5

900 Series Input/Output Channels

Peripheral Channels

HP Small Computer System Interface (SCSI)

HP's SCSI link is an interface card used to connect disks, DDS tape drives, 1/2-inch cartridge tape (3480 compatible), optical drives, and the HP 5000 high-end printer family of products. There are two SCSI interface cards available:

28642A   HP-PB SCSI host adapter card for use on Precision Bus (PB) systems. Supported on Series 9x7LX, 9x7, and Corporate Business Systems (CS).

27251A   CIB SCSI host adapter card for use on Channel I/O Bus (CIB) systems. Supported on Series 980 systems.

The following SCSI peripherals are supported on all 900 Series systems:

- Disks
  - C2461F/R/S
  - C2462F/R/S
- DDS Tape
  - C2463F/R - 1.3 GB (supported only on Series 9x7LX and 9x7 systems - obsolete)
  - C2464F/R - 2.0 GB
  - C2465F/R - 2 x 2.0 GB
  - C1520B - 2 GB (standalone)
  - C1521B - 8 GB data compression (standalone; support planned 1Q93)
  - C2466F/R - 8 GB data compression (support planned 1Q93)
  - C2467F/R - 2 x 8 GB data compression (support planned for 1Q93)
- Optical
  - C1700A - 20 GB
  - C1703A - 10 GB
- Printers
  - HP 5000 Model F100
- 1/2-inch Cartridge Tape
  - 4220[1,2] with auto loader
  - 4280 Model A01[1,2] - 1 transport
  - 4280 Model A02[1,2] - 2 transports with or without auto loader

[1]*Available 2H92 (post MPE/iX Release 4.0)*
[2]*From StorageTek*

Maximum Cable Length

The maximum combined length of single ended SCSI bus is six meters. The maximum length applies to cables that interconnect each daisy-chained device and to the cable lengths that are internal to each device.

The total cable length is the sum of the length of all SCSI cables:

Series 9x7LX and 9x7 Systems

Where	Cable Length
Inside SPU - Series 9x7LX - Series 9x7	 1.5 meters 3.0 meters
Inside Series 6000 Multi-Mechanism Package - Mini Tower - Rackmount	 1.8 meters 2.2 meters*
Between the Series 9x7LX and 9x7 SPU and the first peripheral	1 or 1.5 meters
Between the CS SPU and the first peripheral	Base CS SPU is provided standard with one 2.5 meter SCSI cable Add-on SCSI cards allow a choice of 1.0 meter or 2.5 meter SCSI cable
Between Peripherals	.5, 1, or 2 meters
* See chapter 6 for further discussion on mini-tower and rackmount for Series 9x7LX and 9x7 systems and Chapter 4 for further discussion on rackmounting for the CS 99x.	

To increase cabling flexibility, the following SCSI cables may be ordered separately:

- .5 meter SCSI cable: P/N 92222A
- 1.0 meter SCSI cable: P/N 92222B
- 2.0 meter SCSI cable: P/N 92222C

The cables listed above are peripheral-to-peripheral cables with male-to-male connectors. For an extender cable order P/N 92222D, a 1 meter cable with female-to-male connectors.

For best performance results with SCSI, follow these guidelines:

- connect 5 or less disks per SCSI bus on systems with heavy disk I/O workloads
- connect tape and back-up devices on separate SCSI bus from disks on systems with ≥10 Gbytes of storage

Device Loading

A maximum of 7 peripheral devices can be attached to each bus.

Note	The integrated SCSI interface on Series 9x7LX and 9x7 systems supports only 5 devices. C2463F/R DDS drive is not supported external to the SPU via the integrated bus. A SCSI interface card is required to support C2463F/R external DDS. The new 2 GB DDS and 8 GB DDS models are supported via the integrated bus and via a SCSI interface card.

The 900 Series SCSI implementation adheres to the HP Common SCSI (HPCS) specification which is a superset of the ANSI SCSI-2 specification.

