

# DIVO (Digital Video Option) XIO™ Board Installation Instructions

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Document Number 108-0173-001**

**Silicon Graphics, Inc.  
Mountain View, California**



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## About This Guide

The Silicon Graphics® DIVO (Digital Video Option) board is a half-height XIO™ board (marketing code XT-DIVO). With software (SC4-DIVO-1.0), it provides video I/O for an Onyx2™ or Origin2000™ deskside or rackmount system.

This guide explains how to install and configure the DIVO XIO board and its software, how to test the newly installed board, and how to remove a DIVO board.

**Note:** This option requires IRIX™ 6.4 or later.

## Audience for This Guide

The instructions in this guide are intended for Silicon Graphics System Support Engineers only. You should be familiar with the Origin2000 deskside and rackmount systems and the Onyx2 deskside and rackmount systems, and Silicon Graphics SCSI peripherals.

## Structure of This Guide

This guide consists of the following chapters and appendix:

- Chapter 1, “Kit Contents,” summarizes option components and briefly describes XIO board and DIVO board features.
- Chapter 2, “Installing the Option,” explains how to select an XIO slot for the DIVO board, how to install the board, and how to cable it.
- Chapter 3, “Testing the System and Installing the Software,” gives instructions on testing the new installation.
- Chapter 4, “Maintenance,” explains how to clean the board’s compression connector and how to remove a DIVO board.
- Appendix A, “DIVO I/O Panel Connector Specifications,” gives technical data for the connectors on the DIVO I/O panel.

Besides this guide, you should also have available the installation guide for the host system in which the board is to be installed. For connections to analog equipment, see *Digital Media Connections* (007-3525-001 or later). This customer documentation is included in the

shipment, along with the *DIVO (Digital Video Option) XIO Board Owner's Guide* (007-3524-001).

## *Chapter 1*

### **Kit Contents**

This chapter consists of these sections:

- Section 1.1, “Option Components”
- Section 1.2, “XIO and DIVO Board Components”

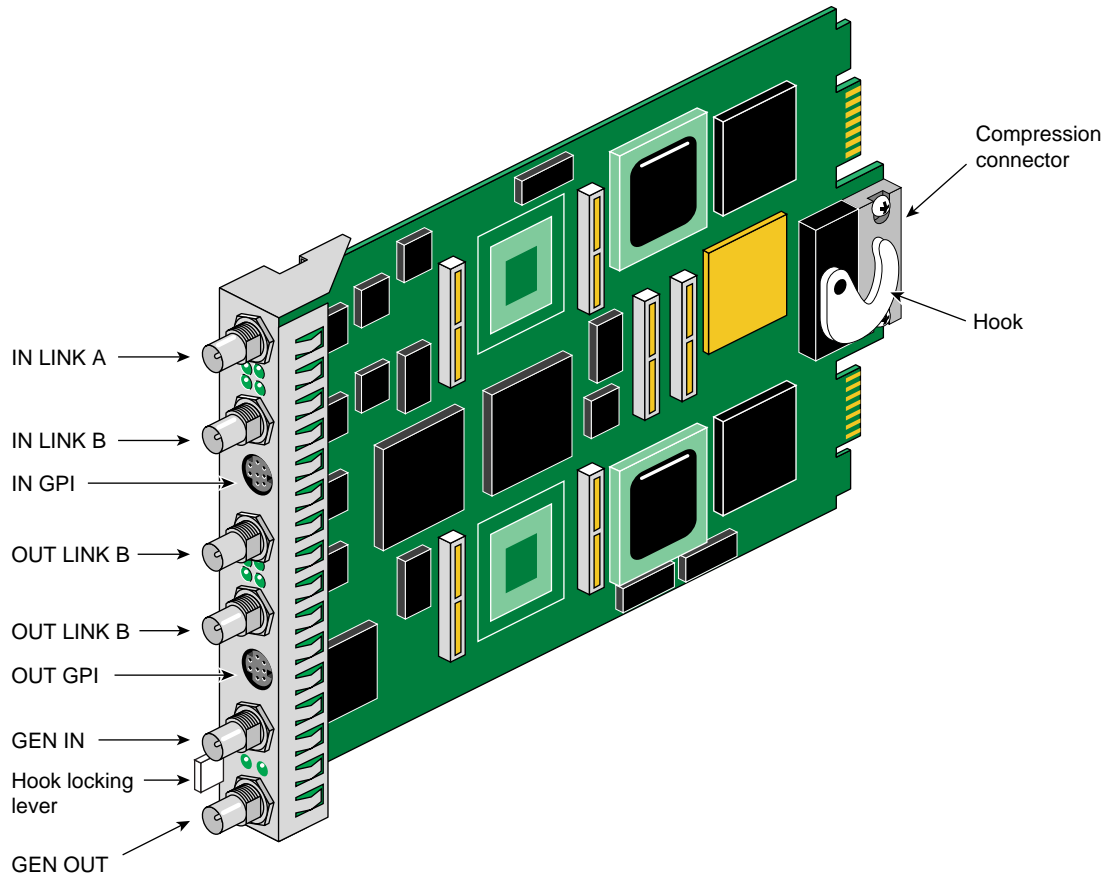
#### **1.1 Option Components**

The option consists of a base board (030-1046-002). DIVO software is a separate marketing code (SC4-DIVO-1.0), packaged separately from the board. No cables are shipped with the board.

#### **1.2 XIO and DIVO Board Components**

XIO boards are optional products for Silicon Graphics platforms that are based on the scalable shared-memory multiprocessing (SSMP) architecture. XIO boards are installed into the XIO slots of Origin2000 and Onyx2 systems. Each active XIO slot provides up to 800 megabytes per second of bidirectional bandwidth (that is, 400 megabytes in each direction) through a nonblocking crossbar switch on the system’s midplane. All XIO slots in a system can be active simultaneously. Actual delivered bandwidth depends on the PCI bus on the DIVO board.

Figure 1-1 shows components of the DIVO board.



**Figure 1-1** DIVO XIO Board

Table 1-1 summarizes important components of the DIVO XIO board.

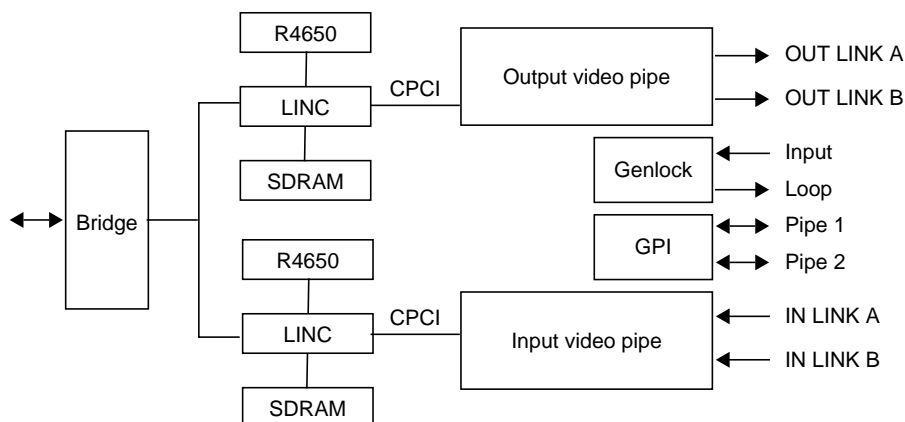
**Table 1-1** Important DIVO Board Components

Component	Explanation
BNCs (6)	Video in (two channels); video out (two channels); genlock in and out.
9-pin mini-DIN connectors (2)	GPI (General-Purpose Interface) in and out.
Compression connector	Provides communication between the board and the system via the midplane or frontplane.
Connector hooks	Holds compression connector securely to midplane or frontplane. There is one hook on each side of the compression connector. The hook actuator (next entry in this list) pushes/pulls the hooks into/out of the locked position.
Hook actuator	Device for moving hooks into and out of their locked position on the midplane.

**Table 1-1 (continued)** Important DIVO Board Components

Component	Explanation
Thick side of board	Board surface with the compression connector and the tallest components.
Thin side of board	Side of the board with low-profile components.

Figure 1-2 diagrams the DIVO board.



**Figure 1-2** DIVO Board Architecture

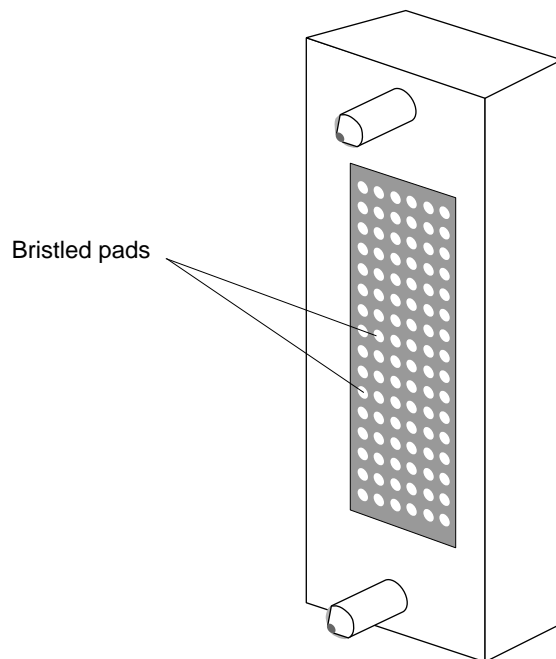
### 1.2.1 Hook Actuator

For an XIO board to function, its compression connector must be locked tightly to a mate (other half) on the midplane or frontplane, inside the chassis. Each XIO board has two hooks (one on each side of the compression connector). A hook actuator presses against one of the hooks, thus moving the hooks into and out of their locked position. The hook actuator functions as follows:

- Pushing the handle locks the hooks and seats the compression connector to the midplane.
- Pulling the handle releases the hooks, in preparation for removing the board.

### 1.2.2 Compression Connector

The compression connector used for XIO boards has 96 pads that enable passage of signals between the system (via the midplane) and the XIO board. This compression connector has two halves: one half is physically located on the XIO board (illustrated in Figure 1-3); the other half is on the midplane of the chassis. Each pad on a midplane connector is a flat gold-plated surface. Each pad on an XIO board connector is composed of hundreds of tiny bristles (dendrites). When a bristled pad is pressed into a gold-plated pad, a connection is created for one signal.



