Configuring XIO Boards in the Origin2000™ System

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Mountain View, California

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For More Information

The following Origin™-related manuals can be found in the online Technical Publications library, found at http://techpubs.engr.sgi.com/. You can search for these and other documents in the Technical Publications library this same URL.

Note: Some of these are internal SGI documents, and are not available outside the firewall.

- *IRIS 4-Port Fast Ethernet Adapter With Asynchronous Serial XIO Board Installation Instructions* (108-0151-*nnn*)

  These SSE-only instructions cover installation on the Origin2000 and Onyx2™ platforms.

- *Origin and Onyx2 Programmer's Reference Manual* (007-3410-*nnn*)

  This manual describes the Origin family and Onyx2 memory map, and the physical and virtual address spaces. This includes the following spaces: Hub Special, I/O, Memory Special, and Uncached.

- *Origin Vault Owner's Guide* (007-3455-*nnn*)

  This guide describes how to set up and operate the Silicon Graphics® Origin Vault expansion option. Accommodating six Fast-20 (Ultra) SCSI 3.5-inch disk drives and one full-height or two half-height SCSI-2 5.25-inch drives, this option provides additional I/O for the Origin2000, Origin200™ (with a SCSI option PCI card), or Onyx2 system. Written for owners and users, this guide presumes general knowledge of SCSI devices and of the host system with which the Origin Vault storage option is to work.

- *Origin200 and Origin Vault Installation Instructions* (108-0153-*nnn*)

  This guide describes how to set up and configure Origin200 servers and Origin Vault expansion cabinets in both tower (deskside) and rackmount installations. The book also contains procedures for removing and replacing all customer-replaceable units and field-replaceable units, lists of LED error codes, cable descriptions, and connector pin assignments.

- *Origin200 Owner's Guide*
  (007-3415-*nnn*)

  This guide describes how to set up and configure an Origin200 server as a tower
  (free-standing) and rackmounted system. It provides an overview of the server's
  features (including physical and environmental specifications) as well as detailed
  steps to add peripherals (such as drives, memory, and PCI option boards). Other
  information provided includes: using the AUX port and system controller to check
  system status—fan speed, temperature—and to turn the power on and off remotely;
  accessing the server using a World Wide Web browser; interpreting the system status
  and Ethernet LEDs; and removing and replacing various components.

- *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions*
  (108-0155-*nnn*)

  This manual describes the hardware and software information necessary to install
  and configure an Origin2000 and Onyx2 deskside, rackmount, or multirack system.

- *Origin2000 Deskside Owner's Guide*
  (007-3453-*nnn*)

  This guide is designed to help you learn to use, manage, troubleshoot, and upgrade
  your Origin2000 deskside server.

- *Performance Tuning Optimization for Origin2000 and Onyx2*
  (007-3430-*nnn*)

  This book contains lecture material and some worked examples from a course on
  tuning and optimizing application programs for the Origin2000 and Onyx2 systems.
  Topics include concepts of the MIPS® R10000™ superscalar CPU; Origin2000 cache and
  memory architecture: use of Fortran and C compiler options; profiling; and
  parallelization.

- *Origin2000 Power-On Diagnostics*
  (108-0161-*nnn*)

  This document describes the power-on diagnostics for the Origin2000 series computer
  systems. It is written for System Support Engineers (SSEs) to use as a reference
  document in training and onsite. It describes the boot sequence, how to invoke the
  power-on diagnostics manually, the IP27 PROM tests, the BaseIO PROM tests, and
  POD mode.

- *Origin2000 Rackmount Owner's Guide*
  (007-3456-*nnn*)

  The Origin2000 Rackmount Owner's Guide describes how to operate the Origin2000
  rackmount system. Specifically, it describes how to set up an Origin2000 rackmount
  system and turn it on; install peripherals; install and remove software; diagnose
  hardware problems; replace faulty parts, and correctly maintain the system.

- *Site Preparation for Origin Family and Onyx2*
  (007-3452-*nnn*)

  This guide presents, in a step-by-step fashion, the information system support
  engineers (SSEs), site personnel, and other interested parties need to know in order to
  prepare a customer site for the arrival of a Silicon Graphics Origin200 server,
  Origin2000 server, or Onyx2 graphics supercomputer system.

