AM311A Smart Array P411/256 Controller for HP Integrity Servers Installation Guide

Abstract

This guide includes procedures to install, update, and configure HP Smart Array P411/256 controllers on HP Integrity servers.

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Legal notice

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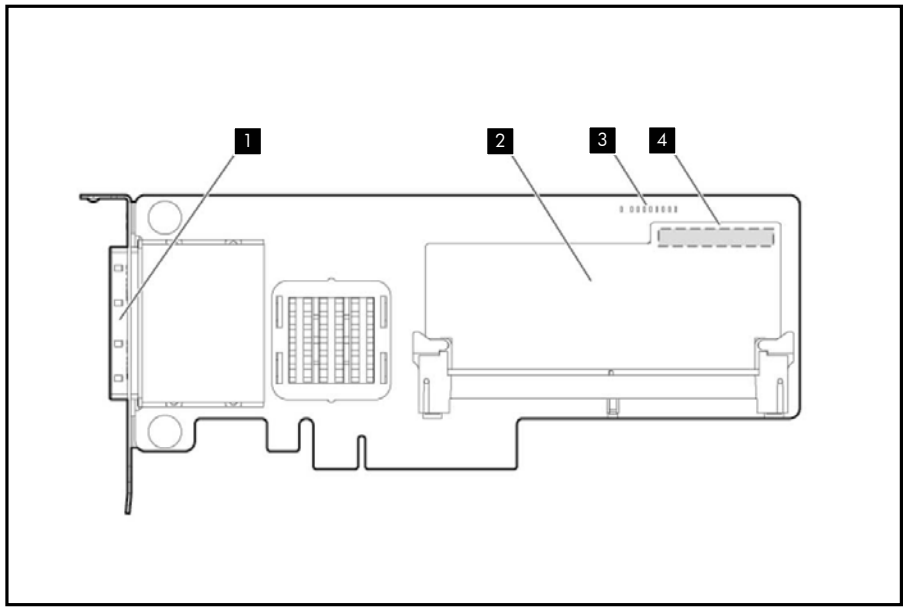
Contents

1 Controller overview

This chapter provides an overview of the physical characteristics of the HP Smart Array P411/256 Controller.

Figure 1 HP AM311A Smart Array 411 controller components



1. Connector for SAS miniports 1 and 2, each 4x wide.
2. Cache module (also known as array accelerator).
3. Status LEDs (runtime LEDs). To interpret the illumination pattern of these LEDs, see Table 2 (page 31).
4. (On rear of cache) Connector for the cable to an optional cache battery that upgrades the cache to BBWC.

2 Windows installation

This chapter describes installing Smart Array P411/256 Controllers on HP Integrity servers running Microsoft Windows.

Installation overview

⚠ **WARNING!** The HP AM311A Smart Array P411 controller does not support SATA disks in its initial release with adapter firmware version 3.30. SATA support will be added in a future firmware update.

For the latest information on recommended adapter firmware, see the *HP Smart Array RAID Controllers Support Matrix* at:

http://www.hp.com/go/smart-array-raid-docs.

NOTE: PCI card hot-plug addition and deletion operations are not supported on this controller; you must install it offline.

To install your Smart Array P411/256 controller, follow these steps:

1. Confirm that the server model, storage enclosure, and operating system are supported with the Smart Array P411/256 controller. Also, determine the required versions for the system firmware, adapter firmware, UEFI driver, and enclosure firmware.
   - For information about supported servers, disk enclosures, and firmware versions, see the *HP Smart Array RAID Controllers Support Matrix* at:

     http://www.hp.com/go/smart-array-raid-docs.
   - For information about supported tape devices, see the following documents:
     - The Smart Array P411 QuickSpecs, at:

       http://h18004.www1.hp.com/products/quickspecs/13765_div/13765_div.html
     - The HP StorageWorks Single Point of Connectivity Knowledge (SPOCK) website, at:

       http://www.hp.com/storage/spock

       An HP Passport account is required to access the SPOCK website.
2. Update the system firmware on the server, if necessary. For more information, see the documentation for your server.
3. Back up all server data.
4. Power off the server.
5. Power off any peripheral devices.
6. Unplug the AC power cord from the server.
7. Disconnect any peripheral devices.
8. Install the controller hardware. See "Installing the controller hardware" (page 11).
9. Connect storage devices to the controller. See "Connecting and verifying external storage devices" (page 11).

   NOTE: If you are connecting both disk and tape devices, do not combine them on the same SAS connector. Connect disk devices to one connector, and tape devices to the other.
10. Reconnect the peripheral devices and the AC power supply to the server.
11. Power on the peripheral devices and storage devices.
12. Power on the server.

13. Update the controller firmware, if necessary. See "Verifying and updating controller firmware offline" (page 14).
14. Determine whether the controller is in RAID mode; if not, then set it to RAID mode. See "Determining and setting the controller mode" (page 19).
15. Update the storage enclosure firmware, if necessary. See "Verifying and updating enclosure firmware offline" (page 21).
16. (Optional) Set the Smart Array P411/256 as the boot controller. For more information about setting the boot controller, see the server documentation.
17. Configure an array. See "Creating a logical drive" (page 28).

3 HP-UX installation

This chapter describes installing Smart Array P411/256 Controllers on HP Integrity servers running HP-UX.

Installation overview

⚠ **WARNING!** The HP AM311A Smart Array P411 controller does not support SATA disks in its initial release with adapter firmware version 3.30. SATA support will be added in a future firmware update.

For the latest information on recommended adapter firmware, see the *HP Smart Array RAID Controllers Support Matrix* at:

http://www.hp.com/go/smart-array-raid-docs.

NOTE: HP-UX Online Addition, Removal and Deletion (OL*) operations are not supported on this controller; you must install it offline.

To install your Smart Array Series Controller, follow these steps:

1. Plan your storage device configurations.
   - For more information on supported RAID levels, see the *HP Smart Array SAS Controllers for Integrity Servers Support Guide* at:
     http://www.hp.com/go/smart-array-raid-docs
   - For information about supported servers and disk enclosures, see the *HP Smart Array RAID Controllers Support Matrix* at:
     http://www.hp.com/go/smart-array-raid-docs.
   - For information about supported tape devices, see the following documents:
     - The Smart Array P411 QuickSpecs, at:
       http://h18004.www1.hp.com/products/quickspecs/13765_div/13765_div.html
     - The HP StorageWorks Single Point of Connectivity Knowledge (SPOCK) website, at:
       http://www.hp.com/storage/spock
       An HP Passport account is required to access the SPOCK website.
2. Update the system firmware on the server, if necessary. For more information, see the documentation for your server.
3. Check the installation prerequisites. See "HP-UX installation prerequisites" (page 9).
4. Install the software. See "Downloading software" (page 9) and "Installing software" (page 10).
5. Back up all server data.
6. Power off the server.
7. Power off any peripheral devices.
8. Unplug the AC power cord from the server.
9. Disconnect any peripheral devices.
10. Install the controller hardware. See "Installing the controller hardware" (page 11).
11. Connect storage devices to the controller. See "Connecting and verifying external storage devices" (page 11).

    NOTE: If you are connecting both disk and tape devices, do not combine them on the same SAS connector. Connect disk devices to one connector, and tape devices to the other.

12. Reconnect the peripheral devices and the AC power supply to the server..
13. Power on the peripheral devices and storage devices.
14. Power on the server.
15. Update the controller firmware, if necessary. See "Verifying and updating controller firmware offline" (page 14).
16. Determine whether the controller is in HBA mode or RAID mode; if necessary, change the mode to suit your configuration.
    - Use RAID mode to take advantage of hardware-based fault-tolerant data storage methods such as RAID 1, RAID 1+0, or RAID 5. This reduces the amount of available storage space.
    - Use HBA mode to access raw disks for increased storage capacity, to allow fault-tolerant storage to be managed by the enclosure firmware, or to implement software-based RAID modes using a volume manager.

    Tape devices are supported in both controller modes.

    See "Determining and setting the controller mode" (page 19).
17. Verify the enclosure firmware version and upgrade the enclosure firmware if necessary. See "Verifying and updating enclosure firmware offline" (page 21).
18. Update the storage enclosure firmware, if necessary. See "Verifying and updating enclosure firmware offline" (page 21).
19. (Optional) Set the Smart Array P411/256 as the boot controller. For more information about setting the boot controller, see the server documentation.
20. Configure an array. See "Creating a logical drive" (page 28).
21. Boot the server to HP-UX.

