Fibre Channel Hub
Owner's Guide

Document Number 007-3722-001

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St. Peter's Basilica image courtesy of ENEL SpA and InfoByte SpA. Disk Thrower image courtesy of Xavier Berenguer, Animatica.

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This equipment has been tested and found compliant with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

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About This Guide

The Silicon Graphics Fibre Channel Hub is an intelligent digital hub for fibre channel arbitrated loop (FC-AL) storage clusters, including Storage Area Networks (SANs) and IRIS FailSafe 2.0. The hub provides gigabit-speed storage connectivity, network management, data reliability, and module network scalability for configurations using Silicon Graphics Origin FibreVault and Fibre Channel RAID storage systems. The Fibre Channel Hub can be used with fibre channel XIO or PCI option boards in Origin2000, Origin200, Onyx2, and OCTANE servers and workstations running IRIX 6.4 or later.

Fiber optic cabling is optional with the Fibre Channel Hub. Observe the following warnings for fiber optic cabling.

Warning: Never look into the end of a fiber optic cable to confirm that light is being emitted (or for any other reason). Most fiber optic laser wavelengths (1300 nm and 1550 nm) are invisible to the eye and cause permanent eye damage. Shorter wavelength lasers (for example, 780 nm) are visible and can cause significant eye damage. Use only an optical power meter to verify light output.

Warning: Never look into the end of a fiber optic cable on a powered device with any type of magnifying device, such as a microscope, eye loupe, or magnifying glass. Such activity causes cause a permanent, irreversible burn on the retina of the eye.

Audience

This guide is written for owners and users of a Fibre Channel Hub. It presumes general knowledge of FC-AL technology and familiarity with the fibre channel storage and the servers and workstations being used.

Structure of This Document

This guide consists of the following chapters and appendixes:

- Chapter 1, “Features of the Fibre Channel Hub,” gives an overview of and describes included and optional cables for the unit.
- Chapter 2, “Loop Configuration With the Fibre Channel Hub,” explains Fibre Channel Hub applications and configurations, and points to consider in planning your configuration.
- Chapter 3, “Fibre Channel Hub Setup and Cabling,” explains how to prepare for hub installation, how to set up a hub for desktop use, how to cable it, and how to connect equipment for local or remote hub management.
- Chapter 4, “Setting Up Local or Remote Hub Management,” explains how to enable and disable connections, set port parameters, and set passwords and privileges.
- Chapter 5, “Fibre Channel Hub Operation and Management,” explains how to obtain operation parameters, bypass a port, change threshold settings, set the hub for segmented operation into two five-port hubs and restore it to normal operation, reset the hub to factory defaults, and accomplish other administrative tasks.
- Appendix A, “Technical Specifications,” gives technical details of the Fibre Channel Hub and other relevant technical data.
- Appendix B, “Command-Line Interface Summary,” summarizes commands in the command-line interface.
- Appendix C, “Setup Checklist,” summarizes steps for setting up the hub for desktop use.

An index completes this guide.

Other Documentation

Besides this manual, have handy the latest versions of the owner's guides for the Silicon Graphics servers, workstations, fibre channel interface boards, and fibre channel storage in your configuration. If you do not have these guides handy, the information is also online in the following locations:

- IRIS InSight Library: from the Toolchest, choose Help > Online Books > SGI EndUser or SGI Admin, and select the applicable owner's or hardware guide.
- Technical Publications Library: if you have access to the Internet, enter the following URL in your Web browser location window: http://techpubs.sgi.com/library/

  Once you are in the library, choose Catalogs > Hardware Catalog > and look under the Owner's Guides for the applicable owner's guide.

Conventions

In command syntax descriptions and examples, square brackets ([ ]) or angle brackets (< >) surrounding an argument indicate an optional argument. Variable parameters are in *italics*. Replace these variables with the appropriate string or value.

Document titles, commands, IRIX filenames, variables in command lines, and names of buttons in the graphical user interface are in *italics*.

Messages and prompts that appear onscreen are shown in `fixed-width type`. Entries that are to be typed exactly as shown are in **`boldface fixed-width type`**.

Command-line flags and switches are in **boldface regular type**; for example, **enable** and **disable**.

Product Support

Silicon Graphics, Inc., provides a comprehensive product support and maintenance program for its products. If you are in North America, and would like support for your Silicon Graphics-supported products, contact the Technical Assistance Center at 1-800-800-4SGI or your authorized service provider. If you are outside North America, contact the Silicon Graphics subsidiary or authorized distributor in your country.

In the unlikely event that your Fibre Channel Hub needs service, you need the revision number that is on the product ID label on the bottom of the case. This number has the form FC HUB-Rev*letter*; for example, FC-HUB-RevA.

Record the number here for convenience: Product revision number: FC-HUB-Rev__

Chapter 1

Features of the Fibre Channel Hub

The Fibre Channel Hub is a managed 10-port gigabit interface hub for Silicon Graphics FibreVault or fibre channel arbitrated loop (FC-AL) storage clusters or networks, whether RAID or non-RAID (JBOD, or "just a bunch of disks").

This chapter explains

For more information on fibre channel basics, see the *Origin FibreVault and Fibre Channel RAID Owner's Guide*.

For information on using the administrative interfaces for a Silicon Graphics fibre channel storage configuration, see the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.

Note: The Fibre Channel Hub is transparent and thus does not appear in the fibre channel storage software's administrative interfaces.

Fibre Channel Hub Kit

The Fibre Channel Hub option kit (FC-HUB) contains the following:

- Fibre Channel Hub
- four hub feet on peel-off backing
- standard power cord

  This power cord accommodates United States power outlets only.
- serial 10-meter (32.8 feet) copper console cable

  This cable is required for connecting the hub to a PC or terminal for management purposes. The cable has an RJ-11 connector at each end.
- two DB-9/RJ11 adapters

  These adapters are supplied to accommodate PC serial connectors.
- this manual

Figure 1-1 shows FC-HUB kit contents.

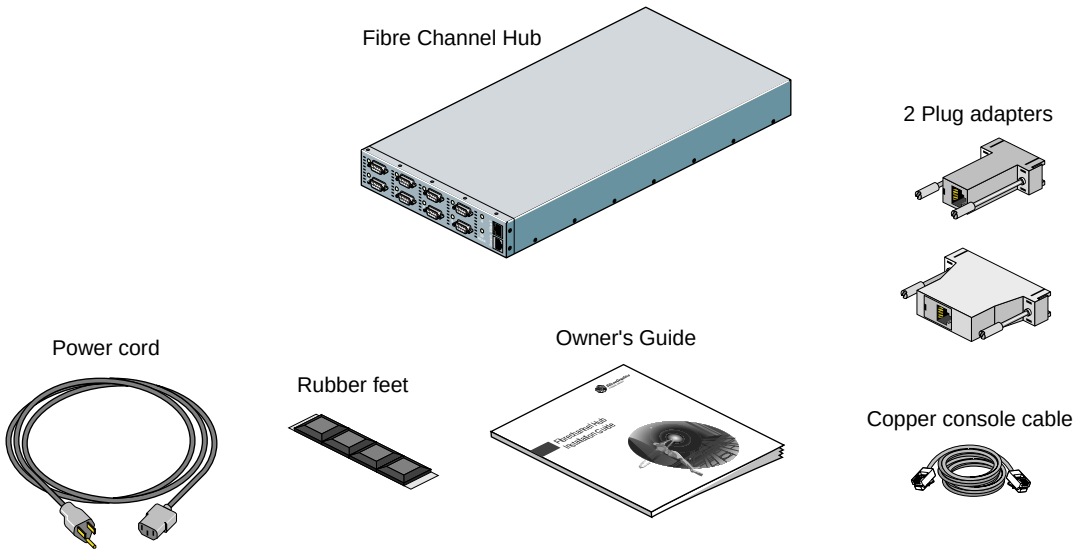

Figure 1-1 FC-HUB Kit Contents

A different power cord with a special connector for the Fibre Channel Rack power distribution unit (PDU) is supplied in the rackmount kit.

If any parts described in this section are missing, contact your service provider.

Appendix C contains a checklist for setting up the hub, with references to specific parts of this guide.

Fibre Channel Hub Physical Features

Figure 1-2 shows the Fibre Channel Hub in a typical application.

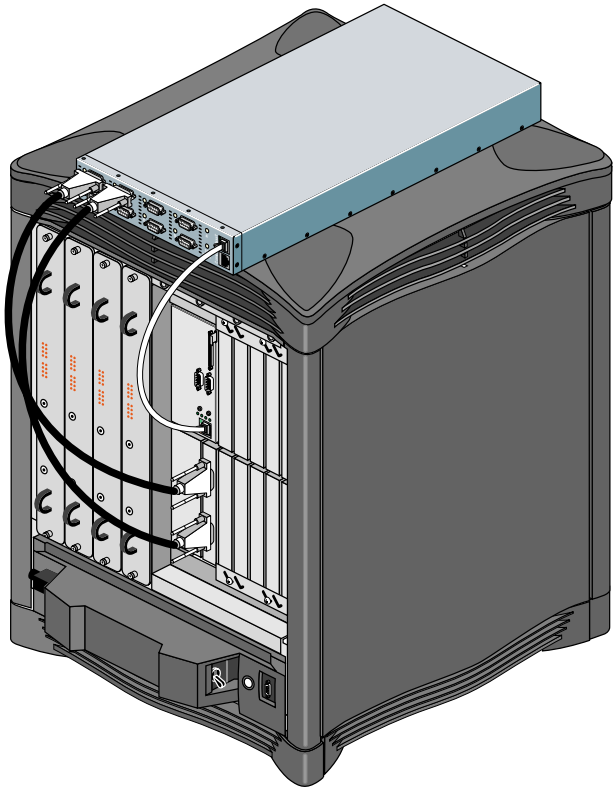

Figure 1-2 Fibre Channel Hub, Desktop Use

The Fibre Channel Hub can be used as a desktop unit or can be mounted in a Silicon Graphics Fibre Channel Rack that is not fully configured, or in a third-party standard 19-inch rack (such as a rack used for networking equipment) using the optional rackmounting kit. Figure 1-3 shows two Fibre Channel Hub units in a Fibre Channel Rack. (Cabling to hosts is not shown.)

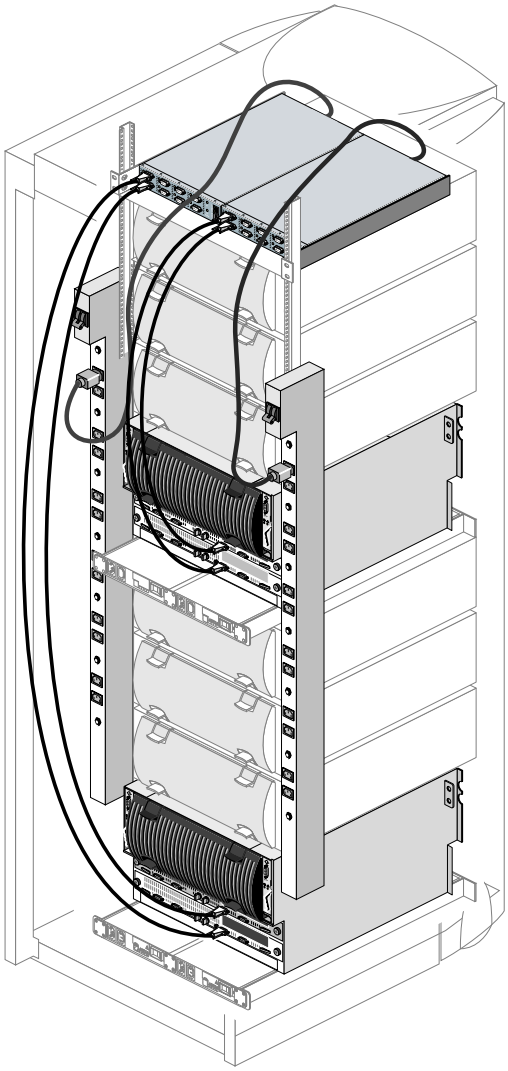

Figure 1-3 Fibre Channel Rack: Rear View, With Two Fibre Channel Hub Units

See “Fibre Channel Hub Rackmounting Requirements” on page 8 for information on using the Fibre Channel Hub in a rack.

This section explains

- “Connectors and Ports” on page 5
- “LEDs” on page 7

Connectors and Ports

The Fibre Channel Hub has these connectors and ports:

- one 10-Base-T Ethernet management port, on the front panel

  The Fibre Channel Hub Ethernet management port does not support 100-Base-T.

- one serial console port, on the front panel, for connection to a host for management purposes
- one power connector for the hub, on the rear panel

  This connector is autoranging. A power on/off switch is located above the power cord socket on the Fibre Channel Hub, as shown in Figure 1-4. See “System Specifications” on page 75 in Appendix A for voltage and power requirements.

- ten copper DB-9 fibre channel ports, all fully digital

  All ten ports are functionally identical.

  For any of these ports, you can use copper or fibre optic cabling. Fibre optic cabling requires a media interface adapter (MIA) at each end of the cable. See “Compatibilities, Fibre Channel Cables, and Adapters” on page 9.

Figure 1-4 points out the connectors and ports.

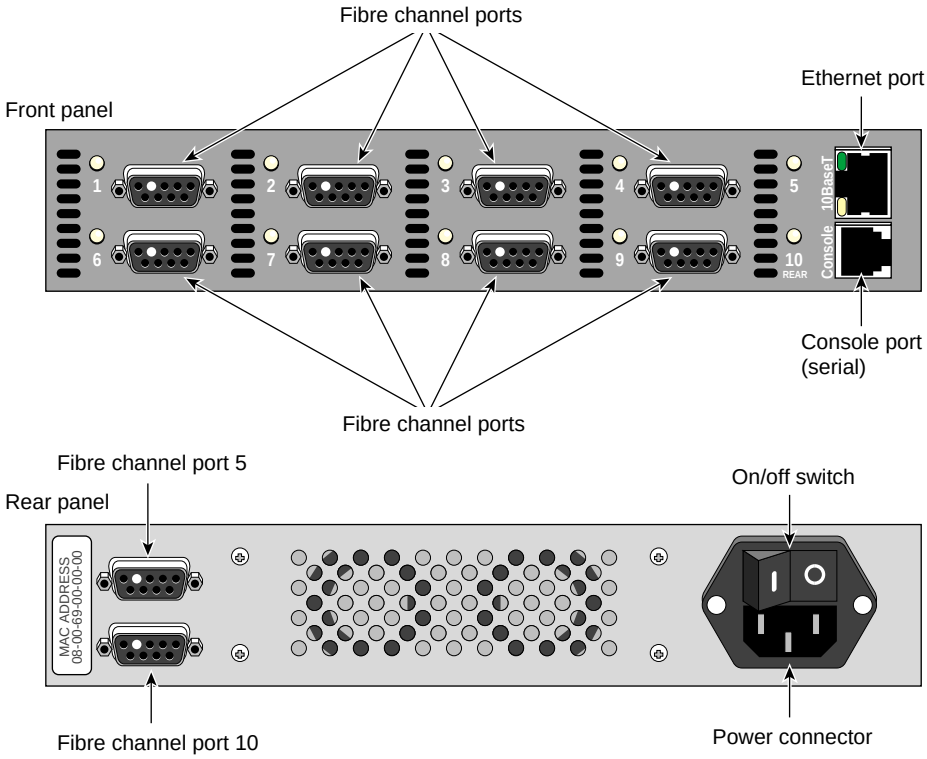

Figure 1-4 Fibre Channel Hub Ports

All ten fibre channel ports are hot-pluggable: you can disconnect a server or storage option from the hub without powering off the hub or the server or storage option.

