RS/6000 SP

Planning Vol. 1, Hardware and Physical Environment

GA22-7280-11

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Note
Before using this information and the product it supports, be sure to read the general information under “Notices” on page 243.

Eleventh edition (April 2002)

This edition replaces GA22-7280-10. Significant changes or additions to the text or illustrations are indicated by a vertical line (|) to the left of the change.

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About this book

This book is an installation site physical planning guide. Its purpose is to help you prepare your site in advance for installation of your IBM RS/6000 SP. Early planning gives you the opportunity to make alterations to your site, order any necessary additional components, and reduce the time it takes to install your system. An organized plan helps ensure that your system is configured in the most efficient manner to best suit your particular needs.

Save your original book

If you receive this book as part of an SP system upgrade, be sure to retain the book that came with your original system. This book emphasizes the latest SP system hardware and does not include complete information on previous hardware releases.

Who should use this book

This book is intended for those technical professionals responsible for planning the installation of an IBM RS/6000 SP system.

Related information

This book and other RS/6000 SP hardware and software documentation are available both online and, for some books, in printed form from the following sources:

- The Web site at
  http://www.ibm.com/servers/eserver/pseries/library/sp_books/index.html
- Printed documents and CD-ROM versions, which can be ordered from IBM
- The Resource Center on the PSSP product media

For more information on these sources and an extensive listing of RS/6000 SP related publications, see “Bibliography” on page 255.

How to send your comments

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Summary of changes

GA22-7280-11

Changes made since the previous edition (GA22-7280-10) are indicated throughout this book by a vertical bar on the left margin of the page. Changes in this edition include:

- Added new 450 MHz CPU card for the 375/450 MHz POWER3 SMP Thin and Wide Nodes
- Added p690 and p670 as SP-attached servers
- Revised scaling limits for SP-attached servers
- Added new Models 557 and 558 switch packages for 19″ racks
- Added new SP Switch2 Expansion frame (F/C 2034)
- Added frame information for p690-like frames (Model 556 and F/C 2034)
- Added 73.4 GB disk drive (F/C 3844) for 375/450 MHz POWER3 SMP Wide Nodes
- Withdrawls of several disk drive features

GA22-7280-10

Changes made since the previous edition (GA22-7280-09) are indicated throughout this book by a vertical bar on the left margin of the page. Changes in this edition include:

- SP Switch2 two-plane implementation
- New SP Switch2 Frame feature, adding four additional switches for two-plane configurations (F/C 2033)
- New SP Switch2 adapters for additional node types
- New 1.93 m frame (Model 556) for clustered nodes SP Switch2 configurations
- New clustered node system options
- Additional PCI adapters
- New SP-attached server feature code (F/C 9125) for network cabling
- Added external hard disk drive models

Chapter 1. Introducing the RS/6000 SP

This chapter is an overview of the IBM RS/6000 SP. It introduces the processor nodes, model and expansion frames, the standard and optional hardware, and installation site planning. Figure 1 is a conceptual illustration of an RS/6000 SP system.

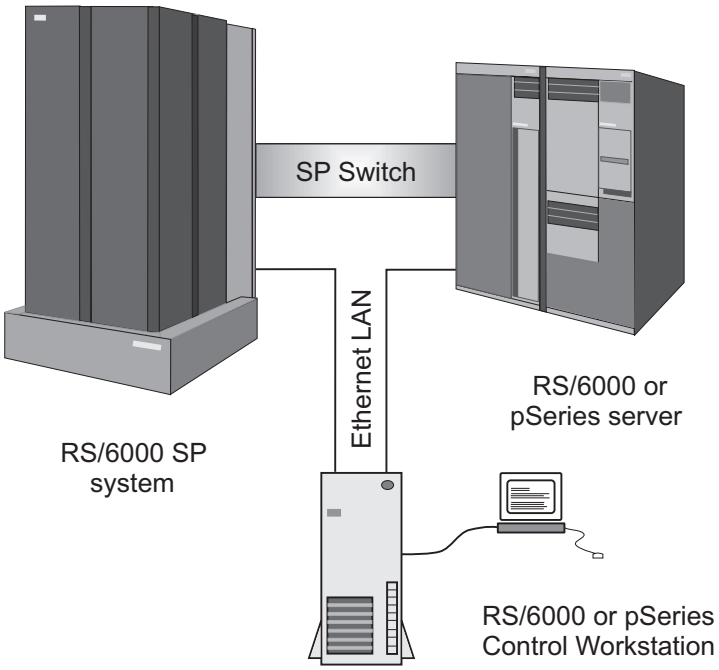

Figure 1. Conceptual RS/6000 SP system

RS/6000 SP system overview

The IBM RS/6000 SP is IBM's family of scalable, parallel computing solutions. It provides a state-of-the-art parallel computing system and industry-leading application enablers and applications. The RS/6000 SP runs the AIX operating system along with the Parallel System Support Programs (PSSP) system software on the control workstation and all processor nodes. For complete information on SP system software issues, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

The scalable architecture of the SP system, its high-performance communication, PowerPC and POWER3 processors give you the power to handle data-intensive, compute-intensive and I/O-intensive jobs with ease. You can execute both serial and parallel applications simultaneously, while managing your system from a single workstation. For scientific and technical applications, the SP system delivers the power and connectivity for rapid turnaround; from structural analysis and seismic modeling to circuit simulation and molecular modeling. Multiple users can run complex queries against very large amounts of data and obtain results interactively. This makes the SP system an ideal solution for database query, online transaction processing, business management, and batch business applications.

The IBM software offerings for the SP system provide an interlocking set of licensed programs designed to address a wide range of system and application needs. The open architecture, based on the AIX operating system (IBM's implementation of

UNIX), enables you to easily integrate the SP system into your existing environments. The software architecture is closely tuned to the SP system hardware design for maximum usability and performance.

The SP system family continues the AIX and RS/6000 policy of adherence to open systems standards. Connection to I/O devices, networks of workstations, and mainframe networks is a key element of the SP system. Ethernet, HIPPI, SCSI, FDDI, Token-Ring, ATM, SSA, ESCON, BMCA and Fibre Channel 266 and 1 GB interfaces are supported by the SP system. In addition to the standard network interface cards, the SP offers versatile, high-speed network connections using extension nodes.

The SP system can also provide scalable e-business interfaces using both IBM RS/6000 Enterprise Servers and @server pSeries servers connected as SP-attached nodes. Additionally offered is the IBM @server Cluster 1600 (M/T 9078 Model 160). This scalable system can include all RS/6000 SP system components as well as clusters of RS/6000 or @server pSeries servers along with a control workstation, all running PSSP software. You can install up to 16 M/T 7017 or 7040 servers or up to 64 M/T 7026 servers. These systems all benefit from the PSSP software single point-of-control.

Hardware planning

The basic components of the RS/6000 SP system are:

- Processor nodes (includes SP-attached servers)
- Frames with integral power subsystems
- Switches
- Extension nodes
- Control workstations (a high availability option is available)
- Network connectivity adapters
- External disk drives

These components connect to your existing computer network through a local area network (LAN), making the RS/6000 SP system accessible from any network-attached workstation.

Processor nodes

The IBM RS/6000 SP System is scalable from one to 128 processor nodes. Up to sixteen thin, eight wide, or four high processor nodes can be mounted in a tall frame while a short frame can hold up to eight thin or four wide nodes.

SP systems with more than 128 processor nodes are available on a special order basis; for details, consult your IBM account representative.

There are four types of RS/6000 SP processor nodes:

- High nodes
- Wide nodes
- Thin nodes
- SP-attached servers

Nodes have either a Symmetric MultiProcessor (SMP) configuration or a uniprocessor configuration. SMP-type nodes use Peripheral Component Interconnect (PCI) architecture, while the withdrawn uniprocessor nodes use Micro Channel Architecture (MCA).

See the following chapters for complete details on processor nodes and their features:

High nodes

- Chapter 2, “375 MHz POWER3 SMP High Node (F/C 2058)” on page 9.
- “POWER3 SMP High Node (F/C 2054)” on page 219 (withdrawn from production).

Wide nodes

- Chapter 3, “375/450 MHz POWER3 SMP Wide Node (F/C 2057)” on page 15.
- “POWER3 SMP Wide Node (F/C 2053)” on page 225 (withdrawn from production).
- “332 MHz SMP Wide Node (F/C 2051)” on page 231 (withdrawn from production).

Thin nodes

- Chapter 4, “375/450 MHz POWER3 SMP Thin Node (F/C 2056)” on page 19.
- “POWER3 SMP Thin Node (F/C 2052)” on page 222 (withdrawn from production).
- “332 MHz SMP Thin Node (F/C 2050)” on page 228 (withdrawn from production).

SP-attached servers

An SP-attached server is an IBM server configured to operate as a node within the SP system. Each is a high-end, PCI based, 64-bit SMP unit that supports concurrent 32-bit and 64-bit applications.

Like a standard SP system processor node, the SP-attached server can perform most SP system processing and administration functions. However, unlike a standard SP system processor node, the SP-attached server is housed in its own frame. Thus, it has both node-like and frame-like characteristics.

SP-attached servers require the installation of several SP system-specific cables and communications adapters. For details, see Chapter 5, “SP-attached servers (M/T 7040, 7026, 7017)” on page 23.

Frames

IBM RS/6000 SP system frames contain and provide power for processor nodes, switches, hard disk drives and other hardware. A frame feature code provides an empty frame with its integral power subsystem and ac power cable. You order nodes and other components using their respective feature codes.

Frames are offered in a list of five options:

- Tall (1.93 m) ***model*** frames
- Tall ***expansion*** frames
- Short (1.25 m) model frames
- Short expansion frames
- SP Switch frames

Frames have locations known as ***drawers*** into which the processor nodes are mounted. Tall frames have eight drawers and short frames have four. Each drawer location is further divided into two ***slots***. A slot has the capacity of one thin node. Wide nodes occupy one full drawer while high nodes fill two drawers.

Complete details on current production frames can be found in the following chapters:

Tall model and expansion frames
Chapter 6, “Tall frames – Model 550/5/6, F/C 1550/5, 2031/2/4” on page 35.

Short model and expansion frames
Chapter 7, “Short frames – 1.25 m (Model 500 and F/C 1500)” on page 39.

SP Switch frames
“SP Switch frames (F/C 2031, 2032, 2034)” on page 38.

Control workstations

When planning your control workstation, you can view it as a server to the SP system applications. The subsystems running on the control workstation are the SP system server applications for the SP system nodes. The nodes are clients of the control workstation server applications. The control workstation server applications provide configuration data, security, hardware monitoring, diagnostics, a single point of control service, and optionally, job scheduling data and a time source.

Since most control workstation planning decisions are based on the ability of the control workstation to handle your software requirements, most of the planning information for the CWS is covered in *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*. Also included are the requirements for a high-availability option (**F/C 1245**), which eliminates the control workstation as a single point of failure. For the latest list of supported control workstations, see the “Read this First” document at:
www.rs6000.ibm.com/resource/aix_resource/sp_books/planning/index.html.

Control workstation planning information in this book is limited to the following:

- I/O adapter features for both PCI and MCA-type control workstations; see “Control workstation interface adapters” on page 46.
- Electronic Service Agent and Service Director; system monitoring and fault reporting applications. For details, see “Electronic Service Agent and Service Director” on page 47.

Switches

Switches provide a message-passing network that connects all processor nodes with a minimum of four paths between every pair of nodes. The SP Switch series can also be used to connect the SP system with optional external devices.

For information on planning inter-frame switch cabling, see “Planning for SP Switch and SP Switch2 cabling” on page 84.

SP Switch
SP Switches are available in both 8-port (**F/C 4008**) and 16-port (**F/C 4011**) configurations. For detailed information, see Chapter 9, “SP Switch (F/C 4011 and F/C 4008)” on page 49.

SP Switch2
The SP Switch2 is available in a 16-port (**F/C 4012**) configuration. For detailed information, see Chapter 10, “SP Switch2 (F/C 4012)” on page 53.

SP Switch Router

The IBM RS/6000 SP Switch Router is a licensed version of the Ascend GRF switched IP router that is enhanced for direct connection to the SP Switch. Network connections through SP Switch Routers are typically faster and have better availability than network connections through SP system nodes.

Connections between the SP system and the SP Switch Router require an SP Switch mounted in an SP frame and an SP Switch Router Adapter in the router connected by a switch cable. For detailed information, see Chapter 11, “SP Switch Router (M/T 9077 04S and 16S)” on page 57.

Network communications

SP systems have several communication requirements, including the following:

- All SP systems require an SP Ethernet LAN for system administration.
- Switch-configured systems require a frame-to-frame switch cable network.
- SP systems connected to external networks (or with networks between SP system partitions) require additional communication adapters.

The required SP Ethernet LAN that connects all nodes to the control workstation is needed for system administration and is to be used for that purpose exclusively. If you attempt to route non-administrative traffic over the SP Ethernet and it interferes with administrative traffic, you have to reroute the non-administrative traffic. Further network connectivity is supplied by various adapters, some optional, that provide connection to I/O devices, networks of workstations, and mainframe networks. Ethernet, FDDI, Token-Ring, HIPPI, SCSI, FCS, and ATM are examples of adapter types that can be used as part of an RS/6000 SP system.

On boot/install server nodes, some adapters are needed to support systems that contain nodes running on different PSSP software release levels. For details, see Chapter 12, “Communication cabling” on page 71 and *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Communication cabling

Cables are an important part of planning the setup of a communication network.

Cable planning for your SP system communication network includes:

- Placing hardware items on your floor plan (control workstation, processor frames, routers, and servers) so that cables are the correct length to reach all necessary connection points.
- Ensuring that all wiring standards are followed for the cable types you install.
- For switch-configured systems; laying out the frame-to-frame switch cable network and determining the quantity, length, and type of switch cable you need for each switch-equipped frame.

For details on completing these tasks, see Chapter 12, “Communication cabling” on page 71.

Communication and I/O adapters

If you plan to connect your entire SP system (or partitions within your SP system) to external networks, you must install communication adapters. If you have an SP system with multiple system partitions, you can enhance system performance by using optional network adapters, rather than the switch network, for communication between partitions.

Two different communication-bus architectures are used in SP systems; Peripheral Component Interconnect (PCI) in current systems and Micro Channel Architecture (MCA) in earlier production.

PCI adapters are used in the following nodes:

- POWER3 and 375/450 MHz POWER3 SMP nodes
- 332 MHz SMP nodes
- SP-attached servers

MCA communication adapters were used in the following withdrawn nodes:

- 160 MHz Uniprocessor Thin Nodes (withdrawn from production)
- 200 MHz SMP High Nodes (withdrawn from production)
- 135 MHz Uniprocessor Wide Nodes (withdrawn from production)

Planning for communication I/O adapters

Planning for I/O adapters involves two high-level tasks:

1. Determining ***which*** adapters to use
2. Determining ***how many*** adapters to use

Determining which adapters to use: Factors for deciding which adapters to use include:

- Performance capability
- What is included with the adapter
- What you must supply for the adapter, including cables if needed
- Software requirements

These details for each PCI-type adapter are in Chapter 14, “PCI communication adapters” on page 103. For withdrawn MCA-type adapters, see Appendix C, “MCA communication adapters” on page 209.

Determining how many adapters to use: Each communication adapter has limitations placed on it including:

- The maximum number allowed per node type
- Performance requirements
- Placement restrictions

This information is shown in tables and lists for each PCI-type adapter in “PCI bus I/O adapter requirements for SMP nodes” on page 91. For MCA-type adapters, see “MCA bus adapter requirements” on page 209.

Hard disk drives

Hard disk drives for the SP system can be either of two types as follows:

- Internal (contained within the node)
- External (mounted separately, outside of the node)

Internal hard disk drives

Internal hard disk drives are installed in bays within the node. If a node does not use an external boot device, it must be configured with internal hard disk drives. In this configuration, nodes have a minimum and maximum limit for hard disk drives. For details, see “Internal hard disk drives” on page 143.

External hard disk drives

Some later nodes can be configured with no internal hard disk drives. Nodes having only external drives use them as the source of boot information. In this application, external hard disk drives are called ***external boot disks***. For details, see “External boot disks” on page 147.

For available features to extend node storage, see “External hard disk drives” on page 145.

Installation site planning

Electrical power planning

Chapter 16, “Power and electrical requirements” on page 151 describes power planning issues, such as the electrical subsystem used in SP system frames and the power requirements of individual SP system components. These issues are covered in the following sections:

- “Scalable Electric Power Base Unit (SEPBU)” on page 154 describes the power subsystem.
- “SEPBU input branch circuit requirements” on page 154 provides branch circuit information for each frame configuration.
- “Power cord specifications for SEPBU-equipped frames” on page 156 describes the power cables provided with each SP system and lists the plugs and connectors required.
- “Planning for power requirements of SP frames and features” on page 161 discusses SP system component and auxiliary equipment power requirements.
- “Obtaining power system backup devices” on page 151 provides information on obtaining uninterruptible power supplies that are properly matched with your SP system.
- “Upgrading power systems in early SP frames” on page 202 describes the equipment supplied in the features for upgrading early SP system power subsystems.

Environmental planning

Chapter 17, “Environmental factors” on page 165 covers the following topics:

- “Environmental specifications of the RS/6000 SP” on page 165 lists temperature and humidity specifications for the SP system.
- “Acoustical environment of the RS/6000 SP system” on page 166 has a table listing acoustic emissions of nodes and frames.
- “SP thermal output and cooling requirements” on page 167 describes the procedures you use to calculate air conditioning requirements for your installation.
- Evaluating electromagnetic interference on page 171.
- Evaluating electrostatic discharge on page 171.
- “SP frame tie-down considerations” on page 172 provides drawings showing the tie-down locations on SP system frames.

Floor planning

In addition to providing weights and dimensions for SP system frames and their shipping containers, Chapter 18, “Floor planning” on page 175 provides information needed to develop the work space for your SP system. Some of the topics related to this are:

- “Raised floor installations” on page 179.
- “Non-raised floor installations” on page 180.
- “Service clearance specifications for frames” on page 181 has tables and illustrations showing the floor space required for SP system frames and the locations of cable openings and leveling casters for each frame type.
- “Multi-frame system floor planning and illustrations” on page 191 contains tables and illustrations showing floor layouts for a variety of multi-frame SP system installations.
- “RS/6000 SP system floor load analysis” on page 196 contains the formula you use to calculate the actual load placed on your installation site floor.

RS/6000 SP system upgrades

Many upgrades, conversions, and feature additions are available to enhance SP system performance and capability. Examples of typical upgrades include adding frames to your SP system, installing new higher-performance nodes, and converting MCA-type nodes to PCI nodes. For details, see Appendix A, “SP system upgrades, conversions, and feature additions” on page 199.

Chapter 2. 375 MHz POWER3 SMP High Node (F/C 2058)

Description

375 MHz POWER3 SMP High Nodes (F/C 2058) use PCI bus architecture and have four, eight, twelve, or sixteen 375 MHz 630FP 64-bit processors per node. Your IBM RS/6000 SP system must be operating at PSSP 3.2 (or later) to use these nodes.

The 375 MHz POWER3 SMP High Node occupies two full drawer locations, thus four nodes can be housed in a tall frame. These nodes require a 1.93 m tall, deep frame (**Model 550**) or expansion frame (**F/C 1550**); they are not supported in the withdrawn 2.01 m frame or in the 1.25 m frame. These nodes can be placed in the first node slot of a frame without requiring additional nodes.

The 375 MHz POWER3 SMP High Node provides additional hard disk drive and PCI adapter capacity by connecting to SP Expansion I/O Units; for details, see “SP Expansion I/O Unit (F/C 2055)” on page 12.

PCI bus description

The 375 MHz POWER3 SMP High Node PCI bus contains one 32-bit and four 64-bit PCI slots for I/O adapters.

Additional PCI adapters can be attached to the bus by using up to six optional SP Expansion I/O Units. Each expansion unit has eight 64-bit PCI adapter slots.

Requirements and options

F/C 2058 requirements

375 MHz POWER3 SMP High Nodes occupy two full node drawers. Up to four 375 MHz POWER3 SMP High Nodes can be installed in one tall/deep frame. Mandatory prerequisites are:

- PSSP 3.2 (or later) on the processor node, control workstation, and backup nodes
- Four processors (on one card, mounted in one slot)
- 1 GB of memory
- 9.1 GB of mirrored storage (with internal booting)

F/C 2058 options

Available options include the following:

- Four processor slots allowing a maximum of sixteen processors per node
- Four memory slots supporting up to 64 GB of memory
- Five PCI slots (four 64-bit and one 32-bit) for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional SP Switch adapter
- A dedicated port for an optional SP Switch2 adapter
- Integrated Ethernet with BNC and RJ45 ports (only one port can be used at a time):
  - 10BASE2 Ethernet (BNC)
  - 10BASE-T or 100BASE-TX Ethernet (RJ45)

- Support for up to six SP Expansion I/O Units (**F/C 2055**)
- Two internal hard disk drive bays supporting up to 72.8 GB of storage (36.4 GB mirrored)
- Integrated Ultra SCSI network
- Two external, nine-pin, RS-232 connectors on the planar S2 and S3 ports. The S3 port is supported only for HACMP serial heartbeat; the S2 port is not supported for this use. A 9-pin to 25-pin converter cable is included with the node for this connector.
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options

375 MHz POWER3 SMP High Nodes require a minimum of four 375 MHz, 630FP processors mounted on one card. You can order up to three additional four-processor cards (**F/C 4350**) to configure the node with a total of sixteen CPUs.

Table 1. Processor options for 375 MHz POWER3 SMP High Nodes (F/C 2058)

Feature Code	Description	Minimum per node	Maximum per node
4350	One processor card with four CPUs	1	4

Memory requirements and options

375 MHz POWER3 SMP High Nodes have one to four memory cards, require a minimum of one GB of memory, and support a maximum of 64 GB. Memory is supplied by 128, 256, and 512 MB DIMMs which must be mounted in banks of eight DIMMs. Different capacity DIMMs (in banks of eight) can be mixed on the memory cards.

For the best memory-access bandwidth, memory DIMMs should be distributed evenly across four memory cards. As an example, you can realize better bandwidth by using four banks of 128 MB DIMMs (4 GB total) distributed evenly over four memory cards rather than by using one bank of 512 MB DIMMs (4 GB total) on one memory card. The following list illustrates this:

- 1 to 16 GB memory mounted on one card yields 16.8 - 24.3% of peak bandwidth
- 2 to 32 GB mounted on two cards yields 33.5 - 48.5% of peak
- 4 to 64 GB mounted on four cards yields 67 - 97% of peak

The configurator rules used for memory placement in these nodes are designed to yield the best memory performance. Any plans to increase the amount of memory in the future should always be taken into consideration when deciding what size DIMMs to use and the quantity of memory cards to order.

Table 2. Memory features for 375 MHz POWER3 SMP High Nodes (F/C 2058)

Feature Code	Description	Minimum Node Requirement	Maximum Features Per Node
4880	Base Memory Card	1	4
4133	1 GB – (8 x 128 MB DIMMs)	1	16
4402	2 GB – (16 x 128 MB DIMMs)	0	8
4403	3 GB – (24 x 128 MB DIMMs)	0	4
4404	4 GB – (32 x 128 MB DIMMs)	0	4

Table 2. Memory features for 375 MHz POWER3 SMP High Nodes (F/C 2058) (continued)

Feature Code	Description	Minimum Node Requirement	Maximum Features Per Node
4134	2 GB – (8 x 256 MB DIMMs)	0	16
4412	4 GB – (16 x 256 MB DIMMs)	0	8
4413	6 GB – (24 x 256 MB DIMMs)	0	4
4414	8 GB – (32 x 256 MB DIMMs)	0	4
4421	4 GB – (8 x 512 MB DIMMs)	0	16
4422	8 GB – (16 x 512 MB DIMMs)	0	8
4423	12 GB – (24 x 512 MB DIMMs)	0	4
4424	16 GB – (32 x 512 MB DIMMs)	0	4

Hard disk drive requirements and options

375 MHz POWER3 SMP High Nodes can have one pair of internal hard disk drives attached through an integrated Ultra SCSI network. The node can have either no internal hard disk drives (with external booting) or from 9.1 GB to a maximum of 36.4 GB of mirrored, internal disk storage.

Additional hard disk drives can be attached to the 375 MHz POWER3 SMP High Node by connecting up to six SP Expansion I/O Units. Each expansion unit has four hard disk drive bays. For details, see “SP Expansion I/O Unit (F/C 2055)” on page 12.

Optional internal hard disk drives are available as follows:

- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 2909**) – withdrawn 4/02
- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 2918**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3804**) – withdrawn 4/02
- 18.2 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3810**)
- 36.4 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3820**)

External storage devices can be accessed through optional Ultra SCSI adapter (**F/C 6207**) and SSA adapter (**F/C 6230**).

Switch and communication adapter requirements and options

Switch Restrictions

- 375 MHz POWER3 SMP High Nodes are not supported with the SP Switch-8. You must use either the SP Switch, 16-port (**F/C 4011**) or the SP Switch2, 16-port (**F/C 4012**).
- 375 MHz POWER3 SMP High Nodes are not compatible with the older High Performance series of switches (F/C 4007, 4010). They can only be used with the SP series switches.

Switch adapters

For systems using the SP Switch, these nodes require the SP Switch MX2 Adapter (**F/C 4023**); see “POWER3 and 375/450 MHz POWER3 SMP node adapter” on page 50.

For systems using the SP Switch2, these nodes require the SP Switch2 Adapter (**F/C 4025**); see “High node adapter” on page 53.

I/O adapters

The 375 MHz POWER3 SMP High Node has five PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON
- Serial HIPPI

For more information about these adapters, see Chapter 14, “PCI communication adapters” on page 103.

Note: A 10BASE2 or 10BASE-T/100BASE-TX Ethernet adapter for the SP Ethernet LAN is integrated into the POWER3 High Node and does not occupy a PCI slot.

SP Expansion I/O Unit (F/C 2055)

Each SP Expansion I/O Unit is an extension of the 375 MHz POWER3 SMP High Node, providing eight additional PCI adapter slots and four hard disk drive bays. PCI adapter hot-plug capability is supported for the SP Expansion I/O Unit with AIX 4.3.3 software loaded on the node.

Up to six expansion units can be connected to each processor node in one to three loops of one or two expansion units in each loop.

Each expansion unit (or pair of units) requires a mounting shelf (**F/C 9935**). This shelf occupies the space of one drawer in a frame. If only a single expansion unit is mounted in the shelf, a filler plate (**F/C 9936**) is required for the other side.

Expansion units can be mounted in the same frame as the node, using 2 m cables (**F/C 3126**), or in separate frames using 15 m cables (**F/C 3127**). These units require a tall, deep frame (**Model 550** or **F/C 1550**); they are not supported in the withdrawn 2.01 m frame or in the 1.25 m frame.

SP Expansion I/O Unit Placement

IBM suggests that SP Expansion I/O Units be mounted in separate frames, so as not to interfere with switch port utilization.

Hard disk drive options

Each SP Expansion I/O Unit has four hard disk drive bays, supporting one or two pairs of hard disk drives.

SCSI and SSA type hard disk drives ***cannot be mixed*** within an expansion unit.

Note: Empty pairs of hard disk drive bays require a filler plate (**F/C 9612**).

Optional hard disk drive pairs for SP Expansion I/O Units are available as follows:

- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 3803**) - requires adapter (**F/C 6206**)
- 18.2 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3811**) - requires adapter (**F/C 6206**)
- 36.4 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3821**) - requires adapter (**F/C 6206**) and an SP Expansion I/O Unit power upgrade (**F/C 9955**)

Withdrawn disk drives:

- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 3800**) - requires adapter (**F/C 6206**) – withdrawn 4/02
- 9.1 Gigabyte SSA disk pair (**F/C 3802**) - requires adapter (**F/C 6230**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3805**) - requires adapter (**F/C 6206**) – withdrawn 4/02
- 18.2 Gigabyte SSA 10K RPM disk pair (**F/C 3812**) - requires adapter (**F/C 6230**)
- 36.4 Gigabyte SSA 10K RPM disk pair (**F/C 3822**) - requires adapter (**F/C 6230**) and an SP Expansion I/O Unit power upgrade (**F/C 9955**)

Chapter 3. 375/450 MHz POWER3 SMP Wide Node (F/C 2057)

Description

375/450 MHz POWER3 SMP Wide Nodes (F/C 2057) have PCI bus architecture and either two or four 375 or 450 MHz 64-bit processors per node. These nodes are functionally equivalent to an IBM RS/6000 7044-270 workstation. Your IBM RS/6000 SP system must be operating at PSSP 3.1.1 (or later) to use these nodes.

The node occupies one full drawer, thus eight nodes can be housed in a tall frame. These nodes can be placed in the first node slot of a frame without requiring additional nodes.

For electromagnetic compliance, these nodes are housed in an enclosure (F/C 9930).

If you plan to install a 375/450 MHz POWER3 SMP Wide Node into an early-style 2.01 m or 1.25 m frame, a power system upgrade is required. Once the power system upgrade is done, these nodes are fully compatible with all existing SP system hardware excepting High Performance switches. For details on power system upgrades, see “Upgrading power systems in early SP frames” on page 202.

PCI bus description

The 375/450 MHz POWER3 SMP Wide Node PCI bus contains two 32-bit slots and eight 64-bit PCI slots divided into three logical groups. The first group (slots I2 and I3) comprises two 32-bit slots on the CPU side of the node (the I1 slot is reserved for an optional switch adapter). The second and third group each contain four 64-bit PCI slots (slots I1-I4 and slots I5-I8) on the I/O side of the node.

Requirements and options

F/C 2057 requirements

375/450 MHz POWER3 SMP Wide Nodes occupy one full node drawer. They can be asymmetrically configured for memory, hard disk drives, and adapters. Up to eight of these nodes can be installed in a tall frame and up to four in a short frame. Mandatory prerequisites are:

- PSSP 3.1.1 (or later) on the control workstation, backup nodes, and processor node.
- Two processors (mounted in one slot)
- 256 MB of memory
- 4.5 GB of mirrored storage (with internal booting)
- An upgraded power system on early-style frames (see “Upgrading power systems in early SP frames” on page 202 for details)

F/C 2057 options

Available options include the following:

- Two processor slots allowing a maximum of four processors per node
- Two memory slots supporting up to 16 GB of memory
- Ten PCI slots (two 32-bit and eight 64-bit) for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter

- Integrated Ethernet with BNC and RJ45 ports (only one port can be used at a time)
  - 10BASE2 Ethernet (BNC)
  - 10BASE-T Ethernet or 100BASE-TX Ethernet (RJ45)
- Four hard disk drive bays supporting up to 223.2 GB of storage (111.6 GB mirrored)
- Integrated Ultra SCSI
- Standard service processor
- External nine-pin RS-232 on the planar S2 port (supported only for HACMP serial heartbeat); a 9 to 25-pin converter cable is included with the node
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options

375/450 MHz POWER3 SMP Wide Nodes require a minimum of two processors mounted on one card. Optionally, you can order an additional processor card for a total of four CPUs. Pairs of processor cards must be of the same feature code.

Table 3. Processor options for 375/450 MHz POWER3 SMP Wide Nodes (F/C 2057)

Feature code	Description	Minimum per node	Maximum per node
4444	One processor card with two 375 MHz CPUs	1	2
4445	One processor card with two 450 MHz CPUs	0	2

Memory requirements and options

375/450 MHz POWER3 SMP Wide Nodes require two memory cards and a minimum of 256 MB of memory. These nodes support a maximum of 16 GB of memory; each card has an 8 GB capacity. Memory is supplied by 128, 256, and 512 MB DIMMs which must be mounted in pairs. Different capacity DIMM-pairs can be mixed on the memory cards. Note that with the minimum memory (256 MB) installed, the second memory card contains no DIMMs.

Table 4. Memory features for 375/450 MHz POWER3 SMP Wide Nodes (F/C 2057)

Feature code	Description	Minimum node requirement	Maximum features per node
4098	Base Memory Card	2	2
4110	256 MB – (2 x 128 MB DIMMs)	1	16
4133	1 GB – (8 x 128 MB DIMMs)	0	4
4402	2 GB – (16 x 128 MB DIMMs)	0	2
4403	3 GB – (24 x 128 MB DIMMs)	0	1
4404	4 GB – (32 x 128 MB DIMMs)	0	1
4119	512 MB – (2 x 256 MB DIMMs)	0	16
4134	2 GB – (8 x 256 MB DIMMs)	0	4
4412	4 GB – (16 x 256 MB DIMMs)	0	2
4413	6 GB – (24 x 256 MB DIMMs)	0	1
4414	8 GB – (32 x 256 MB DIMMs)	0	1

Table 4. Memory features for 375/450 MHz POWER3 SMP Wide Nodes (F/C 2057) (continued)

Feature code	Description	Minimum node requirement	Maximum features per node
4100	1 GB – (2 x 512 MB DIMMs)	0	16
4421	4 GB – (8 x 512 MB DIMMs)	0	4
4422	8 GB – (16 x 512 MB DIMMs)	0	2
4423	12 GB – (24 x 512 MB DIMMs)	0	1
4424	16 GB – (32 x 512 MB DIMMs)	0	1

Hard disk drive requirements and options

375/450 MHz POWER3 SMP Wide Nodes can have up to two pairs of internal hard disk drives attached through an integrated Ultra SCSI network. This node can have either no internal hard disk drives (with external booting) or from 4.5 GB to a maximum of 111.6 GB of mirrored internal disk storage.

Optional direct access storage devices are available as follows:

- 4.5 Gigabyte Ultra SCSI disk pair (**F/C 2904**) – withdrawn
- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 2909**) – withdrawn 4/02
- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 2918**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3804**) – withdrawn 4/02
- 18.2 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3810**)
- 36.4 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3820**) - available only for I/O side hard disk drive bays
- 73.4 Gigabyte Ultra3 SCSI 10K RPM disk pair (**F/C 3844**) - available only for I/O side hard disk drive bays

Note: No special cables or adapters are required to mount these internal hard disk drives. However, this node has an option (**F/C 1241**) which provides an independent SCSI hookup with the following characteristics:

- Eliminates the hard disk drive controller as a single point of failure during mirroring
- Increases disk performance
- Balances disk loading

The F/C 1241 option requires a PCI type SCSI adapter **F/C 6206**; see “SCSI-2 Ultra/Wide SE PCI adapter (F/C 6206)” on page 132 for details.

External storage devices can be accessed through optional Ultra SCSI adapter (**F/C 6207**), SCSI-2 adapter (**F/C 6209**), and SSA adapter (**F/C 6230**).

Switch and communication adapter requirements and options

Switch restrictions

- 375/450 MHz POWER3 SMP Wide Nodes are not compatible with the older High Performance series of switches (F/C 4007, 4010). If you install this node into a switch-configured system, you must use an SP Switch series switch.

- Switch adapters for these nodes are not interchangeable with either the switch adapters used on uniprocessor wide nodes or with the SP Switch MX adapter used on 332 MHz SMP nodes.

Switch adapters

The switch adapter for the 375/450 MHz POWER3 SMP Wide Node is installed in the Mezzanine (MX) bus in slot I1 (CPU side). The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

These adapters are:

- For the SP Switch – SP Switch MX2 Adapter (**F/C 4023**)
- For the SP Switch2 – SP Switch2 MX2 Adapter (**F/C 4026**)

I/O adapters

The 375/450 MHz POWER3 SMP Wide Node has ten PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON
- Serial HIPPI

For more information about these adapters, see Chapter 14, “PCI communication adapters” on page 103.

Note: A 100BASE-TX, 10BASE-T, or 10BASE2 adapter for the SP Ethernet is integrated into the node and does not occupy a PCI slot.

Chapter 4. 375/450 MHz POWER3 SMP Thin Node (F/C 2056)

Description

375/450 MHz POWER3 SMP Thin Nodes (F/C 2056) have PCI bus architecture and either two or four 375 or 450 MHz 64-bit processors per node. These nodes are functionally equivalent to an IBM RS/6000 7044-270 workstation. Your IBM RS/6000 SP system must be operating at PSSP 3.1.1 (or later) to use these nodes.

The node occupies half of a drawer (one slot). Up to sixteen of these nodes can be housed in a tall frame. When installed singly within a drawer, these nodes must be placed in an odd-numbered node slot. For complete information on node/frame configurations, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

For electromagnetic compliance, these nodes are housed in an enclosure (F/C 9930). If you order a single node, a cover plate (F/C 9931) is included to fill the even-numbered slot opening.

If you plan to install a 375/450 MHz POWER3 SMP Thin Node into an early-style 2.01 m or 1.25 m frame, a power system upgrade is required. Once the power system upgrade is done, these nodes are fully compatible with all existing SP system hardware excepting High Performance switches. For details on power system upgrades, see “Upgrading power systems in early SP frames” on page 202.

PCI bus description

The 375/450 MHz POWER3 SMP Thin Node PCI bus has two 32-bit slots, I2 and I3 (the I1 slot is reserved for an optional switch adapter).

Requirements and options

F/C 2056 requirements

375/450 MHz POWER3 SMP Thin Nodes occupy one half node drawer. They can be asymmetrically configured for memory, hard disk drives, and adapters. Up to sixteen of these nodes can be installed in a tall frame and up to eight in a short frame. Mandatory prerequisites are:

- PSSP 3.1.1 (or later) on the control workstation, backup nodes, and processor node
- Two processors (mounted in one slot)
- 256 MB of memory
- 4.5 GB of mirrored storage (with internal booting)
- An upgraded power system on early-style frames (see “Upgrading power systems in early SP frames” on page 202 for details)

F/C 2056 options

Available options include the following:

- Four processors in two slots
- Two memory slots supporting up to 16 GB of memory
- Two (32-bit) PCI slots for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter

- Integrated Ethernet with BNC and RJ45 ports (only one port can be used at a time)
  - 10BASE2 Ethernet (BNC)
  - 10BASE-T or 100BASE-TX Ethernet (RJ45)
- Two hard disk drive bays supporting up to 36.4 GB of storage (18.2 GB mirrored)
- Integrated Ultra SCSI
- Standard service processor
- External nine-pin RS-232 on the planar S2 port (supported only for HACMP serial heartbeat); a 9 to 25-pin converter cable is included with the node
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options

375/450 MHz POWER3 SMP Thin Nodes require a minimum of two processors mounted on one card. Optionally, you can order an additional processor card for a total of four CPUs. Pairs of processor cards must be of the same feature code.

Table 5. Processor options for 375/450 MHz POWER3 SMP Thin Nodes (F/C 2057)

Feature code	Description	Minimum per node	Maximum per node
4444	One processor card with two 375 MHz CPUs	1	2
4445	One processor card with two 450 MHz CPUs	0	2

Memory requirements and options

375/450 MHz POWER3 SMP Thin Nodes require two memory cards and a minimum of 256 MB of memory. These nodes support a maximum of 16 GB of memory; each card has an 8 GB capacity. Memory is supplied by 128, 256, and 512 MB DIMMs which must be mounted in pairs. Different capacity DIMM-pairs can be mixed on the memory cards. Note that with the minimum memory (256 MB) installed, the second memory card contains no DIMMs.

Table 6. Memory features for 375/450 MHz POWER3 SMP Thin Nodes (F/C 2056)

Feature Code	Description	Minimum Node Requirement	Maximum Features Per Node
4098	Base Memory Card	2	2
4110	256 MB – (2 x 128 MB DIMMs)	2	16
4133	1 GB – (8 x 128 MB DIMMs)	0	4
4402	2 GB – (16 x 128 MB DIMMs)	0	2
4403	3 GB – (24 x 128 MB DIMMs)	0	1
4404	4 GB – (32 x 128 MB DIMMs)	0	1
4119	512 MB – (2 x 256 MB DIMMs)	0	16
4134	2 GB – (8 x 256 MB DIMMs)	0	4
4412	4 GB – (16 x 256 MB DIMMs)	0	2
4413	6 GB – (24 x 256 MB DIMMs)	0	1
4414	8 GB – (32 x 256 MB DIMMs)	0	1
4100	1 GB – (2 x 512 MB DIMMs)	0	16

Table 6. Memory features for 375/450 MHz POWER3 SMP Thin Nodes (F/C 2056) (continued)

Feature Code	Description	Minimum Node Requirement	Maximum Features Per Node
4421	4 GB – (8 x 512 MB DIMMs)	0	4
4422	8 GB – (16 x 512 MB DIMMs)	0	2
4423	12 GB – (24 x 512 MB DIMMs)	0	1
4424	16 GB – (32 x 512 MB DIMMs)	0	1

Hard disk drive requirements and options

375/450 MHz POWER3 SMP Thin Nodes can have one pair of internal hard disk drives attached through an integrated Ultra SCSI network. The node can have either no internal hard disk drives (with external booting) or from 4.5 GB up to a maximum of 36.4 GB of mirrored internal disk storage.

Optional internal direct access storage devices are available as follows:

- 4.5 Gigabyte Ultra SCSI disk pair (**F/C 2904**) – withdrawn
- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 2909**) – withdrawn 4/02
- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 2918**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3804**) – withdrawn 4/02
- 18.2 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3810**)

Note: No special cables or adapters are required to mount these internal hard disk drives.

External storage devices can be accessed through an optional Ultra SCSI adapter (**F/C 6207**), SCSI-2 adapter (**F/C 6209**), or SSA adapter (**F/C 6230**).

Switch and communication adapter requirements and options

Switch restrictions

- 375/450 MHz POWER3 SMP Thin Nodes are not compatible with the High Performance series of switches (F/C 4007, 4010). If you install a this node into a switch-configured system, you must use either an SP Switch or an SP Switch-8.
- Switch adapters for these nodes are not interchangeable with either the switch adapters used on uniprocessor thin nodes or with the SP Switch MX adapter (F/C 4022) used on 332 MHz SMP nodes.

Switch adapters

The switch adapter for the 375/450 MHz POWER3 SMP Thin Node is installed in the Mezzanine (MX) bus in slot I1. The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

These adapters are:

- For the SP Switch – SP Switch MX2 Adapter (**F/C 4023**)
- For the SP Switch2 – SP Switch2 MX2 Adapter (**F/C 4026**)

I/O adapters

The 375/450 MHz POWER3 SMP Thin Node has two PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON

For details on these adapters, see Chapter 14, “PCI communication adapters” on page 103.

Note: A 100BASE-TX, 10BASE-T, or 10BASE2 adapter for the SP Ethernet is integrated into the 375/450 MHz POWER3 SMP Thin Node and does not occupy a PCI adapter slot.

Chapter 5. SP-attached servers (M/T 7040, 7026, 7017)

SP-attached servers are IBM RS/6000 and @server pSeries servers configured to operate as nodes within an SP system to enhance its performance and provide scalability. The following servers are supported for this configuration:

- M/T 7040
  - @server pSeries 670
  - @server pSeries 690
- M/T 7026
  - @server pSeries 660 model 6M1
  - @server pSeries 660 model 6H0
  - @server pSeries 660 model 6H1
  - RS/6000 model M80 (withdrawn 1/02)
  - RS/6000 model H80
- M/T 7017
  - @server pSeries 680
  - RS/6000 model S80
  - RS/6000 model S7A
  - RS/6000 model S70

In brief, SP-attached servers require the following for connection to an SP system:

1. A supported Ethernet card and its cable connection to the SP LAN.
2. Custom RS-232 cables connecting to the control workstation (excepting 7040 servers).
3. For M/T 7026 servers only, an SP Internal Attachment Adapter.
4. For switch-configured SP systems only, an optional switch adapter and cable.

Server specifications

This section contains brief specification lists for attached servers. For the latest complete information on these servers, consult your IBM account representative or the appropriate server documentation.

M/T 7040 servers

- 64-bit POWER4™ symmetric multiprocessing (SMP)
- System configurations with 4, 8, 16, 24, or 32-way processors
- Up to 64 KB L1, 5.6 MB L2, 128 MB L3 cache per system
- 8 to 256 GB of system memory
- Up to 160 hot-pluggable PCI slots per system
- Up to 128 disk-drives per system
- AIX and LINUX operating systems
- Reliability from redundant fans; hot-swappable disk drives, power supplies, and fans; and a built-in service processor

Note: Service processors continuously monitor system operations and continue to operate even if the main system is down. Service processors can also be programmed to report potential malfunctions before they occur.

M/T 7026 servers

- 64-bit symmetric multiprocessing (SMP)
- Systems configurations with 1, 2, 4, 6, and 8-way processors
- Support for concurrent 32- and 64-bit applications
- Reliability from redundant fans; hot-swappable disk drives, power supplies, and fans; and a built-in service processor
- Hot-pluggable for many current adapters
- Up to 4 MB L2 cache per processor
- Up to 32 GB of system memory
- Up to 56 PCI slots per system
- AIX operating system

Note: Service processors continuously monitor system operations and continue to operate even if the main system is down. Service processors can also be programmed to report potential malfunctions before they occur.

M/T 7017 servers

- 64-bit symmetric multiprocessing (SMP)
- Systems configurations with 4, 8, 12, or 24-way processors
- Support for concurrent 32- and 64-bit applications
- Reliability from redundant fans; hot-swappable disk drives, power supplies, and fans; and a built-in service processor
- Up to 8 MB ECC L2 cache per processor
- Up to 16 GB of system memory for the S70, up to 32 GB for the S7A, up to 64 GB for the S80, and up to 96 GB for the S85
- Up to 56 PCI slots per system
- AIX operating system

SP-attached server scaling limits

An SP system using SP-attached servers can contain from two to 128 logical nodes which can be any of the following:

- A 7017 server
- A 7026 server
- A 7040 server (running as a full-system partition)
- A 7040 LPAR (Logical PARtition)
- A 9076 SP node

The maximum of 128 logical nodes is subject to the scaling limits and rules in this section. There are variables determining the maximum quantities of the different node types in the system, such as the type of server installed, whether or not the system contains a switch, the type of switch used, and whether or not a server is divided into LPARs.

M/T 7040 maximum limits

Table 7 on page 25 shows SP-attached server scaling limits specific to 7040 servers. Use this table in conjunction with the switch-specific rules which follow to determine valid configurations.

*Table 7. SP-attached server **maximum limits** for 7040 servers*

	Using SP Switch – all nodes connected to switch	**Using SP Switch2 – all nodes connected to switch**	**Using SP Switch2 – some non-switched nodes**	**Using no switches**
7040 servers per system	2	16	16	16
LPARs per p690 server	8	8	16	16
LPARs per p670 server	4	4	16	16
LPARs per system	16	48	48	48
Reference information				
7040 servers per HMC	2	4	4	4
Quantity of switch planes	1	1 or 2	1 or 2	0
Note: Using the SP Switch, all logical nodes must be connected to the switch.				

Switch-dependent SP-attached server scaling limits

This section contains scaling limits and rules for SP systems specific to whether or not the system contains a switch and which type of switch is installed. For purposes of these rules, the notation ***from the set {nnnn, nnnn}*** indicates that any model of server from the indicated machine type can be installed and is subject to that rule.

SP Switch2 configurations

All of the following limits apply:

1. No more than 16 servers from the set {7017}
2. No more than 16 servers from the set {7040}
3. No more than 16 servers from the set {7017, 7040}
4. No more than 64 servers from the set {7017, 7026, 7040}
5. No more than 128 logical nodes with no more than 48 LPARs from the set {7040}

SP Switch configurations

All of the following limits apply:

1. No more than 16 servers from the set {7017}
2. No more than 2 servers from the set {7040}
3. No more than 16 servers from the set {7017, 7040}
4. No more than 64 servers from the set {7017, 7026, 7040}
5. No more than 128 logical nodes with no more than 16 LPARs from the set {7040}

Non-switched configurations

All of the following limits apply:

1. No more than 16 servers from the set {7017}
2. No more than 16 servers from the set {7040}
3. No more than 16 servers from the set {7017, 7040}

4. No more than 64 servers from the set {7017, 7026, 7040}
5. No more than 128 logical nodes with no more than 48 LPARs from the set {7040}

SP-attached server feature codes

You order SP-attached servers and features using ***RS/6000*** feature codes. However, the features which represent the connections from the SP-attached servers to the SP system are ordered using the following ***RS/6000 SP*** feature codes:

- **F/C 9122** – Two RS-232 cables – M/T 7017 only
- **F/C 9125** – CSP RS-232 cable – M/T 7026 only (also requires RS/6000 F/C 3154)
- **F/C 9123** – Frame ID and installation documentation – M/T 7017 and 7026
- **F/C 9126** – Specify Code – M/T 7040 switched LPAR

SP-attached servers use these features to function as nodes in the SP system. Your IBM account representative can help you decide which server best matches your needs and can furnish all the feature codes you need to order any of the options described in this book.

SP-attached server attachment rules and limits

Because the SP-attached server has both frame and node characteristics, it must have both a frame and a node number. For these numbering rules, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

When you add an SP-attached server to an SP system, the following limitations apply:

1. The system must have at least one SP frame containing at least one node.
2. Each SP-attached server requires one valid, unused node slot in the SP system for switch port assignment in both switch-configured and switchless SP systems. For information on these configurations, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.
3. In some cases, the number of SP-attached servers you plan to install can exceed the number of available node slots in an SP frame. In this case, you can take advantage of any valid, unused node slots (and the associated switch ports) that exist in other SP frames in your system.

   As an example, consider a two-frame SP system. The first SP frame contains ten thin nodes and an SP Switch. The second SP frame contains five single SMP thin nodes and another SP Switch. You want to attach eight M/T 7017 servers.

   In this example, you can attach six of the servers to the first frame and two to the second SP frame. As an alternative, all eight servers can be connected to the second SP frame.
4. In some cases, the number of SP-attached servers you plan to install can exceed the number of available node slots in your SP system. In this case, you need to add an additional SP frame to your SP system.

   Only the first SP frame is required to have at least one node, additional SP frames can be empty.
5. Each SP-attached server counts as one ***node*** that must be subtracted from the total node count of 128 allowed in an SP system.

6. Each SP-attached server also counts as one ***frame*** that must be subtracted from the total frame count allowed in an SP system.

SP-attached server installation requirements

Several hardware and software requirements must be met before you can install an SP-attached server into your SP system as follows:

System requirements

The following requirements must be met before you can install an SP-attached server into an SP system:

1. Your SP system must be a tall-frame system; short frames are not compatible with the SP-attached server.
2. Each SP-attached server also requires its own PSSP license. For details and system configuration requirements, see "Software requirements" on page 28.
3. If you plan to attach a ***pre-existing*** server to your SP system and that server is connected to an ***IPv6*** network, you must remove the server from that network before making the SP attachment.
4. If your SP system is switch-configured, it must use either the 16-port SP Switch or SP Switch2. A special switch adapter and connecting cable must be installed. For details, see "SP-attached server-to-switch adapters and cabling" on page 31.
5. All PCI adapters in both new and pre-existing servers, excepting M/T 7040, must be SP-supported. For details, see "Network media card requirements" on page 28.
6. You must make two or three cable connections to the control workstation. Since the cables used have limited lengths, you must keep those lengths in mind when locating your SP-attached servers in relation to the other SP system equipment. For details on these connections, see "Network requirements" on page 28.

SP-attached server placement limitations

Placement of the server is limited by the length of the following supplied cables:

- The 15-m (49 ft.) RS-232 cables
- Optional 10 or 20-m (33 or 66 ft.) switch cables

Approximately 3 m (10 ft.) of cable is needed for the ***vertical*** portion of the cable runs. Thus, the SP-attached server must be no more than 17 m (56 ft.) from the SP frame and no more than 12 m (40 ft.) from the control workstation.

Physical requirements

For complete physical descriptions, specifications, environmental conditions and power requirements of SP-attached servers, see *Site and Hardware Planning Information* and other appropriate server documentation.

Software requirements

The SP-attached server requires an SP system operating with one of the following software levels:

- AIX 5L 5.1 **and** PSSP 3.4
- AIX 4.3.3 **and** PSSP 3.4

Note: Coexistence features provided by PSSP software permit other nodes in the system to operate at lower software levels. However, if you use an application that has coexistence requirements (such as PE), those requirements must be met.

Each SP-attached server requires its own PSSP license. PSSP is available as a CD (**F/C 5813**).

For details on software requirements of the SP-attached server, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*. For the latest software information and requirements, see the "Read this First" document at: www.rs6000.ibm.com/resource/aix_resource/sp_books/planning/index.html

Network media card requirements

Each network media card requires one media card slot in the SP-attached server. All network adapters in SP-attached servers use PCI architecture.

PCI adapter restrictions

- For M/T 7026 or 7017 servers, only SP system-supported PCI adapters can be used in with the exception of the System Attachment Adapter (**F/C 8396**) and the SP Switch2 PCI Attachment Adapter (**F/C 8397**). You can find a list with detailed specifications of currently-supported SP system adapters in Chapter 14, "PCI communication adapters" on page 103.
- For M/T 7040 only, all adapters which are supported for use in standalone server applications are supported for SP-attached server use.
- If you plan to attach a pre-existing M/T 7026 or 7017 server as an SP-attached server, you must remove any non-SP system-supported PCI adapters.
- PCI adapter availability and plugging rules are subject to change between editions of this book. You can find the latest rules for supported PCI adapters such as required adapters, maximum quantites, and placement restrictions in the RS/6000 SP Sales Manual.

Network requirements

Each SP-attached server requires a minimum of two or three cable connections, depending on the server model, to the SP system control workstation as follows:

1. An Ethernet connection to the SP LAN for system administration purposes.
2. RS-232 cable connections:

- For 7017 models – Two custom cables connecting the CWS to both the server SAMI port and to the S1 serial port.
- For 7026 models – One custom cable connecting the CWS to the Internal Attachment Adapter.

Figure 2 is an example of the cabling connections for the SP LAN, RS-232, and optional SP Switch2 for two SP-attached servers in an SP system.

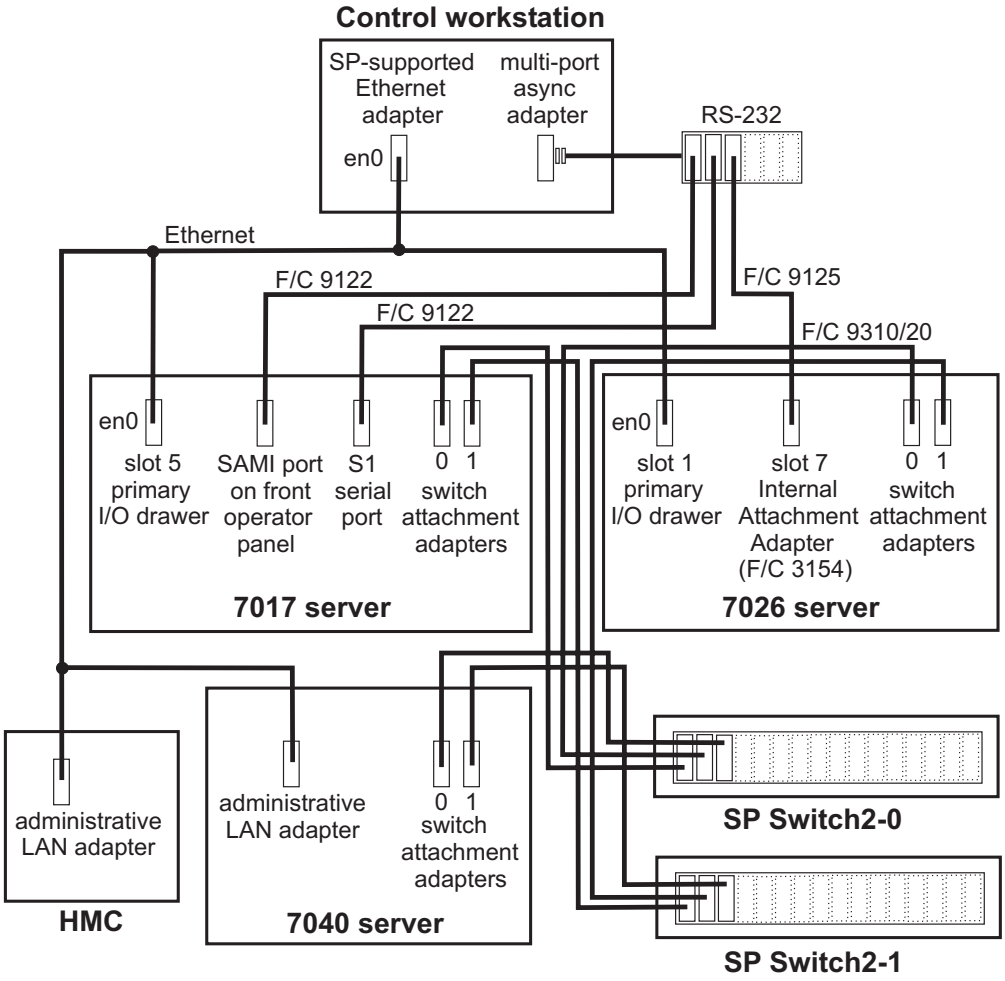

Figure 2. SP-attached server cabling. The SP Switch2 node switch boards are shown as free-standing; they can be installed in the Model 556 or 558 as well as in SP frames containing nodes.

For details on the connections, see “Planning for SP network hardware”.

Planning for SP network hardware

This section contains the following network hardware planning information:

SP LAN Ethernet adapters and cabling

SP LAN Ethernet hardware includes the Ethernet communication adapters and their interconnecting cabling.

Ethernet restriction

Do not use the integrated Ethernet for the SP LAN.

Ethernet cable requirements

The customer must supply all Ethernet cables. For details and specifications of the different Ethernet cabling types, see “Planning for unshielded twisted pair (UTP) cabling” on page 77 or “Planning for coaxial LAN cabling” on page 71.

SP LAN Ethernet adapter requirements

For M/T 7026 and 7017, these adapters must be placed in the ***en0*** position of the servers (the lowest-numbered Ethernet bus slot in the primary I/O drawer). For 7017 model servers, this adapter must be installed in slot 5 of the primary I/O drawer; for 7026 models, in slot 1 of the primary I/O drawer.

For M/T 7040, one LAN adapter is required for each LPAR. An administrative LAN adapter must also be placed in each Hardware Management Console.

- For systems configured with an SP Switch2, the LAN adapters must be placed in I/O subsystem slot 8 using the same respective LPAR as the switch adapter. Place a second LAN adapter in slot 9.
- For systems configured with an SP Switch, the LAN adapter must be placed in the same respective LPAR as the switch adapter, but does not need to be in the same I/O subsystem.

Adapters for twisted-pair (UTP) Ethernet

- 10/100 Mbps Ethernet PCI Adapter II (**F/C 4962**) – ***Required for 7026 servers***
- 10/100 Ethernet 10BASE-TX adapter (**F/C 2968**) (withdrawn 12/01)
- 10 MB AUI/RJ-45 Ethernet adapter (**F/C 2987**) (withdrawn 7/01)

Adapters for BNC Ethernet

- 10 MB BNC/RJ-45 Ethernet adapter (**F/C 2985**)

  Use of this adapter requires one **RS/6000 SP F/C 9222** for each SP-attached server (configures BNC connection to server); includes an IBM-supplied, 15-m BNC Ethernet cable.

Ethernet adapter descriptions

For details on the Ethernet adapters, see:

- “10/100 Ethernet 10BASE-TX PCI adapter (F/C 2968)” on page 237
- “10/100 Mbps Ethernet PCI Adapter II (F/C 4962)” on page 127
- “10BASE5 and 10BASE-T (AUI/RJ-45) Ethernet LAN PCI adapter (F/C 2987)” on page 238
- “10BASE2/10BASE-T Ethernet PCI adapter (F/C 2985)” on page 120

SP LAN Ethernet adapter restrictions in pre-existing servers

If you plan to attach an existing M/T 7017 or 7026 server to your system, you must place an SP LAN Ethernet adapter in the slot en0 position inside the server. Due to the fact that the Ethernet adapter in this slot must be configured for PSSP communications, any non-supported Ethernet adapter which is in the en0 slot must be removed.

Additionally, if the existing Ethernet adapter in slot en0 is either of F/C 2968, 2985 or 2987, that adapter must be de-configured and then reconfigured as an SP LAN Ethernet adapter.

SP-attached server RS-232 cabling

Since the SP-attached server requires multiple RS-232 connections, you must use a multi-port, asynchronous adapter inside the control workstation. For a listing of the available adapters, RANs, and cables, see “Control workstation interface adapters” on page 46.

RS-232 connections must be made from the SP system control workstation to each SP-attached server. The location of the servers is limited by the 15 m (49 ft.) length of these IBM-supplied, custom cables. These RS-232 connections are:

- For 7017 models –
  1. From the CWS multi-port async adapter to each server SAMI port in the control panel on the front of the CEC with RS-232 cable (**F/C 3151** or **RS/6000 SP F/C 9122**).
  2. From the CWS multi-port async adapter to the S1 serial port on the rear of the primary I/O tower with RS-232 cable (**F/C 3150** or **RS/6000 SP F/C 9122**).
- For 7026 models – From the CWS multi-port async adapter to each server CSP port on the Internal Attachment Adapter (**F/C 3154**) in the I/O drawer with RS-232 cable (**F/C 3151** or **RS/6000 SP F/C 9125**).
- For 9076 models – From the CWS multi-port async adapter to each SP frame supervisor card with RS-232 cable (**RS/6000 SP F/C 9125**).

SP-attached server-to-switch adapters and cabling

If you plan to install the SP-attached server into an SP system containing an SP Switch or SP Switch2, you must install at least one switch adapter in each M/T 7017 and 7026 server and M/T 7040 LPAR that is connected to a switch. These adapters are:

- SP Switch – SP System Attachment Adapter (**RS/6000 F/C 8396**)
- SP Switch2 – SP Switch2 PCI Attachment Adapter (**RS/6000 F/C 8397**) – For installations in M/T 7040 servers, this adapter requires a double-wide carrier (**F/C 4593**)

For each adapter, you must also order one of the following cables (depending on your floor plan layout) to connect the adapter to a valid switch port:

- 2.6-m (9 ft.) switch cable (**F/C 9302**)
- 5-m (16 ft.) switch cable (**F/C 9305**)
- 10-m (33 ft.) switch cable (**F/C 9310**)
- 15-m (49 ft.) switch cable (**F/C 9315**)
- 20-m (66 ft.) switch cable (**F/C 9320**)

Two-plane switch configuration

For SP Switch2-equipped systems implementing the two-plane configuration, two adapters and two interconnecting switch cables are required for each server.

Switch adapter requirements

These adapters have the following requirements:

1. One valid, unused switch port on the switch corresponding to a legitimate node slot in your SP configuration. For information on switch port assignment, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.
2. Three media card slots (M/T 7017) or two media card slots (M/T 7026 and 7040) in an I/O drawer for each adapter.
3. A switch cable to connect the adapter to a valid switch port.

Switch adapter placement restrictions

M/T 7040 models:

- For SP System Attachment Adapter (**F/C 8396**) – Install in I/O subsystem slot 8 only (one adapter per LPAR).
- For SP Switch2 Attachent Adapter (**F/C 8397**):
  - Single-plane – Install in I/O subsystem slot 3 or 5, or both if on separate LPARs (one adapter per LPAR).
  - Two-plane – Install in I/O subsystem slot 3 for CSS0 and slot 5 for CSS1 (one adapter per LPAR).

M/T 7017 models:

- For the first adapter:
  1. The adapter must be installed in slot 10 of the SP-attached server ***primary*** I/O drawer.
  2. Slot 9 must be left empty to ensure the adapter has sufficient bandwidth.
  3. Slot 11 must be left empty to provide clearance for the switch adapter heat sinks.
- For a second adapter (SP Switch2 two-plane configurations only):
  1. A second adapter must be installed in slot 10 of the SP-attached server ***secondary*** I/O drawer.
  2. Slot 9 must be left empty to ensure the adapter has sufficient bandwidth.
  3. Slot 11 must be left empty to provide clearance for the switch adapter heat sinks.

M/T 7026 models:

- For the first adapter:
  1. The adapter must be installed in slot 5 of the SP-attached server ***primary*** I/O drawer.
  2. Slot 6 must be left empty.
  3. You must remove the plastic divider between slots 5 and 6 due to the width of the adapter.
- For a second adapter (SP Switch2 two-plane configurations only):
  1. The adapter must be installed in slot 3 of the SP-attached server ***primary*** I/O drawer.
  2. Slot 4 must be left empty.
  3. You must remove the plastic divider between slots 3 and 4 due to the width of the adapter.

Installing a switch adapter into a pre-existing M/T 7017 server

If you attach a pre-existing M/T 7017 server to an SP system, you might find a SCSI adapter installed in slot 9 of the server. This SCSI adapter must be relocated; but, it is typically connected to a boot device and requires special attention ***before*** it is removed. Incorrect execution of this step can result in a system which cannot be booted.

Boot device SCSI adapter relocation overview

1. Boot up the server you are attaching to the SP system.
2. Follow standard AIX procedures to change the boot device:
   a. Change device codes
   b. Change device address
3. Take the server down.
4. Move SCSI card from slot 9 to the new location (remember, slots 9 and 11 must be left open and the SP System Attachment adapter must be placed in slot 10).
   - Place SCSI adapter F/C 6206 and F/C 6208 either in slot 12 or slot 14
   - Place SCSI adapter F/C 6207 and F/C 6209 either in slot 12, slot 13, or slot 14
5. Reboot the server and continue with the SP attachment.

Note: Consult the appropriate documentation for specific installation procedures.

Configuring Electronic Service Agent and Service Director

Electronic Service Agent and Service Director are IBM software applications supplied with M/T 7017 and 7026 servers. Electronic Service Agent is a replacement for the previously-supplied Service Director. Both applications perform the same function and are referred to as Service Agent in this book. For details on these applications, see “Electronic Service Agent and Service Director” on page 47.

Service Agent monitors the “health” of the system. In a typical M/T 7017 and 7026 server installation, Service Agent transmits reports through a modem supplied with the unit. However, when the server is used as an SP-attached server, the modem supplied with the server is not used. In this installation, the SP-attached server acts like a system node and forwards its Service Agent messages to the system. When the system receives messages from the SP-attached server, the messages are transmitted through the Service Agent modem on the control workstation.

To configure Service Agent for the SP-attached server, perform the following:

1. Configure the SP-attached server as a M/T 7017 or 7026 in Service Agent. Do this manually.
2. Configure Service Agent on each SP-attached server to forward messages to the system. (The modem supplied with the server is not used.)
3. Configure Service Agent on the system to forward messages received from the SP-attached server to the SP system. (The Service Agent modem for the SP system is attached to the control workstation.)

