VXI Overview

A Proven High Performance Instrument Architecture

VXIbus (VMEbus Extensions for Instrumentation) (IEEE-STD-1155)

Developed in 1987 to provide a standard modular open industry architecture for instrumentation.

Intended to provide:

- High-density platform through shared resources
- Precise timing coordination between instruments
- Longer system support through multi-vendor solutions
- Capability to address high-performance requirements

VXIbus Basics

A VXIbus system or subsystem consists of a mainframe, VXIbus devices, a slot 0 card, resource manager, and host controller.

- **VXIbus Devices:**
  Typically message-based or register-based devices

- **VXIbus Mainframe:**
  Houses the VXIbus devices (4,5,6 and 13 slot mainframes)
  Contains the power and cooling mechanism
  Contains the communication backplane

- **Slot 0 Interface:**
  Backplane management and (Shared) System Clock sources
  Arbitration
  Remote control through various comm interfaces

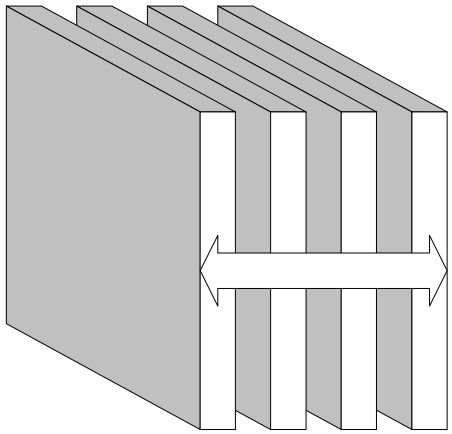
- **Resource Manager:**
  Configures the modules for proper operation at power-up and reset

- **Host Controller:**
  Controls the operations of the ATE system and environment

Specification Overview *Electrical*

The VXIbus specifies has two primary backplane connectors (P1 and P2). The P1 connector, (mandatory in VME or VXIbus), carries the data transfer bus. The P2 connector, expands the data transfer bus to a full 32-bit size, and adds:

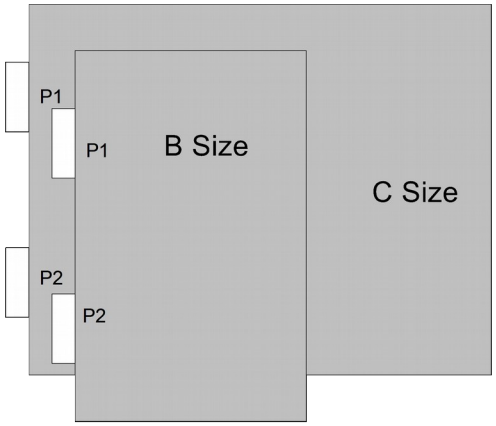
- Four additional power supply voltages
- The local bus
- Analog sumbus
- TTL and ECL trigger buses
- 10 MHz differential ECL clock signal



Specification Overview *Mechanical*

P1 16-bit data VMEbus
24-bit addressing
+5, +/-12 Volts

P2 32-bit data VMEbus
10 MHz clock bus
Analog sumbus
12-pin local bus
TTL/ECL trigger buses
-5.2, -2, +/-24 Volts



- **C-size cards allow for the addition of EMC/EMI shielding**
- **Industry's most common and widely supported modular footprint is the C-size card**
- **One unique logical address (ULA) per VXIbus device, allowing for 256 ULAs in a single VXIbus system**
- **Other platforms (i.e. M-modules, PMC, PXI, VME) can be accommodated through the use of adapters**

	Size	Spacing
C Size	23.3 x 34 cm (9.2 x 13.4 in.)	3 cm (1.2 in.)
B Size (VME)	23.3 x 16 cm (9.2 x 6.3 in.)	2 cm (0.8 in.)

Specification Overview *Power & Cooling*

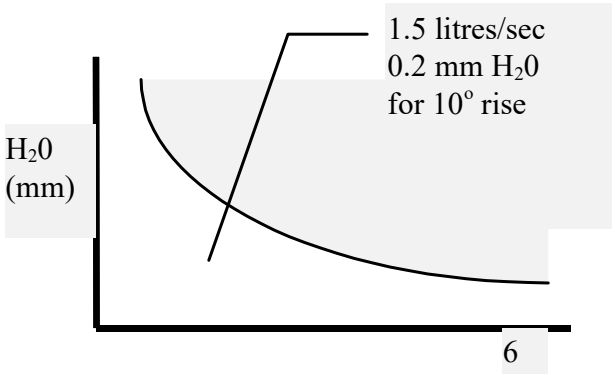
P1

Volts P1	Qty Pins P1	Power P1
GND	8	
+ 5V	3	15W
+ 12V	1	12W
-12V	1	12W

P2

Volts P2	Qty Pins P2	Power P2	Power P1 & P2
GND	18		
+ 5V	4	20W	35W
+ 12V			12W
-12V			12W
+ 24V	1	24W	24W
-24V	1	24W	24W
-5.2V	5	26W	26W
-2V	2	4W	4W

- The VXIbus mainframe is specified for power delivered. Each power supply has a peak DC current delivery and peak-to-peak dynamic current delivery.
- By calculating the total power and current of modules within the system, the total system power can be determined.
- The VXIbus mainframe specifies worst-case pressure drops vs. airflow rate through a single slot.
- Each instrument must specify airflow and back pressure required (normally for a 10°C rise in temperature). System cooling can be determined by plotting on a mainframe graph.
- Optimize mainframe for cooling/power. Remember that more cooling extends component life.