The Rewritable Optical Autochanger is supported as a serial device accessed through TurboSTORE/XL II. Two versions of TurboSTORE/XL II are available for support of the Rewritable Optical Autochanger: 36397A Support for Rewritable Optical Disk and 36398A Support for Online Backup for Rewritable Optical Disk.

Configuration limitations for C1700A and C1703A are:

- No boot capabilities are provided.
- Only one C1700A or C1703A per SCSI channel.
- Only three C1700A or C1703A products per system.
- The SCSI channel includes a 2m cable. P/N 92222D can be ordered for 1m SCSI cable extender.
- The SCSI channel has to be configured at address 7 (factory standard).
- The maximum cable length is 6 meters (including internal cables).

SCSI Guidelines

- Third party SCSI devices are not supported, except the 1/2-inch cartridge tape.
- SCSI switch boxes are not supported.
- Use daisy chain configuration for all devices.
- All devices must have a unique address between 0 and 6.
- All cables should be attached to a device at both ends.
- The last SCSI device in the chain must have a terminator installed in its second connector.
- All devices must be connected to a common (single point) reference ground. Refer to appropriate Site Preparation Guide for details.
- All devices must be powered up with the self-test completed before power is applied to SPU.
- Keep all devices powered up during and after system boot-up.

SCSI Performance Guidelines for Corporate Business Systems 990 and 992.

- Maximum of 5 SCSI disks per SCSI interface card.
- Maximum of 5 SCSI interface cards per HP-PB I/O card cage. Remaining slots can be used for any other non-disk activity as long as power limits are not violated.

SCSI Extender .

HP's SCSI extender (P/N 28643A) is supported for use with the Rewritable Optical Autochangers and with the HP 5000 high end printers.

The SCSI extender has performance implications when used with SCSI devices that are asynchronous. The Optical Autochangers have asynchronous interfaces and therefore performance can be impacted by as much as 50%. The extender is **only** recommended for customers who **must have greater cabling flexibility** than 6 meters allows.

The extender is available in 50 meter and 100 meter lengths. Only one device may be connected to each extender and **NO** devices are allowed to be connected to the same SCSI bus.

SPU   SCSI   SCSI Extender   SCSI Device

The F100 printer has a synchronous interface and therefore should see little performance degradation when connected to the extender.

HP-IB Channels

HP's HP-IB channel card is a hardware controller used to interface HP-IB (IEEE 488 protocol) peripherals to the 900 Series systems.

- 27113A – CIB HP-IB channel for use on Channel I/O Bus (CIB) systems
- A1747A – PBA-IB channel for use on Precision Bus (PB) systems

Each HP-IB channel is a board that supports one HP-IB cabling system. Each HP-IB cabling system may be used to connect from one to six HP-IB peripherals. Peripherals connected to one HP-IB channel are linked together with HP-IB cables. The number of peripherals which may be practically connected to a single HP-IB channel depends on cable length restrictions and performance considerations.

Series 9x7LX and 9x7

HP-IB channels are only supported in the Series 9x7LX and 9x7 via the Precision Bus Adapter (PBA-IB). Each PBA-IB uses 2 I/O slots (double-wide card).

HP-IB channels may be ordered two ways:

- option 401 (9x7 only) at time of initial purchase
- A1747A (PBA-IB) after initial purchase

Refer to page 2-1 for HP-IB channel maximums of Series 9x7LX and 9x7 systems.

Series 980

The Series 980/100, 980/200, 980/300, and 980/400 are supplied standard with two HP-IB channels. Additional HP-IB channels may be ordered as product number 27113A. System option 550 will delete one HP-IB channel and replace it with an HP-FL channel.

Up to 4 HP-IB channels are supported on each CIB. As a rule of thumb, you should not exceed 3 HP-IB channels per CIB without consulting a performance specialist. Order product 27113A to obtain additional HP-IB channels. *Refer to page 4-1 for HP-IB channel maximums of systems.*

Corporate Business Systems 990 and 992

Corporate Business System (CS) HP-IB channels are supported on the Series 990 Business System via the Precision Bus Adapter (PBA). Only one HP-IB channel can be connected to each PBA. The CS does not support PBA-IB as a system disk. The following ordering information should be used to order a PBA with or without an HP-IB card:

- A1747A – PBA with HP-IB
- Option 001 – PBA without HP-IB
- Option 002 – supplies version of PBA required for the Corporate Business System

Refer to page 4-1 for HP-IB channel maximums.