Chapter 6. Tall frames – Model 550/5/6, F/C 1550/5, 2031/2/4

Tall frame overview

Tall frames are available in three variations:

- Tall ***model*** frames (Model 550, 555, 556)
- Tall ***expansion*** frames (F/C 1550, 1555)
- SP Switch frames (F/C 2031, 2032, 2034)

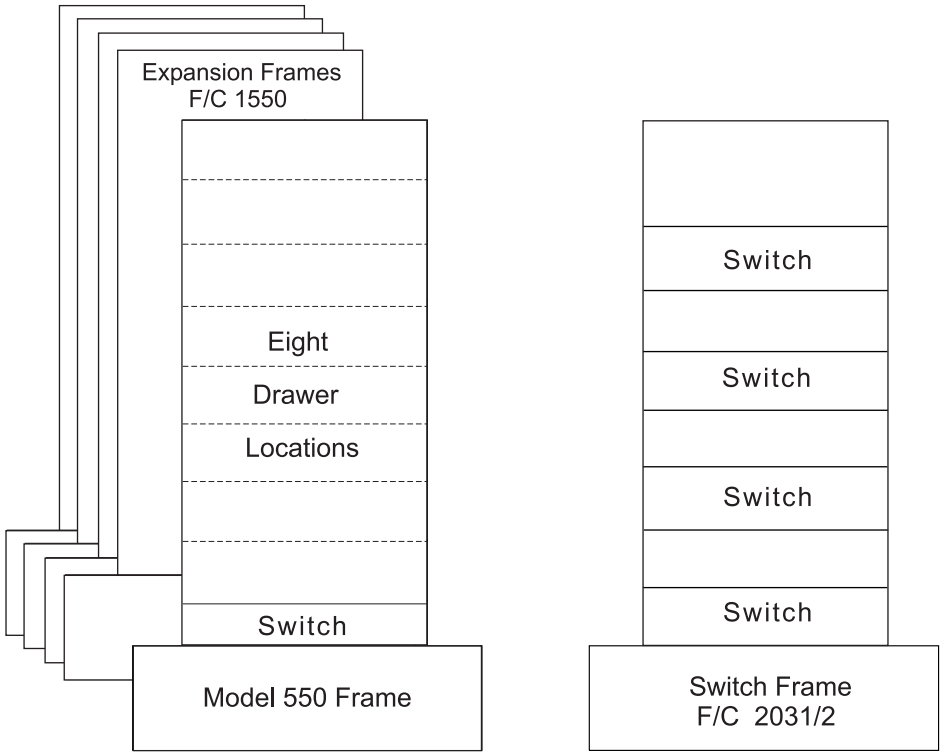

Figure 3. Model 550 system with frame-mounted SP Switch, four expansion frames, and an SP Switch frame

Tall frames have eight drawers and can house up to sixteen thin nodes, eight wide nodes, or four high nodes and an optional switch. All node types can be mixed in these frames. These frames are designed for concurrent maintenance; each processor node can be repaired without interrupting operations on other nodes.

Tall frames contain a SEPBU power subsystem to accommodate the processor nodes. The SEPBU is equipped with redundant (N+1) power supply modules; if one module fails, another takes over. The self-regulating SEPBUs are designed for concurrent maintenance; a failed power module can be removed and repaired without interrupting running processes on the nodes. For improved system availability, you can use two separate ac power sources for your SP system. For details, see “SP Frame Redundant Power Supply (F/C 3885, 3886)” on page 159.

These 1.93 m frames are completely compatible with all existing SP systems. All existing nodes and SP switch types can be directly installed as long as

configuration rules are not violated. However, High Performance switches are withdrawn from production and are not compatible with most current SP system hardware.

Note: In order to maintain your entire SP system at the same electrical potential, you must attach a frame-to-frame ground between all frames in your SP system using IBM-supplied cables (P/N 46G5695).

Model 550 frames

The ***model frame*** is always the first frame in an SP system and it designates the type or model class of your SP system. The base level Model 550 SP system has a tall frame with eight empty node drawers and a 10.5 kW, three-phase SEPBU power subsystem.

You order the processor nodes and optional switches separately for these frames. One switch and up to sixteen thin nodes, eight wide nodes, or four high nodes, can be installed in these frames. Other frames that connect to the model frame are known as ***expansion frames***.

Model 550 SP systems can be developed into several different configurations, both switched and non-switched.

Model 550 non-switched configuration

This configuration consists of 1-64 processor nodes mounted in a required Model 550 frame and in additional non-switched expansion frames (F/C 1550).

Model 550 SP Switch-8 configuration

This configuration consists of 1-8 processor nodes mounted in a required Model 550 frame equipped with an eight-port SP Switch-8 (F/C 4008). A non-switched expansion frame (F/C 1550) is supported in this configuration only if the model frame is filled before the total node count of eight is reached. Nodes in the non-switched expansion frames share the unused switch ports in the model frame.

Model 550 single-stage switch configuration

This configuration consists of 1-80 processor nodes mounted in a required Model 550 frame equipped with a sixteen-port switch and up to four switched expansion frames.

Single-stage system configurations can also contain non-switched expansion frames. Nodes in the non-switched expansion frames share the unused switch ports in the model frame and in the switched expansion frames.

Model 550 two-stage switch configuration

The standard two-stage switch configuration has 65-128 processor nodes.

These nodes are mounted in one required Model 550 frame equipped with a sixteen-port switch and in switched expansion frames. The switches in these frames form the first switching layer.

This configuration also requires a switch frame which forms the second switch layer. The second stage switches in the switch frame are used for high-performance parallel communication between all the switches mounted in the model frame and in

any switched expansion frames. Switch traffic is carried through concurrent data transmissions using the Internet Protocol (IP).

Two-stage switch system configurations can also utilize non-switched expansion frames. Nodes in the non-switched expansion frames share unused switch ports in the model frame and in switched expansion frames.

Note: Two-stage switch configurations for fewer than 65 nodes or more than 128 nodes are available. Two-stage configurations of less than 65 nodes are simpler to scale up with more switches than are single-stage switch configurations. Consult your IBM representative for more information.

Model 555 SP Switch Frame

The Model 555 is a tall frame with an integral SEPBU power supply, one SP Switch node switch board (**F/C 4011**), but no processor nodes. This frame provides switch ports for Cluster 1600 systems of two to 16 logical nodes. For configurations of 17 to 32 nodes, you need to add an SP expansion frame (**F/C 1555**) containing one SP Switch.

The internal switch ports in these frames connect to the SP System Attachment Adapters (**RS/6000 F/C 8396**) in the Cluster 1600 servers and to SP Switch Adapters in SP nodes.

Model 556 SP Switch2 Frame

The Model 556 shares the 79 in. frame and covers of the @server pSeries 690. It has an integral SEPBU power supply, one to eight SP Switch2 node switch boards (**F/C 4012**), but no processor nodes. This frame provides node switch board (NSB) ports for Cluster 1600 and SP processor nodes for both single and two-plane switch configurations within scaling limits. Installation of more than four SP Switch2s requires the addition of a frame extender for cable management (**F/C 9941**).

The internal switch ports in the Model 556 frame connect to the SP Switch2 PCI Attachment Adapters (**RS/6000 F/C 8397**) in Cluster 1600 servers and to SP Switch2 Adapters in SP nodes.

Expansion frames (F/C 1550)

An expansion frame (F/C 1550) is a 1.93 m (75.8 inch) tall frame with eight empty node drawers and a 10.5 kW three-phase SEPBU power supply and is used in Model 550, 3BX, 20X, 30X, 40X, and 55H systems. For these frames, you order the processor nodes and optional switches separately. A switch and up to sixteen thin nodes, eight wide nodes, or four high nodes can be installed in each frame as permitted by system configuration rules. These rules impose limits on the number and location of each type of node and switch that can be included in each system and vary depending on how the associated SP model frame is configured.

There are two standard configurations for F/C 1550 expansion frames:

1. ***Non-switched expansion frame*** – An expansion frame configured with processor nodes only
2. ***Switched expansion frame*** – An expansion frame configured with processor nodes and a switch

Using F/C 1550 non-switched expansion frames

A non-switched expansion frame is a base offering expansion frame equipped with processor nodes only. Some Model 550 SP system configurations can be scaled into larger systems using these frames. These SP system configurations are:

- Model 550 frames equipped with processor nodes and a switch.
- Switch-configured Model 550 frames and F/C 1550 expansion frames equipped with processor nodes and a switch.
- Model 550 frames equipped with processor nodes only.

Using non-switched expansion frames with frames containing processor nodes and a switch

Non-switched expansion frames are added to SP frames configured with processor nodes and a switch to take advantage of unused switch ports resulting from certain system configurations. These unused switch ports can be in the model frame or in switched expansion frames. In these cases the switch, which can have ports to attach up to 16 nodes, is not fully utilized.

An example of an under-utilized switch is a tall frame with eight wide nodes and an SP Switch. In this case, the frame is fully populated yet only eight of the sixteen switch ports are used. In this case, you can add non-switched expansion frames to the model frame to take advantage of the eight unused switch ports.

Using non-switched expansion frames with frames containing only processor nodes

Non-switched expansion frames containing only processor nodes can be added to the Model 550 SP frame to take advantage of unused node slots. In this case, node-to-node data transfers are completed over the SP LAN.

Using F/C 1550 switched expansion frames

A switched expansion frame is an expansion frame containing processor nodes and a switch. These frames are added to SP systems with switch-configured Model 550 frames. Configuration rules permit you to attach up to four switched expansion frames to these model frames. In some system configurations, you can have unused switch ports in either the model frame or the switched expansion frames. Those unused switch ports can be used with non-switched expansion frames to complete your system.

If your SP system uses single-stage switching, you can scale it up to 80 nodes. For more information, see “Model 550 single-stage switch configuration” on page 36.

If your SP system uses two-stage switching, you can scale up to 128 nodes or more. For more information, see “Model 550 two-stage switch configuration” on page 36.

SP Switch frames (F/C 2031, 2032, 2034)

Switch frames are tall frames with an integral SEPBU power supply equipped with intermediate switch boards (ISB) but no processor nodes. A switch frame is required for systems having more that five switches in one switch plane; it interconnects the external node switch board ports in both the model and the expansion frames.

For details on switch frame use, see “SP Switch frame (F/C 2031)” on page 51, “SP Switch2 Frame (F/C 2032)” on page 54, or “SP Switch2 Expansion Frame (F/C 2034)” on page 54.

Chapter 7. Short frames – 1.25 m (Model 500 and F/C 1500)

Short frame overview

Short frames are available in two variations:

1. Short ***model*** frames (Model 500)
2. Short ***expansion*** frames (F/C 1500)

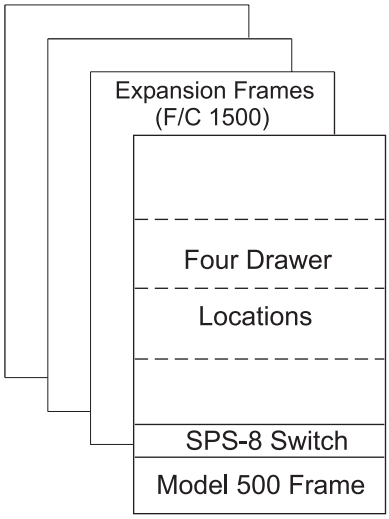

Figure 4. Model 500 system with optional SP Switch-8 and three expansion frames

Short frames have four drawers and can house up to eight thin nodes or four wide nodes and an optional eight-port switch. All node types can be mixed in these frames; however, POWER3 SMP High Nodes cannot be installed due to a depth limitation. The frames are designed for concurrent maintenance; each processor node can be repaired without interrupting operations on other nodes.

Short frames contain a single-phase SEPBU power subsystem which provides 5.0 kW output power. Redundant power (**F/C 1213**) is an option with this SEPBU. With this option, if one power supply fails, another takes over. The self-regulating SEPBU units with the N+1 feature are designed for concurrent maintenance; a failed power supply module can be removed and repaired without interrupting running processes on the nodes.

Early-style short frames require a power supply upgrade before you can install SMP-type nodes; for details, see “Upgrading power systems in early SP frames” on page 202.

These frames are completely compatible with all existing SP systems. However, High Performance switches are withdrawn from production and are not compatible with most current SP system hardware.

Note: In order to maintain your entire SP system at the same electrical potential, you must attach a frame-to-frame ground between all frames in your SP system using IBM-supplied cables (P/N 46G5695).

Model 500 frames

The ***model frame*** is always the first frame in an SP system and it designates the type or model class of your SP system. The base level Model 500 SP system has a short frame with four empty node drawers and a 5.0 kW, single-phase SEPBU power subsystem.

You order the processor nodes and optional switch separately for these frames. One SP Switch-8 and up to eight thin nodes, four wide nodes, or two 200 MHz High Nodes (withdrawn from production) can be installed in these frames. Other frames that connect to the model frame are known as ***expansion frames***.

Model 500 SP systems can be developed into two different configurations, either non-switched or switched.

Model 500 non-switched configuration

This configuration consists of 1-8 processor nodes mounted in one required Model 500 frame and up to three additional short, non-switched expansion frames (F/C 1500).

Model 500 switched configuration

This configuration consists of 1-8 processor nodes connected through an eight-port SP Switch-8 (F/C 4008). These nodes are mounted in one required Model 500 frame containing the SP Switch-8 and in up to three additional short, non-switched expansion frames (F/C 1500). Nodes in the non-switched expansion frames share unused switch ports in the model frame. Only the Model 500 frame can be equipped with a switch, switches cannot be mounted in the expansion frames.

Expansion frames (F/C 1500)

The base offering expansion frame is a 1.25 m (49 in.) short frame with four empty node drawers and a 5.0 kW, single-phase SEPBU power subsystem. Up to eight thin nodes, four wide nodes, or two high nodes can be installed in these frames as permitted by configurator rules. These configuration rules impose limits on the number and location of each type of node that can be included in each system and vary depending on how the model frame is configured. Switches cannot be mounted in F/C 1500 expansion frames. Since these expansion frames can be configured only with processor nodes, they are known as ***non-switched expansion frames***.

Using F/C 1500 non-switched expansion frames

Model 500, 2AX, 3AX, or 50H SP systems can be fully utilized by adding expansion frames. Model 500 systems have a capacity for up to eight nodes. If you fill the model frame before installing all eight nodes, you can install additional nodes in the system by using non-switched expansion frames.

Using non-switched expansion frames with model frames containing processor nodes and a switch

Non-switched expansion frames can be added to the Model 500 SP frame configured with processor nodes and an SP-8 Switch to take advantage of unused switch ports.

An example of an under-utilized switch is a Model 500 frame with four wide nodes and an SP-8 Switch. In this case, the frame is fully populated yet only four of the eight switch ports are used. You can add non-switched expansion frames to take

advantage of the four unused switch ports. In these systems, node-to-node data transfers are completed through the switch.

Note: Nodes must be placed sequentially in this system configuration. Empty node drawers are not allowed.

Using non-switched expansion frames with model frames containing only processor nodes

Non-switched expansion frames can be added to the Model 500 SP frame configured with only processor nodes to take advantage of unused node slots. Model 500 systems have a capacity for up to eight nodes. If you fill the model frame by placing two high nodes in that frame, you can install six additional nodes in the system by using non-switched expansion frames. In these systems, node-to-node data transfers are completed over the SP LAN.

Chapter 8. Control workstations

The control workstation serves as a point of control for managing, monitoring, and maintaining the RS/6000 SP frames and individual processor nodes. A system administrator can perform these control tasks by logging into the control workstation from any other workstation on the network.

The control workstation also acts as a boot/install server for other servers in the RS/6000 SP system. In addition, it can be set up as an authentication server using Kerberos. It can be the Kerberos primary server, with the master database and administration service, as well as the ticket-granting service. As an alternative, the control workstation can be set up as a Kerberos secondary server, with a backup database, to perform ticket-granting service.

Pre-existing workstations

If you plan to use a workstation that you have been using for other applications, IBM suggests that you observe the following steps prior to using it as a control workstation in your SP system:

1. Ensure that all required hardware configuration prerequisites are met; for details, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.
2. Run diagnostics to ensure that the control workstation is functioning properly.
3. Run ***only*** PSSP on your control workstation to ensure optimum performance of your SP system.

Planning for the control workstation

Planning for the control workstation requires many hardware and software considerations. Optional features such as High Availability Control Workstations (**F/C 1245**), SP-attached servers, and system routers each have different requirements. To take advantage of the latest software enhancements your SP system, along with its control workstation, must be running the latest version of the RS/6000 SP Parallel System Support Programs (PSSP) and of the AIX operating system.

The RS/6000 SP system requires a control workstation with a color monitor. For the latest list of supported control workstations, see the “Read this First” document at: www.rs6000.ibm.com/resource/aix_resource/sp_books/planning/index.html. There are three different types of control workstations as follows:

- SMP control workstations using PCI adapters
- Uniprocessor control workstations using PCI adapters
- Control workstations using MCA adapters

  Each of these workstations can have either four or eight-mm tape drives.

Control workstations must be connected to each SP frame through both RS-232 and SP LAN Ethernet cables. The SP LAN can use either BNC or twisted-pair cable. 15-meter (49 ft.) cables are supplied with each SP frame for the RS-232 connections and for BNC-type Ethernet cabling only. It is the customer’s

responsibility to supply the cables for twisted-pair (UTP) SP LAN Ethernet applications. For UTP cabling details, see “Planning for unshielded twisted pair (UTP) cabling” on page 77.

For BNC-type Ethernet connections, the control workstation, SP frames, and attached nodes must be no more than 12 m apart, leaving 3 m of cable for the vertical portions of the cable runs. If you need longer vertical runs or if there are under-floor obstructions, you must place the control workstation closer to the frames. The quantity of network stations (CWS + nodes + routers) must be limited to 30 per BNC LAN segment.

The control workstation must also be connected to all SP-attached servers in your SP system. Each SP-attached server requires RS-232 connections as well as the SP LAN Ethernet connection. For details, see “Network requirements” on page 28.

Note: Most PCI control workstations provide either a 10BASE-T or AUI connection for the SP LAN. If you are connecting the CWS to nodes using BNC connections, ensure that you order the appropriate transceiver.

Some withdrawn control workstations, such as the 7025-F50 and 7025-F40, offer a support processor as either a standard or optional feature (**F/C 1001**). The support processor is a standby processor that handles system start-up and some system monitoring functions. When this option is installed with a modem on the **S1** serial port, you can perform remote system restarts on SP systems located in unmanned locations.

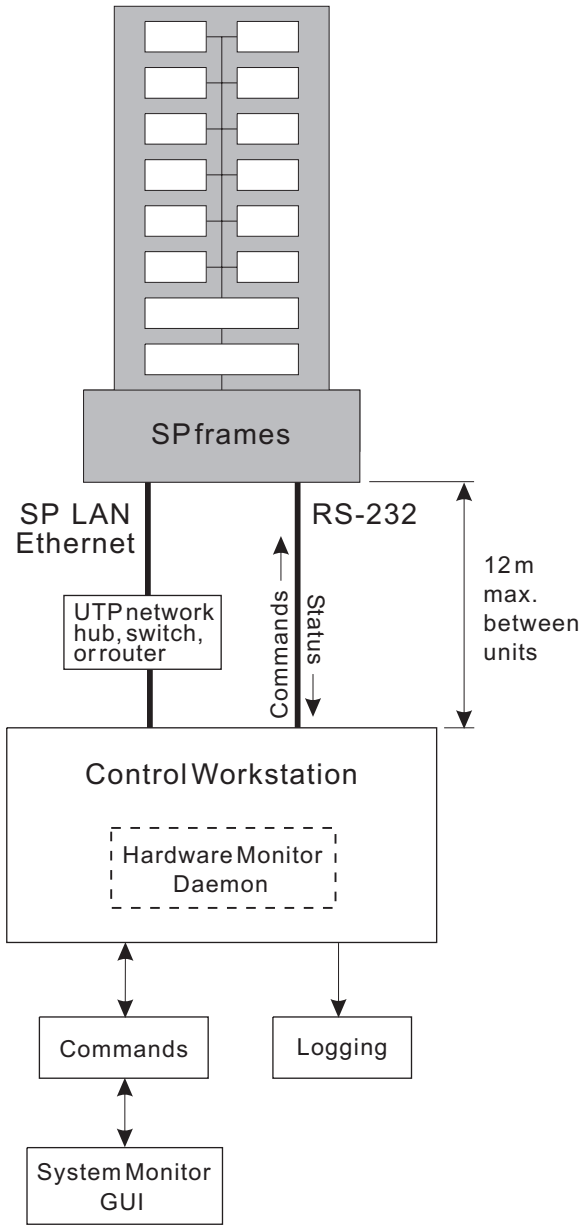

Figure 5. Control workstation. The customer-supplied control workstation is the point of control for the RS/6000 SP system. The control workstation and all SP processor nodes run both the AIX operating system and the SP system software (PSSP).

Control workstions supported for SP systems

The control workstation is provided by the customer and connects to each logical node and to the administrative Ethernet LAN. The following RS/6000 workstations and servers are supported. This information is subject to revision between editions of this book. For the latest list of supported control workstations, see the “Read this First” document at:
www.rs6000.ibm.com/resource/aix_resource/sp_books/planning/index.html

Table 8. Supported control workstations

Machine type	Model
Currently available	
7044	170
7025	6F1
7026	6H1
7028	6C1, 6E1
No longer available	
7012	37T, 370, 375, 380, 397, G30, G40
7013	570, 58H, 580, 59H, 590, 591, 595, J30, J40, J50
7015	97B, 970, 98B, 980, 990, R30, R40, R50
7024	E20, E30
7025	F30, F40, F50, F80
7026	H10, H50, H80
7030	3AT, 3BT, 3CT
7043	140, 240

Notes:

1. These workstations can have either four or eight-mm tape drives
2. All workstations require a CD-ROM device
3. M/T 7043 and 7044 can only be used on SP systems with up to four frames. This limitation applies to the number of frames, not the number of nodes. The 7043 and 7044 should not be used for Cluster 1600 or SP systems with 7017 servers

Control workstation interface adapters

Several different control workstations are available; each model has different communications adapters offered as standard equipment. Depending on the model of workstation you choose, you might want to add serial and Ethernet adapters to satisfy the needs of your SP system.

PCI serial port adapters

All new PCI control workstations require a minimum of one additional async adapter. For additional PCI serial ports, select from the following feature codes:

Note: In addition to the listed PCI bus adapters, the 7024-EXX and 7025-F30 control workstations also support the listed ISA bus adapters. All other PCI control workstations support only PCI bus adapters. PCI adapters offer performance advantages in all PCI control workstations and should be used whenever possible.

8-port PCI adapters

F/C 2943 8-port asynchronous adapter PCI BUS EIA-232/RS-422

F/C 2931 8-port asynchronous adapter ISA BUS EIA-232 (withdrawn 12/97)

F/C 2932 8-port asynchronous adapter ISA BUS EIA-232/422A (withdrawn 12/97)

128-port PCI adapters and accessories

F/C 2933 128-port asynchronous controller ISA bus (withdrawn 9/98)

F/C 2944 128-port asynchronous controller PCI bus

F/C 8130 1.2 MB/sec remote asynchronous node (RAN) 16-port EIA-232 (US) (withdrawn 9/98)

F/C 8137 2.4 MB/sec enhanced remote asynchronous node (RAN) 16-port EIA-232

F/C 8138 2.4 MB/sec enhanced remote asynchronous node (RAN) 16-port RS-422 (withdrawn 9/01)

F/C 8131 128-port asynchronous controller cable, 4.5 m (1.2 MB/sec transfers)

F/C 8132 128-port asynchronous controller cable, 23 cm (1.2 MB/sec transfers)

F/C 8133 RJ-45 to DB-25 converter cable

F/C 8134 World Trade version of F/C 8130 (withdrawn 9/98)

F/C 8136 1.2 MB/sec rack-mountable remote asynchronous node (RAN) 16-port EIA-232

F/C 2934 Asynchronous terminal/printer cable, EIA-232 (2.4 MB/sec transfers)

F/C 3124 Serial port to serial port cable for drawer-to-drawer connections (2.4 MB/sec transfers)

F/C 3125 Serial port to serial port cable for rack-to-rack connections (2.4 MB/sec transfers)

PCI Ethernet adapters

For additional PCI Ethernet ports, select from the following feature codes:

F/C 2968 IBM 10/100 Mbps Ethernet PCI adapter

F/C 2975 IBM 10/100/1000 BASE-T Ethernet PCI adapter

F/C 4962 10/100 Mbps Ethernet PCI Adapter II

F/C 2985 PCI Ethernet BNC/RJ-45 adapter (withdrawn 7/01)

F/C 2987 PCI Ethernet AUI/RJ-45 adapter (withdrawn 7/01)

F/C 4224 Ethernet 10BASE2 transceiver (withdrawn 9/01)

Electronic Service Agent and Service Director

What are Electronic Service Agent and Service Director?

Electronic Service Agent and Service Director are IBM software applications supplied with M/T 7017 and 7026 servers. Electronic Service Agent is a replacement for the previously-supplied Service Director. Both applications perform the same function and are referred to as Service Agent in this book.

Service Agent monitors the “health” of your SP system. When a system fault is detected, the severity of the fault is analyzed and, if required, Service Agent notifies the IBM support center. In addition, you can also configure Service Agent to send an automated e-mail message containing the fault information to your system

administrator. This requires mail to be active on each node. Upon receiving the fault notification, IBM automatically dispatches a service representative, along with parts if needed, to correct the fault.

Hardware requirements

Service Agent for the SP System requires a local server. Typically, the local server is the control workstation, but it can be any workstation connected to the LAN. The local server must have an available serial port. However, if you are using a control workstation which has a support processor (F/C 1001), the support processor modem must be connected to the S1 serial port. Thus, you cannot use the S1 serial port for Service Agent if your control workstation has a support processor installed.

The local host requires the serial port for a modem which transmits fault messages over local telephone lines. All new RS/6000 SP systems include a modem package as part of the ship group. The telecommunication cable plugs and ac power cable plugs vary according to the country code used for the SP system order. This package includes:

- An IBM compatible modem (minimum 9600 bps baud rate)
- A 9-pin to 25-pin serial cable
- A 15-meter, 25-pin extension cable

The customer must supply the following:

- A dial-up, analog telephone line (public switched network) with 24-hour, 7-day availability

  Note: Digital telephone lines cannot be used.
- A telephone extension cable to connect the modem to the phone jack

The local host and all nodes in your SP system must have disk space available for installation of the Service Agent software. This and other planning information can be found in *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

You can find instructions for service personnel about installing, operating, and registering Service Agent in *Electronic Service Agent for pSeries and RS/6000 User's Guide* and *Service Director for RS/6000 Information Guide*.

Chapter 9. SP Switch (F/C 4011 and F/C 4008)

The SP Switch provides a message-passing network that connects processor nodes with a minimum of four paths between any pair of nodes. The switch can also be used to connect the SP system with optional external devices. A switch feature code provides both the switch assembly and the required number of switch-to-node cables for your system.

This chapter contains information on the following switches:

1. SP Switch, 16-port (**F/C 4011**)
2. SP Switch-8, 8-port (**F/C 4008**)

Switch software considerations

Switch planning involves many issues; node placement, node addressing, and system partitioning are a few that you must consider when planning your switch layout. Consult *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment* for software-related switch planning issues before you finalize your switch plans.

SP Switch Restrictions

The SP Switch and its adapters are not compatible with the SP Switch2 or the High Performance Switch series or their adapters; they cannot coexist in the same SP system.

SP Switch (F/C 4011)

The SP Switch provides low-latency, high-bandwidth communication between nodes; supplying a minimum of four paths between any pair of nodes. The SP Switch can be used in conjunction with the SP Switch Router to dramatically increase the speed for TCP/IP, file transfers, remote procedure calls, and relational database functions.

This switch has 32 ports; 16 internal ports for switch-to-node connections and 16 external ports for switch-to-switch connections. The required SP Switch adapters and cables connect all the processor nodes to the SP Switch fabric. One adapter of the required type must be ordered for each node in a switch-configured SP system.

When you order F/C 4011, you receive one 16-port SP Switch and all of the switch-to-node cables you need to connect the switch internal ports to up to sixteen nodes mounted both in the switch-equipped frame and in any non-switched expansion frames.

The SP Switch can be configured as a node switch board (NSB) in SP frames containing processor nodes and in Models 555 and 557.

Notes:

1. An SP Switch Router Adapter is needed to connect the RS/6000 SP Switch Router to the SP Switch.
2. An RS/6000 SP System Attachment adapter is needed in each SP-attached server or Cluster 1600 server to connect to the SP Switch.

SP Switch-8 (F/C 4008)

Eight-port switches are a lower-cost alternative to the sixteen port switches. The 8-port SP Switch-8 (**F/C 4008**) provides switch functions for up to eight processor nodes in Model 500 and Model 550 systems. N+1 internal power for the SP Switch-8 is available using **F/C 1212**.

When you order F/C 4008, you receive one 8-port SP Switch and all of the cables you need to connect the switch internal ports to up to eight nodes, both within the switch-equipped frame and in any non-switched expansion frames.

An SP Switch-8 can be configured in one of two ways:

1. In a Model 500 (1.25 m) frame with up to four F/C 1500 (1.25 m) non-switched expansion frames attached
2. In a Model 550 (1.93 m) frame with a F/C 1550 non-switched expansion frame supporting up to a total of eight nodes

The SP Switch-8 has two active switch chip entry points. Thus, your ability to create system partitions is restricted with this switch. With the maximum of eight nodes attached to the switch, you have two possible system configurations:

- A single partition with up to eight node system
- Two system partitions, with up to four nodes each

For upgrades to greater than eight node support, the SP Switch-8 is replaced by the 16 port SP Switch (**F/C 4011**). The SP Switch uses a similar network topology, proprietary protocol and communication physical layer as the SP Switch-8.

SP Switch-8 restrictions

POWER3 and 375/450 MHz POWER3 High Nodes, SP-attached servers, and Cluster 1600 servers cannot be attached to the SP Switch-8.

SP Switch adapters

This section describes the adapters you need to connect the various node types to the SP Switch.

POWER3 and 375/450 MHz POWER3 SMP node adapter

An SP Switch MX2 Adapter (**F/C 4023**) must be installed in each POWER3 and 375/450 MHz POWER3 SMP-type node to connect to the switch fabric.

SP-attached server adapter

Each SP-attached server connected to the SP Switch requires at least one RS/6000 SP System Attachment Adapter (**RS/6000 F/C 8396**. For details on installing this adapter, see “SP-attached server-to-switch adapters and cabling” on page 31.

SP Switch Router adapter

An SP Switch Router Adapter (**F/C 4021**) must be installed in the SP Switch Router (**M/T 9077**) for each connection to the SP Switch. For details, see Chapter 11, “SP Switch Router (M/T 9077 04S and 16S)” on page 57.

Withdrawn 332 MHz SMP node adapter

An SP Switch MX Adapter (**F/C 4022**) must be installed in each 332 MHz Thin and Wide Node to connect to the switch fabric.

Withdrawn MCA-type node adapter

An SP Switch Adapter (**F/C 4020**) must be installed in each MCA-type node to connect to the switch fabric.

9076 Model 557 – SP Switch package

The Model 557 consists of one SP Switch (**F/C 4011**) packaged with a SEPBU power supply having redundant power input cables. This package is installed at the customer site. It occupies 16 EIA positions in a separately-ordered, IBM 19″ rack (**M/T 7014 model T00**). The Model 557 power input cables connect to one receptacle in each of two separate PDB outlets in the rack.

The Model 557 provides switch ports for Cluster 1600 systems within scaling limits. The internal switch ports in the switch connect to the SP System Attachment Adapters (**F/C 8396**) in the Cluster 1600 servers and to SP Switch Adapters in SP nodes.

SP Switch frame (F/C 2031)

An SP Switch Frame (F/C 2031) is a base, tall frame with integral SEPBU power supply, equipped with four SP Switch intermediate switch boards (ISB) but no processor nodes. The SP Switch Frame is required for systems using more than five SP Switches; it interconnects all the switches in the system.

An SP Switch Frame supports systems with from 65 to 128 nodes; however, it can also be configured into systems with fewer than 65 nodes to greatly simplify future expansion as more switches are added. For details, see “Considerations for future switch expansion” on page 84.

SP Switch Frames can also be used in special-order systems having more than 128 nodes by using RPQ 8P2006. For details, consult your IBM account representative.

Planning for SP Switch cabling

Switch-to-node cabling

For SP frames, the internal ports in each switch must be connected to all the nodes in that frame as well as to all the nodes in non-switched expansion frames. These switch cables are automatically ordered and shipped with your SP system according to configurator rules. For details, see “Switch-to-node cabling” on page 85.

SP-attached server cabling

For SP-attached servers, you must specifically order switch-to-node cables. For details, see “SP-attached server-to-switch adapters and cabling” on page 31.

Switch-to-switch cabling

You need to plan for a number of cables that connect each switch external port to all the other switches in multi-switch systems. For detailed instructions on choosing these cables, refer to “Planning for switch-to-switch cabling” on page 85.

Chapter 10. SP Switch2 (F/C 4012)

The SP Switch2 provides a low-latency, high-bandwidth, message-passing network that interconnects the nodes in your SP system. This switch has 32 ports; 16 internal ports for switch-to-node connections and 16 external ports for switch-to-switch connections. The N+1 feature of these switches allows for concurrent replacement of any failed power supplies or cooling fans. The supervisor can also be replaced while the switch is operating. PSSP level 3.2 software is required to use these switches.

When you order **F/C 4012**, you receive one SP Switch2 and all of the switch-to-node cables you need to connect up to sixteen nodes mounted both in the switch-equipped frame and in any non-switched expansion frames.

Each occupied switch port in the SP Switch2 contains an interposer card (**F/C 4032**). Interposer cards can be changed or added while the switch is operating. Any unused switch ports must have blank interposer cards (**F/C 9883**) installed, which prevent contamination of the connector and ensure proper cooling air flow.

For SP systems implementing the improved performance of the two-plane configuration (**F/C 9977**), the quantity requirements for switches, interconnecting cabling, switch adapters, and switches in SP Switch2 frames are all doubled. PSSP level 3.4 software is required for SP systems implementing the two-plane configuration.

The SP Switch2 can be configured as a node switch board (NSB) in SP frames containing processor nodes and in Models 556 and 558.

Switch software considerations

Switch planning involves many issues; node placement, node addressing, and system partitioning are a few that you must consider when planning your switch layout. Consult *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment* for software-related switch planning issues before you finalize your switch plans.

SP Switch2 restrictions

- The SP Switch2 and its adapters are not compatible with the SP Switch or the High Performance Switch series or their adapters; they cannot coexist in the same SP system.
- The SP Switch2 cannot be connected to an SP Switch Router.

SP Switch2 adapters

This section describes the adapters you need to connect the various node types to the SP Switch2.

High node adapter

An SP Switch2 Adapter (**F/C 4025**) must be installed in each POWER3 or 375/450 MHz POWER3 High Node connected to the switch fabric.

For two-plane installations, two adapters are required.

Thin and wide node adapter

An SP Switch2 MX2 Adapter (**F/C 4026**) must be installed in each POWER3 and 375/450 MHz POWER3 Thin and Wide Node and 332 MHz Thin and Wide Node connected to the switch fabric.

SP-attached server adapter

Each SP-attached server connected to the SP Switch2 requires at least one SP Switch2 PCI Attachment Adapter (**RS/6000 F/C 8397**). For details on installing this adapter, see “SP-attached server-to-switch adapters and cabling” on page 31. PSSP level 3.4 software is required for SP systems implementing this adapter.

For two- plane installations, two adapters are required in each server node.

9076 Model 558 – SP Switch2 package

The Model 558 consists of one to two SP Switch2s (**F/C 4012**) packaged with a SEPBU power supply having redundant power input cables. This package is installed at the customer site. It occupies 16 EIA positions in a separately-ordered, IBM 19″ rack (**M/T 7014 model T00**). The Model 558 power input cables connect to one receptacle in each of two separate PDB outlets in the rack.

The Model 558 provides node switch board (NSB) ports for Cluster 1600 systems within scaling limits. The internal switch ports in the switch connect to the SP Switch2 PCI Attachment Adapters (**F/C 8397**) in the Cluster 1600 servers and to SP Switch2 adapters in SP nodes.

SP Switch2 Frame (F/C 2032)

An SP Switch2 Frame (**F/C 2032**) is a base, tall frame with integral SEPBU power supply, equipped with four SP Switch2 intermediate switch boards (ISB), including their interposers, but no processor nodes. The SP Switch2 frame is required for systems having more than five switches; it interconnects all the switches in the system.

For two-plane applications (**F/C 9977**), four additional SP Switch2 ISBs (**F/C 2033**) are installed in the SP Switch2 Frame.

An SP Switch2 frame supports systems with from 65 to 128 logical nodes; however, it can also be configured into systems with fewer than 65 nodes to greatly simplify future expansion as more switches are added. For details, see “Considerations for future switch expansion” on page 84.

SP Switch2 Frames can also be used in special-order systems having more than 128 nodes by using **RPQ 8P2006**. For details, consult your IBM account representative.

SP Switch2 Expansion Frame (F/C 2034)

An SP Switch2 Expansion Frame (**F/C 2034**) shares the 79 in. frame and covers of the @server pSeries 690. It has an integral SEPBU power supply, equipped with four SP Switch2 intermediate switch boards (ISB), including their interposers, but no processor nodes. This frame is required for systems configured with the Model 556 having more than five node switch boards in one switch plane; it interconnects all the node switch boards in the system.

For two-plane applications (**F/C 9977**), four additional SP Switch2 intermediate switch boards (**F/C 2035**) are installed in the frame.

An SP Switch2 expansion frame supports systems with from 65 to 128 logical nodes; however, it can also be configured into systems with fewer than 65 nodes to greatly simplify future expansion as more switches are added. For details, see “Considerations for future switch expansion” on page 84.

Planning for SP Switch2 cabling

Switch-to-node cabling

For SP frames, the internal ports in each switch must be connected to the nodes in that frame as well as to the nodes in non-switched expansion frames. These switch cables are automatically ordered and shipped with your SP system according to configurator rules. For details, see “Switch-to-node cabling” on page 85.

SP-attached server cabling

For SP-attached servers, you must specifically order switch-to-node cables. For details, see “SP-attached server-to-switch adapters and cabling” on page 31.

Switch-to-switch cabling

You need to plan for a number of cables that connect each switch to all the other switches in multi-switch systems. For detailed instructions on choosing these cables, refer to “Planning for switch-to-switch cabling” on page 85.

Chapter 11. SP Switch Router (M/T 9077 04S and 16S)

The IBM 9077 SP Switch Router is a licensed version of the Ascend GRF switched IP router that is enhanced for direct connection to the SP Switch.

SP Switch Router description

A physical dependent node such as an RS/6000 SP Switch Router (**M/T 9077**) can have multiple logical dependent nodes; one for each dependent node adapter it contains. If a dependent node like the SP Switch Router contains more than one dependent node adapter, it can route data between SP systems or system partitions. For the RS/6000 SP Switch Router, this card is the Switch Router Adapter (**F/C 4021**). Data transmission is accomplished by linking the dependent node adapters in the switch router with the logical dependent nodes located in different SP systems or system partitions.

SP Switch Router requirements

If you plan to attach an SP Switch Router to your SP system, you ***must*** have one valid, unused switch port for each Switch Router Adapter that you install. For details, see “Adapter requirements” on page 59.

The SP Switch Router uses networking cards that fit into slots in the SP Switch Router. In the same way that the SP Switch Router Adapter connects the SP Switch Router directly to the SP Switch, these networking cards enable the SP Switch Router to directly connect to an external network.

Both versions of the RS/6000 SP Switch Router can be used with the SP Switch. The Model 04S has four media card slots while the Model 16S has sixteen. Except for the additional traffic capacity of the Model 16S, both units offer similar performance and network availability.

The following networks can be connected to the RS/6000 SP Switch Router using available media cards:

- Ethernet 10/100 BASE-T, 1000 BASE-SX, and 1000 BASE-LX
- FDDI
- ATM OC-3c (single or multimode fiber)
- SONET OC-3c (single or multimode fiber)
- ATM OC-12c (single or multimode fiber)
- HiPPI
- HSSI

  For a complete listing and descriptions of available networking cards, see “Planning for network media cards and memory options” on page 66.

Although you can equip an SP node with a variety of network adapters and use the node to make your network connections, the SP Switch Router (with Switch Router Adapter and optional network media cards) offers many advantages when connecting the SP to external networks, as follows:

1. Each media card contains its own IP routing engine (with separate memory) containing a full route table of up to 150,000 routes. Direct access provides much faster lookup times compared to software driven lookups.

2. Media cards route IP packets independently at rates of 60,000 to 130,000 IP packets per second. With independent routing available from each media card, the SP Switch Router gives your SP system excellent scalability characteristics.
3. The SP Switch Router has dynamic network configuration to bypass failed network paths using standard IP protocols.
4. Using multiple Switch Router Adapters in the same SP Switch Router, you can provide high performance connections between system partitions in a single SP system or between multiple SP systems.
5. A single SP system can have more than one SP Switch Router attached to it, further ensuring network availability.
6. Media cards are hot-swappable for uninterrupted SP Switch Router operations.
7. Each SP Switch Router has redundant (N+1), hot-swappable power supplies.

SP Switch Router installation requirements

There are several requirements for hardware and software that must be met before you can place the RS/6000 SP Switch Router into service with your SP system. These requirements are in the following categories:

- SP Switch Router system requirements
- Switch Router physical requirements
- Switch Router Adapter
- Network media cards
- Software

System requirements

In addition to the SP Switch Router, the following requirements must be met before you can place the router into service:

1. You must have at least one SP Switch Router Adapter.
2. A VT100-compatible terminal (with an RS-232 cable and null modem) is needed for initial configuration of the SP Switch Router.
3. You need a 10BASE-T connection between your SP control workstation and the SP Switch Router. If your control workstation uses 10BASE2 Ethernet, you must also supply a 10BASE-T to 10BASE2 bridge.
4. Your SP system ***must*** be equipped with either an SP Switch **(F/C 4011)** or an SP Switch-8 **(F/C 4008)**.
5. You must attach a frame-to-frame ground between the SP Switch Router and the SP system, using the IBM-supplied cable.

Physical requirements

Physical dimensions and weight of the SP Switch Router

Table 9 provides information on the physical dimensions and weight of SP Switch Routers. The SP Switch Router is available as Machine Type 9077-4S with four adapter slots and as Machine Type 9077-16S with sixteen adapter slots.

Table 9. Physical dimensions and weight of SP Switch Router

Specification	**9077-4S**	**9077-16S**
Width	483 mm (19 in.)	483 mm (19 in.)
Depth	483 mm (19 in.)	483 mm (19 in.)
Height	134 mm (5.25 in.)	534 mm (21 in.)

Table 9. Physical dimensions and weight of SP Switch Router (continued)

Specification	9077-4S	9077-16S
Weight	11.9 kg (26.5 lbs.)	45 kg (100 lbs.)

The SP Switch Router can be mounted in a standard 19-inch equipment rack, such as the 7015-R00. Rails should be used in the rack to support the weight of the 9077-16S.

Note: All rack mounted routers must be installed so that sufficient cooling air can flow around the side of the router.

SP Switch Router power requirements

If you use an SP Switch Router as an integral part of your SP system, you must plan for the power requirements of each unit. You can find this information in the “Bibliography” on page 255, in the “RS/6000 SP Switch Router” publications list.

Adapter requirements

Each SP Switch Router Adapter **(F/C 4021)** that you place into the SP Switch Router requires the following:

1. One valid, unused switch port on the SP Switch corresponding to a legitimate node slot in your SP configuration.

   A legitimate node slot can be empty, the second half of a wide node, or one of the last three positions of a high node, provided that the node slot satisfies the other rules for configuring nodes in an SP system.

   For example, if you have a frame with 16 thin nodes installed, you cannot attach a Switch Router Adapter to that frame until you remove a node and delete its configuration from the system image.
2. One media card slot in the Switch Router. The RS/6000 SP Switch Router Model 04S has the capacity of a total of four SP Switch Router Adapters and network media cards in any combination. The Model 16S has the capacity of a total of sixteen adapters and network media cards in any combination.

Network media card requirements

Each network media card requires one media card slot in the RS/6000 SP Switch Router. Keep in mind that the network media cards use the same slots as the SP Switch Router Adapters.

For a complete listing and description of available media cards, see “Planning for network media cards and memory options” on page 66.

Software requirements

The SP Switch Router requires an SP system operating at PSSP 2.3 (or later), with the appropriate APAR level and AIX 4.2.1 (or later) on the primary and backup nodes for the SP Switch and on the control workstation.

If the SP Switch Router is used in an SP partition where there are nodes operating at lower than the required level of PSSP and AIX, you must apply service updates to the software operating on those nodes.

Planning for the SP Switch Router network interface

The RS/6000 SP Switch Router (**Machine Type 9077**) requires a minimum of three connections with your SP system in order to establish a functional and safe network. These connections are as follows:

1. A network connection with the control workstation.

   The SP Switch Router must be connected to the control workstation for system administration purposes. This connection can be either of the following:

   - A direct Ethernet connection between the SP Switch Router and the control workstation.
   - An Ethernet connection from the SP Switch Router to an external network, which then connects to the control workstation.

   See “Connecting the SP Switch Router to the control workstation” for more information.

2. A connection between an SP Switch Router Adapter and the SP Switch.

   The SP Switch Router transfers information into and out of the processor nodes of your SP system. The link between the SP Switch Router and the SP processor nodes is implemented by the following:

   - An SP Switch Router Adapter (F/C 4021).
   - A switch cable connecting the Switch Router Adapter to a valid switch port on the SP Switch.

   See “Connecting the SP Switch Router to the SP Switch” on page 64 for more information.

3. A frame-to-frame electrical ground.

   The SP Switch Router frame must be connected to the SP frame with a grounding cable. This frame-to-frame ground is required in addition to the SP Switch Router electrical ground. The purpose of the frame-to-frame ground is to maintain the SP and SP Switch Router systems at the same electrical potential.

Both the SP Switch cable and the grounding cable are shipped with each SP Switch Router Adapter. The suggested cable for connecting the SP Switch Router Adapter to the SP Switch is 10 meters long **(F/C 9310)**. An optional 20 meter cable **(F/C 9320)** is also available for the SP Switch connection. A frame-to-frame ground cable the same length as the SP Switch cable is included with both F/C 9310 and F/C 9320 (order using M/T 9077).

The following sections describe how to connect the SP Switch Router to the control workstation and how to connect the SP Switch Router Adapter to a valid SP Switch port.

Connecting the SP Switch Router to the control workstation

Although a dependent node such as the SP Switch Router does not function like a processor node, it must be administered by the SP system as if it is a processor node. Thus, the SP Switch Router must be attached to the control workstation. All SP system administrative connections are made to the SP Switch Router using the port on the router control board. From the SP Switch Router control board, the connection to the control workstation is made using one of the following methods:

1. If the control workstation is connected to the SP system through a 10BASE2 (thin coax) network, the SP Switch Router can be connected to the network through a customer supplied 10BASE-T to 10BASE2 hub (or bridge) such as the IBM 8222 Ethernet Workgroup Hub. For more information on the IBM 8222, contact your IBM marketing representative.

All coax and twisted pair Ethernet cables must be supplied by the customer.

2. If the control workstation is connected to the SP system through a twisted pair (TP) Ethernet LAN, the SP Switch Router can be connected to an available port on the Ethernet hub (switch).

   All coax and twisted pair Ethernet cables must be supplied by the customer.

3. The RS/6000 SP Switch Router can also be connected to an additional 10BASE-T adapter (such as F/C 2992) that has been installed directly in the control workstation for this purpose. If you decide to use this method, you ***must*** set up a separate Ethernet subnet for the SP Switch Router.

   When using separate 10BASE-T adapters for the control workstation connection, in addition to the 10BASE-T adapter you must also supply a twisted pair Ethernet cable with a crossed connection appropriate for use between two network interface cards.

4. The SP Switch Router can also be indirectly connected to the control workstation using an external network. In this configuration, the Ethernet connection from the router control board is attached to external network equipment. The external network connection to the control workstation can be one of the following:

   - A separate (non SP-LAN) Ethernet
   - ATM
   - FDDI

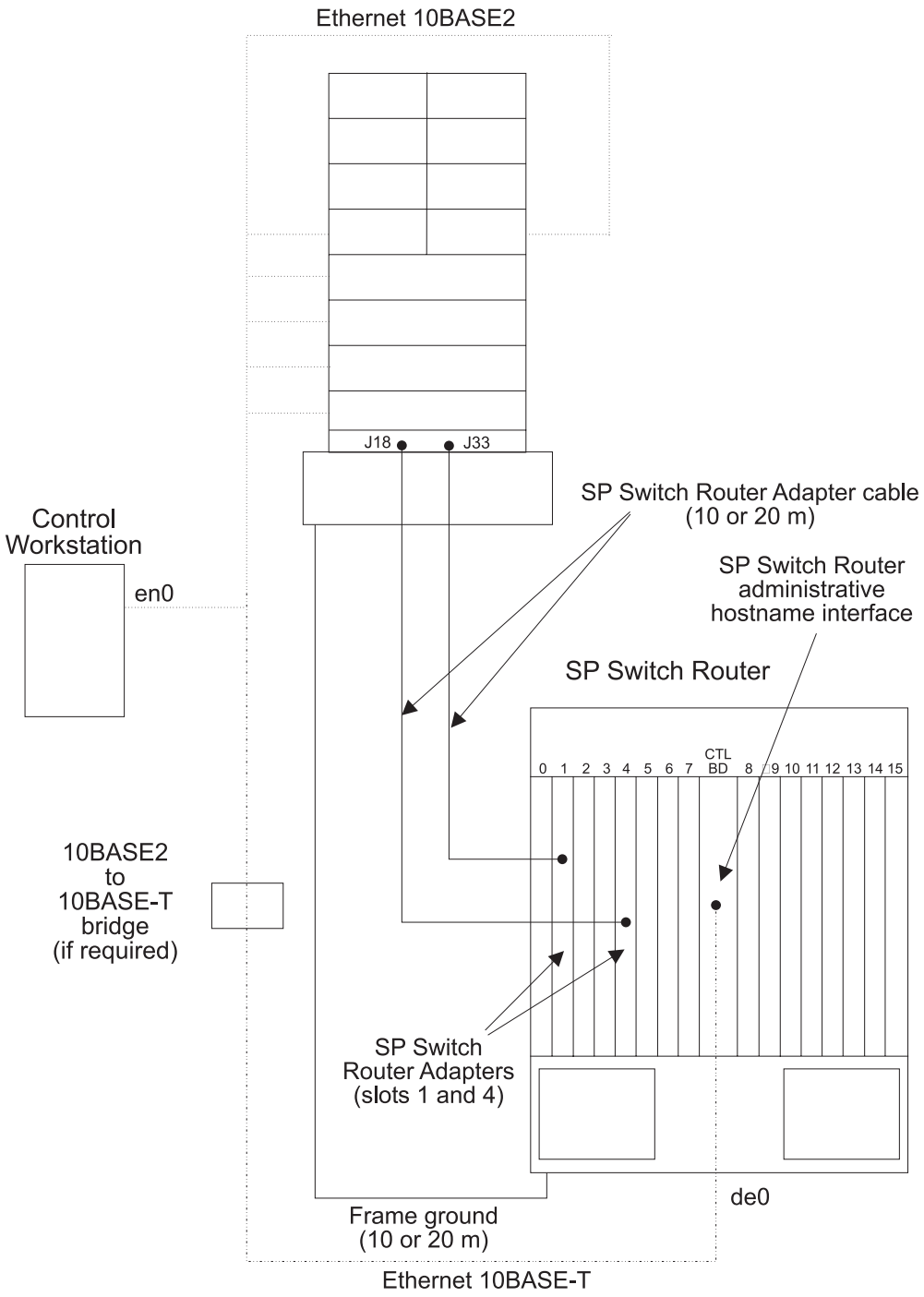

Figure 6. Typical connections between the RS/6000 SP Switch Router, the control workstation, and the SP Switch

Connecting the SP Switch Router to multiple SP systems

If you plan to connect one SP Switch Router to multiple, independent SP Systems, you need the following:

1. One SP Switch Router Adapter for each SP system being connected. For details, see “Adapter requirements” on page 59.

2. A Switch Router Adapter cable to connect each of the adapters to an SP Switch located in each of the SP systems. For details, see “Planning for the SP Switch Router network interface” on page 60.
3. An Ethernet connection from the SP Switch Router control board to an external network. The router control board Ethernet connection is de0 and uses 10/100BASET Ethernet.
4. Connections from the external network must attach to the control workstation(s) administering each SP system. The external networks can be one of the following:
   - Other Ethernets
   - ATM
   - FDDI
5. Frame-to-frame grounds are required.

Valid control workstation connections

Other methods can be used to make the connection between the router control board and all control workstations used in the SP systems. Any method providing the ability to ping SP control workstations from the router control board will provide a valid path.

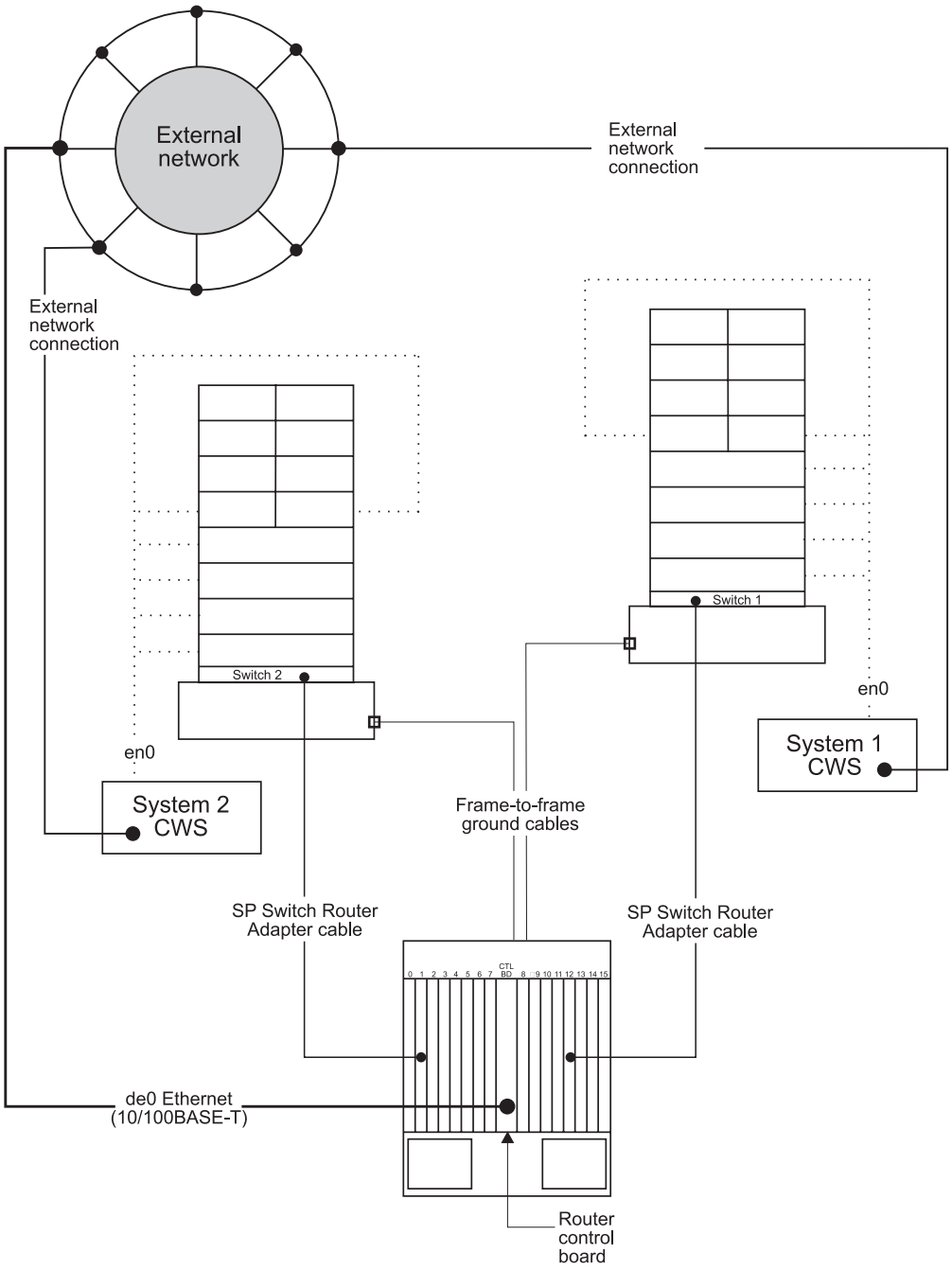

Figure 7. Configuring the RS/6000 SP Switch Router for communications with multiple SP systems

Connecting the SP Switch Router to the SP Switch

In addition to the control workstation Ethernet connection, the RS/6000 SP Switch Router requires a connection between the SP Switch and the SP Switch Router. To make this connection, your system requires the SP Switch Router Adapter (**F/C 4021**). This adapter occupies one media card slot in the attached SP Switch Router.

See the appropriate SP Switch Router documentation (listed in “Bibliography” on page 255) for specific details on connecting the RS/6000 SP Switch Router to your SP system. The general steps required to choose a valid SP Switch port are outlined here.

Selecting a valid switch port

An SP Switch Router Adapter in the SP Switch Router can be attached to an SP Switch to improve throughput of data coming into and going out of the RS/6000 SP system. Each SP Switch Router Adapter in the RS/6000 SP Switch Router requires a valid unused switch port in the SP system. A valid unused switch port is a switch port which meets the rules for configuring frames and switches.

There are two basic sets of rules for choosing a valid switch port:

1. Rules for selecting a valid switch port associated with an empty node slot.
2. Rules for selecting a valid switch port associated with an unused node slot created by a wide or high node. These node slots are either the second half of a wide node or one of the last three positions of a high node.

For more information see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Examples of using an empty node slot position: One example of using an empty node slot position would be a single frame system with an SP Switch and 14 thin nodes located in slots 1 through 14. This system has two unused node slots in positions 15 and 16. These two empty node slots have corresponding switch ports which provide valid connections for the SP Switch Router Adapter.

Another example is a two-frame system with one switch. The first frame is fully populated with eight wide nodes. The second frame has three wide nodes in system node positions 17, 19, and 21. The only valid switch ports in this configuration are those switch ports associated with system node numbers 23, 25, 27, 29, and 31 in the second frame.

In a four-frame system with an SP Switch and fourteen high nodes, there are only two empty node positions. In this example, the first three frames are fully populated with four high nodes in each frame. The last frame has two high nodes and two empty high node slots. This means the system has two valid switch ports associated with system node numbers 57 and 61.

For more information, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Examples of using node slot positions within a wide node or high node: The first example is a single frame with an SP Switch and eight wide nodes. These wide nodes occupy the odd numbered node slots. Thus, all of the even number slots are said to be unoccupied and would have valid switch ports associated with them. These ports can be used for an SP Switch Router Adapter.

A second example is a single-frame system with an SP Switch, twelve thin nodes in slots 1 through 12, and a high node in slot 13. A high node occupies four slots but uses only one switch port. Thus, the only valid switch ports in this configuration are created by the three unused node slots occupied by the high node. In other words, the switch ports are associated with node slots 14, 15, and 16.

For more information, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Planning for network media cards and memory options

This section has planning information for the RS/6000 SP Switch Router options. Use these options to connect your SP system to an external network with the SP Switch Router and to increase the memory capacity for routing information.

SP Switch Router memory is used for storing both static and dynamic routing information. Both the 9077-04S and 9077-16S contain standard 128 MB memory.

- For the 9077-04S only, **F/C 1114** provides memory increments of 64 MB, up to a total of 192 MB.
- For both the 9077-04S and 16S, **F/C 1116** provides memory increments of 128 MB, up to a total of 384 MB for the 04S and 512 MB for the 16S.

The features listed in Table 10 are described in detail in this section.

Table 10. SP Switch Router network media cards and options

SP Feature Code	Description	Notes
1101	ATM OC3, two port SM fiber	
1102	ATM OC3, two port MM fiber	
1103	SONET/IP OC3, one port MM fiber	
1104	SONET/IP OC3, one port SM fiber	
1105	ATM OC12, one port SM fiber	
1106	FDDI, four port MM fiber	
1107	Ethernet 10/100BASE-T, eight port	
1108	HIPPI, one port	
1109	HSSI, two port	
1112	Ethernet 10/100BASE-T, four port	
1113	Blank faceplate	
1114	64 MB DRAM SIMM Memory option	
1115	ATM OC12, one port MM fiber	
1116	128 MB DRAM SIMM Memory option	
1117	1000BASE-SX Gigabit Ethernet	
1118	1000BASE-LX Gigabit Ethernet	
4021	SP Switch Router Adapter	1
9310	SP Switch Router Adapter Cable, 10 meter option (includes 10 m frame-to-frame ground cable, F/C 9311)	
9320	SP Switch Router Adapter Cable, 20 meter option (includes 20 m frame-to-frame ground cable, F/C 9321)	
Notes: 1. Your choice of either F/C 9310 or 9320 is included with each F/C 4021.		

ATM OC-3c Two-port single-mode IP Forwarding Media Card (F/C 1101)

The ATM OC-3c IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance ATM OC-3c support for the SP Switch Router.

Technical description: The ATM IP Forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The two full-duplex OC-3c ports use 9/125 micron single-mode optical fiber and provide exceptional configuration flexibility and port density.

ATM OC-3c Two-port Multimode IP Forwarding Media Card (F/C 1102)

The ATM OC-3c IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance ATM OC-3c support for the SP Switch Router.

Technical description: The ATM IP Forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The two full-duplex OC-3c ports use 62.5/125 micron multimode optical fiber and provide exceptional configuration flexibility and port density.

SONET/IP OC-3c One-port Multimode IP Forwarding Media Card (F/C 1103)

The SONET OC-3c IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance SONET OC-3c support for the SP Switch Router.

Technical description: The SONET IP Forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The card provides one SONET OC3c port and uses 62.5/125 micron multimode optical fiber.

SONET/IP OC-3c One-port Single-mode IP Forwarding Media Card (F/C 1104)

The SONET OC-3c IP Forwarding Media Card is an intelligent, self- contained IP forwarding engine that provides high-performance SONET OC-3c support for the SP Switch Router.

Technical Description: The SONET IP Forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The card provides one SONET OC3c port and uses 9/125 micron single-mode optical fiber.

ATM OC-12c One-port Single-mode IP Forwarding Media Card (F/C 1105)

The ATM OC-12c IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance ATM OC-12c support for the SP Switch Router.

Technical description: The ATM IP Forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The full-duplex OC-12c port uses 9/125 micron single-mode optical fiber. The card supports up to 1408 Permanent Virtual Circuits of which 1000 can be active at any one time. This adapter does not support Switched Virtual Circuits.

FDDI Four-port IP Forwarding Media Card (F/C 1106)

The FDDI IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance FDDI support for the SP Switch Router.

Technical description: The FDDI IP Forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. Four 100 megabit/second FDDI ports can be configured as four single attach interfaces, as two dual attach interfaces, or as two single attach and one dual attach interface, providing exceptional flexibility and port density. The ports use 62.5/125 micron multimode optical fiber.

Ethernet 10/100BASE-T 8-port IP Forwarding Media Card (F/C 1107)

The 10/100BASE-T IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance Ethernet support for the SP Switch Router.

Technical description: The 10/100BASE-T IP forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The card supports both 10BASE-T or 100BASE-TX autosensing interfaces to provide exceptional configuration flexibility and port density.

HIPPI One-port IP Forwarding Media Card (F/C 1108)

The HIPPI IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance HIPPI support for the SP Switch Router.

Technical description: The HIPPI IP forwarding Media Card leverages the SP Switch Router to deliver packets at full interface speeds.

HSSI Two-port IP Forwarding Media Card (F/C 1109)

Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance HSSI support for the SP Switch Router.

Technical description: The HSSI IP forwarding Media Card leverages the SP Switch Router to deliver packets at full interface speeds. Two 52 megabit/second, full-duplex HSSI data channels provide exceptional configuration flexibility and port density.

Ethernet 10/100BASE-T four-port IP Forwarding Media Card (F/C 1112)

The 10/100BASE-T IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance Ethernet support for the SP Switch Router.

Technical description: The 10/100BASE-T IP forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The card supports both 10BASE-T or 100BASE-TX autosensing interfaces to provide exceptional configuration flexibility and port density.

Faceplate (F/C 1113)

F/C 1113 provides a blank faceplate that is needed if a media card is not required or if one is removed from an SP Switch Router.

64 MB DRAM SIMM memory option (F/C 1114)

F/C 1114 provides memory in 64 MB increments (2 x 32 MB DRAM).

ATM OC-12c One-port Multimode IP Forwarding Media Card (F/C 1115)

The ATM OC-12c IP Forwarding Media Card is an intelligent, self-contained IP forwarding engine that provides high-performance ATM OC-12c support for the SP Switch Router.

Technical Description: The ATM IP Forwarding Media Card leverages the SP Switch Router to deliver packets at full line speeds. The full-duplex OC-12c port uses 62.5/125 micron multimode optical fiber. The card supports up to 1408 Permanent Virtual Circuits of which 1000 can be active at any one time. This adapter does not support Switched Virtual Circuits.

128 MB DRAM SIMM Memory Option (F/C 1116)
F/C 1116 provides memory in 128 MB increments (2 x 64 MB DRAM).

1000BASE-SX Gigabit Ethernet media card (F/C 1117)
F/C 1117 supports standard 1518 byte Ethernet packets and 9000 byte Jumbo Frames for short distances of up to 550 meters.

1000BASE-LX Gigabit Ethernet media card (F/C 1118)
F/C 1118 supports standard 1518 byte Ethernet packets and 9000 byte Jumbo Frames for long distances of up to 5 kilometers.

SP Switch Router Adapter (F/C 4021)
The SP Switch Router Adapter is used to connect the SP Switch to an SP Switch Router. You must have one SP Switch Router Adapter for each SP system or SP system partition you are going to connect to the SP Switch Router.

Each F/C 4021 includes your choice of either F/C 9310 or F/C 9320.

Technical Description: The SP Switch Router Adapter provides a high performance, 100 MB/s, full-duplex interface between the SP Switch and the SP Switch Router and is able to sustain IP packet rates of up to 30,000 packets per second in each direction.

When the SP Switch Router Adapter is installed in the RS/6000 SP Switch Router, it allows the SP Switch Router to be used as a networking gateway for the SP.

Each SP Switch Router Adapter requires one available node switch port on the SP Switch.

SP Switch Router - 10 meter cable (F/C 9310)
IBM provides a 10 meter cable for connecting each SP Switch Router Adapter to an SP switch.

Each F/C 9310 includes a 10 m frame-to-frame ground cable.

SP Switch Router - 20 meter cable (F/C 9320)
This optional 20 meter cable is available for connecting each SP Switch Router Adapter to an SP switch.

Each F/C 9320 includes a 20 m frame-to-frame ground cable.

Chapter 12. Communication cabling

This chapter describes planning for the cabling connecting the RS/6000 SP system components. When planning for cabling, consider the following to protect inter-frame cables from damage:

- Raised floor installations need under-floor raceways to protect the cable from possible damage.
- Office floor environments need above-floor raceways or protective ramps to protect the cables from possible damage and to ensure safety at your site.

The RS/6000 SP system is connected to your control workstation and file servers with the following cables:

- RS-232 cable (originating at each frame)
- One 50-ohm coaxial Ethernet or Twisted Pair Ethernet link

The RS/6000 SP system can also be connected to external networks through the RS/6000 SP Switch Router and adapters. For an overview of attaching the RS/6000 SP Switch Router, see “Planning for the SP Switch Router network interface” on page 60.

Planning the location of the control workstation based on cable length

RS-232 cable provided by IBM

The location of your control workstation depends, in part, on the length of the RS-232 cable that connects it to the RS/6000 SP system. IBM supplies a 15-meter (50-foot) RS-232 cable to link each RS/6000 SP frame to your control workstation. This cable is the communication link between the frame and your control workstation for hardware monitoring and control and system management.

Note: A similar set of cables is provided for each SP-attached server. However, the two RS-232 cables provided with the SP-attached server are customized for use with the SP-attached server.

When planning your floor layout, remember to keep the need for cable drops in mind. For that reason, the recommended ***maximum*** distance between the control workstation and each SP frame and any SP-attached server is 12 meters. This leaves a free length of 1.5 meters at each end to reach between the cable tray and the connector.

