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User Manual

Tektronix

VX1401
C Size Mainframe

070-9065-00

Please check for change information at the rear of this manual.

First Edition: June 1994

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Operators Safety Summary

The general safety information in this summary is for both operating and servicing personnel. Additional specific warnings and cautions are found throughout the manual where they apply, and may not appear in this summary.

TERMS

In This Manual

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the module or other property.

Marked on the Module

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property, including the module itself.

SYMBOLS

In This Manual

This symbol indicates where applicable cautionary or other information is to be found.



This symbol indicates where special explanatory information is included in the manual. There is no caution or danger associated with the information.

Marked on the Module



DANGER — High Voltage.



Protective ground (earth) terminal.



ATTENTION — Refer to the manual.



Refer to manual before using.

Power Source

This module is intended to operate in a mainframe whose power source does not apply more than 250V rms between the supply conductors or between either supply conductor and ground. A protective ground connection through the grounding conductor in the power cord(s) is essential for safe operation.

Grounding the Module

This module is grounded through the grounding conductor of the mainframe power cord(s). To avoid electrical shock, plug the mainframe power cord(s) into a properly wired receptacle before connecting to the module connectors. A protective ground connection through the mainframe is essential for safe operation.

Danger Arising from Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts can render an electric shock.

Use the Proper Fuse

To avoid fire hazard, use only fuses specified in the module parts list. A replacement fuse must meet the type, voltage rating, and current rating specifications required for the fuse that it replaces.

Do Not Operate in Explosive Atmosphere

To avoid explosion, do not operate the module in an explosive atmosphere.

Do Not Remove Covers or Panels

To avoid personal injury, the module covers should be removed only by qualified service personnel. Do not operate the module without covers and panels properly installed.

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Preface

This is the user manual for the VX1401 Mainframe.

Please read and follow all instructions for installation and configuration.

This manual assumes you are familiar with VXIbus instruments and operation, and with the purpose and function of this instrument. The *Operating Basics* section presents an overview of this instrument's operation.

Conventions

The names of all switches, controls, and indicators appear in this manual exactly as they appear on the instrument.

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Getting Started

Product Description

System Configuration

The Tektronix/CDS Instrument on a Card (IAC) System is an easy-to-use integrated modular system for implementing automatic testing, data acquisition and control, and remote-monitoring instrumentation systems. Based on IAC technology, the system permits the compact, inexpensive "test station in a box" approach to ATE, instead of bulky, expensive, "rack and stack" stations. Versatile and rugged, the Tektronix/CDS IAC system provides significant advantages in space, cost, and performance.

One of the primary building blocks for this system is a Tektronix/CDS VXIbus mainframe for C size and smaller modules. Tektronix/CDS offers two versions of a C size mainframe with 13 slots capacity. (A five-slot C size mainframe, the VX1405, is also available.) The two 13-slot mainframes, the VX1400 and VX1401, provide alternatives not only in cost, power, and weight, but also in dynamic current and noise performance.

The VX1400 Mainframe provides slightly more useable power (702 Watts vs. 570 Watts). At lower cost and weight, though, the VX1401 Mainframe is the preferred model in most other respects. By making more efficient use of available power, the VX1401 provides substantially better dynamic current capacity and low noise levels over a wider range of instrument loading than the VX1400. The lower power capacity also permits extending the operating temperature range to -10° to 55° C (from 0° to 50° C).

The VX1400 or VX1401 Mainframe is designed to hold up to 12 instrument modules plus a Resource Manager/Slot 0 module, such as the Tektronix/CDS VX4521 Advanced Slot 0 Device/Resource Manager Module, for use in IEEE-488 applications with an external system controller. Alternately, the mainframe can use an embedded PC-AT-386 compatible system controller/slot 0 unit, such as the Tektronix/CDS VX4544. The VX4544, with a hard drive, floppy drive, and a full-size expansion slot, occupies three instrument slots, leaving ten slots for instrument modules.

The VX1401 is delivered complete with backplane, power supplies, all chassis hardware, and a decorative front panel. The unit also includes rack mounting hardware so that it may be mounted in a standard 19 inch NEMA equipment rack. Sufficient room (3 inches) is provided between the front panel and the metal front panel of the IAC modules to conceal cables being routed to the UUT (Unit Under Test) or other instruments. Cables are normally routed from connectors located on the module front panels through an integral cable tray to the rear of the chassis. In addition, vertical cabling between instruments in VX1401 Mainframes is provided by cabling openings at the top and bottom of the chassis in front of the instrument front panels. (Note that the unit may be operated without the decorative panel installed. The thermal integrity of the

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VX1401 will not be affected if filler panels are properly installed in empty slots.)

The VX1401 Mainframe with its installed plug-in IAC modules operates as an integrated unit controlled by a user-defined system controller, which may be an external device or an internal embedded computer. All Tektronix/CDS Series IAC Modules are fully compatible with the VX1401. In addition, CDS 53/63 series modules may also be utilized by using a 73A-853 Adapter Module.

Backplane

The VX1401 eight-layer monolithic backplane supports all of the VXIbus system architecture features designed to facilitate system performance, including fast bus arbitration, asynchronous bus structure, powerful capabilities for handling interrupts, and non-multiplexed paths for address and data. All of the specifications for signal timing, noise, crosstalk, termination, driving, and loading fully comply with the VXIbus Standard. The VXIbus signal lines specified for P2 (MODID, CLK10, LBUS, SUMBUS, TRIG lines, etc.) are incorporated into the backplane.

Compatibility

The required VMEbus terminations are also included as part of the backplane. In addition, the VMEbus Specification requires that certain signals (IACK*, BGINX*, BGOUTX*) be daisy-chained along the backplane. The provisions for meeting this requirement are accessible through the front of the VX1401 Mainframe.

The VX1401 Mainframe supports all of the VXIbus requirements for a C size mainframe. All VXIbus defined voltages are supplied (+5, -5.2, -2, +12, -12, +24, and -24 Volt power supplies are mounted in the VX1401). The VX1401 is switch selectable for either 115 or 230 Volts AC at frequencies ranging from 45 Hz to 440 Hz.

Cooling is supplied by four internally-mounted fans, one of which is dedicated to cooling the power supplies. This results in a cooling capacity of an average of 35 Watts per slot for typical VXIbus IAC modules (455 Watts for a fully loaded system), based on a maximum temperature rise of 10° C in the card cage and an ambient temperature range of -10° to +55° C. The VX1401 will operate in environmental conditions from -10° to +55° C, and in relative humidity ranging from 0% to +95%. Its rugged 0.125 inch thick aluminum skin permits operation in physically demanding applications.