- *Ultra SCSI XIO Board Installation Instructions*
  (108-0157-*nnn*)

  Written for SSEs, this guide explains how to install and cable the Ultra SCSI external SCSI expander option board, a half-height XIO board that provides up to four additional external SCSI port for an Origin2000 or Onyx2 deskside or rackmount system. This guide also explains board replacement, and cleaning of the board's compression connectors.

- *Ultra SCSI XIO Board Owner's Guide*
  (007-3499-*nnn*)

  The Ultra SCSI XIO option provides up to four additional external SCSI ports for the Origin family of Origin2000 or Onyx2 servers and graphics workstations. Written for owners and users, this guide explains board features, SCSI basics, and topologies using the Ultra SCSI option board.

Configuring Origin2000 XIO Boards

This manual describes the efficient configuration of XIO boards in Origin2000 systems. It covers the XIO boards, Node boards, Router boards, and a brief description of the Crossbow (XBOW) ASICs.

This section covers:

- board locations and arrangements
- configuring single- and multiple-module systems

Configuration guidelines are given for:

- single-module systems
- systems with more than one module (multimodule)

A multimodule system is normally mounted in a rack and contains more than one system module and/or graphics module.

These configuration guidelines assume that a multimodule system has two Standard Router cards in each module.

Board Locations and Arrangements

This section describes the location, preferred arrangement, and orientation of XIO boards, Node boards, and Router boards. It describes the mandatory orientation of XIO boards in the midplane, and the connections of Node boards with Router boards.

Location of the XIO and Node Boards

A Node board can control up to six XIO boards.

Figure 1 shows the locations of Node and XIO boards as viewed from the rear of the Origin2000 chassis.
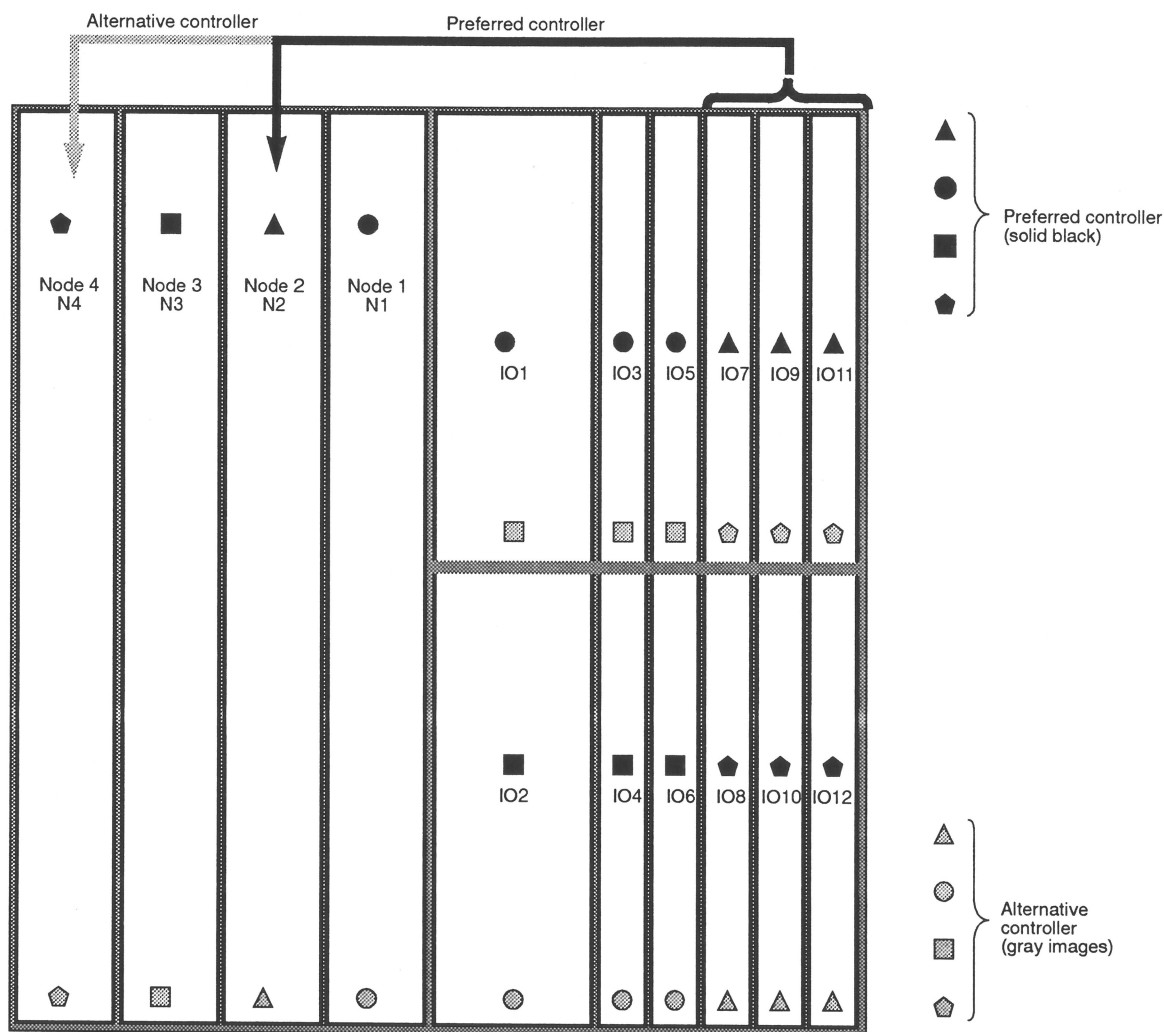
Figure 1   Board Positions and Preferable/Alternative XIO Configurations in Origin2000 Chassis

