
Using the Canon EOS 6D Digital Camera for Manuscript Digitization

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The Hill Museum & Manuscript Library (HMML) is using the Canon 6D digital single-lens-reflex camera as a primary tool in the digitization of manuscripts. This document outlines the camera settings and workflow procedures for the photography of manuscript pages.

NOTE: Some of the pictures in this manual were created when HMML was using the 5D camera, so they show the older camera model. The concepts are the same for both cameras.

Note to User

The Canon 6D is a complex piece of photographic equipment designed to handle a wide variety of tasks. This guide is not intended to be a replacement for Canon's comprehensive user manual (supplied with the camera). Users who desire to know and understand all the controls and settings of the camera should study the Canon user manual.

Getting to Know the Canon 6D

The Canon 6D is a digital single-lens-reflex (SLR) camera resembling a conventional film camera. It can be fitted with a huge array of interchangeable lenses and other accessories. It also offers the user a bewildering array of menus, buttons, switches and settings. These are explained in detail in the camera's user manual. Fortunately, HMML camera technicians need only concern themselves with the controls needed for manuscript photography, many of which are set using computer software. In preparation for digitization projects, HMML generally sets up the camera prior to sending it to a project location. In any case, it is good for users of the camera to know how to do this themselves.



Canon EOS Digital SLR Camera. Shown with 50mm macro lens. This is the 5D model; the 6D is very similar in appearance and operation.

Choice of Lens

The Canon Compact-Macro 50mm lens is the standard camera lens used by HMML to photograph manuscript pages. It is a fixed-focal-length lens (sometimes referred to a *prime* lens) of very high quality that can focus on object ranging from infinity to about 20cm from the focal plane of the camera. In practice, this means that the lens can focus on and fill the frame with an object measuring 7cm in length. This allows it to be used for general page photography as well as close-up pictures of small page details.

The lens has an aperture range of $f/2.5$ to $f/32$. In practice HMML recommends photographing manuscript pages using an f -stop ranging from $f/11$ to $f/16$ in order to obtain proper depth-of-field. Setting the aperture is done using the camera's controls or (more likely in photographing manuscripts) the remote capture computer software that HMML uses to control the camera.

Autofocus (AF) or Manual Focus?

The user can choose to manually focus the pictures taken with the 6D or rely on the camera's autofocus system. This selection is made by sliding a small switch on the lens. Moving the switch to the “MF” position engages the rubber focusing ring on the lens. The user focuses the camera by turning this rubber ring while examining the image through the camera viewfinder or by viewing the image on the computer screen while in “live view.” Sliding the switch to the “AF” position disengages the focusing ring and allows the camera's internal sensors to focus the lens automatically just before the picture is taken.



Focus Mode Switch on Canon Lens. Switch is shown in the “AF” position, allowing the autofocus mechanism to function.

Selecting the Autofocus Mode page 92 of the Canon User Manual

The Canon 6D can operate in a number of autofocus modes. The user chooses the mode that best suits the type of photography being done (static shots, sports, whatever). For the sort of studio work being done by HMML, set the autofocus mode to “ONE SHOT” mode. The other AF modes are mostly suited for the photography of moving subject matter, such as sports photography.

Selecting the Autofocus Points page 94 of the Canon user manual

The Canon has a diamond-shaped pattern of autofocus (AF) points; these can be seen by looking through the viewfinder. The user can choose to have the camera pick from all of these points or from a single point that can be selected. The camera is set up by HMML to use all the focus points; this will cause the camera to focus on a wide portion of the middle of the image, averaging the setting to obtain the best overall focus on the page. Using a small aperture (mentioned above) will provide the depth of field to produce a sharp image across the entire page.

Manually Focusing the Camera page 97 of the Canon user manual

There are times when autofocus mechanisms don't work well. In dim light or when the subject matter contains certain patterns or lacks contrast, the autofocus can fail, causing the lens to focus in and out (*hunting*) to find proper focus. In such cases, HMML recommends focusing the camera manually.

To use manual focus, switch the lens to the "MF" setting and look through the viewfinder, rotating the rubber focusing ring until the image is sharp. Once the image is as sharp as it can be, adjust the viewfinder dioptic adjustment (page 43 of the Canon User Manual) to fine-tune the viewfinder display to best match your personal eyesight. This only has to be done once for any particular photographer.



Dioptic Control. This is located at the upper right of the viewfinder eyepiece. Use this dial to fine-tune the viewfinder to match the user's individual eyesight.