HP-IB Performance Considerations/Device Loading

- A maximum of six non-disk devices may be attached to each HP-IB device adapter
- A maximum of 4 disks should be attached to each HP-IB device adapter for consistent performance results
- A mixture of disk, tapes, and printers may be attached to an HP-IB device adapter as long as the firmware date code is 2912 or greater
- Any variance from these guidelines must have prior written approval from your local Hewlett-Packard Support office
- The electrical device load maximum remains at 8 external device loads per HP-IB device adapter

Configuring HP-IB Cabling

HP-IB Guidelines

- HP-IB Switch Boxes are not supported
- Use daisy-chain configuration for all devices
- All devices must have a unique address between 0 and 7
- All cable connections should occur at device (i.e., no cables should be connected together simply to extend to effective cable length)
- There should be no unterminated cables. All cables should be attached to a device at both ends
- All devices must be connected to a common (single point) system reference ground. Refer to appropriate Site Preparation Guide for details.
- All devices must be powered with the self test completed before power is applied to the SPU
- Keep all devices powered during and after system boot-up

Maximum Cable Length

The maximum combined length of HP-IB cables connected to a single device adapter is 15 meters. However, this maximum may be further restricted by the "seven plus one rule" described below. When connecting multiple peripherals to a single device adapter, the first device in the chain connects via a special 4 meter HP-IB cable included with the device adapter.

The calculation of maximum cable length also includes the length of HP-IB cable internal to the system and/or peripherals. The maximum length applies to the combination of cables whether they are "daisy-chained" in a line or connected in a branched layout.

The total cable length is the sum of the length of all HP-IB cables:

a. Inside the peripheral devices
b. Between peripherals
c. Between the nearest peripheral and the junction panel (HP-IB interface)
d. Between the HP-IB DA and the first device (4m)

The Seven Plus One Rule

The maximum combined length of HP-IB cables is restricted by electrical device loading as well as total cable length. *The total HP-IB cable length may not exceed seven meters plus one meter for each electrical device load attached to the HP-IB cable, up to a 15 meter maximum.* This calculation optimizes data transfer rates, ensuring correct performance.

All HP-IB cables internal to either the system or the peripherals are supplied standard with the product ordered. A special 4 meter cable is supplied standard with the HP-IB device adapter. External HP-IB cables are usually supplied with the peripheral, but there are exceptions.

To increase cabling flexibility, the following HP-IB cables may be ordered separately:

- 1 meter HP-IB cable: P/N 10833A
- 2 meter HP-IB cable: P/N 10833B
- 4 meter HP-IB cable: P/N 10833C

HP-IB Extenders (for printers only)

For environments which require printers to be located longer distances from a 900 Series system, an HP-IB extender configuration may be installed. Extenders are available with coaxial cabling. Coaxial cable lengths are supported up to 250 meters. Coaxial cables must be ordered separately. Coaxial cable is P/N 92179G.