Tektronix/CDS offers a variety of instrument and interface cards compatible with the VX1401, which are designed to accomplish a wide range of test and measurement functions. The current copy of the Tektronix/CDS Information and Ordering Guide gives detailed specifications and functional descriptions of available IAC modules.

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Installation

To mount a mainframe in a standard 19 inch rack, refer to the diagrams and the steps below. To remove a mainframe, reverse these steps. The tools required are a #2 Phillips-head screwdriver, a flat blade screwdriver, and a 3/8 in. wrench.

1. The VX1401 Mainframe is shipped with the mainframe chassis slides attached when ordered as part of a configured system. Remove the cabinet slide sections, the mounting brackets, and the separately-bagged hardware (nuts, bolts, and washers) from the shipping container. Save the shipping container for future use. Any hardware remaining after installation may be used as spares.

2. Referring to Figure 1, attach the front and rear mounting brackets to the cabinet slide section. The rear brackets are longer than the front brackets. Leave the hardware loose. If more than one mainframe is to be installed, determine the position of all mainframes before installing the first one.

   NOTE:

   The mounting holes on the rails of a standard 19 inch rack are in an asymmetric pattern. Use the correct mounting pattern for the mainframe to be installed.

   Be sure that the TOP and TWO BOTTOM slots on the mounting bracket are aligned with a tapped #10-32 hole on the rack rail. The second slot will partially cover the hole beneath it. If the slots are not properly aligned, installation of more than one mainframe will not be possible.

3. Adjust the length of the combined mounting brackets and cabinet slide section. Position the rear mounting brackets at the back of the cabinet. Position the front mounting brackets against the rear side of the cabinet front mounting rails, approximately in line with the front of the cabinet slide section. Tighten the hardware once the brackets are adjusted.

4. There should be a distance of 1.985 in. from the bottom of the mainframe to the centerline of the bottom slot of the mounting bracket. Mount the cabinet slide section to the cabinet as shown. Be sure that the cabinet slide sections on both sides are mounted at the same height.

   To make any necessary vertical adjustments, loosen the #10-32 screws that secure the rack slide mounting brackets to the rack mounting rails. Move the mainframe into position and tighten the screws. The vertical adjustment range is approximately 0.06 inches.

5. Check all of the hardware to see that it is tight and secure.

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WARNING

Inserting the VX1401 Mainframe into the cabinet requires two people: one to help lift and guide the card cage chassis slide wheel bearings into the cabinet slide section, and one to lift the mainframe. Because of the size and weight of the mainframe, injury may result if one person tries to install it alone.

6. Fully extend the sliding section of one of the cabinet slides until it locks into place. Repeat this procedure with the other cabinet slide.

7. Lift the VX1401 Mainframe by its handles, and insert both attached chassis slide sections into the sliding sections of the two cabinet slides. Make sure that the chassis slide wheel bearings are engaged and are riding freely.

8. Completely insert the VX1401 Mainframe into the rack by depressing both chassis member latches from their locked position, and pushing the mainframe until its rack ears are flush against the cabinet mounting rails.

Additional mainframes can now be installed, if desired.

To install another mainframe above or below the first one, find the next set of properly aligned mounting holes in the rack rails, and install the mounting brackets of the mainframe rack slide assemblies as described above. If necessary, adjust the height of either or both mainframes for proper vertical clearance between them.

Repeat as needed to install all remaining mainframes.

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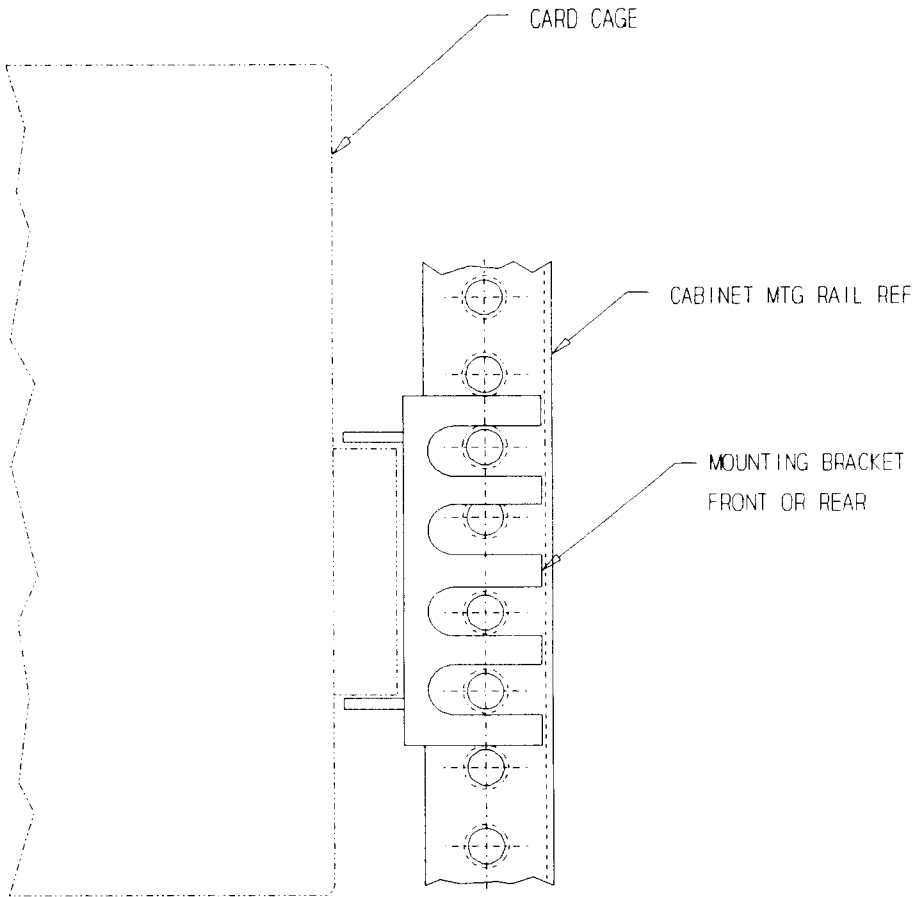


Figure 1: Cabinet Mounting

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Operating Basics

Functional Overview

Modules installed in the VX1400 are programmed by ASCII characters issued from the system controller to the modules via the module's VXIbus commander and the VXIbus mainframe backplane. Refer to the manual for the VXIbus device that will be the commander for details on the operation of that device.