**Figure 1-3** DIVO Board Compression Connector

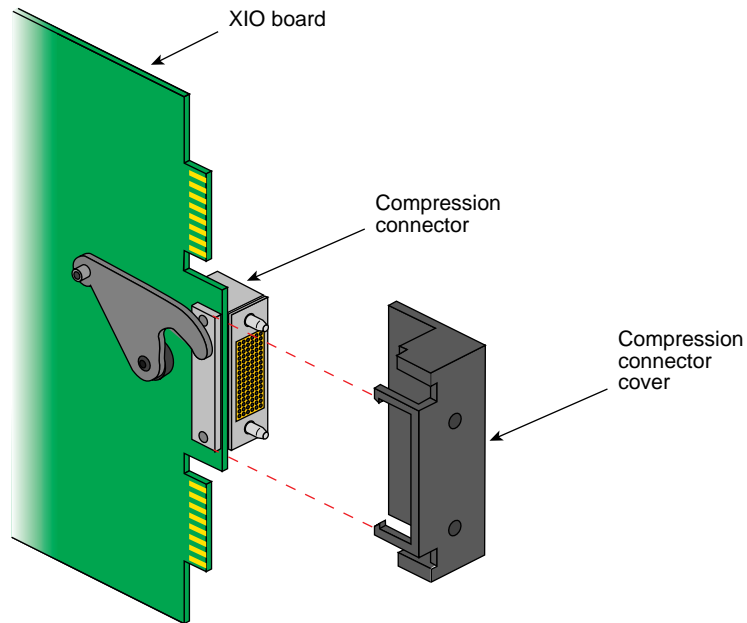
### 1.2.2.1 Storing and Handling the Compression Connector

The bristled pads of the compression connector can attract and hold dust, lint, grease, powder, and dirt, which clogs or damages the bristles and prevents them from making proper contact with the gold-plated pads on the system's midplane.

To avoid damaging an XIO board's compression connector and to keep it in optimal working condition, follow these guidelines whenever the board is not installed:

- Inspect the compression connector for debris (hard gray material, hair, dust buildup, and so on). If there is debris or hard gray material in the threads, return the boards and replace them with clean ones.
- Do not wipe or touch the pads of the compression connector with anything (no human fingers, no brushes, no cloth, no probes), except as specified in the cleaning instructions in "Cleaning the Compression Connector" in Chapter 4. The bristles might be damaged.
- Whenever the board is not in an XIO slot, put the protective cap over the compression connector and store the board in an antistatic bag. Make sure to close (fold over) the open end of the bag in order to minimize exposure to dust and atmospheric gases. Figure 1-4 shows the cap.

**Caution:** Failure to follow these instructions can result in irreparable damage to the surface of the connector's pads, which may result in intermittent or complete failure of the product.



**Figure 1-4** Compression Connector Protective Cover

- Do not put anything (not even water) onto the pads, except as specified in the cleaning instructions in Chapter 4, “Maintenance.”
- Before laying the board down on a surface, make sure that the surface is free of dust, lint, powder, metal filings, oil, water, and so on.
- Do not blow dust, dirt, or powder anywhere near the board when it is not inside its protective bag.



## Installing the Option

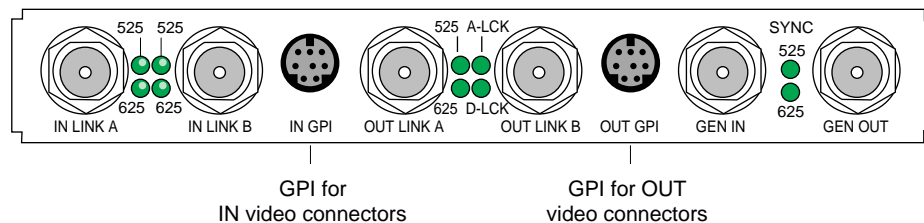
This chapter explains

- configuring the GPI ports (if required)
- selecting an XIO slot for the DIVO board
- installing the DIVO board

### 2.1 Configuring the GPI Ports

The DIVO board has two General Purpose Interface (GPI) connectors, each associated with one of the serial digital video ports. (two transmit and two receive channels each).

Figure 2-1 points out the General Purpose Interface (GPI) connectors on the DIVO panel.



**Figure 2-1** GPI Connectors

If the customer intends to use GPI event triggering, the optical isolator device associated with each GPI receive channel may require reconfiguration from the factory setting, as explained in this section. This reconfiguration must be performed before the DIVO board is installed.

**Note:** The customer must fabricate or customize his/her own cable to interface between the 8-pin mini-DIN connectors of the GPI ports and the source/destination equipment. Appendix A in this document and Appendix A in the *DIVO (Digital Video Option) XIO Board Owner's Guide* give pinout information.

This section explains

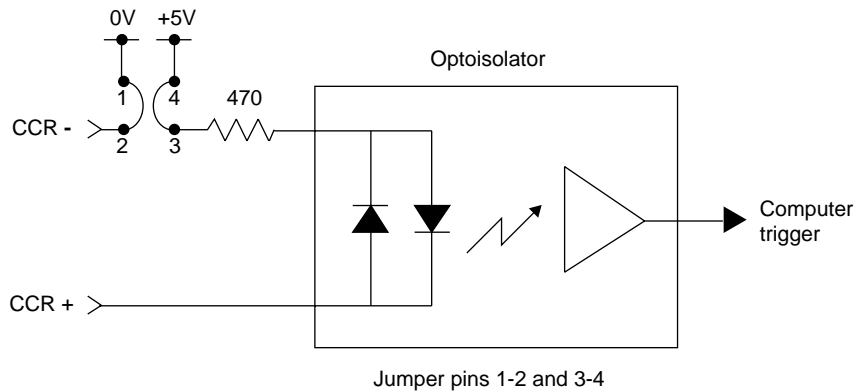
- GPI receiver electrical diagrams
- GPI jumper locations

- jumper configuration

### 2.1.1 GPI Receiver Electrical Diagrams

The GPI receivers (optoisolators) are configurable for two modes: switch closure mode (the factory setting) or current sense operation. Configuration is changed by repositioning the two-pin shorting jumpers that are included on the DIVO board, as explained later in this section.

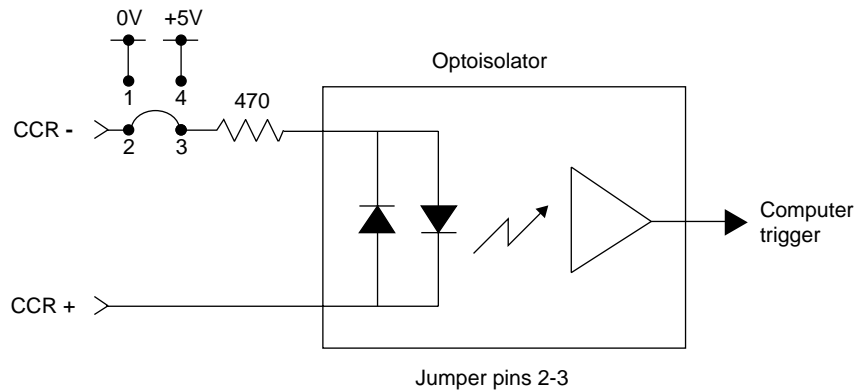
Figure 2-2 is the electrical diagram for switch closure mode.



**Figure 2-2** Jumpering for GPI Switch Closure (Factory Setting)

**Note:** In switch closure mode, the +5V power supply and ground of the DIVO board are not electrically isolated from the chassis of the source equipment.

Figure 2-3 is the electrical diagram for current sense mode.



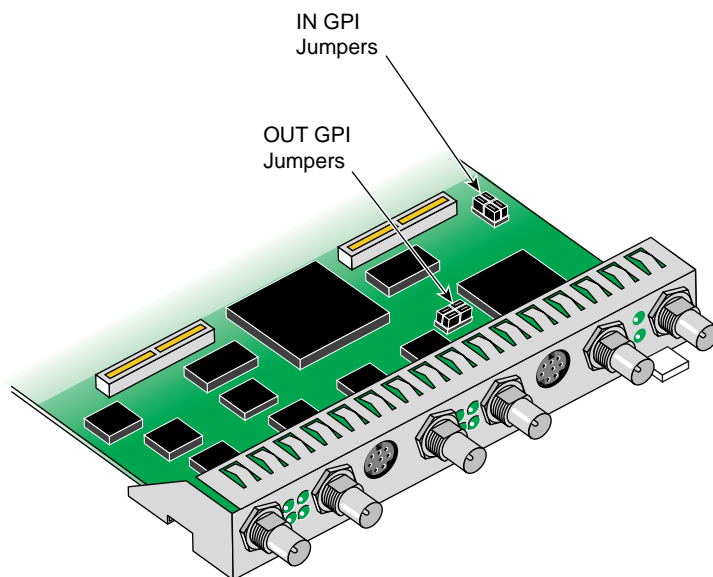
**Figure 2-3** Jumpering for GPI Current Sense Mode

**Note:** In current sense mode, the DIVO board is electrically isolated from the chassis of the source equipment.

**Note:** Everything in this manual pertaining to the GPI interface is also included in Appendix A of the *DIVO (Digital Video Option) XIO Board Owner's Guide*.

## 2.1.2 GPI Jumper Locations

Figure 2-4 shows the location of the jumper pins on the board.



**Figure 2-4** GPI Jumper Locations (Factory Setting)

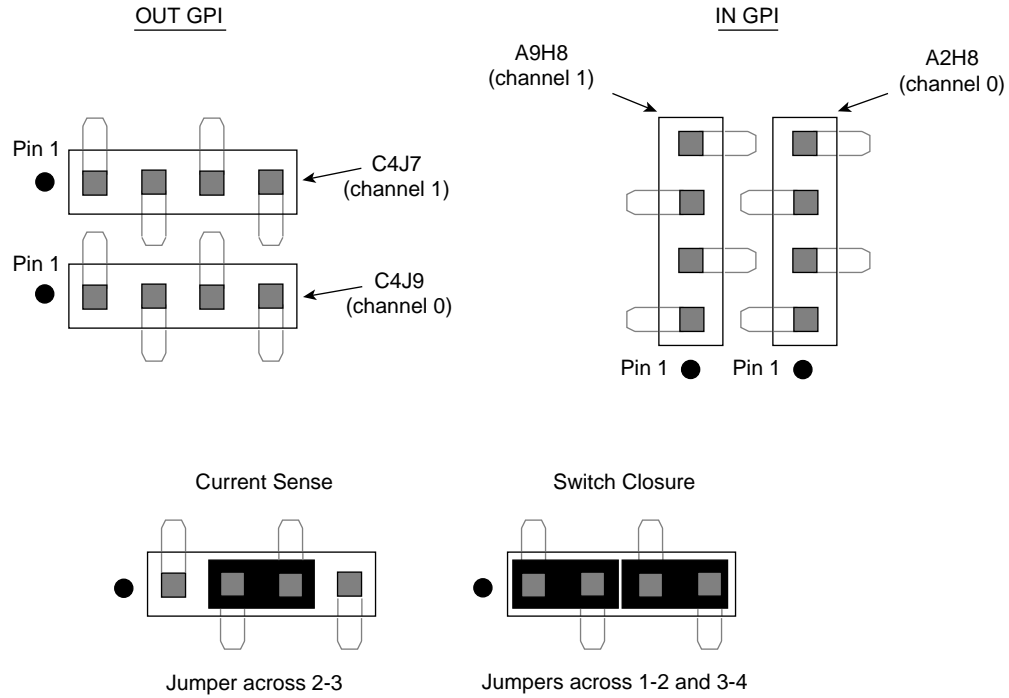
While the jumpers for the **OUT GPI** connector are near the **OUT GPI** mini-DIN connector, the jumpers for the **IN GPI** connector are far away from the **IN GPI** connector.