Each extender configuration requires a pair of extenders, one at each end. A configuration example is shown below.
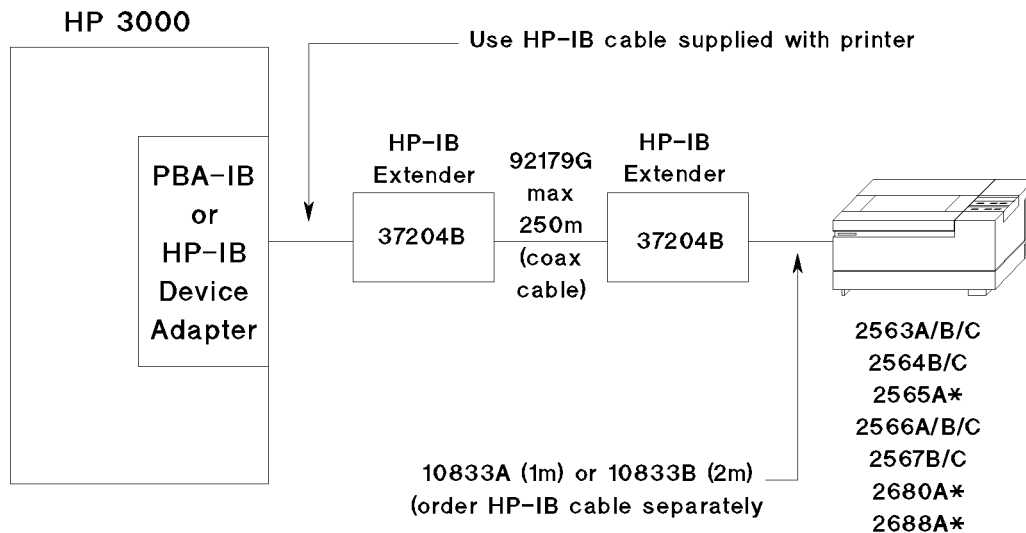
* Discontinued

Single Printer Cabling with HP-IB Extenders (37204B)

An HP-IB extender configuration is subject to the following limits:

- HP-IB extenders are supported on MPE/iX release 1.2 or later
- A maximum of four printers are supported per extender configuration. These may be a combination of 256x, 2688A* or 2680A* printers. However, only two page printers (2688A or 2680A) are supported per extender configuration.

- When multiple printers are connected to an extender configuration, a maximum of 1 meter HP-IB cable (P/N 10833A) can be installed between printers. This cable must be ordered separately.
- Two sets of extender pairs may be connected to a single HP-IB device adapter, but only 256x printers may be used on both extender pairs.

Discontinued

Note	For HP-IB device adapters with firmware 27113-81002 (Rev 2733), a firmware upgrade is required to support HP-IB extenders. See service note 27113A-02 for details.

HP Fiber-Optic Link Channels

HP's Fiber-Optic link is an interface channel used to connect HP-FL disk drives to the 900 Series systems. The following interface cards are available:

- 27115A – CIB HP-FL link for the channel I/O bus (CIB) systems. Supported on Series 980 systems.
- 28616A – PB-FL link for the Precision Bus systems. Supported on Series 9x7LX, 9x7, and Corporate Business systems.
- A1748A – PBA-FL link for the Precision Bus systems. Supported only on 9x7LX and 9x7 systems. The PB-FL replaces the PBA-FL.

Each interface uses two I/O slots and attaches one fiber-optic cable. The cable needed to connect the channel to its first disk drive is included with the HP-FL channel. Each channel may support up to 8 disks in a daisy-chain using a disk-to-disk bus called P-Bus.

The advantages of HP-FL (PB-FL) relative to HP-IB (PBA-IB) are numerous. First, up to eight HP-FL disks can be placed on a single HP-FL Device Adapter (DA) while, for performance reasons, it is not recommended to exceed five HP-FL (PB-FL) disks per HP-FL (PB-FL) DA. This means larger disk configurations can be achieved with HP-FL using fewer system I/O slots. Second, HP-FL (PB-FL) supports fiber-optic cable lengths up to 500 meters while HP-IB (PBA-IB) supports a maximum cable length of 15 meters. This allows HP-FL (PB-FL) a higher degree of configuration flexibility because disks can be placed further away from the CPU. Third, HP-FL (PB-FL) offers an improved data transfer rate relative to HP-IB (PBA-IB), 5 megabytes per second versus 1 megabyte per second, respectively.

HP-FL (PB-FL) also has advantages over SCSI. The HP-FL (PB-FL) interface uses the link more efficiently than SCSI, providing higher sustained data transfer rates. In addition, HP-FL (PB-FL) supports all high availability solutions such as Disk Mirroring and SPU Switchover/XL and supports larger configurations.

