

RS/6000 SP



Planning Volume 1, Hardware and Physical Environment

RS/6000 SP



Planning Volume 1, Hardware and Physical Environment

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Contents

About This Book	xvii
Who Should Use This Book	xvii
Related Information	xvii
How To Send Your Comments	xvii
Introducing the RS/6000 SP System	1
RS/6000 SP System Overview	1
Hardware Planning	2
Processor Nodes	2
Frames	4
Control Workstations	4
Switches	5
SP Switch Routers	5
Network Communications	5
Communication and I/O Adapters	6
Direct Access Storage Devices (DASD)	7
Installation Site Planning	8
Electrical Power Planning	8
Environmental Planning	8
Floor Planning	8
RS/6000 SP System Upgrades	9
375 MHz POWER3 SMP Wide Node (F/C 2057)	11
Description	11
Bus Description	11
Requirements and Options	11
F/C 2057 Requirements	11
F/C 2057 Options	12
Processor Requirements and Options	12
Memory Requirements and Options	12
DASD Requirements and Options	13
Switch and Communication Adapter Requirements and Options	13
375 MHz POWER3 SMP Thin Node (F/C 2056)	15
Description	15
Bus Description	15
Requirements and Options	15
F/C 2056 Requirements	15
F/C 2056 Options	16
Processor Requirements and Options	16
Memory Requirements and Options	16
DASD Requirements and Options	17
Switch and Communication Adapter Requirements and Options	17
POWER3 SMP High Node (F/C 2054)	19
Description	19
PCI Bus Description	19
Requirements and Options	19
F/C 2054 Requirements	19
F/C 2054 Options	20

Processor Requirements and Options	20
Memory Requirements and Options	20
DASD Requirements and Options	21
Switch and Communication Adapter Requirements and Options	21
SP Expansion I/O Unit (F/C 2055)	22
DASD Options	22
POWER3 SMP Wide Node (F/C 2053)	25
Description	25
Bus Description	25
Requirements and Options	25
F/C 2053 Requirements	25
F/C 2053 Options	26
Processor Requirements and Options	26
Memory Requirements and Options	26
DASD Requirements and Options	27
Switch and Communication Adapter Requirements and Options	27
POWER3 SMP Thin Node (F/C 2052)	29
Description	29
Bus Description	29
Requirements and Options	29
F/C 2052 Requirements	29
F/C 2052 Options	30
Processor Requirements and Options	30
Memory Requirements and Options	30
DASD Requirements and Options	31
Switch and Communication Adapter Requirements and Options	31
332 MHz SMP Wide Node (F/C 2051)	33
Description	33
Bus Description	33
Requirements and Options	33
F/C 2051 Requirements	33
F/C 2051 Options	34
Processor Requirements and Options	34
Memory Requirements and Options	34
DASD Requirements and Options	35
Switch and Communication Adapter Requirements and Options	35
332 MHz SMP Thin Node (F/C 2050)	37
Description	37
Bus Description	37
Requirements and Options	37
F/C 2050 Requirements	37
F/C 2050 Options	38
Processor Requirements and Options	38
Memory Requirements and Options	38
DASD Requirements and Options	39
Switch and Communication Adapter Requirements and Options	39
SP-Attached Server (RS/6000 M/T 7017-S70, S7A, and S80)	41
RS/6000 SP-Attached Server (F/C 9122 plus F/C 9123) Overview	41
System Highlights	42

7017 Enterprise Server Description	42
How the SP System Views the SP-Attached Server	43
RS/6000 SP-Attached Server Installation Requirements	45
SP-Attached Server SP System Requirements	45
SP-Attached Server Physical Requirements	46
SP-Attached Server Switch Adapter Requirements	47
SP-Attached Server Network Media Card Requirements	49
SP-Attached Server Software Requirements	49
Planning for the RS/6000 SP-Attached Server Network Interface	51
Connecting the SP-Attached Server to the Control Workstation	52
Connecting the SP-Attached Server to the SP Switch	54
Tall Frames – 1.93 m (Model 550, F/C 1550, and F/C 2031)	57
Tall Frame Overview	57
Model 550 Frames	58
Model 550 Non-Switched Configuration	58
Model 550 SP Switch-8 Configuration	58
Model 550 Single-Stage SP Switch Configuration	58
Model 550 Two-Stage SP Switch Configuration	59
Expansion Frames (F/C 1550)	59
Using F/C 1550 Non-Switched Expansion Frames	60
Using F/C 1550 Switched Expansion Frames	61
SP Switch Frames (F/C 2031)	61
Short Frames – 1.25 m (Model 500 and F/C 1500)	63
Short Frame Overview	63
Model 500 Frames	64
Model 500 Non-Switched Configuration	64
Model 500 Switched Configuration	64
Expansion Frames (F/C 1500)	64
Using F/C 1500 Non-Switched Expansion Frames	65
Control Workstations	67
Planning for the Control Workstation	67
Control Workstation Interface Adapters	69
Service Director	71
What is Service Director?	71
Hardware Requirements	71
SP Switches (F/C 4011 and F/C 4008)	73
Switch Overview	73
SP Switch (F/C 4011)	73
SP Switch-8 (F/C 4008)	74
Switch Adapters (F/C 4020, 4022, and 4023)	74
Special Switch Adapters (F/C 4021 and RS/6000 F/C 8396)	75
SP Switch Frame (F/C 2031)	76
Planning Switch Cable Networks	76
RS/6000 SP Switch Router (M/T 9077 04S and 16S)	77
SP Switch Router Description	77
Switch Router Installation Requirements	78
System Requirements	78
Physical Requirements	79
Adapter Requirements	79

Network Media Card Requirements	80
Software Requirements	80
Planning for the RS/6000 SP Switch Router Network Interface	80
Connecting the SP Switch Router to the Control Workstation	81
Connecting the SP Switch Router to the SP Switch	84
Planning for Network Media Cards and Memory Options	86
Communication Cabling	91
Planning the Location of the Control Workstation Based on Cable Length	91
RS-232 Cable Provided by IBM	91
Planning for Coaxial LAN Cabling	91
Ethernet LAN and Ethernet Cable Provided by IBM	92
Requirements for Coaxial Cables	93
Customer Responsibilities for Coaxial Cabling	94
Connecting Station Protectors	95
IBM Station Protector	95
Labeling Coaxial Cables	96
Planning For Cabling Tests	97
Preparing a Site for Coaxial Cabling	97
Routing Indoor Cabling	97
Planning for Twisted Pair LAN Cabling	98
Requirements for Twisted Pair Ethernet Cabling	98
Planning for Switch Cabling	99
Considerations for Future Switch Expansion	100
Switch-to-Node Cabling	100
Planning for Switch-to-Switch Cabling	101
Communication Adapter Requirements	107
PCI Bus I/O Adapter Requirements for SMP Nodes	107
PCI Bus Group and Slot Descriptions	107
PCI Adapter Maximum Quantities	108
PCI Adapter Plugging Rules and Restrictions	111
Suggested PCI Adapter Quantities for Optimum Operation	114
MCA Bus Adapter Requirements	117
PCI Communication Adapters	121
Short-Wave Serial HIPPI PCI Adapter (F/C 2732)	122
Feature Characteristics	122
Feature Components	122
Customer Components	123
Hardware Requirements	123
Software Requirements	123
Long-Wave Serial HIPPI PCI Adapter (F/C 2733)	123
Feature Characteristics	123
Feature Components	123
Customer Components	124
Hardware Requirements	124
Software Requirements	124
FDDI SK-NET LP SAS PCI Adapter (F/C 2741)	124
Feature Characteristics	124
Feature Components	124
Customer Components	124
Hardware Requirements	125
Software Requirements	125

FDDI Typical SP Configuration	125
External Cabling Routing for FDDI Cables	127
FDDI SK-NET LP DAS PCI Adapter (F/C 2742)	127
Feature Characteristics	127
Feature Components	127
Customer Components	128
Hardware Requirements	128
Software Requirements	128
FDDI Typical SP Configuration	128
External Cabling Routing for FDDI Cables	131
FDDI SK-NET UP DAS PCI Adapter (F/C 2743)	132
Feature Characteristics	132
Feature Components	132
Customer Components	133
Hardware Requirements	133
Software Requirements	133
FDDI Typical SP Configuration	133
S/390 ESCON Channel PCI Adapter (F/C 2751)	133
Feature Characteristics	133
Feature Components	134
Customer Components	134
Hardware Requirements	134
Required Software	134
Auto LANstreamer Token Ring PCI Adapter (F/C 2920)	134
Feature Characteristics	134
Feature Components	135
Customer Components	135
Hardware Requirements	135
Required Software	135
Cable Routing	135
8-Port Async PCI Adapter EIA 232/RS-422 (F/C 2943)	135
Feature Characteristics	136
Feature Components	136
Customer Supplied Components	136
Hardware Requirements	136
Required Software	136
WAN 128-Port Async PCI Adapter EIA-232 (F/C 2944)	136
Feature Characteristics	137
Customer Supplied Components	137
Hardware Requirements	137
Required Software	137
ARTIC960Hx 4-Port Selectable PCI Adapter (F/C 2947)	138
Feature Characteristics	138
Feature Components	138
Hardware Requirements	138
Required Software	139
2-Port Multiprotocol X.25 PCI Adapter (F/C 2962)	139
Feature Characteristics	139
Customer Supplied Components	139
Hardware Requirements	140
Required Software	140
TURBOWAYS 155 UTP ATM PCI Adapter (F/C 2963)	140
Feature Characteristics	140
Customer Components	141

Hardware Requirements	141
Required Software	141
ATM Cable Routing	141
10/100 Ethernet 10BaseTX PCI Adapter (F/C 2968)	142
Feature Characteristics	142
Feature Components	143
Customer Supplied Components	143
Hardware Requirements	143
Required Software	143
Gigabit Ethernet - SX PCI Adapter (F/C 2969)	143
Feature Characteristics	143
Feature Components	143
Customer Supplied Components	144
Hardware Requirements	144
Required Software	144
10Base2 and 10BaseT (BNC/RJ-45) Ethernet LAN PCI Adapter (F/C 2985)	144
Feature Characteristics	144
Feature Components	145
Customer Supplied Components	145
Hardware Requirements	145
Required Software	145
Cable Routing	145
10Base5 and 10BaseT (AUI/RJ-45) Ethernet LAN PCI Adapter (F/C 2987)	146
Feature Characteristics	146
Feature Components	146
Customer Supplied Components	147
Hardware Requirements	147
Required Software	147
Cable Routing	147
TURBOWAYS 155 ATM PCI Adapter (F/C 2988)	148
Feature Characteristics and Requirements	148
Customer Components	148
Required Software	148
ATM Cable Routing	148
High-Speed Token-Ring PCI Adapter (F/C 4959)	149
Feature Characteristics	149
Feature Components	150
Customer Components	150
Hardware Requirements	150
Software Requirements	150
Typical SP System Configuration	150
SCSI-2 Ultra/Wide DE PCI Adapter (F/C 6204)	150
Feature Characteristics	151
Customer Components	151
Hardware Requirements	151
Software Requirements	151
F/C 6204 Cable Options	151
SCSI-2 F/W Cable Routing	151
External Cable Routing	152
Dual Channel Ultra2 SCSI PCI Adapter (F/C 6205)	153
Feature Characteristics	153
Feature Components	154
Customer Components	154
Hardware Requirements	154

Software Requirements	154
SCSI-2 Ultra/Wide SE PCI Adapter (F/C 6206)	154
Feature Characteristics	154
Customer Components	155
Hardware Requirements	155
Software Requirements	155
F/C 6206 Cable Options	155
SCSI-2 Ultra Cable Routing	156
External Cable Routing	156
SCSI-2 Ultra/Wide DE PCI Adapter (F/C 6207)	157
Feature Characteristics	157
Customer Components	157
Hardware Requirements	158
Software Requirements	158
F/C 6207 Cable Options	158
SCSI-2 F/W Cable Routing	158
External Cable Routing	159
SSA Fast-Write Cache Option (F/C 6222)	160
Gigabit Fibre Channel PCI Adapter (F/C 6227)	160
Feature Characteristics	161
Feature Components	161
Customer Components	161
Hardware Requirements	161
Software Requirements	161
Advanced SerialRAID Plus PCI Adapter (F/C 6230)	161
Feature Characteristics	162
Feature Components	162
Customer Components	163
Hardware Requirements	163
Software Requirements	163
Limitations	163
Typical SP System Configuration	163
128 MB DIMM Option Card (F/C 6231)	163
32 MB Fast-Write Cache Option Card (F/C 6235)	163
ARTIC960RxD Quad Digital Trunk PCI Adapter (F/C 6310)	164
Feature Characteristics	164
Feature Components	164
Hardware Requirements	165
Required Software	165
ARTIC960RxF Digital Trunk Resource Adapter (F/C 6311)	165
Feature Characteristics	165
Feature Components	165
Hardware Requirements	166
Required Software	166
Typical Configuration	166
Direct Access Storage Devices (DASD)	167
Internal DASD	167
Planning for Internal DASD	169
External DASD	169
External Boot Disks	172
Power and Electrical Requirements	177
Preliminary Power Planning Considerations	177

Evaluating Primary Computer Power Service	177
Obtaining Power System Backup Devices	177
Evaluating Location and Availability of Receptacles	177
Installing Emergency Power-Off Controls	177
Protecting Branch Circuits and Connecting Ground Conductors	178
Evaluating SP System Power Requirements	179
Scalable Electric Power Base Unit (SEPBU)	180
SEPBU Input Power Requirements	182
Evaluating Power Line Cords, Plugs, and Receptacles	183
Planning for Power Requirements of SP Frames and Features	186
Using the SP Frame Power Computation Worksheet	186
Upgrading Power Systems in Early SP Frames	189
Upgrading 2.01 m Frames from 7.0 to 10.5 kW SEPBU's	189
Upgrading 1.25 m Frames from 3.5 to 5.0 kW SEPBU's	190
Upgrading 2.01 m Frames with PDU to 10.5 kW SEPBU	191
Environmental Factors	193
Environmental Specifications of the RS/6000 SP	193
Operating, Shipping, and Storage Environment	193
Recommended Operating Point and Range	194
Acoustical Environment of the RS/6000 SP System	194
Evaluating Your Site Environment	196
Evaluating Thermal Output	196
Evaluating Electromagnetic Interference	199
Evaluating Electrostatic Discharge	199
Frame Tie-down Considerations	200
Floor Plans	203
Planning Your RS/6000 SP Installation Site	203
Determining the Devices to Include in Your System	203
Developing Your Floor Plan	203
Planning Your Site Alterations	203
RS/6000 SP Physical Specifications and Illustrations	203
SP System Physical Dimensions and Weights	204
Wooden Shipping Container Dimensions and Weights	206
Site Floor Preparation Considerations	208
Service Clearance Specifications for Frames	211
Service Clearance and Frame Footprint Illustrations	212
Multi-Frame System Floor Planning and Illustrations	221
RS/6000 SP System Floor Load Analysis	227
Appendix A. SP System Upgrades, Conversions, and Feature Additions	229
Adding Nodes	229
Adding 375 MHz POWER3 SMP Thin and Wide Nodes	229
Adding POWER3 SMP High Nodes	229
Adding POWER3 and 332 MHz SMP Thin and Wide Nodes	229
Adding Frames	230
Adding Switches	230
Upgrading Nodes	230
Upgrading POWER3 and 332 MHz Thin and Wide Nodes to POWER3 High Nodes	230
Upgrading SMP Thin and Wide Nodes	230
Replacing Withdrawn Processor Nodes	231
Relocating Processor Nodes	231

Upgrading Frames	231
Upgrading Model 500 and F/C 1500 to Model 550 and F/C 1550	231
Upgrading Model T70 to Model 550	232
Appendix B. SEPBU Power Control Interface	233
RS/6000 SP Power Control Interface Function	233
Typical Configurations	233
Appendix C. MCA Communication Adapters	235
MCA Adapter Descriptions	236
SCSI-2 High Performance External I/O Controller (F/C 2410) MCA	236
Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C 2412) MCA	236
SCSI-2 Fast/Wide Adapter/A (F/C 2415) MCA	236
4-Port Multiprotocol Communications Controller - (F/C 2700) MCA	236
Fiber Distributed Data Interface - FDDI - (F/C 2724, 2723) MCA	237
High Performance Parallel Interface - HIPPI - (F/C 2735) MCA	237
S/390 ESCON Channel Emulator Adapter (F/C 2754) MCA	237
Block Multiplexer Channel Adapter - BMCA - (F/C 2755) MCA	237
ESCON Control Unit Adapter (F/C 2756) MCA	238
8-Port Async Adapter - EIA-232 - (F/C 2930) MCA	238
X.25 Interface Co-Processor/2 - (F/C 2960) MCA	238
Token-Ring High Performance Network Adapter (F/C 2970) MCA	238
Auto Token-Ring LANstreamer MC 32 Adapter - (F/C 2972) MCA	238
Ethernet High Performance LAN Adapter (F/C 2980) MCA	238
TURBOWAYS 155 ATM Adapter (F/C 2989) MCA	238
High-Performance Ethernet LAN Adapter AUI and 10Base-T (F/C 2992) MCA	239
High-Performance Ethernet LAN Adapter 10Base2 (BNC) (F/C 2993) MCA	239
10/100 Ethernet Twisted Pair MC Adapter (F/C 2994) MCA	239
Ethernet 10BaseT Transceiver - (F/C 4224) MCA	239
9333 High Performance Subsystem Adapter (F/C 6212) MCA	239
SSA 4-Port Adapter (F/C 6214) MCA	239
Enhanced SSA 4-Port Adapter (F/C 6216) MCA	240
SSA 4-Port RAID Adapter (F/C 6217) MCA	240
Micro Channel SSA Multi-Initiator/RAID EL Adapter (F/C 6219) and SSA Fast-Write Cache Option (F/C 6222) MCA	240
Notices	241
Trademarks	241
Electronic emissions notices	241
Federal Communications Commission (FCC) statement	241
European Union (EU) statement	242
United Kingdom telecommunications safety requirements	242
Industry Canada compliance statement	242
For installations in Japan:	242
Electromagnetic interference (EMI) statement - Taiwan	242
Radio protection for Germany	242
Glossary	243
Bibliography	251
Information Formats	251
Finding Documentation on the World Wide Web	251
Accessing PSSP Documentation Online	251

Manual Pages for Public Code	252
RS/6000 SP Planning Publications	252
RS/6000 SP Hardware Publications	252
RS/6000 SP Switch Router Publications	252
RS/6000 SP Software Publications	253
AIX and Related Product Publications	255
DCE Publications	255
Red Books	255
Non-IBM Publications	255
Index	257

Figures

1.	Conceptual RS/6000 SP System	1
2.	Model 550 System with Frame-Mounted SP Switch, Four Expansion Frames, and an SP Switch Frame	57
3.	Model 500 System with Optional SP Switch-8 and Three Expansion Frames	63
4.	Control Workstation	69
5.	Typical Connections Between the RS/6000 SP Switch Router, the Control Workstation, and the SP Switch	82
6.	Configuring the RS/6000 SP Switch Router for Communications With Multiple SP Systems	84
7.	Factory Shipped SP Ethernet LAN, RF Shunt and Ethernet Cable in Rear of SP Frame	92
8.	Station Protector and Its Connection to Coaxial Cable	96
9.	Switch Cable Paths for SP Systems Using Single-Stage Switch Configurations	102
10.	Switch Cable Paths for an SP System Using Two-Stage Switch Configuration	103
11.	Typical FDDI Configuration for the SP System	125
12.	Typical FDDI Single-Ring Attachment Cabling for the SP System	126
13.	Typical FDDI Configuration for the SP System	129
14.	Typical FDDI Dual-Ring Attachment Cabling for the SP System	130
15.	Typical FDDI Dual Homing Cabling for the SP System	131
16.	Typical ATM Cabling for the SP System	142
17.	Ethernet Cable Routing	146
18.	Ethernet Cable Routing	147
19.	Typical ATM Cabling for the SP System	149
20.	SCSI-2 Ultra/Wide Configuration for Processor Cabling	152
21.	SCSI-2 Ultra Configuration for Processor Cabling	156
22.	SCSI-2 Ultra/Wide Configuration for Processor Cabling	159
23.	Typical Power Distribution System	179
24.	Three-Phase Power Connectors (U.S.A.)	184
25.	Single-Phase Power Connectors (U.S.A.)	185
26.	Frame Layout for Optimal Air Flow Using Perforated Tiles	197
27.	Locations of Tie-down Holes on the 1.93 m and 1.36 m Frames	200
28.	Locations for M10 Tapped Holes in 1.25 m and 2.01 m Frames	201
29.	Service Clearances for 1.93 m Frames (not to scale)	213
30.	1.93 m Frame: Cable Cut-out Dimensions and Caster Locations (not to scale)	214
31.	Service Clearances for 1.36 m Frames (not to scale)	215
32.	1.36 m Frame: Cable Cut-out Dimensions and Caster Locations (not to scale)	216
33.	Service Clearances and Weight Distribution 1.25 m Frames (not to scale)	217
34.	Floor Cutout Dimensions for the 1.25 m (49 in.) Frame	218
35.	1.93 m SP Switch Frame Service Clearances For Frames Produced After 4/98 (not to scale)	219
36.	1.93 m SP Switch Frame: Cable Cut-out Dimensions and Caster Locations For Frames Produced After 4/98 (not to scale)	220
37.	Basic Model 550 SP System	222
38.	Moderate-Scale Model 550 SP System	224

39. Large-Scale Model 550 SP System 226

Tables

1.	Processor Options for 375 MHz POWER3 SMP Wide Nodes (F/C 2057)	12
2.	Memory features for 375 MHz POWER3 SMP Wide Nodes (F/C 2057)	13
3.	Processor Options for 375 MHz POWER3 SMP Thin Nodes (F/C 2056)	16
4.	Memory features for 375 MHz POWER3 SMP Thin Nodes (F/C 2056)	17
5.	Processor Options for POWER3 SMP High Nodes (F/C 2054)	20
6.	Memory features for POWER3 SMP High Nodes (F/C 2054)	20
7.	Processor Options for POWER3 SMP Wide Nodes	26
8.	Memory features for POWER3 SMP Wide Nodes (F/C 2053)	27
9.	Processor Options for POWER3 SMP Thin Nodes	30
10.	Memory features for POWER3 SMP Thin Nodes (F/C 2052)	31
11.	Processor Options for 332 MHz SMP Nodes	34
12.	Memory features for 332 MHz SMP Wide Nodes (F/C 2051)	35
13.	Processor Options for 332 MHz SMP Nodes	38
14.	Memory features for 332 MHz SMP Thin Nodes (F/C 2050)	38
15.	Physical Dimensions of SP-Attached Server	46
16.	Weight Specification of SP-Attached Server	46
17.	Power Specification of SP-Attached Server	47
18.	Switch Adapter Features	75
19.	Physical Dimensions and Weight of SP Switch Router	79
20.	SP Switch Router Network Media Cards and Options	86
21.	Characteristics of RG-58 Cables Suitable for Coaxial Link	94
22.	Separation Distances for Separate Grounded Metallic Conduits	98
23.	Quantities of Switch-to-Switch Cables Required per SP System	103
24.	Switch Cable Length Tracking Chart	105
25.	Quantity of Switch-to-Switch Cables per Length for a New SP system	106
26.	Quantity of Switch Cables To Order for an Expanded SP System	106
27.	PCI Bus Descriptions for SMP nodes	108
28.	Maximum quantities of PCI adapters for SMP thin and wide nodes	109
29.	Maximum quantities of PCI adapters for POWER3 High nodes and SP Expansion I/O Units	110
30.	PCI Adapter Weighting Factors	114
31.	Micro Channel Adapter Requirements	117
32.	Available RS/6000 SP PCI Adapter Features	121
33.	Cable Budget Information for FDDI Feature	127
34.	Cable Budget Information for FDDI Feature	132
35.	Cable Information for 2-port Multiprotocol Adapter	140
36.	Cable Budget Information for SCSI-2 Ultra/Wide Feature	153
37.	Cable Budget Information for SCSI-2 Fast/Wide Feature	157
38.	Cable Budget Information for SCSI-2 Ultra/Wide Feature	160
39.	Cable use for ARTIC960RxD and ARTIC960RxF	166
40.	DASD Options for Current Node Types	167
41.	SP Nodes Supporting Bootable SSA Functions With the 7133	173
42.	SP Nodes Supporting Bootable SCSI Functions With the 7027	174
43.	SP Nodes Supporting Bootable SCSI Functions With the 7131	175
44.	SEPBU Low-Voltage (200-240 V ac) Requirements	182
45.	SEPBU High-Voltage (380-415 V ac) Requirements	183
46.	Power Line Cord Specifications for Frames with 10.5 kW SEPBU	184
47.	Power Line Cord Specifications for SP Systems with 5.0 kW SEPBU	185
48.	SP System Frame Power Computation Worksheet	186
49.	Temperature and Humidity Specifications for RS/6000 SP systems	193

50.	Recommended Operating Range for RS/6000 SP systems	194
51.	Declared Acoustical Noise Emission Values for Components and a Selected Custom Configuration Installed in 1.93 m Frames	195
52.	Specifications for Tie-down Hole Locations (See figure above)	201
53.	Dimensions and Weights of the 1.93 m Frame (with covers)	204
54.	Dimensions and Weights of the 1.36 m Frame (with covers)	204
55.	Dimensions and Weights of 1.25 m Frame (with covers)	205
56.	Dimensions and Weights of Switch Frame (F/C 2031) (with covers) . . .	205
57.	Weights and dimensions of processor nodes and components	206
58.	Dimensions and Weights of Shipping Container for 1.93 m Frame Assembly With Covers	206
59.	Dimensions and Weights of Shipping Container for 1.36 m Frame Assembly With Covers	207
60.	Dimensions and Weights of Shipping Container for 1.25 m Frame Assembly With Covers	207
61.	Service Clearances for 1.93 m SP Frames	211
62.	Service Clearances for 1.36 m (53.5 in.) Frames	211
63.	Service Clearances for 1.25 m (49 in.) Frames	212
64.	Floor Cutout Dimensions for the 1.25 m (49 in.) Frame	218
65.	MCA Adapter Features	235

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 for your RS/6000 SP installation 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 some 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 RS/6000 website at <http://www.rs6000.ibm.com>
- The Resource Center on the PSSP product media
- Printed documents and CD-ROM versions, which can be ordered from IBM
- IBM internal use versions available on MKTTOOLS

For more information on these sources and an extensive listing of RS/6000 SP related publications, see "Bibliography" on page 251.

How To Send Your Comments

Your feedback is important in helping to provide the most accurate and highest quality information. If you have any comments about this book or any other RS/6000 SP documentation:

- Send your comments by e-mail to mhvrcfs@us.ibm.com. Be sure to include the name of the book, the order number of the book, and, if applicable, the specific location of the text you are commenting on (for example, a page number or table number).
- Fill out one of the forms at the back of this book and return it by mail, by fax, or by giving it to an IBM representative.

Introducing the RS/6000 SP System

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.

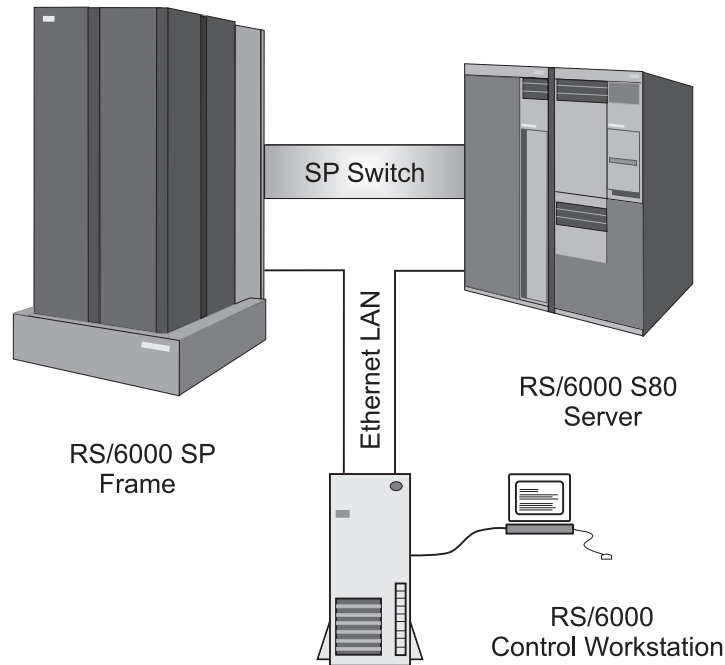


Figure 1. Conceptual RS/6000 SP System

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 *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

The scalable architecture of the SP system, its high-performance communication, POWER3, POWER2, and PowerPC Architecture 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 offering. 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 IBM RS/6000 SP system now offers versatile, high speed network connections using extension nodes. Also, the SP system now offers an optional e-business interface using the IBM RS/6000 7017 Enterprise Server as an SP-Attached Server.

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 sales 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 Intercon-

nect (PCI) architecture, while uniprocessor nodes use Micro Channel Architecture (MCA).

See the following chapters for complete details on the available processor nodes:

High Nodes

- “POWER3 SMP High Node (F/C 2054)” on page 19.

Wide Nodes

- “375 MHz POWER3 SMP Wide Node (F/C 2057)” on page 11.
- “POWER3 SMP Wide Node (F/C 2053)” on page 25.
- “332 MHz SMP Wide Node (F/C 2051)” on page 33.

Thin Nodes

- “375 MHz POWER3 SMP Thin Node (F/C 2056)” on page 15.
- “POWER3 SMP Thin Node (F/C 2052)” on page 29.
- “332 MHz SMP Thin Node (F/C 2050)” on page 37.

SP-Attached Servers

An SP-Attached Server is an IBM RS/6000 7017 Enterprise Server configured to operate with the RS/6000 SP System. Enterprise Servers are available as models S70, S7A, and S80. 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, the SP-Attached Server has both node-like and frame-like characteristics.

For SP system attachment, the Enterprise Server requires the installation of several SP system-specific cables and communications adapters.

For details, see “SP-Attached Server (RS/6000 M/T 7017-S70, S7A, and S80)” on page 41.

Extension Nodes

An extension node is a non-standard node that extends the capabilities of the SP system, but that cannot be used in all of the same ways as a standard node.

Note: SP systems with Extension Nodes require PSSP 2.3 software or later.

Dependent Nodes: One type of extension node is a dependent node. A dependent node depends on SP system nodes for certain functions, but implements much of the switch-related protocol that standard nodes use on the SP Switch. Typically, dependent nodes consist of four major components as follows:

1. A physical dependent node - The hardware device requiring SP system processor node support.
2. A dependent node adapter - A communication card mounted in the physical dependent node. This card provides a mechanical interface for the cable connecting the physical dependent node to the SP system.

3. A logical dependent node - Made up of a valid, unused node slot and the corresponding unused SP system switch port. The physical dependent node logically occupies the empty node slot by using the corresponding SP system switch port. The switch port provides a mechanical interface for the cable connecting the SP system to the physical dependent node.
4. A cable - To connect the dependent node adapter with the logical dependent node. It connects the extension node to the SP system.

One specific type of dependent node is the IBM 9077 SP Switch Router. These optional external devices are used for high-speed network connections or system scaling using HIPPI backbones or other communications subsystems such as ATM or 10/100 Ethernet. (See “SP Switch Routers” on page 5.)

Frames

IBM RS/6000 SP system frames contain and provide power for processor nodes, switches, DASD and other hardware. A frame feature code provides an empty frame with its integral power subsystem and line cord; 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

“Tall Frames – 1.93 m (Model 550, F/C 1550, and F/C 2031)” on page 57.

Short Model and Expansion Frames

“Short Frames – 1.25 m (Model 500 and F/C 1500)” on page 63.

SP Switch Frames

“SP Switch Frames (F/C 2031)” on page 61.

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, planning information for this item is covered in *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*. Included in that book is the latest list of supported control workstations. Also included are the requirements for a high-availability option (**F/C 1245**), which eliminates the control workstation as a single point of failure.

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 69.
- Service Director; a system monitoring and fault reporting application. For details, see “Service Director” on page 71.

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 Switch Cabling” on page 99.

SP Switch Series

SP Switches are available in both 8-port (**F/C 4008**) and 16-port (**F/C 4011**) configurations. For detailed information, see “SP Switches (F/C 4011 and F/C 4008)” on page 73.

SP Switch Routers

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 the SP system and an SP Switch Router adapter mounted in the router. A switch cable is required to complete the connection between the SP switch and the SP Switch Router adapter. For detailed information on the router, its components, and installation requirements, see “RS/6000 SP Switch Router (M/T 9077 04S and 16S)” on page 77.

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 inter-

feres with administrative traffic, you will have to reroute the non-administrative traffic. Further 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 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 “Communication Cabling” on page 91 and *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Communication Cabling

Cables are among the most important things you plan for when you set up 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 “Communication Cabling” on page 91.

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 instead of the SP Switch network for communication between partitions.

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

Use of PCI adapters is limited to the following nodes:

- POWER3 SMP Nodes
- 332 MHz SMP Nodes
- SP-Attached Servers

Use of MCA communication adapters is limited to the following 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 can be found in “PCI Communication Adapters” on page 121.

For MCA-type adapters, see Appendix C, “MCA Communication Adapters” on page 235.

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 107.

For MCA-type adapters, see “MCA Bus Adapter Requirements” on page 117.

Direct Access Storage Devices (DASD)

Direct Access Storage Devices (DASD) can be either of two types as follows:

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

Internal DASD

Internal DASD are installed in the node internal DASD bays. If a node does not use an external boot device, it must be configured with internal DASD. In this configuration, a node has both a minimum requirement and a maximum limit for DASD.

For a complete description, see “Internal DASD” on page 167.

External DASD

Previously, external DASD were used only to extend the storage capacity of processor nodes. However, some later nodes can be configured with no internal DASD. Nodes with external DASD only use them also as the source of boot information. In these applications, external DASD are called **external boot disks**. For a complete description of these features, see “External Boot Disks” on page 172.

For available features to extend node storage, see “External DASD” on page 169.

Installation Site Planning

Electrical Power Planning

“Power and Electrical Requirements” on page 177 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 180 describes the power subsystem.
- “SEPBU Input Power Requirements” on page 182 provides branch circuit information for each frame configuration.
- “Power Line Cord Specifications for SEPBU-equipped Frames” on page 183 describes the line cords provided with each SP system and lists the plugs and connectors required.
- “Planning for Power Requirements of SP Frames and Features” on page 186 discusses SP system component and auxiliary equipment power requirements.
- “Obtaining Power System Backup Devices” on page 177 provides information on obtaining uninterruptible power supplies and dual line cord static transfer switches that are properly matched with your SP system.
- “Upgrading Power Systems in Early SP Frames” on page 189 describes the equipment supplied in the features for upgrading early SP system power subsystems.

Environmental Planning

“Environmental Factors” on page 193 covers the following topics:

- “Environmental Specifications of the RS/6000 SP” on page 193 lists temperature and humidity specifications for the SP system.
- “Acoustical Environment of the RS/6000 SP System” on page 194 has a table listing acoustic emissions of nodes and frames.
- “Evaluating Thermal Output” on page 196 describes the procedures you use to calculate air conditioning requirements for your installation.
- “Evaluating Electromagnetic Interference” on page 199.
- “Evaluating Electrostatic Discharge” on page 199.
- “Frame Tie-down Considerations” on page 200 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, “Floor Plans” on page 203 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 208.
- “Non-Raised Floor Installations” on page 209.