Other Camera Settings

Sensitivity (ISO Equivalence) page 106 of Canon user manual

In the old days of film, users purchased film with different ISO "speed" ratings. Higher ISO numbers meant that the film was more sensitive to light and the user could obtain photos in dim situations. The drawback of higher-speed films was that they usually had a coarser grain structure. "Slow" films with low ISO ratings had finer grain, but using them often meant that the camera would have to be used on a tripod, using such films often required slower shutter speeds.

Digital cameras have the same sort of situation. The Canon 6D has ISO sensitivity settings ranging from 100 to 25600. The lower the ISO setting used, the less *noise* will be produced in the digital image. In digital imaging terms, noise is essentially non-image information produced by the camera's sensor and image processing circuitry that ends up in the final image. It usually takes the form of random color specks and a general coarseness in the image, often more visible in the darker areas. It's the digital equivalent of grain in film.

HMML strives to get images of the highest quality possible in its preservation projects. For this project, I would recommend using the lowest ISO that is practical given the lighting conditions encountered. For situations with sufficient amounts of controlled light (as is the case with flash lighting equipment), the lowest ISO setting of 100 should be used.

Drive Mode page 98 of Canon user manual

The Canon camera can be operated in a number of different drive modes—that is, the number of frames taken when the shutter release is actuated. Single shooting, continuous shooting and self-timer shooting are among the choices. For HMML's work, the "single shooting" setting is used. With this setting, one photograph is taken each time the camera is actuated.

In the days of film, a photographer purchased a particular type of film based on the kind of lighting that the pictures were to be taken under, usually “daylight” or “tungsten.” Making the right choice ensured that the color balance of the photographs would be correct.

With digital cameras, this color rendition setting is called “white balance.” The user can set the camera to any one of a number of built-in white balance settings, including one called “auto” where the camera attempts to interpret the lighting conditions and produce an average white balance on the fly.

For HMML’s projects, we strive for precise control of color balance. Generally, the white balance setting is set to “color temperature” (K setting). Then, during testing, different color temperature settings (degrees Kelvin) are tested to find the one that produces the most neutral gray balance. Once this is successfully done, the setting should not have to be changed for a particular studio photography situation. This procedure is described in the next section of this guide.

The 6D can produce digital images in a variety of formats, pixel sizes, and levels of image compression. In working in the field, there’s always a trade-off in the quality of images desired and the storage capacity of the flash cards, hard disks, etc. needed to store the image files.

In our studios, we bypass the camera storage media and transfer images directly to the computer, so we can opt for the highest quality possible. This would be a “RAW plus JPEG” workflow as described in other HMML documents.

Canon’s RAW files have a filename in the format “filename.CR2.” This is the actual, unprocessed data directly from the camera’s image sensor. These types of files have a number of advantages:

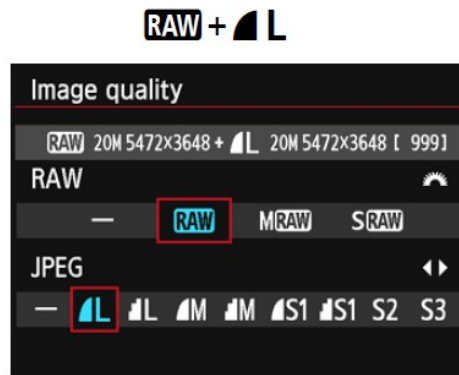
- The image data is uninterpolated—it’s the most original form of the image data, sometimes called the “digital negative.”
- The image data is encoded at 14 bits-per-pixel. Processed image files usually have 8 bits per pixel of color level encoding. This allows greater manipulation of the image in post-processing if necessary.
- The image data is unsharpened. Upon post processing, different levels of sharpening can be applied to different files to achieve optimal results.
- The image data, while it carries the *metadata* of the white balance chosen at the time of photography, can be reassigned any other white balance if the user decides that the original white balance was not correct. This is a huge advantage over a JPEG produced in camera, which carries the white balance “cooked” into the image data itself. RAW files can be batch-processed with any new (or fine-tuned) white balance chosen in post-processing. This gives the user total control over color after the fact.

The 6D can produce RAW image files in three different pixel sizes. We choose the largest of them, simply called “RAW.”

In addition to the RAW file, we produce a JPEG file of each shot as well. There are a number of different settings for JPEG files on the 6D. For this project we will use:

Large Size	5472 x 3648 pixels
Fine Compression	The lowest amount of compression (fewest compression artifacts)

This is referred to as a “LARGE/FINE” JPEG image.