## 2.1.3 Jumper Configuration

Each GPI header (row of four pins) configures one of four receiver channels: two channels for GPI in and two channels for GPI out. The customer can choose to mix the modes for the various channels.

For the factory setting of switch closure mode, two jumpers are factory-installed, shorting pins 1-2 and pins 3-4. These jumpers need not be moved unless the customer wants current sense mode.

Figure 2-5 shows GPI headers and jumpering. The printed circuit board (PCB) reference designators are included to aid identification of the header associated with each GPI receiver channel.



**Figure 2-5** GPI Headers and Jumpering

To change jumpering from switch closure to current sense mode for a particular channel, follow these steps:

1. Remove one jumper; this jumper is to be stored.
2. Move the remaining jumper to the middle pins (2 and 3) of the same header.
3. Repeat this process for each channel that the customer wants reconfigured from switch closure to current sense mode.

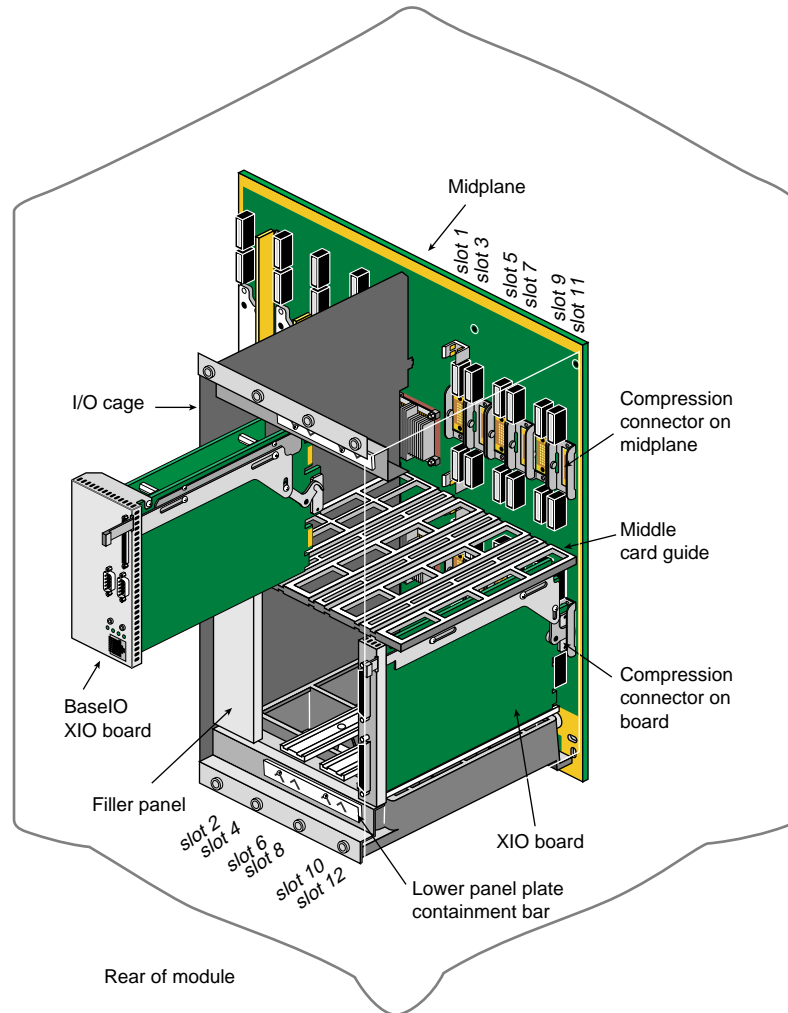
## 2.2 Selecting an XIO Slot for the DIVO Board

This section explains

- I/O for Origin2000 and Onyx2 systems
- determining the available XIO slots
- DIVO board placement restrictions

## 2.2.1 I/O for Origin2000 and Onyx2 Systems

Figure 2-6 shows I/O in the Origin2000 deskside chassis.



**Figure 2-6** I/O in the Origin2000 Deskside Chassis

Figure 2-7 shows I/O in the Onyx2 deskside chassis.

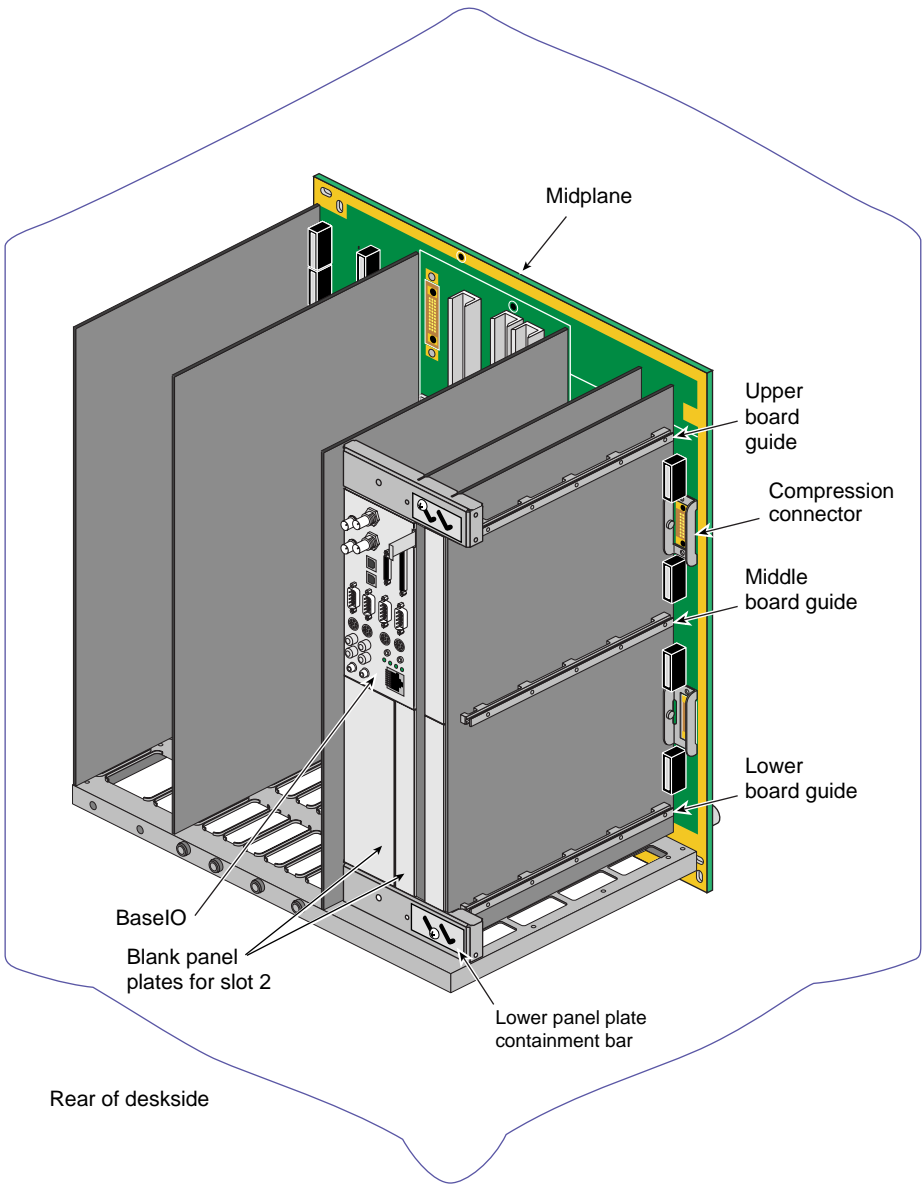


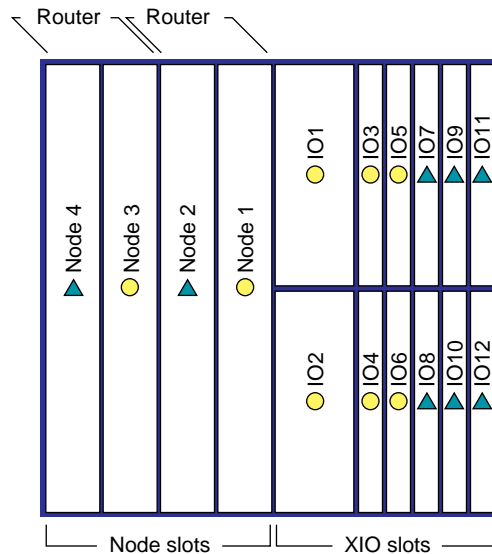
Figure 2-7 I/O in the Onyx2 Deskside Chassis

## 2.2.2 Determining the Available XIO Slots

In the Origin2000 and Onyx 2 systems, the number of installed Node boards determines the number of XIO slots that can be activated. If a system module has only one Node board, then only six of the twelve XIO slots are activated. When two Node boards are installed, all XIO slots can be activated, *if* the Node boards are positioned in the correct slots.

Figure 2-8 diagrams the Node board-to-XIO board correlation. The Node boards and their corresponding XIO board slots are indicated with either a circle or triangle. When Node 1 is present, IO slots 1 through 6 (designated by a circle) are activated. When Node 2 is also present, then IO slots 7 through 12 (designated by a triangle) are activated.

Node boards 3 and 4 also have corresponding XIO slots indicated by a circle or a triangle. For example, if Node boards are installed in slot 1 and slot 3, then only the corresponding XIO slots (1 through 6) are activated.