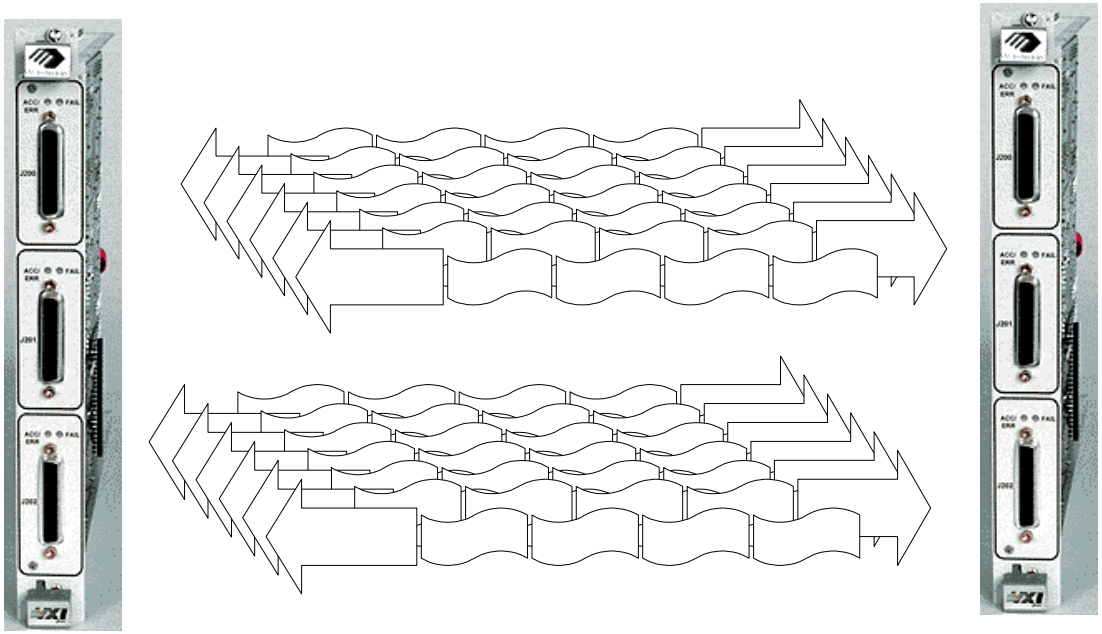


Specification Overview *Power & Cooling*

- **Power - VXI added power supplies**
  - **+5 V DC - Main power source for most VXI Instruments**
  - **+/- 12 V DC - Used for powering analog devices, communications interfaces**
  - **+/- 24 V DC - Used for powering analog signal sources (20V into hi Z) plus +/- 15 V regulators**
  - **-5.2 V DC - For ECL devices**
  - **-2 V DC - Used for the termination of ECL loads**
  - **+5 V DC STDBY - Standby for memory / power lost**

Specification Overview *EMI/EMC*

The VXIbus specifies radiated and conducted EMC limits for both generation and susceptibility. This ensures that modules containing sensitive electronic circuits perform to expectations without interference from any other module operating in the system.

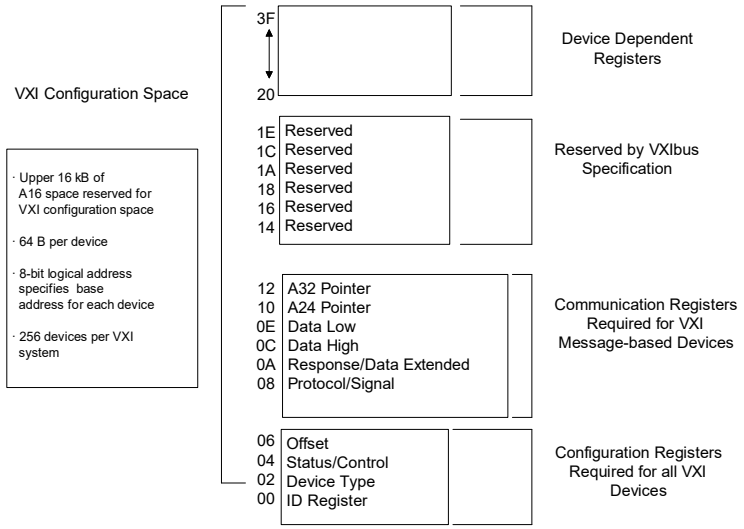


Communicating with the VXIbus Instruments

Hardware Communications:

- External computer to VXIbus chassis interface:
  GPIB/VXI, MXI2/VXI, USB 2.0/VXI, Firewire/VXI, LAN/VXI, etc.
  PC-platform and OS independent

- Embedded computer:
  Resides in the slot 0, generally PC-based



Two main ways to communicate with a VXIbus device:

- **Message-based devices**
  The message-based device has a Word Serial Protocol to allow ASCII-level communications. SCPI builds upon this.

- **Register-based devices**
  The register-based device communicates only through register reads and writes. Configuration is controlled by VXIbus-defined configuration registers but programmed through device dependent registers.