RAW and JPEG settings for HMML manuscript photography. This is set using the menu system on the camera or through the remote capture software on a computer.

The reasons to use a RAW+JPEG workflow can be summarized as such:

- The JPEG files are relatively light in byte-weight, easy to copy, view, and store. Users can view these files without the need of any specialized software. For almost all purposes, they are ideal.
- The RAW files can be used to generate custom-processed versions of images for special purposes, such as posters, large printed reproductions, etc. If a manuscript was photographed with an improper white balance or less-than-optimal exposure, the RAW files can be reprocessed into better working files.
- Having two files of each image serves as a sort of built-in backup system. If the RAW and JPEG images are stored in separate folders, the chances of losing any images due to corrupt files, etc. is minimized.

Cleaning the Canon Image Sensor

page 279 of the Canon user manual

Unlike a film camera, the sensor element of the 6D is fixed in place behind the shutter. If dust gathers on the sensor, it will affect every picture taken. These dust spots usually take the form of out-of-focus dark spots in the digital image. The Canon user manual describes the procedure for cleaning the image sensor (actually, the filter in front of the sensor). The kit supplied by HMML also contains special cleaning swabs sized for the 6D along with cleaning fluid (use sparingly—a couple of drops on the swab are plenty). HMML's advice, though, is to leave the lens on the camera body to avoid having to do this in the first place. If the lens stays attached to the camera, dust shouldn't get in. In addition, the newer Canon cameras have an automatic sensor cleaning action that takes place every time the camera is turned on or off. This should prove sufficient to keep the sensor clean in normal use.

Choosing the Camera's "Auto power off" Setting

page 350 of the Canon user manual

When turned on, all digital cameras use battery power even if the user isn't taking pictures. Because of this, most cameras have an "Auto power off" setting that can be set to turn the camera off after a chosen interval of non-activity. This is handy for saving battery power in the field, but isn't as useful in a controlled studio situation where the camera often turns itself off while the user is working on other things. HMML has turned this setting to "disable," so that the camera never shuts itself down during work.

Setting the Canon's Mode Dial

page 148 of the Canon user manual

The Canon 6D can operate in a number of automatic exposure modes. In HMML's studio projects, complete user control is desired, so set this dial to the "M" position (manual control).



Mode Dial set to Manual. Aperture and shutter speed are now completely controllable by the user.

Cords and Connections

A digital camera like the 6D works well as a hand-held camera for all sorts of live-action photography. The rechargeable battery provides power for hundreds of photographs and the camera can be fitted with all sorts of portable flash units if extra illumination is needed. In HMML's projects, the situation is a bit different. The camera is mounted on a sturdy copy stand to allow precise framing of the subject matter. External flash lighting units are used to illuminate the book pages and a computer controls the camera and gathers the image files. This requires the camera to be connected to external devices.

There are three electrical connections needed on the digital 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

Canon ACK-E6 AC Power Adapter *page 338 of the Canon user manual*

Rather than rely on battery power, HMML uses regular AC household electricity to provide power for the camera. The Canon ACK-E6 adapter replaces the camera's battery and can be plugged into line voltage ranging from 100V to 240V AC, making it usable worldwide with the proper plug adapter.



AC Power Adapter for Canon 6D. This is inserted into the 6D's battery compartment. A small rubber door at the bottom of the body grip accommodates the electrical cord.

To synchronize the action of the camera's shutter with the external flash lighting units, a “sync cord” needs to be connected between the camera and the flash unit. Generally, this is done via a “PC” style plug that is inserted into a PC terminal on the camera. With the 6D, there is no built-in PC terminal, however, so HMML supplies a small “hot shoe adapter” that is placed in the camera’s hot shoe on top of the camera. The sync cord is then plugged into the PC terminal on the adapter.



PC Hot Shoe Adapter. This small accessory slides into the existing hot shoe of the Canon 6D, providing a standard PC flash terminal.

USB Data Connection page 390 of the Canon user manual

The camera comes with a USB data cable measuring about a meter in length. Generally, this isn't long enough to reach the computer when the camera is mounted on a copy stand, so a three-meter USB extension cable is also supplied. Plug the small end of the data cable into the port marked “A/V Out” on the side of the 6D (this is located under a rubber flap). The other end of the extension cable is plugged into the USB port of the computer.



USB Port on Camera. The cable connecting the camera to the computer allows the computer to control the camera and store the photographic images.

