

# HP Workstation: Intel® Rapid Storage Technology (RST) remapping of PCIe storage devices



The [specific](#) HP Workstations with the Intel® C236-chipset or later contain remapping hardware in the chipset. This allows a PCIe storage device connected to the Platform Controller Hub (PCH) to appear to the OS as if it were connected on an extra port on the chipset’s internal SATA RAID controller.

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## Remapping a PCIe storage device

Enabling remapping lets you manage the storage devices within the Intel® Rapid Storage Technology (RST) software framework and provides RAIDing capability for PCIe storage devices. It is the only mechanism available today to create RAIDed bootable PCIe storage devices.

**NOTE:** Remapping requires specific BIOS settings. Changing the state of a prerequisite setting to one that is not compatible with remapping will disable remapping and result in loss of RAID volumes managed by Intel® RST. If you accidentally disable remapping, change the settings back to re-enable remapping before attempting to boot to the OS.

HP recommends backing up your data and OS before changing any settings.

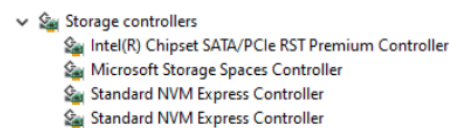
### Why remap a PCIe storage device?

The primary reason for remapping PCIe storage devices is to create a bootable RAID volume that can be managed by Intel® RST. If you do not intend to boot from a PCIe storage RAID volume, you do not need to enable remapping. In Microsoft Windows, you can create non-bootable PCIe storage software RAID volumes using the Windows Disk Management applet.

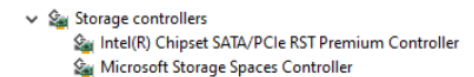
### How does PCIe RST remapping work?

Before remapping is enabled, PCIe storage devices that contain a controller appear in Windows Device Manager as separate storage controllers. After remapping is enabled, they are hidden from the OS and appear as if they are connected to the SATA RAID controller.

Before enabling remapping



After enabling remapping



PCIe storage devices can be RAIDed by Intel® RST using the BIOS third-party option ROM management menu, the Intel® UEFI RAID configuration utility (RCfgSata.efi) from within the UEFI shell, the Intel® OS command line utility (rstcli64.exe), ~~or~~ Intel® RST graphical user interface (GUI), [or Intel® Optane™ Memory and Storage Management App \(Win10 and 17.9.x afterward driver version\)](#) in the OS. The utilities are available from [hp.com](http://hp.com) as part of the Intel® RST utility/driver package for your platform.

## System requirements

### Hardware

- [Specific](#) Intel® Chipset, [Refer to Supported HP Workstation](#)
- PCIe NVMe storage device connected to a PCIe slot or M.2 slot on the PCH
- **NOTE:** All devices used in RAID volumes must have the same controller type. For example, all devices must be displayed in device manager as NVMe storage devices prior to enabling remapping. A best practice is to use devices from the same manufacturer with the same model number and capacity. Other PCIe storage devices, such as M.2 PCIe AHCI devices, may be recognized through remapping, but combining NVMe and AHCI devices in a RAID volume is not permitted by Intel® RST.

### Supported OSs

- Windows 10 x64 UEFI install
- Windows 7 x64 UEFI install
- **NOTE:** Windows 7 does not have native support for NVMe, Intel® USB 3.0 eXtensible Host Controller, or Intel® RST remapping, so a special process is needed to inject and load drivers during installation. See Appendix for more information.

## Drivers

Intel® RST driver [15.9.8.1050](#) or newer [\(related to the HP workstation platform\)](#). You can download [appropriate driver versions](#) and tools for your platform from [hp.com](#).

You must be in RAID mode to check the driver version. Using the Windows Device Manager applet, open Device Manager and navigate down to Storage controllers. Expand the Storage controller category and right click on the Intel® Chipset SATA RAID Controller [or Intel Chipset SATA/PCIe RST Premium Controller](#). Select Properties. The driver version will display on the Driver tab.

You can also check the driver version through the Intel® RST GUI. Launch the GUI from the start menu, click on the help button at the top of the window, and from the help window that launches, select System Report. The driver version will display under the Intel® RST category. ~~Moreover, you can also check the driver version through the Intel® Optane™ Memory and Storage Management App.~~ Launch the App from the start menu, click on the About button at the left of the window. The driver version will display in the window.

## BIOS settings

- Prerequisites (required before remapping can be enabled)
  - RAID mode set (Configure Storage Controller for RAID checked)
  - OptionROMLaunchPolicySet to AllUEFI or AllUEFIExceptVideo  
**NOTE:** OptionROMLaunchPolicyset to All Legacy is not supported
- Remapping specific (Available only after prerequisites have been set)
  - Remapping enabled

## Supported HP Workstations

- HP Z1G3 (2x M.2 PCIe NVMe modules)
- HP Z240 TWR (1 - PCIe NVMe device in Slot 3, 1 - M.2 PCIe NVMe module)
- [HP Z240 SFF \(1 - PCIe NVMe device in Slot 4, 1 - M.2 PCIe NVMe module\)](#)
- [HP Z2 G4 TWR/SFF \(2 - M.2 PCIe NVMe module\)](#)
- [HP Z2 G5 TWR/SFF/MINI \(2 - M.2 PCIe NVMe module\)](#)

## Unsupported devices

- PCIe storage devices connected to CPU slots or PCH slots that do not support remapping
- M.2 PCIe AHCI storage devices
- PCIe storage devices that are not NVMe compliant
- RAID with of mixed storage device types

## Unsupported OSs

- 32-bit OSs
- Linux (Kernel drivers do not have support for remapping)

## Remapping considerations

Before you enable remapping, decide if you want to keep your existing OS, replace your OS, or migrate your OS to RAID. The following rules may help you make this decision.

