Origin™ and Onyx2™ VME Option Owner's Guide

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Origin™ and Onyx2™ VME Option Owner's Guide
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About This Guide

This guide provides basic operating and troubleshooting information for the Silicon Graphics® VME option product. It is written for Silicon Graphics customers and contains the following chapters:

- Chapter 1, "Introduction," provides a product overview, special restrictions, and safety instructions.
- Chapter 2, "General Operating Procedures," provides basic VME option operating and troubleshooting procedures.
- Chapter 3, "VME Chassis Information," provides VME chassis slot designation, power, and grounding information.
- Chapter 4, "VME Interface Board," provides general VME interface board information.

Additional information about this product can be found in the following documents:

- *VMEbus Specification Revision D*
- *Device Driver Programmer's Guide*

Typographical Conventions

This *VME Option Owner's Guide* uses the following conventions:

- Commands, filenames, and references to document titles are in *italics*.
- Steps to perform tasks are in numbered sentences. When a numbered step needs more explanation, the explanation follows the step and is preceded by a square bullet.
- Text that the user enters appears in **`Courier bold.`**
- Screen text appears in `Courier plain`.

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Chapter 1

Introduction

This chapter describes the basic VME option functionality. It contains the following sections:

- "VME Option Product Description" describes basic product functionality.
- "Restrictions and Important Notes" describes special VME restrictions.
- "Safety Considerations" describes product safety instructions.

VME Option Product Description

The VME option is designed to provide VME bus access to Origin200 GIGAchannel server, Origin2000, and Onyx2 deskside and rackmount systems. This option kit consists of a VME interface board, VME XIO board, Xtown VME cable, and VME grounding cable (see Figure 1-1). One of the three user-supplied VME chassis described below is also required for proper system operation.

The VME XIO board installs into any Origin or Onyx2 XIO system slot. The VME interface board plugs into slot 1 in the VME chassis and functions as the system controller. The Xtown VME cable and VME grounding cable connect directly to the both boards. According to specific customer needs, VME boards are inserted into the VME chassis to provide VME device integration within an Origin or Onyx2 system.

The VME interface board is available in two sizes: 6U and 9U. The VME chassis is available in three sizes: 6U/21-slot, 6U/5-slot, and 9U/5-slot. Silicon Graphics does not supply the VME chassis, but has qualified three chassis configurations that are available from ELMA Electronics. These VME chassis are specially designed to meet Silicon Graphics VME grounding and EMI requirements. Customers can purchase a VME chassis from ELMA Electronics. (For detailed ordering information, call 1-510-656-5829 in the U.S.A. or access their web page at http://www.elma.com.)