Power Budget

The VX1401 has two power supplies located at the rear of the mainframe. At an ambient temperature over +55°C, the power supplies are rated at 500 W. At ambient temperatures of less than +55°C, the supplies are rated at 570 W. The VX1401 Mainframe is designed to dissipate an average of 35 W per slot with a 10°C temperature rise within the card cage. The Power Budget Worksheet in Appendix A should be filled out before applying power to the card cage for the first time to ensure that individual power supply voltages will not be exceeded.

Grounding

A terminal block, providing access to chassis ground and power-supply ground, is located at the rear of the card cage. Terminal 1, labeled PSGND, is power supply ground and Terminal 2, labeled ACGND, is chassis (water-pipe) ground. The system is shipped with a shorting bar between Terminals 1 and 2, connecting the two grounds together. The shorting bar may be removed to float the power supplies.

CAUTION

At frequencies over 63 Hz, leakage current becomes significant and agency safety approvals no longer apply. Never operate the VX1401 without the safety ground properly connected.

5V Standby Power Supply

The terminal block, located at the rear of the VX1401 Mainframe, has a screw terminal labeled +5V SBY that can be used to connect a 5V standby power supply to the VX1401 Mainframe. The total current on the 5V standby input may not exceed 0.5 amps.

Fuses

Each power supply has a fuse. For 115 V operation, fuse F1, located toward the side of the mainframe, should be a 7A fuse. F2, located toward the center of the mainframe, should be a 5A fuse.

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For 230 V operation, fuse F1 should be a 3A fuse, and F2 should be a 2.5A fuse. The unit is shipped with the appropriate fuses for the country it is being shipped to.

230 Volt Operation

The VX1401 is shipped from the factory with the ac input voltage set for the appropriate ac voltage of the country it is being shipped to. If the unit's operating voltage must be changed for any reason, the AC Select switch on the rear panel of the unit must be changed. To change the operating voltage, use a slotted screwdriver to move the switch to the desired position (115 V or 230 V).

For continued protection against fire, replace the fuse with the specified values when changing to 230V operations.

CAUTION

Unplug the unit from the electrical outlet before moving the switch, or the unit will be damaged.

Since all of the cooling fans are operated on 24V dc, no other modifications to the unit are required.

Power Cords

WARNING

The card cage operates from a single-phase power source, using a detachable three-wire power cord with a two-pole, three-terminal grounding type plug. The voltage to ground (earth) from either pole of the power source must not exceed 250 volts.

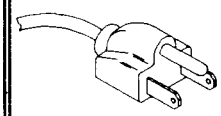
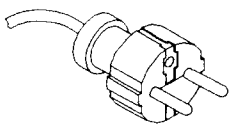
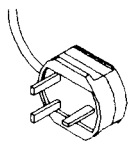
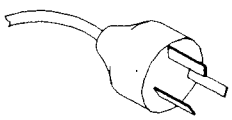
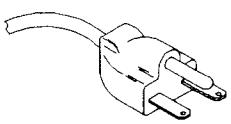
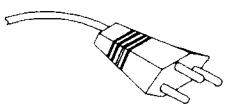
Before you connect the mainframe to the power source, be sure that the AC Select switch on the rear fan plate is set to match the power source, and that the power cords have suitable plugs (two-pole, three-terminal, GROUNDING type).

All accessible conductive parts of the card cage are directly connected through the grounding connector of the power cord to the grounding contact of the power plug. Therefore, the power plug must be inserted into a mating receptacle with a grounding contact. Do not defeat the grounding connection. Any interruption in the grounding connection can create an electric shock hazard.

Card cages are shipped with the required power cords (as ordered by the customer). Information on the available power cords is shown in the following table. Contact your Tektronix representative or local Tektronix Field Office for additional power-cord information.

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POWER CORD AND PLUG INFORMATION

PLUG CONFIGURATION	USAGE	LINE VOLTAGE	REFERENCE STANDARDS	OPTION NUMBER
	North American 120/15A	120V	ANSI C73.11 NENA 5-15-P	Standard
	Universal Euro 240V/ 10-16A	240V	CEE (7),II.IV.VII	A1
	UK 240V 13A	240V	BS 1363 IEC 83	A2
	Australian 240V/ 10A	240V	AS C112	A3
	North American 240V/ 15A	240V	ANSI C73.20 NEMA 6-15-P IEC 83	A4
	Switzerland 220V/ 6A	220V	SEV	A5

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Backplane

The backplane is a circuit board with two 96-pin DIN gas-tight connectors (P1, P2) for each slot. Connector P1 is located on top of the backplane, and connector P2 is located on the bottom of the backplane.

The backplane is fully VXIbus-compatible. The specifications for timing, noise, crosstalk, termination, driving, and loading all comply with the VXIbus Specification. Refer to Appendix B for signal names. For details on the definition of these signals, refer to the IEEE 1014-1987 Specification for the VMEbus signals and to the VXIbus Specification for definition of the VXIbus signals.

The backplane contains circuitry on each end of the board which provides the required signal-line-termination networks as described in IEEE 1014-1987. The VXIbus signals requiring termination are also terminated by circuitry on the backplane.

A Power Monitor circuit is included which meets the specifications in IEEE-1019-1987. The reset time on power-up is about 250 msecs. The delay from ACFAIL* to reset on power failure is approximately 8 msecs.

The backplane also contains the VXIbus-required MODID termination resistor, differential ECL active clock drivers, and bus termination and protection.

A ground surface is provided around each connector to allow modules with a totally enclosed shield to make contact with the backplane ground. The VXIbus recommended clearance is provided.

Backplane Jumpers

The P1 bus on the backplane includes five daisy-chained signals for bus arbitration and interrupt handling, as described in IEEE 1014-1987. If an empty slot appears between used slots in the chassis, these daisy-chained signals must be jumpered across the empty slot in order to allow the signals to propagate down the backplane.

Thirty molded jumpers (CDS Part #45001-10201, packaged separately) are supplied with the mainframe for jumpering backplane signals.

Individual molded jumpers can be placed on the backplane's jumper pins between each BGIN to BGOUT signal (four jumpers), and between the IACKIN to IACKOUT signal (one jumper). These jumper pins are accessible through the front of the VX1401 Mainframe. The five sets of pins for a slot are to the left of the P1 connector for that slot.

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Signal	Jumper to	Signal
BG0IN (B4) (B5)		BG0OUT
BG1IN (B6) (B7)		BG1OUT
BG2IN (B8) (B9)		BG2OUT

Cooling

Cooling for the VX1401 Mainframe is provided by three 24V dc fans located at the rear of the chassis just above the power supply. The air intake for the blowers is through louvers located on the sides of the card cage. The exhaust is through the three fans on the back panel of the card cage. A fourth fan is located on the right side of the card cage and provides air to the power supplies. The fan speed will increase as the air temperature in the card cage increases.