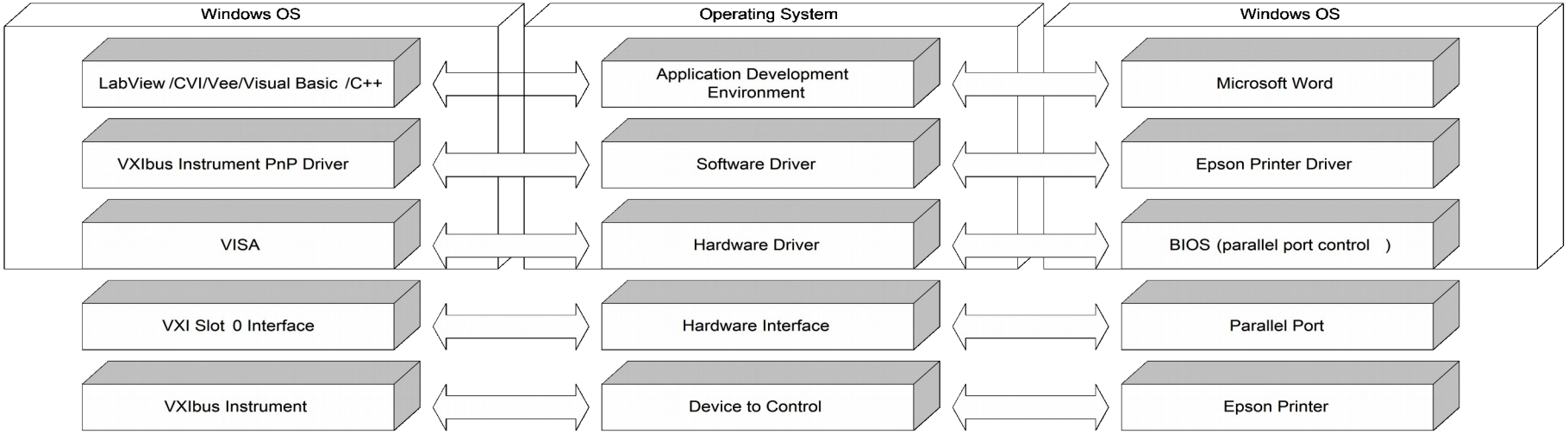
VXI plug&play drivers use the VISA protocol to provide an API that is communications agnostic.

Software

Controlling a VXIbus Instrument

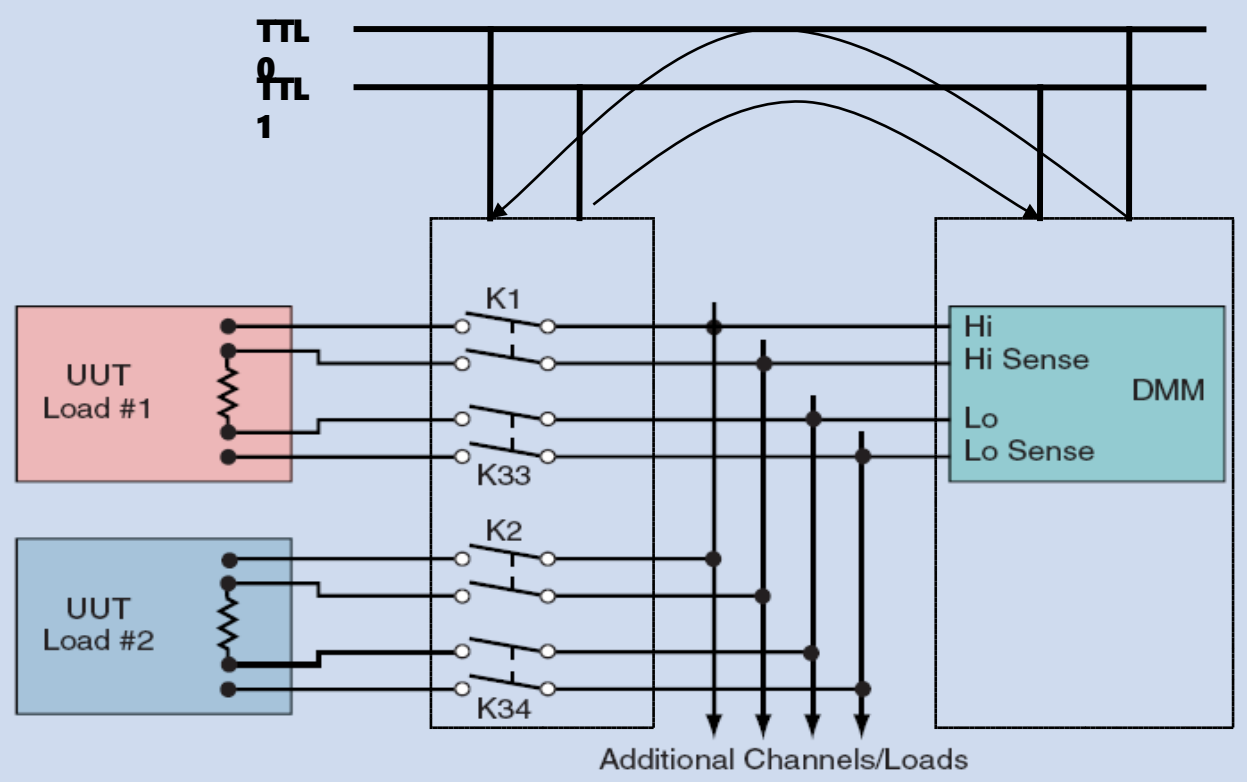
Software Model

Controlling a printer



Using the Trigger Bus *Application*

- TTL0 – DMM measure complete, close next relay channel
- TTL1 – Relay has settled, initiate DMM measurement