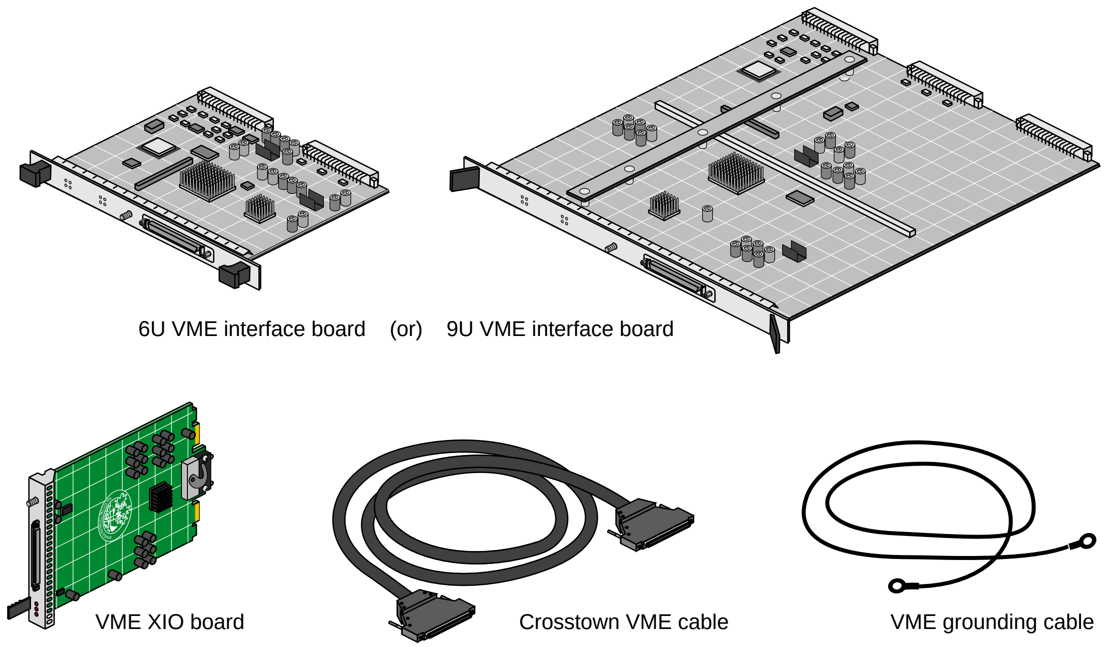

Figure 1-1 VME Option Components

Restrictions and Important Notes

- Installation and initial verification of the VME option must be performed by authorized Silicon Graphics personnel. For more information, contact your nearest Silicon Graphics representative.
- Silicon Graphics ensures proper VME board operation only when used in an authorized VME chassis obtained from ELMA Electronics.
- If you are running IRIX 6.4 on the host system, you must install patches to the operating system.
- To ensure proper operation, both the Silicon Graphics system and the VME chassis must be powered by the same AC power supply so that they share a common ground.
- Ground cables cannot be extended.
- Each Origin or Onyx2 system supports a maximum of 5 VME option boards. Each VME XIO board requires one XIO slot.
- When connecting multiple VME chassis to the same Silicon Graphics host system, separate ground cables must be attached between each VME XIO board and each VME interface board.
- Due to conflicting cooling requirements, the VME chassis cannot be installed in a Silicon Graphics rack.
- The number of available slots in each VME chassis is one less than the total slot number, because slot 1 is required for the VME interface board.
- The Silicon Graphics VME interface board must be placed in the VME chassis slot 1, and provides system controller functions. No other card in the VME chassis can be used as the system controller.
- Jumper settings are required only for Origin200 GIGAchannel server operation.
- Daisy-chain operation within the chassis is configured automatically, so that no backplane jumpers are required if slots are skipped.

Note: Each ELMA VME chassis has been certified and licensed by international safety agencies for use either as a stand-alone unit or for installation in a third-party 19-inch equipment rack. Regardless of whether the VME chassis is set up and installed by the customer or by a Silicon Graphics authorized service person, installation in a rack may require submittal to an approved safety agency for their evaluation and certification or licensing of the new rack-system combination.

Caution: The Silicon Graphics VME interface board is designed in compliance with standard ELMA/VME mechanical specifications. It is also designed to meet FCC Class A regulations when installed in a Silicon Graphics approved chassis in which all slots are filled either with shielded blank panels or with VME boards that include shielded front panels.

If your VME boards are not compliant with ELMA/VME mechanical specifications, VME board problems can occur. The VME interface board has a row of grounding fingers adhered to the side of the front panel that provide EMI shielding (see Figure 1-2). In some cases, adjacent IC leads from non-compliant ELMA/VME boards can contact these grounding fingers and cause the VME board to short out.

Therefore, it is recommended that you observe the following precautions when installing non-compliant ELMA/VME boards. With the system turned off, install a VME board in VME chassis slot 2 and visually inspect it to ensure that it is not contacting the VME interface board grounding fingers. If the adjacent VME board is contacting the grounding fingers, one of the following options will resolve the problem. (Note that these options apply only to systems where EMI shielding is not required.)

- Remove the VME board from the VME chassis slot 2 and always leave slot 2 empty.
- Cover the VME interface board grounding fingers with a non-conductive, protective tape.
- Remove the grounding fingers from the VME interface board.

It is recommended that the Silicon Graphics VME interface board be used only with other ELMA/VME-compliant boards. The customer assumes full responsibility for all non-compliant ELMA/VME boards installed in the system. Silicon Graphics is not liable for any system problems that occur as a result of using non-compliant ELMA/VME boards.

Safety Considerations

Warning: **All board installations or removals should be performed only by Silicon Graphics trained or certified personnel. Unauthorized access to the cardcage area could result in system damage or even bodily harm, and could void the warranty or safety agency approvals for the system.**