Series 9x7LX and 9x7

PBA-FL channels may be ordered for the Series 9x7 systems either as an option to the system (option 407) or via a Precision Bus Adapter with HP-FL (A1748A). The Precision Bus (PB-FL), part number 28616A, is also supported on the 9x7LX and 9x7 systems. *Refer to page 2-1 for PB-FL channel maximums. The PB-FL replaces the PBA-FL.*

The new HP-FL disk arrays (C2252, C2254) are **NOT** supported by the PBA-FL bus adapter. Series 9x7 customers who have a PBA-FL bus and want to connect disk arrays must order the new PB-FL (28616A).

Series 980

Each system supports a maximum of 3 HP-FL channels per CIB. As a rule of thumb, you should not exceed 2 HP-FL channels per CIB without consulting a performance specialist. *Refer to page 4-1 for HP-FL channel maximums.*

Corporate Business Systems 990 and 992

Each system supports a maximum of 5 HP-FL channels per HP-PB I/O card cage. Each PB-FL card supports 8 devices. PBA-FL card is not supported on the Corporate Business Systems.

HP-FL Cabling

Unlike HP-IB (PBA-IB), there are two cabling methods incorporated into the HP-FL (PB-FL) interface. The fiber-optic cable is used to connect a group of HP-FL disk drives to the HP-FL (PB-FL) DA. The fiber-optic cable is a duplex cable of glass fiber containing two fiber-optic strands. One strand is used to transmit data from the CPU to the disks and the other is used to transmit data from the disks to the CPU. As shown in the figure below, the fiber-optic link connects from the system to one or a group of disks. A 30 meter fiber-optic link is included with P/N 27115A and P/N 28616A. The 30 meter cable can be replaced by a custom fiber-optic cable, up to 500 meters long. This is orderable as HFBR-AWQnnn, where nnn is the length in meters.
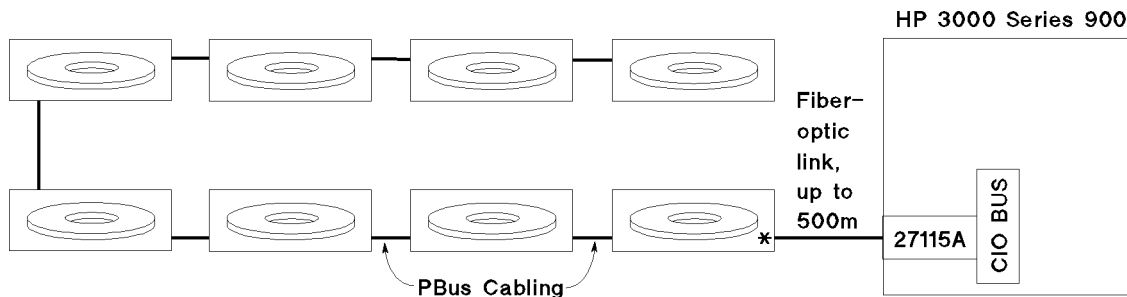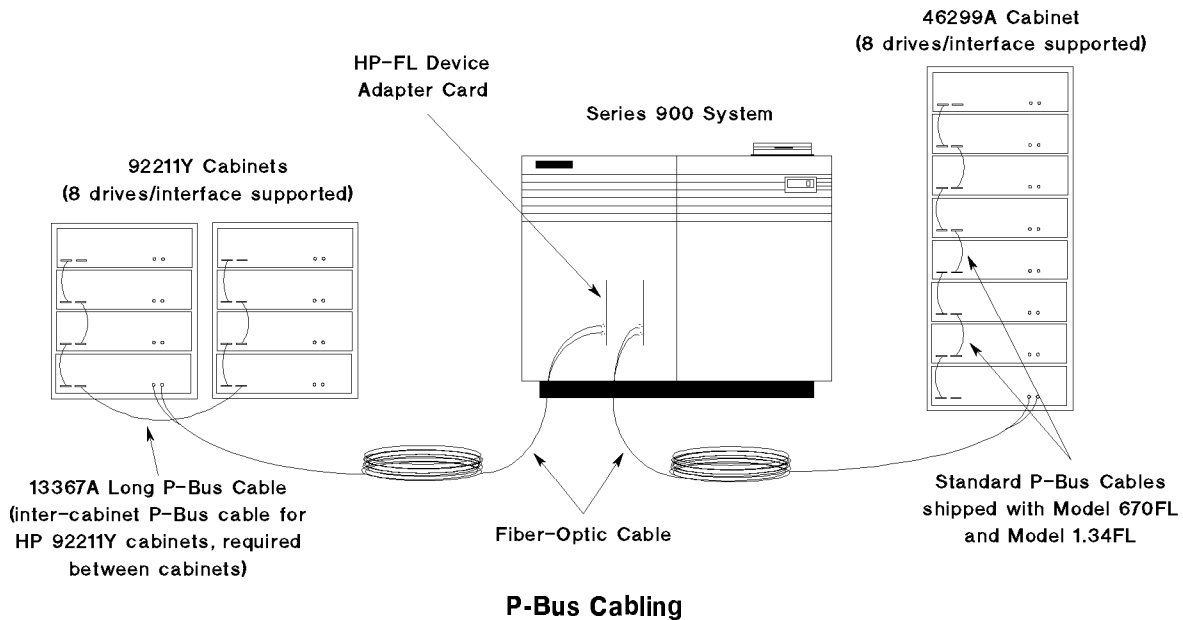