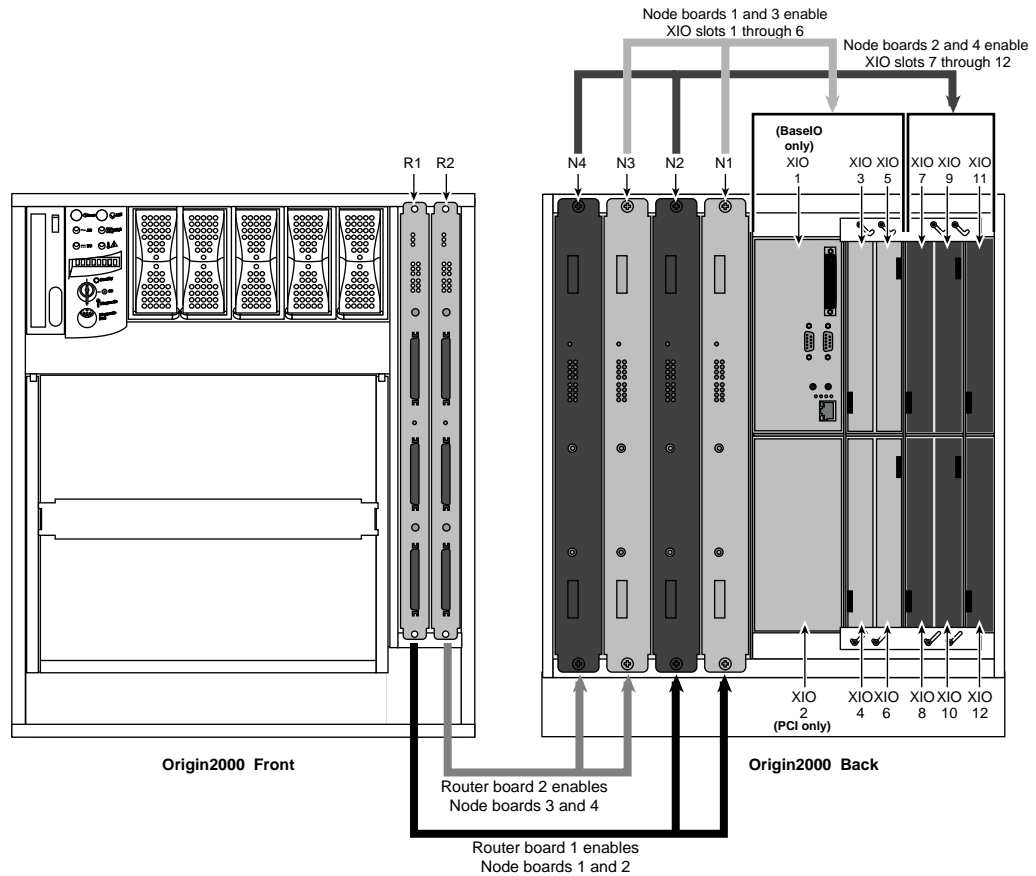


**Figure 2-8** Board Configuration and Layout for System Module

In summary:

- If a module has a Node board in slot N1 or N3, then XIO slots 1 through 6 are available.
- If it has a Node board in slot N2 or N4, XIO slots 7 through 12 are available.
- If a module has two Node boards, one in N1 or N3 and one in N2 or N4, then all twelve XIO slots are available.

Figure 2-9 diagrams the relationship between router boards, Node boards, and XIO boards.



**Figure 2-9** Router Board, Node Boards, and XIO Boards

Generally, plan to fill available odd-numbered XIO slots before filling even-numbered ones, and fill lower-numbered slots before higher-numbered ones.

The Onyx2 desktide system has a different board orientation scheme from the other three systems. You can install either three full-height boards or five half-height boards. Slot 4 combines with slot 3 to provide a full-height slot. You can install the DIVO board (a half-height board) into slot 3, but you cannot install it or any other half-height board into slot 4. (Also, the DIVO board cannot be used in XIO slot 2, as in the other systems.)

### 2.2.3 Planning DIVO Board Placement

To determine where to place the DIVO board, particularly in multi-module systems, follow the guidelines in these steps:

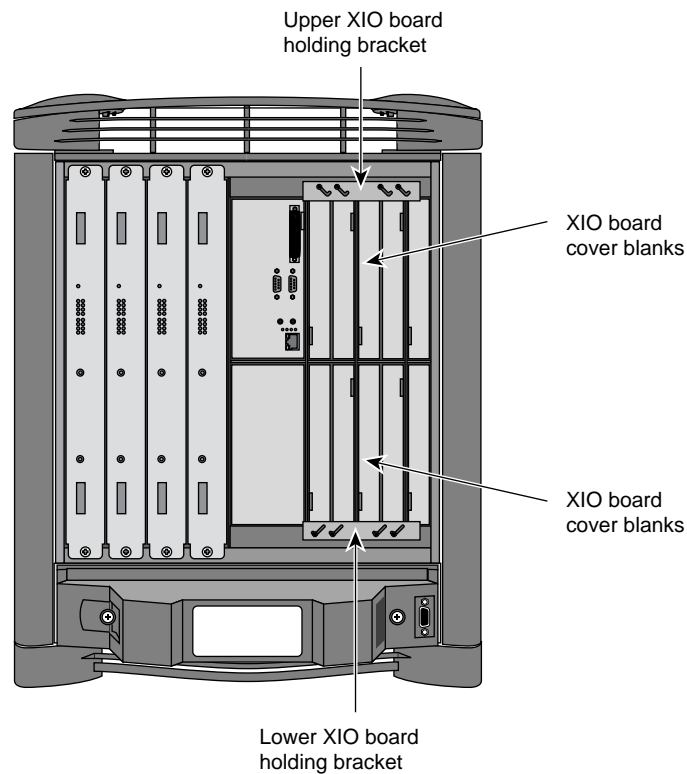
1. If you are installing the DIVO board into a system of interconnected racks, determine the rack and module into which you are going to install the board.
2. Consult with the customer to determine the video devices to which the DIVO board is to be cabled and their location.

3. Select the XIO slot(s) for the board(s), following guidelines in “Selecting an XIO Slot for the DIVO Board,” earlier in this chapter.

## 2.3 Installing the DIVO Board

After you have selected a slot for each DIVO board you are installing, follow these steps:

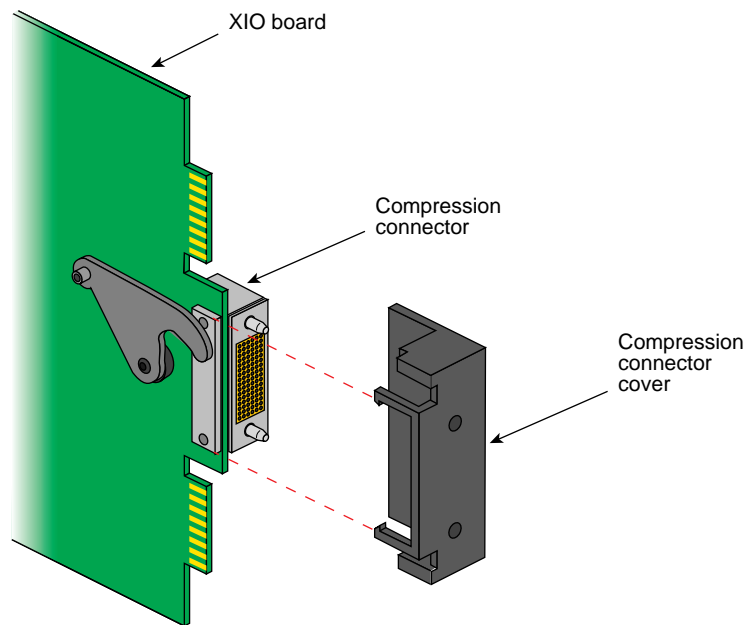
1. Be familiar with the care and handling of XIO boards, particularly the compression connectors, as explained in Chapter 1.
2. Inspect the compression connector for debris (hard gray material, hair, dust buildup, and so on). If debris or hard gray material is present in the threads, return the boards and replace them with clean ones.
3. If necessary, consult with the customer to bring down the system, making sure all users are off the system before proceeding.
4. Loosen the holding brackets (containment plates) that secure the XIO boards in place, and slide the bracket diagonally up or down to fully expose the board slots (see Figure 2-10).



**Figure 2-10** XIO Cardcage Holding Brackets and Cover Blanks

5. Remove the XIO cover blank as required (see Figure 2-10).

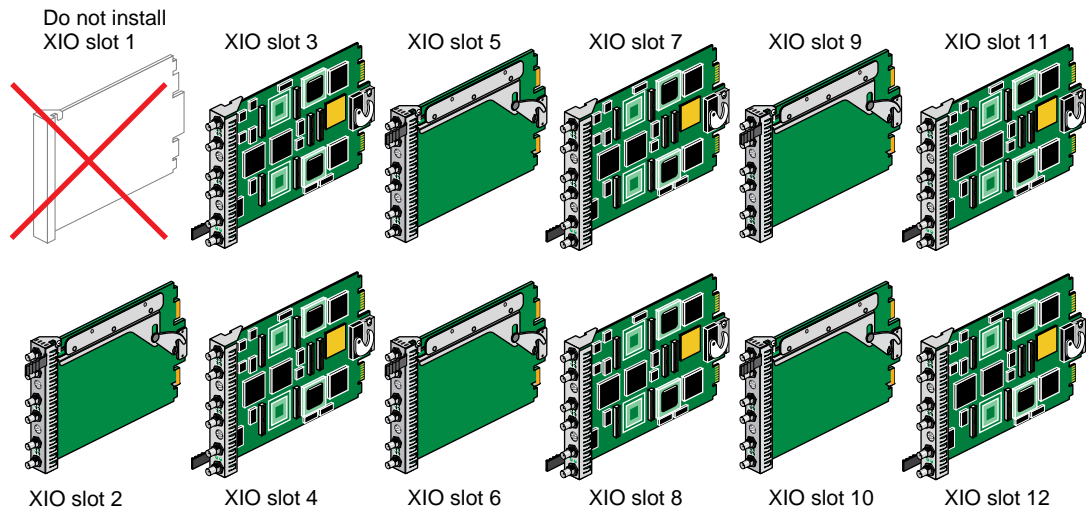
6. Remove the protective cover from the board's compression connector, as illustrated in Figure 2-11. This cover must be stored to cover the compression connector if the board is removed for any reason.



**Figure 2-11** Removing the Protective Cover From the Compression Connector

7. Orient the board appropriately for the slot. For the Origin2000 systems and the Onyx2 rackmount, the XIO boards have a different installation orientation from slot to slot:
  - The thick side faces left for slots IO1/ IO2, IO5/IO6, and IO9/IO10.
  - The thick side faces right for slots IO3/IO4, IO7/IO8, and IO11/IO12.

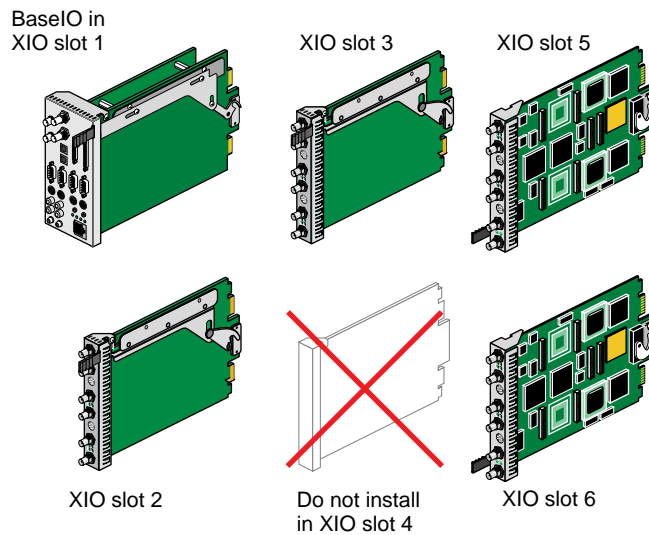
Figure 2-12 diagrams this arrangement for Onyx2 rackmount and for Origin2000 deskside and rackmount systems.



**Figure 2-12** DIVO Board Orientation (Origin2000 Systems and Onyx2 Rackmount)

**Note:** The DIVO board cannot be inserted into XIO slot 1 in an Origin2000 deskside or rackmount or an Onyx2 rackmount system.