NOTE:
In some operating environments it may be necessary to have the VX1401's cooling fans running at full speed all the time. Refer to the Cooling Fan Speed Selection section in the Service Manual for instructions on how to set the fans to full speed.

The air going across the IAC modules is filtered by a large rectangular internal filter in a tray below the bottom of the IAC modules and above the cable tray. A filter for the power supply fan is mounted externally on the side of the card cage. The filters should be cleaned regularly, with a schedule appropriate to the operating environment. See the Cleaning Air Filters section in the Service Manual.

CAUTION

The cooling design of the VX1401 Mainframe relies on the front panels of the individual modules in the card cage to completely enclose the front opening of the card cage. If any slot in the card cage is not occupied by a module with a front panel, a blank front panel must be installed for that slot. Tektronix/CDS provides the required number of blank panels for each card cage shipped, based on the number of cards ordered. The plexiglas front panel is cosmetic, and is not required for proper cooling.

The VX1401 Mainframe delivers cooling capacity evenly across all thirteen slots. The graph shown in Figure 4 is accurate for any position in the card cage.

To determine if a VXIbus device will operate in the VX1401 Mainframe, the system integrator must obtain the cooling requirement of the module to be used. Take the published pressure drop in inches of water and check the cooling capacity at that pressure drop. If the VX1401 can deliver an equal or greater

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cooling capacity than the module requires, the module may be used in the VX1401 Mainframe.

Example:
The VX4520 Module requires 1.6 l/sec at a pressure drop of 0.02 in. H_20 to achieve a temperature rise of less than 10° C over ambient temperature. Looking at the graph, the VX1401 delivers about 6.5 l/sec at that pressure. The VX4520 will operate in the VX1401 Mainframe.

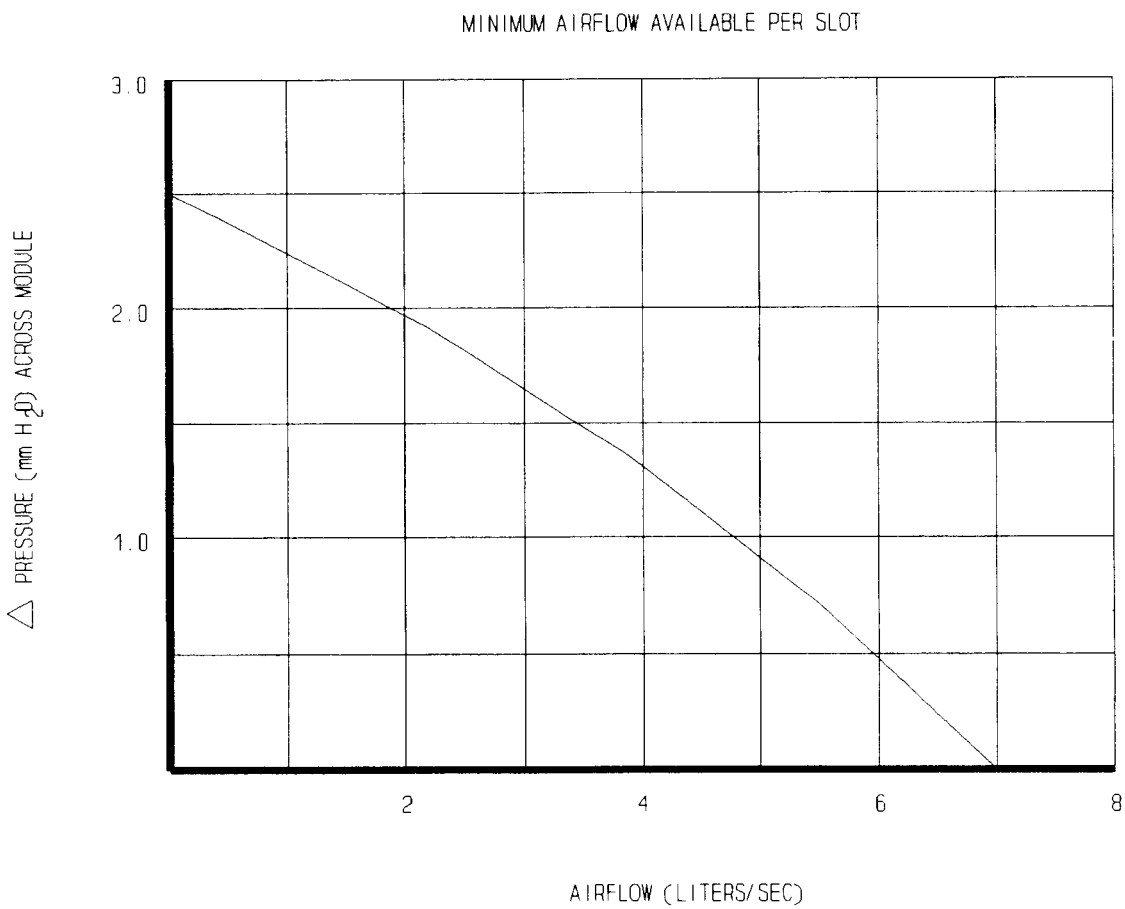


Figure 4: Cooling Graph

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Syntax and Commands

The VX1401 Mainframe does not require programming.

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Status and Events

Refer to the Operating Manuals for the installed modules to determine their status and events.

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Examples

The VX1401 does not require programming.

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Appendix A
Specifications

Card Positions:	Total of 13 positions. The left-most position is dedicated to the VXIbus Slot 0 device. The remaining 12 positions are available for instrument modules.
Installation:	The mainframe is supplied with rack-mounting hardware and chassis slides. Using the supplied hardware, the mainframe may be mounted in a standard 19-in. NEMA equipment rack (EIA RS 310, ANSI C83.9-1972).
AC Input Voltage:	90 V to 132 V ac or 180 V to 250 V ac. Switch selectable on rear panel. The unit is shipped set for 115 V (U.S and Japan) or 230 V (Europe).
AC Input Frequency:	45 to 63 Hz. The VX1401 will perform at frequencies up to 440 Hz. At frequencies over 63 Hz, leakage current becomes significant and agency safety approvals no longer apply. Never operate the VX1401 without the safety ground properly connected.
AC Input Current:	10 Amperes at 115 V ac. 6 Amperes at 230 V ac.
Inrush, Cold Start:	70 Amperes, maximum for ½ cycle.
Maximum Power Available:	570 Watts -10° to 55° C.