- “Service Clearance Specifications for Frames” on page 211 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 221 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 227 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 229.

375 MHz POWER3 SMP Wide Node (F/C 2057)

Description

375 MHz POWER3 SMP Wide Nodes (F/C 2057) have PCI bus architecture and either two or four 375 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 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 189.

Bus Description

The 375 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 slot group (slots I2 and I3) is composed of the two 32-bit slots on the CPU side of the node. 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. The I1 slot on the CPU side is reserved for the optional SP Switch MX2 Adapter.

Requirements and Options

F/C 2057 Requirements

375 MHz POWER3 SMP Wide Nodes occupy one full node drawer. They can be asymmetrically configured for memory, DASD, 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 DASD (with internal booting)
- An upgraded power system on early-style frames (see "Upgrading Power Systems in Early SP Frames" on page 189 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 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 (only one port can be used at a time)
 - 10Base2 Ethernet (BNC)
 - 10BaseT Ethernet or 100BaseTX Ethernet (RJ45)
- Four DASD 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

375 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.

Table 1. Processor Options for 375 MHz POWER3 SMP Wide Nodes (F/C 2057)

Feature Code	Quantity	Description	Comments
4444	1-2	One processor card with two CPUs	One required

Memory Requirements and Options

375 MHz POWER3 SMP Wide Nodes have two memory cards and require a minimum of 256 MB of memory. These nodes support a maximum of 8 GB of memory. Memory is supplied by 128 or 256 MB DIMMs mounted in pairs. The memory cards are not required to be configured symmetrically. Each card has a 4 GB capacity, with 8 GB addressable per node. Note that with the minimum memory installed (256 MB), the second card contains no DIMMs. Memory cards and DIMMs are not interchangeable between SMP and non-SMP nodes. Memory cards are not interchangeable between 332 MHz and 375 MHz POWER3 SMP nodes.

Table 2. Memory features for 375 MHz POWER3 SMP Wide Nodes (F/C 2057)

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
4119	One Pair of 256 MB DIMMs (512 MB total)	n/a	16 pairs

DASD Requirements and Options

375 MHz POWER3 SMP Wide Nodes can have up to two pairs of internal DASD attached through an integrated Ultra SCSI network. This node can have either no internal DASD (with external booting) or from 4.5 GB 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 DASD bays

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

- Eliminates the DASD 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 154 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 375 MHz POWER3 SMP Wide Nodes does not occupy a PCI slot. 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, 375 MHz POWER3 SMP Wide Nodes require SP Switch MX2 Adapter (**F/C 4023**). For details on this adapter, see “Switch Adapters (F/C 4020, 4022, and 4023)” on page 74.

Switch Restrictions: 375 MHz POWER3 SMP Wide Nodes are not compatible with the older High Performance series of switches. If you install this node into a switch-configured system, you must use an SP Switch or an SP Switch-8.

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.

I/O Adapters

The 375 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 “PCI Bus I/O Adapter Requirements for SMP Nodes” on page 107 and “PCI Communication Adapters” on page 121.

Note: A 100BaseTX, 10BaseT, or 10Base2 adapter for the SP Ethernet is integrated into the node and does not occupy a PCI slot.

375 MHz POWER3 SMP Thin Node (F/C 2056)

Description

375 MHz POWER3 SMP Thin Nodes (F/C 2052) have PCI bus architecture and either two or four 375 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 *Planning Vol. 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 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 189.

Bus Description

The 375 MHz POWER3 SMP Thin Node PCI bus has two 32-bit slots, I2 and I3. The I1 slot is reserved for the optional SP Switch MX2 Adapter.

Requirements and Options

F/C 2056 Requirements

375 MHz POWER3 SMP Thin Nodes occupy one half node drawer. They can be asymmetrically configured for memory, DASD, 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 DASD (with internal booting)
- An upgraded power system on early-style frames (see "Upgrading Power Systems in Early SP Frames" on page 189 for details)

F/C 2056 Options

Available options include the following:

- Four processors in two slots
- 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 (only one port can be used at a time)
 - 10Base2 Ethernet (BNC)
 - 10BaseT or 100BaseTX Ethernet (RJ45)
- Two DASD 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

375 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.

Table 3. Processor Options for 375 MHz POWER3 SMP Thin Nodes (F/C 2056)

Feature Code	Quantity	Description	Comments
4444	1-2	One processor card with two CPUs	One required

Memory Requirements and Options

375 MHz POWER3 SMP Thin Nodes have two memory cards and require a minimum of 256 MB of memory. These nodes support a maximum of 8 GB of memory. Memory is supplied by 128 or 256 MB DIMMs mounted in pairs. The memory cards are not required to be configured symmetrically. Each card has a 4 GB capacity, with 8 GB addressable per node. Note that with the minimum memory installed (256 MB), the second card contains 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 375 MHz POWER3 SMP Thin Nodes.

Table 4. Memory features for 375 MHz POWER3 SMP Thin Nodes (F/C 2056)

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
4119	One Pair of 256 MB DIMMs (512 MB total)	n/a	16 pairs

DASD Requirements and Options

375 MHz POWER3 SMP Thin Nodes can have one pair of internal DASD attached through an integrated Ultra SCSI network. The node can have either no internal DASD (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: No special cables or adapters are required to mount these internal DASD.

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 6225**).

Switch and Communication Adapter Requirements and Options

Switch Adapters

The switch adapter for 375 MHz POWER3 SMP Thin Nodes does not occupy a PCI slot. 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 adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

In switch-configured systems, 375 MHz POWER3 SMP Thin Nodes require SP Switch MX2 Adapter (**F/C 4023**). For details on this adapter, see “Switch Adapters (F/C 4020, 4022, and 4023)” on page 74.

Switch Restrictions: 375 MHz POWER3 SMP Thin Nodes are not compatible with the High Performance series of switches. If you install a this node into a switch-configured system, you must use 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.

I/O Adapters

The 375 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 “PCI Bus I/O Adapter Requirements for SMP Nodes” on page 107 and “PCI Communication Adapters” on page 121.

Note: A 100BaseTX, 10BaseT, or 10Base2 adapter for the SP Ethernet is integrated into the 375 MHz POWER3 SMP Thin Node and does not occupy a PCI adapter slot.

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 DASD 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 22.

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 may 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 DASD (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 switch adapter
- Integrated Ethernet with BNC and RJ45 ports (only one port at a time can be used):
 - 10Base2 Ethernet (BNC)
 - 10BaseT or 100BaseTX Ethernet (RJ45)
- Support for up to six SP Expansion I/O units (**F/C 2055**)
- Two internal DASD bays supporting up to 36.4 GB of mirrored disk storage
- Integrated Ultra SCSI network
- 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 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 5. Processor Options for POWER3 SMP High Nodes (F/C 2054)

Feature Code	Quantity	Description	Comments
4849	1 - 4	One processor card with two CPUs	1 required

Memory Requirements and Options

POWER3 SMP High Nodes have one to four memory cards, a minimum of one GB (8 x 128 MB DIMMs) and a maximum of 16 GB (16 x 8 x 128 MB DIMMs).

Table 6. 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	(8) 128 MB DIMMs	1	16

DASD Requirements and Options

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

Additional DASD can be attached to the POWER3 High Node by using up to six SP Expansion I/O units. Each expansion unit has four DASD bays. For details, see “SP Expansion I/O Unit (F/C 2055)” on page 22.

Optional internal DASD 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 6225**).

Switch and Communication Adapter Requirements and Options

Switch Restrictions

POWER3 SMP High Nodes are not supported with the SP Switch-8. You must use the SP Switch, 16-port (**F/C 4011**).

Note: The POWER3 SMP High Node is not compatible with the older High Performance series of switches. If you install a POWER3 Wide Node 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 “Switch Adapters (F/C 4020, 4022, and 4023)” on page 74.

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 107 and “PCI Communication Adapters” on page 121.

Note: A 10Base2 or 10BaseT/100BaseTX Ethernet adapter for the SP Ethernet 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 POWER3 SMP High Node, providing eight additional PCI adapter slots and four DASD 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.

DASD Options

Each SP Expansion I/O Unit has four DASD bays, supporting one or two pairs of DASD.

SCSI and SSA type DASD **cannot be mixed** within an expansion unit.

Optional DASD pairs for SP Expansion I/O Units are available as follows:

- 9.1 Gigabyte Ultra SCSI disk pair (**F/C 3800**) - requires adapter (**F/C 6206**)
- 18.2 Gigabyte Ultra SCSI disk pair (**F/C 3803**) - requires adapter (**F/C 6206**)
- 9.1 Gigabyte SSA disk pair (**F/C 3802**) - requires adapter (**F/C 6225**)
- 9.1 Gigabyte Ultra SCSI 10K RPM disk pair (**F/C 3805**) - 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**)

Note: Empty, unused DASD bay pairs require a filler plate (**F/C 9612**).

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 189.

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, DASD, 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 DASD (with internal booting)
- An upgraded power system on older frames (see “Planning for Power Requirements of SP Frames and Features” on page 186 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
 - 10BaseT Ethernet or 100BaseTX Ethernet on RJ45
- Four DASD 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 7. 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.

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

DASD Requirements and Options

POWER3 SMP Wide Nodes can have up to four internal DASD attached through an integrated Ultra SCSI network. The POWER3 SMP Wide Node can have either no internal DASD (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 DASD bays

Note: This node does not require special cables or adapters to mount internal Ultra DASD. However, the POWER3 SMP Wide Node has an option (**F/C 1241**) which provides an independent SCSI hookup with the following characteristics:

- Eliminates the DASD 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 154 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 “Switch Adapters (F/C 4020, 4022, and 4023)” on page 74.

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 107 and “PCI Communication Adapters” on page 121.

Note: A 100BaseTX/10BaseT/10Base2 Ethernet adapter for the SP Ethernet is integrated into the SMP Wide Node and does not use 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 *Planning Vol. 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 189.

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, DASD, 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 DASD (with internal booting)
- An upgraded power system on older frames (see "Planning for Power Requirements of SP Frames and Features" on page 186 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
 - 10BaseT Ethernet or 100BaseTX Ethernet on RJ45
- Two DASD 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 9. 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.

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

DASD Requirements and Options

POWER3 SMP Thin Nodes can have up to two internal DASD attached through an integrated Ultra SCSI network. The POWER3 SMP Thin Node can have either no internal DASD (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 DASD.

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 “SP Switches (F/C 4011 and F/C 4008)” on page 73.

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 107 and “PCI Communication Adapters” on page 121.

Note: A 100BaseTX/10BaseT/10Base2 Ethernet adapter for the SP Ethernet is integrated into the POWER3 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 189.

Note: 332 MHz SMP Wide Nodes are not compatible with High Performance switches (F/C 4010 and F/C 4007).

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) is composed of the two 32-bit slots residing on the CPU side of the 332 MHz SMP Wide Node while the second and third group reside on the I/O side of the node. Both the second and third group 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) is made up of the last four 32-bit slots on the I/O side of the node. The third group is a physical extension on the second group. The I1 slot on the CPU side of the node is reserved for the optional SP Switch MX Adapter.

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, DASD, 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 DASD (with internal booting)
- An upgraded power system on older frames (see “Planning for Power Requirements of SP Frames and Features” on page 186 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 10BaseT/10Base2 Ethernet (only one port may be used at a time)
- Four DASD bays supporting up to 36.4 GB of disk storage
- 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 11. Processor Options for 332 MHz SMP Nodes

Feature Code	Quantity	Description	Comments
4320	1-2	One processor card with two CPUs	One required

Memory Requirements and Options

332 MHz SMP Wide Nodes have two memory cards and require a minimum of 256 MB of memory. These nodes will support a maximum of 3 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 GBs of DIMMs, however, only 3 GBs are addressable per node. Memory cards and DIMMs are not interchangeable between SMP and non-SMP wide nodes.

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4093	Base Memory Card	2	2
4110	One Pair of 128 MB DIMMs (256 MB total)	1 pair	12 pair

DASD Requirements and Options

332 MHz SMP Wide Nodes can have up to four internal DASD attached through an integrated SCSI-2 network. The 332 MHz SMP Wide Node can have either no internal DASD (with external booting) or from 4.5 GB up to a maximum of 36.4 GB of internal disk storage.

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 DASD. 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 DASD 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 154 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 SMP wide 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, 332 MHz SMP Wide Nodes require the following switch adapter:

- SP Switch MX Adapter (**F/C 4022**)

For more information on this adapter, see “SP Switches (F/C 4011 and F/C 4008)” on page 73.

332 MHz SMP Wide Node Switch Restrictions: The 332 MHz SMP Wide Node is not compatible with the older High Performance series of switches.

If an SMP wide node is going 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 SMP wide nodes are not interchangeable with switch adapters used on uniprocessor wide nodes.

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 107 and “PCI Communication Adapters” on page 121.

Note: A 10BaseT/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 *Planning Vol. 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 189.

Note: 332 MHz SMP Thin Nodes are not compatible with High Performance switches (F/C 4010 and F/C 4007).

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 SP Switch MX 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, DASD, 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 DASD (with internal booting)

- An upgraded power system on older frames (see “Planning for Power Requirements of SP Frames and Features” on page 186 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 DASD bays supporting up to 18.2 GB of storage
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Two PCI slots for communication adapters
- Integrated 10BaseT/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 13. Processor Options for 332 MHz SMP Nodes

Feature Code	Quantity	Description	Comments
4320	1-2	One processor card with two CPUs	One required

Memory Requirements and Options

332 MHz SMP Thin Nodes have two memory cards and require a minimum of 256 MB of memory. These nodes will support a maximum of 3 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, however, only 3 GB are addressable per node. Memory cards and DIMMs are not interchangeable between SMP and non-SMP thin nodes.

Table 14. Memory features for 332 MHz SMP Thin Nodes (F/C 2050)

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4093	Base Memory Card	2	2
4110	One Pair of 128 MB DIMMs (256 MB total)	1 pair	12 pair

DASD Requirements and Options

332 MHz SMP Thin Nodes can have up to two internal DASD attached through an integrated SCSI-2 network. The 332 MHz SMP Thin Node can have either no internal DASD (with external booting) or from 4.5 GB up to a maximum of 18.2 GB of internal disk storage.

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 DASD.

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, 332 MHz SMP Thin Nodes require the following switch adapter:

- SP Switch MX Adapter (F/C 4022)

For more information on this adapter, see “SP Switches (F/C 4011 and F/C 4008)” on page 73.

332 MHz SMP Thin Node 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 placed into an SP system configured with a switch, that switch must be either an SP switch or an SPS-8 switch.

Switch adapters for 332 MHz SMP Thin Nodes are not interchangeable with switch adapters used on uniprocessor thin nodes.

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 107 and “PCI Communication Adapters” on page 121.

Note: A 10BaseT/10Base2 Ethernet adapter for the SP Ethernet is integrated into the SMP thin node and does not use a PCI slot.

SP-Attached Server (RS/6000 M/T 7017-S70, S7A, and S80)

The SP-Attached Server is an IBM RS/6000 7017 Enterprise Server that is configured to operate with an RS/6000 SP System. This configuration requires the following:

1. Use of an SP-supported Ethernet card for connection to the SP LAN.
2. A custom RS-232 cable, connecting the SP system control workstation to the 7017 SAMI port.
3. A second custom RS-232 cable, connecting the SP system control workstation to the 7017 S1 serial port.
4. For switch-configured systems; the 7017 must have an optional RS/6000 SP System Attachment adapter (**RS/6000 F/C 8396**) installed. This adapter uses an SP Switch cable to connect to a valid switch port on an SP Switch.

With this configuration, the SP-Attached Server enhances the performance of the SP system and provides the scalability needed for e-business applications.

This chapter is divided into the following three sections:

1. "RS/6000 SP-Attached Server (F/C 9122 plus F/C 9123) Overview" describes the Enterprise Server and its system attachment.
2. "RS/6000 SP-Attached Server Installation Requirements" on page 45 describes system and component requirements.
3. "Planning for the RS/6000 SP-Attached Server Network Interface" on page 51 describes the physical connections needed for server attachment.

RS/6000 SP-Attached Server (F/C 9122 plus F/C 9123) Overview

The 7017-S70 Enterprise Server, the 7017-S7A, and the 7017-S80 use RS/6000 feature codes, not RS/6000 SP feature codes. Your IBM sales representative can furnish any feature codes you need to order the options listed in this overview.

The **RS/6000 SP** feature codes associated with the SP-Attached Server (**F/C 9122** plus **F/C 9123**) refer to the **system connections** that attach the RS/6000 Enterprise Server to your RS/6000 SP system, they do not refer to hardware components. Because the Enterprise Servers are stand-alone devices with cable attachments to the SP system, they have some attributes that appear node-like and others that appear frame-like to the SP system.

F/C 9122 Refers to the node-like attachment between the SP-Attached Server and your SP system

F/C 9123 Refers to the frame-like attachment between the SP-Attached Server and your SP system

The 7017-S70, S7A, and S80 servers appear nearly identical to your SP system and they all use F/C 9122 plus F/C 9123 to attach to the SP system. Your IBM sales representative can help you decide which 7017 Enterprise Server best matches your e-business needs.

System Highlights

The 7017-S70, S7A, and S80 Enterprise Servers have the following system characteristics:

- 64-bit symmetric multiprocessing (SMP)
- Systems configurations with 4, 8, or 12-way PowerPC 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 S70 Advanced, and up to 64 GB for the S80
- 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.

7017 Enterprise Server Description

The 7017 Enterprise Servers excel in online transaction processing (OLTP), Enterprise Resource Planning (ERP), server consolidation, Supply Chain Management, and large database server applications. These servers run both 32- and 64-bit applications concurrently. Most existing 32-bit applications run unaltered due to the binary compatibility of AIX.

7017 Enterprise Servers are packaged in two side-by-side units. The first unit is the Central Electronics Complex (CEC) and the second unit is a standard 19-inch I/O tower. Up to three more I/O towers can be added to a system.

The Central Electronics Complex contains the following:

- 64-bit 125 MHz RS64 I processors (S70 Server), 262 MHz RS64 II (S70 Advanced Server), or 450 MHz RS64 III (S80)
- A high-speed multi-path switch
- A memory controller and system memory
- Two high-speed memory ports with a total collective memory bandwidth of up to 5.6 GB per second
- Standard 512 MB ECC SDRAM memory expands to 16 GB (S70 Server), 32 GB (S70 Advanced Server), or 64 GB (S80)
- A base configuration consisting of a 4-way SMP processor card
- Optional 4-way processor cards that scale your configuration to 8-way or 12-way SMP processing

Note: The S80 has 6-way cards and scales up to 24-way.

- 4 MB ECC L2 cache memory per 125 MHz processor, 8 MB per 262 MHz and 450 MHz processor

Each I/O tower accommodates up to two I/O drawers (a maximum of four drawers per system) with additional space for storage and communications subsystems.

The base I/O drawer contains the following:

- A high-performance 4.5GB UltraSCSI disk drive
- A 20X (Max) CD-ROM
- A 1.44 MB 3.5-inch diskette drive
- A service processor
- Eleven available PCI slots
- Two available media bays
- Eleven available hot-swappable disk drive bays

Each additional I/O drawer contains the following:

- Fourteen available PCI slots (nine 32-bit and five 64-bit) providing an aggregate data throughput of 500 MB per second to the I/O hub
- Three available media bays
- Twelve available hot-swappable disk drive bays

When all four I/O drawers are installed, the 7017 contains twelve media bays, forty-eight hot-swappable disk drive bays, and fifty-six PCI slots per system.

How the SP System Views the SP-Attached Server

With a few hardware control exceptions, the SP-Attached Server performs the same functions that standard SP processor nodes perform. However, since the SP-Attached Server is mounted in its own frame and not in an SP frame, the SP system cannot view the SP-Attached Server as just another node. Instead, the SP system views the SP-Attached Server as an object with both frame and node characteristics. The node-like features of the SP-Attached Server are driven by F/C 9122 while the frame-like features of this device are driven by F/C 9123.

Because the SP-Attached Server has both frame and node characteristics, it must have both a frame number and a node number. However, since the SP-Attached Server does not have full SP frame characteristics, it cannot be considered as a standard SP expansion frame. Thus, when you assign the frame number to the SP-Attached Server, you must observe two rules as follows:

1. The SP-Attached Server cannot be the first frame in the SP system.
2. The SP-Attached Server cannot be inserted between a switch configured frame and any non-switched expansion frame using that switch.

As an example, consider that frames one and five of an SP system are switch configured. Frame two is a non-switched expansion frame attached to frame one. Frame six, seven, and eight are non-switched expansion frames attached to frame five.

In this configuration, an SP-Attached Server could be given frame number three, but that would forbid any future attachment of non-switched expansion frames to the switch in frame one.

If you assigned the SP-Attached Server frame number nine, your system could still be scaled using other switch configured frames and non-switched expansion frames.

The SP-Attached Server can be inserted between two switch-configured frames.

Note: Once the frame number has been assigned, the node number of the server (which is based on the frame number) is automatically generated. The following system defaults are used:

- a. The SP-Attached Server is viewed by the system as a single frame containing a single node.
- b. The system places the node-like features of the server in the slot one position.
- c. Each SP-Attached Server installed in an SP system subtracts one node from the total node count allowed in the system; however, because the SP-Attached Server has frame-like features, it reserves sixteen node numbers that are used in determining the node number of nodes placed after the attached server.

Server Attachment Limits

When you attach a 7017 Enterprise Server to an SP system, certain limitations apply as follows:

1. The first frame in the SP system must be an SP frame containing at least one node.
2. You can attach up to sixteen 7017 Enterprise Servers onto an RS/6000 SP system.
3. Each SP-Attached Server requires one valid, unused node slot in the SP system for switch port assignment.

An assigned switch port is required in both switch-configured and switchless SP systems. For information on configuring the SP-Attached Servers, see “Assigning a Frame Number” on page 50 and “Assigning a Switch Port Number” on page 50.

4. 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 7017 Enterprise Servers.

In this example, you can attach six of the Enterprise Servers to the first frame and two Enterprise Servers to the second SP frame. As an alternative, all eight SP-Attached Servers can be connected to the second SP frame.

5. 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 nodes, additional SP frames can be empty.

6. Each SP-Attached Server counts as one node that must be subtracted from the total node count of 128 allowed in an SP system.
7. Each SP-Attached Server also counts as one frame that must be subtracted from the total frame count allowed in an SP system.

RS/6000 SP-Attached Server Installation Requirements

There are several requirements for hardware and software that must be met before you can place the SP-Attached Server into service with your SP system. These requirements are in the following categories:

- System requirements
- Physical requirements
- Switch adapter requirements
- Network media card requirements
- Software requirements

SP-Attached Server SP System Requirements

The following requirements must be met before you can place the SP-Attached Server into service:

1. Your SP system must be operating with a minimum of PSSP 3.1 and AIX 4.3.2.
Each SP-Attached Server also requires its own PSSP license. See “SP-Attached Server Software Requirements” on page 49 for details and system configuration requirements.
2. Your SP system must be a tall frame system. (Short frames are not compatible with the SP-Attached Server.)
3. The SP-Attached Server must not be the first frame in an SP system.
4. The system can be switched or non-switched.
5. If your SP system is switched, it must use 16-port SP Switches (F/C 4011). (The SP Switch-8 is not compatible with the SP-Attached Server.)
A special switch adapter must be installed. For details, see “SP-Attached Server Switch Adapter Requirements” on page 47.
6. Three control workstation connections are required as follows:
 - a. The SP-LAN connection from the control workstation must use an SP supported Ethernet card mounted in the SP-Attached Server.
 - b. A custom RS-232 cable must connect the SP system control workstation to the SP-Attached Server SAMI port.
 - c. A second custom RS-232 cable must connect the SP system control workstation to the SP-Attached Server S1 serial port.

For information on these connections see “Connecting the SP-Attached Server to the Control Workstation” on page 52.

7. To ensure that the entire SP system is at the same electrical potential, the frame-to-frame ground cables provided with your SP system must be connected between the SP system and the SP-Attached Server.

8. Some cables used with your SP-Attached Server have limited lengths. You must keep those lengths, and any required cable drops, in mind when locating your SP-Attached Server in relation to other SP system equipment.

SP-Attached Server Physical Requirements

Physical Dimensions and Weight of the SP-Attached Server

The SP-Attached Server has two modules:

1. The Central Electronics Complex (CEC)
2. The I/O Towers

The CEC contains processors and system memory. I/O towers contain DASD and I/O planars. Each SP-Attached Server consists of one CEC unit and at least one I/O tower. The first I/O tower has ports used to connect the control workstation and up to three additional I/O towers. Table 15 and Table 16 provide information on the physical dimensions and weights of these SP-Attached Server modules.

<i>Table 15. Physical Dimensions of SP-Attached Server</i>		
Specification	Central Electronics Complex	I/O Towers
Width	567 mm (22.3 in.)	648 mm (25.5 in.)
Depth	1041 mm (41 in.)	1019 mm (40.1 in.)
Height	1575 mm (62 in.)	1575 mm (62 in.)

<i>Table 16. Weight Specification of SP-Attached Server</i>			
Specification	Central Electronics Complex	I/O Towers	I/O Drawer (max. four per tower)
Weight	400 kg (880 lbs.) fully loaded	130 kg (286 lbs.) basic tower	61 kg (135 lbs.) max. wt.

Power Requirements for SP-Attached Servers

If you use the SP-Attached Server as an integral part of your SP system, you must plan for the power requirements of each unit. Table 17 on page 47 provides information on the basic power requirements of the two SP-Attached Server modules.

<i>Table 17. Power Specification of SP-Attached Server</i>			
Specification	Central Elec- tronics Complex	I/O Towers	I/O Drawer (max. four per tower)
Electrical Load	1887 VA	Power require- ments for each I/O tower are based on the number of I/O drawers installed.	based on configuration
Voltage Requirement	200-240 V ac (50-60 Hz)		200-240 V ac (50-60 Hz)
Power Requirement	1698 W (max.)		360 W (typ.) 900 W (max.) (per drawer)
Thermal Load	5796 BTU/Hr		1228 BTU/Hr (typ.) 3071 BTU/Hr (max.) (per drawer)
Power Factor	0.9		0.9
Phase Con- nection	Depends on local requirements		Depends on local requirements
Line Cord Termination			
Note: For complete RS/6000 Machine Type 7017 power planning information, you must refer to: <i>Site and Hardware Planning Information</i> , SA38-0508.			

SP-Attached Server Environmental Specifications

The SP-Attached Server has the following specifications which you need to plan the operating environment:

Maximum Altitude:	2133 m (7000 ft.)
Operating Temperature:	10 to 37.8° C (50 to 100° F)
Non-operating Temperature:	1.0 to 60.0° C (34 to 140° F)
Non-condensing Humidity:	8 to 80%
Wet Bulb Temperature:	23° C (73° F)
Noise Emissions:	7.0 BELs (operating and non-op., LWAD Cat 3C)

SP-Attached Server Switch Adapter Requirements

RS/6000 SP System Attachment Adapter (RS/6000 F/C 8396)

If you install an SP-Attached Server into a system which uses SP Switches, you must install an SP Switch adapter in the SP-Attached Server. However, unlike the SP Switch Router, which can have several router-specific switch adapters installed, the SP-Attached Server must have only one server-specific switch adapter installed for each server system. The adapter you use to connect the SP-Attached Server to the SP Switch is called the RS/6000 SP System Attachment adapter (**RS/6000 F/C 8396**). Because the RS/6000 SP System Attachment adapter is not an SP system adapter, you must order it using an RS/6000 feature code.

The single RS/6000 SP System Attachment adapter you place into each SP-Attached Server 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 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 must not attach an RS/6000 SP System Attachment adapter to that frame until you remove a node and delete its configuration from the system image.

2. One media card slot (slot 10) in the primary (first) I/O tower of SP-Attached Server.

For other limitations, see “RS/6000 SP System Attachment Adapter Placement Restrictions.”

RS/6000 SP System Attachment Adapter Placement Restrictions

The RS/6000 SP System Attachment adapter has the following placement restrictions:

1. The RS/6000 SP System Attachment adapter must be installed in slot 10 of the SP-Attached Server I/O tower.
2. Slot 9 must be left open to ensure the adapter has sufficient bandwidth.
3. Slot 11 must be left open to provide clearance for the switch adapter heat sinks.

Installing an RS/6000 SP System Attachment adapter in existing 7017 Enterprise Servers: If you attach an existing 7017 Enterprise Server to an SP System, you might find a SCSI adapter installed in slot 9 of the server. This SCSI adapter must be relocated. However, the SCSI adapter in slot 9 is typically connected to a boot device and requires special attention **before** it is removed.

Boot Device SCSI Adapter Relocation Overview

1. Boot-up the Enterprise 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 Enterprise 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.

RS/6000 SP System Attachment Adapter Cables

When you order the RS/6000 SP System Attachment adapter, you must also order the following cable:

- A 10 meter switch cable (**F/C 9310**) (connects the RS/6000 SP System Attachment adapter to a valid switch port on the SP Switch).

There are no optional cables for the RS/6000 SP System Attachment adapter.

Note: Although the SP System Attachment adapter is ordered with the Enterprise Server, you must order the 10 m cable (F/C 9310) with the SP system.

SP-Attached Server Network Media Card Requirements

Each network media card requires one media card slot in the SP-Attached Server. All network adapters in the SP-Attached Server use PCI architecture.

PCI Adapter Restriction

Only SP system supported PCI adapters can be used in a 7017 Enterprise Server when it is used as an SP-Attached Server. Thus, if you attach an existing RS/6000 7017 Enterprise Server to an SP system, you must remove any non-SP system supported PCI adapters.

Note: Rules for supported PCI adapters, such as the following, can be found in the RS/6000 7017 Enterprise Server documentation:

- Required adapters (including minimum requirements)
- Maximum quantity of each adapter allowed
- Bus placement restrictions

For a complete listing and detailed specifications of currently supported SP system adapters, see “PCI Communication Adapters” on page 121. With the exception of the RS/6000 SP System Attachment adapter (which is supported); if an adapter does not appear in the list, it is not supported for the SP-Attached Server. If you plan to use an existing Enterprise Server and any installed adapters do not appear in this list, they must be removed before it can be attached to the SP system.

Note: F/C 2985 and 2987 have placement restrictions when used as the SP-LAN adapter. See “Attaching the SP-LAN Ethernet” on page 52 for more information.

SP-Attached Server Software Requirements

The SP-Attached Server requires an SP system operating with the following software levels:

- PSSP 3.1 (or later)
- AIX 4.3.2 (or later)

Notes:

1. 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.
2. If you attach an **existing** Enterprise Server, and that server is connected to an

IPv6 network, you must remove the server from the network before making the SP attachment.

Each SP-Attached Server also requires its own PSSP license. PSSP is available in the following formats:

- **F/C 5800** (4 mm tape)
- **F/C 5801** (8 mm tape)
- **F/C 5802** (CD-ROM)

Software Configuration Requirements

The SP-Attached Server requires two software inputs for network configuration:

1. Assigning a frame number
2. Assigning a switch port number

Assigning a Frame Number: SP-Attached Servers are fully integrated into the PSSP software and appear similar to regular processor nodes to the PSSP software. This is in contrast to dependent nodes like the SP Switch Router which are mostly ignored by the PSSP software. Also, unlike the SP Switch Router, the SP-Attached Server must be assigned a frame number.

The SP-Attached Server frame number must be manually configured because the server has frame-like characteristics but does not have a frame supervisor card. When you assign the frame number, observe the following:

1. Do not make the SP-Attached Server the first frame in the SP system.
2. The assigned frame number cannot be a number that comes between the number assigned to a switch-configured frame and the frame numbers assigned to any non-switched expansion frames attached to the switch-configured frame.
3. You can select any frame number up to the maximum number of frames allowed, provided it does not violate the first two points.
4. Specify the hardware protocol (SAMI) for the SP-Attached Server.

For more information on this topic see “How the SP System Views the SP-Attached Server” on page 43.

Assigning a Switch Port Number: Regardless of whether your SP system is switch-configured or switchless, you must assign a switch port number to the SP-Attached Server.

- For a switch-configured SP system, this number can be any valid, unused switch port in the SP system.

For specific details, see “Connecting the SP-Attached Server to the SP Switch” on page 54.

- For a switchless SP system, an unused node slot is required in the SP frame associated with the SP-Attached Server.

For specific details, see “Software Configuration in a Switchless System” on page 51.

Why You Must Assign a Switch Port Number

With a standard SP frame, once the frame number is assigned, the PSSP software generates the node numbers. Also, a configuration algorithm determines the switch port assignment for any non-switched expansion frame attached to the switch-configured frame.

With an SP-Attached Server, the PSSP software generates the node numbers but cannot assign a switch port number, because the software does not see the server as a standard non-switched expansion frame. As a result, you must assign the switch port number.

Software Configuration in a Switchless System: SP-Attached Servers can be installed in a switchless SP system. You install and configure SP-Attached Servers in these systems just as you would in a switch configured system. The only difference occurs in assigning a switch port number to the server. In a switch configured system, the switch port number you assign must be any valid, unused switch port. In a switchless system, you must calculate the switch port number.

This calculation is required even though a switchless system does not have a switch, and the SP-Attached Server does not require an RS/6000 SP System Attachment adapter. In a switchless system, the switch port number is assigned to the SP-Attached Server based on availability of a valid, open node slot in the system.

To determine what switch port you must assign to the SP-Attached Server, use the following formula:

$$\text{switch_port_number} = ((\text{frame_number_of_associated_SP_frame} - 1) \times 16) + \text{assigned_node_slot_number}$$

In this formula, the associated SP frame contains the valid, open node slot you are assigning to the SP-Attached Server. Even though the SP-Attached Server is not directly connected with this SP frame, the number of that frame and the number of the open node slot are used to calculate the switch port number.

Planning for the RS/6000 SP-Attached Server Network Interface

There is a maximum number of SP-Attached Servers that can be connected to an SP system. See “Server Attachment Limits” on page 44 for more information.

The SP-Attached Server requires a minimum of four connections with your SP system in order to establish a functional and safe network. If your SP system is configured with an SP Switch, there are five required connections as follows:

1. Three connections with the control workstation:
 - a. An Ethernet connection to the SP-LAN for system administration purposes. For cable details, see “Attaching the SP-LAN Ethernet” on page 52.
 - b. A custom RS-232 cable, connecting the SP system control workstation to the SP-Attached Server SAMI port, using IBM supplied 15 m (49 ft.) cable.

- c. A second custom RS-232 cable, connecting the SP system control workstation to the SP-Attached Server S1 serial port, using IBM supplied 15 m (49 ft.) cable.

For details on these connections, see “Connecting the SP-Attached Server to the Control Workstation.”

2. The fourth connection is a 10 m (33 ft.) frame-to-frame electrical ground cable.

The SP-Attached Server must be connected to the SP frames with an IBM supplied grounding cable. This cable is supplied with the SP system when you order F/C 9122 and F/C 9123.

The frame-to-frame ground is required in addition to the SP-Attached Server electrical ground. The frame-to-frame ground maintains the SP system and the SP-Attached Server at the same electrical potential.