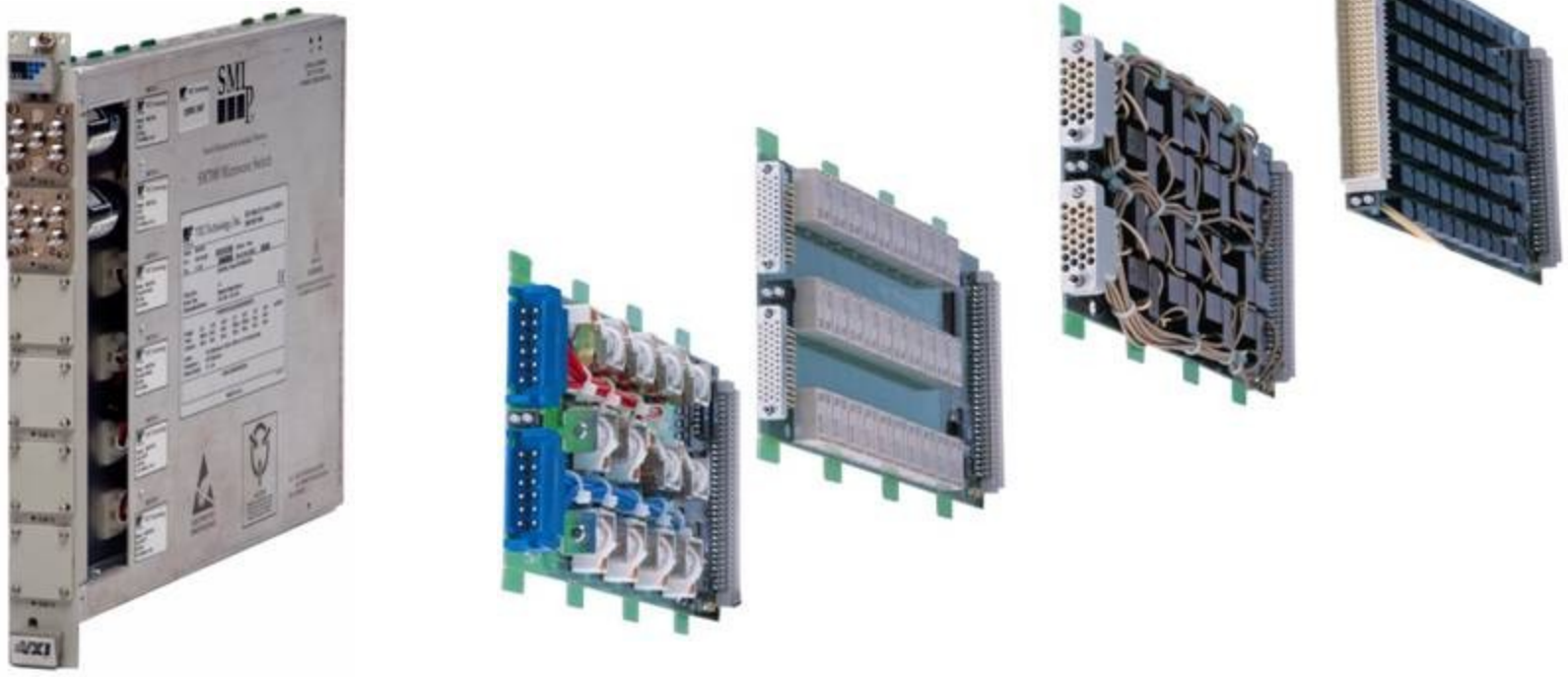


- Highly deterministic asynchronous handshaking **significantly** reduces test time by removing any dependency on host controller to manage the switch/measure sequencing