All ten ports are hot-cascadable: you need not power off the hub to attach the cascade cable to connect two hubs into an 18-port loop. This cable (marketing code FC-HUB-CBL) has two DB-9 connectors and is 51 cm (20 inches) long, including connectors.

LEDs

On the Fibre Channel Hub front panel are LEDs for each port and for the Ethernet port and network connections. Figure 1-5 points out the LEDs.

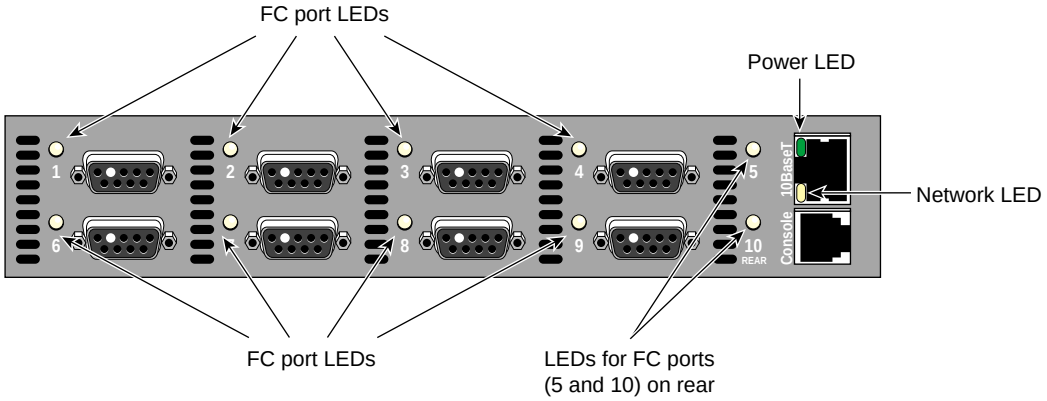

Figure 1-5 Fibre Channel Hub LEDs (Front Panel)

Table 1-1 summarizes LED functions for the network and power LEDs.

Table 1-1 Power and Network LED Functionality

Purpose	Color	Location	State	Meaning
Power	Green	Left of 10-Base-T socket; top	Unlit On, steady High intensity, blinking	No power is applied Power is applied Segmented hub
Network	Yellow	Left of 10-Base-T socket; bottom	Unlit Low intensity, steady High intensity, blinking	No connection to network Link up Network activity

Table 1-2 summarizes fibre channel port LED functions.

Table 1-2 Fibre Channel Port LED Functionality

Color or State	Meaning
Unlit	Forced bypass (accomplished via hub management software)
Yellow	Port is bypassed: no device is cabled, or there is a problem between source and target
Green	Link between port and another device is established (link up); arbitrated loop is intact

Note: A cable connected to a port does not constitute a valid link unless its other end is connected to a device.

Fibre Channel Hub Rackmounting Requirements

The Fibre Channel Hub can be mounted in a rack using the optional rackmounting kit (marketing code FC-HUB-R). The shelf included in the rackmounting kit accommodates two Fibre Channel Hub devices side by side.

Note: A qualified Silicon Graphics System support Engineer must install the mounting shelf and hub(s) in a rack.

The shelf and hubs fit in the following racks that have the required space:

- a Silicon Graphics Fibre Channel Rack that is not fully configured

  If the Fibre Channel Rack cannot accommodate the rackmounting shelf and hub(s), you can set up the hub as a desktop unit for use with that storage.
- a third-party standard 19-inch rack (such as a rack used for networking equipment)

Note: For airflow reasons, the Origin Rack cannot accommodate the Fibre Channel rackmounting shelf and hub(s). To use the Fibre Channel Hub with the Origin Rack, set it up as a desktop unit outside the Origin Rack.

Fibre Channel Hub height is 4.3 cm, or 1.69 inches. The shelf and hub(s) fit in a 1U space (4.45 cm, or 1.75 inches). However, if cabling is routed across the top of the hub(s), an additional space of 1U to 2U is required, depending on the clearances required for such

cabling. Thus the total space required for the Fibre Channel Hub in a rack can be as much as 3U (13.35 cm, or 5.25 inches).

A special power cord is included in the rackmount kit for connection to the Fibre Channel Rack power distribution unit (PDU). The sockets of the Fibre Channel Rack PDU require a special connector.

Compatibilities, Fibre Channel Cables, and Adapters

This section consists of the following subsections:

- "Fibre Channel Disk Drives" on page 9
- "Fibre Channel Cabling Options for the Hub" on page 10
- "Media Interface Adapter (MIA)" on page 11

Note: The Fibre Channel Hub operates with Silicon Graphics systems running IRIX 6.4 or later.

Fibre Channel Disk Drives

Table 1-3 lists some fibre channel disk drives that are compatible with the Fibre Channel Hub.

Table 1-3 Some Fibre Channel Disk Drives Compatible With the Fibre Channel Hub

Disk Type	Size	Sectors (Bytes)	Part Number	Marketing Code
JBOD	18 GB	512	9470255	P-F-18
JBOD	9 GB; 10,000 rpm	512	9470282	P-F-9F
FC RAID	8.8 GB	520	9470192	F-RAID-9
FC RAID	17.8 GB	520	9470257	F-RAID-18
FC RAID	8.8 GB; 10,000 rpm	520	9470281	F-RAID-9F

This information is subject to change; check with your service provider.

Note: The 9.1 GB 7200 rpm JBOD disk drive (P-F-9, 9470140) is not compatible with the Fibre Channel Hub. The Fibre Channel Hub does not support the K5+ storage processor.

Fibre Channel Cabling Options for the Hub

The native interface for Silicon Graphics FC-AL disk drive enclosures and for fibre channel XIO and PCI interface boards is a female copper DB-9 connector. For technical details of Fibre Channel Hub connectors, see Appendix A, "Technical Specifications."

The Fibre Channel Hub accepts copper and optical cabling options:

- for distances up to 30 meters: ANSI-compliant copper twinax cable assemblies
- for distances of 10 to 300 meters: fiber optic cable assemblies, using media interface adapters (MIAs)

  Distances longer than 300 m require special MIAs and special cables.

  MIAs are described in "Media Interface Adapter (MIA)" on page 11.

It is recommended that you use fibre channel cabling from Silicon Graphics for the Fibre Channel Hub. Table 1-4 summarizes fibre channel interface cables currently available from Silicon Graphics that are compatible with the Fibre Channel Hub.

Table 1-4 Fibre Channel Cabling Options: Codes and Part Numbers

Cable	Length	Marketing Code
FC copper cable with 9-pin DIN	0.3 m (.98 ft)	X-F-COP-0.3M
	10 m (32.8 ft)	X-F-COP-10M
	25 m (82 ft)	X-F-COP-25M
FC optical cable (requires X-F-OE-KIT)	3 m (9.84 ft)	X-F-OPT-3M
	10 m (32.8 ft)	X-F-OPT-10M
	25 m (82 ft)	X-F-OPT-25M
	100 m (328 ft)	X-F-OPT-100M
	300 m (984 ft)	X-F-OPT-300M
Two media interface adapter (MIA) modules (FC copper-to-optical)	N/A	X-F-OE-KIT

Silicon Graphics fiber optic cables and MIAs are 62.5/125 µm (multimode).

Media Interface Adapter (MIA)

To connect fiber optic cable to one of the copper ports on the Fiber Channel Hub, use a media interface adapter (MIA). This adapter converts from a fiber optic cable with an SC connector to a copper DB-9 connector, providing a non-Open Fibre Control optical link. Silicon Graphics supplies the MIA in pairs.

The MIA is a full-duplex module that converts photons to electrons in one direction and converts electrons to photons in the other direction. An industry-standard duplex SC connector supplies the external fiber-optic connection on the MIA. The Fibre Channel Hub powers the MIA, which converts the differential electrical signal into light for transmission through the fiber optic cable. The MIA has a DB-9 male plug on one end, which connects to the hub, and an optical SC connector on the other end, which connects to any fiber optic cable assembly or jumper cable. Figure 1-6 shows the MIA.

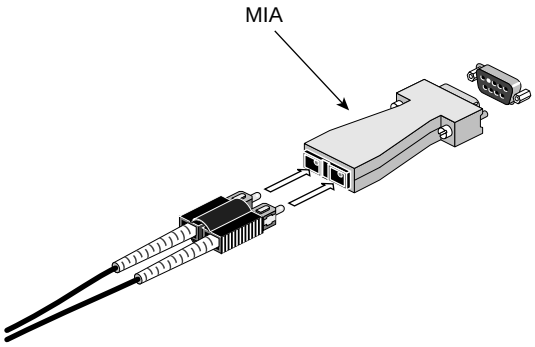

Figure 1-6 Media Interface Adapter (Optional)

At the other end of the fibre optic cable, another MIA converts the signal back to a differential electrical signal for the system to which it is attached.

Note: It is recommended that you use MIAs from Silicon Graphics for fibre optic cabling with the Fibre Channel Hub.

Fault and Error Management

The digital architecture of the Fibre Channel Hub eliminates all signal jitter and provides automatic clock speed matching on every port. As a result, two hubs can be cascaded, providing flexibility in network design and extending potential cabling distances.

Fibre Channel Hub error management improves the reliability and availability of fibre channel arbitrated loops by isolating faults that could damage the rest of the loop, and correcting error conditions that could cause loop downtime.

- Loop initialization procedure (LIP) F8 bypass isolates faulty nodes, allowing the loop to operate normally while cabling problems and other errors are diagnosed and corrected. LIP F8 character streaming is described in greater detail in "Automatic LIP F8 Word Substitution and Bypass."
- Synchronous cut-in and cut-out ensure that only complete words are forwarded through the hub. Character integrity control ensures that only valid Fibre Channel words are forwarded through the hub. Thus, recovery issues in remote devices are avoided.
- Automatic LIP insertion notifies all loop participants when nodes are added or when active loops are combined. Automatic LIP insertion is described in greater detail in "Automatic Loop Reconfiguration" on page 13.

Automatic LIP F8 Word Substitution and Bypass

If a hub port receives three consecutive LIP F8 primitive sequences from an attached device, the port automatically enters bypass mode.

LIP F8 sequences slow the loop or make it nonfunctional. However, by default, the Fibre Channel Hub automatically bypasses a port that is streaming LIP F8 characters. The port's status is shown as auto-bypass in the Hub Port Status screen and in the output of the *show port* command.

When LIP F8 bypass occurs, the hub transmits LIP F0s and IDLEs to keep the loop alive. Thus, LIP F8 sequences do not enter the loop.

The attached device is determined to be functional again when the LIP F0 sequence can be propagated. When the device no longer sends LIP F8 sequences and the port receives valid data again, the hub software reinserts the port into the loop by sending LIP F7 F7.

Automatic Loop Reconfiguration

AutoLIP (Originate LIP F7 on insertion) automatically reconfigures the loop when a hub port becomes active.

Any change in loop membership requires loop reconfiguration. Normally, loop reconfiguration is triggered when a device transmitting an LIP F7 F7 sequence is inserted into a loop.

When a port comes out of bypass, it automatically inserts LIP F7 F7 into the loop until the device attached to the port sends a LIP sequence other than LIP F8.

When two hubs are cascaded, there is no “device” to sense insertion. The Fibre Channel Hub uses the AutoLIP option, so that it can insert the necessary LIP F7 sequence when it is connected to another hub.

Also, after a port comes out of bypass and before the port is reinserted into the loop, the hub port automatically inserts LIP F7 into the loop until a LIP sequence (other than LIP F8) is received.

Loop Management Software

The Fibre Channel Hub software provides statistics for each port detailing the number of invalid transmission words, comparative error rates, and port down counts. You can use the management tools to reconfigure the loop remotely to optimize performance or to diagnose and isolate failures. You can view port operation statistics, force-bypass a port, join two loops or separate a loop into two loops, change passwords, or perform other management tasks.

Included with the Fibre Channel Hub are these interfaces for managing loops:

- HTML interface, compatible with most standard Web browsers
- command-line interface for use via a local console or Telnet connection
- SNMP agent interface

For complete information on software configuration and management of the hub, see Chapter 4, “Setting Up Local or Remote Hub Management,” and Chapter 5, “Fibre Channel Hub Operation and Management.”

You can manage the hub:

- locally through an ANSI console terminal, or a PC with a serial port; details are in “Determining Hub Management” on page 24 in Chapter 2
- remotely through an SNMP MIB browser, Internet browser, or Telnet console

Requirements for setting up these management options are in “Determining Hub Management” on page 24 in Chapter 2.

Chapter 2

Loop Configuration With the Fibre Channel Hub

This chapter explains

Fibre Channel Hub Configurations and Applications

Fibre Channel Hub configurations are as follows:

- single loop

  Two Fibre Channel Hubs can be connected (cascaded) to create a larger single loop.
- dual-loop: two Fibre Channel Hubs

  One Fibre Channel Hub can be used for two separate loops.

This section gives configuration overviews and planning considerations, in these subsections:

Single-Loop Configuration

A single Fibre Channel Hub accommodates up to ten devices. Note the following:

- All ports function the same way.
- Devices need not be cabled to adjacent ports; that is, you can skip ports when attaching cables.

A factor in cabling the devices is the location of the devices to be cabled. Attach cables following conventions at your site; other cable order possibilities include the following:

- hosts to ports on the front of the hub, storage to ports on the rear
- hosts to ports 1 through 4, storage to ports 6 through 9

It is a good idea to label the ends of the cables that are to be connected to the hub with the device names, or some appropriate indication of them.

Figure 2-1 shows port numbering.

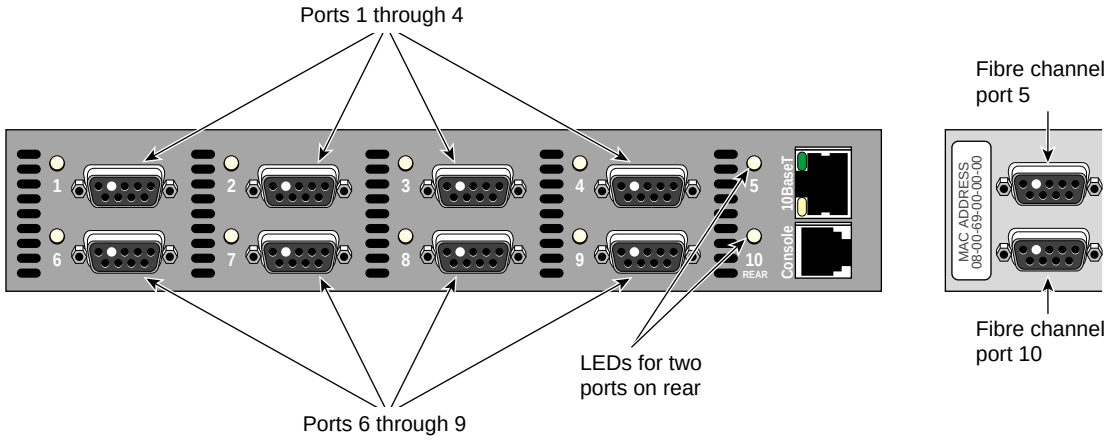

Figure 2-1 Hub Port Numbering

Figure 2-2 shows a typical single-loop configuration with one disk drive enclosure (Fibre Channel RAID).