3. The fifth connection is required only if the SP system is switch-configured. In switched systems, the SP-Attached Server must also have an optional RS/6000 SP System Attachment adapter (RS/6000 F/C 8396) installed. This adapter uses a 10 m SP Switch cable to connect to a valid switch port on an SP Switch.

For details, see “Connecting the SP-Attached Server to the SP Switch” on page 54.

SP-Attached Server Placement Limitations

Placement of the SP-Attached Server is limited by the length of its following supplied cables:

1. The 10 m (33 ft.) frame-to-frame ground cable and RS/6000 SP System Attachment adapter cable
2. The 15 m (49 ft.) RS-232 cables
3. The 15 m (49 ft.) BNC Ethernet cable

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 7 m (23 ft.) from the SP frame and no more than 12 m (40 ft.) from the control workstation.

Connecting the SP-Attached Server to the Control Workstation

The SP-Attached Server requires three connections to the control workstation. These connections are:

1. An Ethernet connection to the SP-LAN for system administration purposes.
2. A custom RS-232 cable connecting the SP system control workstation to the SP-Attached Server SAMI port.
3. A second custom RS-232 cable connecting the SP system control workstation to the SP-Attached Server S1 serial port.

Attaching the SP-LAN Ethernet

Two Ethernet adapters are supported for SP-LAN Ethernet communication. These adapters are:

1. 10 MB BNC/RJ-45 Ethernet (**F/C 2985**); ordered with the 7017 Enterprise Server.

Requires one **F/C 9222** for each SP-Attached Server; ordered with the SP system (configures BNC connection to server); includes a 15 m BNC Ethernet cable.

For details on this adapter, see “10Base2 and 10BaseT (BNC/RJ-45) Ethernet LAN PCI Adapter (F/C 2985)” on page 144.

2. 10 MB AUI/RJ-45 Ethernet (**F/C 2987**); ordered with the 7017 Enterprise Server.

Requires one **F/C 9223** for each SP-Attached Server; ordered with the SP system (configures twisted pair connection to server). The customer must supply all twisted pair Ethernet cables.

For details on this adapter, see “10Base5 and 10BaseT (AUI/RJ-45) Ethernet LAN PCI Adapter (F/C 2987)” on page 146.

SP-LAN Ethernet Connection

The adapter you select (F/C 2985 or F/C 2987) must match the configuration of the SP-LAN on your SP system. These adapters must be placed in the en0 position of the SP-Attached Server (the lowest numbered Ethernet bus slot in the first I/O tower).

Although the 10/100 MB Ethernet adapter (F/C 2968) is an SP supported Ethernet adapter, it is not supported for SP-LAN communication. F/C 2968 can be used in other slots in the SP-Attached Server, but it must not be used in the en0 position.

Ethernet Adapter Restrictions: If you attach an existing 7017 Enterprise Server to an SP System, you must place an SP-LAN Ethernet adapter in the en0 position inside the SP-Attached Server. Because the Ethernet adapter in this slot must be configured for SP communications, any non-SP supported Ethernet adapter that is in this slot must be removed.

Also, even if the Ethernet adapter in en0 is either F/C 2985 or F/C 2987, the adapter must be de-configured and then reconfigured as an SP-LAN Ethernet adapter.

Attaching the RS-232 to the SP-Attached Server

Two RS-232 connections must be made from the control workstation to the SP-Attached Server. These connections go to the following ports on the SP-Attached Server:

1. SAMI port in the control panel on the front of the CEC (uses an IBM-supplied 15 m custom RS-232 cable).
2. S1 serial port on the rear of the primary (first) I/O tower (uses an IBM-supplied 15 m custom RS-232 cable).

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 69.

Note: The 16-port asynchronous adapter (F/C 2955) used in MCA control workstations is not compatible with the SP-Attached Server.

Configuring Service Director

Service Director is a set of IBM software applications supplied with the SP system and with the 7017 Enterprise Server. Service Director monitors the “health” of these systems (for more information see “Service Director” on page 71).

In a typical Enterprise Server installation, Service Director transmits reports through a modem supplied with the unit. However, when the 7017 Enterprise Server is used as an SP-Attached Server, the modem supplied with the 7017 is not used. In an SP installation, the SP-Attached Server acts like an SP system node and forwards its Service Director messages to the SP system. When the SP system receives messages from the SP-Attached Server, the messages are transmitted through the Service Director modem.

To configure Service Director for the SP-Attached Server you must perform the following:

1. Configure the SP-Attached Server as a Machine Type 7017 in Service Director (must be done manually).
2. Configure Service Director on the SP-Attached Server to forward messages to the SP system (the modem supplied with the 7017 Enterprise Server is not used).
3. Configure Service Director on the SP system to forward messages received from the SP-Attached Server (the Service Director modem on the SP system is attached to the control workstation or other local server).

Connecting the SP-Attached Server to the SP Switch

If your SP system is configured with an SP Switch, the SP-Attached Server requires a connection between the SP Switch and the server. To make this connection your system requires the RS/6000 SP System Attachment adapter (**RS/6000 F/C 8396**). This adapter occupies three media card slots in the SP-Attached Server. For specific details on configuring the RS/6000 SP System Attachment adapter, see “SP-Attached Server Switch Adapter Requirements” on page 47.

Once the adapter is installed in the SP-Attached Server, the 10 m switch cable (**F/C 9310**) must be attached to a valid switch port on the SP Switch. The general steps for choosing a valid SP Switch port are outlined here.

Selecting a Valid Switch Port

In a switch-configured SP system, each SP-Attached Server requires one RS/6000 SP System Attachment adapter. **Only one switch adapter** can be used per server. Each of these RS/6000 SP System Attachment adapters 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 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 *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Examples of Using an Empty Node Slot Position: As an example, consider the use of an empty node slot position in a single-frame system with a switch and 14 thin nodes located in slots 1 through 14. This system has two unused node slots in position 15 and 16. These two empty node slots have corresponding switch ports which provide valid connections for the RS/6000 SP System Attachment adapter.

For another example, consider 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.

For a four-frame system with one 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. Thus, the system has two valid switch ports associated with system node numbers 57 and 61.

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

Examples of Using Node Slot Positions Within a Wide Node or High Node:

As an example, consider a single frame with a 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 RS/6000 SP System Attachment adapter.

For a second example, consider a single-frame system with a switch, twelve thin nodes in slots 1 through 12, and a high node in slot 13. A high node occupies four slots but only uses 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 *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Tall Frames – 1.93 m (Model 550, F/C 1550, and F/C 2031)

Tall Frame Overview

Tall frames are available in three variations:

- Tall **model** frames (Model 550)
- Tall **expansion** frames (F/C 1550)
- SP Switch frames (F/C 2031)

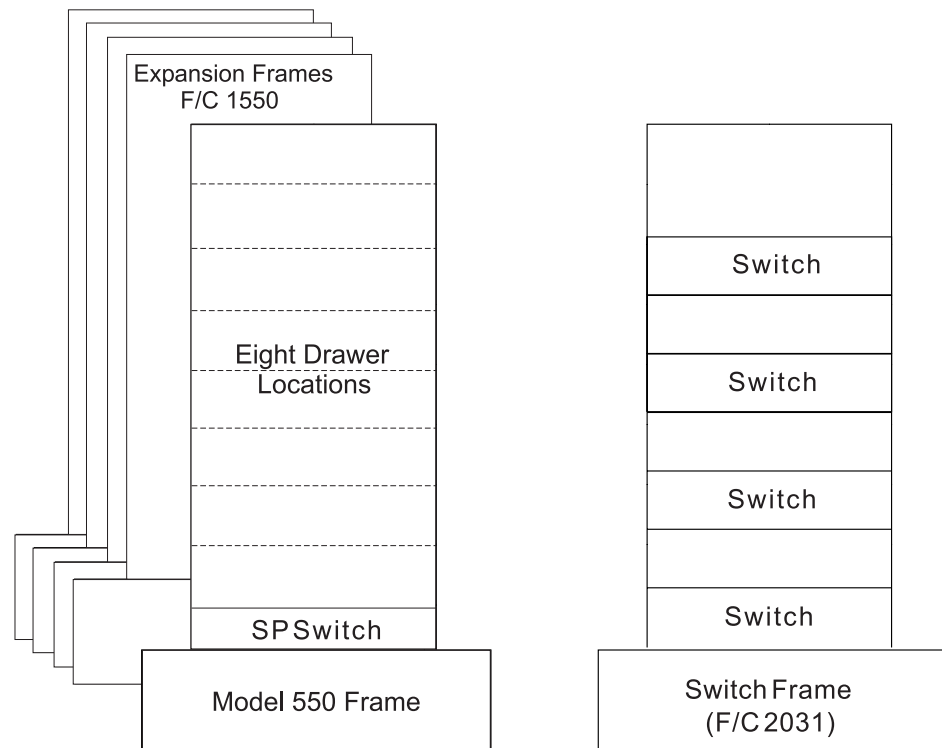


Figure 2. Model 550 System with Frame-Mounted SP Switch, Four Expansion Frames, and an SP Switch Frame

Tall frames have eight drawers and can house up to sixteen thin nodes, eight wide nodes, or four high nodes. All node types can be mixed in these frames. They also accommodate a switch. 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 all SP processor nodes. The SEPBU is equipped with redundant (N+1) power supply modules; if one module fails, another takes over. The self-regulating SEPBU's are designed for concurrent maintenance; a failed power module can be removed and repaired without interrupting running processes on the nodes.

Early-style tall 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 189.

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.

When you order a frame feature, you receive the frame with its integral SEPBU and ac power line cord. All nodes, switches, and other auxiliary equipment must be ordered separately.

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.

All processor nodes and optional switches must be purchased 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. Some of these configurations use switches and some do not.

Model 550 Non-Switched Configuration

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

Model 550 SP Switch-8 Configuration

This configuration consists of 1-8 processor nodes mounted in one 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. In this configuration, each node requires either an SP Switch Adapter (F/C 4020), an SP Switch MX Adapter (F/C 4022), or an SP Switch MX2 Adapter (F/C 4023). Nodes in the non-switched expansion frames share unused switch ports in the model frame.

Model 550 Single-Stage SP Switch Configuration

This configuration consists of 1-80 processor nodes mounted in one required Model 550 frame equipped with a sixteen-port SP Switch (F/C 4011). Depending on the number of nodes in your system, up to four switched expansion frames (four F/C 1550 plus four F/C 4011) can be added to the system.

Single-stage system configurations can also utilize non-switched expansion frames (F/C 1550). Nodes in the non-switched expansion frames share unused switch ports both in the model frame and in the switched expansion frames.

In single-stage switch configurations, all nodes require either an SP Switch Adapter (F/C 4020), an SP Switch MX2 Adapter (F/C 4023), or an SP Switch MX2 Adapter (F/C 4023). No more than 64 of the 80 nodes in these systems can be high nodes.

Model 550 Two-Stage SP Switch Configuration

The standard two-stage switch configuration has 65-128 processor nodes. No more than 64 of the 128 nodes can be high nodes. All nodes in the system must have either an SP Switch Adapter (F/C 4020) or an SP Switch MX2 Adapter (F/C 4023).

These nodes are mounted in one required Model 550 frame equipped with a sixteen-port SP Switch (F/C 4011) and in switched expansion frames (F/C 1550 plus F/C 4011). The SP Switches in these frames form the first switching layer.

This system configuration also requires an SP Switch frame (F/C 2031) which forms the second switch layer. The second stage switches in the SP Switch frame are used for high-performance parallel communication between the SP switches mounted in the model frame and in switched expansion frames. Switch traffic is carried through concurrent data transmissions using the Internet Protocol (IP). See “Switch Overview” on page 73 for more information on the switch.

Two-stage switch system configurations can also utilize non-switched expansion frames (F/C 1550). Nodes in the non-switched expansion frames share unused switch ports in the model frame and in switched expansion frames.

Note: Alternate two-stage switch configurations mounting fewer than 65 nodes or more than 128 nodes are available. Two-stage configurations using less than 65 nodes are simpler to scale up when you add more switches than are single-stage switch configurations. Consult your IBM representative for more information.

Expansion Frames (F/C 1550)

Used in Model 550, 3BX, 20X, 30X, 40X, and 55H systems, F/C 1550 is a tall frame with eight empty node drawers and a SEPBU power supply. All processor nodes and optional switches must be purchased separately for these frames. An SP Switch and up to sixteen thin nodes, eight wide nodes, or four high nodes can be installed in these frames.

F/C 1550 is the base offering for the 1.93 m (75.8 inch) SP expansion frame. These frames are equipped with a 10.5 kW three-phase SEPBU self regulating power subsystem. All 1.93 m frames have eight empty node drawers for separately purchased nodes. Up to sixteen thin nodes, eight wide nodes, or four high nodes can be installed in these frames.

You must populate each expansion frame with optional SP switches and nodes as permitted by system configuration rules. These configuration 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 your SP model frame is configured.

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

1. An expansion frame configured with processor nodes only; known as a ***non-switched expansion frame***.

2. An expansion frame configured with processor nodes and an SP switch; known as a **switched expansion frame**.

Non-Switched Expansion Frame Terminology

Non-switched expansion frames were sometimes previously referred to as “logical switch expansion frames.”

Both of these terms indicate a shared-switch frame set. The frames of a shared-switch frame set include the first frame (containing the switch) and one or more additional frames which do not contain a switch. The additional frames share the switch of the first frame in the set.

For more information on selecting valid switch ports and configuring shared-switch framesets, refer to *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Uniprocessor and SMP Thin Node Pair Alert

Frames which have uniprocessor thin nodes cannot be used as non-switched expansion frames. Similarly if a frame has uniprocessor thin nodes and a switch with unused switch ports, it cannot have a non-switched expansion frame attached to the unused switch ports. Frames having uniprocessor thin nodes require an SP switch for expansion.

SMP thin nodes can, however, be used as single thin nodes. Frames having **single** SMP thin nodes **only** can be used for expansion and switch sharing. However, if a pair of SMP thin nodes is used, uniprocessor thin node rules apply to expansion and switch sharing.

Using F/C 1550 Non-Switched Expansion Frames

A non-switched expansion frame is defined as 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:

- Configurations using Model 550 frames equipped with processor nodes and a switch.
- Configurations using switch-configured Model 550 frames and F/C 1550 expansion frames equipped with processor nodes and a switch (switched expansion frames).
- Model 550 frames equipped with processor nodes only.

Non-Switched Expansion Frames Used 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.

One example of an under-utilized switch would be a tall frame with eight wide nodes and an SP Switch. In this example, 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 switch-configured frame to take advantage of the eight unused switch ports. In these cases, node-to-node data transfers are completed through the switch.

Note: If the switch used in this configuration is an SP Switch-8, the nodes must be placed sequentially in this system configuration. Empty node drawers are not allowed. If the switch is a 16-port SP Switch, nodes can be placed in any order and empty drawers are permissible; however, node-to-node Ethernet BNC jumper cables might be too short if a drawer is left empty.

Non-Switched Expansion Frames Used with Frames Containing Processor Nodes Only

Non-switched expansion frames (configured with processor nodes only) can be added to the Model 550 SP frame to take advantage of unused node slots. In these cases, node-to-node data transfers are completed over the SP LAN.

Using F/C 1550 Switched Expansion Frames

A switched expansion frame is defined as a base offering expansion frame equipped with 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 your SP system into a system containing up to 80 nodes. See “Model 550 Single-Stage SP Switch Configuration” on page 58 for more information.

If your SP system uses two-stage switching, you can scale your SP system even larger. In these systems, 128 nodes (or more) are supported. See “Model 550 Two-Stage SP Switch Configuration” on page 59 for more information.

SP Switch Frames (F/C 2031)

An SP Switch Frame (F/C 2031) is a base tall frame with integral SEPBU power supply, equipped with four SP Switches but no processor nodes. The SP Switch Frame is a mandatory prerequisite for systems using more than five SP Switches; it interconnects the switches in model frames and in expansion frames. Note that SP Switch Frames transfer data only within the local SP system.

An SP Switch Frame with four SP Switches 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 information on the advantages of installing an SP Switch Frame into a smaller system, see “Considerations for Future Switch Expansion” on page 100.

SP Switch Frames can be used in special-order systems which have more than 128 nodes using RPQ 8P2006; for more information, consult your IBM sales representative.

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)

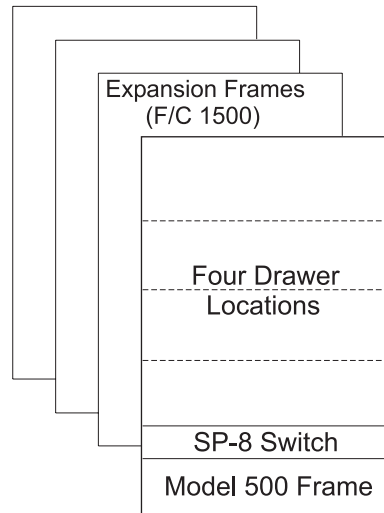


Figure 3. Model 500 System with Optional SP Switch-8 and Three Expansion Frames

Short frames have four drawers and can house up to eight thin nodes or four wide nodes. All node types can be directly installed as long as configuration rules are not violated. However, note that POWER3 SMP High Nodes cannot be installed in these frames due to a depth limitation. Short frames can also accommodate an eight-port switch. All 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 the short-frame SEPBU. With this option, if one power supply fails, another takes over. These self-regulating SEPBU units with the N+1 feature are also designed for concurrent maintenance; if a power supply module fails, it 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 189.

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.

When you order a frame feature, you receive the frame with its integral SEPBU and ac power line cord. All nodes, switches, and other auxiliary equipment must be ordered separately.

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.

All processor nodes and the optional switch must be purchased 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 the Model 500 frame. 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 a single 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). In this configuration, each node requires either an SP Switch Adapter (F/C 4020), an SP Switch MX Adapter (F/C 4022), or an SP Switch MX2 Adapter (F/C 4023).

Nodes in the non-switched expansion frames (F/C 1500) share unused switch ports in the model frame. When short frames are used in a switched configuration, only the Model 500 frame can be equipped with a switch. SP switches cannot be mounted in the F/C 1500 frames.

Expansion Frames (F/C 1500)

F/C 1500 is the base offering for the 1.25 m (49 in.) SP expansion frame. These frames are equipped with a 5.0 kW single-phase SEPBU self-regulating power subsystem. All 1.25 m frames have four empty node drawers for separately purchased nodes. Up to eight thin nodes, four wide nodes, or two high nodes can be installed in these frames.

Note: Switches cannot be mounted in F/C 1500 expansion frames.

You must populate each expansion frame with optional nodes as permitted by system configuration 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 your SP model frame is configured.

F/C 1500 expansion frames can only be configured with processor nodes. Expansion frames that are configured with processor nodes only are known as a ***non-switched expansion frames***.

Using F/C 1500 Non-Switched Expansion Frames

Model 500, 2AX, 3AX, or 50H SP systems can be fully utilized using F/C 1500 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 F/C 1500 non-switched expansion frames. The model frame can be either of the following:

- Configured with processor nodes and a switch
- Configured with processor nodes only

Expansion Frame Terminology

“Non-switched expansion frames” were sometimes previously referred to as “logical switch expansion frames.”

Both of these terms indicate a shared-switch frame set. The frames of a shared-switch frame set include the first frame (containing the switch) and one or more additional frames which do not contain a switch. The additional frames share the switch of the first frame in the set.

For more information on selecting valid switch ports and configuring shared-switch frame sets, refer to *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Configurations with Processor Nodes and a Switch

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

One 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. In this case, you can add non-switched expansion frames to the model frame 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 in sequence in this system configuration. Empty node drawers are not allowed.

Configurations with Processor Nodes Only

Non-switched expansion frames can be added to the Model 500 SP frame configured with processor nodes only (no switch) 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 F/C 1500 non-switched expansion frames. In these systems node-to-node data transfers are completed over the SP LAN.

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.

Previously-purchased Workstation Alert

If you intend to use a previously-purchased RS6000 workstation that you have been using for other applications, IBM suggests that you perform the following steps prior to integrating it into your SP system as a control workstation:

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

IBM also suggests that you 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 an RS/6000 control workstation with a color monitor. A list of supported control workstations and their requirements and options can be found in *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*. 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

These workstations can also have either four or eight-mm tape drives.

Control workstations must be connected to each SP system frame through both an RS-232 cable and an SP Ethernet BNC cable. These 15 meter (49 ft.) cables are

supplied with each frame. Thus, the control workstation and SP frames must be no more than 12 m apart, leaving 3 m of cable for the vertical portion 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.

All SP-attached servers must also be connected to the control workstation. However, each SP-attached server requires two RS-232 connections as well as the SP LAN Ethernet connection. See “Planning for the RS/6000 SP-Attached Server Network Interface” on page 51 and “Connecting the SP-Attached Server to the Control Workstation” on page 52 for details.

Note: Most PCI control workstations provide either a 10BaseT or AUI connection for the SP Ethernet LAN. If you are attaching to nodes or SP-attached servers using BNC connections, ensure that you order the appropriate transceiver.

Some newer 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.

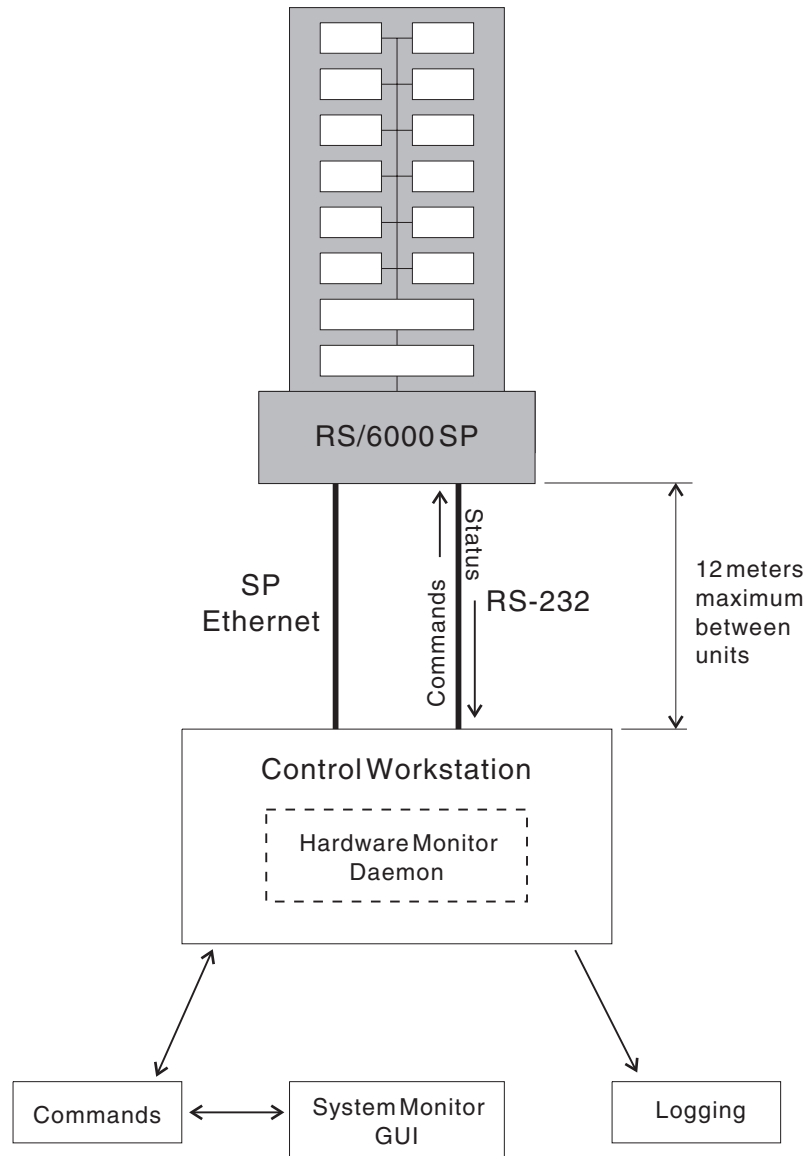


Figure 4. Control Workstation. The customer-supplied control workstation is the point of control for the RS/6000 SP system. The control workstation and all SP processor nodes run both the AIX operating system and the SP system software (PSSP).

Control 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 have to add serial and Ethernet adapters to satisfy the needs of your SP system.

Serial Port Adapters

PCI Control Workstations: All new PCI control workstations require a minimum of one additional asynchronous 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 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)
- F/C 2943** 8-port asynchronous adapter PCI BUS EIA-232/RS-422

128-PORT PCI Adapters

- F/C 2933** 128-port asynchronous controller ISA bus (withdrawn 12/97)
- 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)
- 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
- F/C 8136** 1.2 MB/sec rack-mountable remote asynchronous node (RAN) 16-port EIA-232
- 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
- 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)

MCA Control Workstations: For additional **MCA** serial ports, select the following feature codes:

8-PORT MCA Adapters

- F/C 2930** 8-port asynchronous adapter
- F/C 2995** multiport interface cable

16-PORT MCA Adapters

- F/C 2955** 16-port asynchronous adapter

Note: F/C 2955 is not compatible with the SP-attached server.

- F/C 2996** multiport interface cable

128-PORT MCA Adapters

- F/C 8128** 128-port asynchronous controller
- F/C 8130** remote asynchronous node 16-port EIA-232

F/C 8134 World trade version of F/C 8130

Ethernet Adapters

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

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

F/C 2985 PCI Ethernet BNC/RJ-45 adapter

F/C 2987 PCI Ethernet AUI/RJ-45 adapter

F/C 4224 Ethernet 10Base2 transceiver

MCA Control Workstations: For additional MCA Ethernet adapters, select from the following feature codes:

F/C 2980 Ethernet high performance LAN adapter

F/C 2992 Ethernet twisted pair (TP) adapter

F/C 2993 Ethernet BNC/AUI adapter

F/C 4224 Ethernet 10Base2 transceiver

Service Director

What is Service Director?

Service Director is a set of IBM software applications that monitor the “health” of your SP system. When a system fault is detected, the severity of the fault is analyzed and, if required, Service Director will notify the IBM support center. In addition to notifying the IBM support center, you can also configure Service Director to send an automated E-mail message containing the fault information to your system administrator (requires mail to be active on each node). Upon receiving the fault notification, IBM will automatically dispatch a service engineer (with parts if needed) to correct the problem.

Hardware Requirements

Service Director for the RS/6000 SP 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 utilizes 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 Director 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 power line cord 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 Director software. This and other pertinent Service Director planning information can be found in *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*.

Specific details for service personnel about installing, operating, and registering Service Director are contained in *Service Director for RS/6000 SP CE Information Guide*.

SP Switches (F/C 4011 and F/C 4008)

Switch Overview

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

This chapter contains information on the current production SP series of 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. Make certain that you consult *IBM 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 (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. The SP Switch offers the following improvements over the earlier High Performance series of switches:

- Higher availability
- Fault isolation
- Concurrent maintenance for nodes
- Improved switch chip bandwidth

The required SP Switch Adapter (F/C 4020), SP Switch MX Adapter (F/C 4022), or SP Switch MX2 Adapter (F/C 4023) connects each SP node to the SP Switch subsystem. One adapter of the required type must be ordered for each node in a switch-configured SP system. If you are using switch expansion frames, the SP Switch subsystem will allow you to scale your SP system up to 128 nodes.

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 ports to up to sixteen nodes, both within the switch-equipped frame and in any non-switched expansion frames. You must specify the length of all switch-to-switch cables that make the connections between switch-equipped frames and to an SP Switch Frame. For details, see "Planning for Switch-to-Switch Cabling" on page 101.

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 to connect the SP-Attached Server to the SP Switch.

SP Switch-8 (F/C 4008)

Eight port switches are a lower-cost alternative to the full-size 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 ports to up to eight nodes, both within the switch-equipped frame and in any non-switched expansion frames. For details, see "Switch-to-Node Cabling" on page 100.

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 F/C 1550 a 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.

Note: The SP-Attached Server and POWER3 High Nodes cannot be attached to the SP Switch-8.

Switch Adapters (F/C 4020, 4022, and 4023)

If you plan to use a switch in your SP system, you need switch adapters to connect each RS/6000 SP node to the switch subsystem. SP Switches use either the SP Switch Adapter (**F/C 4020**) for MCA-type nodes or the SP Switch MX Adapter (**F/C 4022**) or SP Switch MX2 Adapter (**F/C 4023**) for PCI-type nodes. One switch adapter is needed for each node in the SP system.

Note: High Performance Switch adapters are not compatible with any of the SP Switch adapters; they cannot coexist in the same system configuration.

<i>Table 18. Switch Adapter Features</i>	
Adapter Feature Code	Description
4020 (Note 1, 2)	SP Switch Adapter For installation as follows: <ul style="list-style-type: none"> • Optional • Order one adapter per MCA type node
4021 (M/T 9077)	SP Switch Router Adapter For installation as follows: <ul style="list-style-type: none"> • Required for the RS/6000 Switch Router • Multiple adapters allowed in each SP Switch Router
4022 (Note 1, 2,)	SP Switch MX Adapter (for 332 MHz SMP nodes) For installation as follows: <ul style="list-style-type: none"> • one adapter per PCI type node
4023 (Note 1, 2)	SP Switch MX2 Adapter (for POWER3 SMP nodes) For installation as follows: <ul style="list-style-type: none"> • Optional • Order one adapter per PCI type node
RS/6000 F/C 8396	SP System Attachment Adapter (used in SP-attached servers) For installation as follows: <ul style="list-style-type: none"> • Required in servers attached to a switch-configured SP system • Only one adapter is allowed per server
<i>Reference information for withdrawn adapters</i>	
4017 (Note 1, 2, 3)	HiPS Adapter-1
4018 (Note 1, 2)	HiPS Adapter-2
<p>Notes:</p> <ol style="list-style-type: none"> 1. The HiPS Adapter-1 and Adapter-2 cannot coexist in the same system with any SP Switch adapter. 2. In some thin node configurations, unused switch ports are not available for expansion purposes. 3. F/C 4017 is only available for coexistence with an SP1. 	

Special Switch Adapters (F/C 4021 and RS/6000 F/C 8396)

Some optional SP system equipment requires special adapters in order to connect to the SP Switch network. These devices include:

- SP Switch Router (**M/T 9077**)
 - Requires one SP Switch Router Adapter (**F/C 4021**) for each SP Switch connection. This adapter is ordered with the SP Switch Router.

- The SP Switch Router Adapter is placed in the SP Switch Router. The included cable attaches to the SP Switch and uses up one valid node slot on the switch.

For details, see “RS/6000 SP Switch Router (M/T 9077 04S and 16S)” on page 77.

- **SP-Attached Server (M/T 7017)**
 - Requires one RS/6000 SP System Attachment Adapter (**RS/6000 F/C 8396**) **only if** the SP-Attached Server is mounted in a switch-configured system. This adapter is ordered with the SP-Attached Server.
 - The RS/6000 SP System Attachment Adapter is placed in the SP-Attached Server and requires a cable to connect with the SP Switch.
 - Requires one valid switch port on the SP Switch
 - The cable is ordered with the SP system
 - SP-Attached Servers do not require this adapter if used in a switchless SP system.
 - This adapter **is not compatible** with the SPS-8 switch.
 - Only one adapter is allowed to be installed in each SP-Attached Server.

For details, see “SP-Attached Server (RS/6000 M/T 7017-S70, S7A, and S80)” on page 41.

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 Switches but no processor nodes. The SP Switch Frame is a mandatory prerequisite for systems using more than five SP Switches; it interconnects the switches in model frames and in expansion frames. Note that SP Switch Frames transfer data only within the local SP system.

An SP Switch Frame with four SP Switches 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 information on the advantages of installing an SP Switch Frame into a smaller system, see “Considerations for Future Switch Expansion” on page 100.

Consult your IBM sales representative for information on using SP Switch Frames in single-stage systems which have fewer than five switches and also for use in special-order systems which have more than 128 nodes.

Planning Switch Cable Networks

The switch ports in a switch-equipped frame 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 100.

You need to plan for a number of cables that run between each switch-equipped frame in multi-switch systems. For detailed instructions on choosing these cables, refer to “Planning for Switch-to-Switch Cabling” on page 101.

RS/6000 SP Switch Router (M/T 9077 04S and 16S)

The IBM 9077 SP Switch Router is one type of dependent node (see “Dependent Nodes” on page 3 for details). It 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 (**Machine Type 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 Requirement

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 79.

In addition to the four major dependent node components (listed in “Dependent Nodes” on page 3), the SP Switch Router (a dependent node) has a fifth optional category of components – 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
- 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 86.

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.

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 10Base-2 Ethernet, you must also supply a 10Base-T to 10Base-2 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 19 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.

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.)
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 251, 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 86.

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 RS/6000 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” on page 81 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 84 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 10Base-2 (thin coax) network, the SP Switch Router can be connected to the network through a customer supplied 10Base-T to 10Base-2 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

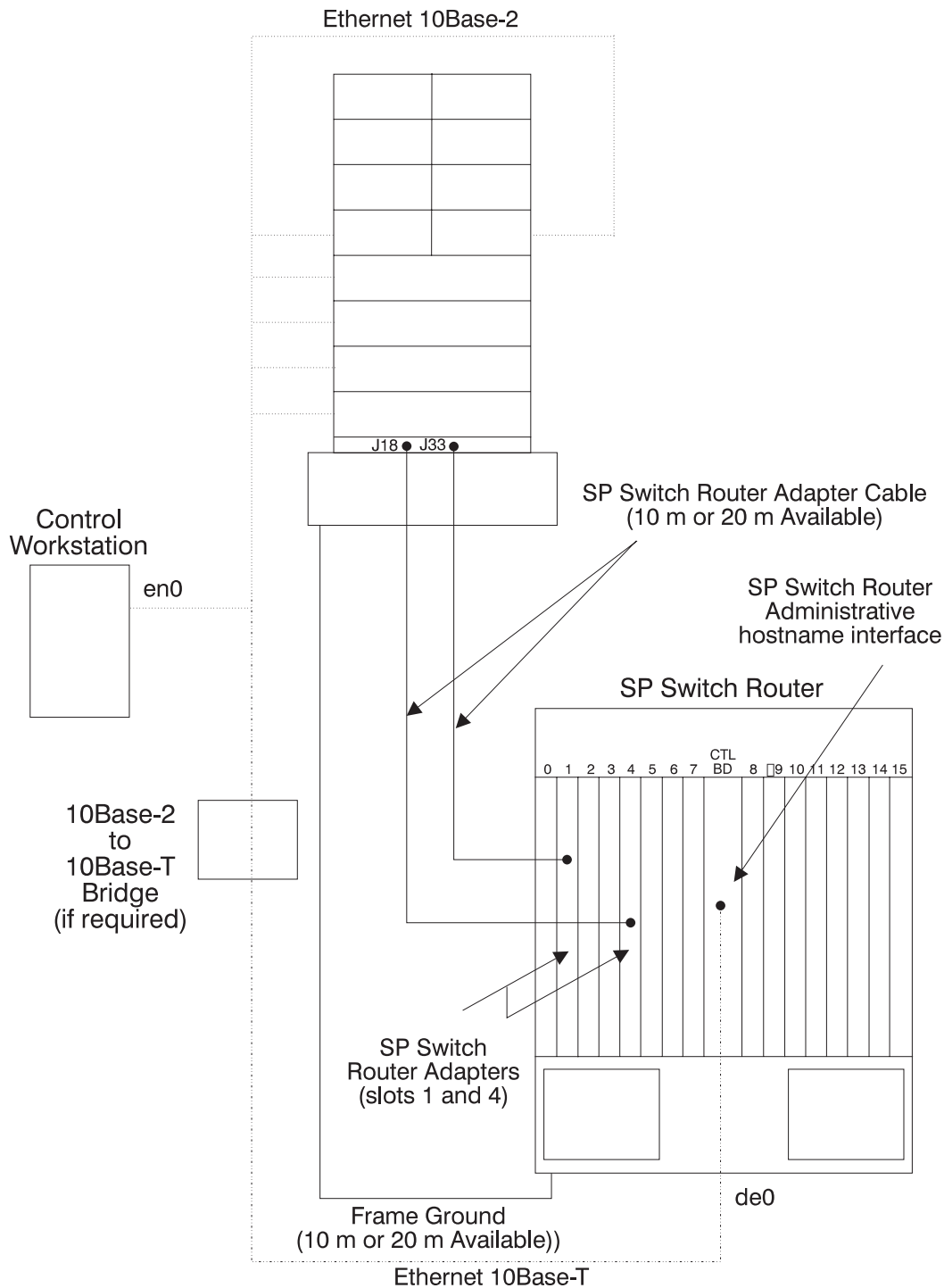


Figure 5. Typical Connections Between the RS/6000 SP Switch Router, the Control Workstation, and the SP Switch

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 79.