XIO Board Configurations

Two types of tags—black and gray—are used in this document to indicate *preferred* and *alternative* XIO board configurations.

- The solid black shapes in Figure 1—circle, triangle, square, pentagon—indicate the **preferred** IO-board-to-Node-board control connections.

- The gray shapes in Figure 1 indicate allowable **alternative** configurations.

Note: These labels are used in this document only; they are not on the system.

For instance, it is preferred that IO slot 7 (IO7) be controlled by Node board 2; therefore, both locations (IO7 and N2 in Figure 1) are tagged with solid black triangles. The solid black arrow going from IO7 to N2 in Figure 1 also indicates this preferred arrangement.

Although it is not the preferred configuration, IO7 can also be controlled by Node 4. This is indicated by the gray pentagons on IO7 and N4 in Figure 1. The gray arrow in Figure 1 also indicates this alternative configuration.

Orientation of XIO Boards

Figure 2 shows the way the XIO boards must be oriented when sliding them into their midplane slots. The component sides of each of the following pairs of XIO boards must face towards each other:

> 3 and 5
>
> 7 and 9
>
> 4 and 6
>
> 8 and 10

Installing them in any other position could damage the boards or the system.
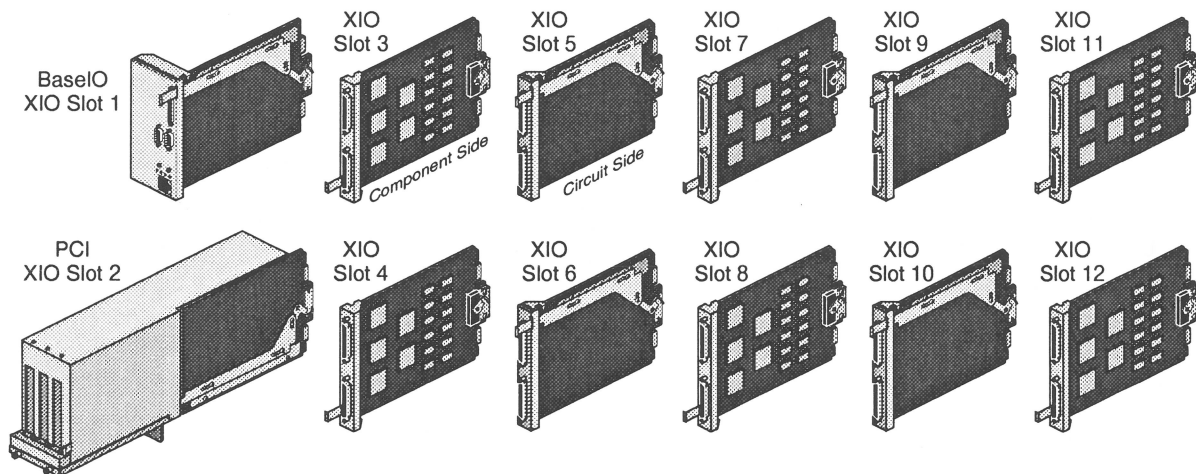