Getting Ready to Take Photographs

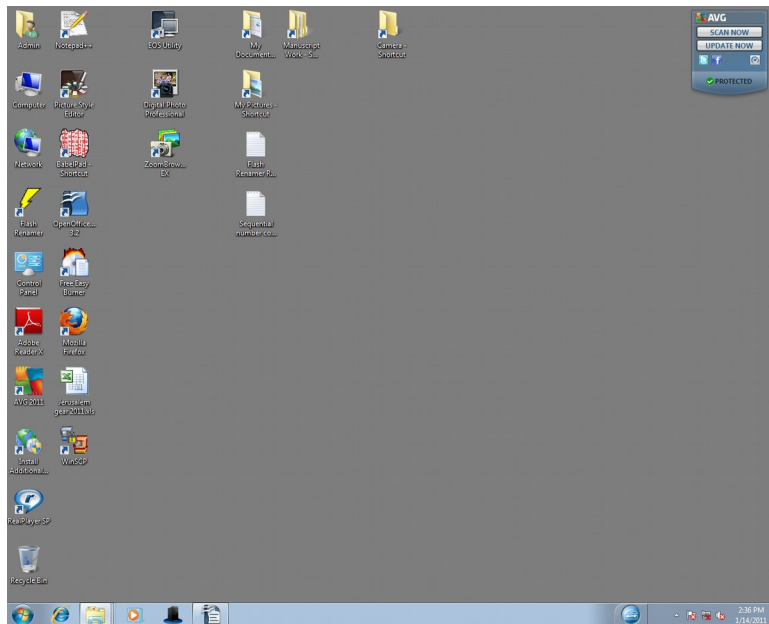
The camera settings described here have been made by HMML prior to the installation of the camera at the studio location. The instructions outlined here should only be needed if the camera's settings have been changed for any reason. It is good to verify a few things before starting:

- The camera should be connected to the AC power supply using the ACK-E6 adapter
- The flash synchronization cable should be in place between the camera and flash unit
- The USB data cable is plugged into the camera and computer
- The mode dial on the Canon is set to “M”
- The Canon is turned on using the on/off switch located at the upper left of the rear of the camera

Using the Canon EOS 6D with EOS Utility and Digital Photo Professional

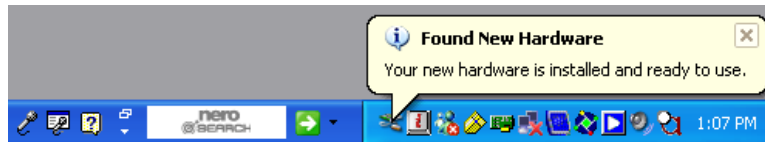
In HMML's digital studios, images are captured using special Canon software on a personal computer running Microsoft Windows as its operating system. Instead of manipulating controls on the Canon camera, the operator controls things using this software. This is actually easier for users who are unfamiliar with the Canon's rather complex set of controls.

The following instructions were made using Windows version 7. The software needed to do HMML work has been used on XP, Vista, 8.1, and version 10 of Windows. The concepts are consistent with cosmetic differences between the versions. Microsoft Windows training is beyond the scope of this document—there are many sources of information on this that the user can take advantage of.



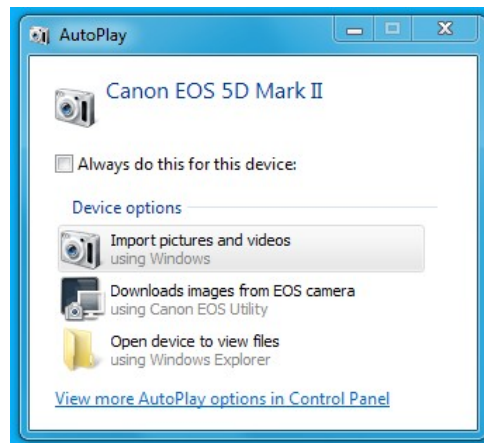
Windows 7 Desktop Display. Icons called *shortcuts* have been placed on the Windows desktop to allow instant access to the applications and folders needed by the user. Note the gray desktop background; this gives the user a neutral viewing environment for evaluating the color of the captured images.

Windows works well, but it does have some quirks. One of the things Windows does quite frequently is display little messages to the user. For example, when plugging in a camera, flash drive, or whatever, a message balloon will often appear. Generally, these can be ignored and they usually go away by themselves. Sometimes the user has to click on the “x” to get rid of them.