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 RS/6000 SP Switch Router Network Interface” on page 80.
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.

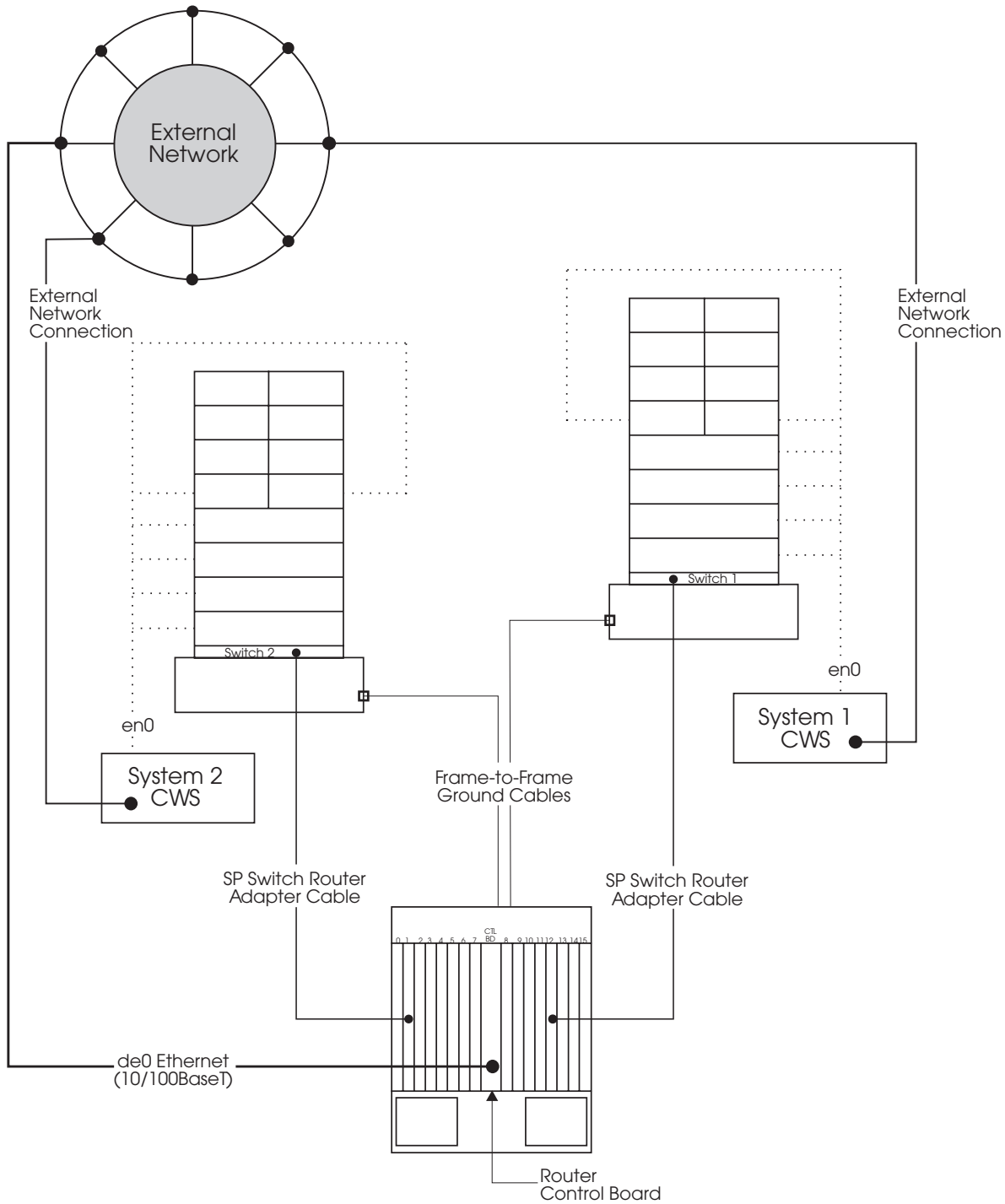


Figure 6. Configuring the RS/6000 SP Switch Router for Communications With Multiple SP Systems

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 251) 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 *IBM 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 *IBM 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 *IBM 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 20 are described in detail in this section.

<i>Table 20. SP Switch Router Network Media Cards and Options</i>		
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	1000BaseSX Gigabit Ethernet	
1118	1000BaseLX 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 Multi Mode 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 4-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 Multi Mode 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).

1000BaseSX 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.

1000BaseLX 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 Cables (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.

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 RS/6000 SP Switch Router Network Interface” on page 80.

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 RS232 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

Planning for coaxial LAN cabling includes the following:

- Ethernet LAN and Ethernet cable provided by IBM
- Requirements for coaxial cables.

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 the SP system is configured for twisted pair, the customer 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 7 shows the configuration of the Ethernet LAN in a RS/6000 SP frame, the RF shunt, and the 15-meter Ethernet cable.

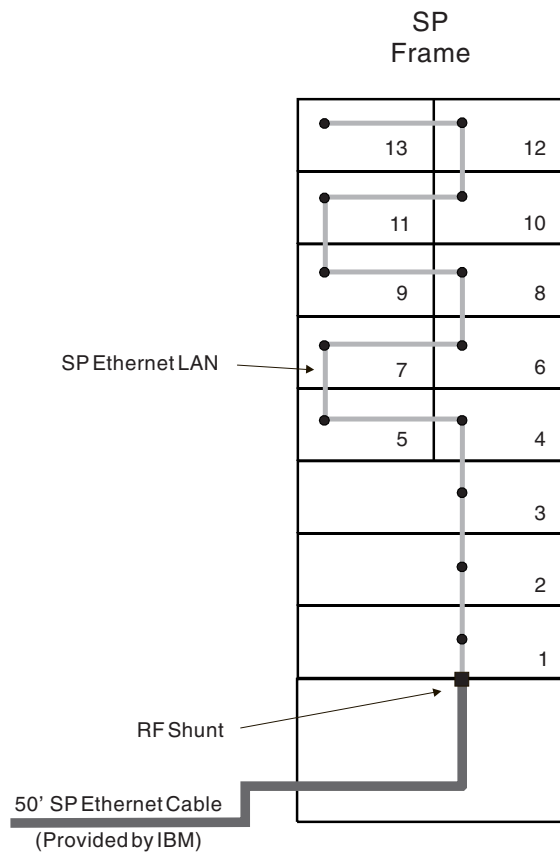


Figure 7. Factory Shipped SP Ethernet LAN, RF Shunt and Ethernet Cable in Rear of SP Frame

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 21 on page 94.

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 21 on page 94 lists the characteristics of the coaxial-type cable, RG-58, that is suitable for Ethernet cabling at your site.

<i>Table 21. Characteristics of RG-58 Cables Suitable for Coaxial Link</i>	
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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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.
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	<ul style="list-style-type: none"> • 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 on all outdoor coaxial cables.

Note: Your system installer can provide advice about additional customer-supplied hardware you may 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 8 on page 96. 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.

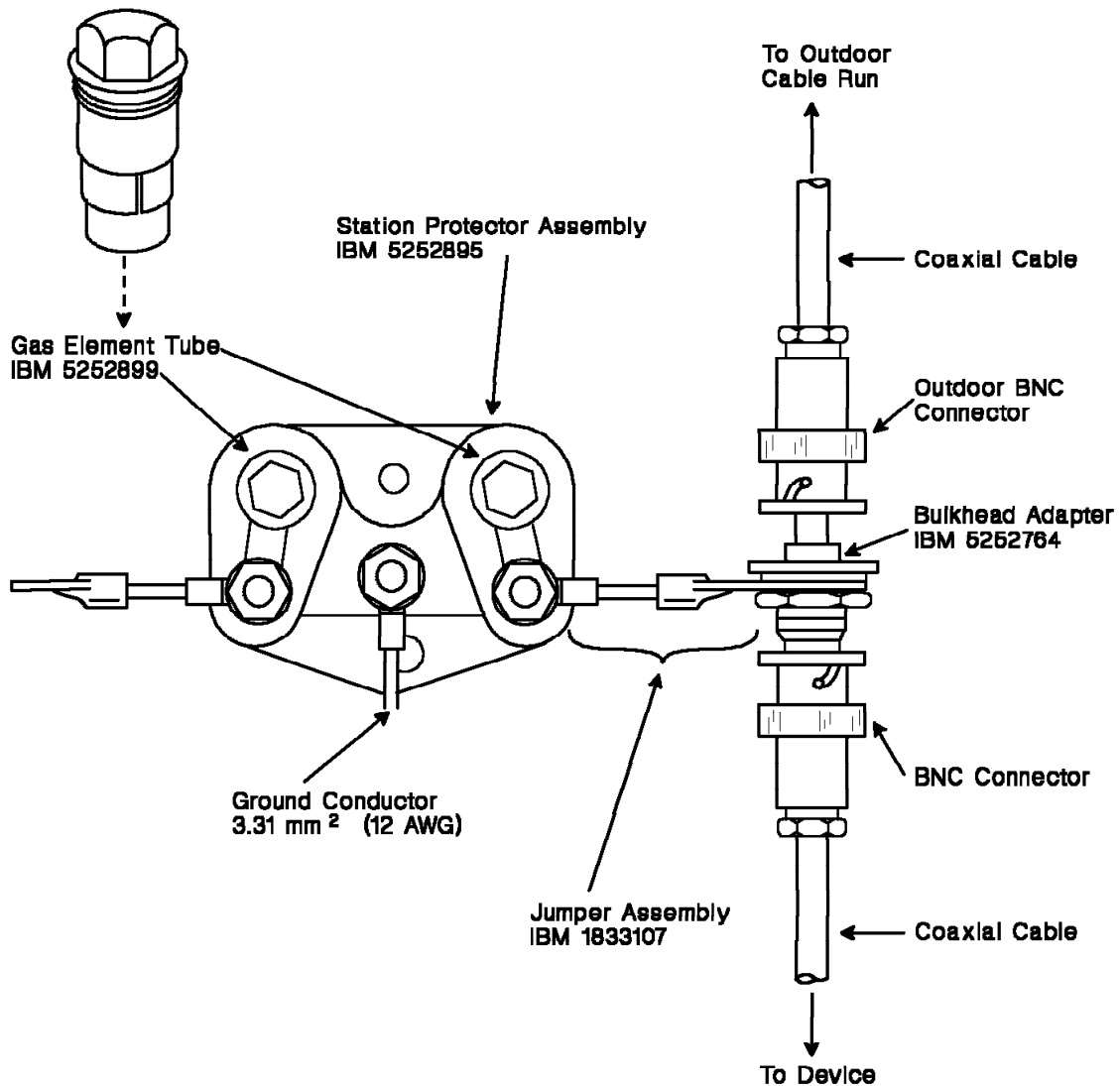


Figure 8. Station Protector and Its Connection to Coaxial Cable

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 22 on page 98 provides guidelines for minimum distances between unshielded coaxial cables and unshielded power line cables for three different usages of separate, grounded, metallic conduits.

Table 22. 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 Twisted Pair LAN Cabling

This section contains planning information for both SP LAN and external LAN twisted pair Ethernet connections.

Twisted Pair – Customer Responsibility

IBM does not supply twisted pair Ethernet cables or Ethernet hubs. As the customer, you must provide your own cables and hubs.

Requirements for Twisted Pair Ethernet Cabling

Twisted pair Ethernet uses four wires divided into two pairs. Each pair is evenly twisted together over the length of the pair. Twisting the wires improves signal carrying characteristics by canceling out induced signals from external electrical sources. Using twisted pair Ethernet, 10Base-T and 100Base-TX cable lengths of up to 100 meters are possible.

If you use ordinary phone cable in place of Ethernet twisted pair cable, 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.

100Base-TX Ethernet

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" on page 99 for information sources related to planning 100 MB Ethernet networks.

Your cable segments may be longer or shorter than the nominal length due to the amount of cross-talk and signal attenuation induced in your 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

Wire terminations are done using RJ-45 connectors. However, some SP and control workstation Ethernet adapters require an external transceiver in addition to the RJ-45 jack. You must include all connectors and transceivers when measuring signal attenuation in your system.

Ethernet Cable Routing Practices

The basic cable configuration for twisted pair Ethernet is star wiring. Star wiring completes a network by routing cables from individual machines directly into a central hub. The hub processes incoming signals, makes the required connections, and directs the signal to its intended destination.

The wire used in twisted pair Ethernet networks must meet certain specifications. These are:

- For 10Base-T, wire must be EIA/TIA category 3, 4, or 5 unshielded twisted pair (UTP).
- For 100Base-TX, wire must be EIA/TIA category 5 UTP.
- An Ethernet signal must not pass through more than four hubs enroute from source to destination.

Published Ethernet Standards

The specifications 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 – (800) 854-7179

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

Institute of Electrical and Electronic Engineers – (800) 678-IEEE

Planning for Switch Cabling

If you plan to incorporate switches in your system, you need to plan for a number of cables that run between switches and processor nodes and between each switch and any switch frame in multi-switch systems. This section helps you determine the switch-cable lengths and quantities you need for a new system and for any future expansion.

Note: SP systems with *up to five* SP Switches (single-stage switch configuration) do not need a dedicated switch frame; systems with *more than five* switches require an SP Switch frame (two-stage configuration).

Switch Software Planning

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 *IBM 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

An SP Switch Frame is required for systems using more than five switches. However, for future expansion purposes you might want to install a switch frame in a system that would normally require only single-stage switching if you plan to scale up to two-stage configuration at a later date.

As you can see by comparing Figure 9 on page 102 to Figure 10 on page 103, switch cabling is much simpler in a two-stage switch configuration due to the dedicated switch frame. 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.

Consult your IBM sales representative for information on using SP Switch Frames in single-stage systems which have fewer than six switches.

Switch-to-Node Cabling

This section is provided as reference information since you do not need to separately order switch-to-node cabling. These cables are automatically ordered and shipped according to configurator rules.

The switch ports in a switch-equipped frame must be connected to all the nodes in that frame as well as to all the nodes in non-switched expansion frames. As an example, a Model 550 frame containing four high nodes and an SP Switch has twelve unused switch ports; the four nodes within the model frame are connected to four switch ports with four 2-meter cables. The unused ports can be shared by up to twelve additional nodes mounted in non-switched expansion frames. In this case, twelve 10-meter cables are provided to connect these available switch ports to the nodes in the non-switched expansion frames.

Use the following cables to connect switch ports to processor nodes:

- **F/C 9302** – 2-meter switch-to-node cable (for nodes within the switch-equipped frame)
- **F/C 9310** – 10-meter 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 switch-equipped frames in multi-switch SP systems.

The 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 switch-equipped frames. Use them 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 section.

Switch Cabling Paths for Single-Stage Switch Configurations: In an SP system with single-stage switching, each switch must be connected to every other switch. You must determine the switch-cable lengths and quantities required for each of these connections.

As an example, Figure 9 on page 102 illustrates conceptual floor plans for four different single-stage configurations with from two to five switches. For clarity, only switch-equipped frames are shown; your system might also include non-switched expansion frames.

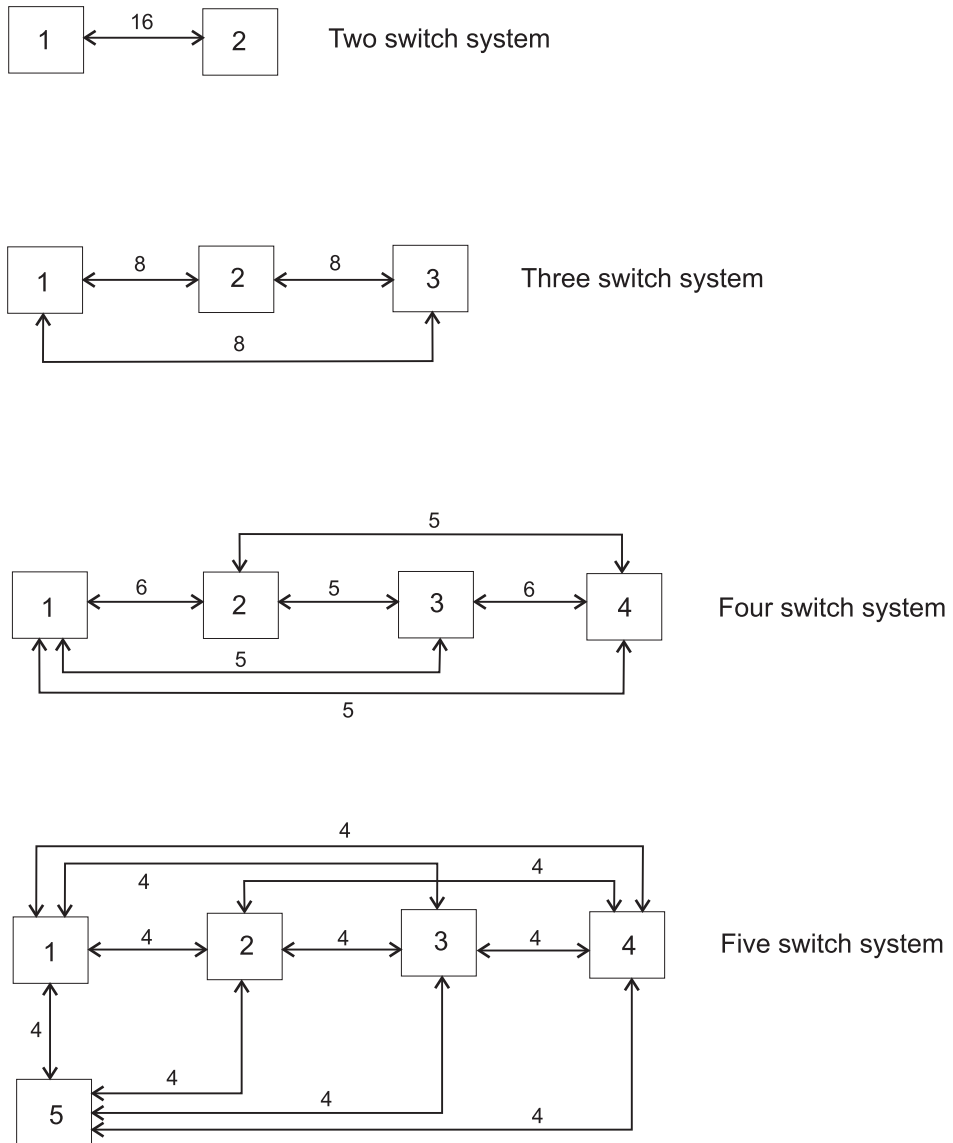


Figure 9. Switch Cable Paths for SP Systems Using Single-Stage Switch Configurations. The numbered squares represent switch-equipped frames and the arrows are the cable sets with the quantity of individual cables in each set as indicated. (Switch-to-node cabling is not shown.)

Switch Cabling Paths for Two-Stage Switch Configurations: The SP Switch frame (F/C 2031) is a mandatory prerequisite for all SP systems using more than five switches (two-stage switch configuration). Each switch in a two-stage system connects to the SP Switch frame.

Figure 10 on page 103 illustrates a conceptual cable plan for a two-stage switch configuration. For clarity, only switch-equipped frames are shown; your system might also include non-switched expansion frames.

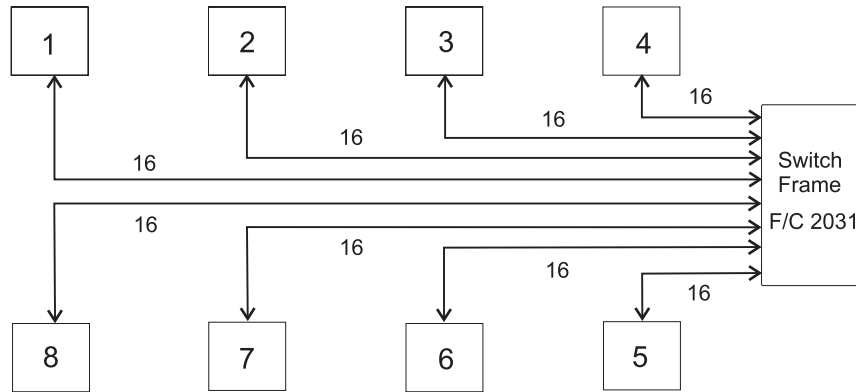


Figure 10. Switch Cable Paths for an SP System Using Two-Stage Switch Configuration. The numbered squares represent switch-equipped frames and the arrows are the cable sets. In systems with an SP Switch frame, all switch cable sets have 16 individual cables as indicated. (Switch-to-node cabling is not shown.)

Determining Switch-to-Switch Cable Quantities

The quantity of switch cables depends on the quantity of switch-equipped frames in the system. Use Table 23 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 25 on page 106.

Table 23. 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
Single-Stage	1	N/A	N/A	(not shown)
Single-Stage	2	16	16	Figure 9 on page 102
Single-Stage	3	8	24	Figure 9 on page 102
Single-Stage	4	5 / 6 (See note 1)	32	Figure 9 on page 102
Single-Stage	5	4	40	Figure 9 on page 102
<i>Two-stage configurations requiring SP Switch frames</i>				
Two-Stage	6	16	96	(not shown)
Two-Stage	7	16	112	(not shown)
Two-Stage	8	16	128	Figure 10
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 “Floor Plans” on page 203).
2. Calculate the cable lengths required between switch-equipped frames using the following formula:

Cable Length Formula

$$\text{Cable Length} = (\text{Floor Distance}) + (2 \times \text{Floor Depth}) + (\text{Frame Routing})$$

Where:

- *Floor Distance* = The manhattan distance between frames; the sum of the x and y distances following the 90-degree junctions:
 - For systems with single-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).
- *Floor Depth* = Raised-floor depth measured from the surface of the sub-floor 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 24 on page 105 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.
 - 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 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 24. Switch Cable Length Tracking Chart						
	To switch in frame number:					
From switch in frame number:	1	2	3	4	5	F/C 2031
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 sales representative.

- After you determine the quantity and lengths of cables you need, use that information to fill in Table 25 on page 106 in “Recording Your Switch-to-Switch Cable Requirements.”

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 25 on page 106 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 25 on page 106 equals the total quantity of cables listed in Table 23 on page 103 for your size system.

<i>Table 25. Quantity of Switch-to-Switch Cables per Length for a New SP system</i>						
	Quantity of Cables					Total Quantity of Cables
	5 Meter F/C 9305	10 Meter F/C 9310	15 Meter F/C 9315	20 Meter F/C 9320		
Quantity of cables in a new installation						

Planning Switch Cable Requirements for Future Expansion

Use Table 26 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 104.)
3. Fill in the quantity of switch cables in the expanded system for each cable length (and check against Table 23 on page 103).
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.

<i>Table 26. Quantity of Switch Cables To Order for an Expanded SP System</i>					
	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:					
Quantity of cables to be ordered for expansion:					

Communication Adapter 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 on some withdrawn adapters is included for planning purposes, since you might want to migrate older adapters to newly-acquired nodes.

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 28 on page 109 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 “Suggested PCI Adapter Quantities for Optimum Operation” on page 114.

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 111.

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 both POWER3 and 332 MHz 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 as **I2 and I3 (I/O side)**.

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

Descriptions of PCI bus group numbering, bus type, slot width and slot speed for POWER3 and 332 MHz SMP nodes are shown in Table 27 on page 108.

<i>Table 27. PCI Bus Descriptions for SMP nodes</i>					
Node type	Bus group	Bus type	Slot numbers	Slot width	Slot speed
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
375 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 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 28 on page 109.

POWER3 High Nodes and SP Expansion I/O Units are shown in Table 29 on page 110.

Quantities suggested for improved performance are shown in “Suggested PCI Adapter Quantities for Optimum Operation” on page 114.

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

Table 28 (Page 1 of 2). Maximum quantities of PCI adapters for SMP thin and wide nodes

Feature Code	PCI Adapter Name	Number of PCI Slots Required	Max. Number Allowed Per Node Wide / Thin	Notes
2732	Serial HIPPI Channel	1	2 / 1	
2733	Serial HIPPI Channel	1	2 / 1	
2741	FDDI SK-NET LP SAS	1	4 / 2	1
2742	FDDI SK-NET LP DAS	1	4 / 2	1
2743	FDDI SK-NET UP SAS	1	4 / 2	1
2751	S/390 ESCON	1	2 / 1	2
2920	Token Ring Auto Lanstream	1	8 / 2	2
2943	RS-422 8-port Async.	1	6 / 2	
2944	WAN RS232 128-port	1	7 / 2	
2947	ARTIC960Hx 4-port selectable	1	6 / 2	
2962	2-port Multiprotocol Adapter	1	6 / 2	
2963	ATM Turboways 155 UTP	1	4 / 2	1
2968	Ethernet 10/100 MB	1	4 / 2	1
2969	Gigabit Ethernet-SX	1	2 / 1	2
2985	Ethernet 10 MB BNC	1	8 / 2	
2987	Ethernet 10 MB AUI	1	8 / 2	
2988	ATM 155 MMF	1	4 / 2	1
4959	Token Ring	1	4 / 2	
6204	Ultra SCSI DE	1	6 / 2	3
6205	Dual Channel Ultra2 SCSI	1	2 / 1	2
6206	Ultra SCSI SE	1	6 / 2	
6207	Ultra SCSI DE	1	6 / 2	
6208	SCSI-2 F/W SE	1	8 / 2	
6209	SCSI-2 F/W DE	1	8 / 2	
6215	SSA RAID 5	1	6 / 2	
6222	F/W Cache Option	0	(mounts on 6215)	
6225	SSA RAID EL	1	6 / 2	
6227	Fibre Channel AL	1	2 / 1	2
6230	SSA RAID EL	1	6 / 2	
6231	128 MB DIMM Option	0	(mounts on 6225 and 6230)	
6235	Fast-Write Cache Option for F/C 6225	0	(mounts on 6225 and 6230)	

Table 28 (Page 2 of 2). Maximum quantities of PCI adapters for SMP thin and wide nodes

Feature Code	PCI Adapter Name	Number of PCI Slots Required	Max. Number Allowed Per Node Wide / Thin	Notes
6310	ARTIC960RxD Quad Digital Trunk	1	4 / 2	2
6311	ARTIC960RxF Digital Trunk Resource	1	3 / 1	3
Notes: <ol style="list-style-type: none"> Group restrictions apply. For details, see “PCI Adapter Plugging Rules and Restrictions” on page 111. Quantity of three (3) for 375 MHz POWER3 SMP Wide Node. Used only in 375 MHz POWER3 SMP Thin and Wide nodes. 				

POWER3 High Node and SP Expansion I/O Unit

The maximum quantities for POWER3 High nodes, SP Expansion I/O Units, and high node/expansion unit combinations are shown in Table 29.

Table 29 (Page 1 of 2). Maximum quantities of PCI adapters for POWER3 High nodes and SP Expansion I/O Units

Feature Code	PCI Adapter Name	Max. Quantity Per POWER3 High node	Max. Quantity Per SP Expansion I/O Unit	Combination Max. Quantity (see Note 1)
2732	Serial HIPPI SW	1	3	8
2733	Serial HIPPI LW	1	3	8
2741	FDDI SK-NET LP SAS	5	8	21
2742	FDDI SK-NET LP DAS	5	8	21
2743	FDDI SK-NET UP SAS	5	8	21
2751	S/390 ESCON	0	4	10
2920	Token Ring Auto Lanstream	5	8	21
2943	RS-422 8-port Async.	5	8	21
2944	WAN RS232 128-port	5	8	21
2947	ARTIC960Hx 4-port selectable	4	8	21
2962	2-port Multiprotocol Adapter	5	8	21
2963	ATM Turboways 155 UTP	3	8	21
2968	Ethernet 10/100 MB	5	8	21
2969	Gigabit Ethernet-SX	1	2	8
2985	Ethernet 10 MB BNC	5	8	21

Table 29 (Page 2 of 2). Maximum quantities of PCI adapters for POWER3 High nodes and SP Expansion I/O Units

Feature Code	PCI Adapter Name	Max. Quantity Per POWER3 High node	Max. Quantity Per SP Expansion I/O Unit	Combination Max. Quantity (see Note 1)
2987	Ethernet 10 MB AUI	5	8	21
2988	ATM 155 MMF	3	8	21
4959	Token Ring	3	8	21
6204	Ultra SCSI DE	3	8	21
6205	Dual Channel Ultra2 SCSI	1	2	6
6206	Ultra SCSI SE	3	8	21
6207	Ultra SCSI DE	3	8	21
6215	SSA RAID 5	2	4	21
6222	F/W Cache Option	(mounts on 6215)		
6225	SSA RAID EL	2	2	12
6227	FC-AL	2	3	10
6230	SSA RAID EL	2	2	12
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
6311	ARTIC960RxF Digital Trunk Resource	3	0	3
Notes:				
1. The combination column shows 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.				

PCI Adapter Plugging Rules and Restrictions

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

375 MHz POWER3 SMP Wide Node

- No more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If one F/C 2969 is installed, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If two F/C 2969 are installed, none of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- F/C 2751 must be placed in either slot I3 (CPU side) or in slot I4.
- If one F/C 2969 is installed, place it in slot I1 through I8 (I/O side).

- If two F/C 2969 are installed, place one in slot I1 through I4 (I/O side) and the other in slot I5 through I8.
- F/C 2963 and 2988 cannot be placed in slot I5.
- F/C 2732, 2733, 2969, 6205, 6225, 6227, 6230 cannot occupy the same PCI bus.
- The combined quantity of F/C 6225 and 6230 cannot exceed two per PCI bus.
- 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).
- Sum of F/C 6310 and 6311 cannot be more than four.

375 MHz POWER3 SMP Thin Node

- No more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If one F/C 2969 is installed, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If two F/C 2969 are installed, none of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- 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.)
- F/C 2732, 2733, 2969, 6205, 6225, 6227, 6230 cannot occupy the same PCI bus.
- The combined quantity of F/C 6225 and 6230 cannot exceed two per PCI bus.
- Sum of F/C 6310 and 6311 cannot be more than two.

POWER3 High Node

- F/C 6204, 6206, 6207 cannot be placed in slot 1 or 2.
- F/C 6215, 6225, 6227, 6230 must be placed in slot 3 or 5.
- F/C 2947, 6310, 6311 cannot be placed in slot 1.
- F/C 2732, 2733, 2751, 2969, 6205 must be placed in slot 5.
- F/C 2963 and 2988 cannot be placed in the adjacent slot to the right of F/C 2751
- Sum of F/C 6310 and 6311 cannot be more than four.

SP Expansion I/O Unit

- F/C 2732, 2733, 6227 must be placed in slot 1, 3, or 5.
- F/C 6215 must be placed in slot 1, 3, 5, or 7.
- F/C 2969, 6205, 6225, 6230 must be placed in slot 1 or 3.
- F/C 2963 and 2988 cannot be placed in the adjacent slot to the right of F/C 2751

- F/C 2751 must be placed in slot 1, 3, 5, or 7 in unit 3 or 4, or in slot 5 or 7 in unit 5.

POWER3 Wide Node

- No more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If one F/C 2969 is installed, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If two F/C 2969 are installed, none of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- F/C 2751 must be placed in either slot I3 (CPU side) or in slot I4.
- If one F/C 2969 is installed, place it in slot I1 through I8 (I/O side).
- If two F/C 2969 are installed, place one in slot I1 through I4 (I/O side) and the other in slot I5 through I8.
- F/C 2963 and 2988 cannot be placed in slot I5.
- Maximum of one F/C 2732, 2733, 2969, 6205 per PCI bus.
- Maximum of two F/C 6206, 6207, 6225, 6230 per PCI bus.
- The combined quantity of F/C 6225 and 6230 cannot exceed two per PCI bus.
- 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).

332 MHz Wide Node

- No more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If one F/C 2969 is installed, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If two F/C 2969 are installed, none of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- F/C 2751 must be placed in either slot I3 (CPU side) or 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 is installed, it must be placed in slot I2 or I3 (CPU side) or in slot I4.
- If two F/C 2969 are installed, place one in slot I2 or I3 (CPU side) and the other in slot I4.
- F/C 2732, 2733, 2751, 2947, 2962, 2963, 2968 (when operating in 100 Mbps mode), 2969, 2988, 6205, 6206, 6207, 6208 (when operating in SCSI-2 Fast/Wide mode), 6209 (when operating in Fast/Wide mode or to tape), 6215, 6225, 6230, 6227, 6310, 6311 cannot be placed in slot I5 through I8.
- Maximum of one F/C 2732, 2733, 2969, 6205, 6225, 6230 per PCI bus.
- If two F/C 6225 or 6230 are installed, each must be placed in a separate PCI bus in slot I2 or I3 (CPU side) or slot I1 to I4 (I/O side).

- 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).
- Sum of F/C 6310 and 6311 cannot be more than four.

POWER3 and 332 MHz Thin Node

- No more than four (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If one F/C 2969 is installed, no more than two (in any combination) of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- If two F/C 2969 are installed, none of F/C 2741, 2742, 2743, 2963, 2968, 2988 can be installed.
- 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.)
- Maximum of one F/C 2732, 2733, 2969, 6205 per thin node.
- The combined quantity of F/C 6225 and 6230 cannot exceed two per PCI bus.

Suggested PCI Adapter Quantities for Optimum Operation

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

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 30.

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	

Table 30 (Page 2 of 2). PCI Adapter Weighting Factors

Feature	Description	Type	Weighting Factor	Notes
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	
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	
2985	Ethernet 10 BNC/RJ-45	Comm	Low	
2987	Ethernet 10 AUI/RJ-45	Comm	Low	
2988	ATM 155 MMF	Comm	Medium	
4959	Token Ring	Comm	Low	
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
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	
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

Following are lists of weighting factor guidelines and suggested quantities of adapters (by node type, PCI bus, and weighting factor) to help you achieve optimum operation on PCI buses:

Adapter Guidelines for using Weighting Factors

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 111. (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.

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

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

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

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

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)

MCA Bus Adapter Requirements

The following table contains reference information on MCA communication adapters.

These features are briefly described in Appendix C, "MCA Communication Adapters" on page 235.