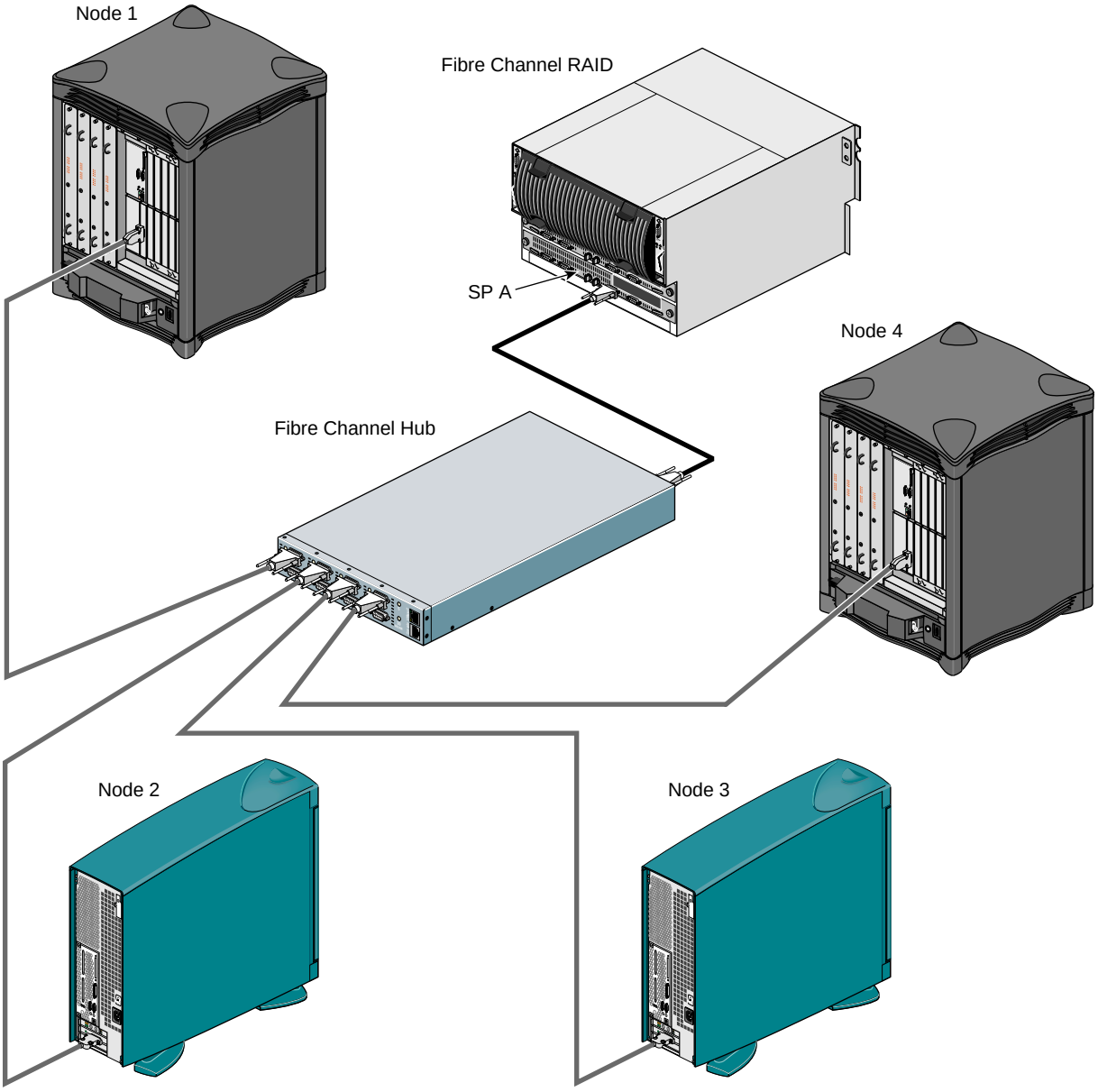

Figure 2-2 Single-Loop Configuration Example, Fibre Channel RAID Storage

Dual-Loop Configuration

In a dual-loop configuration, each host or storage enclosure is connected to each of two hubs, or to the separate segments of a segmented hub.

Figure 2-3 diagrams examples that use Fibre Channel RAID storage; each loop is connected to a separate storage processor (SP).

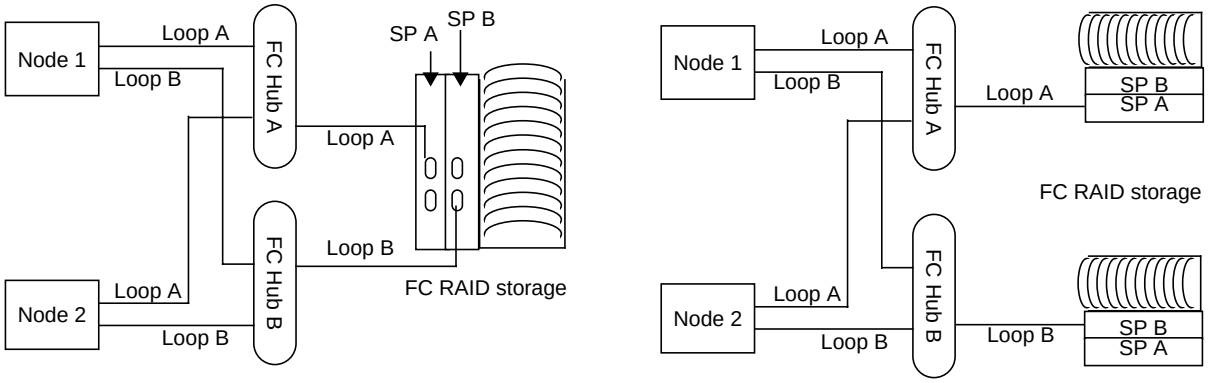

Figure 2-3 Dual-Loop Configurations With Fibre Channel RAID Storage

You can connect the Fibre Channel Hub to either port in an SP. Both SP ports in a Fibre Channel RAID DPE cannot be connected to the same hub.

Figure 2-4 shows an example of Fibre Channel Hub cabling with one storage unit and several servers.

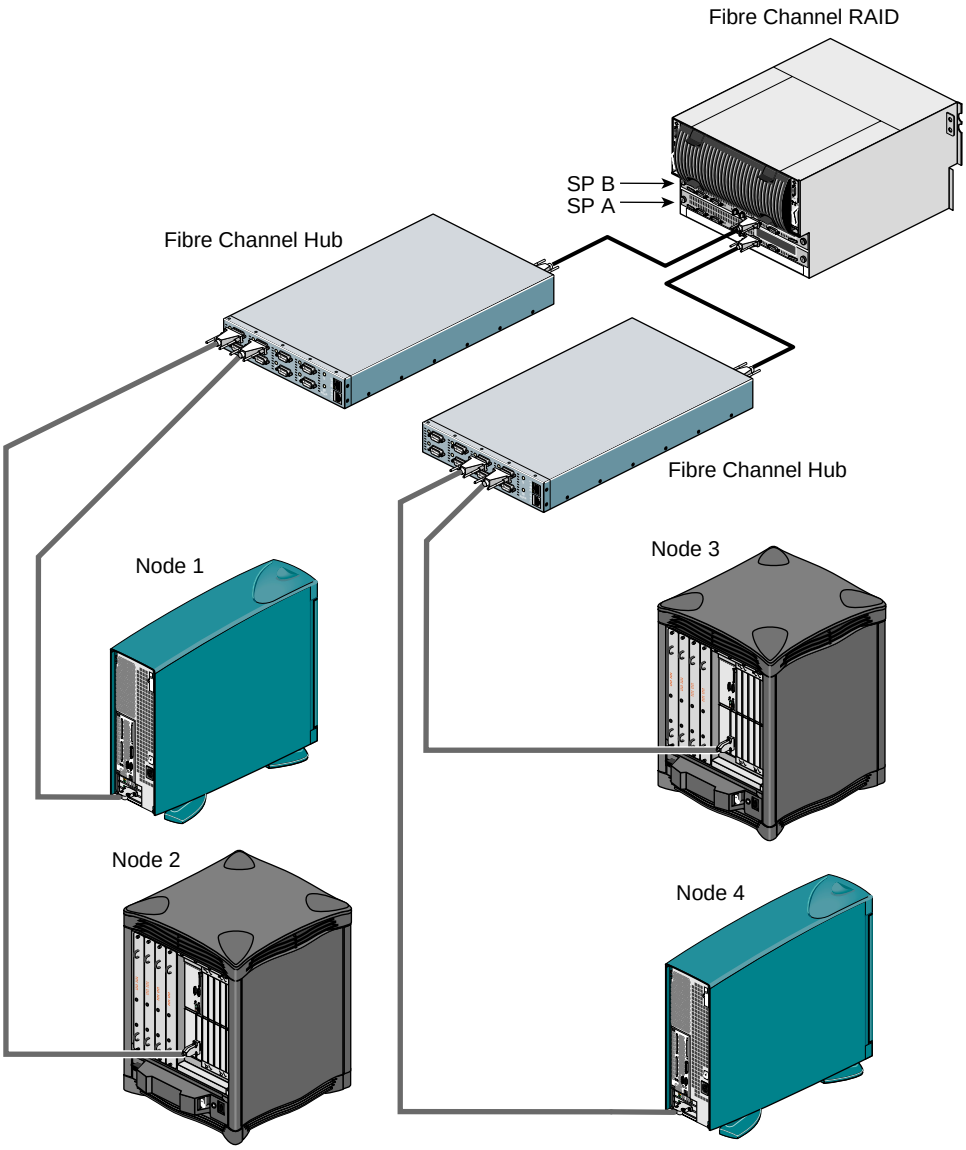

Figure 2-4 Dual-Loop Configuration Example, Fibre Channel RAID Storage

Figure 2-5 diagrams dual-loop configurations with JBOD storage.

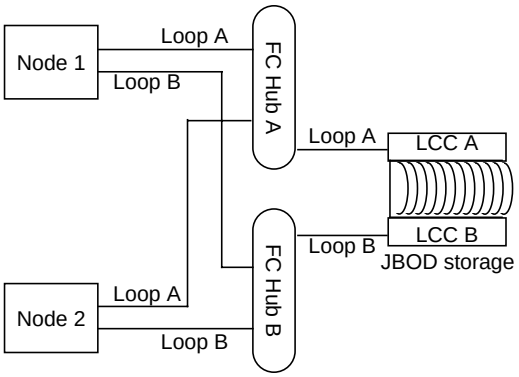

Figure 2-5 Dual-Loop Configurations With JBOD Storage

You can connect the Fibre Channel Hub to either LCC. Both LCCs in a Fibre Channel RAID DAE cannot be connected to the same hub.

Figure 2-6 diagrams an example dual-loop configuration with JBOD storage.

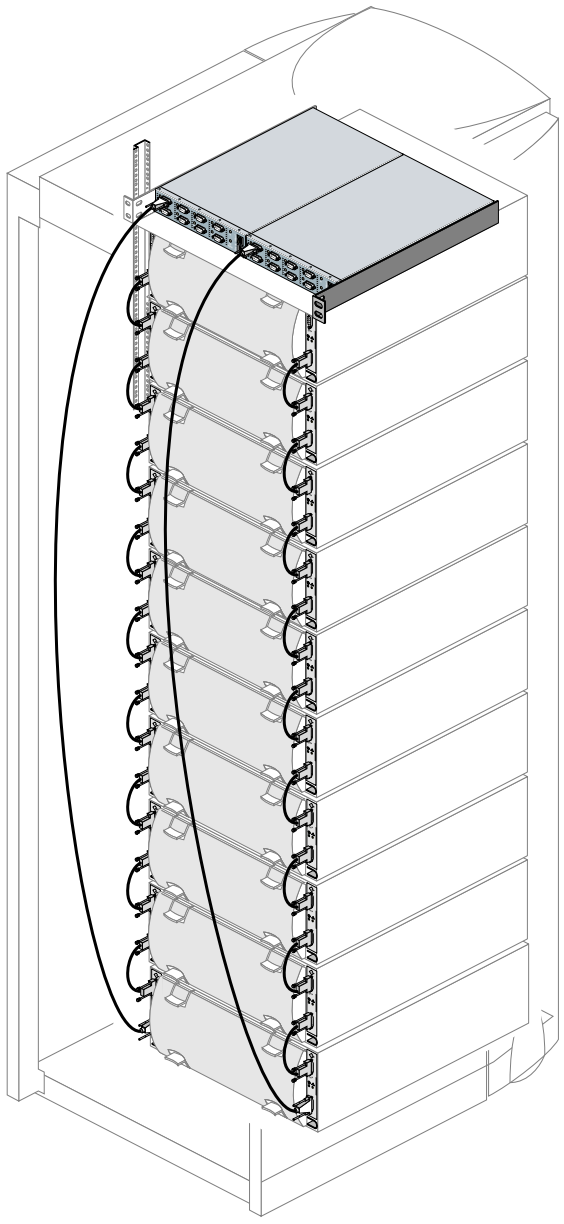

Figure 2-6 Dual-Loop Configuration Example, JBOD Storage

Cascaded Hubs

The optional cascade cable can connect two Fibre Channel Hub units to increase connectivity, creating a single logical loop. Note the following:

- Only one cascaded hub is supported (two connected Fibre Channel Hub units). Although the FC-AL limit is 127 ports (126 NL_Ports), the supported limit of two cascaded hubs yields 18 ports.
- All ports are identical; each can be used for an NL_port connection or for a cascaded hub connection. For convenience, generally, ports on the front of the two hubs are connected with the cascade cable.
- Cascading hubs does not affect hub address, or port numbering in the management interfaces. That is, to get information on ports on cascaded hubs, you log in to each hub the same as if it were not cascaded; each hub still requires its own IP address.

Hub Segmentation

Under normal operation, the Fibre Channel Hub acts as a single loop. For dual-loop configurations, two hubs are recommended. The Fibre Channel Hub is designed as a precise half-rack chassis so that two hubs can be installed in a single 1U-to-3U rack space, providing full redundance. Two hubs used together for dual-loop applications provide dual power supplies and independent loop ports, and allow for field repairs without system downtime.

You can also achieve a dual-loop configuration by segmenting a single hub into two smaller loops via the Fibre Channel Hub configuration software. The Fibre Channel Hub contains two controller boards: one board controls ports 1 through 5; the second board controls ports 6 through 10.

Note: Segmenting hubs does not affect port numbering in the management interfaces. A segmented hub requires only one IP address for management purposes.

“Segmenting and Unsegmenting the Hub” on page 50 in Chapter 4 contains instructions for segmenting a hub and for restoring it to normal operation.