1. Remapping is necessary only if you want to boot from RAIDed PCIe NVMe storage devices connected to the PCH, or if you want to manage a PCIe NVMe data RAID with Intel® RST. If you have a UEFI bootable OS on a single PCIe NVMe device, you can migrate the OS during RAID creation to preserve your existing OS.
2. Remapping requires UEFI Option ROM launch policy, so the OS must be UEFI bootable.
3. RAID must be set up on like controllers. A PCIe NVMe SSD must be RAIDed with another PCIe NVMe SSD. A SATA drive must be RAIDed with another SATA drive. When remapping is enabled, BIOS may incorrectly identify PCIe NVMe devices as SATA HDDs. Remapped PCIe NVMe devices that are identified as SATA HDDs in BIOS cannot be RAIDed with any SATA drive.
4. Remapping is only supported on PCIe slots or M.2 sockets connected to the PCH. Remapping provides benefits only when you have more than one NVMe device connected to the PCH.
5. Devices connected to SATA ports are not impacted by remapping. If your OS on SATA is UEFI bootable, you can keep the existing OS on SATA.

## NVMe SSD firmware update considerations

Before you enable remapping, consider updating the NVMe SSD firmware on your SSDs. Updating firmware on your device may result in loss of data, so back up your data before attempting to update NVMe SSD firmware. Keep in mind:

- Some NVMe SSD firmware updates may completely wipe the drive.
- Most firmware update utilities will not find the devices after remapping is enabled.



- Some firmware update utilities require AHCI mode. When AHCI mode is set, remapping is disabled. In this state, the OS is not aware of the RAID and may corrupt user data and RAID metadata.
- Disabling remapping or changing RAID mode to AHCI to update firmware on NVMe SSDs will result in loss of data if the NVMe SSDs were included in a RAID array.
- A firmware update may cause a PCIe NVMe SSD to not work with remapping if the firmware changes the device's capabilities.

## Checking the OS and enabling PCIe RST remapping

### *If you want to keep your existing OS*

If you want to keep the OS installed on your SATA HDD or NVMe SSD, verify that the OS is UEFI bootable.

1. Press **F10** while booting to enter BIOS Setup.
2. Navigate to Advanced > Option ROM Launch Policy.
3. From the pull-down menu, select All UEFI or All UEFI Except Video.
4. Press **Enter** to select the desired option and collapse the pull-down menu.
5. To save changes and reboot, press **F10**, and click Yes, or use the arrow keys to select Yes, and press **Enter**.
6. If your system rebooted to the OS, your system should be PCIe RST Remapping compatible. You can skip ahead to Enable PCIe RST Remapping. Once remapping is enabled, you can proceed to Creating RAID Volumes on PCIe NVMe SSDs. If your system did not boot, you can set Option ROM Launch Policy back to the previous state and not use RST Remapping.

### *If you don't want to keep your existing OS, or if you don't have an OS installed*

#### Windows 10 64-bit

The 64-bit version of Windows 10 includes all the drivers needed to work with your system and RST remapping, except the Intel® RST Drivers. Download the latest Intel® RST Driver version available for your platform. Copy the unzipped 64-bit driver folder to your install media or on a USB key. You will need to navigate to this folder during the install process. See the OS Installation section below for step-by-step instructions. You can now skip ahead to Enable PCIe RST Remapping.

#### Windows 7 64-bit

The 64-bit version of Windows 7 does not include drivers for NVMe, Intel® USB 3.0 eXtensible Host Controller, or Intel® RST. The NVMe and USB drivers must be injected into the install media. The Intel® RST drivers should not be injected into the install media Windows Image (WIM) due to a Windows installer issue that will produce an unbootable OS when the USB driver and RST driver coexist in the WIM. See the OS Installation section below for install options. You can now skip ahead to Enable PCIe RST Remapping.

### *Enable PCIe RST Remapping*

Enabling PCIe RST Remapping requires a specific combination of BIOS settings, including RAID mode, UEFI Option ROM Launch Policy, and Remapping "Enabled". The Remapping setting cannot be changed until the RAID mode is set and one of the UEFI Option ROM Launch Policies is selected.

Verify or set Option ROM Launch Policy to one of the UEFI options:

1. Press **F10** while booting to enter BIOS Setup.
2. Navigate to Advanced > Option ROM Launch Policy.
3. From the pull-down menu, select All UEFI or All UEFI Except Video.
4. Press **Enter** to select the desired option, and collapse the pull-down menu.
5. Proceed to *Verify or set RAID mode*.

Verify or set RAID mode:

1. Navigate to Advanced > System Options.
2. Configure Storage Controller for RAID should be selected. If the box is not checked, press **Enter** while the line is selected, or use the mouse to click on the check box.
3. Proceed to *Enable Remapping*.

### Enable Remapping

1. If the Option ROM Launch Policy and RAID mode are set correctly, the RST Remapping option is available for configuration in the Advanced > System Options. If you don't see the RST Remapping option, or it is grayed out, verify that you have the latest version of BIOS and that the Option ROM Launch Policy and RAID mode are set correctly following the steps above.
2. From the RST Remapping pull-down menu, select Enable.
3. Press **Enter** to select the desired option, and collapse the pull-down menu.
4. To save changes and reboot, press **F10**, and click Yes, or use the arrow keys to select Yes, and press **Enter**.

