J1/E or J1/H backplanes to implement a full VMEbus 32-bit system. Terminating resistors are placed inside the last connector position to match the mechanical alignment of the J1/E backplanes. This reduces the overall length of the backplane to allow room for cable routing.

- 3-layer construction
- Controlled impedance
- Multiple power termination
- 3-21 slots
- VME lab certified to Rev C.1

VMEbus Backplane: J2 Series

The J2 backplanes are used with the J1/E or J1/H backplanes to implement a full VMEbus 32-bit system. The high signal integrity of the J1 backplanes is matched in the J2 backplanes by using a four-layer microstrip construction.

- 4-layer construction
- Controlled impedance
- 5 auxiliary power busses
- Meets VME specification B.1

VMEbus Backplane: VSB Series

The VSB backplanes are mounted on the wire side of the DIN connectors on the J2/E or J2 backplanes. Terminating resistors are mounted inboard for end to end backplane stacking in multiple VSB applications. The VSB backplanes use a 4 layer microstrip construction. One +5V and one ground plane are accessed through VSB power terminals and J2 B row power pins.

- 4-layer microstrip
- 2 power termination option
- In-board termination
- Geographical addressing
- 2-6 slots

Introduction, cont.

DIN Backplane : J3/E Series

The J3/E series backplanes provide an unbussed, totally user-defined backplane for I/O signals, additional power distribution, or inter-board signals on a .8" pitch. They can be used as an auxiliary backplane with the .8" pitch, J1/J2 Monolithic, J1/E and J2/E VMEbus backplanes, or in a stand-alone configuration.

- 3-21 slots
- .8" pitch
- Wire-Wrap interconnections
- Optional inboard terminating Wire-Wrap pins
- 3 Power Termination Options

DIN Backplane: J3 Series

The J3 Series is a low cost version of the J3/E series. The J3 series provides an unbussed, user definable, .8" pitch backplane. The terminating Wire-Wrap connectors are placed outside the first & last connectors to be compatible with the J1/H and J2 backplanes.

- .8" pitch
- Optional terminating Wire-Wrap pins
- Wire-Wrap interconnections

DIN Backplane: VG Series

The VG backplane are similar to J3 backplanes except the connector mounting position are on a .6" pitch. When every other connector position is populated, the resulting 1.2" pitch gives you the optimum packaging density for using Wire-Wrap panels.

- .6" or 1.2" pitch
- Wire-Wrap interconnections
- 2 auxiliary power busses

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VME/DIN Backplanes

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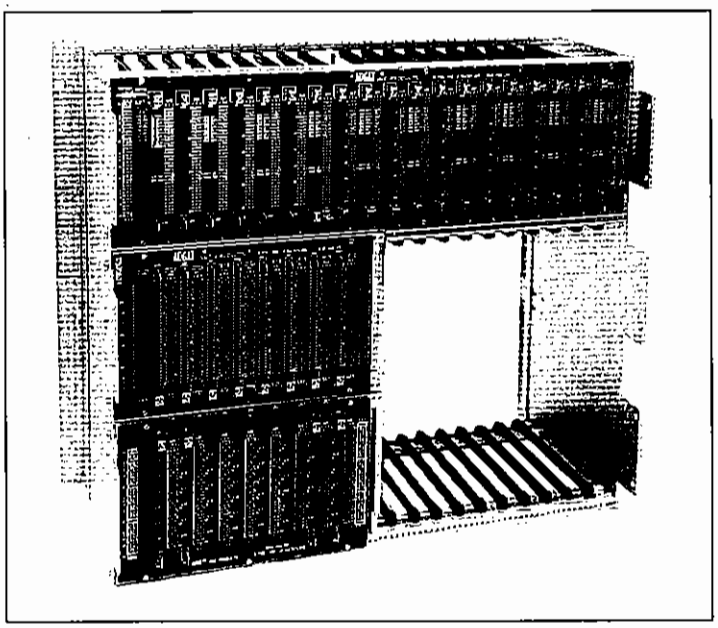
Introduction, cont.