Planning for coaxial LAN cabling

This section contains planning information for coaxial Ethernet cabling, also known as BNC or thin-wire Ethernet. For details on using twisted-pair cabling, see “Planning for unshielded twisted pair (UTP) cabling” on page 77.

For descriptions and illustrations of typical coaxial SP LAN network setups, see “Typical SP LAN topologies” on page 79.

Ethernet LAN and Ethernet cable provided by IBM

IBM supplies an Ethernet LAN and one 15-meter (50-foot) Ethernet cable for each RS/6000 SP frame and each SP-attached server, as well as the required node-to-node cables.

Note: The Ethernet cables provided by IBM are BNC-type cables. If you plan to use twisted-pair cabling in your SP system, you must supply the cables.

When planning your floor layout, remember to keep in mind the need for cable drops. For that reason, the recommended ***maximum*** distance between the control workstation and each frame is 12 meters. This leaves a free length of 1.5 meters at each end to reach between the cable tray and the connector.

Figure 8 shows the configuration of the Ethernet LAN in a RS/6000 SP frame, the RF shunt, and the 15-meter Ethernet cable.

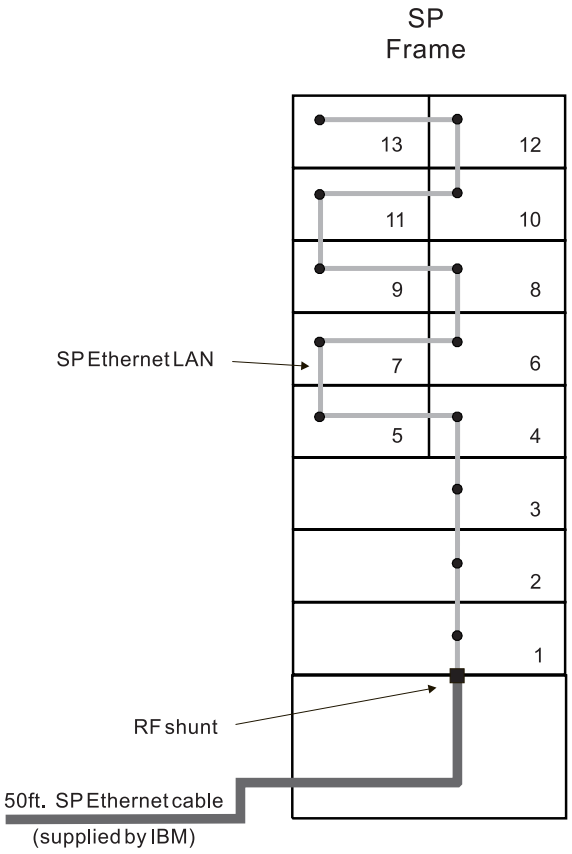

Figure 8. Factory-shipped SP Ethernet LAN, RF shunt and Ethernet cable in rear of SP frame

RF Shunt

The provided RF shunt (**P/N 46H9751**) is required on each Ethernet BNC exiting an SP frame.

Note: You can reconfigure your SP Ethernet as appropriate for your net-install service. However, SP support is limited to a maximum of 16 Ethernet cables exiting the frame.

Requirements for coaxial cables

Coaxial cable types RG-58 A/U or RG-58 C/U meet the parameters specified in Table 11 on page 73.

Cables RG-58 A/U and RG-58 C/U include these characteristics:

- The coaxial cable segment is the sum of all components, not to exceed 30 stations and a total length of 185 meters. The segment is a continuous transmission bus with BNC terminators on two ends, with station drops accomplished through trunk cable connectors.
- The sum of the center conductor, connectors, and shield shall not exceed 10 ohms total per cable segment. The maximum end-to-end propagation delay for a coaxial segment is 950 nanoseconds.

Notes:

1. To comply with Part 15 of the Federal Communications Commission rules (requirements for radio frequency interference from computing devices), use either double-shielded cable or cable with 95 per cent shield coverage.
2. When the RS/6000 SP system is operating, the maximum signal on the coaxial cable is five volts. This complies with the voltage and power limits of Article 725 in the National Electric Code for Class 2 and 3 circuits.
3. Do not use aluminum foil-shielded cable, because of its high electrical resistance and mechanical fragility.

Table 11 lists the characteristics of the coaxial-type cable, RG-58, that is suitable for Ethernet cabling at your site.

Table 11. Characteristics of RG-58 cables suitable for coaxial link

Category	**Characteristics of Cable (RG-58 A/U, RG-58 C/U)**
Coaxial Segment Components:	
Trunk cable connector	Use a plug-plug-jack BNC 'Y' connector with external insulator. The trunk cable section should contribute no more than 10 milliohms.
Terminator	• **Impedance**: 50 ohms (plus or minus 1 percent.) measured from 0–20 megahertz, with a magnitude of the phase angle of impedance not to exceed 5 degrees • **Power rating**: 0.5 watts or greater
Coaxial Cable Assembly:	
Type	RG-58 A/U or RG-58 C/U
Length	Use minimum cable length section of 0.5 meters to maintain reflections of an acceptable level.
Connectors	Cable section ends to utilize two BNC plug type connectors
Electrical Parameters:	
Characteristic impedance	• Average cable impedance should be 50, plus or minus two ohms. • Periodic variations in impedance along a single piece of cable may be plus or minus three ohm sinusoidal, centered around the average value, with a period of less than two minutes.
Attenuation of 185 meter cable segment	Attenuation should not to exceed 8.5 decibels measured at 10 megahertz, or 6.0 decibels measured at five megahertz.

Table 11. Characteristics of RG-58 cables suitable for coaxial link (continued)

Category	Characteristics of Cable (RG-58 A/U, RG-58 C/U)
Velocity of propagation	Minimum velocity required is 0.65c (c= 3.0 x 10**8)
Cable DC loop resistance	Sum of the center conductor resistance, plus the shield resistance measured at 20° Centigrade, not to exceed 50 milliohms per meter.
Coaxial Cable Physical Parameters:	
Mechanical requirements	Stranded, tinned copper with overall diameter of 0.89 millimeter, plus or minus 0.05 millimeter
Dielectric material	Polyethylene 2.95 nominal core
Shielding system	• 95 percent or greater required • Inside diameter to be 2.95 millimeter, plus or minus 0.15 millimeter
Note: Cable used in outdoor cable runs should have the same electrical characteristics as indoor cable.	

Customer responsibilities for coaxial cabling

You have the following responsibilities:

- If your file server is located more than 15 meters from your RS/6000 SP system, obtain and install coaxial link cables that fit your RS/6000 SP configuration.
- Obtain and install BNC connectors.
- Ensure that cables comply with all applicable codes and standards.
- Check that both BNC connectors on a port use coaxial cable of the same impedance.
- Plan for continuous unit-to-unit lengths of cable. Cable splicing is not recommended.
- Provide lightning protection (station protectors) on all outdoor coaxial cables.

Note: Your system installer can provide advice about additional customer-supplied hardware you might need (such as a convertor box) if you plan to use a combination of multiple (thick) and single (thin) coaxial cables.

Connecting station protectors

To protect personnel and to prevent damage to your equipment from sudden surges of lightning energy, connect a station protector to the shield at both ends of each coaxial cable that runs out-of-doors.

DANGER

Do not install, maintain, connect, disconnect, or handle either lightning protectors or coaxial cables that connect the protector to the terminal in any way during periods of lightning activity.

IBM station protector

You can order a station protector kit (**P/N 1830818**) from IBM. An illustration of the station protector kit is shown in Figure 9 on page 75. The kit contains two

gas-element station protectors. Each protector can have two coaxial cables connected to it; thus, if you run two cables between the same two points, only one protector kit is required.

An attachment kit (**P/N 1833106**) contains the parts necessary to connect the station protector to each end of a coaxial cable. The kit consists of a bulkhead coupling adapter and a jumper assembly to connect the bulkhead adapter to the station protector.

IBM station protectors are designed for inside installation only. Install the protector inside the building at the point where the cable enters the building. Also, ensure that the protector is as close to a suitable ground as is practical. You must ground the protector.

On all protector installations, allow ready access to elements that must be serviced or replaced. Ensure that the area of the building where the cables enter or leave does not contain combustible material and is not considered a hazardous area.

For information about outdoor cable runs (including lightning protection), see *Installation and Assembly of Coaxial Cable and Accessories for Attachment to IBM Products*, GA27-2805.

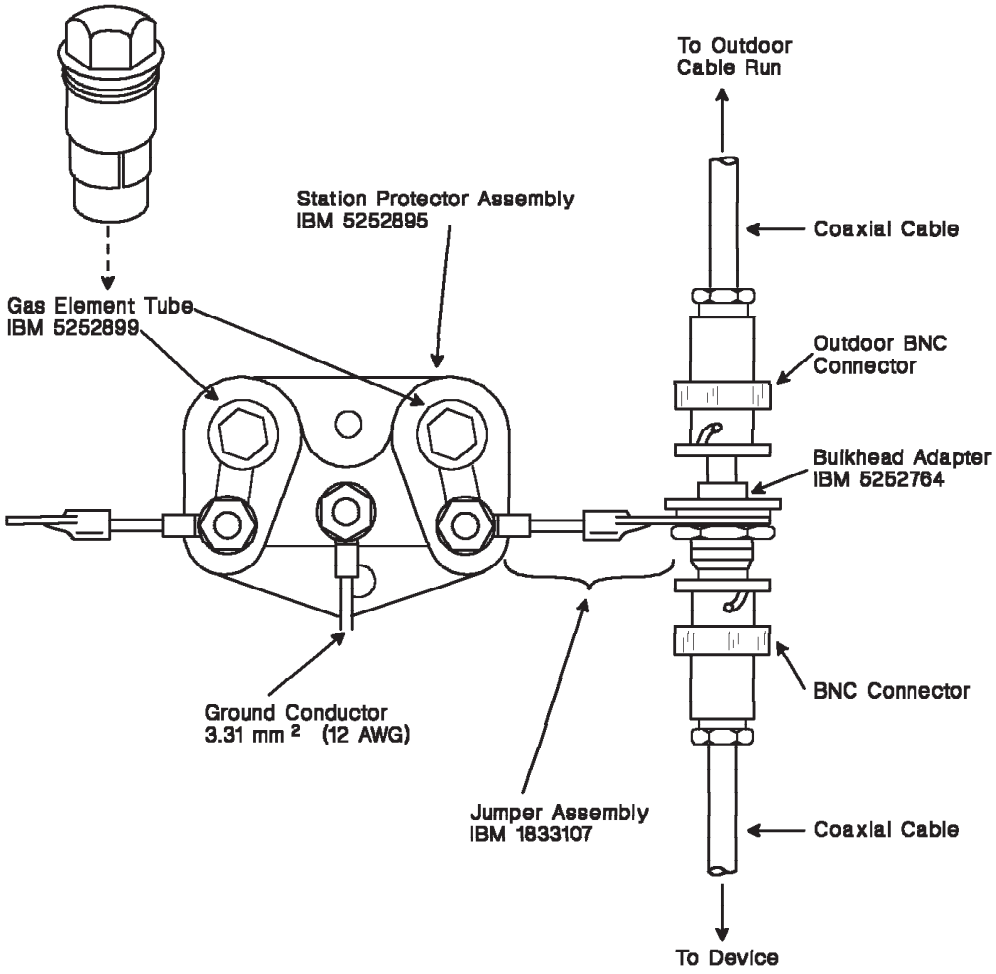

Figure 9. Station protector and its connection to coaxial cable

Labeling coaxial cables

When installing coaxial cables, attach a label containing the following information to both ends of each cable:

- The device to which the end being labeled is connected.
- The device to which the other end is connected.
- The physical location of the other end of the cable (use an identifier such as a building, floor, column, or other positive location information).
- The length of the cable run.
- The cable tag-out label.

Planning for cabling tests

IBM recommends that you test and label coaxial cables that you have ordered before the RS/6000 SP system is installed. Check completion tests on contracts for installation of cabling to ensure that there are no faults, high-resistance connections, or circuit imbalances.

IBM suggests that you check for the following faults:

- Open circuits in individual conductors or shields.
- Short circuits between conductors and shields.
- Grounds on individual conductors or shields.
- Short circuits between the shields of individual cables.

Preparing a site for coaxial cabling

Consider these important points before installing coaxial link cable:

- Cover coupling adapters with shrink tubing to prevent accidental grounding.
- Mount connectors and adapters on shock absorbing material to prevent vibration problems.
- Use non-conductive material for patch panels.

Transmission errors in a coaxial link are often related to the quality of cable, connectors, and adapters used in the installation. A cable or connection fault could cause significant signal distortion.

The level of externally-induced noise in a coaxial link increases with cable length. However, you can minimize externally-induced noise by increasing the space between the coaxial cable and the noise sources.

For more information about the installation of coaxial cable, refer to the *Installation and Assembly of Coaxial Cable and Accessories For Attachment to IBM Products*, GA27-2805.

Routing indoor cabling

When planning the layout of your RS/6000 SP, it is important to consider the distance between cables. Unshielded high-power or high-energy sources may require a large separation.

For voltage greater than 440 volts, consult your IBM representative for information on the minimum distances. For voltages up to 440 volts, use the following guidelines for minimum separation distances.

- The minimum distance between coaxial cable and fluorescent, neon, or incandescent lighting fixtures is 127 mm (5 in.).

- The minimum distance between coaxial cable and unshielded power lines or electrical equipment is a function of the power of the equipment.

  Table 12 provides guidelines for minimum distances between unshielded coaxial cables and unshielded power line cables for three different usages of separate, grounded, metallic conduits.

Table 12. Separation distances for separate grounded metallic conduits

Power of your equipment	Minimum distance
Neither cable in a conduit	
2 kVA or below	130 mm (5 in.)
2 to 5 kVA	300 mm (12 in.)
Over 5 kVA	610 mm (24 in.)
Either cable in a conduit	
2 kVA or below	70 mm (2.5 in.)
2 to 5 kVA	150 mm (6 in.)
Over 5 kVA	300 mm (12 in.)
Both cables in conduits	
2 kVA or below	30 mm (1.2 in.)
2 to 5 kVA	80 mm (3 in.)
Over 5 kVA	150 mm (6 in.)

Note: You can run cable in the same conduit as telephone lines without causing adverse effects.

Planning for unshielded twisted pair (UTP) cabling

This section contains planning information for twisted-pair Ethernet connections for both the SP LAN and any external LANs. For descriptions and illustrations of typical twisted-pair SP LAN networks, see “Typical SP LAN topologies” on page 79.

Ordering twisted-pair network components

IBM does not supply twisted-pair Ethernet cables or hubs. The customer must provide all cables, network hubs, LAN switches, and routers.

Requirements for twisted-pair cabling

Twisted-pair cables have four wires divided into two pairs. Each pair is evenly twisted together over their length which improves signal carrying characteristics by canceling out induced signals from external electrical sources. UTP connections running at 10 Mbps are called 10BASE-T; those running at 100 Mbps are known as 100BASE-TX. With UTP category 5 cable, 10BASE-T and 100BASE-TX cable lengths of up to 100 meters are possible.

Do not use ordinary phone cable in place of UTP since you can experience system problems. Regular phone cable contains parallel wires, resulting in excessive signal cross-talk that triggers CSMA/CD (Carrier Sense Multiple Access/Collision Detection) system responses.

Your cable segments might be longer or shorter than the nominal length due to the amount of cross-talk and signal attenuation in your particular environment. The actual distance you can extend twisted-pair Ethernet is based on a signal loss (or insertion loss) of 11.5 dB. When signal losses exceed this value, the signal is no longer reliable.

Insertion losses consist of the following:

- Signal attenuation in the Ethernet cable
- Signal attenuation in the connectors
- Losses resulting from mismatched components

100BASE-TX Ethernet alert

Due to limitations imposed by CSMA/CD on 100BASE-TX Ethernet networks, achieving the maximum cable length depends on an accurate network plan. See “Published Ethernet standards” for information sources to assist in planning these 100 Mbps Ethernet networks.

UTP terminations use RJ-45 connectors. However, some SP and control workstation Ethernet adapters require an external transceiver/media converter in addition to the RJ-45 jack. You must include all connectors and transceivers when measuring signal attenuation in your system.

To use twisted-pair in ***full-duplex*** mode there must be a native RJ-45 TP connector (no transceiver) at the node and an Ethernet switch must be used. Repeaters always work in half-duplex mode and send all IP packets to all ports such as in a 10BASE2 thin-wire environment. Thus, you achieve improved performance with native UTP connections and an Ethernet switch.

Twisted-pair Ethernet cable routing practices

The basic cable configuration for twisted-pair Ethernet is known as star wiring. Star wiring completes a network by routing cables from individual nodes directly into a central hub, repeater, or switch located outside of the SP frames. The hub processes incoming signals, makes the required connections, and directs the signal to its intended destination.

Although a UTP network has more cabling than thin-wire Ethernet, fault isolation is much easier with UTP and there are more opportunities for performance improvements.

The wire used in twisted-pair Ethernet networks must meet the following specifications:

- For 10BASE-T, wire can be EIA/TIA category 3, 4, or 5 unshielded twisted pair (UTP).
- For 100BASE-TX, wire must be EIA/TIA category 5 UTP.

Published Ethernet standards

The specification given in EIA/TIA-568 lists other cable and connector standards. EIA/TIA-569 describes standard wiring practices for running Ethernet cables.

EIA/TIA documentation is available from:

Global Engineering – 1-800-854-7179

Other Ethernet specifications are covered by IEEE 802.x standards. IEEE documents are available from:

Institute of Electrical and Electronic Engineers – 1-800-678-IEEE

Typical SP LAN topologies

This section contains information to assist you in deciding which topology you want to use. While not all possible setups are described here, the ones shown should be helpful in planning your SP LAN. Typical twisted-pair (UTP) and thin-wire (BNC) Ethernet network layouts, their advantages, and limitations are described and illustrated for comparison purposes.

The network topology you select depends mainly on the size of your SP system and should be planned on an individual basis. If the applications you plan to run perform significant communication among nodes, additional network connectivity should be provided by SP Switch, Ethernet, Token Ring, FDDI, or ATM networks. To avoid overloading the SP LAN with application traffic, it should be used only for SP node installations and system management tasks.

Shared or switched 100BASE-TX network

SP LANs used in systems populated exclusively with POWER3 SMP nodes can run at 100 Mbps including network installation. These setups require using unshielded twisted-pair (UTP) cabling.

One possible setup is to use a repeater capable of sustaining 100 Mbps with a fast Ethernet adapter in the CWS. This boosts the available bandwidth up to 100 Mbps but it is shared among all stations and connections are only half-duplex. Although the bandwidth is higher by a factor of ten compared to 10BASE2, an Ethernet switch which supports full-duplex at 100 Mbps provides improved performance over a repeater. Many node-to-node and node-to-CWS connections can be processed by the Ethernet switch simultaneously rather than with shared access through a repeater. As described in the previous section, the limiting factor for the quantity of simultaneous network installations of nodes is most likely the processing power of the CWS and not the network bandwidth.

For larger SP systems, the cabling needed to establish point-to-point connections can be extensive. However, switches with the required switching capabilities are available. An illustration of a 100BASE-TX network is shown in Figure 10 on page 80.

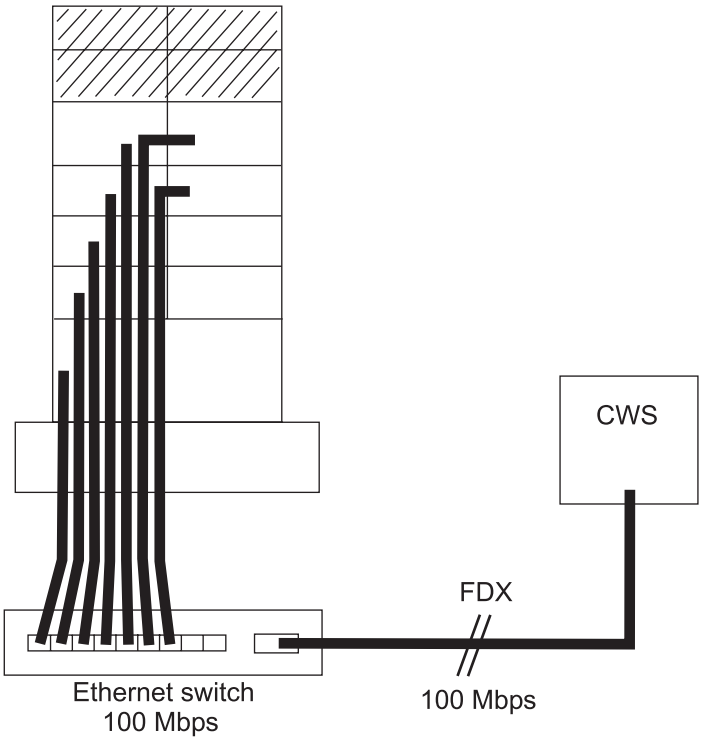

Figure 10. Shared or switched 100BASE-TX network

Heterogeneous 10/100 Mbps network

SP systems can be upgraded with new nodes having fast Ethernet connections while older or more lightly loaded nodes can continue to run with 10 Mbps SP LAN connections. In this case, you can use an Ethernet switch to provide a single LAN which connects to the CWS at 100 Mbps FDX. As illustrated in Figure 11 on page 81, one frame has new nodes with a 100 Mbps Ethernet which are individually cabled by 100BASE-TX UTP to ports of the Ethernet switch and operate in full-duplex mode. Two frames with older nodes having 10BASE2 cabling are connected to ports of the same Ethernet switch using BNC to UTP media converters.

In a similar case, you can use this same setup if a particular frame contains a mix of older nodes with 10 Mbps BNC and newer nodes with 100 Mbps UTP connections.

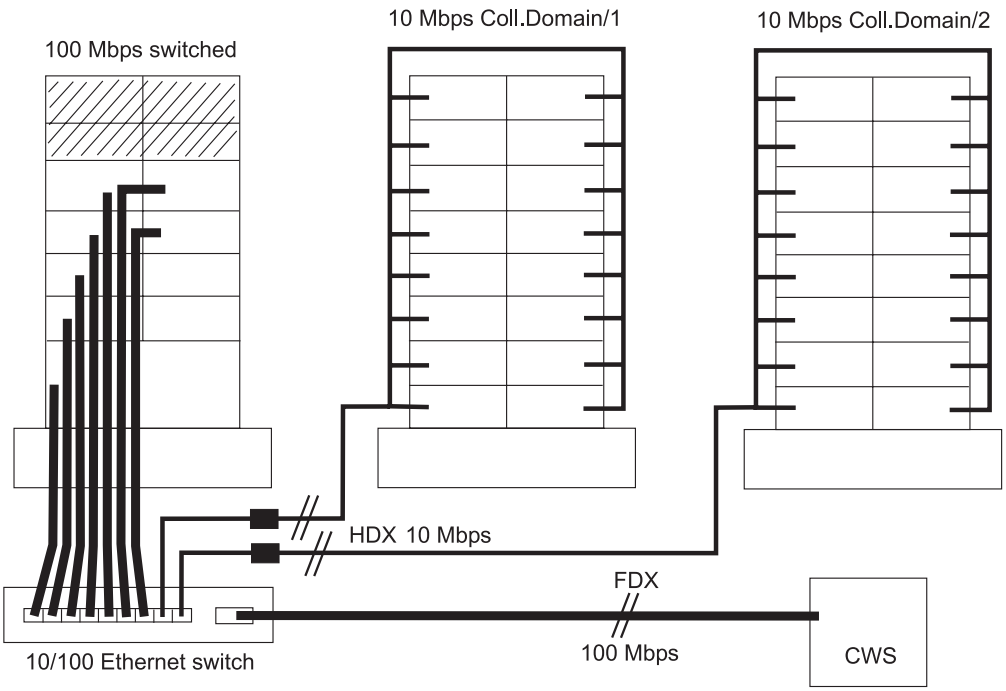

Figure 11. Heterogeneous 10/100 Mbps network

Shared 10BASE2 network

In small SP systems such as a single frame, the control workstation and the nodes typically share a single thin-wire Ethernet as illustrated in Figure 12.

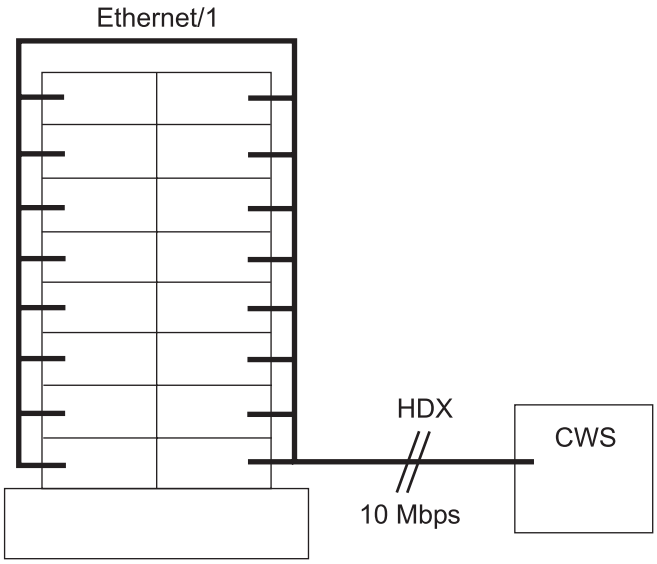

Figure 12. Shared 10BASE2 network

This network has the following properties:

- No routing is required since the CWS and all nodes share one subnet.
- The entire SP LAN is a single broadcast domain as well as a single collision domain.

- The CWS acts as the boot/install server for all nodes.
- Performance is limited to one 10 Mbps HDX connection at a time.
- Only six to eight network installs of SP nodes from the CWS NIM server can be performed simultaneously.

Even if this performance limitation is acceptable, this setup is limited by a maximum quantity of 30 stations on a 10BASE2 segment. In practice, no more than 16 to 24 stations should be connected to a single 10BASE2 Ethernet segment.

Segmented 10BASE2 network

Ethernet segmentation is used to overcome the limitations of a single shared Ethernet. The CWS is equipped with additional Ethernet adapters and each one is connected to a different shared 10BASE2 subnet as illustrated in Figure 13.

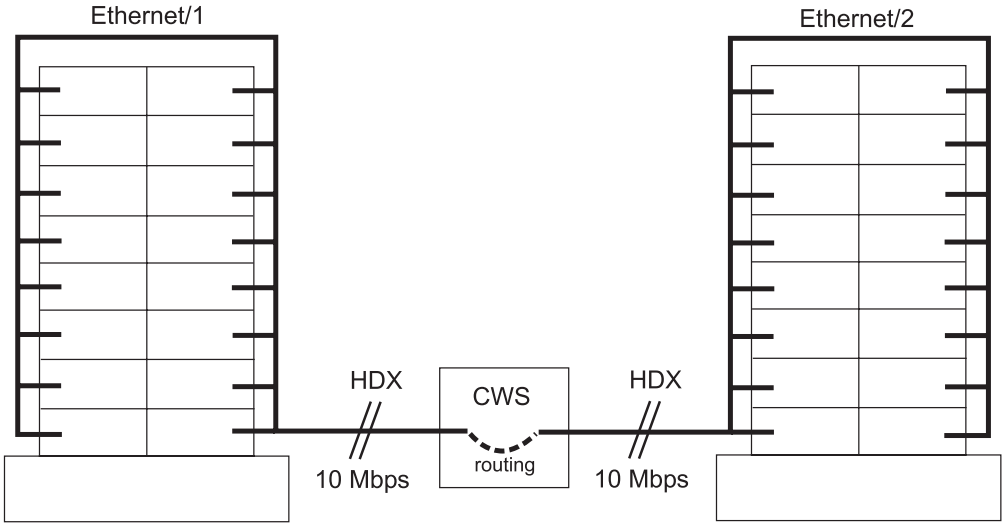

Figure 13. Segmented 10BASE2 network

A network with N separate subnets and N Ethernet cards in the CWS has the following properties:

- Nodes in one subnet need static routes to the (N-1) other subnets through the CWS and routing or IP forwarding must be enabled on the CWS.
- The SP LAN is split into N broadcast domains.
- The CWS acts as the boot/install server for all nodes since it is a member of all N subnets.
- Aggregate performance is limited to a maximum of N times 10 Mbps HDX. This is only achievable if the CWS communicates with one node in each of the subnets simultaneously.

Note: This approach is limited by the number of available adapter slots in the CWS and the ability of the CWS to simultaneously handle the traffic among these subnets or to serve 6N to 8N simultaneous network installations. In practice, no more than four subnets should be used.

Switched 10BASE2 network

A network which overcomes performance limitations in shared or segmented Ethernet networks is Ethernet switching, also known as micro-segmentation. Even

with an added router, this setup is usually preferable to a segmented network with boot/install servers from the viewpoints of performance, management, and complexity. This network is illustrated in Figure 14.

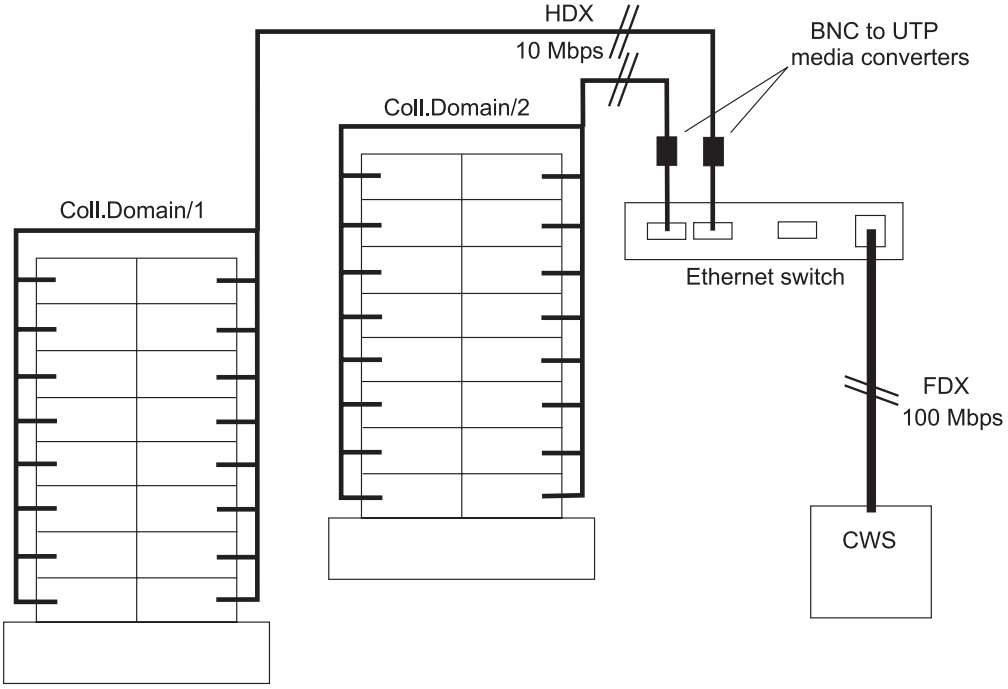

Figure 14. Switched 10BASE2 network

This network setup has the following properties:

- No routing is required. All Ethernet segments are transparently combined into one large LAN by the Ethernet switch.
- Node-to-node connections within a single Ethernet segment still have to share that 10BASE2 medium in half-duplex mode. However, many communications between different ports can be switched simultaneously by the Ethernet switch. The uplink to the CWS can be run at 100 Mbps in full-duplex mode.
- The CWS can act as the boot/install server for all nodes since the Ethernet switch combines the CWS and the nodes into one network or broadcast domain.

This setup eliminates the routing overhead for communications between nodes or a node and the CWS. With a 100 Mbps, full-duplex uplink to the CWS there should be no bottleneck in the connection to the CWS if the quantity of 10BASE2 segments is not much larger than ten. The CWS should be able to install six to eight nodes in each segment simultaneously since each segment is a separate collision domain. Rather than the network bandwidth, the limiting factor is the ability of the CWS to serve a very large quantity of NIM clients simultaneously. To quickly install a large SP system, it might still be useful to set up boot/install server nodes. However, this setup in itself does not neccesitate using boot/install servers.

Using this setup, the advantages of both a hierarchy of boot/install servers and a flat network with only the CWS acting as a NIM server are combined. Future installations of individual nodes can be served from the CWS. Note that if the BIS nodes are removed, the CWS is the only file collection server but this should not cause performance problems.

This type of network scales well to about 128 nodes. For larger systems, the fact that all switched Ethernet segments form a single broadcast domain can cause network problems if operating system services or applications frequently issue broadcast messages which can overload the network.

To avoid problems with broadcast traffic, no more than 128 nodes should be connected to a single switched Ethernet subnet. Larger systems should be set up with a suitable quantity of switched subnets. To be able to network boot and install from the CWS, each of these switched LANs must have a dedicated connection to the CWS. This can be achieved either through multiple uplinks between one Ethernet switch and the CWS or through multiple switches which each have a single uplink to the CWS.

Planning for SP Switch and SP Switch2 cabling

The processor nodes in a switched SP system are connected to the internal ports of node switch boards by switch-to-node cables. Node switch boards can be installed in SP frames containing processor nodes as well as in Models 555/6/7/8. External ports in each switch are also connected to the external ports in every other switch by switch-to-switch cables. You need to plan for the cables that interconnect each switch in multi-switch systems. This section helps you determine the switch-cable lengths and quantities you need for both new systems and for any future expansion.

Note: SP systems with ***up to five*** SP Switches or SP Switch2s, which are known as one-stage switch configurations, do not require a dedicated switch frame. Systems with ***more than five*** switches, which are known as two-stage configurations, do require an SP Switch Frame (F/C 2031/2/4). The intermediate switch board ports in these frames interconnect all the node switch boards in the system.

Switch planning considerations

Switch planning involves many other tasks besides selecting cables. Node placement, node addressing, and system partitioning are just three of the vital issues that you must consider when planning your switch layout. Make certain that you consult *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment* for software-related switch planning issues before you finalize your switch cabling plans.

Considerations for future switch expansion

For systems with one to five switches which require only one-stage switching, you might want to initially install an SP Switch Frame if you plan to scale up to a two-stage configuration at a later time.

The switch cabling is much simpler in a two-stage switch configuration due to the SP Switch frame, as you can see by comparing Figure 15 on page 86 to Figure 16 on page 86. Installing an SP Switch Frame initially greatly simplifies future expansion by eliminating the need to re-cable your switch fabric every time you add another switch.

For information on using an SP Switch Frame in a one-stage system, consult your IBM account representative.

Switch-to-node cabling

This section is provided as reference information only since you do not need to specifically order switch-to-node cabling. Switch-to-node cables are automatically ordered and shipped with your system according to configurator rules.

The internal switch ports in a switch-equipped frame are connected to the nodes in that frame as well as to the nodes in its non-switched expansion frames.

As an example, consider a Model 550 frame containing four high nodes and an SP Switch. The switch has sixteen ports; the four nodes within that model frame are connected to four of the switch ports with four 2-meter cables. The rest of the ports can be used by up to twelve additional nodes mounted in non-switched expansion frames. In this example, twelve 10-meter cables are provided to connect the switch to the nodes in the non-switched expansion frames.

The following cables are automatically ordered to connect the switch ports to the switch adapters in the processor nodes:

- **F/C 9302** – 2.6-m switch-to-node cable (for nodes within the switch-equipped frame)
- **F/C 9310** – 10-m switch-to-node cable (for nodes in non-switched expansion frames)

Planning for switch-to-switch cabling

Use this section to plan for the cable connections between the external switch ports in multi-switch SP systems.

Issues that you must consider when planning switch cable connections include:

1. Determining the quantity of cables required
2. Determining the length of required cables
3. Minimizing cable lengths to reduce latency
4. Placing cables to reduce noise from other switch cables and ac sources
5. Making certain that your raised floor is high enough to contain all cables
6. Placing cables so that cooling air flow is unrestricted through raised floor space
7. Labeling and laying cables in an orderly manner, to allow for improved maintenance and reduced risk of mechanical failure
8. Placing cables and frames to allow for system growth

Switch-to-switch cable path illustrations

This section contains illustrations of typical switch-cable paths between the external switch ports in node switch boards. Use these to help in determining the cables that you need for your system. The actual calculations you use to determine cable quantities and lengths are given in the following sections.

For two-plane installations, the cabling requirements described in the following two sections are doubled.

One-stage switch cabling: In SP systems with one-stage switching, the external ports in each node switch board are connected to the external ports in every other node switch board with a minimum of four individual cables. You must determine the switch-cable lengths and quantities required for each of these connections. Figure 15 on page 86 illustrates one-stage configurations with from two to five switches.

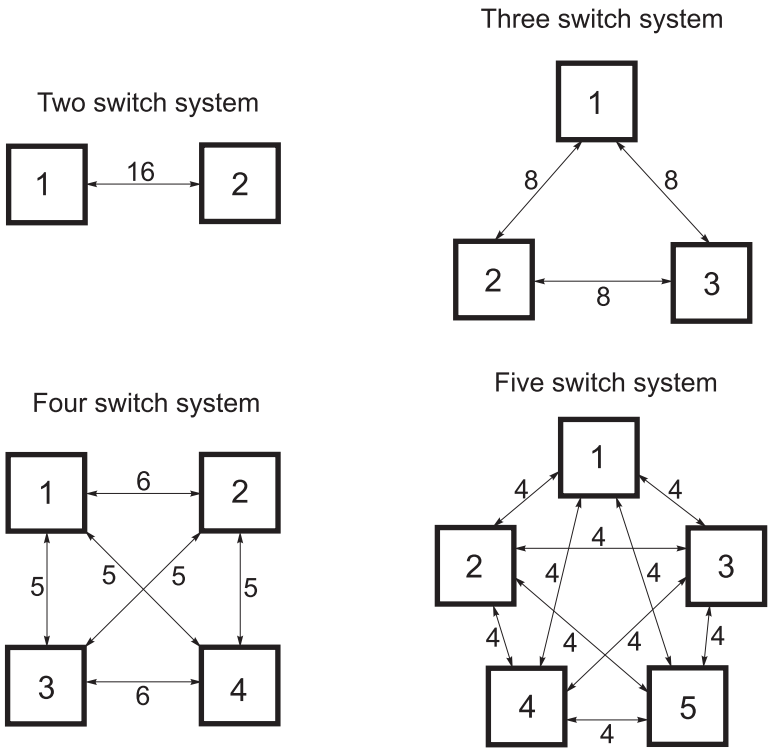

Figure 15. One-stage switch cable paths. The numbered squares represent the node switch boards and the arrows are the cable sets with the quantity of individual cables in each set indicated. (Switch-to-node cabling is not shown.)

Two-stage switch cabling: An SP Switch Frame (**F/C 2031**) or SP Switch2 Frame (**F/C 2032**) is required for systems using more than five switches (known as two-stage switching). The external ports in each node switch board in a two-stage system are connected to the intermediate switch boards in the switch frame. Figure 16 illustrates an example of a two-stage switch configuration having eight switches.

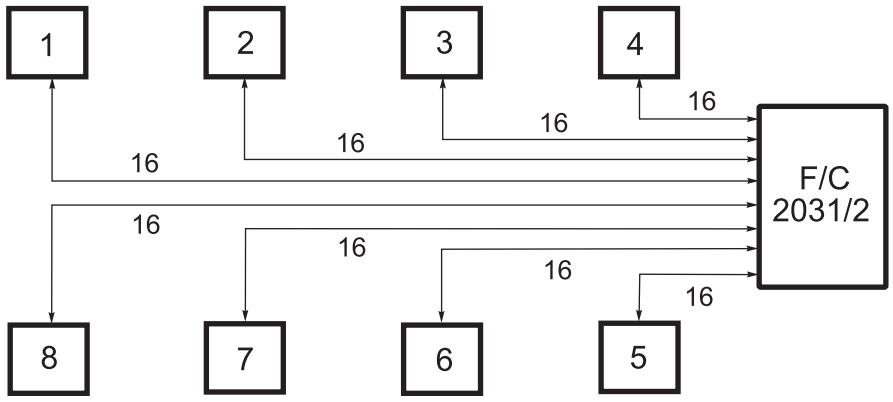

Figure 16. Two-stage switch cable paths. The numbered squares represent the switches and the arrows are the cable sets. Each cable set has 16 individual cables as indicated. (Switch-to-node cabling is not shown.)

Planning for two-plane switch cabling

If you plan to implement the two-plane feature of the SP Switch2, the requirements for the quantity of switches and their interconnecting cabling are doubled as compared to a single switch plane configuration. Each node contains two SP

Switch2 adapters. One set of switch adapters are connected to the internal switch ports in the SP Switch2 in the model and switched expansion frames, while the other set of adapters are connected to the internal switch ports in the SP Switch2 in the first expansion frames. As in single switch plane configurations, all switch-to-node cables are automatically ordered and shipped with your system according to configurator rules.

Since the requirements for quantities of switches are doubled, double the quantities of cables for two-plane configurations as you use the following sections.

Determining switch-to-switch cable quantities

The quantity of switch cables depends on the quantity of switch-equipped frames in the system. Use Table 13 to determine quantities required for standard switch configurations. After determining the quantity and lengths of cables you need, use that information to fill in Table 15 on page 89.

Table 13. Quantities of switch-to-switch cables required per SP system

Switch configuration type	Quantity of switch-equipped frames (excluding SP Switch frame)	Quantity of cables between any two switches	Total quantity of cables required	Illustration
One-stage	1	N/A	N/A	(not shown)
One-stage	2	16	16	Figure 15 on page 86
One-stage	3	8	24	Figure 15 on page 86
One-stage	4	5 / 6 (See note 1)	32	Figure 15 on page 86
One-stage	5	4	40	Figure 15 on page 86
Two-stage configurations requiring SP Switch frames				
Two-stage	6	16	96	(not shown)
Two-stage	7	16	112	(not shown)
Two-stage	8	16	128	Figure 16 on page 86

Notes:

1. Frames 1 to 2 and Frames 3 to 4 require six cables; all other paths require five.
2. Each cable is approximately 0.5 in. in diameter. IBM recommends that these cables be routed in a customer-supplied raceway or similar protective device to help prevent damage, both in raised and non-raised floor environments.

Determining switch-to-switch cable lengths

Use the following procedure to calculate the actual length required for each cable connecting switch-equipped frames:

1. First develop your floor plan to determine frame placement (see Chapter 18, “Floor planning” on page 175).
2. Calculate the cable lengths required between switch-equipped frames using the following formula:

Cable Length Formula

Cable Length = (Floor Distance) + (2 x Floor Depth) + (Frame Routing)

Where:

- *Floor Distance* = The manhattan distance between frames; the sum of the x and y distances following the 90-degree junctions:
  - For systems with one-stage switching, measure the over-the-floor distance from the rear-center of each switch-equipped frame to the rear-center of every other switch-equipped frame.
  - For systems with two-stage switching, measure from the rear-center of each switch-equipped frame to the rear-center of the SP Switch Frame (F/C 2031) or SP Switch2 Frame (F/C 2032).
- *Floor Depth* = Raised-floor depth measured from the surface of the subfloor to the top surface of the raised floor.
- *Frame Routing* = The length of cable required within the frame:
  - If frames are facing in the same direction – 2 m (6.5 ft.)
  - If frames are facing in opposite directions – 2.8 m (9.5 ft.)
  - For two-stage switch configurations – 4.8 m (16 ft.)

3. As a check, use Table 14 to record the switch-to-switch cable length for each path. Use the following procedure:
   a. Cross out the table cells that do not apply. For example, if you are planning a three-frame system, cross out cells 4 and 5 in each row and column, as well as the column for F/C 2031/2.
   b. Since cables run directly from the switch-equipped expansion frames to the SP Switch frame in a two-stage switch configuration, cross out all table cells except those under F/C 2031/2 for systems using this configuration.
   c. For each switch in the left column, record the cable length required to reach the switch in the frames listed to the right.

Table 14. Switch cable length tracking chart

	To switch in frame number:					
From switch in frame number:	1	2	3	4	5	F/C 2031/2
1	N/A					
2	N/A	N/A				
3	N/A	N/A	N/A			
4	N/A	N/A	N/A	N/A		
5	N/A	N/A	N/A	N/A	N/A	
6	N/A	N/A	N/A	N/A	N/A	
7	N/A	N/A	N/A	N/A	N/A	
8	N/A	N/A	N/A	N/A	N/A	
For SP systems requiring more than eight switch-equipped frames, contact your IBM account representative.						

4. After you determine the quantity and lengths of cables you need, use that information to fill in Table 15 on page 89 in “Recording your switch-to-switch cable requirements” on page 89.

Recording your switch-to-switch cable requirements

Use the switch cables listed here for switch-to-switch connections between switch-equipped frames. You can choose from the following lengths:

- **F/C 9305**: 5-meter (16 ft.)
- **F/C 9310**: 10-meter (33 ft.)
- **F/C 9315**: 15-meter (49 ft.)
- **F/C 9320**: 20-meter (66 ft.)

It is important that you select the cable size longer than, but as close to, the size you require. Spending the time to calculate the ideal length for each cable enhances your SP system operational efficiency by giving you optimal switch signal performance. Also, with less cable occupying underfloor area, there is improved cooling air flow and better maintenance access.

Use Table 15 to record and check the quantity of switch-to-switch cables required for a new system installation. Fill in the quantity of cables needed per length based on your measurements. To check your work, be sure the total quantity of cables calculated in Table 15 equals the total quantity of cables listed in Table 13 on page 87 for your size system.

Table 15. Quantity of switch-to-switch cables per length for a new SP system

	Quantity of Cables				
	5 Meter F/C 9305	**10 Meter** F/C 9310	**15 Meter** F/C 9315	**20 Meter** F/C 9320	**Total Quantity of Cables**
Quantity of cables in a new installation					

Planning switch cable requirements for future expansion

Use Table 16 to calculate the quantity of switch cables to order for an expanding system:

1. Fill in the quantity of switch cables in the initial (or existing) system for each cable length.
2. Based on your floor plan for the expanded system, calculate the cable length required between frames. (See “Determining switch-to-switch cable lengths” on page 87.)
3. Fill in the quantity of switch cables in the expanded system for each cable length (and check against Table 13 on page 87).
4. Calculate the difference between the quantity of cables in the initial system and the quantity in the expanded system.
5. Order the cables required for expansion.

Table 16. Quantity of switch cables to order for an expanded SP system

	Cable Type			
	5 Meters F/C 9305	**10 Meters F/C 9310**	**15 Meters F/C 9315**	**20 Meters F/C 9320**
Quantity of cables in the expanded system:				
Quantity of cables in the initial system:				

Table 16. Quantity of switch cables to order for an expanded SP system (continued)

	Cable Type			
	5 Meters F/C 9305	**10 Meters F/C 9310**	**15 Meters F/C 9315**	**20 Meters F/C 9320**
Quantity of cables to be ordered for expansion:				

Chapter 13. PCI adapter rules and requirements

This chapter contains information on the quantities of adapters of each type that can be installed in specific node types, suggested quantities to use, and adapter placement rules and restrictions. Information for withdrawn adapters is included for planning purposes, since you might want to move an existing adapter to another node.

Note: Availability of these adapters, as well as recommended quantites and restrictions on their use are subject to updates between editions of this book. For the latest adapter information, consult your IBM account representative.

PCI bus I/O adapter requirements for SMP nodes

If you install the maximum permissible quantity of adapters in the processor nodes, you can achieve ***maximum connectivity*** for the nodes in your system. Use Table 18 on page 92 to determine the maximum quantity of adapters you can use and to determine the resulting power load.

Improved I/O performance, or ***optimum operation***, can usually be realized if you install fewer than the maximum quantity of adapters. For guidelines to help you achieve this improved performance, see “Optimum operation for PCI adapters” on page 98.

To effectively use the information in this chapter, you need to know the PCI bus and slot naming conventions; for these, see “PCI bus group and slot descriptions”.

For important installation restrictions for specific adapters, see “PCI adapter plugging rules and restrictions” on page 95.

PCI bus group and slot descriptions

This section contains details on PCI bus group and slot naming and labeling conventions for the RS/6000 SP.

PCI bus slot labeling

In wide nodes, two slots are labeled I2 and two are labeled I3 . They are differentiated in this book as I2 and I3 ***(CPU side)*** and I2 and I3 ***(I/O side)***.

Viewed as you face the side of the node with the slot labels, CPU side is on the left and I/O side is on the right.

Descriptions of PCI bus group numbering, bus type, slot width and slot speed for POWER3 and 332 MHz SMP nodes are shown in Table 17.

Table 17. PCI bus descriptions for SMP nodes

Node type	Bus group	Bus type	Slot numbers	Slot width	Slot speed
375 MHz POWER3 and POWER3 High	0	Primary	I1	32-bit	33 MHz
	0	Primary	I2 and I3	64-bit	33 MHz
	1	Primary	I4 and I5	64-bit	33 MHz
SP Expansion I/O	0-3	Primary	I1 to I8	64-bit	33 MHz

Table 17. PCI bus descriptions for SMP nodes (continued)

Node type	Bus group	Bus type	Slot numbers	Slot width	Slot speed
375/450 MHz POWER3 and POWER3 Wide	1	Primary	I2 and I3 (CPU side)	32-bit	33 MHz
	2	Primary	I1 to I4 (I/O side)	64-bit	33 MHz
	3	Primary	I5 to I8 (I/O side)	64-bit	33 MHz
375/450 MHz POWER3 and POWER3 Thin	1	Primary	I2 and I3	32-bit	33 MHz
332 MHz Wide	1	Primary	I2 and I3 (CPU side)	32-bit	33 MHz
	2	Primary	I1 to I4 (I/O side)	(See Note 1)	33 MHz
	3	Secondary	I5 to I8 (I/O side)	32-bit	33 MHz
332 MHz Thin	1	Primary	I2 and I3	32-bit	33 MHz

Notes:

1. Slot I1 through I3 (I/O side) are 64-bit slots; slot I4 is a 32-bit slot

PCI adapter maximum quantities

The maximum quantities of adapters for POWER3 and 332 MHz SMP Thin and Wide nodes are shown in Table 18.

POWER3 High Nodes and SP Expansion I/O Units are shown in Table 19 on page 94.

Quantities suggested for improved performance are shown in “Optimum operation for PCI adapters” on page 98.

375/450 MHz POWER3, POWER3, and 332 MHz SMP Thin and Wide nodes

Table 18. Maximum quantities of PCI adapters for SMP thin and wide nodes

F/C	Adapter name	Max. per node wide / thin	Notes
2732	Serial HIPPI Channel	2 / 1	
2733	Serial HIPPI Channel	2 / 1	
2741	FDDI SK-NET LP SAS	4 / 2	1
2742	FDDI SK-NET LP DAS	4 / 2	1
2743	FDDI SK-NET UP SAS	4 / 2	1
2751	S/390 ESCON	3 / 1	2
2920	Token-Ring Auto Lanstream	8 / 2	
2943	RS-422 8-port Async.	6 / 2	
2944	WAN RS232 128-port	7 / 2	

Table 18. Maximum quantities of PCI adapters for SMP thin and wide nodes (continued)

F/C	Adapter name	Max. per node wide / thin	Notes
2946	Turboways ATM	2 / 0	
2947	ARTIC960Hx 4-port selectable	8 / 2	4
2962	2-port Multiprotocol Adapter	8 / 2	4
2963	ATM Turboways 155 UTP	4 / 2	1
2968	Ethernet 10/100 MB	6 / 2	1, 5
2969	Gigabit Ethernet-SX	3 / 1	2
2975	10/100/1000 BASE-T Ethernet	3 / 1	2
2985	Ethernet 10 MB BNC	8 / 2	
2987	Ethernet 10 MB AUI	8 / 2	
2988	ATM 155 MMF	4 / 2	1
4951	Four-port 10/100 LAN	3 / 1	2
4953	ATM 155 UTP	4 / 2	
4957	ATM 155 MMF	4 / 2	
4958	Crypto	4 / 0	
4959	Token-Ring	6 / 2	
4960	Crypto Accelerator	4 / 1	
4962	10/100 Ethernet	6 / 2	1, 5
4963	Crypto coprocessor	4 / 0	
6203	Dual Ultra3 SCSI	3 / 1	3
6204	Ultra SCSI DE	6 / 2	3
6205	Dual Channel Ultra2 SCSI	3 / 1	2
6206	Ultra SCSI SE	6 / 2	8
6207	Ultra SCSI DE	6 / 2	8
6208	SCSI-2 F/W SE	8 / 2	
6209	SCSI-2 F/W DE	8 / 2	
6215	SSA RAID 5	6 / 2	
6222	F/W Cache Option	mounts on 6215	
6225	SSA RAID EL	6 / 2	7
6227	FC-AL	4 / 2	6
6228	FC-AL 64-bit	4 / 2	6
6230	SSA RAID EL	6 / 2	7
6231	128 MB DIMM Option	mounts on 6225 and 6230	
6235	Fast-Write Cache Option for F/C 6225	mounts on 6225 and 6230	
6310	ARTIC960RxD Quad Digital Trunk	3 / 2	5
6311	ARTIC960RxF Digital Trunk Resource	3 / 1	3

Table 18. Maximum quantities of PCI adapters for SMP thin and wide nodes (continued)

F/C	Adapter name	Max. per node wide / thin	Notes

Notes:

1. Group restrictions apply. For details, see “PCI adapter plugging rules and restrictions” on page 95.
2. Quantity of two (2) for POWER3 and 332 MHz Wide Nodes.
3. Used ***only*** in 375/450 MHz POWER3 SMP Thin and Wide nodes.
4. Quantity of six (6) for 332 MHz Wide Nodes.
5. Quantity of four (4) for POWER3 and 332 MHz Wide Nodes.
6. Quantity of three (3) for POWER3 and 332 MHz Wide Nodes.
7. Quantity of one (1) for 332 MHz Thin Nodes and quantity of two (2) for 332 MHz Wide Nodes.
8. Quantity of four (4) for 332 MHz Wide Nodes.

375 MHz POWER3, POWER3 High Node, and SP Expansion I/O Unit

The maximum quantities for 375 MHz POWER3 High Nodes, POWER3 High Nodes, SP Expansion I/O Units, and node/expansion unit combinations are shown in Table 19.

Table 19. Maximum quantities of PCI adapters for 375 MHz POWER3 and POWER3 High Nodes and SP Expansion I/O Units

F/C	PCI adapter name	Max. per node	Max. per expansion unit	Combined (Note 1)	Combined (Note 2)
2732	Serial HIPPI SW	1	3	8	8
2733	Serial HIPPI LW	1	3	8	8
2741	FDDI SK-NET LP SAS	5	8	24	24
2742	FDDI SK-NET LP DAS	5	8	24	24
2743	FDDI SK-NET UP SAS	5	8	24	24
2751	S/390 ESCON	0	4	10	10
2920	Token Ring Auto Lanstream	5	8	24	24
2943	RS-422 8-port Async.	5	0	5	5
2944	WAN RS232 128-port	5	0	5	5
2946	Turboways ATM	1	2	8	12
2947	ARTIC960Hx 4-port selectable	4	8	24	24
2962	2-port Multiprotocol Adapter	5	8	24	24
2963	ATM Turboways 155 UTP	3	8	16	24
2968	Ethernet 10/100 MB	3	8	24	24
2969	Gigabit Ethernet-SX	1	2	8	12
2975	10/100/1000 BASE-T Ethernet	1	2	8	12
2985	Ethernet 10 MB BNC	5	8	24	24
2987	Ethernet 10 MB AUI	5	8	24	24
2988	ATM 155 MMF	3	8	24	24

Table 19. Maximum quantities of PCI adapters for 375 MHz POWER3 and POWER3 High Nodes and SP Expansion I/O Units (continued)

F/C	PCI adapter name	Max. per node	Max. per expansion unit	Combined (Note 1)	Combined (Note 2)
4951	Four-port 10/100 LAN	1	3	6	12
4953	ATM 155 UTP	3	8	24	24
4957	ATM 155 MMF	3	8	24	24
4958	Crypto	2	4	4	4
4959	Token Ring	3	8	24	24
4960	Crypto Accelerator	2	4	4	4
4962	10/100 Ethernet	3	8	24	24
4963	Crypto coprocessor	2	4	4	4
6203	Ultra3 SCSI (Note 3)	1	2	N/A	8
6204	Ultra SCSI DE	3	8	24	24
6205	Dual Channel Ultra2 SCSI	1	2	6	8
6206	Ultra SCSI SE	3	8	24	24
6207	Ultra SCSI DE	3	8	24	24
6215	SSA RAID 5	2	4	24	24
6222	F/W Cache Option	(mounts on 6215)			
6225	SSA RAID EL	2	2	12	16
6227	FC-AL	3	3	11	15
6228	FC-AL 64-bit	3	3	11	15
6230	SSA RAID EL	2	2	12	16
6231	128 MB DIMM Option	(mounts on 6225 and 6230)			
6235	Fast-Write Cache Option	(mounts on 6225 and 6230)			
6310	ARTIC960RxD Quad Digital Trunk	3	0	3	3
6311	ARTIC960RxF Digital Trunk Resource	3	0	3	3

Notes:

1. The maximum quantity of adapters supported for a specific POWER3 SMP High Node and six (6) SP Expansion I/O Units connected to that node.
2. The maximum quantity of adapters supported for a specific 375 MHz POWER3 SMP High Node and six (6) SP Expansion I/O Units connected to that node.
3. Cannot be used in POWER3 SMP High Node.

PCI adapter plugging rules and restrictions

This section lists specific PCI adapter installation rules and restrictions by node type.

375 MHz POWER3 and POWER3 High Node and SP Expansion I/O Unit

- F/C 2732, 2733, 2746, 2751, 2969, 2975, 4951, 6205, 6225, 6227, 6228, 6230 cannot occupy the same PCI bus; the other slot in that bus should be empty. For failover redundancy, two F/C 6227 or 6228 can be installed in slots I2 and I3 on the first PCI bus.
- The combined quantity of F/C 2732 and 2733 cannot exceed the maximum quantity listed for either one.
- F/C 2963, 2988, 4953, 4957 cannot be placed in the adjacent slot to the right of F/C 2751.
- F/C 2751 must be placed only in expansion unit 3, 4, or 5. If installed in a system with one expansion unit, that unit must be connected as unit 4 (connectors Q3 and Q4).
- The combined quantity of F/C 6225 and 6230 cannot be more than two per PCI bus with a maximum of 96 SSA drives.
- F/C 6311 requires one 6310; combined quantity cannot be more than four.
- F/C 2498, 2946, 2969, 2975, 4951, 6203, 6205 restricted to node slot 5 and expansion unit slot 1 and 3.
- F/C 2732, 2733 restricted to node slot 5 and expansion unit slot 1, 3, and 5.
- F/C 2947, 6310 restricted to node slot 2, 3, 4, and 5.
- F/C 6204, 6206, 6207 restricted to node slot 3, 4, and 5.
- F/C 6225 restricted to node slot 3 and 5 and expansion unit slot 1 and 3.
- F/C 6227, 6228 restricted to node slot 3 and 5 and expansion unit slot 1, 3, and 5.

375/450 MHz POWER3 Wide and Thin Node

- No more than six (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
  - If the total combined quantity of F/C 2946, 2969, 2975, 4951 is one, no more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
  - If the total combined quantity of F/C 2946, 2969, 2975, 4951 is two, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
  - If the total combined quantity of F/C 2946, 2969, 2975, 4951 is three, none of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
- F/C 2732, 2733, 2946, 2969, 2975, 4951, 6205, 6225, 6227, 6228, 6230 cannot occupy the same PCI bus. For failover redundancy, two F/C 6227 or 6228 can be installed in slots I2 and I3 on the first PCI bus.
- The combined quantity of F/C 6225 and 6230 cannot be more than two per PCI bus with a maximum of 96 SSA drives.
- The combined quantity of F/C 2732 and 2733 cannot exceed the maximum quantity listed for either one.
- F/C 4958 cannot be placed in slot I1 or I2 (CPU side)
- F/C 6311 requires one 6310.
- F/C 2751 must be placed in either slot I3 (CPU side) or in slot I4.
- If one F/C 2969 or 2975 is installed, place it in slot I1 through I8 (I/O side).
- If two F/C 2969 or 2975 are installed, place one in slot I1 through I4 (I/O side) and the other in slot I5 through I8.
- If two F/C 6225 or 6230 are installed, place each in a separate PCI bus.

- If two F/C 2732 are installed, one must be placed in slot I2 or I3 (CPU side) and the other must be placed in slot I1 to I4 (I/O side).
- If two F/C 2733 are installed, one must be placed in slot I2 or I3 (CPU side) and the other must be placed in slot I1 to I4 (I/O side).
- F/C 2963, 2988, 4953, 4957 cannot be placed in slot I5.
- F/C 6205 cannot be placed in slot I5 to I8.
- Maximum of one F/C 6203 per PCI bus
- Maximum of one F/C 4951 per PCI bus

375/450 MHz POWER3 SMP Thin Node exceptions:

- F/C 2751 must be placed in slot I3. (If only one of any other adapter is installed, placing the other adapter in slot I2 initially avoids moving it if you install F/C 2751 later.)

POWER3 Wide and Thin Node

- No more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
  - If the total combined quantity of F/C 2946, 2969, 2975, 4951 is one, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
  - If the total combined quantity of F/C 2946, 2969, 2975, 4951 is two, none of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
- F/C 2732, 2733, 2946, 2969, 2975, 4951, 6205, 6225, 6227, 6228, 6230 cannot occupy the same PCI bus. For failover redundancy, two F/C 6227 or 6228 can be installed in slots I2 and I3 on the first PCI bus.
- The combined quantity of F/C 6225 and 6230 cannot exceed two per PCI bus.
- The combined quantity of F/C 2732 and 2733 cannot exceed the maximum quantity listed for either one.
- The combined quantity of F/C 6225 and 6230 cannot be more than two per PCI bus with a maximum of 96 SSA drives.
- F/C 2751 must be placed in either slot I3 (CPU side) or in slot I4.
- If one F/C 2969 or 2975 is installed, place it in slot I1 through I8 (I/O side).
- If two F/C 2969 or 2975 are installed, place one in slot I1 through I4 (I/O side) and the other in slot I5 through I8.
- F/C 6205 cannot be placed in slot I5 to I8.
- If two F/C 2732 are installed, one must be placed in slot I2 or I3 (CPU side) and the other must be placed in slot I1 to I4 (I/O side).
- If two F/C 2733 are installed, one must be placed in slot I2 or I3 (CPU side) and the other must be placed in slot I1 to I4 (I/O side).
- F/C 2963, 2988 cannot be placed in slot I5.
- Maximum of one F/C 4951 per PCI bus

POWER3 Thin Node exceptions:

- F/C 2751 must be placed in slot I3. (If only one of any other adapter is installed, placing the other adapter in slot I2 initially avoids moving it if you install F/C 2751 later.)

332 MHz Wide and Thin Node

- No more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.

  - If the total combined quantity of F/C 2946, 2969, 2975, 4951 is one, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
  - If the total combined quantity of F/C 2946, 2969, 2975, 4951 is two, none of F/C 2741, 2742, 2743, 2963, 2968, 2988, 4953, 4957, 4962 can be installed.
- F/C 2732, 2733, 2946, 2969, 2975, 4951, 6205, 6225, 6227, 6228, 6230 cannot occupy the same PCI bus. For failover redundancy, two F/C 6227 or 6228 can be installed in slots I2 and I3 on the first PCI bus.
- The combined quantity of F/C 2732 and 2733 cannot exceed the maximum quantity listed for either one.
- If two F/C 2751 are installed, place one in slot I3 (CPU side) and the other in slot I4, except – If F/C 2969 is placed in slot I4, F/C 2751 must be placed in slot I3 (I/O side).
- If one F/C 2969 or 2975 is installed, place it in slot I2 or I3 (CPU side) or in slot I4.
- If two F/C 2969 or 2975 are installed, place one in slot I2 or I3 (CPU side) and the other in slot I4.
- If two F/C 6225 or 6230 are installed, place one in slot I2 or I3 (CPU side) and the other in slot I4.
- If two F/C 2732 are installed, place one in slot I2 or I3 (CPU side) and the other in slot I1 to I4 (I/O side).
- If two F/C 2733 are installed, place one in slot I2 or I3 (CPU side) and the other in slot I1 to I4 (I/O side).
- F/C 2751, 2947, 2962, 2963, 2969, 2975, 2988, 4951, 6206, 6207, 6215, 6225, 6310 cannot be placed in slot I5 to I8; F/C 2968 (when operating in 100 Mbps mode) cannot be placed in slot I5 to I8; F/C 6208 and 6209 (when operating in Fast/Wide mode to tape) cannot be placed in slot I5 through I8.
- F/C 2732, 2733, 2946, 4953, 4957, 4958, 4963 6227, 6228, 6230 cannot be placed in slot I5 through I8.
- Maximum of one F/C 4951 per PCI bus

332 MHz Thin Node exceptions:

- F/C 2751 must be placed in slot I3. (If only one of any other adapter is installed, placing the other adapter in slot I2 initially avoids moving it if you install F/C 2751 later.)

Optimum operation for PCI adapters

The guidelines in this section help you configure your PCI nodes for optimum operation with good throughput for each adapter. To achieve this, each adapter type is assigned a ***weighting factor***, which provides the following:

1. Estimates of the quantity of adapters to use concurrently
2. The bus locations for the different adapter types

Weighting factors for PCI adapters

The weighting factors are based on the node and PCI bus architecture, and processor and memory utilization for larger I/O read and write operations. (Larger and smaller I/O reads and writes refers to the basic I/O payload.) Nodes are assumed to have the maximum quantity of CPUs along with sufficient memory as required by a particular application.

Smaller I/O reads and writes increase the required node resources and decrease the quantity of adapters from that which is suggested for optimum operation.

The weighting factor for each PCI adapter type is shown in Table 20.

