Power Systems

Enclosures and expansion units

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Note

Before using this information and the product it supports, read the information in "Notices," on page 77, "Safety notices" on page v, the *IBM Systems Safety Notices* manual, G229-9054, and the *IBM Environmental Notices and User Guide*, Z125–5823.

This edition applies to IBM Power Systems servers that contain the POWER6 processor and to all associated models.

Contents

Safety notices

Safety notices may be printed throughout this guide:

- **DANGER** notices call attention to a situation that is potentially lethal or extremely hazardous to people.
- **CAUTION** notices call attention to a situation that is potentially hazardous to people because of some existing condition.
- **Attention** notices call attention to the possibility of damage to a program, device, system, or data.

World Trade safety information

Several countries require the safety information contained in product publications to be presented in their national languages. If this requirement applies to your country, a safety information booklet is included in the publications package shipped with the product. The booklet contains the safety information in your national language with references to the U.S. English source. Before using a U.S. English publication to install, operate, or service this product, you must first become familiar with the related safety information in the booklet. You should also refer to the booklet any time you do not clearly understand any safety information in the U.S. English publications.

German safety information

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

Laser safety information

IBM® servers can use I/O cards or features that are fiber-optic based and that utilize lasers or LEDs.

Laser compliance

All lasers are certified in the U.S. to conform to the requirements of DHHS 21 CFR Subchapter J for class 1 laser products. Outside the U.S., they are certified to be in compliance with IEC 60825 as a class 1 laser product. Consult the label on each part for laser certification numbers and approval information.

CAUTION:
This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

(C026)

CAUTION:
Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. (C027)

CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

CAUTION:
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following information: laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam. (C030)

Power and cabling information for NEBS (Network Equipment-Building System) GR-1089-CORE

The following comments apply to the IBM servers that have been designated as conforming to NEBS (Network Equipment-Building System) GR-1089-CORE:

The equipment is suitable for installation in the following:

- Network telecommunications facilities
- Locations where the NEC (National Electrical Code) applies

The intrabuilding ports of this equipment are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of this equipment *must not* be metallically connected to the interfaces that connect to the OSP (outside plant) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

Note: All Ethernet cables must be shielded and grounded at both ends.

The ac-powered system does not require the use of an external surge protection device (SPD).

The dc-powered system employs an isolated DC return (DC-I) design. The DC battery return terminal *shall not* be connected to the chassis or frame ground.

Chapter 1. Enclosures and expansion units

You can attach your expansion units to system units using either remote input/output (RIO), also known as high-speed link (HSL), adapters (RIO/HSL), (12X adapters), 12X adapter Double Data Rate (12X DDR), Serial-attached SCSI (SAS) adapters, or SCSI adapters.

Note: The terms *enclosure* and *expansion unit* are synonymous.

Important: You can add your expansion units concurrently. This means you can add or install the expansion units with the server at firmware running state. Active partitions do not have to be shut down. **Only in the following situations must the server be shut down (powered off) to add expansion units:**

- The expansion units are being added to an IBM Power Systems™ server that is not managed by an Hardware Management Console (HMC).
- GX adapters (I/O hub cards) must be added to accommodate the new expansion units.
- The existing RIO/HSL/12X or 12X DDR fabric must be redistributed across the GX adapters to accommodate the new expansion units as determined in the planning steps for adding the expansion units.
- The system firmware level is equal to or less than EM320_040_031 or EM310_069_048 and the loop you are adding expansion units to currently has one or more 5796 or 7314-G30 expansion units.

If you are adding a new expansion unit or migrating expansion units from another IBM Power Systems server, you may not be able to allocate the expansion unit resources to logical partitions on the new server until an SPCN firmware update is completed for the expansion units.

RIO/HSL/12X/12X DDR configuration changes, such as moving existing expansion units to different GX adapters, should not be performed at the same time as adding new expansion units. If these two tasks must be performed, first make configuration changes involving existing expansion units with server power off. After the configuration changes are complete, power on the server to firmware standby or running state and add the new expansion units using this procedure.

Preparing to connect your expansion units

Use this information to plan the cable layout and to learn the configuration rules.

This topic collection provides information about connecting your expansion units with remote input/output (high-speed link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), 12X adapter Double Data Rate (12X DDR) cables, and system power control network (SPCN) cables. This is a customer task. You can perform this task yourself or contact a service provider for this service.

You should be familiar with the system, display, and keyboards. In addition, you will need to know how to shut down and perform a system initial program load (power on), and how to shut down system peripheral devices such as printers, monitors, and PCs.

To prepare to connect the expansion units, complete the following tasks:

1. Decide where you want to install the new expansion unit. For details, see “Where to install a new expansion unit” on page 2.
2. Unpack the expansion units by using the unpacking instructions.
3. Identify the cables. For details, see “RIO/HSL, 12X/12X DDR, and SPCN cable identification” on page 2.
4. Plan for cable layout. For details, see “Cable layout options” on page 3.

5. Continue with “Connecting your expansion units” on page 11.

Where to install a new expansion unit

Before you begin the installation process, plan where you will install the new expansion units.

When deciding where to install a new expansion unit, consider several elements that include size, security, and environmental factors. For more information, see Site preparation and physical planning.

If you plan to install your expansion unit in a rack, refer to Racks, rack features, and installing systems or expansion units into a rack.

Note: If you are installing an expansion unit that uses a 12X communications adapter, the part number of the 12X adapter will determine where you can install the expansion unit:

- The Short Run GX Dual-Port 12X Channel Attach adapter (FC 6446) *does not contain* a repeater and requires the use of shorter cables. An expansion unit containing this adapter must be placed in the same rack as the system unit.
- The Long Run GX Dual-Port 12X Channel Attach adapter (FC 6457) *contains* a repeater and allows the use of longer cables. An expansion unit containing this adapter can be placed in a different rack than the system unit.

RIO/HSL, 12X/12X DDR, and SPCN cable identification

You might need to identify the RIO/HSL, GX Dual-Port 12X Channel Attach adapter (12X), 12X adapter Double Data Rate (12X DDR) cables, and SPCN cables for the expansion unit.

The system uses RIO/HSL /12X/12X DDR cables to send and receive customer data and auxiliary control information to and from the expansion unit, and to download expansion unit firmware. The SPCN network is used to control power to the expansion units and as a backup to the RIO/HSL /12X/12X DDR cables for auxiliary control and firmware control.

Table 1. RIO/HSL cables

Cable feature	CCIN	Cable type	Length	Part number
1307 (copper)	1307	HSL-2/RIO-2	1.75 meters	03N5867
1308 (copper)	1308	HSL-2/RIO-2	2.5 meters	03N5866
1481 (copper)	1481	HSL-2/RIO-2	1 meters	44V5140
1482 (copper)	1482	HSL-2/RIO-2	3.5 meters	39J2554
1483 (copper)	1483	HSL-2/RIO-2	10 meters	39J2561
1485 (copper)	1485	HSL-2/RIO-2	15 meters	39J2560
3170 (copper)	3170	HSL-2/RIO-2	8 meters	39J2556
7924 (copper)	7924	HSL-2/RIO-2	0.6 meters	39J2550

Table 2. 12X cables

Cable feature	Cable type	Length	Part number
1828 (copper)	12X to 4X channel conversion adapter	1.5 meters	45D2235
1841	12X to 4X channel conversion cable	3.0 meters	45D2236
1842	12X to 4X channel conversion cable	10 meters	45D2237
1861	DDR 12X	0.6 meters	45D4785

Table 2. 12X cables (continued)

Cable feature	Cable type	Length	Part number
1862	DDR 12X	1.5 meters	45D4786
1863	DDR 12X	2.5 meters	45D4787
1864	DDR 12X	8.0 meters	45D4788
1865	DDR 12X	3.0 meters	45D5271

Table 3. SPCN cables

Cable feature	CCIN	Length	Part number
6001	6001	2 meters	22R5217
6006	6006	3 meters	22R5239
6007	6007	15 meters	22R5221
6008	6008	6 meters	22R5219
6029	6029	30 meters	22R5222

Cable layout options

Learn about cable topologies, options, and configuration requirements.

When you decide where to place the cables, follow your site plan and keep the following items in mind:

- Avoid creating a safety hazard.
- Avoid damaging the cables.
- Avoid placing cables parallel to high-voltage lines.

Important:

- Expansion units with RIO/HSL adapters cannot be in the same loop as expansion units with GX Dual-Port 12X Channel Attach adapters or 12X adapter Double Data Rate (12X DDR).
- Expansion units with GX Dual-Port 12X Channel Attach adapters cannot be in the same loop as expansion units with 12X DDR adapters.
- 5796 expansion units are only used in loops with other 5796 expansion units.
- 5797 and 5798 expansion units are only used in loops with other 5797 and 5798 expansion units.
- 5802 and 5877 expansion units are only used in loops with other 5802 and 5877 expansion units.
- 5803 and 5873 expansion units are only used in loops with other 5803 and 5873 expansion units.

Example: Topologies of RIO/HSL, 12X, and 12X DDR loops

You can achieve link redundancy by cabling the remote input/output (high-speed link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), or 12X adapter Double Data Rate (12X DDR) in a loop. Use this information to review examples of RIO/HSL, 12X and 12X DDR loops.

Note: 5802 and 5877 are currently restricted to two expansion units for each loop.

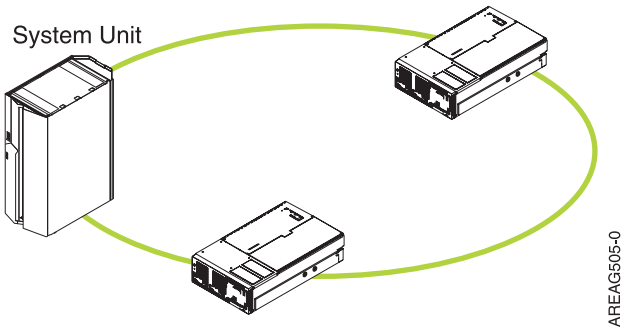


Figure 1. RIO/HSL, 12X, or 12X DDR loop example

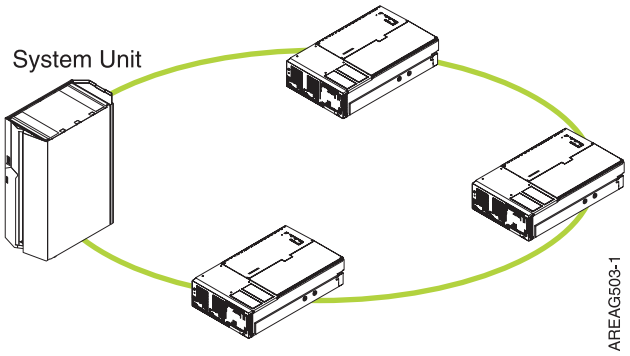


Figure 2. RIO/HSL or 12X loop example

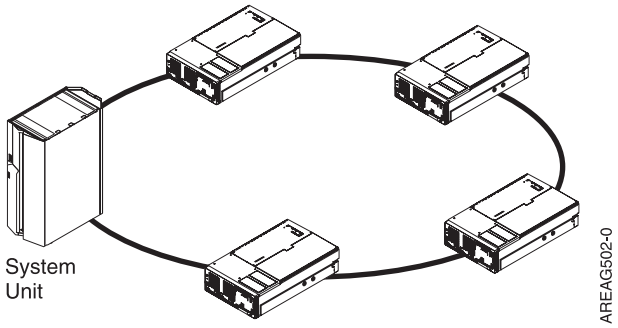


Figure 3. RIO/HSL or 12X loop example

System unit cable options

Learn which remote input/output (high-speed link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) cables are supported on which system units.

Use the following table to identify the RIO/HSL/12X/12X DDR cables for the machine types and model numbers identified.

Table 4. System unit RIO/HSL, 12X and 12X DDR cable options

Cable feature	9117-MMA or 9406-MMA	8203-E4A or 8204-E8A	9408-M25 or 9409-M50
1460 (copper)	X	X	
1461 (copper)	X	X	
1462 (copper)	X	X	
1474	X	X	
1475	X	X	
1485	X	X	
1487	X	X	
1482 (copper)	X	X	X
1481 (copper)	X	X	X
1483 (copper)	X	X	X
1307 (copper)	X	X	X
1308 (copper)	X	X	X
1828 (copper)	X	X	
1835	X		
1836	X		
1840 (12X adapter)	X	X	X
1841	X	X	
1861 (DDR 12X adapter)	X	X	
1862 (DDR 12X adapter)	X	X	
1863 (DDR 12X adapter)	X	X	
1864 (DDR 12X adapter)	X	X	
1865 (DDR 12X adapter)	X	X	
3146	X	X	
3147	X	X	
3148	X	X	
3156	X	X	
3168	X	X	

Expansion unit cable options

Learn which RIO/HSL, 12X and 12X DDR cables are available for which expansion units.

Use the following tables to identify the RIO/HSL, 12X and 12X DDR cables for the expansion units identified.

Table 5. Expansion unit RIO/HSL cable options for IBM Power Systems

Cable feature	0588, 5088	5094 and 5294	5095, 0595	5096, 5296	5790	7311-D11	7311-D20
1307 (copper)	X	X	X	X	X		
1308 (copper)	X	X	X	X	X		
1460 (copper)	X	X	X	X	X		
1461 (copper)	X	X	X	X	X		
1462 (copper)	X	X	X	X	X		

Table 5. Expansion unit RIO/HSL cable options for IBM Power Systems (continued)

Cable feature	0588, 5088	5094 and 5294	5095, 0595	5096, 5296	5790	7311-D11	7311-D20
1474 (copper)	X	X	X	X	X		
1475 (copper)	X	X	X	X	X		
1481 (copper)	X	X	X	X	X		
1482 (copper)	X	X	X	X	X		
1483 (copper)	X	X	X	X	X		
1485 (copper)	X	X	X	X	X		
1487 (copper)	X	X	X	X	X		
3146 (copper)						X	X
3147 (copper)						X	X
3148 (copper)						X	X

Table 6. Expansion unit 12X and 12X DDR cable options

Cable feature	7314-G30, 5796, or 5802 and 5877
1861 0.6M DDR 12X adapter	X
1862 1.5M DDR 12X adapter	X
1863 2.5M DDR 12X adapter	X
1864 8.0M DDR 12X adapter	X
1865 3.0M DDR 12X adapter	X

Expansion unit configuration requirements for RIO/HSL, 12X, and 12X DDR cables

Learn about the configuration requirements for RIO/HSL, GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) cables.

When you set up an expansion unit, observe the configuration requirements as shown in the following table.

Table 7. RIO/HSL, 12X and 12X DDR adapter configuration rules for expansion units for IBM Power Systems servers

Machine type and model	Maximum number of loops	Maximum number of expansion units per loop	Maximum number of supported expansion units
8203-E4A (12X adapter and 12X DDR adapter) 7314-G30 5796 5802	The maximum number of loops vary with the number of processor cores: 1 core = 0 loops 2 core = 1 loop 4 core = 2 loops	7314-G30 & 5796 = 4 5802 = 2	7314-G30 & 5796 = 8 5802 = 4

Table 7. RIO/HSL, 12X and 12X DDR adapter configuration rules for expansion units for IBM Power Systems servers (continued)

Machine type and model	Maximum number of loops	Maximum number of expansion units per loop	Maximum number of supported expansion units
8203-E4A (RIO/HSL) 0595 0588 5088 5094 5095 5294 5096 5296 5790 7311-D20 7311-D11	The maximum number of loops vary with the number of processor cores: 1 core = 0 loops 2 core = 1 loop 4 core = 2 loops	6	12
8204-E8A (12X adapter and 12X DDR adapter) 7314-G30 5796 5802	The maximum number of loops vary with the number of processor cores (2 cores per processor card): 2 core = 1 loops 4, 6, and 8 core = 2 loops	7314-G30 & 5796 = 4 5802 = 2	7314-G30 & 5796 = 8 5802 = 4
8204-E8A (RIO/HSL) 0595 0588 5088 5094 5095 5294 5096 5296 5790 7311-D20 7311-D11	The maximum number of loops vary with the number of processor cores (2 cores per processor card): 2 core = 1 loops 4, 6, and 8 core = 2 loops	6	12

Table 7. RIO/HSL, 12X and 12X DDR adapter configuration rules for expansion units for IBM Power Systems servers (continued)

Machine type and model	Maximum number of loops	Maximum number of expansion units per loop	Maximum number of supported expansion units
8234-EMA (12X adapter and 12X DDR adapter) 7314-G30 5796 5802	The maximum number of loops vary with the number of processor cores (4 cores per processor card): 4 core = 1 loops 8 core = 2 loops 16 core = 3 loops	7314-G30 & 5796 = 4 5802 = 2	7314-G30 & 5796 = 12 5802 = 6
8234-EMA(RIO/HSL) 7311-D20 7311-D11	The maximum number of loops vary with the number of processor cores (4 cores per processor card): 4 core = 1 loops 8 core = 2 loops 16 core = 3 loops	6	18
9117-MMA (12X adapter and 12X DDR adapter) 7314-G30 5796 5802	1 node with 1 processor card = 1 loop 1 node with 2 processor cards = 2 loops 2 nodes = 4 loops 3 nodes = 6 loops 4 nodes = 8 loops	7314-G30 & 5796 = 4 5802 = 2	7314-G30 & 5796 = 32 5802 = 16
9117-MMA (RIO/HSL) 0595 0588 5088 5094 5095 5294 5096 5296 5790 7311-D20 7311-D11	1 node with 1 processor card = 1 loop 1 node with 2 processor cards = 2 loops 2 nodes = 4 loops 3 nodes = 6 loops 4 nodes = 8 loops	6	48

Table 7. RIO/HSL, 12X and 12X DDR adapter configuration rules for expansion units for IBM Power Systems servers (continued)

Machine type and model	Maximum number of loops	Maximum number of expansion units per loop	Maximum number of supported expansion units
9119-FHA (12X adapter and 12X DDR adapter) 5797 **Note:** Can be installed in an expansion rack. 5798 **Note:** Cannot be installed in an expansion rack,, only in the CEC frame. 5803 and 5873	32 (4 loops per node)	1	32
9119-FHA (RIO/HSL) 0595 0588 5088 5094 5294 5096 5296 5790 5791 5794 5809	32 (4 loops per node)		96 (IBM i) 12 (AIX®)
9125-F2A (12X adapter and 12X DDR adapter) 5798 5803	1		1
9125-F2A(RIO/HSL) None			
9406-MMA (12X adapter) 7314-G30 5796	1 node with 1 processor card = 1 loop 1 node with 2 processor cards = 2 loops 2 nodes = 4 loops 3 nodes = 6 loops 4 nodes = 8 loops	4	32

Table 7. RIO/HSL, 12X and 12X DDR adapter configuration rules for expansion units for IBM Power Systems servers (continued)

Machine type and model	Maximum number of loops	Maximum number of expansion units per loop	Maximum number of supported expansion units
9406-MMA (RIO/HSL) 0595 0588 5088 5094 5095 5294 5096 5296 5790 7311-D20 7311-D11	1 node with 1 processor card = 1 loop 1 node with 2 processor cards = 2 loops 2 nodes = 4 loops 3 nodes = 6 loops 4 nodes = 8 loops	6	48
9407-M15 (12X adapter) None	The maximum number of loops vary with the number of processor cores: 1 core = 0 loops	0	0
9407-M15 (RIO/HSL) None	The maximum number of loops vary with the number of processor cores: 1 core = 0 loops	0	0
9408-M25 (12X adapter) 5796	The maximum number of loops vary with the number of processor cores: 2 core = 1 loop	4	4
9408-M25 (RIO/HSL) 0595 0588 5088 5094 5095 5294 5096 5296 5790	The maximum number of loops vary with the number of processor cores: 2 core = 1 loop	6	6

Table 7. RIO/HSL, 12X and 12X DDR adapter configuration rules for expansion units for IBM Power Systems servers (continued)

Machine type and model	Maximum number of loops	Maximum number of expansion units per loop	Maximum number of supported expansion units
9409-M50 (12X adapter) 5796	The maximum number of loops vary with the number of processor cores (2 cores per processor card): 2 core = 1 loop 4, 6, and 8 core = 2 loops	4	8
9409-M50 (RIO/HSL) 0595 0588 5088 5094 5095 5294 5096 5296 5790	The maximum number of loops vary with the number of processor cores (2 cores per processor card): 2 core = 1 loop 4, 6, and 8 core = 2 loops	6	12

Connecting your expansion units

Learn important information about connecting your expansion units. Some installations require that a unit be powered off. You should verify your remote input/output (high-speed link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) configuration prior to connecting any expansion unit.

Important:

- Expansion units with RIO/HSL adapters cannot be in the same loop as expansion units with GX Dual-Port 12X Channel Attach adapters or 12X adapter Double Data Rate (12X DDR).
- Expansion units with GX Dual-Port 12X Channel Attach adapters cannot be in the same loop as expansion units with 12X DDR adapters.
- 5802 and 5877 expansion units are only used in loops with other 5802 and 5877 expansion units.
- 5803 and 5873 expansion units are only used in loops with other 5803 and 5873 expansion units.
- 5796 expansion units are only used in loops with other 5796 expansion units.
- 5797 and 5798 expansion units are only used in loops with other 5797 and 5798 expansion units.

To add expansion units, follow these steps:

1. You can install the expansion units with the system unit power on or off. For more information about when system unit power must be off before installation, refer to Chapter 1, "Enclosures and expansion units," on page 1.
   a. If you are installing a new system unit and expansion units, refer to step 5 on page 13.

b. If you must power off the system to add the expansion units, or you are choosing to add the expansion units with the system power off and the system unit is not currently powered off, power it off now. For details, refer to Stopping a system or logical partition. After you have powered off your system unit, continue with step 5 on page 13 to complete this procedure.

c. If you are installing an expansion unit to an existing system and can leave the power on, continue with step 2.

2. Verify the existing RIO/HSL/12X/12X DDR configuration.

   Important: When simultaneously adding multiple expansion units to an existing RIO/HSL/12X/12X DDR loop, it is required that the units be adjacent to each other so the existing loop is broken at only one spot.

   Tip: If multiple expansion units are to be added with the system power on, it is recommended to work with one RIO/HSL/12X/12X DDR loop at a time. For example, if the plan is to add three expansion units to loop X and two to loop Y, follow the complete procedure to simultaneously add the three units to loop X. When the first procedure has been completed, then follow the procedure to simultaneously add the two units to loop Y. It is not necessary to complete the procedure for each expansion unit separately.

   If problems with the RIO/HSL/12X/12X DDR loops are discovered in this step, they must be corrected before continuing with this procedure to add expansion units. Follow the appropriate step below to determine if there are problems with the RIO/HSL/12X/12X DDR loops.

   - If your system *is not* managed by an HMC and you are running the IBM i operating system, refer to "Verify the RIO/HSL loops without an HMC" on page 29.
   - If your system *is* managed by an HMC, see "Verifying the RIO/HSL and 12X loops with an HMC" on page 28. You can use the **Save** button to overwrite the existing Last Valid Hardware Topology. This action allows you to compare the topology before and after the addition of the expansion units.

3. To verify the System Power Control Network (SPCN), see "Verifying the system power control network (SPCN)" on page 30. If you discover a problem with the SPCN, you must correct the problem before continuing.

   Important: When simultaneously adding multiple expansion units to an existing SPCN loop, the units must be adjacent to each other so the existing loop is broken at only one spot.

4. Set the SPCN Firmware Update Policy.

   The SPCN Firmware Update Policy controls when and how SPCN firmware on expansion units will be updated. The default setting shipped with your system is for the SPCN Firmware Update Policy Enabled. This setting allows for firmware updates to be completed over the RIO/HSL/12X/12X DDR interface whenever an update is required and does not allow updates over the slower serial SPCN interface.

   a. Access the ASMI using an authority level of Administrator or Authorized service provider. For details, see Managing the Advanced System Management Interface.

   b. In the ASMI navigation area, expand **System Configuration** and select **Configure I/O Enclosures**.

   c. Verify there are no SPCN firmware updates in progress by checking the **Power Control Network Firmware Update Status** column. This will show the words **In Progress** and a percent complete if an SPCN firmware update is in progress.

      If there is an SPCN firmware update in progress, determine if the update is a Serial or HSL update by checking the Power Control Network Firmware Update Status column for one of these words indicating the type of update.

      If the SPCN firmware update is an HSL update, wait for the update to complete before continuing.

Tip: To determine when the update is complete, select **Configure I/O Enclosures** every 15 to 30 seconds until the words `Not Required` are displayed in the **Power Control Network Firmware Update Status** column. Do not use the **Back** or **Refresh** buttons on the browser to monitor the status.

