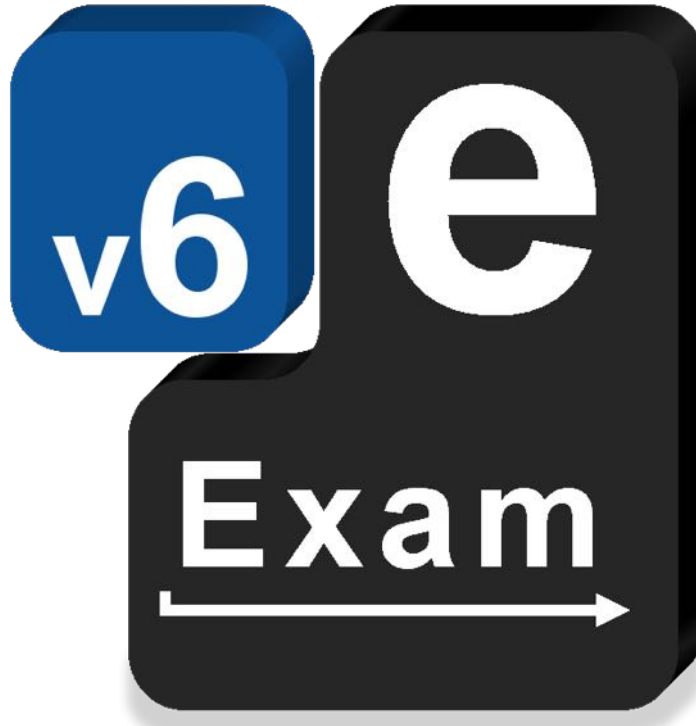


# Alternative Admin Guide



## e-Exam System v6

This document provides:

- An alternative for setting up e-Exam USB sticks:
  - Obtain and create first e-Exam USB
  - Customise the e-Exam USB
  - Create disk image of USB
  - Duplicate USBs
  - Other Matters
- Note: post-exam response retrieval is not covered.
- Managing e-Exam USBs

## Acknowledgements

The e-Exam System version 5 and version 6 platform project is supported by an Australian Government grant. The project is being lead by Monash University in partnership with nine Australian Universities.



Australian Government  
Department of Education and Training

The views expressed in this document do not necessarily reflect the views of the Australian Government Department of Education and Training or participating institutions.

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Special thanks to Ken Howah, University of Central Queensland, for his tips and guides on Administering e-Exam USBs with Windows.

*This is a work in progress! Last Updated 24 May 2019*

*\* Note some features and topics are still under development.*

# Contents

- Alternative work flow for creating e-Exam USBs..... 1
  - General Advice..... 1
  - Phase 1. Create first e-Exam USB stick ..... 2
  - Phase 2: Customise/update e-Exam USB..... 5
  - Phase 3: Create master disk image..... 6
  - Phase 4: Burn the disk image to one or more USBs ..... 8
- Advanced Techniques ..... 9
  - Old Windows versions and Win32 Disk Imager ..... 9
  - Terminal Commandline Tools ..... 9
    - Burning a disk image to a USB stick..... 9
    - Creating a disk image file from an e-Exam USB (by excluding unused space) ..... 16
- Other Matters..... 20
  - Checking downloaded files for integrity (MD5 Hash check)..... 20
  - Master USB stick capacity considerations..... 20
  - Possible cause of a failure to burn or image an e-Exam USB ..... 21
  - Not covered: Retrieval of exams files post-exam ..... 22
  - Not covered: Re-initializing multiple e-exam USBs (recycling)..... 22
- Managing e-Exam USB Sticks..... 22
  - Changing the Exam Content ..... 22
  - Recommended Quality Control for Exam Files ..... 23
  - Enabling the 'Clean up' feature ..... 24
  - Recycling Existing e-Exam USB Sticks for the Next Exam ..... 25
  - Administrative Helper Scripts ..... 25
  - Manually Resetting an e-Exam System USB Stick..... 26
  - Returning an e-Exam USB Stick to a Generic Storage Device..... 27
- e-Exam USB Stick Management Hardware ..... 28
  - Extended discussion on Hardware ..... 28



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# Alternative work flow for creating e-Exam USBs

This guide outlines an alternative to using the Admin Tool to create e-Exam USBs. The process requires both Windows and Apple OSX computers.

e-Exam software required:

**Obtain a disk image file** containing a version of the e-Exam system student client. Download it from e-Exam HQ. See also 'Checking downloaded files for integrity'.

Tools required:

**Option 1 Windows computer** with USB Type A ports. To maximise utility - we recommend using a minimum of Windows 10 version 1703 (or greater) to enable mounting of e-Exam USBs (multi-partition removable USB devices). *Note: Some tasks described in this guide cannot be performed using older versions of Windows.*

- ImageUSB software version 1.3 or above (1086 KB) for use on Windows 10 version 1703 (or greater) <http://www.osforensics.com/tools/write-usb-images.html>  
Note: older versions of Windows or ImageUSB are not able to produce an image from e-Exam USBs or to write over the top of e-Exams USBs.
- Checksums calculator. <http://www.sinf.gr/en/hashcalc.html>

**Option 2 Apple (Or Linux) computer** with USB Type A ports (standard rectangle shape). OSX 10.11 El Capitan was used in this guide. Other Apple OSX/macOS versions should also work.

- Etcher software to burn disk images to USBs 100MB <https://www.balena.io/etcher/> (or Terminal commandline tools can be used).
- Checksums calculator. <http://www.sinf.gr/en/hashcalc.html>
- For Apple users: "Show Hide Hidden Files.app" that allows you to 'show and hide hidden files' in OSX/macOS.  
<https://cloudstor.aarnet.edu.au/plus/index.php/s/Ak38LUzcxj2YZS1> (a tiny app made by Mathew).
- Note: Commandline tools will be required for some tasks in this guide such as creating a disk image from a USB stick.

## General Advice

**Always use 'safe eject' methods to remove e-Exam USBs from the operating system.** Each of Windows, Apple OSX/macOS and Linux all have safe ejection tools or steps.

- Failure to do so may result in corrupted master e-Exam USBs (that then spreads the problem when used to duplicate other USBs) or individual e-Exam USBs that result in failures in part or fully during an exam.

**Follow the guidelines for preparing exam question documents in the Admin User Guide.** This covers advice on how to prepare exam question documents and collections of files for the e-exam system.

- Failure to follow guidelines is likely to result in problematic usability, disrupted formatting, missing details etc when the question document is used in the e-Exam system.

## Phase 1. Create first e-Exam USB stick

You need to obtain/download a disk image from e-Exam HQ and burn it to a USB stick.

You will need at least one USB stick. Be sure to use USBs that are bigger than the disk image file you intend to use. Most e-Exam client images are under 4GB but be sure to check because this may change in the future.

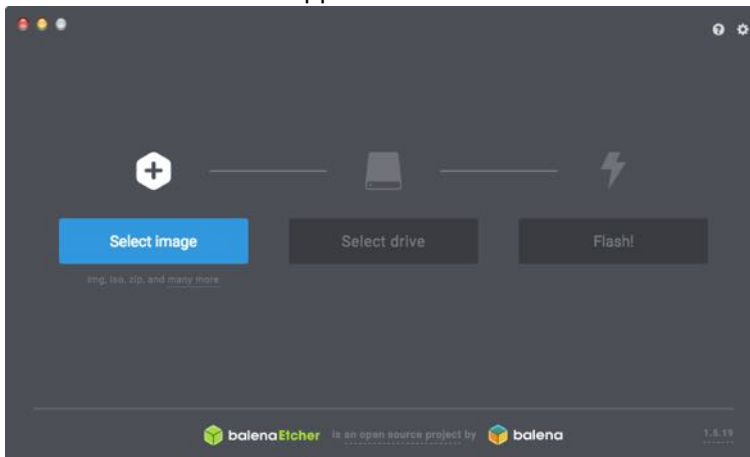
Note: if you already have a working e-Exam USB then skip to Phase 2.

1. Download an initial e-Exam disk image file (.img) file into your computer.
2. Unzip the file. This will give you the disk image (.img) file and a .md5 file (note: older editions of eexam don't have the md5 – this is a checking file – see 'Checking downloaded files for integrity').

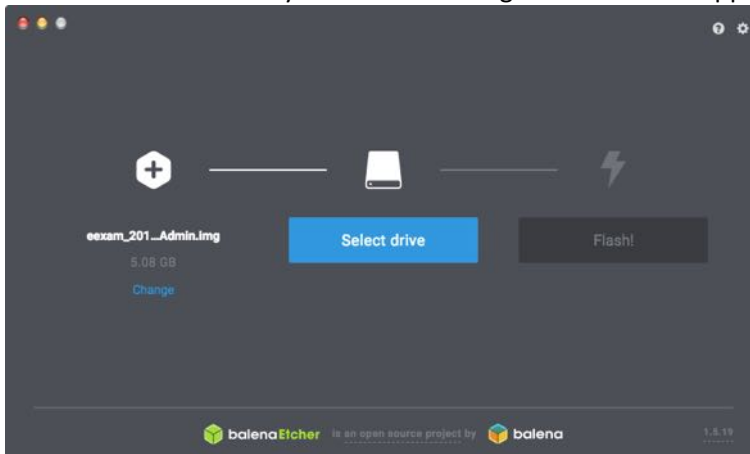
Next - Burn the image to a USB using Etcher (option 1 on any operating system) or ImageUSB (Option 2 for Windows only).

*Option 1: Use Etcher (for Windows, Apple or Linux)*

1. Open the Etcher software (it doesn't need to be installed).  
The Etcher window will appear:

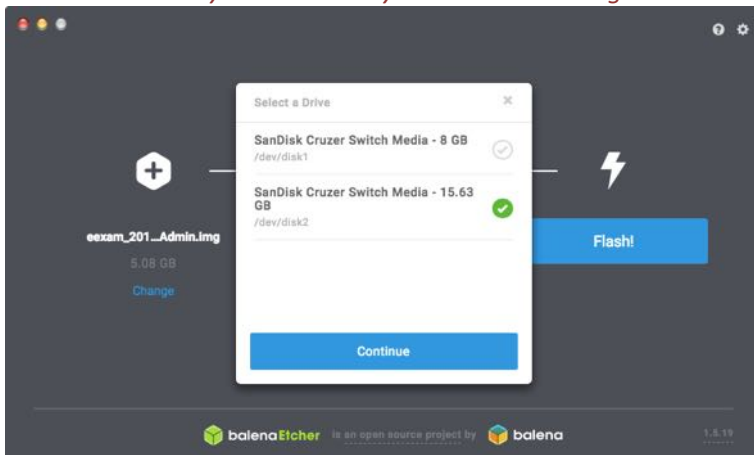


2. Next, press the 'Select Image' button. Then navigate to the downloaded disk image file and select it. When correctly selected the image file name will appear.



3. Next, Insert a blank USB. It is best that the USB is formatted as a single fat32 drive/partition. Most USBs are so when purchased new. However existing e-Exam USBs will also be detected. The software should detect the USB and update the screen accordingly. If you have multiple USBs inserted you may need to press the 'Select drive' button or the 'change' link to ensure you select the correct one. *Warning – be careful you select the*

correct device or you will destroy data on the wrong drive!



4. When you are sure you have the correct target device, click the 'Flash' Button.



5. A progress indicator will be displayed and the completion screen shown when done.



6. You can now boot a computer from the newly minted e-Exam USB stick.

User documentation for Etcher is available at <https://github.com/balena-io/etcher/blob/master/docs/USER-DOCUMENTATION.md>

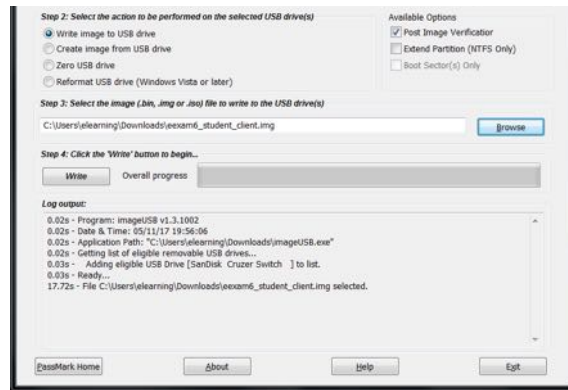
*Option 2: Use ImageUSB (Windows only)*

1. Open ImageUSB.exe. This will request admin rights (user/pass).
2. Plug in your USB stick.
3. On the Image USB screen:
  - a. The USB stick should appear in the top part of ImageUSB. If not, click the 'Refresh Drives' button.
  - b. Step 1: select the target USB stick (all data will be lost on the selected stick/drive/device).