The Onyx2 deskside system has a different board orientation scheme (see Figure 2-13).



**Figure 2-13** DIVO Board Orientation (Onyx2 Deskside)

**Note:** The DIVO board cannot be inserted into XIO slot 4 in an Onyx2 deskside system.

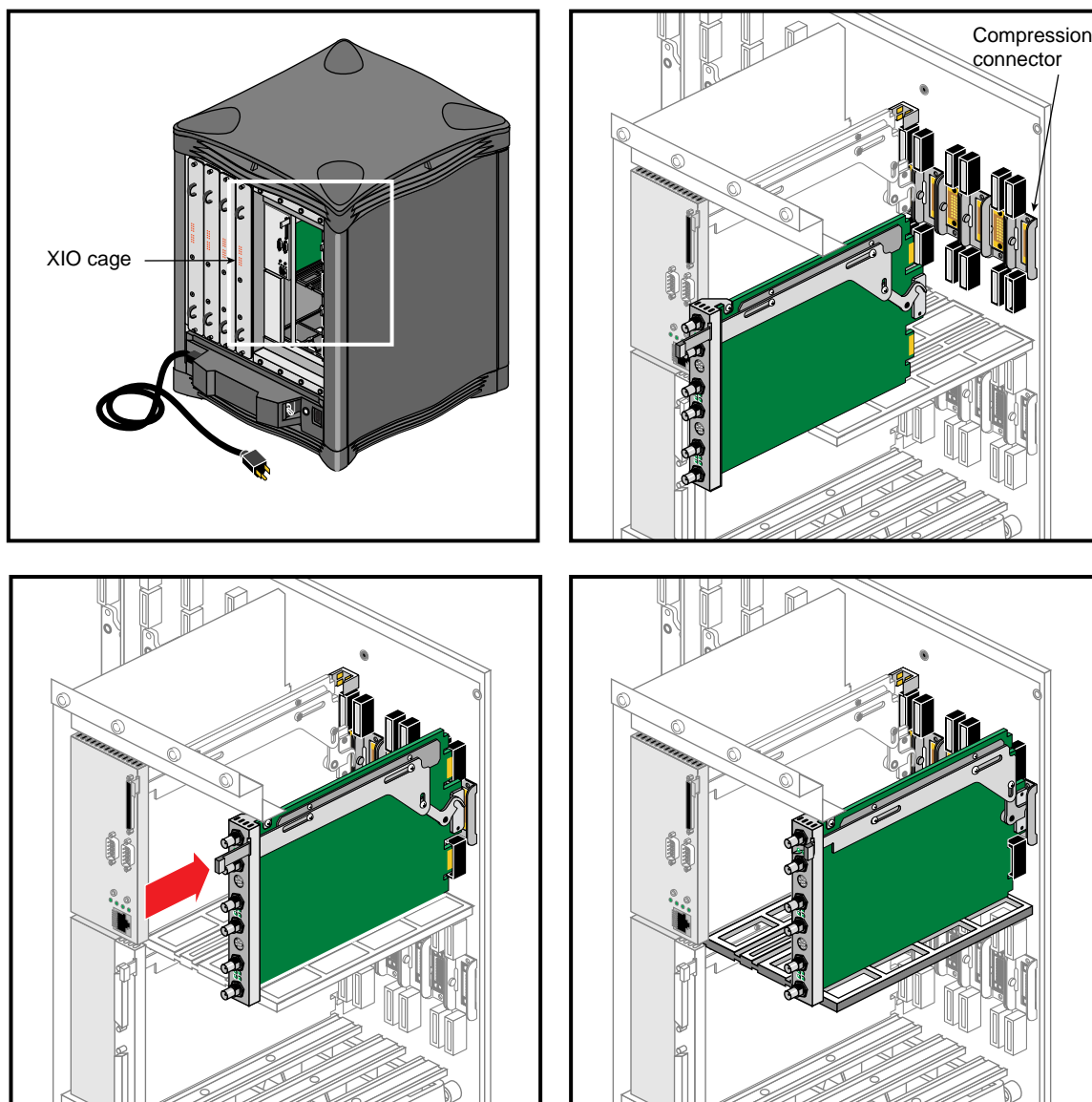
8. Position the board between the card guides and slide it into the chassis.

**Caution:** Take care that no board components are damaged as you slide the board past other XIO boards in the chassis.

- Verify that the board's panel plate is flush with the other panel plates. If it is not flush, check that the board is properly positioned between the card guides, and then press gently until it is flush. The board snaps into place.

**Caution:** Do not use force to seat the board; thumb pressure should suffice. If the board hangs an inch before going in all the way, work (wiggle) it gently so that it mates with the connectors on the midplane.

- When the board is in place, push the hook actuator handle forward to engage the compression connector; see Figure 2-14.



**Figure 2-14** Installing the DIVO Board

- Install additional DIVO boards, if the customer has ordered them.

12. Secure the DIVO board(s) in place using the holding brackets (containment plates; see Figure 2-10). Slide the bracket diagonally up or down to hold the board in place in the cardcage.
13. Repeat the steps in this section for other modules if necessary.
14. To test the new installation and install the software, follow instructions in Chapter 3, "Testing the System and Installing the Software."



## Chapter 3

# Testing the System and Installing the Software

After the upgrade hardware and new IRIX operating system have been installed, check the newly installed system. The DIVO software includes a diagnostic test shell script, *divo\_confidence*, which runs numerous tests for basic DIVO board functionality to the component level, plus VL-based test programs.

This chapter explains

- running power-on tests
- installing the software
- running *divo\_confidence*

### 3.1 Running Power-On Tests

If something is wrong with the system, it is easier to spot problems if additional devices are not connected. Leave any console terminal connected to the system. Follow these procedures to power on the system:

1. Turn on the main power switch on the back of the system.
2. Turn on the graphics monitor (and console terminal if installed).
3. Turn the System Controller key switch to the On position.
4. If desired, use the System Controller menu and display to watch the boot process status messages.

When the power-on diagnostics have been completed, you see this message on the monitor or console terminal:

```
Starting up the system ...
```

```
To perform System Maintenance instead, press <Esc>
```

5. Press **Esc** within five seconds after the completion of the power-on diagnostic. You should see a menu similar to the following:

```
System Maintenance Menu
```

- 1) Start System
- 2) Install System Software
- 3) Run Diagnostics
- 4) Recover System

5) Enter Command Monitor

Option ?

6. Enter 5, "Enter Command Monitor," and see the >> prompt.
7. Enter `hinv` to check and verify the basic hardware configuration of the system. Below is an example output.

```
System SGI-IP27
4 190 MHz IP27 Processors
Main memory size: 256 Mbytes
Integral SCSI controller 0
Integral SCSI controller 1
Integral Fast Ethernet
IOC3 serial port
Disk drive: unit 1 on SCSI Controller 0, (dksc (0,1,0))
```

**Note:** Some hardware options (such as a network board) may not be recognized by the PROM monitor and are not listed by the `hinv` command. However, after you load and boot the operating system, the `hinv` command (executed at the IRIX prompt) should list most of the system hardware options. You can also type `/usr/gfx/gfxinfo` at the IRIX prompt to obtain graphics hardware information.

8. Check the number of boards seen versus the number installed.

Another way to check that the system sees the board and attached peripherals is to run the hardware graph listing, giving the specific module, Node board slot, node, and XIO slot. Use the `-l` option for more detail about the option; for example:

```
# ls -l /hw/module/1/slot/n1/node/xtalk
```

The following is a possible output, showing entry 12 linked to a DIVO board in XIO slot 6 (IO6).

```
# ls -l /hw/module/1/slot/n1/node/xtalk
total 0
drwxr-xr-x  2 root  sys           0 Apr 22 17:44 0
lrw-----  1 root  sys          27 Apr 22 17:44 12 ->
/hw/module/1/slot/io6/divo
lrw-----  1 root  sys          29 Apr 22 17:44 15 ->
/hw/module/1/slot/io1/baseio
lrw-----  1 root  sys          30 Apr 22 17:44 8 ->
/hw/module/1/slot/io4/xwidget
```

For more information, see the *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions*. You can also use `hinv` to check the number of system controllers and devices.

## 3.2 Installing the Software

If necessary, upgrade the system software to IRIX 6.4 or later.

Make sure a CD-ROM drive is attached to the system (or is available on the network). Insert the DIVO CD, which is shipped in a separate package, into the workstation's CD-ROM drive.

Use *inst* to install the software. See the *IRIX Admin: Software Installation and Licensing* manual (007-1364-xxx) if you need more detailed information on booting the miniroot from a remote CD-ROM.

Run *hinv* at the IRIX level to determine whether the system sees all boards installed. Output might look like the following; it does not specify modules in the system.

```
FPU: MIPS R10010 Floating Point Chip Revision: 0.0
CPU: MIPS R10000 Processor Chip Revision: 2.6
4 190 MHZ IP27 Processors
Main memory size: 256 Mbytes
Instruction cache size: 32 Kbytes
Data cache size: 32 Kbytes
Secondary unified instruction/data cache size: 1 Mbyte
Integral SCSI controller 0: Version QL1040B
  Disk drive: unit 1 on SCSI controller 0
Integral SCSI controller 1: Version QL1040B
IOC3 serial port: tty1
IOC3 serial port: tty2
Integral Fast Ethernet: ef0, version 1
DIVO Video: controller 3 unit 0 state 0
IOC3 external interrupts: 1
```

You can use *hinv -m* to get board serial number, revision level, and other statistics.

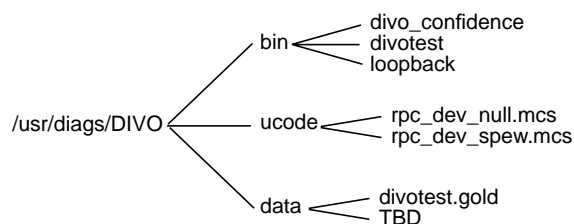
## 3.3 Running the Diagnostic Test Suite

After you have run power-on tests, bring up IRIX and run the *divo\_confidence* diagnostic test shell script (included in *divo.sw.diags*) to verify proper DIVO board operation. This script calls the diagnostic software for DIVO field service hardware diagnosis and board fault isolation.

Unlike previous video hardware diagnostics, the tests that the *divo\_confidence* script calls do not use the IDE harness and do not have a prompting interface. The operation of these tests greatly resembles that of the InfiniteReality™ diagnostic tests.

You must have root privilege to run *divo\_confidence* from the local or remote console.

Figure 3-1 diagrams the contents of the `/usr/diags/DIVO` directory.



**Figure 3-1** `/usr/diags/DIVO` Contents

The script `divo_confidence` calls board-level tests and VL-based tests. This script is also documented for customer use in the customer document, *DIVO (Digital Video Option) XIO Board Owner's Guide*.