Figure 2   Orientation of the XIO Boards in Midplane Slots

Connecting Node Boards to Router Boards

Once they are in the module, Node boards are electrically connected to Router boards and Crossbow (XBOW) ASICs through the midplane. These connections are shown in Figure 3 (Router boards are physically located opposite the midplane from the Node boards, and XBOWs are located on the midplane).

- Node boards N1 and N2 connect to Router board R1
- Node boards N3 and N4 connect to Router board R2
- Node boards N1 and N3 connect to XBOW 1
- Node boards N2 and N4 connect to XBOW 2

These connections are also indicated by the black configuration tags (circle, square, etc.) that were first described in Figure 1.
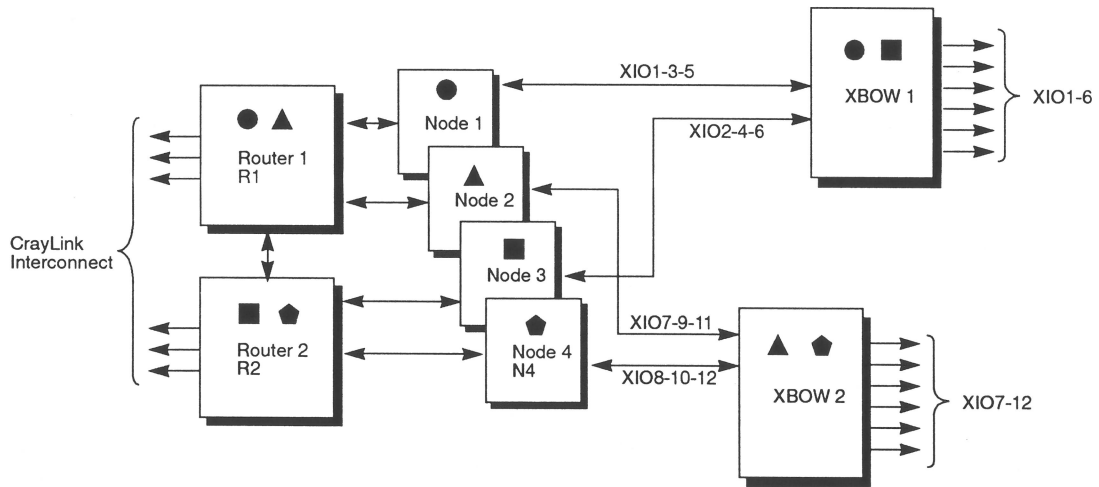