Regardless - ImageUSB will still write all the new partitions over the top of the old ones.

- a. Step 2: select 'write image to USB'. Keep the 'post image verifcator' ticked. Leave other options as-is.
- c. Step 3: browse to find the downloaded disk image file (.bin or .img).
- d. Step 4: Click 'Write' to start the process.



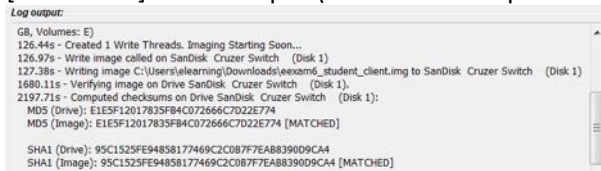
4. The process will take several minutes. Progress and write speed will be displayed in the upper portion of the window.



And a progress bar in the middle



5. Towards the end of the process it will also perform a checksum, the results of which will be displayed in the log output box at the bottom of the window. Check to ensure you see [MATCHED] in the output (note actual output numbers will be different).



6. When done it will display 'Write complete'.
7. This will give you a working e-Exam USB stick.

### Check the USB

Test boot the USB on both an Apple and a 'windows' laptop. Check that it will display the e-Exam correctly, save files etc.

If the process fails see 'Possible cause of a failure to burn or image an e-Exam USB'.



## Phase 2: Customise/update e-Exam USB

This section outlines how to update the exam materials. These are located on the 'eexam' drive on an e-Exam USB stick. The 'eexam' drive contains the exam document file, background image and configuration file.

This task can be done using Apple OSX/MacOS, Linux or Windows 10 version 1703+ (you could also use the Admin Tool USB or a generic Ubuntu live USB stick to boot an older Windows computer – See the Admin tool user guide for details).

We assume you have a working and tested e-Exam USB at this point.

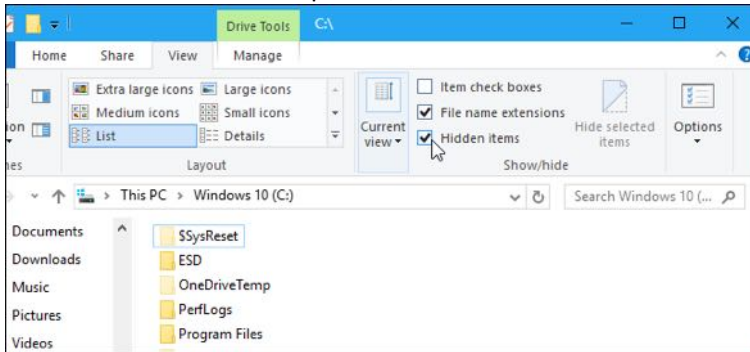
*In your preferred operating system:*

It is best to close all other applications and windows.

1. Show 'hidden files' in Finder/File manager. This will allow you to see the .config.txt and .background.png files.

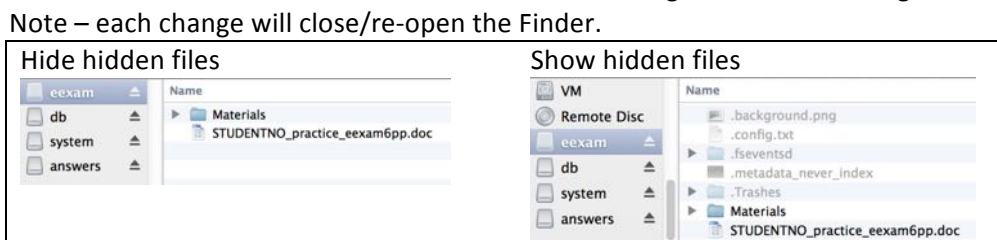
In Linux: go to file manager and use CTRL+ H keys.

In windows: Go to 'File Explorer', on the 'View' tab, tick the 'Hidden items' check box.



In Apple:

- a. Apple users can download the tiny app called "Show Hide Hidden Files.app" from e-Exam HQ. <https://cloudstor.aarnet.edu.au/plus/index.php/s/Ak38LUzcxj2YZS1>  
This is an on/off switch that allows you to show and hide hidden files in OSX. (Mathew made this app so it is safe!).
- b. Unzip and put the app into the applications folder (this needs admin access).
- c. Go to app icon in applications (two eyes icon).
- d. Double click it once to show hidden files. Double click again to hide them again.



2. Insert the e-Exam USB inside Apple MacOS, Linux, Windows.  
You will see 4 drives (eexam, db, system, answers) appear in the Finder / File manager and on the Desktop (as per Apple example as above).
3. Go to the 'eexam' drive and replace/put relevant files of your own:
  - a. Delete old STUDENTNO\_something.doc exam file and replace with your own (the file name must start with: STUDENTNO\_ and there must not be any spaces in the file name) and remove/update the contents of the 'Materials' folder as needed.
  - b. Optional for practice exams: Delete old .background.png image and replace with your own. Be sure the file name is .background.png
  - c. The .config.txt file may be OK as is.
    - i. If necessary: The .config.txt file can be edited in-place by 'right-click' > 'open-with', choose TextEdit (Apple) or Notepad (Windows).
    - ii. Be careful not to disturb the formatting/layout in this file. Refer to Appendix 1 of the 'Admin tool guide' for details of the settings.

- Clean up the 'answers' drive by deleting all files in the 'Answers' drive. This will remove any previous exam responses, attempts, logs and session recording data etc (Note: these files can be useful for latter troubleshooting/reporting. You may consider keeping a copy of these files).

Note: it may not be possible to delete some of the hidden folders or files. This is not a problem. Some of these files created by Apple OSX, Windows or Linux disk cataloguing or processes (e.g '.fsevents' and '.Trashes'). While the 'Admin tool' does remove these files, it is advisable for you to leave them in place to avoid any problems with the drive while it is in current use.

Key files to remove from the Answers drive are: .user\_info.txt, User folder, Logs folders, \*.attemptdata files, plus any prior response doc, xls etc files.

The e-Exam USB should now be ready to create a master disk image.

### Phase 3: Create master disk image

Turn the edited e-Exam USB into a disk image ('.img') file.

- Windows users can utilise ImageUSB to perform this task (but see 'considerations' below).
- Apple and Linux users will need to use commandline tools - see the 'Advanced techniques' section.
- The e-Exam Admin tool will also perform this task (See the 'Admin tool guide').

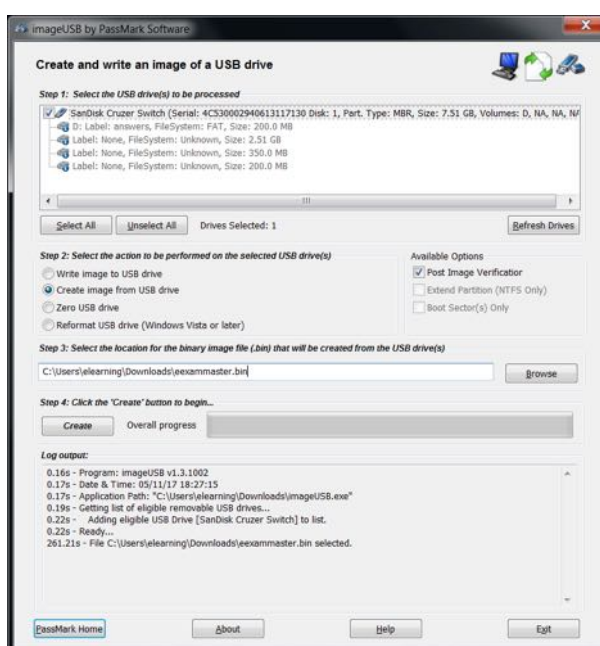
Considerations:

- Using ImageUSB to create a disk image results in a 'full size' disk image (that includes all unused space on the device). See also, 'Master USB capacity considerations' for further information. Apple and Linux users can create smaller disk images that excludes unused space but they will need to use commandline tools.
- Resultant USBs should boot on both Apple and Windows computers.
- Warning: Do not use Apple Disk Utility for this task because it results in USB sticks with more limited compatibility (they only boot via EFI mode and do not boot via BIOS/Legacy mode).*

To create a disk image:

*In Windows*

- Open ImageUSB.exe. This will request admin rights (user/pass).
- Insert the source e-Exam USB stick.
- On the ImageUSB screen:
  - The e-Exam USB stick should appear in the top part of ImageUSB. If not, click the 'Refresh Drives' button.
  - Step 1: select the correct source USB stick by ticking the box next to its name. Note: do not select any of the four individual partitions.
  - Step 2: select 'create image from USB drive'. Keep the 'post image verifiicator' ticked. Leave other options as-is.
  - Step 3: Click 'Browse' to specify the destination and the file name. e.g. eexammaster.bin. Note: You need to use '.bin' in this case. Don't use spaces in the file name.
  - Step 4: Click 'create' to start the process.



- The process will take several minutes. When done it will display 'image completed'. It will also perform a checksum, the results of which will be displayed in the log output box. Check to ensure you see [MATCHED] in the output.



- The new disk image can be found via the file manager in the selected destination.

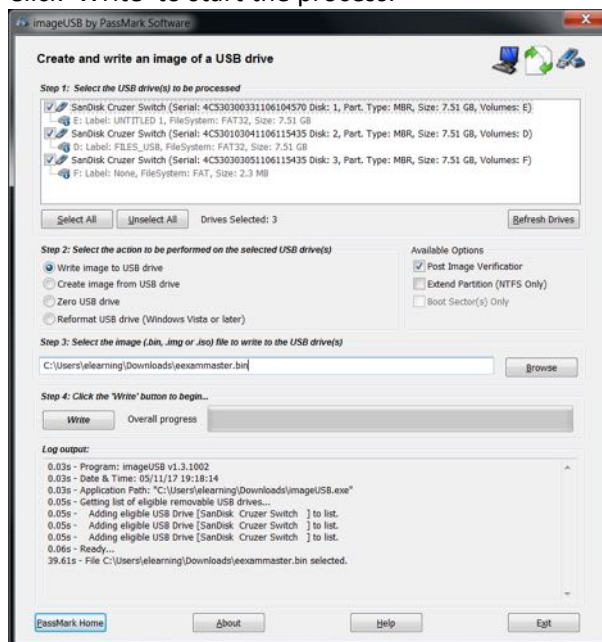
## Phase 4: Burn the disk image to one or more USBs

This process can be used to burn an image to one USB for further testing or to burn an image to multiple USBs i.e. to duplicate using a large USB hub.

Note: when using Etcher only one USB can be burned at a time while ImageUSB is capable of burning multiple USBs at once. As such the process outlined in this section is only available to Windows users. For others – it is recommended that the e-Exam Admin tool be used to create multiple USBs at once (See 'Admin tool guide'), however a slower commandline script is also available (See 'Administrative Helper Scripts' section).

*In windows:*

1. Open ImageUSB.exe. This will request admin rights (user/pass).
2. Plug in your USB stick(s) e.g. using a large hub.
3. On the Image USB screen:
  - e. The USB sticks should appear in the top part of ImageUSB. If not, click the 'Refresh Drives' button.
  - f. Step 1: select the target USB sticks (all data will be lost the selected sticks/drives/devices).
    - i. If these are new USBs then they appear as shown below, each with a drive letter.
    - ii. If these are existing e-Exam USBs then you will also see the four partitions. Regardless - ImageUSB will still write all the new partitions over the top of the old ones.
  - g. Step 2: select 'write image to USB'.
  - h. Step 3: browse to find your master disk image file (.bin or .img).
  - i. Click 'Write' to start the process.