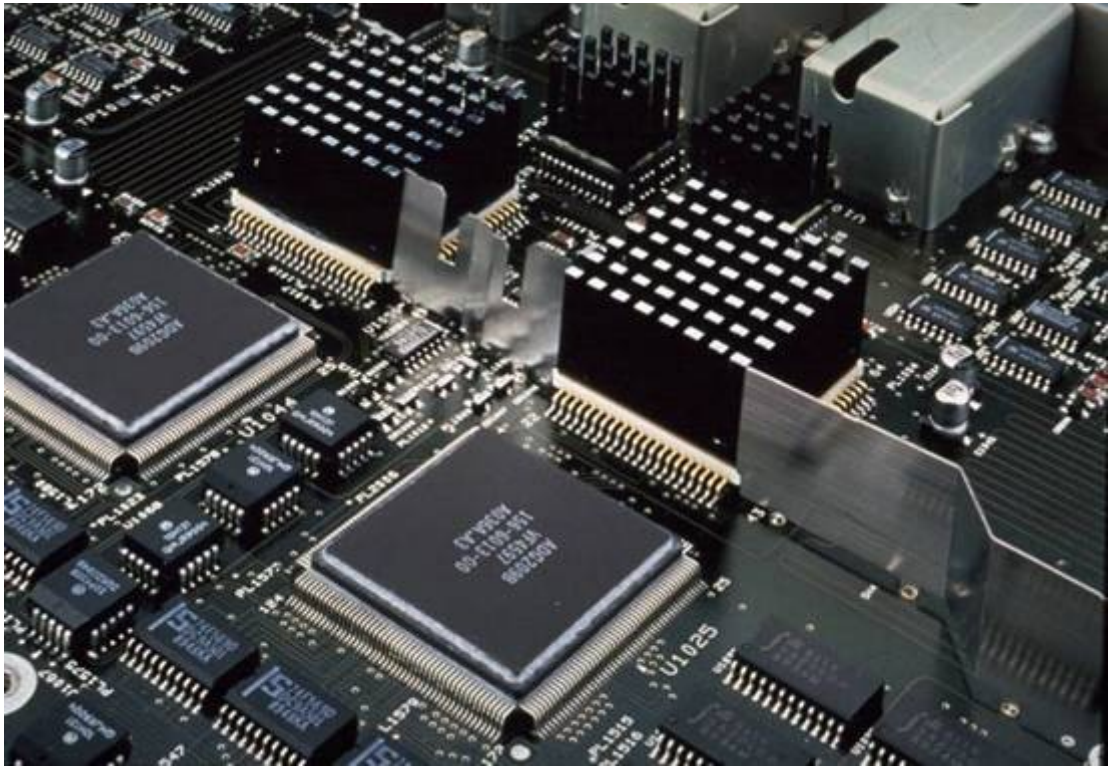
Connectors

Mechanical

- **1.2" Center spacing permits use of larger components, and more robust, ergonomically friendly connectors**
  - 6 x 6 RF matrix (18 GHz) in two slots
  - (20) SPST 30 A relays in one slot
  - (144) 2-wire crosspoint, 2 A switched relays in ½ slot



Larger Components = Robust Designs



Flexible Remote Control

The VXIbus can attribute its longevity in part to its ability to adapt to newer communication bus architectures for remote control without affecting backward compatibility.

PCI-VXI

USB 2.0-VXI

PCIe-VXI

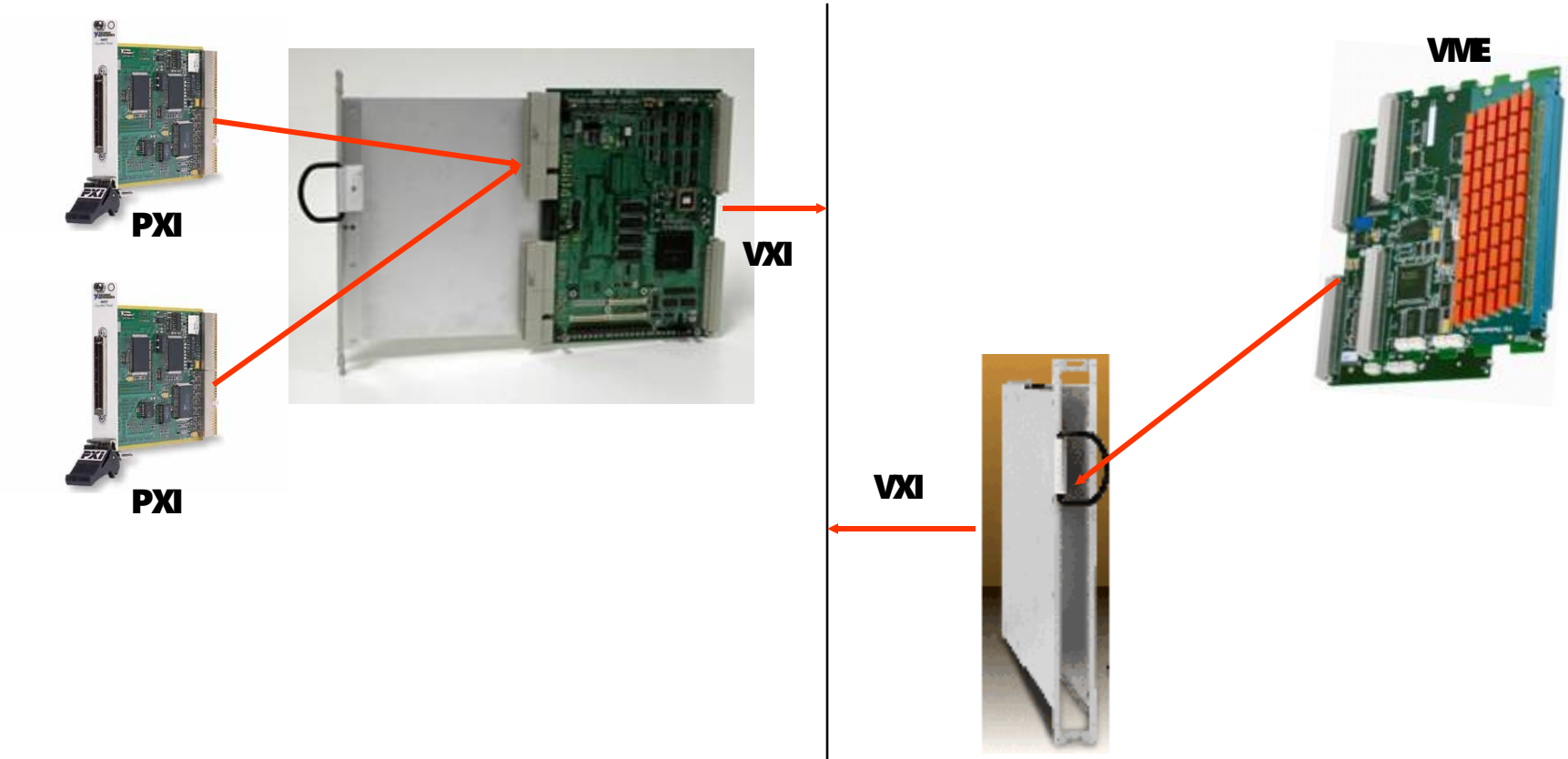
GPIB-VXI

IEEE1394-VXI

LXI-VXI

A Platform that Unites

- VXI adapts many platforms via carriers in a single mainframe
  - Can eliminate need for multiple mainframes within a system



Module within a module platform

The VXIbus specification permits multiple 'sub-modules'.