VME/DIN Backplane Part Numbering System

8160 - VME 0 20 E - 1 A

- 8160 - Prefix for all VME/DIN Backplanes
- VME: VMEbus; VG: DIN (Eurocard)
- 0: J1/J2; 1: J1; 2: J2; 3: J3
- 20: 3 thru 21 slots; ex: 21: 21 slots; 12: 12 slots; 03: 3 slots
- E: M : M Series; E : E Series; H : H Series
- 1: Options (See details of each backplane)
- A: Power Terminal Option (see details of each backplane)

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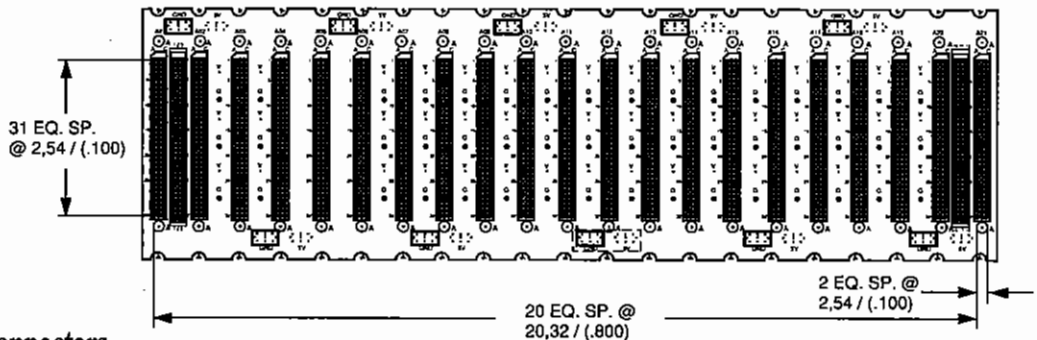
"E" Series Backplanes

Augat's E series backplanes are available in 3-21 slot sizes for J1, J2, and J3. All E Series VME backplanes are designed to meet VMEbus specification C. , and therefore all termination is placed inboard to allow for the 21st slot.

Design

The J1/J2 Monolithic Series is a 6 layer, high performance, microstrip construction backplane. Signal lines reside on the top and bottom layers sandwiching the inner layers which consist of 2 voltage and 2 ground planes. The nominal thickness of the backplane is .125".



Connectors

The J1/J2 Monolithic Series backplanes are loaded with 96 pin, press-fit, DIN connectors that ensure gas tight and reliable connection (see page 2-1 for specifications). The connectors in the first and last slots on both the J1 and J2 have 96 pins with 3-level Wire-Wrap tails and a shroud over the pins to serve as an interconnection point to another backplane or logic analyzer. All other connectors on the J1 have PC tail length pins. All connectors on theJ2 have 3-level Wire Wrap pins on all three rows (a,b,c).

Optional Ground Pins For User I/O

Optional ground pins can be loaded into the rows of plated-through holes (.043 +/-.002") located .2" from the A and C rows of each J2 connector. These pins can be used when wiring twisted-pair Wire-Wrap signal lines, or they can be used with ordinary ribbon cable headers for interdigitized I/O (GNG/SIG/GND/SIG). Use the option designation of '-1" at the end of the J1/J2 backplane part number to signify a backplane that has all ground pins installed (Example 8160-VME021E-1). Partially populated versions can be ordered as a custom product.

Termination

Terminating resistors are mounted inboard of the last connector at each end of the backplane according to the VMEbus Rev D mechanical specifications. The resistor packs are loaded into Augat Holtite sockets for easy removal. The location of the termination components allows for up to 21 slot positions in a standard 19" RETMA rack. Although the termination components are physically placed inside the last connector, they are "logically placed " outside connector position. Each signal is routed continuously to the last connector and then looped back to the termination components. Placing the termination components at the "logical end" of the backplane signal lines minimizing reflections and makes all connector positions "electrically equal".

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Power

Power can be delivered to the J1/J2E Monolithic backplanes using one of three different terminal options. You can specify your choice of power termination by using the appropriate suffix to the Augat backplane part number. (Example 8160-VME021E-A, defines power cubes).

There are two VCC and two GNG layers in the 6 layer backplane that lower the resistivity of the backplane power supply. These layers are continuous throughout the backplane and provide better distributed capacitance, and a more stable ground reference than a system with individual J1 and J2 backplanes.