If the SPCN firmware update is a Serial update, either wait for the update to complete or stop the update. If you choose to stop the update, the update will need to be restarted from the beginning after you have completed the procedure. To stop the update, perform the following steps:

1) Complete step 4d.
2) Press the **Stop SPCN Firmware Update** button on the Configure I/O Enclosures panel.
3) Select **Configure I/O Enclosures** every 15 to 30 seconds until the word `Pending` is displayed in the **Power Control Network Firmware Update Status** column. Do not use the **Back** or **Refresh** buttons on the browser to monitor the status.

d. If your SPCN Firmware Update Policy is **Expanded**, record the current setting so it can be restored later and then change the setting to **Enabled**. If the SPCN Firmware Update Policy is **Enabled** or **Disabled**, continue without changing the setting.

5. Remove or open the back of the system unit.
6. Locate the connectors on your expansion unit and system unit. For details on the connector locations, refer to "Connector locations" on page 20.

   Note: For system unit slot locations and descriptions, see PCI adapter placement for machine types 82xx and 91xx (http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/areab/areabkickoff.htm).
7. To connect the expansion unit with RIO/HSL cables, refer to "Connecting the expansion unit with RIO/HSL, 12X, and 12X DDR cables" on page 14.
8. To connect the expansion unit with SPCN cables, refer to "Connecting the expansion unit with SPCN cables" on page 17.
9. Connect the power cables for the expansion units that you are installing to the power source. Then connect them to the power supplies on the expansion units. If you installed the expansion units with the system unit's power off, continue with step 11. If not, continue with the next step.

   Note: Plug the power cable into the power source prior to connecting it into the power supply of the expansion unit.
10. The expansion units will power on automatically. After the expansion units that you have installed are powered on and you have waited 10 minutes for the hardware initialization to complete, continue with step 12.

    Tip: For each expansion unit, wait for the green power indicator to light on the control panel of the expansion unit that just powered on. This may take between one and 10 minutes. During this time, the yellow attention indicator may be lit on the control panel of the expansion unit that just powered on. After the green power indicators are lit on the control panels of all of the expansion units that were just powered on, wait 10 additional minutes for hardware initialization to complete before proceeding to step 12.
11. To start the system or logical partition, refer to "Starting the system or logical partition" on page 41.
12. To verify the SPCN, refer to "Verifying the system power control network (SPCN)" on page 30. When following these instructions, consider that the following errors logs are expected depending upon various factors in the system configuration and procedure.
    - 10009133 permanent log entry due to disruption to the RIO/HSL or GX Dual-Port 12X Channel Attach adapter loop.
    - 10009135 informational or permanent log entry due to an open SPCN loop.
    - 10009137 permanent log entry due to disruption to the RIO/HSL or GX Dual-Port 12X Channel Attach adapter loop.

- 10009139 informational log entry for SPCN closed.
- 1000910A, 1000 91DE if SPCN firmware updates were required.
- 1000913B permanent log entry if an SPCN firmware update is required but not automatically started. If this error log entry is found, continue with the procedure and the error will be handled in step 14.

13. Verify the RIO/HSL/12X/12X DDR Loops.

    If your system *is not* managed by an HMC and you are running the IBM i operating system, refer to "Verify the RIO/HSL loops without an HMC" on page 29.

    If your system *is* managed by an HMC, refer to "Verifying the RIO/HSL and 12X loops with an HMC" on page 28. If you saved the original RIO/HSL/12X/12X DDR topology before adding the expansion units, use this saved topology to compare the original and modified configurations.

    When following these instructions, consider that the following errors log entries are expected depending upon various factors in the system configuration and procedure.

    - B7006907 informational log entries for each new expansion unit that was added that has information in its nonvolatile storage from a system which the expansion unit was previously attached to.
    - B7006985 informational log entries before and after the B700 6907 informational log entries.
    - B7006984 informational log entries to indicate a broken HSL loop.

14. Start necessary SPCN firmware updates.

    If error log entry 1000913B was found in step 12 on page 13, an SPCN firmware update is needed; however, due to the current SPCN Firmware Update Policy, the update could not be done automatically. Therefore, the SPCN firmware update must be done manually. To complete this task, see "Updating the SPCN firmware" on page 34.

    Wait for the SPCN firmware updates to complete before continuing to the next step. This could take several hours depending on the number of expansion units on the SPCN loop and the current level of the SPCN firmware in the expansion unit.

15. If you changed the SPCN Firmware Update Policy in step 4 on page 12, ensure that you changed the policy back to the original setting.
    a. Access the ASMI using an authority level of Administrator or Authorized service provider. For details, see Managing the Advanced System Management Interface.
    b. In the ASMI navigation area, expand **System Configuration** and select **Configure I/O Enclosures**.
    c. Change the **SPCN Firmware Update Policy** setting to the setting recorded in step 4 on page 12. The default and recommended setting is **Enabled**.
16. Verify the new configuration. For details, refer to "Verifying that the new configuration is functioning" on page 27.
17. If the system is partitioned, you can now assign the new hardware to a logical partition.

Connecting the expansion unit with RIO/HSL, 12X, and 12X DDR cables

These instructions explain how to connect expansion units with remote input/output (High-Speed Link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) cables in either a new or existing loop. It also includes information about connecting multiple units.

Adding expansion units to a new RIO/HSL, 12X, or 12X DDR loop

Use this procedure to add expansion units to a new remote input/output (high-speed link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) loop.

Unused RIO/HSL/12X/12X DDR connectors might be covered with metal clips. Remove the clips before you install the RIO/HSL/12X/12X DDR cables.

1. On the system unit to which you are going to connect the new RIO/HSL/12X/12X DDR, identify connectors 0 and 1 of the RIO/HSL/12X/12X DDR connector pair that you are going to use.
2. Find the RIO/HSL/12X/12X DDR cables that were included with the expansion units.
3. Connect a RIO/HSL/12X/12X DDR cable to connector 0 on an expansion unit.
4. Connect another RIO/HSL/12X/12X DDR cable to connector 1 on the expansion unit.
5. If there is another expansion unit to add, do the following:
   a. Connect the other end of the cable from connector 1 on the expansion unit just added to connector 0 on the next expansion unit.
   b. Connect another cable to connector 1 on the expansion unit from step 5a.
   c. Repeat step 5 for each additional expansion unit.
6. Connect the other end of the cable from connector 0 on the first expansion unit added to connector 0 on your system unit.
7. Connect the other end of the cable from connector 1 on the last expansion unit added to connector 1 on your system unit.
8. Return to the procedure that sent you here.

Adding expansion units to an existing RIO/HSL, 12X, or 12X DDR loop

Use this procedure to add expansion units to an existing remote input/output (high-speed link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), or 12X adapter Double Data Rate (12X DDR) loop.

Unused RIO/HSL/12X/12X DDR connectors might be covered with metal clips. Remove the clips before you install the RIO/HSL/12X cables.

Before doing this procedure, review "Examples: RIO/HSL, 12X, and 12X DDR expansion unit connections" on page 16.

1. Identify the RIO/HSL/12X/12X DDR loop to which you want to add the expansion units.
2. Identify connectors 0 and 1 of the RIO/HSL/12X/12X DDR connector pair on the system unit that are associated with the loop identified in step 1.
3. Find the RIO/HSL/12X/12X DDR cables that were included with the expansion units.
4. Choose from the following options:
   - To add the expansion units to the beginning of the loop, go to step 5.
   - To add the expansion units to the middle of the loop, go to step 6.
   - To add the expansion units to the end of the loop, go to step 7 on page 16.
5. To add the expansion units to the beginning of the loop, complete the following steps:
   a. Move the RIO/HSL/12X/12X DDR cable from connector 0 on the first expansion unit on the loop (the one connected to connector 0 on the system unit) to connector 0 on the new expansion unit.
   b. Connect another RIO/HSL/12X/12X DDR cable to connector 1 on the new expansion unit.
   c. If you are adding another expansion unit, do the following:
      1) Connect the other end of the cable from connector 1 on the expansion unit just added to connector 0 on the next expansion unit.
      2) Connect another cable to connector 1 on the expansion unit from step 5c1.
      3) Repeat step 5c for each additional expansion unit.
   d. Connect the other end of the cable from connector 1 on the last expansion unit added to connector 0 on the expansion unit that was disconnected in step 5a.
6. To add the expansion units to the middle of the loop, complete the following steps:
   a. Move the RIO/HSL/12X/12X DDR cable from connector 0 on the existing expansion unit that follows the location of the new expansion unit to connector 0 on the new expansion unit.
   b. Connect another RIO/HSL/12X/12X DDR cable to connector 1 on the new expansion unit.

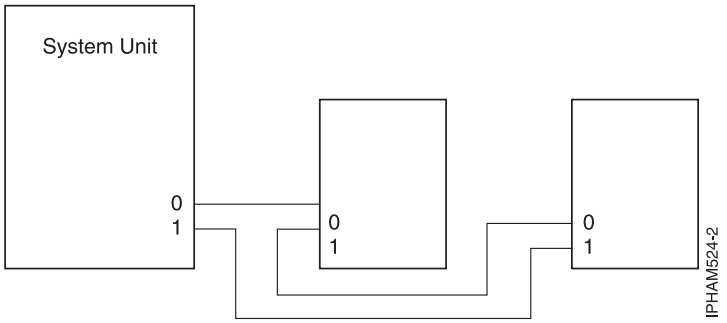
c. If you are adding another expansion unit, do the following:
   1) Connect the other end of the cable from connector 1 on the expansion unit just added to connector 0 on the next expansion unit.
   2) Connect another cable to connector 1 on the expansion unit from step 6c1.
   3) Repeat step 6c for each additional expansion unit.
d. Connect the other end of the cable from connector 1 on the last expansion unit added to connector 0 on the expansion unit that was disconnected in step 6a on page 15.

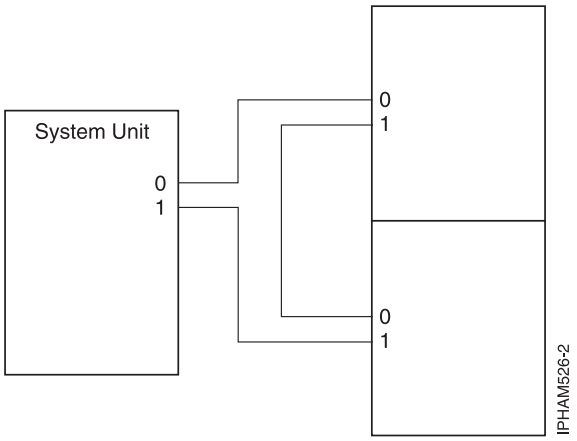
7. To add the expansion units to the end of the loop, complete the following steps:
   a. Move the RIO/HSL/12X/12X DDR cable from connector 1 on the system unit to connector 0 on the new expansion unit.
   b. Connect another RIO/HSL/12X/12X DDR cable to connector 1 on the new expansion unit.
   c. If you are connecting another expansion unit, do the following:
      1) Connect the other end of the cable from connector 1 on the expansion unit just added to connector 0 on the next expansion unit.
      2) Connect another cable to connector 1 on the new expansion unit from step 7a.
      3) Repeat step 7c for each additional expansion unit.
   d. Connect the other end of the cable from connector 1 on the last expansion unit added to connector 1 on the system unit.
8. Return to the procedure that sent you here.

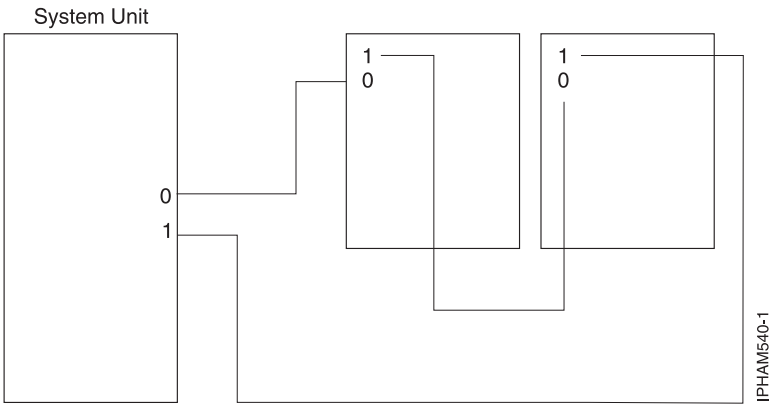
Examples: RIO/HSL, 12X, and 12X DDR expansion unit connections

See examples of possible remote input/output (High-Speed Link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) expansion unit connections.

Note: Some hardware might not have labels for the 12X connectors, or it might have labels other than T1/T2, such as 0/1 or 1/2. In those cases, the top connector corresponds to T1 in the examples below and the bottom connector corresponds to T2 in the examples below.







Connecting the expansion unit with SPCN cables

You can connect expansion units to system units with system power control network (SPCN) cables. System units use SPCN cables to control the power to expansion units.

Review the "Examples: SPCN connections" on page 19 and then return here and continue with the instructions.

If you encounter difficulties during the procedure, contact your service provider for assistance.

If you are installing an expansion unit in an existing SPCN loop with the system unit power on, errors are logged when you disconnect and reconnect cables. You can ignore these error messages.

1. Choose from the following options:
   - To connect SPCN cables when there is not already an SPCN loop, go to step 2.
   - To connect SPCN cables to the beginning of an existing SPCN loop, go to step 3 on page 18.
   - To connect SPCN cables to the middle of an existing SPCN loop, go to step 4 on page 18.
   - To connect SPCN cables to the end of an existing SPCN loop, go to step 5 on page 18.
2. To connect SPCN cables when there is not already an SPCN loop, do the following:
   a. Find the SPCN cables that were included with your expansion units.
   b. Connect an SPCN cable to connector SPCN0 on your system unit.

      Note: For an E4A system unit connect to SPCN1.
   c. Connect the other end of the SPCN cable to connector SPCN 0 on one of the new expansion units.

d. Connect another cable to connector SPCN 1 on the new expansion unit.
e. If there is another expansion unit to add, do the following:
   1) Connect the other end of the cable from connector SPCN 1 on the expansion unit just added to connector SPCN 0 on the next expansion unit.
   2) Connect another cable to connector SPCN 1 on the expansion unit from step 2e1.
   3) Repeat step 2e for each additional expansion unit.
f. Connect the other end of the cable from connector SPCN 1 on the last expansion unit added to connector SPCN1 on your system unit.

   Note: For an E4A system unit connect to SPCN2.
g. Return to the procedure that sent you here.

3. To connect SPCN cables to the beginning of an existing SPCN loop, do the following:
   a. Find the SPCN cables that were included with your expansion units.
   b. Move the SPCN cable from connector SPCN 0 on the first expansion unit (the one connected to connector SPCN0 on the system unit) to connector SPCN 0 on one of the new expansion unit.

      Note: For an E4A this is the cable connected SPCN1 on the system unit.
   c. Connect another SPCN cable to connector SPCN 1 on the new expansion unit.
   d. If there is another expansion unit to add, do the following:
      1) Connect the other end of the cable from connector SPCN 1 on the expansion unit just added to connector SPCN 0 on the next expansion unit.
      2) Connect another cable to connector SPCN 1 on the expansion unit from step 3d1.
      3) Repeat step 3d for each additional expansion unit.
   e. Connect the other end of the cable from connector SPCN 1 on the last expansion unit added to connector SPCN 0 on the expansion unit that was disconnected in step 3b.
   f. Return to the procedure that sent you here.
4. To connect SPCN cables to the middle of an existing SPCN loop, do the following:
   a. Find the SPCN cables that were included with your expansion units.
   b. Move the SPCN cable from connector SPCN 0 on the expansion unit to follow the expansion units which are being added to connector SPCN 0 on the new expansion unit.
   c. Connect another SPCN cable to connector SPCN 1 on one of the new expansion units.
   d. If there is another expansion unit to add, do the following:
      1) Connect the other end of the cable from connector SPCN 1 on the expansion unit just added to connector SPCN 0 on the next expansion unit.
      2) Connect another cable to connector SPCN 1 on the expansion unit from step 4d1.
      3) Repeat step 4d for each additional expansion unit.
   e. Connect the other end of the cable from connector SPCN 1 on the last expansion unit added to connector SPCN 0 on the expansion unit that was disconnected in step 4b.
   f. Return to the procedure that sent you here.
5. To connect SPCN cables to the end of an existing SPCN loop, do the following:
   a. Find the SPCN cables that were included with your expansion units.
   b. Move the SPCN cable from connector SPCN 1 on the last expansion unit (the one connected to connector SPCN1 on the system unit) to connector SPCN 1 on one of the new expansion units.

      Note: For an E4A this is the cable connected SPCN2 on the system unit.
   c. Connect another SPCN cable to connector SPCN 0 on the new expansion unit.
   d. If there is another expansion unit to add, do the following:

1) Connect the other end of the cable from connector SPCN 0 on the expansion unit just added to connector SPCN 1 on the next expansion unit.
2) Connect another cable to connector SPCN 0 on the expansion unit from step 5d1.
3) Repeat step 5d on page 18 for each additional expansion unit.

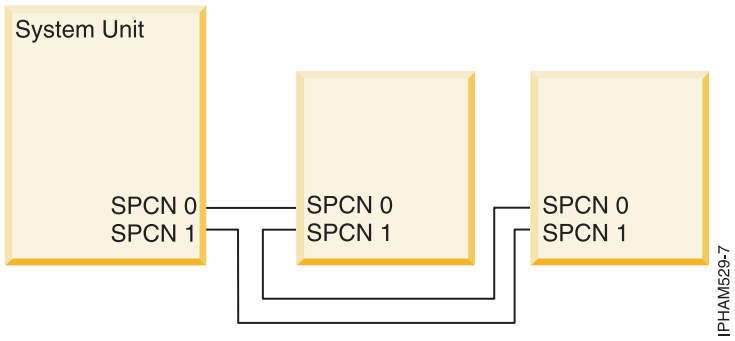
e. Connect the other end of the cable from connector SPCN 0 on the last expansion unit added to connector SPCN 1 on the expansion unit that was disconnected in step 5d on page 18.

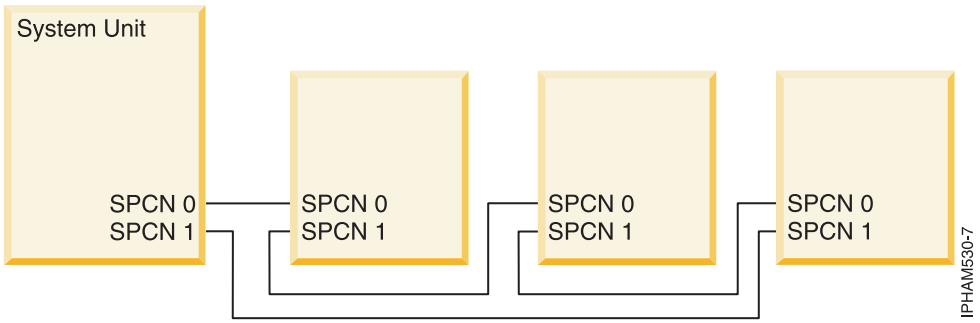
f. Return to the procedure that sent you here.

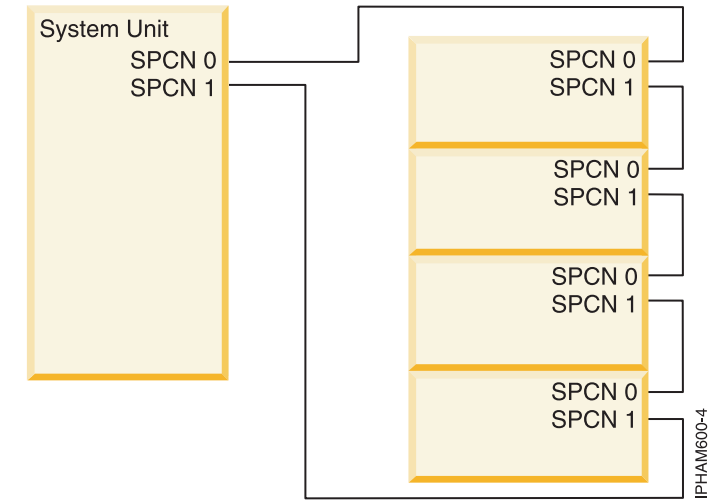
Examples: SPCN connections

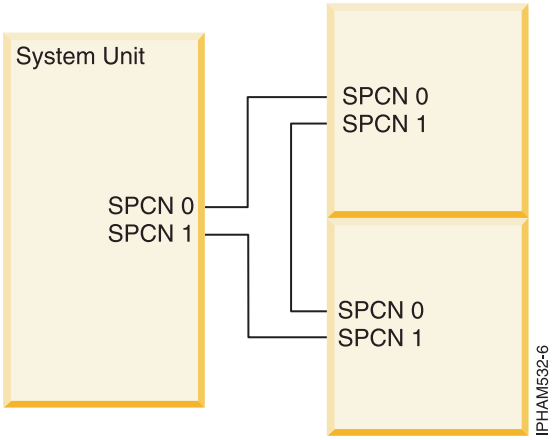
See examples that show possible system power control network (SPCN) connections.

Note: Some hardware might not have labels for the SPCN connectors, or it might have labels other than T1/T2, such as J15/J16 or 0/1. In those cases, the connector to the left or on top of the other connector corresponds to T1 in the examples below and the connector to the right or on the bottom of the other connector corresponds to T2 in the examples below.