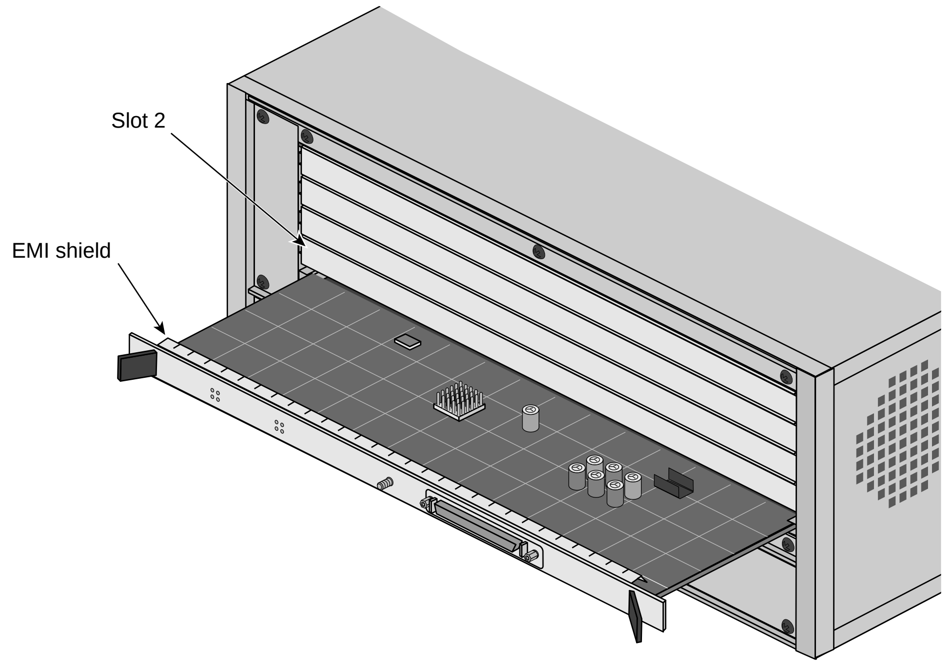

Figure 1-2 VME Interface Board EMI Shielding

Chapter 2

General Operating Procedures

This chapter describes general VME option operating procedures. It contains the following sections:

- "Powering the System On and Off" describes VME option power on and off procedures.
- "Basic Troubleshooting" describes VME troubleshooting procedures.

Powering the System On and Off

Power on the host Silicon Graphics system only after the VME chassis is installed, configured, properly connected, and powered on.

To power the system on, complete the following instructions:

1. Power on the VME chassis by turning the power switch to the On position.
2. Set the Silicon Graphics host system circuit breaker to the On position.
3. Power on the host system by turning the key in the module's System Controller to the On position.
4. Log on after the system boots.

   Note: Depending on the IRIX release on the host system, you may be required to install patches to the operating system. (For more information, contact your Silicon Graphics representative.)
5. If you have not installed the software and configured the system on IRIX 6.4, complete this operation now. The new VME interface board will not function correctly until the software has been properly installed on IRIX 6.4.

   Note: After the software is configured, run the *autoconfig* command to build a new operating system (kernel) that includes the new drivers. Then reboot the host to start running the new operating system.
6. To power the system off, complete steps 1-3 in reverse order.

Basic Troubleshooting

The following information provides basic VME troubleshooting procedures if the system is not functioning properly. Possible problems are described first, followed by corrective action.

Problem

- The VME interface board LEDs are not functioning correctly. The eight LEDs should be lit according to the following information. (See the "VME LED Functionality" section in Chapter 4 for more details.)
  - LED0 (yellow)-On
  - LED1 (yellow)-On
  - LED3 (yellow)-Off
  - LED4 (yellow)-Off
  - 1.7 V OK (green)-On
  - 2.4 V OK (green)-On
  - 3.3 V OK (green)-On
  - Link OK (green)-On
- The VME interface is not recognized by the system. After IRIX is booted and you have logged in, type the following hardware inventory command:

  `hinv -m`

  If the system XIO-VME interface is properly installed, this command should produce a line similar to the following examples:

  - 9U VME Interface:

    ```
    VME_XTOWN_9U Board: barcode xxxxxx     part 030-1213-xxx rev x
    ```

  - 6U VME Interface:

    ```
    VME_XTOWN_6U Board: barcode xxxxxx     part 030-1221-xxx rev x
    ```

  (The letter `x` indicates numbers that could change with each interface.)

  Note: Individual, user-supplied VME cards do not appear as output to hinv. Cards can be identified only through probing of VME address space via user supplied software.

Corrective Action

- In some cases (for example, an XIO card relocated to different slot), it is possible that multiple hwgraph structures will be created for the VME interface board and a device will not be recognized upon power-on. If you suspect this is the case, try removing the */etc/ioconfig.conf* file and then reboot the system.
- Power off and on both the Silicon Graphics host system and the VME chassis. (For detailed information, see “Powering the System On and Off”.)
- Power off both the Silicon Graphics host system and the VME chassis. Disconnect, inspect, and reconnect both ends of the Xtown VME cable that connects the XIO board to the VME interface board. Then, power on the VME chassis and the Silicon Graphics host system.
- If problems persist, contact Silicon Graphics technical support or your local service provider.

Chapter 3

VME Chassis Information

This chapter describes miscellaneous VME chassis information. It contains the following sections:

- "VME Chassis Description" describes VME chassis physical characteristics and slot designations.
- "VME Chassis Power Supply Specifications" describes VME chassis power supply specifications.
- "VME Chassis Grounding Information" describes VME chassis grounding perimeters.

VME Chassis Description

The VME option uses three different-size chassis configurations from ELMA Electronics (6U/21-slot, 6U/5-slot, and 9U/5-slot). These chassis have special EMI and grounding standards that meet Silicon Graphics requirements and must be used for proper VME operation. (For ordering information, see Chapter 1.) Figure 3-1, Figure 3-2, and Figure 3-3 show the VME chassis slot locations.