Figure 3   Origin2000 Overall Block Diagram

Figure 4 shows the connection dependencies of the Node boards, Routers boards, XBOWs, and XIO boards. For instance, Node 3 is connected to XBOW 1 and Router 2; Router 1 is connected to both Nodes 1 and 2.
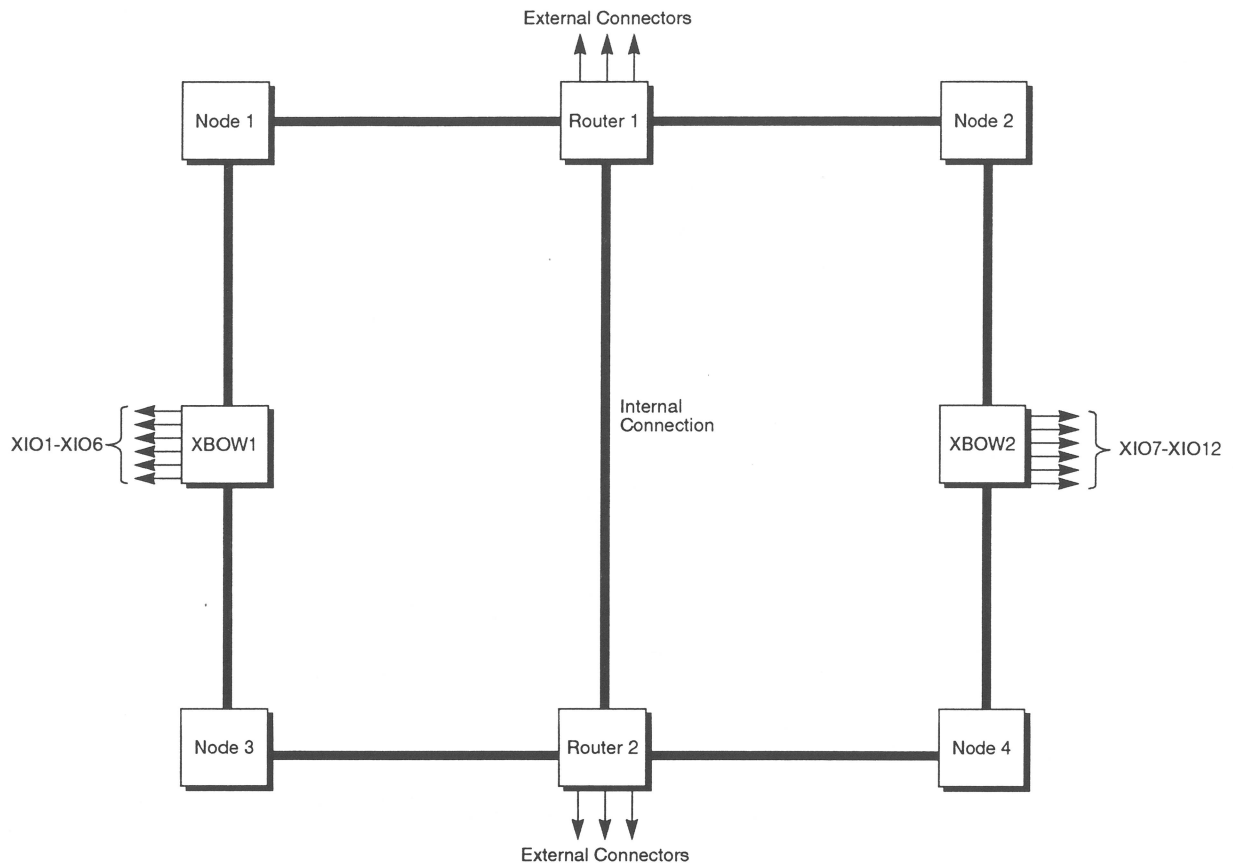
Figure 4   Graph of XIO, XBOW, Router, and Node Board Connections

Configuring Single and Multiple-Module Systems

This section lists six basic configuration rules that must be followed when configuring the Origin2000. It also provides configuration guidelines for:

- single modules

    - installing Node boards in a single-module system

    - installing XIO boards in a single-module system

    - loading the BaseIO board and the optional PCI expansion module

- multiple modules

    - optimizing the installation of Node boards in more than one module

    - optimizing the installation of XIO boards in more than one module

Configuration Rules

There are six rules, for both single-module and multiple-module systems, that *must be followed* when configuring the Origin2000 system:

- Each Origin2000 module must have at least one Node board.

- There must be at least one BaseIO board in the system (whether you have a single-module or multiple-module system).

- The BaseIO board must be placed in slot IO1.

- If present, the PCI expansion must be placed in slot IO2 (beneath the BaseIO board).

- Neither a BaseIO board nor an MSCSI board can ever go into slot IO2.

- To use all 12 of the XIO slots in a module, there must be at least two Node boards installed: one Node board must be placed in an odd slot (either N1 or N3) and one Node board must be placed in an even slot (either N2 or N4).

Caution: Remember, when installing XIO boards 3 through 9 and 4 through 10, each pair of boards must be inserted with their component sides facing **towards** each other, as shown in Figure 2.

Guidelines for a Single-Module System

This section provides guidelines for adding XIO (including BaseIO and the optional PCI expansion module) and Node boards to a single-module system.