HP-UX installation prerequisites

Before installing the Smart Array Series Controller, be sure the following hardware and software prerequisites are met:

1. Confirm that your server and HP-UX operating system version are supported by the controller. Use the `swlist` command to determine the HP-UX version you are using. For example:

   ```
   # swlist | grep OE
     HPUX11i-DC-OE          B.11.31.1003   HP-UX Data Center Operating Environment
   ```

   The Smart Array P411 controller requires HP-UX version B.11.31.1003 or later, and RAID-01 (ciss) driver bundle verson B.11.31.1005 or later.

   For information about the supported server models and HP-UX versions, see the *HP Smart Array RAID Controllers Support Matrix* at:

   http://www.hp.com/go/smart-array-raid-docs
2. Read the *RAID-01 (ciss) HP Smart Array Controller Release Notes* for your HP-UX version to check for any known problems, required patches, or other information you need for installation.
3. Make sure you have superuser (`root`) privileges.
4. Make sure the **`/usr/sbin`**, **`/sbin`**, and **`/usr/bin`** directories are in your PATH statement by logging in as `root` and entering the following command:

   #**`echo $PATH`**

Downloading software

The drivers, utilities, and manpages for the Smart Array series controllers are located at the HP Software Depot website. To locate and download the software, follow these steps:

Smart Array P411 controllers require version B.11.31.1005 or later of the `ciss` driver for HP-UX 11i v3. To download the driver, follow these steps:

1. Go to the HP Software Depot website at:
   http://software.hp.com.
2. Search for **RAID-01**.
3. Click **Receive for Free**.
4. If prompted, sign in with your HP Passport account credentials or create a new account.
5. In the Software Specifications section, select HP-UX 11.31.1005 Itanium (or later).
6. Complete all other required fields, then click **Next**.
7. Follow the prompts to download the driver bundle and installation instructions.

Installing software

The drivers, utilities, and manpages for the Smart Array Series Controllers are contained in the RAID-01 bundle located in the downloaded depot. See "Downloading software" (page 9). Follow the procedure in the Download/Installation Instructions to verify the download and install the bundle.

Verifying the installation

After the system boots, verify that the installation was successful by following these steps:

1. Enter the `swlist` command:

   ```
   # swlist
   ```

   If the Smart Array Controller is installed correctly, the generated output includes an item similar to the following:

   ```
   RAID-01 B.11.31.1005   RAID SA; Supptd HW=A7143A/A9890A/A9891A
   ```

   The version string that appears indicates the version of the RAID-01 bundle installed on your server.

2. Enter the `ioscan -kfnd ciss` command:

   ```
   # ioscan -kfnd ciss
   ```

   If the Smart Array Controller software is installed correctly, the generated output looks similar to this:

   ```
   # ioscan -kfnd ciss
   Class     I  H/W Path       Driver   S/W State   H/W Type     Description
   ============================================================================
   ext_bus   5  0/6/0/0/0/0/1/0/0/0  ciss     CLAIMED     INTERFACE    PCIe SAS SmartArray P400 RAID Controller
                                /dev/ciss5
   ```

   If the software is not installed correctly, reinstall it using `swinstall`. See "Installing software" (page 10).

4 Installing, verifying, and configuring the controller

Card installation varies by server type and model. The following procedures are a general guideline for installing the card. For more information, see your server documentation.

WARNING! To reduce the risk of personal injury or damage to the equipment, consult the server documentation safety information. Ensure that you are properly grounded before continuing the installation procedure to not damage electronic components from electrostatic discharge (ESD). For more information on ESD safety procedures, see Appendix A (page 35).

Review the installation procedures below before performing any installation.

Installing the controller hardware

WARNING! To reduce the risk of personal injury or damage to the equipment, consult the safety information and user documentation provided with the server before attempting the installation.

Many servers are capable of providing energy levels that are considered hazardous and are intended to be serviced only by qualified personnel who have been trained to deal with these hazards. Do not remove enclosures or attempt to bypass any interlocks that may be provided for the purpose of removing these hazardous conditions.

To install the card, follow these steps:

1. Remove or open the access panel.

   WARNING! To reduce the risk of personal injury from hot surfaces, allow the drives and the internal system components to cool before touching them.

2. Select an available x8 or larger PCIe slot.
3. Remove the slot cover. Save the retaining screw, if one is present.
4. Install the cache module on the controller:
   a. Install the cache module in the DIMM socket.
   b. Verify that the ejector latches on the DIMM socket are firmly closed.
5. Slide the controller board along the slot alignment guide, if one is present, and then press the board firmly into the slot so that the contacts on the board edge are properly seated in the system board connector.
6. Secure the controller board in place with the retaining screw. If the slot alignment guide has a latch (near the rear of the board), close the latch.
7. Close or replace the access panel, then secure it with thumbscrews, if any are present.

   CAUTION: Do not operate the server for long periods with the access panel open or removed. Operating the server in this manner results in improper airflow and improper cooling that can lead to thermal damage.

Connecting and verifying external storage devices

Follow the procedures in this section to connect and verify external storage devices.

IMPORTANT: SATA disks are not supported when the Smart Array controller is in HBA mode.

Connecting external storage devices

To connect external storage devices, follow these steps:

1. Power off the server, if necessary.

2. Connect an external SAS cable to the external port of the controller:
   a. Pull back the tab on the mini SAS 4x connector on the cable.
   b. Insert the cable connector into the external port of the controller.
   c. Release the tab.

   For more information on SAS cables, see Appendix B (page 36).
3. Connect the other end of the cable to the SAS input connector of the external storage enclosure or tape devices. If you are connecting both disk and tape devices, do not combine them on the same SAS connector. Connect disk devices to one connector, and tape devices to the other.
   - If the storage device uses a standard SAS 4x connector, insert the cable connector into the enclosure connector, and then tighten the lock screws on the cable connector.
   - If the storage device uses a mini SAS 4x connector, pull back the tab on the cable connector, insert the cable connector into the enclosure connector, and then release the tab.
   - For tape devices, use the cable supplied with the device or see the tape device QuickSpecs to determine the recommended cables.
4. Power on the external storage devices.
5. Power on the server.

Verifying external disk enclosure connections

Use `saupdate` from the UEFI Shell to verify the external disk enclosures connected to the Smart Array controller. For information about accessing and using the UEFI shell, see the server documentation.

To verify the external disk enclosure connections with `saupdate`, follow these steps:

1. Prepare to run `saupdate` from the Offline Diagnostics CD or the UEFI partition:
   - To run `saupdate` from the Offline Diagnostic CD:
     a. Place the Offline Diagnostic CD containing `saupdate.efi` in the CD drive before booting the system.
     b. Boot the system to the UEFI Shell prompt.
     c. Locate the `cdrom` entry in the list of mapped devices, and change to the device by entering its associated `fs` number (for example, **`fs0`**) under UEFI Shell prompt.
     d. If the UEFI utility is not located in the root directory, move to the directory where the file is located, for example:

     ```
     fs0:\>cd \EFI\HP\TOOLS\IO_CARDS\SmartArray
     ```

   - To run `saupdate` from the UEFI partition:
     a. Download the Smart Array UEFI update utility `saupdate.efi` and copy it to the UEFI partition.
     b. Boot the system to the UEFI Shell and change directories to the UEFI partition.
     c. If the UEFI utility is not in the root directory, move to the directory where the file is located, for example:

     ```
     fs0:\>cd \EFI\HP\TOOLS\IO_CARDS\SmartArray
     ```

2. Use `saupdate LIST` to display all detected Smart Array controllers and the active firmware versions. For example:

```
fs0:\EFI\TOOLS> saupdate list
*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                             Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

         Seg  Bus  Dev  Func        Description          Version    Build

          1   71    0    0       HP Smart Array P411      3.22         0

            External Enclosures Connected :
            Index       Description             Version
               0        MSA60                   2.18
               1        MSA70                   2.18
               2        MSA60                   2.18
               3        MSA70                   2.18
```

In this example, four Modular Storage Array enclosures are connected to the Smart Array P411 Controller at segment 1, bus 71, device 0, function 0.