Caution: The Silicon Graphics VME interface board is designed in compliance with standard ELMA/VME mechanical specifications. It is also designed to meet FCC Class A regulations when installed in an Silicon Graphics approved chassis in which all slots are filled either with shielded blank panels or with VME boards that include shielded front panels.

If your VME boards are not compliant with ELMA/VME mechanical specifications, VME board problems can occur. The VME interface board has a row of grounding fingers adhered to the side of the front panel that provide EMI shielding. In some cases, adjacent IC leads from non-compliant ELMA/VME boards can contact these grounding fingers and cause the VME board to short out.

Therefore, it is recommended that you observe the following precautions when installing non-compliant ELMA/VME boards. With the system turned off, install a VME board in VME chassis slot 2 and visually inspect it to ensure that it is not contacting the VME interface board grounding fingers. If the adjacent VME board is contacting the grounding fingers, one of the following options will resolve the problem. (Note that these options apply only to systems where EMI shielding is not required.)

- Remove the VME board from the VME chassis slot 2 and always leave slot 2 empty.
- Cover the VME interface board grounding fingers with a non-conductive, protective tape.
- Remove the grounding fingers from the VME interface board.

It is recommended that the Silicon Graphics VME interface board be used only with other ELMA/VME-compliant boards. The customer assumes full responsibility for all non-compliant ELMA/VME boards installed in the system. Silicon Graphics is not liable for any system problems that occur as a result of using non-compliant ELMA/VME boards.

6U/21-Slot VME Chassis

This VME chassis holds a maximum of twenty 6U VME boards, plus one VME interface board (see Figure 3-1).

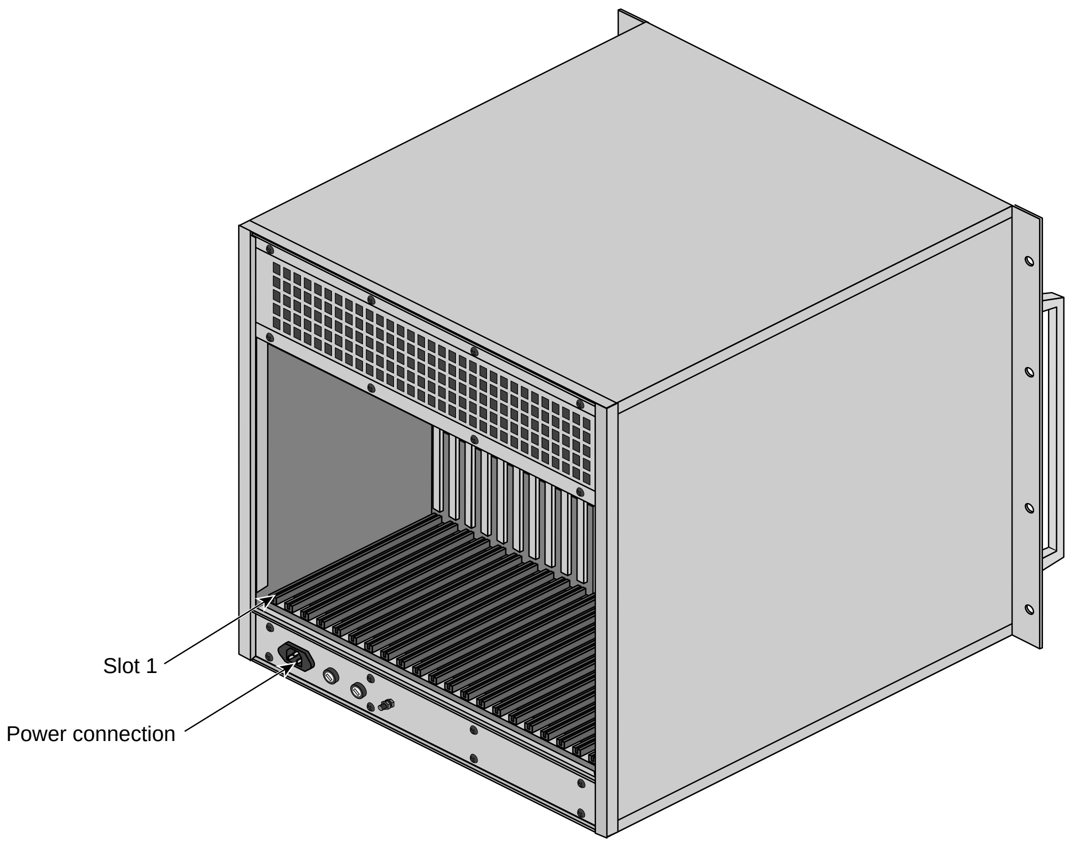

Figure 3-1 6U/21-Slot VME Chassis Slot Locations

6U/5-Slot VME Chassis

This VME chassis holds a maximum of four 6U VME boards, plus one VME interface board (see Figure 3-2).