Table 20. PCI adapter weighting factors

Feature	Description	Type	Weighting factor	Notes
2732	Serial HIPPI SW	Comm	High	
2733	Serial HIPPI LW	Comm	High	
2741	FDDI LP SAS	Comm	Low	
2742	FDDI LP DAS	Comm	Low	
2743	FDDI UP SAS	Comm	Low	
2751	ESCON CU Emulation	Comm	Medium	
2920	Token Ring	Comm	Low	
2943	WAN RS232, 8-port	Comm	Low	
2944	WAN RS232, 128-port	Comm	Low	
2946	Turboways ATM	Comm	High	
2947	ARTIC960Hx, Multi 4-port	Comm	Low	
2962	Multiprotocol, 2-port	Comm	Low	
2963	ATM 155 UTP	Comm	Medium	
2968	Ethernet 10/100	Comm	Low (10) Medium (100)*	2
2969	Gigabit Ethernet	Comm	High	
2975	10/100/1000 BASE-T Ethernet	Comm	Low (10) Medium (100) High (1000)*	
2985	Ethernet 10 BNC/RJ-45	Comm	Low	
2987	Ethernet 10 AUI/RJ-45	Comm	Low	
2988	ATM 155 MMF	Comm	Medium	
4951	Four-port 10/100 LAN	Comm	Low (no 100) Med. (1-2 100) High (3-4 100)	7
4953	ATM 155 UTP	Comm	Medium	
4957	ATM 155 MMF	Comm	Medium	
4958	Crypto Coprocessor	Crypto	Low	
4959	Token Ring	Comm	Low	
4960	Crypto Accelerator	Crypto		
4962	10/100 Ethernet	Comm	Low (10) Medium (100)*	2
4963	Crypto coprocessor	Crypto	Low	
6203	Dual-channel Ultra3 SCSI	Storage	High	
6204	Ultra SCSI DE	Storage	High	
6205	Dual Channel Ultra2 SCSI	Storage	High	5
6206	Ultra SCSI SE	Storage	Low (F) Medium (F/W)* High (Ultra)	3
6207	Ultra SCSI DE	Storage	Low (F) Medium (F/W) High (Ultra)*	4

Table 20. PCI adapter weighting factors (continued)

Feature	Description	Type	Weighting factor	Notes
6208	SCSI-2 F/W SE	Storage	Medium	
6209	SCSI-2 F/W DE	Storage	Medium	
6215	SSA RAID 5	Storage	Medium (RAID) High (Dual Loop)	
6225	SSA RAID	Storage	High	6
6227	FC/AL	Storage	High	
6228	FC/AL 64-bit	Storage	High	
6230	SSA RAID	Storage	High	
6310	ARTIC960RxD WAN DT Quad	Comm	Low	
6311	ARTIC960RxF Dig. Trunk	Comm	Low	

Notes:

1. Asterisk (*) indicates the ***default*** weighting factor used by the configurator
2. Low for 10 Mbps operation, Medium* for 100
3. Low for Fast SCSI operation, Medium* for Fast/Wide, High for Ultra
4. Low for Fast SCSI operation, Medium for Fast/Wide, High* for Ultra
5. Medium for single channel in Fast SCSI operation, High for all other single or dual channel Fast SCSI, Fast/Wide, Ultra or Dual Channel Ultra2 operation
6. Medium* for RAID single loop operation, High for non-RAID
7. Low for no ports at 100 Mb, Medium with 1 or 2 ports at 100 Mb, High for 3 or 4 ports at 100 Mb

Weighting factor guidelines

1. Distribute adapters across the PCI buses to equalize the weighting factor on each bus (application usage might require a different distribution).
2. Place adapters with high and medium weighting factors in slots on a ***primary*** PCI bus.
3. Except as suggested otherwise in this section, adapters with a low weighting factor can be placed in slots on a secondary PCI bus where allowed by “PCI adapter plugging rules and restrictions” on page 95. (Adapters on a primary PCI bus usually give better performance than on a secondary bus.)
4. F/C 2969 is a 64-bit PCI adapter, capable of operating in a 32-bit slot at lower throughput.
5. The total quantity of adapters used on a node can actually be fewer than the sum suggested below, due to system resource limitations.

Quantities of adapters for optimum operation

The following sections list the suggested quantities of adapters by node type, PCI bus, and weighting factor to help you achieve optimum operation on PCI buses.

375 MHz POWER3 and POWER3 High Node: Select ***one*** of the following options for PCI Bus 0:

- 1 High
- 2 Medium
- 1 Medium and 2 Low
- 3 Low

Select ***one*** of the following options for PCI Bus 1:

- 1 High
- 2 Medium
- 1 Medium and 1 Low
- 2 Low

SP Expansion I/O Unit: Select ***one*** of the following options for ***each*** PCI Bus (0, 1, 2, and 3):

- 1 High
- 2 Medium
- 1 Medium and 1 Low
- 2 Low

375/450 MHz POWER3 and POWER3 Wide Node: Select ***one*** of the following options for ***both*** PCI Bus 2 and PCI Bus 3:

- 1 High
- 2 Medium and 2 Low
- 1 Medium and 3 Low
- 4 Low

375/450 MHz POWER3 and POWER3 Thin and Wide Node: Select ***one*** of the following options for PCI Bus 1:

- 1 High
- 2 Medium
- 1 Medium and 1 Low
- 2 Low

332 Mhz Wide Node: Select ***one*** of the following options for PCI Bus 2 and PCI Bus 3 ***combined***:

- 1 High (place on Bus 2)
- 2 Medium (place on Bus 2) and 2 Low (should be on Bus 2)
- 1 Medium (place on Bus 2) and 4 Low (3 should be on Bus 2 with precedence given to comm-type adapters, and 1 on Bus 3)
- 6 Low (4 on Bus 2, with precedence given to comm-type adapters, and 2 should be on Bus 3)

332 MHz Thin and Wide Node: Select ***one*** of the following options for PCI Bus 1:

- 1 High
- 2 Medium
- 1 Medium and 1 Low
- 2 Low

Chapter 14. PCI communication adapters

This chapter contains details on ***currently available*** PCI-type communication adapters and associated options for the RS/6000 SP system. These features are installed in SMP-type processor nodes to connect SP systems to external networks and storage devices.

Note: Availability of these adapters, as well as recommended quantites and restrictions on their use are subject to updates between editions of this book. For the latest adapter information, consult your IBM account representative.

PCI adapter rules

For PCI adapter plugging rules, restrictions, and maximum and suggested quantities, see “PCI bus I/O adapter requirements for SMP nodes” on page 91.

Table 21. **Currently available** *RS/6000 SP PCI adapter features*

F/C	Adapter name
2732	“Short-Wave Serial HIPPI PCI adapter (F/C 2732)” on page 104
2733	“Long-Wave Serial HIPPI PCI adapter (F/C 2733)” on page 105
2741	“FDDI SK-NET LP SAS PCI adapter (F/C 2741)” on page 105
2742	“FDDI SK-NET LP DAS PCI adapter (F/C 2742)” on page 109
2751	“S/390 ESCON Channel PCI adapter (F/C 2751)” on page 112
2943	“8-Port Async EIA 232/RS-422 PCI adapter (F/C 2943)” on page 113
2944	“WAN 128-Port Async EIA-232 PCI adapter (F/C 2944)” on page 114
2946	“Turboways 622 Mbps MMF ATM PCI adapter (F/C 2946)” on page 115
2947	“ARTIC960Hx 4-Port Selectable PCI adapter (F/C 2947)” on page 116
2962	“2-Port Multiprotocol X.25 PCI adapter (F/C 2962)” on page 117
2969	“Gigabit Ethernet - SX PCI adapter (F/C 2969)” on page 118
2975	“10/100/1000 BASE-T Ethernet PCI adapter (F/C 2975)” on page 119
2985	“10BASE2/10BASE-T Ethernet PCI adapter (F/C 2985)” on page 120
4951	“Four-Port 10/100 BASE-TX Ethernet PCI adapter (F/C 4951)” on page 121
4953	“64bit/66MHz ATM 155 UTP PCI adapter (F/C 4953)” on page 122
4957	“64bit/66MHz ATM 155 MMF PCI adapter (F/C 4957)” on page 123
4958	“Crytographic Coprocessor PCI adapter (F/C 4958)” on page 123
4959	“High-Speed Token-Ring PCI adapter (F/C 4959)” on page 125
4960	“IBM e-business Cryptographic Accelerator (F/C 4960)” on page 126
4962	“10/100 Mbps Ethernet PCI Adapter II (F/C 4962)” on page 127
4963	“Cryptographic Coprocessor (FIPS-4) PCI adapter (F/C 4963)” on page 127
6203	“Dual Channel Ultra3 SCSI PCI adapter (F/C 6203)” on page 129
6204	“SCSI-2 Ultra/Wide DE PCI adapter (F/C 6204)” on page 130
6206	“SCSI-2 Ultra/Wide SE PCI adapter (F/C 6206)” on page 132
6207	“SCSI-2 Ultra/Wide DE PCI adapter (F/C 6207)” on page 134
6228	“Gigabit Fibre Channel for 64-bit PCI bus adapter (F/C 6228)” on page 136

Table 21. **Currently available** *RS/6000 SP PCI adapter features (continued)*

F/C	Adapter name
6230	“Advanced SerialRAID Plus PCI adapter (F/C 6230)” on page 137
6231	“128 MB DIMM Option Card (F/C 6231)” on page 139
6235	“32 MB Fast-Write Cache Option Card (F/C 6235)” on page 139
6310	“ARTIC960RxD Quad Digital Trunk PCI adapter (F/C 6310)” on page 139
6311	“ARTIC960RxF Digital Trunk Resource Adapter (F/C 6311)” on page 140

Short-Wave Serial HIPPI PCI adapter (F/C 2732)

The Short-Wave Serial HIPPI adapter (F/C 2732) provides high-speed connectivity via the ANSI serial HIPPI channel. It provides (via short-wave optics) the capability to participate in supercomputer environments, attach to disk-array subsystems, other SP systems, HIPPI switches, other vendor computers, and tape subsystems. It is a 32-bit, 33 MHz universial PCI serial HIPPI adapter and supports TCP/IP for communication. Data is sent and received over optical fiber at 1.2 Gbps using the HIPPI standard 20/24-bit encoding scheme. The effective maximum data rate of the HIPPI interface is 800 Mbps.

Feature characteristics

This feature has the following characteristics:

- Single-slot, full-size 32-bit PCI adapter
- PCI 2.1 Specification compatible
- Intel 960 processor
- 2 MB DRAM program store
- 2 MB transmit and receive RAM
- Short-wave optics

Feature components

This feature order provides the following:

- Adapter card
- Diagnostic wrap plugs
- Installation instructions

Customer components

You must supply the following components for this feature:

- Short-wave cabling
- Dual SC connector 50/125 micron multi-mode fiber

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Software requirements

This feature has the following software requirements:

- AIX 4.3.2 or later installed on the node
- PSSP 3.1 or later installed on the node

- Order PID 5765-E07 for serial HIPPI driver set

Long-Wave Serial HIPPI PCI adapter (F/C 2733)

The Long-Wave Serial HIPPI adapter (F/C 2733) provides high-speed connectivity via the ANSI serial HIPPI channel. It provides (via long-wave optics) the capability to participate in supercomputer environments, attach to disk-array subsystems, other SP systems, HIPPI switches, other vendor computers, and tape subsystems. It is a 32-bit, 33 MHz universial PCI serial HIPPI adapter and supports TCP/IP for communication. Data is sent and received over optical fiber at 1.2 Gbps using the HIPPI standard 20/24-bit encoding scheme. The effective maximum data rate of the HIPPI interface is 800 Mbps.

Feature characteristics

This feature has the following characteristics:

- Single-slot, full-size 32-bit PCI adapter
- PCI 2.1 Specification compatible
- Intel 960 processor
- 2 MB DRAM program store
- 2 MB transmit and receive RAM
- Long-wave optics

Feature components

This feature order provides the following:

- Adapter card
- Diagnostic wrap plugs
- Installation instructions

Customer components

You must supply the following components for this feature:

- Short-wave cabling
- Dual SC connector 50/125 micron multimode fiber

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Software requirements

This feature has the following software requirements:

- AIX 4.3.2 or later installed on the node
- PSSP 3.1 or later installed on the node
- Order PID 5765-E07 for serial HIPPI driver set

FDDI SK-NET LP SAS PCI adapter (F/C 2741)

The SYSKONNECT SK-NET FDDI-LP SAS PCI Adapter (F/C 2741) is a fiber optical FDDI Single Attach Station that is compatible with the FDDI-ANSI X3T12 specifications and FDDI Standard Series. The adapter provides single attachment to a FDDI concentrator (or point-to-point) using fiber optic cabling (not supplied with the adapter).

Feature characteristics

This feature has the following characteristics:

- Supports single-ring FDDI attachment at 100 Mbps via a customer-supplied FDDI concentrator
- Supports all TCP/IP protocols and ANSI Station Management (SMT) 7.3

Feature components

This feature order provides the following:

- Adapter card
- Diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions

Customer components

You must supply the following components for this feature:

- A FDDI concentrator such as the IBM 8240 (or equivalent) concentrator to connect to your FDDI local area network
- One 62.5/125 micron multimode fiber duplex cable with SC connectors

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Software requirements

This feature has the following software requirements:

- AIX 4.2.1 or later installed on the node
- PSSP 2.4 or later installed on the node
- Adapter device driver and FDDI common code (provided with adapter)

FDDI typical SP configuration

Figure 17 on page 107 shows a typical FDDI configuration for the SP system.

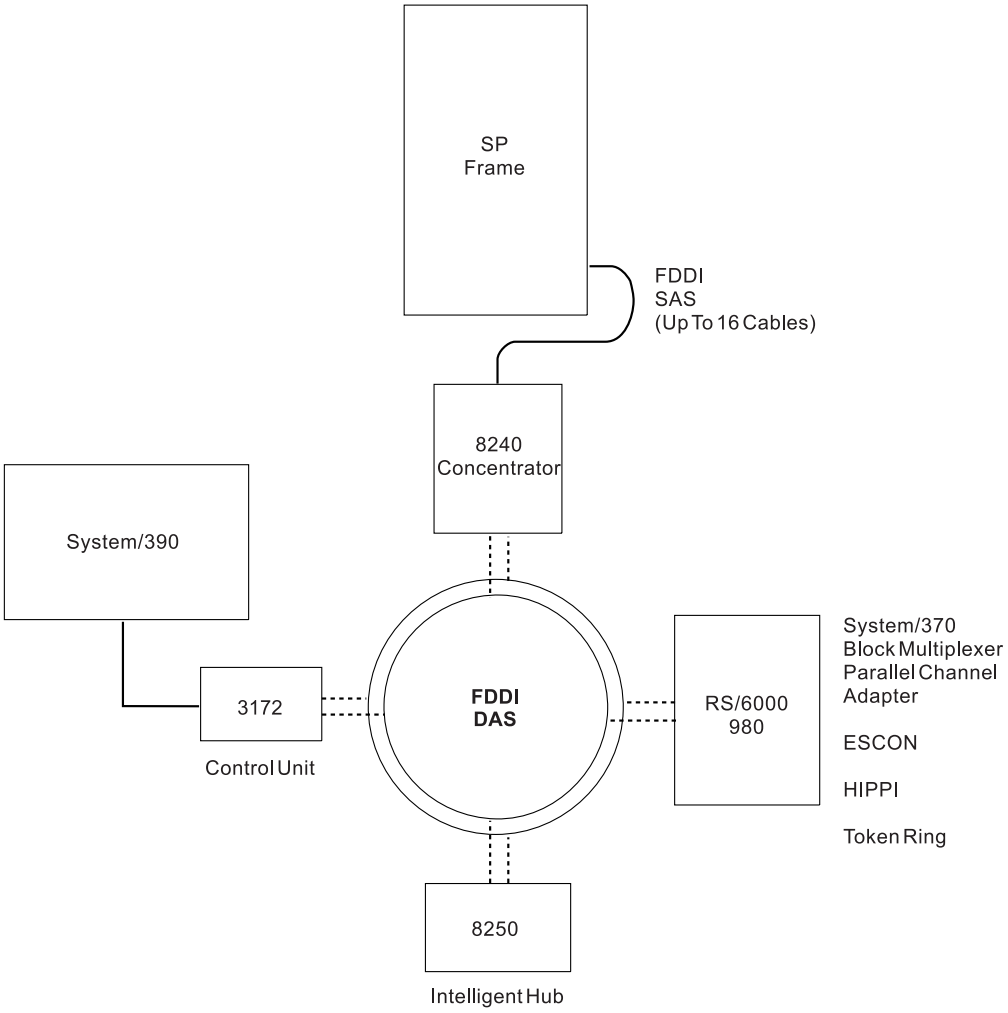

Figure 17. Typical FDDI configuration for the SP system

FDDI Single-Ring Attachment Station

Figure 18 on page 108 shows a typical FDDI single-ring attachment station (SAS) cabling from the RS/6000 SP frame to the IBM 8240 Concentrator:

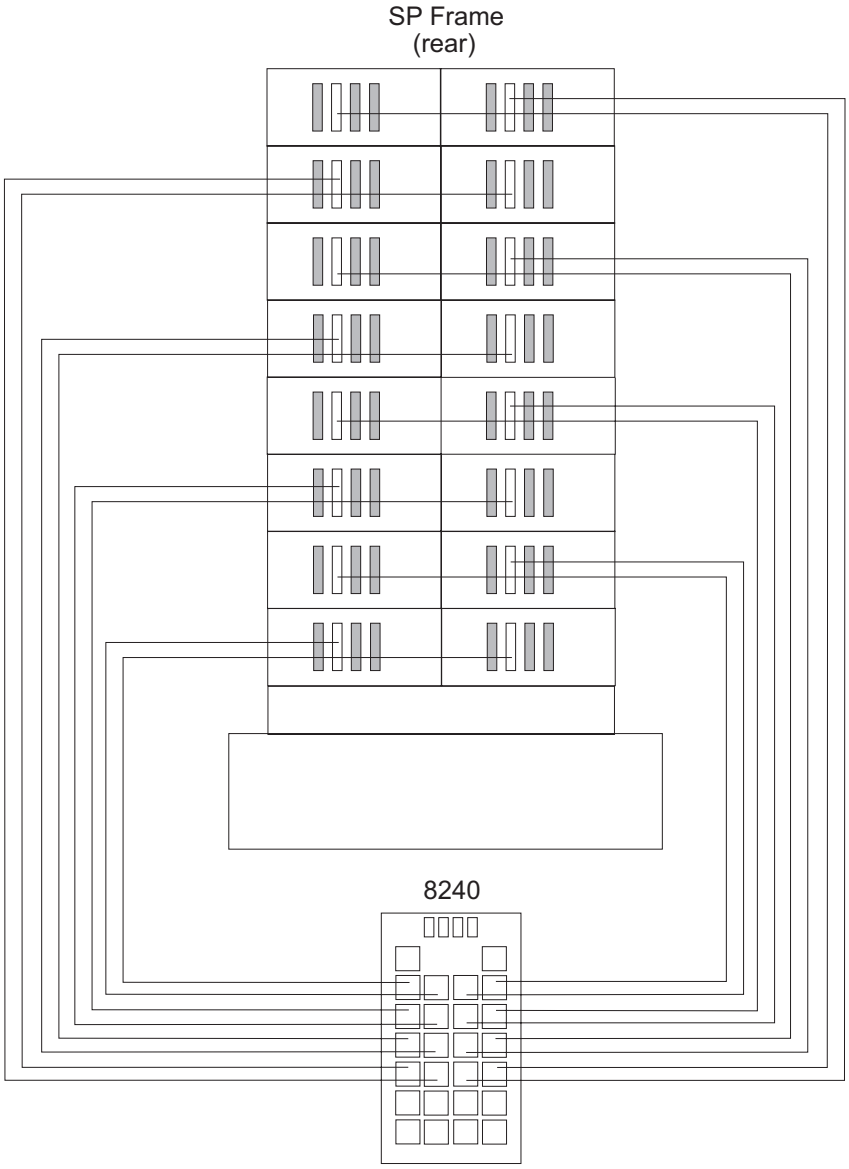

Figure 18. Typical FDDI single-ring attachment cabling for the SP system

The IBM 8240 Concentrator provides six plug modules. Each module has four port fiber modules or four port copper-shielded modules. The SP supports only the fiber connection.

External cabling routing for FDDI cables

The SP uses a maximum of 120 inches of FDDI cable budget. Table 22 shows the cable budget needed to reach individual nodes in an SP frame.

Table 22. Cable budget information for FDDI feature

To Node	Measured in Millimeters	Measured in Inches
1	1780	71
2	1500	59
3	1680	66
4	1980	78

Table 22. Cable budget information for FDDI feature (continued)

To Node	Measured in Millimeters	Measured in Inches
5	2160	85
6	1850	73
7	2030	80
8	2340	92
9	2510	99
10	2210	87
11	2390	94
12	2690	106
13	2870	113
14	2570	101
15	2740	108
16	3050	120

FDDI SK-NET LP DAS PCI adapter (F/C 2742)

The SYSKONNECT SK-NET FDDI-LP DAS PCI Adapter (F/C 2742) is a fiber optical FDDI Dual Attach Station that is compatible with the FDDI-ANSI X3T12 specifications and FDDI Standard Series. The adapter provides either dual attachment to the main ring path or dual homing to one or two FDDI concentrators using fiber optic cabling (not supplied with the adapter).

Feature characteristics

This feature has the following characteristics:

- Supports dual ring FDDI attachment at 100 Mbps
- Supports all TCP/IP protocols and ANSI Station Management (SMT) 7.3

Feature components

This feature order provides the following:

- Adapter card
- Diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions

Customer components

You must supply the following components for this feature:

- A FDDI concentrator such as the IBM 8240 (or equivalent) concentrator to connect to the FDDI network for dual homing configurations
- Two 62.5/125 micron multimode fiber duplex cables with SC connectors

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Software requirements

This feature has the following software requirements:

- AIX 4.2.1 or later installed on the node
- PSSP 2.4 or later installed on the node
- Adapter device driver and FDDI common code (provided with adapter)

FDDI typical SP configuration

Figure 17 on page 107 shows a typical FDDI configuration for the SP system.

FDDI Dual-Ring Attachment Station

Figure 19 shows typical FDDI dual-ring attachment cabling from the SP frame to a concentrator or an external LAN.

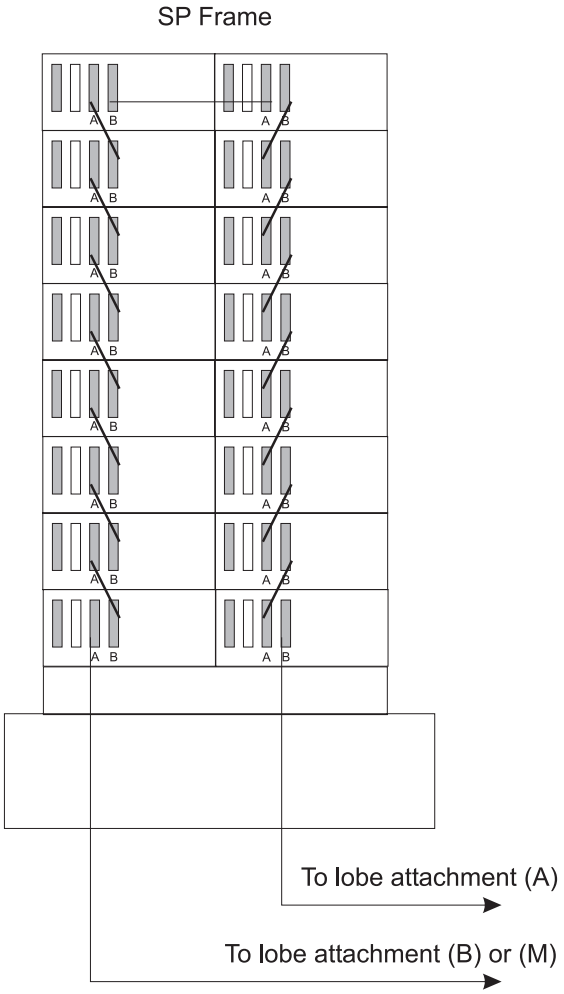

Figure 19. Typical FDDI dual-ring attachment cabling for the SP system

FDDI Dual Homing cabling

Figure 20 on page 111 shows a typical FDDI dual homing cabling from the SP frame to a concentrator.

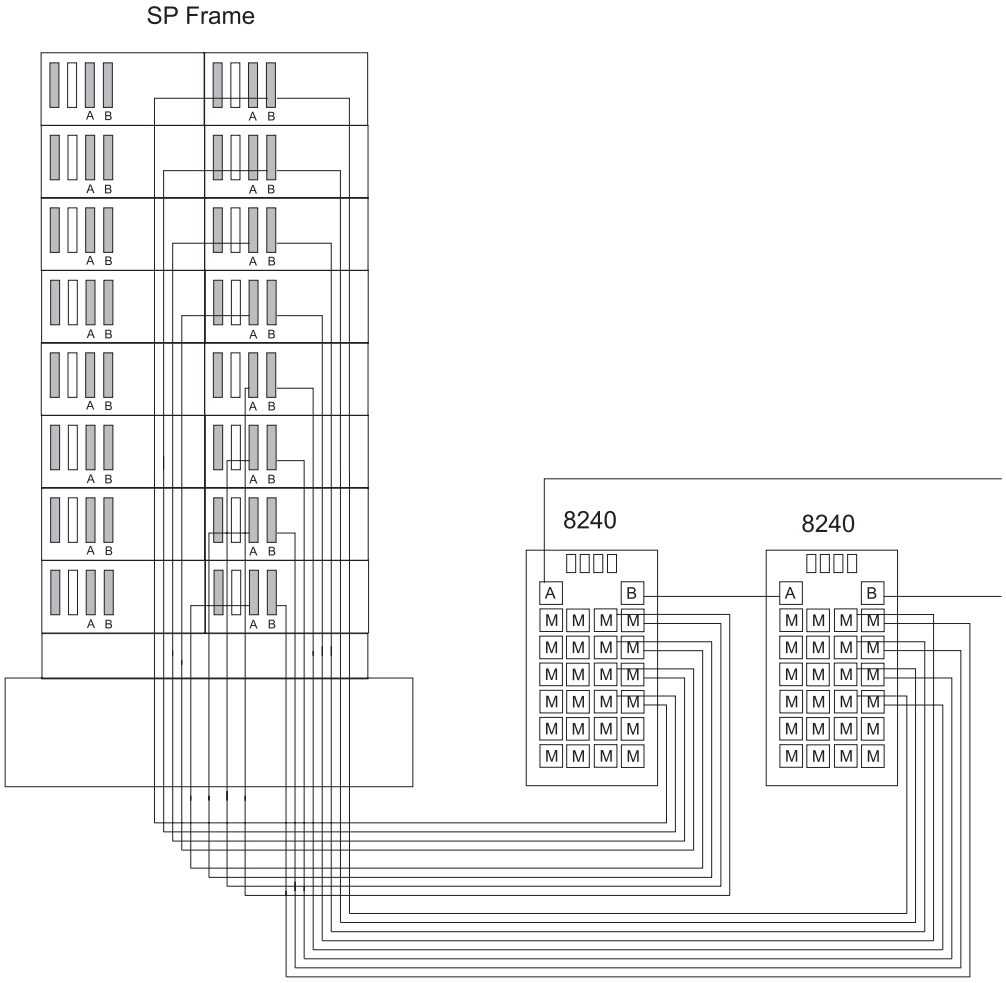

Figure 20. Typical FDDI dual homing cabling for the SP system

External cabling routing for FDDI cables

The SP uses a maximum of 120 inches of FDDI cable budget. Table 23 shows the cable budget needed to reach individual nodes in an SP frame.

Table 23. Cable budget information for FDDI feature

To Node	Measured in Millimeters	Measured in Inches
1	1780	71
2	1500	59
3	1680	66
4	1980	78
5	2160	85
6	1850	73
7	2030	80
8	2340	92
9	2510	99
10	2210	87

Table 23. Cable budget information for FDDI feature (continued)

To Node	Measured in Millimeters	Measured in Inches
11	2390	94
12	2690	106
13	2870	113
14	2570	101
15	2740	108
16	3050	120

S/390 ESCON Channel PCI adapter (F/C 2751)

The PCI S/390 ESCON Channel Adapter (F/C 2751) provides the SP system an attachment to IBM Enterprise Systems Connection (ESCON) channels on System/390 mainframes. This direct ESCON channel connection provides a fiber optic link that can take advantage of ESCON Directors (fiber optic switches) permitting multiple channel connections. Supports: VM/ESA, MVS/ESA, and OS/390.

Feature characteristics

This feature has the following characteristics:

- Full length PCI adapter
- Supports attachment to either 10 MB or 17 MB ESCON channels
- Supports VM, MVS, and OS/390
- Supports CLIO/S
- Supports ESCON multiple Image Facility (EMIF)
- Maximum distance supported, 43 Km using LED and XDF ESCON links
- S/390 TCP/IP for VM and MVS
- PCI 32-bit Bus Master Adapter

Feature components

This feature order provides the following:

- One full length PCI adapter
- CD-ROM with device drivers
- Instruction manual
- Diagnostic wrap plug

Customer components

The customer must supply the following components for this feature:

- ESCON cabling, requires 62.5/125 multimode fiber cable with ESCON duplex connectors on both ends
- AIX program feature, ESCON Control Unit LPP 5765-D49

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required Software

This feature has the following software requirements:

- AIX 4.3.2 or later
- PSSP 3.1 or later
- Device drivers (included with adapter)
- ESCON Control Unit LPP (separately ordered as LPP 5765-D49)

8-Port Async EIA 232/RS-422 PCI adapter (F/C 2943)

The 8-port Async feature (**F/C 2943**) provides the RS/6000 SP with up to eight EIA 232 or RS-422 asynchronous serial lines from a single PCI bus slot. This adapter adheres to the Peripheral Component Interconnect (PCI) Revision 2.1 standards for EIA 232 and RS-422. It features a low cost, high performance 32-bit card, 33 MHz bus speed, and a PCI bus transfer rate of 132 Mbps.

This adapter provides a single DB-78 output which connects directly to the 8-port DB-25 connector box. All eight ports are software programmable to support either protocol at baud rates up to 230 K. The full set of modem control lines for asynchronous communication are provided for each port. Devices such as, terminals, modems, processors, printers, and controllers may be attached.

Feature characteristics

This feature has the following characteristics:

- 8-port asynchronous device connections
- 32-bit Bus Master PCI bus (132 Mbps)
- Short-form factor PCI adapter
- EIA-232 maximum distance 31 m and 62 m dependent on baud rate and RAN
- RS-422 maximum distance 1200 m dependent on baud rate
- 230 K maximum baud rate
- Supports TxD, RxD, RTS, CTS, DSR, DCD, DTR, and RI on EIA 232
- Supports +TxD, -TxD, +RxD, and -RxD on RS-422

Feature components

This feature order provides the following:

- Adapter card
- 25-pin diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions
- Includes external 3 m DB78 cable to 8-port DB25 breakout box

Customer supplied components

A 3 m cable with attached breakout box is supplied with each adapter. You must supply all cables needed to connect peripheral equipment to this adapter.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.2 or later installed on the node
- PSSP 3.1 or later installed on the node
- Adapter device driver LPP image (provided with adapter)

WAN 128-Port Async EIA-232 PCI adapter (F/C 2944)

The 128-port Async feature (F/C 2944) provides the RS/6000 SP with up to 128 EIA-232 asynchronous serial lines from a single PCI bus slot. This adapter adheres to the Peripheral Component Interconnect PCI standard. It features a low cost, high performance 32-bit card, 33 MHz bus speed, and a PCI bus transfer rate of 132 Mbps.

Two 2.4 Mbps synchronous channels link the adapter to a maximum of eight 16-port remote async nodes (RANs). Each synchronous channel uses an HD-15 female connector to link up to four RANs. Each RAN supports either EIA-232 or RS-422 connections (sixteen per RAN) and up to eight RANs may be connected together yielding a total of 128 ports. The RAN utilizes an RJ-45 connector to provide interface signals at speeds up to 230K baud at a limited number of ports.

Feature characteristics

This feature has the following characteristics:

- 32-bit Bus Master PCI bus
- Two synchronous channels to RAN
- EIA-232 maximum distance 31 m and 62 m dependent on baud rate and RAN
- RS-422 maximum distance 1200 m dependent on baud rate

Customer supplied components

F/C 2944 uses the following optional remote asynchronous nodes (RANs) and device cables which are available from IBM:

- 1.2 Mbps RANs and cables:

  F/C 8130
  1.2 Mbps remote asynchronous node, 16-port, EIA-232 (US)

  F/C 8131
  128-port asynchronous controller node cable, 4.5 m

  F/C 8132
  128-port asynchronous controller cable 23 cm (9 in.)

  F/C 8133
  RJ-45 to DB-25 converter cable

  F/C 8134
  1.2 Mbps remote asynchronous node, 16-port, EIA-232 (World Trade)

  F/C 8136
  1.2 Mbps rack mountable remote asynchronous node, 16-port, EIA-232

- 2.4 Mbps RANs and cables:

  F/C 8137
  2.4 Mbps enhanced remote asynchronous node, 16-port, EIA-232

F/C 8138
2.4 Mbps enhanced remote asynchronous node, 16-port, RS-422

F/C 2934
Asynchronous terminal/printer cable, EIA-232

F/C 3124
Serial port to serial port cable for drawer-to-drawer connections

F/C 3125
Serial port to serial port cable for rack-to-rack connections

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.2.1 or later installed on the node
- PSSP 2.4 or later installed on the node
- Adapter device driver LPP image (provided with adapter)

Turboways 622 Mbps MMF ATM PCI adapter (F/C 2946)

The IBM Turboways 622 Mbps PCI MMF ATM adapter is a 64-bit, Universal PCI Adapter. This adapter provides direct access to the ATM network at a dedicated 622 Mbps full-duplex connection. This is a short form-factor adapter that interfaces to the system via the PCI bus and connects to the 622 Mbps ATM network via dual SC-type, multi-mode fiber cables. This adapter utilizes 16MB of SDRAM for control and 16MB of SDRAM for packet memory. It also provides a hardware assist for TCP checksum, which can provide a performance improvement by minimizing the host CPU cycles.

Feature characteristics

This feature has the following characteristics:

- PCI 2.1 compliant, universal 3.3/5 volt adapter

Feature components

This feature provides the following:

- Adapter card
- Wrap plug
- Installation instructions

Customer components

You must supply the following components with this feature:

- Network equipment, such as a hub or switch which is required to attach to Token-Ring LANs
- All Token-Ring Category 5 cables

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) 32 or 64-bit adapter slot

Note: For optimum performance, this adapter should be placed in a 64-bit slot.

Software requirements

This feature requires the following software:

- AIX 4.3.3 or later installed on the node
- PSSP 3.1.1 or later installed on the node
- Adapter device driver

ARTIC960Hx 4-Port Selectable PCI adapter (F/C 2947)

The ARTIC960Hx 4-Port Selectable PCI Adapter is a one-slot, standard-length, 32-bit PCI card. It provides 4-Ports of either EIA-232, EIA530, RS-449, X.21, or V.35. Only one standard can be used at a time. Each port supports speeds up to 2.0 Mbps. Software support is provided by ARTIC960 Support for AIX, Developer's Kit, AIX versions 4.2.1 or 4.3.2 or later, that provide SDLC and Bisync support. The adapter can also be used for real-time device control, telephony signaling, and custom serial communication protocols.

This adapter is also equipped with a high-performance, eight-channel DMA controller. This DMA controller supports intelligent DMA operations, such as data buffer chaining and end-of-frame processing, to support high-performance communications protocols and high-throughput applications. The DMA controller is fully programmable for OEM and third-party device drivers.

Feature characteristics

This feature has the following characteristics:

- One 120-pin port
- Supports up to four connections of the same type
- Data transfer rates of up to 2 Mbps
- Supported interfaces are:
  - EIA-232
  - EIA-530
  - RS-449
  - X.21
  - V.35
- Support for SDLC and X.25 full-duplex, synchronous protocols

Feature components

- One ARTIC960Hx adapter (F/C 2947)
- A connecting cable (required); the following are available from IBM:

  F/C 2861
  ARTIC960Hx 4-port EIA-232 cable

  F/C 2862
  ARTIC960Hx 4-port RS-449 cable

  F/C 2863
  ARTIC960Hx 4-port X.21 cable

  F/C 2864
  ARTIC960Hx 4-port V.35 (DTE) cable

F/C 2865
ARTIC960Hx 4-port EIA-530 cable

Hardware requirements

This feature has the following hardware requirements:

- One 32-bit Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.2.1 and APAR IX81861, AIX 4.3.2 and APAR IX81860 (for SDLC or Bisync) or later
- Adapter device driver (provided with adapter)

2-Port Multiprotocol X.25 PCI adapter (F/C 2962)

The 2-Port Multiprotocol adapter (F/C 2962) provides the RS/6000 SP with high speed connections between stand alone system units on a wide area network (WAN). This adapter adheres to the Peripheral Component Interconnect PCI standard and also supports SDLC and X.25 protocols. The 2-port Multiprotocol adapter connects to WAN lines through externally attached data communication equipment including Channel Service Units (CSU), Data Service Units (DSU), and synchronous modems.

This adapter operates at speeds up to 2.048 Mbps and provides two ports that accommodate four selectable interfaces. These interfaces are:

- EIA 232D/V.24
- V.35
- V.36/EIA 449
- X.21

Interface configuration is selected by the type of cable attached. These cables are ordered separately and you may configure with the 2-Port Multiprotocol adapter with two different cables.

Feature characteristics

This feature has the following characteristics:

- 32-bit Bus Master PCI 2.1 adapter
- Provides two, 36-pin high density (male) ports
- Provides four interface types, EIA 232D/V.24, V.35, V.36/EIA 449, and X.21
- Simultaneously supports two different interfaces
- Supports SDLC and X.25 full duplex synchronous protocols

Customer supplied components

If you plan to operate this adapter using X.25 protocols, then you must separately order the IBM AIXLINK/X.25 LPP (5696-926). This package provides a V.24, V.35, or X.21 port connection to X.25 packet switched networks.

The system interface is determined by the cable connected to this adapter. See Table 24 on page 118 for a list of available cables and the interface supported by each cable.

Note: The 2-port Multiprotocol Adapter can be configured with different cable types on each port.

Table 24. Cable information for 2-port Multiprotocol Adapter

Cable Feature Code	Interface Configuration	Cable Terminations (Length)
2951	EIA 232D/V.24	36-pin to male DB25 (3 m)
2952	V.35	36-pin to 34-pin male (3 m)
2953	V.36/EIA 449	36-pin to 37-pin male (3 m)
2954	X.21	36-pin to male DB15 (3 m)

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.2 or later
- PSSP 3.1 or later
- SDLC protocol support provided as part of the AIX Base Operating System
- X.25 protocol support requires a separately ordered LPP, IBM AIXLINK/X.25 (5696-926)
- This adapter also functions with AIX 4.2.1 and PSSP 2.4

Gigabit Ethernet - SX PCI adapter (F/C 2969)

The PCI Gigabit Ethernet - SX Adapter (F/C 2969) is a 1000 Mbps PCI Ethernet adapter that is compatible with IEEE 802.3z specifications. The adapter has one external fiber connection that attaches to 1000BASESX networks via 50 and 62.5 micron multi-mode cables with SC connectors.

Feature characteristics

This feature has the following characteristics and requirements:

- Compatible with IEEE 802.3z Standards
- Supports full duplex operation over 1000BASESX networks
- Supports jumbo frames with AIX 4.3.2 Device Driver

Feature components

This feature order provides the following:

- Adapter card
- Fiber wrap plug
- Installation instructions

Customer supplied components

You must supply the following components for this feature:

- Network equipment such as a switch or router is required to attach to 1000BASESX networks
- All Ethernet cables

Note: The maximum operating distances for the fiber cables are:

- 260 meters with 62.5 micron multimode fiber
- 440 meters with 50 micron multimode fiber

Hardware requirements

This feature has the following hardware requirement:

- One (1) Peripheral Component Interconnect (PCI) 32-bit or 64-bit adapter slot in POWER3 nodes
- One (1) Peripheral Component Interconnect (PCI) 32-bit adapter slot in 332 MHz nodes

Required software

This feature has the following software requirements:

- POWER3 thin and wide nodes
  - PSSP 3.1 and AIX 4.3.2 or later
- 332 Mhz thin and wide nodes
  - PSSP 3.1 and AIX 4.3.2 or later

10/100/1000 BASE-T Ethernet PCI adapter (F/C 2975)

The 10/100/1000 BASE-T Ethernet PCI adapter is a full-duplex Gigabit Ethernet adapter designed with highly integrated components to optimize cost and performance. The adapter interfaces to the system via the PCI bus and connects to the network using a four-pair CAT-5 Unshielded Twisted Pair (UTP) cable for distances of up to 100m. This adapter supports jumbo frames for full-duplex Fast and Gigabit Ethernet

Feature characteristics

This feature has the following characteristics and limitations:

- Compatible with IEEE 302.3z standards
- Supports 10 Mbps, 100 Mbps, or 1000 Mbps full-duplex operation on CAT-5 UTP networks
- Supports 10 Mbps or 100 Mbps half-duplex operation on CAT-5 UTP networks
- 1000 Mbps is not supported in half-duplex (HDX) mode
- Supports jumbo frames
- PCI 2.1 compliant, universal 3.3/5 volt adapter

Feature components

This feature order provides the following:

- Adapter card
- Wrap plug
- Installation instructions

Customer supplied components

You must supply the following components for this feature:

- Network equipment such as a hub or switch required to attach to Ethernet LANs
- All Ethernet cables

Note: For 100 and 1000 BASE-TX connections, Unshielded Twisted Pair (UTP) Category 5 cabling is required. For 10BASE-T, UTP Category 3, 4, or 5 cabling is required. UTP Category 5 is strongly suggested to facilitate upgrades to 100 or 1000 Mbps Ethernet LAN without cabling changes.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Note: For optimum performance, adapter should be placed in a 64-bit slot.

Required software

This feature has the following software requirements:

- AIX 4.3.3 or later installed on the node
- PSSP 3.1.1 or later installed on the node
- Adapter device driver

AIX Network Install Manager (NIM) boot capability is supported with this adapter provided that your system firmware is at the proper support level. Systems manufactured prior to July 2001 might require a firmware update. To review and download the latest system firmware, go to http://www.austin.ibm.com/support/micro/.

10BASE2/10BASE-T Ethernet PCI adapter (F/C 2985)

The PCI Ethernet 10BASE2/10BASE-T BNC/RJ-45 Adapter (F/C 2985) is a 10 Mbps PCI Ethernet adapter that is compatible with IEEE 802.3 specifications. The adapter has two external connections: BNC to attach to 10BASE2 networks and RJ-45 to attach to 10BASE-T networks.

Feature characteristics

This feature has the following characteristics and requirements:

- 10 Mbps Ethernet compatible with IEEE 802.3 Standards
- 32-bit Bus Master PCI Bus 132 Mbps
- Supports half duplex operations over 10BASE2 networks via the BNC connector
- Supports both full and half duplex operation over 10BASE-T networks via the RJ-45 connector

Feature components

This feature order provides the following:

- Adapter card
- RJ-45 and BNC diagnostic wrap plugs
- Installation instructions

Customer supplied components

You must supply the following components for this feature:

- Network equipment such as a hub or switch required to attach to 10BASE-T Ethernet LANs
- All Ethernet cables

Note: For 10BASE-T connections, Unshielded Twisted Pair (UTP) Category 3, 4, or 5 cabling is required. UTP Category 5 cabling is strongly suggested to facilitate upgrades to 100 Mbps Ethernet LAN without cabling changes.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Required software

This feature has the following software requirements:

- AIX 4.2.1 or later installed on the Node
- PSSP 2.4 or later installed on the Node
- Adapter device driver (part of base AIX BOS code)

Cable routing

Figure 21 represents a typical Ethernet cable routing in an SP frame.

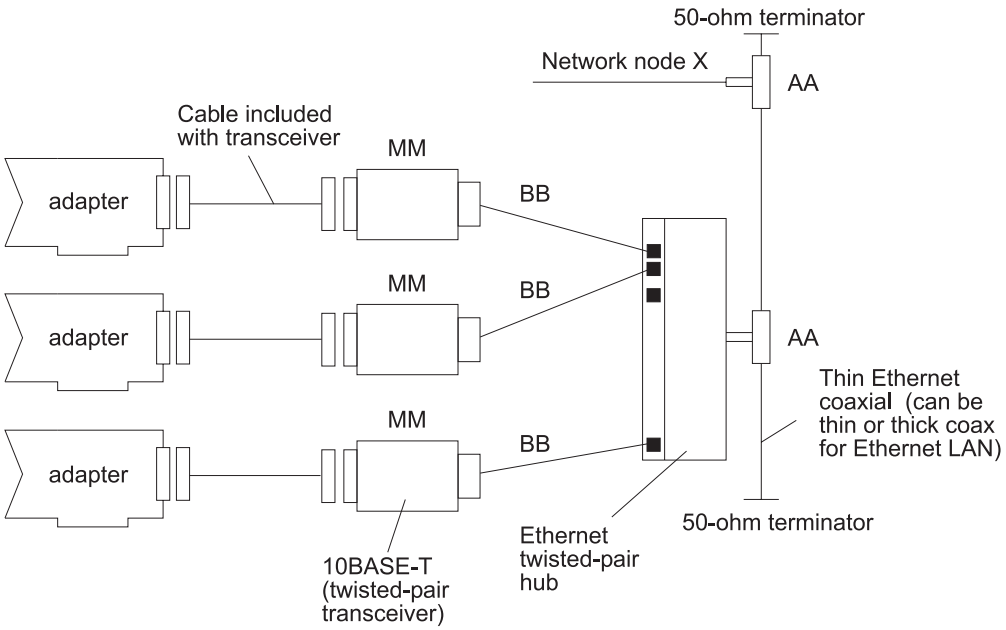

Figure 21. Ethernet cable routing

Four-Port 10/100 BASE-TX Ethernet PCI adapter (F/C 4951)

The IBM Four-Port 10/100 BASE-TX Ethernet PCI Adapter makes available four Ethernet ports using a single PCI slot. It is a 32/64-bit, long PCI adapter, supporting four industry-standard Ethernet 10BASE-T or 100BASE-TX interfaces supporting 10 or 100 Mbps data rates, either half or full duplex on each of four separate ports. Each port has an RJ-45 connector for attachment to standard CAT-3/5 unshielded, twisted-pair cable. The adapter is IEEE 802.3u compatible and has full auto-negotiation for detecting speed and duplex capability across each port. It provides network boot and Network Install Manager (NIM) capability.

Feature characteristics

This feature has the following characteristics and requirements:

- Supports UTP-5 (RJ45) cable connections
- Capable of communicating at 10 or 100 Mbps
- Has auto-negotiation to determine speed and duplex capability
- Supports 32/64 bit PCI data width
- Supports both full and half duplex operation
- Includes status LEDs for speed and data activity
- Supports NIM install
- Meets PCI 2.1 specifications
- Operates at PCI bus speed of 33 MHz
- Fits in full-size PCI slots

Feature components

This feature order provides the following:

- Adapter card
- Diskette with adapter device driver
- Installation Instructions.

Customer supplied components

You must supply the following components for this feature:

- Network equipment such as a hub or switch
- All Ethernet cables

Note: For 100BASE-TX connections, Unshielded Twisted Pair (UTP) Category 5 cabling is required.

Hardware requirements

This feature has the following hardware requirements:

- One 32 or 64-bit Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.3 with 2/2000 update CD-ROM, or later installed on the node
- PSSP 3.2 or later installed on the Node
- Adapter device driver (provided with adapter)

64bit/66MHz ATM 155 UTP PCI adapter (F/C 4953)

The IBM 64bit/66MHz PCI ATM 155 UTP Adapter provides dedicated, 155 Mbps full-duplex connection to ATM networks over either permanent virtual circuits (PVC) or switched virtual circuits (SVC). This adapter enables TCP/IP to run over an ATM network with Category-5 Unshielded Twisted Pair (UTP). It also supports communication with devices located on an ATM network or bridged to a Token-Ring, Ethernet, or other LAN.

Feature components

This feature order provides the following:

- Adapter card

Hardware requirements

This feature has the following hardware requirements:

- One 32 or 64-bit Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.3 ML9 and 5.1.0 ML1 or later
- PSSP 3.1.1 or later

64bit/66MHz ATM 155 MMF PCI adapter (F/C 4957)

The IBM 64bit/66MHz PCI ATM 155 MMF Adapter provides direct access to ATM networks. This adapter provides dedicated 155 Mbps full-duplex connection using permanent virtual circuits (PVC) or switched virtual circuits (SVC) and enables TCP/IP to run over an ATM network. The adapter also supports communication with devices located on an ATM network or bridged to a Token-Ring, Ethernet, or other LAN.

This adapter is compatible with:

- IBM 8285 ATM Workgroup Switch
- IBM 8260 ATM Subsystem
- IBM 8282 ATM Concentrator
- IBM 8281 ATM LAN Bridge

Feature components

This feature order provides the following:

- Adapter card

Hardware requirements

This feature has the following hardware requirements:

- One 32 or 64-bit Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.3 ML9 and 5.1.0 ML1 or later
- PSSP 3.1.1 or later

Crytographic Coprocessor PCI adapter (F/C 4958)

The PCI Cryptographic Coprocessor is a 2/3 length PCI adapter combining hardware and software to provide high performance, secure hardware engines for secure internet transactions such as secure data exchange, verifying electronic signatures, bulk data encryption and decryption. Cryptographic processes are performed within a tamper-proof enclosure on the adapter that is designed to meet FIPS PUB 140-1 standard for commercial cryptographic devices at security Level 3.

Security functions supported by the adapter include the following:

- Data Encryption Standard (DES) (56 and 40-bit keys) encryption and decryption, with pre- and post-padding; the coprocessor uses both electronic and codebook (ECB) and cipher block chain (CBC) modes of encryption
- Message Authentication (MAC) and financial PIN processing
- Triple DES encryption and decryption of general data
- Secure RSA key-pair generation
- RSA signature generation and signature verification
- Secure Hashing Algorithm (SHA-1) in hardware
- Hardware random number generation
- Secure data storage and retrieval
- Other non-cryptographic security utilities can be carried out using the onboard processor

As part of the physical security features of this adapter, the following events will cause an adapter shutdown and secure data zeroization:

- Shipping/storage temperature greater than 95°C ±5°C
- Dead battery (VBAT less than 2.4 V)
- Supply voltage greater than 3.3 V/12 V max
- Inner covers opening attack

For additional information on this adapter, go to http://www.ibm.com/security/cryptocards. Included at this Web site are the following:

- IBM software to enable your use of the coprocessors. Two different approaches to cryptographic functions are offered for download – PKCS #11 Version 2.01, an implementation of the industry-standard API and IBM Common Cryptographic Architecture (CCA), featuring support of special interest to the finance industry.
- Under custom contract, IBM also offers toolkits that you can employ to develop extensions to the CCA offering and to develop your own application to exploit the secure computing environment and cryptographic hardware.

Feature characteristics

This feature has the following characteristics:

- PCI 2.1 compatible, universal 3.3/5 V adapter
- 486 DX2 Internal processor at 99 MHz
- 8 MB of RAM
- 4 MB of FLASH ROM
- 32 KB of battery-backed RAM
- Supports standard interrupts, DMA, controls, real-time clock
- PCI 32-bit Bus Master

Feature components

This feature order provides the following:

- Adapter card
- CD-ROM with adapter device driver
- Installation instructions

Limitations

The PCI Cryptographic Coprocessor Adapter is a field-installed only device in order to meet restrictive shipping requirements.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot per adapter

Software requirements

This feature has the following software requirements:

- AIX 4.3.3 or later installed on the node
- PSSP 3.1.1 or later installed on the node
- Adapter device driver

AIX support for this adapter is limited to the 32-bit kernal only.

High-Speed Token-Ring PCI adapter (F/C 4959)

The High-Speed Token-Ring PCI Adapter (F/C 4959) is a PCI 16/4 Token-Ring Adapter that is compatible with IEEE 802.5 specifications. The adapter has two external connections: RJ-45 to attach to UTP cabling and a 9-pin D-Shell to attach to STP cabling.

Feature characteristics

This feature has the following characteristics:

- Supports full duplex operation at all three speeds
- Supports both UTP-5 (RJ-45) and STP (9-Pin D-shell)
- PCI bus specification 2.1:
  - Fits in PCI half-size slots
  - Supports both 5.0 and 3.3 volt signaling
  - Supports PCI data streaming
  - Operates in 64-bit slots as a 32-bit device
  - Operational at PCI bus speeds from 16 MHz to 33 MHz
- Consumes less than 2 watts of power
- Includes adapter and ring-status LEDs
- Supports field update of on-card microcode, via sectored FLASH EPROM
- On-card diagnostics implemented in microcode
- FCC Class B and CISPR Class B certified
- Supports NIM functions

Feature components

This feature order provides the following:

- Adapter card
- CD-ROM with adapter device driver
- Installation instructions

Customer components

You must supply the following components for this feature:

- Network equipment such as a MAU and/or switching hub to connect the token-ring network
- UTP or STP cable to attach to the token-ring network

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot per adapter

Software requirements

This feature has the following software requirements:

- AIX 4.2.1, 4.3.3 or later installed on the node

  Note: Requires an update to operate properly. The update CD-ROM is provided with the adapter.
- PSSP 3.1 or later installed on the node
- Adapter device driver (provided with the adapter)

Typical SP system configuration

For planning attachment of the RS/6000 SP system to a Token-Ring network, refer to *Token-Ring Network Introduction and Planning Guide* for configuration and attachment options.

IBM e-business Cryptographic Accelerator (F/C 4960)

The IBM e-business Cryptographic Accelerator is a short form-factor PCI Secure Socket Layer (SSL) hardware accelerator adapter. For Secure Web transactions, SSL operations is a key requirement. To do this, public-key cryptographic operations using SSL handshake protocol is employed. This adapter is a hardware cryptographic solution that off-loads this compute-intensive, public-key cryptographic processing from the host. The overall operation control, including command decoding, is implemented in hardware and requires no on-card microprocessor subsystem. As such, the adapter is a less expensive alternative if you do not need the high security of the on-card secure programming environment such as that offered by the Cryptographic Coprocessor (F/C 4958), but do need the high cryptographic performance that hardware acceleration provides by off-loading the host processor.

Feature characteristics

This feature has the following characteristics:

- 32-bit, 33-MHz, short-size PCI card
- PCI 2.2 compliant
- Universal voltage signaling for either +5 or +3.3 volts

Feature components

This feature provides the following:

- Adapter card
- Installation instructions

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Software requirements

This feature has the following software requirements:

- AIX 4.3.3 or later installed on the node
- PSSP 3.1.1 or later installed on the node
- Adapter device driver

10/100 Mbps Ethernet PCI Adapter II (F/C 4962)

The 10/100 Mbps Ethernet PCI Adapter II is a small form factor, single port PCI Ethernet adapter. This high-performance, low-power Ethernet 10/100Mbps LAN adapter can be used in both client and server PCI systems. This adapter provides both 10BASE-T and 100BASE-TX full-duplex Ethernet LAN connectivity. The adapter supports Category-5 unshielded twisted pair cabling for both 10 and 100 Mbps and Category-3 unshielded twisted pair cabling for 10 Mbps.

Feature characteristics

This feature has the following characteristics:

- Half/full-duplex 10/100 Mbps Ethernet interface
- 10/100 Mbps data rates
- Auto-negotiation for 10/100 speed and half/full duplex
- Network boot capability and Network Install Manager (NIM)
- IEEE 802.3 Ethernet Specification
- IEEE 802.3u Fast Ethernet Specification
- 802.3x Ethernet flow control support

Feature components

This feature order provides the following:

- Adapter card

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.3 ML9 and 5.1.0 ML1 or later
- PSSP 3.1.1 or later

Cryptographic Coprocessor (FIPS-4) PCI adapter (F/C 4963)

The PCI Cryptographic Coprocessor (FIPS-4) is a 2/3 length PCI adapter which combines hardware and software to provide a wide variety of security services. The PCI Cryptographic Coprocessor (FIPS-4) is a second generation adapter of the Cryptographic Coprocessor family that provides high-performance, secure hardware engines for secure internet transactions such as transmiting data, verifying

electronic signatures, bulk data encryption and decryption. In addition, the card is enclosed in a tamper-proof enclosure to restrict access to on-card resources, designed to FIPS 140-1 Level 4 standards.

An IBM Web site is available for additional information on this adapter. Go to www.ibm.com/security/cryptocards for the following:

- Two different software approaches to cryptographic functions offered for download:
  - PKCS #11 Version 2.01, an implementation of the industry-standard API
  - IBM Common Cryptographic Architecture (CCA), featuring support of special interest to the finance industry
- Under custom contract, IBM offers toolkits that you can employ to develop extensions to the CCA offering and to develop your own application to exploit the secure computing environment and cryptographic hardware

Feature characteristics

This feature supports the following security functions:

- DES (Data Encryption Standard) (40 and 56 bit key) encryption and decryption, with pre- and post-padding; the coprocessor uses both ECB (electronic and codebook) and CBC (cipher block chain) modes of encryption
- MAC (Message Authentication) generation and MAC verification services
- Triple DES (three key) encryption and decryption of eight-byte units
- Secure RSA key-pair generation
- RSA signature generation and signature verification at 18 signatures/sec at 2048 bits
- Hardware random number generation
- Secure data storage and retrieval
- Other non-cryptographic security utilities can be carried out using the onboard processor

As part of the physical security features, the following events cause an adapter shutdown and secure data zeroization:

- Shipping/storage temperature less than -15C or greater than +95C
- Dead battery (VBAT less than 2.4V dc)
- Supply voltage greater than 3.3V/12V dc max
- Mesh sensor opens/shorts detection
- X-ray exposure

Feature limitations

This feature has the following limitations:

- The adapter is a field-only installed device in order to meet restrictive shipping requirements
- AIX support for this adapter is limited to the 32-bit kernel only

Feature components

This feature order provides the following:

- Adapter card

Hardware requirements

This feature has the following hardware requirements:

- One 32 or 64-bit Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.3 ML9 and 5.1.0 ML1 or later
- PSSP 3.1.1 or later

Dual Channel Ultra3 SCSI PCI adapter (F/C 6203)

The PCI Dual Channel Ultra3 SCSI Adapter is a 64-bit adapter and is an excellent solution for high-performance SCSI applications. This adapter provides two SCSI channels (busses). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. It supports a data rate of up to 160 MBytes per second; up to twice the maximum data transfer rate of the previous Dual Channel Ultra2 SCSI adapter (80 MBps). In order to achieve an Ultra3 SCSI bus data rate of up to 160 MBps and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To fully utilize this Ultra3 160 MBps performance, all attaching devices or subsystems should also be Ultra3 LVD devices. However; if Ultra2 and Ultra3 devices co-exist on the same bus, each device will operate at its rated speed. For lower-speed, single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface at the lower SE bus data rate of the device.

Two industry-standard VHDCI 68-pin connectors are mounted on the adapter end bracket allowing attachment of various LVD and SE external subsystems. A 0.3-meter converter cable, VHDCI to P, Mini 68-pin to 68-pin, (F/C 2118) can be used with older external SE subsystems to allow connection to the VHDCI connector on the PCI Dual Channel Ultra3 SCSI Adapter.

Note: If any Single Ended (SE) SCSI subsystem is attached to an external port of this adapter, the SCSI port will auto-throttle to “Fast” interface speed running no faster than 20MB/s. This auto-throttle function is performed to ensure best signal quality between host adapter and attaching subsystem. The second external port is unaffected unless an SE subystem is also attached to it. If so, it also will auto-throttle as described above.

Feature components

This feature order provides the following:

- Adapter card

Hardware requirements

This feature has the following hardware requirements:

- One 32 or 64-bit Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.3.3 ML9 and 5.1.0 ML1 or later
- PSSP 3.1.1 or later

SCSI-2 Ultra/Wide DE PCI adapter (F/C 6204)

The PCI SCSI-2 Ultra/Wide Differential Adapter (F/C 6204) provides a differential SCSI-2 Ultra/Wide interface that can burst data between devices on the SCSI bus at 40 MBps. F/C 6204 supports Ultra and Fast/Wide synchronous data transfers and it supports external devices (no internal connections) up to 25 m away. This adapter conforms to SCSI-2 standards and the Fast-20 (Ultra) documentation. Industry standard SCSI P (68-pin) connectors are incorporated on the adapter.

Note: Data transfer rates with F/C 6204 are limited to the speed of the slowest device on the SCSI bus.

Feature characteristics

This feature has the following characteristics:

- 32-bit Bus Master Adapter
- Supports attachment of external 8-bit or 16-bit SCSI devices on the J2 port using a 68 pin SCSI-3 standard connector

Customer components

Optional cables are available through IBM.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot per adapter

Note: Single Ended (SE) and Double Ended SCSI adapters **cannot** be twin-tailed to the same external disk array when used in a high-availability configuration.

Software requirements

This feature has the following software requirements:

- AIX 4.3.1 or later installed on the node
- PSSP 3.1 or later installed on the node
- This adapter also functions with AIX 4.2.1 and PSSP 2.4

Cable options

The following optional cables are available for the F/C 6204 SCSI adapter:

F/C 2114
16-bit DE external Y-cable, 0.9 m

F/C 2424
16-bit adapter-to-adapter SCSI cable, 0.6 m long

F/C 2425
16-bit adapter-to-adapter SCSI cable, 2.5 m long

All cables must conform to X3T9.2/90-048 standards.

Note: F/C 6204 supports a maximum cable length of 25 m.

SCSI-2 F/W cable routing

Figure 22 represents the cable routing to the SCSI-2 Differential Ultra/Wide feature installed in an SP frame, from an IBM 9076 SP Frame to an IBM 7015 Expansion Rack.

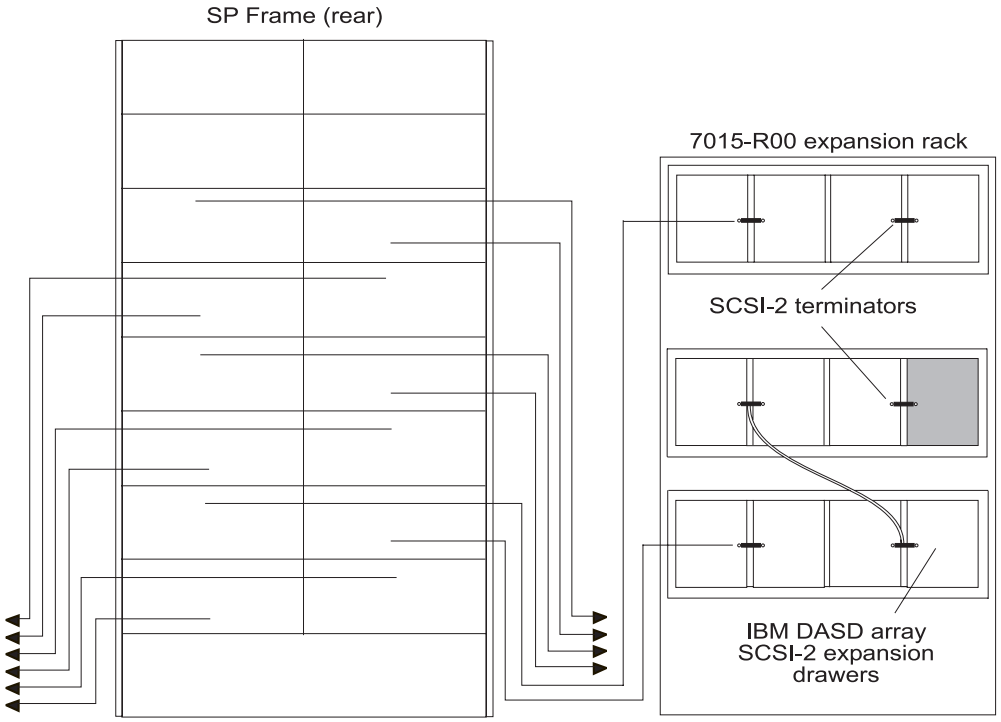

Figure 22. SCSI-2 ultra/wide configuration for processor cabling

External cable routing

The SP uses a maximum of 120 inches of SCSI-2 Ultra/Wide cable to reach the most distant node in a frame. Table 25 shows the cable budget needed to reach individual nodes in an SP frame. Subtracting these values from the overall cable length will give you the cable length available to reach other devices. Remember, F/C 6204 supports a maximum cable length of 25 m.

Table 25. Cable budget information for SCSI-2 Ultra/Wide feature

To Node	Measured in Millimeters	Measured in Inches
1	1780	71
2	1500	59
3	1680	66
4	1980	78
5	2160	85
6	1850	73
7	2030	80
8	2340	92
9	2510	99
10	2210	87
11	2390	94

Table 25. Cable budget information for SCSI-2 Ultra/Wide feature (continued)

To Node	Measured in Millimeters	Measured in Inches
12	2690	106
13	2870	113
14	2570	101
15	2740	108
16	3050	120

SCSI-2 Ultra/Wide SE PCI adapter (F/C 6206)

The PCI SCSI-2 Ultra/Wide Single Ended Adapter (F/C 6206) provides a single ended SCSI-2 Ultra/Wide interface that can burst data between devices on the SCSI bus at 40 MBps (twice the fast/wide rate) using block sizes greater than 64K. It conforms to SCSI-2 standards and Fast-20 (Ultra) documentation. Feature Code 6206 supports both internal and external devices connected to the same SCSI bus. Industry standard SCSI P (68-pin) connectors are incorporated on the adapter.

Feature characteristics

This feature has the following characteristics:

- 32-bit Bus Master PCI 2.1 adapter
- Supports attachment of internal and external single ended 8-bit and 16-bit SCSI or Ultra SCSI devices.
  - External connections on J2 with 68 pin SCSI-3 standard P connector
  - Internal connections on J3 with 68 pin high density SCSI connector for 16-bit attachments
  - Internal connections on J4 with 50 pin (2x25) SCSI connector for 8-bit attachments

Feature limitations

- Data transfer rates are limited to the speed of the slowest attached device. For example, if you connect an Ultra drive and a fast/wide drive, the adapter will limit data transfers to fast/wide rates
- If a cable is attached to the external J2 connector, data transfer rates will be limited to fast/wide rates
- Ultra data transfer rates can only be achieved using the internal connections with cable lengths of 1.5 m or less
- External cable lengths are limited to 3 m for fast/wide data transfer rates
- The internal J3 and J4 connectors cannot be used at the same time

Customer components

You must supply the following components for this feature:

- If you are using F/C 6206 to configure independent internal hard disk drives in an 332 MHz SMP wide node, you must also order F/C 1241.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot per adapter
- Optional cables listed below

Note: Single Ended (SE) SCSI adapters ***cannot*** inter-operate with Differential SCSI adapters in twin-tailed (high availability) configurations.

Software requirements

This feature has the following software requirements:

- AIX 4.3.2 or later installed on the node
- PSSP 3.1 or later installed on the node
- This adapter also functions with AIX 4.2.1 and PSSP 2.4

F/C 6206 cable options

The following optional cables are available for the F/C 6206 SCSI adapter:

F/C 2117
16-bit SE external Y-cable, 0.9 m

F/C 2424
16-bit adapter-to-adapter SCSI cable, 0.6 m long

F/C 2425
16-bit adapter-to-adapter SCSI cable, 2.5 m long

All cables must conform to X3T9.2/90-048 standards.

See “Feature characteristics” on page 132 for a list of restrictions on cables used with F/C 6206.

Note: Due to the short length of PCI SCSI cables, you must pay close attention to cable planning. You may want to limit these adapters to the lower nodes in a frame and you will want to consider such issues as frame layout and service clearances as you plan your system configuration.

SCSI-2 Ultra cable routing

Figure 22 on page 131 represents the cable routing to the SCSI-2 Single End Ultra feature installed in an SP frame, from an IBM 9076 SP Frame to an IBM 7015 Expansion Rack.

External cable routing

The SP uses a maximum of 120 inches of SCSI-2 Ultra/Wide cable to reach the most distant node in a frame. Table 26 shows the cable budget needed to reach individual nodes in an SP frame. Subtracting these values from the overall cable length will give you the cable length available to reach other devices.

Note: When an external cable is connected to F/C 6206, data transfer rates through this adapter are limited to fast/wide rates. At fast/wide data transfer rates, maximum cable length increases to 3 m for this adapter.

Table 26. Cable budget information for SCSI-2 Fast/Wide feature

To Node	Measured in Millimeters	Measured in Inches
1	1780	71
2	1500	59
3	1680	66
4	1980	78
5	2160	85

Table 26. Cable budget information for SCSI-2 Fast/Wide feature (continued)

To Node	Measured in Millimeters	Measured in Inches
6	1850	73
7	2030	80
8	2340	92
9	2510	99
10	2210	87
11	2390	94
12	2690	106
13	2870	113
14	2570	101
15	2740	108
16	3050	120

SCSI-2 Ultra/Wide DE PCI adapter (F/C 6207)

The PCI SCSI-2 Ultra/Wide Differential Adapter (F/C 6207) provides a differential SCSI-2 Ultra/Wide interface that can burst data between devices on the SCSI bus at 40 MBps. F/C 6207 supports Ultra and Fast/Wide synchronous data transfers and it supports external devices (no internal connections) up to 25 m away. This adapter conforms to SCSI-2 standards and the Fast-20 (Ultra) documentation. Industry standard SCSI P (68-pin) connectors are incorporated on the adapter.