## Creating RAID volumes on PCIe NVMe SSDs

After you enable remapping, there are several methods for creating RAID volumes on PCIe NVMe SSDs:

- Pre-OS third-party option ROM management in BIOS
  - Allows you to create RAID volumes from blank drives
  - Does not preserve any existing OS or data
- UEFI shell (RCfgSata.efi) is useful when automating configuration of multiple systems
- The Windows command line utility (rstcli64.exe)
  - Automates the configuration of multiple systems
  - Enables migration of the existing OS or data from one drive to a RAID 0 or RAID 1 when creating the RAID array
- The Intel® RST GUI is useful for creating a data RAID on an existing system, or for migrating the OS from a single drive to a RAID 0 or RAID 1

### NOTE:

1. When migrating an existing drive to RAID, make sure there is room for metadata at the end of the drive. You may need to shrink the system partition by 5 MB on the OS drive, delete the recovery partition at the end of the OS drive, or shrink the partition on the data drive by 5 MB.
2. RAID 0 stripe size may affect read and write performance of your RAID 0 volume. Stripe sizes of 32 K, 64 K and 128 K are generally good choices for most applications. If your application consistently produces a specific data stream, you may want to experiment with stripe size to optimize performance.

### Pre-OS creation of RAID using third-party option ROM management in BIOS

Use this option to create a new blank RAID array that can be used for the OS or DATA. Any existing data on the drives will be lost.

1. Press **F3** while booting to display the Devices List.
2. Use the **UP** and **DOWN** arrows to highlight Intel® Rapid Storage Technology and press **Enter**.
3. If you have enough devices to create a RAID volume, you will see Create RAID Volume. You may also see a list of RAID Volumes if already created and a list of Non-RAID Physical Disks. Press **Enter** when Create RAID Volume is highlighted.
4. Use the arrow keys to navigate through the settings. Use **Enter** to activate a field for making changes, use the **UP** and **DOWN** arrows to select options, and press **Enter** to apply selections. Hints display in the upper-right corner of the screen, and navigation guidance displays at the bottom of the screen. The final Create Volume setting will change from gray to blue when a valid configuration has been specified.
5. Navigate to Create Volume, and press **Enter** to create the RAID volume and return to the previous screen.
6. Review your newly created RAID volume in the list of RAID Volumes, then press **Esc** several times to initiate reboot of your system.

### Pre-OS UEFI Shell creation of RAID using RCfgSata.efi

Use this option to create a new blank RAID array that can be used for the OS or DATA. Any existing data on the drives will be lost.

These parameters are useful with RCfgSata.efi. Examples show how commands are structured with multiple parameters.

- /C: Create a volume with the specified name. /S, /DS, /SS, and /L can be specified along with /C.
- /DS: Specify disk IDs to be used in the creation of a volume. List should be delimited by spaces.
- /L: Specify RAID Level (0 or 1); only valid with /C
- /SS: Specify strip size in KB (4, 8, 16, 32, 64, or 128); only valid with /C

- /D: Delete a volume with specified name
- /X Remove all metadata from all disks; use with /DS to delete metadata from selected disks
- /Y Suppress any user input; used with options /C, /D, & /X
- /I Display all drive/volume/array information; /P can be specified
- /ST Display volume/RAID/disk status
- /P Pause display between sections; only valid with /I or /ST
- /? Help

### Instructions

- To boot the UEFI shell, insert the USB key that contains RCfgSata.efi into the system to be configured.
- Power up the system. The system should automatically boot to the UEFI bootable USB key. If the system does not boot to the USB key, reboot and press **F9** during POST. Select the UEFI instantiation of your USB key from the boot menu, and press **Enter** to boot.
- At the shell, look in the Device mapping table to determine the ID corresponding to your USB key, and enter that ID followed by ":". For example:

```
Shell> fs0:
```

- The prompt will change to fs0:\> to indicate that you are at the root of fs0. Use dir or ls to list the directory contents. Use cd <directory name> to change to the directory where RCfgSata.efi is located (if it is not at the root).
- Determine IDs of existing non-RAID disks available for use in RAID by using the "ST" parameter.

```
RCfgSata.efi /ST
```

The table displays existing RAID volumes and disks managed by Intel® RST. The ID is in the format controller.DriveNumber. For systems with a single SATA controller and two NVMe devices, the NVMe devices will have IDs 1.0 and 2.0.

- Create RAID volume example commands with parameters:

RAID 0 (64 K stripe)

```
RCfgSata.efi /C:NVMeR0 /DS: 1.0 2.0 /L:0 /SS:64
```

RAID 1

```
RCfgSata.efi /C:NVMeR1 /DS 1.0 2.0 /L:1
```

Add /Y at the end of the above commands to execute the commands without prompting.

- Verify your new configuration using:

```
RCfgSata.efi /ST
or
RCfgSata.efi /I
```

- Reboot.

### Windows command line creation of RAID using rstcli64.exe

Use this option to create a RAID array for use with the OS or data. To avoid losing existing data or the OS on the drives, use the -E option. Keeping the existing OS or data during RAID creation is called RAID migration.