Windows Notification Message. These pop up all the time when using Windows. Simply click on the “x” in the balloon’s upper right corner to make them go away.

When devices are attached to a Windows computer, message windows often pop up with various choices for the user. In particular, when the Canon camera is turned on after being plugged into the computer, the user will see a message like this:

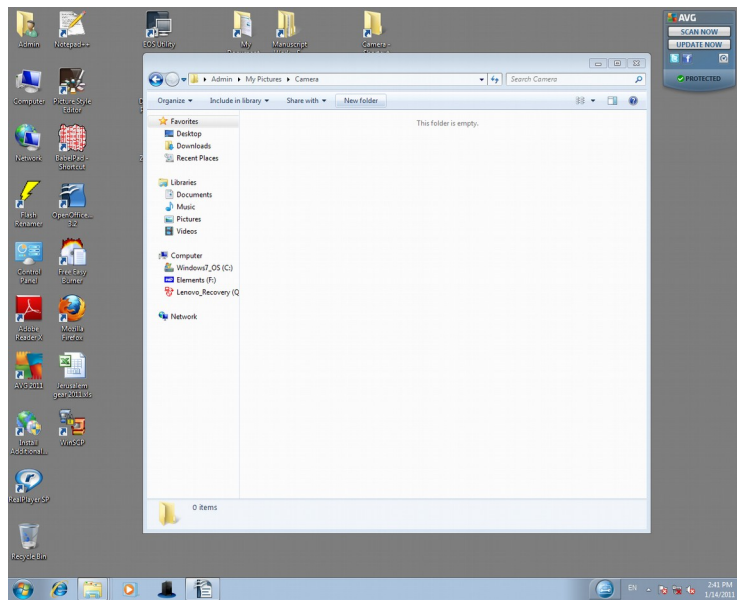


None of the choices presented by this pop-up are what is needed for manuscript photography, so simply click the “cancel” button (the X at the top right) to close this window. The user will be launching the proper software applications to use the digital camera.

With all the annoying pop-up messages out of the way, the user can set up the computer and software to take pictures. It’s a step-by-step process that, for many of the steps, only needs to be done once.

Step 1: Create a Place for the Images to be Sent To

The first order of business is to specify where the photographic images are to be stored when the camera is operated. Under the “My Pictures” folder on the computer’s hard disk, a folder titled “Camera” has been created as the destination for incoming images. This folder has to exist before the software can be directed to place images there.



Folder “Canon” Opened. Screen shot shows the empty folder titled “Camera.”

In many cases, HMML has already created a folder titled “Camera” within the “My Pictures” folder. The software for remote photography has also been set up to send pictures to this folder. The user can, of course set up whatever folder scheme is desired.

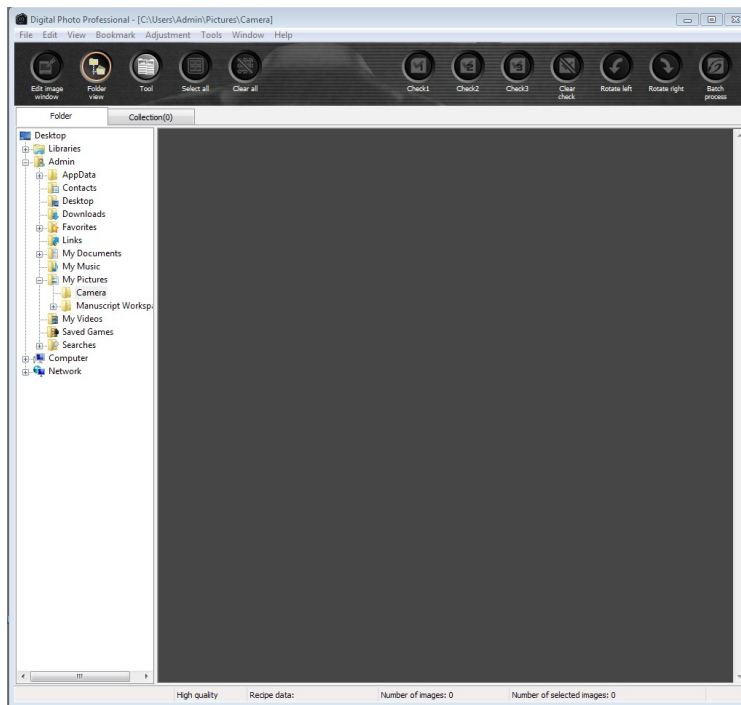
Step 2: Launch the Canon Software Applications Needed for Photography

There are two software applications that work together to allow the user to take pictures remotely using the computer. Shortcut icons for these programs are on the computer “desktop” to give the user easy access to them.