Planning Loop Configuration

Follow these guidelines when you plan your fibre channel loop:

1. Determine the devices (storage and servers) in the loop and their physical location.
2. Make sure that the necessary cables and MIAs are on hand. Make sure that the cabling is the correct length and type (copper or fiber optic) for the storage and servers. Note the following:
   - If you plan to cascade two hubs, make sure you have the cascade cable.
   - It is a good idea to label the ends of the cables that are to be connected to the hub with the device names, or an appropriate indication of them.
   - For the connection between the hub and the console terminal or PC, use only the serial cable and adapters included with the hub.
3. Determine the order in which you want to cable devices to the hub. You can skip ports when you attach cables to the hub.

   Fibre Channel Hub ports are numbered as shown on the front panel, with ports 5 and 10 on the rear; see Figure 2-1.

   LEDs on the front panel show activity for the eight ports on the front panel and the two ports on the rear panel; see Figure 2-7.

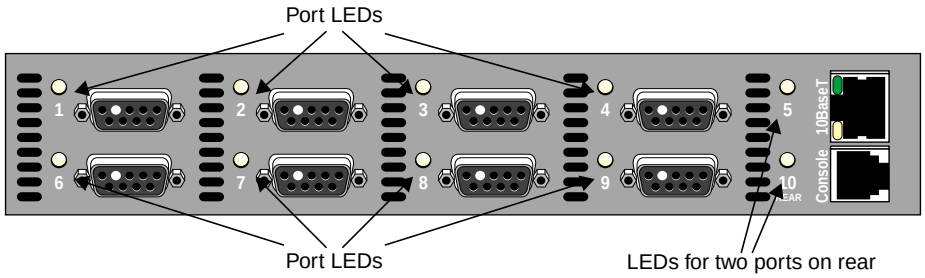

Figure 2-7 Port LEDs

Determining Hub Management

Follow these guidelines for planning hub management:

1. Determine how the hub is to be managed:
   - locally: ANSI console terminal, or a PC with a serial port

     If you use a PC, its serial port must support 9600 bps, 8 data bits, Xon/Xoff flow control, no parity, and 1 stop bit.

     For the connection between the hub and the console terminal or PC, use only the serial cable and adapters included with the hub.
   - remotely: Internet browser, Telnet console, or SNMP MIB browser

     You can use the 10-Base-T Ethernet port on the hub's front panel for this connection.

     Obtain a unique IP address for the hub from the system administrator. For this, you need the hub's media access control (MAC) address, which is located on the far left of the hub's rear panel, as shown in Figure 2-8.

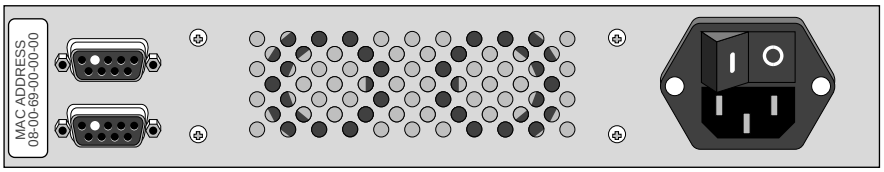

Figure 2-8 Hub MAC Address Location

     For initial installation, it is recommended that the hub be on the same subnet as the server or workstation you are using—the same subnet as the network to which it will be initially connected.

2. Make sure you have the cabling required for the management option you select.

Selecting a Spot for the Hub

Select a spot for the FIbre Channel Hub that is close to an electrical outlet and to the servers and storage that are to be cabled to the hub. Follow these guidelines:

- Ensure that sufficient airflow exists to cool the hub beneath its maximum operating temperature of 45˚ C (113˚ F).
- Stay within the hub power ratings (90-240 VAC, 65 W, 50-60 Hz) to prevent overload of supply circuits or damage to overcurrent protection and supply wiring.
- Maintain reliable earth ground, especially if connection is to a power strip instead of directly to a branch circuit.
- Protect the hub from exposure to sunlight and to very intense electrical or magnetic fields.

Note: Appendix C contains a checklist for setting up the hub, with references to specific parts of this guide.

Chapter 3

Fibre Channel Hub Setup and Cabling

This chapter explains

Note: Appendix C contains a checklist for setting up the hub, with references to specific parts of this guide.

Preparing and Setting Up the Hub

Before cabling the hub, do the following:

1. Determine how the hub is to be managed: see "Determining Hub Management" on page 24 in Chapter 2. Fulfill requirements for the management connection, such as cabling and IP address.
2. Determine the devices (storage and servers) in the loop and their physical location; see "Planning Loop Configuration" on page 23 in Chapter 2.

3. Attach the Fibre Channel Hub feet, if they have not already been attached. Four nonskid pads (feet) are included with the hub for stability when the hub is used as a desktop unit.

   Peel one of the feet of the backing and attach it at a corner of the hub case bottom, about 2.54 cm (1 inch) from the edge. Attach the other three feet in the remaining corners. See Figure 3-1.

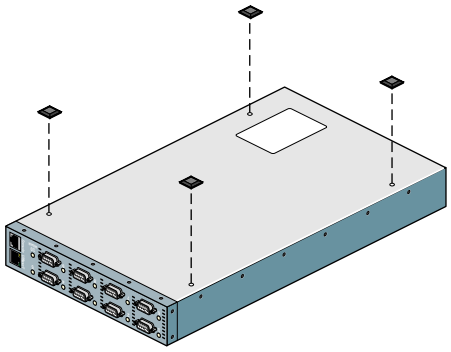

Figure 3-1 Attaching Feet

   Note: If the hub is to be rackmounted, do not attach the feet, because they cause interference. A qualified Silicon Graphics Systems Support Engineer installs the hub in a rack.

4. Set up the Fibre Channel Hub in the spot you have selected; see "Selecting a Spot for the Hub" on page 25 in Chapter 2.

5. Attach the power cord to the socket on the rear of the hub, as shown in Figure 3-2.

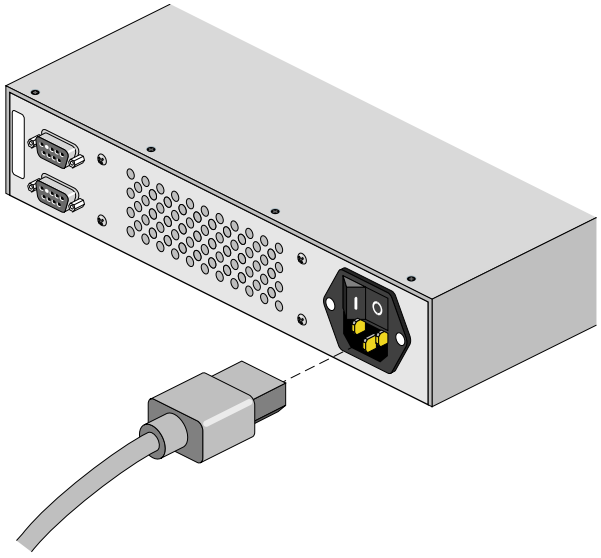

Figure 3-2 Attaching the Power Cord

Do not power on the hub at this time; leave the power switch in the off position.

Cabling the Management Port

For a 10-Base-T Ethernet connection, insert an Ethernet cable into the port at the upper right of the front panel; see Figure 3-3.

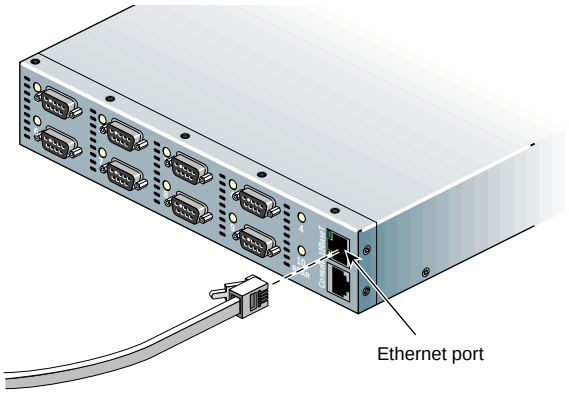

Figure 3-3 Cabling the Ethernet Port

Alternatively, connect the hub to an ANSI console terminal or to the serial (console) port of a PC; see Figure 3-4. See step 1 on page 27 for serial connection requirements.

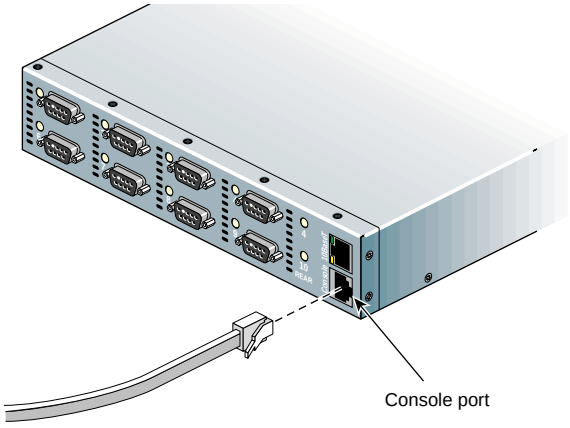

Figure 3-4 Cabling the Serial (Console) Port

Connect the other end of the cable to the ANSI console terminal or PC using the appropriate DB-9/RJ11 adapter included with the hub.

Cabling Servers, Workstations, and Storage to the Fibre Channel Hub

This section consists of the following:

Note the following:

- Only one port of a Fibre Channel Hub can be cabled to a storage processor (SP) in a Fibre Channel RAID unit. That is, one port of a Fibre Channel Hub can be cabled to either the A or B port of a Fibre Channel RAID SP.
- Only one port of a Fibre Channel Hub can be cabled to a JBOD unit. That is, one Fibre channel Hub can be cabled to either LCC A or LCC B, but not both.

Cascading Two Hubs (Optional)

To set up a loop with up to 18 nodes, you can cascade two hubs. Cascading hubs requires the optional cascade cable.

All ports are identical; each can be used for an NL_port connection or for a cascaded hub connection. For convenience, generally, ports on the front of the two hubs are cabled, as shown in Figure 3-5.

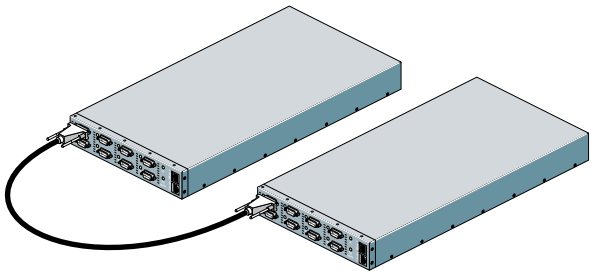

Figure 3-5 Cascaded Hubs (Example)

For two short loops, you can segment one hub into two loops with five ports each. Commands for segmenting and unsegmenting the hub (accomplished completely in software), are given in "Segmenting and Unsegmenting the Hub" on page 50 in Chapter 4.

Using Copper Cabling

Follow these steps to cable the servers and storage to the hub with copper cabling:

1. Power off the servers and workstations (FC-AL nodes) that are to be connected to the hub, following procedures in the manuals for those systems.

   Note: During normal hub operation, you can attach devices to the Fibre Channel Hub without powering them off; however, powering off these devices is recommended when you are setting up the hub connections for the first time.

2. Cable the servers, workstations, and storage to the hub ports. You need not cable to adjacent hub ports; that is, you can skip ports when attaching cables.
3. Tighten the jackscrews on each DB-9 connector to ensure EMC emissions compliance and proper system operation.

Using Fiber Optic Cabling

To connect devices to the hub with optical cabling, you must use MIAs. Follow these steps to cable the servers and storage to the hub with fiber optic cabling:

1. Power off the servers and workstations (FC-AL nodes) that are to be connected to the hub, following procedures in the manuals for those systems.

   Note: This step is required for fiber optic cabling. Attaching the connectors before applying power to the system confines all light within the fiber optic wave guide, which practically eliminates any potential hazard.

2. Taking care not to touch the tips of the fiber optic cable connections, remove the protective caps from each cable's connectors and place an MIA on each connector. This connection is keyed.
3. Attach an MIA to each end of each cable.

Figure 3-6 shows the MIA and an optical cable connector.

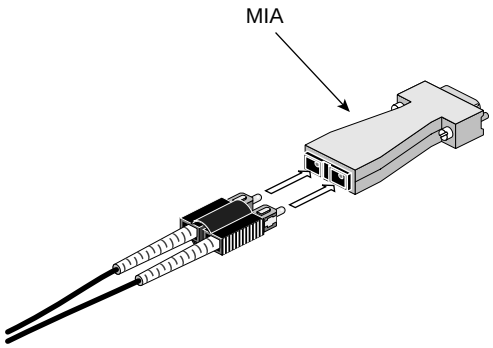

Figure 3-6 Media Interface Adapter (MIA) for Optical Fibre Channel Cables

Make sure the cable connectors are completely inserted into the sockets on the MIA. They can be a snug fit; a click occurs when the connectors seat properly.

Caution: Do not touch the tips of the fiber optic cable connections.

If the fiber optic cable tips become dirty, clean and dry the tip of each fiber within the cable by gently rubbing the tip with a soft, lint-free cloth that has been moistened with reagent-grade isopropyl alcohol. Do not use prepared cleaning compounds, such as tape-head cleaner or denatured (rubbing) alcohol. If you do not have the proper equipment, skip this step.

4. Attach a fiber optic cable with MIA to each server, workstation, and storage unit you are cabling to the hub.

   Tighten the jackscrews on each MIA at the DB-9 connector to ensure EMC emissions compliance and proper system operation.

   Do not power on the devices at this time.

5. Making sure the connection is tight, connect the free ends of the fiber optic cables with MIAs to the ports of the hub. You need not cable to adjacent hub ports; that is, you can skip ports when attaching cables.

Connecting the Hub Power Cord and Powering On the Loop

Follow these steps:

1. Connect the Fibre Channel Hub power cord(s) to a power source.
2. Turn on the Fibre Channel Hub power switch(es). On the hub(s):

   The green power LED at the top left of the Ethernet port should illuminate.

   The yellow LED at the bottom left of the Ethernet port should illuminate, indicating network activity.

   The LED for each port should be

   - yellow if the device cabled to it is not yet powered on, indicating that the port is not participating in the loop (bypassed)
   - green if the device cabled to it is powered on

   Figure 3-7 shows LED locations.

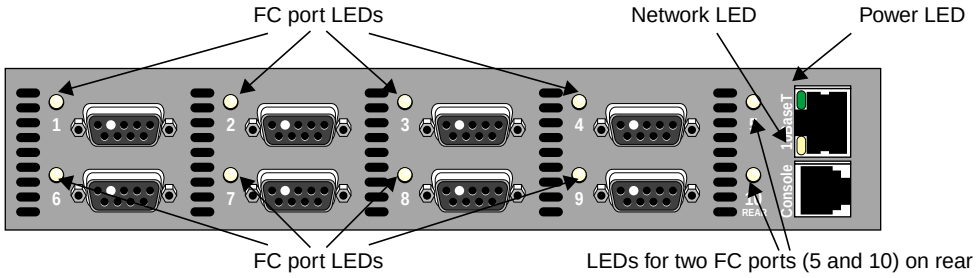

Figure 3-7 Hub LEDs

Table 3-1 outlines LED activity when the hub is powered on.

Table 3-1 LED Activity at Hub Power-On

Purpose	Location	Color or State	Meaning
Power	Left of 10-Base-T socket; top (green)	On	Power is applied
Network	Left of 10-Base-T socket; bottom (yellow)	Unlit Low intensity, steady High intensity, blinking	No connection to network Link up Network activity
Fibre channel	Front panel	Yellow Green	Port is bypassed: cabled device is not powered on Link is established

Note: A cable connected to a port does not constitute a valid link unless its other end is connected to a device.