#### NOTE:

- The rstcli64.exe command line utility must be executed in an administrator command window or from a batch file executed as Administrator. If you receive an error message, "Could not get system info", you are not running the command as Administrator.
- Before migrating an existing drive to RAID, it is necessary to have room for metadata at the end of the existing drive. You may need to shrink the system partition by 5MB on the OS drive, delete the recovery partition at the end of the OS drive, or shrink the partition on the data drive by 5MB. If you receive an error message, "INVALID\_SIZE: Size request is invalid. Cannot create a new volume given disk(s).", with error code 22, you must create at least 5 MB of free space at the end of the drive.

To get command line usage information, enter rstcli64.exe --help at a command line prompt.



### Instructions

1. Have the command line utility `rstcli64.exe` available on a USB key, in a folder on the target system, or in a folder on the OS being used to deploy a custom OS image.
2. Power up the system, open an administrative command window, and change directory to the location where `rstcli64.exe` is located.
3. If you are keeping data from a drive, make a note of the serial number of the drive that contains the data you want to keep.
4. Enter `rstcli64.exe -I` for information about the drives. The END DEVICE INFORMATION shows the list of drives starting with the drive's ID (four digits separated by dashes). Make a note of the IDs corresponding to the drives you want to include in the RAID volume. If you are keeping data from a drive, use the drive's serial number to identify the corresponding drive ID that contains the existing data.
5. Create RAID volume example commands with parameters.

RAID 0 (default Stripe) Keep no data.

```
rstcli64.exe -C -I 0 -n NVMe_RO 0-5-0-0 0-6-0-0
```

RAID 0 (64K Stripe) Keep no data.

```
rstcli64.exe -C -I 0 -n NVMe_RO 0-5-0-0 0-6-0-0 -s 64
```

RAID 0 (64K Stripe) keeping existing data from drive ID 0-5-0-0. This will migrate the data or OS from drive ID 0-5-0-0 to the new volume.

```
rstcli64.exe -C -I 0 -n NVMe_RO -E 0-5-0-0 0-6-0-0 -s 64
```

RAID 1 Keep no data.

```
rstcli64.exe -C -I 1 -n NVMe_R1 0-5-0-0 0-6-0-0
```

RAID 1 keeping existing data from drive ID 0-5-0-0. This will migrate the data or OS from drive ID 0-5-0-0 to the new volume.

```
rstcli64.exe -C -I 1 -n NVMe_R1 -E 0-5-0-0 0-6-0-0
```

6. Verify your new configuration using:

```
rstcli64.exe -I
```

You should see the new volume under VOLUME INFORMATION. The "Usage" type listed in END DEVICE INFORMATION should be "Array member" for each drive used in a RAID volume.

## Intel® RST GUI creation of RAID in Windows OS

Use this option to create a RAID array that can be used for the OS or data. Existing data on the drives will be lost unless you specify keep data from one of the disks, then the data or OS will be migrated to the newly created RAID volume.

### NOTE:

1. The create option is available in the GUI if all system conditions are met for RAID support and drives are available for inclusion in a RAID volume.
2. The option of keeping data (migration) from a disk will display only if the disk containing the data has adequate free space at the end of the drive for metadata. If you don't see an option to keep data from your drive, you must shrink the system partition by 5 MB on the OS drive, delete the recovery partition at the end of the OS drive, or shrink the partition on the data drive by 5 MB. Restart the GUI to detect changes.

### Instructions

1. Select and run Intel® RST from the start menu. (Hint: press the Windows key and start typing Intel rapid, then select the application from the short list.)
2. Click Create at the top of the [application and](#) follow the steps in the configuration wizard. The option to keep existing data from a drive will appear in the configure step if the drive with the data has room for RAID metadata. If none of the drives has room for metadata, you can still create a RAID volume, but existing data will not be preserved.
3. RAID created in the OS can be used immediately. Performance is slower during initialization of the array or while migrating.

## Intel® Optane™ Memory and Storage Management App creation of RAID in Windows OS

If your Intel® RST driver version is 17.9.x or newer one, use this option to create a RAID array that can be used for the OS or data. Existing data on the drives will be lost unless you specify keep data from one of the disks, then the data or OS will be migrated to the newly created RAID volume.

### NOTE:

1. The create option is available in the App if all system conditions are met for RAID support and drives are available for inclusion in a RAID volume.
2. The option of keeping data (migration) from a disk will display only if the disk containing the data has adequate free space at the end of the drive for metadata. If you don't see an option to keep data from your drive, you must shrink the system partition by 5 MB on the OS drive, delete the recovery partition at the end of the OS drive, or shrink the partition on the data drive by 5 MB. Restart the App to detect changes.

### Instructions

1. Select and run the App from the start menu. (Hint: press the Windows key and start typing Intel rapid, then select the application from the short list.)
2. Click Create Volume at the Left of the application, and follow the steps in the configuration wizard. The option to keep existing data from a drive will appear in the configure step if the drive with the data has room for RAID metadata. If none of the drives has room for metadata, you can still create a RAID volume, but existing data will not be preserved.
3. RAID created in the OS can be used immediately. Performance is slower during initialization of the array or while migrating.

## OS installation

### Preparation of drives for OS install

To prevent install issues, start with new or clean drives. Some types of residual data prevent the drive from being seen or may result in the Windows installer declaring that the OS cannot be installed.

**NOTE:** Cleaning and invoking HP Secure Erase will permanently delete data on drives. Backup any data and carefully choose which drives to clean.

#### *Clean with DISKPART*

Using the clean function from DISKPART may be sufficient to resolve issues with data remnants that are preventing OS install. DISKPART CLEAN will not remove unwanted RAID metadata left from a previous configuration.