4. This will give you a set working e-Exam student USB sticks.

Final checks...

- Test a sample of the USBs to ensure they can boot on both an Apple and a 'windows' laptop and that it will display the e-Exam correctly!
- After the test, go back and clear out the answers drive(s) by removing all the files/folders you see there. This will remove any previous attempts/boot session data etc (Note, some of the hidden folders such as '.Trashes' may not be removable but this is not a problem!).

If the process fails, See 'Possible cause of a failure to burn or image an e-Exam USB'.

# Advanced Techniques

## Old Windows versions and Win32 Disk Imager

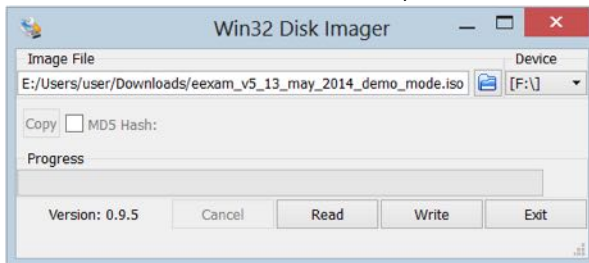
If the suggested tools do not work on an older version of Windows you can try Win32DiskImager as an alternative tool. Win32DiskImager is a tool used for writing a disk image to a single partition USB stick or SD/CF card. It can be used on one USB at a time.

Download it <http://sourceforge.net/projects/win32diskimager/>

Note: When using older versions of Windows Win32DiskImager may strike trouble if an existing e-Exam USB is used because all four partitions cannot be mounted and read (A work around is to revert the e-Exam USB to a factory default single partition drive – see **xxxxx**)

Run Win32DiskImager by opening the folder and double-clicking the Win32DiskImager.exe file.

1. The Win32DiskImager program starts.
2. Click on the small blue folder icon to locate the e-Exam ISO file on your computer. You will need to change the file format selection from '.img' to '\*.\*' in order to see the .iso file.
3. The USB stick will probably be located automatically – make sure the drive letter matches the correct device because this process destroys all existing data on the target device.
4. Once these two items are correct, click on the Write button.



5. A warning may appear. Double check you have selected the correct USB drive, if so then click YES.



6. A progress bar will be displayed. The process of making an e-Exam USB can take several minutes depending on the speed of your computer and the speed of the USB stick itself.
7. When the process is complete, you will see a 'complete' notification dialog box – click 'OK'.
8. Close down Win32 Disk Imager using the Exit button.
9. Perform a 'safe' removal for your USB and eject it.

The e-Exam USB is now ready for use.

## Terminal Commandline Tools

### Burning a disk image to a USB stick

#### Apple MacOS / OSX

A USB created using this process will be bootable on both Apple branded Intel based hardware and a range of non-Apple Intel hardware (i.e. regular 'windows' laptops).

We assume you have the e-Exam v6 disk image file (e.g. \*.img file) downloaded onto your Mac (if it came as a ZIP file, unzip the package). The examples in this section use the filename e-exam-demo.img to represent the e-exam system disk image.

*Note:* If you are use an ISO as the source file and if the process below fails in OSX – see the section 'Convert ISO to DMG'.

**Warning:** To avoid unintentional data loss, follow the instructions very very carefully.

It is best to remove all 'removable' storage devices from the computer before starting (i.e. USB sticks, memory cards/card readers, portable HDDs etc).

Don't insert the target USB stick yet.

We will use the command line (Terminal).

First, open Terminal (in /Applications/Utilities/ or search for 'Terminal' in Spotlight).

### Stage 1 Determine the allocated Identifier of the target USB stick.

We recommend that you use a new USB stick that is approximately 20% bigger than the image file. This gives a reasonable safety margin. I use 8GB sticks I have on hand but as will become apparent they are not 8GB in reality!

Do *not* format the USB stick to a Mac format. New USB sticks are normally formatted as FAT32 (windows format) out of the box and this is what we want.

Now we need to determine the correct disk ID of the USB stick.

Do not insert the USB stick yet.

We recommend that you remove all externally connected USB storage devices or external hard disk drives. This will help avoid making any tragic mistakes later! If you are not able to remove external drives then take extra heed of the instructions below!

To start we need to determine the current set of identifiers.

Type this command:

```
diskutil list
```

On the screen it will look similar to this:

```
MacBook-Pro:~ user$ diskutil list
/dev/disk0
#:   TYPE NAME                SIZE          IDENTIFIER
0:   GUID_partition_scheme     *500.3 GB     disk0
1:   EFI                       209.7 MB      disk0s1
2:   Apple_HFS Macintosh HD     100.0 GB      disk0s2
3:   Apple_Boot Recovery HD     650.0 MB      disk0s3
4:   Apple_HFS APPS             90.0 GB       disk0s4
5:   Apple_HFS FILES            208.3 GB      disk0s5
6:   Apple_HFS VM               100.7 GB      disk0s6
```

This list will display all the 'drives' mounted on your Mac's file system. Your computer will look different.

In this case my Mac has one internal physical HDD given the identifier 'disk0'.

There are a number of partitions (volumes in Mac speak) numbered 0 to 6.

If you have more than one physical HDD these will be numbered disk1, disk2 and so on. The number of volumes on your HDD will likely be different.

So a computer with three physical HDDs (connected internally or externally) would display disk0, disk1, disk2.

We want to make sure that we do not burn to any of these because all existing data on it would be lost!

Now we need to find the correct target disk identifier.

Next insert the new USB stick and run the command again.

Type this command:

```
diskutil list
```

Again, on screen it would look similar to this:

```
MacBook-Pro:~ user$ diskutil list
/dev/disk0
#    TYPE NAME                SIZE          IDENTIFIER
0:   GUID_partition_scheme    *500.3 GB    disk0
1:   EFI                      209.7 MB     disk0s1
2:   Apple_HFS Macintosh HD    100.0 GB     disk0s2
3:   Apple_Boot Recovery HD   650.0 MB     disk0s3
4:   Apple_HFS APPS           90.0 GB      disk0s4
5:   Apple_HFS FILES          208.3 GB     disk0s5
6:   Apple_HFS VM             100.7 GB     disk0s6
/dev/disk1
#    TYPE NAME                SIZE          IDENTIFIER
0:   FDisk_partition_scheme    *7.7 GB      disk1
1:   DOS_FAT_32 UNTITLED       7.7 GB       disk1s1
```

Again you see the list of drives mounted. You will notice one new disk in the list, in this case 'disk1'. This is my target USB stick.

You will notice the size of 7.7GB despite it saying 8GB on the box!

The identifier digit assigned will likely be one greater than the highest number seen in the previous command. However, this may not always be the case if you had mounted and removed other devices during your current session.

Again the example of a computer with three physical HDDs (disk0, disk1, disk2) it is likely the USB stick would be given the id of 'disk3'.

You must be \*certain\* of the correct designation of the USB stick because this will be the target of the 'burn'. On my Mac the USB stick was assigned 'disk1'.

Write down the diskID assigned to your USB.

### Stage 2: Unmounting the target USB stick.

We now need to unmount (disconnect at a software level) the target disk (USB).

However, do not physically remove the USB stick from the computer.

The command structure:

```
diskutil unmountDisk /dev/diskID
```

(replace **ID** with the disk number from the last command; in the previous example, **ID** would be 1).

So I typed:

```
diskutil unmountDisk /dev/disk1
```

On screen it would look similar to this:

```
MacBook-Pro:~ user$ diskutil unmountDisk /dev/disk1
Unmount of all volumes on disk1 was successful
```

If you do not get the above success message, check that you had not opened a Finder window to the USB stick. If so close all Finder windows and other software programs and try again.

### Stage 3. Burn to the stick

Now things get high stakes!

We are using the deadly 'dd' command.

It has the structure:

```
sudo dd if=[input path to file] of=[target diskID] bs=1m
```

This command will irrevocably overwrite all data on the target.

To burn to the USB stick with the disk identifier 'disk1' I type the following command all on a single line (remember to adjust your path to file and target diskID to suit, also note the use of rdiskID instead of just diskID as it speeds things up a bit):

```
sudo dd if=/Volumes/VM/e-Examv6/e-exam-demo.img of=/dev/rdisk1  
bs=1m
```

After hitting 'return' you will be asked for your password.

On the screen it looks similar to this:

```
MacBook-Pro:~ user$ sudo dd if=/Volumes/VM/e-Examv6/e-exam-demo.img  
of=/dev/rdisk1 bs=1m  
Password:
```

This process will take a long time, depending on your computer, speed of the USB stick, size of the file etc, it could be anywhere from 10 minutes to 45 minutes.

There will be no indication of anything happening after you enter your password until it completes. Do not be tempted to disturb it! I tend to just go and have lunch or work on another computer to be safe. (See the tip box following if you want to monitor progress).

When the burn completes you will receive feedback like this:

```
9926656+0 records in  
9926656+0 records out  
5082447872 bytes transferred in 770.383157 secs (6597299 bytes/sec)
```

Note – the actual numbers will be different in your case.

Also, you will probably notice a number of drives (Volumes) will appear on your desktop. These are part of the e-Exam USB.

#### Monitoring DD on OSX

Tip:

If you want to maintain a watch on the burn process you need to open a NEW Terminal window (do not close the existing one).

In the new terminal window type this command (remember to adjust the disk# to suit):

```
iostat -Iw 5 disk1
```

This gives an update of progress every 5 seconds for activity on disk1. Change the 5 to another number for a different interval.

#### Stage 4: safely remove the USB stick

The final step is to 'eject' the USB so you can safely remove it from the computer.

Type this command:

```
diskutil eject /dev/disk1
```

On screen:

```
MacBook-Pro:~ user$ diskutil eject /dev/disk1  
Disk /dev/disk1 ejected
```

The USB stick can now be safely removed.

It is ready to use!

*Ref*

*Instructions for creating a bootable USB stick from a disk image (follow the link and start at 'step 2')*

<http://www.ubuntu.com/download/desktop/create-a-usb-stick-on-mac-osx>



## Convert ISO to DMG

Note that if OSX doesn't play nicely with an ISO file we can to convert it to a Mac friendly format.

Terminal command structure:

```
hdiutil convert -format UDRW -o ~/pathto/destination.dmg ~/pathto/source.iso
```

Be sure to change the **pathto** to a real path and note:

- *destination* = the new dmg file to be created, for example you might want to name it 'e-exam-demo.dmg'.
- *source* = the name of the ISO file you downloaded.

Tip: you can 'insert' the path and file at the active cursor position in Terminal by dragging the file from Finder into the Terminal window. This saves typing and lessens the chance of errors.

So, to convert the ISO file that was downloaded I typed the following command (be sure to adjust/insert path and file names to suit):

```
hdiutil convert -format UDRW -o /Volumes/VM/e-Examv6/e-exam-demo.dmg /Volumes/VM/e-Examv6/eexam_v6_demo.iso
```

On the screen it looks similar to this (note; the stuff up to and including \$ is your prompt and will look different on your computer):

```
MacBook-Pro:~ user$ hdiutil convert -format UDRW -o /Volumes/VM/e-Examv6/e-exam-demo.dmg /Volumes/VM/e-Examv6/eexam_v6_demo.iso
Reading Master Boot Record (MBR : 0)...
Reading (Apple_Free : 1)...
Reading (DOS_FAT_32 : 2)...
Reading (DOS_FAT_32 : 3)...
Reading (DOS_FAT_32 : 4)...
.....
Elapsed Time: 11.631s
Speed: 206.4Mbytes/sec
Savings: 0.0%
created: /Volumes/VM/e-Examv6/e-exam-demo.dmg
```

Then in just several seconds the conversion is done.

If you browse to the location using Finder you will see the new file.

Note down the full path to the 'created' file. You will need this later (or select it, copy and paste to a text editor).

e.g. /Volumes/VM/e-Examv6/e-exam-demo.dmg

Note: If following the directions to 'Burn a disk image to a USB' use your DMG file name instead in place of the file name for the disk image.