The test suite is explained in these sections:

- `divo_confidence` functionality
- running `divo_confidence`
- `divo_confidence` output

For detailed information on the board tests, see the `divotest(1M)` reference (man) page (`/usr/share/catman/a_man/cat7/divotest.z`), or use

```
/usr/diags/DIVO/bin/divotest -help
```

or

```
/usr/diags/DIVO/bin/loopback -help
```

### 3.3.1 `divo_confidence` Functionality

A `divo_confidence` loop takes about five minutes per DIVO board. On the first DIVO board it finds, the script performs the following actions.

1. It runs a set of board-level tests on the first DIVO board it finds, printing the results at the end.
2. It runs VL-based tests on the same board, printing results at the end.
3. It repeats each set of tests.
4. It writes this output to a log file in `/usr/tmp/DIVO/logs` that reflects the number of the DIVO board; for example:
  - `/usr/tmp/DIVO/logs/divo_confidence.log0` contains test output for DIVO board 0 (the first board)
  - `/usr/tmp/DIVO/logs/divo_confidence.log1` contains test output for DIVO board 1
5. It runs the same tests on all other DIVO boards it finds, in numerical order, with repeats as above, and writes them to a log file in `/usr/tmp/DIVO/logs` that reflects the number of the DIVO board.

6. It creates a summary of all test results for all boards and prints them to the screen as well as to a separate log file, `/usr/tmp/DIVO/logs/elog.<n>`.

### 3.3.2 Running `divo_confidence`

Follow these steps:

1. In `/usr/diags/DIVO/bin`, enter  
`./divo_confidence`
2. In the test summary, check the number of boards seen by the diagnostic test suite versus the number installed.

One iteration of `divo_confidence` takes less than five minutes per DIVO board. It requires IRIX 6.4 or later.

An example output for a system with one DIVO board follows.

```
=====
=====  DIVO TEST SUMMARY  =====
=====
DIVO board 0 serial #: CEK544
Test log for board 0: /usr/tmp/DIVO/logs/divo_confidence.log0
Started on:          Tue Apr 22 10:04:11 PDT 1997
Ended on:            Tue Apr 22 10:09:00 PDT 1997
Total loops run:    2
Overall test results: board 0 in slot io6 in module 1 passed!

=====  DIVO TEST SUMMARY  =====
=====
```

The example output below notifies you that the DIVO board passed all tests. If DIVO board 0 had failed, output might be as follows.

```
=====
=====  DIVO TEST SUMMARY  =====
=====
DIVO board 0 serial #: CEK544
Logfile for board 0: /usr/tmp/DIVO/logs/divo_confidence.log0
Started on:          Mon Apr 21 22:34:28 PDT 1997
Ended on:            Mon Apr 21 22:39:17 PDT 1997
Total loops run:    2
Overall test results: board 0 in slot io6 in module 1 failed!
-> Please replace DIVO board 0 in slot io6 in module 1.
-> View /usr/tmp/DIVO/logs/elog.0 for details of test failures.

=====  DIVO TEST SUMMARY  =====
=====
```

To see ERROR and FAIL messages for each failed DIVO board in the system, look in the error log file for that board, `/usr/tmp/DIVO/logs/elog.<n>`.

To see the complete `divo_confidence` output for an individual board, view its log file, `/usr/tmp/DIVO/logs/divo_confidence.log<n>` (for example,

`/usr/tmp/DIVO/logs/divo_confidence.log0`). See Section 3.3.3, “divo\_confidence Output,” for more information.

The *divotest* suite reports failures to the field-replaceable unit (FRU) level; for DIVO, this level is the board itself. If the board fails any test, replace it.

### 3.3.3 divo\_confidence Output

As mentioned previously, when *divo\_confidence* runs the *divotest* suite, it prints results at the end of each test iteration. The output format is line-based and never more than 80 characters long. Table 3-1 summarizes the four-character identifiers that head each line of output.

**Table 3-1** divotest Output Identifiers

Identifier	Meaning
TEST	Test start marker, generated at the beginning of a test; gives test’s symbolic name and description. All lines up to next TEST line belong to this test.
RSLT	Test result, generated at the end of a test; gives test’s symbolic name and the test result (PASS, FAIL, UNRESOLVED, UNTESTED).
DIAG	Diagnostic message: one or more of these lines precedes any FAIL or UNRESOLVED message. Message indicates components or wires that are possible causes of the failure.
INFO	Information useful to advanced user of the diagnostic test including test progress reports, exp/rcv pairs, and so on.
DEBUG	Gives information only when debugging output is turned on (not recommended for field use).
TIME	Time stamp, generated at important time boundaries such as the beginning and end of divotest.
META	Summarizes information for several tests or across multiple full test loops in table format, giving PASS and FAIL counts of each test and totals over all tests.
ABRT	Reports an exceptional error condition leading to the abortion of the diagnostic tests; probably caused by a malloc failure, unexpected system call failure, or assertion failure; rare.
FILES	<code>/usr/diags/DIVO/bin/divotest</code> contains executables for DIVO diagnostics. <code>/usr/diags/DIVO/ucode</code> is a directory of DIVO diagnostic microcode. <code>/usr/diags/DIVO/data</code> is a directory of data files for DIVO diagnostics. See Figure 3-1.

The following is an example test output for *divo\_confidence*—that is, both *divotest* and the VL-based tests—for a system with two DIVO boards correctly installed.

**Note:** For ease of understanding, iterations are indicated rather than reproduced in full.

```
===== DIVO_CONFIDENCE ===== DIVO_CONFIDENCE ===== DIVO_CONFIDENCE =====
===== DIVO_CONFIDENCE ===== DIVO_CONFIDENCE ===== DIVO_CONFIDENCE =====
```

```
Starting divo_confidence script .....
```

Found 2 DIVO(s) installed .....

divo\_confidence script takes about 5 minutes per board to run .....  
Looping 2 time(s) .....

Test log for board 0 is /usr/tmp/DIVO/logs/divo\_confidence.log0

```
Uname:                IRIX64 testsystem28-3 6.4 02121744 IP27
Divotest is:          /usr/diags/DIVO/bin/divotest
VL tests path:        /usr/dmedia/bin/DIVO
```

```
==> Tue Apr 22 10:04:12 PDT 1997
==> Running divotest (ex_loop 1) on board 0 slot io6 module 1
TIME      0.005   Tue Apr 22 10:04:12 1997
CMDL      /usr/diags/DIVO/bin/divotest MODNUM=1 DEVNUM=0 REPEAT=10
CMDL      -continue -fe0 -fel TRACE=/usr/tmp/DIVO/logs/divotest.0
CMDL      -notime -noinfo -notrace
TEST init0      Initialize INPIPE front-end hardware
RSLT init0      PASS
TEST init1      Initialize OUTPIPE front-end hardware
RSLT init1      PASS
TEST refresh0   Refresh INPIPE SDRAM
RSLT refresh0   PASS
TEST refresh1   Refresh OUTPIPE SDRAM
RSLT refresh1   PASS
TEST bridge     BRIDGE sanity test
RSLT bridge     PASS
TEST linc0sanity INPIPE LINC sanity test
RSLT linc0sanity PASS
TEST linc1sanity OUTPIPE LINC sanity test
RSLT linc1sanity PASS
TEST flash0sanity INPIPE FLASHPROM sanity test
RSLT flash0sanity PASS
TEST flash1sanity OUTPIPE FLASHPROM sanity test
RSLT flash1sanity PASS
TEST sdram0     INPIPE SDRAM stress test
RSLT sdram0     PASS
TEST sdram1     OUTPIPE SDRAM stress test
RSLT sdram1     PASS
TEST linc0mbox  INPIPE LINC mailbox test
RSLT linc0mbox  PASS
TEST linc1mbox  OUTPIPE LINC mailbox test
RSLT linc1mbox  PASS
TEST linc0dma   INPIPE LINC DMA engine0/engine1 stress test
RSLT linc0dma   PASS
TEST linc1dma   OUTPIPE LINC DMA engine0/engine1 stress test
RSLT linc1dma   PASS
```

<<<you might see other tests as well as these>>>  
<<<test series repeats>>>  
<<<results of divotest appear>>>

META	ITERATION=10	PASSES	NON-PASSES
META	init0	10	0
META	init1	10	0
META	refresh0	10	0
META	refresh1	10	0

META	bridge	10	0
META	linc0sanity	10	0
META	linclsanity	10	0
META	flash0sanity	10	0
META	flashlsanity	10	0
META	sdram0	10	0
META	sdram1	10	0
META	linc0mbox	10	0
META	linclmbox	10	0
META	linc0dma	10	0
META	lincldma	10	0
META	TOTAL	150	0

<<<VL-based tests run next>>>  
<<<results of VL-based tests appear>>>

<<<both test series repeat>>>  
<<<complete suite is run on other board installed>>>  
<<<then results of all tests are summarized>>>

=====  
===== DIVO TEST SUMMARY =====

DIVO board 0 serial #: CEK544  
Test log for board 0: /usr/tmp/DIVO/logs/divo\_confidence.log0  
Started on: Tue Apr 22 10:04:11 PDT 1997  
Ended on: Tue Apr 22 10:09:00 PDT 1997  
Total loops run: 2  
Overall test result: board 0 in slot io6 in module 1 passed!

DIVO board 1 serial #: CEK545  
Test log for board 1: /usr/tmp/DIVO/logs/divo\_confidence.log1  
Started on: Tue Apr 22 10:10:11 PDT 1997  
Ended on: Tue Apr 22 10:15:00 PDT 1997  
Total loops run: 2  
Overall test result: board 1 in slot io7 in module 1 passed!

=====  
===== DIVO TEST SUMMARY =====

## *Chapter 4*

# **Maintenance**

This chapter describes

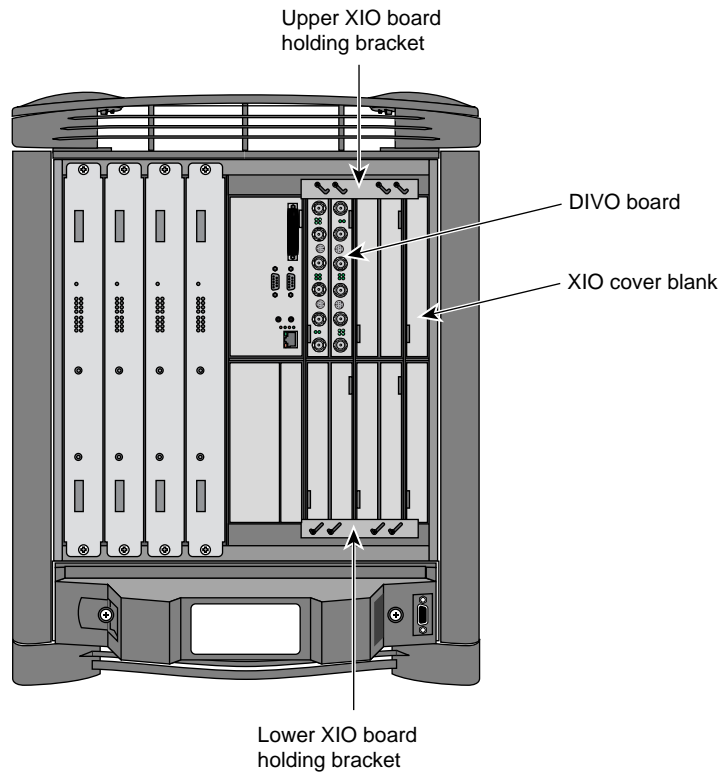
- removing a DIVO board
- cleaning the compression connector

### **4.1 Removing the DIVO Board**

To remove a DIVO board, follow these steps:

1. Make sure all users are off the affected systems.
2. Have ready an antistatic surface or packaging for the board. Have ready the compression connector cover and an XIO slot cover.
3. At the back of the chassis, detach all I/O cables for the DIVO boards you are removing. If necessary, attach labels or make a diagram to prevent wrong connections when the system is recabled. For a rackmount system, remove the securing bands that hold the cables in place.