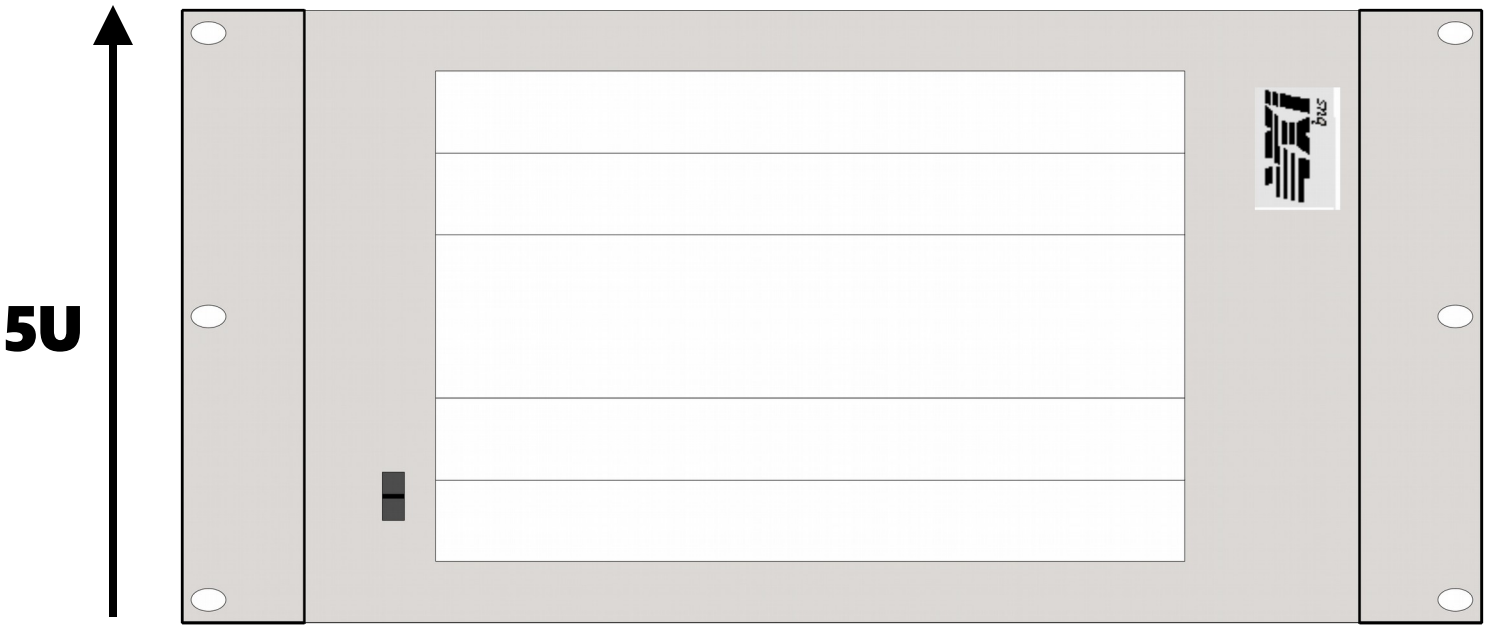
- Each can be treated as an independent instrument with discrete logical address.

Enables very high-density, flexible system

- 6.5 Digit DMM
- 200 MHz Dual Channel Counter/Timer
- 50 MSa/s AWG

- 6 unique functions in two slots

VXIbus Capability in Small Footprint



SYSTEM DEFINITION, 6-slot VXI Mainframe (5U)

Host Communication Interface, LXI-VXI bridge
16 channel 100 V threshold detector/interrupter
8 channels, independent, isolated DAC, 32 V dc/0 – 20 mA
50 MSa/s Arbitrary Waveform/Function Generator
6.5 Digit DMM
16 channel 16-bit independent 100 kSa/s ADC (40 V)
Dual Channel 200 MHz Counter/Timer

(80) SPST, 300 V/2 A relays
Prototyping breadboard
12 x 24, 300 V/2 A matrix (two modules)
(10) SP4T 50 Ohm Coaxial Trees, 1.3 GHz
(12) SPDT, 16 A, 300 W dc relays
(8) SPDT, 20 A, 600 W dc relays
(2) 1 x 24 1000 V multiplexers

Interfacing DUTs to VXI Instrumentation

A Test Receiver…

- Brings all of the instrument and switching I/O out to a common interface panel
  - ICA= Interface Connector Assembly
  - Or
  - Receiver
- Permits use of multiple adapters to map into the I/O of a unit being tested
  - ITA= Interface Test Adapter
  - Or
  - ID = Interface Device

When to use a receiver

When using a common tester to test…

- **Multiple products**
- **Multiple assembly levels of the same product**
  - **Assembled unit vs. PCB**
  - **LRU vs. SRU in military terms**