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

Table 31 (Page 2 of 3). Micro Channel Adapter Requirements

Feature Code	MCA Adapter Name	Number of MCA Slots Required	Max. Number Allowed per Node Wide/Thin/High	Notes
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
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

Table 31 (Page 3 of 3). Micro Channel Adapter Requirements

Feature Code	MCA Adapter Name	Number of MCA Slots Required	Max. Number Allowed per Node Wide/Thin/High	Notes
2994	10/100 Ethernet Twisted Pair MC Adapter	1	2 / 2 / 4	
4224	Ethernet 10BaseT 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.

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.

Network connections through SP nodes are typically slower than, and might not have the availability of, network connections through an SP Switch Router. For details, see “RS/6000 SP Switch Router (M/T 9077 04S and 16S)” on page 77.

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 107.

Table 32 lists all **currently available** PCI adapters and adapter options.

<i>Table 32 (Page 1 of 2). Available RS/6000 SP PCI Adapter Features</i>	
Feature Code	Adapter Type
2732	“Short-Wave Serial HIPPI PCI Adapter (F/C 2732)” on page 122
2733	“Long-Wave Serial HIPPI PCI Adapter (F/C 2733)” on page 123
2741	“FDDI SK-NET LP SAS PCI Adapter (F/C 2741)” on page 124
2742	“FDDI SK-NET LP DAS PCI Adapter (F/C 2742)” on page 127
2743	“FDDI SK-NET UP DAS PCI Adapter (F/C 2743)” on page 132
2751	“S/390 ESCON Channel PCI Adapter (F/C 2751)” on page 133
2920	“Auto LANstreamer Token Ring PCI Adapter (F/C 2920)” on page 134
2943	“8-Port Async PCI Adapter EIA 232/RS-422 (F/C 2943)” on page 135
2944	“WAN 128-Port Async PCI Adapter EIA-232 (F/C 2944)” on page 136
2947	“ARTIC960Hx 4-Port Selectable PCI Adapter (F/C 2947)” on page 138
2962	“2-Port Multiprotocol X.25 PCI Adapter (F/C 2962)” on page 139
2963	“TURBOWAYS 155 UTP ATM PCI Adapter (F/C 2963)” on page 140
2968	“10/100 Ethernet 10BaseTX PCI Adapter (F/C 2968)” on page 142
2969	“Gigabit Ethernet - SX PCI Adapter (F/C 2969)” on page 143
2985	“10Base2 and 10BaseT (BNC/RJ-45) Ethernet LAN PCI Adapter (F/C 2985)” on page 144
2987	“10Base5 and 10BaseT (AUI/RJ-45) Ethernet LAN PCI Adapter (F/C 2987)” on page 146
2988	“TURBOWAYS 155 ATM PCI Adapter (F/C 2988)” on page 148
4959	“High-Speed Token-Ring PCI Adapter (F/C 4959)” on page 149
6204	“SCSI-2 Ultra/Wide DE PCI Adapter (F/C 6204)” on page 150
6205	“Dual Channel Ultra2 SCSI PCI Adapter (F/C 6205)” on page 153
6206	“SCSI-2 Ultra/Wide SE PCI Adapter (F/C 6206)” on page 154

<i>Table 32 (Page 2 of 2). Available RS/6000 SP PCI Adapter Features</i>	
Feature Code	Adapter Type
6207	“SCSI-2 Ultra/Wide DE PCI Adapter (F/C 6207)” on page 157
6222	“SSA Fast-Write Cache Option (F/C 6222)” on page 160
6227	“Gigabit Fibre Channel PCI Adapter (F/C 6227)” on page 160
6230	“Advanced SerialRAID Plus PCI Adapter (F/C 6230)” on page 161
6231	“128 MB DIMM Option Card (F/C 6231)” on page 163
6235	“32 MB Fast-Write Cache Option Card (F/C 6235)” on page 163
6310	“ARTIC960RxD Quad Digital Trunk PCI Adapter (F/C 6310)” on page 164
6311	“ARTIC960RxF Digital Trunk Resource Adapter (F/C 6311)” on page 165

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 universal 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 universal 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 11 shows a typical FDDI configuration for the SP system.

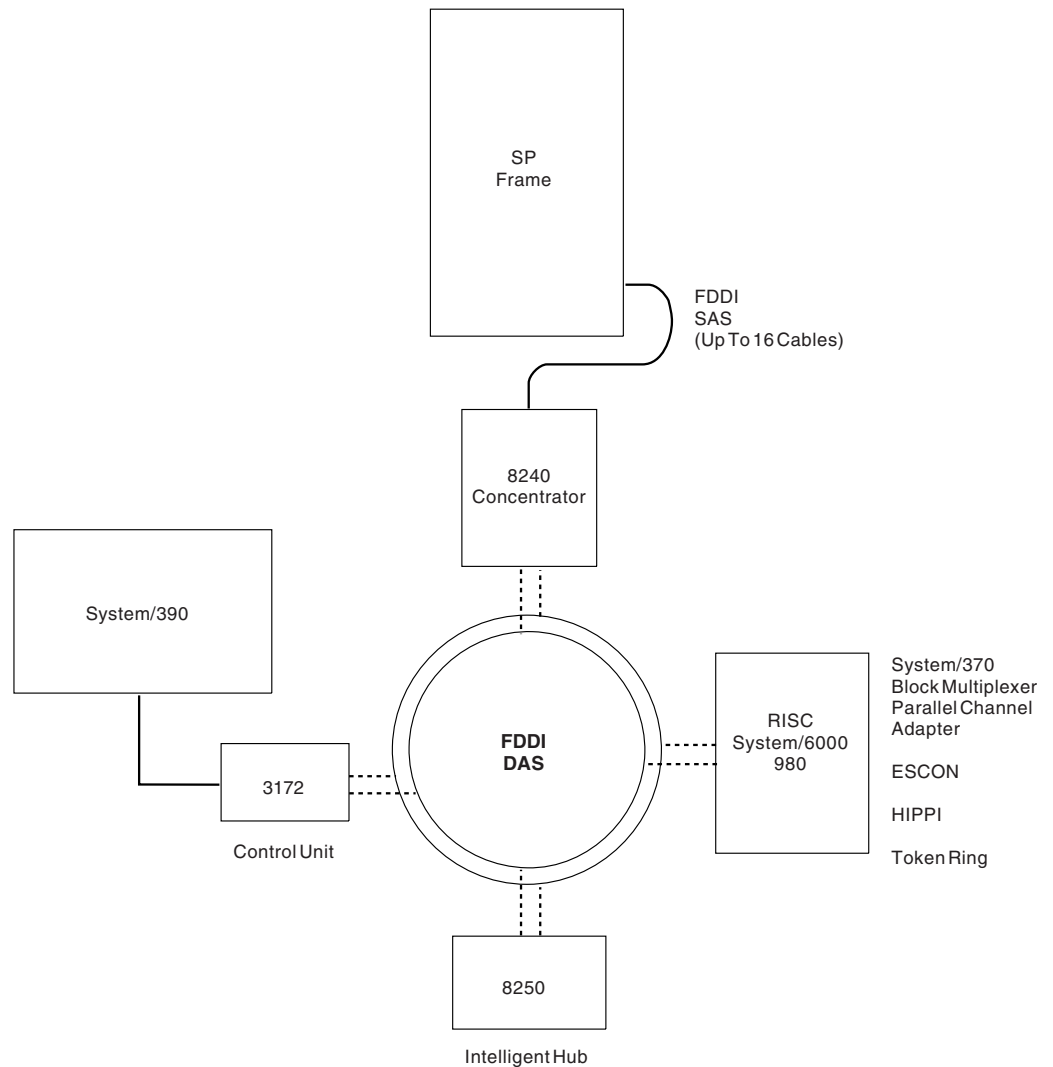


Figure 11. Typical FDDI Configuration for the SP System

FDDI Single-Ring Attachment Station

Figure 12 shows a typical FDDI single-ring attachment station (SAS) cabling from the RS/6000 SP frame to the IBM 8240 Concentrator:

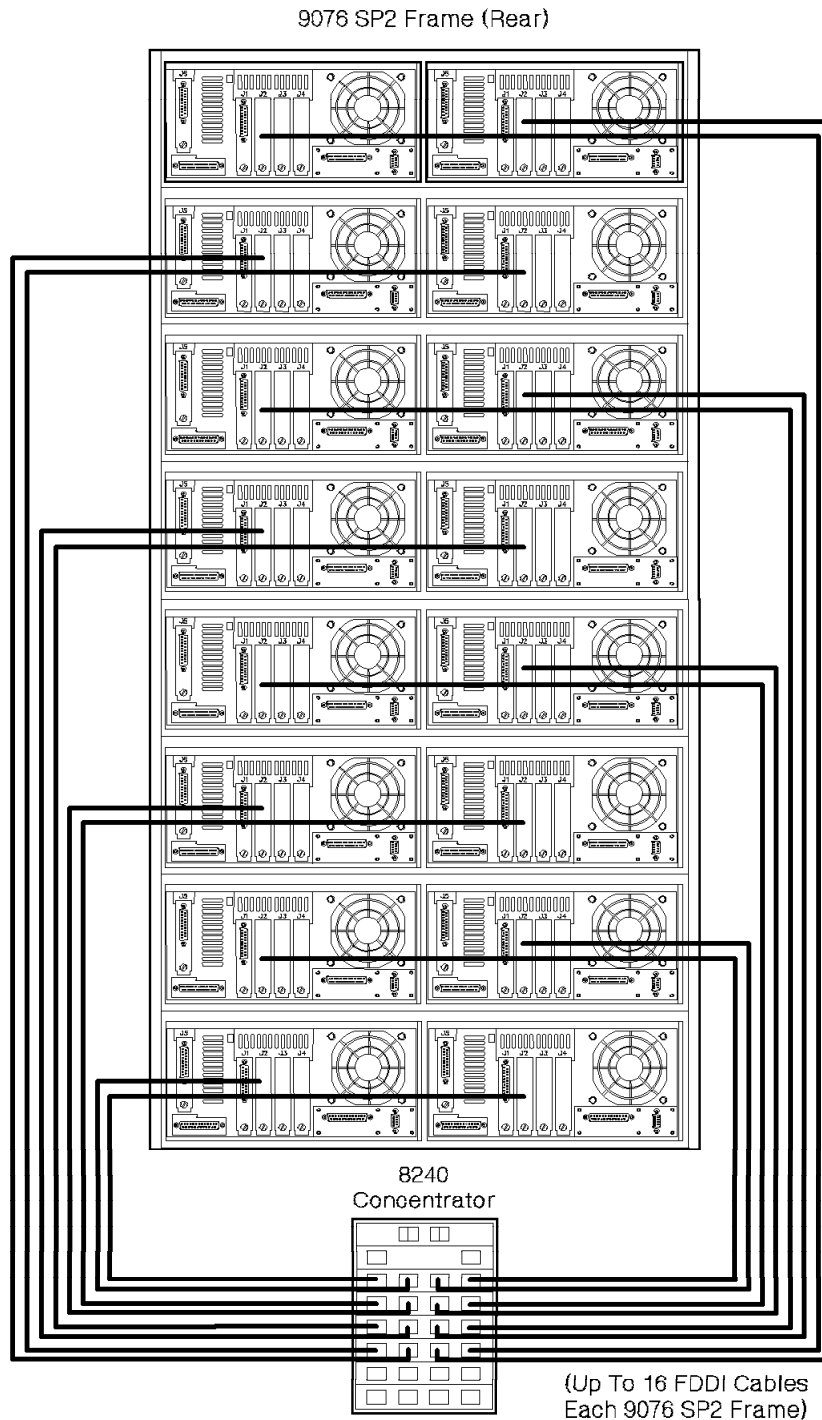


Figure 12. Typical FDDI Single-Ring Attachment Cabling for the SP System

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 33 shows the cable budget needed to reach individual nodes in an SP frame.

Table 33. 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
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 13 on page 129 shows a typical FDDI configuration for the SP system.

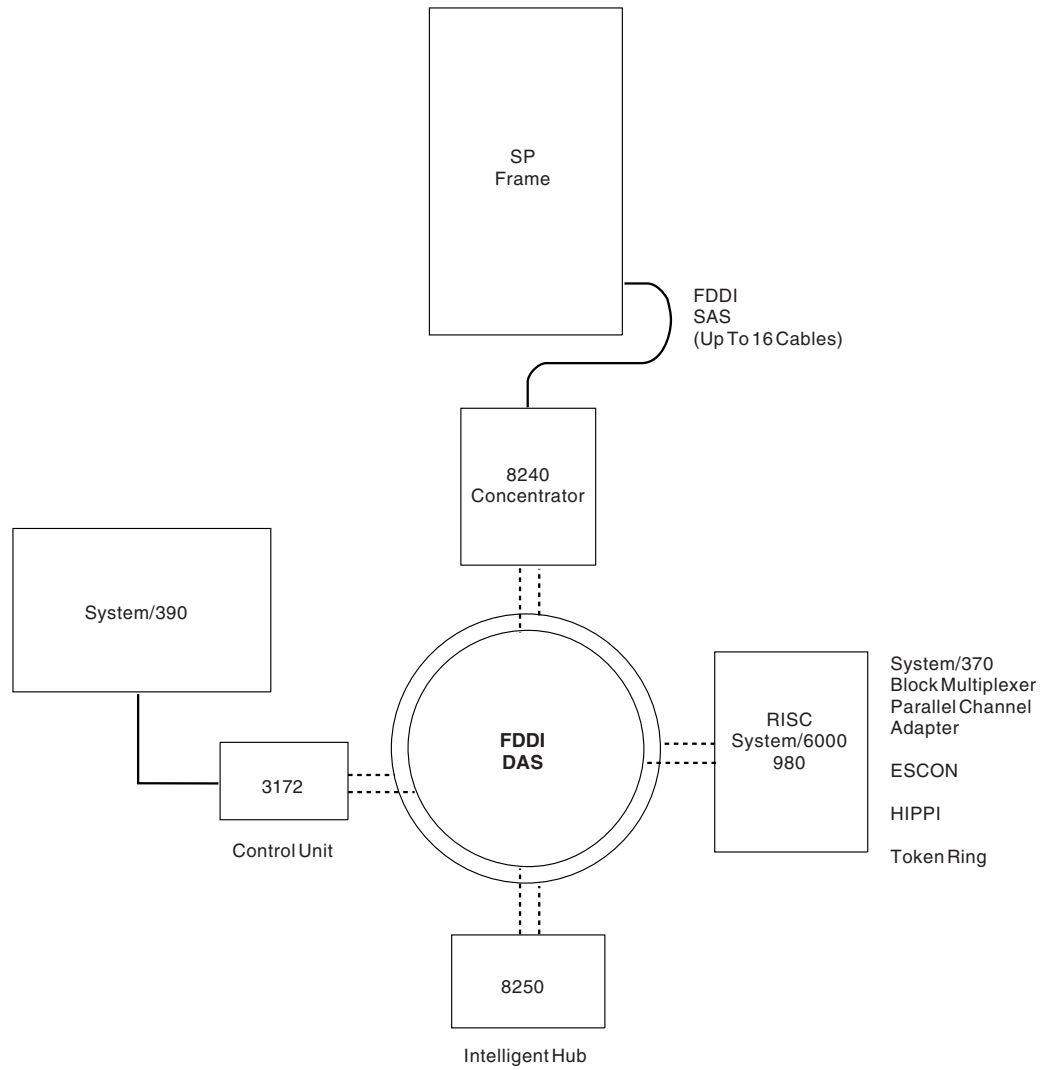


Figure 13. Typical FDDI Configuration for the SP System

FDDI Dual-Ring Attachment Station

Figure 14 on page 130 shows typical FDDI dual-ring attachment cabling from the SP frame to a concentrator or an external LAN.

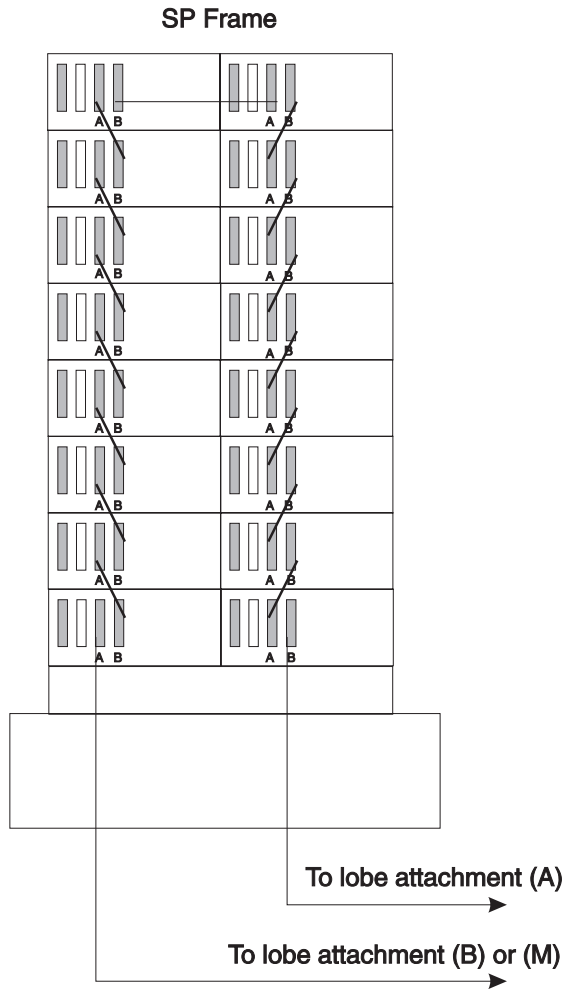


Figure 14. Typical FDDI Dual-Ring Attachment Cabling for the SP System

FDDI Dual Homing Cabling

Figure 15 on page 131 shows a typical FDDI dual homing cabling from the SP frame to a concentrator.

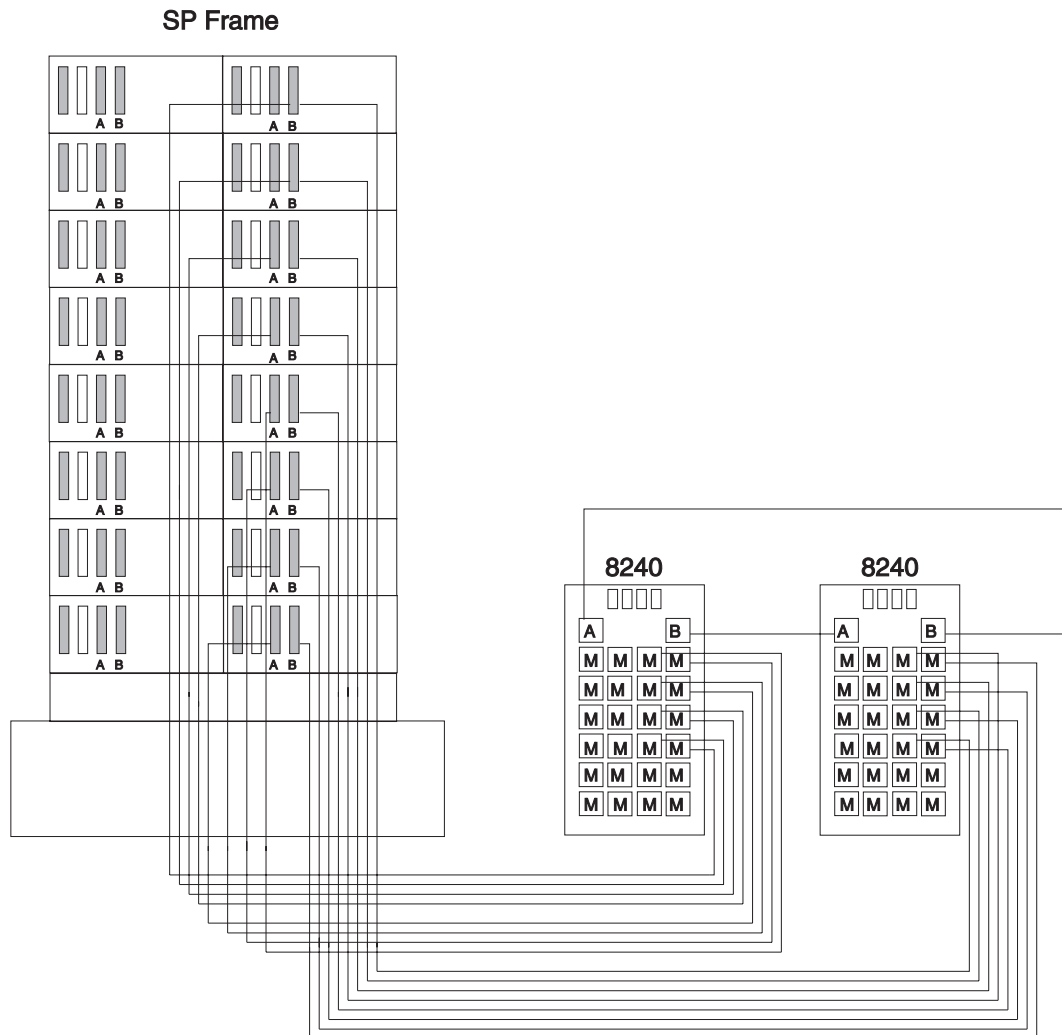


Figure 15. Typical FDDI Dual Homing Cabling for the SP System

External Cabling Routing for FDDI Cables

The SP uses a maximum of 120 inches of FDDI cable budget. Table 34 on page 132 shows the cable budget needed to reach individual nodes in an SP frame.

<i>Table 34. Cable Budget Information for FDDI Feature</i>		
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

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 124 for a typical SP system FDDI configuration.

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)

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.

8-Port Async PCI Adapter EIA 232/RS-422 (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 PCI Adapter EIA-232 (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)

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 35 on page 140 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.

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

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 16 on page 142 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.

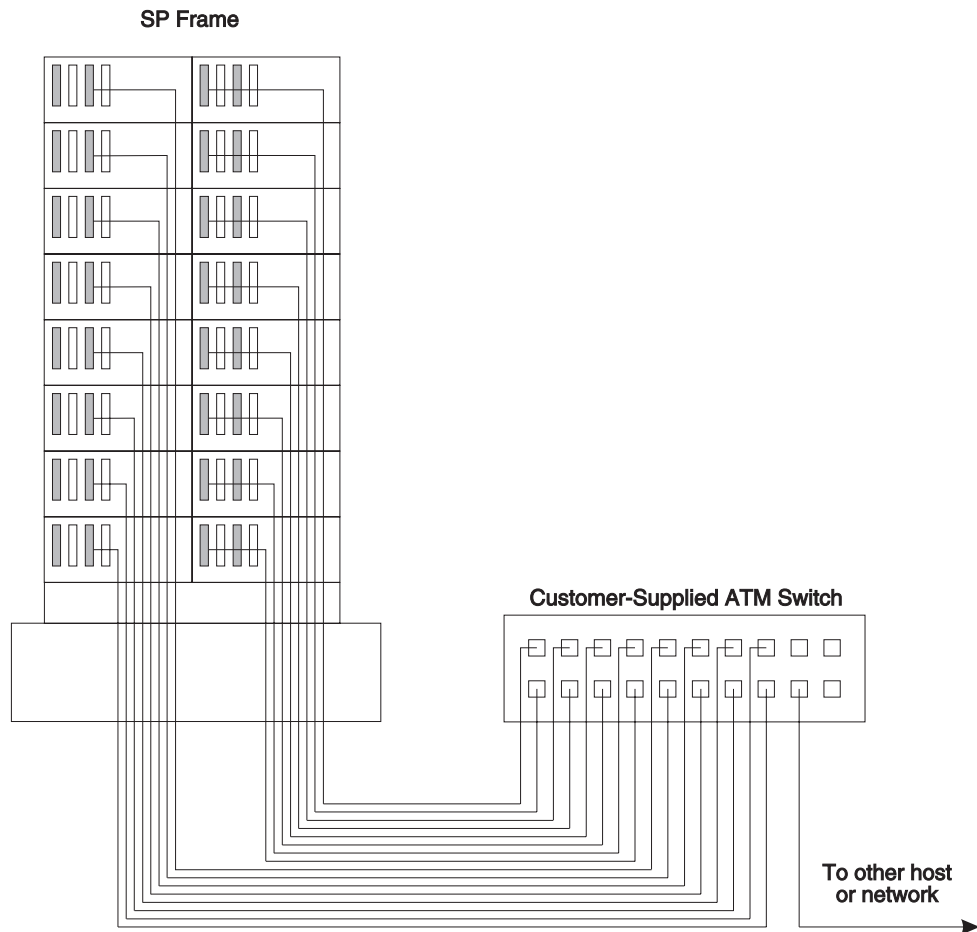


Figure 16. Typical ATM Cabling for the SP System

10/100 Ethernet 10BaseTX 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 100BaseTX and 10BaseT 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-negotiation of media speed and duplex operation
- Supports both full and half duplex operation over 10BaseT 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 10BaseT Ethernet LANs
- All Ethernet cables

Note: For 100BaseTX 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)

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

10Base2 and 10BaseT (BNC/RJ-45) Ethernet LAN PCI Adapter (F/C 2985)

The PCI Ethernet 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 10BaseT 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 10BaseT 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 10BaseT Ethernet LANs
- All Ethernet cables

Note: For 10BaseT 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 17 on page 146 represents a typical Ethernet cable routing in an SP frame.

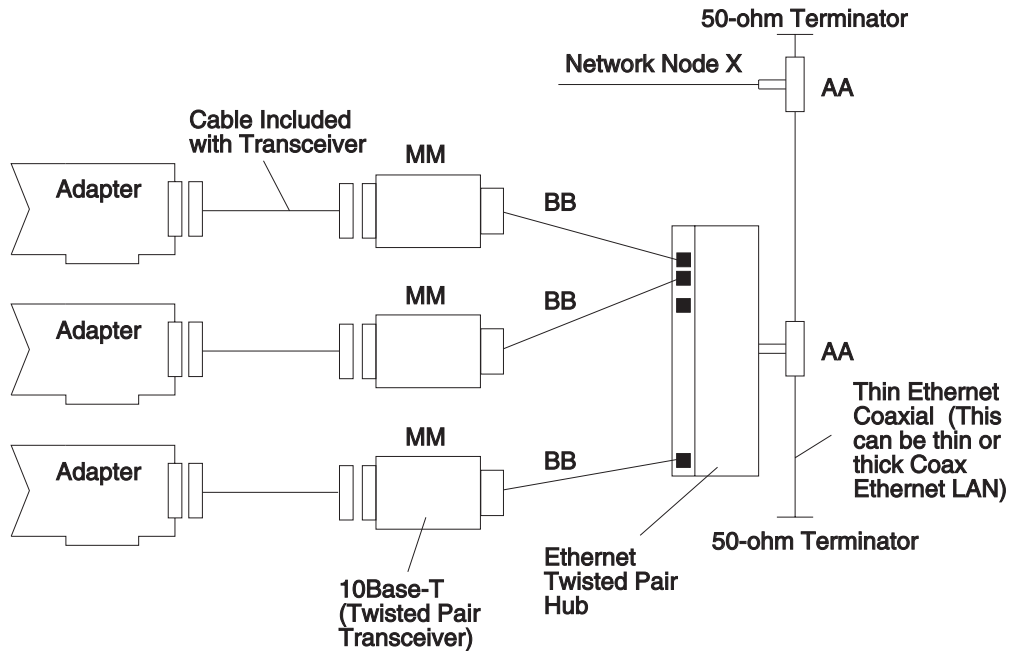


Figure 17. Ethernet Cable Routing

10Base5 and 10BaseT (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 10BaseT 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 10BaseT 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 10BaseT Ethernet LANs
- All Ethernet cables

Note: For 10BaseT 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 18 represents a typical Ethernet cable routing in an SP frame.

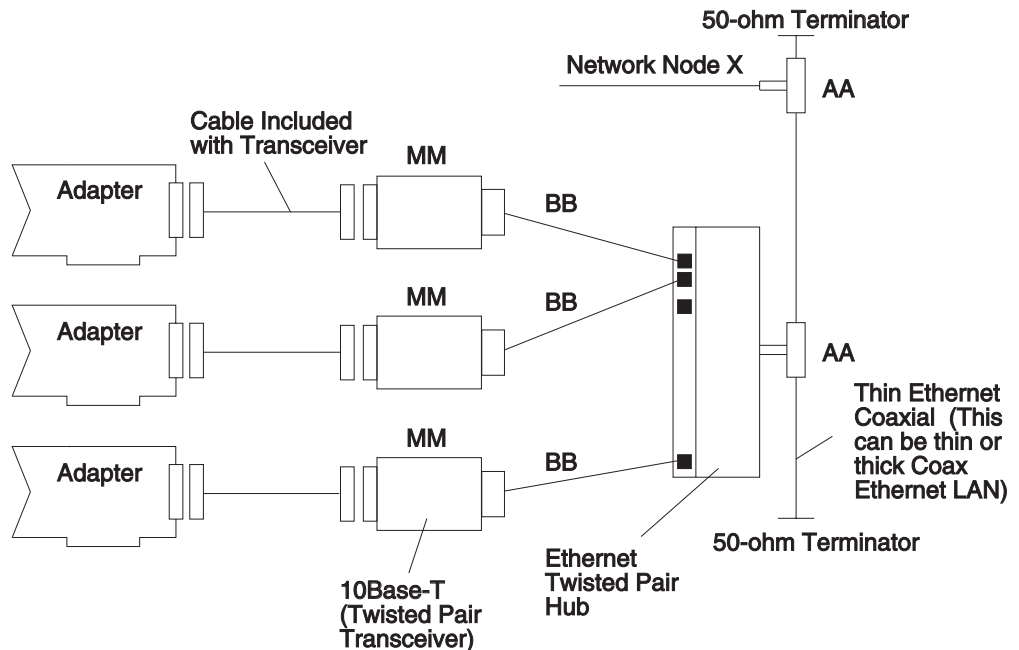


Figure 18. Ethernet Cable Routing

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 19 on page 149 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.

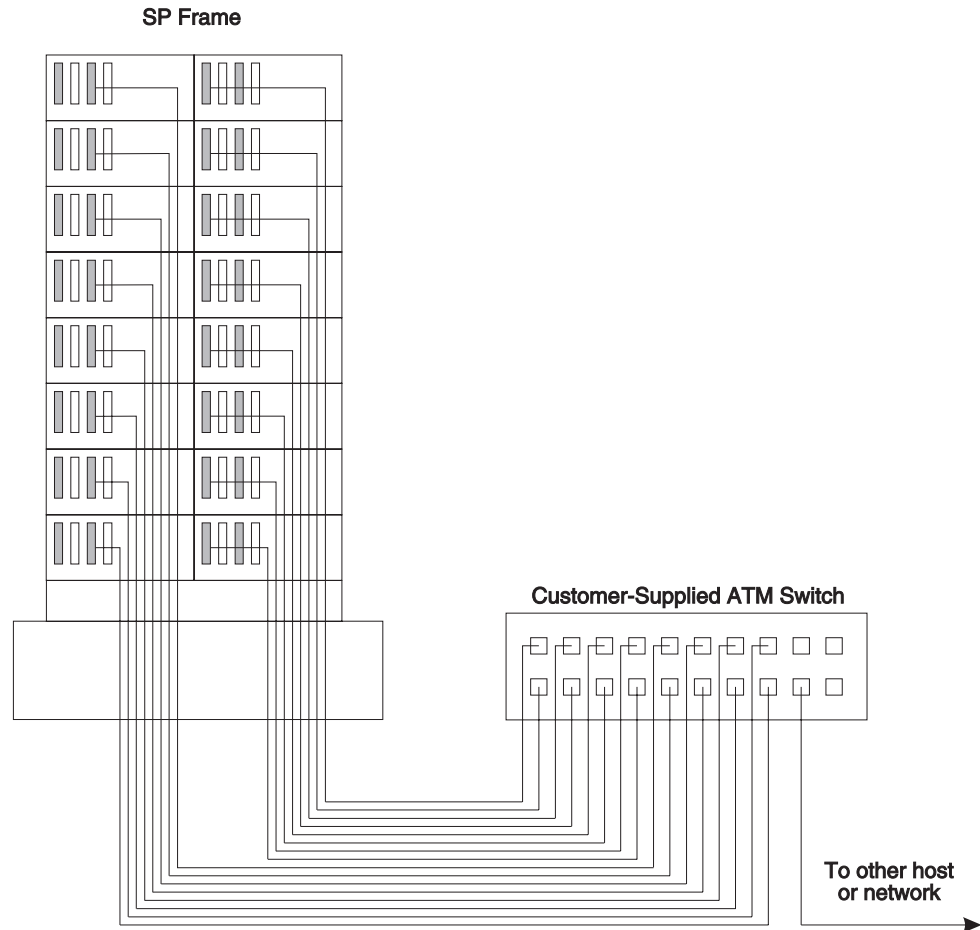


Figure 19. Typical ATM Cabling for the SP System

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.

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

F/C 6204 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 20 on page 152 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.

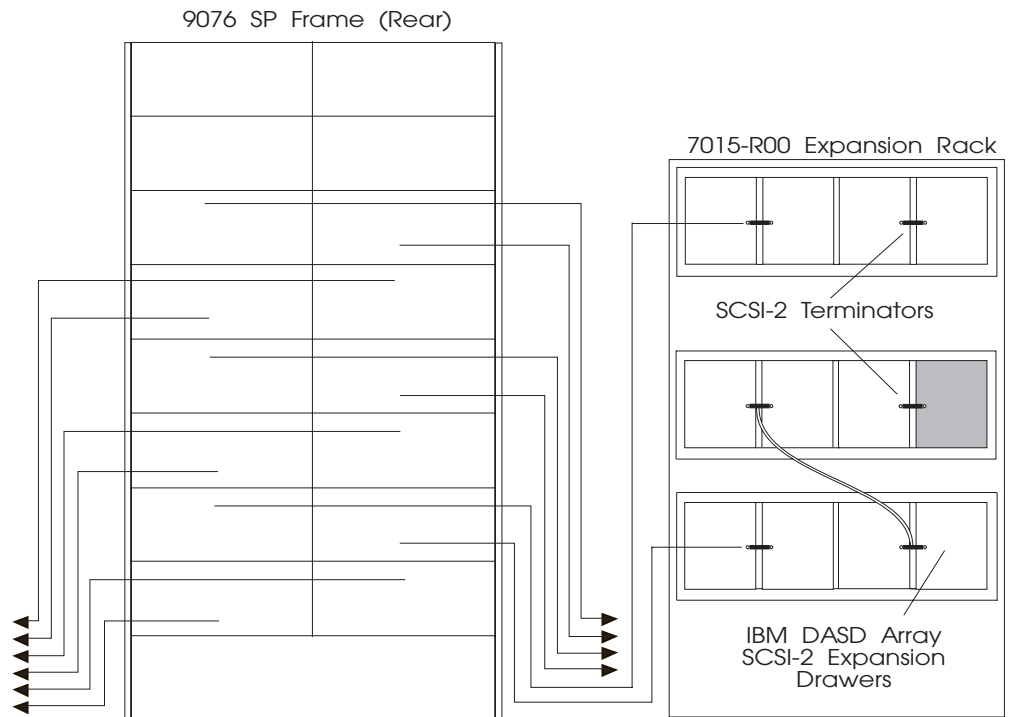


Figure 20. SCSI-2 Ultra/Wide Configuration for Processor Cabling

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 36 on page 153 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.