Verifying tape device connections

To verify that tape devices are connected to the controller, follow these steps:

1. Exit to the UEFI Shell prompt. For information about accessing and using the UEFI shell, see the server documentation.

2. Use the `reconnect -r` shell command to reinitialize the cards connected to the server. As the command executes, watch for a message indicating that one or more tape devices has been detected. For example:

```
Shell> reconnect -r
HP PCI-X 2Port 2Gb Fibre Channel Adapter (driver 1.50, firmware 3.03.171)
HP PCI-X 2Port 2Gb Fibre Channel Adapter (driver 1.50, firmware 3.03.171)
HP Smart Array P411 Controller     (version 3.66)
Currently the controller is in HBA mode
                                                                                HP Smart Array
 P411 Controller     (version 3.66)  0 Logical Drives
     Tape Drive(s) Detected:
     Port: 1E, box:0, bay:  1 (SAS)
Currently the controller is in RAID mode
ReconnectController(0,0,0) : Status = Success
Shell>
```

In this example, two Fibre Channel adapters and a Smart Array P411 controller are installed. The Smart Array P411 controller has a tape device connected at Port 1E, box 0, bay 1.

Verifying and updating controller firmware offline

Follow the procedures in this section to verify that the correct adapter firmware version is installed before you boot the server. Firmware version requirements are found in the *HP Smart Array RAID Controllers Support Matrix* at:

http://www.hp.com/go/smart-array-raid-docs

⚠ **WARNING!** HP Smart Array controllers have specific adapter firmware version requirements for use in HP Integrity servers. Follow the steps in this section to ensure that the correct firmware version is installed.

Verifying the controller firmware

Use `saupdate` from the UEFI Shell to verify the firmware image on the controller.

To verify the controller firmware with `saupdate`, follow these steps:

1. Prepare to run `saupdate` from the Offline Diagnostics CD or the UEFI partition:
   - To run `saupdate` from the Offline Diagnostic CD:
     a. Place the Offline Diagnostic CD containing `saupdate.efi` in the CD drive before booting the system.
     b. Boot the system to the UEFI Shell prompt.
     c. Locate the `cdrom` entry in the list of mapped devices, and change to the device by entering its associated `fs` number (for example, **`fs0`**) under UEFI Shell prompt.
     d. If the UEFI utility is not located in the root directory, move to the directory where the file is located, for example:

     ```
     fs0:\>cd \EFI\HP\TOOLS\IO_CARDS\SmartArray
     ```

   - To run `saupdate` from the UEFI partition:
     a. Download the Smart Array UEFI update utility `saupdate.efi` and copy it to the UEFI partition.
     b. Boot the system to the UEFI Shell and change directories to the UEFI partition.
     c. If the UEFI utility is not in the root directory, move to the directory where the file is located, for example:

     ```
     fs0:\>cd \EFI\HP\TOOLS\IO_CARDS\SmartArray
     ```

2. Use `saupdate LIST` to display all detected Smart Array controllers and the active firmware versions. For example:

```
fs0:\EFI\TOOLS> saupdate list
********************************************************************************
```

```
                    Smart Array Offline Firmware Update Utility
                                Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*****************************************************************************

         Seg  Bus  Dev  Func        Description          Version    Build

          1   55    0    0       HP Smart Array P812      3.22         0

            External Enclosures Connected :
            Index       Description             Version
               2        MDS600                  2.62
               3        MDS600                  2.62
               4        P812 INT EXP            3.02


          1   71    0    0       HP Smart Array P411      3.22         0

            External Enclosures Connected :
            Index       Description             Version
               0        MSA60                   2.18
               1        MSA70                   2.18
               2        MSA60                   2.18
               3        MSA70                   2.18


          1   C7    0    0       HP Smart Array P812      3.22         0

            External Enclosures Connected :
            Index       Description             Version
               2        D2700 SAS AJ941A                0052
               3        D2600 SAS AJ940A                0052
               4        P812 INT EXP            3.02


          1   E4    0    0       HP Smart Array P411      3.22         0

            External Enclosures Connected :
            Index       Description             Version
               0        MDS600                  2.62
```

In this example, the system contains two Smart Array P411 Controllers. The first is at segment 1, bus 71, device 0, function 0. The second is at segment 1, bus E4, device 0, function 0. Both controllers are running firmware version 3.22.

3. Compare the installed firmware version to the minimum recommended firmware version found in the *HP Smart Array RAID Controllers Support Matrix* at:

   http://www.hp.com/go/smart-array-raid-docs

   If the controller firmware meets the minimum recommended version, no further action is necessary.

Downloading the firmware update

To locate and download firmware for the Smart Array P411/256 Controller, follow these steps:

1. Go to the Business Support Center, at:

   http://www.hp.com/go/bizsupport
2. Search for "Smart Array P411".
3. In the "Narrow search using only" section, click **Drivers and software**.
4. Locate and click the link for the firmware download package.
5. Review the installation instructions and release notes on the download page.
6. Download the firmware.
7. Follow the procedures supplied with the update package to install the firmware update.

Updating the controller firmware

NOTE: The following is a generic procedure to update firmware from the UEFI shell. HP recommends that you follow the procedures supplied with the update package to install the firmware update.

Use `saupdate` from the UEFI Shell to update the firmware image on the controller.:

To update the controller firmware with `saupdate`, follow these steps:

1. Prepare to run `saupdate` from the Offline Diagnostics CD or the UEFI partition:
   - To run `saupdate` from the Offline Diagnostic CD:
     a. Download the firmware and copy it to the UEFI partition.
     b. Place the Offline Diagnostic CD containing `saupdate.efi` in the CD drive before booting the system.
     c. Boot the system to the UEFI Shell prompt.
     d. Locate the `cdrom` entry in the list of mapped devices, and change to the device by entering its associated `fs` number (for example, **`fs0`**) under UEFI Shell prompt.
     e. If the UEFI utility and firmware image files are not located in the root directory, move to the directory where these files are located, for example:

     ```
     fs0:\> cd \EFI\HP\TOOLS\IO_CARDS\SmartArray
     ```

   - To run `saupdate` from the UEFI partition:
     a. Download the Smart Array UEFI update utility `saupdate.efi` and copy it to the UEFI partition.
     b. Download the firmware and copy it to the UEFI partition.
     c. Boot the system to the UEFI Shell and change directories to the UEFI partition.

IMPORTANT: The firmware image file and `saupdate.efi` must be located in the same directory. If they are not, copy them to the UEFI partition and run `saupdate` from there.

2. Use `saupdate UPDATE` to update the firmware on the controller.

   To update a single controller, the syntax of the `saupdate UPDATE` command is as follows:

   `saupdate UPDATE <seg:bus:dev:func> <smartarray_firmware_file>`

   For example, to update the controller at segment 1, bus E4, device 0, function 0 from the example output above:

   `fs0:\> saupdate UPDATE 1:E4:0:0 sandman.bin`

   To update all controllers of the same model in the server, the syntax of the `saupdate UPDATE` command is as follows:

   `saupdate UPDATE <model> <smartarray_firmware_file>`.

   For example, to update all Smart Array P411 controllers in the system:

```
fs1:\> saupdate update P411 sandman.bin

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                              Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

 Updating controller in Seg: 1, Bus: 71, Dev: 0, Func: 0
 Current firmware version 3.22  Build 0

     Percentage completed: 100%

     Activating firmware now, this may take several minutes.

     Resetting and reinitializing controller.

     Retrieving firmware version, this may take several minutes.

 Current controller firmware version is 3.26 Build 0

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                              Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

 Updating controller in Seg: 1, Bus: E4, Dev: 0, Func: 0
 Current firmware version 3.22  Build 0

     Percentage completed: 100%

     Activating firmware now, this may take several minutes.

     Resetting and reinitializing controller.

     Retrieving firmware version, this may take several minutes.

 Current controller firmware version is 3.26 Build 0
```

   You can also update all controllers in the server that are supported by a firmware file. The syntax of the `saupdate UPDATE` command is as follows:

   `saupdate UPDATE all <smartarray_firmware_file>`.

Verifying the firmware update

To verify that the firmware update was successful, follow these steps:

1. After updating the firmware, cycle the power on the system and on any external JBODS connected to the system.

2. Use `saupdate list` to confirm that the correct firmware version is installed. See "Verifying the controller firmware" (page 14).