Connector locations

Learn about remote input/output (high-speed link) (RIO/HSL), GX Dual-Port 12X Channel Attach adapter (12X), 12X adapter Double Data Rate (12X DDR), and system power control network (SPCN) connector locations.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

Model 8203-E4A, 8261-E4S, 9407-M15, and 9408-M25 connector locations

Learn about connector locations on rack-mounted and stand-alone models.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

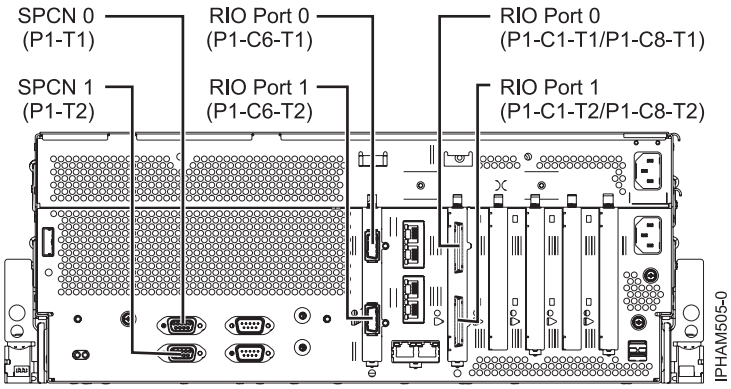


Figure 4. Model 8203-E4A, 8261-E4S, 9407-M15, and 9408-M25 connector locations on rack-mounted model

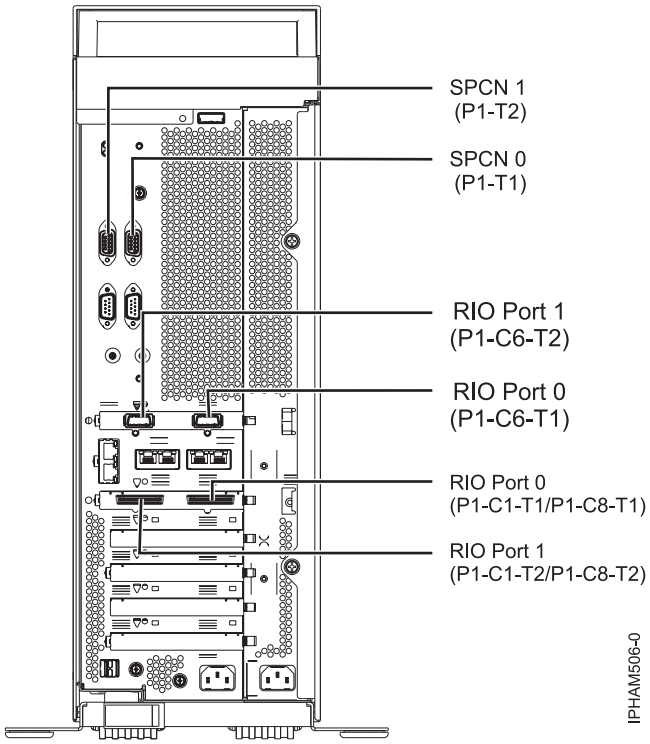


Figure 5. Model 8203-E4A, 8261-E4S, 9407-M15, and 9408-M25 connector locations on a stand-alone model

Model 8204-E8A and 9409-M50 connector locations

Learn about connector locations on rack-mounted and stand-alone models.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

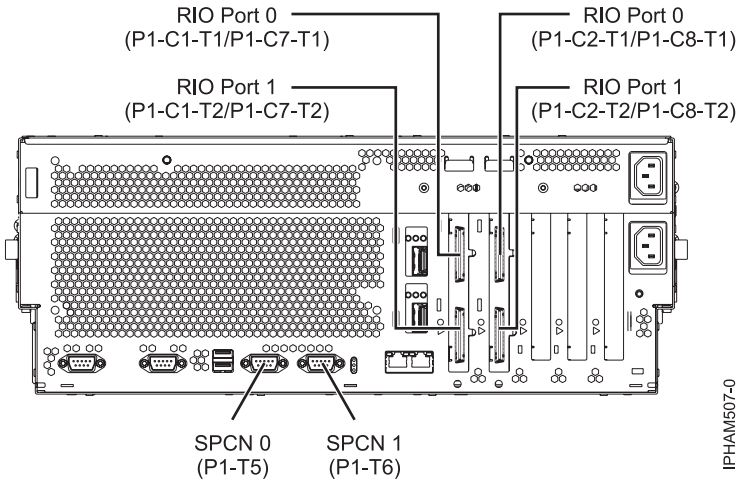


Figure 6. Model 8204-E8A and 9409-M50 connector locations on rack-mounted model

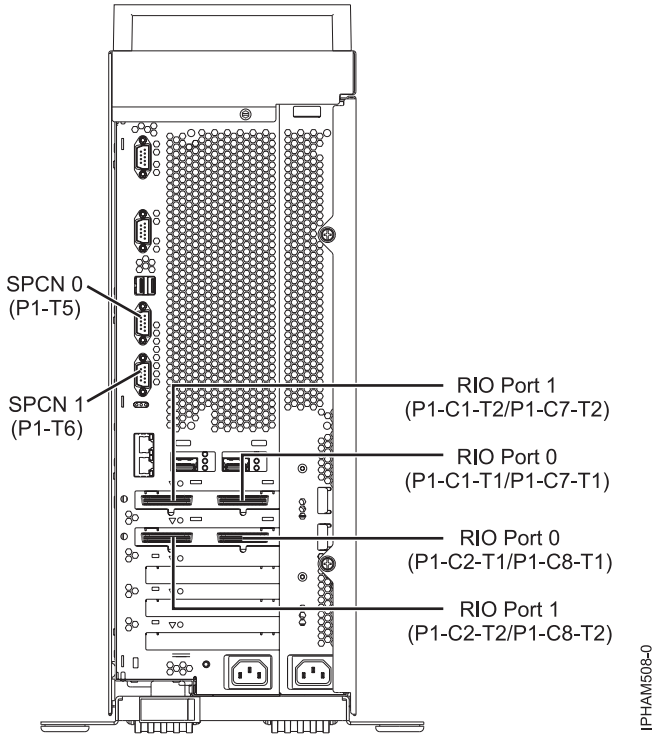


Figure 7. Model 8204-E8A and 9409-M50 connector locations on stand-alone model

Model 9117-MMA or connector locations

Learn about connector locations.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

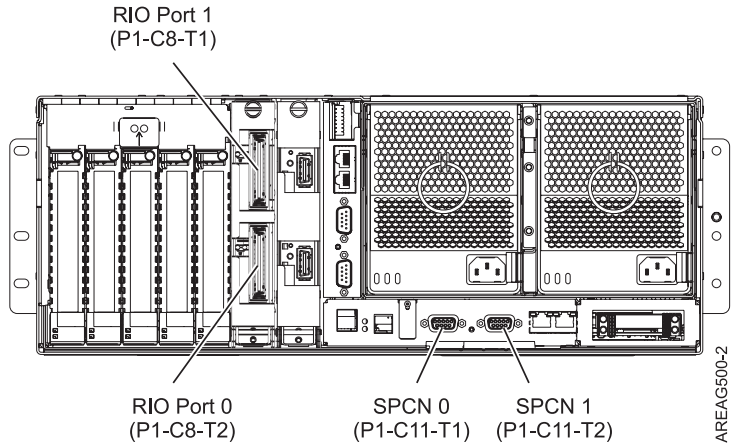


Figure 8. Model 9117-MMA connector locations

Model 5790 or 7311-D11 connector locations

Learn about connector locations.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

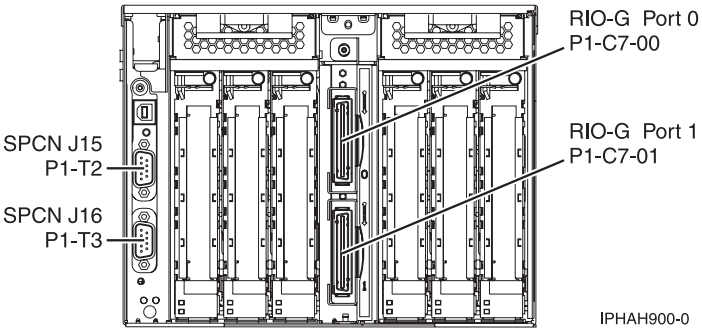


Figure 9. Model 5790 or 7311-D11 connector locations

Model 0595 or 7311-D20 connector locations

Learn about connector locations.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

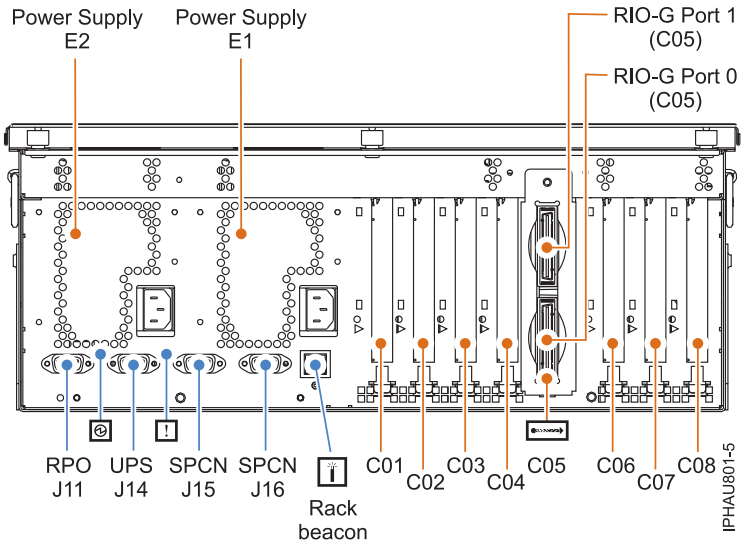


Figure 10. Model 0595 or 7311-D20 connector locations

Model 5796 or 7314-G30 connector locations

Learn about connector locations.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

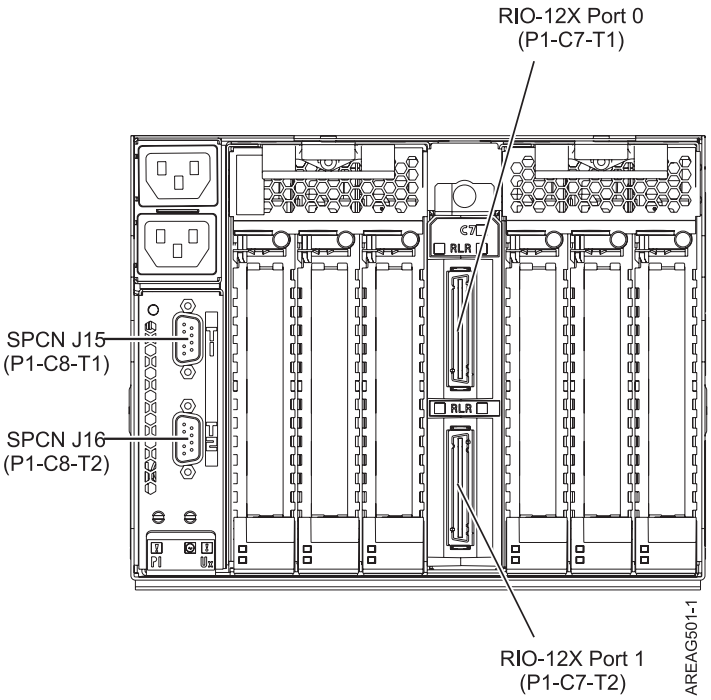


Figure 11. Model 5796 or 7314-G30 connector locations

Model 0588 or 5088 connector locations

Learn about connector locations.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

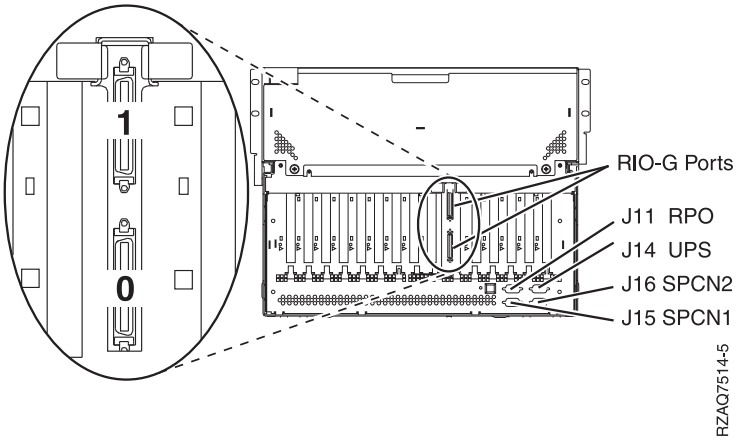


Figure 12. Model 0588 or 5088 connector locations

Model 0595 or 5095 connector locations

Learn about connector locations on rack-mounted or stand-alone models.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

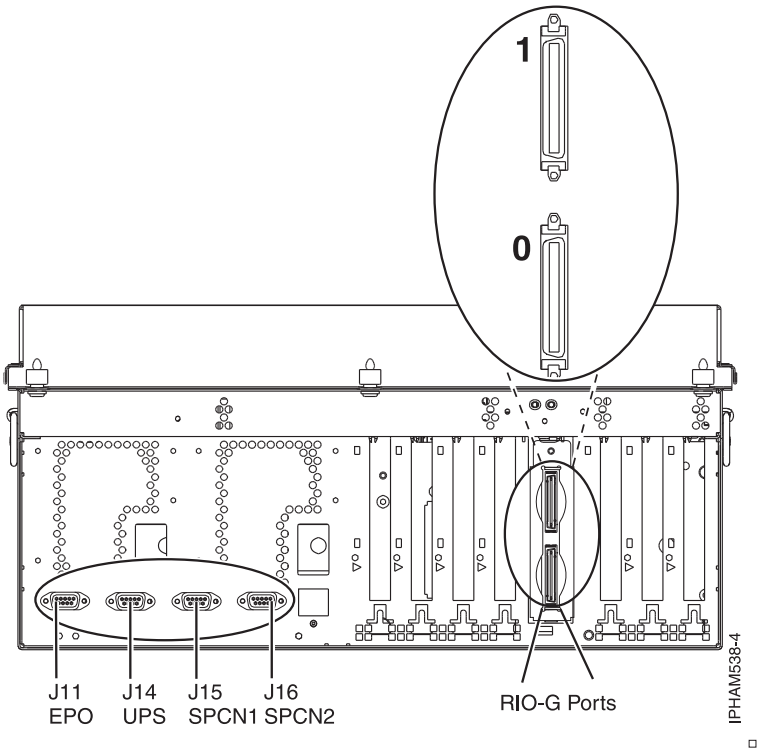


Figure 13. Model 0595 connector locations on rack-mounted unit

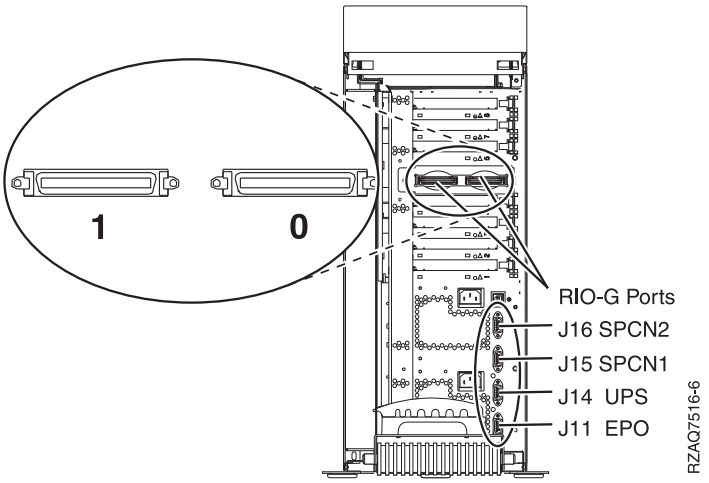


Figure 14. Model 5095 connector locations on stand-alone unit

Model 5094, 5294, 5096, or 5296 connector locations

Learn about connector locations.

Note: Each remote input/output (RIO) label in the figures of this section is also applicable to high-speed link (HSL), GX Dual-Port 12X Channel Attach adapter (12X), and 12X adapter Double Data Rate (12X DDR) adapters.

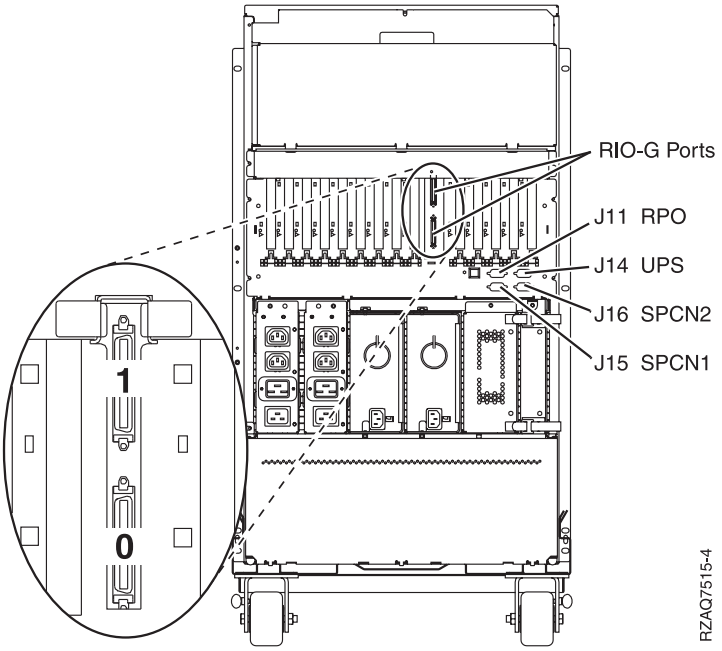


Figure 15. Model 5094, 5294, 5096, or 5296 connector locations

Model 5802 and 5877 connector locations

Learn about connector locations.

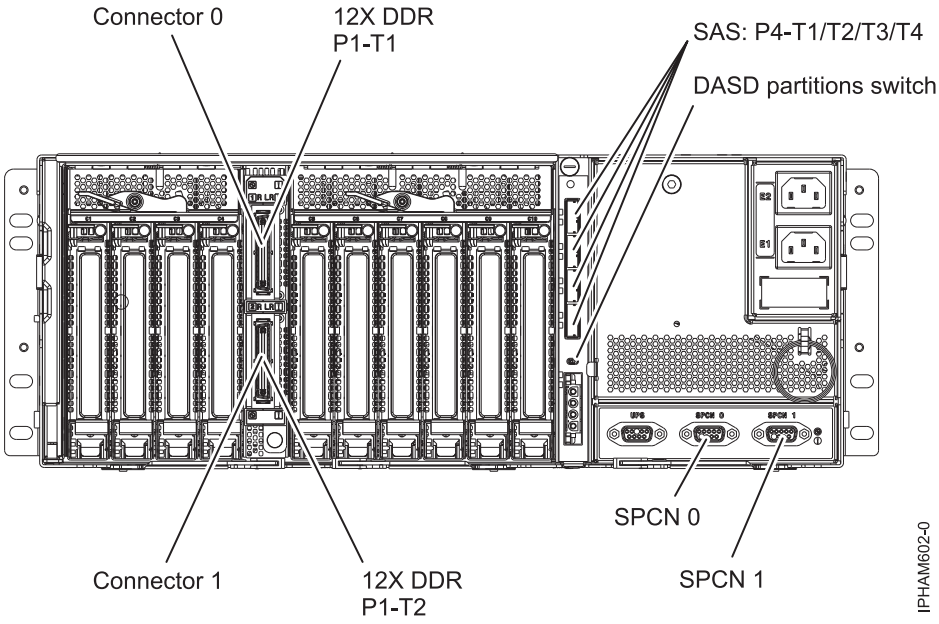


Figure 16. Model 5802 and 5877 connector locations

Verifying that the new configuration is functioning

Use the procedures in this section to verify that the new configuration is correctly functioning.

1. Choose from the following options:
   - If your system is not managed by an HMC, refer to Verify the installed part. When you are finished, return to the procedure that sent you here.
   - If your system is managed by an HMC, continue with step 2.
2. To view more information about the managed system, complete the following steps:
   a. From the navigation area of the HMC, expand **Systems Management**.
   b. Click **Servers**.
   c. Select the server with which you want to work. Information about the system is shown under the Tasks section in the contents area.
3. View the properties of the managed system and verify the new expansion units by doing the following:
   a. Select your server with which you want to work.
   b. Click **Tasks** → **Properties**.
   c. Select the **I/O** tab.
   d. Verify that the new expansion unit is displayed in the list and that the unit ID information displayed on the panel for the I/O unit matches the label on the I/O unit.

      Note: Wait up to 10 minutes for the new expansion units to be displayed in the list. If they are not displayed after 10 minutes, go to the next step. If they are displayed, go to step 5 on page 28.

      Tip: To refresh the list of expansion units, you must completely exit and re-enter the function.
4. If the expansion units are not displayed on the I/O panel, verify the installation by performing the following steps:

a. Make sure that the expansion units are powered on and the power cables are connected to the power source and the expansion units.
b. Make sure that the RIO/HSL and SPCN cables are installed correctly. For cabling information, see "Connecting your expansion units" on page 11.
c. Make sure you verified the MTMS and Configuration ID of the new expansion units. For details, refer to Setting I/O enclosure configuration ID and MTMS value.
d. If the expansion units still are not displayed, contact your service provider for assistance.

5. Return to the procedure that sent you here.

Verifying the RIO/HSL and 12X loops with an HMC

You can verify the remote input/output (High-Speed Link) (RIO/HSL) and GX Dual-Port 12X Channel Attach adapter (12X) loops with a Hardware Management Console (HMC).

To verify the RIO/HSL/12X cables are hooked up and seated correctly, complete the following steps with the system unit power on:

1. Use the HMC to verify that there are no B70069xx errors by completing the following steps:
   a. In the Navigation area, select **Service Management**.
   b. Select **Manage Serviceable Events**.
   c. In the Manage Serviceable Events window, perform the following steps:
      1) Select **Open** for the Serviceable event status field.
      2) Select the machine type and model (MTM) numbers of the server you are working with for Reporting MTMS field.
      3) Select **ALL** for all other fields.
   d. Click **OK**.
   e. Scan for any B70069xx errors.
   f. Choose from the following options:
      - If there are no errors, click **Cancel** to exit and continue with step 2.
      - If there are errors, they must be corrected before continuing. If you need assistance, contact your service provider.

      Note: If you were sent here as part of a repair procedure, you do not need to correct serviceable events related to the failure for which the repair is being done including the one for which the repair procedure was launched before continuing.
2. Use the HMC to verify the existing RIO/HSL/12X loops by completing the following steps:
   a. From the navigation bar, expand **Systems Management**.
   b. Select **Servers**.
   c. Select the server you are working from.
   d. From the Tasks area, do the following:
      1) Expand **Hardware Information**.
      2) Select **View Hardware Topology**.
   e. In the 'Current Hardware Topology' section, verify that each row has 'Operational' in the 'Leading Port Status' and 'Trailing Port Status' columns. If there are rows with something other than 'Operational' in these columns, these links must be repaired before continuing. If you need assistance, contact your service provider.

      Notes:
      - If you were sent here as part of a repair procedure, the expansion unit being repaired might have port statuses of other than 'Operational.' These links do not have to be repaired before continuing.

- A bus (loop) that has no expansion units on it will have one row showing the status of 'Open/Failed' for the ports on the GX card. This is normal for empty loops and does not have to be corrected before continuing.
- Be sure you are viewing the data in 'Current Hardware Topology' section and not the data in the 'Last Valid Hardware Topology' section.

3. Return to the procedure that sent you here.

Verify the RIO/HSL loops without an HMC

Use this procedure to verify RIO/HSL loops when an HMC is not connected to the system.

Note: This procedure must be done from a partition running i5/OS.

Complete the following steps to verify the RIO/HSL loops on a system that is not managed by an HMC with the system unit power on:

1. If you were sent here from Powering off an I/O enclosure as part of a repair procedure, skip to step 3.
2. Use the service action log to verify there are no B700 69xx errors. Complete the following steps to view the service action log:
   a. Signed on to i5/OS with at least service level authority.
   b. On the command line of the i5/OS session, type `strsst` and press Enter.

      Note: If you cannot get to the System Service Tools display, use function 21 from the control panel.
   c. Type your service tools user ID and service tools password on the System Service Tools (SST) Sign On display. Press Enter. The service tools password is case sensitive.
   d. Select **Start a service tool** from the System Service Tools (SST) display. Press Enter.
   e. Select **Hardware service manager** from the Start a Service Tool display. Press Enter.
   f. Select **Work with service action log** from the Hardware Service Manager display. Press Enter.
   g. On the **Select Timeframe** display, change the **From: Date and Time** to the appropriate date and time range. The suggested range is 30 days.
   h. Search for any B700 69xx errors.
      - If there are no errors, press F3 to exit and return to the Hardware Service Manager display. Go to step 3.
      - If there are errors, they must be corrected before continuing. If you need assistance, contact your service provider.
3. Use the Hardware Service Manager to verify the existing RIO/HSL loop by completing the following steps:
   a. Type your service tools user ID and service tools password on the System Service Tools (SST) Sign On display. Press Enter. The service tools password is case sensitive.
   b. Select **Logical hardware resources** from the Hardware Service Manager display. Press Enter.
   c. Select **High-speed link resources** from the Logical Hardware Resources display. Press Enter.
   d. Select **Display port information for the first RIO/HSL loop**. Press Enter.
   e. For each row that has a connection type of **External**, verify that the status is Operational. If the status is operational, press F12 to cancel and select **Display port information for the next HSL/RIO loop**. If all of the external RIO/HSL connections are operational, press F3 to exit and continue to the next step. If the status is not operational for any one of the external RIO/HSL connections, the links must be repaired before continuing. If you need assistance, contact your service provider.

Note: If you were sent here from Powering off an I/O enclosure during a repair procedure, it is possible that the status values will not be operational for the ports on the enclosure being powered off and repaired. It is not necessary to correct those failures before proceeding.

4. Return to the procedure that sent you here.

Verifying the system power control network (SPCN)

Check for system power control network (SPCN) errors and inactive enclosures, and fix machine type, model, and serial number (MTMS) problems.

1. Choose from the following options:
   - If your system *is* managed by an HMC, continue with step 2.
   - If your system *is not* managed by an HMC, continue with step 3.
2. Use the HMC to verify that there are no 1000 9xxx errors by completing the following steps:
   a. In the navigation area of the HMC, select **Service Management**.
   b. In the contents area, select **Manage Serviceable Events**.
   c. In the Manage Serviceable Events – Select Serviceable Events window, select the following:
      1) **Open** for the Serviceable Event Status.
      2) The MTMS of the server you are working with for Reporting MTMS.
      3) **ALL** for all other fields
   d. Click **OK**.
   e. Scan for any 1000 9xxx errors, and do the following:
      - If there are no errors, click **Cancel** twice to exit Manage Serviceable Events.
      - If there are errors, they must be corrected before continuing. If you need assistance, contact your service provider.
   f. Go to step 5 on page 31.
3. If your system *is not* managed by an HMC, choose from the following options:
   - If you have a Power Systems server with IBM i operating system, continue with step 4.
   - If you have a Power Systems server with the AIX or Linux operating system, continue with step 5 on page 31.
4. Use the service action event log to verify that there are no 10009xxx errors by completing the following steps:
   a. Sign on with at least service level authority.
   b. On the command line of the IBM i session, type `strsst` and press Enter.

      Tip: If you cannot get to the System Service Tools display, use `function 21` from the control panel.
   c. Type your service tools user ID and service tools password on the System Service Tools (SST) Sign On display. Press Enter.

      Tip: The service tools password is case-sensitive.
   d. Select **Start a Service Tool** from the System Service Tools (SST) display. Press Enter.
   e. Select **Hardware Service Manager** from the Start a Service Tool display. Press Enter.
   f. Select **Work with Service Action Event Log** from the Hardware Service Manager display. Press Enter.
   g. On the **Select Timeframe** display, change the **From: Date and Time** to the desired date and time range. The suggested range is 30 days.
   h. Search for any 1000 9xxx errors, and do the following:
      - If there are no errors, press F3 to exit and return to the Hardware Service Manager display.

- If there are errors, they must be corrected before continuing. If you need assistance, contact your service provider.

i. Go to step 5.