In addition to the +5V, +12V, and -12V power distribution, the J1/J2E Monolithic backplane provides 5 auxiliary power buses for increased system flexibility. The auxiliary power networks are accessed through any one of the three power terminal options.

Bus Grant Jumpers

If the ABG Connector is not used then Bus grant jumpers can be connected to Wire-Wrap pins on either side of the backplane to bridge unused slot positions. (Use Augat Part No. 015-001.) Easy to read nomenclature clearly identifies bus grant signals on both sides of the backplane.

Control Signals

ACFAIL, SYSFAIL, and SYSRESET signals are accessed through power terminals.

Suffix	Description	Rating
A	6 Pin metric Power Cubes	18 Amps each
B	Snap-on Lugs	15 Amps each
C	Metric Press Fit Post	60 Amps each

Auto-Bus Grant Connector

The Augat automatic Bus Grant (ABG) connector backplane system eliminates jumpers. The "ABG" system is accurate, timesaving and effortless to use. The switches eliminate the inconvenience and safety hazard of installing daisy chain jumpers or tripping dip switches on the backplane for the Bus Grant and/or the Interrupt Acknowledge lines when removing a module from the subrack or in the event of an empty slot on the VMEbus or VXIbus backplane.

The switching is accomplished by a unique mechanical scheme that is internal to the cavities of the insulator of Augat's standard 96 pin DIN connector. The connector is mounted to the backplane in the same manner as the 96 pin DIN and no special tooling is required to provide the switching option. The connector takes up no more room than the standard 96 pin DIN and the internal method of jumpering does not interfere with the VXI module shielding requirement.

Both the high performance VME and VXI backplanes can be equipped with this innovative 96 pin DIN connector with internal switching. (See chapter 9 for further information)

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Power Termination Table (Reference Drawing on page 2-14 for location)

Part Number	Slots mm./in.	Dim. A Option	Power	Power Terminal Locations			
				+5V	GND	+12V	-12V
8160-VME021E	21	425,27/16.743	A	A10,A14,B2,B6, B15,B19,D8, D13	A5,A13,A17,B1, B5,B12,B20,C5, C9,C16,D1,D5,D16	B3 B18	B4 B17
			B	A6,A10,A14,B2, B6,B8,B13,B15 B19,D4,D8,D13, D17	A3,A5,A7,A13, A17,B1,B5,B12, B14,B20,C5,C9, C12,C14,C16,D1 D5,D12,D16,D20	A1 B3 B18	A2 B4 B17
			C	A10,B6,B15,D8	A5,A17,B1,B20, C9,D5,D16	B18	B17
8160-VME020E	20	404,95/15.943	A	A10,A14,B2,B6, B15,B18,D8,D13	A5,A13,B1,B5,B12, B14,B19,C5,C9,C16, D1,D5,D16	B3 B17	B4 B16
			B	A6,A10,A14,B2, B6,B8,B13,B15, B18,D4,D8,D13	A3,A5,A7,A13,B1, B5,B12,B14,B19 C5,C9,C16,D1,D5, D12,D16,D19	B3 B17	B4 B16
			C	B6,B15,D8	A5,B1,B19,C9,D5 D16	B17	B16
8160-VME019E	19	384,63/15.143	A	A10,B2,B6,B15, C13,D8,D13	A5,A13,B1,B5,B12 B18,C5,C9,C16, D1,D5,D16	B3 B17	B4 B16
			B	A6,A10,B2,B6 B8,B13,B15,C6, C13,D4,D8,D13	A3,A5,A7,A13,B1, B5,B12,B14,B18, C5,C9,C12,C16, D1,D5,D12,D16	B3 B17	B4 B16
			C	B6,B15,D8	A5,B1,B18,C9,D5, D16	B17	B16

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Power Termination Table (Reference Drawing on page 2-14 for location)