Note: Data transfer rates with F/C 6207 are limited to the speed of the slowest device on the SCSI bus.

Feature characteristics

This feature has the following characteristics:

- 32-bit Bus Master Adapter
- Supports attachment of external 8-bit or 16-bit SCSI devices on the J2 port using a 68 pin SCSI-3 standard connector

Customer components

Optional cables are available through IBM.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot per adapter

Note: Single Ended (SE) and Double Ended SCSI adapters **cannot** be twin-tailed to the same external disk array when used in a high-availability configuration.

Software requirements

This feature has the following software requirements:

- AIX 4.3.1 or later installed on the node
- PSSP 3.1 or later installed on the node
- This adapter also functions with AIX 4.2.1 and PSSP 2.4

F/C 6207 Cable Options

The following optional cables are available for the F/C 6207 SCSI adapter:

F/C 2114
16-bit DE external Y-cable, 0.9 m

F/C 2424
16-bit adapter-to-adapter SCSI cable, 0.6 m long

F/C 2425
16-bit adapter-to-adapter SCSI cable, 2.5 m long

All cables must conform to X3T9.2/90-048 standards.

Note: F/C 6207 supports a maximum cable length of 25 m.

SCSI-2 F/W cable routing

Figure 22 on page 131 represents the cable routing to the SCSI-2 Differential Ultra/Wide feature installed in an SP frame, from an IBM 9076 SP Frame to an IBM 7015 Expansion Rack.

External cable routing

The SP uses a maximum of 120 inches of SCSI-2 Ultra/Wide cable to reach the most distant node in a frame. Table 25 on page 131 shows the cable budget needed to reach individual nodes in an SP frame. Subtracting these values from the overall cable length will give you the cable length available to reach other devices. Remember, F/C 6207 supports a maximum cable length of 25 m.

Table 27. Cable budget information for SCSI-2 Ultra/Wide feature

To Node	Measured in Millimeters	Measured in Inches
1	1780	71
2	1500	59
3	1680	66
4	1980	78
5	2160	85
6	1850	73
7	2030	80
8	2340	92
9	2510	99
10	2210	87
11	2390	94
12	2690	106
13	2870	113
14	2570	101
15	2740	108
16	3050	120

Gigabit Fibre Channel for 64-bit PCI bus adapter (F/C 6228)

The Gigabit Fibre Channel for 64-bit PCI bus adapter is a 64-bit address/data, short form factor PCI adapter with LC-type external fiber connectors that provides single or dual initiator capability over an optical fiber link or loop running up to 100 MBps. With the use of appropriate optical fiber cabling, this adapter provides the capability for a network of high speed local and remote located storage. Distances of up to 500 meters are supported. When used with IBM supported Fibre Channel Storage Hub and switches supporting longwave optics, distances of up to 10 kilometers are capable. The Gigabit Fibre Channel for 64-bit PCI Bus can be used to attach devices either directly, or by means of Fibre Channel Switches. If attaching a device or switch with SC type fiber connectors, use of an LC-SC Fibre Channel Conversion Cable (F/C 2456) is required.

For additional supported server attachment information for IBM devices, go to http://www.storage.ibm.com/hardsoft/disk/products.htm.

Consult your IBM account representative or Business Partner for additional information related to any third party attachment.

Feature characteristics

This feature has the following characteristics:

- Single fiber channel loop per adapter
- Single initiatior support (one adapter for PCI bus per loop)
- Full support for point-point, loop, fabric topologies
- High throughput, low latency transfers at full 66 MHz, 64-bit PCI 2.2 bus speed, uninhibited by communication link latencies
- Imbedded shortwave 1,2 Gbs transceiver
- Optical fiber link cabling supporting a distance of up to 500 m (1640 ft.)
- Fiber optic interface data rates of up to 100 MBps
- PCI 2.1 compatible, universal 3.3/5 volt adapter

Feature components

This feature order provides the following:

- Adapter card
- Installation instructions

Cable options

The LC-SC Fibre Channel Converter Cable (**F/C 2456**) is available from IBM to convert from LC to SC-type connectors. This cable has a male LC-type connector on one end and a female SC-type on the other. The cable length is two meters.

Customer components

You must supply the following components for this feature:

Cables to connect to SC devices using F/C 2456:

- Multimode 50/125 micron fiber with SC connectors:
  - 1062.5 MBps
  - 2 - 500 m
- Multimode 62.5/125 micron fiber with SC connectors:

  - 1062.5 MBps
  - 2 - 175 m

Cables to connect to SC devices without using F/C 2456:

- Multimode 50/125 micron fiber with LC-SC connectors:
  - 1062.5 MBps
  - 2 - 500 m
- Multimode 62.5/125 micron fiber with LC-SC connectors:
  - 1062.5 MBps
  - 2 - 175 m

Cables to connect to LC devices:

- Multimode 50/125 micron fiber with LC connectors:
  - 1062.5 MBps
  - 2 - 500 m
- Multimode 62.5/125 micron fiber with LC connectors:
  - 1062.5 MBps
  - 2 - 175 m

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Software requirements

This feature has the following software requirements:

- AIX 4.3.3 or later installed on the node
- PSSP 3.1.1 or later installed on the node
- Adapter device driver

Advanced SerialRAID Plus PCI adapter (F/C 6230)

The Advanced SerialRAID Plus Adapter (F/C 6230) is a functional enhancement to the withdrawn Advanced SerialRAID Adapter (F/C 6225; described in the next paragraph) and supports 2-initiator FWC and 2-way RAID 10.

The Advanced SerialRAID Adapter (F/C 6225), which has been withdrawn from marketing, has a data transfer rate of up to 160 MBps per loop. This high-performance multi-initiator Serial Storage Architecture (SSA) adapter provides eight-initiator non-RAID capability, two-initiator RAID-5 capability, and one-initiator RAID-0 capability. The adapter utilizes the SSA Enhanced Loop (EL) architecture which offers a choice for SSA HA data protection; disk mirroring for the best performance or multi-initiator RAID for the lowest total system cost. SSA EL adapter architecture enables RS/6000 SP PCI systems to share SSA storage in a multi-host SSA environment (cluster/SP). The Advanced SerialRAID Adapter with up to 160 MBps data transfer rate per loop and optional 32 MB Fast-Write Cache increases the RS/6000 SP storage performance in single-initiator and multi-initiator/multi-host environments. Boot support is only via the AIX Network Install Manager (NIM). The adapter accepts a 32 MB Fast-Write Cache Option Card (F/C 6235) in either a one-initiator RAID or one-initiator non-RAID application.

Feature characteristics

- Up to 160 MBps data transfer rates per loop
- Support for the following options:
  - 8-way JBOD
  - 2-way RAID 5
  - 2-way RAID 10
  - 1-way RAID 0
  - 2-initiator Fast Write Cache with failover (F/C 6235)
  - 128 MB DIMM (F/C 6231) available for full capacity FWC with two initiatiors
  - TMSSA and fencing (used primarily by HACMP)
  - Two adapters in same host on same loop - automatic adapter takeover on failure
  - Hot spares on same loop - automatic rebuild on disk failure (RAID 5 and RAID 10 configurations)
- Interoperates with PCI SSA Multi-Initiator/RAID EL Adapter (F/C 6215), MCA SSA Multi-Initiator/RAID EL Adapter (F/C 6219), and Advanced SerialRAID Adapter (F/C 6225) in JBOD and RAID 5
- PCI 2.1 compatible, universal 3.3/5 volt adapter
- Native and NIM boot/install from JBOD disks:
  - Boot after NIM AIX install on AIX 4.2.1 and 4.3.2/n
  - Boot after Native AIX install on AIX 4.3.n
- Supports 48 drives per loop, 96 drives per adapter
- Operates at 40 MBps on SSA link when attached to another 40 MBps capable port

Feature components

This feature order provides the following:

- Adapter card
- CD-ROM with adapter device driver
- Installation instructions

Customer components

No customer components required.

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Software requirements

This feature has the following software requirements:

- AIX 4.2.1, 4.3.2 or later installed on the node

  Note: Requires updates to operate properly. An update CD-ROM (9903, or later) containing these updates can be obtained by calling 1-800-879-2755 in USA and ordering feature number 0837 for AIX Version 4.2.1 or feature number 0838 for AIX Version 4.3.2.
- PSSP 3.1 or later installed on the node

- Adapter device driver (provided with the adapter)

Limitiations

The adapter has the following limitations:

- Will not operate in SSA configurations supporting High-Performance 4-Port SSA Adapter (F/C 6214) or Enhanced 4-Port SSA Serial Adapter, Micro Channel (F/C 6216)
- No native IPL boot support from SSA disk drives
- RAID arrays must have all array members in the same SSA loop
- PCI system interface only

Typical SP system configuration

The Advanced SerialRAID Adapter operated in a RAID 5 configuration supports (2+P) to (15+P) arrays and up to six (15+P) arrays. The adapter also supports hot spares in RAID 5 mode. For help in configuring your system, consult the *Advanced Serial Raid Adapter User Guide* which is shipped with the adapter.

128 MB DIMM Option Card (F/C 6231)

The 128 MB DIMM Option Card provides full capacity Fast Write Cache with two initiatiors for both the Advanced SerialRAID Adapter (F/C 6225) and the Advanced SerialRAID Plus Adapter (F/C 6230). The feature includes the DIMM module and its installation instructions.

32 MB Fast-Write Cache Option Card (F/C 6235)

The 32 MB Fast-Write Cache Option Card is a 32 MB fast-write optional feature that plugs into the Advanced SerialRAID Adapter (F/C 6225) and the Advanced SerialRAID Plus Adapter (F/C 6230). It utilizes non-volatile RAM. If an Advanced SerialRAID Adapter fails, a replacement adapter can be installed and the fast-write cache can be removed from the failing adapter and installed in the new adapter insuring data integrity. The 32 MB Fast-Write Cache Option Card provides a significant improvement of data throughput and response time under certain conditions compared to SSA RAID adapters without the fast-write cache. The response time and data transfer improvement using the optional card varies depending upon data block sizes, percentage of sequential writes, and machine type/model application parameters. The 32 MB Fast-Write Cache Option Card plugged into the Advanced SerialRAID Adapter operates in either non-RAID or RAID 5 mode, in a single-initiator configuration.

ARTIC960RxD Quad Digital Trunk PCI adapter (F/C 6310)

The ARTIC960RxD Quad Digital Trunk Adapter provides voice processing for up to four T1 or E1 digital trunk lines, providing connectivity for 96 (T1) or 120 (E1) voice channels in a single PCI slot. The voice processing function is provided by DirectTalk for AIX, Version 2.1 LPP. The adapter provides high-function control of I/O operations and serves to off-load I/O tasks from the system microprocessor.

Feature characteristics

This feature has the following characteristics:

- 32-bit PCI 2.1 adapter
- One 36-pin, high-density port

- Support for up to four (4) T1 or E1 trunk lines
- Supports voice processing using DirectTalk for AIX

Feature components

- One ARTIC960RxD adapter (F/C 6310)
- A connecting cable (required); the following cables are available from IBM:

  F/C 2709
  ARTIC960Hx 4-port T1 RJ45 cable

  F/C 2710
  ARTIC960Hx 4-port E1 RJ45 cable

  F/C 2871
  ARTIC960RxD Quad DTA, T1, 100 ohm, 3 m 4-port cable

  F/C 2872
  ARTIC960RxD Quad DTA, T1, 100 ohm, 15 m extension cable

  F/C 2873
  ARTIC960RxD Quad DTA, E1, 120 ohm balanced, 3 m 4-port cable

  F/C 2874
  ARTIC960RxD Quad DTA, E1, 120 ohm balanced, 7.5 m extension cable

  F/C 2875
  ARTIC960RxD Quad DTA, E1, 75 ohm unbalanced-grounded, 1.8 m 4-port cable

  F/C 2876
  ARTIC960RxD Quad DTA, E1, 75 ohm unbalanced-ungrounded, 1.8 m 4-port cable

  F/C 2877
  ARTIC960RxD Quad DTA, H.100, 4-drop cable

Hardware requirements

This feature has the following hardware requirements:

- One 32-bit Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature has the following software requirements:

- AIX 4.2.1, AIX 4.3.2 or later
- DirectTalk for AIX, Version 2.1 LPP (5765-B81) to provide voice processing
- Adapter device driver (provided with adapter)

ARTIC960RxF Digital Trunk Resource Adapter (F/C 6311)

The Artic960RxF Digital Trunk Resource Adapter provides H.100/SCBus support for TDM-based functions such as conferencing, DSP speech recognition and text-to-speech plus one-call FAX. It is intended for use with the Corepoint DT/6000 Voice Recognition product. It has no external connections.

Feature characteristics

This feature has the following characteristics:

- Must be used in conjunction with DTXA

- Intel 80960 RD processor with 4 MB DRAM
- Universal PCI adapter
- Replaces Dialogic Antaries ISA adapter
- 32-bit PCI interface
- A PLX 9080 local bus provides access to the SC4000s and DSPs from the i960
- Two TI C67x floating point DSPs; each with 512 KB external SBSRAM, 4MB of external SDRAM, operating at a clock cycle of 167 MHz
- Two SC4000 chips provide H.100/SCBus support for TDM-based functions such as conferencing, DSP speech recognition, and text-to-speech plus one-call FAX
- A PMC connector to allow attachment of an optional daughter card

Feature components

- One ARTIC960RxF adapter (F/C 6311)
- ARTIC RTE CD kit
- Diagnostics disk
- A connecting cable (required); the following cables are available from IBM:

  F/C 2877
  ARTIC960RxD Quad DTA, H.100, 4-drop cable

  F/C 4353
  ARTIC960RxD Quad DTA, H.100, 8-drop cable

Hardware requirements

This feature has the following hardware requirements:

- One 32-bit Peripheral Component Interconnect (PCI) adapter slot
- Must be used in conjunction with the ARTIC960RxD adapter

Required software

This feature has the following software requirements:

- AIX 4.2.1 or later installed on the node
- PSSP 3.1 or later installed on the node
- DirectTalk for AIX, Version 2.2 (5765-B81) to provide voice processing
- Adapter device driver (provided with adapter)

Typical configuration

A total of 6 Artic960RxD adapters and Artic960RxF adapters can be configured into a node dependent on the node limitations and restrictions. A maximum of 3 Artic960RxD adapters and 3 Artic960RxF adapters are supported. Any combination of the two can be used as long as at least 1 Artic960RxD is used. These cards are connected together via one of two top card cables. The table below is a usage matrix for the cables with the two adapters.

Table 28. Cable use for ARTIC960RxD and ARTIC960RxF

Quantity of ARTIC960RxD	Quantity of ARTIC960RxD	Use F/C 2877	Use F/C 4353
1	0	No	No
	1, 2, or 3	Yes	No

Table 28. Cable use for ARTIC960RxD and ARTIC960RxF (continued)

Quantity of ARTIC960RxD	Quantity of ARTIC960RxD	Use F/C 2877	Use F/C 4353
2	0, 1, or 2	Yes	No
	3	No	Yes
3	0 or 1	Yes	No
	2 or 3	No	Yes

Chapter 15. Hard disk drives

Hard disk drives are either internally or externally mounted. Internal hard disk drives are installed in bays within the node, while external hard disk drives are mounted in separate hard disk drive frames.

Internal hard disk drives

Hard disk drive feature options available for each node type are listed in Table 29. Note that you can order some node types with no internal hard disk drives (with external booting). For information on the hard disk drive capacity of a specific node type, refer to the respective node sections. For pointers, see “Planning for internal hard disk drives” on page 144.

Table 29. Hard disk drive options for current node types

Feature code	Size	Type	Node type
2918	18.2 GB	Ultra SCSI disk pair	375 MHz POWER3 High 375/450 MHz POWER3 Thin 375/450 MHz POWER3 Wide POWER3 High POWER3 Thin POWER3 Wide 332 MHz Thin 332 MHz Wide
3803	18.2 GB	Ultra SCSI disk pair	SP Expansion I/O Unit
3810	18.2 GB	Ultra SCSI 10K RPM disk pair	375 MHz POWER3 High 375/450 MHz POWER3 Thin 375/450 MHz POWER3 Wide POWER3 High POWER3 Thin POWER3 Wide
3811	18.2 GB	Ultra SCSI 10K RPM disk pair	SP Expansion I/O Unit
3820	36.4 GB	Ultra SCSI 10K RPM disk pair	375 MHz POWER3 High 375/450 MHz POWER3 Wide POWER3 High POWER3 Wide
3821 (note 4)	36.4 GB	Ultra SCSI 10K RPM disk pair	SP Expansion I/O Unit
3844	73.4 GB	Ultra3 SCSI 10K RPM disk pair	375/450 MHz POWER3 Wide
Reference information for withdrawn hard disk drives			
2900	4.5 GB	Ultra SCSI	332 MHz Thin 332 MHz Wide 160 MHz thin
2904	4.5 GB	Ultra SCSI disk pair	POWER3 Thin POWER3 Wide 332 MHz Thin 332 MHz Wide

Table 29. Hard disk drive options for current node types (continued)

Feature code	Size	Type	Node type
2908	9.1 GB	Ultra SCSI	332 MHz Thin 332 MHz Wide 160 MHz Thin
2909	9.1 GB	Ultra SCSI disk pair	375 MHz POWER3 High 375/450 MHz POWER3 Thin 375/450 MHz POWER3 Wide POWER3 High POWER3 Thin POWER3 Wide 332 MHz Thin 332 MHz Wide
3000	4.5 GB	Fast / Wide	332 MHz Thin 332 MHz Wide 200 MHz High 160 MHz Thin 135 MHz Wide
3010	9.1 GB	Fast / Wide	332 MHz Thin 332 MHz Wide 160 MHz Thin 135 MHz Wide
3800	9.1 GB	Ultra SCSI disk pair	SP Expansion I/O Unit
3802	9.1 GB	SSA disk pair	SP Expansion I/O Unit
3804	9.1 GB	Ultra SCSI 10K RPM disk pair	375 MHz POWER3 High 375/450 MHz POWER3 Thin 375/450 MHz POWER3 Wide POWER3 High POWER3 Thin POWER3 Wide
3805	9.1 GB	Ultra SCSI 10K RPM disk pair	SP Expansion I/O Unit
3812	18.2 GB	SSA 10K RPM disk pair	SP Expansion I/O Unit
3822 (note 4)	36.4 GB	SSA 10K RPM disk pair	SP Expansion I/O Unit

Notes:

1. Some nodes support independent mirroring. Consult node chapters for details.
2. Some node types have a minimum and maximum allowable quantity of hard disk drives. For details, consult the respective node chapter.
3. Some nodes require Micro Channel adapters and cables to utilize particular hard disk drive options.
4. Requires SP Expansion I/O Unit power upgrade (F/C 9955).

Planning for internal hard disk drives

Some nodes require adapters to attach internal hard disk drives while other nodes have integral SCSI drops for that purpose. Also, these nodes can use optional SCSI adapters which allow you to configure internal and external hard disk drives to meet your needs. You can find specific information for hard disk drive requirements and options for each node type in the following node sections:

- 375 MHz POWER3 High Node, see “Hard disk drive requirements and options” on page 11.
- SP Expansion I/O Unit, see “Hard disk drive options” on page 12.
- 375/450 MHz POWER3 Wide Node, see “Hard disk drive requirements and options” on page 17.
- 375/450 MHz POWER3 Thin Node, see “Hard disk drive requirements and options” on page 21.
- Withdrawn nodes, see “Withdrawn processor nodes” on page 217.

External hard disk drives

External hard disk drives can be used to greatly increase the storage capacity of your SP system. The available capacity is limited only by such issues as the following:

- How many adapter slots are available in your system?
- Are you using data protection, such as RAID5?
- Are you using disk mirroring?
- What are your required data storage and retrieval rates?
- Do you need hot spares?

In addition, there are hardware configuration issues that your IBM representative can help you assess.

The following external hard disk drive subsystems are compatible with the IBM R/S 6000 SP System:

2104 The 2104 Expandable Storage Plus disk enclosure has space for up to ten hot-swappable Ultra2 (LVD) disk drives, including high-performance 9.1, 18.2, and 36.4 GB (7,200 and 10,020 rpm) Ultrastar drives. It offers affordable high performance, high availability, redundant power and cooling, and HACMP support for clustered server environments.

2104 models available include:

- 2104-DU3
- 2104-TU3
- 2104 Model TL1 (tower with 10 bays) (withdrawn)
- 2104 Model DL1 (frame-mount drawer with 10 bays) (withdrawn)

2105 The 2105 Versatile Storage Server disk subsystem attaches to the SP system through multiple SCSI-2 fast/wide DE adapters or differential Ultra SCSI adapters. Up to eight dual-port Ultra SCSI adapters can be installed in the 2105. Each adapter provides two Ultra SCSI buses that support up to four hosts each. All hosts must be of the same type, and cable lengths cannot exceed 20 m (65 ft.).

The 2105 supports high performance processors and up to 6 GB of memory. Up to eighteen 7133 drawers can be controlled by the VS 2105. Four of these drawers are installed in the base frame and the others are mounted in optional 2105-100 frames. In order to size your system, you need to know your projected workload and I/O rates.

- 2105-F10/F20 ESS
- 2105-B09 VSS (withdrawn)
- 2105-E10/E20 ESS (withdrawn)

7027 The 7027 High Capacity Storage Drawer provides large amounts of SCSI

disk space in a standard frame. The base system includes four 2.2 GB, hot-swappable disk drives and includes twenty additional hot-swappable, one-inch disk bays. The 7027 will support up to twenty 2.2 GB drives or ten 4.5 GB drives connected through two internal SCSI attachments. This unit provides up to 53.8 GB of storage. An optional expansion unit adds up to six additional 2.2 GB (or three 4.5 GB) drive bays for 67.3 GB of storage.

There are two model 7027s:

- 7027 HSC connects to the host through a single ended SCSI
- 7027 HSD connects to the host through a differential SCSI (withdrawn)

The 7027 has standard redundant fans, dual power cords, remote power-on, and hot-swappable disks that work with an optional N+1 power supply to meet high availability requirements. A twin initiator option is available for the configurations without the expansion unit. The 7027 attaches to your SP system through a fast/wide SCSI-2 PCI RAID adapter that enables RAID 0, 1, or 5 support.

7131-105

The 7131 Model 105 SCSI Multi-Storage Tower incorporates disk-drive modules, tape, and CD-ROM options. The 7131-105 is initially configured with two disk drives of either 2.2, 4.5, or 9.1 GB each. The tower also has three additional hot-swappable slots and two media slots. The hot-swappable slots can be configured with a mix of available drives. The media slots will accept additional disks, tape, or optical storage options.

7131 SCSI Multi-Storage Tower Model 105 supports a total of 63.7 GB of disk capacity with RAID 0, 1, and 5 support. The SCSI-2 interface operates in a fast/wide mode using optional single-ended or differential adapters. High Availability Cluster Multi-Processing (HACMP) is supported and with two towers and you can mirror data.

7131-405 (withdrawn)

The 7131 Model 405 SSA Multi-Storage Tower provides high performance SSA (Serial Storage Architecture) that exceeds the capabilities of SCSI-attached storage. The 7131-405 is initially configured with two Ultra disk drives of either 2.2, 4.5, or 9.1 GB each. The tower also has three additional hot-swappable disk slots that can be configured with a mix of available drives.

7131 SSA Multi-Storage Tower Model 405 supports a total of 45.5 GB of disk capacity with RAID 5 support. The SSA interface can be connected to multiple systems. Using a 4-port adapter, two hosts can be attached. With an enhanced 4-port SSA adapter, up to eight hosts can be attached. The 7131-405 can be configured for either MCA or PCI, RAID or non-RAID applications by your choice of adapters. Using two towers, you can mirror data.

7133 The 7133 SSA Disk Subsystem provides high performance SSA (Serial Storage Architecture) storage. The 7133 is available in four models:

- 7133 D40
- 7133 T40
- 7133 010 (frame mounted) (withdrawn)
- 7133 500 (frame mounted) (withdrawn)
- 7133 020 (tower unit) (withdrawn)
- 7133 600 (tower unit) (withdrawn)

The 7133 010 and 500 can be configured with three different disk modules using a mix of 1.1 GB, 2.2 GB, and 4.5 GB Ultra disk drives. The 7133 020 and 600 can be configured with combinations of 2.2 GB, 4.5 GB, and 9.1 GB Ultra disk drives. All drives are hot-swappable using auto-docking carriers.

7133 SSA Disk Subsystems support a total of 145 GB of disk capacity per unit and 873 GB per host adapter. Single-host attachment with RAID 5 support is available for PCI and MCA systems. The SSA interface can also be connected to multiple systems. Using a 4-port adapter, two hosts can be attached. With an enhanced 4-port SSA adapter, up to eight hosts can be attached.

7137 All 7137 Disk Array Subsystems have a base configuration of three drives, a high performance controller card and redundant power supplies. Each model can be expanded to a maximum of eight drives. All drives are hot-swappable. All 7137 Disk Arrays attach to your SP system through a fast/wide SCSI-2 differential interface.

The models available in the 7137 line include:

- 7137 Model 413 (tower with 2.1 GB drives)
- 7137 Model 513 (frame mount with 2.1 GB drives)
- 7137 Model 414 (tower with 4.3 GB drives)
- 7137 Model 514 (frame mount with 4.3 GB drives)
- 7137 Model 415 (tower with 8.8 GB drives)
- 7137 Model 515 (frame mount with 8.8 GB drives)

Models 413, 414, 513, and 514 have a standard 1 MB write cache and a 4 MB optional cache. Models 415 and 515 have a standard 4 MB cache. The 7137 also supports RAID 0 and 5 and HACMP.

External boot disks

Some external hard disk drive subsystems can be used as boot disks for some node types. If you configure your SP system with external boot disks, nodes attached to the external boot subsystem can be configured without any internal disks. To specify a node with external booting and no internal hard disk drives, order the following feature codes:

- **F/C 9121** for nodes using an external SSA hard disk drive subsystem
- **F/C 9124** for nodes using an external SCSI hard disk drive subsystem

Consult the tables in each section below for valid system configurations.

External SSA drives (F/C 9121)

This section lists the external SSA hard disk drives that are valid boot disks for SP nodes.

7133 SSA Disk Subsystem: The following 7133 models are supported for external booting in the SP system:

- 7133-D40
- 7133-T40
- 7133 010 (withdrawn)
- 7133 500 (withdrawn)
- 7133 020 (withdrawn)
- 7133 600 (withdrawn)

Table 30 lists the SP node types that can be configured for external booting with the 7133.

Table 30. SP nodes supporting bootable SSA functions with the 7133

Node type	Supported adapters
375 MHz POWER3 SMP High Node (F/C 2058)	F/C 6225, 6230
375/450 MHz POWER3 Wide Node (F/C 2057)	F/C 6225, 6230
375/450 MHz POWER3 Thin Node (F/C 2056)	F/C 6225, 6230
Reference information for withdrawn nodes	
POWER3 High Node (F/C 2054)	F/C 6225, 6230
POWER3 Wide Node (F/C 2053)	F/C 6225, 6230
POWER3 Thin Node (F/C 2052)	F/C 6225, 6230
332 MHz Wide Node (F/C 2051)	F/C 6225, 6230
332 MHz Thin Node (F/C 2050)	F/C 6225, 6230
160 MHz Thin Node (F/C 2022)	F/C 6214, 6216, 6217, 6219
200 MHz High Node (F/C 2009)	F/C 6214, 6216, 6217, 6219
135 MHz Wide Node (F/C 2007)	F/C 6214, 6216, 6217, 6219
120 MHz Thin Node	F/C 6214, 6216, 6217, 6219
112 MHz SMP High Node	F/C 6214, 6216, 6217, 6219
77 MHz Wide Node	F/C 6214, 6216, 6217, 6219

Notes:

1. If you do not see a node listed, it **is not supported** for external booting using the 7133.
2. F/C 6225 is withdrawn from production.

External SCSI drives (F/C 9124)

This section lists the external SCSI hard disk drives that are valid boot disks for SP nodes.

2104 Expandible Storage Plus: The following 2104 models are supported for external booting in the SP system:

- 2104-DU3
- 2104-TU3

Table 31 on page 149 lists the SP node types that can be configured for external booting with the 2104.

7027 High Capacity Storage Drawer: The following 7027 model is supported for external booting in the SP system:

- 7027 HSD (withdrawn)

Table 31 on page 149 lists the SP node types that can be configured for external booting with the 7027.

Table 31. SP nodes supporting bootable SCSI functions with the 7027

Node type	Supported adapters
375 MHz POWER3 SMP High Node (F/C 2058)	F/C 6203, 6204, 6207
375/450 MHz POWER3 SMP Wide Node (F/C 2057)	F/C 6203, 6204, 6207, 6209
375/450 MHz POWER3 SMP Thin Node (F/C 2056)	F/C 6203, 6204, 6207, 6209
Reference information for withdrawn nodes	
POWER3 SMP High Node (F/C 2054)	F/C 6204, 6207
POWER3 SMP Wide Node (F/C 2053)	F/C 6204, 6207, 6209
POWER3 SMP Thin Node (F/C 2052)	F/C 6204, 6207, 6209
332 MHz SMP Wide Node (F/C 2051)	F/C 6204, 6207, 6209
332 MHz SMP Thin Node (F/C 2050)	F/C 6204, 6207, 6209
160 MHz Thin Node (F/C 2022)	F/C 2412, 2416, 2420
200 MHz High Node (F/C 2009)	F/C 2412, 2416, 2420
135 MHz Wide Node (F/C 2007)	F/C 2412, 2416, 2420
120 MHz Thin Node	F/C 2412, 2416, 2420
112 MHz High Node	F/C 2412, 2416, 2420
77 MHz Wide Node	F/C 2412, 2416, 2420
66 MHz Wide Node	F/C 2412, 2416, 2420
66 MHz Thin Node (and Thin 2)	F/C 2412, 2416, 2420
Notes: 1. If you do not see a node listed, it **is not supported** for external booting using the 7027. 2. F/C 2416 and 2420 are withdrawn from production.	

7131 SCSI Multi-Storage Tower: The following 7131 model is supported for external booting in the SP system:

- 7131 Model 105

Table 32 lists the SP node types that can be configured for external booting with the 7131.

Table 32. SP nodes supporting bootable SCSI functions with the 7131

Node type	Supported adapters
375 MHz POWER3 SMP High Node (F/C 2058)	F/C 6204, 6207
375/450 MHz POWER3 SMP Wide Node (F/C 2057)	F/C 6204, 6207, 6209
375/450 MHz POWER3 SMP Thin Node (F/C 2056)	F/C 6204, 6207, 6209
Reference information for withdrawn nodes	
POWER3 SMP High Node (F/C 2054)	F/C 6204, 6207
POWER3 SMP Wide Node (F/C 2053)	F/C 6204, 6207, 6209
POWER3 SMP Thin Node (F/C 2052)	F/C 6204, 6207, 6209
332 MHz SMP Wide Node (F/C 2051)	F/C 6204, 6207, 6209

Table 32. SP nodes supporting bootable SCSI functions with the 7131 (continued)

Node type	Supported adapters
332 MHz SMP Thin Node (F/C 2050)	F/C 6204, 6207, 6209
160 MHz Thin Node (F/C 2022)	F/C 2412, 2416, or 2420
200 MHz High Node (F/C 2009)	F/C 2412, 2416, 2420
135 MHz Wide Node (F/C 2007)	F/C 2412, 2416, 2420
120 MHz Thin Node	F/C 2412, 2416, 2420
112 MHz High Node	F/C 2412, 2416, 2420
77 MHz Wide Node	F/C 2412, 2416, 2420
66 MHz Wide Node	F/C 2412, 2416, 2420
66 MHz Thin Node (and Thin 2)	F/C 2412, 2416, 2420

Notes:

1. If you do not see a node listed, it **is not supported** for external booting using the 7131.
2. F/C 2416 and 2420 are withdrawn from production.

Chapter 16. Power and electrical requirements

This chapter describes the planning tasks for your RS/6000 SP power and electrical needs. Information is included to help you calculate the power and electrical requirements for your particular system configuration. A worksheet you can photocopy to calculate and record your SP frame power requirements is in “Using the SP frame power computation worksheet” on page 161.

RS/6000 SP system frames each contain an individual power subsystem with an attached ac power cord. You, along with your IBM representative, must plan for your power needs based on the frame configuration you select.

Remember to keep in mind any future power loads and branch circuit requirements as you design your system wiring.

Note: The air conditioning system at your installation must provide year-around temperature and humidity control. Use the information in this section to assist in assessing your air conditioning requirements.

Preliminary power planning considerations

Evaluating primary computer power service

While a dedicated power supply is not necessary for maximum reliability, the computer room power panel should connect to feeders that do not serve other loads. Connect electrical noise producing devices such as motors or air conditioning equipment to panels separate from those feeding the system frames.

For improved system availability, you can use two separate ac power sources for your SP system. For details, see “SP Frame Redundant Power Supply (F/C 3885, 3886)” on page 159.

Obtaining power system backup devices

The primary input power to your SP system can be protected with an uninterruptible power supply (UPS) which is available through IBM. For information on performance and availability, contact:

IBM Global Services
1-888-426-4343
Request the “UPS connection”

Evaluating location and availability of receptacles

Consider the location and availability of adequate electrical power outlets to ensure maximum reliability for your RS/6000 SP system. Ensure that you plan the frame positions with consideration given to power cord lengths in addition to any communication cable length requirements, such as Ethernet and RS-232 cables.

Installing emergency power-off controls

As a safety precaution, you can provide emergency power-off controls for disconnecting the main service wiring that supplies the RS/6000 SP system. Install these controls at a convenient place for the operators and next to the main exit doors of the room after checking local electrical codes for further guidelines.

Protecting branch circuits and connecting ground conductors

The following are recommendations for protecting your site ac wiring:

1. Install circuit protection for the individual branch circuits that complies with national and local electrical codes.
2. Label each protector to identify the branch circuit that it controls.

   IBM ac power cords contain an insulated equipment-grounding wire (solid green or green with yellow stripe) that connects the machine frame to the ground terminal at the power plug. Electrical branch circuits provide a ground pin at the branch receptacle.
3. Connect the ground pin through a green ground wire to the building ground at the electrical service entrance box.

   If your building does not have a ground pin at the receptacle, upgrade your power distribution system to provide properly grounded receptacles before connecting your RS/6000 SP system. This ensures electrical safety and reduces the possibility of electrical interference problems.
4. Ensure that the ground has sufficiently low impedance to limit the voltage to ground and to ensure the proper operation of protective devices in the electrical circuit. As an example, the ground path should not exceed one (1) ohm for 120-volt, 20-ampere branch circuit devices. Your local requirements might be more stringent.
5. Ensure that all grounds entering the room are interconnected somewhere within the building to provide a common ground potential. This includes any separate power sources, lighting and convenience outlets, and other grounded objects such as building steel, plumbing, and duct work.
6. Ensure that the equipment grounding conductor to the power distribution center is electrically bonded to the enclosure and to the connector grounding terminal. The conduit must not be used as the only grounding means and it must be connected in parallel with any grounding wires it contains.

Frame-to-Frame Grounding

In order to maintain your entire SP system at the same electrical potential, frame-to-frame ground cables ***must*** be installed between all frames in your SP system. IBM ships these ground cables (P/N 46G5695) with the SP system and they are attached during system installation.

Frame-to-frame ground cables must also be installed to all optional SP equipment such as SP-attached servers and SP Switch Routers.

Figure 23 on page 153 illustrates a correctly-wired, typical power distribution network. Use this and the power system recommendations in *IBM General Information Manual: Installation Manual–Physical Planning*, GC22-7072 as you evaluate the power distribution for your SP installation.

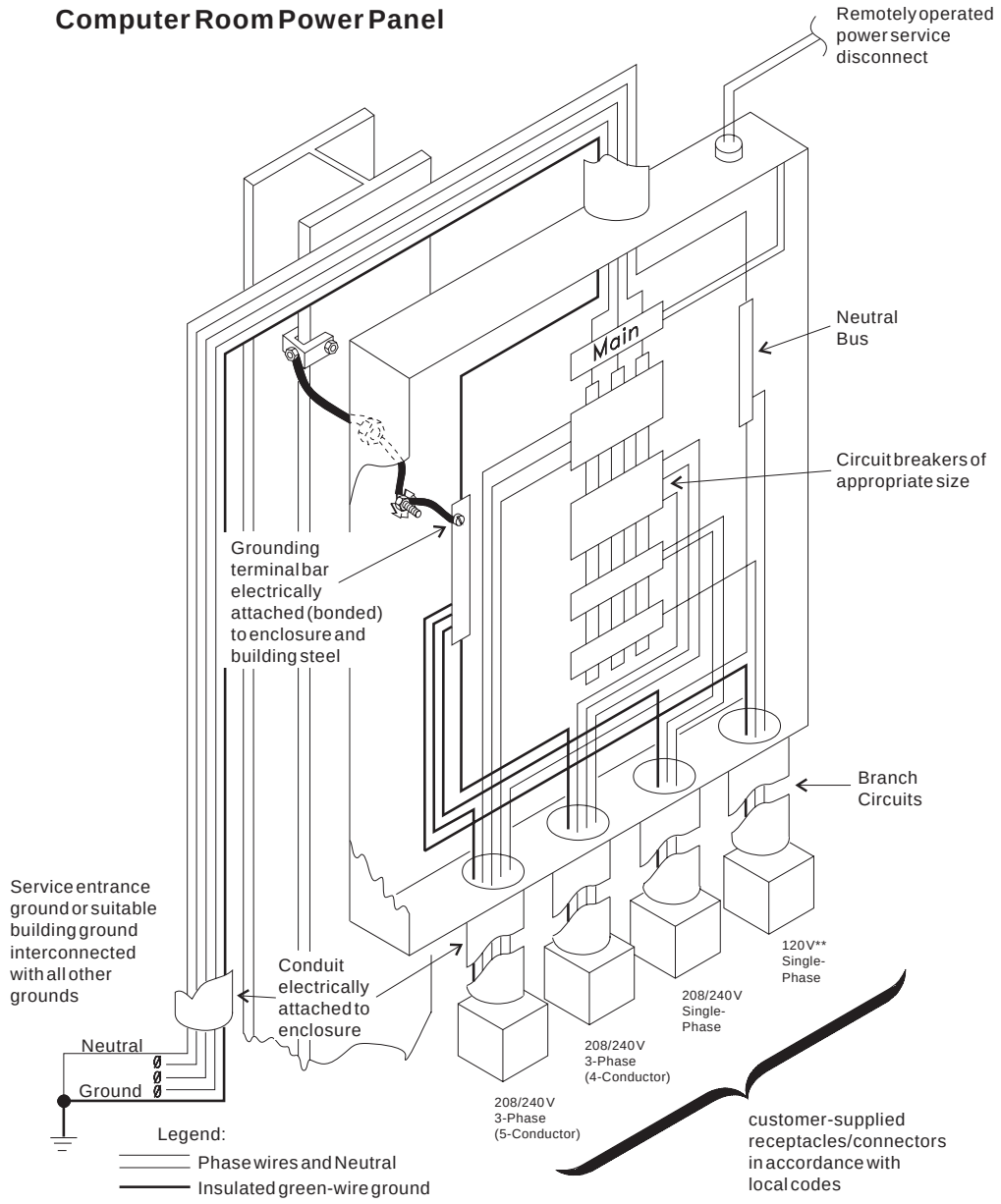

Figure 23. Typical power distribution system

Evaluating SP system power requirements

Power for the components in RS/6000 SP frames is provided by the Scalable Electric Power Base Unit (SEPBU). This section has information on these power supplies, their required power input, branch circuits and circuit breakers, and their IBM-supplied ac power cords and plugs.

Scalable Electric Power Base Unit (SEPBU)

What is a SEPBU?

The SEPBU provides base +12 V dc and bulk +48 V dc power for the SP system. The SEPBU contains individual power supply modules known as Base Power Regulators which draw only the electrical current required to support the components installed in the frame.

Three-phase SEPBUs accept both low-voltage (200-240 V ac nominal) and high-voltage (380-415 V ac nominal) input power options without the use of an external transformer. Three-phase 10.5 kW SEPBUs are used in 1.93 m frames and have N+1 redundant power as a standard feature.

Single-phase SEPBUs accept only low voltage (200-240 V ac nominal) input power. Single-phase 5.0 kW SEPBUs are used in 1.25 m frames. Redundant power (N+1) is an optional feature (**F/C 1213**).

Note: Frames with early-style 3.5 kW or 7.0 kW SEPBUs ***must*** be upgraded to 5.0 kW or 10.5 kW capability, respectively, before SMP nodes using PCI adapters can be installed in an SP frame. For details, see “Upgrading power systems in early SP frames” on page 202.

SEPBU Base Power Regulators (BPRs): Power supply modules called Base Power Regulators (BPRs) or ***books***, are installed in the SEPBU to provide scalable power output configurations. This modular design allows you to reconfigure the SEPBU to meet changing power requirements as you expand or reconfigure your SP system.

The BPRs each contain individual circuit breakers (CBs); the SEPBU has no mainline circuit breaker. The electrical branch circuit breaker that protects the installation site wiring also protects the input sections of the SEPBU. The proper branch circuit CB is required for safe installation and operation of the SEPBU. CBs with motor-start characteristics are necessary to allow inrush currents of 90 amperes maximum peak during the power-on of the SP system. This inrush current decays within five cycles. For details, see “Balancing circuit breaker performance” on page 155.

SEPBU Power Control Interface: The SEPBU Power Control Interface provides remote power control. This allows an SP frame with a SEPBU to either control or be controlled by external devices, such as disk units or tape drives, or another SP frame with a SEPBU. Outputs from different SEPBUs can be connected in parallel to allow any SEPBU to control a device. Two auxiliary inputs allow external devices to control the SP. A local/auxiliary switch at the rear of the SEPBU overrides the remote input when it is in the local position. The frame main power on/off switch can act as a unit emergency power off (UEPO) switch for the SP system. For details on implementing this function, see Appendix B, “SEPBU Power Control Interface” on page 207.

SEPBU input branch circuit requirements

The SEPBU is capable of supporting various power circuit configurations. Fifty-ampere branch circuit cables can be installed but must have branch circuit CBs appropriate for the SEPBU type. You can use higher-power configurations for future growth, eliminating the need to rewire your branch circuits.

A green/yellow safety ground is required for all configurations. The SEPBU is not phase-rotation sensitive. A proper branch circuit with an appropriate circuit breaker (CB) must be used. SEPBU branch power circuit requirements are listed in Table 33 and Table 34 on page 156.

For details on using two independent input circuits to prevent SP system outages, see “SP Frame Redundant Power Supply (F/C 3885, 3886)” on page 159.

Balancing circuit breaker performance

SP frames connected to high-voltage (380-415 V ac nominal) branch feeds are often protected by current limiting miniature circuit breakers or supplementary protectors. The most commonly used protectors have a C-curve time/current characteristic offering moderate transient overload capability.

The same type of protector is used in the individual BPRs (books). Thus, some planning is required to set up a system with branch breakers and BPR breakers that trip in a coordinated manner. In SP installations where branch and BPR breakers have similar characteristics, an electrical fault in a BPR can result in the branch circuit breaker tripping simultaneously with the circuit breaker on the BPR. Thus, rather than the SEPBU functioning in N– mode, the entire frame powers down.

Beyond the branch circuit, you must also coordinate the response time of circuit breakers from the building main to the branch feed. Failure to do so can result in the loss of power to a large portion of an installation if an overload develops in a branch circuit. Since the building distribution path can include a wide variety of circuit breakers and possible UPS devices, site-specific research is required.

When you plan a new installation or an upgrade to an existing ***high-voltage*** (380-415 V ac) system, slow-transfer type circuit breakers must be installed in the branch circuits supplying the frames.

Recommended high-voltage branch CBs

The following slow-transfer circuit breakers have been tested and are recommended for ***high-voltage*** branch circuits:

Siemens (ITE) EFC3M030

Eaton (Heinemann) CD3-A3-AB0030-01B

Philips (Airpax) 219-3-1-66-5-8-30

Low-voltage (200-240 V ac nominal) branch circuit requirements

Table 33. Low-voltage (200-240 V ac) branch circuit requirements

SEPBU output power	Quantity of BPRs	BPR locations	Frame power configuration	Branch circuit	Branch circuit breaker
5.0 kW	1	Pos D	1.25 m frames without redundant power	Single-phase, 50/60Hz, 30 amp	40 amp preferred 50 amp acceptable

Table 33. Low-voltage (200-240 V ac) branch circuit requirements (continued)

SEPBU output power	Quantity of BPRs	BPR locations	Frame power configuration	Branch circuit	Branch circuit breaker
5.0 kW	2	Pos C,D	1.25 m frames with N+1 redundant power	Single-phase, 50/60Hz, 30 amp	40 amp preferred 50 amp acceptable
10.5 kW	3	Pos A,B,C	1.93 m frames with N+1 redundant power	Three-phase, 50/60Hz, 35 amp	50 amp preferred 60 amp acceptable

High-voltage (380-415 V ac nominal) branch circuit requirements

Table 34. High-voltage (380-415 V ac) branch circuit requirements

SEPBU output power	Quantity of BPRs	BPR locations	Frame power configuration	Branch circuit	Branch circuit breaker
10.5 kW	3	Pos A,B,C	1.93 m frames with N+1 redundant power	Three-phase, 50/60Hz, 20 amp	30 amp
Note: High-voltage SEPBUs are not available for 1.25 m frames					

Evaluating ac power cables, plugs, and receptacles

Once you have decided on a system configuration that meets your needs, you can evaluate your requirements for the ac power cords and attached plugs which are supplied with your RS/6000 SP system.

Note: You ***must*** adhere to local electrical codes at your site.

Branch circuit receptacle requirements

For each RS/6000 SP ac power cord, a receptacle with an internal jumper between the metal back-box and the grounding wire is required if the branch circuit wiring uses metallic conduit. This required jumper is in addition to the required grounding wire.

Power cord specifications for SEPBU-equipped frames

This section describes the ac power cords which are supplied with your RS/6000 SP frames and also lists the required customer-supplied mating connectors. You need to supply either the receptacles or the in-line connectors depending on your site requirements.

Phase connections

On 1.93 m frames, the ac power cord is a four-wire cable designed for three-phase power with a safety ground. There is no neutral connection to the RS/6000 SP and there are no phase rotation requirements.

Note: For some ac power cords which are supplied without a plug, the blue conductor must be connected to a non-neutral phase. This is permitted by international standards for four-wire systems.

On 1.25 m frames, the ac power cord is a three-wire cable designed for single-phase power (phase-to-phase or phase-to-neutral) with a safety ground. This allows these frames to be installed in all countries using phase-to-phase or phase-to-neutral connectors as appropriate for a specific country.

1.93 m Frames: Table 35 applies to 1.93 m frames using the 10.5 kW SEPBU. This table describes the ***IBM-supplied*** ac power cords and the required ***customer-supplied*** mating connectors. You, as the customer, must supply either receptacles or in-line connectors, depending on your site requirements.

Table 35. Power cord specifications for 10.5 kW SEPBUs

Location	Length m (ft.)	Plug type	Conductor dimension mm^2 (AWG)	Customer-supplied parts	
				Connector (Note 3)	Receptacle (Note 4)
North America (including Canada) and Japan	4.3 (14)	Hubbell P/N 460P9V05 (Note 5)	8.4 (#8)	Any IEC309 460C9W (Note 5)	Any IEC309 460R9W (Note 5)
Chicago, USA (F/C 9986)	1.8 (6)				
AP (excluding Japan)	4.3 (14)	None (Note 1)	8.4 (#8)	(Note 1)	(Note 1)
EMEA (Note 2)	4.3 (14)	None (Note 1)	6 (#10)	(Note 1)	(Note 1)
LA	4.3 (14)	None (Note 1)	8.4 (#8)	(Note 1)	(Note 1)

Notes:

1. Terminations to be supplied by customer per local requirements.
2. Except for Bulgaria, Liberia, Libya, Saudi Arabia, Somalia, Syria and Egypt, conductor dimensions are 8.4 mm^2 (#8 AWG).
3. The connector cannot be installed on a metal conduit because it is a safety hazard.
4. IBM suggests using IEC309 components in powering their equipment to comply with the National Electric Code (NEC) and to provide a safe environment for IBM service personnel and customer facilities personnel. If the Feature Code selection for the product specifies an IEC309 plug, IBM suggests that it is attached to an IEC309 receptacle mounted in a metallic back-box with the ground pin of the receptacle attached to the ground lug in the box.
5. Applies to 200-240 V ac installations only.

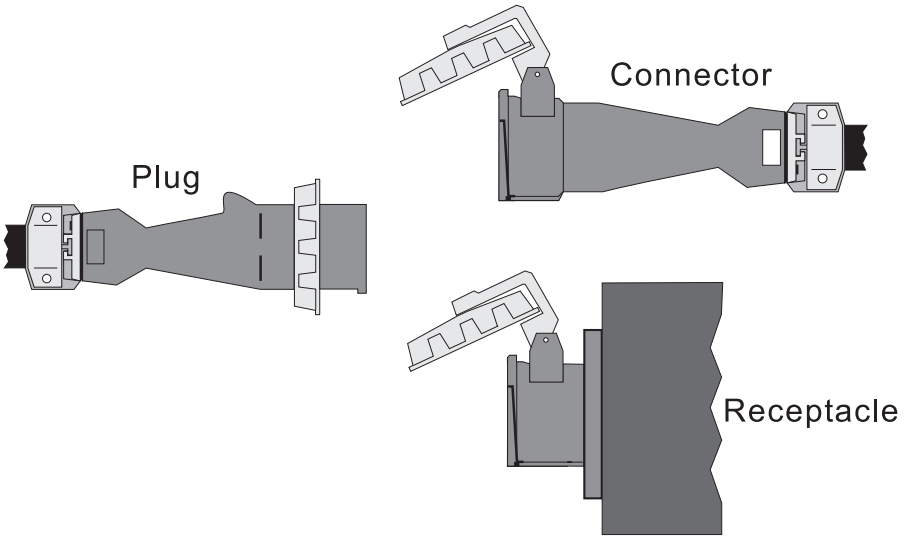

Figure 24. Three-phase power connectors (U.S.A.)

1.25 m Frames: The information in Table 36 applies to the ***IBM-supplied*** ac power cords and the required ***customer-supplied*** mating connectors used with the 5.0 kW SEPBU. These SEPBUs do not have a high voltage option and can only be connected to a 200-240 V ac input line (phase-to-phase or phase-to-neutral).

You, as the customer, must supply either receptacles or in-line connectors, depending on your site requirements.

Table 36. Power cord specifications for 5.0 kW SEPBUs

Location	Length m (ft.)	Plug type	Conductor dimension mm² (AWG)	Customer-supplied parts	
				Connector	Receptacle
North America (including Canada) and Japan	4.3 (14)	Russell-Stoll P/N 9P53U0 ***or*** 9P53G0/KF (Note 1)	13.5 (#6)	Russell-Stoll P/N 9C53U0	Russell-Stoll P/N 9R53U0
Chicago, IL (F/C 9986)	1.8 (6)				
AP (excluding Japan)	4.3 (14)	None (Note 2)	13.5 (#6)	(Note 2)	(Note 2)
EMEA	4.3 (14)	None (Note 2)	13.5 (#6)	(Note 2)	(Note 2)
LA	4.3 (14)	None (Note 2)	13.5 (#6)	(Note 2)	(Note 2)

Notes:

1. Either of the plug P/Ns might be on the power cord and both are compatible with the listed connector and receptacle
2. Terminations to be supplied by customer per local requirements

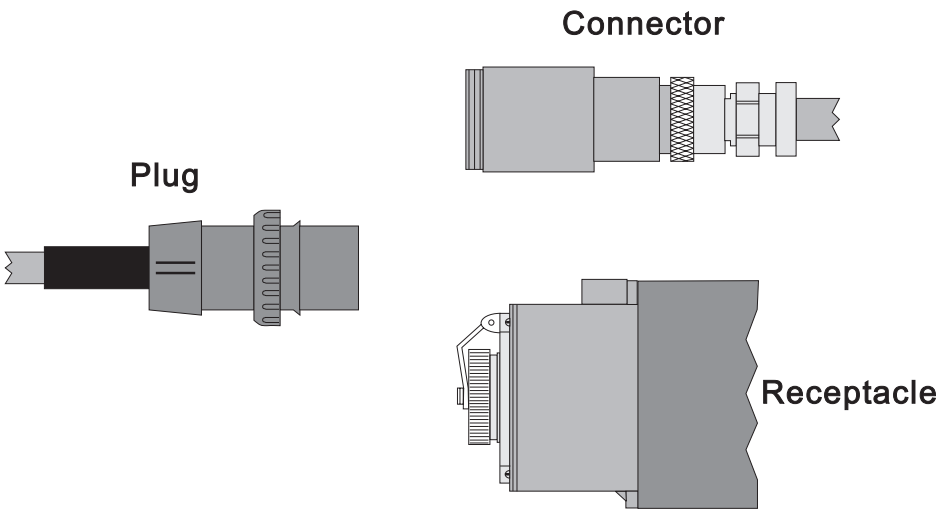

Figure 25. Single-phase power connectors (U.S.A.)

SP Frame Redundant Power Supply (F/C 3885, 3886)

What is the Redundant Power Supply feature?

The Redundant Power Supply feature permits feeding ac power to SP system frames from two separate sources to prevent system outages caused by the failure of a single ac power source. With this feature, the SP system operates normally with power applied to only one of the two power cables. Two separate power cables are attached to a special SEPBU enclosure having two side-by-side connectors and four standard power books. No special voltage or synchronization requirements of the two ac sources are required. The two ac sources are galvanically isolated within the SP system. When both power sources are operating within their normal range, the power cables share the system load.

This feature is offered only for tall frames. For upgrades to existing frames, see “Upgrading standard SEPBUs to Redundant Power Supply” on page 204.

Making the most of the Redundant Power Supply feature: Ensuring the availability of one power source during a failure of the other is the primary consideration. Optimally, each power cable should be fed from a different power grid. As an example, one power source could be the local utility with the second source being a UPS system. Do not use the same branch circuit for both power cables since a power failure will result in an SP system outage. The requirements for the standard SEPBU branch circuit in “Balancing circuit breaker performance” on page 155 also apply to this feature.

Input branch circuit requirements

The Redundant Power Supply feature is available for three-phase, “open V” low-voltage (200-240 V ac nominal) and high-voltage (380-415 V ac nominal) sources (**F/C 3885**), and for single-phase low-voltage (200-240 V ac nominal) sources (**F/C 3886**).

Load balancing for three-phase circuits: The three-phase, “open V” input does not present a balanced three-phase load, so you must ensure that loads are balanced at the facilities level. The loading of the system appears as two

single-phase loads between phases A-C and B-C. As a result, the line current on phases A and B is lower than that on phase C by SQRT(3).

Three-phase low-voltage (200-240 V ac nominal) branch circuit requirements:

Table 37. Three-phase low-voltage (200-240 V ac) branch circuit requirements

SEPBU output power	Quantity of BPRs	BPR locations	Frame power configuration	Branch circuit	Branch circuit breaker
8.6 kW	4	Pos A,B,C,D	1.93 m frames with redundant power	Three-phase, 50/60Hz, 45 amp	60 amp

Three-phase high-voltage (380-415 V ac nominal) branch circuit requirements:

Table 38. Three-phase high-voltage (380-415 V ac) branch circuit requirements

SEPBU output power	Quantity of BPRs	BPR locations	Frame power configuration	Branch crcuit	Branch circuit breaker
8.6 kW	4	Pos A,B,C,D	1.93 m frames with redundant power	Three-phase, 50/60Hz, 20 amp	30 amp

Single-phase low-voltage (200-240 V ac nominal) branch circuit requirements:

Table 39. Single-phase low-voltage (200-240 V ac) branch circuit requirements

SEPBU output power	Quantity of BPRs	BPR locations	Frame power configuration	Branch circuit	Branch circuit breaker
8.6 kW	4	Pos A,B,C,D	1.93 m frames with redundant power	Single-phase, 50/60Hz, 60 amp	60 amp

Redundant Power Supply plugs, connectors, and receptacles

Three-phase low and high-voltage installations: The specifications for three-phase power cables and receptacles are the same as for the standard SEPBU. See Table 35 on page 157.

Single-phase low-voltage installations: The information in Table 40 on page 161 applies to the ***IBM-supplied*** ac power cables and the required ***customer-supplied*** mating connectors used with the Redundant Power Supply. These SEPBUs do not have a high voltage option and must be connected to a single-phase 200-240 V ac input (phase-to-phase or phase-to-neutral).

You, as the customer, must supply either receptacles or in-line connectors, depending on your site requirements.

Table 40. Power cord specifications for single-phase 8.6 kW SEPBUs

Location	Length m (ft.)	Plug type	Conductor dimension (AWG)	Customer-supplied parts	
				Connector	Receptacle
Worldwide (excepting Chicago, IL)	4.3 (14)	Hubbell P/N 360P6V0	#8	Any IEC 360C6W	Any IEC 360R6W
Chicago, IL	1.8 (6)	Hubbell P/N 360P6V0	#8	Any IEC 360C6W	Any IEC 360R6W

Planning for power requirements of SP frames and features

The total power requirement of your RS/6000 SP system is the sum of the power required by all of the following individual components:

- Each base frame with integral power subsystem
- Each processor node
- All options and adapters in each node
- Each switch
- All auxiliary equipment, such as SP-attached servers, routers, RAIDs, extension nodes, printers, etc.

  For the RS/6000 SP Switch Router, this information can be found in publications listed in the “Bibliography” on page 255, in the “RS/6000 SP Switch Router” list. For the SP-attached server, see the appropriate server documentation.

  For the power usage of auxiliary equipment obtained from other vendors, consult the documentation provided for that equipment.

After calculating frame power requirements (see “Using the SP frame power computation worksheet”), add the total of all auxiliary equipment power to the total power usage of all the frames in your system.

Using the SP frame power computation worksheet

Make one copy of Table 41 on page 162 for each frame in your SP system. Fill in the worksheet copies using your quantities of all applicable features. Complete the calculations, using the power factors given for each feature, to determine the total power requirement of each frame. After calculating the power requirements of each frame, you can use the results to calculate the thermal output of your system.

Table 41. SP system frame power computation worksheet

System Name_____ **Frame Number**_____ **Quantity of Frames in System**_____			
Component	**Feature**	**Qty. x Factor**	**Watts**
Frame	Any empty frame with power subsystem	(1) x 41	41
Nodes	375 MHz POWER3 SMP High Node (**F/C 2058**)	(___) x 650	
	375/450 MHz POWER3 SMP Wide Node (**F/C 2057**)	(___) x 104	
	375/450 MHz POWER3 SMP Thin Node (**F/C 2056**)	(___) x 59	
	POWER3 SMP High Node (**F/C 2054**)	(___) x 575	
	SP Expansion I/O Unit (**F/C 2055**)	(___) x 52	
	POWER3 SMP Wide Node (**F/C 2053**)	(___) x 104	
	POWER3 SMP Thin Node (**F/C 2052**)	(___) x 59	
	332 MHz SMP Wide Node (**F/C 2051**)	(___) x 154	
	332 MHz SMP Thin Node (**F/C 2050**)	(___) x 108	
	160 MHz Uniprocessor Thin Node (**F/C 2022**)	(___) x 135	
		Node subtotal	
CPUs	375 MHz POWER3 SMP High Node CPU card (**F/C 4350**)	(___) x 168	
	POWER3 SMP High Node CPU card (**F/C 4849**)	(___) x 132	
	375/450 MHz POWER3 SMP Thin or Wide Node 375 MHz CPU card (**F/C 4444**)	(___) x 160	
	375/450 MHz POWER3 SMP Thin or Wide Node 450 MHz CPU card (**F/C 4445**)	(___) x 175	
	POWER3 SMP Thin or Wide Node CPU card (**F/C 4342**)	(___) x 113	
	332 MHz SMP Thin or Wide Node CPU card (**F/C 4320**)	(___) x 77	
		CPU subtotal	
Memory	POWER3 SMP High Node memory card (**F/C 4880**)	(___) x 66	
	375/450 MHz POWER3 SMP Thin and Wide Node memory card (**F/C 4098**)	(___) x 65	
	POWER3 SMP Thin and Wide Node memory card (**F/C 4098**)	(___) x 65	
	332 MHz SMP Thin and Wide Node memory card (**F/C 4093**)	(___) x 40	
	160 MHz Uniprocessor Thin Node memory card (**F/C 4086, 7, 8, 9**)	(___) x 12	
		Memory subtotal	
Switches and switch adapters	SP Switch (**F/C 4011, 4008**)	(___) x 167	
	SP Switch adapters (**F/C 4020, 4022, 4023**)	(___) x 26	
	SP Switch2 (**F/C 4012**)	(___) x 618	
	SP Switch2 adapter (**F/C 4025, 4026**)	(___) x 78	
		Switch subtotal	

Table 41. SP system frame power computation worksheet (continued)

System Name_____ **Frame Number**_____ **Quantity of Frames in System**_____			
Component	**Feature**	**Qty. x Factor**	**Watts**
Hard disk drives	4.5 GB Ultra SCSI (**F/C 2900**)	(___) x 9	
	4.5 GB Ultra SCSI disk pair (**F/C 2904**)	(___) x 18	
	9.1 GB Ultra SCSI (**F/C 2908**)	(___) x 22	
	9.1 GB Ultra SCSI disk pair (**F/C 2909**)	(___) x 44	
	18.2 GB Ultra SCSI disk pair (**F/C 2918**)	(___) x 58	
	9.1 GB Ultra SCSI disk pair (**F/C 3800**)	(___) x 44	
	9.1 SSA disk pair (**F/C 3802**)	(___) x 55	
	18.2 GB Ultra SCSI disk pair (**F/C 3803**)	(___) x 58	
	9.1 GB Ultra SCSI 10K RPM disk pair (**F/C 3804**)	(___) x 42	
	18.2 GB Ultra SCSI 10K RPM disk pair (**F/C 3810**)	(___) x 52	
	36.4 GB Ultra SCSI 10K RPM disk pair (**F/C 3820**)	(___) x 75	
		Hard disk drive subtotal	
PCI adapters	Serial HIPPI SW (**F/C 2732**)	(___) x 40	
	Serial HIPPI LW (**F/C 2733**)	(___) x 40	
	FDDI SK-NET LP SAS (**F/C 2741**)	(___) x 10	
	FDDI SK-NET LP DAS (**F/C 2742**)	(___) x 15	
	FDDI SK-NET UP DAS (**F/C 2743**)	(___) x 10	
	ESCON Channel (**F/C 2751**)	(___) x 23	
	Token Ring (**F/C 2920**)	(___) x 3	
	8-Port Async (**F/C 2943**)	(___) x 20	
	WAN 128-Port Async (**F/C 2944**)	(___) x 9	
	Turboways 622 Mbps MMF ATM (**F/C 2946**)	(___) x 20	
PCI adapters	2-Port Multiprotocol X.25 (**F/C 2962**)	(___) x 11	
	TURBOWAYS 155 UTP ATM (**F/C 2963**)	(___) x 11	
	10/100 Ethernet 10BASE-TX (**F/C 2968**)	(___) x 9	
	Gibabit Ethernet-SX (**F/C 2969**)	(___) x 27	
	10/100/1000 BASE-T Ethernet LAN (**F/C 2975**)	(___) x 25	
	10BASE2/10BASE-T Ethernet LAN (**F/C 2985**)	(___) x 3	
	10BASE5/10BASE-T Ethernet LAN (**F/C 2987**)	(___) x 5	
	TURBOWAYS 155 ATM (**F/C 2988**)	(___) x 10	
	64Bit/66MHz ATM 155 UTP (**F/C 4953**)	(___) x 20	
	64Bit/66MHz ATM 155 MMF (**F/C 4957**)	(___) x 20	

Table 41. SP system frame power computation worksheet (continued)

System Name_____ **Frame Number**_____ **Quantity of Frames in System**_____			
Component	**Feature**	**Qty. x Factor**	**Watts**
PCI adapters	Token-Ring (**F/C 4959**)	(___) x 3	
	Cryptographic Accelerator (**F/C 4960**)	(___) x 34	
	10/100 Mbps Ethernet LAN II (**F/C 4962**)	(___) x 5	
	Cryptographic Coprocessor (**F/C 4963**)	(___) x 11	
	Dual Channel Ultra3 SCSI (**F/C 6203**)	(___) x 20	
	SCSI-2 Ultra/Wide DE (**F/C 6204, 6207**)	(___) x 12	
	SCSI Ultra2 (**F/C 6205**)	(___) x 26	
	SCSI-2 Ultra/Wide SE (**F/C 6206**)	(___) x 12	
	SCSI-2 Fast/Wide SE (**F/C 6208**)	(___) x 12	
	SCSI-2 Ultra/Wide DE (**F/C 6209**)	(___) x 12	
	SSA RAID 5 (**F/C 6225**)	(___) x 37	
	Fibre Channel (**F/C 6227**)	(___) x 27	
	SSA RAID 5 (**F/C 6230**)	(___) x 37	
	F/W Cache Module (**F/C 6235**)	(___) x 6	
	ARTIC960RxD Quad Digital Trunk (**F/C 6310**)	(___) x 31	
		PCI subtotal	
MCA adapters	MCA slots occupied in uniprocessor thin nodes	(___) x 46	
	MCA slots occupied in uniprocessor high and wide nodes	(___) x 36	
		MCA subtotal	
Total Power for Frame			

Notes:

1. 1 Watt = 3.412 BTU/Hour
2. The SEPBU has a power factor of 1, thus W = VA
3. The PDU power supply ***does not*** have a power factor of 1, thus:
   - For frames with a PDU, multiply W x 1.16 for VA
   - For a PDU ***and*** High-voltage transformer, multiply W x 1.19 for VA

Chapter 17. Environmental factors

After planning your overall RS/6000 SP system configuration, you can prepare your site environment. Preparing the environment in advance ensures that it is suitable for your SP system when it arrives.

Environmental specifications of the RS/6000 SP

The RS/6000 SP system operates in conditions typical for digital devices marketed for commercial, industrial, or scientific environments; exclusive of home or general use environments.

Operating, shipping, and storage environment

Table 42 lists the environmental specifications of the RS/6000 SP system.

Table 42. Temperature and humidity specifications for RS/6000 SP systems

Environment	Maximum Dry Bulb	Relative Humidity	Maximum Wet Bulb
Operating	10° to 32°C (50° to 89.6°F)	8% to 80%	23°C (73.4°F)
Non-operating	10° to 43°C (50° to 109.4°F)	8% to 80% (non-condensing)	27°C (80.6°F)
Storage	1° to 60°C (33.8° to 140°F)	5% to 80% (non-condensing)	29°C (84.2°F)
Shipping	-40° to 60°C (-40° to 140°F)	5% to 100% (non-condensing)	29°C (84.2°F)

Thermal shock precautions

Although it is permissible to ship and store your RS/6000 SP system in cold environments without damage (see Table 42), you must allow all SP hardware to gradually warm up to room temperature before you open the shipping container.

Warmup-time alert

An SP system in its shipping crates has many layers of material protecting it and has considerable thermal mass. If you are not certain that warmth has sufficiently penetrated into the system, delay opening the shipping crates!

Two hazards can result from exposing unprotected, cold components to a warm environment:

1. Condensation can form, creating a failure potential for electronic components.
2. Hard disk drives can fail at power-up due to precision clearances, moisture, and lubrication problems.

Because these are potentially serious conditions, you must allow sufficient time for the core modules of your SP system to reach thermal equilibrium with the operating environment. The time required to reach equilibrium varies depending on the environmental extremes to which the system was exposed.