5. Verify that none of the existing expansion units with control panels have a 'C62E' code on the display area of the control panel. This indicates that the expansion unit is unable to communicate with the system. If one or more of them do, there is a problem with the SPCN cabling. Correct the problem before continuing.
6. To verify that there are no inactive expansion units in the SPCN, do the following:
   a. Access the ASMI using an authority level of Administrator or Authorized service provider. For details, on using the ASMI, refer to the Managing the Advanced System Management Interface.
   b. In the ASMI navigation area, expand **System Configuration** and select **Configure I/O Enclosures**.
   c. Verify that each row has the word **Active** in the Status column. If any of the I/O enclosures have a status of **Inactive**, do one of the following:
      1) If you were sent here as part of an expansion unit concurrent add procedure and you have already connected the expansion units to the system and powered them on, do not invoke **Clear inactive enclosures**. Contact your service provider for assistance.
      2) Click the **Clear inactive enclosures** button on this panel. Wait for the completion indication, then repeat steps 6b and 6c. If the problem persists, contact your service provider.
7. If you were sent here as part of an expansion unit concurrent add procedure and you have already connected the expansion units to the system and powered them on, go to step 8. Otherwise, go to step 9.
8. Perform the tasks in "Setting I/O enclosure configuration ID and MTMS value" for the expansion units you just added. Then go to step 10.
9. Complete the following steps for all expansion units on the system.
   a. Access the ASMI using an authority level of Administrator or Authorized service provider. For details, on using the ASMI, refer to Managing the Advanced System Management Interface.
   b. In the ASMI navigation area, expand **System Configuration** and select **Configure I/O Enclosures**.
   c. Verify that none of the values in the **Location code** column are of the form UTMP*x.xxx.xxxxxxx* where '*x*' may be any number 0-9 or character A-Z. If any of the expansion units have a Location Code with the format UTMP*x.xxx.xxxxxxx*, perform the tasks in "Setting I/O enclosure configuration ID and MTMS value" to correct it.
10. Return to the procedure that sent you here.

Setting I/O enclosure configuration ID and MTMS value

Updating the configuration ID and the machine type, model, and serial number (MTMS) values keep the configuration and error information in sync, and is used by the system when you create the location codes.

To set the configuration ID, use the Advanced System Management Interface (ASMI). However if the ASMI is not available you can use the physical control panel to set the configuration ID. To set the MTMS value you must use the ASMI, not the control panel. However, if you do not have access to the ASMI, the system will still operate without updating this information. The MTMS value should match the original value of the enclosure, which can be found on a label affixed to the enclosure.

For details, refer to "Using the ASMI to verify and set the configuration ID and MTMS value."

Using the ASMI to verify and set the configuration ID and MTMS value:

You can use the Advanced System Management Interface to verify and set the configuration ID and machine type, model, and serial number (MTMS) value for your system.

To perform this operation, verify that the following prerequisites have been met:

- The server must be powered on to a firmware standby or a firmware running state.
- The expansion unit must have ac power and be correctly installed in the system power control network.
- Your authority level must be one of the following:
  - Administrator
  - Authorized service provider

1. Login in to ASMI.
2. Expand **System Configuration**.
3. Select **Configure I/O Enclosures**.
4. Select **Clear Inactive Enclosures**.
5. If you were directed here from a replacement procedure, the expansion unit that was replaced contained the nonvolatile storage where the expansion unit machine type-model-serial (MTMS) was stored. It is necessary to restore the expansion unit MTMS now. It may also be necessary to set or change the expansion unit configuration ID (power control network identifier).

   The nonvolatile storage where the expansion unit MTMS value is stored in a new replacement expansion unit is uninitialized. The system will detect the uninitialized value and assign an obvious, unique value of the form TMP*x.xxx.xxxxxxx*, where *x* can be any character 0-9 and A-Z. As a result, the expansion units location code will change to UTMP*x.xxx.xxxxxxx*. You must use the new UTMP*x.xxx.xxxxxxx* location code in the instructions below when selecting the expansion unit to power off and selecting the expansion unit to change settings for.
6. From the ASMI utility, expand **System Configuration**.
7. Select **Configure I/O Enclosures**.
8. Verify the configuration ID and MTMS data
   a. Compare the power control network identifier value shown for the expansion unit you are working with to the power control network identifier (configuration ID) values in the following list.
      - 0x84 for 5096 and 5296 expansion units
      - 0x88 for 7311-D11 and 5790 expansion units
      - 0x89 for 5088 and 0588 expansion units
      - 0x8A for 5094, 5294, 5096, and 5296 expansion units
      - 0x8B for 5095 and 0595 expansion units
      - 0x8C for 7311-D20 expansion units
      - 0x8D for 7314-G30 and 5796 expansion units
      - 0x8E for 5802 and 5877 expansion units
   b. Compare the values shown on the 'Type-Model' and 'Serial number' columns for the expansion unit you are servicing to the type, model, and serial values on the label located on the expansion unit. The expansion unit location code format will be either UTMPx.xxx.xxxxxxx or UTTTT.MMM.SSSSSSS, where TTTT, MMM, and SSSSSSS are the enclosure type (TTTT), model (MMM), and serial number (SSSSSSS).

      Notes:

      - A 10009132 information log will be produced following a platform IPL, or when an expansion unit is added indicating that a temporary MTMS was assigned to an expansion unit. The temporary MTMS has the following location code format, UTMPx.xxx.xxxxxxx. This is an indication that the MTMS should be updated.
      - Serial numbers are case sensitive. (All alphabetic characters contained in the serial number must be entered as a capital letter.)
   c. If any changes must be made, go to step 9 on page 33. Otherwise go to step 21 on page 34.

9. If the server is powered on to the firmware running state, go to step 10. If the server is powered on to the firmware standby state, go to step 11.
10. Choose from the following options:
    - If the configuration ID must be changed, perform the following steps:
      a. Read the notes below.
      b. Power off the I/O enclosure.
      c. Go to step 11.
    - If the MTMS data must be changed and the system has partitions running the AIX or Linux operating system and any of the resources in the expansion unit are owned by active partitions running AIX or Linux, perform the following steps:
      a. Read the notes below.
      b. Power off the I/O enclosure.
      c. Go to step 11.
    - If neither of the above statements apply, go to step 11.

    Note:
    - Do not disconnect the ac power cables after powering off the expansion unit.
    - If the expansion unit is not immediately displayed on the service utility used to power off the expansion unit, refresh the utility periodically for up to ten minutes until it does. If it still is not displayed, go to step 1 on page 32 and repeat this procedure.
    - Remember to use the new UTMPx.xxx.xxxxxxx location code when selecting the expansion unit to power off if you were directed here from a replacement procedure.
    - If the procedure that directed you here involved powering off the expansion unit and while powering off the expansion unit you were instructed to use panel function 69 to power on the expansion unit, perform panel function 69 now (with the control panel set to manual mode) from the system unit control panel. Do this even though the expansion unit is already on.
11. From the ASMI utility, expand **System Configuration**.
12. Select **Configure I/O Enclosure**.
13. Select the expansion unit you are working with.
14. Select **Change settings**.
15. If in step 8 on page 32 you determined that the power control network identifier (configuration ID) value is not correct, enter the correct value now.
16. If in step 8 on page 32 you determined that the Type-Model and Serial number values are not correct, enter the correct values now.

    Note: Serial numbers are case sensitive. All alphabetic characters contained in the serial number must be entered as a capital letter.
17. Click **Save settings** to complete the operation.
18. Verify that the values you just entered are reflected in the Power Control Network Identifier, Type-Model, Serial number, and Location code columns for the expansion unit you are servicing. Do not use the browser Back button to do this. Rather, expand System Configuration. Then select **Configure I/O Enclosures**.
19. If the server is powered on to a firmware standby state and you entered a new power control network identifier (Configuration ID) in step 15, the expansion unit will power off and back on automatically. If this is the case, go to step 21 on page 34. Otherwise go to step 20.
20. If you powered off the expansion unit in step 10, read the notes below to power on the expansion unit.

    Notes:

- If the system is not managed by an HMC, disconnect all power to the expansion unit by disconnecting the cables from the power supplies on the expansion unit. Wait for the display panel to go off, wait an additional 30 seconds, and then reconnect the power cables. The expansion unit will power on automatically.
- If the system is managed by an HMC, power on the expansion unit using the Power On/Off Unit utility on the HMC. If the values you just entered are not immediately reflected in the location code of the expansion unit in the Power On/Off Unit utility, restart the utility periodically for up to ten minutes until the values you entered are reflected.

21. Log off and close the ASMI.
22. Return to the procedure that sent you here.

Updating the SPCN firmware

The system power control network (SPCN) firmware update policy is not initially set to update. Therefore, an SPCN firmware update is needed and must be done manually.

Notes:

- Do not perform maintenance on an expansion unit or change the SPCN network while the SPCN firmware update is being performed.
- If you power off the system while performing firmware updates, the SPCN firmware update is interrupted and must be restarted.
- This procedure can take several hours depending on the number of expansion units on the SPCN loop and the current level of the SPCN firmware on the expansion unit.

To change the SPCN firmware update policy to expanded and start an SPCN firmware update, perform the following steps:

1. Access the Advanced System Management Interface (ASMI).
2. Click **System Configuration → Configure I/O Enclosures**.
3. Record the current SPCN Firmware Update Policy setting so that it can be restored later.
4. Change the **SPCN Firmware Update Policy** setting to **Expanded**, and click **Save Policy Setting** to allow SPCN firmware updates to be performed over the RIO/HSL and serial SPCN interfaces.
5. Click **Start SPCN Firmware Update**. The SPCN firmware is then downloaded to the expansion units that require an update.
6. Change the SPCN Firmware Update Policy setting back to what it was originally set to in step 3, and click **Save Policy Setting**.

   Notes:

   - To monitor the progress of the SPCN firmware update, click **Configure I/O Enclosures**. The window is refreshed. Do not use the browser **Back** or **Refresh** button to monitor the update progress. The Power Control Network Firmware Update Status column shows the percentage completed, and `In Progress` is displayed while the download operation is in progress. `Not Required` is displayed when the download process is completed.
   - To stop the SPCN firmware update (not recommended), click **Stop SPCN Firmware Update**.

Removing an expansion unit

Learn about removing an expansion unit from a system unit concurrently or nonconcurrently.

You can remove expansion units from a system with the system powered on and running (concurrently), or with the system powered off (nonconcurrently), depending on your situation.

Note: If you are removing a 5791 (5797/5798), 5803, or 5873 expansion unit from an IBM Power 595, you do not use this procedure. You must use the remove enclosure task in the HMC. To do this, select **Serviceability** → **Hardware** → **Remove Enclosure** for the managed system from which the expansion unit is being removed.

Removing an expansion unit concurrently

Learn about removing an I/O expansion unit from a system unit concurrently.

Perform the following tasks before beginning this procedure:

- Record the time that you start the procedure. You need to reference this time later during error log analysis.
- If you are planning to print this topic to perform the procedure, also print the SPCN and RIO/HSL/12X diagrams. For details, see Examples: RIO/HSL, 12X, and 12X DDR SPCN connections and Examples: RIO/HSL, 12X, and 12X DDR expansion unit connections.
- Before performing any procedure that involves changes to the 12X or RIO/HSL cabling or configuration for a system that is managed by an HMC, obtain a record that identifies for each expansion unit which I/O buses exist in that expansion unit. To acquire this information, use one of the following methods:
  - From an HMC, select the managed system and then select the **Properties** task.
  - From the HMC command line, enter the command `lshwres –r io ––rsubtype bus –m <managed system>`.

Important: Be aware of the following items when you are removing an expansion unit:

- Concurrent I/O expansion unit removal is supported only on POWER6® processor-based Power 570 systems running firmware level EM350 and Power 595 systems running firmware level EH350.
- Concurrent I/O expansion unit removal is supported only for 12X-attached I/O expansion units. It is not supported for RIO/HSL-attached I/O expansion units.
- If you are removing a 5791 (5797/5798), 5803, or 5873 expansion unit from an IBM Power 595, you do not use this procedure. You must use the remove enclosure task in the HMC. To do this, select **Serviceability** → **Hardware** → **Remove Enclosure** for the managed system from which the expansion unit is being removed.
- Concurrent I/O expansion unit removal is supported only on systems that are managed by a Hardware Management Console (HMC).
- An I/O expansion unit that is concurrently removed from a system by using these procedures and then later added back to the system configuration either concurrently or nonconcurrently is assigned new bus numbers when it is added back to the configuration.
- Concurrent removal of I/O expansion units must be done one expansion unit at a time. If multiple expansion units are to be removed concurrently, the procedure must be done separately for each one.

Use the following steps to remove an I/O expansion unit from the system configuration.

1. Verify the existing 12X and RIO/HSL configuration. For details, see “Verifying the RIO/HSL and 12X loops with an HMC” on page 28. If problems occur with the 12X or RIO/HSL configuration, they must be corrected before continuing with the expansion unit removal procedure.
2. Verify the existing system power control network (SPCN) configuration using the Advanced System Management Interface (ASMI). For details, see “Verifying the system power control network (SPCN)” on page 30. If problems with the SPCN configuration occur, they must be corrected before continuing with the expansion unit removal procedure.
3. Optional: Identify the expansion unit that you want to remove. Select the **Operations** → **LED Status** → **Identify LED** task for the managed system from which the expansion unit is being removed to activate and deactivate identify indicators.

   Note: The identify indicators (LEDs) can help you verify the physical enclosure.

4. Select from the following options:
   - If the system is not in manufacturing default configuration (MDC), continue with step 5
   - If the system is in manufacturing default configuration (MDC), continue with step 7.
5. Ensure that none of the I/O resources in the expansion unit that is to be removed are owned by active logical partitions by doing one of the following actions:
   - Use dynamic logical partitioning (DLPAR) to dynamically remove I/O resources in the expansion unit from active partitions, if necessary.
   - Power off logical partitions that own I/O resources in the expansion unit.
6. Remove all I/O resources in the expansion unit that is to be removed from logical partition profiles.

   Note: Failure to complete this step can produce messages when a profile that includes resources in an expansion unit that was removed is activated or edited. When such a profile is activated or edited, the HMC presents a message about missing resources. At that time the option to have the HMC automatically remove the missing resources from the profile is shown.
7. Power off the expansion unit that is to be removed by performing the following steps:
   a. Select *the managed system*, **Serviceability** → **Hardware** → **Power On/Off Unit**.
   b. In the Power On/Off Unit window, expand the managed system and select the expansion unit that is to be removed.
   c. Click the **Power Off** button and follow the instructions on the HMC until the expansion unit is powered off.
8. Remove ac power from the expansion unit that is to be removed by disconnecting the ac cables from the power supplies on the expansion unit.
9. Familiarize yourself with the SPCN cabling rules. For SPCN cabling examples, see Examples: RIO/HSL, 12X, and 12X DDR SPCN connections.
10. Perform the following steps:
    a. Remove the SPCN cable between the T1 connector on the expansion unit that is to be removed and the corresponding connector on the preceding unit on the SPCN loop.

       Note: The preceding unit on the SPCN loop could be another expansion unit or a system unit.
    b. Disconnect the SPCN cable from the T2 connector on the expansion unit that is to be removed and attach it to the connector on the preceding unit on the SPCN loop that was opened in the previous step.
11. Familiarize yourself with the 12X cabling rules. For 12X cabling examples, see "Examples: RIO/HSL, 12X, and 12X DDR expansion unit connections" on page 16.
12. Choose from the following options for removing an expansion unit.

    Note: To review the connector locations for your expansion unit, see "Connector locations" on page 20.
    - To remove an expansion unit from a 12X loop that has only one expansion unit, continue with step 13.
    - To remove an expansion unit from the beginning of a 12X loop, continue with step 14 on page 37.
    - To remove an expansion unit from the middle of a 12X loop, continue with step 15 on page 37.
    - To remove an expansion unit from the end of a 12X loop, continue with step 16 on page 37.
13. To remove an expansion unit from a 12X loop with only one expansion unit, complete the following steps.
    a. Remove the 12X cable between connector T1 on the system unit and connector T1 on the expansion unit that is to be removed.
    b. Disconnect the 12X cable from connector T2 on the expansion unit that is to be removed and attach it to connector T1 on the system unit.

Important: This step creates a 12X loop with no expansion units on it. The 12X cable runs between connectors T1 and T2 on the system unit. Do not skip this step. It is necessary to allow system firmware to complete the removal process.

c. Wait 2 minutes.

d. Remove the 12X cable between connectors T1 and T2 on the system unit.

e. Continue with step 17.

14. To remove an expansion unit from the beginning of a 12X loop, complete the following steps.
    a. Remove the 12X cable between connector T1 on the system unit and connector T1 on the expansion unit that is to be removed.
    b. Disconnect the 12X cable from connector T2 on the expansion unit that is to be removed and attach it to connector T1 on the system unit.
    c. Continue with step 17.
15. To remove an expansion unit from the middle of a 12X loop, complete the following steps.
    a. Remove the 12X cable between connector T1 on the expansion unit that is to be removed and connector T2 on the expansion unit that precedes the expansion unit that is to be removed.
    b. Disconnect the 12X cable from connector T2 on the expansion unit that is to be removed and attach it to connector T2 on the expansion unit that precedes the expansion unit that is to be removed.
    c. Continue with step 17.
16. To remove an expansion unit from the end of a 12X loop, complete the following steps.
    a. Remove the 12X cable between connector T2 on the system unit and connector T2 on the expansion unit that is to be removed.
    b. Disconnect the 12X cable from connector T1 on the expansion unit that is to be removed and attach it to connector T2 on the system unit.
    c. Continue with step 17.
17. Clear the inactive enclosure record for the expansion unit that was removed.
    a. Access the ASMI from the HMC: Select **Operations → Launch Advanced System Management (ASM)** task for the managed system from which the expansion unit is being removed.
        1) In the navigation pane, select **System Management → Servers**.
        2) In the contents pane, select the server that has the expansion unit you want to remove.
        3) Select **Tasks → Launch Advanced Systems Management (ASM)**.
    b. Log in to ASMI with administrator or authorizes service provider authority.
    c. Expand **System Configuration**.
    d. Click **Configure I/O Enclosures → Clear inactive enclosures**.
18. Repeat step 1 on page 35 to verify the 12X configuration.

    Note: While concurrently removing an expansion unit, it is normal for error logs and event logs to be created with the following reference codes. The number and combination of these logs is dependent on the configuration. The logs can be ignored during this verification step if their timestamps indicate that they occurred during the removal procedure and if the resources that they refer to were involved in the procedure.
    - B7006981 permanent reference code indicates a 12X adapter failure
    - B7006982 permanent reference code indicates 12X link failure
    - B7006984 informational reference code indicates an open 12X loop
    - B7006985 informational reference code indicates the 12X loop was closed
    - B70069E6 informational reference code indicates a 12X link stopped
    - B70069E7 informational reference code indicates a 12X link started
19. Repeat step 2 on page 35 to verify the SPCN configuration.

Note: While concurrently removing an expansion unit, it is normal for error logs and event logs to be created with the following reference codes. The number and combination of these logs is dependent on the configuration. The logs can be ignored during this verification step if their timestamps indicate that they occurred during the removal procedure and if the resources that they refer to were involved in the procedure.

- 100090F0 permanent reference code indicates an expansion unit was dropped from the power control network
- 10009135 informational or permanent reference code indicates an open SPCN loop
- 10009137 permanent reference code indicates disruption of the 12X loop
- 10009139 informational reference code indicates the SPCN loop was closed

20. Check for new serviceable events that were generated during the removal procedure by performing the following steps:
    a. Select the managed system, then select **Serviceability** → **Manage Serviceable Events**.
    b. In the Manage Serviceable Events window, specify event criteria that will include any events that were generated during the procedure. Using the default criteria will work as well.
    c. Click **OK** when you have specified the criteria you want for the serviceable events you want to view. A table appears with the serviceable events that match your criteria.
    d. You can close any serviceable events generated during the procedure that include one of the reference codes identified in step 18 on page 37 or 19 on page 37 and call out resources involved in the procedure, such as the expansion unit that was removed, should be closed.
    e. Perform standard problem analysis on any remaining open serviceable events generated during the procedure.

    The expansion unit is now removed from the system configuration.
21. Physically remove the expansion unit from the rack.

Removing an expansion unit nonconcurrently

Learn about removing an I/O expansion unit from a system unit nonconcurrently with the system powered off.

Be aware of the following items when you are removing an expansion unit:

- If you are planning to print this topic to perform the procedure, also print the SPCN and RIO/HSL/12X diagrams. For details, see Examples: RIO/HSL, 12X, and 12X DDR SPCN connections and Examples: RIO/HSL, 12X, and 12X DDR expansion unit connections.
- Before performing any procedure that involves changes to the 12X or RIO/HSL cabling or configuration for a system that is managed by an HMC, obtain a record that identifies for each expansion unit which I/O buses exist in that expansion unit. To acquire this information, use one of the following methods:
  - From an HMC, select the managed system and then select the **Properties** task.
  - From the HMC command line, enter the command `lshwres –r io ––rsubtype bus –m <managed system>`.

Use the following steps to remove an I/O expansion unit from the system configuration that has the system powered off.

1. If the system is powered on, power it off.
2. Remove ac power from the expansion unit that is to be removed by disconnecting the ac cables from the power supplies on the expansion unit.
3. Familiarize yourself with the SPCN cabling rules. For SPCN cabling examples, see Examples: RIO/HSL, 12X, and 12X DDR SPCN connections.
4. Perform the following steps:

a. Remove the SPCN cable between the T1 connector on the expansion unit that is to be removed and the corresponding connector on the preceding unit on the SPCN loop.

   Note: The preceding unit on the SPCN loop could be another expansion unit or a system unit.

b. Disconnect the SPCN cable from the T2 connector on the expansion unit that is to be removed and attach it to the connector on the preceding unit on the SPCN loop that was opened in the previous step.

5. Familiarize yourself with the RIO/HSL/12X cabling rules. For RIO/HSL/12X examples, see "Examples: RIO/HSL, 12X, and 12X DDR expansion unit connections" on page 16.

   Note: Some hardware might not have labels for the RIO/HSL/12X connectors, or it might have labels other than T1/T2, such as 0/1 or 1/2. In those cases, the top connector corresponds to T1 and the bottom connector corresponds to T2.

6. Choose from the following options for removing an expansion unit.

   Note: To review the connector locations for your expansion unit, see "Connector locations" on page 20.

   - To remove an expansion unit from a RIO/HSL or 12X loop that has only one expansion unit, continue with step 7.
   - To remove an expansion unit from the beginning of a RIO/HSL or 12X loop, continue with step 8.
   - To remove an expansion unit from the middle of a RIO/HSL or 12X loop, continue with step 9.
   - To remove an expansion unit from the end of a RIO/HSL or 12X loop, continue with step 10.

7. To remove an expansion unit from a RIO/HSL or 12X loop with only one expansion unit, complete the following steps.
   a. Remove the RIO/HSL or 12X cable between connector T1 on the system unit and connector T1 on the expansion unit that is to be removed.
   b. Remove the RIO/HSL or 12X cable between connector T2 on the system unit and connector T2 on the expansion unit that is to be removed.
   c. Continue with step 11 on page 40.
8. To remove an expansion unit from the beginning of a RIO/HSL or 12X loop, complete the following steps.
   a. Remove the RIO/HSL or 12X cable between connector T1 on the system unit and connector T1 on the expansion unit that is to be removed.
   b. Disconnect the RIO/HSL or 12X cable from connector T2 on the expansion unit that is to be removed and attach it to connector T1 on the system unit.
   c. Continue with step 11 on page 40.
9. To remove an expansion unit from the middle of a RIO/HSL or 12X loop, complete the following steps.
   a. Remove the RIO/HSL or 12X cable between connector T1 on the expansion unit that is to be removed and connector T2 on the expansion unit that precedes the expansion unit that is to be removed.
   b. Disconnect the RIO/HSL or 12X cable from connector T2 on the expansion unit that is to be removed and attach it to connector T2 on the expansion unit that precedes the expansion unit that is to be removed.
   c. Continue with step 11 on page 40.
10. To remove an expansion unit from the end of a RIO/HSL or 12X loop, complete the following steps.
    a. Remove the RIO/HSL or 12X cable between connector T2 on the system unit and connector T2 on the expansion unit that is to be removed.

b. Disconnect the RIO/HSL or 12X cable from connector T1 on the expansion unit that is to be removed and attach it to connector T2 on the system unit.
c. Continue with step 11.