DC Voltage Capacity:

+5.0 V dc	55 Amperes
-5.2 V dc	10 Amperes
-2.0 V dc	2.5 Amperes
+24 V dc	6 Amperes
-24 V dc	6 Amperes
+12 V dc	5 Ampere
-12 V dc	1 Ampere

Voltage Regulation:

+5.0 V dc	+250 mV/-125 Mv
-5.2 V dc	-260 mV/+156 mV
-2.0 V dc	-100 mV/+100 mV
+24 V dc	+1.2 V/-720 mV
-24 V dc	-1.2 V/+720 mV
+12 V dc	+600 mV/-360 mV
-12 V dc	-600 mV/+360 mV

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Voltage PARD:	+5.0 V dc	50 mVpp
	-5.2 V dc	50 mVpp
	-2.0 V dc	50 mVpp
	+24 V dc	150 mVpp
	-24 V dc	150 mVpp
	+12 V dc	50 mVpp
	-12 V dc	50 mVpp

Power Supply Protection: Thermal shutdown provided for +5V, ±12V, and -2V. All voltages are provided with short circuit crowbar protection.

Cable Routing: All cables are routed either through the cable tray provided in the bottom of the cage and out the rear of the unit, or out the front of the unit with the plexiglas front panel removed.

Cable Clearance: All cables used must have a bend radius of less than 3 inches minus the distance the module's connector hood extends from the module's front panel. If this maximum is not met, the VX1401's plexiglass front panel must be permanently removed. The cable tray is 1.75 inches in height. The card cage cooling system will function properly with the plexiglas front panel removed.

CAUTION

All empty module slots must have a blank front panel installed for the VX1401's cooling system to function properly. Any specifications of cooling capacity of the VX1401 are voided by operating the unit with a slot uncovered.

Noise, dB: +66 dB, measured at 3 ft. in front of the card cage's plexiglas front panel with the cage free-standing and a hard, sound reflecting surface one foot behind the rear of the mainframe. With plexiglas front panel removed, noise level is +68 dB.

Cooling System: Four internal 24 V dc blowers.

Exhaust BTUs: 1370 BTUs, fully loaded card cage.

Airflow Direction: P2 to P1.

Mainframe Intake: Intake along sides of card cage, at bottom and front edges.

Mainframe Exhaust: Exhaust is out the rear panel.

Cooling Capacity: 136 l/sec maximum. 115 l/sec across modules and 21 l/sec across power supplies.

Slot Thermal Capacities: See Operation section.

Temperature, Ambient: -10° C to +55° C, operating.
-40° C to +85° C, storage.

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	In a rack system, the ambient air temperature in the rack must not exceed +55° C.
Humidity:	Less than 95% R.H. non-condensing, -10°C to +30°C. Less than 75% R.H. non-condensing, +31°C to +40°C. Less than 45% R.H. non-condensing, +41°C to +55°C.
Dimensions:	431.8 mm wide (482.63 mm with rack-mounting ears), 355.6 mm high, 622.3 mm deep (not including handles). (17 in x 14 in x 24.5 in).
Weight:	25.5 kg. (56 lb).
Weight, Shipping: (empty)	30 kg. (66 lb).
Equipment Supplied:	1 - VX1401 Mainframe. 1 - Operating Manual (Part # 00000-31401). 1 - Service Manual (Part # 00000-41401).
Safety Approvals:	UL Listed: File number E137225. CSA Certified: File number LR97263-1. Modules installed in the VX1401 must use circuit boards rated at a minimum of 94V-1.

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Appendix B
Input/Output Connections

P1 CONNECTOR PINOUTS

Pin No.	Row A	Row B	Row C
1	D00	BBSY	D08
2	D01	BCLR	D09
3	D02	ACFAIL	D10
4	D03	BG0IN	D11
5	D04	BG0OUT	D12
6	D05	BG1IN	D13
7	D06	BG1OUT	D14
8	D07	BG2IN	D15
9	GND	BG2OUT	GND
10	SYSCLK	BG3IN	SYSFAIL
11	GND	BG3OUT	BERR
12	DS1	BR0	SYSRST
13	DS0	BR1	LWORD
14	WRITE	BR2	AM5
15	GND	BR3	A23
16	DTACK	AM0	A22
17	GND	AM1	A21
18	AS	AM2	A20
19	GND	AM3	A19
20	IACK	GND	A18
21	IACKIN	SERCLK	A17
22	IACKOUT	SERDAT	A16
23	AM4	GND	A15
24	A07	IRQ7	A14
25	A06	IRQ6	A13
26	A05	IRQ5	A12
27	A04	IRQ4	A11
28	A03	IRQ3	A10
29	A02	IRQ2	A09
30	A01	IRQ1	A08
31	-12V	+5V STBY	+12V
32	+5V	+5V	+5V

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P2 CONNECTOR PINOUTS

Pin No.	Row A	Row B	Row C
1	ELECTRG0	+5V	CLK10+
2	-2V	GND	CLK10-
3	ELCTRG1	RSV1	GND
4	GND	A24	-5.2V
5	LBUSA00	A25	LBUSC00
6	LBUSA01	A26	LBUSC01
7	-5.2V	A27	GND
8	LBUSA02	A28	LBUSC02
9	LBUSA03	A29	LBUSC03
10	GND	A30	GND
11	LBUSA04	A31	LBUSC04
12	LBUSA05	GND	LBUSC05
13	-5.2V	+5V	-2V
14	LBUSA06	D16	LBUSC06
15	LBUSA07	D17	LBUSC07
16	GND	D18	GND
17	LBUSA08	D19	LBUSC08
18	LBUSA09	D20	LBUSC09
19	-5.2V	D21	-5.2V
20	LBUSA10	D22	LBUSC10
21	LBUSA11	D23	LBUSC11
22	GND	GND	GND
23	TTLTRIG0*	D24	TTLTRIG1*
24	TTLTRIG2	D25	TTLTRIG3*
25	+5V	D26	GND
26	TTLTRIG4*	D27	TTLTRIG5*
27	TTLTRIG6*	D28	TTLTRIG7*
28	GND	D29	GND
29	RSV2	D30	RSV3
30	MODID	D31	GND
31	GND	GND	+24V
32	SUMBUS	+5V	-24V

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Appendix C
Power Budget Worksheet

The system integrator must use the power budget worksheet to determine the operating parameters of the card cage and any instrument modules installed in it.