- Loosen the holding brackets that secure the XIO boards in place, and slide the bracket diagonally up or down (see Figure 4-1).



**Figure 4-1** XIO Cardcage Holding Brackets and Cover Blanks

- Pull out the hook actuator handle on the DIVO board to disengage the compression connector and gently pull the board out from the system.  
**Caution:** Take care that no board components are damaged as you move the carrier past other XIO boards in the cage.
- Attach the compression connector cap and package the board.
- Replace the XIO slot cover.
- Slide and secure the holding brackets back in place.

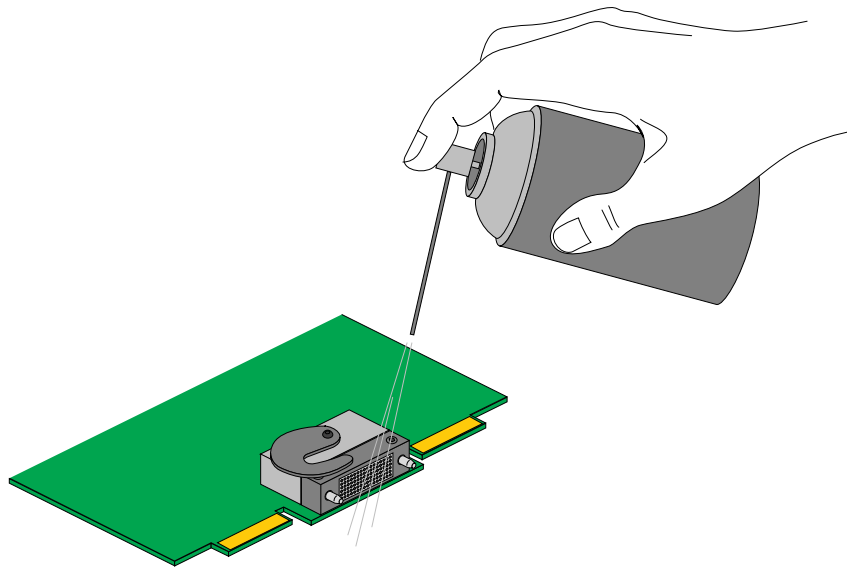
## 4.2 Cleaning the Compression Connector

A compression connector should never need to be cleaned, if you keep the protective cover on whenever the XIO board is not installed.

**Note:** Some pollutants can irreversibly damage (corrode or chemically alter) the pad surfaces. Although cleaning may remove the pollutant, it will not repair damage incurred by this contact.

To remove pollutants, follow these instructions:

1. Obtain a can of dry, compressed inert gas (for example, 100% pure nitrogen).  
**Caution:** Do not use a cleaning product that contains any of the following ingredients: halogenated hydrocarbons, aromatic hydrocarbons, ethers, sulphur, ketones, or solvents of any kind. These substances will cause irreparable damage to the connector's surface.
2. Prepare the can for use as instructed on the can. For example, attach the spray tube, if provided, to the can's dispensing mechanism.
3. Remove the compression connector cap. Hold the can so that the tip of the applicator is 1 to 2 inches away from the first row of pads at the topmost edge of the connector (as illustrated in Figure 4-2) and at a slight angle so that the spray hits each pad and flows downward. You will be spraying at the pads on one row but in the direction of the next row of pads. Do not allow the applicator to touch the pads.



**Figure 4-2** Cleaning the Compression Connector

4. Spray, moving the spray along the side of the connector until the entire first row has been sprayed. Move down (to the next row). Repeat until all the pads have been sprayed.
5. Replace the compression connector cap.



## Appendix A

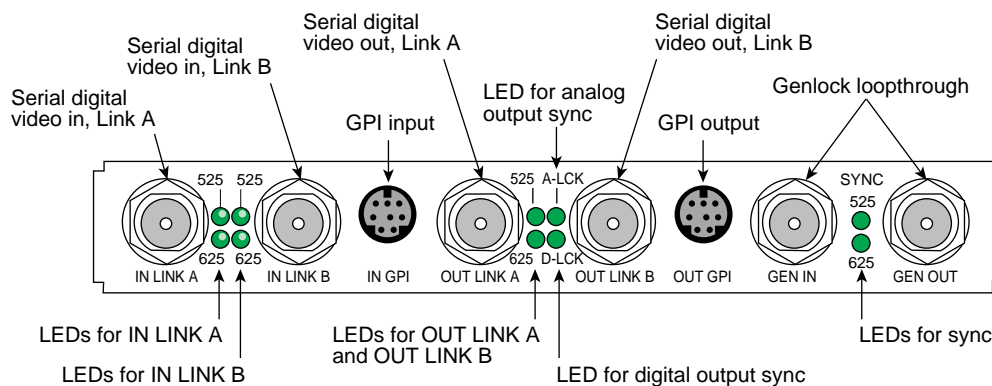
### DIVO I/O Panel Connector Specifications

This appendix summarizes hardware specifications for the DIVO option:

- DIVO connectors
- GPI interface

#### A.1 DIVO Connectors and LEDs

Figure A-1 shows features of the DIVO I/O panel. Although the board is installed vertically in the chassis, Figure A-1 shows the panel sideways to aid in reading the connector and LED labels.



**Figure A-1** DIVO I/O Panel

This section discusses

- connector function
- 4:2:2:4 and 4:4:4:4 usage
- genlock connectors
- LED function

### A.1.1 Connector Function

Table A-1 summarizes DIVO board external connectors that interface with video equipment.

**Table A-1** Interface for Video Equipment

Connector	Format	Use
<b>IN LINK A, IN LINK B</b>	10-bit CCIR 601 75-ohm BNCs Terminated, unbalanced	Serial digital video input from digital tape deck or other recording device. Conforms to SMPTE 259M for component video, SMPTE 272M for embedded audio, and SMPTE 266M for DVITC. Both inputs autophased.
<b>OUT LINK A, OUT LINK B</b>	10-bit CCIR 601 75-ohm BNCs	Serial digital video output to digital tape deck or other recording device. Conforms to SMPTE 259M for component video, SMPTE 272M for embedded audio, and SMPTE 266M for DVITC.  <b>Note:</b> The transfer mode (packing format) selected determines LINK A and LINK B usage, as explained in Table A-4 and Table A-5.
<b>GEN IN</b>	75-ohm BNC Loophrough, unbalanced, unterminated	External analog sync source (precision time base or other source of house sync) or analog loophrough. Composite sync (1Vp-p) or black burst.
<b>GEN OUT</b>	75-ohm BNC Loophrough, unbalanced, unterminated	External reference loop out; passive loophrough for genlock input with buffered signal to workstation.  <b>Note:</b> If you attach a cable to one <b>GEN</b> connector, you must attach either another cable to other equipment accepting analog sync or a 75-ohm BNC terminator to the other <b>GEN</b> connector.
<b>GPI IN, GPI OUT</b>	8-pin mini-DIN	General Purpose Interface for each video port; frame-accurate event triggering to or from source or destination (tape deck or digital recorder). configurable for switch closure (factory setting) or current sense operation.

Table A-2 summarizes return loss for the **IN LINK A**, **IN LINK B**, and **GEN IN** connectors.

**Table A-2** Return Loss for IN LINK A, IN LINK B, and GEN IN Connectors

Channel	Value
<b>IN LINK A, IN LINK B</b>	>15 dB @ 270 MHz
<b>GEN IN</b>	>35 dB @ 5 MHz

Table A-3 summarizes output characteristics for the **OUT LINK A** and **OUT LINK B** connectors.

**Table A-3** Characteristics for OUT LINK A and OUT LINK B Channels

Characteristic	Value
Amplitude	800 mv +/-10%
Rise/fall time	.75 ns to 1.5 ns
Overshoot	<10% p-p
Alignment jitter	<740ps p-p

### A.1.2 4:2:2:4 and 4:4:4:4 Usage

Table A-4 explains the use of **LINK A** and **LINK B** connectors for 4:2:2:4 mode. If **LINK B** is not used in 4:2:2:4 format, the resulting format is 4:2:2. The **LINK A** connector carries 10-bit wide UVY information, sampled as 4:2:2; the **LINK B** connector carries 10-bit alpha information, sampled as 0:0:4.

**Table A-4** Usage for LINK A and LINK B in 4:2:2:4 Mode

Sample	LINK A	LINK B
1	Cb <sub>0</sub>	x
2	Y <sub>0</sub>	A <sub>0</sub>
3	Cr <sub>0</sub>	x
4	Y <sub>1</sub>	A <sub>1</sub>

Table A-5 explains the use of **LINK A** and **LINK B** connectors for 4:4:4:4 mode. The **LINK A** connector carries 10-bit wide UVY information, sampled as 4:2:2; the **LINK B** connector carries the remaining 10-bit UV samples and 10-bit alpha, sampled as 4:4:2. Usage is similar for 10-bit RGBA.

**Table A-5** Usage for LINK A and LINK B in 4:4:4:4 Mode

Sample	LINK A	LINK B
1	Cb <sub>0</sub>	Cb <sub>1</sub>
2	Y <sub>1</sub>	A <sub>0</sub>
3	Cr <sub>0</sub>	Cr <sub>1</sub>
4	Y <sub>1</sub>	A <sub>1</sub>

**Note:** For more detail, see SMPTE Recommended Practice (RP) 175-1993: Digital Interface for 4:4:4:4 Component Video Signals (Dual Link).

### A.1.3 Genlock Connectors

The **GEN OUT** and **GEN IN** connectors comprise a passive genlock loopthrough connection, accepting a one-volt peak-to-peak analog composite video signal or reference black burst.

If you attach a cable to one **GEN** connector, you must attach to the other **GEN** connector either a 75-ohm BNC terminator or a cable to other equipment accepting analog sync. If another cable is connected, it must ultimately be terminated.

### A.1.4 LED Function

Figure A-2 points out the LEDs.

