

## RAID Adapter Analysis – i5/iSeries

This StorFacts™ Report analyzes the current IBM i5/iSeries RAID adapters. Features discussed include the following:

1. FC0628 / FC0648
2. FC2780 / FC5580
3. FC5703
4. FC5709 / FC5726
5. FC5727 / FC5728
6. FC5737
7. FC5776



For more information – <http://www.gstinc.com/store/SCSI-C141.aspx>



# StorFacts™ Report

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## RAID Overview

Short for **Redundant Array of Independent (or Inexpensive) Disks**, a category of disk drives that employ two or more drives in combination for fault tolerance and performance.

- **Level 0 -- Striped Disk Array without Fault Tolerance:** Provides *data striping* (spreading out blocks of each file across multiple disk drives) but no redundancy. This improves performance but does not deliver fault tolerance. If one drive fails then all data in the array is lost.
- **Level 1 -- Mirroring and Duplexing:** Provides disk mirroring. Level 1 provides twice the read transaction rate of single disks and the same write transaction rate as single disks.
- **Level 2 -- Error-Correcting Coding:** Not a typical implementation and rarely used, Level 2 stripes data at the bit level rather than the block level.
- **Level 3 -- Bit-Interleaved Parity:** Provides byte-level striping with a dedicated parity disk. Level 3, which cannot service simultaneous multiple requests, also is rarely used.
- **Level 4 -- Dedicated Parity Drive:** A commonly used implementation of RAID, Level 4 provides block-level striping (like Level 0) with a parity disk. If a data disk fails, the parity data is used to create a replacement disk. A disadvantage to Level 4 is that the parity disk can create write bottlenecks.
- **Level 5 -- Block Interleaved Distributed Parity:** Provides data striping at the byte level and also stripe error correction information. This results in excellent performance and good fault tolerance. Level 5 is one of the most popular implementations of RAID.
- **Level 6 -- Independent Data Disks with Double Parity:** Provides block-level striping with parity data distributed across all disks.
- **Level 0+1 – A Mirror of Stripes:** Not one of the original RAID levels, two RAID 0 stripes are created, and a RAID 1 mirror is created over them. Used for both replicating and sharing data among disks.
- **Level 10 – A Stripe of Mirrors:** Not one of the original RAID levels, multiple RAID 1 mirrors are created, and a RAID 0 stripe is created over these.



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**0628**

**Direct Attach-5703**

#0628 is ordered when the function of a #5703 IOA is required but the card will be controlled by a non-OS/400 operating system.

Cards controlled by a non-OS/400 operating system do not use/require PCI IOPs. Direct attach cards are supported only in a non-OS/400 partition.

Prerequisites:

- #0140 Logical Partitioning Specify.
- #0142 Linux Partitioning Specify or #0145 AIX Partitioning Specify
- Attributes provided: #5703 controlled by Linux or AIX Operating System
- Attributes required: #0140, #0142 or #0145

**0648**

**PCI-X Disk Ctlr-90MB No IOP**

The #0648 has two U320 SCSI buses each with a bus data rate of up to 320MBs. A maximum of 12 internal disk drives and up to two internal removable media devices (tape, CD-ROM, DVD-ROM or DVD-RAM) are supported on the #0648.

A minimum of three disk drives are required for RAID-5, providing protection against a single drive failure in an array. A minimum of four disk drives are required for RAID-6, providing protection against up to two drives failing in an array.

#0648, #5737, and #5776 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools how the card is being used. #0648 indicates that the card is dedicated to an AIX 5L or Linux partition and an IOP is not being used.

- Attributes provided: Two U320 SCSI VHDCI ports
- Attributes required: One available 3.3V long PCI or PCI-X slot



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**2780**

**PCI-X Ultra4 RAID Disk Ctrl**

The #2780 is an Ultra4 (u320) SCSI controller with a maximum compressed write cache of 757MB and a maximum compressed read cache size of 1GB, that provides RAID-5 protection for internal disks and also supports internal tape units, CD-ROM and DVD units. The #2780 has four Ultra4(U320) SCSI buses.