Part Number	Slots	Dim. A mm./in.	Power Option	Power Terminal Locations +5V	GND	+12V	-12V
8160-VME018E	18	364,31/14.343	A	A10,B2,B6,B14, C13,D8,D13	A5,A13,B1,B5,B13 B17,C5,C9,D1,D5, D9,D14	B3 B16	B4 B15
			B	A6,A10,B2,B6, B8,B12,B14, C13,D4,D8,D13	A3,A5,A7,A13,B1, B5,B13,B17,C5, C9,C12,D1,D5,D9, D14,D17	B3 B16	B4 B15
			C	B6,B14,D8	A5,B1,B17,C9,D5, D14	B17	B16
8160-VME017E	17	343,99/13.543	A	A10,B2,B6,B12 C13,D8,D13,	A5,A13,B1,B5, B13,B16,C5,C9, D1,D5,D9,D14	B3 B15	B4 B14
			B	A6,A10,B2,B6, B8,B12,C4,C13, D4,D8,D13	A3,A5,A7,A13,B1, B5,B7,B13,B16, C5,C9, C12,D1, D5 D9,D14,D16,	B3 B15	B4 B14
			C	B6,B12,D8	A5,B1,B16,C9,D5, D14	B15	B14
8160-VME016E	16	323,67/12.743	A	A10,B2,B6,B12 C13,D8	A5,B1,B5,B15,C9, C12,D1,D5,D15	B14	B13
			B	A6,A10,B2,B6, B8,B12,C4,C13 D4,D8,	A3,A5,A7,A11,B1, B5,B7,B15,C3,C7, C9,C12,D1,D5,D15	B3 B14	B4 B13
			C	B6,B12,D8	A5,B1,B15,C9,D5,	B14	B13

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Power Termination Table (Reference Drawing on page 2-14 for location)

Part Number	Slots	Dim. A mm./in.	Power Option	Power Terminal Locations +5V	GND	+12V	-12V
8160-VME015E	15	303,35/11.943	A	A7,B2,B6,B11, C12,D7,	A4,A10,B1,B7, B14,C4,C11,D4, D11	B13	B12
			B	A3,A7,B2,B6, B11,C3,C12,D3, D7	A4,A6,A10,B1,B5, B7,B14,C4,C8, C11,D1,D4,D11 D14	B3 B13	B4 B12
			C	B6,B11,D7	A4,A10,B7,D4,D11,	B13	B12
8160-VME014E	14	283,03/11.143	A	A8,B2,B10,C6, D6,D11	A3,A9,B1,B5,B13 C3,C10,D3,D10,	B12	B11
			B	A4,A8,B2,B6, B10,C6,C11,D6, D11	A3,A7,A9,B1,B5, B13,C3,C5,C7,C9, D1,D3,D10,D13	B3 B12	B4 B11
			C	B2, B10,D6	A3,A9,B5,D3,D10	B12	B11
8160-VME013E	13	262,71/10.343	A	A8,B2,B6,C10, D5	A3,A9,B1,B5,B12, D1,D6,D12	B11	B10
			B	A4,A8,B2,B6, C3, C10,D5,D10	A3,A7,A9,B1,B5, B12,C4,C6,C9,D1, D6,D9,D12	B3 B11	B4 B10
			C	B2,C10	A3,A9,B5,D6	B11	B10

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J1/J2 Monolithic Series

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Power Termination Table (Reference Drawing on page 2-14 for location)

Part Number	Slots	Dim. A mm./in	Power Option	Power Terminal Locations +5V	GND	+12V	-12V
8160-VME012E	12	242,39/9.543	A	A8,B2,C4,C9,D5	A3,A7,B1,B5,B11, C8,D1,D8	B10	B9
			B	A2,A8,B2,C4, C9, D3,D5,D9	A3,A5,A7,B1,B5, B11,C3,C5,C8,D1, D4,D8,D11	B3 B10	B4 B9
			C	B2,C9	A3,A7,B5,D8	B10	B9
8160-VME011E	11	222,07/8.743	A	A6,B2, C8,D3	A3, A7,B1,B10,C4, D1,D7	B9	B8
			B	A2,A6,B2,C3, C8,D3,D8	A1,A3,A5,A7,B1, B10,C4,C7,D1,D4, D7,D10	B3 B9	B4 B8
			C	B2,C8	A3,B10,C4,D7	B9	B8
8160-VME010E	10	201,75/7.943	A	A5,B1,C7,D1	A2,A6,B9,C3,C6, D3,D9	B8	B7
			B	A1,A5,B1,C7, D1,D7	A2,A4,A6,B9,C3, C6,D3,D6,D9	B8	B7
			C	B1,C7	A2,B9,D3	B8	B7
8160-VME009E	9	181,43/7.143	A	A4,C2,C6,D6	A3,A5,B8,C5,C7, D5,D8	B7	B6
			B	A2,A4,C2,C6, D1,D6	A1,A3,A5,B8,C5, C7,D5,D8	B7	B6
			C	C2,C6	A3,B8,D5	B7	B6