Recommended operating point and range

Table 43 lists the optimum operating point and the recommended operating range for RS/6000 SP systems.

Table 43. Recommended operating range for RS/6000 SP systems

Environment	Temperature	Relative Humidity
Optimum Operating Environment	22°C (72°F)	45%
Recommended Operating Range	20° to 25°C (68° to 77°F)	40% to 50%

Note: For temperature measurement procedures, see “Completing a temperature survey” on page 171.

Acoustical environment of the RS/6000 SP system

The following table lists the acoustical noise emissions of the RS/6000 SP system.

Acoustical emissions for 1.93 m frames

Table 44. Declared acoustical noise emission values for components and a selected custom configuration installed in 1.93 m frames

Feature Code Description	L_{WAd}		L_{pAm}		$<L_{pA}>_m$	
	Operating (B)	Idling (B)	Operating (dB)	Idling (dB)	Operating (dB)	Idling (dB)
(2) FC 2050 332 MHz SMP Thin Nodes	6.2	6.2	N/A	N/A	46	46
FC 2051 332 MHz SMP Wide Node	6.1	6.1	N/A	N/A	45	45
(2) FC 2052 POWER3 Thin Nodes	6.3	6.3	N/A	N/A	47	47
FC 2053 POWER3 Wide Node	6.2	6.2	N/A	N/A	45	45
FC 2054 , 2058 POWER3 High Node	6.4	6.4	N/A	N/A	53	53
FC 2055 SP Expansion I/O Unit	6.5	6.5	N/A	N/A	54	54
(2) FC 2056 375 MHz POWER3 Thin Nodes	6.3	6.3	N/A	N/A	47	47
FC 2057 375 MHz POWER3 Wide Node	6.2	6.2	N/A	N/A	45	45
FC 4008/4011 SPS-8/SPS Switch	5.7	5.7	N/A	N/A	46	46

Table 44. Declared acoustical noise emission values for components and a selected custom configuration installed in 1.93 m frames (continued)

Feature Code Description	L_{WAd}		L_{pAm}		$<L_{pA}>_m$	
	Operating (B)	Idling (B)	Operating (dB)	Idling (dB)	Operating (dB)	Idling (dB)
SEPBU, 4 power books (used in 1.93 m frames)	6.5	6.5	N/A	N/A	49	49
SEPBU, 1 power book (used in 1.25 m frames)	6.1	6.1	N/A	N/A	44	44
Selected configuration: (1) FC 2058, (1) FC 2055, (1) FC 2051, (4) FC 2056, (1) FC 4011, 3-book SEPBU	7.1	7.1	N/A	N/A	55	55

Definitions:

L_{WAd} The declared (upper limit) sound power level for a random sample of machines.

L_{pAm} The mean value of the A-weighted sound pressure levels at the operator position (if any) for a random sample of machines.

$<L_{pA}>_m$ The mean value of the A-weighted sound pressure levels at the one meter (bystander) positions for a random sample of machines.

N/A Not applicable (no operator position).

B, dB Abbreviations for bels and decibels, respectively.

All measurements made in accordance with ISO 7779, and reported in conformance with ISO 9296.

Evaluating your site environment

Evaluate the suitability of environmental factors at your site based on the information in the following sections.

SP thermal output and cooling requirements

The air-conditioning system at your installation must provide year-around temperature and humidity control. You can use Table 41 on page 162 to calculate the thermal output of your SP system based on its power consumption. Based on your analysis, changes to your air-conditioning system might be required to maintain the proper operating environment for the RS/6000 SP system.

If you have an air-conditioning system that discharges cooled air under the raised floor, use perforated floor tiles in front of the SP frames to help achieve the recommended operating temperature. SP frame covers are perforated both front and rear, allowing air to enter from the top to the bottom of the front of the frame and to exit from the rear. Figure 26 on page 168 illustrates how cooling air flows through a frame.

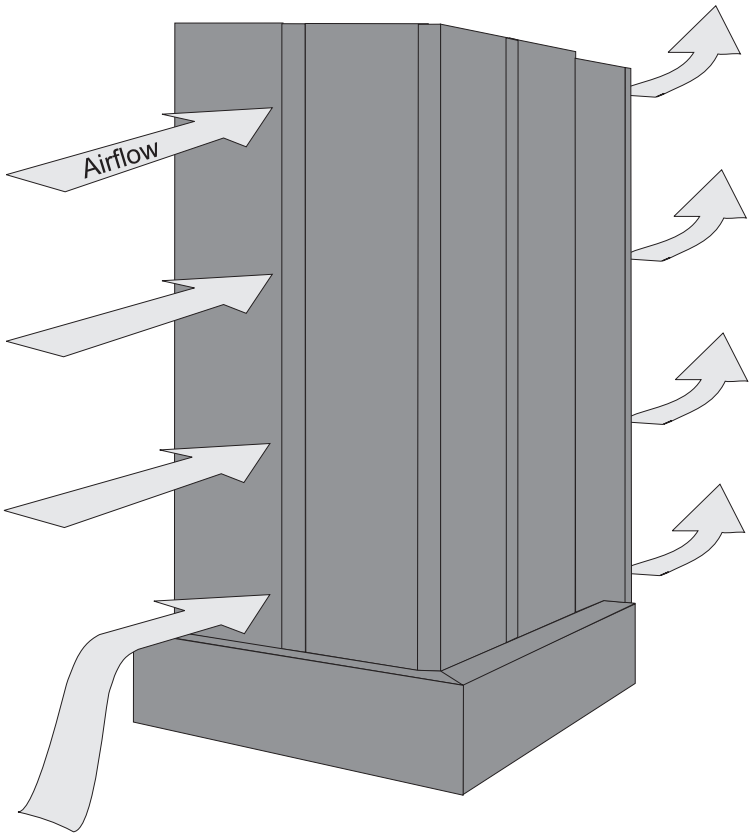

Figure 26. Cooling airflow through an SP frame.

Thermal planning considerations for your site

The recommended temperature range for an operating SP system is 20° to 25° C (68° to 72° F). Use the following guidelines when planning your SP installation to help ensure that the optimum environment is created:

- Align SP frames perpendicular to air conditioner outlets, if possible. This allows for better airflow into and around the system.
- Adjust the position and quantity of perforated tiles to achieve optimum temperatures. As a guideline, install one fully perforated tile, without dampers, per ton of air conditioning capacity. At least one perforated tile, without a flow adjusting damper, is usually required for each SP frame. More might be required depending on the total heat load .
- Ensure that the exhaust from other SP frames or other equipment is not venting into the air intakes of other SP units. If SP frames are placed into rows, the air intakes should be facing each other. Enough under-floor air must be supplied for all units (see Figure 27 on page 169).
- Install SP frames so that the frame front is aligned with the edge of the perforated tile (see Figure 27 on page 169).

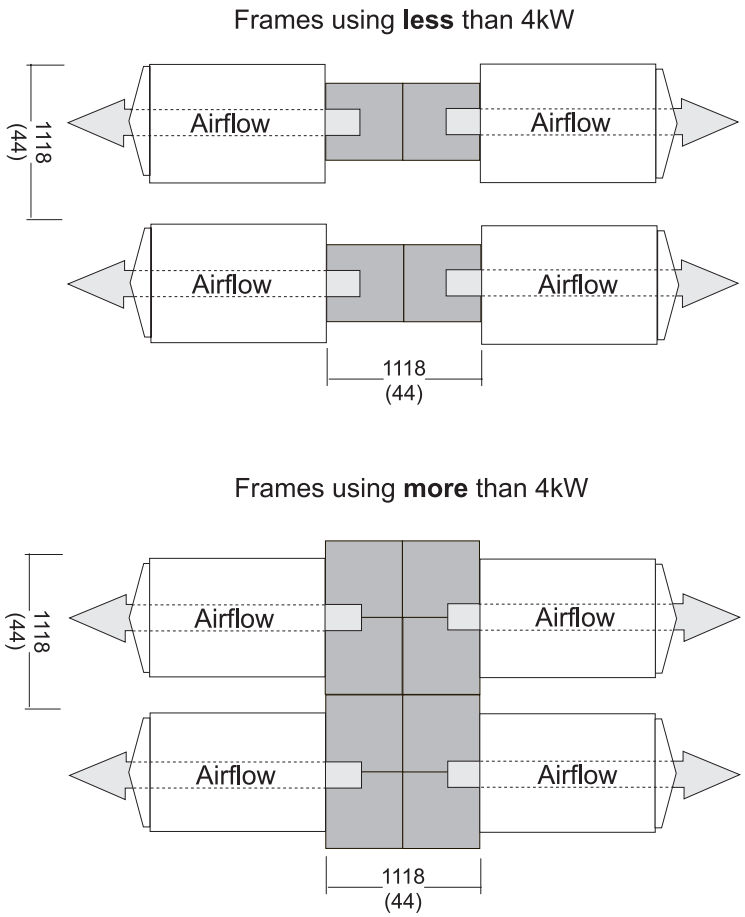

Figure 27. Frame layouts for optimal air flow through perforated floor tiles. The front of the frames should be aligned with the edge of the perforated tiles (gray squares between the frames).

- When two rows of frames are installed facing each other, each row requires its own set of perforated tiles. Allow 44 inches of clearance between the rows. The front of each row should be aligned with the tile seam. This allows the greatest flexibility in arranging perforated tiles for cooling.
- For new computer rooms and rebalancing activities, start off with one perforated tile per ton of air conditioning. Add or delete tiles in areas that do not meet temperature recommendations.
- Do not place perforated tiles directly under any of the SP frames.
- Place perforated tiles 2 m away from the front of air conditioning units to help eliminate short cycling.
- Plug all cable cutouts with a pillow (P/N 2317361).
- Make cable cutouts in floor tiles as close to the recommended size as possible.
- Perform a load-balance assessment between heat-load and cooling capacity. Do this by sections of the room and not as one calculation for the entire room.
- Provide adequate cooling capacity, including redundant cooling, for each section of the room. This should include a minimum of one extra air conditioning unit per room section.

If you need assistance in achieving and maintaining the proper environment for your system, consult with your IBM installation planning representative.

Assessing the total heat load of your installation

This procedure describes how to perform a total heat load assessment, which indicates the overall environmental balance point for your SP installation .

1. Determine the total equipment heat load. This is the sum of the heat loads for every piece of heat generating equipment in the room. Divide the total kW for all equipment by 3.516 to determine the total equipment heat load in tons.

   Note: Use the values listed in Table 41 on page 162 to determine the heat load for RS/6000 SP system frames and their components. In the case of the RS/6000 SP Switch Router, you can find this information in the Ascend publications listed in the bibliography of this book under “RS/6000 SP Switch Router”. For the SP-attached server, see the appropriate server documentation.

   For information on other auxiliary equipment, consult with the respective vendors of that equipment.
2. Determine the general room heat load. This is the heat load caused by lights, power distribution units, and people in the room. Calculate this value by dividing the square foot area of the room by 300 and then multiplying the result by 0.8. The result is the general room heat load in tons.
3. Combine the total equipment load in tons with the general room load in tons. This equals the total room heat load.
4. Determine current air conditioning capacities for cooling and air flow as follows:
   - Number of air conditioning units x number of tons = tons of air conditioning
   - Number of air conditioning units x number of cubic feet per minute (CFM) per unit = total CFM
5. Determine the total number of fully perforated tiles needed in the room (one per ton of cooling).
6. Once you have gathered the above information:
   - For ***new*** installations, use this information as a basis for calculating air conditioning requirements. For ***existing*** installations, use this information to evaluate your present air conditioning configuration.
   - Compare this value (total room heat load) against the total air conditioning capacity of the room. There should be a minimum of 25% additional air conditioning capacity over the maximum room heat load.
   - After you have looked at the entire room or your planned layout, break the room into logical sections as defined by size, air flow blockages, air conditioning unit locations, and so on. Then perform the above comparison to ensure enough cooling capacity exists in each section to allow one air conditioning unit to be shut down without causing temperatures to rise.
   - Determine if the installation has proper airflow. As a minimum, there should be one fully perforated tile per ton of air conditioning capacity. Each row of SP frames placed in parallel rows requires its own set of perforated tiles.
7. Once the installation is complete, adjust the perforated tile positions and the number of tiles to achieve the optimum operating temperature for each SP frame. See, “Completing a temperature survey” on page 171 for instructions on measuring temperatures.
8. Allow the room to stabilize for 24 hours, and then resurvey the temperatures. Adjust the number of tiles and their positions to further optimize the temperature in the room.

For thermal planning assistance, contact your IBM Global Services representative.

Completing a temperature survey

If you suspect that computer room temperatures are not optimal, it is strongly recommended that you complete a temperature survey.

1. Record the frame air inlet temperatures at the following locations:
   - Bottom center at the front of the frame
   - Midpoint at the front of the frame
   - Top center at the front of the frame
2. Temperatures should be taken about 25 to 50 mm (1 to 2 inches) in front of the outside covers
3. All temperatures should fall within the 20° to 25° C recommended operating range

If your installation does not reasonably meet the recommended temperature range, see “Assessing the total heat load of your installation” on page 170 for help on planning corrective actions.

Evaluating electromagnetic interference

Any location can have electromagnetic fields that could interfere with the normal operation of the RS/6000 SP system. These fields are generated by AC power paths, radio frequency transmitters, and other sources. If you suspect that any of these RF sources are near your proposed installation, it is appropriate to assess the environment to determine whether any special installation or product considerations are advisable to reduce possible interference. Consult your IBM Global Services planning representative for guidelines.

Evaluating electrostatic discharge

Electrostatic charges can accumulate on people and furniture because of direct contact with floor coverings or movement while in contact with furniture coverings. Discharge of static electricity to a metal surface on the RS/6000 SP frame can interfere with the system’s operation and cause discomfort to anyone who comes in contact with it.

Some factors that contribute to electrostatic discharge are:

- High-resistance floor covering
- Carpeting without anti-static properties
- Plastic seat covers
- Synthetic fabrics in clothing
- Low humidity (less than 20%) [1]

If you suspect that one or more of these factors affect your site, consult your IBM planning representative for guidelines.

Evaluating other environmental factors

Ensure that your SP installation site meets the requirements for air quality, cleanliness, and input power as specified in *IBM General Information Manual: Installation Manual–Physical Planning*, GC22-7072.

1. See “Recommended operating point and range” on page 166.

SP frame tie-down considerations

If your site is in a geographical area that is susceptible to severe earthquakes, you might have additional installation considerations. Check with your IBM account representative and your local building codes for guidance.

1.93 frame tie-down locations

These frames have four M10 x 5.6 mm weld-nuts on the bottom of the frame for attachment to customer-supplied frame tie-down devices. See Figure 28 for weld-nut locations.

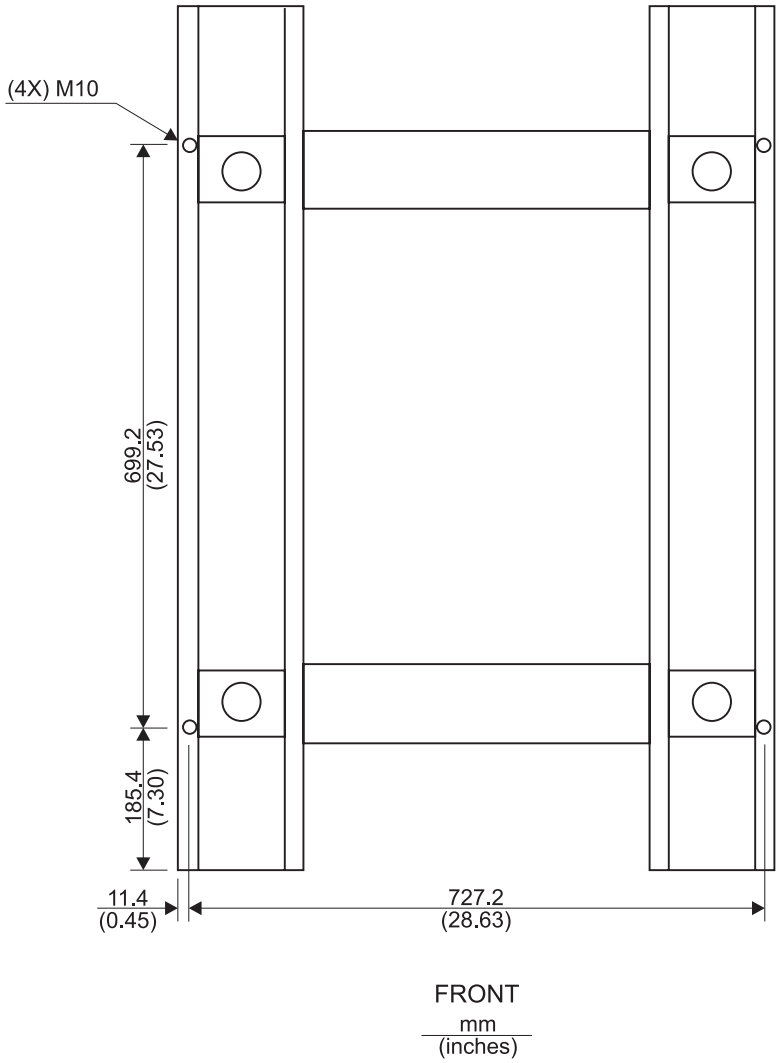

Figure 28. Locations of frame tie-down weld-nuts on 1.93 m frames (bottom view)

1.25 and 2.01 m frame tie-down locations

The 1.25 m short frame and the withdrawn 2.01 m RS/6000 SP frame have two M10 tapped holes in each side of the frame for attachment to customer-supplied tie-down devices. See Figure 29 on page 173 and Table 45 on page 173 for hole locations.

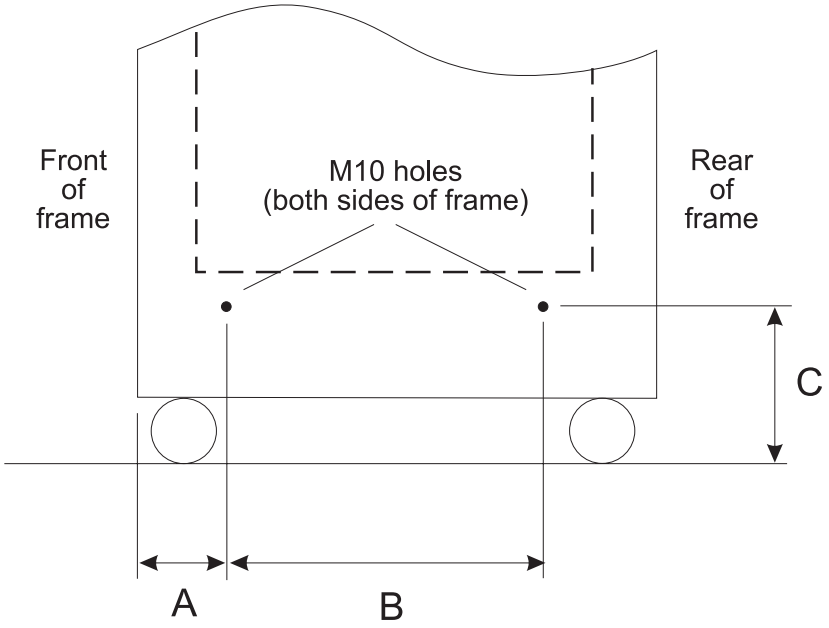

Figure 29. Locations for M10 tapped holes in 1.25 m and 2.01 m frames

Table 45. Specifications for tie-down hole locations (see figure above)

Frame	**A (Front of Frame to M10 Hole)**	**B (M10 Hole to M10 Hole)**	**C (M10 Hole to Floor)**
1.25m (49 in.)	150mm (5.9 in.)	615mm (24.2 in.)	90mm (3.5 in.)
2.01 m (79 in.) (After midyear 1996)	175mm (6.9 in.)	565mm (22.2 in.)	123mm (4.8 in.)
2.01 m (79 in.)	150mm (5.9 in.)	615mm (24.2 in.)	123mm (4.8 in.)

Chapter 18. Floor planning

Use the information in this chapter to plan your RS/6000 SP installation site.

Planning your RS/6000 SP installation site

Site planning for a successful installation includes the following:

- Determining all the components of your system
- Developing a good floor plan
- Planning site alterations

Determining the devices to include in your system

Determine the quantity of RS/6000 SP frames, control workstations, and file servers to include in your RS/6000 SP configuration. Ensure that your list includes all auxiliary equipment, such as RAIDs and SSAs, Extension Nodes, printers, and all other I/O devices attached to your SP system. Add this information to your site floor plan.

Developing your floor plan

Developing a floor plan for your RS/6000 SP system helps you organize and accomplish other site planning tasks. See “RS/6000 SP physical specifications and illustrations” for physical specifications, space requirements, and the service access needs of your system.

Planning your site alterations

Use the information in this chapter, as well as the results of your electrical power calculations and cooling requirements, to help you plan any alterations. Remember also to consider additional utility needs, such as electrical outlets, cable connections, and communication equipment.

For information regarding the physical specifications of any auxiliary equipment, such as footprints and power requirements, consult the documentation provided with that equipment.

RS/6000 SP physical specifications and illustrations

Use this section to help develop your site installation plan. Included in this section are:

Doorway and Obstruction Clearance Alert

Make certain that your SP system components can clear all doorways and any other obstructions between your receiving dock and the final location of the system. If you have any clearance restrictions, you must contact a commercial mover or rigger to transport the system through the doorway or past the obstruction.

Keep in mind that a fully populated SP frame can weigh 984 kg (2165 lbs); proper consideration must be given to the mass of the frames and the fragile nature of electronic components.

SP system physical dimensions and weights

The tables in this section give the physical dimensions and weights of SP system frames and processor nodes.

1.93 m frame

Table 46 gives the physical dimensions and weights of the 1.93 m (75.8 in.) frame with covers.

Table 46. Dimensions and weights of the 1.93 m frame (with covers)

Specification	Dimensions and Weights
Width	922 mm (36.3 in.)
Depth	1295 mm (51 in.)
Height	1925 mm (75.8 in.)
Weight • Minimum Base Configuration • Maximum Populated Configuration	 • 441 kg (971 lbs) • 984 kg (2165 lbs)

1.25 m frame

Table 47 gives the physical dimensions and weights of the 1.25 m (49 in.) frame with covers.

Table 47. Dimensions and weights of 1.25 m frame (with covers)

Specification	Dimensions
Width	711 mm (28 in.)
Depth	915 mm (36 in.) (no covers) 1015 mm (40 in.)
Height	1245 mm (49 in.)
Weight • 1 Drawer installed • 4 Drawers installed	 • 232 kg (510 lbs) • 414 kg (910 lbs)

SP Switch Frames Produced After 4/98 (F/C 2031/2)

Table 48 on page 177 gives the physical dimensions and weights of SP Switch Frames (F/C 2031/2) with covers.

Table 48. Dimensions and weights of Switch Frame (F/C 2031/2) (with covers)

Specification	Dimensions and Weights
Width	922 mm (36.3 in.)
Depth	1519 mm (59.8 in.)
Height	1925 mm (75.8 in.)
Weight • 4 Switches (Basic Frame)	 • 579 kg (1275 lbs)

Model 556 and F/C 2034 frames

Table 49 gives the physical dimensions and weights of Model 556 frames with covers.

Table 49. Dimensions and weights of Model 556 Frame (with covers)

Specification	Dimensions and Weights
Width	785 mm (30.9 in.)
Depth	1566 mm (61.7 in.)
Height	2025 mm (79.72 in.)
Weight (with one to eight switches)	441 kg (971 lbs.) to 693 kg (1525 lbs.)

Model 557 and 558

Table 50 gives the weights of Models 557 and 558 components as shipped.

Table 50. Weight of Models 557 and 558

Model configuration	Weight
Model 557 (with one SP Switch)	98 kg (215 lbs.)
Model 558 (with one SP Switch2)	100 kg (220 lbs.)
Model 558 (with two SP Switch2s)	124 kg (272 lbs.)

Processor node and component dimensions and weights

Table 51 lists the weights and dimensions of available processor nodes. The maximum weight shown is for a node with a full complement of hard disk drives, memory, and adapters; the mimimum weight is for a minimum configuration. Dimensions shown are for the node alone, without its enclosure.

Table 51. Weights and dimensions of processor nodes and components

Node type	Maximum weight	Minimum weight	Dimensions (W x H x D)	Notes
POWER3 High	137 kg 302 lbs	108 kg 237 lbs	560 x 356 x 1016 mm 22 x 14 x 40 in.	
SP Expansion I/O Unit	28 kg 62 lbs	18 kg 39 lbs	280 x 160 x 813 mm 11 x 6.3 x 32 in.	5
SMP Thin (all)	19 kg 42 lbs	17 kg 37 lbs	280 x 160 x 725 mm 11.1 x 6.3 x 28.6 in.	1, 2
SMP Wide (all)	38 kg 84 lbs	32 kg 70 lbs	560 x 160 x 725 mm 22.1 x 6.3 x 28.6 in.	1
Reference information for withdrawn nodes				
160 MHz Thin	15 kg 32 lbs	11 kg 25 lbs	285 x 158 x 684 mm 11.2 x 6.2 x 26.9 in.	2

Table 51. Weights and dimensions of processor nodes and components (continued)

Node type	Maximum weight	Minimum weight	Dimensions (W x H x D)	Notes
200 MHz High	77 kg 170 lbs	67 kg 147 lbs	445 x 260 x 840 mm 17.5 x 10.3 x 33.1 in.	3
135 MHz Wide	23 kg 51 lbs	16 kg 35 lbs	572 x 175 x 670 mm 22.5 x 6.9 x 26.4 in.	4

Notes:

1. Requires enclosure unit, 17 kg (36 lbs) additional
2. Weight of a single (1) thin node
3. Requires circuit breaker asm., 3.6 kg (8 lbs) additional
4. Requires enclosure unit, 4.5 kg (10 lbs) additional
5. Requires mounting shelf, 12.3 kg (27 lbs)

Wooden shipping container dimensions and weights

This section contains physical specifications for the wooden ARBO shipping containers for RS/6000 SP frames.

1.93 m frame

Table 52 describes the physical dimensions and weights of the shipping container for 1.93 m frame assembly with covers.

Please note that these wooden shipping containers are used only for shipments outside the U.S.A.

Table 52. Dimensions and weights of shipping container for 1.93 m frame assembly with covers

Specification	Dimensions and weights
Length	1448 mm (57 in.)
Width	965 mm (38 in.)
Height	2185 mm (86 in.)
Weight (loaded)	1065 kg (2343 lbs)
Weight (empty)	174 kg (382 lbs)
Note: Frame skirts and ship group items are shipped on a separate pallet.	

1.25 m frame

All 1.25 m frames, including those shipped within the U.S.A., are packaged in one reusable, wooden shipping container for the frame assembly, covers and ship group items.

Table 53 describes the physical dimensions and weights of the shipping container for 1.25 m frames.

Table 53. Dimensions and weights of shipping container for 1.25 m frame assembly with covers

Specification	Dimensions and weights
Length	1226 mm (48.25 in.)
Width	908 mm (35.75 in.)

Table 53. Dimensions and weights of shipping container for 1.25 m frame assembly with covers (continued)

Specification	Dimensions and weights
Height	1512 mm (59.5 in.)
Weight (empty)	91 kg (200 lbs)

Returning wooden shipping containers

Wooden ARBO shipping containers are returnable, from U.S.A. addresses, for reuse. After unpacking the containers at their final destination, take the following steps to return them:

Note: Do not return shipping containers from locations ***outside*** the U.S.A.

1. Ensure that the containers are empty of all SP system components. Container parts such as ramps and supports should be placed in the bottom of the container. Front and rear doors should be securely closed with klimp fasteners.
2. Ship the container(s) via common carrier, based on consolidation center location, to the following address (also found on the ARBO box label):

   Atlantic Metal Products
   21 Fadem Road
   Springfield, New Jersey 07081
   Attn: B. Santoriello
3. Bill the charges to the following third-party:

   IBM-922
   STI
   P.O. Box 4093
   Iselin, NJ 08830

Site floor preparation considerations

Raised floor installations

Use this section as a guide to installing your RS/6000 SP System on a raised floor. For installing your system on floor level, see “Non-raised floor installations” on page 180.

Floor preparation for all frame types: Based on your planned configuration, establish a floor plan that details the location of all the equipment that you plan to install in and around your RS/6000 SPsystem.

Refer to the cut-away view of each frame type in order to locate the position and size of your floor cutouts. Note that for a raised floor rated at 345 kg/m² (70 lbs/ft.²), you ***must*** follow the minimum service clearances given in Table 54 on page 182 to maintain floor loading limits.

Notes:

1. All measurements are taken from the outside edge of the machine frame.
2. The dimensions shown for each frame type are required for correct weight distribution and servicing. If the dimensions are altered, or clearances are overlapped, you should obtain the services of a qualified consultant or structural engineer to determine floor loading.

Cutting and placement of floor tiles:

1. Establish a floor plan identifying panels to be cut, noting their positions and orientations.

2. Label or number each panel to be cut.
3. If molding is used around the cutout, enlarge the cutout by the thickness of the molding.
4. For small cable access openings, make the floor cutout larger than the frame opening to more easily allow cables to be passed through the cutout. An additional 25 mm (1 in.) in length and width is sufficient.
5. You can make a floor panel cutout considerably larger than the frame access opening, provided that the cutout does not interfere with leveling pad or caster clearance.
6. Allow a minimum of 25 mm (1 in.) clearance between a cutout edge and a leveling pad or caster edge clearance.
7. Provide additional support pedestals at the following areas:
   a. Panels substantially weakened by cutting
   b. Corner cut panels that do not have load bearing stringers
   c. Panels identified by the panel manufacturer as requiring additional support if cut
   d. Panels that might tip with a load placed on them

Raised floor cutouts should be protected by electrically non-conductive molding, appropriately sized, with edges treated to prevent cable damage and to allow safe handling of machines during installation and removal.

For more information about physical planning, you can refer to *IBM General Information Manual: Installation Manual – Physical Planning*.

Floor preparation for 1.93 m frames: The diagrams in “Multi-frame system floor planning and illustrations” on page 191 show the required clearances between 1.93 m frames and adjacent units. This information is detailed in Table 54 on page 182 and illustrated in Figure 30 on page 183.

The size and location of the 1.93 m frame cable cut-out and the location of the casters are illustrated in Figure 31 on page 184.

Floor preparation for 1.25 m frames: Refer to Figure 32 on page 185 for the required clearances between the 1.25 m frame and other adjacent units.

Floor preparation for SP Switch frames produced after 4/98: Refer to Figure 34 on page 187 and Table 54 on page 182 for the required clearances between the 1.93 m SP Switch frame and adjacent units.

The size and location of the 1.93 m SP Switch frame’s cable cut-out and the location of the frame’s casters are illustrated in Figure 35 on page 188.

Non-raised floor installations

Non-Raised floor alert

Non-raised floor installations ***are not suggested*** for large-scale RS/6000 SP systems due to the extensive inter-frame cabling requirements.

Floor preparation for all frame types: If you place cables or cable assemblies on the floor surface, you must protect them from physical damage. Additionally, this

cable protection must allow frame doors to swing fully without interference. Any protective covering must not block any more of the machine base than is necessary for the cables to enter the machine. For ease of cable installation, units should be located on the same side of the machine in which the cables enter. If this is not possible, extra cable length must be allowed for proper routing and organization of cables.

Notes:

1. All measurements are taken from the outside edge of the machine frame.
2. The dimensions shown in the illustrations for each frame type are ***required*** for correct weight distribution and servicing. If the dimensions are altered, or clearances are overlapped, you should obtain the services of a qualified consultant or structural engineer to determine floor loading.

Floor preparation for 1.93 m frames: The clearance between the floor and the bottom of the rear door of the 1.93 m frame is 76 mm (3 in.). The front and side skirt clearance is 25 mm (1 in.) off the floor. The diagrams in "Multi-frame system floor planning and illustrations" on page 191 show the required clearances between 1.93 m frames and adjacent units. This information is also detailed in Table 54 on page 182 and illustrated in Figure 30 on page 183.

The size and location of the 1.93 m frame cable cut-out and the location of the casters are illustrated in Figure 31 on page 184.

Floor preparation for 1.25 m frames: The clearance between the floor and the bottom of the rear door of the 1.25 m frame is 76 mm (3 in.).

Refer to Figure 32 on page 185 for the required clearances between the 1.25 m frame and other adjacent units. For information about 1.25 m frame cable access points and leveling devices, see Figure 33 on page 186.

Floor preparation for SP Switch frames produced after 4/98: The clearance between the floor and the bottom of the rear door of the 1.93 m SP Switch frame is 76 mm (3 in.). The front and side skirts' clearance is 25 mm (1 in.) off the floor.

Refer to Figure 34 on page 187 and Table 54 on page 182 for the required clearances between SP Switch frames and adjacent units. For information about the frame's cable cut-out, see Figure 35 on page 188.

Storing service equipment

Where required, certain service equipment is shipped with the RS/6000 SP system or with system upgrade components. This equipment is used to install and service nodes in the system frames. Please make provisions to store this equipment so that it can be made available to service personnel, as needed. Service equipment includes the following:

- Ladder and stool (**F/C 9203**)
  - Platform ladder - 914 mm (36 in) high
  - Step stool - 355 mm (14 in) high

Service clearance specifications for frames

1.93 m frame

Service clearances for 1.93 m (75.8 in.) SP frames are listed in Table 54 on page 182 and are illustrated in Figure 30 on page 183. For the 1.93 m SP Switch frame, see Figure 34 on page 187.

Service clearances are also shown as typical SP system layouts in “Multi-frame system floor planning and illustrations” on page 191.

Table 54. Service clearances for 1.93 m frames

Service clearance area	Dimensions
Front Clearance	1118 mm (44 in.)
Rear Clearance	915 mm (36 in.)
Side Clearance	• End frames in each row require a minimum of 915 mm (36 in.) between the side of the frame and the wall (see Note). • Frames within a row require 368 mm (14.5 in.) between each frame. • When four or more frames are installed in a row, IBM suggests that you leave a minimum of 915 mm (36 in.) between each fourth and fifth frame for efficient service access.
Ceiling	Suggested distance: 488 mm (19.2 in.) from the top of the frame to the ceiling.
Note: If you do not leave the correct clearance between the left-end frame in a row and the wall, it can cause a serviceabilty problem. Since the frame front doors are hinged on the right, this makes it difficult to get the service ladder in place for working on upper nodes in these end frames. If you must install a left-end frame less than 915 mm (36 in.) from the wall, increase the front clearance to 1525 mm (60 in.) to allow placing the service ladder in front of the end frame.	

1.25 m Frame

Table 55 lists the service clearances for 1.25 m (49 in.) SP frames.

Table 55. Service clearances for 1.25 m (49 in.) frames

Service Area	**Dimensions** *(See Figure 32 on page 185)*
Front	1118 mm (44 in.)
Rear	762 mm (30 in.)
Sides	75 mm (3 in.) on both sides
Note: An access path of not less than 762 mm (30 in.) wide must be maintained to allow access between the front and back of the system.	

Service clearance and frame footprint illustrations

This section contains drawings of frames and specifications you use to help develop your floor plans.

1.93 m frame

Service clearances for 1.93 m frames: Figure 30 illustrates the service clearances and the associated weight distribution area for 1.93 m (75.8 in.) frames.

Notes:

1. Clearance dimensions are shown to the frame itself, not the skirts.
2. The side clearances can be different than shown, depending on frame placement with respect to any other frames and walls. For specific clearances, see Table 54 on page 182.

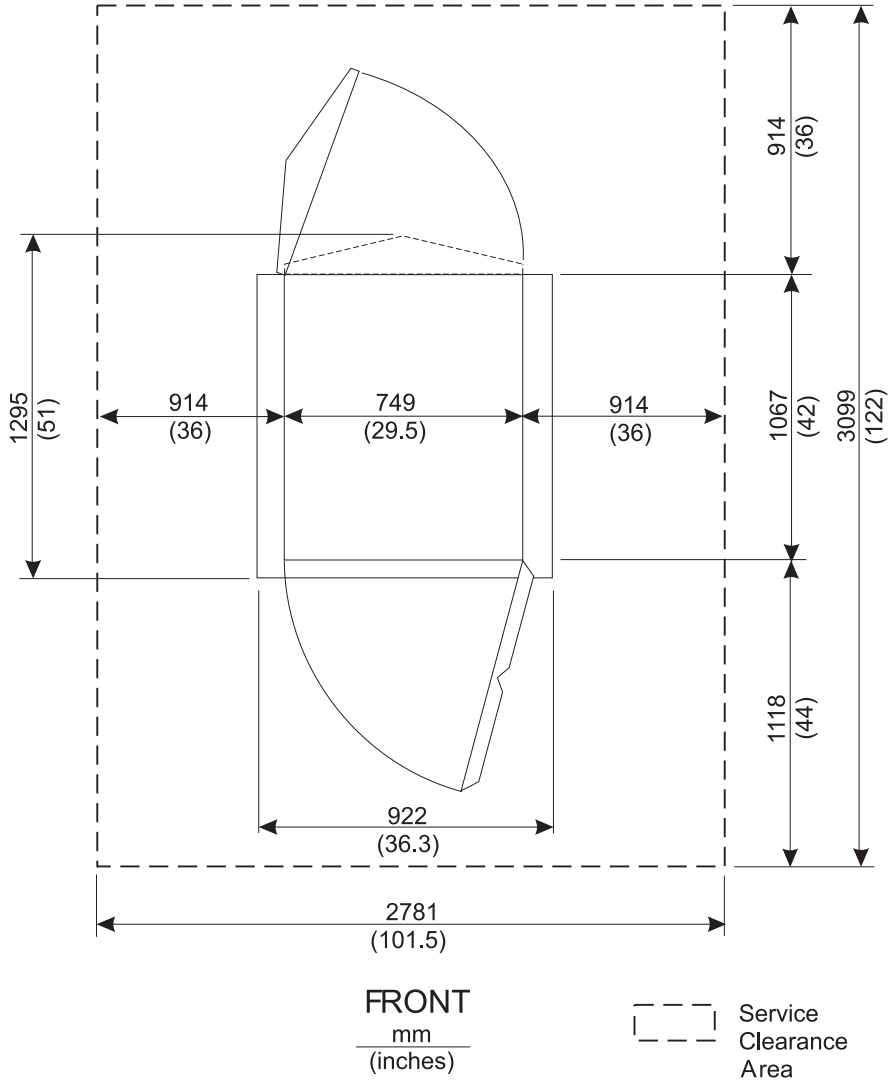

Figure 30. Service clearances for 1.93 m frames (not to scale)

Cut-away view of 1.93 m frame: The following figure details the location and size of the casters and cable cut-out on the base of the 1.93 m frame. For frame tie-down points, see “SP frame tie-down considerations” on page 172.

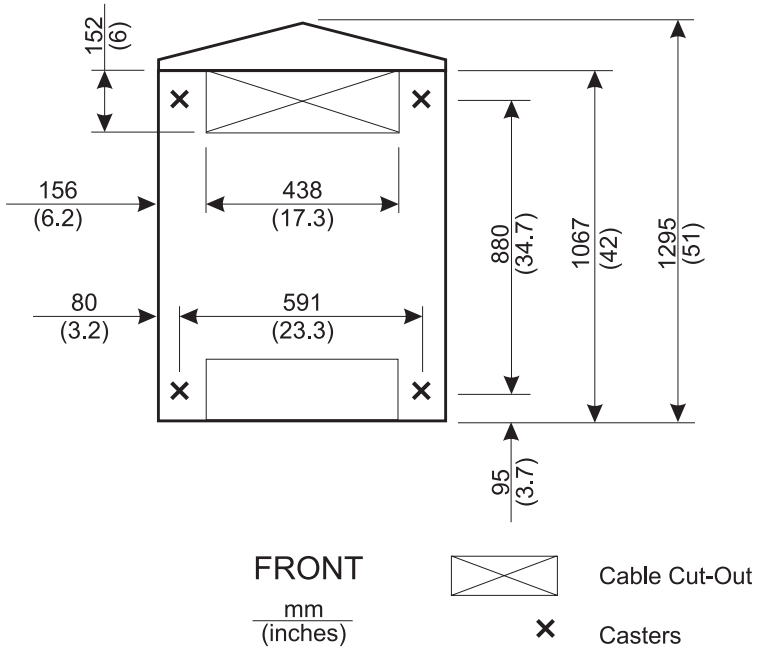

Figure 31. 1.93 m frame: cable cut-out dimensions and caster locations (not to scale).

Notes:

1. Frame outline is shown. Rear cover is added for orientation, side covers not shown.
2. Front cut-out not for SP system use.
3. Use wheel chocks for 1.93 m frames.

1.25 m frame

This section contains illustrations for 1.25 m frames.

Service clearances and weight distribution for 1.25 m frame:

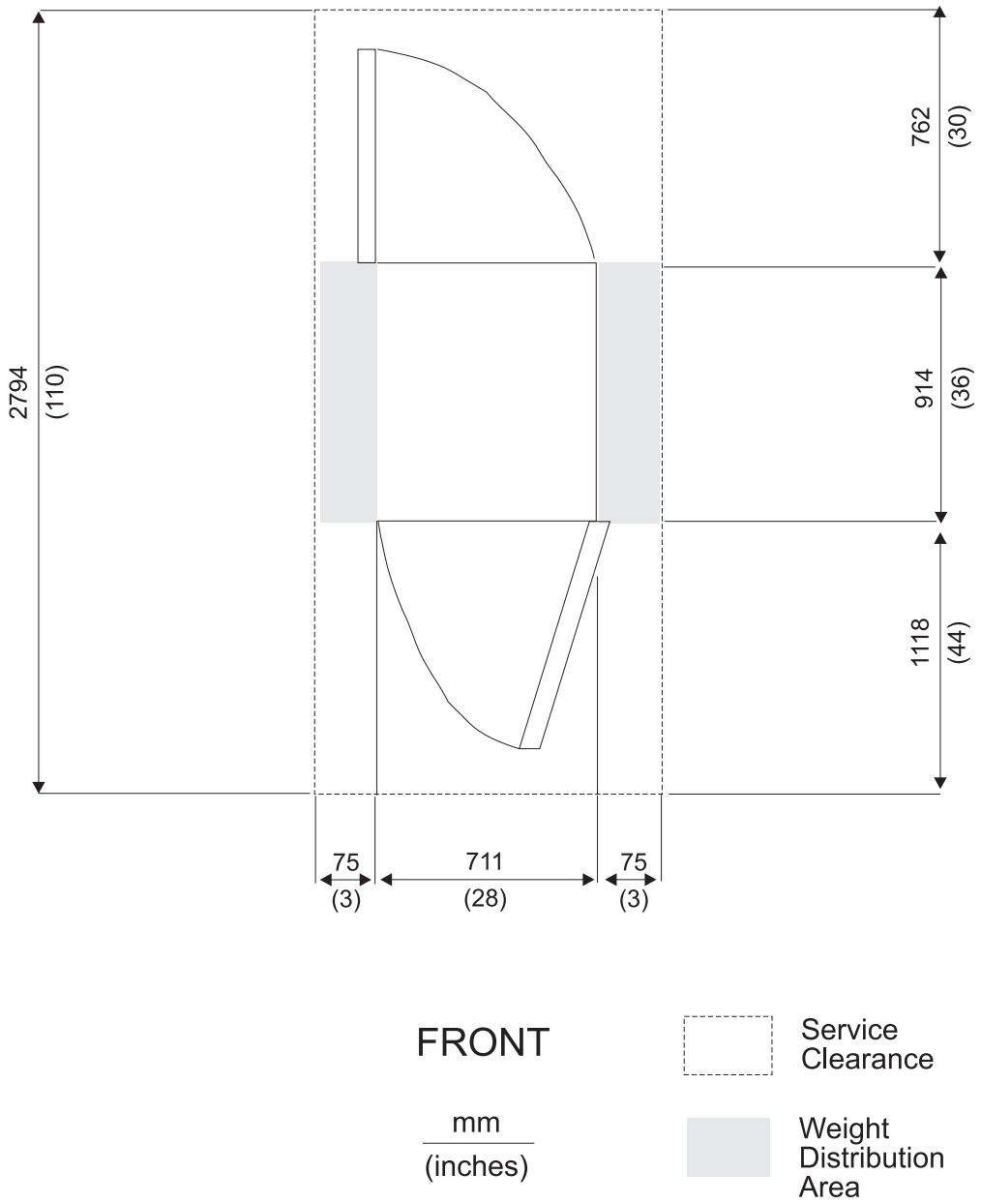

Figure 32. Service clearances and weight distribution 1.25 m frames (not to scale)

Notes:

1. The Weight Distribution Area applies to both raised and non-raised floor applications.
2. An access path of not less than 762 mm (30 in.) wide must be maintained to allow access between the front and back of the system.

Cut-away view of the 1.25 m (49 in.) frames: Figure 33 details the location and size of the casters, leveling pads, ac power cord, and input/output cable egress on the base of the 1.25 m frame. Dimensions are shown in mm and inches.

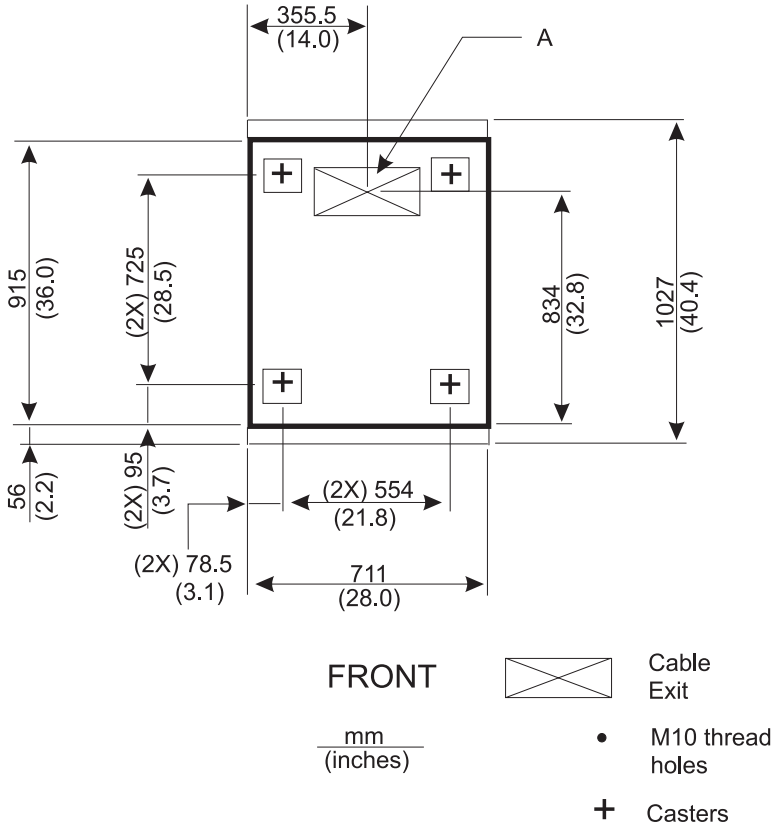

Figure 33. Floor cutout dimensions for the 1.25 m (49 in.) frame

Table 56. Floor cutout dimensions for the 1.25 m (49 in.) frame

Cutout	Size	Use
A	102 mm (4.0 in.) x 388.4 mm (15.3 in.)	Input/output cables and power cord

SP Switch frames

Service clearances for 1.93 m SP Switch frames (f/c 2031, 2032) produced After 4/98: Service clearances and the associated weight distribution area for the 1.93 m SP switch frame are shown in Figure 34.

Notes:

1. Clearance dimensions are shown to the frame itself, not the skirts.
2. The side clearances can be different than shown, depending on frame placement with respect to any other frames and walls. For specific clearances, see Table 54 on page 182.

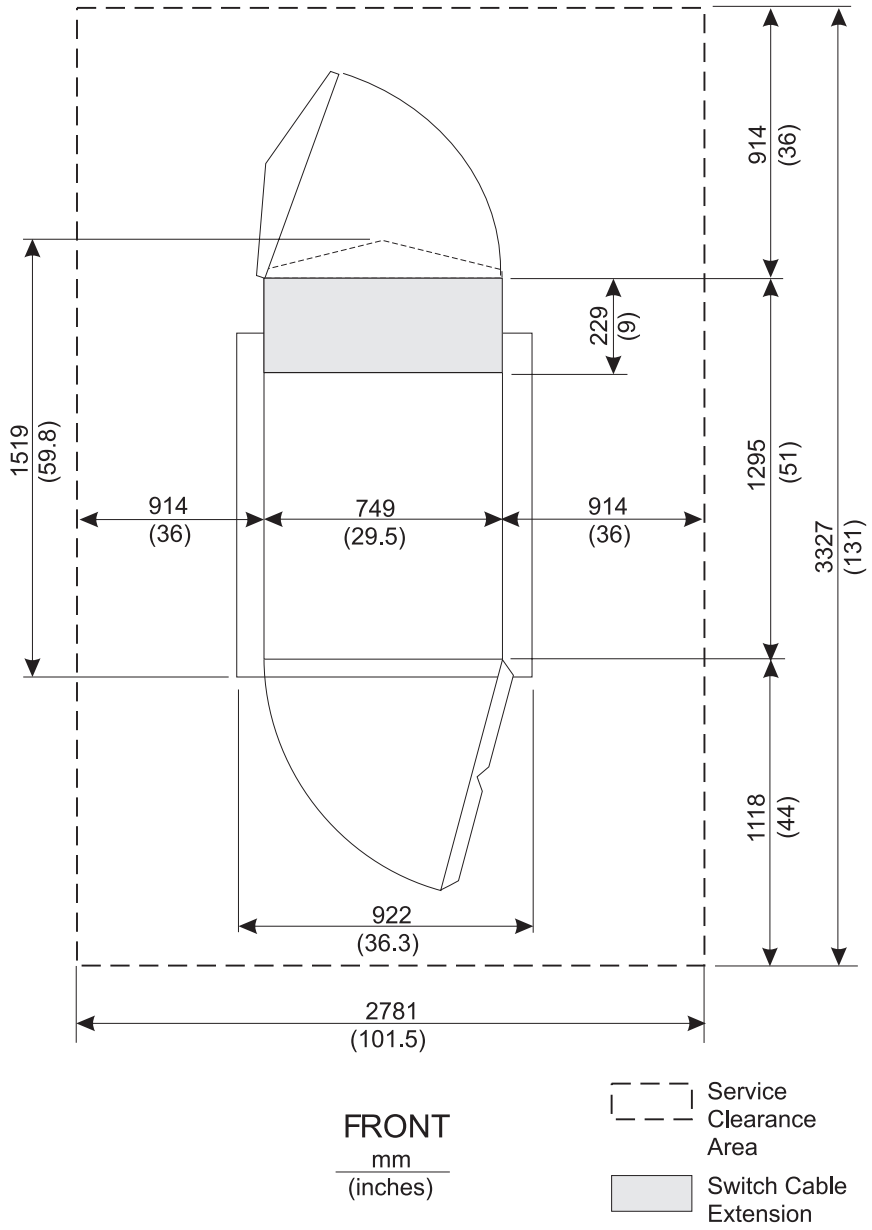

Figure 34. Service clearances for 1.93 m SP Switch frames (not to scale)

Cut-away view of 1.93 m SP Switch frames (f/c 2031, 2032) produced after 4/98: The following figure details the location of the casters and the cable cut-out on the base of the 1.93 m SP Switch frame. For frame tie-down points, see “SP frame tie-down considerations” on page 172.

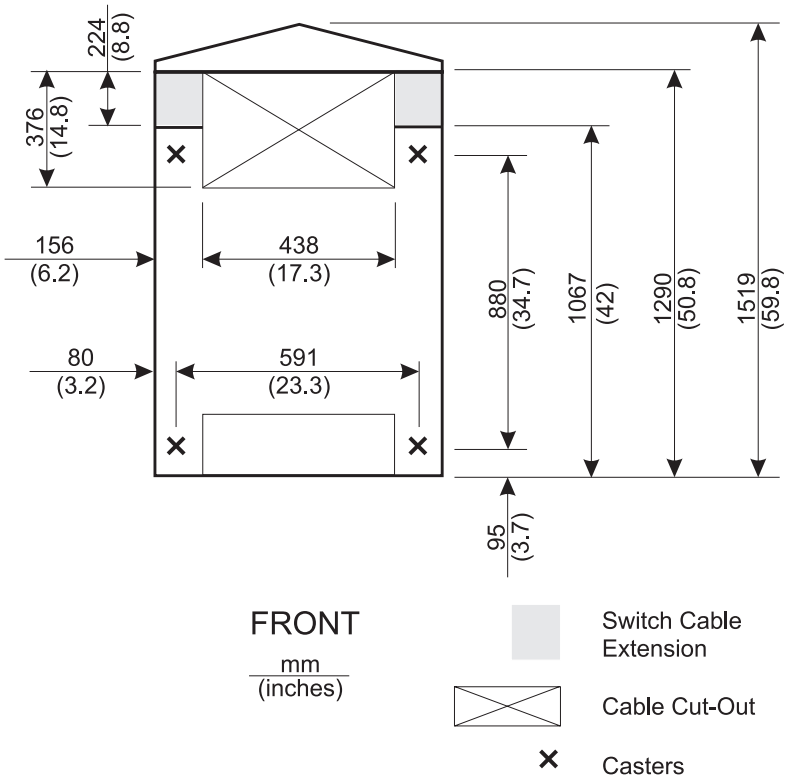

Figure 35. 1.93 m SP Switch frame: cable cut-out dimensions and caster locations (not to scale).

Notes:

1. Frame outline is shown. Rear cover is added for orientation, side covers not shown.
2. Front cut-out is not used for SP systems.
3. Use wheel chocks on 1.93 m Switch Frames.

Model 556 and F/C 2034 frames

Service clearances for Model 556 and F/C 2034 frames: The Model 556 shares the frame and covers of the @server pSeries 690. Service clearances and the associated weight distribution area for the Model 556 frame are shown in Figure 36.

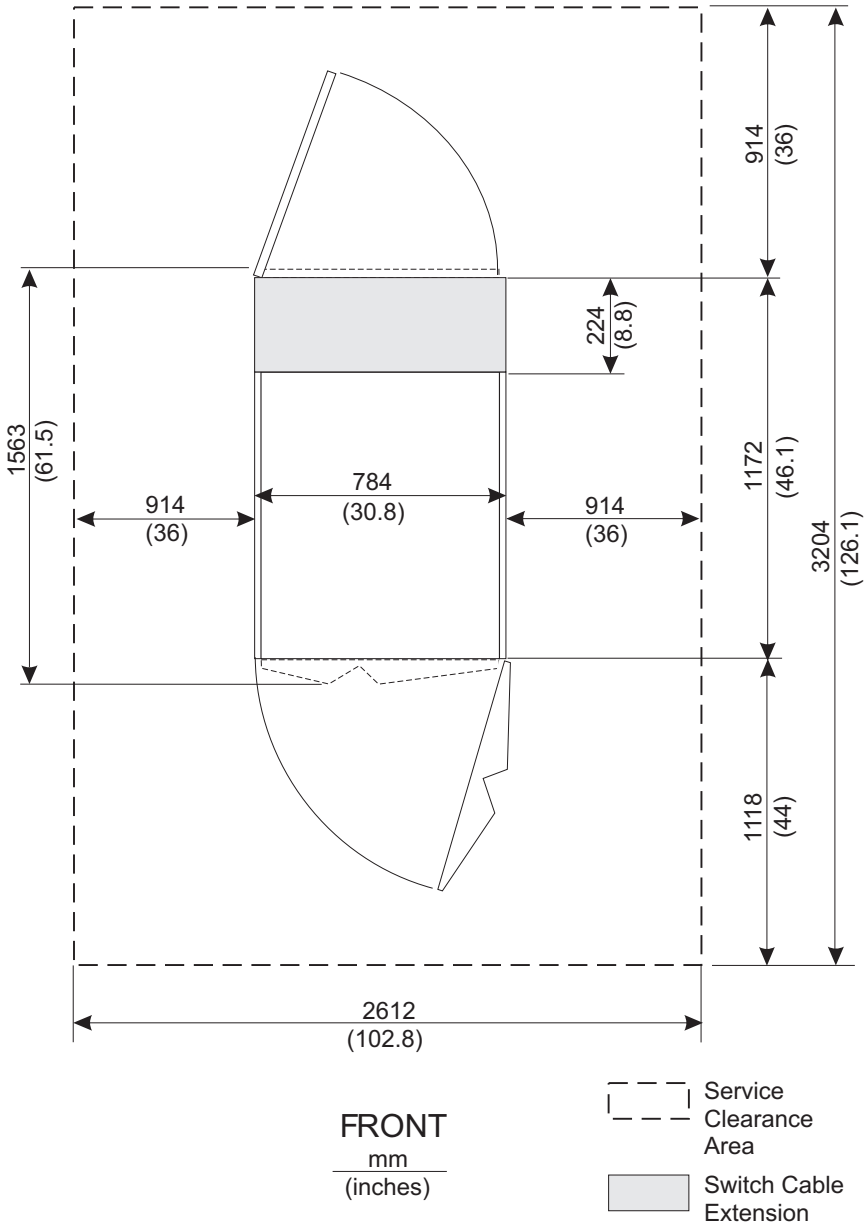

Figure 36. Service clearances for Model 556 and F/C 2034 frames (not to scale)

Notes:

1. The frame extender (**F/C 9941**) is shown as the shaded area in the illustration. This extender is installed only on frames configured with more than four switches. For configurations of one to four switches, subtract 224 mm (8.8 in.) from the frame depth measurements shown.
2. The side clearances can be different than shown, depending on frame placement with respect to any other frames and walls. For specific clearances, see Table 54 on page 182.

For cable cutouts, caster locations and other details on this frame, refer to *Site and Hardware Planning Information*, @server pSeries 690.

Multi-frame system floor planning and illustrations

This section contains specifications, configurator rules, and floor planning considerations for the following multi-frame configurations:

- Model 500
- Basic Model 550
- Moderate-scale Model 550
- Large-scale Model 550

Model 500 SP systems

Quantity of Frames

1 to 4

Model 500 base frame plus up to three F/C 1500 expansion frames.

Quantity of Nodes

1 to 8

Nodes must be ordered and placed according to configurator rules.

Service Clearances

See “Service clearance specifications for frames” on page 181 and Figure 32 on page 185.

Switch

Model 500 SP systems may be either switchless or equipped with one SP Switch-8 in the first frame only.

If switch-configured, all nodes must have the appropriate switch adapter installed.

Switch Cables

5, 10, and 15 meter; customer-selectable.

Switch cables are required if the system is switch-configured.

Ground Cables

All frames must be grounded together by connecting each frame to its closest neighbor on each side with the frame-to-frame ground cable (**P/N 46G5695**). The frames must be within 3 meters (10 ft.) of each other.

Basic Model 550 SP Systems

Quantity of Frames

1 to 16 frames in a non-switched configuration.

1 or 2 frames if configured with the SP Switch-8.

Quantity of Nodes

1 to 64 nodes in a non-switched configuration.

1 to 8 nodes in configurations using the SP Switch-8

Note: Nodes must be ordered and placed according to configurator rules.

Service Clearances

See “Service clearance specifications for frames” on page 181, Figure 30 on page 183 and Figure 37 on page 192.

Switches

The basic Model 550 SP system can be either a switchless system or equipped with one SP Switch-8 in the first frame only.

If switch-configured, all nodes must have the appropriate switch adapter installed.

Switch Cables

5, 10, and 15 meter; customer-selectable.

Ground Cables

All frames must be grounded together by connecting each frame to its closest neighbor on each side with the frame-to-frame ground cable (**P/N 46G5695**). The frames must be within 3 meters (10 feet) of each other.

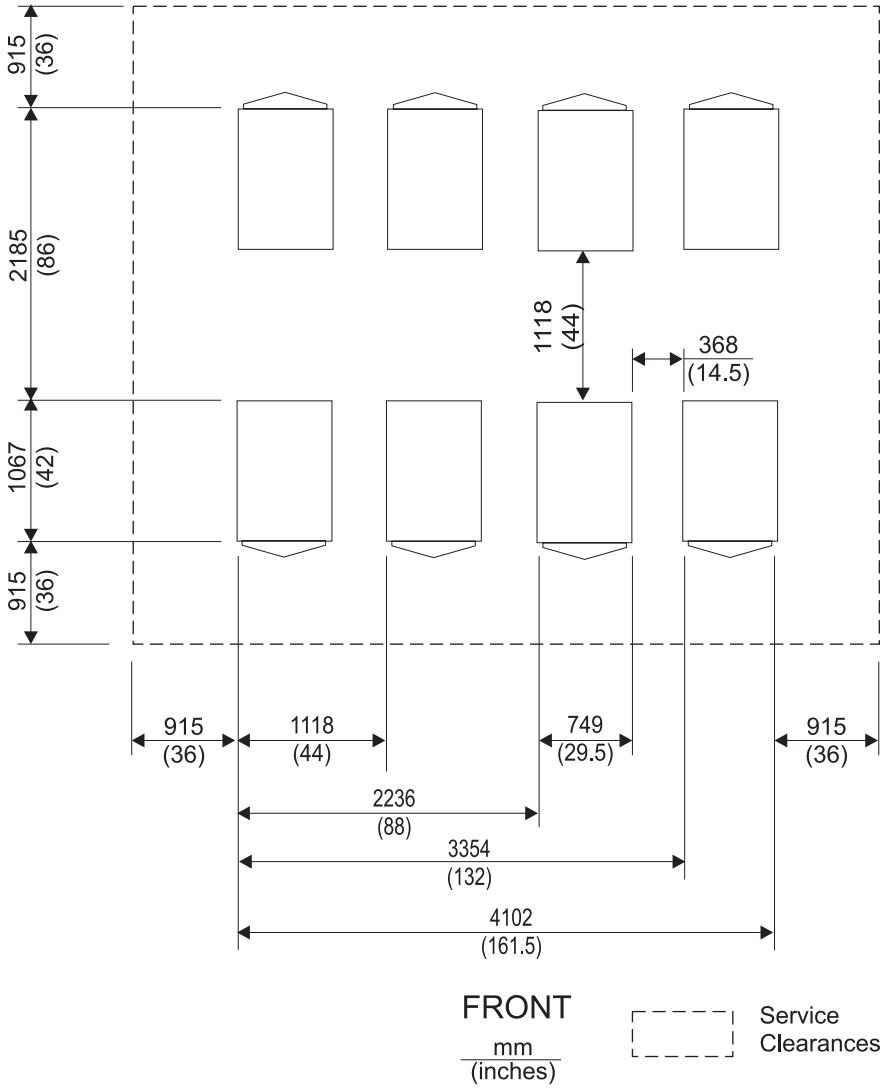

Figure 37. Basic Model 550 SP system. This is a typical configuration showing frame-to-frame service clearances. Your system might have fewer or more frames. Actual layout is highly dependent on your building layout.

Moderate-scale model 550 SP systems

Quantity of Frames

1 to 18

Quantity of Nodes

1 to 80

Note: Nodes must be ordered and placed according to configurator rules.

Service Clearances

See “Service clearance specifications for frames” on page 181, Figure 30 on page 183 and Figure 38 on page 194.

Switches

Moderate-scale systems typically use single-stage switching (all switches are mounted in processor frames). In this configuration, up to five SP switches can be used. Nodes in frames without switches must “share” the unused switch ports in the switch-equipped frames.

All nodes must have the appropriate switch adapter installed.

Moderate-scale systems can also be configured with two-stage switching; for details, see“Considerations for future switch expansion” on page 84.

Notes:

1. No more than 64 of the 80 nodes may be high nodes.
2. Thin nodes cannot be used for switch sharing.

Switch Cables

5, 10, and 15 meter; customer-selectable.

Ground Cables

All frames must be grounded together by connecting each frame to its closest neighbor on each side with the frame-to-frame ground cable (**P/N 46G5695**). The frames must be within 3 meters (10 ft.) of each other.

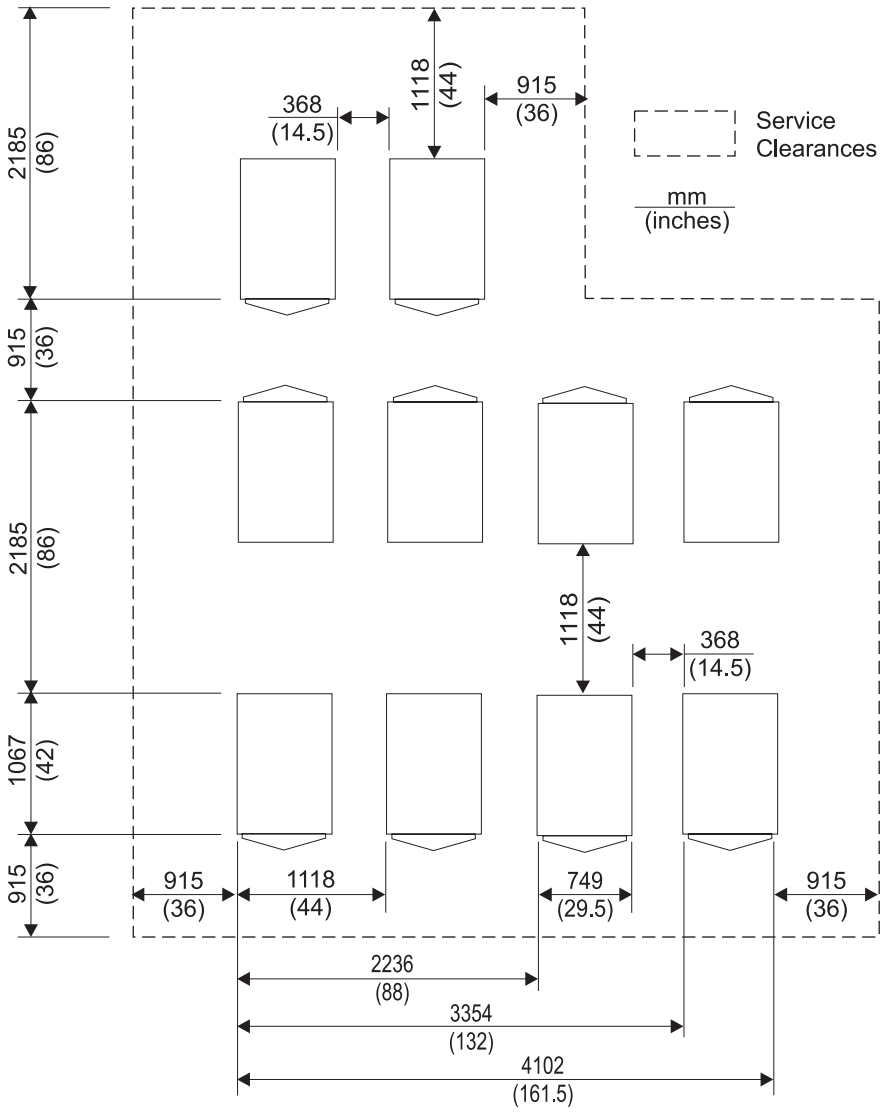

Figure 38. Moderate-scale Model 550 SP system. This is a typical configuration showing frame-to-frame service clearances and frame orientations. Your system might have fewer or more frames. Actual layout is highly dependent on your building layout.

Large-scale Model 550 SP systems

Quantity of Frames

1 to 24 processor frames **plus** one SP Switch Frame in the standard configuration. Consult your IBM account representative for information on larger, special-order systems.

Quantity of Nodes

65 to 128 nodes in the standard configuration. Consult your IBM account representative for information on systems with fewer or more nodes.

Note: All nodes must be ordered and placed according to configurator rules.