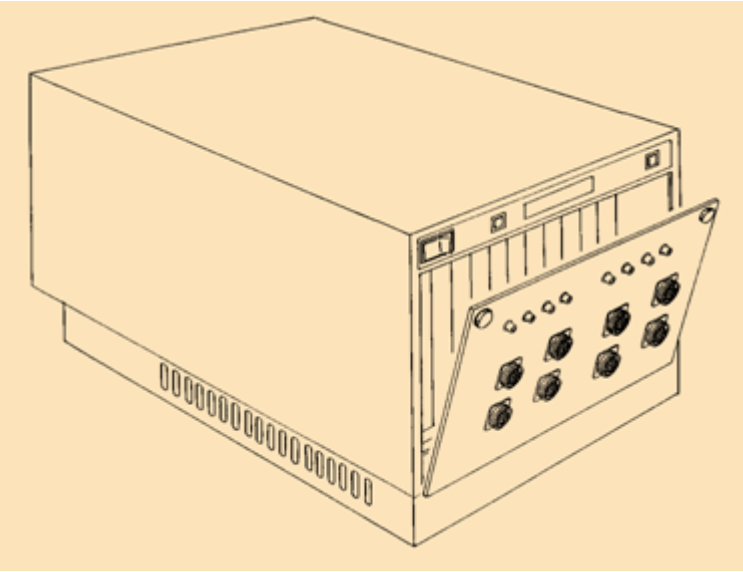
To minimize failures of instrument contacts

- **Reduces wear/tear directly on instrument**
- **Receiver contacts have higher insertion counts/easier to repair**

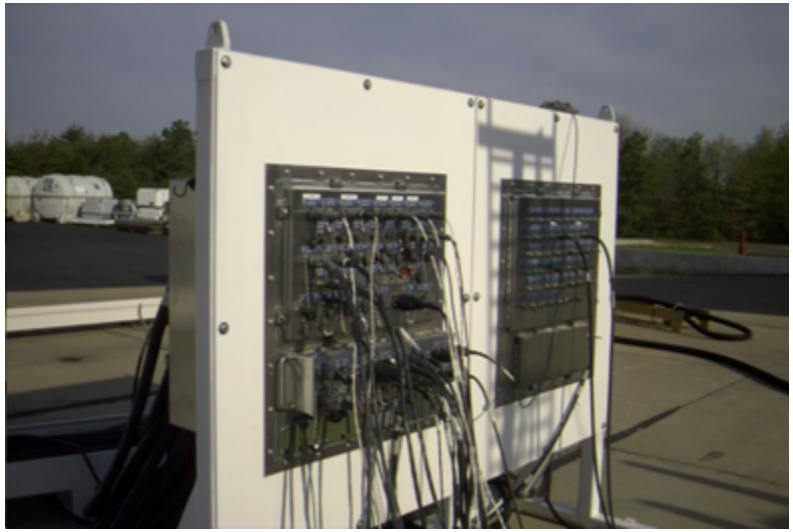
When a receiver is not needed

Single-Purpose Test Systems may not require a Receiver

- Dedicated connectors on VXI chassis



- Dedicated connectors on external panel



Direct Connector Hinged

Direct Connect shortens cables, reduces capacitance, path resistance

Hinged Assembly provides service loop

VXI Bus Consortium 2008

- **VXIbus Consortium owns, develops and promotes the VXI standard**
- **New Officers, Exec. Director, and members in last two years**
- **Working on advances to the VXI Specification**
  - **VXI 4.0 Technical Working Group**
- **Four pillars of VXI messaging**
  - **Well Conceived –** Created by leading test and measurement companies, the VXI bus is a well defined and open industry standard.
  - **Established** – With a 21 year history of success, VXI has established itself as the most prevalent modular instrumentation bus.
  - **Time Tested** – VXI is the de-facto standard for applications that have long life cycle requirements. The VXI bus provides system designers the security of knowing that their test platform will outlive the device it was originally designed to test.
  - **Thriving** – As significant investment in the new development on the platform continues, VXI is thriving. Its flexibility allows VXI to play a key role in hybrid systems that also PXI, LXI, and GPIB components.

VXI Bus Consortium 2008

- **Marketing Promotion of the VXI standard**
  - **Website re-design and content renewal in last two years (www.vxibus.org)**
  - **VXI Newsletter**
  - **VXI Panel at AUTOTESTCON 2008:**
    - **VXI Current and Future Panel – 1:15-3:00 PM– Wed., Sept. 10th**
      - **Moderator**
        - Bob Helsel, *Executive Director – VXIbus Consortium, PXI Systems Alliance, LXI Consortium*
        - *Director of Services - IVI Foundation*
      - **Panelists**
        - Charles Greenberg, *Technical Working Group Co-Chair, VXIbus Consortium (EADS)*
        - Fred Bloennigen, *Bustec – representing Torsten Rissel, Technical Working Group Co-Chair, VXIbus Consortium (Bustec)*
        - Tom Sarfi, *President, VXIbus Consortium (VXI Technology, Inc.)*
- **VXI is alive and well!**
  - **Promotion of >20 new VXI products in the last two years**

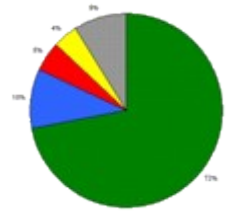
VXI Bus Consortium Officers

- **President:**
  - **Tom Sarfi, VXI Technology**
- **Technical Working Group Co-Chairs:**
  - **Charles Greenberg, EADS-NA Defense & Torsten Rissel, Bustec**
- **Executive Director & Marketing Working Group Chair:**
  - **Bob Helsel, Bode Enterprises, LLC**

The Evolution To VXI 4.0

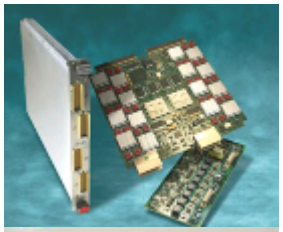
- **Survey results: In January, 2007, the VXIbus consortium surveyed all consortium members about some proposed VXI enhancements. Fourteen member companies responded:**