<i>Table 36. Cable Budget Information for SCSI-2 Ultra/Wide Feature</i>		
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

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)

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

Adapter 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 DASD 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 154 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 21 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.

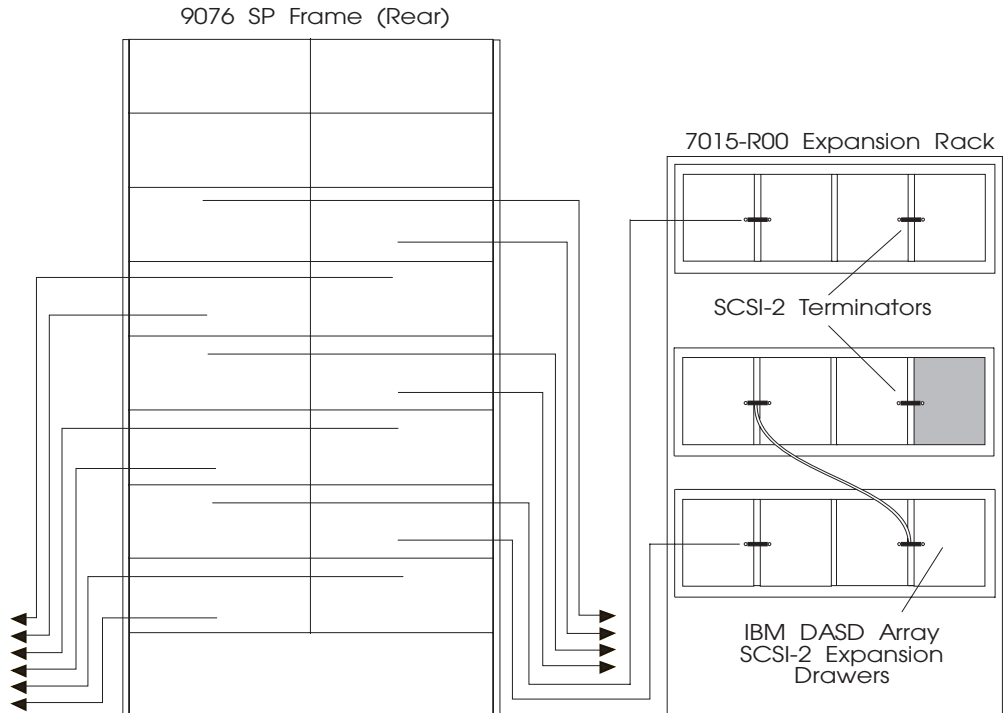


Figure 21. SCSI-2 Ultra Configuration for Processor Cabling

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 37 on page 157 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.

<i>Table 37. Cable Budget Information for SCSI-2 Fast/Wide Feature</i>		
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

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 20 on page 152 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.

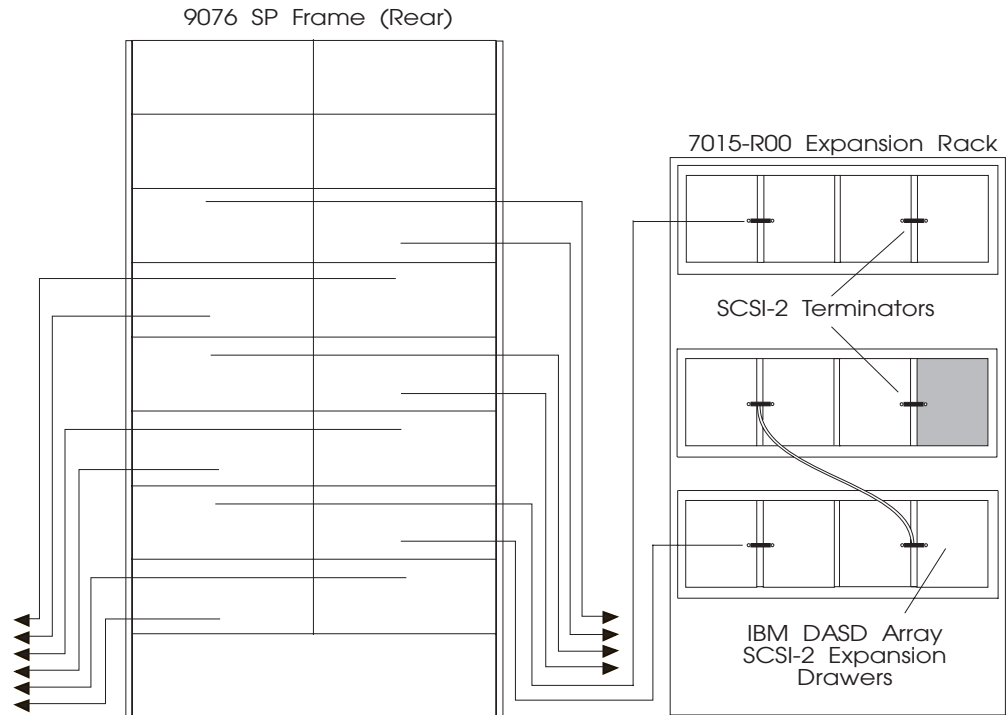


Figure 22. SCSI-2 Ultra/Wide Configuration for Processor Cabling

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 36 on page 153 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.

<i>Table 38. Cable Budget Information for SCSI-2 Ultra/Wide Feature</i>		
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

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 initiator 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:
 1. 1062.5 MBps
 2. 2 - 500 m
- Multimode 62.5/125 micron fiber with SC connectors:
 1. 1062.5 MBps
 2. 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)

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 initiators
 - 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)

Limitations

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 initiators 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 39. 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
2	0, 1, or 2	Yes	No
	3	No	Yes
3	0 or 1	Yes	No
	2 or 3	No	Yes

Direct Access Storage Devices (DASD)

Direct Access Storage Devices (DASD) are either internally or externally mounted. Internal DASD are installed in DASD bays within the node, while external DASD are mounted in separate DASD frames.

Internal DASD

DASD feature options available for each node type are listed in Table 40. Note that you can order some node types with no internal DASD (with external booting). For information on the DASD capacity of a specific node type, refer to the respective node sections; see “Planning for Internal DASD” on page 169 for pointers.

Table 40 (Page 1 of 3). DASD Options for Current Node Types

Feature Code	DASD Size	DASD Type	Node Type
2908	9.1 GB	Ultra SCSI	332 MHz SMP Thin 332 MHz SMP Wide 160 MHz Thin
2909	9.1 GB	Ultra SCSI disk pair	375 MHz POWER3 Thin 375 MHz POWER3 Wide POWER3 SMP High POWER3 SMP Thin POWER3 SMP Wide 332 MHz SMP Thin 332 MHz SMP Wide
2918	18.2 GB	Ultra SCSI disk pair	375 MHz POWER3 Thin 375 MHz POWER3 Wide POWER3 SMP High POWER3 SMP Wide POWER3 SMP Thin 332 MHz SMP Thin 332 MHz SMP 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
3803	18.2 GB	Ultra SCSI disk pair	SP Expansion I/O Unit

Table 40 (Page 2 of 3). DASD Options for Current Node Types

Feature Code	DASD Size	DASD Type	Node Type
3804	9.1 GB	Ultra SCSI 10K RPM disk pair	375 MHz POWER3 Thin 375 MHz POWER3 Wide POWER3 SMP High POWER3 SMP Wide POWER3 SMP Thin
3810	18.2 GB	Ultra SCSI 10K RPM disk pair	375 MHz POWER3 Thin 375 MHz POWER3 Wide POWER3 SMP High POWER3 SMP Wide POWER3 SMP Thin
3820	36.4 GB	Ultra SCSI 10K RPM disk pair	375 MHz POWER3 Wide POWER3 SMP High POWER3 SMP Wide
3805	9.1 GB	Ultra SCSI 10K RPM disk pair	SP Expansion I/O Unit
3811	18.2 GB	Ultra SCSI 10K RPM disk pair	SP Expansion I/O Unit
3821 (note 4)	36.4 GB	Ultra SCSI 10K RPM disk pair	SP Expansion I/O Unit
<i>Reference Information for Withdrawn DASD</i>			
2900	4.5 GB	Ultra SCSI	332 MHz SMP Thin 332 MHz SMP Wide 160 MHz Thin
2904	4.5 GB	Ultra SCSI disk pair	POWER3 SMP Thin POWER3 SMP Wide 332 MHz SMP Thin 332 MHz SMP Wide
3000	4.5 GB	Fast / Wide	332 MHz SMP Thin 332 MHz SMP Wide 200 MHz High 160 MHz Thin 135 MHz Wide
3010	9.1 GB	Fast / Wide	332 MHz SMP Thin 332 MHz SMP Wide 160 MHz Thin 135 MHz Wide

Table 40 (Page 3 of 3). DASD Options for Current Node Types

Feature Code	DASD Size	DASD Type	Node Type
Notes:			
1. Some nodes support independent mirroring. Consult node chapters for details.			
2. Some node types have a minimum prerequisite and a maximum allowable DASD allocation. Consult the respective node chapters for details.			
3. Some nodes require Micro Channel adapters and cables to utilize particular DASD options.			
4. Requires SP Expansion I/O Unit power upgrade (F/C 9955).			

Planning for Internal DASD

Some nodes require adapters to attach internal DASD while other nodes have integral SCSI drops for that purpose. Also, each node has optional SCSI adapters which allow you to configure internal and external DASD to meet your needs. Specific information for DASD requirements and options for each node type can be found in the following sections:

375 MHz POWER3 Wide Node

See “DASD Requirements and Options” on page 13.

375 MHz POWER3 Thin Node

See “DASD Requirements and Options” on page 17.

POWER3 SMP High Node

See “DASD Requirements and Options” on page 21.

SP Expansion I/O Unit

See “DASD Options” on page 22.

POWER3 SMP Wide Node

See “DASD Requirements and Options” on page 27.

POWER3 SMP Thin Node

See “DASD Requirements and Options” on page 31.

332 MHz SMP Wide Node

See “DASD Requirements and Options” on page 35.

332 MHz SMP Thin Node

See “DASD Requirements and Options” on page 39.

External DASD

External DASD 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 DASD 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 Model TL1 (tower with 10 bays)
- 2104 Model DL1 (frame-mount drawer with 10 bays)

VS 2100 The Versatile Storage Server 2100 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 VS 2100. 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 VS 2100 supports high performance processors and up to 6 GB of memory. Up to eighteen 7133 drawers can be controlled by the VS 2100. 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.

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

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 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 010 (frame mounted)
- 7133 500 (frame mounted)
- 7133 020 (tower unit)
- 7133 600 (tower unit)

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 DASD 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 to enable the no-internal DASD option, order the following feature codes:

- **F/C 9121** for nodes using an external SSA DASD subsystem
- **F/C 9124** for nodes using an external SCSI DASD subsystem

Consult the tables in each section below for valid system configurations.

External SSA DASD (F/C 9121)

This section lists the external SSA DASD 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 010
- 7133 500
- 7133 020
- 7133 600

Table 41 on page 173 lists the SP node types that can be configured for external booting with the 7133.

<i>Table 41. SP Nodes Supporting Bootable SSA Functions With the 7133</i>	
Node Type	Supported Adapters
375 MHz POWER3 Wide Node (F/C 2057)	F/C 6225, 6230
375 MHz POWER3 Thin Node (F/C 2056)	F/C 6225, 6230
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
<i>Reference information for withdrawn nodes</i>	
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.	

External SCSI DASD (F/C 9124)

This section lists the external SCSI DASD that are valid boot disks for SP nodes.

7027 High Capacity Storage Drawer (SCSI): The following 7027 model is supported for external booting in the SP system:

- 7027 HSD

Table 42 on page 174 lists the SP node types that can be configured for external booting with the 7027.

<i>Table 42. SP Nodes Supporting Bootable SCSI Functions With the 7027</i>	
Node Type	Supported Adapters
375 MHz POWER3 SMP wide node (F/C 2057)	F/C 6207, 6209
375 MHz POWER3 SMP thin node (F/C 2056)	F/C 6207, 6209
POWER3 SMP high node (F/C 2054)	F/C 6207
POWER3 SMP wide node (F/C 2053)	F/C 6207, 6209
POWER3 SMP thin node (F/C 2052)	F/C 6207, 6209
332 MHz SMP wide node (F/C 2051)	F/C 6207, 6209
332 MHz SMP thin node (F/C 2050)	F/C 6207, 6209
<i>Reference information for withdrawn nodes</i>	
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 43 on page 175 lists the SP node types that can be configured for external booting with the 7131.

<i>Table 43. SP Nodes Supporting Bootable SCSI Functions With the 7131</i>	
Node Type	Supported Adapters
375 MHz POWER3 SMP wide node (F/C 2057)	F/C 6207, 6209
375 MHz POWER3 SMP thin node (F/C 2056)	F/C 6207, 6209
POWER3 SMP high node (F/C 2054)	F/C 6207
POWER3 SMP wide node (F/C 2053)	F/C 6207, 6209
POWER3 SMP thin node (F/C 2052)	F/C 6207, 6209
332 MHz SMP wide node (F/C 2051)	F/C 6207, 6209
332 MHz SMP thin node (F/C 2050)	F/C 6207, 6209
<i>Reference information for withdrawn nodes</i>	
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:	
<ol style="list-style-type: none"> 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. 	

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 186.

RS/6000 SP system frames each contain an individual power subsystem with an attached ac line 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.

Obtaining Power System Backup Devices

The primary power supply to your SP system can be protected with either an uninterruptible power supply (UPS) or a dual line cord static transfer switch (STS). Both options are available through IBM. For more 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, 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 line 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. Figure 23 on page 179 shows the correct wiring of a typical power distribution system. 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.

Computer Room Power Panel

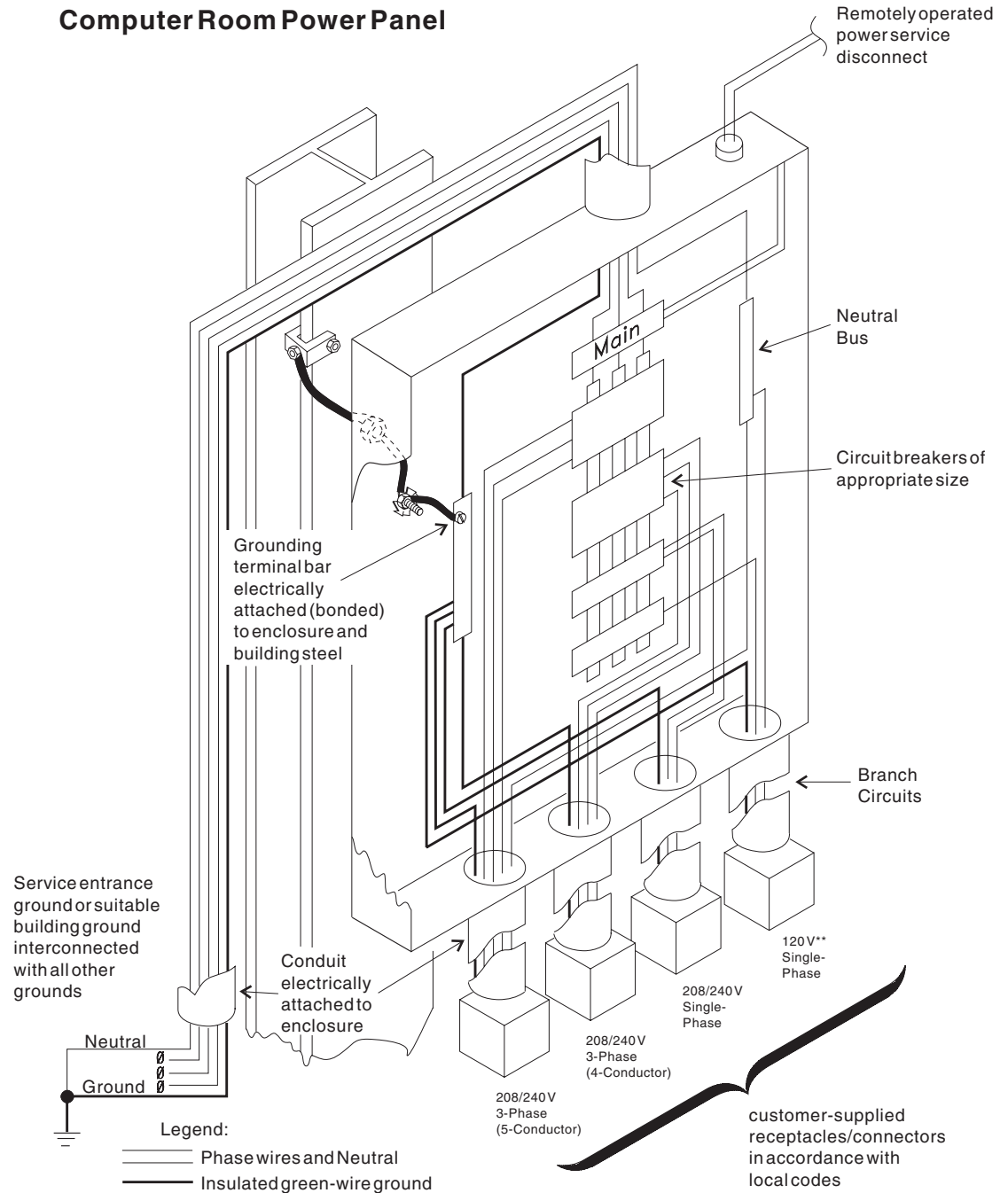


Figure 23. Typical Power Distribution System

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 line cords and plugs.

Scalable Electric Power Base Unit (SEPBU)

What is a SEPBU?

The Scalable Electric Power Base Unit (SEPBU) provides base (+12 V) and bulk (+48 V) power for the SP system. The SEPBU contains individual power supply modules known as Base Power Regulators. The SEPBU draws only the electrical current required to support the number of nodes installed in the SP frame.

Three-phase SEPBU's accept both low-voltage (200-240 V ac) and high-voltage (380-415 V ac) input options without the use of an external transformer. Single-phase SEPBU's accept only low voltage (200-240 V ac) power. A 4.3 meter (14 ft.) ac input line cord (6 ft. for Chicago, IL) is supplied with both three-phase and single-phase SEPBU's.

Note: For floor layout planning purposes; power drops to the frames must be within the reach of the ac line cord supplied with the SP frames.

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 main-line 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.

Balancing Circuit Breaker Performance

SP frames connected to high-voltage (380-415 V) 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 BPR modules (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)* system, slow-transfer type circuit breakers must be installed in the branch circuits supplying the frames.

Recommended Branch Circuit Breakers: The following slow-transfer circuit breakers have been tested and are recommended for **10.5 kW / 30 amp**, high-voltage SEPBU's:

Siemens (ITE) EFC3M030

Eaton (Heinemann) CD3-A3-AB0030-01B

Philips (Airpax) 219-3-1-66-5-8-30

SEPBU Power Control Interface

The SEPBU Power Control Interface provides remote power control. This allows an SP system with a SEPBU to either control or be controlled by external devices (such as disk units or tape drives) or another SP system with a SEPBU. The SEPBU provides two main (MAIN) outputs (+15 V @ 0.8 A maximum) to control external devices.

Outputs from different SEPBU's can be connected in parallel to allow either SEPBU to control the device. In addition, two auxiliary (AUX) inputs allow external devices to control the SP. These inputs accept +10 to 30 V (20 mA maximum) for power-on signal control. A local/auxiliary (LOC/AUX) switch at the rear of the SEPBU overrides the remote power control input when placed in the local (LOC) position.

Attention - Powering Off Frames with Power Control Interface

Powering off a frame that is configured to use 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 Cable Planning: Take cable lengths into account when you implement the Power Control Interface capabilities of the SEPBU. A 10-meter (33 ft.) cable (**P/N 00G1277**) is required to connect the SP system 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 one of the frames; you need to order both cables. See Appendix B, "SEPBU Power Control Interface" on page 233 for more information.

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.

Emergency Power Off: The main power switch on the SP frame can act as the unit emergency power off (UEPO) switch when used with the Power Control Interface. For more information, see Appendix B, "SEPBU Power Control Interface" on page 233.

SEPBU Input Power Requirements

Both three-phase and single-phase voltage input SEPBU are available as follows:

- Single-phase, 5.0 kW SEPBU are used in both 1.25 and 1.36 m frames. Redundant power (N+1) is an optional feature (**F/C 1213**).
- Three-phase, 10.5 kW SEPBU are used in 1.93 m frames. These SEPBU have N+1 redundant power as a standard feature.

Note: Frames with early-style 3.5 kW or 7.0 kW SEPBU **must** be upgraded to 5.0 kW or 10.5 kW service, respectively, before SMP-type nodes can be installed. See “Upgrading Power Systems in Early SP Frames” on page 189 for more information.

The SEPBU is capable of supporting higher-power configurations. Fifty-ampere branch circuit cables can be installed but must have branch circuit CBs appropriate for the SEPBU type. This allows the use of higher-power configurations for future growth, eliminating the need to rewire branch circuits at a later date.

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 power requirements are listed in Table 44 and Table 45 on page 183.

SEPBU Low Voltage (200-240 V ac) Requirements

Table 44 describes voltage requirements for the low-voltage input range SEPBU.

Output Power	Number of BPRs	Ratings	Branch Circuit Required	Configuration	SEPBU book locations
5.0 kW	1	Single-phase, 50/60Hz, 30 ampere	40 amp preferred 50 amp acceptable	1.25 m frames without redundant power	Pos D
5.0 kW	2	Single-phase, 50/60Hz, 30 ampere	40 amp preferred 50 amp acceptable	1.25 m frames with N+1 redundant power	Pos C,D
10.5 kW	3	Three-phase, 50/60Hz, 35 ampere	50 amp preferred 60 amp acceptable	1.93 m frames with N+1 redundant power	Pos A,B,C

SEPBU High Voltage (380-415 V ac) Requirements

Table 45 on page 183 describes voltage requirements for the high-voltage input range SEPBU.

Table 45. SEPBU High-Voltage (380-415 V ac) Requirements					
Output Power	Number of BPRs	Ratings	Branch Circuit Required	Configuration	SEPBU book locations
10.5 kW	3	Three-phase, 50/60Hz, 20 ampere	30 ampere	1.93 m frames with N+1 redundant power	Pos A,B,C
Note: 1.25 m frames are not offered with a high-voltage SEPBU configuration.					

Evaluating Power Line Cords, Plugs, and Receptacles

Once you have decided on a system configuration to fit your computing needs, you can evaluate your requirements for the ac line cords and attached plugs which are supplied with your RS/6000 SP system.

Branch Circuit Requirements

For each RS/6000 SP ac line 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.

Note: You *must* adhere to local electrical codes at your site.

Power Line Cord Specifications for SEPBU-equipped Frames

This section describes the ac line cords supplied with your RS/6000 SP frames and also lists the required customer-supplied mating connectors. You need to supply either receptacles or in-line connectors, depending on your specific site requirements.

Phase Connections

On 1.93 m frames, the ac line 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 line cords supplied without a plug, the blue conductor is to be connected to a non-neutral phase. This is permitted by international standards for four-wire systems.

On 1.25 and 1.36 m frames, the ac line 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 Frame: Table 46 on page 184 applies to 1.93 m frames using the 10.5 kW SEPBU. This table describes the **IBM-supplied** ac line cords and the required **customer-supplied** mating connectors. You, as the customer, must supply either the receptacle or the in-line connector, depending on your site requirements.

Table 46. Power Line Cord Specifications for Frames with 10.5 kW SEPBU's

Location	Length meters (feet)	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 mm² (#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.

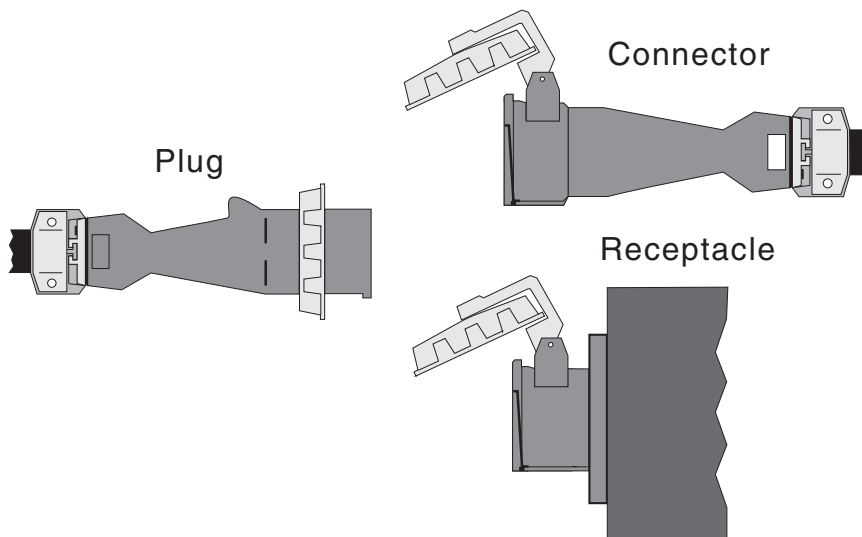


Figure 24. Three-Phase Power Connectors (U.S.A.)

1.25 and 1.36 m Frames: The information in Table 47 on page 185 applies to the **IBM-supplied** ac line cords and the required **customer-supplied** mating connectors used with the 5.0 kW SEPBU. These SEPBU's 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 the receptacle or the in-line connector, depending on your site requirements.

Location	Length meters (feet)	Plug Type	Conductor Dimension mm ² (AWG)	Customer-supplied Parts	
				Connector	Receptacle
North America (including Canada) and Japan	4.3 (14)	Russell-Stoll P/N 9P53U0 <i>or</i> 9P53G0/KF (See 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 line cord and both are compatible with the listed connector and receptacle
2. Terminations to be supplied by customer per local requirements

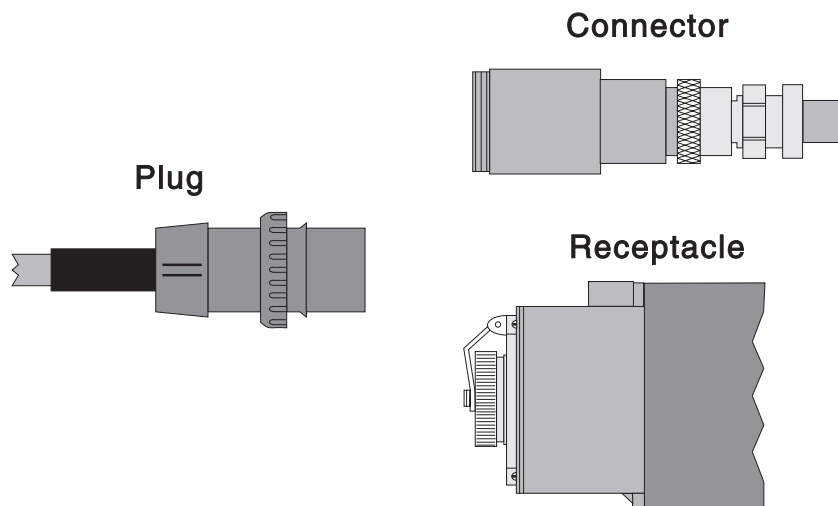


Figure 25. Single-Phase Power Connectors (U.S.A.)

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 251, in the “RS/6000 SP Switch Router” list. For the SP-Attached Server, see “Power Requirements for SP-Attached Servers” on page 46.

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 48 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 48 (Page 1 of 4). SP System Frame Power Computation Worksheet

System Name _____ Frame Number _____ Quantity of Frames in System _____			
Component	Feature	Qty. x Factor	Watts
Frame	Empty frame with power subsystem (500, 550, T70, 1500, 1550)	(1) x 41	41
Nodes	375 MHz POWER3 SMP Wide Node (F/C 2057)	(__) x 104	
	375 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			

Table 48 (Page 2 of 4). SP System Frame Power Computation Worksheet

System Name _____ Frame Number _____ Quantity of Frames in System _____			
Component	Feature	Qty. x Factor	Watts
CPUs	POWER3 SMP High Node CPU card (F/C 4849)	() x 132	
	375 MHz POWER3 SMP Thin or Wide Node CPU card (F/C 4362)	() x 160	
	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 76.5	
	CPU subtotal		
Memory	POWER3 SMP High Node memory card (F/C 4880)	() x 66	
	375 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 39.8	
	160 MHz Uniprocessor Thin Node memory card (F/C 4086, 7, 8, 9)	() x 11.5	
	Memory subtotal		
Switches	SP Switch (F/C 4011, 4008)	() x 167	
Switch adapters	SP Switch adapters (F/C 4020, 4022, 4023)	() x 26	
	Switch subtotal		
DASD	4.5 GB Ultra SCSI (F/C 2900)	() x 8.9	
	4.5 GB Ultra SCSI disk pair (F/C 2904)	() x 17.8	
	9.1 GB Ultra SCSI (F/C 2908)	() x 22.1	
	9.1 GB Ultra SCSI disk pair (F/C 2909)	() x 44.2	
	18.2 GB Ultra SCSI disk pair (F/C 2918)	() x 57.6	
	9.1 GB Ultra SCSI disk pair (F/C 3800)	() x 44.2	
	9.1 SSA disk pair (F/C 3802)	() x 54.2	
	18.2 GB Ultra SCSI disk pair (F/C 3803)	() x 57.6	
	9.1 GB Ultra SCSI 10K RPM disk pair (F/C 3804)	() x 41.7	
	18.2 GB Ultra SCSI 10K RPM disk pair (F/C 3810)	() x 51.3	
	36.4 GB Ultra SCSI 10K RPM disk pair (F/C 3820)	() x 74.1	
	DASD subtotal		

Table 48 (Page 3 of 4). SP System Frame Power Computation Worksheet

System Name _____ Frame Number _____ Quantity of Frames in System _____			
Component	Feature	Qty. x Factor	Watts
PCI adapters	Serial HIPPI SW (F/C 2732)	() x 39.7	
	Serial HIPPI LW (F/C 2733)	() x 39.7	
	FDDI SK-NET LP SAS (F/C 2741)	() x 9.9	
	FDDI SK-NET LP DAS (F/C 2742)	() x 15.2	
	FDDI SK-NET UP DAS (F/C 2743)	() x 9.9	
	ESCON Channel (F/C 2751)	() x 22.8	
	Token Ring (F/C 2920)	() x 2.3	
	8-Port Async (F/C 2943)	() x 19.1	
	WAN 128-Port Async (F/C 2944)	() x 9.0	
	ARTIC960Hx 4-Port Selectable (F/C 2947)	() x 26.9	
	2-Port Multiprotocol X.25 (F/C 2962)	() x 10.8	
	TURBOWAYS 155 UTP ATM (F/C 2963)	() x 10.5	
	10/100 Ethernet 10BaseTX (F/C 2968)	() x 9.1	
	Gigabit Ethernet-SX (F/C 2969)	() x 27.4	
PCI adapters	10Base2/10BaseT Ethernet LAN (F/C 2985)	() x 3.0	
	10Base5/10BaseT Ethernet LAN (F/C 2987)	() x 5.0	
	TURBOWAYS 155 ATM (F/C 2988)	() x 10.2	
	Token Ring (F/C 4959)	() x 2.7	
	SCSI-2 Ultra/Wide DE (F/C 6204, 6207)	() x 11.9	
	Ultra2 SCSI (F/C 6205)	() x 24.5	
	SCSI-2 Ultra/Wide SE (F/C 6206)	() x 11.9	
	SCSI-2 Fast/Wide SE (F/C 6208)	() x 11.9	
	SCSI-2 Fast/Wide DE (F/C 6209)	() x 11.9	
	SSA RAID 5 (F/C 6225)	() x 36.5	
	Fibre Channel (F/C 6227)	() x 26.6	
	SSA RAID 5 (F/C 6230)	() x 36.5	
	F/W Cache Module (F/C 6235)	() x 5.9	
	ARTIC960RxD Quad Digital Trunk (F/C 6310)	() x 30.4	
		PCI subtotal	
MCA adapters	MCA slots occupied in uniprocessor thin nodes	() x 46	
	MCA slots occupied in uniprocessor high and wide nodes	() x 35.6	
		MCA subtotal	
Total Power for Frame			

Table 48 (Page 4 of 4). SP System Frame Power Computation Worksheet

System Name _____ Frame Number _____ Quantity of Frames in System _____			
Component	Feature	Qty. x Factor	Watts
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:			
<ul style="list-style-type: none"> • For frames with a PDU, multiply $W \times 1.16$ for VA • For a PDU and High-voltage transformer, multiply $W \times 1.19$ for VA 			

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 circuit breakers, and a 1-to-2 breakout.
3. A new line cord with connector. For details on plugs and connectors, see Table 46 on page 184.

4. New power rating information plates.

Note: Power system upgrades for early SP frames S/N 76000 to 76131 also require line 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 44 on page 182 and Table 45 on page 183.
2. All wall receptacles and line connectors. For details and specifications, see Table 46 on page 184.
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 circuit breakers, and a 1-to-2 breakout.
4. A new line cord with connector. For details on plugs and connectors, see Table 47 on page 185.
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 44 on page 182.
2. All wall receptacles and line connectors. For details and specifications, see Table 47 on page 185.
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-bay, 10.5 kW SEPBU with N+1 power redundancy.
2. Eight (8) 48 V dc frame power cables with heavier-gauge wire, in-line circuit breakers, and a 1-to-2 breakout.
3. A new line cord with connector. For details on plugs and connectors, see Table 46 on page 184.
4. New power rating information plates.

Note: Power system upgrades for early SP frames S/N 76000 to 76131 also require line 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 44 on page 182 and Table 45 on page 183.
2. All wall receptacles and line connectors. For details and specifications, see Table 46 on page 184.
3. Any site changes needed to accommodate under-floor power connectors.

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 49 lists the environmental specifications of the RS/6000 SP system.

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

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!

Although it is permissible to ship and store your RS/6000 SP system in cold environments without damage (see Table 49), you must allow all SP hardware to gradually warm up to room temperature before you open the shipping container.

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. DASD 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 50 lists the optimum operating point and the 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 72°F)	40% to 50%

Note: For temperature measurement procedures, see “Completing a Temperature Survey” on page 198.

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 51. 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}		$\langle L_{pA} \rangle_m$	
	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 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
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 2054, (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.
- $\langle L_{pA} \rangle_m$ 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.

Evaluating Thermal Output

The air conditioning system at your installation must provide year-round temperature and humidity control. Use Table 48 on page 186 to determine the thermal output of your SP system. Use your power consumption results from the worksheets to calculate the heat output of your system. 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 achieve the recommended operating temperature.

