

Commodity e-Exam USB Management Hardware Kit

This document provides an overview of how to combine commodity hardware components and software tools to create an e-Exam Administration station. This can be used to create new e-Exam USBs (one to many duplication) as well as to recycle USBs between exams.

This document last updated 20 April 2017.

Recommended Equipment List

The following are all commodity components.

Large, generic USB Hub (examples are listed below, other generic USB hubs may also work)

- a) Option 1: a 19 port USB3.0 hub with integrated power supply in a black metal enclosure box US\$210 plus shipping from <http://eyeboot.com>. Request a plug to suit your country when ordering.



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

- b) Option 2: a 49 port USB2.0 Hub kit (Eyeboot brand). This is a bundle of the 4 items below US\$185 plus shipping from eyeboot.com (note this doesn't come with an enclosure):

- o 1 x 49 port USB 2.0 hub (Yellow in colour, eyeboot brand).
- o 1 x power supply (Mean Well NES-350-5). Request a plug to suit your country when ordering. Before use, be sure to check the voltage switch is set to 220v or 110v to match your country.
- o 1 x 'ATX' to power supply connector cable (this normally ships attached to the power supply).
- o 1 x USB cable (square connector to standard USB connector - aka USB A/B connector).



**300 watt
60 Amp**

Order this bundle from <https://www.eyeboot.com/49-port-usb-hub-60a-power-supply.html>

Computer:

- c) 1 x Apple laptop with standard two USB type A ports (rectangle shape) or
- d) 1 x Windows laptop with standard two USB type A ports (rectangle shape) – Note! Apple is recommended due to limitations with Windows.

Software:

- e) A graphical user interface 'e-Exam Administrator' tool based within a generic Ubuntu Live USB. This works in a similar way as the e-Exam USB sticks in that it is a bootable USB stick. This is designed to be easy to use with a point and click interface. It should work on both Apple and Windows laptops as above.
 - Please get in touch to obtain the disk image file that you can use to create your own e-Exam Admin USB.
 - An 'e-Exam Admin guide' is available that explains all functions needed to administer e-Exam USBs.
- f) e-Exam administration helper command line scripts for use in OSX and Linux. These are an alternative to graphical user interface tool above. Available free from us, see <http://mirror.aarnet.edu.au/pub/eexams/> then look for the most recent version of the eexam_management_scripts file.
- g) Windows users only: ImageUSB software (freeware from OSforensics). A graphical user interface tool designed to burn disk images to a USB. <http://www.osforensics.com/tools/write-usb-images.html>

Equipment Notes:

1) At this time we recommend Apple laptops with standard USB Type A ports (rectangle shape). The reason for this is explained below. We hope work towards a more universal solution in due course.

2) The USB hubs can be purchased from eyeboot.com, or the Eyeboot eBay store. Last checked Feb 2017.

We currently recommend option 1 as the most stable and 'neat' package.

Be sure to request a power plug to suit your country when ordering USB hubs (e.g. Australian three prong plug).

These ship to your door.

Note: Eyeboot also have a 49port fully enclosed product (black metal box) but we have found it to be unstable when burning USB sticks. The yellow kit version is fine, probably because a different power supply or arrangement is used.

In-case this vendor disappears then the HUBs or components can be purchased separately from other vendors. Aliexpress, e-bay and various other online vendors can supply the components to make up option 2. 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 2 are further explained below.

If you prefer option 2 (49 ports) read on, otherwise you may skip the remainder of this section (go to 'The complete kit').

Details - The 49 Port USB hub components (option 2)

In the case of option 2 it 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 and the Hub and ensure the voltage 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 option 1 is a great choice.

The 49 port hub (eyeboot brand) is also available as several 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.