Desktop Icons for Launching Camera Software. Canon's EOS Utility is the application that controls that camera remotely. Canon's Digital Photo Professional is the application that allows the user to view and evaluate the images taken. ZoomBrowser is an image viewing and sorting application.

When the application “Digital Photo Professional” (DPP) is launched, it will appear as a window with a folder tree diagram indicating which folder it is set to. In this case, it is set to look at the folder titled “Camera.”



Digital Photo Professional Set to Show Contents of “Camera” Folder. Since there are no pictures in the Camera folder, the workspace is empty at this time.

Double-clicking on the icon for the “EOS Utility” application brings up a starting screen with various choices for the user. Roll the mouse over the text that reads, “Camera settings/Remote shooting” (it will glow when the mouse cursor is on it) and click on it.



Opening Screen of EOS Utility. Choose the “Camera settings/ Remote shooting” option to begin work.

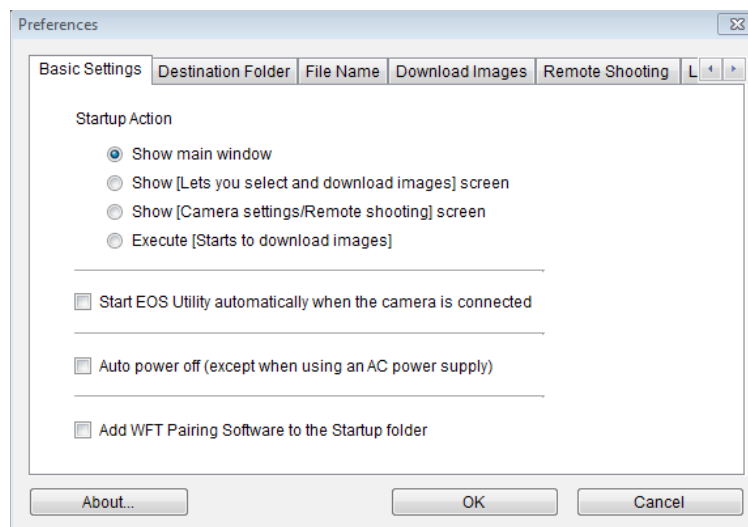
After clicking, the opening screen is replaced by a control panel on the desktop. This is a “remote control” for the Canon camera. It allows the user to set many of the camera's controls from the computer and to take pictures by clicking a button or pressing the computer's space bar.



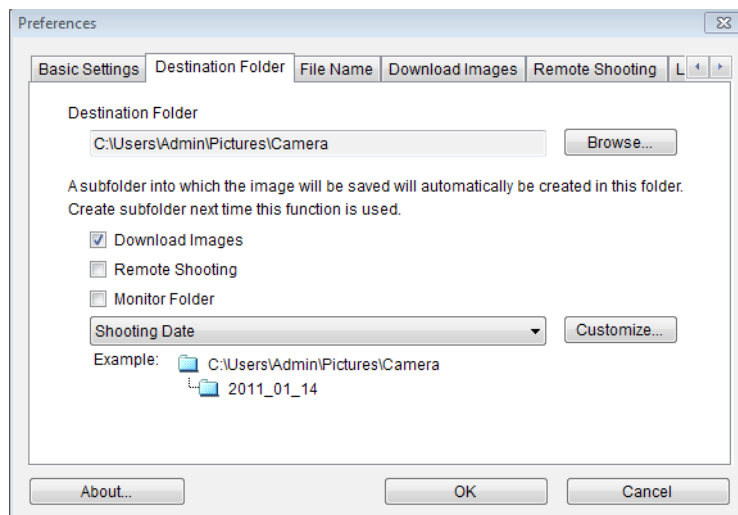
EOS Utility Remote Photography Window. Camera settings are in upper part of window. Button at top right is clicked to take a picture. “Preferences” button at lower left is clicked to bring up the preferences window. “Live View Shoot” button puts the camera in live view mode so photographer can see the image on the computer screen in real time, which is useful for framing the shot and focusing the camera if the eyepiece cannot be easily reached.

