HMML Digitization Studio Setup: Camera, Computer, and Lighting Units

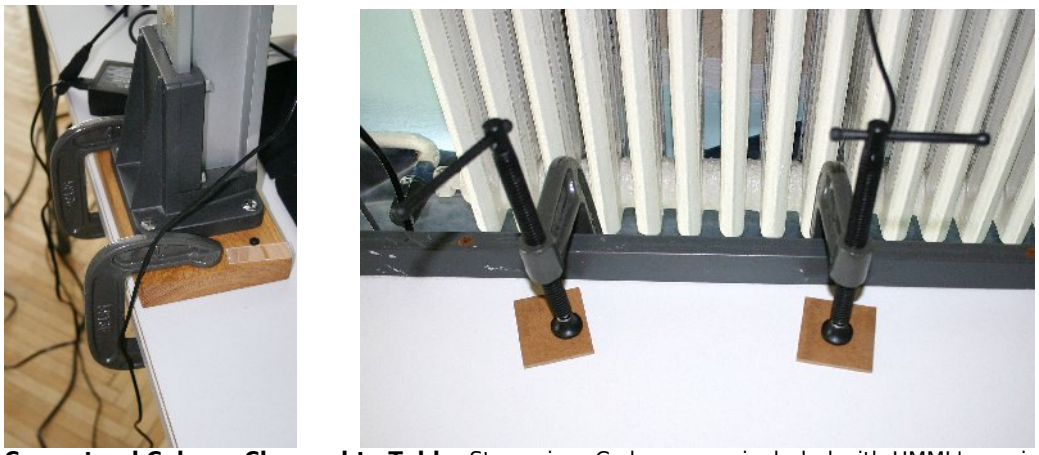
The Hill Museum & Manuscript Library has developed an efficient and versatile system for the digitization of manuscripts. This document outlines the basics of setting up a studio, connecting the various components and achieving proper lighting.

Initial Setup

A copy camera setup takes up more room than one might assume. For a one-camera system, the user will need a space approximately measuring 3x2.5 meters. Ideally, the area will be well-controlled in terms of climate and have adequate security. Hard floors (wood, tile, concrete) are generally preferred over carpeted areas, as these are easier to keep clean and dust-free. Tables are needed for the copy camera, the computer equipment, and (optional) for the organizing and preparation of manuscripts to be photographed.

General View of Digitization Studio. Sturdy tables hold copy stand and computer system; table in foreground used for sorting and preparing manuscripts for photography.

HMML designs the copy system to be quickly and easily assembled with a minimum amount of tools needed by the user. The copy stand column is designed to be clamped to a sturdy table using "C-clamps" (supplied). There are no holes to drill and no need to bolt or screw the column to someone's table. This allows for quick setup. It also allows the system to be easily moved to another location when needed.



Copy stand Column Clamped to Table. Strong iron C-clamps are included with HMML's equipment to allows "tool-free" mounting of copy stand to table. View from underside of table shows how masonite pads are used to cushion the clamps, preventing damage to the table.

Lighting Setup

The lighting system used by HMML is based on traditional copy stand lighting; two light sources are placed to either side of the subject matter to create an even field of light with minimal shadows. Two identical lighting units are used, positioned equidistant from the camera lens and in line with it. The intensity settings of the two lights should match.

Copy Lighting Setup. Two lights are placed at equal distances from the camera lens. The height and angle of the lighting units should match.

The exact height and angle of the lights aren't critical; the important thing is that they match for a given setup. Generally the light stands are positioned about 110cm from the lens. The light units are usually around 150cm from the floor; this will vary with the height of the table. The lights are tilted to direct their light to the center of the table, directly under the camera's lens. It's important in setting up the lights that nothing is interposed between the lights and the subject matter under the camera; this will create shadows in the picture.

Positioning the Computer and Monitor

The camera and lights are used in conjunction with a PC computer system. The camera is connected to the computer using a USB cable measuring about 370cm in length. This means that the computer needs to be fairly close to the camera system. Generally, it's handy to have

the computer positioned to the side of the camera setup. Other setups can be created based on the user's preference as long as the computer and monitor don't block any of the light traveling from the lighting unit to the subject matter. It's important to make sure that whatever sort of table or stand is used for the computer gear can hold the weight of the monitor, as large CRT units can be very heavy.