BaseIO and PCI
expansion module
- **Loading BaseIO and PCI expansion modules**—Install the BaseIO board in slot IO1. If present, install the PCI expansion module in slot IO2. Refer to "Configuration Rules" on page 6 for additional information.

Node boards
- **Installing Node boards in a single-module system**—When filling a single module, install the Node boards from center outward, starting at slot N1. Then add N2, N3, and finally N4, as shown in Figure 5.

  Note: When installing XIO boards in the system (described below), disperse them across all the available Node boards, in order to spread the bandwidth and control as much as possible.

- **Installing XIO Boards in a single-module system**

XIO boards
  - If there is only one Node board in the module, it is placed in slot N1 and only the leftmost XIO slots (slots 1 through 6) are usable. In this case, fill the XIO slots sequentially, 3 through 6. Remember, slot IO1 must hold the BaseIO board, and slot IO2 holds the PCI expansion module (if the PCI expansion module is included in the system).

XIO boards
  - If there is more than one Node board in the module, fill the XIO slots as described in Table 1 and shown in Figure 5, so that XIO boards are spread as evenly as possible across the system.

Table 1 gives a recommended installation pattern. In it, XIO boards are installed so they are connected beginning with Node 1, and then progress through Nodes 2, 3, and 4. Installation then starts over with Node 1 again. In this way the XIO bandwidth and control is equalized over the four Node boards.

Table 1   Installing XIO Boards to Equalize Bandwidth and Control

| Order of Installation	Start Loading XIO Slots At:		Node Board That Controls the XIO Slot
First XIO Board loaded is	IO1	which connects to	Node 1
Next XIO Board loaded is	IO7	which connects to	Node 2
Next XIO Board loaded is	IO2	which connects to	Node 3
Next XIO Board loaded is	IO8	which connects to	Node 4
Next XIO Board loaded is	IO3	which connects to	Node 1
Next XIO Board loaded is	IO9	which connects to	Node 2
Next XIO Board loaded is	IO4	which connects to	Node 3
Next XIO Board loaded is	IO10	which connects to	Node 4
Next XIO Board loaded is	IO5	which connects to	Node 1
Next XIO Board loaded is	IO11	which connects to	Node 2
Next XIO Board loaded is	IO6	which connects to	Node 3
Final XIO Board loaded is	IO12	which connects to	Node 4
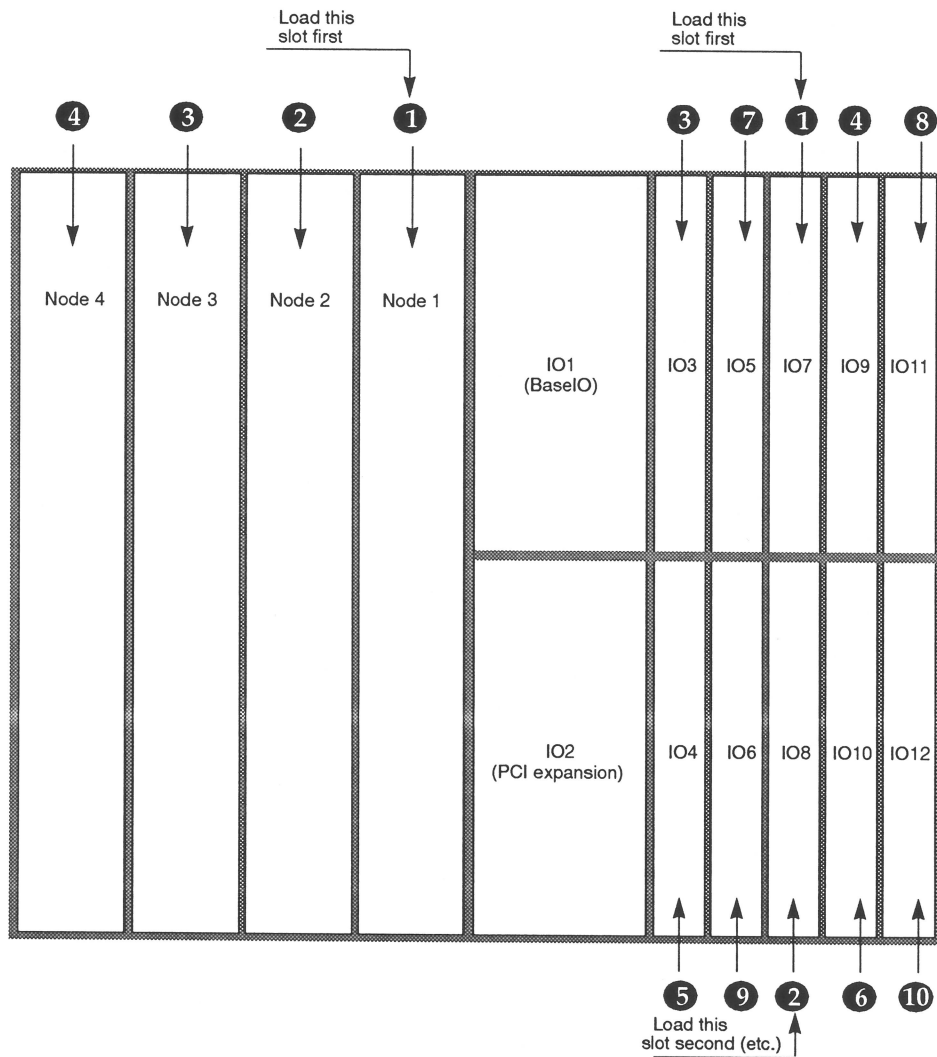
Figure 5   Installing Node and XIO Boards in a Module