   For example:

```
fs0:\EFI\TOOLS> saupdate list

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                              Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

         Seg  Bus  Dev  Func        Description          Version    Build

          1   55    0    0       HP Smart Array P812      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               2        MDS600                  2.62
               3        MDS600                  2.62
               4        P812 INT EXP            3.02


          1   71    0    0       HP Smart Array P411      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               0        MSA60                   2.18
               1        MSA70                   2.18
               2        MSA60                   2.18
               3        MSA70                   2.18


          1   C7    0    0       HP Smart Array P812      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               2        D2700 SAS AJ941A                0052
               3        D2600 SAS AJ940A                0052
               4        P812 INT EXP            3.02


          1   E4    0    0       HP Smart Array P411      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               0        MDS600                  2.62
```

HELP

To display usage text, program version number, and build date, enter `saupdate` without any arguments.

```
fs1:\> saupdate

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                              Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

 Usage: saupdate LIST
        For Controller Flash:
        saupdate UPDATE [<seg:bus:dev:func> | all | <model>  ] <file name>

        For Enclosure Flash:
        saupdate UPDATE [ <seg:bus:dev:func:encl_index> ] <file name>
        saupdate UPDATE [ <seg:bus:dev:func> all_encl ] <file name>
```

```
For querying/changing Controller mode:
saupdate GET_MODE [ <seg:bus:dev:func> | all | <model> ]
saupdate SET_MODE [ <seg:bus:dev:func> | all | <model> ] [ hba | raid ] [-f]
```

Error messages

The following error messages might appear when using `saupdate`:

- When keyword `LIST` or `UPDATE` is misspelled or extra parameters are specified:

  ```
  Error: Syntax Error

  Usage: saupdate LIST or saupdate UPDATE [ | all ]
  ```

- When the controller ID in the `saupdate UPDATE` command is not correct:

  ```
  No matching controller found
  ```

- When a firmware file does not exist in the `saupdate UPDATE` directory:

  ```
  SANDMAN.BIN does not exist.
  File SANDMAN.BIN: Not Found
  ```

- When an invalid or corrupted firmware file is specified in the `saupdate UPDATE` command:

  ```
  SANDMAN.BIN does not exist.
  File SANDMAN.BIN: invalid or corrupted
  ```

Determining and setting the controller mode

The Smart Array P411/256 controller has two operating modes:

- Use RAID mode to take advantage of hardware-based fault-tolerant data storage methods such as RAID 1, RAID 1+0, or RAID 5. This reduces the amount of available storage space. RAID mode is supported on HP-UX and Windows; it is the required operating mode for servers running Windows.
- Use HBA mode to access raw disks for increased storage capacity, to allow fault-tolerant storage to be managed by the enclosure firmware, or to implement software-based RAID modes using a volume manager.

IMPORTANT: SATA disks are not supported when the Smart Array controller is in HBA mode.

Tape devices are supported in both operating modes.

Use the `saupdate.efi` command with the `get_mode` and `set_mode` options to query or change the mode of the Smart Array P410i and Smart Array P411 controllers to HBA or RAID. Querying or changing modes is not supported for other controllers.

GET_MODE

This option displays the current mode of the controllers.

Syntax

```
saupdate get_mode <controller>
```

`<controller>` can be any one of the strings listed in Table 1.

Table 1 `<controller> strings`

`<controller>`	**Meaning**
`<seg:bus:dev:func>`	A controller having the PCI segment id, bus id, device id and function id is addressed
`all`	Addresses all controllers in the system
`<model>`	Controllers of a particular type indicated by the `<model>` string are addressed

```
fs2:\> saupdate get_mode 0:2:0:0

The controller at 0:2:0:0 is in HBA mode

fs2:\> saupdate get_mode p410i

The controller at 0:2:0:0 is in HBA mode

The controller at 0:42:0:0 is in HBA mode

The controller at 0:82:0:0 is in HBA mode

The controller at 0:C2:0:0 is in HBA mode

fs2:\> saupdate get_mode all

The controller at 0:2:0:0 is in HBA mode

The controller at 0:42:0:0 is in HBA mode

The controller at 0:82:0:0 is in HBA mode

The controller at 0:C2:0:0 is in HBA mode

fs2:\>
```

SET_MODE

IMPORTANT: If you are using HBA mode, do not install any disk that has previously been a part of a RAID volume into the system.

Use `set_mode` to change the mode of the controller. If the controller is already in the required mode the following message appears:

`The controller at <seg:bus:dev:func> is already in HBA|RAID mode`

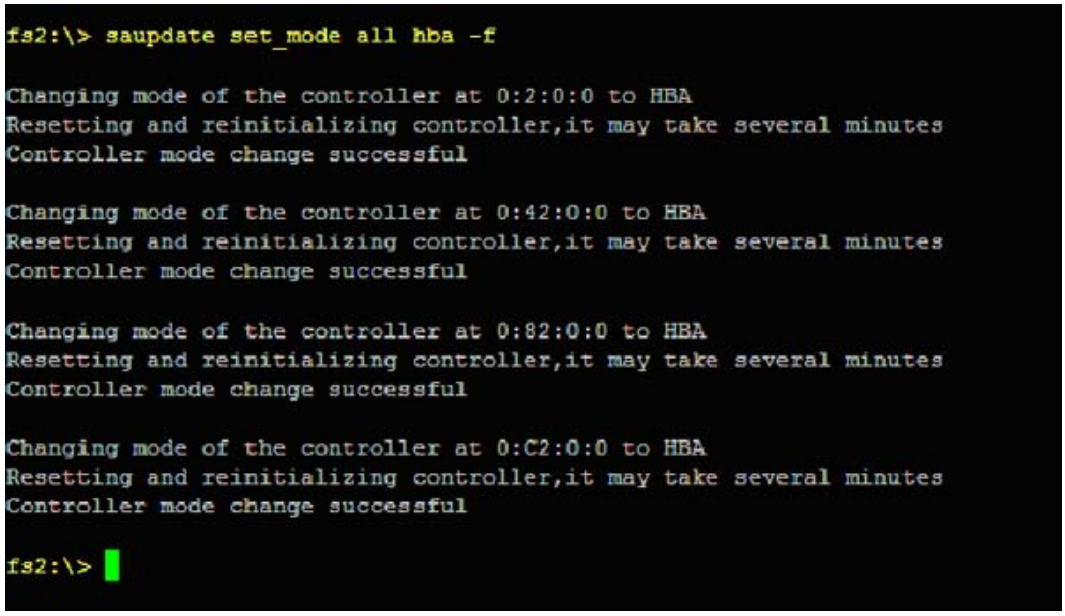
Syntax

`saupdate set_mode <controller> <hba|raid> [-f]`

`<controller>` can be any one of the strings listed in Table 1 (page 20).

An alert message about the possible data loss is displayed when a mode change command is issued. A confirmation is required before the actual mode change is made. This ensures that an unintentional change of mode does not happen.

The `–f` indicates the user is aware of the changes that are being made, and no warning message or confirmation regarding the mode change is needed.



NOTE: Commands are not case-sensitive. A system reset is not required after a mode change.

NOTE: After changing the mode, perform a `reconnect -r` command at UEFI.

Verifying and updating enclosure firmware offline

Follow the procedures in this section to verify and update the firmware in an external enclosure.

Verifying the enclosure firmware

Use `saupdate` from the UEFI Shell to verify the firmware image on the enclosure.