Service Clearances

See “Service clearance specifications for frames” on page 181, Figure 30 on page 183 and Figure 39 on page 196.

Switches

Large-scale systems use two-stage switching. This means that the switches in the first switch layer are mounted in the processor frames while the other switches in the second switch layer are mounted in a dedicated SP Switch Frame (F/C 2031). Nodes can be mounted in switchless frames and “share” unused switch ports in the switch-equipped frames.

All nodes must have the appropriate switch adapter installed.

Notes:

1. No more than 64 of the 128 nodes can be high nodes.
2. Thin nodes cannot be used for switch sharing.

Switch Cables

5, 10, and 15 meter; customer-selectable.

Ground Cables

All frames must be grounded together by connecting each frame to its closest neighbor on each side with the frame-to-frame ground cable (**P/N 46G5695**). The frames must be within 3 meters (10 ft.) of each other.

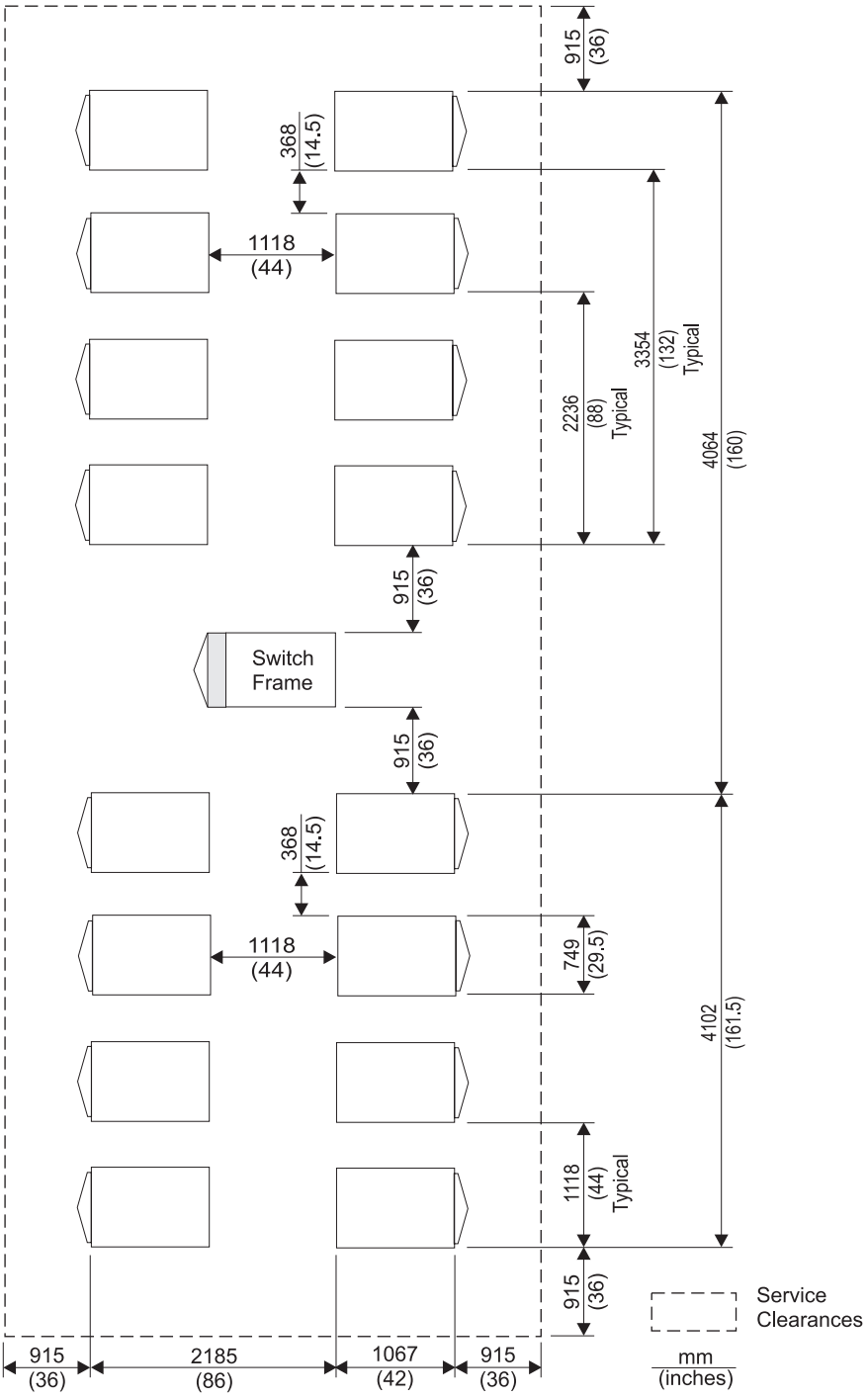

Figure 39. Large-scale Model 550 SP system. This is a typical configuration showing frame-to-frame service clearances and frame orientations. Please note the required, extra-width service isles between every fourth and fifth frame. Your system might have fewer or more frames. Actual layout is highly dependent on your building layout.

RS/6000 SP system floor load analysis

Use this section to determine your floor loading per unit area.

Attention – Floor Load Limits

To prevent possible damage, ***your calculated value*** for floor loading must be less than:

- 345 kg/m^2 (70 lbs/ft^2) for raised floors
- 245 kg/m^2 (50 lbs/ft^2) for non-raised floors

If the result of your floor loading calculation is ***more than*** 345 kg/m^2 (70 lbs/ft^2), consult a local structural engineer.

Your SP system can have a wide variety of frame designs and auxiliary equipment. Floor load calculations must be based on your entire system, including all its components. System-based floor loading calculations are based on architectural constants and specific variables as follows:

Constant values:

1. The area of each frame:
   - 1.93 m frames - 0.75 m X 1.07 m (29.5 in. X 42 in.)
   - 1.25 and 2.01 frames - 0.711 m X 0.914 m (28 in. X 36 in.)
2. Live loads - service personnel and test equipment (75 kg/m^2 for all floor types)
3. Static loads - cables and tiles:
   - 50 kg/m^2 (10 lbs/ft^2) for raised floors
   - 0 kg/m^2 for non-raised floors

Variable values:

1. The total mass of your system
2. The total area available for installing your system
3. The total area occupied by your system's frames
4. The area required for service and weight distribution

Calculate the floor load for your entire SP system by using the above constants and your actual values for the above variables in the following equation:

Floor Load Formula

Floor Load = $(M + (K_1 * S) + (K_2 * T)) / T$

Where:

- Floor Load = mass per unit area
- T = total area available for your installation
- S = service clearance area = T – (the area of each frame times the quantity of frames in your system)
- M = the total system mass
- K_1 = live load constant = 75 kg/m^2 (15 lbs/ft^2) for all floor types
- K_2 = static load constant = 50 kg/m^2 (10 lbs/ft^2) for raised floors

Note: The static load constant is applied to raised floor installations only. For non-raised floors, $K_2 = 0$, thus the term $(K_2 * T)$ is also 0.

Once you determine that the floor loading for your installation is ***below the maximum*** allowed value of 345 kg/m^2 (70 lbs/ft^2), you can continue planning your system layout using the minimum recommended service clearances given in "Service clearance specifications for frames" on page 181. If the result of your floor loading calculation is ***more than*** 345 kg/m^2 (70 lbs/ft^2), consult a local structural engineer.

Appendix A. SP system upgrades, conversions, and feature additions

This appendix contains information on available RS6000 SP upgrades, conversions, and feature additions. This information is intended to help you as the customer plan for upgrades which enhance SP system performance and capability. Examples of typical upgrades include adding frames to your SP system, installing new higher-performance nodes or switches, and converting MCA-type nodes to PCI nodes.

When you receive new SP system documentation with an upgrade, it will be in the PDF format on a CD; however, a few titles will also continue to be distributed as printed books.

Ordering requirements for upgrades

If you are planning an upgrade for your SP system, you might need the following indentifying information for the ordering process:

1. Machine Type (M/T 9076)
2. Model number (see “Indentifying frame model numbers”)
3. SP System serial number

Indentifying frame model numbers

Table 57 shows how to determine the model number based on factors such as when the system was manufactured, its frame size, switched or non-switched capability, and type of node in the first drawer of the frame.

Table 57. SP system model numbering

<table>
<tr><td colspan="3">Frames manufactured prior to 4/98</td></tr>
<tr><td>1st. digit</td><td>2nd. digit</td><td>3rd. digit</td></tr>
<tr><td>2 – Non-switched system</td><td>0 – 79 in. frame</td><td>2 – 66 MHz Thin Node</td></tr>
<tr><td>3 – Single-stage switch system</td><td>A – 49 in. frame</td><td>3 – 66 MHz Wide Node</td></tr>
<tr><td>4 – Two-stage switch system</td><td>B – 79 in. frame with 8-port switch</td><td>4 – 66 MHz Thin2 Node</td></tr>
<tr><td rowspan="6"></td><td rowspan="6"></td><td>5 – 77 MHz Wide Node</td></tr>
<tr><td>6 – 604 High Node</td></tr>
<tr><td>7 – 135 MHz Wide Node</td></tr>
<tr><td>8 – 120 MHz Thin Node</td></tr>
<tr><td>9 – 604e High Node</td></tr>
<tr><td>A – 160 MHz Thin Node</td></tr>
<tr><td colspan="3">Frames manufactured prior to 4/98 – upgraded to 332 MHz or POWER3 nodes</td></tr>
<tr><td rowspan="2">5</td><td>0 – 49″ frame</td><td rowspan="2">H</td></tr>
<tr><td>5 – 79″ frame</td></tr>
<tr><td colspan="3">Frames manufactured after 4/98</td></tr>
<tr><td rowspan="2">5</td><td>0 – 1.25 m short frame</td><td rowspan="2">0</td></tr>
<tr><td>5 – 1.93 m tall frame</td></tr>
</table>

Adding nodes

Adding 375/450 MHz POWER3, POWER3, and 332 MHz SMP Thin and Wide Nodes

SMP Thin and Wide Nodes can be added to earlier SP systems. Adding these nodes to earlier withdrawn frames requires a power system upgrade. Both PDU and SEPBU power subsystems must be upgraded to 10.5 kW level SEPBUs for tall frames or 5.0 kW for short frames.

These nodes can be added to any Model 500, 550, 20X, 30X, or 40X, and F/C 1500 or 1550 expansion frame that has available drawer space and an upgraded PDU.

Adding 375 MHz POWER3 and POWER3 SMP High Nodes

POWER3 High Nodes can be added to any Model 550 or F/C 1550 expansion frame that has available drawer space.

POWER3 High Nodes can also be added to Models 20X, 30X, or 40X only with the addition of a tall, deep expansion frame (F/C 1550), since the POWER3 High Node does not physically fit into the old-style frame. According to configurator rules, if there are no existing POWER3 High Nodes in your system, the MES will include a tall, deep expansion frame. If you determine that a new frame is not required, use RPQ8P2091 to delete the frame from the MES.

The POWER3 High Node Lift Tool is required and included to install these nodes. The tool is returned after use.

Adding SP Expansion I/O Units

SP Expansion I/O Units for POWER3 and 375 MHz POWER3 High Nodes can be installed only in Model 550 or F/C 1550 expansion frames.

If more than eight SP Expansion I/O Units are installed in a single frame, an EMC cover gasket set (ECA065) must be installed in that frame.

Adding frames

You can add a tall expansion frame (F/C 1550) to a Model 550, 20X, 30X, or 40X system allowing additional nodes to be installed.

You can add a short expansion frame (F/C 1500) to a Model 500 (eight nodes maximum) system.

Adding switches

SP Switches can be added in the following configurations:

- Switchless to SP Switch (F/C 4011), SP Switch-8 (F/C 4008), or SP Switch2 (F/C 4012)
- SP Switch (F/C 4011) to SP Switch2 (F/C 4012)
- High Performance Switch (F/C 4010) to SP Switch (F/C 4011)
- High Performance Switch LC8 (F/C 4007) to SP Switch-8 (F/C 4008)

Notes:

1. The SP Switch2 requires the ***three-book***, 10.5 kW SEPBU, which has a unique power connector.
2. Since the SP Switch2 is only supported with POWER3 and 375 MHz POWER3 High Nodes, you might need to split an existing system to remove any nodes which are not supported with the SP Switch2. You will then have two SP systems, each with its own serial number. You can order this "split system" feature using **RPQ 8P2009**.

Upgrading, replacing, and relocating nodes

Unique requirements for high nodes

- POWER3 High Nodes (**F/C 2054, 2058**) require a tall, deep frame (Model 550 or F/C 1550).
- POWER3 High Nodes can be installed into Models 20X, 30X, or 40X only with the addition of a tall, deep expansion frame (F/C 1550), since they do not physically fit into the old-style frame. According to configurator rules, if there are no existing POWER3 High Nodes in your system, the MES will include a tall, deep expansion frame. If you determine that a new frame is not required, use RPQ8P2091 to delete the frame from the MES.
- The POWER3 High Node Lift Tool is required and included with the MES to install these nodes. The tool is returned after use.

Upgrading SMP-type nodes

Available node upgrade features are shown in Table 58.

Note that these are ***one-for-one upgrades*** since some of the parts from the original nodes are used in the replacement nodes. Thus for example, you cannot upgrade four thin nodes to one high node. If the node being upgraded contains multiple processor cards, at least one of the processor cards must be installed into the new replacement node. Any additional processor cards can also be installed in the new node or can be used in other supported nodes in the system.

Table 58. Node-to-node upgrade features

Original node type	Can be upgraded to:
332 MHz Thin (**F/C 2050**)	375/450 MHz POWER3 Thin (**F/C 2056**) 332 MHz Wide (**F/C 2051**) 375/450 MHz POWER3 Wide (**F/C 2057**) POWER3 High (**F/C 2054**) 375 MHz POWER3 High (**F/C 2058**)
332 MHz Wide (**F/C 2051**)	375/450 MHz POWER3 Wide (**F/C 2057**) POWER3 High (**F/C 2054**) 375 MHz POWER3 High (**F/C 2058**)
POWER3 Thin (**F/C 2052**)	375/450 MHz POWER3 Thin (**F/C 2056**) 375/450 MHz POWER3 Wide (**F/C 2057**) POWER3 High (**F/C 2054**) 375 MHz POWER3 High (**F/C 2058**)
POWER3 Wide (**F/C 2053**)	375/450 MHz POWER3 Wide (**F/C 2057**) POWER3 High (**F/C 2054**) 375 MHz POWER3 High (**F/C 2058**)
POWER3 High (**F/C 2054**)	375 MHz POWER3 High (**F/C 2058**)

Table 58. Node-to-node upgrade features (continued)

Original node type	Can be upgraded to:
375 MHz POWER3 Thin (**F/C 2056**)	375/450 MHz POWER3 Thin (**F/C 2057**) 375/450 MHz POWER3 Wide (**F/C 2057**) POWER3 High (**F/C 2054**) 375 MHz POWER3 High (**F/C 2058**)
375 MHz POWER3 Wide (**F/C 2057**)	375/450 MHz POWER3 Wide (**F/C 2057**) POWER3 High (**F/C 2054**) 375 MHz POWER3 High (**F/C 2058**)

Replacing withdrawn processor nodes

Replacement features are available to replace withdrawn early processor nodes with 332 MHz, POWER3, and 375/450 MHz POWER3 SMP Thin, Wide, and 375 MHz High nodes. For details, contact your IBM account representative.

Relocating processor nodes

If you plan to relocate any nodes or switches to another frame, you must order one of the following no-charge features:

- Relocating a Thin node (**F/C 9250**)
- Relocating a Wide node (**F/C 9251**)
- Relocating a High node (**F/C 9252**)
- Relocating an SP Switch (**F/C 9253**)

If you are relocating thin or wide nodes to a frame which does not have the 48 Vdc power and Ethernet cables already installed, you can order the following features for each node you are moving:

- **F/C 9303** - 48 V dc cable
- **F/C 9304** - BNC Ethernet cable

Upgrading SP frames

Upgrading Model 500 and F/C 1500 to Model 550 and F/C 1550

This conversion is available if you want to upgrade your Model 500 short-frame SP system with a maximum of eight nodes to a Model 550 tall-frame system with a maximum capacity of 128 nodes. You receive a new tall frame with its integral SEPBU power subsystem and linecord and then your nodes are transferred from the old frame to the new. In this case, the system retains its original serial number.

Upgrading power systems in early SP frames

The early-style 2.01 m frames had 7.0 kW power supplies and the 1.25 m frames had 3.5 kW supplies. Before you can install SMP-type nodes in these early SP frames, you ***must*** upgrade any old-style SEPBU or PDU power supplies. SMP-type nodes require a 10.5 kW power supply in 2.01 m frames and a 5.0 kW supply in 1.25 m frames. When you order one of the following feature codes for your SP system, you receive all of the components you need to upgrade one SP frame. You, as the customer, must supply any necessary components that are not directly attached to the SP frame.

No-charge features to upgrade power subsystems ***with the initial order*** of each SMP-type node in a frame:

- **F/C 9932** for PDU to 10.5 kW upgrade
- **F/C 9933** for 7.0 to 10.5 kW upgrade
- **F/C 9934** for 3.5 to 5.0 kW upgrade

Priced features to upgrade power subsystems ***if you do not order*** new SMP-type nodes:

- **F/C 8500** for PDU to 10.5 kW upgrade
- **F/C 8501** for 7.0 to 10.5 kW upgrade
- **F/C 8502** for 3.5 to 5.0 kW upgrade

Upgrading 2.01 m frames from 7.0 to 10.5 kW SEPBUs

These 7.0 to 10.5 kw upgrades (**F/C 9933** or **F/C 8501**) are required when you want to install SMP-type nodes into early-style 2.01 m frames. These features include the following replacement parts and new components:

1. An additional 3.5 kW SEPBU power book for 10.5 kW service with N+1 power redundancy.
2. Eight (8) 48 V dc frame power cables with heavier-gauge wire, in-line on/off switches, and a 1-to-2 breakout.
3. A new power cord with connector. For details on plugs and connectors, see Table 35 on page 157.
4. New power rating information plates.

Note: Power system upgrades for early SP frames S/N 76000 to 76131 also require power cord modifications. A certified electrician must make these changes.

Customer-supplied components

You must make the following preparations and supply the necessary components to complete the power system upgrade:

1. Electrical service with circuit breakers capable of handling up to 50-amp. loads. For details on branch circuit requirements, see Table 33 on page 155 and Table 34 on page 156.
2. All wall receptacles and line connectors. For details and specifications, see Table 35 on page 157.
3. Any site changes needed to accommodate under-floor power connectors.

Upgrading 1.25 m frames from 3.5 to 5.0 kW SEPBUs

These 3.5 to 5.0 kW upgrades (**F/C 9934** or **F/C 8502**) are required when you want to install SMP-type nodes into early-style 1.25 m frames. These features include the following replacement parts and new components:

1. A replacement SEPBU base enclosure with a higher-rated backplane.
2. One of the following:
   - A 5.0 kW SEPBU book to replace the 3.5 kW unit.

     or
   - A 5.0 kW SEPBU book with N+1 power redundancy to replace a 3.5 kW unit having the N+1 option.
3. Four (4) 48 V dc frame power cables with heavier-gauge wire, in-line on/off switches, and a 1-to-2 breakout.
4. A new power cord with connector. For details on plugs and connectors, see Table 36 on page 158.

5. New power rating information plates.

Customer-supplied components

You must make the following preparations and supply the necessary components to complete the power system upgrade:

1. Electrical service with circuit breakers capable of handling up to 40-amp. loads. For details on branch circuit requirements, see Table 33 on page 155.
2. All wall receptacles and line connectors. For details and specifications, see Table 36 on page 158.
3. Any site changes needed to accommodate under-floor power connectors.

Upgrading 2.01 m frames with PDU to 10.5 kW SEPBU

These PDU to 10.5 kw SEPBU upgrades (**F/C 9932** or **F/C 8500**) are required when you want to install SMP-type nodes into PDU-equipped 2.01 m frames. These features include the following replacement parts and new components:

1. A four-book, 10.5 kW SEPBU with N+1 power redundancy.
2. Eight (8) 48 V dc frame power cables with heavier-gauge wire, in-line on/off switches, and a 1-to-2 breakout.
3. A new power cord with connector. For details on plugs and connectors, see Table 35 on page 157.
4. New power rating information plates.

Note: Power system upgrades for early SP frames S/N 76000 to 76131 also require power cord modifications. A certified electrician must make these changes.

Customer-supplied components

You must make the following preparations and supply the necessary components to complete the power system upgrade:

1. Electrical service with circuit breakers capable of handling up to 50-amp. loads. For details on branch circuit requirements, see Table 33 on page 155 and Table 34 on page 156.
2. All wall receptacles and line connectors. For details and specifications, see Table 35 on page 157.
3. Any site changes needed to accommodate under-floor power connectors.

Upgrading standard SEPBUs to Redundant Power Supply

Upgrading SEPBUs with 5.0 kW BPRs to Redundant Power Supply

Two features are available as follows:

- Redundant Power Supply – Three-phase, high and low-voltage (**F/C 3887**)
- Redundant Power Supply – Single-phase, low-voltage (**F/C 3888**)

The upgrade for SEPBUs with three 5.0 kW power books includes the following new parts:

1. SEPBU enclosure with two ac power cable connectors
2. One 5.0 kW power book
3. Two frame power rating labels
4. Multiple power cable safety label
5. Two power cables

The three existing SEPBU books, frame supervisor, and Power Control Interface card are transferred to the new SEPBU enclosure.

Customer Supplied Components

You must make the following preparations and supply the necessary components to complete the power system upgrade:

1. Electrical service for both power cables
2. All wall receptables and inline connectors
3. Any site changes to accommodate under-floor connectors

Upgrading SEPBUs with 3.5 kW BPRs to Redundant Power Supply

Two features are available as follows:

- Redundant Power Supply – Three-phase, high and low-voltage (**F/C 3889**)
- Redundant Power Supply – Single-phase, low-voltage (**F/C 3890**)

The upgrade of older SEPBUs with four 3.5 kW power books includes the following new parts:

1. SEPBU enclosure with two ac power cable connectors
2. Four 5.0 kW power books
3. Two frame power rating labels
4. Multiple power cable safety label
5. Two power cables

The existing frame supervisor and Power Control Interface card are transferred to the new SEPBU enclosure.

Customer Supplied Components

You must make the following preparations and supply the necessary components to complete the power system upgrade:

1. Electrical service for both power cables
2. All wall receptables and inline connectors
3. Any site changes to accommodate under-floor connectors

Appendix B. SEPBU Power Control Interface

This appendix describes the SEPBU Power Control Interface. This function allows the user to configure the system and associated hardware, such as hard disk or tape drives, to control power on/off for specific components. Frame on/off switches can be set to act as unit emergency power-off (UEPO) for the entire system.

Attention - Powering Off Frames with Power Control Interface
Powering off a frame which is using the Power Control Interface can power down all attached frames or features, causing all parallel jobs to terminate. The switch network cannot be restarted until power is restored to the frame or until the frame is removed from the active configuration in a multi-frame system.

Power Control Interface function

The RS/6000 SP SEPBU power unit contains a Power Control Interface card. This card has a AUX/LOC switch, two MAIN output jacks (+15 V, 0.8 A maximum), and two AUX input jacks (+10 to +30 V, 20 mA maximum).

The Auxiliary/Local (AUX/LOC) switch sets the power control for a frame as follows:

- **AUX** – In the AUX position, the frame main power switch has no effect. Power on/off signals arriving at the AUX jacks from another source control the SEPBU.
- **LOC** – In the LOC position, the frame main power switch controls the frame SEPBU; signals to the AUX input jacks have no effect. Signals sent to the MAIN jack outputs can control external devices including other frame SEPBUs.

Typical configurations

The following Power Control Interface configurations illustrate typical uses of this function. You can use one or more of these configuration types. Note that using the Power Control Interface function can affect certain outages and service operations; take this into consideration as you plan your configuration.

No Power Control Interface Control

The Power Control Interface switches of all RS/6000 SP frames are in the LOC position. No cabling is necessary. Power control of each frame and attached unit is independent of all other units.

RS/6000 SP Chained Control

First RS/6000 SP frame has Power Control Interface switch in the LOC position; all other RS/6000 SP frames have Power Control Interface switches in the AUX position. A Power Control Interface cable is run from the MAIN jack in the first frame to a AUX jack in the second frame. Another Power Control Interface cable is run from the MAIN jack in the second frame to a AUX jack in third frame, and so on.

Powering on/off the first RS/6000 SP frame controls power of all other attached frames. Note that this can affect how certain outages or service operations impact the system operation.

RS/6000 SP Cross-Control

All RS/6000 SP frames have Power Control Interface switches in the AUX position. A Power Control Interface cable is run from the MAIN jack in each frame to an AUX jack in another frame.

Powering on/off any RS/6000 SP frame controls power of all other attached frames. Note that this can affect how certain outages or service operations impact the system operation.

RS/6000 SP Control of Peripherals

A Power Control Interface cable is run from RS/6000 SP frame MAIN jack to a AUX jack on the peripheral Power Control Interface panel. Powering on/off this frame will have the corresponding effect on any attached peripherals. If the peripheral is connected to processors in more than one RS/6000 SP frame, certain outages or service operations might have an undesirable impact on the system operation. In other cases, this can allow proper power synchronization of the processing units with their respective peripherals.

Power Control Interface cable planning

Take cable lengths into account as you implement the Power Control Interface. A 10-meter (33 ft.) cable (**P/N 00G1277**) is required to connect the Power Control Interface to external devices or to other SP frames. For each SP frame connected by the 10-meter cable, an additional cable (**P/N 42F6839**) is required to adapt the 10-meter cable to the SEPBU Power Control Interface inputs/outputs within each of the frames; you need to order both cables.

System monitor

The System Monitor software controls all power modules in an SP frame with a single setting. By selecting the Frame Environment Layout window for a frame, you can monitor status of the power modules and turn the power on or off for the entire frame or systems that are configured using the Power Control Interface.

Appendix C. MCA communication adapters

This chapter contains reference information on MCA-type communication adapters.

MCA bus adapter requirements

The following table contains reference information on MCA adapter requirements. These features are described in “MCA adapter descriptions” on page 211.

Table 59. Micro Channel Adapter requirements

Feature Code	MCA Adapter Name	Number of MCA Slots Required	Max. Number Allowed per Node Wide/Thin/High	Notes
1902	Optics Daughter Card	0	2 / 1 / NA	9
1904	Fibre Channel 1 GB	1	2 / 2 / NA	1, 9
1906	Fibre Channel 266	1	2 / 2 / NA	1, 9
2402	IBM Network Terminal Accelerator 256	1	7 / 4 / 4	9
2403	IBM Network Terminal Accelerator 2048	1	7 / 4 / 4	9
2410	SCSI-2 External I/O Controller	1	7 / 4 / NA	
2412	Enhanced SCSI-2 Differential Fast/Wide Adapter/A	1	7 / 4 / 14	
2415	SCSI-2 Fast/Wide Adapter/A	1	7 / 4 / 14	
2416	SCSI-2 Differential Fast/Wide Adapter/A	1	7 / 4 / 14	9
2420	SCSI-2 Differential External I/O Controller	1	7 / 2 / NA	9
2700	4-Port Multiprotocol Communications Controller	1	7 / 3 / 8	
2723	FDDI Dual Ring	1	3 / 2 / 4	3
2724	FDDI SAS Single Ring	1	6 / 2 / 8	
2735	HIPPI	5	1 / NA / 2	4
2754	S/390 ESCON Channel Emulator Adapter	2	2 / 1 / 4	
2755	BMCA	1	2 / 2 / 2	5, 6
2756	ESCON Control Unit Adapter	2	2 / 1 / 4	
2930	RS-232 8-port Adapter	1	7 / 4 / 14	
2940	8-port Async Adapter	1	7 / 4 / 14	9
2960	X.25 Interface Co-Processor/2	1	7 / 4 / 8	
2970	Token-Ring	1	7 / 4 / 12	
2972	Auto Token-Ring LANstreamer MC 32	1	7 / 3 / 12	
2980	Ethernet	1	7 / 3 / 12	2
2984	ATM TURBOWAYS 100	1	2 / 2 / 2	9

Table 59. Micro Channel Adapter requirements (continued)

Feature Code	MCA Adapter Name	Number of MCA Slots Required	Max. Number Allowed per Node Wide/Thin/High	Notes
2989	ATM TURBOWAYS 155	1	4 / 2 / 4	9
2992	Ethernet/FDX 10 Mbps TP/AUI MC Adapter	1	7 / 3 / 12	2
2993	Ethernet/FDX 10 Mbps BNC MC Adapter	1	7 / 3 / 12	2
2994	10/100 Ethernet Twisted Pair MC Adapter	1	2 / 2 / 4	
4224	Ethernet 10BASE-T Transceiver	0	8 / 4 / 15	
6212	9333 HPSA (High Performance Subsystem Adapter)	1	6 / 2 / 8	7
6214	SSA 4-Port Adapter	1	4 / 2 / 8	
6216	SSA4-Port Adapter	1	4 / 2 / 8	
6217	SSA 4-Port RAID Adapter	1	4 / 2 / 8	
6219	Micro Channel SSA Multi-Initiator/RAID EL Adapter	1	4 / 2 / 8	8
6222	SSA Fast-Write Cache Option	0	Mounts on F/C 6219	
6305	Digital Trunk Dual	1	6 / 3 / 2	
7006	Realtime Interface Co-Processor Portmaster	1	7 / 4 / 8	
8128	128-Port Async Controller	1	7 / 4 / 7	

Notes:

1. Not supported in 120 MHz thin nodes or 135 MHz wide nodes.
2. High nodes and wide nodes have a minimum of one if used.
3. FDDI dual ring adapters (**F/C 2723**) have a mandatory prerequisite of the FDDI-SAS (**F/C 2724**).
4. The HIPPI feature (**F/C 2735**) uses three physical MCA slots and requires a total of five slots to satisfy power and thermal requirements.
5. The BMCA node-to-node (**F/C 2752**) cables are required on any node having the BMCA adapter and not having an external host connection.
6. BMCA adapters cannot be installed in two adjacent MCA slots due do physical cabling constraints. There is a limit of 32 adapters per frame, and a limit of 16 cables exiting the frame.
7. A maximum of 128 9333 High Performance Subsystem Adapter cables is allowed per frame.
8. Will not operate in SSA loops containing F/C 6214 or F/C 6216.
9. Withdrawn from production.

MCA adapter descriptions

Table 60. MCA adapter features

Feature Code	Adapter Description
2410	SCSI-2 High Performance External I/O Controller
2412	Enhanced SCSI-2 Differential Fast/Wide Adapter/A
2415	SCSI-2 Fast/Wide Adapter/A
2700	4-Port Multiprotocol Communications Controller
2723	FDDI Dual-Ring Attachment
2724	FDDI Single-Ring Attachment
2735	High Performance Parallel Interface - HIPPI
2754	S/390 ESCON Channel Emulator Adapter
2755	Block Multiplexer Channel Adapter - BMCA
2756	ESCON Control Unit Adapter
2930	8-Port Async Adapter-EIA-232
2960	X.25 Interface Co-Processor/2
2970	Token-Ring High Performance Network Adapter
2972	Auto Token-Ring LANstreamer MC 32 Adapter
2980	Ethernet High Performance LAN Adapter
2989	TURBOWAYS 155 ATM Adapter
2992	High-Performance Ethernet LAN Adapter (AUI/10BaseT)
2993	High-Performance Ethernet LAN Adapter (BNC)
2994	10/100 Ethernet Twisted Pair MC Adapter
4224	Ethernet 10BaseT Transceiver
6212	9333 High Performance Subsystem Adapter
6214	SSA 4-Port Adapter
6216	Enhanced SSA 4-Port Adapter
6217	SSA 4-Port RAID Adapter
6219	Micro Channel SSA Multi-Initiator/RAID EL Adapter(accepts optional SSA Fast-Write Cache module (F/C 6222))
6305	Digital Trunk Dual Adapter
7006	Realtime Interface Co-Processor Portmaster Adapter/A
8128	128-Port Async Controller

SCSI-2 High Performance External I/O Controller (F/C 2410) MCA

The SCSI-2 External I/O Controller feature (**F/C 2410**) allows you to attach external single-ended SCSI and SCSI-2 devices. This feature provides for attachment of one IBM 9334 Expansion Unit Model 500 or up to four external IBM supported SCSI devices with IBM supported cables.

Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C 2412) MCA

The IBM Enhanced SCSI-2 Differential Fast/Wide Adapter/A is a dual ported fast (10 MHz) and wide (2 bytes wide) SCSI Micro Channel Adapter that can provide synchronous SCSI bus data rates of up to 20 megabytes per second.

This adapter provides high performance attachment to Differential SCSI disks, disk subsystems, tape devices and read/write optical subsystems. The maximum data rate depends on system and application configurations. This adapter has one internal single ended port and one external differential port. The internal port is capable of attaching up to six single ended devices; the external port is capable of addressing up to fifteen differential devices. The number of physical devices attached to each port is limited by SCSI bus cabling restrictions. The internal port of this adapter supports either 8-bit or 16-bit devices via an 8-bit or a 16-bit connector. Only one of these two connectors may be used at one time. (Devices of different bus attachment widths cannot be connected/used at the same time.) The external Differential SCSI bus is capable of supporting cable lengths of 25 meters (82 feet).

Additional system, subsystem and high availability connections are also available with the differential system-to-system and Y-cable features.

SCSI-2 Fast/Wide Adapter/A (F/C 2415) MCA

The SCSI-2 Fast/Wide adapter feature (**F/C 2415**) is a dual-ported fast (10 MHz) and wide (two bytes) adapter. It provides synchronous SCSI bus rates up to 20 megabytes per second and attaches to single-ended (SE) SCSI disks, CD-ROMs, tape drives, R/W optical devices, and storage subsystems. The maximum data rate depends on the maximum rate of the attached device.

This adapter has one internal SE port and one external SE port. Each SE port can address up to seven SE SCSI devices. The number of physical devices attached to each port is limited by SCSI bus cabling restrictions. The internal port supports either 8-bit or 16-bit devices via an internal fast/wide cable with an interposer for fast-only devices. External cabling may be up to six meters (19.6 feet) when attached to the 9334-010 or 9334-500, or three meters when attached to anything else, and is supplied by the attaching device.

4-Port Multiprotocol Communications Controller - (F/C 2700) MCA

The 4-port Multiprotocol Communications Controller feature (**F/C 2700**) attaches the RS/6000 500 series to synchronous communications networks using EIA-232D, EIA-422A, A.35, and X.21 physical specifications. The adapter supports SDLC and BSC protocols, prepares all inbound and outbound data, performs address searches, and in general relieves the system processor of many communications tasks. It is designed to support data rates up to 64 Kbps per port with appropriate user provided software.

Fiber Distributed Data Interface - FDDI - (F/C 2724, 2723) MCA

The SP supports both single-ring (**F/C 2724**) and dual-ring (**F/C 2723**) attachment.

The FDDI single-ring attachment station (SAS) adapter attaches the SP directly to a primary ring of a FDDI network via a concentrator. The FDDI concentrator offers additional protection by isolating the network from routine on/off activity and individual failure of an SP processor node.

High Performance Parallel Interface - HIPPI - (F/C 2735) MCA

The High Performance Parallel Interface (HIPPI) (**F/C 2735**) provides high-speed connectivity to super computers, RS/6000 processors, HIPPI fiber optic extenders, IBM 9570 Disk Array, and other disk arrays and tape systems.

This feature provides an efficient simplex/duplex point-to-point HIPPI interface achieving peak rates of 100 megabytes per second (simultaneous in each direction)

over a distance of up to 25 meters via copper cabling. This distance can be extended using HIPPI extenders. The adapter can be used for either communication or storage-channel applications.

The HIPPI adapter set occupies three adjacent Micro Channel slots. However, because of power considerations, the adapter set currently must be considered to occupy five Micro Channel slots.

S/390 ESCON Channel Emulator Adapter (F/C 2754) MCA

This adapter provides attachment capability via the IBM ESCON architecture for selected tapes providing IBM customers with more choices for implementing data access applications by an ESCON Channel attachment of S/390 tapes to RS/6000 systems. Supporting a data transfer rate of up to 17 MB per second (Mbps), the ESCON Emulator adapter allows attachment of ESCON attached tape subsystems. The adapter uses two Micro Channel slots. A maximum of two adapters may be installed per processor, depending upon slot availability. Designed to support specifications for ESCON devices, the ESCON Emulator adapter conforms to most of the standard Micro Channel specifications that are required for tape subsystems. One wrap plug, two diagnostic diskettes (stand-alone and runtime), publications, and two device driver diskettes are included with the hardware adapter. Channel cables are also required and should be ordered separately. The ESCON Emulator adapter supports the following tape devices with appropriate software installed:

- IBM 3490 Magnetic Tape Subsystem, all models
- IBM 3490E Magnetic Tape Subsystem, all models
- IBM 3494 Tape Library Dataserver
- IBM 3495 Tape Library Dataserver

Block Multiplexer Channel Adapter - BMCA - (F/C 2755) MCA

A DB78 bus/tag terminator is shipped with **F/C 2753** to end the bus and tag channel string, so you do not need to supply serpentine bus and tag terminators for the channels connected to the SP BMCA feature (**F/C 2755**).

ESCON Control Unit Adapter (F/C 2756) MCA

This adapter (**F/C 2756**) allows you the ability to attach SP nodes to the IBM Enterprise System Connection (ESCON) channels of the System/390. The adapter attaches directly to an ESCON channel, providing fiber optical links using LED technology. It also attaches to ESCON Directors (fiber optic switches) to allow for large numbers of connections.

8-Port Async Adapter - EIA-232 - (F/C 2930) MCA

The 8-port Async feature (**F/C 2930**) provides the RS/6000 500 series system with up to eight EIA-232 asynchronous serial devices such as terminals and printers. The 8-port Async adapter contains all of the electronics required to support eight asynchronous ports and uses one I/O card slot.

X.25 Interface Co-Processor/2 - (F/C 2960) MCA

The X.25 Interface Co-Processor/2 feature (**F/C 2960**) attaches the RS/6000 500 series to an X.25 Packet Switched network. The X.25 adapter provides a single port that accommodates one of the following selectable interfaces: X.21, EIA-232D/V.24, and V.35. This adapter allows the systems to be attached to an X.25 network, and its on-board software is capable of processing inbound and outbound data streams to offload communications tasks from the system processor.

Token-Ring High Performance Network Adapter (F/C 2970) MCA

The Token-Ring High Performance Network adapter (F/C 2970) is designed to allow an SP node to attach to 4 Mbps or 16 Mbps Token-Ring local area network. This adapter is cable-and-network compatible with all IBM PS/2 Token-Ring adapters. The required cable is included with the adapter and is 20 feet in length. Extension cables may be ordered separately.

Auto Token-Ring LANstreamer MC 32 Adapter - (F/C 2972) MCA

The IBM Auto Token-Ring LANstreamer MC 32 feature (**F/C 2972**) is designed to allow a RS/6000 system to attach to 4 Mbps or 16 Mbps token-ring local area networks. The adapter automatically selects the correct token-ring speed (4 or 16 Mbps). It is cable and network compatible with all IBM PS/2 Token adapters, which means that no new cables or network components are required.

Ethernet High Performance LAN Adapter (F/C 2980) MCA

The Ethernet High Performance LAN Adapter (F/C 2980) is a high performance MCA architecture Busmaster adapter that provides a connection to 10 MB Carrier Sense Multiple Access/Collision Detection (CSMA/CD) Ethernet networks. The primary use of this adapter is to attach the 9076 system to Ethernet networks. F/C 2980 has both a 10Base2 (BNC) connector and a 10Base5 (15 pin, thick) connector, but only one connector may be used at one time.

TURBOWAYS 155 ATM Adapter (F/C 2989) MCA

The TURBOWAYS 155 ATM adapter (**F/C 2989**) enables TCP/IP applications to work in an asynchronous transfer mode (ATM) environment. One virtual connection dedicated to each IP address and a transformation of each IP address to the corresponding virtual connection is performed.

The initial release supports AAL-5 adaptation layer interface and supports 1024 active virtual connections.

High-Performance Ethernet LAN Adapter AUI and 10Base-T (F/C 2992) MCA

This adapter allows the RS/6000 SP system to attach to 10 Mbps Ethernet networks. F/C 2992 provides both an AUI port and a 10BaseT (RJ-45) Ethernet connection. Only one of the two ports may be used at one time. This adapter has a parallel processing design which reduces latency and increases data throughput.

High-Performance Ethernet LAN Adapter 10Base2 (BNC) (F/C 2993) MCA

This adapter allows the RS/6000 SP system to attach to 10 Mbps Ethernet networks. F/C 2993 provides a 10Base2 (BNC) Ethernet connection. This adapter has a parallel processing design which reduces latency and increases data throughput.

10/100 Ethernet Twisted Pair MC Adapter (F/C 2994) MCA

The 10/100 Ethernet twisted pair MC adapter allows the RS/6000 SP system to attach to both 100Base-TX (IEEE 802.3u) and 10Base-T (IEEE 802.3) Ethernet networks. The adapter automatically senses network transfer rates and selects the appropriate rate at power-up. F/C 2994 provides network attachment through a single, RJ-45 port that supports category 5 unshielded twisted pair (UTP) wiring for

100Base-TX connections and category 3, 4, or 5 UTP wiring for 10Base-T connections. Type 100 VG wiring is not supported.

Note: If your network currently operates at 10 Mbps and your plans include migration to 100 Mbps operation, you should consider using category 5 cable now.

Ethernet 10BaseT Transceiver - (F/C 4224) MCA

The Ethernet 10BaseT Transceiver feature (**F/C 4224**) provides the complete attachment unit interface (AUI) to a twisted pair LAN connection.

9333 High Performance Subsystem Adapter (F/C 6212) MCA

The 9333 High Performance Subsystem adapter (**F/C 6212**) allows attachment of four (per adapter) 9333 High Performance Disk Drive Subsystems to a RS/6000 processor.

SSA 4-Port Adapter (F/C 6214) MCA

The SSA 4-Port adapter (**F/C 6214**) provides Serial Storage Architecture (SSA) connections that can be configured to provide two SSA loops. Each loop will support the attachment of up to 48 devices (96 devices per adapter). Each adapter will support attachment of up to 6 maximum configuration IBM 7133 Serial Storage Architecture Disk Subsystems (96 drives) for a total disk drive capacity of 432 GB, using 4.5 GB disk drives.

Enhanced SSA 4-Port Adapter (F/C 6216) MCA

The Enhanced SSA 4-Port Adapter serves as an interface between systems using Micro Channel Architecture (MCA) and devices using Serial Storage Architecture (SSA). F/C 6216 provides 4 SSA ports for the attachment of data storage devices. The adapter's 4 ports are arranged in two configurable pairs providing two SSA loops. Each loop will support the attachment of 48 devices or 96 devices per adapter card. F/C 6216 also supports six IBM 7133 SSA Subsystems per adapter. This permits attaching up to 96 disk drives for a storage capacity of 432 GB per adapter when using 4.5 GB disk drives.

SSA 4-Port RAID Adapter (F/C 6217) MCA

The SSA 4-Port RAID adapter (**F/C 6217**) is a new addition to the SSA family of adapters for SP systems. The SSA 4-Port adapter offers the Redundant Array of Independent Disks (RAID) 5 function, which provides protection to your data in the event of a disk drive failure. This adapter also supports attachment to a non-RAID disk in a single-initiator per loop environment. A utility program is provided to control the RAID configuration.

Micro Channel SSA Multi-Initiator/RAID EL Adapter (F/C 6219) and SSA Fast-Write Cache Option (F/C 6222) MCA

The Micro Channel SSA Multi-Initiator/RAID EL Adapter can be configured as either a two initiator non-RAID adapter or as a one initiator RAID 5 adapter. This adapter has four ports and two SSA loops supporting 48 SSA disk drives per loop (96 drives per adapter). F/C 6219 also supports HACMP functions.

The Micro Channel SSA multi-initiator/RAID EL adapter also supports a 4 MB Fast-Write Cache option (F/C 6222) that improves write performance in both the RAID 5 and non-RAID configurations. Details on the F/C 6222 option are listed below.

SSA Fast-Write Cache Option (F/C 6222)

The SSA Fast-Write Cache is an optional 4 MB fast-write module that plugs into the Micro Channel SSA Multi-Initiator/RAID EL Adapter (F/C 6219). The Fast-Write Cache provides up to 10 times faster data throughput and response times when compared to Multi-Initiator RAID adapters without the F/C 6222 option. The level of improvement is dependent on data block sizes, percentage of sequential writes, machine type, and application.

The F/C 6222 cache option uses non-volatile RAM having over seven years of memory retention. Non-volatile memory allows you to transfer the cache module from a failing Multi-Initiator adapter to a new adapter during the unlikely event of an adapter failure. This helps insure data integrity and operational reliability

Appendix D. Withdrawn RS/6000 SP features

This appendix contains information on RS6000 SP features that are withdrawn from production. These features are no longer available from IBM but might be available from other sources. This information is provided for reference purposes and can be helpful if you are upgrading an existing system.

Please note that not all withdrawn features are included here; you can find descriptions of those earlier features in previous editions of this book.

Withdrawn processor nodes

Table 61 contains a brief description of all withdrawn processor node drawer features. For comparison purposes, currently available nodes are described in Table 62 on page 218.

Table 61. Withdrawn processor nodes

Feature Code	Processor Node Description
2002	Thin node drawer consisting of two 66 MHz POWER2 processor nodes which can be asymmetrically configured for memory, hard disk drives and adapters. Each node has an Ethernet for the system control network, two memory card slots, four Micro Channel slots, and two hard disk drive bays.
2003	Wide node drawer consisting of one 66 MHz POWER2 processor node. This node has eight memory card slots, eight Micro Channel and four hard disk drive bays. The Ethernet High Performance LAN adapter (**F/C 2980**) is a prerequisite on all wide nodes.
2004	Thin node drawer consisting of a high performance Thin Node 2 CPU card packaged in an SP thin processor node. The CPU requires the equivalent of two memory cards to maintain high bandwidth to memory. Due to packaging constraints, this is accomplished using a single memory card plus SIMMs on the CPU card. In addition, a new +4 V dc power supply is added to provide an additional required voltage. Other than these changes, the Thin Node 2 processor node components are the same as thin processor node type **F/C 2002**.
2005	Wide node drawer consisting of one 77 MHz POWER2 processor node. This node has eight memory card slots, eight Micro Channel and four hard disk drive bays. The Ethernet High Performance LAN adapter (**F/C 2980**) is a prerequisite on all wide nodes.
2006	604 high node consisting of a 2-, 4-, 6-, or 8-way symmetric multiprocessing system that uses PowerPC 604 processors that operate at 112 MHz. The 604 high node occupies two drawers (four slots) in a frame, has four memory card slots, 16 Micro Channel, three hard disk drive bays and four CPU cards (two CPUs per card).
2007	Wide node drawer consisting of one 135 MHz wide node. This node has eight memory card slots, eight Micro Channel, and four hard disk drive bays. The Ethernet High Performance LAN adapter (**F/C 2980**) is a prerequisite on all wide nodes.
2008	Thin node drawer consisting of two 120 MHz thin nodes. Each node has four memory card slots, four Micro Channel, and two hard disk drive bays.

Table 61. Withdrawn processor nodes (continued)

Feature Code	Processor Node Description
2009	604e high node consisting of a 2-, 4-, 6-, or 8-way symmetric multiprocessing system that uses PowerPC 604e processors that operate at 200 MHz. The 604e high node occupies two drawers (four slots) in a frame, has four memory card slots, 16 Micro Channel, four hard disk drive bays and four CPU cards (two CPUs per card).
2022	Thin node drawer consisting of two 160 MHz thin nodes. Each node has four memory card slots, four Micro Channel, and two hard disk drive bays.
2050	One 332 MHz SMP Thin Node, can be ordered and installed singly or in pairs. A node pair occupies one drawer. Each node may be equipped with either two or four processors and has two memory slots, two PCI slots, two hard disk drive bays, and a dedicated MX slot for an optional SP Switch MX adapter.
2051	One 332 MHz SMP Wide Node occupying one drawer. Each node may be equipped with either two or four processors and has two memory slots, ten PCI slots, four hard disk drive bays, and a dedicated MX slot for an optional SP Switch MX adapter.
2052	POWER3 SMP Thin Nodes use PCI bus architecture and have either one or two 200 MHz 64-bit processors per node. They have two memory slots supporting up to 4 GB of memory, two 32-bit PCI slots for communication adapters, a dedicated Mezzanine Bus (MX) slot for an optional switch adapter, integrated Ethernet with BNC and RJ45 ports, and two hard disk drive bays supporting up to 18.2 GB of mirrored disk storage.
2053	POWER3 SMP Wide Nodes use PCI bus architecture and have either one or two 200 MHz 64-bit processors per node. They have two memory slots supporting up to 4 GB of memory, ten PCI slots (two 32-bit and eight 64-bit) for communication adapters, a dedicated Mezzanine Bus (MX) slot for an optional switch adapter, integrated Ethernet with BNC and RJ45 ports, and four hard disk drive bays supporting up to 36.4 GB of mirrored disk storage.
2054	POWER3 SMP High Nodes use PCI bus architecture and have either two, four, six, or eight 222 MHz 64-bit processors per node, four memory slots supporting up to 16 GB of memory, one 32-bit and four 64-bit PCI adapter slots, three pairs of expansion I/O connectors supporting up to three loops of two SP expansion I/O units each, integrated Ultra SCSI bus, integrated Ethernet (10BASE-T/100BASE-TX or 10BASE2), and two internal hard disk drive bays supporting up to 18.2 GB of mirrored disk storage.

Available processor node comparisons

For comparison purposes, Table 62 contains descriptions of currently available processor nodes.

Table 62. Currently-available processor nodes

Feature Code	Processor Node Description
2056	375 MHz POWER3 SMP Thin Nodes use PCI bus architecture and have either two or four 375 MHz 64-bit processors per node. They have two memory slots supporting up to 8 GB of memory, two 32-bit PCI slots for communication adapters, a dedicated Mezzanine Bus (MX) slot for an optional switch adapter, integrated Ethernet with BNC and RJ45 ports, and two hard disk drive bays supporting up to 18.2 GB of mirrored disk storage.

Table 62. Currently-available processor nodes (continued)

Feature Code	Processor Node Description
2057	375 MHz POWER3 SMP Wide Nodes use PCI bus architecture and have either two or four 375 MHz 64-bit processors per node. They have two memory slots supporting up to 8 GB of memory, ten PCI slots (two 32-bit and eight 64-bit) for communication adapters, a dedicated Mezzanine Bus (MX) slot for an optional switch adapter, integrated Ethernet with BNC and RJ45 ports, and four hard disk drive bays supporting up to 72.8 GB of mirrored disk storage.
2058	375 MHz POWER3 SMP High Nodes use PCI bus architecture and have four, eight, twelve, or sixteen 375 MHz 64-bit processors per node. They have four memory slots supporting up to 32 GB of memory, five PCI slots (one 32-bit and four 64-bit) for communication adapters, three pairs of expansion I/O connectors supporting up to three loops of two SP Expansion I/O Units each, integrated Ultra SCSI bus, a dedicated Mezzanine Bus (MX) slot for an optional switch adapter, integrated Ethernet with BNC and RJ45 ports, and two hard disk drive bays supporting up to 36.4 GB of mirrored disk storage.

POWER3 SMP High Node (F/C 2054)

Description

POWER3 SMP High Nodes (**F/C 2054**) use PCI bus architecture and have either two, four, six, or eight 222 MHz 64-bit processors per node. Your IBM RS/6000 SP system must be operating at PSSP 3.1.1 (or later) to use these nodes.

The POWER3 High Node provides additional hard disk drive and PCI adapter capacity by connecting to SP Expansion I/O Units; for details, see “SP Expansion I/O Unit (F/C 2055)” on page 12.

The POWER3 SMP High Node occupies two full drawer locations, thus four nodes can be housed in a tall (1.93 m) frame. POWER3 SMP High Nodes can be placed in the first node slot of a frame without requiring additional nodes.

POWER3 SMP High Nodes require a tall, deep frame (**Model 550** or **F/C 1550**); they are not supported in the withdrawn 2.01 m frame or in the 1.25 m frame.

Note: POWER3 SMP High Nodes are not compatible with High Performance switches (F/C 4010 and F/C 4007).

PCI bus description: The POWER3 SMP High Node PCI bus contains one 32-bit and four 64-bit PCI slots for I/O adapters.

Additional PCI adapters can be attached to the bus by using up to six optional SP Expansion I/O Units. Each expansion unit has eight 64-bit PCI adapter slots.

Requirements and options

F/C 2054 requirements: POWER3 SMP High Nodes occupy two full node drawers. Up to four POWER3 SMP High Nodes can be installed in one tall/deep frame. Mandatory prerequisites are:

- PSSP 3.1.1 (or later) on the processor node, control workstation, and backup nodes
- Two processors (on one card, mounted in one slot)
- 1 GB of memory

- 9.1 GB of mirrored hard disk drive (with internal booting)

F/C 2054 options: Available options include the following:

- Four processor slots allowing a maximum of eight processors per node
- Four memory slots supporting up to 16 GB of memory
- Five PCI slots (four 64-bit and one 32-bit) for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional SP Switch adapter
- A dedicated port for an optional SP Switch2 adapter
- Integrated Ethernet with BNC and RJ45 ports (only one port at a time can be used):
  - 10BASE2 Ethernet (BNC)
  - 10BASE-T or 100BASE-TX Ethernet (RJ45)
- Support for up to six SP Expansion I/O units (**F/C 2055**)
- Two internal hard disk drive bays supporting up to 72.8 GB of storage (36.4 GB mirrored)
- Integrated Ultra SCSI network
- Two external, nine-pin, RS-232 connectors on the planar S2 and S3 ports. The S3 port is supported only for HACMP serial heartbeat; the S2 port is not supported for this use. A 9-pin to 25-pin converter cable is included with the node for this connector.
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options: POWER3 SMP High Nodes require a minimum of two 222 MHz PowerPC processors mounted on one card. You can order up to three additional two-processor cards (**F/C 4849**) to configure the node with a total of eight CPUs.

Table 63. Processor options for POWER3 SMP High Nodes (F/C 2054)

Feature Code	Description	Minimum per node	Maximum per node
4849	One processor card with two CPUs	1	4

Memory requirements and options: POWER3 SMP High Nodes have one to four memory cards, require a minimum of one GB of memory, and support a maximum of 16 GB. Memory is supplied by 128 MB DIMMs which must be mounted in banks of eight DIMMs.

For the best memory-access bandwidth, memory DIMMs should be distributed evenly across four memory cards. The following list illustrates this:

- 1 to 4 GB memory mounted on one card yields 16.8 - 24.3% of peak bandwidth
- 2 to 8 GB mounted on two cards yields 33.5 - 48.5% of peak
- 4 to 16 GB mounted on four cards yields 67 - 97% of peak

The configurator rules used for memory placement in these nodes are designed to yield the best memory performance. Any plans to increase the amount of memory in the future should always be taken into consideration when deciding what quantity of memory cards to order.

Table 64. Memory features for POWER3 SMP High Nodes (F/C 2054)

Feature Code	Description	Minimum Per Node	Maximum Per Node
4880	Base memory card	1	4
4133	1 GB – (8 x 128 MB DIMMs)	1	16
4402	2 GB – (16 x 128 MB DIMMs)	0	8
4403	3 GB – (24 x 128 MB DIMMs)	0	4
4404	4 GB – (32 x 128 MB DIMMs)	0	4

Hard disk drive requirements and options: POWER3 SMP High Nodes can have one pair of internal hard disk drives attached through an integrated Ultra SCSI network. The POWER3 SMP High Node can have either no internal hard disk drives (with external booting) or from 9.1 GB to a maximum of 36.4 GB of mirrored, internal disk storage.

Additional hard disk drives can be attached to the POWER3 High Node by connecting up to six SP Expansion I/O units. Each expansion unit has four hard disk drive bays. For details, see “SP Expansion I/O Unit (F/C 2055)” on page 12.

Optional internal hard disk drives are available as follows:

- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 2909**)
- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 2918**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3804**)
- 18.2 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3810**)
- 36.4 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3820**)

External storage devices can be accessed through optional Ultra SCSI adapter (**F/C 6207**) and SSA adapter (**F/C 6230**).

Switch and communication adapter requirements and options:

Switch restrictions:

- POWER3 SMP High Nodes are not supported with the SP Switch-8. You must use either the SP Switch, 16-port (**F/C 4011**) or the SP Switch2, 16-port (**F/C 4012**).
- POWER3 SMP High Nodes are not compatible with the older High Performance series of switches. If you install these nodes into a switch-configured system, it must use only SP-type switches.

Switch adapters: The switch adapter for POWER3 SMP High Nodes does not occupy a PCI slot; it is installed into the Mezzanine (MX) bus. The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

For SP Switch systems, these nodes require the SP Switch MX2 Adapter (**F/C 4023**); for details, see “POWER3 and 375/450 MHz POWER3 SMP node adapter” on page 50.

For SP Switch2 systems, these nodes require the SP Switch2 Adapter (**F/C 4025**); for details, see “High node adapter” on page 53.

I/O adapters: The POWER3 SMP High Node has five PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON
- Serial HIPPI

For more information about these adapters, see “PCI bus I/O adapter requirements for SMP nodes” on page 91 and Chapter 14, “PCI communication adapters” on page 103.

Note: A 10BASE2 or 10BASE-T/100BASE-TX Ethernet adapter for the SP Ethernet is integrated into the POWER3 High Node and does not occupy a PCI slot.

POWER3 SMP Thin Node (F/C 2052)

Description

POWER3 SMP Thin Nodes (F/C 2052) have PCI bus architecture and use either one or two 200 MHz 64-bit processors per node. These nodes are functionally equivalent to an IBM RS/6000 7043-260 workstation. Your IBM RS/6000 SP system must be operating at PSSP 3.1 (or later) to use these nodes.

The node occupies half of a drawer (one slot). Up to sixteen of these nodes can be housed in a tall frame. When installed singly within a drawer, these nodes must be placed in an odd-numbered node slot. For complete information on node/frame configurations, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

For electromagnetic compliance, these nodes are housed in an enclosure (F/C 9930). If you order a single node, a cover plate (F/C 9931) is included to fill the even-numbered slot opening.

If you plan to install a POWER3 SMP Thin Node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However; once you have done the power system upgrade, these nodes are fully compatible with all existing SP hardware except for High Performance switches. For more information on power system upgrades, see “Upgrading power systems in early SP frames” on page 202.

Note: POWER3 SMP Thin Nodes are not compatible with High Performance switches (F/C 4010 and F/C 4007).

Bus description: The POWER3 SMP Thin Node PCI bus contains two 32-bit slots PCI slots (slots I2 and I3). The I1 slot is reserved for the optional SP Switch MX2 Adapter.

Requirements and options

F/C 2052 requirements: This feature code returns one POWER3 SMP Thin Node.

POWER3 SMP Thin Nodes occupy one half node drawer. These nodes are asymmetrically configured for memory, hard disk drives, and adapters. Up to sixteen POWER3 SMP Thin Nodes may be installed in one tall frame and up to eight in a short frame. Mandatory prerequisites are:

- PSSP 3.1 (or later) on the control workstation, backup nodes, and processor node
- One processor (mounted in one slot)
- 256 MB of memory
- 4.5 GB of mirrored storage (with internal booting)
- An upgraded power system on older frames (see “Planning for power requirements of SP frames and features” on page 161 for more information)

F/C 2052 options: Available options include the following:

- Two processor slots allowing a maximum of two processors per node
- Two memory slots supporting up to 4 GB of memory
- Two (32-bit) PCI slots for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Integrated Ethernet with BNC and RJ45 ports (only one port can be used at a time):
  - 10BASE2 Ethernet on BNC
  - 10BASE-T Ethernet or 100BASE-TX Ethernet on RJ45
- Two hard disk drive bays supporting up to 18.2 GB of mirrored disk storage
- Integrated Ultra SCSI
- Standard service processor
- External nine-pin RS-232 on the planar S2 port (supported only for HACMP serial heartbeat); a 9 to 25-pin converter cable is included with the node
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options: POWER3 SMP Thin Nodes require a minimum of one POWER3 PowerPC processor mounted on one card. However you can order an additional processor card (**F/C 4342**) to configure the node with a total of two CPUs.

Table 65. Processor options for POWER3 SMP Thin Nodes

Feature Code	Quantity	Description	Comments
4342	1-2	One processor card with one CPU	One required

Memory requirements and options: POWER3 SMP Thin Nodes have two memory cards and require a minimum of 256 MB of memory. These nodes will support a maximum of 4 GB of memory. Memory is supplied by 128 MB DIMMs that must be mounted in pairs (256 MB increments). The memory cards are not required to be configured symmetrically. Each card has the capacity to mount 2 GB of DIMMs, with 4 GB addressable per node. Note that with the minimum memory installed (256 MB), the second card will contain no DIMMs. Memory cards and DIMMs are not interchangeable between SMP and non-SMP Thin Nodes. Memory

cards are not interchangeable between 332 MHz and POWER3 SMP Thin Nodes.

Table 66. Memory features for POWER3 SMP Thin Nodes (F/C 2052)

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4098	Base Memory Card	2	2
4110	One Pair of 128 MB DIMMs (256 MB total)	1 pair	16 pairs

Hard disk drive requirements and options: POWER3 SMP Thin Nodes can have up to two internal hard disk drives attached through an integrated Ultra SCSI network.The POWER3 SMP Thin Node can have either no internal hard disk drives (with external booting) or from 4.5 GB up to a maximum of 18.2 GB of mirrored internal disk storage.

Optional internal direct access storage devices are available as follows:

- 4.5 Gigabyte Ultra SCSI disk pair (**F/C 2904**)
- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 2909**)
- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 2918**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3804**)
- 18.2 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3810**)

Note: This node does not require special cables or adapters to mount internal Ultra hard disk drives.

External storage devices can be accessed through optional Ultra SCSI adapter (**F/C 6207**), SCSI-2 adapter (**F/C 6209**), and SSA adapter (**F/C 6225**).

Switch and communication adapter requirements and options:

Switch adapters: The switch adapter for SMP Thin Nodes does not occupy a PCI slot. Instead, the switch adapter for these nodes is installed into the Mezzanine (MX) bus. The MX bus connects the I/O planar with the system planar, placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

In switch configured systems, POWER3 SMP Thin Nodes require the following switch adapter:

- SP Switch MX2 Adapter (**F/C 4023**)

For more information on this adapters, see Chapter 9, “SP Switch (F/C 4011 and F/C 4008)” on page 49.

POWER3 SMP Thin Node switch restrictions: The POWER3 SMP Thin Node is not compatible with the older High Performance series of switches.

If you install an POWER3 SMP Thin Node into an SP system configured with a switch, that switch must be either an SP switch or an SPS-8 switch.

Switch adapters for POWER3 SMP Thin Nodes are not interchangeable with either the switch adapters used on uniprocessor thin nodes or with the SP Switch MX adapter (F/C 4022) used previously on the 332 MHz SMP nodes.

I/O adapters: The POWER3 SMP Thin Node has two PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON

For more information about these adapters, see “PCI bus I/O adapter requirements for SMP nodes” on page 91 and Chapter 14, “PCI communication adapters” on page 103.

Note: A 100BASE-TX/10BASE-T/10BASE2 Ethernet adapter for the SP Ethernet is integrated into the POWER3 SMP Thin Node and does not use a PCI slot.

POWER3 SMP Wide Node (F/C 2053)

Description

POWER3 SMP Wide Nodes (F/C 2053) have PCI bus architecture and use either one or two 200 MHz 64-bit processors per node. These nodes are functionally equivalent to an IBM RS/6000 7043-260 workstation. Your IBM RS/6000 SP system must be operating at PSSP 3.1 (or later) to use these nodes.

The POWER3 SMP Wide Node occupies one full drawer, thus eight nodes can be housed in a tall frame. POWER3 SMP Wide Nodes can be placed in the first node slot of a frame without requiring additional nodes.

For electromagnetic compliance, these nodes are housed in an SMP enclosure. This enclosure (F/C 9930) is automatically included when you order a POWER3 SMP Wide Node.

If you plan to mount a POWER3 SMP Wide Node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However; once you have done the power system upgrade, these nodes are fully compatible with all existing SP hardware, except for High Performance switches. For more information on power system upgrades, see “Upgrading power systems in early SP frames” on page 202.

Note: POWER3 SMP Wide Nodes are not compatible with High Performance switches (F/C 4010 and F/C 4007).

Bus description: The POWER3 SMP Wide Node PCI bus contains two 32-bit slots and eight 64-bit PCI slots divided into three logical groups. The first slot group (slots I2 and I3) is composed of the two 32-bit slots residing on the CPU side of the POWER3 SMP Wide Node. The second and third group each contain four 64-bit PCI slots (slots I1 through I4 and slots I5 through I8) residing on the I/O side of the node. The I1 slot on the CPU side of the node is reserved for the optional SP Switch MX2 Adapter.

Requirements and options

F/C 2053 requirements: This feature code returns one POWER3 SMP Wide Node.

POWER3 SMP Wide Nodes occupy one full node drawer. These nodes are asymmetrically configured for memory, hard disk drives, and adapters. Up to eight POWER3 SMP Wide Nodes may be installed in one tall frame and up to four in a short frame. Mandatory prerequisites are:

- PSSP 3.1 (or later) on the control workstation, backup nodes, and processor node.
- One processor (mounted in one slot)
- 256 MB of memory
- 4.5 GB of mirrored storage (with internal booting)
- An upgraded power system on older frames (see “Planning for power requirements of SP frames and features” on page 161 for more information)

F/C 2053 options: Available options include the following:

- Two processor slots allowing a maximum of two processors per node
- Two memory slots supporting up to 4 GB of memory
- Ten PCI slots (two 32-bit and eight 64-bit) for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Integrated Ethernet with BNC and RJ45 ports (only one port can be used at a time):
  - 10BASE2 Ethernet on BNC
  - 10BASE-T Ethernet or 100BASE-TX Ethernet on RJ45
- Four hard disk drive bays supporting up to 54.6 GB of mirrored disk storage
- Integrated Ultra SCSI
- Standard service processor
- External nine-pin RS-232 on the planar S2 port (supported only for HACMP serial heartbeat); a 9 to 25-pin converter cable is included with the node
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options: SMP Wide Nodes require a minimum of one POWER3 PowerPC processor mounted on one card. However you can order an additional processor card (**F/C 4342**) to configure the node with a total of two CPUs.

Table 67. Processor options for POWER3 SMP Wide Nodes

Feature Code	Quantity	Description	Comments
4342	1-2	One processor card with one CPU	One required

Memory requirements and options: POWER3 SMP Wide Nodes have two memory cards and require a minimum of 256 MB of memory. These nodes will support a maximum of 4 GB of memory. Memory is supplied by 128 MB DIMMs that must be mounted in pairs (256 MB increments). The memory cards are not required to be configured symmetrically. Each card has the capacity to mount 2 GB of DIMMs, with 4 GB addressable per node. Note that with the minimum memory installed (256 MB), the second card will contain no DIMMs. Memory cards and

DIMMs are not interchangeable between SMP and non-SMP Wide Nodes. Memory cards are not interchangeable between 332 MHz and POWER3 SMP Wide Nodes.