If the LEDs are not functioning this way, check the appropriate connection: check the cable seating, Ethernet configuration if applicable, and system configuration.

Observe the following warnings for fiber optic cabling.

Warning: Never look into the end of a fiber optic cable to confirm that light is being emitted (or for any other reason). Most fiber optic laser wavelengths (1300 nm and 1550 nm) are invisible to the eye and cause permanent eye damage. Shorter wavelength lasers (for example, 780 nm) are visible and can cause significant eye damage. Use only an optical power meter to verify light output.

Warning: Never look into the end of a fiber optic cable on a powered device with any type of magnifying device, such as a microscope, eye loupe, or magnifying glass. Such activity causes cause a permanent, irreversible burn on the retina of the eye.

3. If the green power LED indicates that the hub is ready, power on the nodes that are not already powered on. The LED for each hub port they are connected to should be green.

   If the port LEDs do not function this way, check the connections to the devices. Observe the fiber optic cabling warnings on this page.

Chapter 4

Setting Up Local or Remote Hub Management

You can communicate with the Fibre Channel Hub via a terminal or PC connected to it, or remotely. This chapter explains

In most cases, you can accomplish these tasks using either the command-line interface or the Internet browser interface. The sections in this chapter give instructions for each interface as appropriate.

Setting Up Local Communication With the Hub

You can communicate with the Fibre Channel Hub via a terminal or PC connected to it. Local communication requires an ANSI console terminal or a PC; for requirements, see "Determining Hub Management" on page 24 in Chapter 2.

This section consists of the following:

Logging In via a Console Terminal

To log in via a console, follow these steps:

1. Verify that the following software is installed on the system and configured correctly:
   - *eoe.sw.uucp*
   - */etc/uucp/Devices* configuration file

     For example, this file should contain a line like the following:

     ```
     Direct ttyd2 - 9600 direct
     ```
2. In a window, enter

   `cu -l /dev/ttyd`*X*

   where *X* is the port number; for example, ttyd2. (The *cu* command is "call UNIX.") A message appears:

   ```
   Connected
   ```
3. Press Esc twice. A prompt appears:

   ```
   Enter username or HELP>
   ```
4. Press the space bar and Enter. The hub prompt appears, indicating normal privilege:

   ```
   Server>
   ```
5. For full access to the hub, enter

   ```
   Server> su
   ```
6. At the Password prompt, enter the password. The initial (and default) password is system.

   ```
   Password> system
   ```

   The characters you enter do not echo to the screen.

For information on setting passwords and on administrator privilege, see "Setting Passwords" on page 53.

For information on logging out, see "Terminating the Connection" on page 55.

Using Terminal Emulation

To use a terminal emulation program for managing the hub, assign IP address, subnet mask, and default gateway as explained in “Changing TCP/IP Settings” on page 44.

Setting Up Remote Communication for Hub Management

This section explains how to set up remote communication—Telnet or Internet browser—for Fibre Channel Hub management. It consists of the following:

Preparation

For remote communication, the Fibre Channel Hub must

- be connected to the network via the hub’s 10-Base-T Ethernet port
- have an IP address assigned
- be on the same subnet as the server or workstation you are using, for initial installation

For more information, see “Determining Hub Management” on page 24 in Chapter 2.

If the workstation you are using for remote communication with the hub is not on the same LAN segment as the hub, define a subnet mask and default gateway, as explained in “Changing TCP/IP Settings: Command-Line Interface” on page 44.

Remote Communication Setup: Command-Line Interface

Note: Instead of following the steps below, you can assign the IP address through local communication as explained in "Logging In via a Console Terminal" on page 38.

To use the command-line interface to log in remotely to the Fibre Channel hub, follow these steps:

1. Obtain a unique IP address; to verify that it is available, enter:

   `% ping` *ipaddress*

   where *ipaddress* is the IP address as assigned by the network administrator. Enter the IP address with periods, in this pattern:

   `xxx.xxx.xx.xx`

   For example:

   `123.456.78.90`

   You can stop *ping* command output with Ctrl+C.

   You should not receive a response. If you do, obtain another IP address and repeat this step.

2. Get the MAC (Ethernet) address of the Channel Hub; Figure 2-8 in Chapter 2 points out the location.

3. Assign the IP address:

   `% arp -s` *ipaddress macaddress*

   where *ipaddress* is the IP address as assigned by the network administrator and *macaddress* is the hub's MAC address, such as 08-00-69-00-c1-a9. For example:

   ```
   % arp -s 138.239.252.183 08-00-69-00-c1-a9
   ```

4. Verify that the IP address was assigned:

   `% ping` *ipaddress*

When the *ping* command is issued, the Fibre Channel Hub automatically assigns a default subnet mask based on the class of IP address. If the hub is to receive communication from a system on another LAN segment, define a subnet mask and default gateway for the hub as described in "Changing TCP/IP Settings: Command-Line Interface" on page 44, or an SNMP MIB browser, since the server or workstation is on the same Ethernet subnet as the hub.

Starting the Internet Browser Interface

To use the Internet browser interface to log in remotely to the Fibre Channel Hub, start the Internet browser interface: for the URL, enter **`http://`**, followed by one of the these choices:

- the device IP address as assigned in "Setting Up Remote Communication for Hub Management" on page 39
- the full name of the device as specified in the *etc/hosts* file
- the short name of the device as specified in the *etc/hosts* file

The status screen appears, as shown in Figure 4-1. Note features pointed out in this illustration.

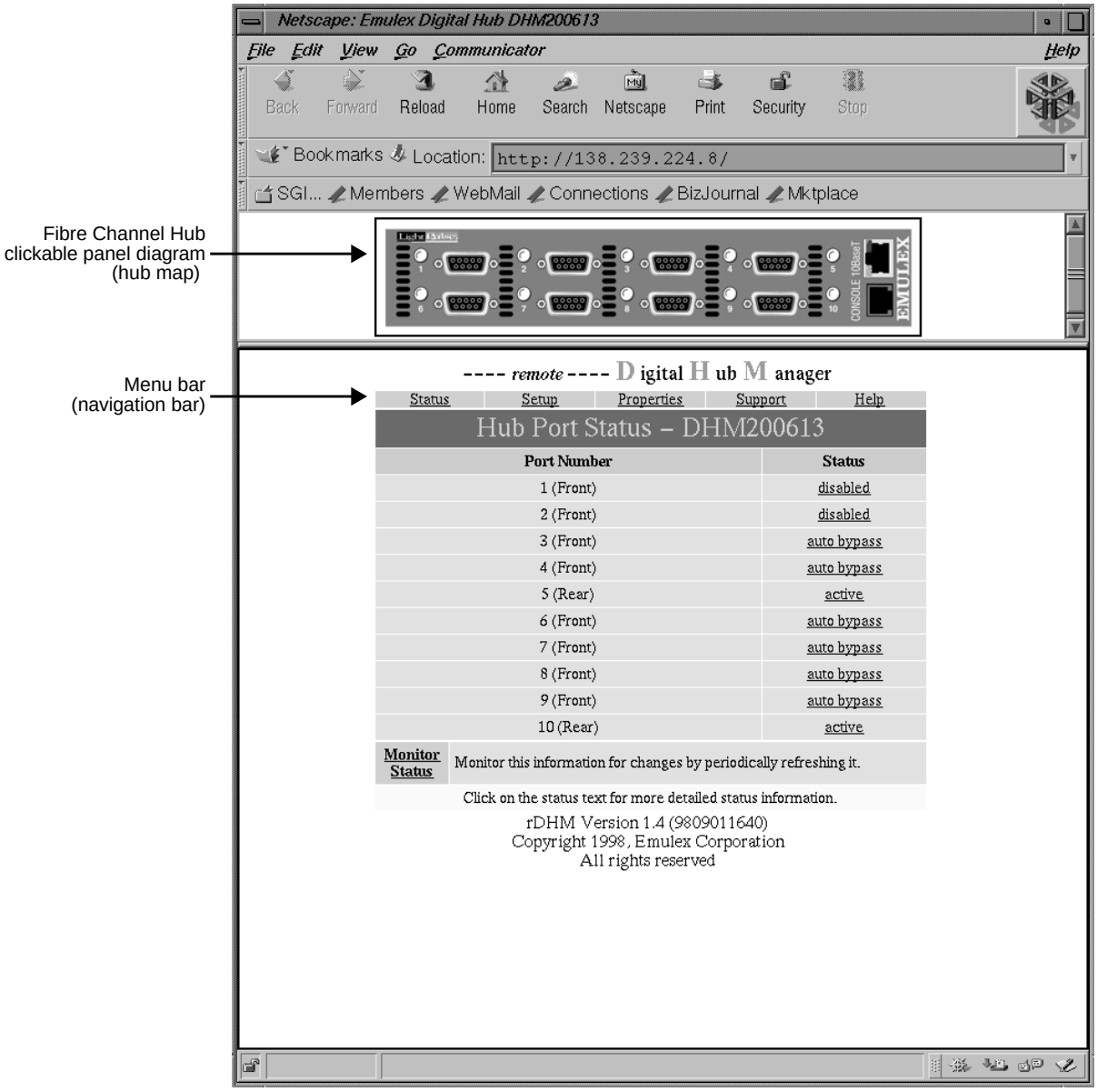

Figure 4-1 Internet Browser: Hub Port Status Screen

Telnet Login

Use this procedure to connect to a Fibre Channel Hub from a workstation with Telnet. Follow these steps:

1. Make sure that the workstation is on the same LAN segment as the hub. If it is not, define a subnet mask and default gateway, as explained in "Changing TCP/IP Settings" on page 44.
2. In a shell window, enter

   `% telnet` *ipaddress*

   where *ipaddress* is the newly assigned IP address of the hub, in this pattern:

   `xxx.xxx.xxx.xxx`

   For example:

   `123.456.123.456`

   If the connection is successful, the `Telnet>` prompt appears.
3. Log in to the hub:

   `Telnet> access`

   where *access* is the default remote login password (it does not echo to the screen).

   The prompt changes to `Local>`.
4. Enter **su**; enter the password. The default administrator password is `system`. (It does not echo to the screen.)
5. If desired, define the subnet mask and default gateway following instructions in "Changing TCP/IP Settings" on page 44.

Obtaining Privileged Status

A user who knows the administrator password has administrator privilege and can control Fibre Channel Hub configuration. Most commands in this chapter require privileged status.

To obtain administrator privilege, follow these steps:

1. Make a connection to the Fibre Channel Hub. The prompt appears, indicating normal privilege:

   ```
   Server>
   ```

2. To gain administrator privilege, enter

   ```
   Server> su
   ```

3. The prompt changes; enter the administrator password (the default password is `system`):

   ```
   Password> password
   ```

   The characters you type do not echo to the screen.

The prompt changes to `Server>>`. The double angle bracket indicates full administrator privilege.

Changing TCP/IP Settings

This section explains how to view and change TCP/IP settings using the command-line interface and the Internet browser interface, in separate subsections.

- "Changing TCP/IP Settings: Command-Line Interface" on page 44
- "Changing TCP/IP Settings: Internet Browser Interface" on page 46

Changing TCP/IP Settings: Command-Line Interface

To display TCP/IP settings, enter

```
Server> show server tcp
```

To enable or disable TCP/IP on the hub manager, a user with administrator privilege enters

```
Server>>define server authorize protocol tcp [enable|disable]
```

If you disable TCP, you can manage the hub only via local communication.

To change the hub's IP address, a user with administrator privilege enters

```
Server>>change server ip ipaddress
```

where *ipaddress* is the address assigned by the network administrator. Enter the IP address in decimal dot notation, in this pattern:

```
xxx.xxx.xx.xx
```

For example:

```
123.234.22.22
```

To change the hub's subnet mask for the hub, a user with administrator privilege enters

```
Server>>change server subnet subnetmask
```

where *subnetmask* is a number between 0 and 255. Enter the subnet mask with periods, in this pattern:

```
xxx.x.x.x
```

For example:

```
255.0.0.0
```

To define a gateway, a user with administrator privilege enters

```
Server>>change server gateway gatewayipaddress
```

where gateway*ipaddress* is the address assigned by the network administrator, in decimal dot notation (xxx.xxx.xx.xx).

The gateway node address must be identified before the hub can communicate across a router. The gateway provides access to the router and the rest of the network segment.

Changing TCP/IP Settings: Internet Browser Interface

To view or change TCP/IP parameters using the Internet browser interface, follow these steps:

1. Click Setup in the menu (navigation) bar. The Setup menu screen appears, as shown in Figure 4-2.

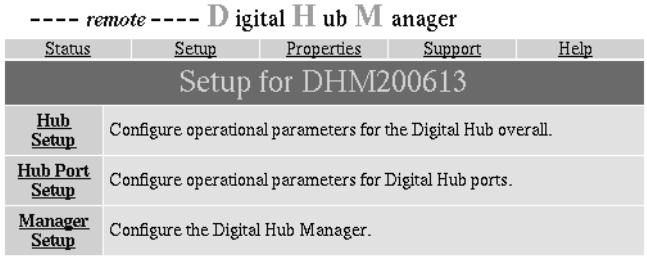

Figure 4-2 Setup Menu

2. Click Hub Setup; the Hub Setup menu appears, as shown in Figure 4-3.

Figure 4-3 Hub Setup Menu

Note: Do not use the Manager upgrade option in the GUI. Obtain firmware upgrades only from your Silicon Graphics service provider; only these have been tested for compatibility with Silicon Graphics fibre channel equipment.

3. Select TCP Setup; Figure 4-4 shows the screen that appears.

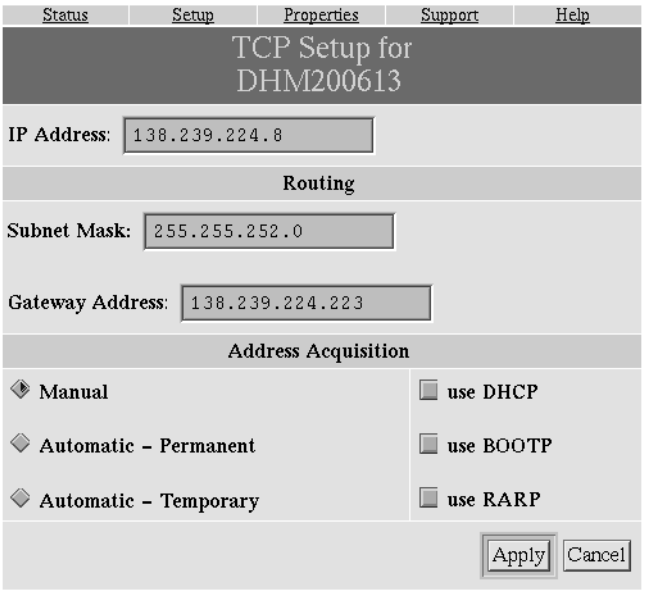

Figure 4-4 Hub Setup: TCP

Note: The default settings in this screen are recommended; do not change these values unless you have good reason to do so.

Enter the IP address, and, if applicable, subnet mask and gateway address.