To verify the enclosure firmware with `saupdate`, follow these steps:

1. Prepare to run `saupdate` from the Offline Diagnostics CD or the UEFI partition:
   - To run `saupdate` from the Offline Diagnostic CD:
     a. Place the Offline Diagnostic CD containing `saupdate.efi` in the CD drive before booting the system.
     b. Boot the system to the UEFI Shell prompt.
     c. Locate the `cdrom` entry in the list of mapped devices, and change to the device by entering its associated `fs` number (for example, **`fs0`**) under UEFI Shell prompt.
     d. If the UEFI utility is not located in the root directory, move to the directory where the file is located, for example:

        `fs0:\>` **`cd \EFI\HP\TOOLS\IO_CARDS\SmartArray`**

   - To run `saupdate` from the UEFI partition:
     a. Download the SA UEFI update utility `saupdate.efi` and copy it to the UEFI partition.
     b. Boot the system to the UEFI Shell and change directories to the UEFI partition.
     c. If the UEFI utility is not located in the root directory, move to the directory where the file is located, for example:

        `fs0:\>` **`cd \EFI\HP\TOOLS\IO_CARDS\SmartArray`**

2. • Use `saupdate LIST` to display all detected Smart Array controllers along with the active firmware versions. For example:

```
fs0:\EFI\TOOLS> saupdate list

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                             Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

         Seg  Bus  Dev  Func        Description          Version    Build

          1   55    0    0       HP Smart Array P812      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               2        MDS600                  2.62
               3        MDS600                  2.62
               4        P812 INT EXP            3.02


          1   71    0    0       HP Smart Array P411      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               0        MSA60                   2.18
               1        MSA70                   2.18
               2        MSA60                   2.18
               3        MSA70                   2.18


          1   C7    0    0       HP Smart Array P812      2.69        12

            External Enclosures Connected :
            Index       Description             Version
               2        D2700 SAS AJ941A                0038
               3        D2600 SAS AJ940A                0052
               4        P812 INT EXP            2.50


          1   E4    0    0       HP Smart Array P411      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               0        MDS600                  2.60
```

In this example, the server contains multiple MSA60 and MSA70 enclosures connected to the Smart Array P411 at segment 1, bus 71, device 0, function 0; enclosure firmware 2.18 is installed. There is one MDS600 enclosure connected to the Smart Array P411 at segment 1, bus E4, device 0, function 0, index 0; enclosure firmware version 2.60 is installed.

Downloading the enclosure firmware

To locate and download firmware for HP StorageWorks enclosures, follow these steps:

1. Go to the HP Software & Driver Downloads website, at:
   http://welcome.hp.com/country/us/en/support.html?pageDisplay=drivers
2. Search for the name of your enclosure; for example, "MDS600" or "MSA70".
3. In the search results, click **Cross operating system (BIOS, Firmware, Diagnostics, etc.)**.
4. Click **Download** to download the firmware package.

Updating the enclosure firmware

NOTE: The following is a generic procedure to update firmware from the UEFI shell. HP recommends that you follow the procedures supplied with the update package to install the firmware update.

Use `saupdate` from the UEFI Shell to update the firmware image on the enclosure.

To update the enclosure firmware with `saupdate`, follow these steps:

1. Prepare to run `saupdate` from the Offline Diagnostics CD or the UEFI partition:
   - To run `saupdate` from the Offline Diagnostic CD:
     a. Download the firmware and copy it to the UEFI partition.
     b. Place the Offline Diagnostic CD containing `saupdate.efi` in the CD drive before booting the system.
     c. Boot the system to the UEFI Shell prompt.
     d. Locate the `cdrom` entry in the list of mapped devices, and change to the device by entering its associated `fs` number (for example, **`fs0`**) under UEFI Shell prompt.
     e. If the UEFI utility and firmware image files are not located in the root directory, move to the directory where these files are located, for example:

     ```
     fs0:\> cd \EFI\HP\TOOLS\IO_CARDS\SmartArray
     ```

   - To run `saupdate` from the UEFI partition:
     a. Download the Smart Array UEFI update utility `saupdate.efi` and copy it to the UEFI partition.
     b. Download the firmware and copy it to the UEFI partition.
     c. Boot the system to the UEFI Shell and change directories to the UEFI partition.

IMPORTANT: The firmware image file and `saupdate.efi` must be located in the same directory. If they are not, copy them to the UEFI partition and run the `saupdate` from there.

2. Use `saupdate UPDATE` to update the firmware on the controller:
   - To update a single enclosure, use this command:

     `saupdate UPDATE <seg:bus:dev:func:encl_index> <firmware_file>`

     For example, to update the enclosure at segment 1, bus E4, device 0, function 0, index 0 with the firmware file `T-262.fuf`:

```
fs1:\> saupdate update 1:E4:0:0:0 T-262.fuf

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                              Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

 Updating Enclosure in Seg: 1, Bus: E4, Dev: 0, Func: 0, Index: 0


.....................................................................
.....................................................................
................................

     Activating firmware now, this may take several minutes.

    Flashing complete. New FW will be loaded when enclosure is reset.
```

   - To update all attached enclosures, use this command:

     `saupdate UPDATE <seg:bus:dev:func> all_encl <firmware_file>`

Verifying the firmware update

1. After updating the firmware, cycle the power on the system and on any external JBODS connected to the system.
2. Use `saupdate LIST` to confirm that the correct firmware version is installed. See "Verifying the controller firmware" (page 14).

   For example:

```
fs0:\EFI\TOOLS> saupdate list

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                              Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

         Seg  Bus  Dev  Func        Description          Version    Build

          1   55    0    0       HP Smart Array P812      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               2        MDS600                  2.62
               3        MDS600                  2.62
               4        P812 INT EXP            3.02


          1   71    0    0       HP Smart Array P411      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               0        MSA60                   2.18
               1        MSA70                   2.18
               2        MSA60                   2.18
               3        MSA70                   2.18


          1   C7    0    0       HP Smart Array P812      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               2        D2700 SAS AJ941A                0052
               3        D2600 SAS AJ940A                0052
               4        P812 INT EXP            3.02


          1   E4    0    0       HP Smart Array P411      3.26         0

            External Enclosures Connected :
            Index       Description             Version
               0        MDS600                  2.62
```

HELP

To display usage text, program version number, and build date, enter `saupdate` without any arguments.

```
fs1:\> saupdate

*******************************************************************************
                  Smart Array Offline Firmware Update Utility
                              Version 2.09.10.02

          (C) Copyright 2009 Hewlett-Packard Development Company, L.P.
*******************************************************************************

 Usage: saupdate LIST
        For Controller Flash:
```

```
saupdate UPDATE [<seg:bus:dev:func> | all | <model>  ] <file name>

For Enclosure Flash:
saupdate UPDATE [ <seg:bus:dev:func:encl_index> ] <file name>
saupdate UPDATE [ <seg:bus:dev:func> all_encl ] <file name>

For querying/changing Controller mode:
saupdate GET_MODE [ <seg:bus:dev:func> | all | <model> ]
saupdate SET_MODE [ <seg:bus:dev:func> | all | <model> ] [ hba | raid ] [-f]
```

Updating tape device firmware

To update tape device firmware, use the HP StorageWorks Library and Tape Tools software.

HP Library and Tape Tools is a robust diagnostic tool for all of HP's tape storage products. The software performs firmware upgrades, verification of device operation, failure analysis and a range of utility functions.

You can download HP StorageWorks Library and Tape Tools and its documentation from the HP website at:

http://h18000.www1.hp.com/products/storageworks/ltt/index.html

Using Option ROM Configuration for Arrays (ORCA)

Smart Array Series Controllers support Option ROM Configuration for Arrays (ORCA) on HP Integrity servers. ORCA enables you to create, view, and delete logical drives.

Accessing ORCA

To reach the ORCA main menu, use the `drvcfg -s` <*dh*> <*ch*> command.

Where:

<dh> The device handle of the Smart Array card.

<ch> The controller handle of the Smart Array card.

To launch ORCA, follow these steps:

1. Boot the server to the UEFI shell.
2. To determine the driver handle for the HP Smart Aray P411/256, use the `drivers -b` command. For example:

```
fs1:\P411> drivers -b
            T   D
D           Y C I
R           P F A
V  VERSION  E G G #D #C DRIVER NAME                          IMAGE NAME
== ======== = = = == == ================================== ==================
18 00000020 B - -  8 21 PCI Bus Driver                      PciBus
23 03001300 B X X  1  1 Intel(R) PRO/1000 3.0.13 EFI-64     PciROM:0A:01:01:000
24 03001300 B X X  1  1 Intel(R) PRO/1000 3.0.13 EFI-64     PciROM:0A:01:00:000
27 00000306 B X X  1  3 Smart Array SAS Driver v3.06        PciROM:10:00:00:001 l
2A 00002160 B - -  1  1 Intel(R) PRO/1000 v2.16 EFI-64      PciROM:49:02:01:000
2B 00002160 B - -  1  1 Intel(R) PRO/1000 v2.16 EFI-64      PciROM:49:02:00:000
2C 00000258 B - -  1  3 Smart Array SAS Driver v2.58        PciROM:49:01:00:001
30 00000304 B - -  1  2 Smart Array SAS Driver v3.04        PciROM:8B:00:00:001
36 00040016 D X X  1  - Emulex SCSI Pass Thru Driver        elxcli400a6
3B 00000020 D X -  2  - Usb Keyboard Driver                 UsbKb
3C 00000020 D - -  1  - Usb Mouse Driver                    UsbMouse
3D 00000020 ? - -  -  - Usb Cbi0 Mass Storage Driver        UsbCbi0
3E 00000020 ? - -  -  - Usb Cbi1 Mass Storage Driver        UsbCbi1
3F 00000010 ? - -  -  - UGA Console Driver                  GraphicsConsole
40 00000000 D - -  1  - PCI VGA Mini Port Driver            PciVgaMiniPort
41 00000010 D - -  1  - VGA Class Driver                    VgaClassDriver
42 00000013 B - -  1  1 Serial 16550 UART Driver            Serial16550
43 00000010 B - -  1  1 Serial Terminal Driver              Terminal
44 00000010 D - -  2  - Platform Console Management Driver  ConPlatform
45 00000010 D - -  3  - Platform Console Management Driver  ConPlatform
46 00000010 B - -  3  3 Console Splitter Driver             ConSplitter
47 00000010 B - -  1  1 Console Splitter Driver             ConSplitter
48 00000011 B - -  2  2 Console Splitter Driver             ConSplitter
49 00000011 B - -  2  2 Console Splitter Driver             ConSplitter
4D 00000040 D - -  2  - Usb Ohci Driver                     SysROM:Usb Ohci Dri
```

```
4E 00000020 B - -  2  6 USB Bus Driver                      SysROM:USB Bus Driv
4F 00000020 D - -  2  - Usb Bot Mass Storage Driver         SysROM:USB Bot Mass
50 00000020 D - -  2  - Generic USB Mass Storage Driver     SysROM:Generic USB
5C 00000010 D - - 22  - Generic Disk I/O Driver             DiskIo
5D 00000011 B - -  7 14 Partition Driver(MBR/GPT/El Torito) Partition
5E 00000010 D - -  2  - FAT File System Driver              Fat
5F 00000011 ? X X  -  - PCI IDE/ATAPI Bus Driver            Ide
60 00000010 ? - -  -  - Intel(R) PRO 100 UNDI Driver        Undi
62 00000021 D - -  4  - Simple Network Protocol Driver      Snp3264
64 00000020 D - -  4  - PXE Base Code Driver                PxeBc
66 00000020 D - -  4  - PXE DHCPv4 Driver                   PxeDhcp4
67 00000010 ? - -  -  - ARP Network Service Driver          Arp
68 00000010 ? - -  -  - DHCP Protocol Driver                Dhcp4
69 00000010 ? - -  -  - IP4 Network Service Driver          Ip4
6A 00000010 ? - -  -  - IP4 CONFIG Network Service Driver   Ip4Config
6B 00000010 ? - -  -  - MNP Network Service Driver          Mnp
6C 00000010 ? - -  -  - MTFTP4 Network Service              Mtftp4
6D 00000010 ? - -  -  - Tcp Network Service Driver          Tcp4
6E 00000010 ? - -  -  - UDP Network Service Driver          Udp4
70 00090404 ? X X  -  - Broadcom Gigabit Ethernet Driver    SysROM:Broadcom Gig
71 00000031 D - -  1  - SCSI Bus Driver                     SysROM:SCSI Bus Dri
72 00000020 ? - -  -  - Scsi Disk Driver                    SysROM:SCSI Disk Dr
73 00000030 ? - -  -  - SCSI Tape Driver                    SysROM:SCSI Tape Dr
```

1 The entry for the Smart Array SAS controller.

The drive handles are shown in the left column. Take note of the drive handle for the Smart Array SAS controller. In this example, the drive handle is **27**.

3. To determine the controller handle for the HP Smart Aray P411/256, use the `drvcfg` command with no arguments. For example:

```
fs1:\P411> drvcfg
Configurable Components
  Drv[23]  Ctrl[26]  Lang[eng]
  Drv[24]  Ctrl[25]  Lang[eng]
  Drv[36]  Ctrl[38]  Lang[eng]
  Drv[3B]  Ctrl[53]  Lang[eng]
  Drv[3B]  Ctrl[56]  Lang[eng]
  Drv[27]  Ctrl[29]  Lang[eng] 1
```

1 The entry for the Smart Array SAS controller.

Locate the row for the drive handle (“Drv”) that corresponds to the Smart Array SAS controller. Take note of the controller handle (“Ctrl”) that is displayed. In this example, the controller handle is **29**.

4. To launch ORCA, enter the `drvcfg -s <dh> <ch>` command. For example:

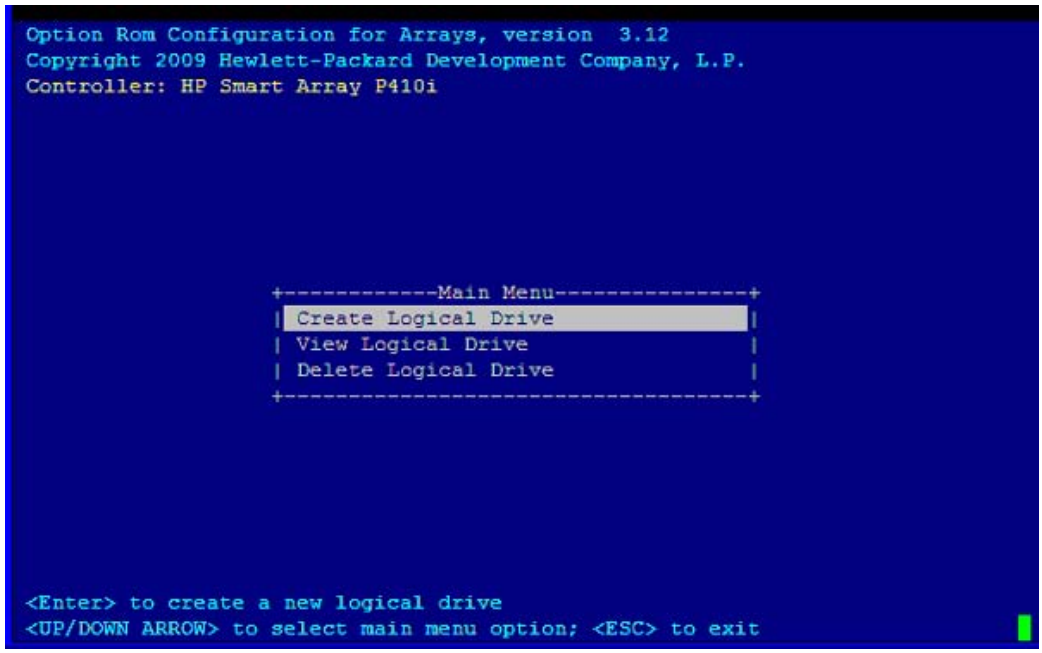
```
fs1:\P411> drvcfg -s 27 29
Set Configuration Options
```

NOTE: In order for ORCA to launch, at least one disk must be connected to the Smart Array controller.

NOTE: In order for ORCA to launch, there must be 32 or fewer logical drives. If more than 32 logical drives are defined, a warning appears indicating that the number of logical drives that can be handled by ORCA has been exceeded.