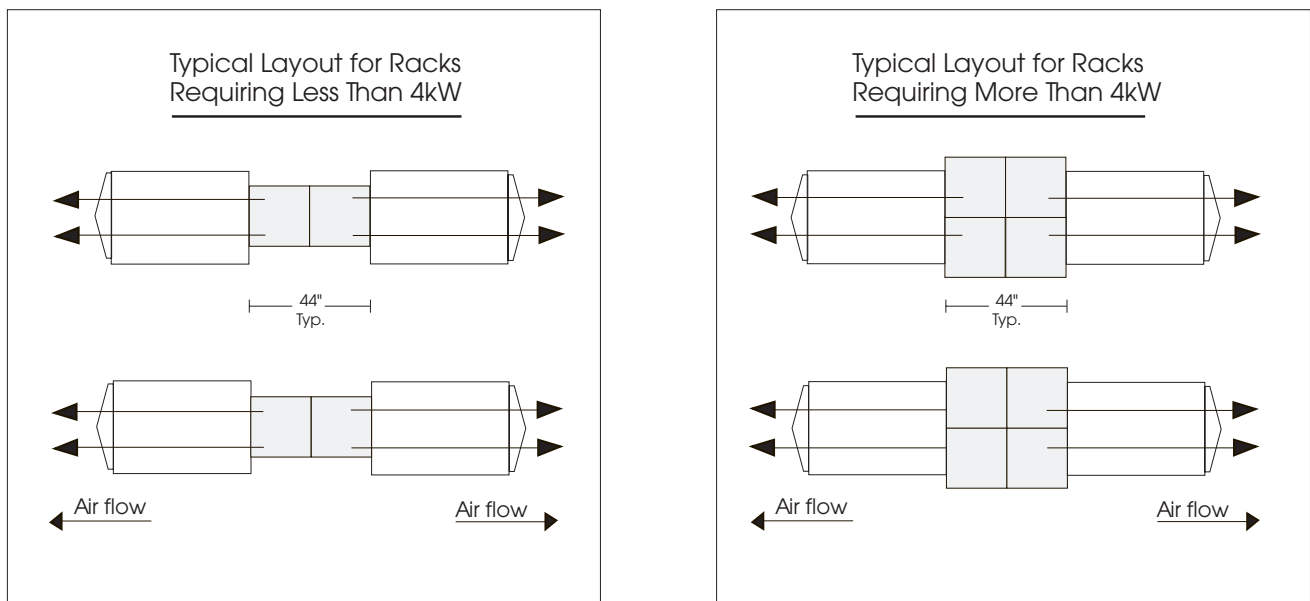
Thermal Planning Considerations for Your Site

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:

- Do not place perforated tiles directly under any of the SP frames (see Figure 26 on page 197).
- Align SP frames perpendicular to air conditioner outlets, if possible. This allows for better airflow into and around the system.
- Plug all cable cutouts with a pillow (P/N 2317361).
- Make cable cutouts in floor tiles as close to the recommended size as possible.
- Adjust the positioning and number of perforated tiles to achieve optimum temperatures. As a guideline, install one fully perforated tile, without dampers, per ton of air conditioning capacity (see Figure 26 on page 197).
- Ensure that all power requirements are met as specified in the *IBM General Information Manual: Installation Manual—Physical Planning, GC22-7072*
- Ensure that the room meets the requirements for cleanliness as specified in the *IBM General Information Manual: Installation Manual—Physical Planning, GC22-7072*
- Ensure that the exhaust from other SP frames or other manufacturer's 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 26 on page 197).
- At least one perforated tile, without a flow adjusting damper, is usually required for each SP frame. More may be required depending on the heat load .
- Install SP frames so that the frame front is aligned with the edge of the perforated tile (see Figure 26 on page 197).
- 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.

- Place perforated tiles 2 m away from the front of air conditioning units to help eliminate short cycling.
- 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.
- 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 with this type of activity, your branch office or area installation planning representative can assist you in achieving and maintaining the proper environment for your data processing equipment.



TOP VIEWS

(Note: align rack fronts to edge of perforated tiles)

Figure 26. Frame Layout for Optimal Air Flow Using Perforated Tiles

Assessing the Total Heat Load of Your Installation

This procedure describes how to do a total heat load assessment, which will indicate your installation's overall environmental balance point.

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 48 on page 186 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 “SP-Attached Server Environmental Specifications” on page 47 .

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” 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 197 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 one or more of these factors affect your site, consult with your IBM Global Services planning representative for guidelines.

Attention

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 cables (P/N 46G5695).

¹ See “Recommended Operating Point and Range” on page 194.

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 representative and your local building codes for guidance.

Frame tie-down protection devices are available through IBM Global Services.

1.93 m and 1.36 m Frame Tie-down Locations

The 1.93 m RS/6000 SP frame and the 1.36 m frame have four M10 tapped holes in the bottom of the frame for attachment to customer-supplied tie-down devices. See Figure 27 for hole locations.

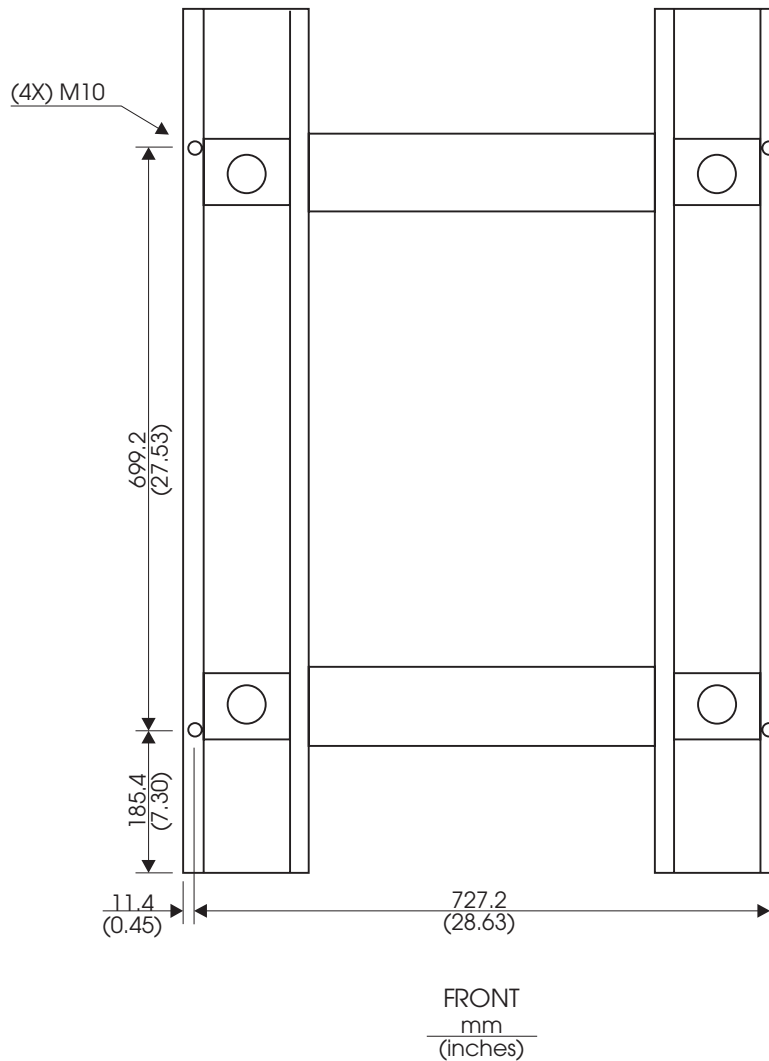


Figure 27. Locations of Tie-down Holes on the 1.93 m and 1.36 m Frames. Bottom View Showing Locations of M10 Tapped Holes for Frame Tie-Down Use.

1.25 m 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 28 and Table 52 for hole locations.

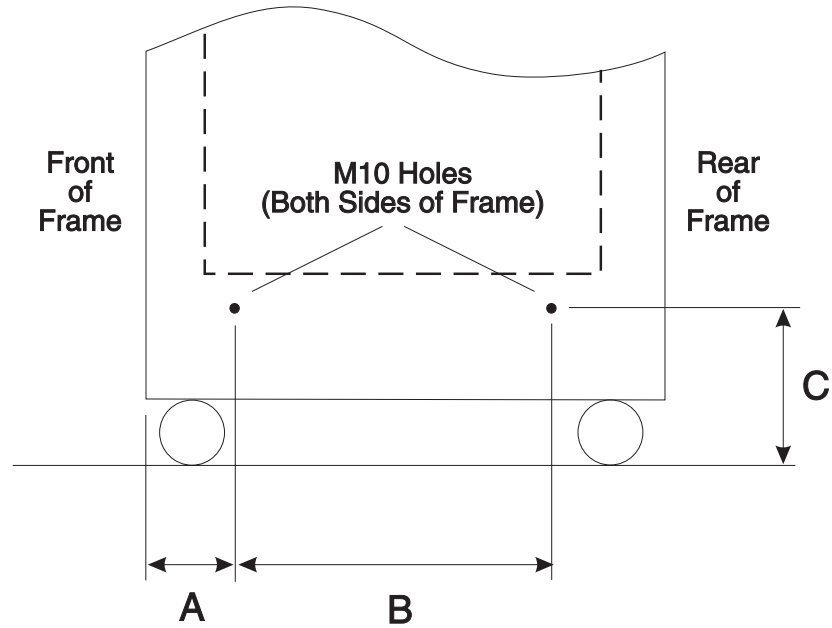


Figure 28. Locations for M10 Tapped Holes in 1.25 m and 2.01 m Frames

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.)

Floor Plans

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 RAID's 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:

- "SP System Physical Dimensions and Weights" on page 204
- "Wooden Shipping Container Dimensions and Weights" on page 206
- "Site Floor Preparation Considerations" on page 208
- "Service Clearance Specifications for Frames" on page 211
- "Service Clearance and Frame Footprint Illustrations" on page 212
- "Multi-Frame System Floor Planning and Illustrations" on page 221

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 53 gives the physical dimensions and weights of the 1.93 m (75.8 in.) frame with covers.

<i>Table 53. Dimensions and Weights of the 1.93 m Frame (with covers)</i>	
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	• 441 kg (971 lbs)
• Maximum Populated Configuration	• 984 kg (2165 lbs)

1.36 m Frame

Table 54 gives the physical dimensions and weights of the 1.36 m (53.5 in.) frame with covers.

<i>Table 54. Dimensions and Weights of the 1.36 m Frame (with covers)</i>	
Specification	Dimensions and Weights
Width	802 mm (31.5 in.)
Depth	1273 mm (50 in.)
Height	1355 mm (53.5 in.)
Weight	
• Minimum Base Configuration	• 412 kg (902 lbs)
• Maximum Populated Configuration	• 538 kg (1185 lbs)

1.25 m Frame

Table 55 gives the physical dimensions and weights of the 1.25 m (49 in.) frame with covers.

<i>Table 55. Dimensions and Weights of 1.25 m Frame (with covers)</i>	
Specification	Dimensions
Width	711 mm (28 in.)
Depth	915 mm (36 in.) (no covers) 1015 mm (40 in.)
Height	1245 mm (49 in.)
Weight	
<ul style="list-style-type: none"> • 1 Drawer installed • 4 Drawers installed 	<ul style="list-style-type: none"> • 232 kg (510 lbs) • 414 kg (910 lbs)

SP Switch Frames Produced After 4/98 (F/C 2031)

Table 56 gives the physical dimensions and weights of SP Switch Frames (F/C 2031) with covers.

<i>Table 56. Dimensions and Weights of Switch Frame (F/C 2031) (with covers)</i>	
Specification	Dimensions and Weights
Width	922 mm (36.3 in.)
Depth	1519 mm (59.8 in.)
Height	1925 mm (75.8 in.)
Weight	
<ul style="list-style-type: none"> • 4 Switches (Basic Frame) 	<ul style="list-style-type: none"> • 579 kg (1275 lbs)

Processor Node and Component Dimensions and Weights

Table 57 on page 206 lists the weights and dimensions of available processor nodes. The maximum weight shown is for a node with a full complement of DASD, memory, and adapters; the minimum weight is for a minimum configuration. Dimensions shown are for the node alone, without its enclosure.

<i>Table 57. Weights and dimensions of processor nodes and components</i>				
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
<i>Reference information for withdrawn nodes</i>				
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
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 58 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.

<i>Table 58. Dimensions and Weights of Shipping Container for 1.93 m Frame Assembly With Covers</i>	
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.	

1.36 m Frame

Table 59 describes the physical dimensions and weights of the shipping container for 1.36 m frame assembly with covers.

Please note that these wooden shipping containers are used only for shipments outside the U.S.A.

<i>Table 59. Dimensions and Weights of Shipping Container for 1.36 m Frame Assembly With Covers</i>	
Specification	Dimensions and Weights
Length	1460 mm (57.5 in.)
Width	1105 mm (43.5 in.)
Height	1651 mm (65 in.)
Weight (empty)	205 kg (451 lbs.)

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 60 describes the physical dimensions and weights of the shipping container for 1.25 m frames.

<i>Table 60. Dimensions and Weights of Shipping Container for 1.25 m Frame Assembly With Covers</i>	
Specification	Dimensions and Weights
Length	1226 mm (48.25 in.)
Width	908 mm (35.75 in.)
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 krimp 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 209.

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 61 on page 211 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 221 show the required clearances between 1.93 m frames and adjacent units. This information is detailed in Table 61 on page 211 and illustrated in Figure 29 on page 213.

The size and location of the 1.93 m frame cable cut-out and the location of the casters are illustrated in Figure 30 on page 214.

Floor Preparation for 1.36 m Frames: Refer to Figure 31 on page 215 for the required clearances between the 1.36 m frame and adjacent units.

The size and location of the 1.36 m frame cable cut-out and the location of the casters are illustrated in Figure 32 on page 216.

Floor Preparation for 1.25 m Frames: Refer to Figure 33 on page 217 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 35 on page 219 and Table 61 on page 211 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 36 on page 220.

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 221 show the required clearances between 1.93 m frames and adjacent units. This information is also detailed in Table 61 on page 211 and illustrated in Figure 29 on page 213.

The size and location of the 1.93 m frame cable cut-out and the location of the casters are illustrated in Figure 30 on page 214.

Floor Preparation for 1.36 m Frames: The clearance between the floor and the bottom of the rear door of the 1.36 m frame is 76 mm (3 in.).

Refer to Figure 31 on page 215 for the required clearances around the 1.36 m frame. For information on cable access points and casters, see Figure 32 on page 216.

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 33 on page 217 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 34 on page 218.

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 35 on page 219 and Table 61 on page 211 for the required clearances between SP Switch frames and adjacent units. For information about the frame's cable cut-out, see Figure 36 on page 220.

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

Table 61 lists the service clearances for 1.93 m (75.8 in.) SP frames. Illustrations in “Multi-Frame System Floor Planning and Illustrations” on page 221 show these service clearances as applied to typical SP system layouts. Service clearances for both the 1.93 m frame and the 1.93 m SP Switch frame are also illustrated in Figure 29 on page 213 and Figure 35 on page 219.

<i>Table 61. Service Clearances for 1.93 m SP Frames</i>	
Service Area	Dimensions
Front Clearance	1118 mm (44 in.)
Rear Clearance	915 mm (36 in.)
Side Clearance	<ul style="list-style-type: none"> • End frames on each row require a minimum of 915 mm (36 in.) between the side of the frame and the wall. • Frames within a row require 368 mm (14.5 in.) between each frame. • When four or more frames are installed in a row, there must be a minimum of 915 mm (36 in.) between each fourth and fifth frame for efficient service access
Ceiling	Recommended distances: 2438 mm (96 in.) from floor to ceiling, or 488 mm (19.2 in.) from the top of the frame to the ceiling.
<p>Note: Primary service access for the nodes is from the front of the frame. When viewed from the front, the service door swings to the right. If you do not install your SP frames with the required service clearances, this creates a potential service problem for frames on the left end of a row. This problem results from the fact that you need a service ladder to access the upper nodes. If there is not 915 mm (36 in.) between the left end frames and the wall, the service engineer will not be able to maneuver the service ladder into position from the side of the frame and the front of the frame will be blocked by the open door. Therefore, if you must install frames less than 915 mm (36 in.) from the left wall, you must increase the front clearance to 1525 mm (60 in.), allowing the service ladder to be placed in front of the frame.</p>	

1.36 m Frame

Table 62 lists the service clearances for 1.36 m (53.5 in.) SP frames.

<i>Table 62. Service Clearances for 1.36 m (53.5 in.) Frames</i>	
Service Area	Dimensions
	<i>(See Figure 31 on page 215)</i>
Front	1118 mm (44 in.)
Rear	914 mm (36 in.)
Sides	914 mm (36 in.)

1.25 m Frame

Table 63 lists the service clearances for 1.25 m (49 in.) SP frames.

<i>Table 63. Service Clearances for 1.25 m (49 in.) Frames</i>	
Service Area	Dimensions <i>(See Figure 33 on page 217)</i>
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

This section contains illustrations for 1.93 m frames.

Service Clearances for 1.93 m Frame: Figure 29 illustrates the service clearances and the associated weight distribution area for 1.93 m (75.8 in.) frames.

Note: Clearance dimensions are shown to the frame, not the skirts. Side clearances shown in this illustration may vary. See Table 61 on page 211 for specific dimensions.

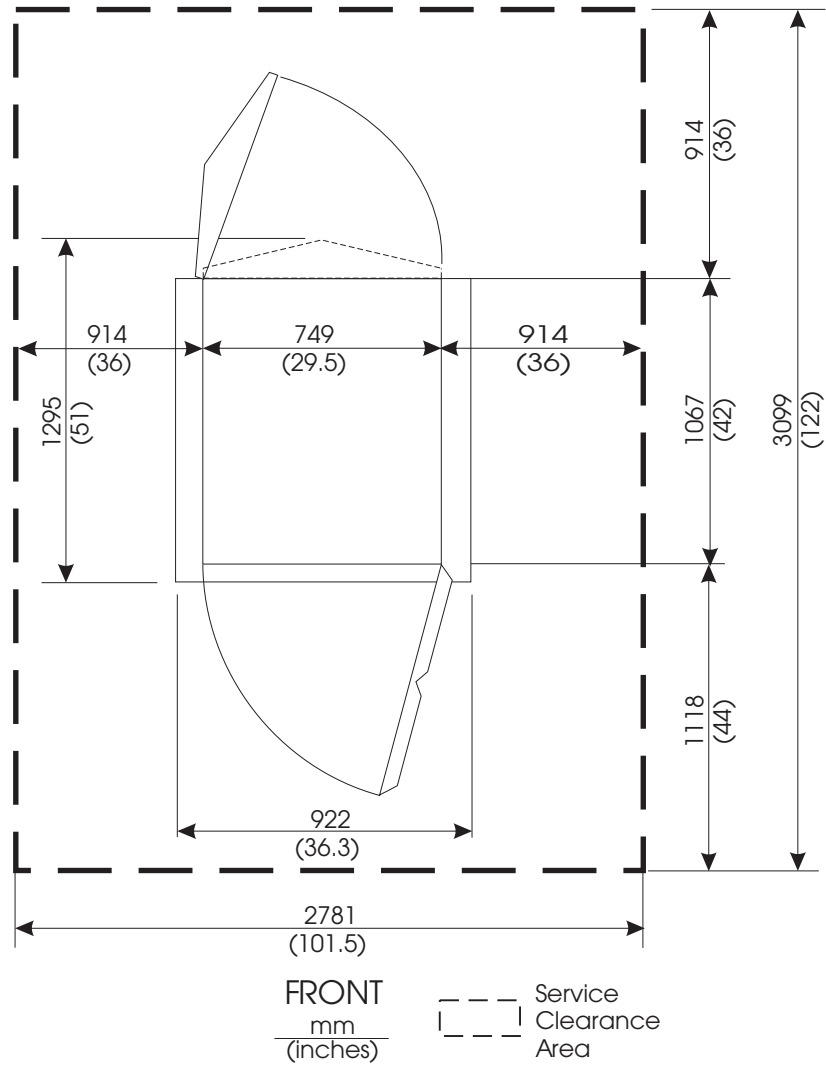


Figure 29. Service Clearances for 1.93 m Frames (not to scale)

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 “Frame Tie-down Considerations” on page 200.

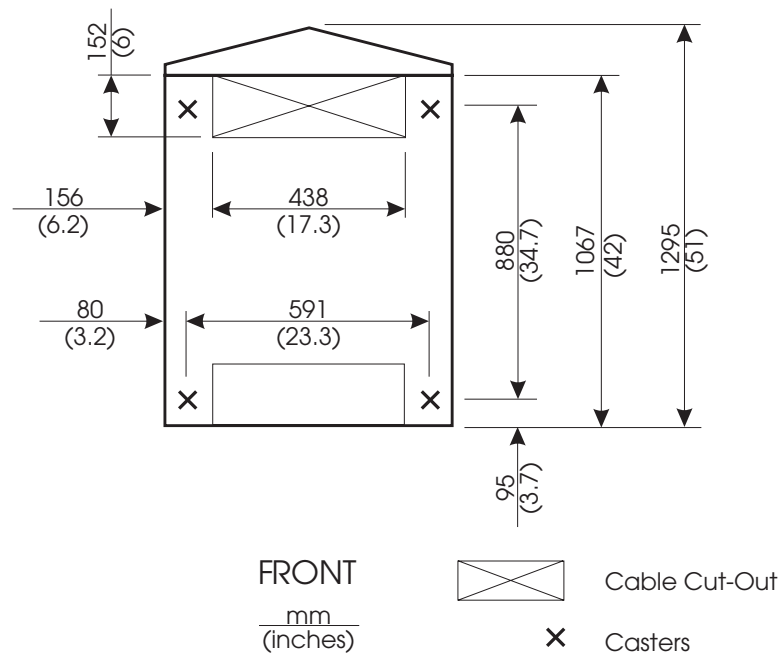


Figure 30. 1.93 m Frame: Cable Cut-out Dimensions and Caster Locations (not to scale).

Notes:

1. Frame outline is shown. Rear cover added for orientation, side covers have been omitted.
2. Front cut-out is not used with SP systems.
3. Leveling pads are replaced with wheel chocks for 1.93 m frames.

1.36 m Frame

This section contains illustrations for 1.36 m frames.

Service Clearances for 1.36 m Frame: Figure 31 illustrates the service clearances and the associated weight distribution area for 1.36 m (53.5 in.) frames.

Note: Clearance dimensions are shown to the frame, not the covers.

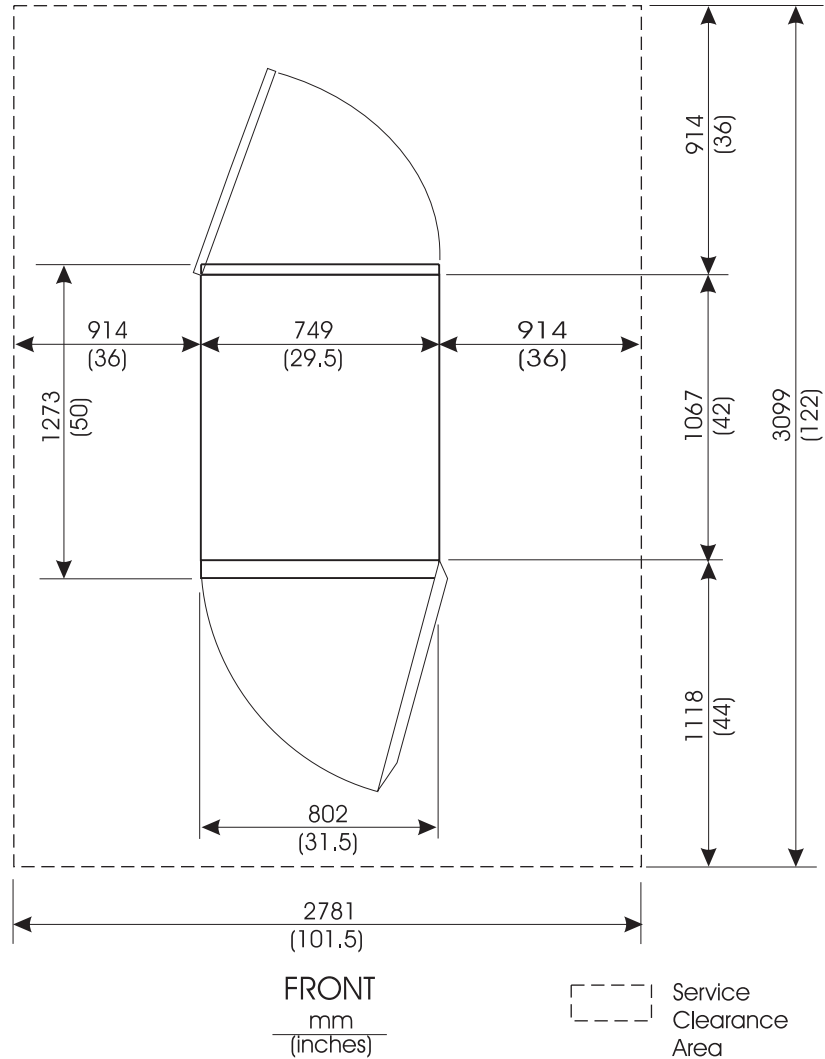


Figure 31. Service Clearances for 1.36 m Frames (not to scale)

Cut-away View of 1.36 m Frame: The following figure details the location and size of the casters and cable cut-out on the base of the 1.36 m frame. For frame tie-down points, see “Frame Tie-down Considerations” on page 200.

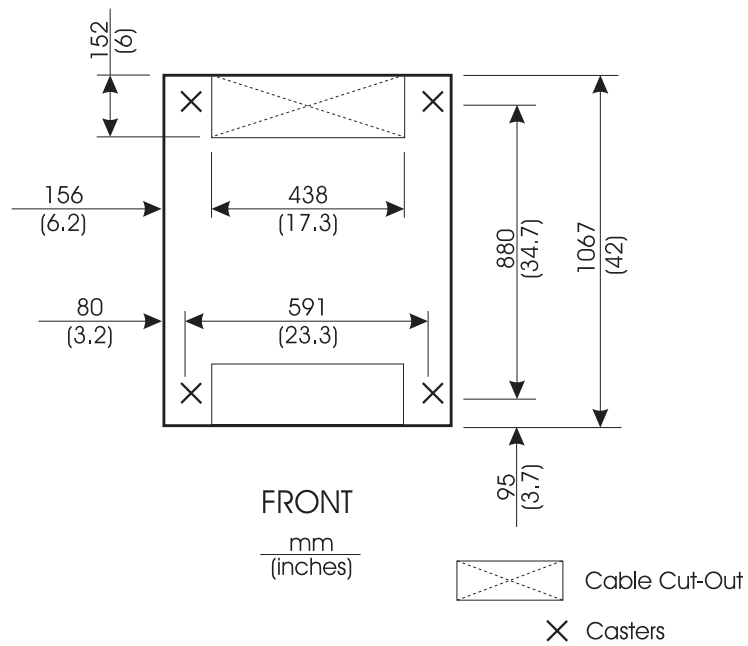


Figure 32. 1.36 m Frame: Cable Cut-out Dimensions and Caster Locations (not to scale).

Notes:

1. Frame outline is shown.
2. Front cut-out is not used
3. Leveling pads are replaced with wheel chocks for 1.36 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

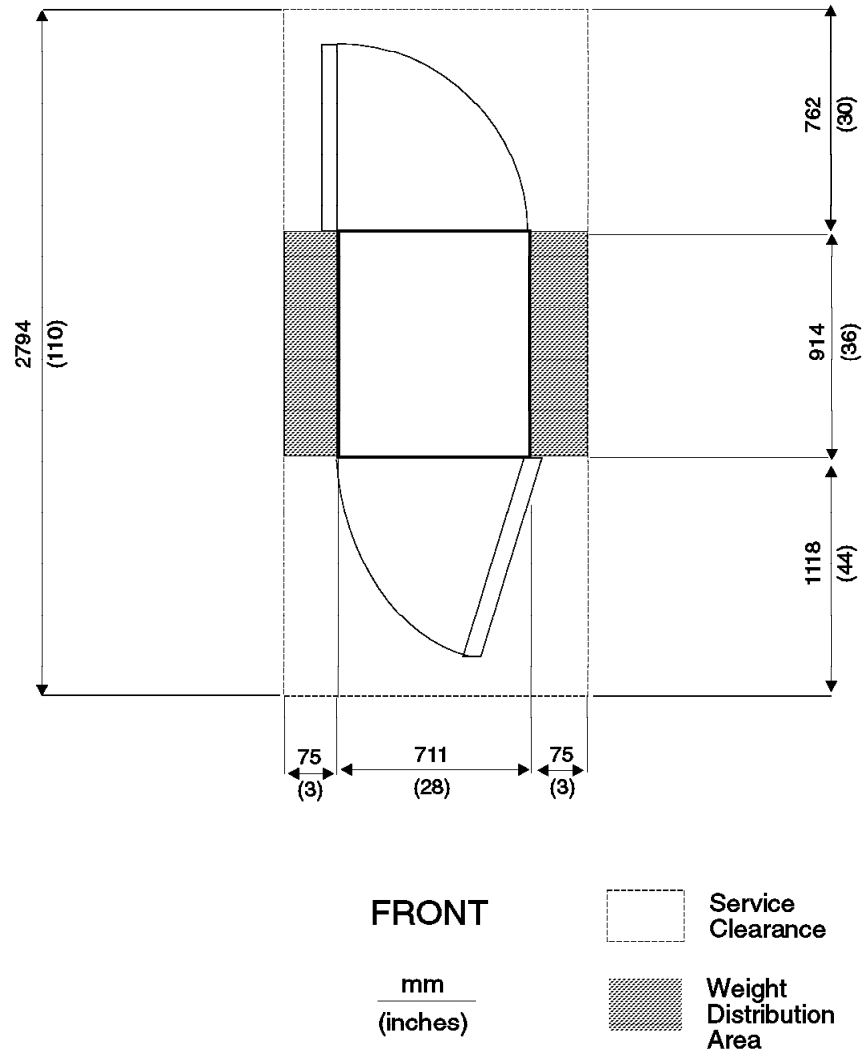


Figure 33. Service Clearances and Weight Distribution 1.25 m Frames (not to scale)

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 34 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.

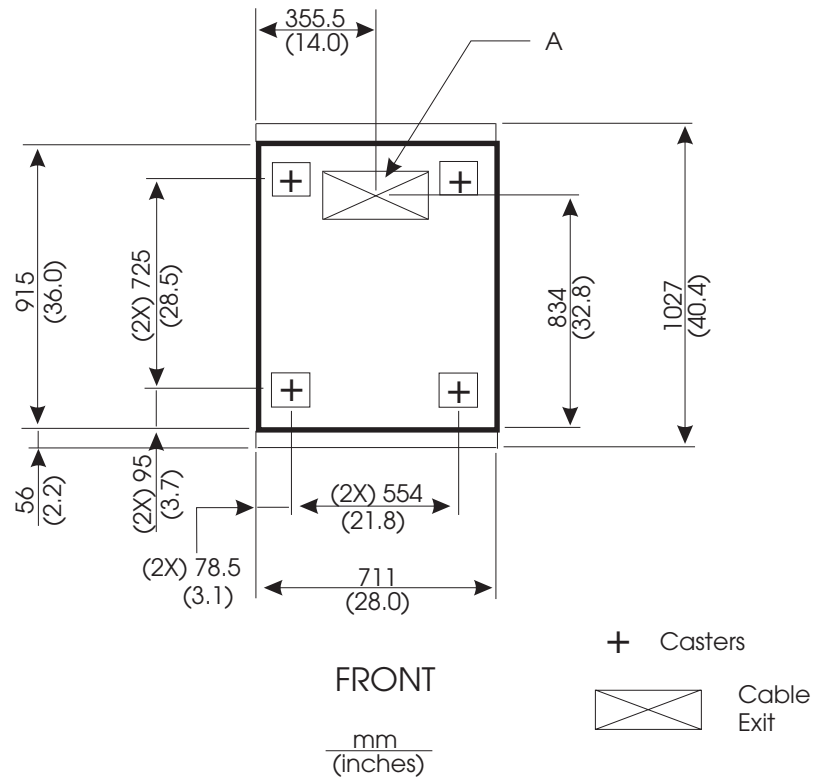


Figure 34. Floor Cutout Dimensions for the 1.25 m (49 in.) Frame

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

This section contains illustrations for 1.93 m switch frames.

Service Clearances for 1.93 m SP Switch Frames (F/C 2031 only) Produced After 4/98: Figure 35 illustrates the service clearances and associated weight distribution area for the 1.93 m SP switch frame.

Note: Clearance dimensions are shown to the frame, not the skirts. Side clearances shown in this illustration may vary. See Table 61 on page 211 for specific dimensions.

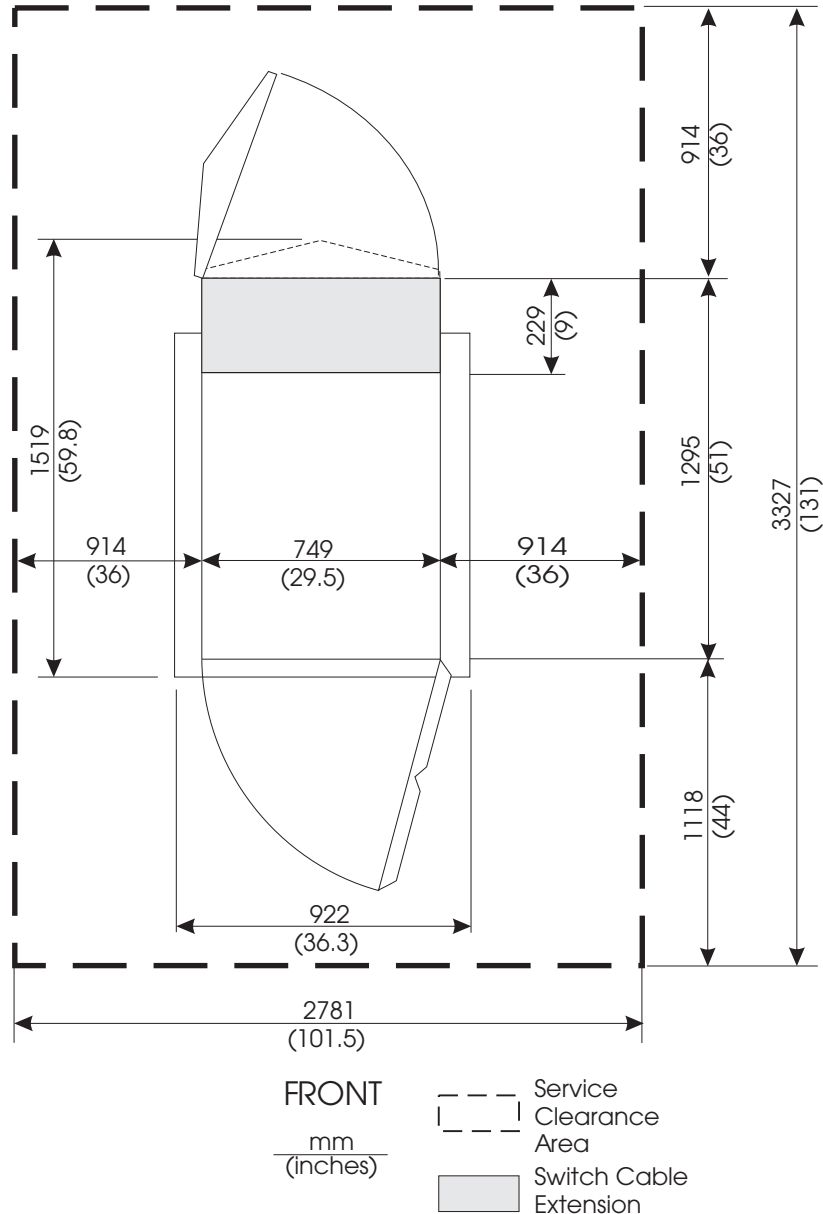


Figure 35. 1.93 m SP Switch Frame Service Clearances For Frames Produced After 4/98 (not to scale)

Cut-away View of 1.93 m SP Switch Frames (F/C 2031 only) Produced After 4/98: The following figure details the location of the casters and cable cut-out on the base of the 1.93 m SP Switch frame. See “Frame Tie-down Considerations” on page 200 for tie-down locations.