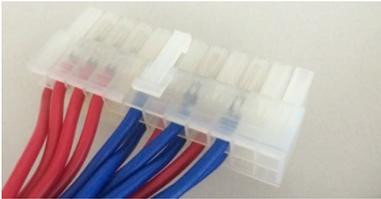
The power supply should also be available separately as it is also a commodity component. Any power supply capable of delivering the same output to an ATX cable would also be acceptable. A commodity computer ATX power supply unit could also be substituted although such a supply is designed to deliver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



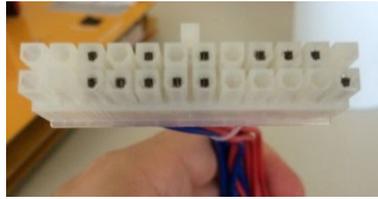
Power supply specifications: Mean Well NES-350-5. DC output 5v 60A. AC input 100-120VAC/7.0A or 200-240VAC/4.0A (the latter for Australia - be sure to correctly set the input switch before using this!) Wiring: Power to the USB hub (ATX connector) from left to right: 3 x Red positive, 3 x Blue negative.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

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

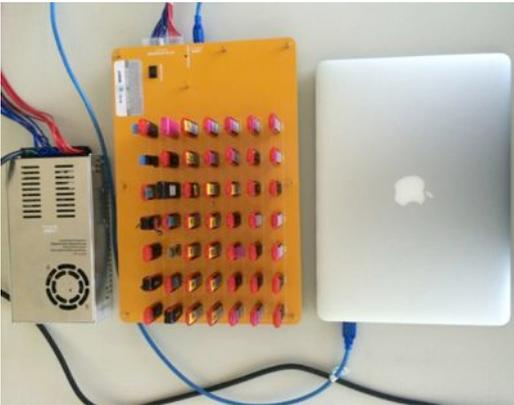


Front view of ATX connector

The Complete Kit

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

Note: Windows has some significant limitations discussed below.



Apple laptop* driven 49 port USB duplication kit



Windows driven 49 port USB duplication kit

Apple and Linux driven admin station

An Apple or Linux laptop with a USB hub can be used to perform all required functions.

The 'e-Exam Administrator' software is available on Apple and Linux to help with most of the required steps. We also have command line scripts that can be used.

The capabilities at this point in time are:

- 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.

Windows driven admin station

A Windows laptop with a USB hub can be used to set-up new e-Exam USBs. 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.

Unfortunately we have not yet created a version of the 'e-Exam Administrator' software for Windows. Some functions will never be possible due to Windows limitations (see 'more about Windows limitations').

The capabilities 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 free Windows only software tool 'ImageUSB'. This software is very efficient and accurate.
- Retrieve student exam responses from multiple USBs to a computer using file level copy – but only if the files are on the 'Answers' partition of the e-Exam USBs. 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).

Recycling e-Exam USBs under Windows requires some 'work-arounds' 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 Windows 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.

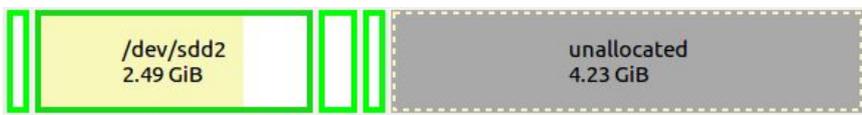
This takes longer compared to the file level operations that are possible on Apple and Linux systems.

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 Windows limitations

a) Windows laptops 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) Windows can only see the first partition ('Answers') on an e-Exam USB stick. 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).



Partition	File System	Label	Size	Used	Unused	Flags
/dev/sdd1	fat16	answers	200.00 MiB	1.23 MiB	198.77 MiB	lba
/dev/sdd2	fat32	system	2.49 GiB	1.90 GiB	604.25 MiB	boot, lba
/dev/sdd3	fat16	eexam	350.00 MiB	4.68 MiB	345.32 MiB	lba
/dev/sdd4	fat16	db	200.00 MiB	1.04 MiB	198.96 MiB	lba
unallocated	unallocated		4.23 GiB	--	--	

* There is an exception to this Windows limitation. 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.

Further Advice

Further advice about e-Exam management is available from transformingexams.com. Refer to the 'Admin Tool guide' and the 'Demo set-up guide' documentation.