The ORCA main menu appears:

Figure 2 ORCA Main Menu Screen

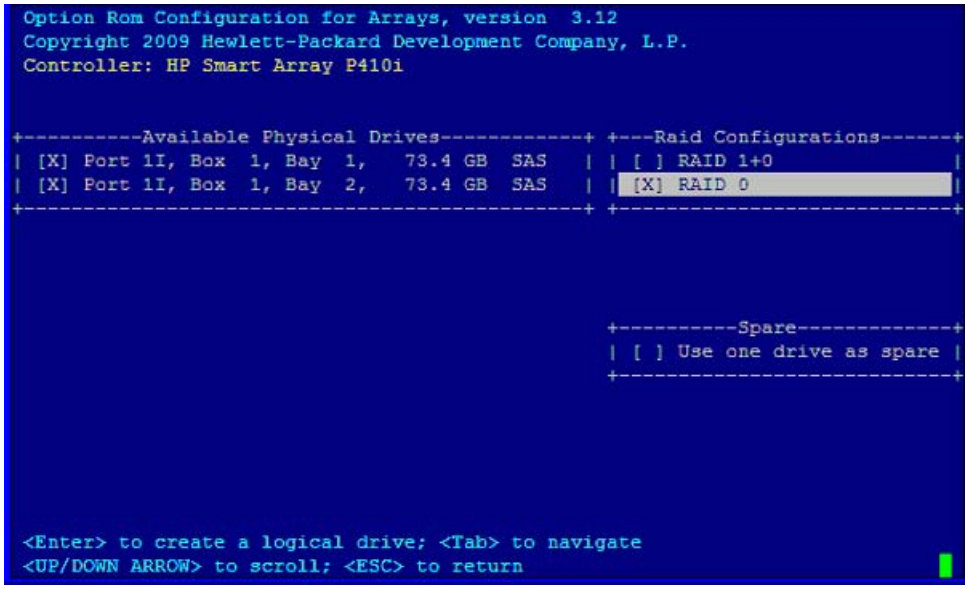


NOTE: ORCA appearance, functionality, and keystrokes might differ between Smart Array controllers. This document provides a generic procedure using a Smart Array P410i controller as an example. Always follow the on-screen prompts when using ORCA.

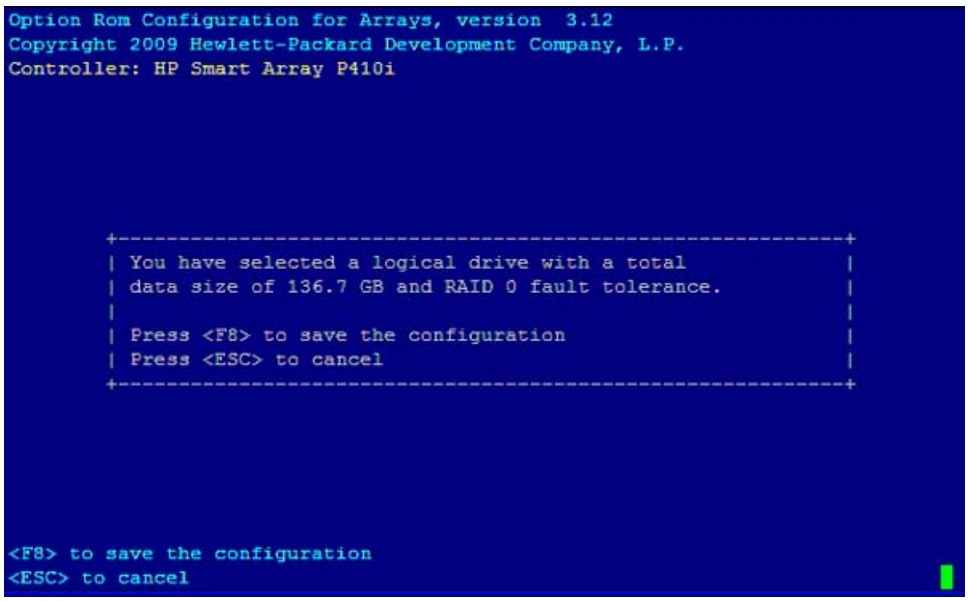
From the main menu, you can use ORCA to create, view, or delete logical drives.

Creating a logical drive

1. At the ORCA main menu, select Create Logical Drive.



2. Select the physical disks to be included in the logical drive in the Available Physical Drives section.
3. To select the Raid Configurations section and select the RAID type for the logical drive, press **Tab**.
4. To select the Spare section and assign spare disks, as needed, press Tab.
5. To create the logical drive, press **Enter**. A summary of your choices appears.

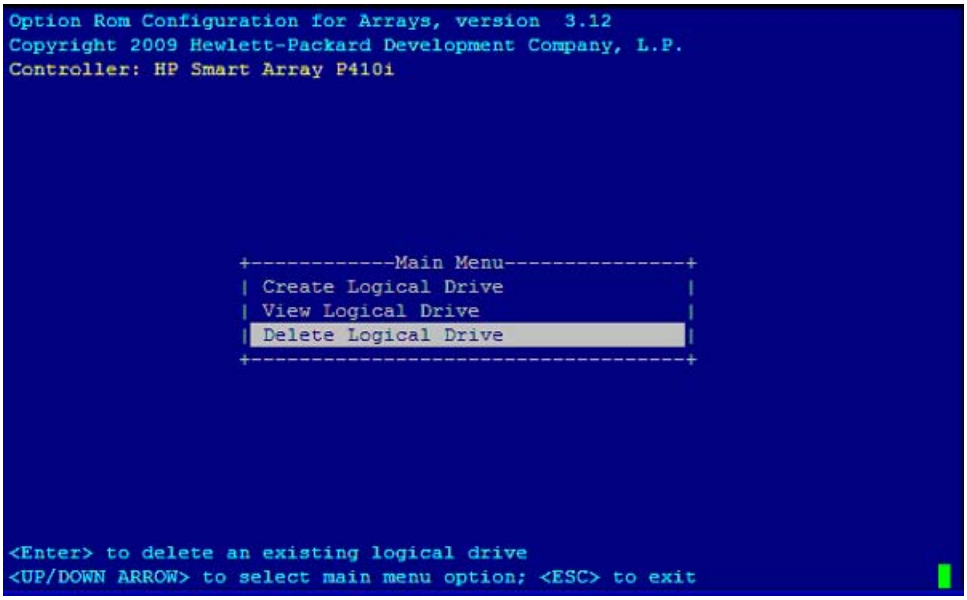


6. To save the configuration, press F8.
7. To acknowledge that the configuration was saved and return to the ORCA Main Menu, press **Enter**.

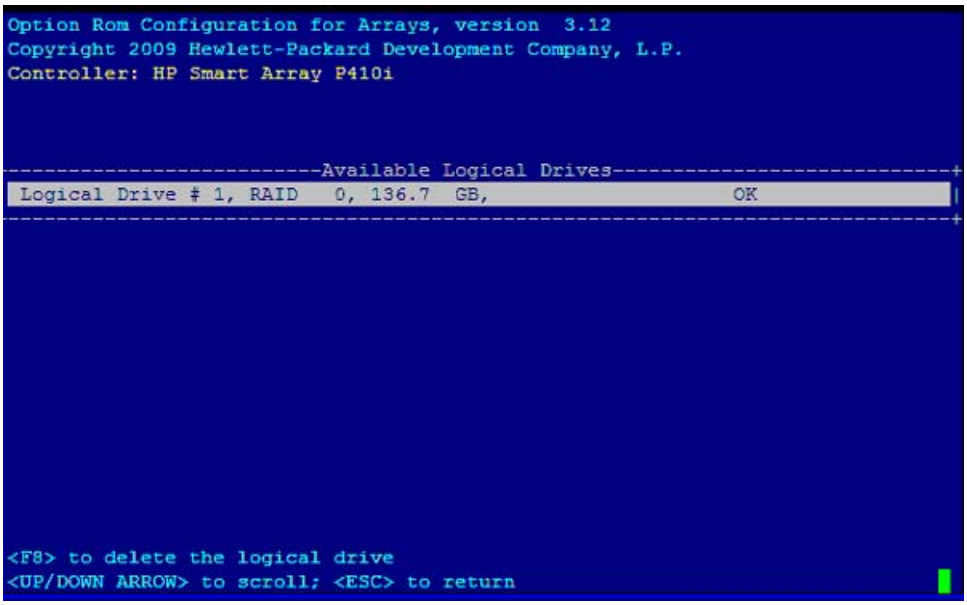
Deleting a logical drive

⚠ **WARNING!** Back up all necessary data before deleting the logical drive. When you delete a logical drive, data on the drive is not preserved.