Slot No.	Card No.	POWER (WATTS) +5V	-5V	+12V	+24V	-12V	-24V	-2V	watts/slot (40 max)
1	VX4520	12.5	0	0	0	0	0		12.5
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
User total									
TOTAL 570 max		275 max	50 max	60 max	144 max	12 max	144 max	5 max	570 max

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Appendix D
Servicing

WARNING

These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Adjusting Power Supply

If the power supplies need to be adjusted, refer to the drawing below and the VX1401 Exploded Mechanical Assembly drawing and use the following procedure:

1. Remove the top and bottom covers as described in the *Assembly and Disassembly* section.

2. Remove the three screws (PSE 4, 5, and 6) holding the 5V power supply (PS1) to the chassis. These screws are on the bottom of the chassis, and are easily accessed by tipping the chassis on its left side (as viewed from the front).

3. Place the chassis back upright and remove the fan plate (RP 1). It is held on by nine screws (CCE 126-134). The fan plate will swing to the left.

4. Remove the five screws holding the baffle plate (BP2) on the power supplies.

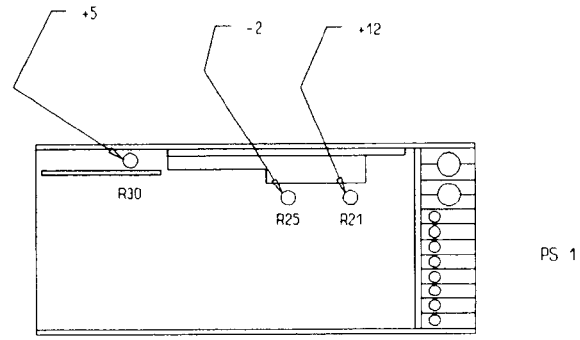
5. The 5V power supply may be lifted over the lip of the chassis and swung to the right. The adjustment pots for both power supplies are now accessible. Refer to the drawings below for their locations.

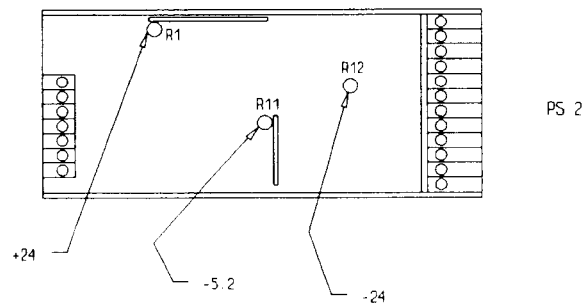
NOTE:

There must be at least a 5.5 amp load on the +5V supply. The backplane draws about 1.25 amps, so an additional load of at least 4.25 amps is needed. This can usually be met by a slot 0 module and one other module.

Re-assemble the unit by reversing the above steps.

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The adjustment for each supply voltage is independent, and may be adjusted without affecting the other supplies. The -12V supply has no adjustment. The VXI Specification and factory adjustments for each supply are as shown:

Power Supply	VXI Spec. Min.	VXI Spec. Max.	Factory Adjustment Min.	Factory Adjustment Max.
+5	+4.875	+5.250	+5.100	+5.200
+12	+11.640	+12.600	+11.930	+12.170
-12	-11.640	-12.600	-11.640 *	-12.600 *
+24	+23.280	+25.200	+23.760	+24.340
-24	-23.280	-25.200	-23.760	-24.340
-2	-1.900	-2.100	-2.010	-2.080
-5.2	-5.044	-5.460	-5.247	-5.353

* The -12V supply has no adjustment.

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Selecting Cooling Fan Speed

In some operating environments, it may be necessary to have the VX1401's cooling fans running at full speed all the time. The VX1401 has a two-position Fan Speed slide switch inside the mainframe. The switch is located in the power supply bay, on the right side (referenced from the front of the mainframe) above the power supply cooling fan. The fans are set to variable speed when the slide switch is in the UP position, and to full speed when the switch is in the DOWN position.

Unplug the VX1401 from the electrical outlet before setting the Fan Speed switch.

Cleaning Air Filters

Removal

The main filter can be removed from either the front or side of the mainframe.

To remove the filter from the front, a #2 Phillips and a flat blade screwdriver are required.

1. Remove any modules or blank filler panels covering slot 6.
2. Remove the small slotted screw that holds the rail's center support standoff in place. Be sure to keep the small lock washer from under the screw.
3. Remove the 6-32 flat screw that holds the standoff from underneath the mainframe. The filter can now be slid out the front of the mainframe.

To remove the filter from the side:

1. Remove the two slotted screws in the filter support bracket located on the left side of the mainframe (referenced from the front).
2. Remove the bracket for the filter support. The filter will drop down and can be removed from the slot on the left side of the mainframe. Be careful not to over-tighten the two slotted screws when re-installing the bracket.

To remove the filter of the power supply's fan, use a flat bladed screwdriver and snap the plastic grill out of the filter housing.

Cleaning

Clean both filters with mild soap and water. Be sure the filters are dry before re-installing them and using the mainframe.

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Assembly And Disassembly

The VX1401 is shipped fully assembled. The procedures for disassembly and assembly included here are for maintenance and repair purposes only. A schematic diagram that may also be used as a reference is included with this manual.

WARNING

Unplug the VX1401 Mainframe from the electrical outlet before removing or installing the power supplies. Severe electrical shock resulting in personal injury may otherwise occur.

The VX1401 is designed so that one person can disassemble the mainframe. To begin disassembly, remove the mainframe from the storage unit (see the Rack Mounting section). Place the mainframe on a large, clean work surface. The only tools required are a #2 Phillips-head screwdriver and a flat bladed screwdriver. To assemble the mainframe simply reverse these steps.

Removing the Top Cover

NOTE:

Do NOT loosen or remove the four screws of the power supply fan on the right side of the cage.

1. Loosen, but do not remove, the four screws that hold the left side rail to the left side of the mainframe. Remove the four screws that hold the right side rail to the right side of the mainframe, and remove the right side rail. If the bottom of the mainframe is to be removed, the side rails may be removed entirely.

2. Remove the five screws on each side of the top cover of the mainframe.

3. Remove the six screws on the top of the top cover of the mainframe.

4. Carefully pull the top cover up and toward the rear of the mainframe until it clears the inner cage and set it to the side where it will not be scratched or damaged. The right lower rear of the top cover (as viewed from the front) needs to be pulled out to clear the power supply fan filter.

Removing the Bottom Cover

1. First remove the top cover.

2. Remove the left slide rail and turn the unit over so that it is resting on its inner cage.

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3. Remove the four screws on each side of the bottom cover of the mainframe.