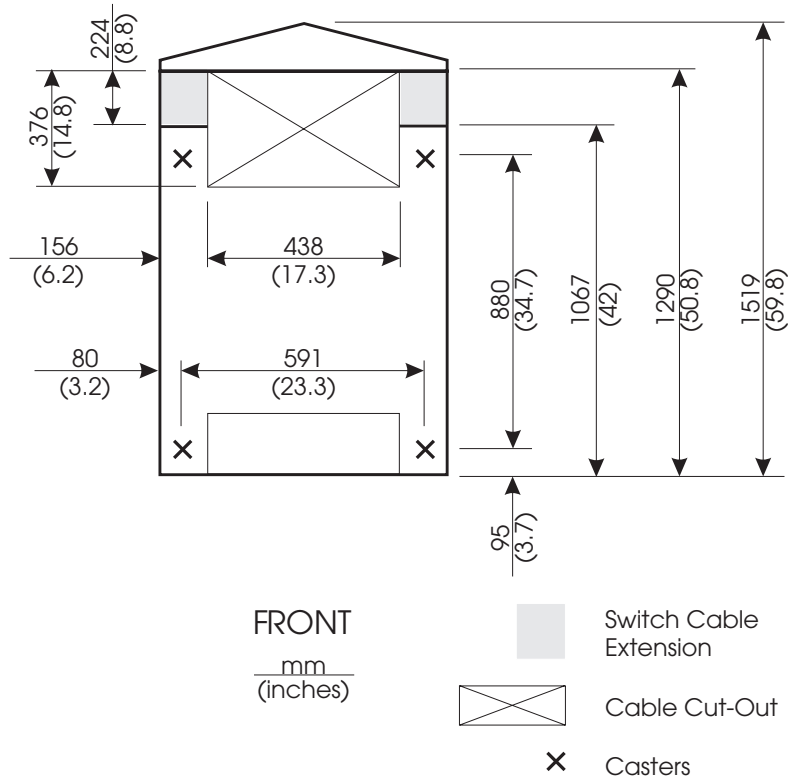


Figure 36. 1.93 m SP Switch Frame: Cable Cut-out Dimensions and Caster Locations For Frames Produced After 4/98 (not to scale).

Notes:

1. Frame outline is shown. Rear cover added for orientation, side covers have been omitted.
2. Front cut-out is not used with SP systems.
3. Leveling pads have been replaced with wheel chocks on 1.93 m frames.

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 211 and Figure 33 on page 217.
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 211, Figure 29 on page 213 and Figure 37 on page 222.
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.

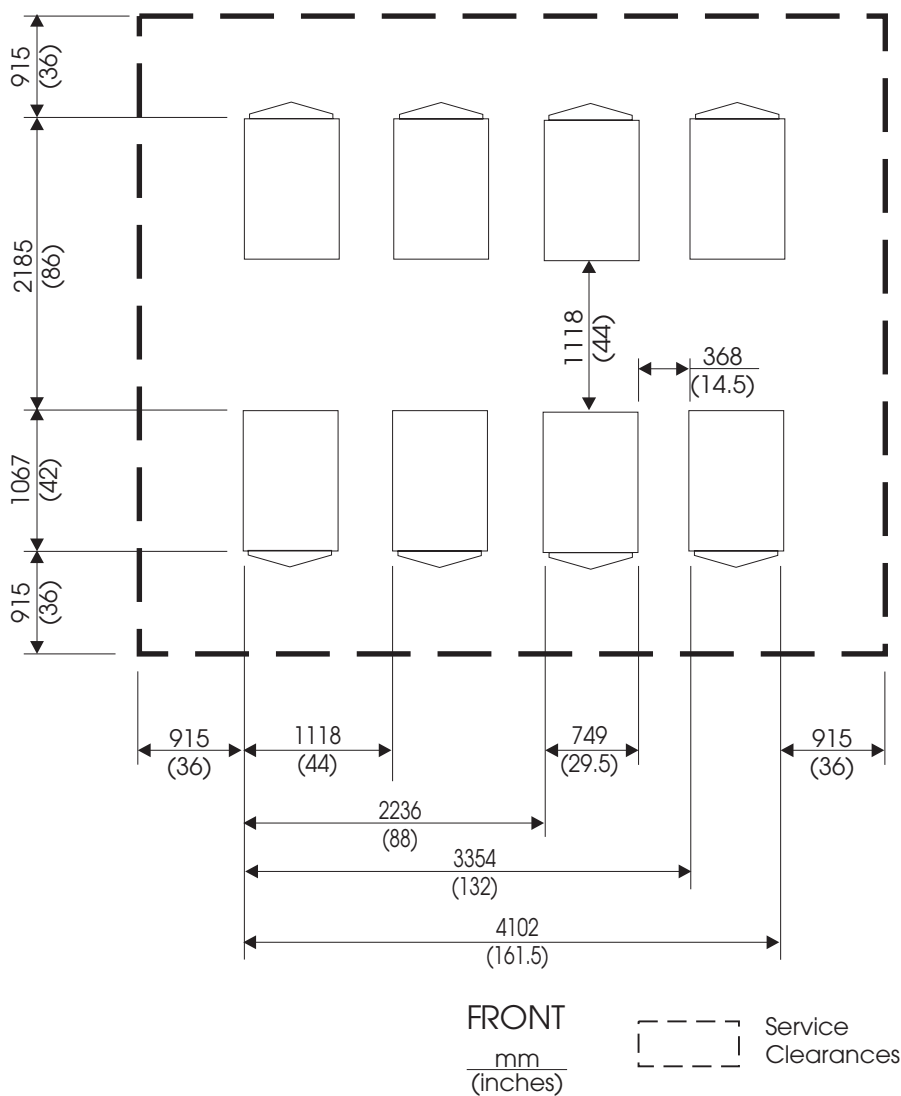


Figure 37. Basic Model 550 SP System. This is a typical configuration showing frame-to-frame service clearances. Your system might have fewer or more frames. Actual layout is highly dependent on your building layout.

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 211, Figure 29 on page 213 and Figure 38 on page 224.

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 100.

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.

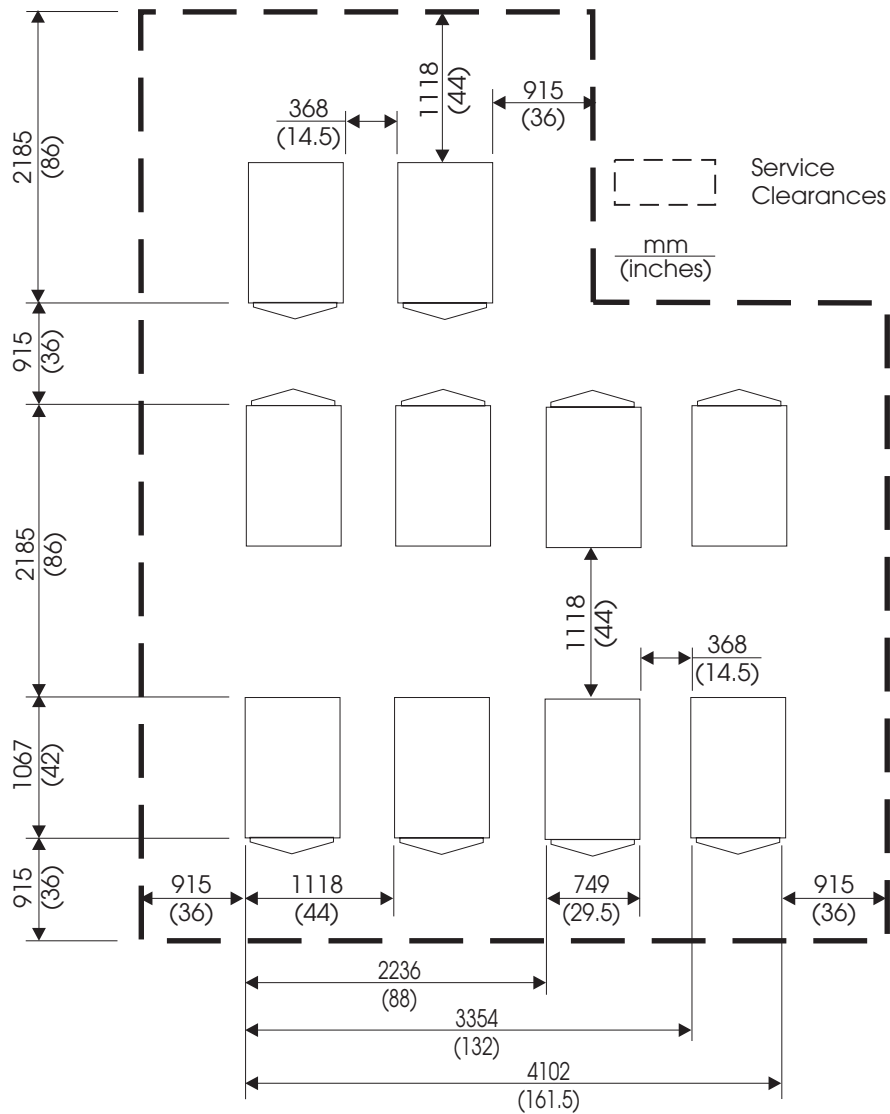


Figure 38. Moderate-Scale Model 550 SP System. This is a typical configuration showing frame-to-frame service clearances and frame orientations. Your system might have fewer or more frames. Actual layout is highly dependent on your building layout.

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 sales representative for information on larger, special-order systems.

Quantity of Nodes

65 to 128 nodes in the standard configuration. Consult your IBM sales 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 211, Figure 29 on page 213 and Figure 39 on page 226.

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.

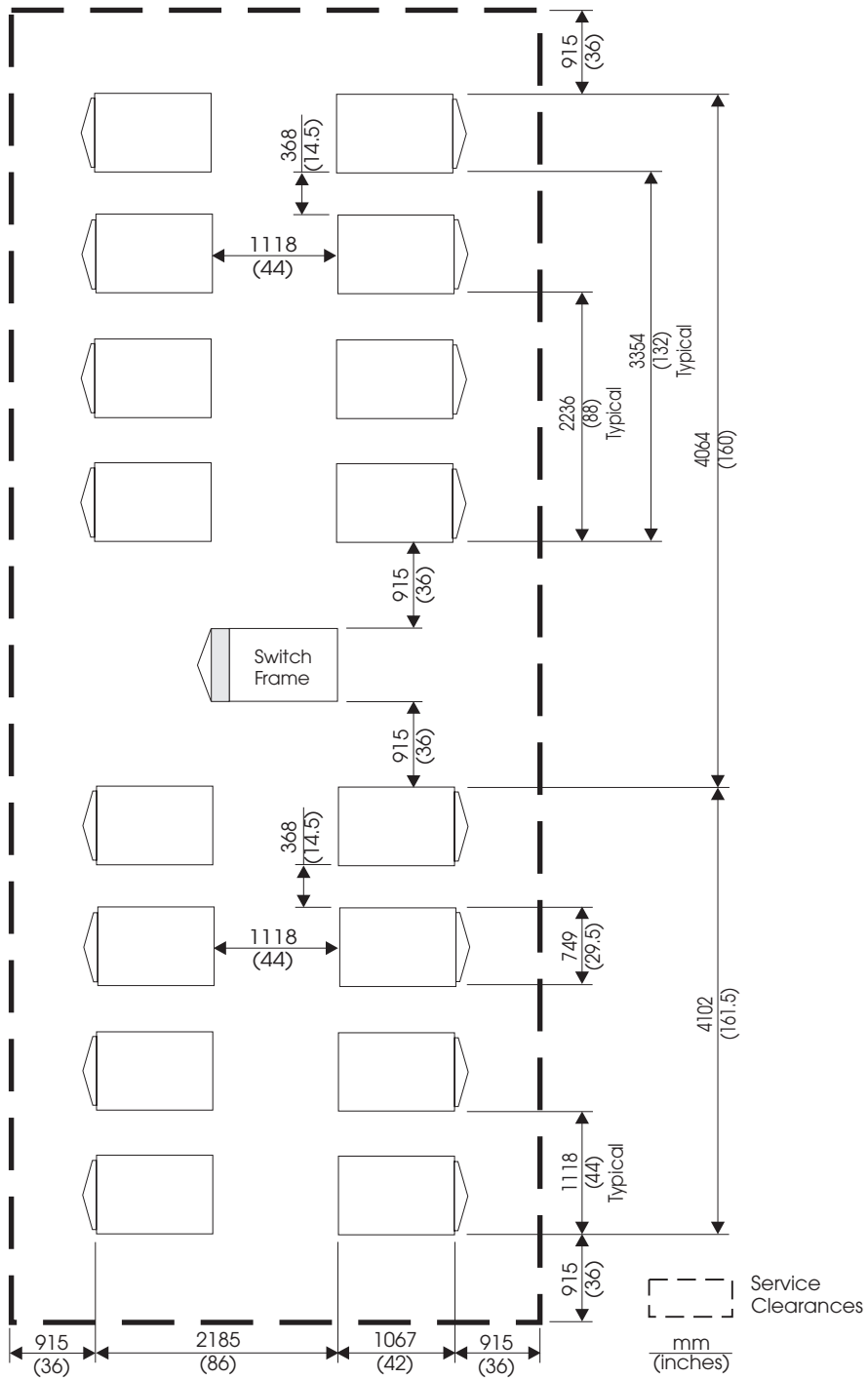


Figure 39. Large-Scale Model 550 SP System. This is a typical configuration showing frame-to-frame service clearances and frame orientations. Please note the required, extra-width service isles between every fourth and fifth frame. Your system might have fewer or more frames. Actual layout is highly 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/m² (70 lbs/ft²) for raised floors
- 245 kg/m² (50 lbs/ft²) for non-raised floors

If the result of your floor loading calculation is ***more than*** 345 kg/m² (70 lbs/ft²), 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 and 1.36 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/m² for all floor types)
3. Static loads - cables and tiles:
 - 50 kg/m² for raised floors
 - 0 kg/m² 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

$$\text{Floor Load} = (M + (K_1 * S) + (K_2 * T)) / T$$

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/m² (34 lbs/ft²) for all floor types
- K_2 = static load constant = 50 kg/m² (23 lbs/ft²) 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/m² (70 lbs/ft²), you can continue planning your system layout using the minimum recommended service clearances given in “Service Clearance Specifications for Frames” on page 211. If the result of your floor loading calculation is **more than** 345 kg/m² (70 lbs/ft²), 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, and converting MCA-type nodes to PCI nodes.

Adding Nodes

Adding 375 MHz POWER3 SMP Thin and Wide Nodes

375 MHz POWER3 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 SEPBU's 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 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 High Nodes can be installed only in Model 550, Model T70, 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 POWER3 and 332 MHz SMP Thin and Wide Nodes

POWER3 and 332 MHz Thin and Wide Nodes can be added to earlier SP systems. Adding these nodes to earlier frames requires a power system upgrade. Both PDU and SEPBU power subsystems must be upgraded to 10.5 kW level SEPBU's for tall frames or 5.0 kW for short frames.

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) or SP Switch-8 (F/C 4008)
- 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)

Upgrading Nodes

Upgrading POWER3 and 332 MHZ Thin and Wide Nodes to POWER3 High Nodes

Several earlier node types can be upgraded to POWER3 High Nodes. These nodes require a tall, deep frame (Model 550 or F/C 1550).

POWER3 High Nodes can be configured into 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.

The following nodes can be upgraded to POWER3 High Nodes:

- POWER3 Thin Nodes (F/C 2050)
- POWER3 Wide Nodes (F/C 2051)
- 332 MHz Thin Nodes (F/C 2052)
- 332 MHz Wide Nodes (F/C 2053)

Note that these are one-for-one upgrades since some of the parts in the older node are transferred to the replacement node. Thus for example, you cannot upgrade four thin nodes to one POWER3 High Node.

Upgrading SMP Thin and Wide Nodes

The following node-to-node conversions are available:

- 332 MHz Thin Node (F/C 2050) to:
 - 332 MHz Wide Node (F/C 2051)
 - POWER3 Thin Node (F/C 2052)

- POWER3 Wide Node (**F/C 2053**)
- 375 MHz POWER3 Thin Node (**F/C 2056**)
- 375 MHz POWER3 Wide Node (**F/C 2057**)
- 332 MHz Wide Node (**F/C 2051**) to:
 - POWER3 Wide Node (**F/C 2053**)
 - 375 MHz POWER3 Wide Node (**F/C 2057**)
- POWER3 Thin Node (**F/C 2052**) to:
 - POWER3 Wide Node (**F/C 2053**)
 - 375 MHz POWER3 Thin Node (**F/C 2056**)
 - 375 MHz POWER3 Wide Node (**F/C 2057**)
- POWER3 Wide Node (**F/C 2053**) to:
 - 375 MHz POWER3 Wide Node (**F/C 2057**)
- 375 MHz POWER3 Thin Node (**F/C 2056**) to:
 - 375 MHz POWER3 Wide Node (**F/C 2057**)

Note that **these are one-for-one upgrades** since some of the parts in the older nodes are used in the replacement nodes. If the node being converted contains multiple processor cards, at least one of the processor cards must be installed in the new replacement node. Additional processor cards can also be installed in the new node or can be used in other supported nodes in the system.

Replacing Withdrawn Processor Nodes

Several replacement features are available to replace withdrawn early processor nodes with 332 MHz, POWER3, and 375 MHz POWER3 SMP Thin and Wide nodes. For details, contact your IBM sales representative.

Relocating Processor Nodes

If you are relocating thin or wide nodes to a new 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 (thin and wide nodes only)
- **F/C 9304** - BNC Ethernet cable

Upgrading 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 Model T70 to Model 550

This conversion transfers the POWER3 High Node and any SP Expansion I/O Units in a Model T70 Workgroup Server to a Model 550 tall frame.

Appendix B. SEPBU Power Control Interface

This appendix describes the SEPBU Power Control Interface function. The SEPBU power unit includes a Power Control Interface function. This function allows the user to configure computer system(s) and associated hardware (such as disk units, tape drives) to control power On/Off for the various components. For example, the user may have external disk unit power controlled by RS/6000 SP frame power, causing the disk unit power to be synchronized to the RS/6000 SP frame power.

RS/6000 SP 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, and two AUX input jacks.

The Auxiliary/Local (AUX/LOC) switch controls whether power for this frame is controlled by:

AUX: Power-On/Off signals from the AUX jacks

LOC: Frame main power switch.

Normally, this switch is left in the LOC position for local control; in the LOC position, Power Control Interface signals will not affect power for this frame. Local power control on this frame can result in signals sent to the MAIN jacks. In this way power On/Off signals can be sent to other equipment (including other RS/6000 SP frames).

When the switch is in the AUX position, local power controls, such as the main power switch, will have no effect. Power-On/Off signals arriving at the AUX jack from another machine will control this SEPBU power state.

Typical Configurations

The following are some Power Control Interface configurations used to illustrate typical uses of the Power Control Interface function. Customer and system configurations may utilize one or more of the following configuration types concerning the Power Control Interface function. Note that using the Power Control Interface function can affect impact of certain outages and service operations; this should be taken into consideration when determining an effective Power Control Interface configuration.

No Power Control Interface Control

The Power Control Interface switches of all RS/6000 SP frames are in "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 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 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. Remember that this may affect how certain outages or service operations will impact the customer.

RS/6000 SP Cross-Control

All RS/6000 SP frames have Power Control Interface switch in AUX position. A Power Control Interface cable is run from the MAIN jack in each frame to a AUX jack in another frame.

Powering On/Off any RS/6000 SP frame controls power of all other attached frames. Remember that this may affect how certain outages or service operations will impact the customer.

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 the attached peripheral(s). If the peripheral is connected to processors in more than one RS/6000 SP frame, certain outages or service operations may have an undesirable impact on the customer. In other cases, this may allow proper power synchronization of the processing units with their respective peripherals.

Note: See also “SEPBU Power Control Interface” on page 181 for information on the Power Control Interface function.

Appendix C. MCA Communication Adapters

This chapter contains reference information on MCA-type communication adapters.

<i>Table 65. MCA Adapter Features</i>	
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

MCA Adapter Descriptions

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.

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Hinweis

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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. 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.%total free` (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 failover, 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 its 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 at 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 manages 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 (offline 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 (DASD) 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 (DASD) 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.

You can order hard copies of the product documentation from IBM. This bibliography lists the titles that are available and their order numbers.

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 from the IBM RS/6000 Web site at:

<http://www.rs6000.ibm.com>

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 Product Documentation Library" page was:

http://www.rs6000.ibm.com/resource/aix_resource/sp_books

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*
- *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*

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

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 (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
- *Performance Monitoring Guide and Reference*, SA22-7353
- *Diagnosis Guide*, GA22-7350
- *Command and Technical Reference*, SA22-7351
- *Messages Reference*, GA22-7352

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*, SA22-7311
- *Diagnosis and Messages Guide*, GA22-7277

GPFS Publications

GPFS:

- *Problem Determination Guide*, GA22-7434
- *Data Management API Guide*, GA22-7435
- *Guide and Reference*, GA22-7452
- *Installation and Tuning Guide*, 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*, SC23-4284

CLIO/S Publications

CLIO/S:

- *General Information*, GC23-3879
- *User's Guide and Reference*, GC28-1676

NetTAPE Publications

NetTAPE:

- *General Information*, GC23-3990
- *User's Guide and Reference*, available from your IBM representative

AIX and Related Product Publications

For the latest information on AIX and related products, including RS/6000 hardware products, see *AIX and Related Products Documentation Overview*, SC23-2456. You can order a hard copy of the book from IBM. You can also view it online from the "AIX Online Publications and Books" page of the RS/6000 Web site at:

http://www.rs6000.ibm.com/resource/aix_resource/Pubs

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>

Red Books

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.redbooks.ibm.com>

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.

Index

Numerics

- 1.25 m frame
 - overview 63
 - physical dimensions and weights 205
 - service clearances 212
 - shipping containers 207
- 1.36 m frame
 - physical dimensions and weights 204
 - SEPBU 182
 - service clearances 211
 - shipping containers 207
- 1.93 m frame
 - overview 57
 - physical dimensions and weights 204
 - SEPBU 182
 - service clearances 211
 - shipping containers 206
- 100Base-TX 98
- 10Base-T 98
- 1500 63
- 1550 57
- 2031 57
- 2050 37
- 2051 33
- 2052 29
- 2053 25
- 2054 19
- 2055 22
- 2056 15
- 2057 11
- 2732 122
- 2733 123
- 2741 124
- 2742 127
- 2743 132
- 2751 133
- 2900 167
- 2904 167
- 2908 167
- 2909 167
- 2918 167
- 2920 134
- 2943 135
- 2944 136
- 2947 138
- 2962 139
- 2963 140
- 2968 142
- 2969 143
- 2985 144
- 2987 146
- 2988 148
- 3000 167
- 3010 167
- 3124 12, 16, 20, 26, 30, 34, 38
- 3125 12, 16, 20, 26, 30, 34, 38
- 3800 167
- 3802 167
- 3803 167
- 3804 167
- 3805 167
- 3810 167
- 3811 167
- 3820 167
- 3821 167
- 4008 74
- 4011 73
- 4020 74
- 4021 75, 77
- 4023 74
- 4959 149
- 500 (model class) 63
- 550 57
- 550 (model class) 58
- 6204 150
- 6205 153
- 6206 154
- 6207 157
- 6225 161
- 6227 160
- 6230 161
- 6231 163
- 6235 163
- 6310 164
- 6311 165
- 7017 (Machine Type) 41
- 8396 41, 47, 75
- 9077 (Machine Type) 77
- 9077-04S 77
- 9077-16S 77
- 9121 172
- 9122 41
- 9123 41
- 9124 172
- 9203 210
- 9222 53
- 9223 53
- 9955 22

A

- ac line cords 183
- acoustical emission declarations 194
- adding frames 230
- adding nodes 229
- additions 229
- audience of this book xvii

B

- base power regulators 180
- boot disks
 - external 172
- bootable SCSI 172
- bootable SSA 172
- BPRs 180
- branch circuits 178

C

- cable runs
 - cable labeling 96
 - coaxial cable separation 97
 - indoor 97
 - lightning protectors 95
 - outdoor 95
- cabling
 - coaxial
 - IBM responsibilities 92
 - coaxial characteristics 93
- circuit breakers
 - performance balancing 180
 - recommended 181
 - requirements 182
- coaxial link
 - customer responsibilities 94
 - externally-induced noise 97
 - IBM responsibilities 92
 - transmission errors 97
- communication adapters
 - MCA bus 235
 - multiprotocol adapter 139
 - PCI 10BaseTX Ethernet 142
 - PCI ARTIC960Hx adapter 138
 - PCI ARTIC960RxD adapter 164
 - PCI ARTIC960RxF adapter 165
 - PCI ATM adapter 148
 - PCI bus 107
 - PCI Ethernet BNC/RJ-45 144, 146
 - PCI FC-AL 160
 - PCI FDDI adapter 124, 127, 132
 - PCI Gigabit Ethernet - SX 143
 - PCI high-speed token-ring 149
 - PCI LANstreamer token ring 134
 - PCI S/390 ESCON Channel 133
 - PCI SCSI-2 Ultra/Wide 150, 154, 157

- communication adapters (*continued*)

- PCI Serial HIPPI 122, 123
- PCI Ultra2 SCSI 153
- PCI UTP ATM adapter 140
- PCI WAN adapter 135, 136
- SP Switch Router 79, 86
- SP Switch Router Adapter 80

- communication cabling

- 100Base-TX cable characteristics 98
- 10Base-T cable characteristics 98
- cabling tests 97
- check coaxial cable characteristics 93
- connect station protectors 95
- control workstation location 91
- customer responsibilities 91
- customer responsibilities for coaxial cabling 94
- label coaxial cables 96
- prepare site for coaxial cabling 97
- routing indoor cabling 97
- RS/6000 SP coaxial LAN cabling 91
- RS/6000 SP RS-232 cabling 91
- steps described 91
- twisted pair cable characteristics 98

- control workstations 67
- conversions 229
- customer responsibilities
 - coaxial cabling 94

D

- DASD 167
 - external 169
 - external SCSI 172
 - external SSA 172
 - internal 167
- dependent nodes 3
- developing floor plans
 - determine devices to include in RS/6000 SP system 203
 - tasks described 203
- Direct Access Storage Devices 167
 - external 169
 - internal 167
- dual line cord 177

E

- electrical
 - branch circuits and grounding 178
 - evaluating power requirements 180
- electromagnetic interference 199
- electrostatic discharge 199
- environmental factors
 - acoustical outputs 194
 - electromagnetic interference 199
 - electrostatic discharge 199

environmental factors (*continued*)
evaluating 193
heat output 196
operating point 194
operating range 194
RS/6000 SP requirements 196
temperature survey 198
thermal output 196
environmental specifications
SP system 193
SP-Attached Server 47
expansion I/O unit 22
extension node power requirements 79
extension nodes 3
external disks
SCSI bootable 172
SSA bootable 172

F

floor load analysis 227
floor plans
developing 203
floor preparation
non-raised floor
1.25 m frames 210
1.36 m frames 210
1.93 m frames 210
all frame types 209
SP switch frames 210
raised floor
1.25 m frames 209
1.36 m frames 209
1.93 m frames 209
all frame types 208
SP switch frames 209
floor tiles, cutting and placement 208
frame illustrations
1.25 m frames 217
1.36 m frames 215
1.93 m frames 213
SP switch frame 219
frame power worksheet 186
frame upgrades 231
frames
1.25 m 63
1.93 m 57
short 63
tall 57

G

grounding 178

H

heat output 196
high nodes
POWER3 SMP High Node 19

I

IBM cabling responsibilities
supplying RS-232 cable
customer responsibilities 91
installation tasks
installing tie-down hardware 200
interference, electromagnetic 199

L

ladder, service 210

M

Machine Type 7017 41
Machine Type 9077 77
manual pages for public code 252
micro channel adapters 235
Model 500 frame options 64
Model 500 frames 63
Model 550 frames 58
model frame options 58

N

network interface
SP Switch Router 80
node upgrades 230
nodes
332 MHz SMP thin 37
332 MHz SMP wide 33
375 MHz POWER3
thin 15
wide 11
dependent 3
extension 3
physical dimensions and weights 205
POWER3
high 19
thin 29
wide 25
non-raised floor installations 209

O

operating environment 193
optional hardware
MCA communication adapters 235
micro channel adapters 235
PCI adapters 107

optional hardware (*continued*)
PCI communication adapters 107

P

patch panels 97

PCI adapters

- 10BaseTX Ethernet 142
- ARTIC960Hx adapter 138
- ARTIC960RxD adapter 164
- ARTIC960RxF adapter 165
- ATM adapter 148
- dual channel Ultra2 SCSI 153
- Ethernet BNC/RJ-45 144, 146
- FC-AL 160
- FDDI adapter 124, 127, 132
- Gigabit Ethernet 143
- gigabit fiber channel 160
- high-speed token-ring 149
- LANstreamer token ring 134
- maximum quantities 108
- multiprotocol adapter 139
- plugging rules 111
- S/390 ESCON Channel 133
- SCSI-2 Ultra/Wide 150, 154, 157
- Serial HIPPI 122, 123
- SerialRAID 161
- suggested quantities 114
- UTP ATM adapter 140
- WAN adapter 135, 136
- weighting factors 114

PCI bus

- 332 MHz SMP thin nodes 37
- 332 MHz SMP wide nodes 33
- group and slot descriptions 107
- SMP High Node 19
- SMP Thin Nodes 29
- SMP Wide Node 25

PDU upgrades 189

physical dimensions and weights

- 1.25 m frame 205
- 1.36 m frame 204
- 1.93 m frame 204
- processor nodes 205
- SP switch frame 205
- SP switch router 79
- SP-Attached Server 46

planning considerations

- 1.25 m frames 221
- 1.93 m frames 221, 223, 224
- all SP systems 221
- model 500 SP systems 221
- model 550 SP systems
 - basic system 221
 - large-scale 224
 - moderate-scale 223

planning site alterations 203

plugging rules, PCI adapters 111

power and electrical needs 180

- ac line cord specifications 183

- backup devices 177

- branch circuits and grounding 178

- check primary computer power service at site 177

- dedicated branch circuits 177

- emergency power-off controls 177

- evaluating location and availability of receptacles 177

- power computation worksheet 186

- power requirements 177

- SP frames and features 186

- tasks described 177

- upgrading early power supplies 189

power computation worksheet 186

power control interface 181, 233

- cable planning 181

- system monitor 181

- UEPO 181

power requirements

- extension node 79

- SP-Attached Server 46

power system backup devices 177

prerequisite knowledge for this book xvii

R

raised floor installations 208

routing indoor cabling 97

RS/6000 SP system

- illustration 1

- overview 1

- SP Switch frame 76

RS/6000 SP System Attachment adapter 41, 47, 75

- switch adapter cables 49

- switch adapter placement restrictions 48

RS/6000 SP views and specifications

- physical dimensions of RS/6000 SP frame 203

S

S70 server 41

S7A server 41

S80 server 41

SCSI, bootable 172

SEPBU 180

- 1.25 m frame 182

- 1.36 m frame 182

- 1.93 m frame 182

- 10.5 kW, ac line cords 183

- 5.0 kW, ac line cords 185

- ac line cords 183

- circuit breakers 180

- input power requirements 182

- SEPBU (*continued*)
 - power control interface 181, 233
 - power supply modules 180
 - upgrades 189
 - upgrading 3.5 kW 190
 - upgrading 7.0 kW 189
 - upgrading PDU 191
- service clearances 211
 - 1.25 m frame 212
 - 1.36 m frame 211
 - 1.93 m frames 211
- Service Director 71
- service equipment 210
- shield coverage 93
- shipping containers
 - 1.25 m frame 207
 - 1.36 m frame 207
 - 1.93 m frame 206
 - returning 207
 - specifications 206
- shipping environment 193
- short frame configurations
 - non-switched configuration 64
 - switched configuration 64
- SMP nodes
 - 375 MHz POWER3 thin 15
 - 375 MHz POWER3 wide 11
 - POWER3 high 19
 - expansion I/O unit 22
 - POWER3 thin 29
 - POWER3 wide 25
- SP Switch 73
 - cable lengths 104
 - cable planning 99
 - cable quantities 103
- SP Switch adapters 74
- SP Switch cabling
 - switch-to-node 100
 - switch-to-switch 101
- SP Switch frame 76
 - physical dimensions and weights 205
- SP Switch MX2 adapter 74
- SP Switch Router
 - 04S 77
 - 16S 77
 - adapter 77
 - communication adapters 86
 - control workstation connection 81
 - installation requirements 78
 - memory options 86
 - multiple SP system connections 82
 - network interface 80
 - network media card requirements 79
 - network media cards 86
 - physical dimensions and weights 79
 - software requirements 80
- SP Switch Router (*continued*)
 - SP Switch Router Adapter requirements 79
 - system requirements 78
- SP Switch Router adapter 75, 77
- SP Switch-8 73, 74
- SP Switch2
 - cable planning 99
- SP system layouts
 - basic 221
 - large-scale 224
 - moderate-scale 223, 224
- SP-Attached Server
 - assigning frame numbers 50
 - assigning switch port numbers 50
 - attachment limits 44
 - configuring switchless systems 51
 - control workstation connection 52
 - environmental specifications 47
 - Ethernet adapter placement restrictions 53
 - installation requirements 45
 - network interface planning 51
 - network media card requirements 49
 - overview 41
 - physical dimensions and weights 46
 - power requirements 46
 - RS/6000 SP System Attachment adapter 47
 - RS/6000 SP System Attachment adapter cables 49
 - RS/6000 SP System Attachment adapter placement restrictions 48
 - S70 41
 - S7A 41
 - S80 41
 - software requirements 49
 - SP Switch connection 54
 - SP system requirements 45
 - SP-LAN Ethernet 53
 - switch adapter 41, 47
 - switch adapter cables 49
 - switch adapter placement restrictions 48
- splice connectors 97
- SPS-8 74
- SSA, bootable 172
- static transfer switch 177
- storage environment 193
- storing service equipment 210
- STS 177
- switch adapters
 - RS/6000 SP System Attachment adapter 41, 47
 - SP Switch 74
 - SP Switch Router Adapter 77
 - SP-Attached Server 47
 - special
 - RS/6000 SP System Attachment 75
 - SP Switch Router 75
- switch cable paths
 - single-stage SP Switch configuration 101

- switch cable paths (*continued*)
 - two-stage SP Switch configuration 102
- switch configurations 58, 64
- switch frame 76
- switches
 - 16-port 73
 - 8-port 73
 - adapters 73

T

- tall frame configurations
 - non-switched 58
 - single stage SP switch 58
 - SP Switch-8 58
 - two-stage SP switch 58
- tie-down hardware 200
- trademarks 241
- twisted pair 98

U

- uninterruptible power supplies 177
- upgrades 229
 - frame 231
 - node 230
- upgrading 3.5 kW SEPBU 190
- upgrading 7.0 kW SEPBU 189
- upgrading PDU 191
- UPS 177

W

- weighting factors, PCI adapters 114
- who should use book xvii

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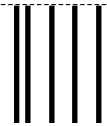
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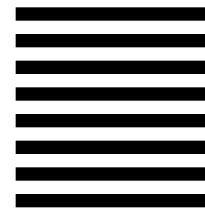
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