The check boxes at the bottom of this screen control automatic IP address maintenance. Automatic IP maintenance can make use of any combination of BootP, RARP, and DHCP. The choices have the following meanings:

- Manual: automatic acquisition is not used.
- Automatic - Permanent: The software looks for an automatically acquired address only when the Digital Hub Manager has no IP address. Once an IP address is found, it is saved for subsequent restarts.
- Automatic - Temporary: The software looks for an automatically acquired address every time the Digital Hub Manager restarts.

4. If required, change subnet mask and gateway address in this screen.
5. When the entries are the way you want them, click *Apply*.

6. In the prompt window that appears, enter a username, a user ID (such as su), and the password (the default is system). Click *OK*.

   The changes take several minutes to go into effect.[1] When the process is complete, a message flashes near the top of the window:

   ```
   CHANGED AS REQUESTED
   ```

Setting BootP, DHCP, and RARP Parameters

The BootP, DHCP, and RARP parameters determine how the hub communicates with the host. At restart, the default sequence of IP address acquisition is as follows:

1. Attempt BootP.
2. If BootP fails, attempt DHCP.
3. If DHCP fails, attempt RARP.

You can change the thresholds at which the hub gives up one IP address acquisition method for the next. This section explains how to change these thresholds using the command-line interface and the Internet browser interface, in separate subsections.

- "Setting BootP, DHCP, and RARP Parameters: Command-Line Interface" on page 48
- "Setting BootP, DHCP, and RARP Parameters: Internet Browser Interface" on page 49

Setting BootP, DHCP, and RARP Parameters: Command-Line Interface

To set the number of times BootP attempts IP address acquisition, a user with administrator privilege enters

```
Server>>define server bootp n m [temp|permanent]
```

[1] The first change requiring a user ID and password usually takes several minutes; subsequent changes take less time.

where

n	Is the number of broadcast requests between 0 (the default) and 7 to be made if the digital hub IP address is not known. This option prevents the use of automatic IP address assignment.
m	Is the number of broadcast attempts to make if the hub IP address is known. The default is 0.
temp	Puts the response in volatile memory only. This option forces automatic IP address assignment every time the hub is rebooted.
permanent	Stores the response for future address acquisition attempts. This choice is the default.

To set the number of times DHCP attempts IP address acquisition, a user with administrator privilege enters

```
Server>>define server dhcp n m [temp|permanent]
```

To set the number of times RARP attempts IP address acquisition, a user with administrator privilege enters

```
Server>>define server rarp n m [temp|permanent]
```

To test if a local or remote IP address exists and is responding, use *ping*.

Setting BootP, DHCP, and RARP Parameters: Internet Browser Interface

To view or change BootP, DHCP, or RARP parameters using the Internet browser interface, click Setup in the menu bar, click Hub Setup, and then click TCP Setup. Figure 4-4 on page 47 shows the screen that appears.

Change the settings as desired; click *Apply* when they are the way you want them. In the window that appears, enter a user name (**su**) and password.

Enabling and Disabling Connections

A user with administrator privilege can enable or disable the Internet browser connection to the hub as follows:

```
Server>>change service http connections [enabled|disabled]
```

To enable or disable the connection to the hub through Telnet, enter

```
Server>>change service telnet connections [enabled|disabled]
```

To test if a local or remote IP address exists and is responding, use *ping*.

Segmenting and Unsegmenting the Hub

This section explains how to segment the hub into two five-port hubs, or how to return it to normal operation. (See "Hub Segmentation" on page 22 in Chapter 2.) You can use the command-line interface or the Internet browser interface; instructions are in separate subsections:

- "Segmenting and Unsegmenting the Hub: Command-Line Interface" on page 50
- "Segmenting and Unsegmenting the Hub: Internet Browser Interface" on page 52

Segmenting and Unsegmenting the Hub: Command-Line Interface

To segment the hub into two five-port hubs, a user with administrator privilege enters

```
Server>>change hub cascade disable
```

When you segment the hub (disable the factory default ten-port functionality), the green power LED at the top left of the Ethernet socket on the hub's front panel blinks at high intensity. At low intensity, this LED indicates that the hub is powered on. Figure 4-5 points out this LED.

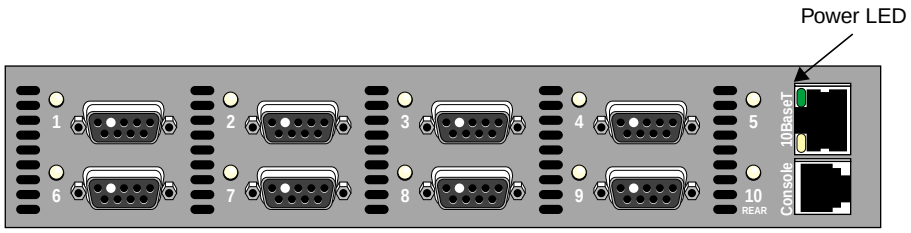

Figure 4-5 Power LED

To return a segmented hub to ten-port operation, a user with administrator privilege enters

```
Server>>change hub cascade enable
```

The power LED returns to low intensity.

Segmenting and Unsegmenting the Hub: Internet Browser Interface

To use the Internet browser interface to split the hub into two five-port hubs, select Setup in the menu bar and click Hub Setup. Figure 4-6 shows the Digital Hub setup screen that appears.

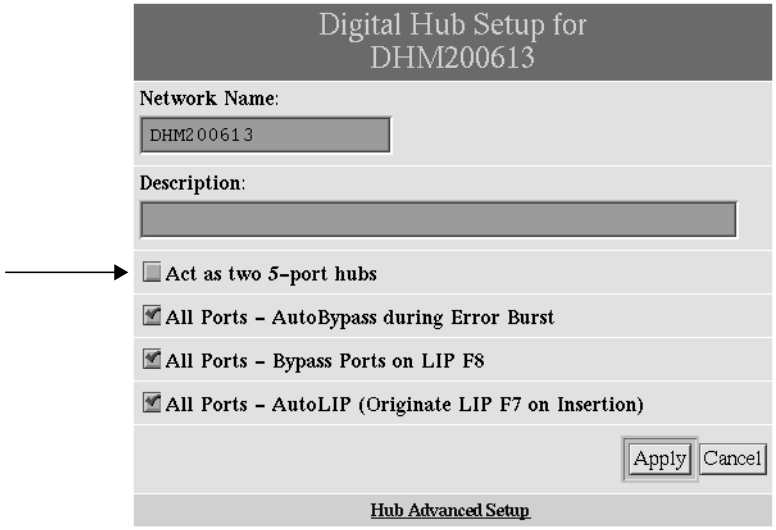

Figure 4-6 Segmenting and Unsegmenting the Hub

In this screen, check the top check box, Act as two 5-port hubs, so that a check mark appears. Click *Apply* to put the change into effect.

When you segment the hub (disable the factory default ten-port functionality), the green power LED at the top left of the Ethernet socket on the hub's front panel blinks at high intensity. At low intensity, this LED indicates that the hub is powered on. Figure 4-5 points out this LED.

To return a segmented hub to normal operation, click the check box to remove the check mark; click *Apply*. In the window that appears, enter a user name (**su**) and password. The power LED returns to low intensity.

Setting Passwords

This section explains how an administrator can set passwords. It consists of the following subsections:

Setting the Login Password

The default password for remote Telnet and rcf access is `access`. To change it using the command-line interface, follow these steps:

1. Enter the following:

   ```
   Server>>change server login password
   ```

2. The prompt changes; enter the new password:

   ```
   Login Password> newpassword
   ```

   where *newpassword* is a string of 0 to 16 letters or numerals, in any combination. If you do not enter any letters or numerals, the password remains set to the default.

   The characters you type do not echo to the screen.

3. The prompt changes; enter the new password a second time to verify it:

   ```
   Verification> newpassword
   ```

   The characters you type do not echo to the screen.

Setting the Administrative Password: Command-Line Interface

The default administrative (administrator superuser, or read/write) password controls which users can change the Fibre Channel Hub manager configuration. The factory default for this password is `system`. To change it, follow these steps:

1. Enter the following:

   ```
   Server>>change server privilege password
   ```

2. The prompt changes; enter the new password:

   `Privileged Password>` *newpassword*

   where *newpassword* is a string of 0 to 16 letters or numerals, in any combination. If you do not enter any letters or numerals, the password remains set to the default.

   The characters you type do not echo to the screen.

3. The prompt changes; enter the new password a second time to verify it:

   `Verification>` *newpassword*

   The characters you type do not echo to the screen.

Setting the Administrative Password: Internet Browser Interface

To change the default administrative password using the Internet browser interface, click Setup, then click, Manager Setup, and then select Set Password. Figure 4-7 shows the screen that appears.

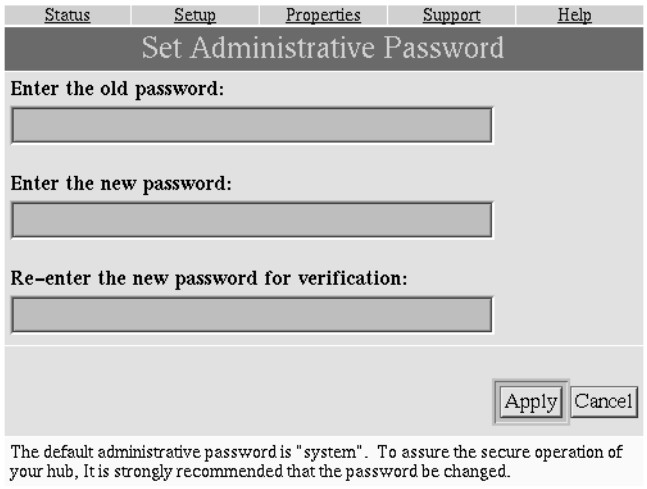

Figure 4-7 Setting the Administrative Password

Change the password as desired; fill in all three fields. Click *Apply* when it is set.

Terminating the Connection

To terminate the local or remote connection with the hub, enter

```
Server> logout
```

or, with privileged status, enter

```
Server>>logout
```

To kill the *cu* command, type a tilde and a period:

```
% ~.
```

Note: If you kill the *cu* command without first logging out at the `Server` prompt, when you try to log in again (see step 3 on page 38), you must press Esc twice and Enter to see the `Server` prompt.

Chapter 5

Fibre Channel Hub Operation and Management

This chapter explains

Viewing Statistics

This section explains how to display configuration and operation parameters and statistics using the command-line interface and the Internet browser interface, in separate subsections.

Viewing Hub and Port Statistics: Command-Line Interface

Table 5-1 gives commands for displaying parameters. Any user can enter these commands, except for *zero all*, which requires privileged status.

Table 5-1 Commands for Obtaining Parameters

Operation	Command at `Server>` Prompt
Display configuration parameters for the hub	*show hub*
Display configuration parameters for the hub ports	*show hub ports*
Display configuration parameters for the hub manager	*show server*
Display configuration parameters for the hub and hub manager	*show server config*
Display configuration parameters for the hub manager	*show server network*
Display TCP/IP parameters for the hub manager	*show server tcp*
Reset counters for error count and down count in *show hub ports* output	*zero all*

Note: Cascading hubs does not affect hub address or port numbering in the management interfaces. That is, to get information on ports on cascaded hubs, you log in to each hub the same as if it were not cascaded. Segmenting hubs also does not affect port numbering in the management interfaces.

The following is example output for the *show hub* command.

```
-  Current Hub Status ----------------------------------------------
 Hub Parameters              Upper:              Lower:
  Auto Bypass Interval:       10                  10
       Error Threshold:       07                  07
  LIP F8 Primitive 1:         BC95B5B5            BC95B5B5
         Primitive 2:         BC15F0F0            BC15F0F0
  SYNC Loss Timeout:          60                  60
  Microsecond Timer:          4FB                 4FB
  Millisecond Timer:          2EE                 2EE
  Second Timer:               35                  35
  Hub Configuration:          10 Port
```

```
 Port Status:
                              1 active             6 auto bypass
                              2 active             7 active
                              3 active             8 active
                              4 active             9 active
                              5 active            10 active
-------------------------------------------------------------------------
```

The following is example output for the *show hub ports* command.

```
- Current Hub Port Status ------------------------------------------
Port Status       LIP F8    AutoLIP   Error       Down     Elapsed Time
                  Bypass    Insert    Count       Count      d hh:mm:ss
 1  active        enabled   enabled    0           0           2
03:07:59
 2  active        enabled   enabled    769         23          2
03:07:59
 3  active        enabled   enabled   >347         1           2
03:07:59
 4  active        enabled   enabled    29          1           2
03:07:59
 5  active        enabled   enabled   >1467547     102         2
03:07:59
 6  auto bypass   enabled   enabled    0           0           2
03:07:59
 7  active        enabled   enabled    330         26          2
03:07:59
 8  active        enabled   enabled    80          8           2
03:07:59
 9  active        enabled   enabled    368         26          2
03:07:59
10  active        enabled   enabled   >21767       275         2
03:07:59
-------------------------------------------------------------------------
```

In the *show hub ports* output, Down Count is the number of times a port was automatically bypassed. Error and down counts are cumulative since the last reset.

To reset the counters for the error and down counts, a user with privileged status enters *zero all*.

The following is example output for the *show server* command.

```
Server Information
    Product: HUB Manager
    Hardware: A.41
    Firmware: (SL) 5.01n5 980810
    Software:      7.2    980915
    Console Port: 2
    Load Type: Selfload
    Uptime: 184199 (2 03:09:59)
```

The following is example output for the *show server config* command.

```
Network Interface Configuration For Ethernet

Server Information
  Product: HUB Manager
  Hardware: A.41
  Firmware: (SL) 5.01n5 980810
  Software:      7.2    980915
  Console Port: 2
  Load Type: Selfload
  Uptime: 184213 (2 03:10:13)
Network Information
  Node Name: DHM0A2908
  MAC Address: 08-00-69-xx-xx-xx
  Circuit Timer (ms): 80
  Protocols:
    TCP/IP
TCP/IP Information
  IP Addr: 128.1.000.000
  Subnet Mask: 255.255.255.0
  Gateway: 128.2.000.000
  BOOTP:  0 0 temp
  DHCP:   0 0 temp
  RARP:   0 0 temp
Port Configuration
  1  Digital HUB
     Access: remote  Queuing: disabled
     Bypass Interval: 10  Error Threshold: 7
  2  Serial - full modem  Type: softcopy
     Access: dynamic  Queuing: disabled
     Modem:  disabled  Speed: 9600
     DSRlogout: disabled  Signal Check: disabled
     Char Size: 8  Parity: none
     Autobaud: disabled  Flow Control: xon
```

```
  3  Transparent Gateway  Type: softcopy
     Access: virtual
  4  Remote Console  Type: ansi
     Access: remote
Service Configuration
  Name: http
    Port(s): 3  Protocol(s): TCP
    Queueing: enabled  Connections: enabled
    Password: disabled  Telnet: disabled
    Filter: disabled  TCP Port: 80
  Name: telnet
    Port(s): 4  Protocol(s): TCP
    Queueing: disabled  Connections: enabled
    Password: disabled  Telnet: enabled
    Filter: disabled  TCP Port: 23
```

The following is example output for the *show server network* command.

```
Network Information
    Node Name: DHM0A2908
    MAC Address: 08-00-69-xx-xx-xx
    Circuit Timer (ms): 80
    Protocols:
      TCP/IP
```

The following is example output for the *show server tcp* command.

```
TCP/IP Information
    IP Addr: 128.1.000.000
    Subnet Mask: 255.255.255.0
    Gateway: 128.2.000.000
    BOOTP:  0 0 temp
    DHCP:   0 0 temp
    RARP:   0 0 temp
```

Viewing Port Statistics: Internet Browser Interface

The Hub Manager Internet browser screen displays hub port statistics; Figure 5-1 shows an example.