11. Physically remove the expansion unit from the rack.
12. Power on the system but do not start partitions.
13. Check for new serviceable events that were created since starting the system:
    - If the system is managed by an HMC, complete the following steps to check for new serviceable events.
      a. Select *the managed system* **Serviceability** → **Manage Serviceable Events**.
      b. In the Manage Serviceable Events window, click **OK** to accept the default criteria. A table appears with the serviceable events that match the criteria. Continue with step 14.
    - If the system is not managed by an HMC, use the serviceable event log tool in the operating system to check for new serviceable events. Continue with step 14.
14. Perform standard problem analysis on any open serviceable events that were created since starting the system.
15. Start the logical partitions.

Common files for expansion units

These files are used throughout the expansion unit topic.

Verifying that the new configuration is functioning

Use the procedures in this section to verify that the new configuration is correctly functioning.

1. Choose from the following options:
   - If your system is not managed by an HMC, refer to Verify the installed part. When you are finished, return to the procedure that sent you here.
   - If your system is managed by an HMC, continue with step 2 on page 27.
2. To view more information about the managed system, complete the following steps:
   a. From the navigation area of the HMC, expand **Systems Management**.
   b. Click **Servers**.
   c. Select the server with which you want to work. Information about the system is shown under the Tasks section in the contents area.
3. View the properties of the managed system and verify the new expansion units by doing the following:
   a. Select your server with which you want to work.
   b. Click **Tasks** → **Properties**.
   c. Select the **I/O** tab.
   d. Verify that the new expansion unit is displayed in the list and that the unit ID information displayed on the panel for the I/O unit matches the label on the I/O unit.

      Note: Wait up to 10 minutes for the new expansion units to be displayed in the list. If they are not displayed after 10 minutes, go to the next step. If they are displayed, go to step 5 on page 28.

      Tip: To refresh the list of expansion units, you must completely exit and re-enter the function.
4. If the expansion units are not displayed on the I/O panel, verify the installation by performing the following steps:
   a. Make sure that the expansion units are powered on and the power cables are connected to the power source and the expansion units.

b. Make sure that the RIO/HSL and SPCN cables are installed correctly. For cabling information, see "Connecting your expansion units" on page 11.
c. Make sure you verified the MTMS and Configuration ID of the new expansion units. For details, refer to Setting I/O enclosure configuration ID and MTMS value.
d. If the expansion units still are not displayed, contact your service provider for assistance.

5. Return to the procedure that sent you here.

Starting the system or logical partition

Learn how to start a system or logical partition after performing a service action or system upgrade.

Starting a system that is not managed by a Hardware Management Console

You can use the power button or the Advanced System Management Interface to start a system that is not managed by a Hardware Management Console.

To start a system that is not managed by a Hardware Management Console (HMC), follow these steps:

1. On a rack-mounted system unit, open the front rack door, if necessary. On a stand-alone system unit, open the front door.
2. Before you press the power button on the control panel, ensure that power is connected to the system unit as follows:
   - All system power cables are connected to a power source.
   - The power-on light, as shown in the following figure, is slowly flashing.
   - The top of the display, as shown in the following figure, shows `01 V=F`.

   Tip: The system attention light, as shown in the following figure, does not appear on the control panel on the model 9117-MMA.
3. Press the power button **(A)**, as shown in the following figure, on the control panel.

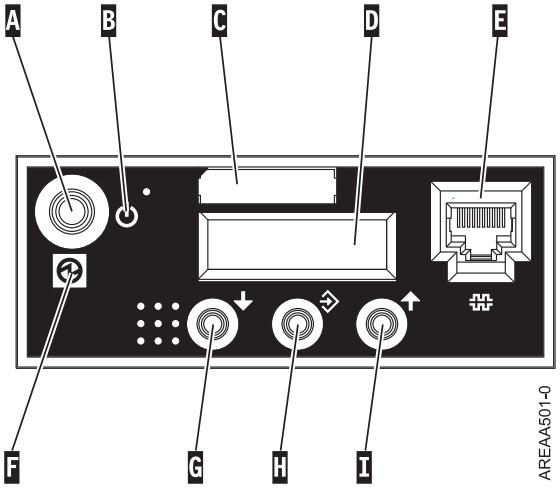


Figure 17. 570 control panel

- **A**: Power-on button
- **B**: On/off power symbol
- **C**: Serial number label
- **D**: Function/Data display
- **E**: System port (S1)
- **F**: Power LED

– A flashing light indicates standby power to the unit.
– A constant light indicates full system power to the unit.

Note: There is approximately a 30 second transition period from the time the power-on button is pressed to when the power LED goes from flashing to solid. During the transition period, you might observe the flashing intervals speed up.

- **G**: Decrement button
- **H**: Enter button
- **I**: Increment button

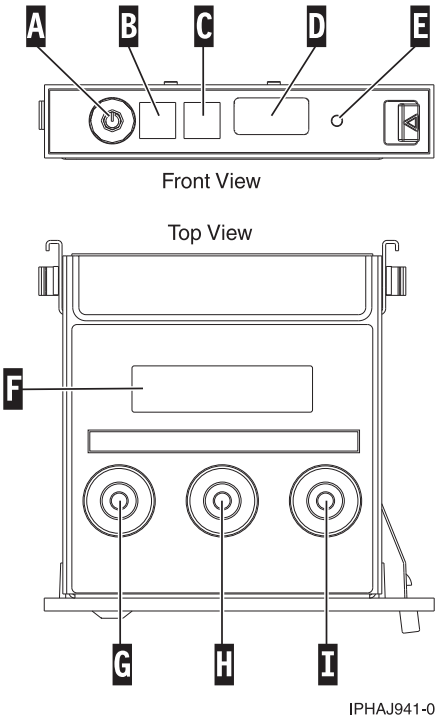


Figure 18. Control panel for the 8203-E4A, 8261-E4S, 8204-E8A, 9407-M15,9408-M25, and 9409-M50.

- **A**: Power-on button
- **B**: Power LED
  – A flashing light indicates standby power to the unit.
  – A constant light indicates full system power to the unit.

  Note: There is approximately a 30 second transition period from the time the power-on button is pressed to when the power LED goes from flashing to solid. During the transition period, you might observe the LED flashing faster.
- **C**: Attention light
- **D**: USB port
- **E**: Pinhole reset button
- **F**: Function/Data display
- **G**: Decrement button
- **H**: Enter button
- **I**: Increment button

4. Observe the following after pressing the power button:

- The power-on light begins to flash faster.
- The system cooling fans are activated after approximately 30 seconds and begin to accelerate to operating speed.
- Progress indicators, also referred to as checkpoints, appear on the control panel display while the system is being started. The power-on light on the control panel stops flashing and remains on, indicating that system power is on.

Tip: If pressing the power button does not start the system, do the following steps to start the system using the Advanced System Management Interface (ASMI):

1. Set up access to the ASMI. For instructions, see Accessing the ASMI.
2. Start the system using the ASMI. For instructions, see Powering the system on and off.

Starting a system or logical partition using the Hardware Management Console

You can use the Hardware Management Console (HMC) user interface to start the system or logical partition after the required cables are installed and the power cables are connected to a power source.

For instructions on working with the HMC, see Managing the Hardware Management Console. For instructions on starting a logical partition, see Logical partitioning. For instructions on starting the system, see Powering on the managed system.

Progress indicators, also referred to as checkpoints, appear on the control panel display while the system is being started. When the power-on light on the control panel stops blinking and remains on, the system power is on.

Stopping a system or logical partition

Learn how to stop a system or logical partition as a part of a system upgrade or service action.

Attention: Using either the power-on button on the control panel or entering commands at the Hardware Management Console (HMC) to stop the system can cause unpredictable results in the data files. Also, the next time you start the system, it might take longer if all applications are not ended before stopping the system.

To stop the system or logical partition, select the appropriate procedure.

Stopping a system that is not managed by a Hardware Management Console

You might need to stop the system to perform another task. Use these instructions to stop the system using the power button or Advanced System Management Interface.

Before you stop the system, follow these steps:

1. If an Integrated xSeries® Adapter (IXA) is present on the system, shut it down using IBM i options.
2. Ensure that all jobs are completed and end all applications.
3. Ensure that the operating system is stopped.

   Attention: Failure to do so can result in the loss of data.
4. Record the IPL type and IPL mode from the control panel display to help you return the system to this state when the installation or replacement procedure is completed.

The following procedure describes how to stop a system that is not managed by a Hardware Management Console (HMC).

1. Log in to the system as a user with the authority to run the shutdown or pwrdwnsys (Power Down System) command.
2. At the command line, enter one of the following commands:
   - If your system is running the AIX operating system, type **shutdown**.

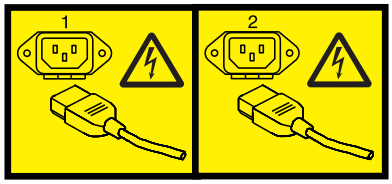
- If your system is running the Linux operating system, type **shutdown -h now**.
- If your system is running the IBM i operating system, type **pwrdwnsys**. If your system is partitioned, use the pwrdwnsys command to power down each of the secondary partitions. Then, use the pwrdwnsys command to power down the primary partition.

The command stops the operating system. The system power turns off, the power-on light begins to slowly blink, and the system goes into a standby state.

3. Set the power switches of any devices connected to the system to off.
4. Unplug any power cables that are attached to the unit from electrical outlets. Ensure that you unplug power cables from peripheral devices, such as printers and expansion units.

   Important: The system might be equipped with a second power supply. Before continuing with this procedure, ensure that all power sources to the system have been completely disconnected.

   (L003)



or

Stopping a system using the Hardware Management Console

You can use the Hardware Management Console (HMC) user interface to stop the system or a logical partition. Use the following steps to accomplish this task.

By default, the managed system is set to power off automatically when you shut down the last running logical partition on the managed system. If you set the managed system properties on the HMC so that the managed system does not power off automatically, you must use this procedure to power off your managed system.

Attention: If possible, shut down the running logical partitions on the managed system before powering off the managed system. Powering off the managed system without shutting down the logical partitions first causes the logical partitions to shut down abnormally and can cause data loss.

To power off a managed system, you must be a member of one of the following roles:

- Super administrator
- Service representative
- Operator
- Product engineer

1. In the Navigation area, expand the **Systems Management** folder.
2. Click the **Servers** icon.
3. In the Contents area, select the managed system.
4. Select **Tasks**, then **Operations**, and then **Power Off**
5. Select the desired power-off mode and click **OK**.

Related information

Shutting down and restarting logical partitions

Identifying a failing part

Use these instructions to learn how to locate and identify a failing part on your system or expansion unit using the appropriate method for your system.

Identify a failing part using the Advanced System Management Interface

If the Linux operating system is running on the system or logical partition, use the procedure in this section to identify a failing part.

To activate the indicator light for a failing part, follow these steps:

1. If the unit ID does not match the label on the system or expansion unit, update the configuration information.
   - For information on setting up the ASMI refer to Accessing the Advanced System Management Interface.
   - For information on using the ASMI, refer to Managing your server using the Advanced System Management Interface.
2. Turn on the failing part indicator light. For instructions, see Changing service indicators.

Identifying a failing part on an AIX system or logical partition

Use these instructions to learn how to locate a failing part, and then activate the indicator light for that part on a system or logical partition running the AIX operating system.

Locating a failing part on an AIX system or logical partition:

You might need to use AIX tools, before activating the indicator light, to locate a part that is failing.

1. Log in as root user or `celogin-`.
2. At the command line, type `diag` and press Enter.
3. From the Function Selection menu, select **Task Selection** and press Enter.
4. Select **Display Previous Diagnostic Results** and press Enter.
5. From the Display Previous Diagnostic Results display, select **Display Diagnostic Log Summary**. The Display Diagnostic Log display shows a chronological list of events.
6. Look in the **T** column for the most recent **S** entry. Select this row in the table and press Enter.
7. Select **Commit**. The details of this log entry are shown.
8. Record the location information and the SRN value shown near the end of the entry.
9. Exit to the command line.

Use the location information for the failing part to activate the indicator light that identifies the failing part. “Activating the indicator light for the failing part.”

Activating the indicator light for the failing part:

Use these instructions to help physically identify the location of a part you are servicing.

1. Log in as root user.
2. At the command line, type `diag` and press Enter.
3. From the Function Selection menu, select **Task Selection** and press Enter.
4. From the Task Selection menu, select **Identify and Attention Indicators** and press Enter.
5. From the list of lights, select the location code for the failing part and press Enter.
6. Select **Commit**. This turns on the system attention and indicator light for the failing part.
7. Exit to the command line.

Identifying a failing part on an IBM i system or logical partition

You can activate or deactivate the indicator light by using IBM i to assist in locating a failing part.

Activating the failing-part indicator light:

You can search the service action log for an entry that matches the time, reference code, or resource of a problem, and then activate the indicator light for a failing part.

1. Sign on to an IBM i session, **with at least service level authority**.
2. On the command line of the session, type `strsst` and press Enter.

   Note: If you cannot get to the System Service Tools display, use function 21 from the control panel. Alternatively, if the system is managed by a Hardware Management Console (HMC), use the Service Focal Point™ utilities to get to the Dedicated Service Tools (DST) display.
3. Type your service tools user ID and service tools password on the System Service Tools (SST) Sign On display. Press Enter.

   Remember: The service tools password is case-sensitive.
4. Select **Start a service tool** from the System Service Tools (SST) display and press Enter.
5. Select **Hardware service manager** from the Start a Service Tool display and press Enter.
6. Select **Work with service action log** from the Hardware Service Manager display and press Enter.
7. On the Select Timeframe display, change the **From: Date and Time** field to a date and time prior to when the problem occurred.
8. Search for an entry that matches one or more conditions of the problem:
   - System Reference code
   - Resource
   - Date and time
   - Failing item list
9. Select option **2** (Display failing item information) to display the service action log entry.
10. Select option **2** (Display details) to display location information for the failing part to be replaced. The information displayed in the date and time fields is the date and time for the first occurrence of the specific System reference code for the resource displayed during the time range selected.
11. If location information is available, select option **6** (Indicator on) to turn on the failing part's indicator light.

    Tip: If the failing part does not contain a physical indicator light, a higher-level indicator light is activated. For example, the indicator light for the backplane or unit that contains the failing part might be lit. In this case, use the location information to locate the actual failing part.

12. Look for the enclosure indicator light to locate the enclosure that contains the failing part.

Deactivating the failing-part indicator light:

Use this procedure to turn off any indicator light that you turned on as a part of a service action.

To deactivate the indicator light, follow these steps:

1. Select option **7** (Indicator off) to turn off the indicator light.
2. Select the **Acknowledge all errors** function at the bottom of the Service Action Log display, if all problems have been resolved.
3. Close the log entry by selecting option **8** (Close new entry) on the Service Action Log Report display.

Identifying a failing part on a Linux system or logical partition

If the service aids have been installed on a system or logical partition, you can activate or deactivate the indicator lights to locate a part or compete a service action.

Locating a failing part on a Linux system or logical partition:

If the service aids have been installed on a system or logical partition, you need to activate the indicator lights to locate a part.

Finding the location code of a failing part in a Linux system or logical partition:

To retrieve the location code of the failing part, if you do not know the location code, use the procedure in this topic.

To locate the failing part in a system or logical partition follow these steps:

1. Log in as root user.
2. At the command line, type `grep diagela /var/log/platform` and press Enter.
3. Look for the most recent entry that contains a system reference code (SRC).
4. Record the location information.

Activating the indicator light for the failing part:

If you know the location code of the failing part, activate the indicator light to help you locate which part to replace.

To activate the indicator light, follow these steps:

1. Log in as root user.
2. At the command line, type `/usr/sbin/usysident -s identify -l`*<location code>* and press Enter.
3. Look for the system attention light to identify the enclosure that contains the failing part.

Deactivating the failing-part indicator light:

After you complete a removal and replacement procedure, you must deactivate the failing-part indicator light.

To deactivate the indicator light, follow these steps:

1. Log in as root user.
2. At the command line, type `/usr/sbin/usysident -s normal -l`*<location code>* and press Enter.

Locating a failing part in a Virtual I/O Server system or logical partition

You can use Virtual I/O Server (VIOS) tools, before activating the indicator light, to locate a part that is failing.

1. Log in as root user or `celogin-`.
2. At the command line, type `diagmenu` and press Enter.
3. From the **Function Selection** menu, select **Task Selection** and press Enter.
4. Select **Display Previous Diagnostic Results** and press Enter.
5. From the **Display Previous Diagnostic Results** display, select **Display Diagnostic Log Summary**. A **Display Diagnostic Log** display appears. This display contains a chronological list of events.
6. Look in the **T** column for the most recent **S** entry. Select this row in the table and press Enter.
7. Choose **Commit**. The details of this log entry are shown.
8. Record the location information and the SRN value shown near the end of the entry.
9. Exit to the command line.

Use the location information for the failing part to activate the indicator light that identifies the failing part. For instructions, see Identifying a part using the Virtual I/O Server.

Identifying a part using the Virtual I/O Server:

Use these instructions to turn on the indicator light to help you physically locate a part using the Virtual I/O Server (VIOS).

1. Log in as root user.
2. At the command line, type `diagmenu` and press Enter.
3. From the Function Selection menu, select **Task Selection**. Press Enter.
4. From the Task Selection menu, select **Identify and Attention Indicators**. Press Enter.
5. From the list of lights, select the location code for the failing part and press Enter.
6. Select **Commit**. This turns on the system attention and indicator light for the failing part.
7. Exit to the command line.

Chapter 2. Connecting and configuring disk drive enclosures

Use this information to learn about the cabling, SCSI addressing, and postconnection requirements for the disk-drive enclosure.

5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure

Learn about the SCSI disk-drive enclosure and how to assemble it.

This SCSI disk-drive enclosure can hold up 24 disk drives. The enclosure is organized into four groups, with each group containing six disk drive slots. The enclosure can be used as a stand-alone enclosure or a rack-mounted drawer.

When connecting with your server, you can connect your SCSI cables to either a single-initiator repeater card or to a dual-initiator repeater card on your SCSI disk drive enclosure. The dual-initiator repeater card allows for high availability and combining groups of disk drive slots.

To determine the level of software you need to support the SCSI disk-drive enclosure, see the IBM Prerequisite.

Tip: Before you connect the enclosure, read the following information:

- You need to install the SCSI adapter that is used to connect the enclosure to your system. Either print this procedure or complete it and return here. To view the PDF file of PCI adapters, approximately 40 MB in size, see http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/iphak/iphak.pdf  .
- For systems or partitions with an AIX or Linux operating system, you need to have the SCSI adapter information for your operating system. This will be critical information for configuring the disks after you have attached the enclosure. You need to print the information before you begin the procedure. This information is available from the SCSI PCI Adapters (http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.pseries.doc/hardware_docs/scsipciadapters.htm) Web site.
- If you are going to configure RAID arrays, ensure that you have the following number of available disks for each RAID level:

  RAID 0 or 1
  Two drives per array

  RAID 5
  At least three drives per array

  RAID 6
  At least four drives per array

Connect the 5786, 5787, 7031-D24, or 7031-T24 to a system with the AIX operating system

Use the information in this section to understand the cabling, SCSI addressing, and post connection requirements for the disk-drive enclosure.

1. Install the initiator repeater cards into the disk drive enclosure. For instructions, see “SCSI repeater card” on page 61.
2. Connect the SCSI cable to your repeater card. Choose one of the following methods based on your situation:

- If you are using only single repeater cards or only dual repeater cards, install your SCSI cable **A** to the initiator repeater card **B** as shown in the following figure.
- **Single SCSI adapter connected to single repeater card:** If in this case you are not sharing resources (disk drives), simply attach each SCSI cable to each repeater card.

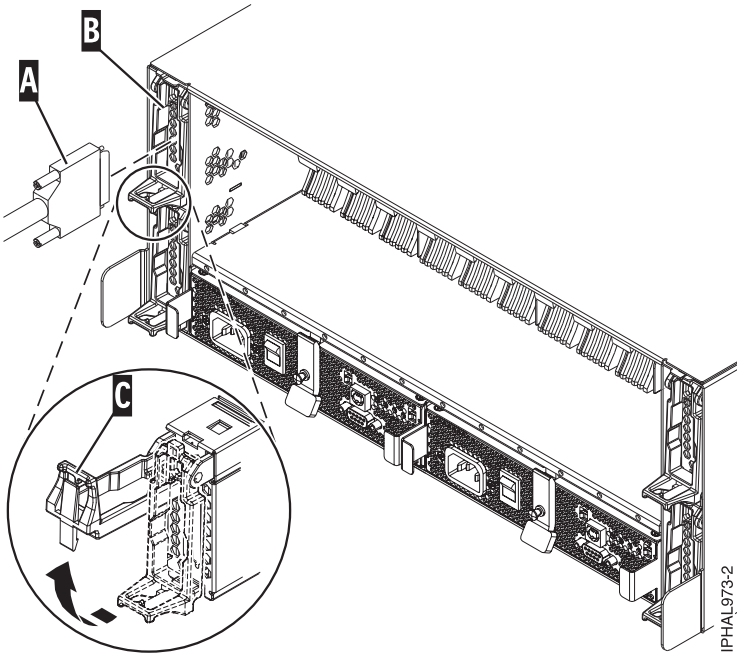


Figure 19. SCSI cable to single repeater card

- **Two SCSI adapters connected to dual repeater cards:** If in this case you are sharing resources (disk drives) between systems or logical partitions, ensure that you understand the SCSI addressing and cabling order. For more information, see "Connecting and configuring the 5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure in an AIX clustered environment" on page 53.

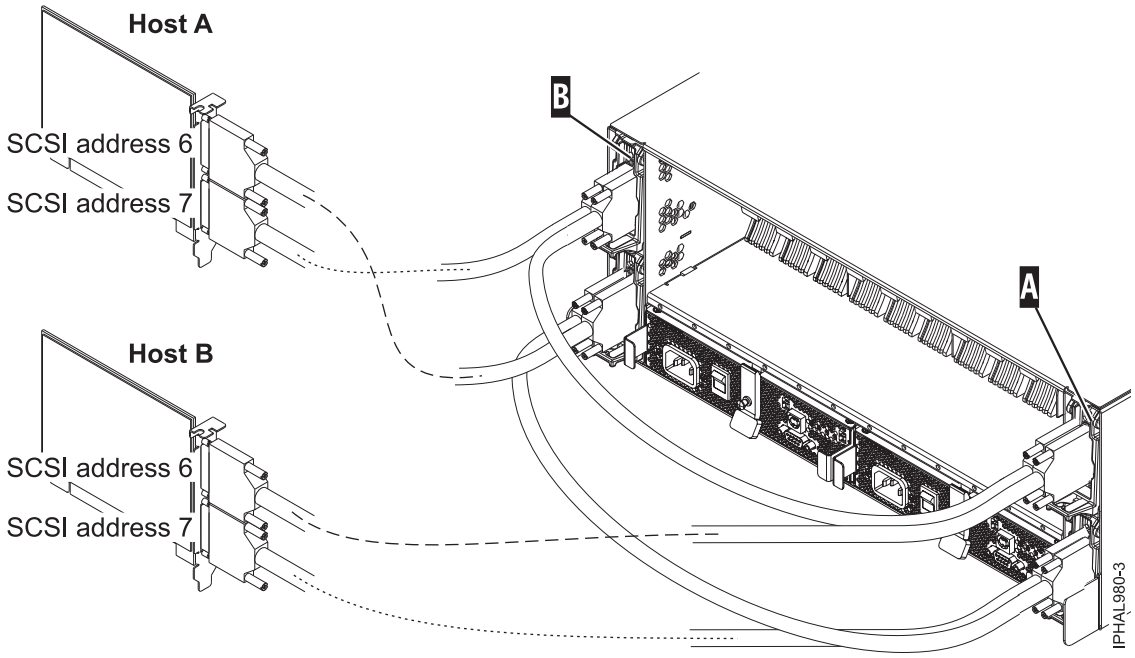


Figure 20. SCSI cable to dual repeater card connected with two SCSI cards

- **Four SCSI adapters connected to dual repeater cards:** If in this case you are sharing resources (disk drives) between systems or logical partitions, ensure that you understand the SCSI addressing and cabling order. For more information, see "Connecting and configuring the 5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure in an AIX clustered environment" on page 53.