## Ubuntu Desktop

You can use a standard Ubuntu LiveUSB, Ubuntu LiveCD or installed Ubuntu to burn a disk image to a USB stick.

1. Open the dash and search for **Startup Disk Creator**.
2. Select the **Startup Disk Creator** to launch the app.
3. Click the '**Other**' button to browse to the downloaded e-Exam ISO file.
4. Select the e-Exam ISO file and click '**Open**'.
5. Select the USB stick in the bottom box and
6. Select the radio button for '**discard on shutdown...**' (Note: The e-Exam ISO has defined storage areas).
7. Click '**Make Startup Disk**'.
8. When the process completes, eject each partition of the USB stick before removing it (e.g. right-click the USB icon and choose 'eject' or 'eject parent drive')

It is now ready for use.

Ref <http://www.ubuntu.com/download/desktop/create-a-usb-stick-on-ubuntu>

**Warning:** To avoid unintentional data loss, follow the instructions very very carefully.

It is best to remove all 'removable' storage devices from the computer before starting (i.e. USB sticks, memory cards/card readers, portable HDDs etc).

Don't insert the target USB stick yet.

At a command prompt, first switch to a root prompt by typing:

```
sudo su
```

Next, we need to detect which device node is assigned to the USB stick.

Type the command:

```
tail -f /var/log/syslog
```

You now have a live view of the system log (syslog).

Now - plug in your USB stick.

You should see some messages on screen. Something like this:

```
Oct 27 00:35:07 Ubuntu kernel: [ 5054.646585] usb 2-1.1: new high-speed USB device number 5
using ehci_hcd
Oct 27 00:35:07 Ubuntu kernel: [ 5054.741437] scsi8 : usb-storage 2-1.1:1.0
Oct 27 00:35:07 Ubuntu mtp-probe: checking bus 2, device 5:
"/sys/devices/pci0000:00/0000:00:1d.0/usb2/2-1/2-1.1"
Oct 27 00:35:07 Ubuntu mtp-probe: bus: 2, device: 5 was not an MTP device
Oct 27 00:35:08 Ubuntu kernel: [ 5055.739177] scsi 8:0:0:0: Direct-Access      JetFlash
TS2GJFV30      8.07 PQ: 0 ANSI: 2
Oct 27 00:35:08 Ubuntu kernel: [ 5055.740198] sd 8:0:0:0: Attached scsi generic sg3 type 0
Oct 27 00:35:08 Ubuntu kernel: [ 5055.741593] sd 8:0:0:0: [sdc] 4005888 512-byte logical
blocks: (2.05 GB/1.91 GiB)
Oct 27 00:35:08 Ubuntu kernel: [ 5055.742214] sd 8:0:0:0: [sdc] Write Protect is off
Oct 27 00:35:08 Ubuntu kernel: [ 5055.742218] sd 8:0:0:0: [sdc] Mode Sense: 03 00 00 00
Oct 27 00:35:08 Ubuntu kernel: [ 5055.742712] sd 8:0:0:0: [sdc] No Caching mode page present
Oct 27 00:35:08 Ubuntu kernel: [ 5055.742715] sd 8:0:0:0: [sdc] Assuming drive cache: write
through
Oct 27 00:35:08 Ubuntu kernel: [ 5055.745326] sd 8:0:0:0: [sdc] No Caching mode page present
Oct 27 00:35:08 Ubuntu kernel: [ 5055.745329] sd 8:0:0:0: [sdc] Assuming drive cache: write
through
Oct 27 00:35:08 Ubuntu kernel: [ 5055.781564] sdc: sdc1
Oct 27 00:35:08 Ubuntu kernel: [ 5055.784191] sd 8:0:0:0: [sdc] No Caching mode page present
Oct 27 00:35:08 Ubuntu kernel: [ 5055.784196] sd 8:0:0:0: [sdc] Assuming drive cache: write
through
Oct 27 00:35:08 Ubuntu kernel: [ 5055.784200] sd 8:0:0:0: [sdc] Attached SCSI removable disk
```

Locate the short identifier in [square] brackets that is repeating - [sdc] in this case. Generally Ubuntu designates USB sticks with the identifier 'sdx' ... where x = an assigned letter.

Note it down on a piece of paper - sdc

Press Ctrl+C to terminate the tail process and get back to an active command prompt.

Next, locate the e-exam disk image file.

If the disk image (ISO, IMG, BIN) file is at /path/to/e-exam.iso; note this path on a piece of paper.

Next, write the disk image onto the USB stick.

**Warning!** Be double sure you have the correct target disk. Typing a drive letter or number wrong will result in permanent data loss on a different drive. Pay extra attention while issuing the dd command!

Type the command:

```
dd if=/path/to/e-exam.iso of=/dev/sdc ibs=20M obs=20M
```

Be sure to:

- replace /path/to/e-exam.iso with the actual path and name of your disk image file.
- replace /dev/sdc with whatever target device you noted down earlier. If the repeating part is sdb ; use /dev/sdb , if it was disk1 then use /dev/disk1 and so on.

The dd process will take some time and will not show any progress indication.

When it is finished it will display something like this:

```
2401+0 records in
2401+0 records out
2517630976 bytes transferred in 566.717 secs (4442482 bytes/sec)
```

You will probably find that the multiple partitions of the newly created USB stick will mount (if are using the Terminal within Ubuntu desktop then you will notice that each will appear in the launcher bar or on your desktop).

You need to 'unmount' each of the partitions before removing the USB stick from the computer e.g. by typing:

```
sudo umount /dev/sdc1
sudo umount /dev/sdc2
sudo umount /dev/sdc3
sudo umount /dev/sdc4
```

You can now remove the USB stick from the computer. It is now ready for use.

*[More Methods](#)*

<http://www.webupd8.org/2009/04/4-ways-to-create-bootable-live-usb.html>

## Creating a disk image file from an e-Exam USB (by excluding unused space)

### Apple MacOS/OSX Using Terminal and DD

This process will create the smallest possible disk image because it excludes any unused (unallocated) space on the source device.

For example, an e-Exam USB stick with all its active partitions may be 3.5GB sitting on a 8GB stick. The process outlined below will produce 3.5GB disk image file because it will only include the sum of the partitions rather than the entire USB stick. Note that the actual size of the disk image file will vary according to the build number of the system.

*Note: the OSX Disk Utility imaging method previously advised for use with version 5 of e-Exam will not work with version 6 e-Exam USBs.*

To start we need to determine the current set of disk identifiers.

First open a terminal.

Do not insert the source USB stick yet.

Type this command:

```
diskutil list
```

On the screen it will look similar to this:

```
MacBook-Pro:~ user$ diskutil list
/dev/disk0
#:   TYPE NAME              SIZE          IDENTIFIER
0:   GUID_partition_scheme *500.3 GB       disk0
1:   EFI                    209.7 MB      disk0s1
2:   Apple_HFS Macintosh HD 100.0 GB      disk0s2
3:   Apple_Boot Recovery HD 650.0 MB      disk0s3
4:   Apple_HFS APPS          90.0 GB       disk0s4
5:   Apple_HFS FILES        208.3 GB      disk0s5
6:   Apple_HFS VM           100.7 GB      disk0s6
```

This list will display all the 'drives' mounted on your Mac's file system. Your computer will look different.

In this case my Mac has one internal physical HDD given the identifier 'disk0'.

There are a number of partitions (volumes in Mac speak) numbered 0 to 6.

If you have more than one physical HDD it will be numbered disk1, disk2 and so on. The number of volumes on your HDD will likely be different.

So a computer with three physical HDDs (connected internally or externally) would display disk0, disk1, disk2.

Now we need to find the correct source USB disk identifier.

Next insert the USB stick and run the command again.

Type this command:

```
diskutil list
```

Again, on screen it will look similar to this:

```
MacBook-Pro:~ user$ diskutil list
/dev/disk0
#    TYPE NAME                SIZE          IDENTIFIER
0:   GUID_partition_scheme    *500.3 GB     disk0
1:   EFI                      209.7 MB      disk0s1
2:   Apple_HFS Macintosh HD    100.0 GB      disk0s2
3:   Apple_Boot Recovery HD    650.0 MB      disk0s3
4:   Apple_HFS APPS            90.0 GB       disk0s4
5:   Apple_HFS FILES           208.3 GB      disk0s5
6:   Apple_HFS VM              100.7 GB      disk0s6
/dev/disk1
#    TYPE NAME                SIZE          IDENTIFIER
0:   FDisk_partition_scheme    *8.0 GB       disk1
1:   DOS_FAT_32 answers        209.7 MB      disk1s1
2:   DOS_FAT_32 system         4.3 GB        disk1s2
3:   DOS_FAT_32 eexam          367.0 MB      disk1s3
4:   DOS_FAT_32 db             209.0 MB      disk1s4
```

Again you see the list of drives mounted. You will notice one new disk in the list, in this case 'disk1'. This is our source USB stick containing the e-Exam system.

You will notice the sum of the individual partitions doesn't add up to the full 8GB. This is because the e-exam image was smaller than the maximum capacity of the USB stick.

The identifier digit assigned will likely be one greater than the highest number seen in the previous command.

Again the example of a computer with three physical HDDs (disk0, disk1, disk2) it is likely the USB stick would be given the id of 'disk3'.

Be sure of the correct designation of the USB stick because this will be used as the source of the disk image. On my Mac it is 'disk1'.

Write down the diskID of your USB.

Now we need to use the 'fdisk' command on the source device to find the last sector number of the last partition on the USB stick. This is to avoid including empty space or to avoid missing any data.

Type the command: `sudo fdisk /dev/disk1`

On screen it will look similar to this:

```
MacBook-Pro:~ user$ sudo fdisk /dev/disk1
Disk: /dev/disk1    geometry: 973/255/63 [15633408 sectors]
Signature: 0xAA55
    Starting      Ending
#  id  cyl  hd sec -   cyl  hd sec [    start -    size]
-----
1:  0C   0  33   3 -   26  217  30 [    2048 -   409600] Win95 FAT32L
*2:  0C   26  217  31 -   574  161  38 [   411648 -  8388608] Win95 FAT32L
3:  0C   574  161  39 -   621  113  56 [   8800256 -   716800] Win95 FAT32L
4:  0C   621  113  57 -   648   51  22 [   9517056 -   409600] Win95 FAT32L
```

Look for the line that has the highest 'start' value.

In this case the last line in the above output has the highest start value of 9517056.

Now add the 'size' value to the start value.

$9517056 + 409600 = 9926656$

Therefore the last sector want to include in our disk image is 9926656.

Unmount the disk (but do not physically remove it)

```
diskutil unmountDisk /dev/disk1
```

Now we will use the 'dd' command to create a disk image from the source device.

Now we can create the disk image file.

WARNING!!! the 'dd' command is dangerous and capable of destroying all content of a target device. Be very sure of how you type the destination value when using dd. In this case the risk is low in that all you may do is create a broken image containing part of your hard-disk drive rather than the e-Exam USB stick.

The relevant dd command in this format:

```
sudo dd if=<source_device> of=<desired_file_name>.img bs=512 count=<last_sector>
```

In this example the source\_device = /dev/disk1, desired\_file\_name can be anything you like and last\_sector = 9926656.

In this case the command will be: `sudo dd if=/dev/disk1 of=eexam.img bs=512 count=9926656`

On screen it will look similar to this:

```
MacBook-Pro:~ user$ sudo dd if=/dev/disk1 of=eexam.img bs=512
count=9926656
Password:
```

This process will take a long time, depending on your computer, speed of the USB stick, size of the file etc, it could be anywhere from 10 minutes to 45 minutes.

There will be no indication of anything happening after you enter your password until it completes. Do not be tempted to disturb it! (See 'Monitoring DD on OSX' if you want to monitor progress).

When the command completes you will see a summary of the data transferred and the command prompt will re-appear. You should now have a complete disk image.

```
6756352+0 records in
6756352+0 records out
3459252224 bytes transferred in 635.825400 secs (5440569 bytes/sec)
```

If you browse to the location using the Finder you will see the new file.