C2201A or C2204A disks (up to 8 drives)

∗ Must be standard HP C2201A, C2204A, C2252B or C2252HA disk drive

HP-FL Disk Interface

As a space and cost savings solution, a multi-wire P-Bus cable is used to daisy-chain up to eight HP-FL disk drives together on a single HP-FL (PB-FL) interface card in a single cabinet. (The HP 46299A is a 19-inch EIA cabinet, 1.6m tall. It can hold up to eight HP C2201A and/or C2204A disk drives.) The P-Bus cable is a 64-wire copper cable. The transfer rate capabilities of the P-Bus cable match that of the fiber-optic cable at 5 megabytes per second.

P-Bus cabling limitations restrict the number of HP-FL disk drives supported in multiple cabinets. Up to eight HP C2201A or C2204A disk drives are supported in two HP 92211Y cabinets. Disks in adjacent cabinets are connected using a long P-Bus cable, P/N 13367A. The C22XXA product P-Bus cables are backward compatible. The older P-Bus cables on the 793X products are not forward compatible.

Option 1BG available on the HP C2201A and C2204A disk drives deletes the fiber-optics hardware from the controller. These disk drives can be interconnected via the P-Bus, but not directly to the system via the fiber-optic cable. At least two disk drives per channel should have fiber-optic circuits (the standard drive) for configuration flexibility.

46299A Cabinet
(8 drives/interface supported)

HP-FL Device
Adapter Card

Series 900 System

92211Y Cabinets
(8 drives/interface supported)

13367A Long P-Bus Cable
(inter-cabinet P-Bus cable for
HP 92211Y cabinets, required
between cabinets)

Fiber-Optic Cable

Standard P-Bus Cables
shipped with Model 670FL
and Model 1.34FL

P-Bus Cabling

Performance Considerations

To enhance performance with TurboSTORE/XL or TurboSTORE/XL II, modified configurations are suggested. If backup devices will only be used sequentially, they may share an HP-IB channel. If devices are used in parallel or parallel in device pools, it is suggested that each backup device have its own HP-IB DA. Additional performance increases can occur with:

Series 980

■ FL disks connected to at least one HP-FL DA. If HP-IB disks are used, they should be spread over at least four HP-IB DAs
■ A maximum of two HP-FL DAs per CIB
■ HP-IB and HP-FL channels on separate CIB
■ A maximum of 3 HP-IB channels per CIB

For best performance results with SCSI disks, follow these guidelines:

■ Place add-on DDSs or other back-up device on a separate SCSI bus from disks
■ Connect 5 or less disks per SCSI bus

Corporate Business Systems 990 and 992

For best performance results with HP-FL disks, follow these guidelines:

■ A maximum of 5 HP-FL disks per PB-FL interface card (single disks and disk arrays)
■ A maximum of 5 HP-FL interface cards per HP-PB I/O card cage. (Remaining slots can be used for any other non-disk activity as long as power limits are not violated).