Step 3: Set the Preferences for the EOS Capture Utility

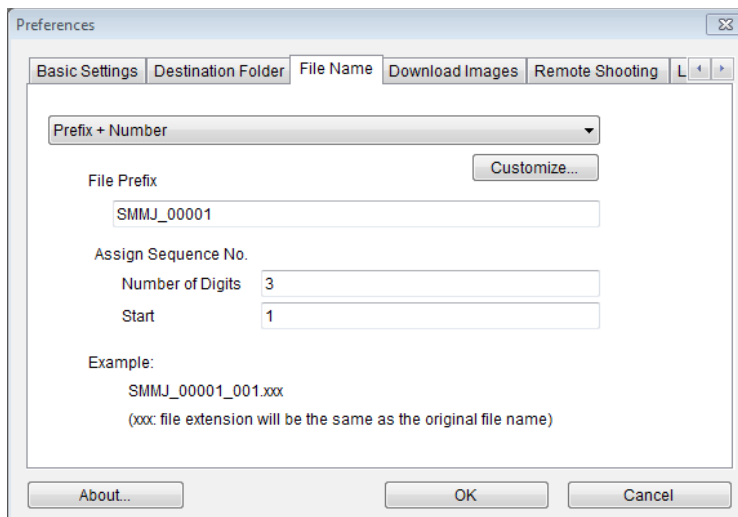
Clicking on the “Preferences” button on the capture control panel brings up a multi-tabbed “preferences” window. From here, the user can set a number of options. Many of these only have to be set once; the user usually won't have to change these from that point on. Rather than explain all the choices presented by the various tabs, the user can simply refer to the screen shots that follow and make sure that their settings are the same. The tabs are shown in the following images:



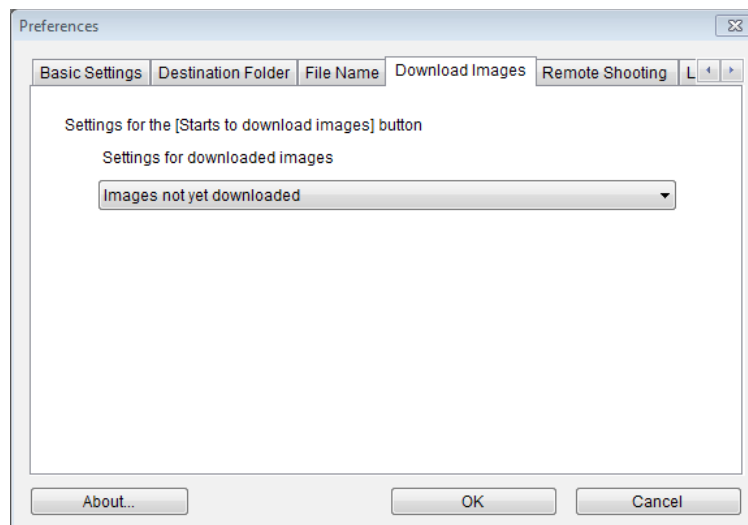
Basic settings. This setting allows the user to set the software to do various things when the software is started up. Choose the settings depicted above. This preference setting only has to be made once; as long as the system isn't altered, there's no need to have to set this after the user completes the initial setup.



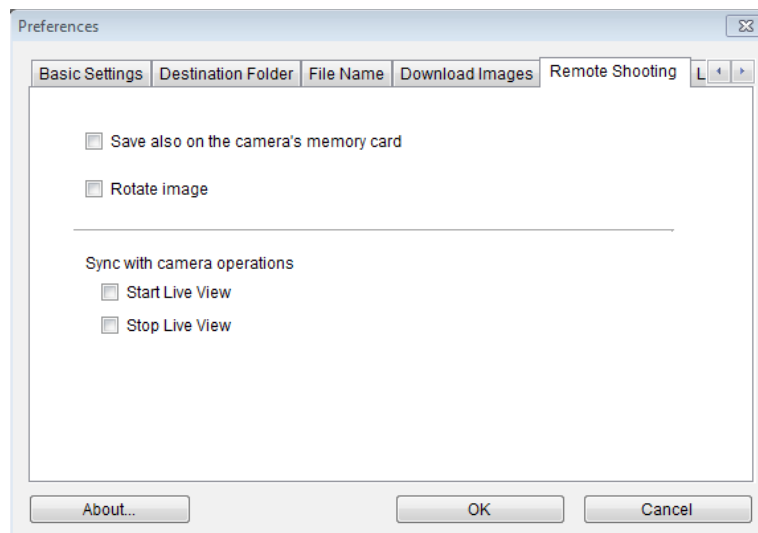
Destination Folder. This has been set by HMML to send the images to the folder titled “Camera” inside the “My Pictures” folder. The user can set the software to any folder chosen as long as the folder has been created prior to launching the EOS Utility.