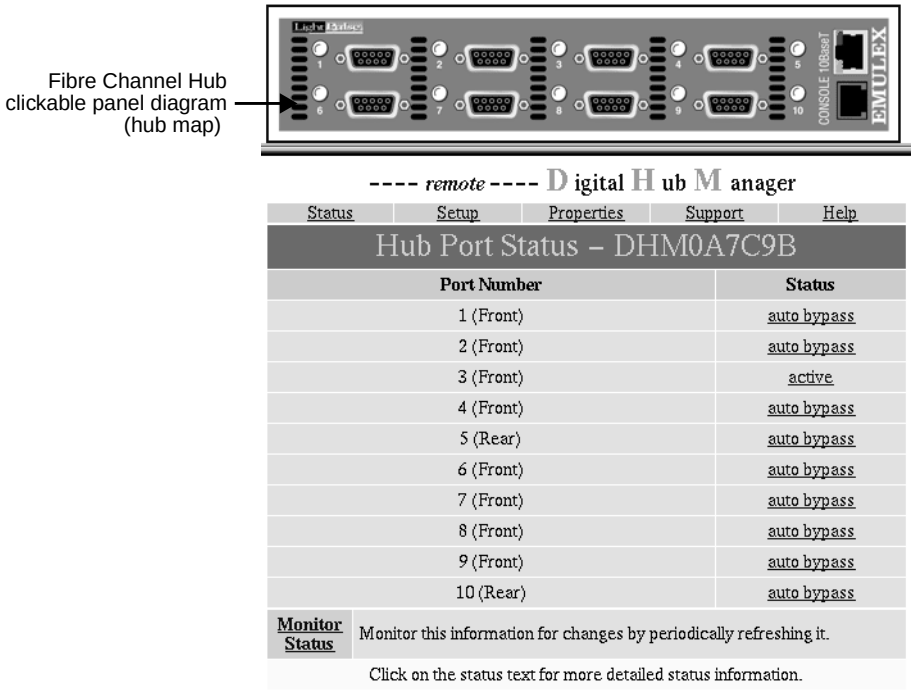

Figure 5-1 Internet Browser Status Screen

To view statistics for a particular port, click on the port or its LED in the hub map, or click on the entry for the port in the Status column. Figure 5-2 shows an example.

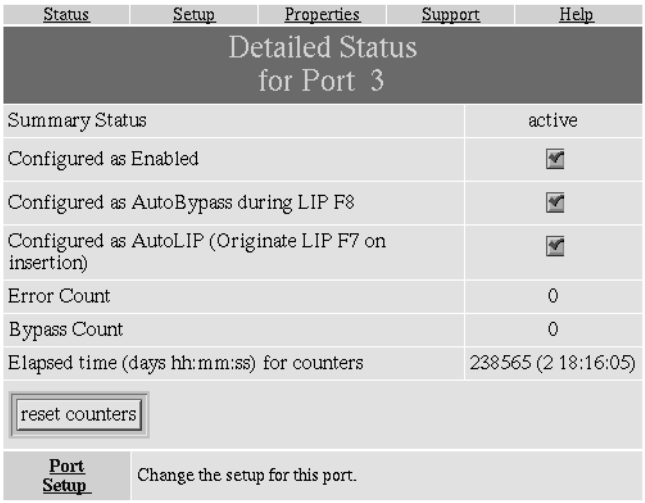

Figure 5-2 Hub Port Detailed Status Screen Example

Note: The default settings in this screen are the recommended settings.

In this screen:

- Summary status shows the basic status of the port, as it is also shown in the Hub Port Status screen.
- Configured as Enabled is checked if the port has not been administratively disabled for use.
- Configured as Autobypass during LIP F8 is checked if the port has been configured to automatically bypass while it is streaming LIP F8 characters. (See "Automatic LIP F8 Word Substitution and Bypass" on page 12 in Chapter 1 for an explanation of LIP F8.)
- Configured as AutoLIP (Originate LIP F7 on insertion) is checked if the port has been configured to originate LIP F7 characters when it inserts into the loop. (See "Automatic Loop Reconfiguration" on page 13 in Chapter 1 for an explanation of LIP F7.)

  You can change the settings in the three configuration check boxes; see "Bypassing Ports" on page 66 for instructions.

- Counts:
  - Error Count is the number of invalid transmission words received on this port.
  - Bypass Count is the number of times the port was automatically bypassed.
  - Elapsed Time is the time since the last port counter reset.

  Clicking *reset counters* at the lower left restarts these counters at 0.

You can use this screen to change port configuration parameters by clicking Port Setup at the lower left; the Port Setup screen for that port appears. Figure 5-7 on page 69 shows an example.

Viewing Hub Statistics: Internet Browser Interface

To view information on the hub and the hub manager, click Properties in the menu bar. Figure 5-3 shows an example screen.

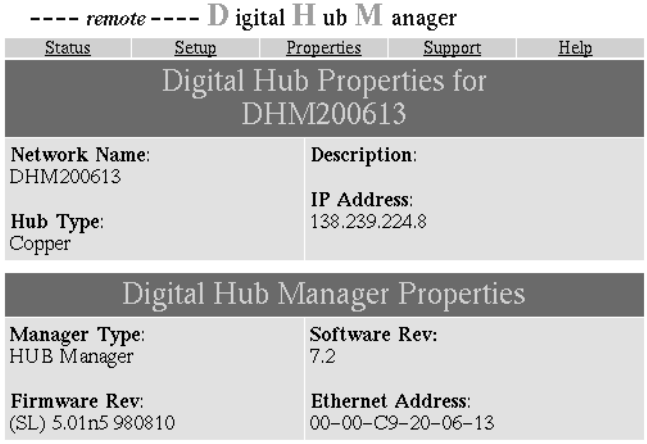

Figure 5-3 Hub and Hub Manager Statistics

To display more detailed hub manager information, follow these steps:

1. In the Hub Port Status (Figure 5-2) or Digital Hub Properties screen (Figure 5-3), click Help in the menu bar.
2. In the help window that appears, click Hub Manager Diagnostic Information. (Scroll down if necessary.) Figure 5-4 shows an example of the screen that is displayed.

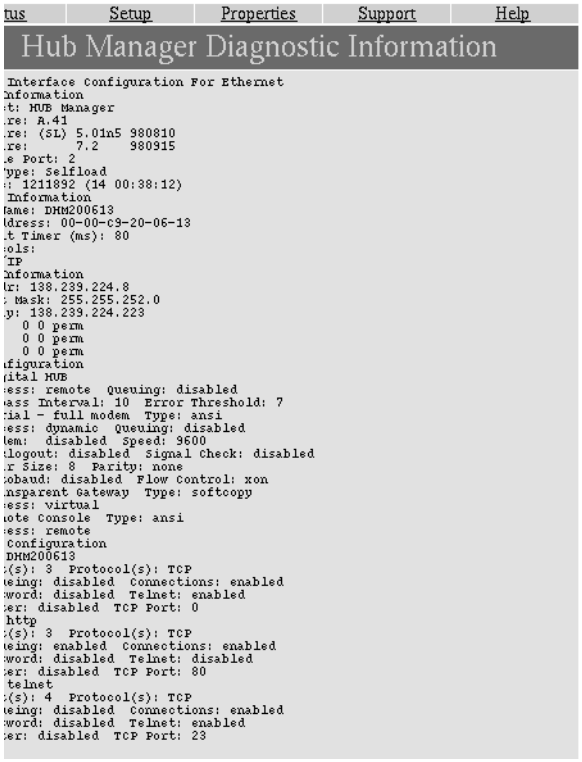

Figure 5-4 Hub Manager Diagnostic Information Example

Bypassing Ports

The Fibre Channel Hub bypasses a port automatically when it receives three consecutive LIP F8 sequences from the port. This sequence is generated when the port does not receive a valid signal from the device cabled to the port, such as when a cable is replaced or a device is disconnected for routine maintenance. The hub can also bypass a port that an administrator disables. This section explains how to bypass a port using the command-line interface and the Internet browser interface, in separate subsections; it also explains how to change the default settings for LIP F8 and F7 bypass:

- "Bypassing Ports: Command-Line Interface" on page 66
- "Bypassing Ports: Internet Browser Interface" on page 67
- "Changing LIP F8 and LIP F7 Settings" on page 71

Bypassing Ports: Command-Line Interface

Note: Bypassing a port disables access to the device connected to it; perform any required steps to prevent loss of I/O.

To use the command-line interface to force-bypass a port, a user with administrator privilege enters

```
Server>>change hub port [port|all] bypass enable
```

where *port* is the port to bypass. You can enter a number (for example, 4), a range of numbers separated by a hyphen (for example, 2-4), or a series of numbers separated by commas or single spaces (for example, 2, 4).* To bypass all ports on the loop, enter **all**. (The software does not prompt for confirmation.)

When a port is bypassed, its LED goes dark, and its status changes in the Status screen.

The following example bypasses ports 2, 3, 4, 6, and 9:

```
Server>>change hub port 2-4, 6, 9 bypass enable
```

* Cascading or segmenting hubs does not change port numbering.

The following example bypasses all ports:

```
Server>>change hub port all bypass enable
```

To disable the bypass and return the port(s) to the loop, a user with administrator privilege enters

```
Server>>change hub port [port|all] bypass disable
```

The following example disables the bypass and returns all ports to the loop:

```
Server>>change hub port all bypass disable
```

Note: When a port generates three LIP F8 sequences, it is automatically bypassed by default to prevent the LIP F8 error from bringing down the entire loop. See "Changing LIP F8 and LIP F7 Settings" on page 71 for relevant command-line interface information; see "Automatic LIP F8 Word Substitution and Bypass" on page 12 in Chapter 1 for information on the LIP F8 sequence.

Bypassing Ports: Internet Browser Interface

Note: Bypassing a port disables access to the device connected to it; perform any required steps to prevent loss of I/O.

To use the Internet browser interface to force-bypass a port, follow these steps:

1. Do one of the following:
   - In the hub map (in any screen it appears), click on the port or its LED; in the Detailed Status screen that appears, click Port Setup at the lower left.
   - In the Status window, click on the entry for the port in the Status column; in the Detailed Status screen that appears, click Port Setup at the lower left.
   - In the Hub Port Status screen, click Setup, and then click Hub Port Setup. In the Hub Port Selection screen that appears (see Figure 5-5), click the port you want to bypass.

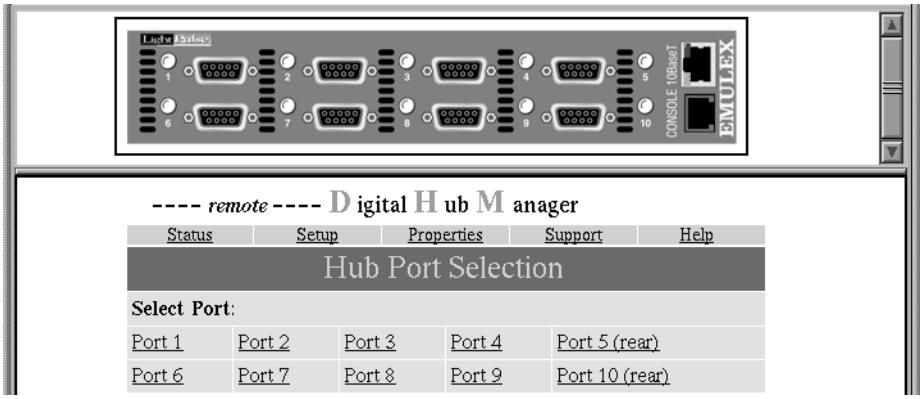

Figure 5-5 Hub Port Selection

All three methods display the Detailed Status screen for the port (see Figure 5-6).

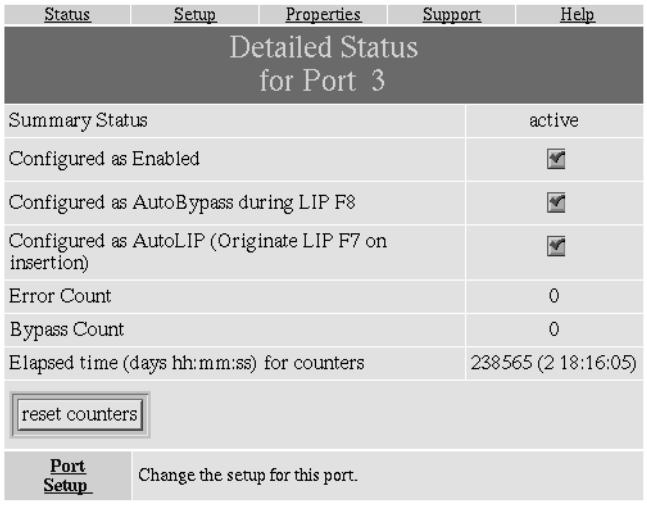

Figure 5-6 Hub Port Status Screen

2. Click *Port Setup* at the lower left to display the Port Setup screen for the port you have chosen; Figure 5-7 shows an example.

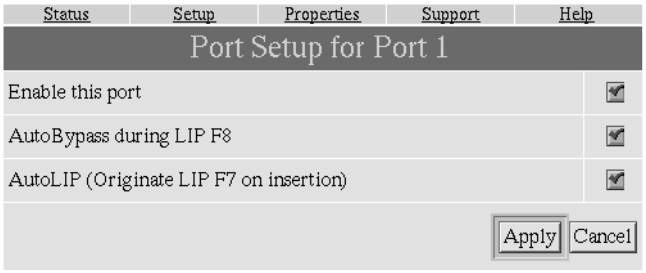

Figure 5-7 Port Setup Example

3. To bypass the port, click the top check box; click *Apply*.
4. At the user ID prompt that appears, enter **`su`**; at the password prompt, enter **`system`** or the current password.

When a port is force-bypassed, its LED goes dark, and its status changes in the Status screen. (When a port is bypassed because no device is cabled to it, its LED is yellow.