#### *Instructions*

1. After loading the storage driver from the “Where do you want to install Windows?” screen, press **Shift F10** to launch an administrator command window.
2. Type diskpart at the prompt, and press **Enter**. The prompt will change to DISKPART>.
3. Type list disk at the prompt, and press **Enter**.
4. Note the disk number of the disk you want to clean (e.g., to clean Disk 1, type select disk 1), and press **Enter**.
5. Type clean, and press **Enter** to clean the selected disk.
6. Repeat the select and clean steps for any disks you want to clean.

#### *Securely erasing drives*

The best method to ensure your drive is ready for OS install is to use HP Secure Erase. Secure Erase should be done prior to creating the RAID, as Secure Erase will delete all data from the drive including the RAID metadata.

#### **NOTE:**

1. To keep an existing RAID on PCIe NVMe SSDs, remove all PCIe devices included in the RAID prior to attempting Secure Erase, as changing the SATA RAID mode will result in loss of RAID metadata on the PCIe NVMe drives. If the PCIe NVMe SSDs are installed directly in M.2 sockets on the motherboard, disable the M.2 SSDs from the Advanced > Port Options menu in the BIOS.
2. If remapping is enabled, PCIe NVMe devices will not display. Prior to performing Secure Erase, clear the check box in front of Configure Storage Controller for RAID in the BIOS Advanced > System Options menu.
3. If drives appear to be locked, power off the system and enter the BIOS setup menu on the next power up. Warm reboots may not clear the lock condition.

#### *Instructions*

1. Reboot the system and press **F10** to enter BIOS setup.
2. Navigate to Advanced > System Options and uncheck Configure Storage Controller for RAID.
3. To save changes and reboot, press **F10**, and click Yes, or use the arrow keys to select Yes, and press **Enter**.
4. On reboot, press **F10** to enter BIOS setup.
5. Navigate to Security > Hard Drive Utilities > Secure Erase.
6. Select the drive and follow the instructions for erasing the drive. When Secure Erase is complete, select another drive to erase.
7. When you are finished erasing drives, navigate to Advanced > System Options and check Configure Storage Controller for RAID.
8. Press **F10**, and click Yes, or use the arrow keys to select Yes, and press **Enter** to save the changes and reboot.

## Windows 10 x64 Installation in RAID mode with remapping enabled

This guide covers the case where the SATA mode is RAID and remapping is enabled. Installing Windows 10 on other configurations is similar but is not covered here.

### NOTE:

1. Windows 10 contains inbox drivers that will allow you to see and install the OS to SATA drives and Intel® SATA RAID volumes. The Windows 10 inbox drivers are not capable of seeing individual remapped PCIe devices or RAIDed PCIe devices. To prevent unforeseen compatibility issues, load the Intel® RST driver at install time, even if you are installing the OS to SATA drives or SATA RAID.
2. Windows installer may create a partition and place swap files on a drive that you did not select for installation. Windows installer also may not refresh your drive list on the “Where do you want to install Windows?” screen even after you have loaded the driver. To prevent these problems, disconnect any drives that are not being used for the OS installation.
3. Certain kinds of data left on a drive may prevent install of a new OS on the drive or result in other unexpected errors. Symptoms may include the target drive not appearing in the list of drives, the drive size shown may be incorrect, or an error message may be shown when you select a drive for OS install. To prevent these kinds of issues, securely erase the drive; from the BIOS menu, Security > Hard Drive Utilities > Secure Erase.

### Assumptions

1. RAID volumes have already been created if desired.
2. The user has install media available on a USB key or DVD or knows how to create install media.
3. The user has downloaded the latest Intel® RST drivers for the platform from the HP support website, and has the unzipped folder that contains the .inf, .sys, and .cat files of the 64-bit drivers on a USB key or in a folder on the install media.

The process of installing Windows 10 is the same whether you are installing to an individual drive or a RAID volume.

### Instructions

1. Insert the bootable install media and follow the on-screen prompts to the step where you see “Where do you want to install Windows?”
2. Click [Load driver](#) and navigate to the location of the drivers, then click [OK](#).
3. The “Intel Chipset SATA RAID Controller” should be selected. Click [Next](#) to initiate the driver load and device discovery.
4. Select the drive where you want to install Windows, and click [Next](#).
5. Follow the onscreen prompts. The system may reboot a few times during install prior to the user customization steps in Windows.

## Windows 7 x64 Installation in RAID mode with remapping enabled

This guide only covers the case where the SATA mode is RAID and remapping is enabled. Installing Windows 7 on other configurations would be similar but is not covered here.

### NOTE:

1. Windows 7 does not have native support for NVMe, Intel® USB 3.0 eXtensible Host Controller or Intel® RST Remapping, so a special process is needed to inject and load drivers during installation. See Appendix for install media preparation instructions.
2. Windows installer may create a partition and place swap files on a drive that you did not select for installation. Windows installer also may not refresh your drive list on the “Where do you want to install Windows?” screen after you have loaded the driver. To prevent these problems, disconnect any drives that are not being used for the OS installation.
3. Certain types of data left on a drive may prevent install of a new OS on the drive or result in other unexpected errors. Symptoms may include the target drive not displaying in the list of drives, the drive size showing incorrectly, or an error message appearing when you select a drive for OS install. To prevent these issues, Secure Erase the drive from the BIOS menu, Security > Hard Drive Utilities > Secure Erase.