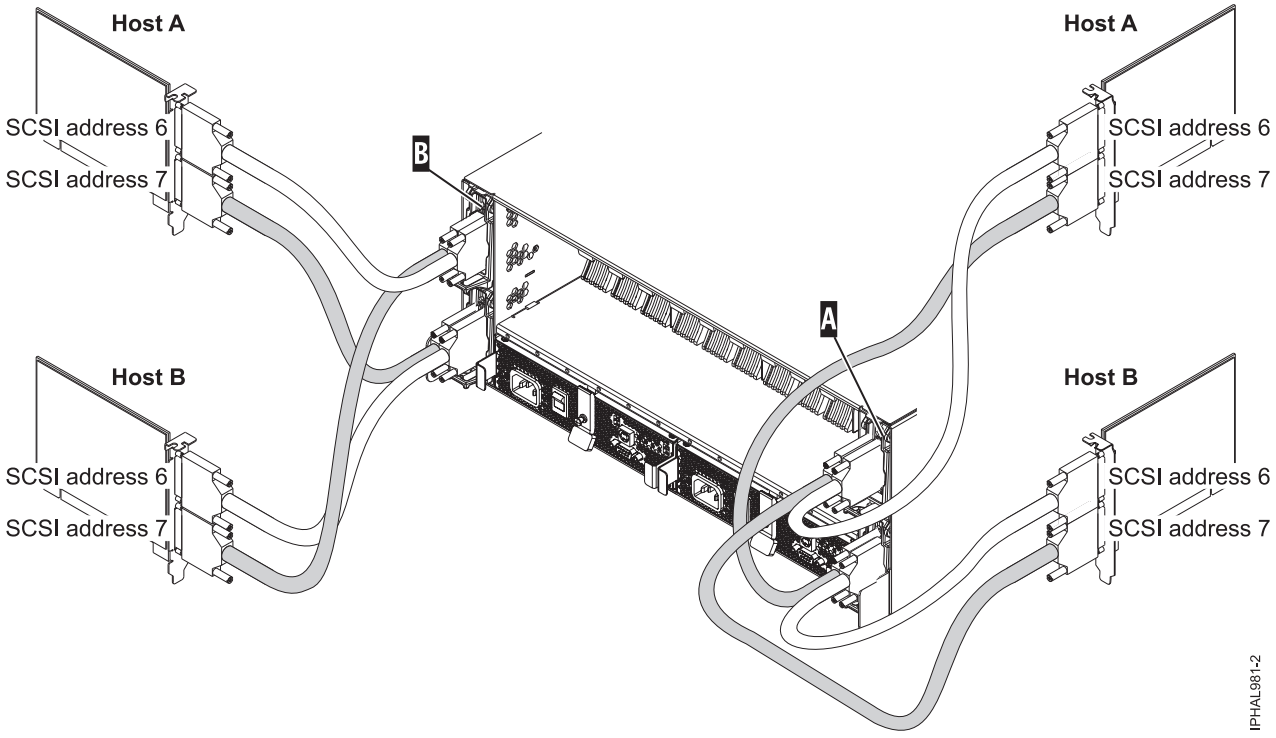


Figure 21. SCSI cable to dual repeater card connected with four SCSI cards

- **Single SCSI adapter connected to a combination of single and dual repeater cards:** If in this case you are sharing resources (disk drives) between systems or logical partitions, ensure that you

understand the SCSI addressing and cabling order. For more information, see “Connecting and configuring the 5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure in an AIX clustered environment” on page 53.

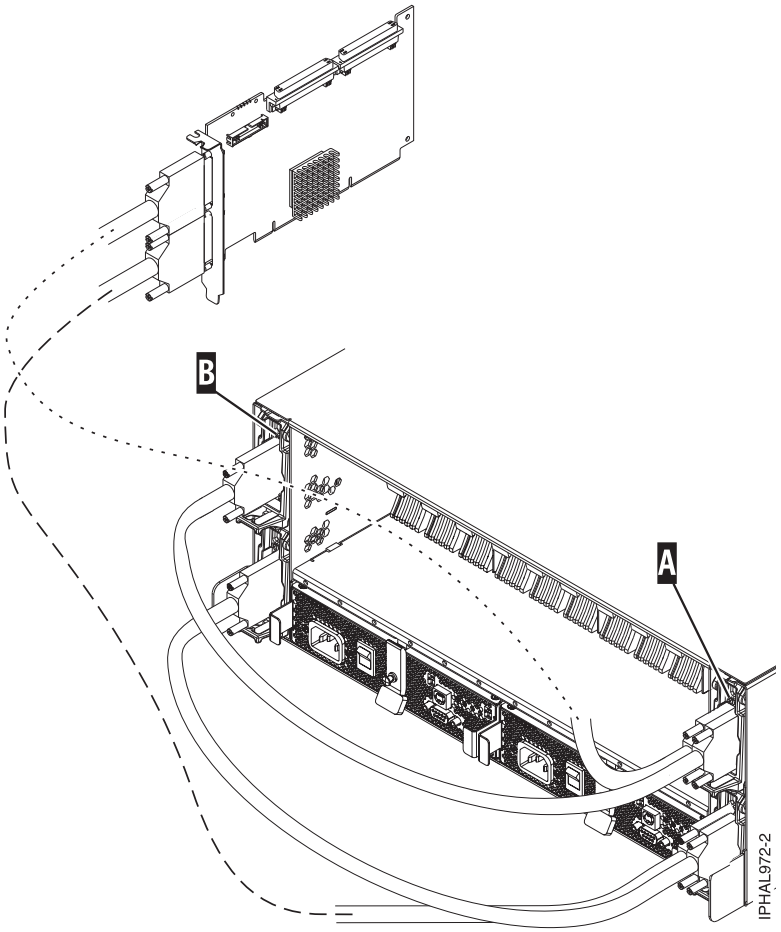


Figure 22. SCSI cable to dual repeater card connected to single repeater card

3. Use the information that you printed for the SCSI adapter to complete the configuration of your disk drives. For more information see the SCSI PCI Adapters (http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.pseries.doc/hardware_docs/scsipciadapters.htm) Web page and locate the file for the adapter you are using to attach the enclosure to your system.

   Important: If you plan on using the disk enclosure in an AIX environment, it is critical that you set up an AIX CRON job so that if errors exist, they report to the attached system. The AIX CRON job needs to be setup during the initial installation.

   Note: Errors on disks in the enclosure will be found without this CRON job (script) through normal Automatic Error Log Analysis; however, other errors such as fan and power supply problems in the enclosure can only be found when running diagnostics manually, which is accomplished by using the following scripts.

   To collect enclosure errors, add this CRON job SES Healthcheck to the system CRON table. Edit the system CRON with the `crontab -e` command. At the bottom of that file, enter:

   ```
   * 3 * * * /usr/lpp/diagnostics/bin/run_ses_healthcheck 1>/dev/null 2>/dev/null
   ```

   This CRON runs the script "run_ses_healthcheck" daily at 3 A.M. The script's contents depend on the configuration of the system that the enclosure is attached to.

   Example 1

If the system the enclosure is attached to has either an HMC or is running Electronic Service Agent™, create the file named "run_ses_healthcheck" in the /usr/lpp/diagnostics/bin directory, with the following contents:

```
-------------------------------------------------------------------
#!/bin/ksh
#Name:run_ses_healthcheck
#Location:/usr/lpp/diagnostics/bin
#Function: SCSI SES hourly heathcheck
for i in 'lsdev -Cc container -t ses -s scsi -F name -S available'
do
     diag -cd $i > /dev/null
     done
#any registered "external notification" will be notified of errors
#(such as HMC or Electronic Service Agent)
-------------------------------------------------------------------
```

Note: On a partitioned system, it is only necessary to have the CRON job and script running on one partition associated with the enclosure, though it is acceptable to have the same CRON job and scripts on any partition associated with the enclosure.

Example 2

If the system the enclosure is attached to has neither an HMC nor is running Electronic Service Agent, create the file named "run_ses_healthcheck" in the /usr/lpp/diagnostics/bin directory, with the following contents:

```
-------------------------------------------------------------------------
#!/bin/ksh
#Name:run_ses_healthcheck
#Location:/usr/lpp/diagnostics/bin
#Function: SCSI SES hourly heathcheck
for i in 'lsdev -Cc container -t ses -s scsi -F name -S available'
do
  diag -cd $i > /dev/null
  if [$? -ne 0]
    then
       /usr/lpp/diagnostics/bin/diagrpt -o >/tmp/ses.health.output
                 #you might want to process the output prior to placing it in
                 #a file
                 #somhow notify the user of the error.  A sample is shown
                 #below.
                     mail -s "7031 Health Check" root</tmp/ses.health.output
                     rm /tmp/ses.health.output
      fi
  done
-------------------------------------------------------------------------
```

Note: You can customize the actual notification in the script based on your preferences. These scripts send mail to root user if there are errors that need attention. You can modify the script if needed to inform certain users about the errors.

In both examples, once you have created the "run_ses_healthcheck" file, make it executable by typing (at AIX command prompt):

chmod 544 /usr/lpp/diagnostics/bin/run_ses_healthcheck.

Connecting and configuring the 5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure in an AIX clustered environment

Special considerations exist for connecting the disk-drive enclosure in a clustered environment. The information in this section can help you meet these considerations.

Gather and have available any planning and cabling documentation that you have for the system to which you are attaching in a clustered environment so that you can refer to it during this procedure.

To assure that the SCSI disk-drive enclosure is ready to be connected to the cluster, complete the following steps.

1. Ensure that each SCSI device that is connected to the shared SCSI bus has a unique ID. A common configuration is to set the SCSI ID of the adapters on the nodes to be higher than the SCSI IDs of the shared devices. (Devices with higher IDs take precedence in a SCSI bus contention.)
   - Use the command `lscfg | grep scsi` to determine and record the logical name of each adapter. In the command output, the first column lists the logical name of the SCSI adapter, such as `+ SCSI0`.
   - Use the `lscfg -vpl` command and logical name of the adapter to record the I/O slot (physical slot) that each SCSI adapter uses, for example, `lscfg -vpl scsi0`, where scsi0 is the logical name of the adapter.
   - Use the `lsattr` command, as in the following example, to find the ID of the adapter scsi0: `lsattr -E -l scsi0 | grep id`

     Note: Do not use wildcard characters or full path names on the command line for the device name designation.

     In the resulting output, the first column lists the attribute names. The integer to the right of the ID attribute is the adapter SCSI ID.
2. If a SCSI adapter address conflict exists, move on to the next step. If no conflict exists, return to the connection page for the operating system of the system you are connecting.
3. Examine the cabling to see if the correct ports on the system are connected to the correct ports on the repeater cards on the disk-drive enclosure. For example, if you are connecting the system using two host adapter cards and a dual repeater card as shown in the following figure, you will want to connect the systems as in the instructions that follow.

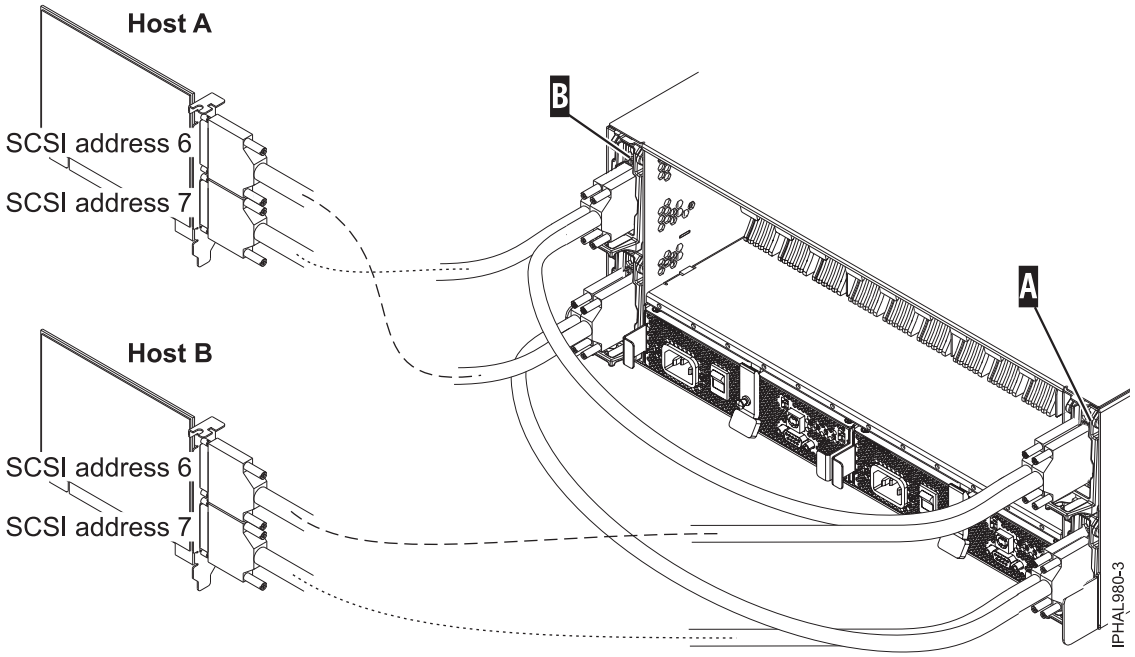


Figure 23. SCSI cable to a dual repeater card that is connected with two SCSI cards

4. Cable the first SCSI bus or set of shared disks by performing the following steps:
   a. Connect the bottom port of the adapter on **Host A** (SCSI address 7) to the exterior port on the repeater card in slot C2 on the enclosure.
   b. Connect the top port of the adapter on **Host B** (SCSI address 6) to the exterior port on the repeater card in slot C3 on the enclosure.

This connection creates a set of shared disks and a shared SCSI bus (such as scsi0) between Host A and Host B. The important thing to consider at this point is that you connect the cables in descending order of the SCSI address on the host adapter. Connecting the cables in descending order of the host SCSI address reduces the potential for address conflicts.

5. Cable the second SCSI bus or set of shared disks by performing the following steps:
   a. Connect the bottom port of the adapter on **Host B** (SCSI address 7) to the interior port on the repeater card in slot C5 on the enclosure.
   b. Connect the top port of the adapter on **Host A** (SCSI address 6) to the interior port on the repeater card in slot C4 on the enclosure.

   This connection creates a set of shared disks and a shared SCSI bus (such as scsi1) between Host A and Host B. The important thing to consider at this point is that this is an independent SCSI bus or set of shared disks from the first set. Ensuring that you do not mistakenly connect one of the cables from either SCSI bus to another SCSI bus reduces the potential for SCSI address conflicts.

   Important: When adding, removing, or replacing SCSI adapters in host systems, you might want to disconnect the cabling at the enclosure first and reconnect the cabling to the enclosure last. This is because the new adapter SCSI ID default might be 7. You should ensure that the correct SCSI ID is set for the port you are cabling.

Connecting and configuring the disk drive enclosure in a system that has a Linux operating system

Use the information in this section to understand the cabling, SCSI addressing, and postconnection requirements for the disk-drive enclosure.

To connect and configure the disk drive enclosure in a system that has a Linux operating system, perform the following steps:

1. Install the initiator repeater cards into the disk drive enclosure. For instructions, see SAS RAID controller for AIX (http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/iphal/scsirepeatcard.htm).
2. Connect the SCSI cable to your repeater card. Choose one of the following options based on your situation:
   - If you are using only single repeater cards or only dual repeater cards, connect your SCSI cable **(A)** to the initiator repeater card **(B)**. For more details, see Figure 24 on page 56, Figure 25 on page 56, Figure 26 on page 57, depending on your situation.

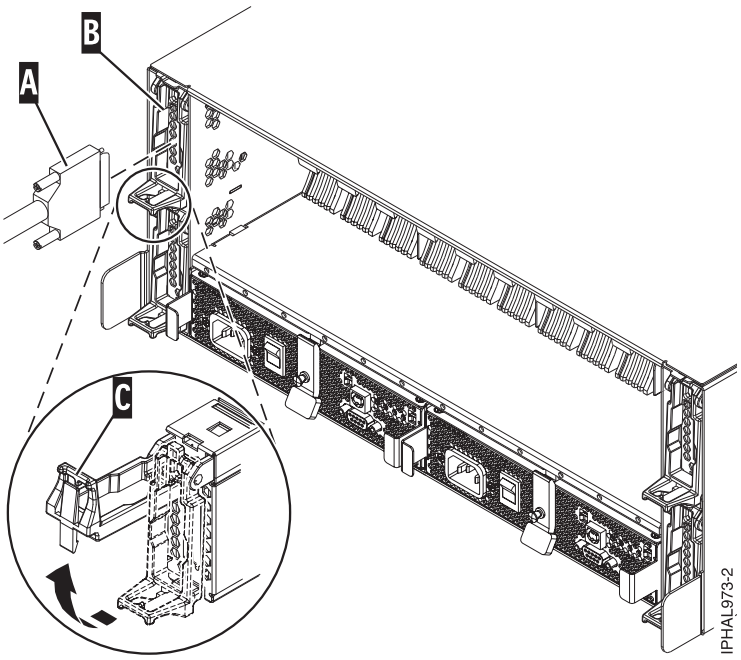


Figure 24. SCSI cable to a single repeater card

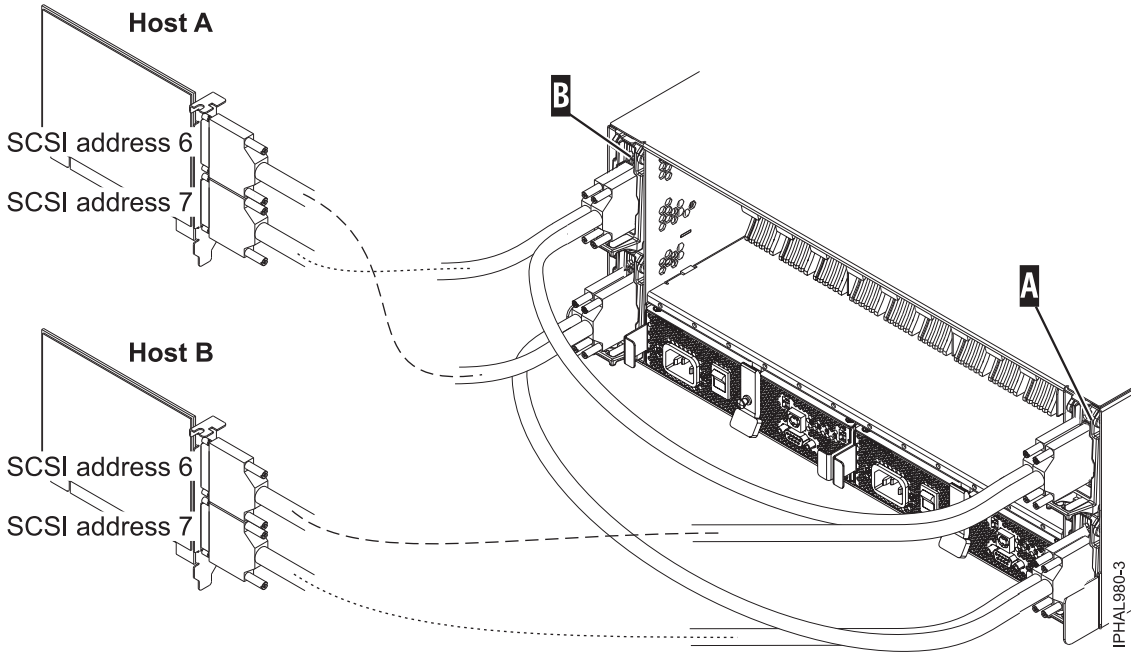


Figure 25. SCSI cable to a dual repeater card that is connected with two SCSI cards

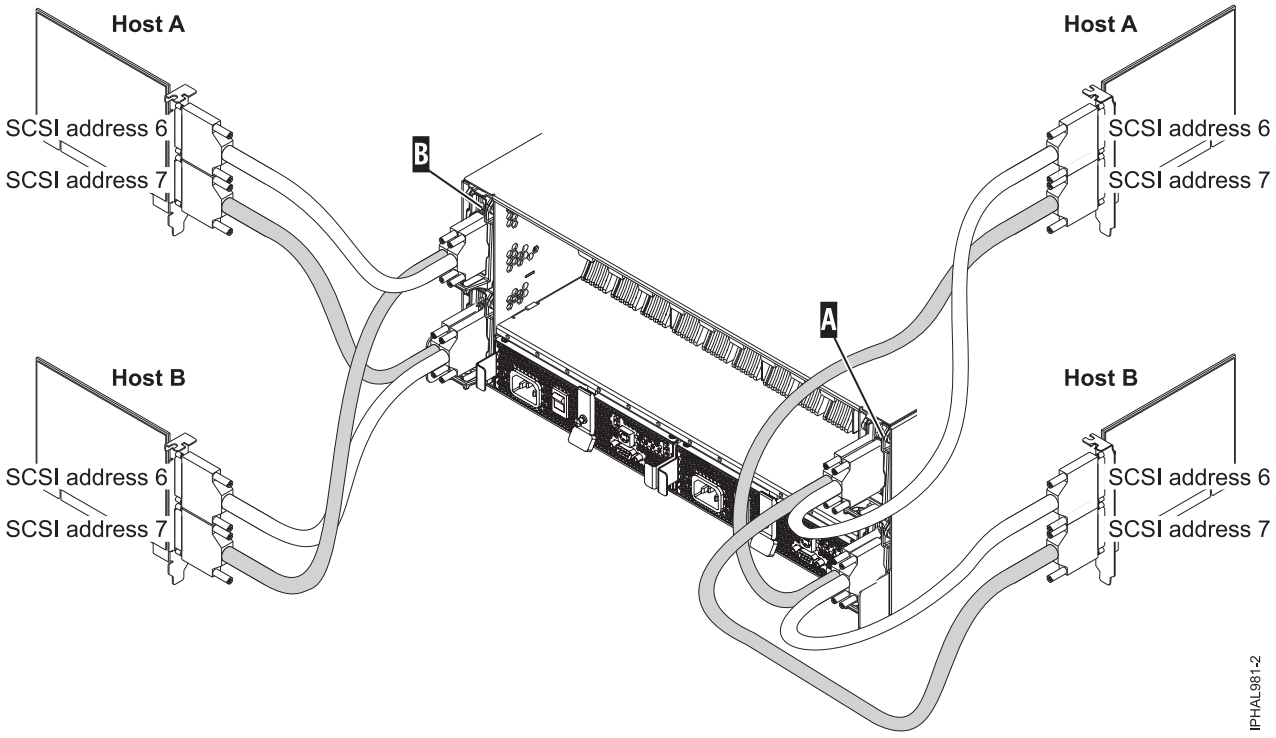


Figure 26. SCSI cable to a dual repeater card that is connected with four SCSI cards

- If you are using a combination of single and dual repeater cards, connect a SCSI cable to the dual-initiator repeater card **(A)**. Then, connect the dual repeater card **(A)** to the single repeater card **(B)** by using a different SCSI cable. For more information, see Figure 27 on page 58.

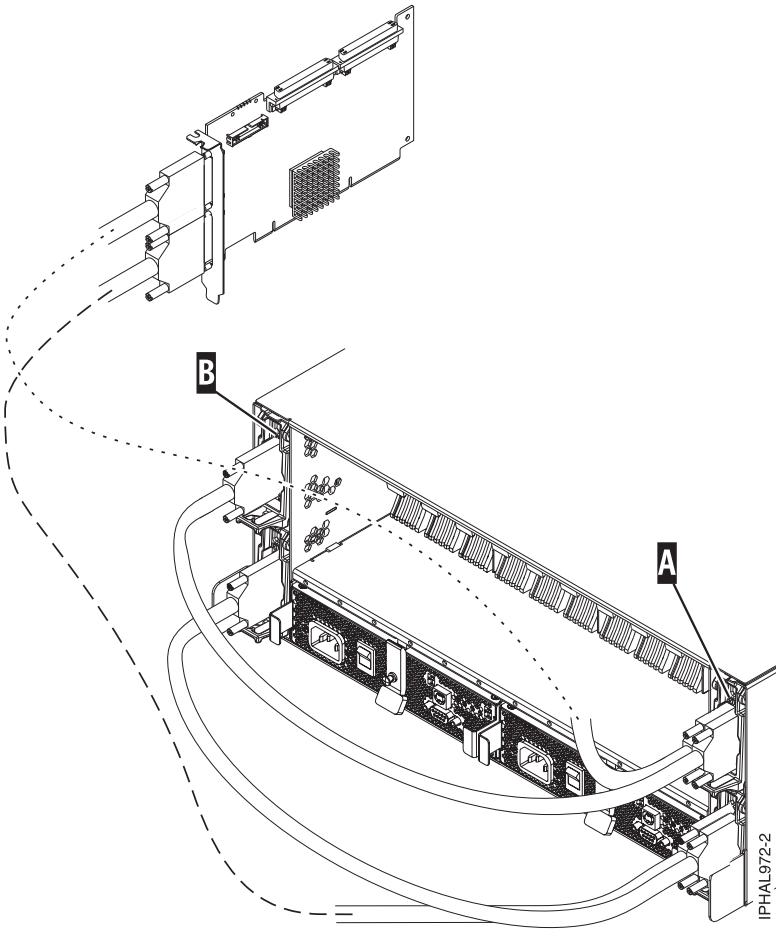


Figure 27. SCSI cable to a dual repeater card that is connected to a single repeater card

3. Connect the other end of the SCSI cable **(C)** to the SCSI adapter **(D)** on the server. For more details, see Figure 28.