4. Remove the one screw on the bottom of the mainframe.

5. Carefully pull the bottom cover up and toward the rear of the mainframe until it clears the inner cage, and set it to the side, where it will not be scratched or damaged.

At this point, the mainframe is disassembled enough to accomplish any maintenance required.

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Appendix E (Option 1M)
MATE Applications

Option 1M: MATE Compatible Mainframe

If the VX1401 Mainframe is ordered with Option 1M, MATE Compatible, the card cage is delivered with the following modifications:

- Aluminum Rack Slides that meet or exceed the MATE guidelines.
- MATE Butch Plate with provisions for mounting the IEEE-488 connector and the DFI BNC connector.

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Appendix F
Replaceable Parts

Description	Part Number	Qty. per Chassis
Top Cover	950-1200-00	1
Bottom Cover	950-1201-00	1
Line Fuse (5A)	159-0014-00	1
Line Fuse (7A)	159-0371-00	1
Internal Line Fuse (15A)	159-0256-00	1
Rack Ear (right)	950-6023-00	1
Rack Ear (left)	950-8676-00	1
Front Handle	950-0091-00	2
Rear Handle	367-0464-00	2
Rear Fan	119-4871-00	3
Side Fan	119-4873-00	1
Chassis Air Filter	378-0423-00	1
Side Fan Filter	378-0421-00	1

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Appendix G
Options

The following options are available for the VX1401:

Plugs

Option A1	220V Euro plug
Option A2	240V UK plug
Option A3	240V Aust. plug
Option A4	240V N. Amer. plug
Option A5	220V Swiss plug

Mainframes are shipped with the required power cords as ordered by the customer. The available power cords are shown in *Power Cords*.

Option 01

Delete Rack Slide, Add Trim: removes the standard rack slides and replaces them with Trim Plates, one on each side of the mainframe. A VX1401 Option 01 is not intended to be mounted in a standard NEMA rack.

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Glossary

The terms in this glossary are defined as used in the VXIbus System. Although some of these terms may have different meanings in other systems, it is important to use these definitions in VXIbus applications. Terms which apply only to a particular instrument module are noted. Not all terms appear in every manual.

Term	Definition
Accessed Indicator	An amber LED indicator that lights when the module identity is selected by the Resource Manager module, and flashes during any I/O operation for the module.
ACFAIL*	A VMEbus backplane line that is asserted under these conditions: 1) by the card cage Power Supply when a power failure has occurred (either ac line source or power supply malfunction), or 2) by the front panel ON/STANDBY switch when switched to STANDBY.
A-Size Card	A VXIbus instrument module that is 100.0 by 160 mm by 20.32 mm (3.9 by 6.3 in by 0.8 in), the same size as a VMEbus single-height short module.
Asynchronous Communication	Communications that occur outside the normal "command-response" cycle. Such communications have higher priority than synchronous communication.
Backplane	The printed circuit board that is mounted in a VXIbus card cage to provide the interface between VXIbus modules and between those modules and the external system.
B-Size Card	A VXIbus instrument module that is 233.4 by 160 mm by 20.32 mm (9.2 by 6.3 in by 0.8 in), the same size as a VMEbus double-height short module.
Bus Arbitration	In the VMEbus interface, a system for resolving contention for service among VMEbus Master devices on the VMEbus.
Bus Timer	A functional module that measures the duration of each data transfer on the Data Transfer Bus (DTB) and terminates the DTB cycle if the duration is excessive. Without the termination capability of this module, a Bus Master attempt to transfer data to or from a non-existent Slave location could result in an infinitely long wait for the Slave response.
Client	In shared memory protocol (SMP), that half of an SMP channel that does not control the shared memory buffers.

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CLK10 A 10-MHz, ±100 ppm, individually buffered (to each module slot), differential ECL system clock that is sourced from Slot 0 and distributed to Slots 1-12 on P2. It is distributed to each module slot as a single source, single destination signal with a matched delay of under 8 ns.

CLK100 A 100-MHz, ±100 ppm, individually buffered (to each module slot), differential ECL system clock that is sourced from Slot 0 and distributed to Slots 1-12 on P3. It is distributed to each module slot in synchronous with CLK10 as a single source, single destination signal with a maximum system timing skew of 2 ns, and a maximum total delay of 8 ns.

Commander In the VXIbus interface, a device that controls another device (a servant). A commander may be a servant of another commander.

Command A directive to a device. There are three types of commands:

In Word Serial Protocol, a 16-bit imperative to a servant from its commander.

In Shared Memory Protocol, a 16-bit imperative from a client to a server, or vice versa.

In a Message, an ASCII-coded, multi-byte directive to any receiving device.

Communication Registers In word serial protocol, a set of device registers that are accessible to the commander of the device. Such registers are used for inter-device communications, and are required on all VXIbus message-based devices.

Configuration Registers A set of registers that allow the system to identify a (module) device type, model, manufacturer, address space, and memory requirements. In order to support automatic system and memory configuration, the VXIbus standard specifies that all VXIbus devices have a set of such registers, all accessible from P1 on the VMEbus.

C-Size Card A VXIbus instrument module that is 340.0 by 233.4 mm by 30.48 mm (13.4 by 9.2 in by 1.2 in).

Custom Device A special-purpose VXIbus device that has configuration registers so as to be identified by the system and to allow for definition of future device types to support further levels of compatibility.

Data Transfer Bus One of four buses on the VMEbus backplane. The Data Transfer Bus allows Bus Masters to direct the transfer of binary data between Masters and Slaves.

DC SUPPLIES Indicator A red LED indicator that illuminates when a DC power fault is detected on the backplane.

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Device Specific Protocol — A protocol for communication with a device that is not defined in the VXIbus specification.

D-Size Card — A VXIbus instrument module that is 340.0 by 366.7 mm by 30.48 mm (13.4 x 14.4 in x 1.2 in).

DTB — See Data Transfer Bus.

DTB Arbiter — A functional module that accepts bus requests from Requester modules and grants control of the DTB to one Requester at a time.

DUT — Device Under Test.

ECLTRG — Six single-ended ECL trigger lines (two on P2 and four on P3) that function as inter-module timing resources, and that are bussed across the VXIbus subsystem backplane. Any module, including the Slot 0 module, may drive and receive information from these lines. These lines have an impedance of 50 ohms; the asserted state is logical High.

Embedded Address — An address in a communications protocol in which the destination of the message is included in the message.

ESTST — Extended STart/STop protocol; used to synchronize VXIbus modules.

Extended Self Test — Any self test or diagnostic power-up routine that executes after the initial kernel self test program.