### Assumptions

1. RAID volumes have already been created if desired.
2. The user has install media available on a USB key or DVD or knows how to create install media.
3. The user has modified the install media to include hotfixes and drivers listed below. See Appendix for instructions on modifying the install media.

From Microsoft:

- a. Hotfix KB2990941 (adds support for NVMe in Windows 7)
- b. Hotfix KB3087873 (fixes BSOD 0x7E resulting from KB2990941)

From hp.com:

- c. USB 3.0 eXtensible Host Controller drivers
  - d. Samsung NVMe driver (HP SoftPaq sp71553.exe; only used with Samsung NVMe SSDs and optional, even with Samsung NVMe SSDs)
4. The user has downloaded the latest Intel® RST drivers for the platform from the HP support website, and has the unzipped folder containing the .inf, .sys, and .cat files of the 64-bit drivers and placed them on a USB key or in a folder on the install media.
  5. The process of installing Windows 10 is the same whether you are installing to an individual drive or a RAID volume.

### Instructions

1. Insert the bootable install media and follow the on-screen prompts to the step where you see “Where do you want to install Windows?”.
2. Click [Load driver](#) and navigate to the Intel® RST drivers, then click [OK](#).
3. The Intel® Chipset SATA RAID Controller should be selected. Click [Next](#) to initiate the driver load and device discovery.
4. Select the drive where you want to install Windows, and click [Next](#).
5. Follow the on-screen prompts. The system may reboot a few times during install prior to the user customization steps in Windows.

## Frequently asked questions

I already have my own Windows 7 installed and added PCIe NVMe SSDs. Why doesn't the OS see them?  
Windows 7 does not have native support for PCIe NVMe SSDs. HP has a SoftPaq that will add NVMe support. Go to [hp.com](#) and download [sp74909](#).

With remapping turned on, my PCIe NVMe SSDs show up as SATA HDDs in BIOS boot menus. Why can't I RAID these SATA HDDs with other SATA HDDs connected to SATA ports?  
BIOS mistakenly reports PCIe NVMe SSDs as SATA HDDs. RAID can only be created across devices using like controllers. The PCIe NVMe SSDs contain NVMe controllers and cannot be RAIDed with SATA HDDs that are physically connected to the SATA controller.

I accidentally changed a BIOS setting and can no longer see my RAIDed PCIe devices. Is my data gone?  
Your data or OS may still be available if you have not written to the drive after changing the BIOS settings. Change settings back to re-enable remapping. Use the Intel® RST User Interface to check the state of the RAID. You may need to mark the individual devices or RAID as normal and rebuild the volume.

Where can I get the utilities mentioned in this document?

The utilities are available as a part of the Intel® RST Utility/Driver package available on [hp.com](#). Scroll to the bottom of the page, and locate the Support heading. Click Download drivers, where you will enter your product information. HP advises using the version of utilities that is provided along with the drivers.

My storage devices are different sizes, can I still RAID them?

Yes, the resulting RAID volume size will be limited by the smallest drive. RAID 0 will be slightly less than twice the capacity of the smallest drive in the volume. RAID 1 will be slightly less than the size of the smallest drive.

Do remapped drives or RAID created from remapped drives support Windows 10 secure boot?

Yes.

Does Linux support SATA hardware RAID?

SATA hardware RAID is not supported on Linux systems. The Linux kernel, with built-in software RAID, provides excellent functionality and performance. It is a good alternative to hardware-based RAID.

## Resources

- [HP white papers](#)
- [Red Hat Enterprise Linux 7 - Storage Administration Guide](#)
- [Red Hat Enterprise Linux 6 - Storage Administration Guide](#)
- [SLED 12 Deployment Guide](#)
- [SLED 11 Deployment Guide](#)
- [Ubuntu 14.04 LTS Server Guide](#)

## Appendix

### Prerequisites for updating Windows 7 x64 SP1 install media

#### *Required OS install media*

The OS install media must be Windows 7 x64 SP1. The process may not work if the correct OS is not used.

#### *Download hotfixes from Microsoft*

- <https://support.microsoft.com/en-us/kb/2990941>
- <https://support.microsoft.com/en-us/kb/3087873>

#### *Download Drivers from hp.com*

The links at hp.com change frequently, so find your platform on the support page, go to the drivers section, and look for:

- Intel USB 3.0 eXtensible Host Controller
- Intel Rapid Storage Technology Utility/Driver for Windows 7/10 x64

If you have Samsung NVMe SSDs, you can optionally add Samsung NVMe drivers available on hp.com.

### Procedure for updating Windows 7 x64 SP1 install media

You can follow the step-by-step instructions to modify a standard Windows 7 x64 SP1 install media. If you prefer a more interactive process, save the embedded Win7x64InstallModCommands.txt file as a batch file. The batch file creates folders and writes files. Be sure to review the commands prior to execution.