   Important: The SCSI adapter or the system or partition must be powered off before making this connection.

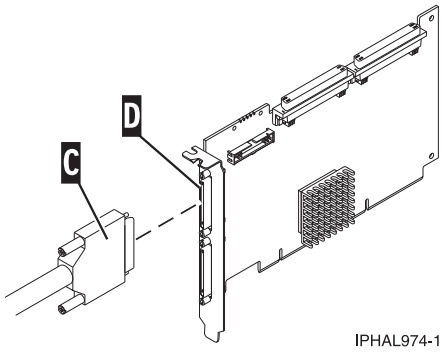


Figure 28. SCSI cable to a SCSI interface card

4. Add the disk drives to the operating system that you are using. See Installing PCI adapters.

Important: If you plan on using the disk enclosure in a Linux environment, it is critical that you set up a Linux CRON job so that if errors exist, they are reported to the attached system. The Linux CRON job needs to be set up during the initial installation.

5. Set up the Linux CRON job during the initial installation of your SCSI disk-drive enclosure. Perform the following tasks to ensure that your Linux CRON job is set up.
   a. Install the following RPMs from Service and productivity tools (http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
      - librtas
      - lsvpd
      - ppc64-utils
      - diagela
   b. If your logical partitions are managed by a Hardware Management Console (HMC), install the src, rsct.core.utils, rsct.core, csm.core, csm.client, and devices.chrp.base.ServiceRM packages in order to report errors to the HMC. Instructions for installing the packages are located on the Web site listed in step 5a.

      Note: Errors on hard disks within the enclosure are not found using this CRON job. This diagnostic test is limited to reporting errors with the fans, power supplies, VPD card, and repeater in the enclosure.
   c. Add a CRON job to run enclosure diagnostics to the system CRON table. As root user, edit the system CRON by running `crontab -e`. At the bottom of that file, enter:

      ```
      * 3 * * * /usr/sbin/diag_encl -s 1>/dev/null 2>&1
      ```

      Adding this line causes the diagnostic application `/usr/sbin/diag_encl` to be run daily at 3:00 a.m. The `diag_encl` diagnostic application reads the contents of the `/etc/diagela/diagela.config` file to determine which applications have been registered to be notified of errors. To add additional notification methods or for more information, see that file. By default, the following notifications will occur.
      - If the system is managed by an HMC, notifications are shown in the Manage Serviceable Events task on the HMC. If the system is not managed by an HMC, the root group will be notified.
      - If the system has the Electronic Service Agent application installed, it will be notified.
      - The error details are printed to the console, to the end of the `/var/log/platform` log file, and to the `syslog` (/var/log/messages).

        Notes:
        – On a logically partitioned system, it is only necessary to have the CRON job on one partition that is associated with the enclosure. However, it is acceptable to have the same CRON job on all partitions.
        – `/usr/sbin/diag_encl` might run at any time to diagnose enclosures that are attached to the system.

Connecting and configuring the enclosure in a system with the IBM i operating system

If you are running the IBM i operating system, use this information to understand the cabling, SCSI addressing, and postconnection requirements for the disk-drive enclosure.

To connect and configure the disk drive enclosure in a system that has an IBM i operating system, perform the following steps:

1. Install the initiator repeater cards into the disk-drive enclosure. For instructions, see “SCSI repeater card” on page 61.

2. Connect the SCSI cable to your repeater card. Choose one of the following options based on your situation:

   Tip: Ensure that the cable length for connections across the enclosure are long enough to allow concurrent maintenance of disk drives.

   - If you are using only single repeater cards or only dual repeater cards, connect your SCSI cable **(A)** to the initiator repeater card **(B)**.

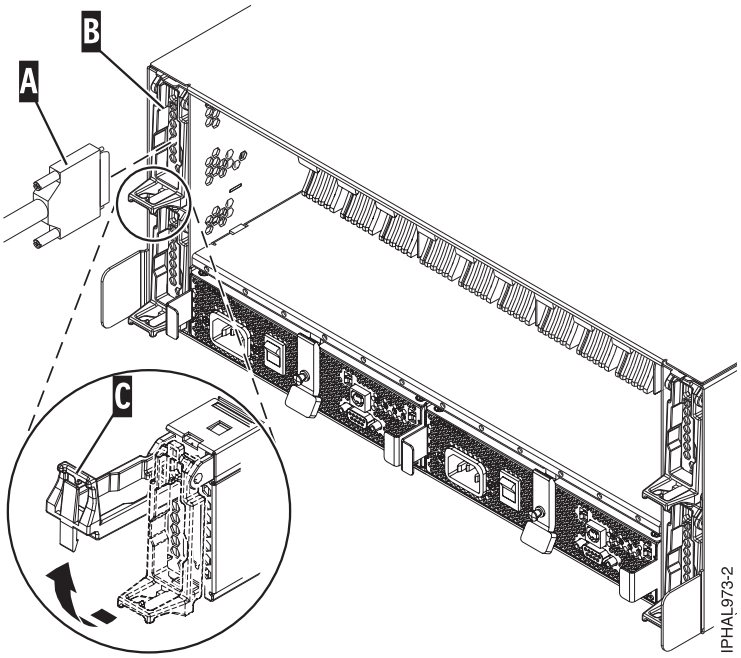


Figure 29. SCSI cable to a single repeater card

   - If you are using a combination of single and dual repeater cards, connect a SCSI cable to the dual-initiator repeater card **(A)**. Then, connect the dual repeater card **(A)** to the single repeater card **(B)** with a different SCSI cable.

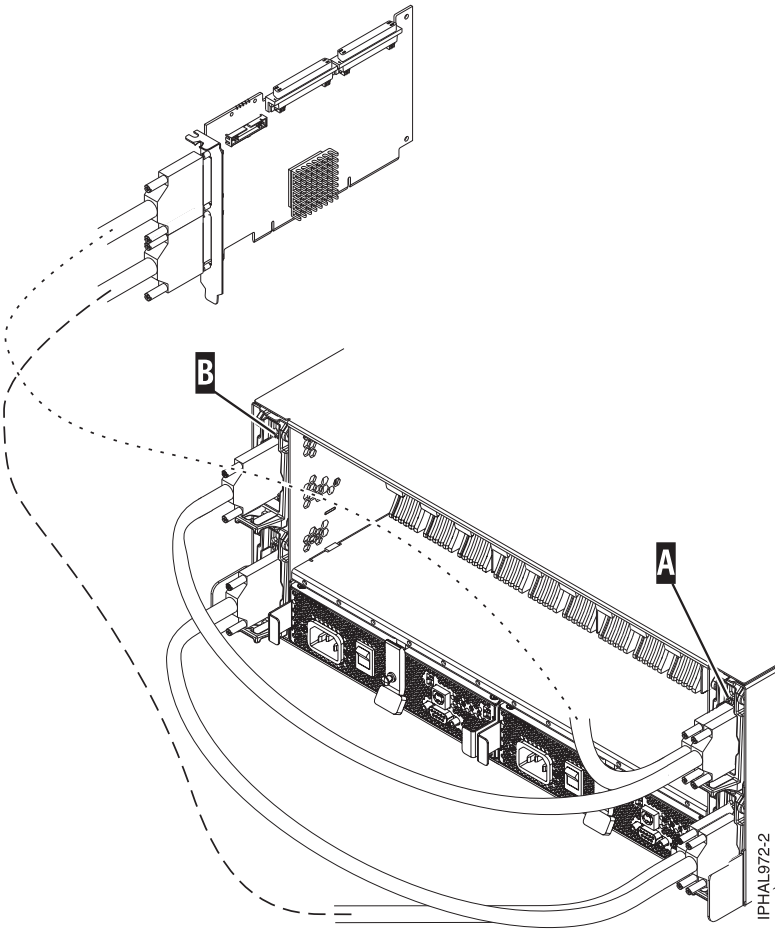


Figure 30. SCSI cable to a dual repeater card connected to a single repeater card

3. Connect the other end of the SCSI cable **(C)** to the SCSI adapter **(D)** on the server.

   Important: The SCSI adapter or the system or logical partition must be powered off before making this connection.

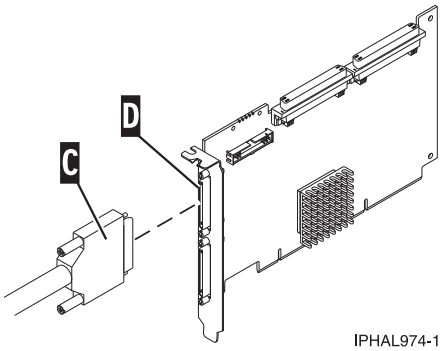


Figure 31. SCSI cable to a SCSI card

4. Add the disk drives to the operating system.

SCSI repeater card

Learn about where to place and how to install the SCSI repeater card.

Use the following figure and instructions to place your repeater cards.

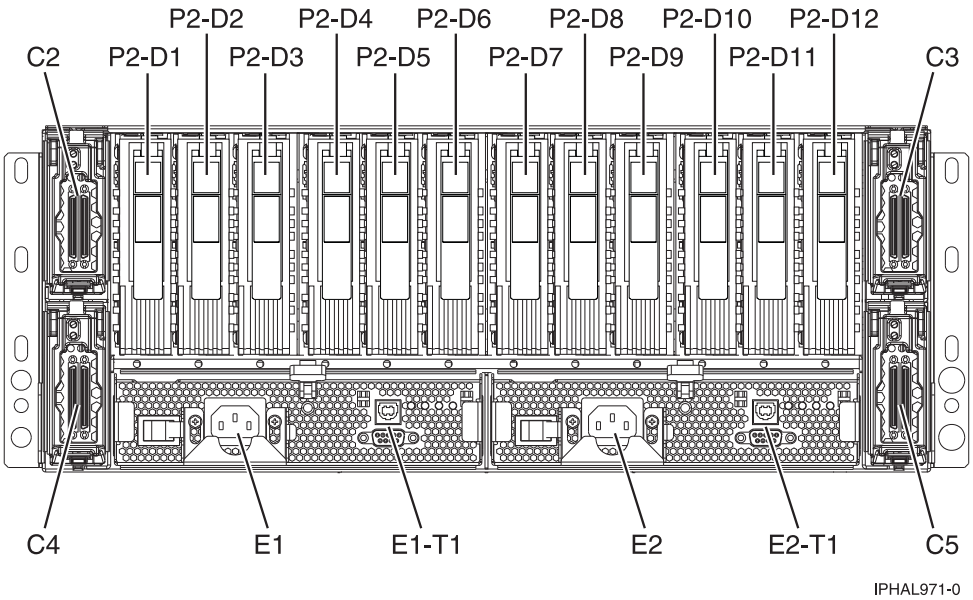


Figure 32. Repeater card location of the 5786 and 7031-D24 SCSI disk-drive enclosure (drawer models)

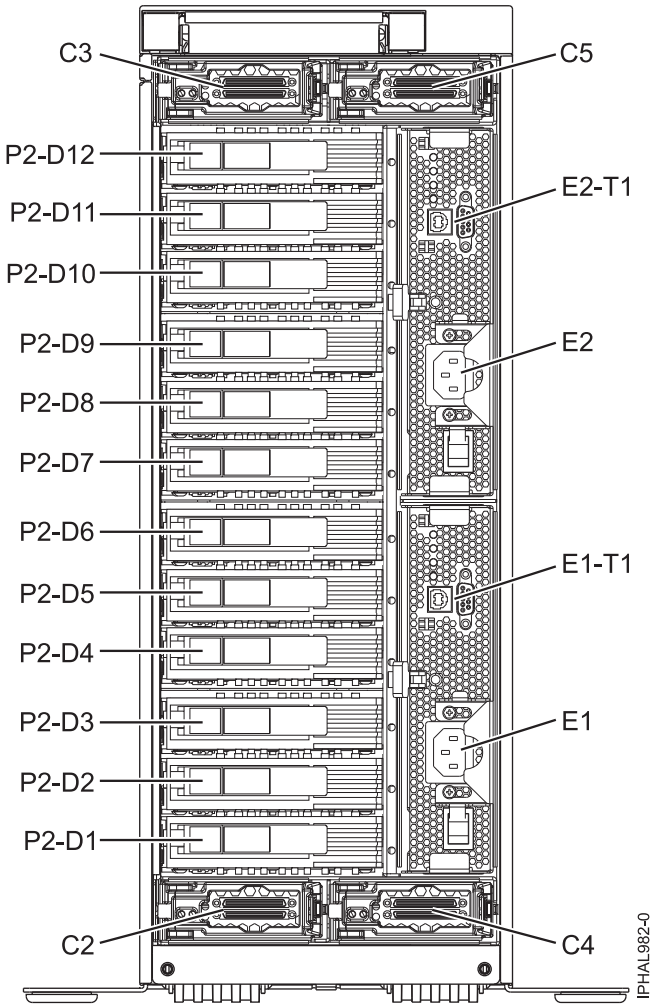


Figure 33. Repeater card location of the 5787 and 7031-T24 SCSI disk-drive enclosure (deskside models)

If you only have dual repeater cards, place as follows:

Important: On deskside models, the locations C3 and C5 are located on top, and C2 and C4 are located on the bottom. Follow the location codes when placing repeater cards.

Table 8. Repeater card placement for single and dual style repeater cards

Type and number of repeater cards	Single repeater card placement	Dual repeater card placement
1 single repeater card and 0 dual repeater cards	C5	
2 single repeater cards and 0 dual repeater cards	Place in order C5 and C2	
3 single repeater cards and 0 dual repeater cards	Place in order C5, C2, and C4	
4 single repeater cards and 0 dual repeater cards	Place in order C5, C2, C4, and C3	
1 single repeater card and 1 dual repeater card	Place in C5 first, and then place dual repeater card	C4
1 single repeater card and 2 dual repeater cards	Place in C5 first, and then place dual repeater card	Place in order C4 and C3

Table 8. Repeater card placement for single and dual style repeater cards (continued)

Type and number of repeater cards	Single repeater card placement	Dual repeater card placement
2 single repeater cards and 1 dual repeater cards	Place in C5, C2, and then place dual repeater card	C4
2 single repeater cards and 2 dual repeater cards	Place in C5, C2, and then place dual repeater card	Place in order C4 and C3
0 single repeater cards and 1 dual repeater card		C4
0 single repeater cards and 2 dual repeater cards		Place in order C4 and C5
0 single repeater cards and 3 dual repeater cards		Place in order C4, C5, and C3
0 single repeater cards and 4 dual repeater cards **Restriction:** This configuration is for System p® models only.		Place in order C4, C5, C3, and C2

The following figures show the locations of the disk drives for the front and back of the 5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure.

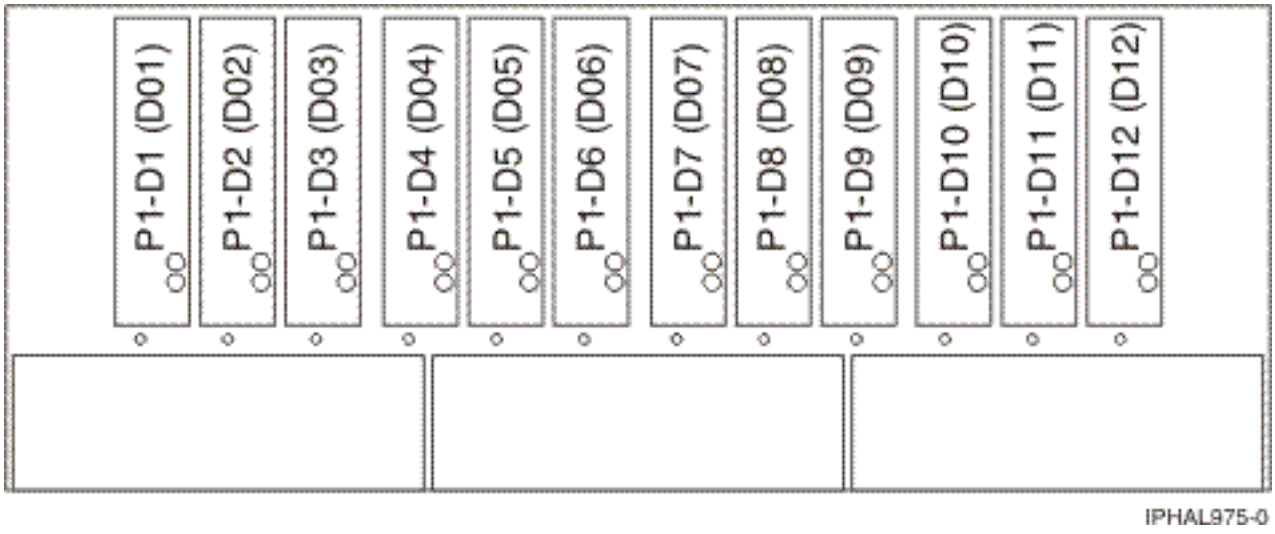


Figure 34. Front view of 5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure

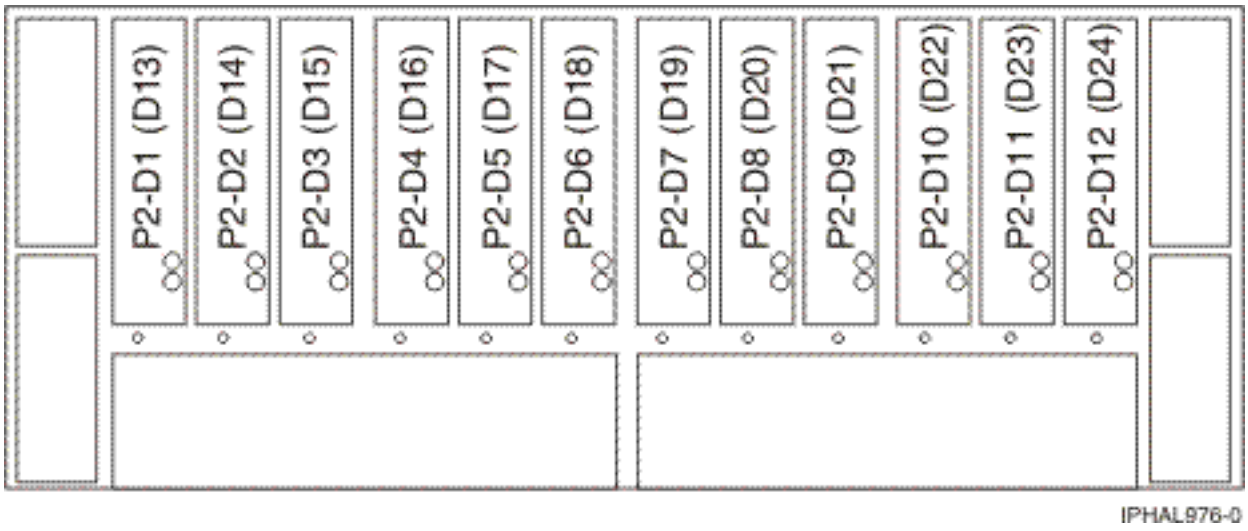


Figure 35. Back view of 5786, 5787, 7031-D24, or 7031-T24 SCSI disk-drive enclosure

The following list describes how the repeater card locations affect the disk drive slots.

- The top left repeater card (C2) drives the front right 6 slots (D07 to D12). Figure 34 on page 64
- The top right repeater card (C3) drives the front left 6 slots (D01 to D06). Figure 34 on page 64
- The bottom left repeater card (C4) drives the back left 6 slots (D13 to D18). Figure 35
- The bottom right repeater card (C5) drives the back right 6 slots (D19 to D24). Figure 35

To install your repeater card, complete the following steps:

1. Remove the filler from the repeater card slot.
2. Install your new repeater card.

Removing and replacing a SCSI repeater card

You might need to remove and replace one of the Small Computer System Interface (SCSI) repeater cards to repair a failing device or as a part of another service action.

Before you remove and replace an SCSI repeater card, follow the instructions for your operating system to save any jobs. For IBM i, power off the partition to save any jobs.

Important: The I/O adapter (IOA) needs to be powered off before disconnecting or reconnecting cables or before removing or replacing the repeater card. The IOA can be powered off by powering off the IOA slot or the logical partition. Depending on the disk protection level, the system or logical partition might be affected during the service procedure. For additional information, see Installing PCI adapters.

Restriction: You must replace the repeater card with the same type of card to continue. If you are changing card configurations from single to dual stop here and follow the instructions in “Connect the 5786, 5787, 7031-D24, or 7031-T24 to a system with the AIX operating system” on page 49 or “Connecting and configuring the disk drive enclosure in a system that has a Linux operating system” on page 55.

The disk-drive enclosure SCSI repeater card can be removed and replaced with the system and enclosure power on. To avoid errors, you must power off the adapter that connects the disk-drive enclosure to your system.

1. Locate the repeater card that you are replacing. For instructions see “Identifying a failing part” on page 45.
2. Remove the cable **(A)** from the repeater card **(B)**.

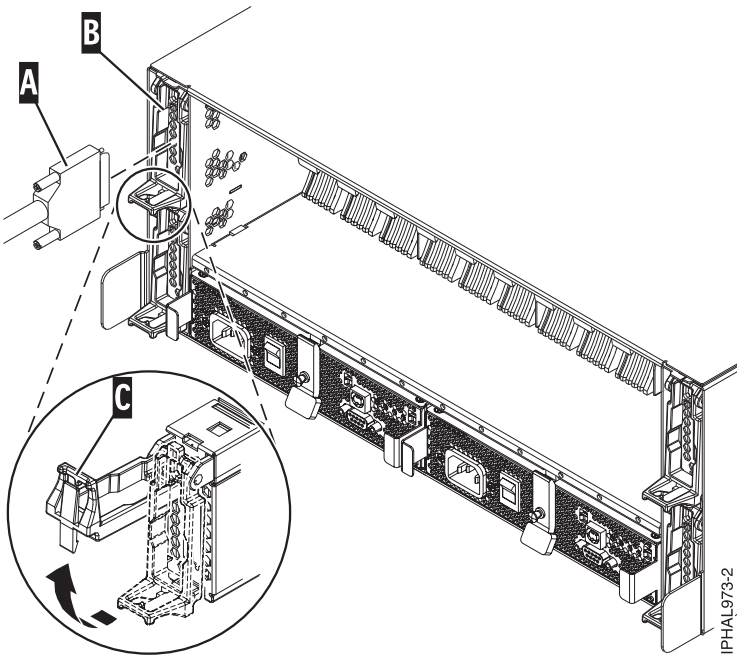


Figure 36. Removing SCSI cable from the repeater card

3. Lift the handle **(C)** to unseat the repeater card from the enclosure.
4. Pull the repeater card out of the enclosure.
5. Align the replacement repeater card with the empty slot on the enclosure, and insert the card until it is firmly seated.
6. Lower the handle to secure the repeater card into place.
7. Reattach the cable to the repeater card.
8. Restart the adapter. See Installing PCI adapters.

Disk-drive concurrent maintenance lights for 5786, 5787, 7031-D24, and 7031-T24 SCSI disk-drive enclosures

Learn where the disk-drive concurrent maintenance lights are located on your system.

The following figures show the locations of the disk-drive concurrent maintenance light **A** for the models 5786, 5787, 7031-D24, and 7031-T24 SCSI disk-drive enclosures.

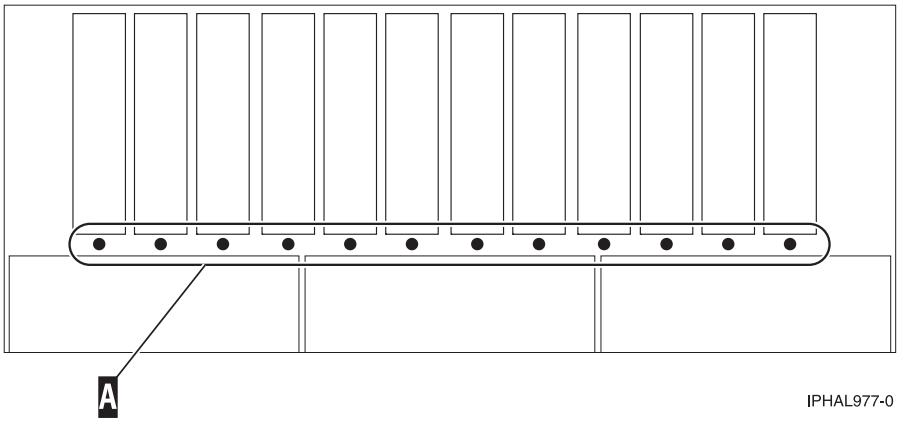


Figure 37. Front view of SCSI disk-drive enclosure concurrent maintenance lights for model 5786, 5787, 7031-D24, and 7031-T24

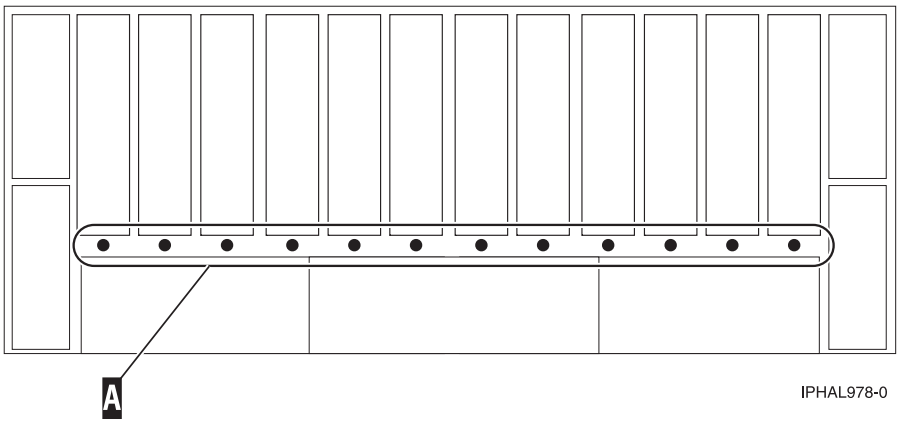


Figure 38. Back view of SCSI disk-drive enclosure concurrent maintenance lights for model 5786, 5787, 7031-D24, and 7031-T24

Configuring the 5802 disk-drive subsystem

Learn about configuring the 5802 disk-drive subsystem and how to connect and configure it to meet your requirements.