In addition to providing RAID-5 protection for disks, #2780 is also designed to work as a high performance controller for disks protected by system mirroring or disks with no protection.

This controller also uses a Cache Battery Pack with can be replaced concurrent with system operation.

The #2780 controller supports a maximum of 20 disk units.

A minimum of three disk units of the same capacity are needed for a valid RAID-5 configuration. A maximum of six arrays are allowed per controller, with a maximum of 18 disk units allowed per array. All disk units in an array must be of the same capacity.

Parity is spread across either two, four, eight, or 16 disk units in an array. If an array of three disk units is started, parity is spread across two disk units. If an array of four to seven disk units is started, parity is spread across four disk units. If an array of 8-15 disk units is started, parity is spread across eight disk units. If an array of 16-18 disk units is started, parity is spread across 16 disk units.

The number of arrays and size of each array can be influenced by specifying an optimization of either "Balance", "Performance", or " Capacity" in Operations Navigator when starting arrays. An optimization of "Balance" will be used by default when starting arrays from the green screens. If disk units are included into an existing array, the number of parity drives does not increase, so parity may be spread across less than the preferred number of disk units. In this case the RAID function must be stopped and then started in order to redistribute the parity.

Note that this controller does not support DASD compression.

- Attributes provided: SCSI Raid Controller
- Attributes required: One 3V long PCI slot

5580

2780 Ctlr w/Aux Write Cache

Provides a disk controller with auxiliary write cache to improve cache data redundancy. The #5580 includes a #2780 PCI-X Ultra4 RAID Disk Controller and a secondary IOA with 757MB of auxiliary maximum compressed write cache. The #2780 and the secondary IOA each require one PCI-X slot and must be installed together in the same CEC or I/O unit/drawer/tower. The #2780 and the auxiliary write cache IOA are connected by a SCSI cable (provided). Feature #2780 will not appear on IBM ordering, shipping, or inventory documentation.

The connecting SCSI cable is attached to port four of the #2780, reducing the number of SCSI buses that support disk drives from four to three. The reduction of SCSI buses may also reduce the number of disk drives supported by the #2780, depending on the CEC or I/O unit/drawer/tower in which the #2780 is installed. No disk drives are driven by the auxiliary write cache IOA.

- Attributes provided: Disk Controller with auxiliary write cache
- Attributes required: Two PCI-X slots within the same CEC or I/O unit/drawer/tower





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**5703**

**PCI-X RAID Disk Unit Ctlr**

The #5703 is a SCSI RAID controller that has a 40MB cache and provides RAID-5 protection of internal disks. It also supports internal tape units, CD-ROM, DVD-RAM, and DVD-ROM units.

The #5703 has two SCSI (VHDCI) buses.

In addition to providing RAID-5 protection for disks, #5703 also works as a high-performance controller for disks protected by system mirroring or disks with no protection.

The #5703 supports a maximum of 12 disk units (this total may be limited due to other expansion tower constraints).

A minimum of three disk units of the same capacity are needed for a valid RAID-5 set. A maximum of four arrays are allowed per controller. All disk units in an array must be of the same capacity.

Parity is spread across either two, four, or eight disk units in an array. If an array of three disk units is started, parity is spread across two disk units. If an array of four to seven disk units is started, parity is spread across four disk units. If an array of 8-12 disk units is started, parity is spread across eight disk units.

The number of arrays and size of each array can be influenced by specifying an optimization of either balance, performance, or capacity in Operations Navigator when starting arrays. An optimization of balance is the default when starting arrays from green screens. If disk units are included into an existing array, parity may be spread across less than the preferred number of disk units. In this case the RAID function must be stopped and then started to redistribute the parity.

A #5703 can control up to two removable media devices (internal tape, CD-ROM, DVD-RAM, and DVD-ROM).

- Attributes provided: Two SCSI VHDCI ports
- Attributes required: One 3V long PCI slot

**5709**

## **RAID Enabler Card**

#5709 is a SCSI RAID controller which is installed into its own specific internal slot of a system unit and does not require a PCI slot. It functionally replaces the base integrated disk controller, adding RAID functionality and 40MB disk controller cache.