Table 68. Memory features for POWER3 SMP Wide Nodes (F/C 2053)

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4098	Base Memory Card	2	2
4110	One Pair of 128 MB DIMMs (256 MB total)	1 pair	16 pair

Hard disk drive requirements and options: POWER3 SMP Wide Nodes can have up to four internal hard disk drives attached through an integrated Ultra SCSI network. The POWER3 SMP Wide Node can have either no internal hard disk drives (with external booting) or from 4.5 GB up to a maximum of 54.6 GB of mirrored internal disk storage.

Optional direct access storage devices are available as follows:

- 4.5 Gigabyte Ultra SCSI disk pair (**F/C 2904**)
- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 2909**)
- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 2918**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3804**)
- 18.2 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3810**)
- 36.4 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3820**) - available only for I/O side hard disk drive bays

Note: This node does not require special cables or adapters to mount internal Ultra hard disk drives. However, the POWER3 SMP Wide Node has an option (**F/C 1241**) which provides an independent SCSI hookup with the following characteristics:

- Eliminates the hard disk drive controller as a single point of failure during mirroring
- Increases disk performance
- Balances disk loading

The F/C 1241 option requires a PCI type SCSI adapter **F/C 6206**; see “SCSI-2 Ultra/Wide SE PCI adapter (F/C 6206)” on page 132 for details.

External storage devices can be accessed through optional Ultra SCSI adapter (**F/C 6207**), SCSI-2 adapter (**F/C 6209**), and SSA adapter (**F/C 6225**).

Switch and communication adapter requirements and options:

Switch adapters: The switch adapter for POWER3 SMP Wide Nodes does not occupy a PCI slot; it is installed into the Mezzanine (MX) bus. The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

In switch-configured systems, POWER3 SMP Wide Nodes require the following switch adapter:

- SP Switch MX2 Adapter (**F/C 4023**)

For more information on this adapter, see “Withdrawn MCA-type node adapter” on page 51.

POWER3 SMP Wide Node Switch restrictions: The POWER3 SMP Wide Node is not compatible with the older High Performance series of switches. If you install a POWER3 Wide Node into a switch-configured system, you must use an SP Switch or an SP Switch-8.

Switch adapters for SMP Wide Nodes are not interchangeable with either the switch adapters used on uniprocessor Wide Nodes or with the SP Switch MX adapter previously used on the 332 MHz SMP nodes.

I/O adapters: The POWER3 SMP Wide Node has ten PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON
- Serial HIPPI

For more information about these adapters, see “PCI bus I/O adapter requirements for SMP nodes” on page 91 and Chapter 14, “PCI communication adapters” on page 103.

Note: A 100BASE-TX/10BASE-T/10BASE2 Ethernet adapter for the SP Ethernet is integrated into the SMP Wide Node and does not use a PCI slot.

332 MHz SMP Thin Node (F/C 2050)

Description

332 MHz SMP Thin Nodes (F/C 2050) have PCI bus architecture and use either two or four 332 MHz PowerPC processors per node. These nodes are functionally equivalent to an IBM RS/6000 7025-F50 workstation. Your IBM RS/6000 SP system must be operating at PSSP 2.4 (or later) to use these nodes.

The node occupies half of a drawer (one slot). Up to sixteen of these nodes can be housed in a tall frame. When installed singly within a drawer, these nodes must be placed in an odd-numbered node slot. For complete information on node/frame configurations, see *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

For electromagnetic compliance, these nodes are housed in an enclosure (F/C 9930). If you order a single node, a cover plate (F/C 9931) is included to fill the even-numbered slot opening.

If you are going to mount a 332 MHz SMP Thin Node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However, once you have done the power system upgrade, these nodes are fully compatible with all existing SP system hardware except for High Performance switches. For more information on power system upgrades, see “Upgrading power systems in early SP frames” on page 202.

Note: 332 MHz SMP Thin Nodes are not compatible with High Performance switches (F/C 4010 and F/C 4007).

PCI bus description: The 332 MHz SMP Thin Node PCI bus contains two 32-bit slots PCI slots (slots I2 and I3). The I1 slot is reserved for the optional switch adapter.

Requirements and options

F/C 2050 requirements: This feature code returns one 332 MHz SMP Thin Node.

332 MHz SMP Thin Nodes occupy one half of a node drawer. When two SMP thin nodes are placed in one drawer, the nodes may be asymmetrically configured for memory, hard disk drives, processor speed, and adapters. Up to sixteen 332 MHz SMP Thin Nodes may be installed in one tall frame and up to eight in a short frame. Mandatory prerequisites are:

- PSSP 2.4 (or later) on the control workstation, backup nodes, and processor node
- Two processors (mounted in one slot)
- 256 MB of memory
- 4.5 GB of storage (with internal booting)
- An upgraded power system on older frames (see “Planning for power requirements of SP frames and features” on page 161 for more information)

F/C 2050 options: Available options include the following:

- Two processor slots allowing a maximum of four processors per node
- Two memory slots supporting up to 3 GB of memory
- Two hard disk drive bays supporting up to 36.4 GB of storage (18.2 GB mirrored)
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Two PCI slots for communication adapters
- Integrated 10BASE-T/10BASE2 Ethernet (only one port may be used at a time)
- Integrated SCSI-2 Fast/Wide
- Standard service processor
- External nine-pin RS-232 on the planar S2 port (supported only for HACMP serial heartbeat); a 9 to 25-pin converter cable is included with the node
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options: SMP thin nodes require a minimum of two 332 MHz PowerPC processors mounted on one card. However, you can order an additional processor card (**F/C 4320**) to configure the node with a total of four CPUs.

Table 69. Processor options for 332 MHz SMP Nodes

Feature Code	Description	Minimum per node	Maximum per node
4320	One processor card with two CPUs	1	2

Memory requirements and options: 332 MHz SMP Thin Nodes require two memory cards, a minimum of 256 MB of memory, and support a maximum of 3 GB. Memory is supplied by 128 MB DIMMs that must be mounted in pairs. The memory cards are not required to be configured symmetrically.

Please note that each card has the capacity to mount 2 GBs of DIMMs; however, only 3 GB are addressable per node.

Table 70. Memory features for 332 MHz SMP Thin Nodes (F/C 2050)

Feature Code	Description	Minimum Node Requirement	Maximum Features Per Node
4093	Base Memory Card	2	2
4110	256 MB – (2 x 128 MB DIMMs)	1	12
4133	1 GB – (8 x 128 MB DIMMs)	0	3
4402	2 GB – (16 x 128 MB DIMMs)	0	1
4403	3 GB – (24 x 128 MB DIMMs)	0	1

Hard disk drive requirements and options: 332 MHz SMP Thin Nodes can have up to two internal hard disk drives attached through an integrated SCSI-2 network. The 332 MHz SMP Thin Node can have either no internal hard disk drives (with external booting) or from 4.5 GB up to a maximum of 36.4 GB of internal disk storage (18.2 mirrored).

Optional direct access storage devices are available as follows:

- 4.5 GB Ultra SCSI disk drive (**F/C 2900**)
- 4.5 GB Ultra SCSI disk drive pair (**F/C 2904**)
- 9.1 GB Ultra SCSI disk drive (**F/C 2908**)
- 9.1 GB Ultra SCSI disk drive pair (**F/C 2909**)
- 18.2 GB Ultra SCSI disk drive pair (**F/C 2918**)

Note: This node does not require special cables or adapters to mount internal hard disk drives.

External storage devices can be accessed through optional Ultra SCSI adapter (**F/C 6207**), SCSI-2 adapter (**F/C 6209**), and SSA adapter (**F/C 6230**).

Switch and communication adapter requirements and options:

Switch restrictions:

- The 332 MHz SMP Thin Node is not compatible with the older High Performance series of switches.
- If a 332 MHz SMP Thin Node is to be placed into an SP system configured with a switch, that switch must be either an SP Switch or an SP Switch-8.
- Switch adapters for 332 MHz SMP Thin Nodes are not interchangeable with switch adapters used on uniprocessor wide nodes.

Switch adapters: The switch adapter for these nodes is installed in the Mezzanine (MX) bus in slot I1. The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

These adapters are:

- For the SP Switch – SP Switch MX Adapter (**F/C 4022**)
- For the SP Switch2 – SP Switch2 MX2 Adapter (**F/C 4026**)

I/O adapters: The 332 MHz SMP Thin Node has two PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON

For more information about these adapters, see “PCI bus I/O adapter requirements for SMP nodes” on page 91 and Chapter 14, “PCI communication adapters” on page 103.

Note: A 10BASE-T/10BASE2 Ethernet adapter for the SP Ethernet is integrated into the SMP thin node and does not use a PCI slot.

332 MHz SMP Wide Node (F/C 2051)

Description

332 MHz SMP Wide Nodes (F/C 2051) have PCI bus architecture and use either two or four 332 MHz PowerPC processors per node. These nodes are functionally equivalent to an IBM RS/6000 7025-F50 workstation. Your IBM RS/6000 SP system must be operating at PSSP 2.4 (or later) to use these nodes.

The 332 MHz SMP Wide Node occupies one full drawer, therefore eight SMP wide nodes can be housed in a tall frame. SMP wide nodes can be placed in the first node slot of a frame without requiring additional nodes. However, ***uniprocessor*** wide nodes in the first node slot still require an additional filled node drawer in that frame.

For electromagnetic compliance, these nodes are housed in an SMP Enclosure. This enclosure (F/C 9930) is automatically included when you order a 332 MHz SMP Wide Node.

If you are going to mount a 332 MHz SMP Wide Node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However, once you have done the power system upgrade, these nodes are fully compatible with all existing SP hardware except for High Performance switches. For more information on power system upgrades, see “Upgrading power systems in early SP frames” on page 202.

Note: 332 MHz SMP Wide Nodes are not compatible with High Performance switches (F/C 4010 and F/C 4007).

PCI bus description: The 332 MHz SMP Wide Node PCI bus is divided into three logical groups of PCI slots. The first slot group (slots I2 and I3) comprises two 32-bit slots on the CPU side (the I1 slot is reserved for an optional switch adapter). The second and third groups reside on the I/O side of the node and have four PCI slots each. The second group (slots I1 through I4) has three 64-bit slots and a single 32-bit slot. The third group (slots I5 through I8) has four 32-bit slots.

Requirements and options

F/C 2051 requirements: This feature code returns one 332 MHz SMP Wide Node.

332 MHz SMP Wide Nodes occupy one full node drawer. These nodes are asymmetrically configured for memory, hard disk drives, and adapters. Up to eight 332 MHz SMP Wide Nodes may be installed in one tall frame and up to four in a short frame. Mandatory prerequisites are:

- PSSP 2.4 (or later) on the control workstation, backup nodes, and processor node
- Two processors (mounted in one slot)
- 256 MB of memory
- 4.5 GB of storage (with internal booting)
- An upgraded power system on older frames (see “Planning for power requirements of SP frames and features” on page 161 for more information)

F/C 2051 options: Available options include the following:

- Two processor slots allowing a maximum of four processors per node
- Two memory slots supporting up to 3 GB of memory
- Ten PCI slots for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Integrated 10BASE-T/10BASE2 Ethernet (only one port may be used at a time)
- Four hard disk drive bays supporting up to 72.8 GB of disk storage (36.4 GB mirrored)
- Integrated SCSI-2 Fast/Wide
- Standard service processor
- External nine-pin RS-232 on the planar S2 port (supported only for HACMP serial heartbeat); a 9 to 25-pin converter cable is included with the node
  - Node-to-node HACMP cable (**F/C 3124**)
  - Frame-to-frame HACMP cable (**F/C 3125**)

Processor requirements and options: SMP wide nodes require a minimum of two 332 MHz PowerPC processors mounted on one card. However you can order an additional processor card (**F/C 4320**) to configure the node with a total of four CPUs.

Table 71. Processor options for 332 MHz SMP Nodes

Feature Code	Description	Minimum per node	Maximum per node
4320	One processor card with two CPUs	1	2

Memory requirements and options: 332 MHz SMP Wide Nodes require two memory cards, a minimum of 256 MB of memory, and support a maximum of 3 GB. Memory is supplied by 128 MB DIMMs that must be mounted in pairs. The memory cards are not required to be configured symmetrically.

Please note that each card has the capacity to mount 2 GBs of DIMMs; however, only 3 GB are addressable per node.

Table 72. Memory features for 332 MHz SMP Wide Nodes (F/C 2051)

Feature Code	Description	Minimum Node Requirement	Maximum Features Per Node
4093	Base Memory Card	2	2
4110	256 MB – (2 x 128 MB DIMMs)	1	12
4133	1 GB – (8 x 128 MB DIMMs)	0	3
4402	2 GB – (16 x 128 MB DIMMs)	0	1
4403	3 GB – (24 x 128 MB DIMMs)	0	1

Hard disk drive requirements and options: 332 MHz SMP Wide Nodes can have up to four internal hard disk drives attached through an integrated SCSI-2 network. The 332 MHz SMP Wide Node can have either no internal hard disk drives (with external booting) or from 4.5 GB up to a maximum of 72.8 GB of internal disk storage (36.4 mirrored).

Optional direct access storage devices are available as follows:

- 4.5 GB Ultra SCSI disk drive (**F/C 2900**)
- 4.5 GB Ultra SCSI disk drive pair (**F/C 2904**)
- 9.1 GB Ultra SCSI disk drive (**F/C 2908**)
- 9.1 GB Ultra SCSI disk drive pair (**F/C 2909**)
- 18.2 GB Ultra SCSI disk drive pair (**F/C 2918**)

Note: This node does not require special cables or adapters to mount internal hard disk drives. However; the 332 MHz SMP Wide Node has an option (**F/C 1241**) which provides an independent SCSI hookup that accomplishes the following:

- Eliminates the hard disk drive controller as a single point of failure during mirroring.
- Increases disk performance.
- Balances disk loading.

The F/C 1241 option requires a PCI type SCSI adapter **F/C 6206**; see “SCSI-2 Ultra/Wide SE PCI adapter (F/C 6206)” on page 132 for details.

External storage devices can be accessed through optional Ultra SCSI adapter (**F/C 6207**), SCSI-2 adapter (**F/C 6209**), and SSA adapter (**F/C 6230**).

Switch and communication adapter requirements and options:

Switch restrictions:

- The 332 MHz SMP Wide Node is not compatible with the older High Performance series of switches.
- If a 332 MHz SMP Wide Node is to be placed into an SP system configured with a switch, that switch must be an SP Switch series switch.
- Switch adapters for 332 MHz SMP Wide Nodes are not interchangeable with switch adapters used on uniprocessor wide nodes.

Switch adapters: The switch adapter for these nodes is installed in the Mezzanine (MX) bus in slot I1 (CPU side). The MX bus connects the I/O planar with the

system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

These adapters are:

- For the SP Switch – SP Switch MX Adapter (**F/C 4022**)
- For the SP Switch2 – SP Switch2 MX2 Adapter (**F/C 4026**)

I/O adapters: The 332 MHz SMP Wide Node has ten PCI (Peripheral Component Interconnect) adapter slots. A full line of PCI adapters is offered for these nodes including:

- SCSI-2
- Ethernet
- Token Ring
- FDDI
- ATM
- Async
- Wide Area Network (WAN)
- SSA RAID5
- S/390 ESCON
- Serial HIPPI

For more information about these adapters, see “PCI bus I/O adapter requirements for SMP nodes” on page 91 and Chapter 14, “PCI communication adapters” on page 103.

Note: A 10BASE-T/10BASE2 Ethernet adapter for the SP Ethernet is integrated into the SMP wide node and does not use a PCI slot.

Withdrawn PCI adapters

FDDI SK-NET UP DAS PCI adapter (F/C 2743)

The SYSKONNECT SK-NET FDDI-UP DAS PCI Adapter (F/C 2743) is a fiber optical FDDI Dual Attach Station that is compatible with the FDDI-ANSI X3T12 specifications and FDDI Standard Series. The adapter provides single attachment to a FDDI concentrator (or point to point) using Category 5 Unshielded Twisted Pair cabling (not supplied with the adapter).

Feature characteristics

This feature has the following characteristics:

- Supports single ring FDDI attachment at 100 Mbps
- Supports all TCP/IP protocols and ANSI Station Management (SMT) 7.3

Feature components

This feature order provides the following:

- Adapter card
- Diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions

Customer components

You must supply the following components for this feature:

- A FDDI concentrator such as the IBM 8240 (or equivalent) concentrator to connect to the FDDI network for dual homing configurations
- One Unshielded Twister Pair Category 5 cable

Hardware requirements
This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Software requirements
This feature has the following software requirements:

- AIX 4.2.1 or later installed on the node
- PSSP 2.4 or later installed on the node
- Adapter device driver and FDDI common code (provided with adapter)

FDDI typical SP configuration
See “FDDI SK-NET LP SAS PCI adapter (F/C 2741)” on page 105 for a typical SP system FDDI configuration.

Auto LANstreamer Token Ring PCI Adapter (F/C 2920)

The PCI Auto LANstreamer Token Ring Adapter (F/C 2920) is a PCI 16/4 Token Ring Adapter that is compatible with IEEE 802.5 specifications. The adapter has two external connections: RJ-45 to attach to UTP cabling and a 9-pin D-Shell to attach to STP cabling.

Feature characteristics
This feature has the following characteristics:

- Complies with IEEE 802.5 specifications
- Attaches to 4 Mbps or 16 Mbps token-ring area networks
- Supports both full and half duplex operations
- PCI 32-bit Bus Master Adapter

Feature components
This feature order provides the following:

- Adapter card
- Diskette with adapter device driver
- Installation instructions

Customer Components
The customer must supply the following components for this feature:

- Network equipment such as a MAU and/or Switching Hub to connect the Token-Ring network
- UTP or STP Cable to attach the adapter to the Token-Ring network

Hardware requirements
This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software
This feature has the following software requirements:

- AIX 4.2.1 or later installed on the node
- PSSP 2.4 or later installed on the node
- Adapter device driver

Cable routing

For planning attachment of the RS/6000 SP system to a token-ring network, refer to *Token-Ring Network Introduction and Planning Guide*, GA27-3677, for configuration and attachment options.

TURBOWAYS 155 UTP ATM PCI adapter (F/C 2963)

The TURBOWAYS 155 UTP ATM adapter (F/C 2963) enables TCP/IP applications to work in an asynchronous transfer mode (ATM) environment. This adapter provides dedicated 155 Mbps, full-duplex connection to ATM networks using either Permanent Virtual Circuits (PVC) or ATM Forum compliant Switched Virtual Circuits (SVC) UNI 3.1 signalling. The adapter supports AAL-5 adaptation layer interface and communication with devices located on an ATM network, bridged Token-Ring, Ethernet, or other LAN. LAN Emulation (LANE) is provided by the AIX operating system.

The TURBOWAYS 155 UTP ATM adapter requires customer provided CAT5 High Speed Unshielded Twisted Pair (UTP) or Shielded Twisted Pair (STP) cables. These cables must be certified for ATM operation. Maximum cable length is 100 m and all cables must be terminated with RJ45 connectors.

Feature characteristics

This feature has the following characteristics:

- 32-bit Bus Master PCI 2.1 adapter
- External RJ45 connector
- Provides signaling channel setup
- Provides virtual connection setup and tear down
- Supports point-to-point and point-to-multipoint switching
- Supports virtual circuits (maximum 1024)
- Supports classical IP and ATRP over ATM (RFC 1577)
- Supports Ethernet LAN Emulation and Token-Ring
- Supports ATM SNMP
- Best effort service

Customer components

You must supply the following components with this feature:

- Category 5 High Speed Unshielded Twisted Pair cables (or shielded) with RJ45 connectors (100 m maximum length)
- If you plan to use multipoint connections, you must provide an ATM switch

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software

This feature requires the following software:

- PSSP 3.1 or later
- AIX 4.3.2 or later
- This adapter will also function with PSSP 2.4 and AIX 4.2.1

ATM cable routing

Figure 40 shows typical ATM cabling from the SP frame to a customer-supplied ATM switch. Customer-supplied UTP ATM cables require an RJ45 type connector at the ATM adapter end and at the switch.

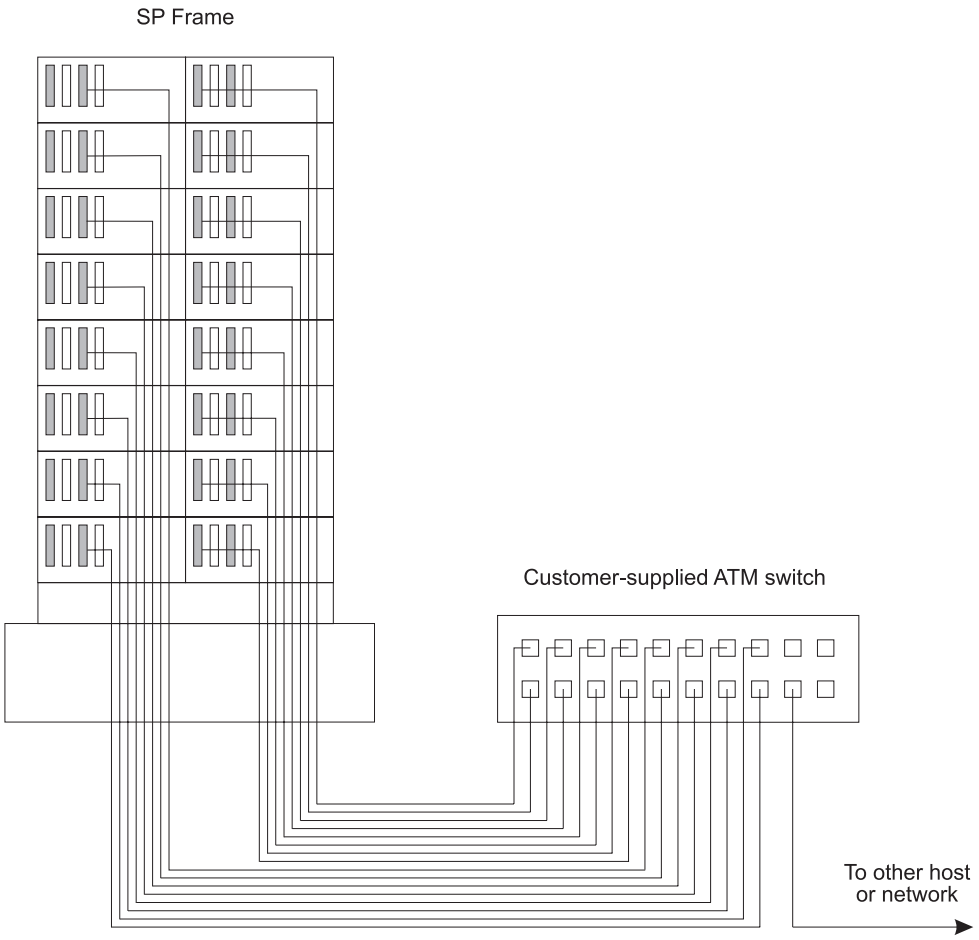

Figure 40. Typical ATM cabling for the SP system

10/100 Ethernet 10BASE-TX PCI adapter (F/C 2968)

The IBM 10/100 Ethernet TX PCI Adapter (F/C 2968) is a 10/100 PCI Ethernet Adapter that is compatible with IEEE 802.3 and 802.3u specifications. The adapter has one RJ-45 connection that supports connections to 100BASE-TX and 10BASE-T networks.

Feature characteristics

This feature has the following characteristics and requirements:

- Compatible with IEEE 802.3 Standards
- 32-bit Bus Master PCI Bus 132 Mbps
- Supports auto-negotiatation of media speed and duplex operation
- Supports both full and half duplex operation over 10BASE-T networks via the RJ-45 connector

Feature components

This feature order provides the following:

- Adapter card

- Diskette with adapter device driver
- Installation Instructions.

Customer supplied components
You must supply the following components for this feature:

- Network equipment such as a hub or switch required to attach to 10BASE-T Ethernet LANs
- All Ethernet cables

Note: For 100BASE-TX connections, Unshielded Twisted Pair (UTP) Category 5 cabling is required.

Hardware requirements
This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software
This feature has the following software requirements:

- AIX 4.2.1 or later installed on the Node
- PSSP 2.4 or later installed on the Node
- Adapter device driver (provided with adapter)

10BASE5 and 10BASE-T (AUI/RJ-45) Ethernet LAN PCI adapter (F/C 2987)

The PCI Ethernet BNC/RJ-45 Adapter (F/C 2987) is a 10 Mbps PCI Ethernet adapter that is compatible with IEEE 802.3 specifications. The adapter has two external connections: BNC to attach to 10BASE5 networks and RJ-45 to attach to 10BASE-T networks.

Feature characteristics
This feature has the following characteristics and requirements:

- 10 Mbps Ethernet compatible with IEEE 802.3 standards
- 32-bit Bus Master PCI Bus 132 Mbps
- Supports half duplex operations over 10BASE5 networks via the BNC connector
- Supports both full and half duplex operation over 10BASE-T networks via the RJ-45 connector

Feature components
This feature order provides the following:

- Adapter card
- RJ-45 and AUI diagnostic wrap plugs
- Installation instructions

Customer supplied components
You must supply the following components for this feature:

- Network equipment such as a hub or switch required to attach to 10BASE-T Ethernet LANs
- All Ethernet cables

Note: For 10BASE-T connections, unshielded twisted pair (UTP) Category 3, 4, or 5 cabling is required. UTP Category 5 cabling is strongly suggested to facilitate upgrades to 100 Mbps Ethernet LAN without cabling changes.

Hardware requirements
This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot

Required software
This feature has the following software requirements:

- AIX 4.2.1 or later installed on the node
- PSSP 2.4 or later installed on the node
- Adapter device driver (part of base AIX BOS code)

Cable routing
Figure 21 on page 121 represents a typical Ethernet cable routing in an SP frame.

TURBOWAYS 155 ATM PCI adapter (F/C 2988)

The TURBOWAYS 155 ATM adapter (F/C 2988) enable TCP/IP applications to work in an asynchronous transfer mode (ATM) environment. This adapter provides dedicated 155 Mbps, full-duplex connection to ATM networks using either Permanent Virtual Circuits (PVC) or ATM Forum compliant Switched Virtual Circuits (SVC) UNI 3.1 signalling. The adapter supports AAL-5 adaptation layer interface and communication with devices located on an ATM network, bridged Token-Ring, Ethernet, or other LAN. LAN Emulation (LANE) is provided by the AIX operating system.

Feature characteristics and requirements
This feature has the following characteristics and requirements:

- Provides signaling channel setup
- Provides virtual connection setup and tear down
- Supports point-to-point and point-to-multipoint switching
- Supports virtual circuits (maximum 1024)
- Supports classical IP and ATRP over ATM (RFC 1577)
- Supports Ethernet LAN Emulation and Token-Ring
- Supports ATM SNMP

Customer components
You must supply the following components with this feature:

- Plenum rated 62.5/125 multimode fiber cables terminated with an SC connector.
- An ATM switch.

Required software
This feature requires the following software:

- PSSP 2.4
- AIX 4.2.1 or later

ATM cable routing
Figure 40 on page 237 shows typical ATM cabling from the SP frame to a customer-supplied ATM switch. Customer-supplied ATM cables requires an “SC” type connector at the ATM adapter end. Connector requirements at the switch end may vary. The cable type is 62.5/125um multimode fiber.

Dual Channel Ultra2 SCSI PCI adapter (F/C 6205)

The Dual Channel Ultra2 SCSI PCI Adapter (F/C 6205) is an ideal solution for applications requiring large block data transfers (more than 64K block size) in a multi-disk-drive environment utilizing Ultra/Ultra2 SCSI protocol. It provides up to

160 MBps aggregate SCSI throughput and is able to support single-ended Fast/Ultra devices or LVD Ultra/Ultra2 devices. The dual channels offer increased connectivity without utilizing an additional PCI slot. One or both channels can be dedicated to LVD devices or as an alternative, one channel can be used to support mixed performance single-ended devices. Industry standard VHDCI connectors are available for external connection to each channel.

Feature characteristics

This feature has the following characteristics:

- Two Ultra2/LVD SCSI buses
- PCI bus specification 2.1
  - Fits in PCI full-size slots
  - Supports both 5.0 and 3.3 volt signaling
  - Supports PCI data streaming
  - Two independent DMA Channels
  - 64-bit PCI Bus Master adapter also operates in a 32-bit PCI slot
  - Operational at PCI bus speeds from 16 MHz to 33 MHz
- Supports 16 bit single ended or LVD connections
- Uses Ultra2 SCSI standard external VLHDCI (Very High Density Cable Interconnect or 8mm) SCSI connectors per channel
- Ultra2 SCSI provides increased connectivity (cable length and number of SCSI devices supported) over Ultra SCSI
- NIM Boot
- Native Boot support on AIX 4.3.3

Feature components

This feature order provides the following:

- Adapter card
- CD-ROM with adapter device driver
- Installation instructions

Customer components

You must supply the following components for this feature:

- Cabling

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot per adapter

Software requirements

This feature has the following software requirements:

- AIX 4.3.2 or later installed on the node
- PSSP 3.1 or later installed on the node
- Adapter device driver (provided with the adapter)

SSA Fast-Write Cache Option (F/C 6222)

The SSA Fast-Write Cache is an optional 4 MB fast-write module that plugs into the PCI SSA RAID 5 Adapter (F/C 6215). The F/C 6222 cache option uses non-volatile RAM having over seven years of memory retention. Non-volatile memory allows you

to transfer the cache module from a failing Multi-Initiator adapter to a new adapter during the unlikely event of an adapter failure. This helps insure data integrity and operational reliability.

- Only one F/C 6222 is supported on each PCI SSA RAID 5 adapter (F/C 6215)
- Requires PSSP 2.4 or greater and either AIX 4.2.1 or later

Gigabit Fibre Channel PCI adapter (F/C 6227)

The Gigabit Fibre Channel PCI Adapter provides single initiator capability through an optical fibre link running up to 100MB/s. With the use of optical fibre cabling, this adapter provides the capability for a network of high-speed local and remote located storage. F/C 6227 is a 32-bit PCI to NL-Port (fibre channel node port connected to an arbitrated loop) host bus adapter. The single speed supported is 1.0625 Gbps (wire-speed) which corresponds to approximately 100 MBps. The supported media includes 50 and 62.5 micron multimode fiber. The supported transmitter is short-wave laser with open fiber control.

Feature characteristics

This feature has the following characteristics:

- Single fiber channel loop per adapter
- Single initiatior support (one adapter for PCI bus per loop)
- Optical fiber link cabling supporting a distance of up to 500 m (1640 ft.)
- Fiber optic interface data rates of up to 100 MBps
- PCI 2.1 compatible, universal 3.3/5 volt adapter

Feature components

This feature order provides the following:

- Adapter card
- CD-ROM with adapter device driver
- Installation instructions

Customer components

You must supply the following components for this feature:

Cables:

- Multimode 50/125 micron fiber with SC connectors:
  - 1062.5 MBps
  - 2 - 500 m
- Multimode 62.5/125 micron fiber with SC connectors:
  - 1062.5 MBps
  - 2 - 175 m

Hardware requirements

This feature has the following hardware requirements:

- One Peripheral Component Interconnect (PCI) adapter slot.

Software requirements

This feature has the following software requirements:

- AIX 4.3.2 or later installed on the node (AIX 4.3 with AIX APAR 1X81852)
- PSSP 3.1 or later installed on the node
- Adapter device driver (provided with the adapter)

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22 / European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

United Kingdom telecommunications safety requirements

Notice to customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunications systems in the United Kingdom.

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This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may arise. When such trouble occurs, the user may be required to take corrective actions.

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Radio protection for Germany

Dieses Gerät ist berechtigt in Übereinstimmung mit Dem deutschen EMVG vom 9.Nov.92 das EG–Konformitätszeichen zu führen.

Der Aussteller der Konformitätserklärung ist die IBM Germany.

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(Auszug aus dem EMVG vom 9.Nov.92, Para.3, Abs.4)

Hinweis

Dieses Genehmigungsverfahren ist von der Deutschen Bundespost noch nicht veröffentlicht worden.

Glossary

A

ACL. Access Control List. A list that defines who has permission to access certain services; that is, for whom a server may perform certain tasks. This is usually a list of principals with the type of access assigned to each.

adapter. An adapter is a mechanism for attaching parts. For example, an adapter could be a part that electrically or physically connects a device to a computer or to another device. In the SP system, network connectivity is supplied by various adapters, some optional, that can provide connection to I/O devices, networks of workstations, and mainframe networks. Ethernet, FDDI, token-ring, HiPPI, SCSI, FCS, and ATM are examples of adapters that can be used as part of an SP system.

address. A character or group of characters that identifies a register, a device, a particular part of storage, or some other data source or destination.

AFS. A distributed file system that provides authentication services as part of its file system creation.

AIX. Abbreviation for Advanced Interactive Executive, IBM's licensed version of the UNIX operating system. AIX is particularly suited to support technical computing applications, including high function graphics and floating point computations.

Amd. Berkeley Software Distribution automount daemon.

API. Application Programming Interface. A set of programming functions and routines that provide access between the Application layer of the OSI seven-layer model and applications that want to use the network. It is a software interface.

application. The use to which a data processing system is put; for example, a payroll application, an airline reservation application.

application data. The data that is produced using an application program.

ARP. Address Resolution Protocol.

ATM. Asynchronous Transfer Mode. (See *TURBOWAYS 100 ATM Adapter*.)

authentication. The process of validating the identity of either a user of a service or the service itself. The process of a principal proving the authenticity of its identity.

authorization. The process of obtaining permission to access resources or perform tasks. In SP security services, authorization is based on the principal identifier. The granting of access rights to a principal.

authorization file. A type of ACL (access control list) used by the IBM AIX remote commands and the IBM PSSP Sysctl and Hardmon components.

B

batch processing. (1) The processing of data or the accomplishment of jobs accumulated in advance in such a manner that each accumulation thus formed is processed or accomplished in the same run. (2) The processing of data accumulating over a period of time. (3) Loosely, the execution of computer programs serially. (4) Computer programs executed in the background.

BMCA. Block Multiplexer Channel Adapter. The block multiplexer channel connection allows the RS/6000 to communicate directly with a host System/370 or System/390; the host operating system views the system unit as a control unit.

BOS. The AIX Base Operating System.

C

call home function. The ability of a system to call the IBM support center and open a PMR to have a repair scheduled.

CDE. Common Desktop Environment. A graphical user interface for UNIX.

charge feature. An optional feature for either software or hardware for which there is a charge.

CLI. Command Line Interface.

client. (1) A function that requests services from a server and makes them available to the user. (2) A term used in an environment to identify a machine that uses the resources of the network.

Client Input/Output Sockets (CLIO/S). A software package that enables high-speed data and tape access between SP systems, AIX systems, and ES/9000 mainframes.

CLIO/S. Client Input/Output Sockets.

CMI. Centralized Management Interface provides a series of SMIT menus and dialogues used for defining and querying the SP system configuration.

Concurrent Virtual Shared Disk. A virtual shared disk that can be concurrently accessed by more than one server.

connectionless. A communication process that takes place without first establishing a connection.

connectionless network. A network in which the sending logical node must have the address of the receiving logical node before information interchange can begin. The packet is routed through nodes in the network based on the destination address in the packet. The originating source does not receive an acknowledgment that the packet was received at the destination.

control workstation. A single point of control allowing the administrator or operator to monitor and manage the SP system using the IBM AIX Parallel System Support Programs.

credentials. A protocol message, or part thereof, containing a ticket and an authenticator supplied by a client and used by a server to verify the client's identity.

css. Communication subsystem.

D

daemon. A process, not associated with a particular user, that performs system-wide functions such as administration and control of networks, execution of time-dependent activities, line printer spooling and so forth.

DASD. Direct Access Storage Device (hard disk drive). Storage for input/output data.

DCE. Distributed Computing Environment.

DFS. distributed file system. A subset of the IBM Distributed Computing Environment.

DNS. Domain Name Service. A hierarchical name service which maps high level machine names to IP addresses.

E

Error Notification Object. An object in the SDR that is matched with an error log entry. When an error log entry occurs that matches the Notification Object, a user-specified action is taken.

ESCON. Enterprise Systems Connection. The ESCON channel connection allows the RS/6000 to communicate directly with a host System/390; the host operating system views the system unit as a control unit.

Ethernet. (1) Ethernet is the standard hardware for TCP/IP local area networks in the UNIX marketplace. It is a 10-megabit per second baseband type LAN that allows multiple stations to access the transmission medium at will without prior coordination, avoids contention by using carrier sense and deference, and resolves contention by collision detection (CSMA/CD). (2) A passive coaxial cable whose interconnections contain devices or components, or both, that are all active. It uses CSMA/CD technology to provide a best-effort delivery system.

Ethernet network. A baseband LAN with a bus topology in which messages are broadcast on a coaxial cabling using the carrier sense multiple access/collision detection (CSMA/CD) transmission method.

event. In Event Management, the notification that an expression evaluated to true. This evaluation occurs each time an instance of a resource variable is observed.

expect. Programmed dialogue with interactive programs.

expression. In Event Management, the relational expression between a resource variable and other elements (such as constants or the previous value of an instance of the variable) that, when true, generates an event. An example of an expression is `X < 10` where X represents the resource variable `IBM.PSSP.aixos.PagSp.%totalfree` (the percentage of total free paging space). When the expression is true, that is, when the total free paging space is observed to be less than 10%, the Event Management subsystem generates an event to notify the appropriate application.

F

failover. Also called fallover, the sequence of events when a primary or server machine fails and a secondary or backup machine assumes the primary workload. This is a disruptive failure with a short recovery time.

fall back. Also called fallback, the sequence of events when a primary or server machine takes back control of its workload from a secondary or backup machine.

FDDI. Fiber Distributed Data Interface.

FFDC. First Failure Data Capture.

Fiber Distributed Data Interface (FDDI). An American National Standards Institute (ANSI) standard for 100-megabit-per-second LAN using optical fiber cables. An FDDI local area network (LAN) can be up to 100 km (62 miles) and can include up to 500 system units. There can be up to 2 km (1.24 miles) between system units and concentrators.

file. A set of related records treated as a unit, for example, in stock control, a file could consist of a set of invoices.

file name. A CMS file identifier in the form of 'filename filetype filemode' (like: TEXT DATA A).

file server. A centrally located computer that acts as a storehouse of data and applications for numerous users of a local area network.

File Transfer Protocol (FTP). The Internet protocol (and program) used to transfer files between hosts. It is an application layer protocol in TCP/IP that uses TELNET and TCP protocols to transfer bulk-data files between machines or hosts.

First Failure Data Capture (FFDC). A set of utilities used for recording persistent records of failures and significant software incidents. It provides a means of associating failures to one another, thus allowing software to link effects of a failure to their causes and thereby facilitating discovery of the root cause of a failure.

foreign host. Any host on the network other than the local host.

FTP. File transfer protocol.

G

gateway. An intelligent electronic device interconnecting dissimilar networks and providing protocol conversion for network compatibility. A gateway provides transparent access to dissimilar networks for nodes on either network. It operates at the session presentation and application layers.

H

HACMP. High Availability Cluster Multi-Processing for AIX.

HACWS. High Availability Control Workstation function, based on HACMP, provides for a backup control workstation for the SP system.

HAL. Hardware Abstraction Layer, a communication device interface that provides communication channels for processes.

Hashed Shared Disk (HSD). The data striping device for the IBM Virtual Shared Disk. The device driver lets application programs stripe data across physical disks in multiple IBM Virtual Shared Disks, thus reducing I/O bottlenecks.

help key. In the SP graphical interface, the key that gives you access to the SP graphical interface help facility.

High Availability Cluster Multi-Processing. An IBM facility to cluster nodes or components to provide high availability by eliminating single points of failure.

HiPPI. High Performance Parallel Interface. RS/6000 units can attach to a HiPPI network as defined by the ANSI specifications. The HiPPI channel supports burst rates of 100 Mbps over dual simplex cables; connections can be up to 25 km in length as defined by the standard and can be extended using third-party HiPPI switches and fiber optic extenders.

home directory. The directory associated with an individual user.

host. A computer connected to a network, and providing an access method to that network. A host provides end-user services.

I

instance vector. Obsolete term for resource identifier.

Intermediate Switch Board. Switches mounted in the switch expansion frame.

Internet. A specific inter-network consisting of large national backbone networks such as APARANET, MILNET, and NSFnet, and a myriad of regional and campus networks all over the world. The network uses the TCP/IP protocol suite.

Internet Protocol (IP). (1) A protocol that routes data through a network or interconnected networks. IP acts as an interface between the higher logical layers and the physical network. This protocol, however, does not provide error recovery, flow control, or guarantee the reliability of the physical network. IP is a connectionless protocol. (2) A protocol used to route data from its source to it destination in an Internet environment.

IP address. A 32-bit address assigned to devices or hosts in an IP internet that maps to a physical address. The IP address is composed of a network and host portion.

ISB. Intermediate Switch Board.

K

Kerberos. A service for authenticating users in a network environment.

kernel. The core portion of the UNIX operating system which controls the resources of the CPU and allocates them to the users. The kernel is memory-resident, is said to run in "kernel mode" and is protected from user tampering by the hardware.

Kernel Low-Level Application Programming Interface (KLAPI). KLAPI provides transport service for communication using the SP Switch.

L

LAN. (1) Acronym for Local Area Network, a data network located on the user's premises in which serial transmission is used for direct data communication among data stations. (2) Physical network technology that transfers data a high speed over short distances. (3) A network in which a set of devices is connected to another for communication and that can be connected to a larger network.

local host. The computer to which a user's terminal is directly connected.

log database. A persistent storage location for the logged information.

log event. The recording of an event.

log event type. A particular kind of log event that has a hierarchy associated with it.

logging. The writing of information to persistent storage for subsequent analysis by humans or programs.

M

mask. To use a pattern of characters to control retention or elimination of portions of another pattern of characters.

menu. A display of a list of available functions for selection by the user.

Motif. The graphical user interface for OSF, incorporating the X Window System. Also called OSF/Motif.

MTBF. Mean time between failure. This is a measure of reliability.

MTTR. Mean time to repair. This is a measure of serviceability.

N

naive application. An application with no knowledge of a server that fails over to another server. Client to server retry methods are used to reconnect.

network. An interconnected group of nodes, lines, and terminals. A network provides the ability to transmit data to and receive data from other systems and users.

NFS. Network File System. NFS allows different systems (UNIX or non-UNIX), different architectures, or vendors connected to the same network, to access remote files in a LAN environment as though they were local files.

NIM. Network Installation Management is provided with AIX to install AIX on the nodes.

NIM client. An AIX system installed and managed by a NIM master. NIM supports three types of clients:
- Standalone
- Diskless
- Dataless

NIM master. An AIX system that can install one or more NIM clients. An AIX system must be defined as a NIM master before defining any NIM clients on that system. A NIM master managers the configuration database containing the information for the NIM clients.

NIM object. A representation of information about the NIM environment. NIM stores this information as objects in the NIM database. The types of objects are:
- Network
- Machine
- Resource

NIS. Network Information System.

node. In a network, the point where one or more functional units interconnect transmission lines. A computer location defined in a network. The SP system can house several different types of nodes for both serial and parallel processing. These node types can include thin nodes, wide nodes, 604 high nodes, as well as other types of nodes both internal and external to the SP frame.

Node Switch Board. Switches mounted on frames that contain nodes.

NSB. Node Switch Board.

NTP. Network Time Protocol.

O

ODM. Object Data Manager. In AIX, a hierarchical object-oriented database for configuration data.

P

parallel environment. A system environment where message passing or SP resource manager services are used by the application.

Parallel Environment. A licensed IBM program used for message passing applications on the SP or RS/6000 platforms.

parallel processing. A multiprocessor architecture which allows processes to be allocated to tightly coupled multiple processors in a cooperative processing environment, allowing concurrent execution of tasks.

parameter. (1) A variable that is given a constant value for a specified application and that may denote

the application. (2) An item in a menu for which the operator specifies a value or for which the system provides a value when the menu is interpreted. (3) A name in a procedure that is used to refer to an argument that is passed to the procedure. (4) A particular piece of information that a system or application program needs to process a request.

partition. See system partition.

Perl. Practical Extraction and Report Language.

perspective. The primary window for each SP Perspectives application, so called because it provides a unique view of an SP system.

pipe. A UNIX utility allowing the output of one command to be the input of another. Represented by the | symbol. It is also referred to as filtering output.

PMR. Problem Management Report.

POE. Formerly Parallel Operating Environment, now Parallel Environment for AIX.

port. (1) An end point for communication between devices, generally referring to physical connection. (2) A 16-bit number identifying a particular TCP or UDP resource within a given TCP/IP node.

predicate. Obsolete term for expression.

Primary node or machine. (1) A device that runs a workload and has a standby device ready to assume the primary workload if that primary node fails or is taken out of service. (2) A node on the switch that initializes, provides diagnosis and recovery services, and performs other operations to the switch network. (3) In IBM Virtual Shared Disk function, when physical disks are connected to two nodes (twin-tailed), one node is designated as the primary node for each disk and the other is designated the secondary, or backup, node. The primary node is the server node for IBM Virtual Shared Disks defined on the physical disks under normal conditions. The secondary node can become the server node for the disks if the primary node is unavailable (off-line or down).

Problem Management Report. The number in the IBM support mechanism that represents a service incident with a customer.

process. (1) A unique, finite course of events defined by its purpose or by its effect, achieved under defined conditions. (2) Any operation or combination of operations on data. (3) A function being performed or waiting to be performed. (4) A program in operation. For example, a daemon is a system process that is always running on the system.

protocol. A set of semantic and syntactic rules that defines the behavior of functional units in achieving communication.

R

RAID. Redundant array of independent disks.

rearm expression. In Event Management, an expression used to generate an event that alternates with an original event expression in the following way: the event expression is used until it is true, then the rearm expression is used until it is true, then the event expression is used, and so on. The rearm expression is commonly the inverse of the event expression (for example, a resource variable is on or off). It can also be used with the event expression to define an upper and lower boundary for a condition of interest.

rearm predicate. Obsolete term for rearm expression.

remote host. *See foreign host.*

resource. In Event Management, an entity in the system that provides a set of services. Examples of resources include hardware entities such as processors, disk drives, memory, and adapters, and software entities such as database applications, processes, and file systems. Each resource in the system has one or more attributes that define the state of the resource.

resource identifier. In Event Management, a set of elements, where each element is a name/value pair of the form `name=value`, whose values uniquely identify the copy of the resource (and by extension, the copy of the resource variable) in the system.

resource monitor. A program that supplies information about resources in the system. It can be a command, a daemon, or part of an application or subsystem that manages any type of system resource.

resource variable. In Event Management, the representation of an attribute of a resource. An example of a resource variable is `IBM.AIX.PagSp.%totalfree`, which represents the percentage of total free paging space. `IBM.AIX.PagSp` specifies the resource name and `%totalfree` specifies the resource attribute.

RISC. Reduced Instruction Set Computing (RISC), the technology for today's high performance personal computers and workstations, was invented in 1975. Uses a small simplified set of frequently used instructions for rapid execution.

rlogin (remote LOGIN). A service offered by Berkeley UNIX systems that allows authorized users of one machine to connect to other UNIX systems across a network and interact as if their terminals were connected directly. The rlogin software passes information about the user's environment (for example, terminal type) to the remote machine.

RPC. Acronym for Remote Procedure Call, a facility that a client uses to have a server execute a procedure call. This facility is composed of a library of procedures plus an XDR.

RSH. A variant of RLOGIN command that invokes a command interpreter on a remote UNIX machine and passes the command line arguments to the command interpreter, skipping the LOGIN step completely. See also *rlogin*.

S

SCSI. Small Computer System Interface.

Secondary node. In IBM Virtual Shared Disk function, when physical disks are connected to two nodes (twin-tailed), one node is designated as the primary node for each disk and the other is designated as the secondary, or backup, node. The secondary node acts as the server node for the IBM Virtual Shared disks defined on the physical disks if the primary node is unavailable (off-line or down).

server. (1) A function that provides services for users. A machine may run client and server processes at the same time. (2) A machine that provides resources to the network. It provides a network service, such as disk storage and file transfer, or a program that uses such a service. (3) A device, program, or code module on a network dedicated to providing a specific service to a network. (4) On a LAN, a data station that provides facilities to other data stations. Examples are file server, print server, and mail server.

shell. The shell is the primary user interface for the UNIX operating system. It serves as command language interpreter, programming language, and allows foreground and background processing. There are three different implementations of the shell concept: Bourne, C and Korn.

Small Computer System Interface (SCSI). An input and output bus that provides a standard interface for the attachment of various direct access storage devices (hard disk drives) and tape drives to the RS/6000.

Small Computer Systems Interface Adapter (SCSI Adapter). An adapter that supports the attachment of various direct-access storage devices (hard disk drives) and tape drives to the RS/6000.

SMIT. The System Management Interface Toolkit is a set of menu driven utilities for AIX that provides functions such as transaction login, shell script creation, automatic updates of object database, and so forth.

SNMP. Simple Network Management Protocol. (1) An IP network management protocol that is used to monitor attached networks and routers. (2) A TCP/IP-based protocol for exchanging network management information and outlining the structure for communications among network devices.

socket. (1) An abstraction used by Berkeley UNIX that allows an application to access TCP/IP protocol functions. (2) An IP address and port number pairing. (3) In TCP/IP, the Internet address of the host computer on which the application runs, and the port number it uses. A TCP/IP application is identified by its socket.

standby node or machine. A device that waits for a failure of a primary node in order to assume the identity of the primary node. The standby machine then runs the primary's workload until the primary is back in service.

subnet. Shortened form of subnetwork.

subnet mask. A bit template that identifies to the TCP/IP protocol code the bits of the host address that are to be used for routing for specific subnetworks.

subnetwork. Any group of nodes that have a set of common characteristics, such as the same network ID.

subsystem. A software component that is not usually associated with a user command. It is usually a daemon process. A subsystem will perform work or provide services on behalf of a user request or operating system request.

SUP. Software Update Protocol.

switch capsule. A group of SP frames consisting of a switched frame and its companion non-switched frames.

Sysctl. Secure System Command Execution Tool. An authenticated client/server system for running commands remotely and in parallel.

syslog. A BSD logging system used to collect and manage other subsystem's logging data.

System Administrator. The user who is responsible for setting up, modifying, and maintaining the SP system.

system partition. A group of nonoverlapping nodes on a switch chip boundary that act as a logical SP system.

T

tar. Tape ARchive, is a standard UNIX data archive utility for storing data on tape media.

TaskGuides. SP TaskGuides are a form of advanced online assistance designed to walk you through complex or infrequently performed tasks. Each TaskGuide does not simply list the required steps. It actually performs the steps for you, automating the steps to the highest degree possible and prompting you for input only when absolutely necessary. You might recognize them as *wizards*.

Tcl. Tool Command Language.

TclX. Tool Command Language Extended.

TCP. Acronym for Transmission Control Protocol, a stream communication protocol that includes error recovery and flow control.

TCP/IP. Acronym for Transmission Control Protocol/Internet Protocol, a suite of protocols designed to allow communication between networks regardless of the technologies implemented in each network. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It assumes that the underlying protocol is the Internet Protocol.

Telnet. Terminal Emulation Protocol, a TCP/IP application protocol that allows interactive access to foreign hosts.

ticket. An encrypted protocol message used to securely pass the identity of a user from a client to a server.

Tk. Tcl-based Tool Kit for X Windows.

TMPCP. Tape Management Program Control Point.

token-ring. (1) Network technology that controls media access by passing a token (special packet or frame) between media-attached machines. (2) A network with a ring topology that passes tokens from one attaching device (node) to another. (3) The IBM Token-Ring LAN connection allows the RS/6000 system unit to participate in a LAN adhering to the IEEE 802.5 Token-Passing Ring standard or the ECMA standard 89 for Token-Ring, baseband LANs.

transaction. An exchange between the user and the system. Each activity the system performs for the user is considered a transaction.

transceiver (transmitter-receiver). A physical device that connects a host interface to a local area network, such as Ethernet. Ethernet transceivers contain electronics that apply signals to the cable and sense collisions.

transfer. To send data from one place and to receive the data at another place. Synonymous with move.

transmission. The sending of data from one place for reception elsewhere.

TURBOWAYS 100 ATM Adapter. An IBM high-performance, high-function intelligent adapter that provides dedicated 100 Mbps ATM (asynchronous transfer mode) connection for high-performance servers and workstations.

U

UDP. User Datagram Protocol.

UNIX operating system. An operating system developed by Bell Laboratories that features multiprogramming in a multiuser environment. The UNIX operating system was originally developed for use on minicomputers, but has been adapted for mainframes and microcomputers. **Note:** The AIX operating system is IBM's implementation of the UNIX operating system.

user. Anyone who requires the services of a computing system.

User Datagram Protocol (UDP). (1) In TCP/IP, a packet-level protocol built directly on the Internet Protocol layer. UDP is used for application-to-application programs between TCP/IP host systems. (2) A transport protocol in the Internet suite of protocols that provides unreliable, connectionless datagram service. (3) The Internet Protocol that enables an application programmer on one machine or process to send a datagram to an application program on another machine or process.

user ID. A nonnegative integer, contained in an object of type *uid_t*, that is used to uniquely identify a system user.

V

Virtual Shared Disk, IBM. The function that allows application programs executing at different nodes of a system partition to access a raw logical volume as if it were local at each of the nodes. In actuality, the logical volume is local at only one of the nodes (the server node).

W

workstation. (1) A configuration of input/output equipment at which an operator works. (2) A terminal or microcomputer, usually one that is connected to a mainframe or to a network, at which a user can perform applications.

X

X Window System. A graphical user interface product.

Bibliography

This bibliography helps you find product documentation related to the RS/6000 SP hardware and software products.

You can find most of the IBM product information for RS/6000 SP products on the World Wide Web. Formats for both viewing and downloading are available.

PSSP documentation is shipped with the PSSP product in a variety of formats and can be installed on your system. The man pages for public code that PSSP includes are also available online.

Finally, this bibliography contains a list of non-IBM publications that discuss parallel computing and other topics related to the RS/6000 SP.

Information formats

Documentation supporting RS/6000 SP software licensed programs is no longer available from IBM in hardcopy format. However, you can view, search, and print documentation in the following ways:

- On the World Wide Web
- Online from the product media or the SP Resource Center

Finding documentation on the World Wide Web

Most of the RS/6000 SP hardware and software books are available at:

http://www.ibm.com/servers/eserver/pseries

You can view a book or download a Portable Document Format (PDF) version of it. At the time this manual was published, the Web address of the ″RS/6000 SP Hardware and Software Books″ page was:

http://www.ibm.com/servers/eserver/pseries/library/sp_books/index.html

However, the structure of the RS/6000 Web site can change over time.

Accessing PSSP documentation online

On the same medium as the PSSP product code, IBM ships PSSP man pages, HTML files, and PDF files. In order to use these publications, you must first install the **ssp.docs** file set.

To view the PSSP HTML publications, you need access to an HTML document browser such as Netscape. The HTML files and an index that links to them are installed in the **/usr/lpp/ssp/html** directory. Once installed, you can also view the HTML files from the RS/6000 SP Resource Center.

If you have installed the SP Resource Center on your SP system, you can access it by entering the **/usr/lpp/ssp/bin/resource_center** command. If you have the SP Resource Center on CD-ROM, see the **readme.txt** file for information about how to run it.

To view the PSSP PDF publications, you need access to the Adobe Acrobat Reader. The Acrobat Reader is shipped with the AIX Version 4.3 Bonus Pack and is also freely available for downloading from the Adobe Web site at:

http://www.adobe.com

To successfully print a large PDF file (approximately 300 or more pages) from the Adobe Acrobat reader, you may need to select the “Download Fonts Once” button on the Print window.

Manual pages for public code

The following manual pages for public code are available in this product:

SUP /usr/lpp/ssp/man/man1/sup.1

Perl (Version 4.036)

/usr/lpp/ssp/perl/man/perl.man

/usr/lpp/ssp/perl/man/h2ph.man

/usr/lpp/ssp/perl/man/s2p.man

/usr/lpp/ssp/perl/man/a2p.man

Manual pages and other documentation for **Tcl**, **TclX**, **Tk**, and **expect** can be found in the compressed **tar** files located in the **/usr/lpp/ssp/public** directory.

RS/6000 SP planning publications

This section lists the IBM product documentation for planning for the IBM RS/6000 SP hardware and software.

IBM RS/6000 SP:

- *Planning, Volume 1, Hardware and Physical Environment*, GA22-7280
- *Planning, Volume 2, Control Workstation and Software Environment*, GA22-7281

RS/6000 SP hardware publications

This section lists the IBM product documentation for the IBM RS/6000 SP hardware.

IBM RS/6000 SP:

- *Planning, Volume 1, Hardware and Physical Environment*, GA22-7280
- *Planning, Volume 2, Control Workstation and Software Environment*, GA22-7281
- *Installation and Relocation*, GA22-7441
- *System Service Guide*, GA22-7442
- *SP Switch Service Guide*, GA22-7443
- *SP Switch2 Service Guide*, GA22-7444
- *Uniprocessor Node Service Guide*, GA22-7445
- *604 and 604e SMP High Node Service Guide*, GA22-7446
- *SMP Thin and Wide Node Service Guide*, GA22-7447
- *POWER3 SMP High Node Service Guide*, GA22-7448
- *Safety Information*, GA22-7467

RS/6000 SP standard ship group publications

- *RS/6000 SP: Installation and Relocation*, GA22-7441
- *RS/6000 SP: Safety Information*, GA22-7467
- *RS/6000 SP and @serverCluster 1600: Hardware Manuals*, GK3T-4268 (CD)
- *Service Director for RS/6000 Information Guide Code Version 3.1*, SA38-0383
- *Electronic Service Agent for pSeries and RS/6000 User's Guide*, SC38-7105

RS/6000 SP Switch Router publications

The RS/6000 SP Switch Router is based on the Ascend GRF switched IP router product from Lucent Technologies. You can order the SP Switch Router as the IBM 9077.

The following publications are shipped with the SP Switch Router. You can also order these publications from IBM using the order numbers shown.

- *Ascend GRF GateD Manual*, GA22-7327
- *Ascend GRF 400/1600 Getting Started*, GA22-7368
- *Ascend GRF Configuration and Management*, GA22-7366
- *Ascend GRF Reference Guide*, GA22-7367
- *SP Switch Router Adapter Guide*, GA22-7310

Adapter publications

- *SP Switch Router Adapter Guide*, GA22-7310
- *FDDI Introduction and Planning Guide*, GA27-3892
- *FDDI User's Guide and Programming Reference*, SC28-2823
- *Planning for Fiber Optic Channel Links*, GA23-0367
- *IBM Token-Ring Network Introduction and Planning Guide*, GA27-3677
- *RS/6000 Token Ring Adapter Card*, G511-1681
- *HIPPI User's Guide and Programmer's Reference*, SA23-0369 and SA23-2488
- *AIX Parallel and ESCON Channel Tape Attachment/6000 Installation and User's Guide*, GA32-0311
- *9334 SCSI Expansion Units Operator Guide*, GA33-3232
- *9334 Models 010 and 011 SCSI Expansion Units: Installation and Service Guide*, SY33-0165
- *9334 Models 500 and 501 SCSI Expansion Units: Installation and Service Guide*, SY33-0167
- *SCSI-2 Fast/Wide Adapter*, SC23-2646
- *IBM SCSI-2 Fast/Wide Adapter/A Technical Reference*, S83G-7545
- *Turboways 100 User's Guide ATM*, GA27-4057
- *9333 Model 010 and 011 High-Performance Disk-Drive Subsystem Operator Guide*, GA33-3208
- *9333 Model 010 and 011 High-Performance Disk-Drive Subsystem Installation and Service Guide*, SY33-0161
- *9333 Model 010 and 011 High-Performance Disk-Drive Subsystem Hardware Technical Information*, SA33-3209
- *9333 Model 500 and 501 High-Performance Disk-Drive Subsystem Operator Guide*, GA33-3234

- *9333 Model 500 and 501 High-Performance Disk-Drive Subsystem Installation and Service Guide*, SY33-0168
- *9333 Model 500 and 501 High-Performance Disk-Drive Subsystem Hardware Technical Information*, SA33-3235
- *IBM SCSI Tape Drive, Medium Changer, and Library Device Drivers Installation and User's Guide*, GC35-0154

Network connectivity

- *IBM LAN Cabling System Planning and Installation Guide*, GA27-3361
- *IBM Cabling System Optical Fiber Planning and Installation Guide*, GA27-3943
- *IBM 8250/8260/8285 Planning and Site Preparation Guide*, GA33-0285
- *IBM 6611 Network Processor: Introduction and Planning Guide*, GK2T-0334

Other service publications

- *IBM AIX Version 3.2 Problem Solving Guide and Reference*, SC23-2204
- *IBM AIX Version 4 Problem Solving Guide and Reference*, SC23-2606
- *IBM AIX Version 4.3 Problem Solving Guide and Reference*, SC23-4123
- *7012 300 Series Operator Guide*, SA23-2623
- *7012 300 Series Installation and Service Guide*, SA23-2624
- *7013 500 Series Operator Guide*, SA38-0530
- *7013 500 Series Installation and Service Guide*, SA38-0531
- *Electrical Safety for IBM Customer Engineers*, S229-8124
- *7015 Model R30 CPU Enclosure Operator Guide*, SA23-2742
- *7015 Model R30 CPU Enclosure Installation and Service Guide*, SA23-2743
- *RS/6000 7017 S Series Installation and Service Guide*, SA38-0548
- *Supplement for RS/6000 7017 S Series Installation and Service*, SN32-9059
- *RS/6000 7017 S Series User's Guide* , SA38-0549
- *IBM General Information Manual: Installation Manual-Physical Planning*, GC22–7072

Related hardware publications

For publications on the latest IBM @server pSeries and RS/6000 hardware products, see the Web site:

http://www.ibm.com/servers/eserver/pseries/library/hardware_docs/

That site includes links to the following:

- General service documentation
- Guides by system (pSeries and RS/6000)
- Installable options
- Hardware Management Console for pSeries guides

RS/6000 SP software publications

This section lists the IBM product documentation for software products related to the IBM RS/6000 SP. These products include:

- IBM Parallel System Support Programs for AIX (PSSP)
- IBM LoadLeveler for AIX 5L (LoadLeveler)
- IBM Parallel Environment for AIX (Parallel Environment)
- IBM General Parallel File System for AIX (GPFS)
- IBM Engineering and Scientific Subroutine Library (ESSL) for AIX
- IBM Parallel ESSL for AIX
- IBM High Availability Cluster Multi-Processing for AIX (HACMP)
- IBM Client Input Output/Sockets (CLIO/S)
- IBM Network Tape Access and Control System for AIX (NetTAPE)

PSSP publications

IBM RS/6000 SP:

- *Planning, Volume 2, Control Workstation and Software Environment*, GA22-7281

PSSP:

- *Installation and Migration Guide*, GA22-7347
- *Administration Guide*, SA22-7348
- *Managing Shared Disks*, SA22-7349
- *Diagnosis Guide*, GA22-7350
- *Command and Technical Reference*, SA22-7351
- *Messages Reference*, GA22-7352
- *Implementing a Firewalled RS/6000 SP System*, GA22-7874

RS/6000 Cluster Technology (RSCT):

- *Event Management Programming Guide and Reference*, SA22-7354
- *Group Services Programming Guide and Reference*, SA22-7355
- *First Failure Data Capture Programming Guide and Reference*, SA22-7454

LoadLeveler publications

LoadLeveler:

- *Using and Administering*, SA22-7881
- *Diagnosis and Messages Guide*, GA22-7882
- *Install Memo*, GI11-2816

GPFS publications

GPFS:

- *Problem Determination Guide*, GA22-7434
- *Administration and Programming Reference*, SA22-7452
- *Concepts, Planning, and Installation*, GA22-7453

Parallel Environment publications

Parallel Environment:

- *Installation Guide*, GA22-7418
- *Messages*, GA22-7419
- *DPCL Programming Guide*, SA22-7420
- *DPCL Class Reference*, SA22-7421
- *MPI Programming Guide*, SA22-7422
- *MPI Subroutine Reference*, SA22-7423
- *Hitchhiker's Guide*, SA22-7424
- *Operation and Use, Volume 1*, SA22-7425
- *Operation and Use, Volume 2*, SA22-7426
- *MPL Programming and Subroutine Reference*, GC23-3893

Parallel ESSL and ESSL publications

- *ESSL Products: General Information*, GC23-0529
- *Parallel ESSL: Guide and Reference*, SA22-7273
- *ESSL: Guide and Reference*, SA22-7272

HACMP publications

HACMP:

- *Concepts and Facilities*, SC23-4276
- *Planning Guide*, SC23-4277
- *Installation Guide*, SC23-4278
- *Administration Guide*, SC23-4279
- *Troubleshooting Guide*, SC23-4280
- *Programming Locking Applications*, SC23-4281
- *Programming Client Applications*, SC23-4282
- *Master Index and Glossary*, SC23-4285
- *HANFS for AIX Installation and Administration Guide*, SC23-4283
- *Enhanced Scalability Installation and Administration Guide, Volume 1*, SC23-4284
- *Enhanced Scalability Installation and Administration Guide, Volume 2*, SC23-4306

AIX publications

You can find links to the latest AIX publications on the Web at:

http://www.ibm.com/servers/aix/library/techpubs.html

You can view the common file information at:

sh2n06.pok.ibm.com/afs/aix/u/spbooks/drafts/pssp/am0xxmst.pdf

DCE publications

The DCE library consists of the following books:

- *IBM DCE 3.1 for AIX: Administration Commands Reference*
- *IBM DCE 3.1 for AIX: Administration Guide—Introduction*
- *IBM DCE 3.1 for AIX: Administration Guide—Core Components*
- *IBM DCE 3.1 for AIX: DFS Administration Guide and Reference*

- *IBM DCE 3.1 for AIX: Application Development Guide—Introduction and Style Guide*
- *IBM DCE 3.1 for AIX: Application Development Guide—Core Components*
- *IBM DCE 3.1 for AIX: Application Development Guide—Directory Services*
- *IBM DCE 3.1 for AIX: Application Development Reference*
- *IBM DCE 3.1 for AIX: Problem Determination Guide*
- *IBM DCE 3.1 for AIX: Release Notes*

You can view a DCE book or download a Portable Document Format (PDF) version of it from the IBM DCE Web site at:

http://www.ibm.com/software/network/dce/library

Redbooks

IBM's International Technical Support Organization (ITSO) has published a number of redbooks related to the RS/6000 SP. For a current list, see the ITSO Web site at:

http://www.ibm.com/redbooks

Non-IBM publications

Here are some non-IBM publications that you may find helpful.

- Almasi, G., Gottlieb, A., *Highly Parallel Computing*, Benjamin-Cummings Publishing Company, Inc., 1989.
- Foster, I., *Designing and Building Parallel Programs*, Addison-Wesley, 1995.
- Gropp, W., Lusk, E., Skjellum, A., *Using MPI*, The MIT Press, 1994.
- Message Passing Interface Forum, *MPI: A Message-Passing Interface Standard, Version 1.1*, University of Tennessee, Knoxville, Tennessee, June 6, 1995.
- Message Passing Interface Forum, *MPI-2: Extensions to the Message-Passing Interface, Version 2.0*, University of Tennessee, Knoxville, Tennessee, July 18, 1997.
- Ousterhout, John K., *Tcl and the Tk Toolkit*, Addison-Wesley, Reading, MA, 1994, ISBN 0-201-63337-X.
- Pfister, Gregory, F., *In Search of Clusters*, Prentice Hall, 1998.
- Barrett, D., Silverman, R., *SSH The Secure Shell The Definitive Guide*, O'Reilly, 2001.

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RS/6000 SP
Planning Vol. 1,
Hardware and Physical Environment

Publication No. GA22-7280-11

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