## Linux (command line)

At a command prompt, type 'dmesg'. Insert the USB,

Observe the output to find the identifier of attached disk, such as [sdb]

Then use `sudo fdisk -l /dev/sdb`

Then find in the output the 'End' sector of the last partition (i.e. the partition that has the highest start value). E.g 9926655. Then add '1' to the end sector number: 9926656.

Then use `dd` to create the disk image:

```
sudo dd if=/dev/sdb of=eexam.img bs=512 count=9926656
```

This may take several minutes.

An example terminal session is shown below:

```
$ sudo dmesg
[ 9351.171616] usb 3-1: New USB device found, idVendor=0781,
idProduct=5572
[ 9351.171620] usb 3-1: New USB device strings: Mfr=1, Product=2,
SerialNumber=3
[ 9351.171622] usb 3-1: Product: Cruzer Switch
[ 9351.171624] usb 3-1: Manufacturer: SanDisk
[ 9351.171626] usb 3-1: SerialNumber: 4C530001120412109201
[ 9351.172358] usb-storage 3-1:1.0: USB Mass Storage device detected
[ 9351.172487] scsi host7: usb-storage 3-1:1.0
[ 9352.206478] scsi 7:0:0:0: Direct-Access      SanDisk  Cruzer Switch
1.26 PQ: 0 ANSI: 6
[ 9352.207076] sd 7:0:0:0: Attached scsi generic sg2 type 0
[ 9352.207887] sd 7:0:0:0: [sdb] 15633408 512-byte logical blocks:
(8.00 GB/7.45 GiB)
[ 9352.211423] sd 7:0:0:0: [sdb] Write Protect is off
[ 9352.211427] sd 7:0:0:0: [sdb] Mode Sense: 43 00 00 00
[ 9352.212919] sd 7:0:0:0: [sdb] Write cache: disabled, read cache:
enabled, doesn't support DPO or FUA
[ 9352.229373] sdb: sdb1 sdb2 sdb3 sdb4
[ 9352.231539] sd 7:0:0:0: [sdb] Attached SCSI removable disk

$ sudo fdisk -l /dev/sdb
[sudo] password for user:

Disk /dev/sdb: 7.5 GiB, 8004304896 bytes, 15633408 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x59115825

Device      Boot      Start          End Sectors   Size Id Type
/dev/sdb1           2048      411647    409600   200M c W95 FAT32 (LBA)
/dev/sdb2 *        411648      8800255   8388608    4G  c W95 FAT32 (LBA)
/dev/sdb3           8800256      9517055    716800   350M c W95 FAT32 (LBA)
/dev/sdb4           9517056      9926655    409600   200M c W95 FAT32 (LBA)

$ sudo dd if=/dev/sdb of=eexam.img bs=512 count=9926656
[sudo] password for user:

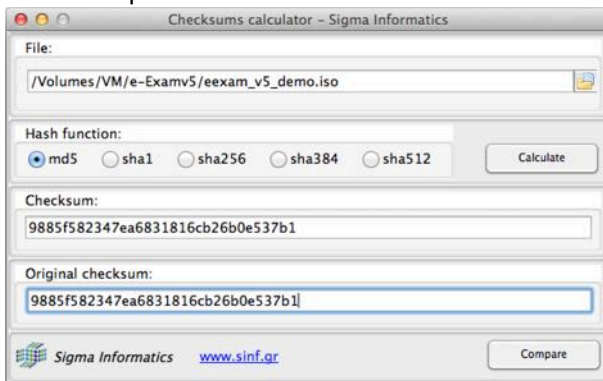
6756352+0 records in
6756352+0 records out
5002447872 bytes (5.1GB, 4.7 GiB) copied, 211.887 s, 24.0MB/s
```

# Other Matters

## Checking downloaded files for integrity (MD5 Hash check)

To ensure the large disk image file you just downloaded arrived intact (without errors), please follow the steps below.

2. Obtain the 'Checksums calculator' software to match your operating system from <http://www.sinf.gr/en/hashcalc.html>
3. Unzip the archive and run the file.
4. Download the desired e-Exam disk image from e-Exam HQ: locate and download the relevant zip file of the system. Be sure you have plenty of spare drive space to unzip the file (at least 3x the size of the zip file).
5. Unzip the archive. Two files will be extracted:
  - a) disk image ".img" file (the system image file)
  - b) hash file ".md5" file (this will be unique for each edition of the e-Exam system).
6. Open the .md5 file in a Text editor.
7. Open the 'Checksums Calculator' software.
8. In the 'Checksums Calculator' software, at the 'File' area select the newly unzipped disk image (.img) file.
9. Set the 'hash function' to 'md5' and click the 'Calculate' button.
10. Copy and paste the MD5 hash from the Text editor into the 'Original checksum' box.
11. Click 'Compare'.



12. Results: A dialog box will appear with either:
  - a. If "checksums are identical" then the file is intact and correct. You can now proceed to create an e-Exam USB stick.
  - OR
  - b. If the results are not identical then there was a problem in downloading or extracting the .img file. You will need to try re-extracting or downloading the file again. If it fails on a second try you may need to get in touch with e-Exam HQ.

## Master USB stick capacity considerations

Considerations for selecting the USB stick that you use to create your own customised e-Exam master disk images.

The Windows software ImageUSB will create a disk image of the 'full size' of the source USB stick. This is because the tool includes the 'empty' and unused space at the end of the device in addition to the four e-Exam disk partitions/drives.

As such when you create your own customised e-Exam master disk image based on a 8GB USB stick you get 8GB disk image from ImageUSB.

A potential problem arises later in the process due to the slight variation in the data capacity of different brands/models of USB sticks (e.g. a given batch of "8GB Scandisk Cruzer" USBs is 7.51GB in reality). Other batches, brands or models of USB stick may be slightly smaller or slightly larger.

If you try to burn a larger disk image to a slightly smaller capacity device it will fail, result in an error or non-functioning e-Exam USB stick.



Therefore you will need to be very sure that the USB sticks that you plan to burn onto are of same or larger capacity than the disk image you produced.

*There is a simple solution!*

Use a smaller USB stick for your master-USB configuration disk images e.g. 4GB (in the case of student/client disk images these are normally under 4GB so will fit nicely without too much wasted empty space. But if creating 'admin' USBs then use 8GB USBs). Then create your customised disk image from that. Having a smaller disk image increases your choice of available USB sticks.

A smaller disk image will have the added benefit of speeding up your large batch USB burning sessions as there will be less data to write to each USB stick.

As of 2019 good quality 8GB and 16GB sticks are common in the market so you are likely to have many of these and thus be using them for deployment in exam rooms. However good quality 4GB sticks are now harder to obtain so keep those for creating disk images. The market is changing so expect to find more of the larger capacity drives.

Get in touch with e-Exam HQ if you need recommendations as to which brands/models to purchase.

A more precise solution to the issue outlined in this section is to utilise commandline tools in Apple or Linux to produce exactly sized disk images to exclude empty and unused space.

### **Possible cause of a failure to burn or image an e-Exam USB**

#### **Imaging from:**

1) *Using ImageUSB* to create a disk image only works if the USB stick is set as a 'removable' USB.

Most USB sticks are set to be 'removable' so it should work most of the time!

If the imaging process fails the USB stick may be set as a 'USB HDD' (you may not know this until you subsequently try to burn it to another USB and then attempt to boot it).

In this case you can:

- Try a different Windows software 'RMPrepUSB.exe' to create the disk image. This tool is somewhat complex to use.  
Refer to their website for further details <https://www.rmprepusb.com>  
OR
- Refer to the 'Advanced techniques' section for methods of using the command line in Apple OSX or Linux to generate disk images.

2) *Do not use Apple Disk Utility* to create the disk images.

Burning such images results in USBs that only boot via EFI mode. Such USBs won't boot via BIOS/Legacy mode thus reducing the range of laptops that can be used.

#### **Burning to:**

1) As mentioned – ImageUSB on Windows may have trouble with overwriting e-Exam USB sticks designated as 'USB HDD'. Using ImageUSB to burn on top of such a USB will fail with "access denied".

In this case you can:

- Use Windows Disk Management tool to 'Delete Volume' (delete all exam partitions), then select 'new single volume', then format it, using defaults. You can now treat it as a new single volume USB and re-burn the image onto it (Note: Windows Disk Management can't delete volumes in a 'removable' USB).  
OR
- Use Apple Disk Utility to re-format the USB into a single partition before going back to Windows for burning / disk imaging etc.  
OR
- Use Linux 'Gparted' tool to re-format the USB into a single partition – see the 'Admin user guide' for instructions.

## Not covered: Retrieval of exams files post-exam

Note you currently can't \*easily\* use Windows to batch retrieve responses from multiple USBs at once (unless you have purchased a rather expensive proprietary USB copy box tool).

It is possible to use the search tool in Windows Explorer to find files across multiple mounted USB drives that match given file name pattern. E.g. use a portion of the file name that will be common to all response files. Then use 'copy' to grab the files and 'paste' to somewhere suitable on the HDD.

We don't have an alternative free/cheap suitable software tool at this time for bulk data retrieval on Windows.

Hopefully you can use the e-Exam Admin tool to do that.

We also have some separate command line scripts that work on OSX.

## Not covered: Re-initializing multiple e-exam USBs (recycling)

Note if using Windows to recycle e-Exam USBs (e.g. delete data from the 'eexam' drive). Then the version of Windows needs to be a minimum of Windows 10, version 1703 (known as 'Creator's edition'). This version introduced to Windows the ability to see/mount multi-partition USB 'removable' devices – i.e. e-Exam USBs.

Older versions of Windows have limitations where by Windows is not able to see/mount the multiple partitions on the e-Exam USB.

Hopefully you can use the e-Exam Admin tool to do that.

We have some separate command line scripts that work in OSX that will do this task.

You can also manually update/delete/copy files to a single e-Exam USB stick via Apple OSX or Linux. Then use it as your next 'master' USB stick. Then follow the rest of this document to re-burn all of your USB sticks. This is slow and will shorten the life of the USB sticks compared to using the e-Exam Admin tool or using command line scripts in OSX.

# Managing e-Exam USB Sticks

The e-Exam System allows for manual configuration of settings such that the same USB stick can be converted to perform different tasks. There are a number of settings in the eexam/.config.txt file. Please refer to Appendix 1 in the Administration tool guide for full details of each setting.

To locate the settings file:

1. Having mounted the e-Exam USB stick inside another operating system, go to the 'eExam' partition and locate the '.config.txt' file (you will need to have hidden files visible or use Terminal to 'ls -a').
2. Open this file in a text editor.

Note: The eexam partition cannot be accessed using an old version of Windows.

## Changing the Exam Content

The e-Exam System v6 Demo serves as a base platform from which to build custom exam environments. The sample ISO files contain a couple of examples to get you started. There is a 'post paper' exam using the word processor ('paper' or 'office' exam type setting) exam and an online example that connects to 'Moodle' server with Safe Exam Browser ('seb' exam type setting).

There are example exams provided on the transforming exams website as ZIP downloads. Additional examples may be added over time.

The example exams provided on the TransformingExams.com site include:

- Example 'paper equivalent' exam. This small ZIP file contains a .doc file and ancillary config files. This utilises the on-board office suite. This style of exam can be done as an e-Exam or via pen-on-paper giving students a choice. This is prepared using a regular word processor

and either printed or copied onto the e-Exam platform. This approach is ideal for first the stage of a transition to e-exams. Tip: save as '.doc' format and avoid '.docx' format.

- Example 'post paper' exam. This is a larger ZIP file that contains .doc file, sample multimedia files, sample applications and ancillary config files. This also utilises the on-board office suite along with multi media components and additional software tools. This style of exam requires a computer to be used by all students as it contains elements that cant be done via pen-on-paper. This could be extended to use any common office file format such as a spreadsheet file and presentation files, or indeed other file formats such as CAD files provided the appropriate software is added to the e-Exam system.