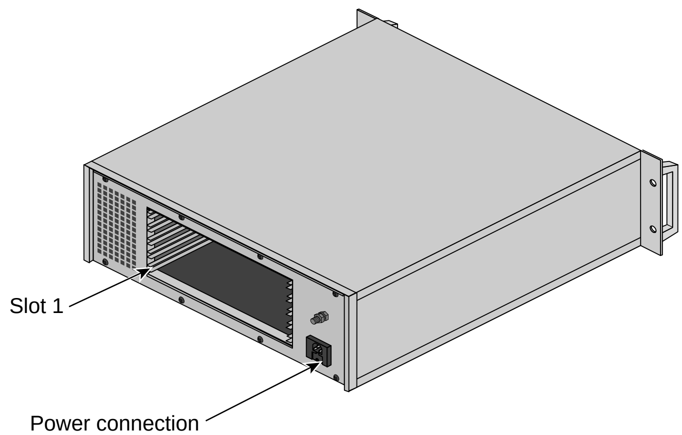

Figure 3-2 6U/5-Slot VME Chassis Slot Locations

9U/5-Slot VME Chassis

This VME chassis holds a maximum of four 9U VME boards, plus one VME interface board (see Figure 3-3).

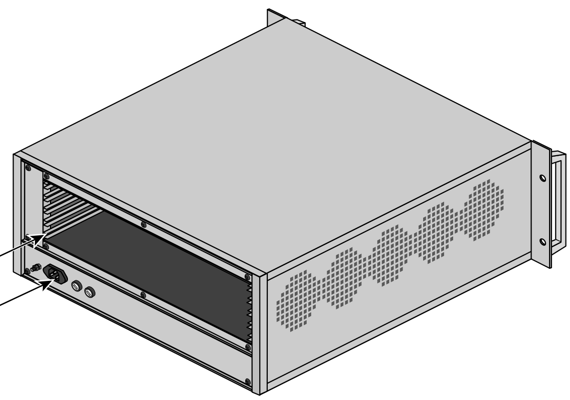

Figure 3-3 9U/5-Slot VME Chassis Slot Locations

VME Chassis Power Supply Specifications

Table 3-1 describes the VME chassis power supply specifications.

Table 3-1 VME Chassis Power Supply Specifications

Chassis Type	Maximum Total Power Supply	Maximum Individual Supply Current			
		+5 V	+12 V	-5 V	-12 V
9U/5-slot	350 W	50 A	8 A	4 A	3 A
6U/5-slot	250 W	40 A	6 A	2.5 A	2.5 A
6U/21-slot	750 W	120 A	12 A	8 A	8 A

VME Chassis Grounding Information

Grounding issues are very important in the Origin family and Onyx2 systems. Each Silicon Graphics system chassis must be well grounded through its power connector. All chassis connected with XIO copper cables must share the same transformer, must be well grounded through the same earthing rod, and must be on the same branch circuit. If you have any doubts about the quality of the ground connection, it is important that you consult with a qualified electrician. A grounding cable connected between the VME enclosure(s) and the host XIO connection eliminates any problems related to common grounding.

Note that the grounding lugs on the VME option board and the VME XIO board must be connected using the VME grounding cable. If needed, the grounding lug on the VME enclosure is used to ground the VME chassis to the rack.

Caution: Any difference in ground potential greater than 500 millivolts (0.5 volts) between two chassis connected by copper XIO cables can cause severe equipment damage, and can create hazardous conditions.

The branch circuit wiring should be provided with an insulated grounding conductor that is identical in size, insulation material, and thickness to the earthed and unearthed branch-circuit supply conductors.

The grounding conductor should be green, with or without one or more yellow stripes. This grounding or earthing conductor should be connected to earth at the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generated set.

The power receptacles in the vicinity of the systems should all be of an earthing type, and the grounding or earthing conductors serving these receptacles should be connected to earth at the service equipment.

Chapter 4

VME Interface Board

This chapter describes general VME interface board operating information. It contains the following sections:

- "VME Interface Board Description" provides a physical description of the VME interface board.
- "VME LED Functionality" describes the VME interface board LEDs.
- "VME Interface Board Jumper Settings" describes the jumper settings required for Origin200 GIGAchannel server operation.
- "VME System Controller Information" describes basic VME system controller card functions.
- "VME Interface Board Operation" describes basic VME interface board operations.

VME Interface Board Description

The VME interface board is available in two sizes (6U and 9U), depending on the VME chassis size (see Figure 4-1). It functions as the System Controller card between the VME chassis and the Silicon Graphics host system. The VME adapter board must always be installed in VME chassis slot 1.