To use the Internet browser interface to force-bypass all ports, follow these steps:

1. In the Hub Port Status screen, click Setup, and then click Hub Setup. Figure 5-8 shows the Digital Hub Setup screen.

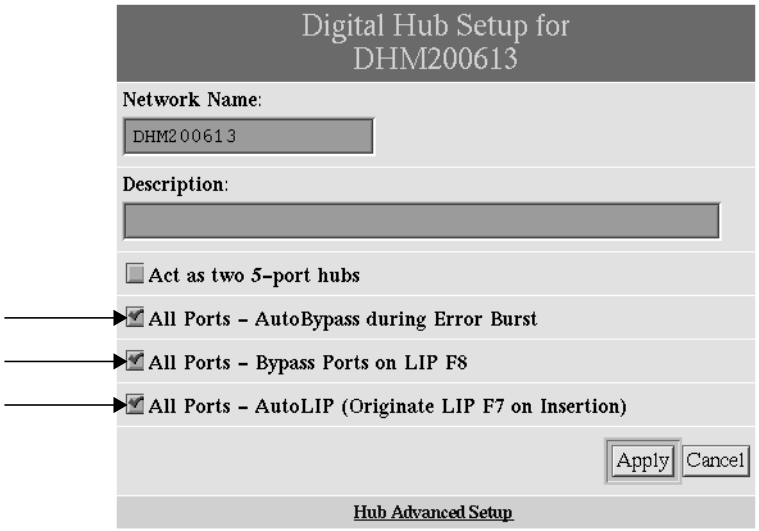

Figure 5-8 Bypassing Ports

2. Check one of the lower three check boxes, depending on the type of bypass you want. Click *Apply* to put the change into effect.
3. At the user ID prompt that appears, enter **`su`**; at the password prompt, enter **`system`** or the current password.

For information on LIP F8 and F7, see "Changing LIP F8 and LIP F7 Settings" on page 71.

Changing LIP F8 and LIP F7 Settings

To use the command-line interface to bypass a port when a LIP F8 error is generated, a user with administrator privilege enters

```
Server>>change hub port [port|all] lipf8 enable
```

This setting is the factory default.

To disable the LIP F8 bypass and return the port to the loop, a user with administrator privilege enters

```
Server>>change hub port [port|all] lipf8 disable
```

To use the Internet browser interface for LIP F8 or AutoLIP bypass, click Setup in the menu bar, and then click Hub Setup; see Figure 5-8. In this screen, click check boxes as follows:

- AutoBypass during LIP F8 automatically excludes the port from the loop while it is streaming LIP F8 characters (which indicate that the attached device is not receiving a valid signal), and reinsert it if it becomes stable again.

  This box is checked (on) by factory default. Three consecutive LIP F8 sequences from a port disable the entire loop.

- AutoLIP (Originate LIP F7 on Insertion) automatically reconfigures the loop when a hub port becomes active.

  This box is checked (on) by factory default.

For more information on the LIP F8 and LIP F7 characters, see “Fault and Error Management” on page 12 in Chapter 1.

Changing Interval and Threshold Settings

An interval is the measure of time—24 microseconds—that is examined for errors. The default interval value is set at 10 (240 microseconds), but you can change it to any value from 1 to 15. The (error) threshold setting determines when a port is automatically bypassed for excessive errors. The default is 7, but you can set it to any value from 1 to 15.

Interval and threshold work together. For example, if the interval is 10 and the threshold is 7, ten frame times are examined for errors. If six or fewer errors are found, no corrective action is taken and transmission continues. If another interval is examined and the total number of errors reaches 7, the port is automatically bypassed. The bypassed port is reinserted if no errors occur during the next interval.

Note: The threshold value must be equal to or less than the interval value.

This section explains how to display and change interval and threshold settings using the command-line interface and the Internet browser interface, in separate subsections.

- "Changing Interval and Threshold Settings: Command-Line Interface" on page 72
- "Changing Interval and Threshold Settings: Internet Browser Interface" on page 73

Caution: Changing these values from their factory defaults changes the behavior of the arbitrated loop, which can have disastrous consequences. Do not change these values unless you have good reason to do so. Setting threshold and interval values both to 1 disables automatic port bypass.

Changing Interval and Threshold Settings: Command-Line Interface

To change the interval using the command-line interface, a user with administrator privilege enters

`Server>>`**`change hub interval`** *intervalvalue*

where *intervalvalue* is a number from 1 to 15 (default 10).

To change the error threshold, a user with administrator privilege enters

`Server>>`**`change hub threshold`** *thresholdvalue*

where *thresholdvalue* is a number from 1 to 15 (default 7).

Changing Interval and Threshold Settings: Internet Browser Interface

To use the Internet browser interface to change the autobypass sample count or autobypass threshold count, click Setup in the menu bar, and then click Hub Setup. In the Digital Hub setup screen that appears, click Hub Advanced Setup at the bottom of the screen; see Figure 5-9.

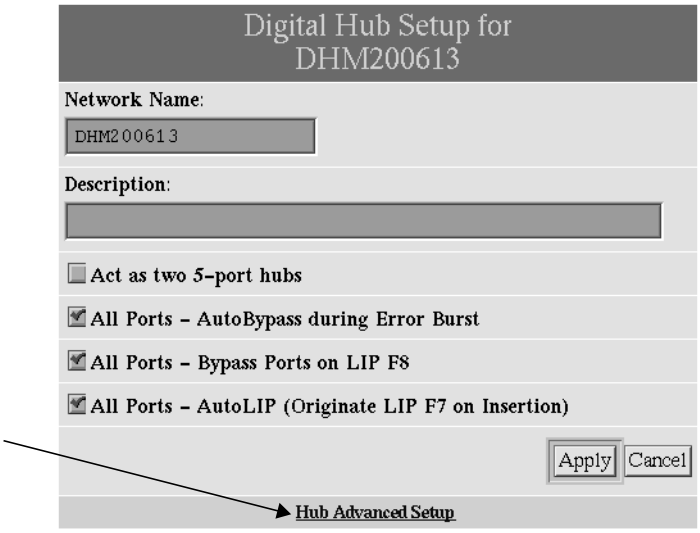

Figure 5-9 Choosing Hub Advanced Setup

In the Hub Advanced Setup screen that appears, set the autobypass sample count, the autobypass threshold count, or both; Figure 5-10 shows an example.

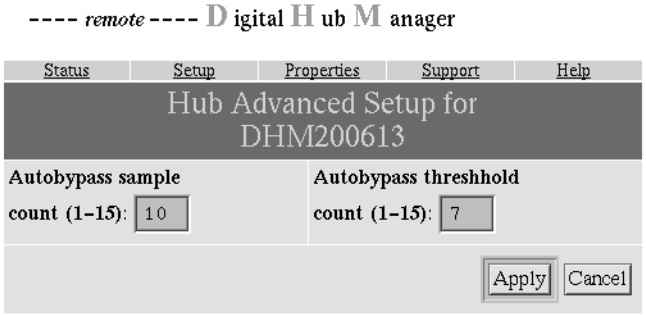

Figure 5-10 Advanced Setup Screen: Changing Autobypass Sample Count and Autobypass Threshold Count

When the settings are the way you want them, click *Apply*. Enter **su** and password at the prompt.

Caution: Changing these values from their factory defaults changes the behavior of the arbitrated loop, which can have disastrous consequences. Do not change these values unless you have good reason to do so. Setting both threshold and interval number to 1 disables automatic port bypass.

Renaming the Hub Manager

The hub manager's name is used in certain commands and by host-initiated connections. This name must be different from all other hub names on the same local network.

Using the command-line interface, a user with administrator privilege can replace the default hub manager name, as follows:

```
Server>>define server name newname
```

where *newname* is a string of 1 to 47 letters or numerals, in any combination. The default is DHMxxxxxx, where xxxxxx is the last six digits of the MAC address without the dashes.

Appendix A

Technical Specifications

This appendix summarizes technical data for the Fibre Channel Hub:

System Specifications

Table A-1 summarizes Fibre Channel Hub physical specifications.

Table A-1 Fibre Channel Hub Physical Specifications

Specification	Value
Chassis dimensions	Height: 43 cm (1.7 in.) Width: 36.8 cm (14.5 in.) Depth: 22.2 cm (8.75 in.)
Weight	Net: 1.8 kg (4 lb)
ANSI standard	ANSI X3T11PH
Bit rate	1.0625 gigabytes per second
Voltage	90-240 VAC autosensing
Power	65 W, 50-60 Hz
Operating temperature	0˚ C to +45˚ C (32˚ F to 113˚F)
Storage temperature	-10˚ C to +55˚ C (14˚F to +131˚ F)
Operating humidity	5% to 95% noncondensing (relative)

Interface Connector Pinouts

The hub ports use the ANSI FC-PH standard DB-9 pinout with an additional power pin to support an external module for electrical-to-optical conversion. Figure A-1 shows Fibre Channel Hub DB-9 pinout.

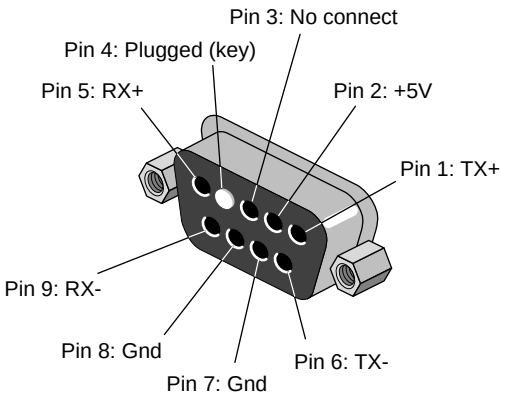

Figure A-1 Fibre Channel Hub DB-9 Pinout

Table A-2 lists Fibre Channel Hub copper connector specifications.

Table A-2 Copper Connector Specifications

Pin	Signal	Direction
1	TX+	Output
2	MIA power supply	VCC
3	Fault-	NC
4	Key	NC
5	RX+	Input
6	TX-	Output
7	ODIS+	Output
8	MIA ground	GND
9	RX-	Input

At the right on the front panel of the Fibre Channel Hub is an RJ11 port for communicating with the system console. Table A-3 shows specifications for this connector.

Table A-3 Console (Serial) RJ11 Connector Specifications

Pin	Signal	Description
1	DTR	Data Terminal Ready
2	TXD	Transmit Data
3	GND	Ground
4	RXC	Receive Data Common
5	RXD	Receive Data
6	DSR	Data Set Ready

The front panel also has a standard 10-Base-T Ethernet port, above the serial port.

Factory Defaults

The factory defaults are the recommended settings. Table A-4 summarizes factory defaults.

Table A-4 Fibre Channel Hub Factory Defaults

Specification	Value
Passwords	Administrator password: system Remote login password: access
Hub manager name	DHMxxxxxx, where xxxxxx is the last six digits of the MAC address without the dashes
Console port configuration	9600 bps, 8 data, 1 stop, no parity, Xon/Xoff
Telnet port number	23
Autobypass ports on error burst	Bypass any port for errors in 7 out of any 10 sample intervals; reinsert if no errors occur in 10 intervals
Forced port bypass	Not bypassed

Table A-4 (continued) Fibre Channel Hub Factory Defaults

Specification	Value
Autobypass port on LIP F8 detection	Enabled
LIP F7 on port insertion	Enabled
Interval	10
Threshold	7
HTTP connections	Enabled
Telnet connections	Enabled
Protocol	TCP enabled

Command-Line Interface Summary

This appendix summarizes commands in the command-line interface.

Table B-1 lists commands alphabetically. All commands require privileged status unless noted otherwise.

Table B-1 Command-Line Interface

Command	Purpose
change hub cascade [**enable** | **disable**]	Sets port configuration to one ten-port hub (**enable**, the default) or two five-port hubs.
change hub interval intervalvalue	Changes interval that is examined for errors; range 1 to 15, default 10.
change hub port [*portnum* | **all**] *bypass* [**enable** | **disable**]	Causes (**enable**, the default) the specified port(s) to be always bypassed; *portnum* can be one or more port numbers separated by commas or spaces, or a range (such as 1-4).
change hub port [*portnum* | **all**] *lipf8* [**enable** | **disable**]	Enables (default) or disables automatic bypass when the port generates a LIP F8 error sequence.
change hub threshold thresholdvalue	Changes error threshold for automatically bypassing a port; range 1 to 15, default 7.
change port type [**ansi** | **softcopy**]	Specifies type of terminal connected to the hub: ANSI-compatible or generic video display terminal.
change server gateway gatewayipaddress	Identifies the gateway node address, which provides access to the router and the rest of the network segment. It must be entered in decimal dot notation; for example, 123.456.78.90.
change server ip ipaddress	Assigns the IP address, which must be entered in decimal dot notation; for example, 123.456.78.90.

Table B-1 (continued) Command-Line Interface

Command	Purpose
change server login password	Changes the default password (access) for remote Telnet and rcf access.
change server privilege password	Changes the default administrator password (system).
change server subnet subnetmask	Defines the subnet mask, which must be entered in decimal dot notation; for example, 255.0.0.0.
change service http connections **[enabled | disabled]**	Allows or prevents connection to the hub through an Internet browser.
change service telnet connections **[enabled | disabled]**	Allows or prevents connection to the hub through Telnet.
define server authorize protocol tcp **[enable | disable]**	Enables (default) or disables TCP on the hub manager; disabling TCP allows only local communication for hub management.
define server bootp **n m [temp | permanent]**	Sets number of times BootP attempts IP address acquisition before attempting DHCP. **n** is the number of broadcast requests if IP address is not known; range 0 (default) to 7, to prevent an IP address being automatically assigned. **m** is the number of broadcast attempts if digital hub IP address is known; default is 0. **temp** enters the response in volatile memory only, forcing automatic IP address assignment every time the hub is rebooted; **permanent** is the default.
define server dhcp **n m [temp | permanent]**	Sets number of times DHCP attempts IP address acquisition before attempting RARP; options are the same as for *define server bootp*
define server rarp **n m [temp] | permanent]**	Sets number of times RARP attempts IP address acquisition; options are the same as for *define server bootp*.
define server name newname	Replaces default hub manager name; range is 1 to 47 alphanumeric characters. The default name is DHMxxxxxx, where xxxxxx is the last six digits of the MAC address without the dashes.

Table B-1 (continued) Command-Line Interface

Command	Purpose
init	Reboots the hub; breaks Telnet connection.
logout	Terminates the local or remote connection to the hub.
ping ipaddress	Tests if a local or remote IP address exists and is responding.
show hub	Displays configuration parameters for the hub; privileged status not required.
show hub ports	Displays status information for all hub ports; privileged status not required.
show server	Displays configuration parameters for hub manager; privileged status not required.
show server config	Displays configuration for hub and hub manager; privileged status not required.
show server network	Displays configuration parameters for the hub manager; privileged status not required.
show server tcp	Displays TCP/IP settings for the hub manager.
zero all	Reset counters for error count and down count in *show hub ports* output.

Appendix C

Setup Checklist

This appendix consists of a checklist for setting up the Fibre Channel Hub for desktop use.

Table C-1 Hub Setup Checklist

Step		Explained In
1.	Check contents of shipment.	"Fibre Channel Hub Kit" on page 2
2.	Determine how the hub is to be managed; determine nodes to be cabled to the hub; determine a location for the hub.	Chapter 2
3.	Find MAC address on rear of hub: Ethernet (MAC) address: ___-___-___-___-___-___	"Determining Hub Management" on page 24
4.	From system administrator, obtain IP address, gateway, and subnet. IP address:_____ Gateway:_____ Subnet:_____	"Determining Hub Management" on page 24
5.	Set up the Fibre Channel Hub and cable it.	Chapter 3
6.	Use console to set IP address.	"Setting Up Local Communication With the Hub" on page 37
7.	If necessary, change TCP/IP parameters.	"Changing TCP/IP Settings: Command-Line Interface" on page 44
8.	Set up communication with desired management method (Internet browser or Telnet).	"Setting Up Remote Communication for Hub Management" on page 39
9.	Set other hub and communications parameters as required.	Chapter 4
10.	Configure ports.	Chapter 5

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