#### *Instructions*

1. Create temporary work folders

```
C:\temp\drivers
C:\temp\hotfix
C:\temp\mount
C:\temp\src
C:\temp\winremount
```

2. Copy the contents of USB and NVMe driver folders to the C:\temp\drivers. The result should look similar to this list (NVMe drivers are optional):

```
DriverLanguageMap.xml
usb3hub.cat
iusb3hub.inf
IUsb3Hub.man
iusb3hub.sys
iusb3xhc.cat
iusb3xhc.inf
iusb3xhc.man
iusb3xhc.sys
nvme.cat
nvme.inf
nvme.sys
```

3. Copy the hotfix .msu files to C:\temp\hotfix  
The list should look exactly like this:  
Windows6.1-KB2990941-v3-x64.msu  
Windows6.1-KB3087873-v2-x64.msu
4. Copy the entire sources folder from your install media to C:\temp\src
5. Expand the Windows6.1-KB3087873-v2-x64.msu files so a specific version of the hotfix can be applied  
Expand -F: \* "C:\temp\hotfix\Windows6.1-KB3087873-v2-x64.msu" C:\temp\hotfix\KB3087873\_exp
6. Expand the Windows6.1-KB3087873-v2-x64.cab file to folder C:\temp\hotfix\KB3087873\_exp.  
Expand -F: \* "C:\temp\hotfix\KB3087873\_exp\Windows6.1-KB3087873-v2-x64.cab" C:\temp\hotfix\KB3087873\_exp
7. Check boot.wim for indexes; hotfixes and drivers will need to be applied to each index  
dism /Get-WimInfo /WimFile:C:\temp\src\sources\boot.wim
8. Mount Index 1 of boot.wim and add hotfixes and drivers  
dism /Mount-Wim /WimFile:C:\temp\src\sources\boot.wim /Index:1 /MountDir:C:\temp\mount  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873\_exp\update-bf.mum  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu  
dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse
9. Commit changes to WIM and unmount image  
dism /Unmount-Wim /MountDir:C:\temp\mount /Commit
10. Mount Index 2 of boot.wim and add hotfixes and drivers  
dism /Mount-Wim /WimFile:C:\temp\src\sources\boot.wim /Index:2 /MountDir:C:\temp\mount  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873\_exp\update-bf.mum  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu  
dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse
11. Manually sort the folder C:\temp\mount\sources by date
12. Copy/overwrite the updated files to C:\temp\src\sources
13. When done copying, press enter to continue
14. Commit changes to WIM and unmount image  
dism /Unmount-Wim /MountDir:C:\temp\mount /commit
15. List Indexes info from Install.wim; hotfixes and drivers will need to be applied to each index  
dism /Get-WimInfo /WimFile:C:\temp\src\sources\install.wim
16. Mount install.wim Index 1 and add hotfixes and drivers  
dism /Mount-Wim /WimFile:C:\temp\src\sources\install.wim /Index:1 /MountDir:C:\temp\mount  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873\_exp\update-bf.mum  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu  
dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse
17. List Indexes info from winRE.wim  
dism /Get-WimInfo /WimFile:C:\temp\mount\windows\system32\recovery\winre.wim
18. Mount winRE.wim Index 1 and add hotfixes and drivers  
dism /Mount-Wim /WimFile:C:\temp\mount\windows\system32\recovery\winre.wim /Index:1 /MountDir:C:\temp\winremount  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873\_exp\update-bf.mum  
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu  
dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse

19. Commit changes and unmount images
 

```
dism /Unmount-Wim /MountDir:C:\temp\winremount /Commit
dism /Unmount-Wim /MountDir:C:\temp\mount /Commit
```
20. Manually sort the folder C:\temp\src\sources by date
21. Copy overwrite the updated files to the sources folder on your install media
22. When done copying, press enter to continue
23. If unmount failed, you may need to execute the following command to clean up mounted images
 

```
dism /cleanup-wim
```

If the user has updated the sources folder of an ISO image, use the ISO image to create a USB install key with one of the following formats

- MBR partition scheme UEFI - this works
- GPT partition scheme UEFI - this works

The newly created install media can then be used to install Win7 directly on PCIe NVMe SSDs or remapped PCIe NVMe SSDs.

## Updating Windows 7 install media

Windows 7 does not have native support for NVMe, Intel® USB 3.0 eXtensible Host Controller, or Intel® RST Remapping, so a special process is needed to inject and load drivers during installation.

The Intel® RST drivers should not be injected into the install media. If you inject the RST drivers into the install media, a USB mouse and keyboard will not function at install time.

There are several methods you can use to update the Windows 7 install media. This guide follows one method. The steps for modification of the install image are listed below in the instructions.