The 5802 SAS disk-drive enclosure can hold up 18 disk drives. The disks in this enclosure can be organized in several different configurations depending on the operating system used, the type of SAS adapter card, and the position of the hard disk drive partitions switch.

Notes:

- The hard disk drive partitions switch is located at the rear of the 5802 SAS disk-drive enclosure. See "Model 5802 and 5877 connector locations" on page 27. The hard disk drive partitions switch is located just below the SAS connectors.
- You must power cycle the 5802 SAS disk-drive enclosure if the hard disk drive partitions switch position is changed, in order for the 5802 to sense the new hard disk drive partitions switch position.

The 5802 SAS disk-drive enclosure supports the following operating systems:

- AIX
- IBM i
- Linux

To determine the level of software you need to support the 5802 SAS disk-drive enclosure, see the IBM Prerequisite.

Table 9. Hard disk drive toggle switch positions

Operating system	Position 1	Position 2	Position 4
AIX	Either a (FC 5901) - PCIe Dual - x4 SAS Adapter or two (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters	Either two (FC 5901) - PCIe Dual - x4 SAS Adapters or two (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters	Four (FC 5901) - PCIe Dual - x4 SAS Adapters
IBM i	Not supported	Either two (FC 5901) - PCIe Dual - x4 SAS Adapters or two (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters	Not supported
Linux	Either (FC 5901) - PCIe Dual - x4 SAS Adapters or two (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters	Either two (FC 5901) - PCIe Dual - x4 SAS Adapters or two (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters	Four (FC 5901) - PCIe Dual - x4 SAS Adapters
Note: FC means feature code.			

Tip: If you are going to configure RAID arrays, ensure that you have the following minimum number of available disks for each RAID level:

RAID 0
1 drive minimum per array

RAID 5
3 drives minimum per array

RAID 6
4 drives minimum per array

RAID 10
2 drives minimum per array

For additional SAS RAID controller information for AIX, see SAS RAID controller for AIX (http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/arebj/sascontroller_kickoff_aix.htm).

For additional SAS RAID controller information for Linux, see SAS RAID controller for Linux (http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/arebk/sascontroller_kickoff.htm).

For information related to device parity protection, see Device parity protection (http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/topic/rzaly/rzalydpy.htm).

Cabling the 5802 disk subsystem

Learn about how to connect the 5802 disk subsystem.

Use this procedure to cable the 5802 disk subsystem:

1. To select a cabling configuration that suits your requirements, see Table 10 on page 69.

2. Cable the 5802 disk subsystem.

   Note: For SAS cable information, see .

Table 10. 5802 disk subsystem configuration requirements

Configuration features	Configuration requirements
Two hard disk drive partitions with 9 disks per hard disk drive partition This is a multi-initiator high-availability configuration. Dual Serial-attached SCSI (SAS) connectivity to all drives.	To see the physical cabling, see Figure 39 on page 70. Operating system: AIX, IBM i, or Linux SAS adapter card: Either two (FC 5901) - PCIe Dual - x4 SAS Adapters or two (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters Hard disk drive partitions switch: position 2 Cables: Four (FC 3688) - SAS cables (AT) 0.6 Meter. **Note:** • For the AIX and Linux operating system, this must be a RAID configuration. • You must have a minimum of one disk drive per hard disk drive partition.
1 hard disk drive partition with 18 disks and a single SAS adapter.	For related physical cabling, see Figure 40 on page 71. Operating system: AIX or Linux SAS adapter card: One (FC 5901) - PCIe Dual - x4 SAS Adapter Hard disk drive partitions switch: position 1 Cables: One (FC 3688) - SAS Cable (AT) 0.6 Meter.
2 hard disk drive partitions with 9 disks per hard disk drive partition and a single SAS adapter.	To see the physical cabling, see Figure 41 on page 71. Operating system: AIX, IBM i, or Linux SAS adapter card: One (FC 5901) - PCIe Dual - x4 SAS Adapter Hard disk drive partitions switch: position 2 Cables: Two (FC 3688) - SAS Cables (AT) 0.6 Meter. **Note:** Must have a minimum of one disk drive per hard disk drive partition.
2 hard disk drive partitions with 9 disks per hard disk drive partition and two SAS adapters.	To see the physical cabling, see Figure 42 on page 71. Operating system: AIX, IBM i, or Linux SAS adapter card: Two (FC 5901) - PCIe Dual - x4 SAS Adapters Hard disk drive partitions switch: position 2 Cables: Two (FC 3688) - SAS Cables (AT) 0.6 Meter. **Note:** Must have a minimum of one disk drive per hard disk drive partition.

Table 10. 5802 disk subsystem configuration requirements (continued)

Configuration features	Configuration requirements
2 hard disk drive partitions with 9 disks per hard disk drive partition and four SAS adapters (Two pairs of SAS adapters, each running a set of 9 disk drives). This is a multi-initiator high-availability configuration. Dual SAS connectivity to all drives.	To see physical cabling, see Figure 43 on page 72. Operating system: AIX, IBM i, Linux SAS adapter card: Either four (FC 5901) - PCIe Dual - x4 SAS Adapters or four (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters Hard disk drive partitions switch: position 2 Cables: Four (FC 3688) - SAS Cables (AT) 0.6 Meter. **Notes:** • For the AIX and Linux operating system, this must be a RAID configuration. • You must have a minimum of one disk drive per hard disk drive partition.
1 hard disk drive partition with 18 disks and dual SAS adapters. This is a multi-initiator high-availability configuration. Dual SAS connectivity to all drives.	For related physical cabling, see Figure 44 on page 72. Operating system: AIX or Linux SAS adapter card: Either two (FC 5901) - PCIe Dual - x4 SAS Adapters or two (FC 5903) - PCIe Dual - x4 3Gb SAS RAID Adapters Hard disk drive partitions switch: position 1 Cables: Two (FC 3688) - SAS Cables (AT) 0.6 Meter. **Note:** For the AIX and Linux operating system, this must be a RAID configuration.
4 hard disk drive partitions: • Partition 1: Drives 01-05 • Partition 2: Drives 06-09 • Partition 3: Drives 10-14 • Partition 4: Drives 15-18 This configuration is optimized for boot partitions.	To see the physical cabling, see Figure 45 on page 72. Operating system: AIX or Linux SAS adapter card: Four (FC 5901) - PCIe Dual - x4 SAS Adapters Hard disk drive partitions switch: position 4 Cables: Four (FC 3688) - SAS Cables (AT) 0.6 Meter. **Note:** You must have a minimum of one disk drive per hard disk drive partition.

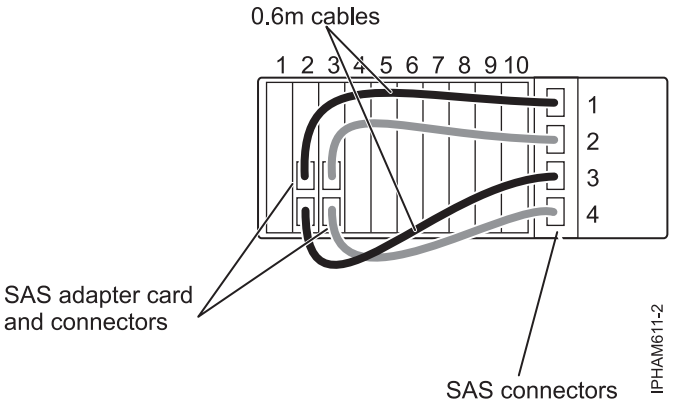


Figure 39. Physical cabling example: Two hard disk drive partitions with nine disks per hard disk drive partition, dual SAS adapters, hard disk drive partitions switch position 2

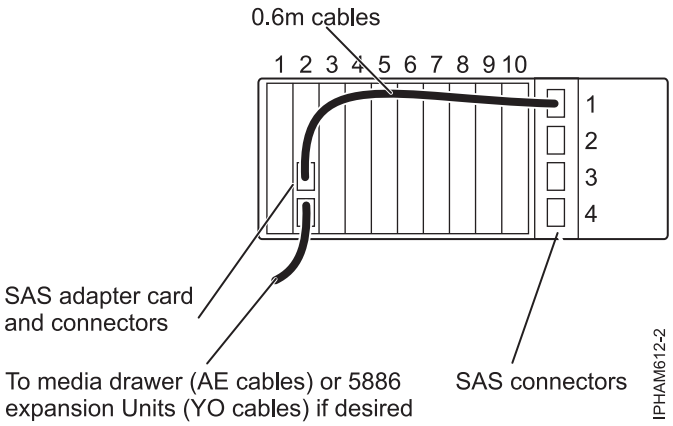


Figure 40. Physical cabling example: One hard disk drive partition with 18 disks, a single SAS adapter, hard disk drive partitions switch position 1

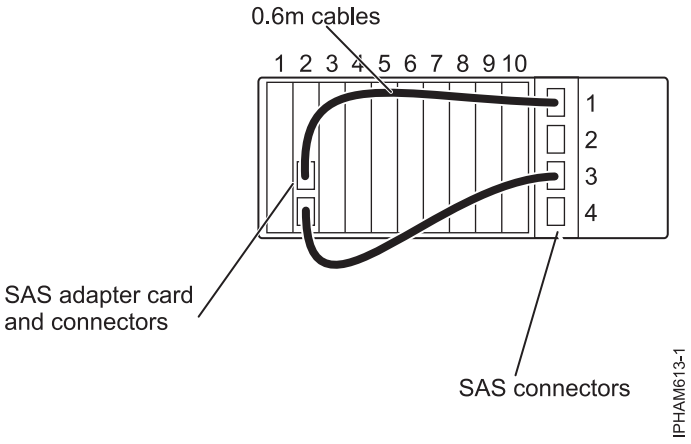


Figure 41. Physical cabling example: Two hard disk drive partitions with nine disks per hard disk drive partition, a single SAS adapter, hard disk drive partitions switch position 2

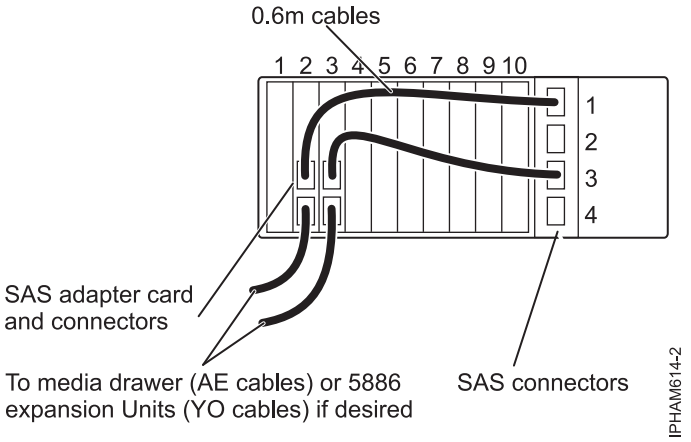


Figure 42. Physical cabling example: Two hard disk drive partitions with nine disks per hard disk drive partition, two SAS adapters, hard disk drive partitions switch position 2

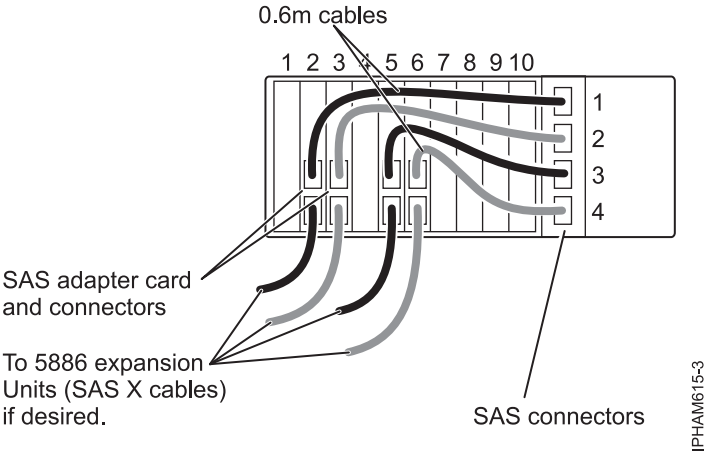


Figure 43. Physical cabling example: Two hard disk drive partitions with nine disks per hard disk drive partition, four SAS adapters, hard disk drive partitions switch position 2

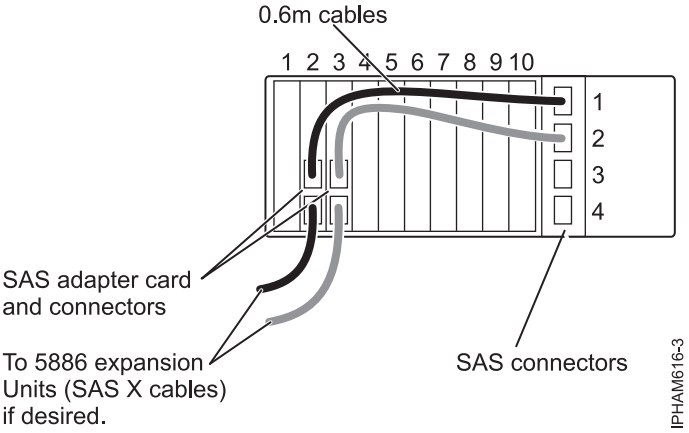


Figure 44. Physical cabling example: One hard disk drive partition with 18 disks, dual SAS adapters, hard disk drive partitions switch position 1

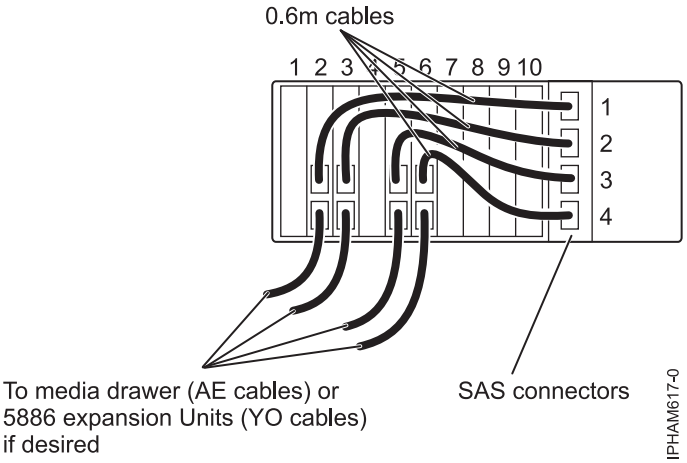


Figure 45. Physical cabling example: Four hard disk drive partitions with four or five disks per hard disk drive partition, hard disk drive partitions switch position 4

3. Set the hard disk drive partitions switch to the proper position for your cabling configuration by using Table 10 on page 69.
4. Cable the 5802 disk subsystem to your server. For details, see "Cabling the 5802 and 5877 to the server."

Cabling the 5802 and 5877 to the server

Learn how to cable the 5802 and 5877 to the server.

Use this procedure to connect the 5802 and 5877 to the server:

1. Install the GX Dual-Port 12X Channel Attach adapter (12X) adapter into your server.
2. Connect the 12X DDR cable to your 5802 or 5877 expansion unit. For information on 12X DDR cables, see "RIO/HSL, 12X/12X DDR, and SPCN cable identification" on page 2.

   Note: Two modes are available for connecting the 12X interface:
   - Double barrel mode: Using two 12X DDR cables, connect port 0 of the 5802 or 5877 expansion unit to port 0 of the 12X interface on the server, and connect port 1 of the 5802 or 5877 expansion unit to port 1 of the 12X interface on the server.
   - Loop mode: For details about the loop mode, see "Example: Topologies of RIO/HSL, 12X, and 12X DDR loops" on page 3.
3. Install the other end of the 12X DDR cable to the 12X adapter on the server.
4. Add the disk drives to the operating system you are using.

Cabling the 5803 disk subsystem

To cable the 5803 disk subsystem, contact your next level of support.

5886 SAS disk-drive enclosure

Learn about the SAS disk-drive enclosure and how to assemble it.

The SAS disk-drive enclosure can hold up to 12 disk drives. The enclosure cannot be split into 2 independent groups.

The SAS disk-drive enclosure supports the following operating systems:

- AIX
- IBM i
- Linux

To determine the level of software that you need to support the SAS disk-drive enclosure, see the IBM Prerequisite.

Tip: If you are going to configure RAID arrays, ensure that you have the following number of available disks for each RAID level:

RAID 0 or 1
: Two drives per array

RAID 5
: At least 3 drives per array

RAID 6
: At least 4 drives per array

Connecting the SAS adapter to the 5886 disk-drive enclosure

Learn about how to connect the 5886 disk-drive enclosure

Use this procedure to connect the 5886 disk-drive enclosure:

For additional information related to Serial-attached SCSI (SAS) cabling and cabling configurations, see Serial attached SCSI cable planning.

Attention: Consult your server documentation to determine if the server must be powered off before the addition of adapters. If you cannot determine the requirement for your server, power off the server before connecting the cables.

1. Install the SAS adapter into your server. For details, see Installing PCI adapters.
2. Connect the SAS cable to your disk drive. Choose one of the following methods based on your situation:
   - Figure 46
   - Figure 47 on page 75
   - Figure 48 on page 76

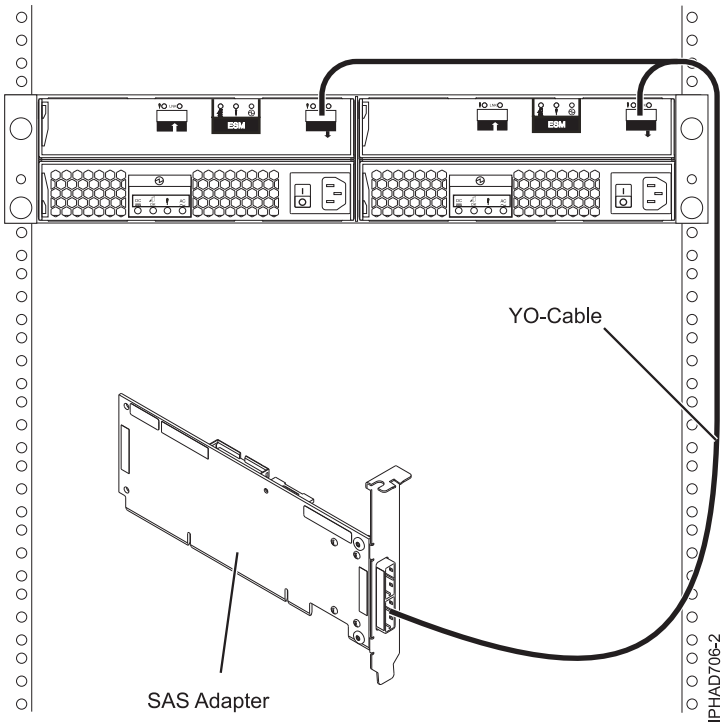


Figure 46. SAS YO cable to single enclosure card

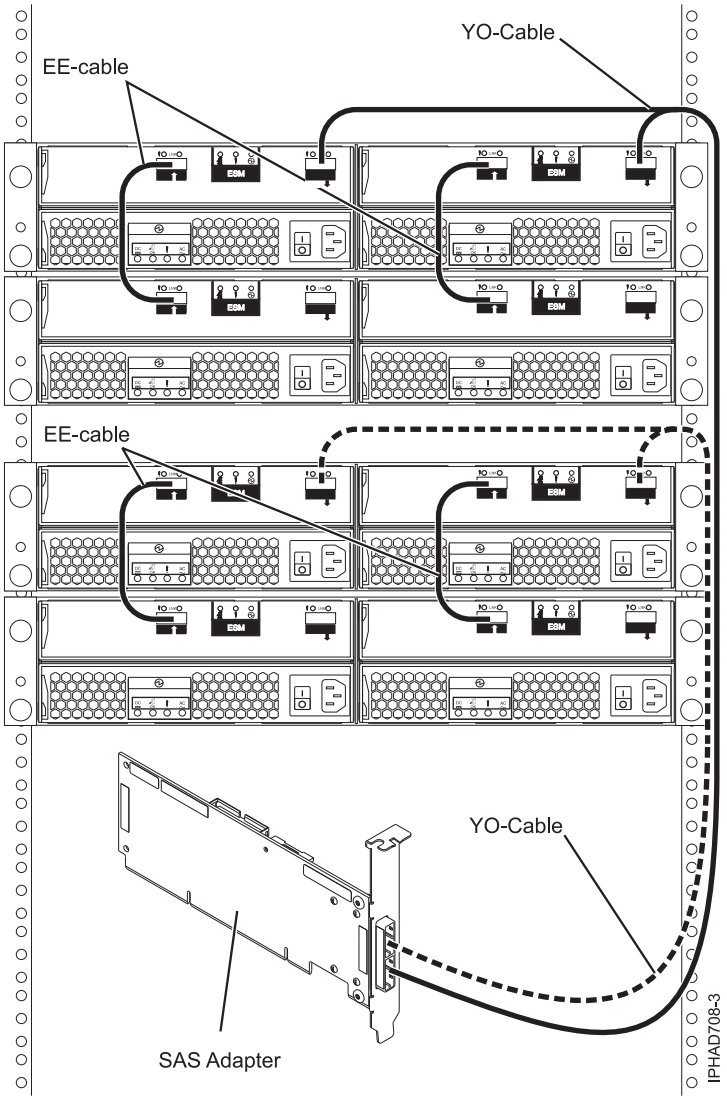


Figure 47. SAS YO cable to single enclosure with EE cables adding an additional enclosure or two YO connected enclosures each with an additional enclosure attached

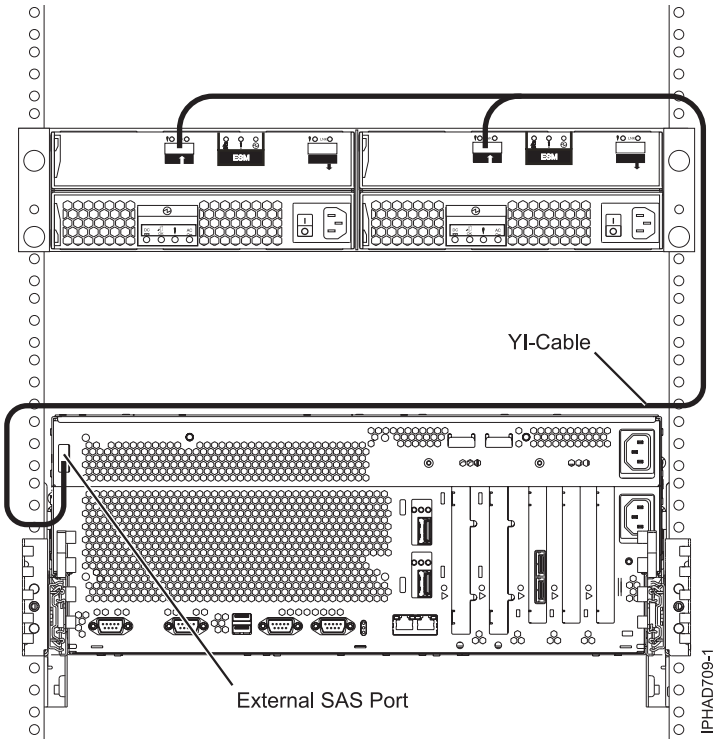


Figure 48. Single enclosure attached with YI cable to external SAS port

3. Install the other end of the SAS cable to the SAS adapter or the external SAS port on the server.
4. Add the disk drives to the operating system you are using.
5. For steps to verify the new configuration, see Hardware service manager Verify option.

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European Community contact:
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