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Power Termination Table (Reference Drawing on page 2-14 for location)

Part Number	Slots	Dim. A mm./in.	Power Option	Power Terminal Locations			
				+5V	GND	+12V	-12V
8160-VME008E	8	161,11/6.343	A	B7,C2,C6	A3,A5,B1,C5,D1, D7	B6	B2
			B	A4,B7,C2,C6,D5	A1,A3,A5,B1,C5, D1,D7	B6	B2
			C	B7,C2	A3,C5,D1	B6	B2
8160-VME007E	7	140,79/5.543	A	A1, B6, D4	A2,A4,B2,B5,D1, D3	B5	B1
			B	A1,A3,A5,B6,D4	A2,A4,B2,B5,D1, D3	B5	B1
			C	B6,D4	A2,C5,D1	B5	B1
8160-VME006E	6	120,47/4.743	ALL	A1,A3,B3,D3	A2,A4,C3,D2,D4	B1	B2
8160-VME005E	5	100,15/3.943	ALL	A2,A4,D2	A3,B2,C3,D3	B5	B4
8160-VME004E	4	79,83/3.143	ALL	A1,B3	A2,B2,D2	B1*	B1*
8160-VME003E	3	59,51/2.343	ALL	A2*,B2	A1,D1	B1*	B1*

**Snap on lugs are loaded in these positions for all options.*

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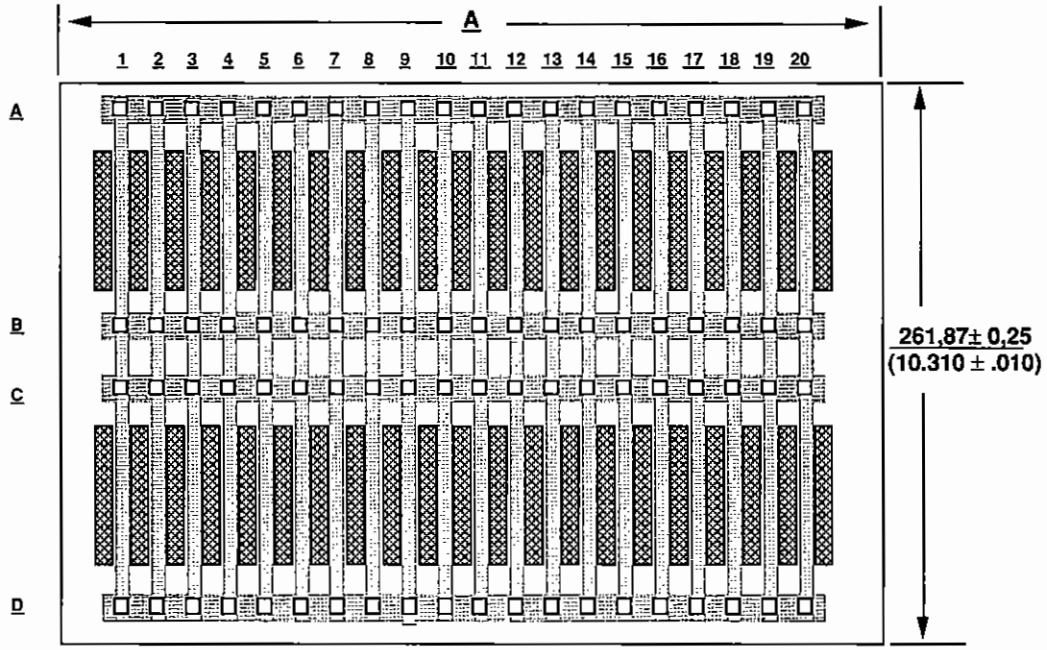
J1/J2 E Mechanical Drawing



See Power Termination Table

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