To set up a different exam on an existing e-Exam System USB follow the steps below. You can obtain one of the sample exam ZIP files or create your own. Tip: for those creating their own be sure to save as '.doc' format and avoid the '.docx' format.

To change the exam file(s) on an existing e-Exam USB you will need to:

1. Create or obtain the exam files (e.g. Download and unzip the example exam files).
2. Mount the USB into another operating system capable of mounting multi-partition USB sticks (i.e. inside OSX or Linux or Windows 10 version 1703+). Note: Old 'windows' versions won't work for this step because it can't mount multi-partition USB sticks. If you only have an old 'windows' computer, you can use a generic Ubuntu Live USB to boot a 'windows' computer and then mount the e-Exam USB within it.
3. Replace the contents of the 'eexam' partition with the contents of the ZIP file.
4. Boot a computer using the e-Exam USB to try.

The minimum files required in the eexam partition for offline use are:

- One x '.config.txt' file: the exam configuration file.
- One x '.background' file: an image file to serve as the wallpaper/background. This should be unique per exam.
- One x '.doc' file. This contains the exam questions. The exam document file name must begin with the string 'STUDENTNO\_' (without the quotes). E.g. STUDENTNO\_s1\_2016\_biology\_final\_exam.doc. This file will be opened and will be copied to the answers partition where the STUDENTNO string is replaced with the student's ID number. This file thus becomes the student own response file. It is then opened by the system for the student. Note: do not use spaces in the file name.

If the e-Exam USB is to be used for an online exam then the doc file may not be required. However it may be desirable to set up automatic login to WiFi networks by placing a .net\_user.txt file on to the eexam partition (see the 'Admin tool guide' for details).

## Recommended Quality Control for Exam Files

It is recommended that you test the exam files by booting to the e-Exam System USB before mass-producing USBs! The process below is recommended for Offline exams.

First try the exam document in the e-exam system:

1. Place the exam file(s) onto the 'eexam' partition of an existing e-Exam System USB.
2. Adjust the .config.txt file to enable the 'clean up' feature (see 'Enabling cleanup').
3. Boot a computer to the e-Exam System USB to try the exam.
4. If changes are necessary follow on here otherwise jump to the next step. Make any adjustments in the e-Exam word processor to ensure the final version will display correctly. Then save the file, exit the word processor.
5. Then press the 'Shut Down' button.
  - a. If no changes were necessary choose 'Clear my data and shutdown', then confirm the shut down. The USB will be 'reset' to as-new condition. Jump to step 6.
  - OR
  - b. If you did make changes choose 'keep my data and shutdown', then confirm the shut down. The adjusted exam file will be retained on the 'answers' partition. Continue on to update the exam file with the new version.

- i. Mount the USB into another operating system capable of mounting multi-partition USB sticks (i.e. inside OSX or Linux).
  - ii. Copy the updated exam file from the 'answers' partition.
  - iii. Replace the original exam file on the 'eexam' partition with the updated file.
  - iv. Adjust the file name to ensure it begins with the string STUDENTNO\_
  - v. Reset the USB stick (See 'Manually Resetting the USB stick' or by booting back into the e-Exam System USB and choosing 'Clear my data' upon shut down).
6. Mount the USB into another operating system capable of mounting multi-partition USB sticks (again).
  7. Adjust the .config.txt file to disable the 'reset feature' (see 'Enabling the reset feature').
  8. Un-mount the e-Exam USB stick.

The customised e-Exam System USB should now be ready to use (or duplicate). You might like to do another round of testing/resetting to be sure!

## Enabling the 'Clean up' feature

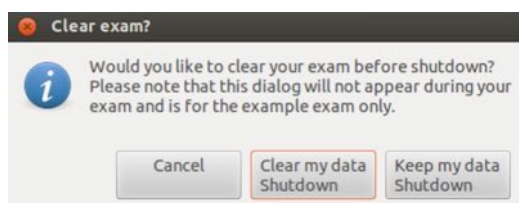
The e-Exam System v6 allows the USB stick to be cleaned up following use (i.e. reset to an as-new condition after it has been used by a 'student' user).

The clean up feature allows this to be done from within the e-Exam System interface itself rather than having to mount the USB stick on a secondary operating system. The clean up feature can be configured to work for both offline and online (SEB) exam modes. Three different trigger events can be configured (See the Admin tool guide for further details):

- Automatically upon submission of a Moodle quiz.
- Automatically upon shut down of the system.
- Manually upon shut down of the system via user choice.

Note: The user choice feature is intended to allow a single USB to be shared between multiple students for practice and demonstration purposes. For example, when a USB stick is put on a short term loan in a library or for use in drop-in help desk sessions. This feature should *not* be used for real exams!

If the user choice is configured, a clean up option is invoked as an extra step when the 'Shut Down' button on the side bar is used. If so, the 'clear exam' dialog box appears. The user has three choices.



- 'Cancel' – cancels the action and returns the user to the desktop.
- 'Clear my data shut down'
  - This re-sets the stick to an 'as new' state. This will wipe student data and any response files in the 'Answers' partition. This should be used before the USB stick is returned.
- 'Keep my data shut down'
  - This is used when a student user wants to continue practicing. It will retain student data and response file(s) so they can practice recovery and loss of power scenarios.

After pressing either of the shutdown buttons, the regular shut down confirmation dialog will appear and will need to be confirmed as normal.

To enable this extra cleanup step:

1. Mount the USB into another operating system capable of mounting multi-partition USB sticks.
2. Go to the 'eExam' partition and locate the '.config.txt' file (you will need to have hidden files visible or use Terminal to 'ls -a').
3. Open this file in a text editor.
4. Change the setting like so:

```
[Cleanup]
enable=y
keep_logs=y
user_prompt_trigger=y
```



5. Save the file.

Note: if you do not want to keep any session logs or session recordings set keep\_logs=n.

The next time you boot using the e-Exam USB stick the clean up function will be available.

To disable the clean up feature set enable=n.

## Recycling Existing e-Exam USB Sticks for the Next Exam

It is possible reuse e-Exam USB sticks multiple times.

Option 1: Re-burn the USBs with a new disk image. Performing a full burn will shorten their usable life and will likely take longer than simple file operations. Refer to the steps:

- Phase 2: Customise/update e-Exam USB,
- Phase 3: Create master disk image, then
- Phase 4: Burn the disk image to one or more USBs.

Option 2: Use file operations on the e-Exam USB sticks (copy, delete, rename). File operations are much less intensive and will serve to extend their life.

A collection of 'Administrative Helper Scripts' is available to perform such tasks on multiple USB sticks at once (batch).

A typical workflow to recycle a set of used e-Exam USBs (collect answers and set up for the next exam):

1. Insert used USBs into a USB Hub connected to a computer.
2. Copy answer file(s) from multiple USBs to a single folder on the computer (while checking each has copied correctly).
  - a. This can be manually done by using the File manager to search for a common string of text in response file name. Then copy and paste can be used to collect all the files.
3. Check that there is an answer file for each student that sat the exam (manual process).
4. Delete student data files (delete all files on the answer partition of each USB).
  - a. This can be manually done by using the File manager to search for a common string of text in response file names, user file etc. Then use delete to remove the files one batch at a time e.g. all response files, all user files.
5. Delete exam question files (delete all files on the eexam partition of each USB).
  - a. This can be manually done by using the File manager to search for a common string of text in response file names, configuration file etc. Then use delete to remove the files.
6. Delete database files (as applicable - delete all files on the db partition of each USB).
  - a. This can be manually done by using the File manager to search for a common string of text in response file names, configuration file etc. Then use delete to remove the files.
7. Copy the new exam question file(s) to multiple USB sticks – this can only be done using the helper script. Or by manually pasting a file into each USB stick in turn (see also 'Recommended Quality Control for Exam Files').

## Administrative Helper Scripts

Several bash or Python scripts are available to assist with administrating e-Exam USBs. These scripts assume you have one or more e-Exam USBs already created. These scripts require OSX or Linux and run via the command line. Please contact the project team to obtain them. A graphical interface tool is available as well (See Admin tool guide').

Note where scripts have a '6' the file name use these for version 6 USBs.

The scripts are:

- **copy\_from.py** This can be used to collect the response file(s) from multiple e-Exam USBs after an exam. This command line script will copy the contents of the specified partition of one or more e-Exam USBs to a specified destination on the host computer. The script will prompt for the relevant source and destinations. The default source is 'answers'. You can drag an empty folder into the command line to insert the path to the destination. E.g. if 20 e-Exam USBs are connected via a Hub then the contents of all 20 'answers' partitions will be copied to the specified folder on your computer.
- **copy\_to.py** This can be used to copy a new set of exam files onto multiple e-Exam USBs before an exam. This command line script will copy the contents of the specified folder on the host computer to one or more e-Exam USBs to a specified partition. The script will prompt for the relevant source and destinations. The default destination is 'eexam'. You can drag the folder containing the exam files into the command line to insert the path for the source.
- **delete.py** This can be used to remove exam answer files or question files from one or more e-Exam USBs in order to get ready for the next exam. This command line script will delete all contents of the specified partition of one or more e-Exam USBs. The script will prompt for the partition name. It defaults to 'answers'. Use with care!
- **cleanup.sh** (single). This command line script will reset a \*single\* e-Exam USB to 'as-new' for an exam and clean up various 'junk' files left after mounting in OSX. This script was designed re-set an e-Exam USB. It acts upon volumes with the names 'system', 'db', 'answers' and 'eExam'. It is configured to reset 'paper' type exams (e.g. after quality control/testing to get it ready for duplication). This script will not remove the exam question file from the eexam partition. However, it will remove the .eexam.sql from the db partition so it may not be suitable for on-board 'moodle' type exams (not to be confused with online exams using SEB) – see variants below. Variations on this script are:
  - **\_all** – as above but does extra and inoculates the partitions against several types OSX temp files.
  - **\_keeplibre** – as per **\_all** but keeps the .libre folder that contains libre office temp files.
  - **\_keepmoodle** - as per **\_all** but keeps the .exam.sql file that contains the latest version of the Moodle database.
- **cleanup\_batch.py** – Python script. Functions as per **\_all** but does so for all attached devices that have volumes with the names 'system', 'db', 'answers' and 'eExam'. Variants are:
  - **\_all** – as above but does extra and inoculates the partitions against several types OSX temp files.
  - **\_keeplibre** – as per **\_all** but keeps the .libre folder that contains libre office temp files.
  - **\_keepmoodle** - as per **\_all** but keeps the .exam.sql file that contains the latest version of the Moodle database.
- **eject\_all.py** – Python script. Will unmount all attached devices that have volumes with the names 'system', 'db', 'answers' and 'eExam'.
- **copybox.sh** This is a simple bit for bit duplication of USBs from a disk image file. Normally only used to set-up new blank USBs with the e-Exam System. Use with great care [further information TBA]. See also 'Initial Set-up of Blank USB Sticks for the e-Exam System'. At present this works sequentially one USB at a time so using this script is much slower than tools like ImageUSB (Windows only) or the e-Exam Admin Tool (See 'Admin tool guide').

## Manually Resetting an e-Exam System USB Stick

An e-Exam USB stick can be manually reset for the next student user. This is used for practice and between testing and getting ready for duplication.

To do so:

1. Mount the USB into an operating system capable of mounting multi-partition USB sticks (OSX or Linux or Windows 10 version 1703 onwards).
2. Go to the 'answers' partition. To get ready for duplication - delete all folders and files. If you want to keep log files and session recordings between use sessions then just remove the following files and directories:
  - .user\_info.txt
  - any .doc files (or other student created response files) that are present.

- any .lock files
  - any files ending in 'old'.
  - The contents of the 'user' directory, but not the directory itself.
3. If for on-board Moodle exams - Go to the 'db' partition. If you want to reset the on-board Moodle then delete the following file (this resets on-board Moodle to the default database and example demo exam – but don't do this for Moodle exams where you want to keep updated Moodle material, instead follow the guidance given in 'Managing Moodle exams'):
- .eexam.sql

The e-Exam USB can now be reused for the next student/user as if it were new.