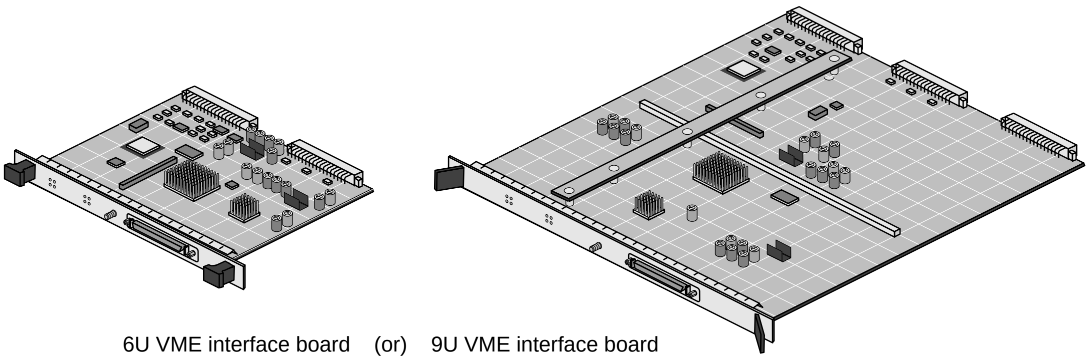

Figure 4-1 6U and 9U VME Interface Boards

VME LED Functionality

The VME interface board has eight LEDs located on the front panel that indicate VME system operating modes (see Figure 4-2 and Table 4-1). Note that LED0, LED1, LED2, and LED3 are not used.

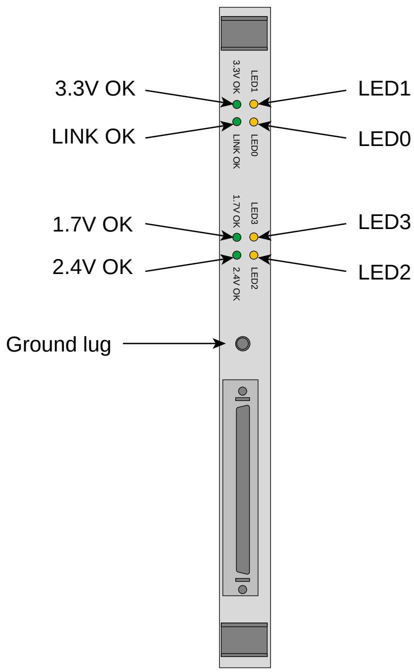

Figure 4-2 VME Interface Board LEDs

Table 4-1 VME Board LED Functions

LED	Function
LED 0 (Yellow)	On, but not used at this time.
LED 1 (Yellow)	On, but not used at this time.
LED 2 (Yellow)	Not used at this time.
LED 3 (Yellow)	Not used at this time.
3.3 V OK (Green)	Displays status of 3.3 voltage board level. On indicates board 3.3 voltage is OK. Off indicates no voltage or voltage out of range. (On during normal operation.)
LINK OK (Green)	Monitors the voltage link connection between the VME interface board and VME XIO board. On indicates link is OK. Off or flashing indicates linkage problem. (On during normal operation.)
1.7 V OK (Green)	Displays status of voltage board level. On indicates board 1.7 voltage is OK. Off indicates no voltage or voltage out of range. (On during normal operation.)
2.4 OK (Green)	Displays status of voltage board level. On indicates board 2.4 voltage is OK. Off indicates no voltage or voltage out of range. (On during normal operation.)

VME Interface Board Jumper Settings

The VME interface board is shipped from the factory with the oscillator jumper settings pre-configured for use in Origin2000 and Onyx2 systems. When using the VME interface board in an Origin200 GIGAchannel server, the oscillator jumper settings must be changed to 360 MHz operation.

6U VME Interface Board 360 MHz Jumper Settings

Use the following steps to set the 6U VME interface board oscillator jumper settings to 360 MHz operation (see Figure 4-3).

1. Move the jumper from D9B7 header pins 2 and 3 to E5B7 header pins 2 and 3.
2. Move the jumper from E3C6 header pins 1 and 2 to pins 2 and 3.
3. Move the jumper from D8C6 header pins 1 and 2 to pins 2 and 3.