Electricity and Wiring

Adequate supplies of standard alternating current are needed for the lighting equipment and the computer system. In HMML's overseas projects, this tends to be 240-Volt 50-hertz single-phase electricity, which is standard throughout Europe and much of the Middle East. The equipment supplied by HMML is either pre-wired for 240V use or is "dual-voltage;" that is, workable with either 240V or 120V (Standard in North America) electricity. If North American dual-voltage gear has been shipped, there will be plug adapters to allow the American-style plugs to fit the European sockets.

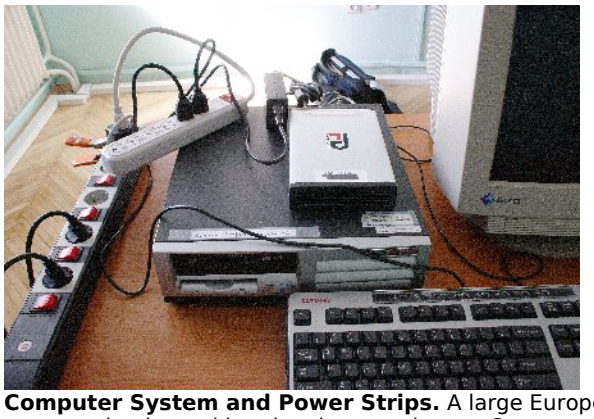
The camera, lighting and computer systems require many electrical sockets. It helps to have a number of multi-outlet "power strips" for each station.

Multi-Outlet "Power Strip." These are very useful to create enough individual sockets to plug all the devices into. It also allows multiple devices to be turned off with a single switch. If the plugs for the lighting units are oriented the same way in the power strip sockets, they will have identical polarity (more on this later).

The items needing an electrical connection are as follows:

- Photographic flash lighting units (2 of them)
- A/C adapter for digital camera
- PC computer
- Computer monitor

- External hard disk drive

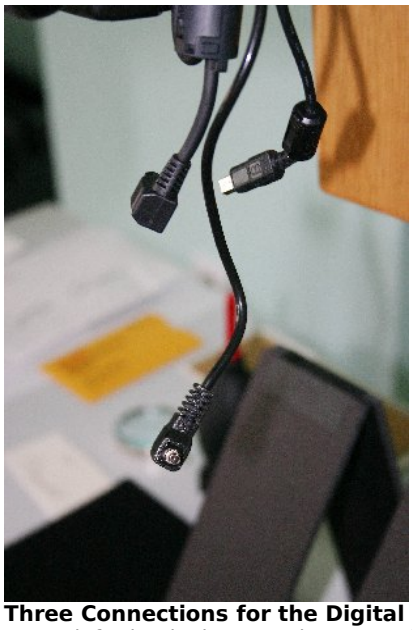


Computer System and Power Strips. A large European-style power strip is at left; note American-style power strip plugged into it using an adapter. Computer and external hard disk drive (on top of computer) are American devices with dual-voltage power supplies.

Connecting the Digital Camera

There are three electrical connections needed on the digital SLR camera. They are:

- Connection to the A/C power supply (eliminating the need for batteries)
- Flash synchronization connection between camera and flash lighting units
- USB data connection to send image data to the PC computer



Three Connections for the Digital Camera. The lower plug is the flash synchronization connection. The upper-left plug is the A/C adapter, and the upper right one is a USB data connection similar to the ones found on PDAs, mobile phones, etc.

Each connection has a different type of plug and socket, so it's impossible to connect the cords in the wrong way.

Three Camera Connections. At left (plugged into socket on camera's front) is the flash sync cord. On the camera's side, the left connection is for the A/C adapter, the right connection is the USB data cable. Rubber covers generally conceal the connections on the side of the camera; they are opened like miniature doors. The flash synchronization connection on the camera's front often has a small round cover which is unscrewed to reveal the connector.

The USB data cable is generally only a meter or so in length, so it usually plugs into a USB extension cable (3 meters in length). The other end of this extension cable plugs into any of the USB ports on the computer.

The rest of the computer gear is hooked together and set up in the conventional manner:

Back of Computer CPU Showing Connections. Going from the upper left: Connection for external hard disk drive (Firewire, IEEE-1394), Green-colored PS/2 connection for mouse, large white VGA connection for monitor, USB connections (bottom is keyboard, top is from the camera), and finally, the AC power plug for the computer itself.