## Returning an e-Exam USB Stick to a Generic Storage Device

To convert a multi-partition e-Exam System USB stick back into a standard USB stick that can be used for file storage, you will need to re-partition it. This will also work to re-birth e-Exam USB sticks that failed to 'burn' correctly (e.g. dud sticks).

*Warning! Re-partitioning the USB device will completely wipe all data on the device.*

To re-partition an e-Exam USB stick you will need to use an operating system capable of mounting/reading multi-partition removable devices – i.e. OSX or Linux. This can't be easily done within old versions of Windows. If you only have old Windows then you can use a generic bootable Live Linux USB or CD to boot the computer into Linux and perform these operations.

1. Mount the e-Exam USB stick inside the operating system.
2. Go to the appropriate tool:
  - a) In MacOS / OSX use 'Disk Utility'
    1. In Disk Utility, select the root of the USB device (not one of the volumes).
    2. Click on the 'Partition' button.
    3. Change the 'Partition layout' to '1 partition' – by default it will select MS-DOS (FAT) and use all of the available device capacity.
    4. Click apply.
    5. It will unmount the volumes and perform the re-partitioning.
  - b) In Linux use 'GParted' (see the user manual here: <http://gparted.org/display-doc.php?name=help-manual> ).
    6. Select the root of the USB device (not one of the volumes).
    7. Unmount all of the partitions.
    8. Select and delete each partition.
    9. Create a single new FAT32 partition to fill all the space.
    10. Click apply.
    11. It will perform the re-partitioning.

You can now unmount/remount the USB as a standard a single FAT32 partition storage device.

# e-Exam USB Stick Management Hardware

See the separate 'Hardware kit' guide provides a summary of the recommended equipment – **updated May 2019**.

The hardware guide can be obtained from [transformingexams.com](http://transformingexams.com)

## Extended discussion on Hardware

The following covers a broader discussion than the summary hardware guide.

Managing multiple e-Exam USB sticks is best done using large USB hubs because this will allow you to process USB sticks in bigger batches.

This section outlines examples of hardware and software combinations that are available from online vendors along with example product costs as of December 2015.

There are three main types of hardware for bulk USB management available in the market.

- **Standard USB Hub hardware.** Standard hubs can be used with free software tools when connected to a computer to perform the full range of e-Exam USB management tasks. Standard USB hubs are the most common and economical with the widest range of choice. Standard hubs are available in USB 3.0 and USB 2.0 varieties. Standard hubs come in sizes of up to 49 ports each. The larger sizes tend to be created for specialist uses such as Bitcoin mining or as charging stations for iPads and as a result tend to be less fancy in appearance than proprietary kits. However standard hubs work very well for all aspects of USB management and provide the most flexible solution for both burning new USB sticks and for recycling USBs between exams. Standard USB hubs can also be used together to increase the size of each batch, each using a USB port on the computer e.g. two 49 port hubs providing 98 ports. They can't be beat for the price especially when combined with free software tools. Standard USB hubs will work with any computer; Windows, OSX or Linux. Given OSX and Linux can mount all partitions of an e-Exam USB a full range of file level operations can be performed to recycle USBs between exams with this category of hardware. This is not the case for the proprietary bundles below.
- **Proprietary hardware and software bundles** that connect to a computer. These are marketed as 'USB duplicators' and tend to be more expensive to purchase. They come in a range of sizes, typically 20 USB ports per unit. These come with proprietary USB duplication software. However the software in this category only works with MS Windows. Some suppliers also use a 'copy protection dongle' that must be present in order for the software to work (i.e. if this gets lost then the system won't work). In addition, because MS Windows can only mount the first partition on the multi-partition e-Exam USBs this prevents data retrieval from partitions other than the first (i.e. if using both the 'answers' and 'db' partitions to store student responses). By default the e-Exam USB places the 'answers' partition first to facilitate this process. However, you will need to perform a full 'burn' to recycle USBs between each exam (i.e. to update the 'eexam' partition and 'db' partition where you will need to create a new ISO or master USB each time and burn the whole image to each USB stick). This repeated burning reduces the life of the USB sticks and takes longer than using file level operations such as copy, delete and rename. The hardware component of the bundle is often as a standard USB hub (it is best to confirm this before purchase) so it could be used with free tools or scripts to perform file level actions to recycle USBs. However in this case it would be best to buy the much cheaper standard hubs without the proprietary software anyway.
- **Proprietary hardware with on-board firmware (software).** These are used 'stand alone' as 'duplicators' and are not connected to a computer. These are the most expensive to purchase but can come in larger sizes with up to 118 USB ports. However, because these do not connect to a computer, only 'one to many' copying is possible. Significantly you can't use these systems to retrieve student responses from many USBs to a single destination. This type of hardware could be used where large-scale initial set-up of new USB sticks is required. However in many cases these are best avoided, because you will still need a mechanism to retrieve the responses, log files and session recordings after the exam (Note



if using online only SEB mode exams without session recording then these devices may suffice). This type of hardware will not work as a standard USB hub.

General advice for purchasing suitable USB hub equipment.

- Ensure there is adequate space between each USB port to allow for easy insertion and removal for a wide range of USB stick shapes.
- Independently powered Hubs are recommended over those that draw power from the computer. For USB hubs above about 5 ports this is a 'must have' feature.
- USB 3.0 versus USB 2.0: USB 3.0 Hubs will provide more data through-put when burning batches of new USBs (a good thing!). When retrieving responses there may not be a noticeable difference in speed. USB2.0 hubs are also currently cheaper than USB3.0. Also USB2.0 while slower, tend to be more widely available in larger sizes (more ports per hub).
- More ports on a single hub are not necessarily better. The bottleneck is often the USB port of the computer itself. Therefore two smaller hubs (e.g. 19 ports) plugged into two separate USB ports are likely to be faster overall than a single large 49 port hub plugged into a single USB port.
- Ports with numbers printed next to them can help with identifying USBs.
- Ports with LED lights adjacent may help identify faulty USBs, although this would require software able to take advantage of such a feature – this is not normally the case for standard Hubs but more expensive proprietary products may provide such features.

Note: Products labelled as 'USB charging' stations, while looking like large USB hubs, only provide electric charge and will not transfer data. Such charge only stations will be missing a 'USB host cable' and are of no use for managing e-Exam USBs. Be sure to read any product description or contact the vendor if in doubt.

Multiple options are outlined below.

#### **Standard 19 Port USB 3.0 Hub (eyeboot) – recommended.**

This standard USB hub includes an internal power supply. It has 16 ports on the top surface and 3 on the side. All ports are well spaced with a black metal enclosure. The built in power supply makes the unit very tidy but is a bit heavy so best used for desktop use, but it is 'luggable'. All required cables are supplied (wall power and USB to connect to a computer). There is an on/off switch on the unit itself.

Available from Eyeboot for US\$210 plus postage.

Be sure to request Australian power plug when ordering for 220volt supply.

<https://www.eyeboot.com/19-port-40a-usb3-hub.html>



#### **Standard 19 Port USB 2.0 Hub (Dipo)**

As above but limited to USB2.0 speeds. Silver color.

Available from a couple of vendors.

Product: "19 Port USB 2.0 HUB with Power Adapter 5V 20 Amps"

Cost: AU \$130 + 66 (shipping), \$196 total (priced in 2015, will vary with exchange rate).

Vendor link:

<http://www.aliexpress.com/item/DIPO-UH219-USB-2-0-19-Port-HUB-Powered-with-20A-Adapter-charger-for-tablet-pc/1437947142.html>

Comment: Request Australian power plug when ordering.



### Standard 10 port USB 2.0 Hub (Dipo)

This standard USB hub includes power supply 'brick' and has a solid metal enclosure in silver. It has 10 well labelled ports on the top surface, all are well spaced. All required cables are supplied (wall power and USB to connect to a computer). Light enough to be portable. Power needs to be turned on/off at the wall.



- Product: "Dipo Electronic 10 Port USB 2.0 hub with Power adapter 12V 5A"
- Cost: AU \$48 + 47 (shipping), \$95 total (priced in 2015, will vary with exchange rate).
- Vendor link: [http://www.aliexpress.com/store/product/usb-hub-10-port-usb2-0-hubs-with-60w-power-adapter-for-bitcoin-mining-Industrial-grade/1016053\\_32217979187.html](http://www.aliexpress.com/store/product/usb-hub-10-port-usb2-0-hubs-with-60w-power-adapter-for-bitcoin-mining-Industrial-grade/1016053_32217979187.html)
- Comment: Request Australian power plug when ordering.

### Standard 10 port USB 3.0 Hub (Orico)

This standard USB hub includes power supply 'brick' and has a solid metal enclosure in black. It has 10 well labelled ports on the top surface, all are well spaced. All required cables are supplied (wall power and USB to connect to a computer). Light enough to be portable. On/off switch on the unit.

- Product: "ORICO A3H10 Aluminum 10 Ports Multi USB3.0 HUB. Power Adapter-Black"
- Cost: AU \$67 (shipping included) (priced in 2015, will vary with exchange rate).
- Vendor link: <http://www.aliexpress.com/item/ORICO-10-Ports-Aluminium-USB3-0-SuperSpeed-HUB-w-PowerSupply-A3H10-Free-Shipping/1963767062.html>
- Comment: Request Australian power plug when ordering.



### Proprietary 20 port USB 2.0 duplicator (NexCopy)

This proprietary 20 port USB duplicator connects to a computer for use and is supplied with proprietary USB management software. The unit includes an internal power supply and has a solid metal enclosure in silver and blue. It has well labelled ports on the top surface, all are well spaced. Each port has a LED indicator light. All required cables are supplied (wall power and USB to connect to a computer). It is intended for desktop use. The 20 port units can be combined to make 40 or 60 port duplicators, each require one extra USB port on the computer.

The proprietary software uses a 'dongle' as copy protection and thus the software only works when it is attached (this requires its own USB port on the computer). It should also be noted that the proprietary software only works with MS Windows. As such due to the limitations of MS Windows, the software can only retrieve data from the first partition of the multi-partition e-Exam USBs (i.e. many-to-one mode). The units work to burn new e-Exam USBs (or re-burning between exams) in one-to-many mode from ISO file or a master USB.



- Product: "Nexcopy USB200pc (requires PC)" 20 ports.
- Cost: AU \$1,895 ex gst + \$40 shipping inc gst. (20 port unit priced in 2013)
- Vendor link: <http://www.usbduplicator.com.au/>
- Comment: Local Australian supplier. Nexcopy is based in the US at <http://www.nexcopy.com>

### Proprietary 22 port USB 2.0 duplicator (Aleratec)

This 22 port USB duplicator connects to a computer and is supplied with proprietary USB management software. The unit includes a separate power supply brick, an on/off switch on the case and has a solid metal enclosure in black. It has the ports on the top surface, all are well spaced but are not numerically labelled. Each port has a LED indicator light. All required cables are supplied (wall power and USB to connect to a computer). It is intended for desktop use but is portable. The hub hardware can be used as a standard USB hub and can be combined with other hubs to increase the batch size, each requiring one extra USB port on the computer.

The proprietary software doesn't have any copy protection so could be used with any USB hub. It should also be noted that the proprietary software only works with MS Windows. As such due to the limitations of MS Windows, the software can only retrieve data from the first partition of the multi-partition e-Exam USBs (i.e. many-to-one mode). The units will work to burn new e-Exam USBs (or re-burning between exams) in one-to-many mode from ISO file or a master USB. The hub hardware is a standard USB hub so can be used without the supplied software.



- Product: "1:22 Copy Cruiser Mini Duplicator".
- Cost: US \$629 + shipping (Also, US \$500 for 16 port USB 3.0 unit and US \$315 for 10 port USB 3.0 unit. Priced in 2015)
- Vendor link: <http://www.aleratec.com/usb-duplicator.html>
- Comment: US supplier, unsure if Australian power plug is available.