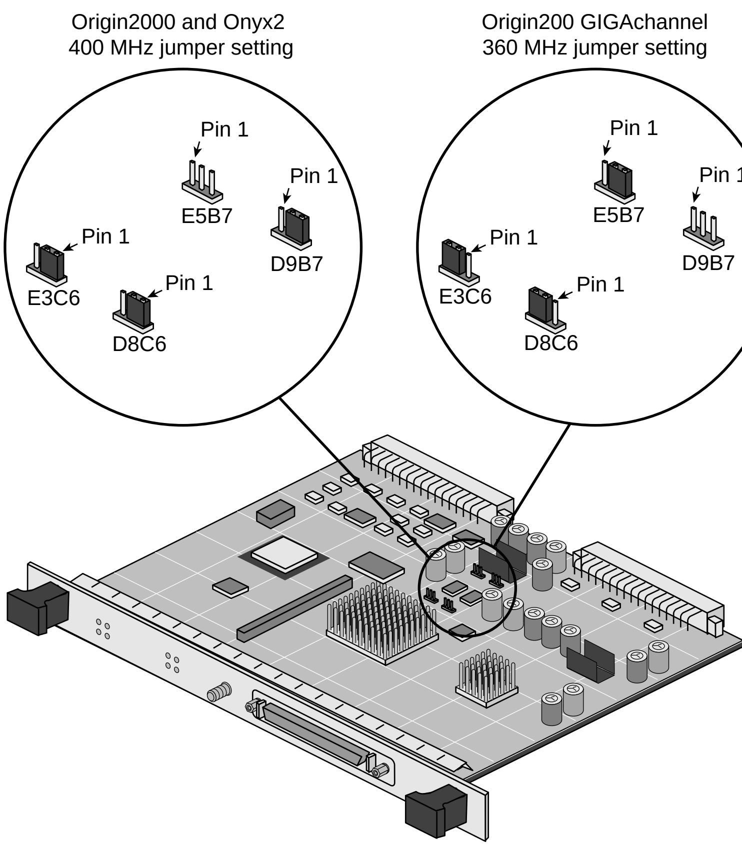

Figure 4-3 6U VME Interface Board 360 MHz Oscillator Jumper Settings

9U VME Interface Board 360 MHz Jumper Settings

Use the following steps to set the 9U VME interface board oscillator jumper settings to 360 MHz operation (see Figure 4-4).

1. Move the jumper from M4M0 header pins 2 and 3 to M4M6 header pins 2 and 3.
2. Move the jumper from L3M4 header pins 1 and 2 to pins 2 and 3.
3. Move the jumper from L3L8 header pins 1 and 2 to pins 2 and 3.

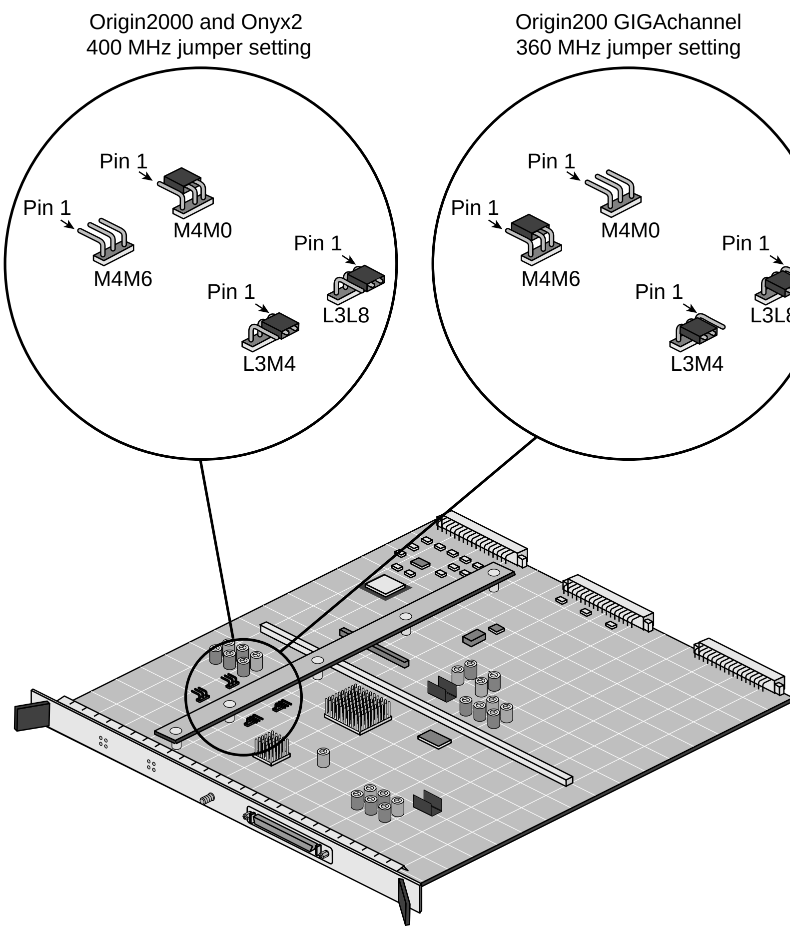

Figure 4-4 9U VME Interface Board 360 MHz Oscillator Jumper Settings

VME System Controller Information

The VME interface board functions as the System Controller on the VME bus chassis to which it is attached. As the System Controller, the VME interface board provides the following functions:

- bus arbitration
- interrupt acknowledgment (IACK)
- system clock (SYSCLK)
- bus timer

Note: The System Controller functions are sometimes referred to as slot 1 functions.