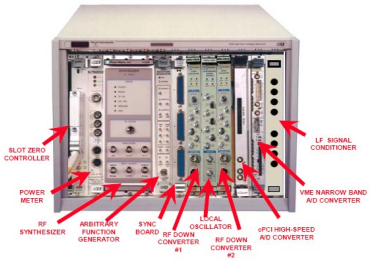
Questions	Response
Update VXI standard to include new features and technologies?	Yes: 64%
Which proposed enhancements would be important to you?	
- 5-row P1 and P2 connector for extra functionality	Yes: 58%
- VITA-41 (VXS) switched serial bus on backplane	Yes: 69%
Should the VXIbus standard include 2eSST protocol?	Yes: 50%
Which VITA-41 protocol is preferred if one is chosen?	PCI Express: 71%
Should multiple VITA-41 Serial Protocols be supported?	Yes: 62%



What Application Spaces Benefit from VXI 4.0?

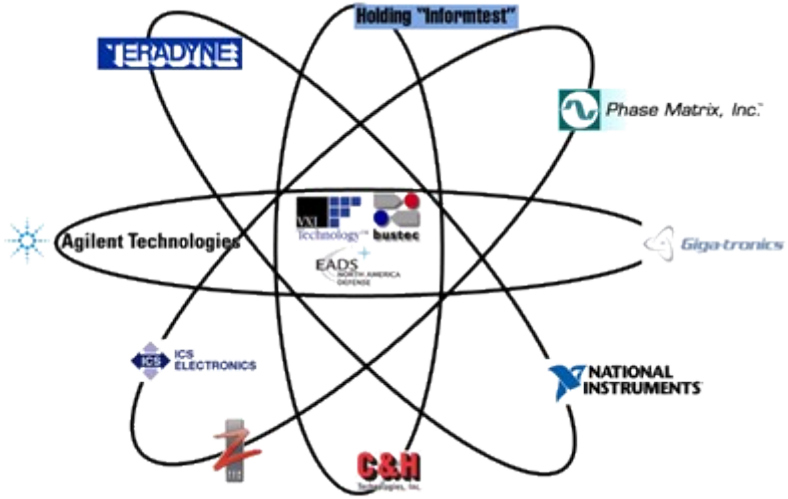
- **Digital Test:** Need more power and throughput for today's high speed serial and parallel bus architectures
- **Data Acquisition:** Need more cumulative throughput across the communications bus
- **RF and Synthetics:** Need more power and high speed paths between measurement and processing blocks
- **Military Test Systems:** New systems like eCASS need existing VXI features plus hot-swap, more throughput and power





The VXI 4.0 Technical Working Group

- Technical Working Group was given the green light by the VXI board to move forward with 4.0 development.
- Agilent Technologies, Bustec, EADS NA, National Instruments and VXI Technology all approved this motion
- More participating companies are encouraged to participate. All have a stake in the platform's direction

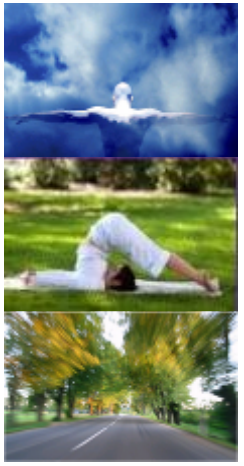


The Benefits of the Specification Update

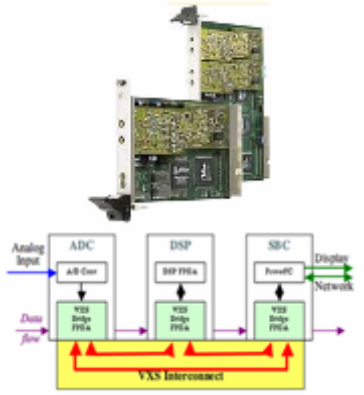
- **Protects Your Investments:** A newly relevant specification adds capability to VXI applications while maintaining backward compatibility with previous revisions
- **Provides a Future Path:** Most powerful modular instrument platform…period
- **Promotes VXI:** The bus you can trust for solutions to DEMANDING electronics test
- **Produces Solutions:** Extends the VXI track record as the primary test solution when:
  - The price of failure is very high
  - The products that are being tested have a long life cycle and need a test platform is not prone to obsolescence
  - Reduced size, open standard, interoperable, fast, and cost-effective solution required
  - C-size VXI is the perfect card geometry

Goals of VXI 4.0

- 5-Row Connector
  - Compatible with Legacy VXI
  - Increases power capability and flexibility
  - Incorporates 2eSST for 320MB/s parallel transfer
- VITA-41 (VXS)
  - Remain compatible with all Legacy VXI
  - Increase cumulative throughput to 48 GB/s (GenII)
  - Compatibility with cPCI, PXI & PXI Express with simple adapters and VME for DSP/CPU, etc.
- Optional VXS Live Insertion Compliance (Hot-Swap)



PCI EXPRESS



VXI 4.0 Summary

- Proposed VXI enhancements would make VXI the world's most powerful instrumentation bus for many years to come
- It would be fully backwards compatible with existing VXI modules
- Transparent support for VITA-41 (VME), PXI and PXI Express modules with no software changes
- A high-end packaging solution for military/aerospace test, high-speed digital, RF, synthetic, and data acquisition applications