A minimum of three disk units is required for a RAID disk array.

- Attributes provided: RAID Data Protection for system unit DASD
- Attributes required: Unused RAID controller slot in a system unit.

**5726**

## **RAID Enabler Card**

Provides a SCSI RAID controller which is installed into its own specific internal slot of a system unit and does not require a PCI slot. It functionally replaces the base integrated disk controller, adding RAID-5 capability and 40MB disk controller write cache.

The model 570 originally used feature #5709 to describe this card. But there is a slightly different enclosure kit for the card and #5726 is now used to better identify the card and enclosure kit.

A minimum of three disk units is required for a RAID disk array.

- Attributes provided: RAID Data Protection for system unit DASD
- Attributes required: Unused RAID controller slot in a system unit



**5727****Integrated Cache - 40MB**

Provides a card which augments the base integrated disk controller of the model 520 or the model 550 with 40MB of write cache and also enables RAID-5 capability for the internal disk drives of the system unit. This feature is functionally equivalent to #5709, but can run in IOP-less mode. #5727 is installed into its own specific internal slot of a system unit and does not require a PCI slot.

A minimum of three disk units are required for a RAID-5 disk array.

- Attributes provided: 40MB write cache and RAID-5 data protection for system unit disk drives
- Attributes required: Unused write cache/RAID controller slot in the system unit

**5728****Integrated Cache - 40MB**

Provides a card which augments the base integrated disk controller in the model 570 with 40MB of write cache and also enables RAID-5 capability for the internal disk drives in the processor enclosure. This feature is functionally equivalent to #5709 and #5726, but can run in an IOP-less mode. #5728 is installed into its own specific internal slot of a 570 processor enclosure and does not require a PCI slot. The #5728 or its #5709/#5726 predecessor is required if i5/OS is to access the 4th, 5th and 6th disk slots in the processor enclosure.

A minimum of three disk units is required for a RAID-5 disk array.

- Attributes provided: 40MB write cache and RAID-5 data protection for processor enclosure disk drives
- Attributes required: Unused write cache/RAID controller slot in processor enclosure.



**5737**

**PCI-X Disk Ctlr-90MB w/IOP**

Provides a PCI-X SCSI disk controller that has a 90MB write cache and can provide RAID-5 or RAID-6 protection of disk units.

The #5737 has two U320 SCSI buses each with a bus data rate of up to 320MBs. A maximum of 12 internal disk drives and up to two internal removable media devices (tape, CD-ROM, DVD-ROM, or DVD-RAM) are supported on the #5737.

A minimum of three disk drives are required for RAID-5, providing protection against a single drive failure in an array. A minimum of four disk drives are required for RAID-6, providing protection against up to two drives failing in an array.

#0648, #5737, and #5776 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration.

Note the #2780/#5580 and #2757/#5581 disk controllers with an effective 757MB write cache provide greater disk performance and can have an auxiliary write cache IOA to protect the write cache contents.

- Attributes provided: Two U320 SCSI VHDCI ports
- Attributes required: One available 3.3V long PCI or PCI-X slot



**What do you mean  
we lost our data?!**



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**5776**

**PCI-X Disk Ctlr-90MB No IOP**

Provides a PCI-X SCSI disk controller that has a 90MB write cache and can provide RAID-5 or RAID-6 protection of disk units.

The #5776 has two U320 SCSI buses each with a bus data rate of up to 320MBs. A maximum of 12 internal disk drives and up to two internal removable media devices (tape, DVD-ROM, or DVD-RAM) are supported on the #5776.

A minimum of three disk drives are required for RAID-5, providing protection against a single drive failure in an array. A minimum of four disk drives are required for RAID-6, providing protection against up to two drives failing in an array.

#0648, #5737, and #5776 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration.

Note the #2780/#5580 and #2757/#5581 disk controllers with an effective 757MB write cache provide greater disk performance and can have an auxiliary write cache IOA to protect the write cache contents.

- Attributes provided: Two U320 SCSI VHDCI ports
- Attributes required: One available 3.3V long PCI or PCI-X slot