Bus Arbitration

As VME bus arbitrator, the VME interface board provides fixed priority arbitration. The fixed priority method arbitrates bus requests in the following order: BR3, BR2, BR1 then BR0 (by convention, BR3 is the highest priority request). One bus grant is issued to the highest requesting device. If a bus request of higher priority than the current bus owner is asserted, the VME interface board asserts BCLR until the current owner releases the bus.

Additionally, the VME interface board bus arbitration logic provides a timeout if a requester does not assert the BBSY within 16 microseconds after the appropriate Bus Grant signal (BGxOUT) has been asserted.

Interrupt Acknowledgment

The VME interface board will complete interrupt acknowledge cycles only to Interrupt Priority Levels (IPLs) identified with VECTOR statements in the *irix.sm* file, or with those explicitly identified in calls to **vmeio_intr_alloc()** calls. Once the IACK cycle is complete, the IRIX device driver handling the interrupt executes on one of the CPUs of the Origin or Onyx2 system. This functionality is similar to the CHALLENGE or Onyx VME bus interface. The interrupt status/ID (interrupt vector) returned by the interrupting device during the IACK cycle must be 8 bits.

All seven VME interrupt request levels (IRQ1-IRQ7) are supported by the VME interface board. All seven VME interrupt request levels are also routable through the DEVICE_ADMIN directive found in the */var/sysgen/system/irix.sm* file. (Up to six of the seven IPL levels may be routed at one time.)

Only Release On Acknowledge (ROAK) interrupting devices are supported, because the interrupt acknowledge cycle is performed independently of the Origin or Onyx2 CPUs (Release On Register Access [RORA] devices are not supported).

System Clock (SYSCLK)

The VME interface board provides the 16 Mhz SYSCLK signal to the VME bus.

Bus Timer

The VME bus timer asserts BERR if a VME bus transaction times out (indicated by one of the VME bus data strobes remaining asserted beyond the timeout period). The VME bus time-out period is set to 64 microseconds.

SYSFAIL

The VME interface board ignores the assertion of the SYSFAIL signal on the VME bus.

SYSRESET

The host system (Origin2000 or Onyx2) panics if a SYSRESET is issued on the VME bus. The only way for the VME bus to be reset is to power cycle both the VME chassis and the host computer system.

VME Interface Board Operation

The VME interface board can function as either a master (initiating I/O requests on the bus) or as a slave (responding to I/O requests on the bus from other masters).

VME Bus Master Operation

As a VME bus master, the VME interface board can access A16, A24, and A32 address space in both supervisory and non-privileged modes. Data accesses via the CPUs (for example, through Programmed IO) can be for D8, D16, and D32 sizes. Data accesses via the VME interface board's DMA engine can be for D8, D16, D32, and D64 sizes. RMW cycles, address-only cycles, tri-byte accesses or non-aligned data accesses are not supported. The VME interface board makes all VME bus requests at bus request level 3 (BR3)-the highest priority level. Bus requests are made by the VME interface board to initiate interrupts, DMA requests, and PIO requests. Bus requests are made regardless of the state of the bus request lines on the VME bus and released in a release-when-done (RWD) fashion (the same policy as the CHALLENGE and Onyx VME interface). In addition, the VME interface board does not monitor BCLR, so its ownership of the VME bus is not affected by other devices asserting BCLR.

VME Bus Slave Operation

As a VME bus slave, the VME interface board accepts accesses to A24 and A32 address space in both supervisory and non-privileged modes. Data accesses from third-party VME devices can be D8, D16, D32, and D64 sizes. RMW cycles, address-only cycles, tri-byte accesses, or non-aligned data accesses are not supported. In order for third-party VME devices to access Onyx2 or Origin memory address space directly, a valid DMA map must exist. This is true even if access to the memory is done only through programmed I/O (PIO).

The VME interface board performs write posting as a VME slave, using its 64-bit, 32-entry deep FIFO. This enables VME bus writes to complete much faster, freeing up the VME bus for other transactions. Similarly, block reads (BLT or MBLT) presented to the VME interface board are prefetched into another 64-bit, 32-entry deep FIFO. In this fashion, the Origin or Onyx2 system can burst data to the VME bus much more quicker, avoiding waiting for relatively slow data cycles on the VME bus. When acting as slave, the VME interface board actively drives DTACK to its negated level when it releases the VME bus. This feature is commonly referred to as DTACK rescinding.

The CHALLENGE or Onyx VME interface permitted VME block transfers to occur across 256-byte boundaries for the D32 transfer and 2048-byte boundaries for the D64 transfer. This was in violation of revision D of the VME specification and is *not* permitted with the XIO-VME interface. Some CHALLENGE and Onyx device drivers and/or third-party VME hardware and software may need modification if the block transfers were performed beyond these 256/2048-byte boundaries.

Miscellaneous VME Interface Board Issues

The following VME64 features are currently *not* supported by the VME interface board:

- lock commands
- RMW cycles
- A64 addressing mode
- A40 addressing mode
- MD32 data cycles