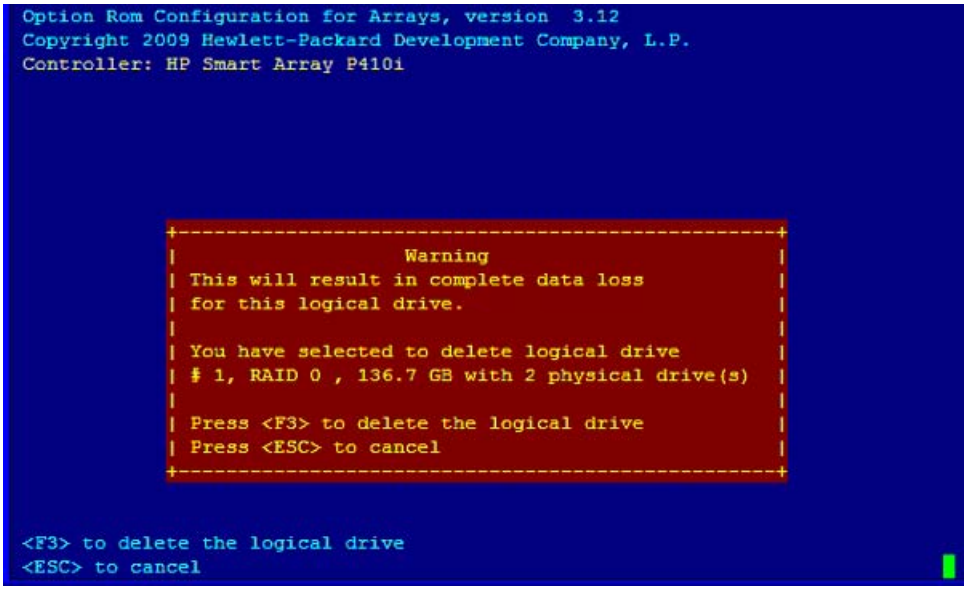
1. At the ORCA main menu, select Delete Logical Drive.



2. Select a logical drive to be deleted.



3. **F3** to delete the logical drive.



4. To acknowledge that the configuration was saved and return to the ORCA Main Menu, press **Enter**.

5 Troubleshooting

This chapter provides an overview of troubleshooting resources.

Smart Array P411 controller board runtime LEDs

The Smart Array P411 Controller board has nine runtime LEDs that indicate activities and error conditions.

Figure 3 Smart Array P411 controller board runtime LEDs

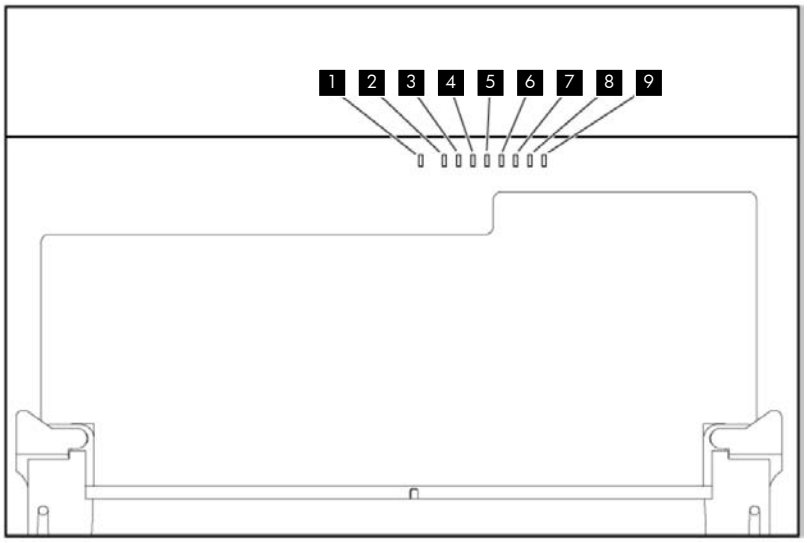


Table 2 Interpreting Smart Array 411 runtime LEDs

LED ID	Color	Name	LED name and interpretation
1	Amber	DS9	System Error LED. The controller ASIC has locked up and cannot process any commands.
2	Green	DS8	Idle Task LED. This LED, with item 3 (DS7), indicates the amount of controller CPU activity. See Table 3.
3	Green	DS7	Gas Pedal LED. This LED, with item 2 (DS8), indicates the amount of controller CPU activity. See Table 3.
4	Green	DS6	Controller Heartbeat LED. This LED flashes every two seconds to indicate controller health.
5	Green	DS5	Pending Command LED. Indicates that the controller is working on a command from the host driver.
6	Green	DS4	Activity LED for SAS port 1.
7	Green	DS3	Activity LED for SAS port 2.
8	Amber	DS2	Disk Failure LED. A physical disk connected to the controller has failed. See the Fault LED on each disk to determine the failed disk.
9	Amber	DS1	Diagnostics Error LED. One of the server diagnostics utilities has detected a controller error.

Table 3 Determining Smart Array P411 controller CPU activity level

DS7 (Gas Pedal) Status	DS8 (Idle Task) Status	Controller CPU activity level
Off	Flashing	0 to 25%
Flashing	Off	25 to 50%
On steadily	Off	50% to 75%
On steadily	On steadily	75% to 100%

NOTE: During server power on, each runtime LED illuminates randomly until POST completes.

POST messages

Smart Array Controllers provide diagnostic error messages to the server BIOS at reboot. Many of these POST messages are self-explanatory and suggest corrective actions for troubleshooting.

A full listing of the error codes that can be returned by HP Smart Array Controller Option ROM during POST is provided in the *HP Smart Array SAS Controllers For Integrity Servers Support Guide*. This document is available on the HP website at:

http://www.hp.com/go/smart-array-raid-docs

6 Support and other resources

About this document

This document describes how to install Smart Array P411/256 Controllers in HP Integrity servers.

Intended audience

This document is for system and network administrators responsible for installing, configuring, and managing fault tolerant data storage. Administrators must know operating system concepts, commands, and configuration. Administrators also must know proper electrostatic discharge (ESD) safety procedures for installing the controller hardware.

This document is not a tutorial.

Typographic conventions

This document uses the following typographical conventions:

%, $, or #	A percent sign represents the C shell system prompt. A dollar sign represents the system prompt for the Bourne, Korn, and POSIX shells. A number sign represents the superuser prompt.
`Command`	A command name or qualified command phrase.
`Computer output`	Text displayed by the computer.
`ENVIRONMENT VARIABLE`	The name of an environment variable, for example, `PATH`.
`User input`	Commands and other text that you type.
WARNING	A warning calls attention to important information that if not understood or followed will result in personal injury or nonrecoverable system problems.
CAUTION	A caution calls attention to important information that if not understood or followed will result in data loss, data corruption, or damage to hardware or software.
IMPORTANT	This alert provides essential information to explain a concept or to complete a task
NOTE	A note contains additional information to emphasize or supplement important points of the main text.

Related information

Additional information about the HP Smart Array Series Controller Family can be found at:

http://www.hp.com/go/smart-array-raid-docs

Other documents in this collection include:

HP RAID Technology Overview

HP Smart Array RAID Controllers Support Matrix

RAID-01 (ciss) Mass Storage Driver Release Notes

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docsfeedback@hp.com

Include the document title, manufacturing part number, and any comment, error found, or suggestion for improvement you have concerning this document.

A Electrostatic discharge

This appendix discusses ways to prevent damage to your system due to Electrostatic Discharge (ESD).

Handling parts

To prevent damage to your system, you must take precautions when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor can damage system boards or other static-sensitive devices. This type of damage can reduce the life expectancy of the device.

To prevent electrostatic damage, observe the following precautions:

- Avoid hand contact; transport and store products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when handling a static-sensitive component or assembly.

Grounding

Use one or more of the following grounding methods when handling or installing electrostatic-sensitive parts:

- A wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats. Use conductive field service tools.
- A portable field service kit with a folding static-dissipating work mat.

B Cable kits

This appendix provides details on the internal and external cable kits that are available for HP Smart Array SAS controllers.

Table 4 Internal SAS cable kits

Description	Part Number
Multi-lane A cable	389647-B21
Host fan cable	389650-B21
Target fan cable	389653-B21
Multi-lane B cable	389659-B21
Multi-lane 76-cm (30-in) cable	389662-B21
Multi-lane 48-cm (19-in) cable	391330-B21

Table 5 lists external cables that can be used with HP Smart Array SAS controllers.

Table 5 External SAS cable kits

Type of Cable	Length	Part Number
External SAS	1.0 m (3.3 ft)	389665-B21
External SAS	2.0 m (6.6 ft)	389668-B21
External SAS	4.0 m (13 ft)	389671-B21
External SAS	6.0 m (20 ft)	389674-B21

NOTE: All HP cables are keyed so that they cannot be installed incorrectly.

Additional cables can be ordered from an authorized HP reseller or authorized HP service provider. If the cable that you need is not listed here, or if you need additional ordering information, see the HP website at:

http://www.hp.com