For best performance results with SCSI disks, follow these guidelines:

■ Place add-on DDSs or other back-up device on a separate SCSI bus from disks
■ Connect 5 or less disks per SCSI bus

Interconnect Positioning

	HP-IB (PBA-IB)	SCSI	HP-FL (PB-FL)
Primary focus	Upgrade systems with HP-IB devices 1/2-inch tape Printers	Disk/DDS on new low end and midrange systems Optical Autochanger 1/2-inch cartridge tape	Disks on midrange, and high end
High availability	No	Mirrored Disk only	Yes
Cable length maximum	15 meter	6 meter	500 meter
Maximum throughput	1 MB/sec	5 MB/sec	5 MB/sec
Sustained throughput relative to HP-IB	1	2x	4x
Maximum disks per interface card	6	7 (5 for performance)	8

SCSI

Use SCSI to:

■ connect disks, optical autochangers for 900 Series low end and midrange systems, HP 5000 printer family, and 1/2-inch cartridge tape (3480 compatible) (configurations larger than 15 Gbytes should consider using HP-FL disks)
■ satisfy industry standard and open system requirements
■ replace HP-IB as customers migrate to new 900 Series systems

HP-IB (PBA-IB)

Use HP-IB (PBA-IB) to:

■ connect 1/2-inch tape devices
■ meet customers need to migrate HP-IB peripherals

HP-FL (PB-FL)

Use HP-FL (PB-FL) to:

■ connect disks on the 900 Series high end systems, including disk arrays
■ satisfy high performance requirements for disk
■ satisfy High Availability requirements for midrange and high end systems (Disk Mirroring, SPU Switchover/XL)
■ satisfy longer distance requirements between host and disk
■ satisfy larger disk configurations (disk configurations over 15 GB are not recommended for SCSI)
■ satisfy fiber-optic requirements (EMI/RFI noise)

I/O Card Summary

I/O Card	Part Number	System Supported
CIB HP-IB	27113A	Series 980
PBA-IB*	A1747A	Series 9x7LX, 9x7, CS 990, and CS 992
CIB SCSI	27251A	Series 980
HP-PB SCSI	28642A	Series 9x7LX, 9x7, CS 990, and CS 992
CIB HP-FL[1]	27115A	Series 980
PB-FL[1]	28616A	Series 9x7LX, 9x7, CS 990, and CS 992
PBA-FL[2,3]	A1748A	Series 9x7

[1] *LDEV 1 C2201, C2204, C2252*
[2] *C2252 and C2254 are NOT supported on the PBA-FL (A1748A) card. If a Series 9x7 customer orders C2252 or C2254, a PB-FL (28616A) MUST also be ordered.*
[3] *PB-FL replaces the PBA-FL*
* *Not supported as a system disk on the Corporate Business System*

Interconnect Product Number Summary

Interface Card	Part Number	Cable(s)	Extender
HP-IB **PBA-IB**	27113A A1747A (PBA)	10833A (1 meter) 10833B (2 meter) 10833C	37204B
HP-FL **PB-FL** **PBA-FL**	27115A 28616A A1748A (with PBA)	HFBR-AWQnnn	

SCSI Interconnect Product Number Summary

From:	High Density Squeeze Lock	High Density Thumb Screw	Low Density Bail Lock	Low Density Thumb Screw	Terminator
To:					
Low Density Bail Lock	K2286 .9m K2285 1.5m	K2296 .9m K2297 1.5m	92222A .5m 92222B 1.0m 92222C 2.0m	K2284 1.0m K2283 1.5m	K2291
Low Density Thumb Screw	K2288 .9m K2287 1.5m	K2294 .9m K2295 1.5m	K2284 1.0m K2283 1.5m	K2207 .5m K2208 1.0m K2209 1.5m K2210 2.2m K2211 3.0m	K2290