External System Controller — The host computer or other external controller that exerts overall control over VXIbus operations.

FAILED Indicator — A red LED indicator that lights when a device on the VXIbus has detected an internal fault. This might result in the assertion of the SYSFAIL* line.

IACK Daisy Chain Driver — The circuit that drives the VMEbus Interrupt Acknowledge daisy chain line that runs continuously through all installed modules or through jumpers across the backplane.

ID-ROM — An NVRAM storage area that provides for non-volatile storage of diagnostic data.

Instrument Module — A plug-in printed circuit board, with associated components and shields, that may be installed in a VXIbus card cage. An instrument module may contain more than one device. Also, one device may require more than one instrument module.

Interface Device — A VXIbus device that provides one or more interfaces to external equipment.

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Interrupt Handler A functional module that detects interrupt requests generated by Interrupters and responds to those requests by requesting status and identity information.

Interrupter A device capable of asserting VMEbus interrupts and performing the interrupt acknowledge sequence.

IRQ The Interrupt ReQuest signal, which is the VMEbus interrupt line that is asserted by an Interrupter to signify to the controller that a device on the bus requires service by the controller.

Local Bus A daisy-chained bus that connects adjacent VXIbus slots.

Local Controller The instrument module that performs system control and external interface functions for the instrument modules in a VXIbus card cage or several card cages. See Resource Manager.

Local Processor The processor on an instrument module.

Logical Address The smallest functional unit recognized by a VXIbus system. It is often used to identify a particular module.

Mainframe **Card Cage** For example, the Tektronix VX1401 Card Cage, an operable housing that includes 13 C-size VXIbus instrument module slots.

Memory Device A storage element (such as bubble memory, RAM, and ROM) that has configuration registers and memory attributes (such as type and access time).

Message A series of data bytes that are treated as a single communication, with a well defined terminator and message body.

Message Based Device A VXIbus device that supports VXI configuration and communication registers. Such devices support the word serial protocol, and possibly other message-based protocols.

MODID Lines Module/system identity lines.

Physical Address The address assigned to a backplane slot during an access.

Power Monitor A device that monitors backplane power and reports fault conditions.

P1 The top-most backplane connector for a given module slot in a vertical card cage such as the Tektronix VX1400. The left-most backplane connector for a given slot in a horizontal card cage.

P2 The bottom backplane connector for a given module slot in a vertical C-size card cage such as the VX1400; or the middle

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	backplane connector for a given module slot in a vertical D-size card cage such as the VX1500.
P3	The bottom backplane connector for a given module slot in a vertical D-size card cage such as the Tektronix VX1500.
Query	A form of command that allows for inquiry to obtain status or data.
READY Indicator	A green LED indicator that lights when the power-up diagnostic routines have been completed successfully. An internal failure or failure of +5-volt power will extinguish this indicator.
Register Based Device	A VXIbus device that supports VXI register maps, but not high level VXIbus communication protocols; includes devices that are register-based servant elements.
Requester	A functional module that resides on the same module as a Master or Interrupt Handler and requests use of the DTB whenever its Master or Interrupt Handler requires it.
Resource Manager	A VXIbus device that provides configuration management services such as address map configuration, determining system hierarchy, allocating shared system resources, performing system self test diagnostics, and initializing system commanders.
Self Calibration	A routine that verifies the basic calibration of the instrument module circuits, and adjusts this calibration to compensate for short- and long-term variables.
Self Test	A set of routines that determine if the instrument module circuits will perform according to a given set of standards. A self test routine is performed upon power-up.
Servant	A VXIbus message-based device that is controlled by a commander.
Server	A shared memory device that controls the shared memory buffers used in a given Shared Memory Protocol channel.
Shared Memory Protocol	A communications protocol that uses a block of memory that is accessible to both client and server. The memory block operates as a message buffer for communications.
Slot 0 Controller	See Slot 0 Module. Also see Resource Manager.
Slot 0 Module	A VXIbus device that provides the minimum VXIbus slot 0 services to slots 1 through 12 (CLK10 and the module identity lines), but that may provide other services such as CLK100, SYNC100, STARBUS, and trigger control.
SMP	See Shared Memory Protocol.

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STARX Two (2) bi-directional, 50 ohm, differential ECL lines that provide for inter-module asynchronous communication. These pairs of timed and matched delay lines connect slot 0 and each of slots 1 through 12 in a card cage. The delay between slots is less than 5 nanoseconds, and the lines are well matched for timing skew.

STARY Two (2) bi-directional, 50 ohm, differential ECL lines that provide for inter-module asynchronous communication. These pairs of timed and matched delay lines connect slot 0 and each of slots 1 through 12 in a card cage. The delay between slots is less than 5 nanoseconds, and the lines are well matched for timing skew.

STST STart/STop protocol; used to synchronize modules.

SYNC100 A Slot 0 signal that is used to synchronize multiple devices with respect to a given rising edge of CLK100. These signals are individually buffered and matched to less than 2ns of skew.

Synchronous Communications A communications system that follows the "command-response" cycle model. In this model, a device issues a command to another device; the second device executes the command; then returns a response. Synchronous commands are executed in the order received.

SYSFAIL* A signal line on the VMEbus that is used to indicate a failure by a device. The device that fails asserts this line.

System Clock Driver A functional module that provides a 16-MHz timing signal on the Utility Bus.

System Hierarchy The tree structure of the commander/servant relationships of all devices in the system at a given time. In the VXIbus structure, each servant has a commander. A commander may also have a commander.

Test Monitor An executive routine that is responsible for executing the self tests, storing any errors in the ID-ROM, and reporting such errors to the Resource Manager.

Test Program A program, executed on the system controller, that controls the execution of tests within the test system.

Test System A collection of hardware and software modules that operate in concert to test a target DUT.

TTLTRG Open collector TTL lines used for inter-module timing and communication.

VXIbus Subsystem One card cage with modules installed. The installed modules include one module that performs slot 0 functions and a given complement of instrument modules. The subsystem may also include a Resource Manager.

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Word Serial Protocol A VXIbus word oriented, bi-directional, serial protocol for communications between message-based devices (that is, devices that include communication registers in addition to configuration registers).

Word Serial Communications Inter-device communications using the Word Serial Protocol.

WSP See Word Serial Protocol.

10-MHz Clock A 10 MHz, ±100 ppm timing reference. Also see CLK10.

100-MHz Clock A 100 MHz, ±100 ppm clock synchronized with CLK10. Also see CLK100.

488-To-VXIbus Interface A message based device that provides for communication between the IEEE-488 bus and VXIbus instrument modules.

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