Connecting the Flash Lighting Units

The lighting units used in the HMML digitization projects use electronic flash lights, sometimes called *strobes*, to illuminate the subject matter for a very brief amount of time (around $1/3000^{th}$ of a second!) when the shutter of the camera is actuated. The synchronizing of the camera's shutter and this burst of light is what the "sync cord" is for. One end of the sync cord is plugged into the flash sync outlet of the camera, as described previously.

Plugging the sync Cord into Digital Camera. Left picture shows the circular flash sync socket common on many cameras. Right picture shows sync cord connected.

The other end of the sync cord has a jack resembling that found on a pair of computer headphones. This is inserted into the sync socket located on the backside of the flash lighting unit.

Back Panel of Flash Lighting Unit. sync cord is plugged into sync socket at left. Slider control for flash intensity is at top. The next row of buttons is as follows:

- sync socket for connection to camera or other flash unit
- "Slave" This reacts to other flash units going off—fires the unit by being triggered by the light of others
- "ON" this turned the modeling light on and off
- "Track" When pressed this makes the modeling light track the intensity of the flash power slider
- "Cycle" When pressed, this makes the modeling light go off when flashed--modeling light comes back on when flash capacitors are recharged and ready for the next flash.
- "OK" This lights up when unit is recharged and ready for the next flash
- "Dump" If the user reduces the power setting with the slider to a lower setting, this will light up to tell the user to dump the excess power and make it ready for the new, lower-power setting.
- "Test" Press this to flash the unit manually.

Below these are the main power switch and the power cord connector.

Flash units work by storing up AC electrical power in capacitors, creating high voltages. When triggered, this pulse of electrical power causes the gas in the flash tube (the ring-like

glass tube on the front of the unit) to emit a very brief burst of intense light. After this, the unit must be given an interval of time to recharge the capacitor. In actual use, the user will find that this time is often less than a second.

Obviously, with such a brief burst of light, it's difficult for the camera operator to be able to preview the effect of their lighting setup. To solve this dilemma, the units also incorporate continuous *modeling lamps*; these look like conventional light bulbs mounted in the center of the flash tube. They don't contribute to the actual lighting of the subject matter at all—they are simply for the operator's convenience. In fact, the modeling lights can be turned off if the user so desires.

Synchronizing the Two Flash Lighting Units

With a typical one-camera setup, the sync cord is plugged into the camera and one of the flash lighting units. How then is the other unit triggered? If you look at the back of the flash unit, there is a white spot labeled "slave." This is a photo-sensitive electrical trigger; when it "sees" the burst of light from one flash, it sets off its own flash as well. This all happens so fast that everything stays in perfect synchronization.

There is one potential problem with this. If another camera setup is operating in the same room, it's highly likely that the other person's flash bursts will trigger your flash units too! The solution is to "hard wire" the flash units so that cords are used to trigger the units (plugging in a sync cord disables the photo-sensitive slave). To accomplish this, a splitter that turns one socket into two is needed, as well as a connecting cable to link the two flash units.

Flash Lights Hard-Wired for synchronization. Left photo shows "splitter" that turns the single flash sync socket into two sockets. The camera cord is plugged into one socket of the splitter, a connecting cord goes into the other—this is then routed to the sync socket of the other flash unit. Now the two flash units are unaffected by other flash light bursts that might happen in other parts of the work area.

For proper operation when using the "hard-wired" sync method, the manufacturer of the flash units suggest making sure that the units that are wired together in this manner have matching voltage polarity with respect to the AC power they are plugged into. The easiest way to achieve this with certainty is to plug both the flash units into a single power strip, making sure that both plugs are oriented in the same way with respect to the sockets in the

power strip (look at the end of the plug; you'll see a definite "up" and "down" orientation with respect to the central grounding contact). Then, no matter which way the power strip is plugged into the wall, the polarity of the flash units will match.

The flash lighting units are usually set up by the HMML technician who does the initial installation of the manuscript digitization system. Generally, there should be no need to alter the wiring or settings of the units. For further knowledge of how the flash units work, refer to the user manual from the manufacturer (Copies have been left at the project location).

Refer to other documents, such as the camera photography manual from HMML or the original camera user manual, for further information about the operation of the camera and related systems.