Guidelines for a Multiple-Module System

This section provides guidelines for adding Node and XIO boards to a system that has more than one module. These guidelines are aimed at providing optimum installation for either Node boards or XIO boards, as follows:

- For most efficient installation of Node boards in a multimodule system, see the section titled, "Optimizing the Installation of Node Boards in More Than One Module" on page 9.

- For most efficient installation of XIO boards in a multimodule system, see the section titled, "Optimizing the Installation of XIO Boards in More Than One Module" on page 9.

Optimizing the Installation of Node Boards in More Than One Module

Follow the guidelines in this section for most efficient placement of Node boards in your system.

Node boards

1. Add Node boards to a module until that module is full, starting with slot N1, then N2, N3, and finally N4. This is the order shown in Figure 5.

    Note: This step differs importantly from Node board installation guidelines presented in the next section, which describes most efficient placement of XIO boards.

Node boards

2. Only when a module is filled should you add Node boards to another module.

    This means you cannot have a module with empty Node board slots. For instance, a seven Node board system can have only two system modules. Four of the Node boards go in one module, and the remaining three Node boards go in the second module.

XIO boards

3. Add XIO boards following the rules starting with Step 2 in the next section, "Optimizing the Installation of XIO Boards in More Than One Module."

Optimizing the Installation of XIO Boards in More Than One Module

Follow the guidelines in this section for most efficient placement of XIO boards in your system.

Node boards

1. Distribute the Node boards among slots N1 and N2 as evenly as possible throughout all modules. That is, fill slots N1 and N2 in all modules before adding any Node boards to slot(s) N3 or N4. This allows optimal distribution of XIO cards in each module: to use all 12 XIO slots, there must be a Node board installed in one of the odd slots (N1, N3) and a Node board installed in one of the even slots (N2, N4). For instance, in a four-module system with seven Node boards, three of the modules have Node boards in both slots N1 and N2, while the remaining module has a single Node board in slot N1 (2N+2N+2N+1N).

    Note: This section describes the most efficient placement of XIO boards. This step differs importantly from Node board installation guidelines presented in the previous section, which describes most efficient placement of Node boards.

BaseIO boards

2. Install all available BaseIO boards into IO1 slots. Remember, there can be only one BaseIO board in a module, and the BaseIO can go only into the IO1 slot.

PCI expansion module

3. Install all available PCI expansion boxes into IO2 slots. Remember, there can be only one PCI expansion box in a module, and the optional PCI expansion can go only into the IO2 slot.

XIO boards

4. Divide the remaining XIO boards evenly among the modules. Use the order described in Table 1 and shown in Figure 5, keeping in mind the number of Node boards installed. (In other words, if you have only Node 1 installed, do not install any XIO boards in slots IO7 through IO12.)