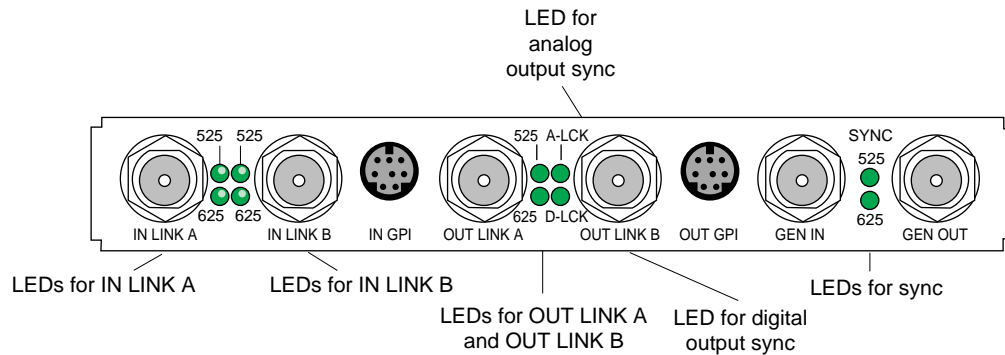


Figure A-2 DIVO LEDs

Table A-6 summarizes the function of the LEDs on the panel.

Table A-6 DIVO Panel LEDs

LED	Purpose
LEDs for <b>IN LINK A</b> (525 and 625) LEDs for <b>IN LINK B</b> (525 and 625)	Top LED lights when valid 525-line serial digital signal detected. Bottom LED lights when valid 625-line serial digital signal detected.
LEDs for <b>OUT LINK A</b> and <b>OUT LINK B</b> (525 and 625)	Valid 525-line (top LED) or 625-line (bottom LED) serial digital signal detected on <b>OUT LINK A</b> and <b>OUT LINK B</b> ; these outputs are locked together, regardless of whether <b>OUT LINK B</b> is used.
LED for analog output sync ( <b>A-LCK</b> )	Lights when <b>OUT LINK A</b> and <b>OUT LINK B</b> are locked to an analog source. Specific choices (standalone, genlock, or free run) are set with the VL_SYNC and VL_SYNC_SOURCE controls, as explained in the <i>DIVO (Digital Video Option) XIO Board Owner's Guide</i> .
LED for digital output sync ( <b>D-LCK</b> )	Lights when <b>OUT LINK A</b> and <b>OUT LINK B</b> are locked to a digital source, either <b>IN LINK A</b> or <b>IN LINK B</b> , as set with the VL_SYNC and VL_SYNC_SOURCE controls, as explained in the <i>DIVO (Digital Video Option) XIO Board Owner's Guide</i> .
LEDs for sync ( <b>SYNC 525</b> and <b>625</b> )	Valid analog 525-line loopthrough or external sync source (top LED) or valid analog 625-line loopthrough or external sync source (bottom LED) detected.

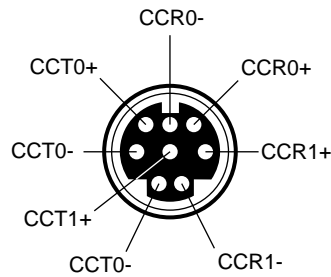
## A.2 GPI Interface

For each video pipe, the General Purpose Interface (GPI) provides two channels of input and output trigger signal pairs. This section explains

- GPI pinouts
- GPI receiver
- GPI transmitter

### A.2.1 GPI Pinouts

Figure A-3 shows pinouts for the GPI; the information is applicable for both the **IN GPI** and **OUT GPI** connectors.



**Figure A-3** GPI Pinouts

Each +/- signal pair of the same name applies to one channel of either a receive or transmit optical device. Table A-7 gives the meaning of the pins in Figure A-3.

**Table A-7** GPI Pinouts

Pin	Symbol	Name	Channel
8	CCT0+	Contact Closure Transmit +	0
4	CCT0-	Contact Closure Transmit -	0
5	CCT1+	Contact Closure Transmit +	1
2	CCT1-	Contact Closure Transmit -	1
6	CCR0+	Contact Closure Receive +	0
7	CCR0-	Contact Closure Receive -	0
3	CCR1+	Contact Closure Receive +	1
1	CCR1-	Contact Closure Receive -	1

## A.2.2 GPI Receiver

GPI Contact Closure Receive (CCR) inputs use an optical isolator device to provide a means of electrical isolation from source equipment. The device consists of a bidirectional input LED optically coupled to a bipolar transistor.

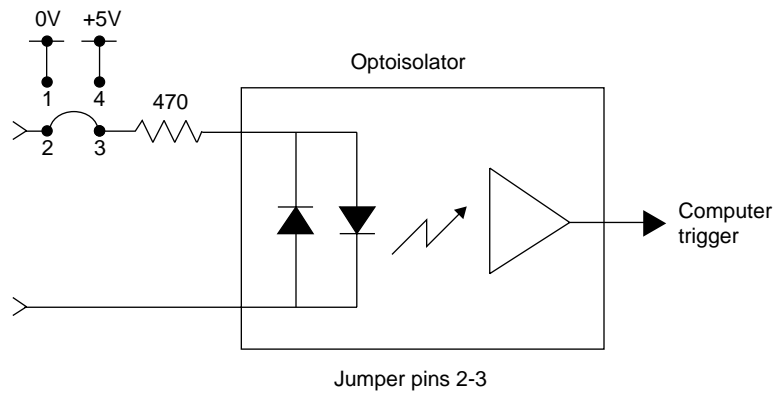
**Note:** The GPI receiver is configurable for switch closure mode or current sense mode. For information on configuring the GPI ports, see “Configuring the GPI Ports” in Chapter 2.

Table A-8 summarizes electrical specifications for the GPI receiver optoisolator.

**Table A-8** GPI Receiver Input Optoisolator

Parameter	Value
Forward voltage ( $V_f$ )	1.55 V, 1.2 V typical ( $I_F = 10$ mA)
Continuous forward current ( $I_f$ )	30 mA
Peak forward current	1000 mA (10 $\mu$ s duration, 1% DC)
Reverse current ( $I_R$ )	0.1 $\mu$ A, 100 $\mu$ A maximum ( $V_R = 6$ V)
Isolation surge voltage ( $V_{10}$ )	2500 VAC <sub>RMS</sub> ( $t=1$ minimum)

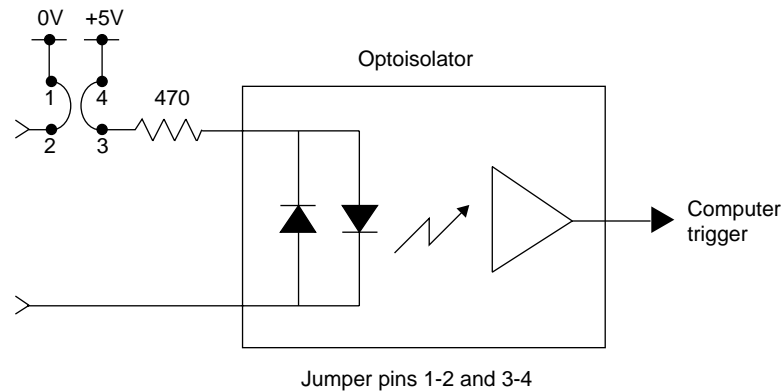
Figure A-4 shows current sense jumpering.



**Figure A-4** Jumpering for GPI Current Sense Mode (Factory Setting)

**Note:** In switch closure mode, the +5 V power supply and ground of the DIVO board are not electrically isolated from the chassis of the source equipment.

Figure A-5 shows switch closure jumpering, which creates a digital pulse.



**Figure A-5** Jumpering for GPI Switch Closure

**Note:** In current sense mode, the DIVO board is electrically isolated from the chassis of the source equipment.

For switch closure mode, the GPI receiver can be interfaced to the source equipment by tying the CCR+ and CCR- terminals across the output terminals of an optoisolator, solid-state relay, or any device that acts like a single-pole contact switch. A GPI trigger is generated as long as the source switch is closed.

**Note:** Polarity of the CCR+/- signals must be observed for the source equipment in switch closure mode.

For current sense mode, the CCR+ and CCR- signals can be interfaced by tying the CCR+ terminal to the output of a TTL or CMOS logic device, and by tying the CCR- terminal to GND of the source equipment. Whenever the logic device is driving a logic high, a GPI trigger is generated.

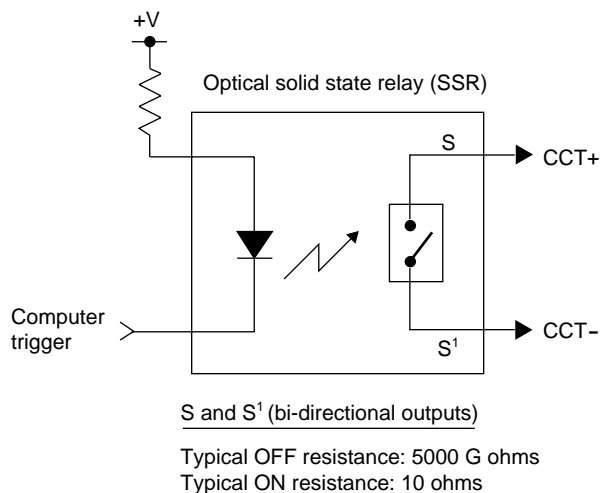
In current sense mode, the logic sense can be swapped (inverted) by moving the CCR- signal from GND to the logic power supply (typically VCC) of the source equipment. The CCR+ signal remains connected to the output of the logic device; however, in this configuration an open collector type device can be used. Whenever the logic device is sinking current a logic low, a GPI trigger is generated.

### A.2.3 GPI Transmitter

GPI Contact Closure Transmit (CCT) outputs use an optically coupled solid-state array (SSR) to provide a means of electrical isolation for destination equipment. The GPI transmitter is triggered by a computer command which forward-biases the internal LED, which in turn drives the output MOSFET, closing the contacts of the SSR.

When the GPI trigger is off, a high resistance exists between the CCT+/- terminals. When the GPI is on (triggered by the computer), a low resistance exists between the terminals.

Figure A-6 and Table A-9 show electrical specifications for the GPI transmitter.



**Figure A-6** GPI Transmitter Electrical Specifications

**Table A-9** GPI Transmitter Electrical Specifications

Parameter	Value
On resistance	10 ohms typical, 15 ohms maximum
Off resistance	5000 G ohms
Current limit	360 mA typical, 460 mA maximum
Output capacitance	60 pF
Continuous DC load current	180 mA
Output power dissipation	600 mW
Isolation voltage	3750 V rms

The GPI transmitter can be interfaced to the destination equipment by tying the CCT- terminal to GND and using the CCT+ terminal as a current sink. The input device can consist of a logic device with active pullup, an optoisolator LED with series-limiting resistor, or relay primary with series-limiting resistor.

The GPI transmitter's logic sense can be swapped (inverted) by tying the CCT+ terminal to the logic power supply (VCC) of the destination equipment and using the CCT- terminal to drive the input of the receiving device.