The commands listed below and can be used to create a batch file. The batch file will pause where user interaction is needed. The batch file does not have error checking, so the user must monitor manually for errors. The commands are listed in the sequence needed without calls for ease of use.

```
echo off
echo.
echo.
echo =====
echo Create temporary work folders
echo =====
REM C:\temp\drivers
REM C:\temp\hotfix
REM C:\temp\mount
REM C:\temp\src
REM C:\temp\winremount

IF NOT EXIST C:\temp\drivers MD C:\temp\drivers
IF NOT EXIST C:\temp\hotfix MD C:\temp\hotfix
IF NOT EXIST C:\temp\hotfix\KB3087873_exp MD C:\temp\hotfix\KB3087873_exp
IF NOT EXIST C:\temp\mount MD C:\temp\mount
IF NOT EXIST C:\temp\src MD C:\temp\src
IF NOT EXIST C:\temp\winremount MD C:\temp\winremount
CLS
echo ***** echo
*****
echo =====
echo.
echo 1. Copy the contents of USB and NVMe driver folders to the C:\temp\drivers
echo The result should look something like this. NVMe drivers are optional.
echo.
echo DriverLanguageMap.xml
echo iusb3hub.cat
echo iusb3hub.inf
```



```
echo IUsb3Hub.man
echo iusb3hub.sys
echo iusb3xhc.cat
echo iusb3xhc.inf
echo iusb3xhc.man
echo iusb3xhc.sys
echo nvme.cat
echo nvme.inf
echo nvme.sys
echo.
echo 2. Copy the hotfix .msu files to C:\temp\hotfix
echo The list should look exactly like this:
echo.
echo Windows6.1-KB2990941-v3-x64.msu
echo Windows6.1-KB3087873-v2-x64.msu
echo.
echo 3. Copy the entire sources folder from your install media to C:\temp\src
echo.
echo =====
echo ***** echo
echo *****

        pause

echo.
echo.
echo =====
echo Expand KB3087873 so that a specific version of the hotfix can be applied
echo =====
        IF NOT EXIST C:\temp\hotfix\KB3087873_exp\update-bf.mum Expand -F:* "C:\temp\hotfix\Windows6.1-
KB3087873-v2-x64.msu" C:\temp\hotfix\KB3087873_exp

        IF NOT EXIST C:\temp\hotfix\KB3087873_exp\update-bf.mum Expand -F:* "C:\temp\hotfix\KB3087873_exp\
Windows6.1-KB3087873-v2-x64.cab" C:\temp\hotfix\KB3087873_exp

echo.
echo.
echo =====
echo List Index info from boot.wim
echo =====
        dism /Get-WimInfo /WimFile:C:\temp\src\sources\boot.wim
echo.
echo.
echo =====
echo =====
echo.
echo Make a note of all indexes. Each index will need to be updated manually.
echo The remaining commands assume only one index was found. If there are multiple
echo indexes, update each index one by one.
echo.
echo =====
echo =====
echo.
echo.

REM pause

echo =====
echo Mount Index 1 of boot.wim and add hotfixes and drivers.
echo =====
        dism /Mount-Wim /WimFile:C:\temp\src\sources\boot.wim /Index:1 /MountDir:C:\temp\mount

        dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873_exp\update-bf.mum
        dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu
```

```
dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse
echo.
echo.
echo =====
echo Commit changes to WIM and unmount image
echo =====
dism /Unmount-Wim /MountDir:C:\temp\mount /Commit
echo.
echo.
echo =====
echo Mount Index 2 of boot.wim and add hotfixes and drivers.
echo =====
dism /Mount-Wim /WimFile:C:\temp\src\sources\boot.wim /Index:2 /MountDir:C:\temp\mount

dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873_exp\update-bf.mum
dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu

dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse
echo.
echo.
echo ***** echo
echo *****
echo =====
echo.
echo 1. Manually sort the folder C:\temp\mount\sources by date
echo 2. Copy overwrite the updated files to C:\temp\src\sources.
echo 3. When done copying, press enter to continue.
echo.
echo =====
echo *****
echo *****
echo.
echo.

pause

echo.
echo.
echo =====
echo Commit changes to WIM and unmount image
echo =====
dism /Unmount-Wim /MountDir:C:\temp\mount /commit
echo.
echo.
echo =====
echo List Indexes info from Install.wim
echo =====
dism /Get-WimInfo /WimFile:C:\temp\src\sources\install.wim
echo.
echo.
echo =====
echo =====
echo.
echo Make a note of all indexes. Each index will need to be updated manually.
echo The remaining commands assume only one index was found. If there are multiple
echo Indexes, update each index one by one.
echo.
echo =====
echo =====

rem pause

echo.
```

```
echo.
echo =====
echo Mount install.wim Index 1 and add hotfixes and drivers
echo =====
echo.
    dism /Mount-Wim /WimFile:C:\temp\src\sources\install.wim /Index:1 /MountDir:C:\temp\mount

    dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873_exp\update-bf.mum
    dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu

    dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse
echo.
echo.
echo =====
echo List Indexes info from winRE.wim
echo =====
    dism /Get-WimInfo /WimFile:C:\temp\mount\windows\system32\recovery\winre.wim
echo.
echo.
echo =====
echo =====
echo.
echo Make a note of all indexes. Each index will need to be updated manually.
echo The remaining commands assume only one index was found. If there are multiple
echo Indexes, update each index one by one.
echo.
echo =====
echo =====

rem pause

echo.
echo.
echo =====
echo Mount winRE.wim Index 1 and add hotfixes and drivers
echo =====
echo.
    dism /Mount-Wim /WimFile:C:\temp\mount\windows\system32\recovery\winre.wim /Index:1 /MountDir:C:\
temp\winremount

    dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\KB3087873_exp\update-bf.mum
    dism /Image:C:\temp\mount /Add-Package /PackagePath:C:\temp\hotfix\Windows6.1-KB2990941-v3-x64.msu

    dism /Image:C:\temp\mount /Add-Driver /Driver:C:\temp\drivers /Recurse
echo.
echo.
echo =====
echo Commit changes and unmount images
echo =====
echo.
    dism /Unmount-Wim /MountDir:C:\temp\winremount /Commit
    dism /Unmount-Wim /MountDir:C:\temp\mount /Commit
echo.
echo.

echo ***** echo
*****

echo =====
echo.
echo 1. Manually sort the folder C:\temp\src\sources by date
echo 2. Copy overwrite the updated files to the sources folder on your install media.
echo 3. When done copying, press enter to continue.
echo 4. If unmount failed, you may need to execute the following command to
echo clean up mounted images.
```



```
echo dism /cleanup-wim
echo.
echo =====
=====
echo *****
echo *****
echo.
echo.
echo.

    pause
```

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[hp.com/go/getconnected](http://hp.com/go/getconnected)

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