### Proprietary 118 port stand-alone USB duplicator (Aleratec)

This proprietary 118 port USB duplicator is a stand-alone unit with on-board duplication firmware. It can't be connected to a computer and thus can't be used to retrieve data from multiple USBs. The unit will work to burn new e-Exam USBs (or re-burning between exams) in one-to-many mode from a master USB.

The unit includes twin internal ATX power supply, an on/off switches on the case and has a solid metal enclosure in black. It has well labelled ports on the front vertical surface, all are well spaced. Each port has a LED indicator light. All required cables are supplied (wall power). The 118 port unit is on coaster wheels and is available in smaller capacities without coaster wheels of 32, 23 or 7 ports. It is intended for floor or table-top use (with wheels removed). The hardware can't be used as a standard USB hub.



This type of unit is available in multiple capacities from 7 to 118 port from multiple vendors.

- Product: "1:118 USB Copy Tower SA Duplicator - Stand-Alone".
- Cost: US \$15,749 + shipping (Also, US \$3,199 for 32 port unit and US \$2,399 for 23 port unit, US \$899 for 7 port unit. Priced in 2015)
- Vendor link: <http://www.aleratec.com/usb-duplicator.html>

Comment: US supplier, unsure if Australian power plug is available.

### Standard 49 Port USB 2.0 Hub (Eyeboot)

This hub is a good option for managing a large number of USB sticks using file level operations at minimal cost for the hardware. Multiple hubs could be connected to a computer to increase the batch size.

This yellow 49Port USB2 hub works well for file copy/delete operations on batches of USB sticks.

However – the USB2 speed will likely mean that burning a large number of USBs will be a slow process. This is likely due to the bottle neck created by trying to push 49 copies of the disk image onto 49 USBs as once via a single USB port.

The hub has well spaced and labelled USB ports on a large flat surface. The hub is a bright yellow colour. These hubs are available from multiple online suppliers and are commonly used by 'Bitcoin' miners or as charging stations for mobile devices. They are less fancy than consumer packaged USB hubs. Most vendors do not sell these hubs with power supplies but some do. The hub can use a commonly available generic ATX power supply used by desktop computers. However, some vendors will sell the hub with a more compatible power supply including suitable connecting cables all wired up – this is the recommended way to purchase.

These hubs are somewhat bulky due to their size and are in two main parts with connecting cables. Thus they are best suited for desktop use. All cables are supplied (wall power, connecting power and USB). Power needs to be switched on/off at the wall.

- Product: "Eyeboot 49 Port USB Hub 60A Power Supply and Cables Bundle 1"
- Cost: US \$185 + \$52 (shipping), total \$237. (priced in 2015).
- Vendor Link:  
<http://www.eyeboot.com/iphone-charging-station>
- Comment: Request Australian power plug when ordering. The separate power supply unit comes fully wired up, just plug the cable clip into the Hub.



Note: Eyeboot also have a 49port USB2 fully enclosed product (black metal box) but we have found it to be unstable when burning USB sticks.

The yellow 'kit' 49port USB2 version works, probably because a different power supply or because the power supply is not close to the data ports.

In-case this vendor disappears then the HUBs or components of the yellow kit hub can be purchased separately from other vendors. Aliexpress, e-bay and various other online vendors can supply the components to make up option yellow kit hub. You can probably use any large generic USB Hub in place of these items, however testing is recommended so buy one first before committing to buy too many. The individual components for option yellow kit hub are further explained below.

#### **Details - The yellow 49 Port USB2 hub components**

This is as a package with the power cable already attached to the power supply. To use this equipment all you need to do is plug in the ATX connector into the yellow USB hub and then connect the USB cable between your laptop. Be sure the voltage on the power supply is set correctly (e.g. 220v for Australia). This combination is much cheaper than proprietary USB duplicator boxes although not quite as neat in its form. If you prefer a neat metal box then the 19 port USB hub is a great choice.

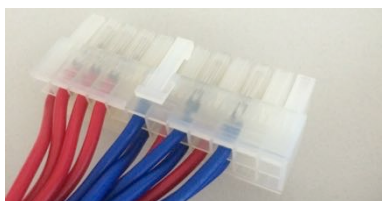
The yellow 49 port hub (eyeboot brand) is also available as several other brands and typically from vendors selling Bitcoin mining equipment. Be careful if looking for USB charging/syncing stations in place of USB hubs because some do not handle data but only deliver power to the USB ports. Always check if the item can operate as a generic USB hub. A hub will likely come with a suitable USB cable.

The power supply should also be available separately as it is also a commodity component. Any power supply capable of delivering the same rated output to an ATX cable would also be acceptable. A commodity computer ATX power supply unit could also be substituted although such a supply is designed to deliver a range of outputs compared to this recommended supply.

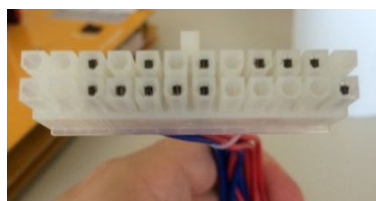


Power supply specifications: Mean Well NES-350-5. DC output 5v 60A. AC input 100-120VAC/7.0A or 200-240VAC/4.0A (the latter for Australia - be sure to correctly set the input switch before using this!) Wiring: Power to the USB hub (ATX connector) from left to right: 3 x Red positive, 3 x Blue negative. Mains power is on the right. This power supply came in the box already wired up.

The power cable is potentially the only non-standard component. However, a standard ATX power supply cable with one end stripped and replaced with spade and loop lug connectors would serve the purpose. But using a heavier gauge wire is probably recommended than what would be typically supplied with PC ATX power supplies. It would be best to get a suitable qualified person (electrician or a computer repair shop) to create the cable if you are facing this situation. The two images below 'ATX cable connector rear' and 'ATX cable connector front' show the wiring into the ATX connector. The power supply end wiring is shown in the image above in 'Power supply specifications'.



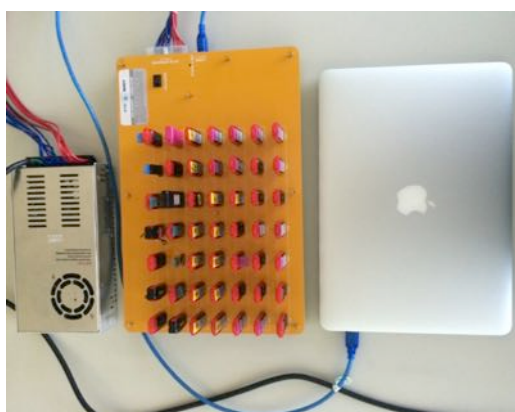
Rear view of ATX connector  
**A Complete Kit (49 Port hub)**



Front view of ATX connector

The hubs work with both Apple and Windows laptops (see photos below).

Note: Old versions of Windows have some significant limitations discussed below.



Apple laptop\* driven 49 port USB duplication kit



Windows driven 49 port USB duplication kit

### Using Apple and Linux

An Apple or Linux laptop is recommended along with a USB hub. This will allow you to perform all required functions using the 'e-Exam Administrator' software that available on Apple and Linux. We also have command line scripts that can be used. You will be able to:

- Create e-Exam USBs by 'burning' a disk image (ISO) to one or more generic USB sticks.
- Retrieve student exam responses from multiple USBs to a computer using file level copy and hash checks,
- Delete responses and exam scripts/files from used USBs using file level functions,

- Configuring the e-exam system for the next exam, and
- Copy new exam files/materials to multiple USBs from a computer in order to set up the next exam.

A key enabling capability is that OSX and Linux can mount multi-partition USB removable devices (regardless of their specification as 'removable' or 'HDD') - as such these operating systems can 'see' all the drives (Answers, eExam, db). This allows for the use of very efficient file level operations for the management and recycling of e-Exam USB sticks between exams. File-level operations mean commands such as copy, hash-check and delete. File operations are less damaging to the life and reliability of USB sticks compared to that of re-burning a new disk image.

### **Using Windows 10 Creators edition (version 1703) or later**

Using Windows means there is a reduced range of methods available to manage e-Exam USBs. However if Windows must be used, a laptop with Windows 10 version 1703 (also called Creator's edition) or later versions is better because this version introduced the ability to see (mount) multi-partition removable USB devices (e-Exam USBs!). Along with a USB hub, Windows can be used to set-up new e-Exam USBs. Unfortunately we have not yet created a version of the 'e-Exam Administrator' software for Windows.

Windows users (and users of proprietary duplicator boxes that are driven by Windows only software) can still complete a full e-Exam lifecycle – Retrieving results and recycling USBs - but not as easily and requiring some work-arounds.

The functions available to Windows users at this point in time are:

- Create e-Exam USBs by 'burning' a disk image (ISO) to one or more generic USB sticks using the software tools, Etcher, ImageUSB or Win32DiskImager.
- Retrieve student exam responses from multiple USBs to a computer using file level copy. To do this use 'Find' in Windows explorer to search for a common element in response file names across all connected drives. However, we don't have any free admin tools to help automate this process yet\*.

\*Note: The duplication (burning) of USB sticks can be done using proprietary USB duplicator boxes. These tend to be many times the price of our hardware set-up. Some proprietary equipment comes with software capable of retrieving the responses from the Answers partition in batches (many to one copy).

### **Using older versions of Windows**

If you are stuck with an older version of Windows note the 'Limitations' section below. But all is not lost. When it comes to the updating e-Exam USBs for the next exam, further 'work-arounds' will need to be used. You need to:

#### 1) Edit the contents of the 'eExam' partition.

To access the eExam partition you can reboot a Windows computer using an Ubuntu Live USB, or use a different computer with Apple or Linux. Then insert the e-Exam USB and update the exam materials.

Alternatively, you can obtain a 'USB-HDD' specified USB stick that older Windows versions will fully mount, that has been burnt as an e-Exam USB. Unfortunately USB sticks are not labelled as being 'removable' or 'USB-HDD' on their packaging. This is therefore trial and error.

#### 2) Create a new disk image.

Return to Windows and use ImageUSB to generate a new disk image from the updated e-Exam USB stick.

#### 2) Recycle e-Exam USBs by 're-burning' the new disk image to each e-Exam USB using ImageUSB.

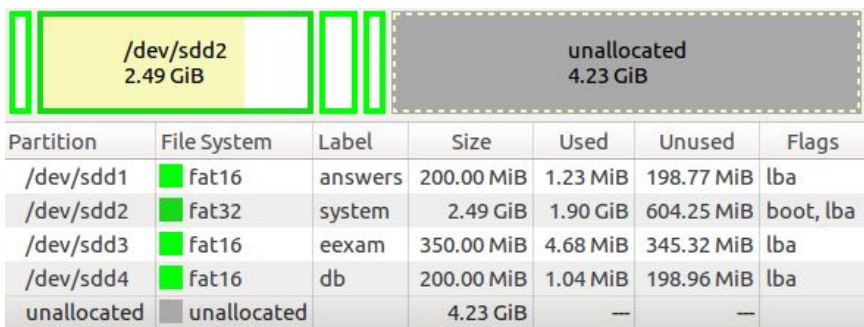
This takes longer compared to the file level operations that are possible on Apple and Linux systems.

This re-burning shortens the life of USBs and we have found that some brands of USB stick tend to become quite slow after several rounds of burning. It is difficult to know which brands/models of USB sticks will be impacted in this way. Therefore repeated re-burning is best avoided.

*More about old Windows version limitations*

a) Computers with old Windows versions may not handle 49 USBs plugged in at once. Your mileage will vary and will likely be limited to drive letters 'd to z' or less.

b) Old Windows versions can only see the first partition ('Answers') on an e-Exam USB stick. Old Windows can't mount (see) the other partitions on e-Exam USBs (multi-partition USB removable devices\*). An e-Exam USB consists of the partitions labelled 'Answers', 'system', 'eExam' and 'db' (see image below).



\* There is an exception to this Old Windows limitation. Old Windows can mount the multi-partition USB sticks only if the USB stick was specified as being 'USB HDD' at the time of manufacture. However, this is not something you can easily change after the fact and it is not easy to find out in advance which USB sticks are made in this way.



Good luck :-)