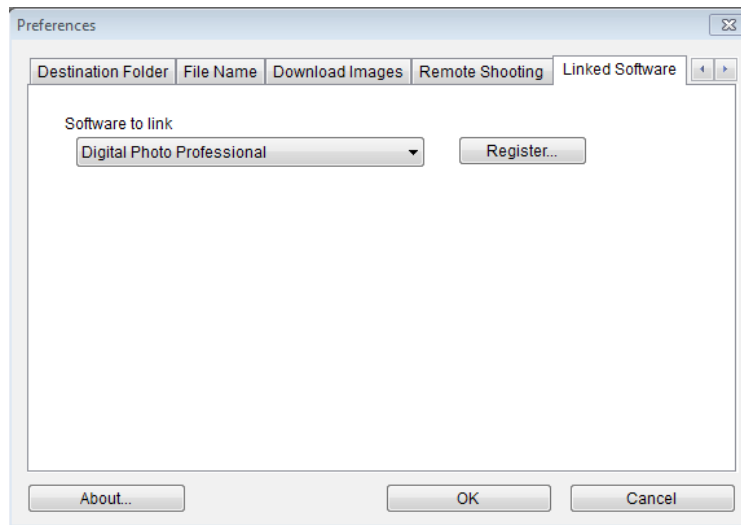
File Name. This is the one preference panel the user will be changing often. At the beginning of photography for each manuscript, the user will create a new “File Prefix” based on the identifying code for the particular manuscript being photographed. An example would be “SMMJ_00001.” The software will automatically create a sequence number after this prefix, starting with whatever number is chosen as the starting point (1 in this case). Pages photographed in order will thus have proper sequencing numbers assigned to the files.



Download Images. Set this control to look like this screen shot.



Remote Shooting. Set this control to look like this screen shot. Make sure that the images aren't saved to the camera's memory card. If this box is checked, the card will quickly fill up with image files and the process will be stopped when the card is full.



Linked Software. The EOS Utility is set to use Digital Photo Professional to view and evaluate the images captured (this is the software that was launched previously).

Step 4: Choose Settings for the Canon Camera's Controls

With the preliminary settings made, the user now must set the various camera controls for manuscript photography. Some of these settings are standardized by HMML and are described here. Other settings will have to be “fine-tuned” by the user on site to create optimal photographs of the manuscripts in a given situation.



EOS Utility Remote Photography Window. The user can see the camera's settings at a glance and make changes by double-clicking a control value and then using the “arrow” buttons to change the value up or down. Here, the shutter speed control value has been double-clicked and is highlighted with controls to change the value up or down. The user makes the adjustment needed; when the mouse moves off the control, the arrows go away and the control panel reverts back to the way it looks on the left.

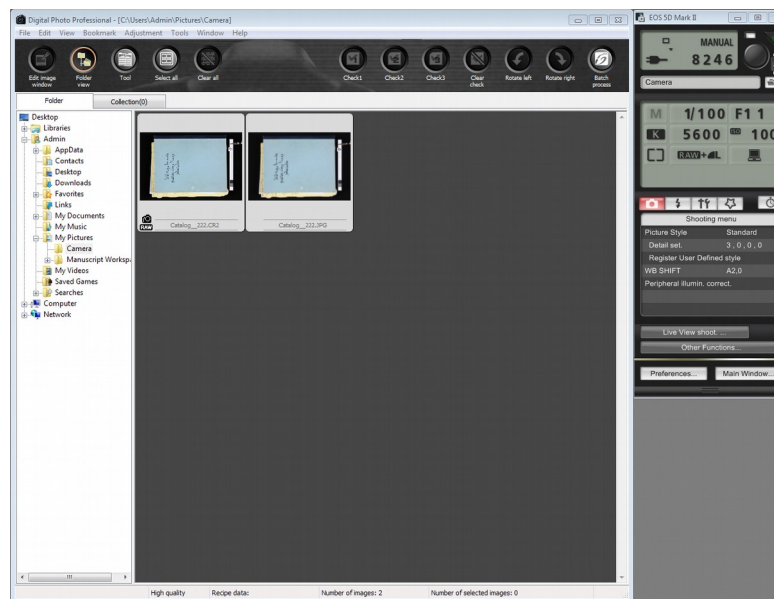
Left to right, top to bottom, here are explanations of the controls:

- Camera Mode: “MANUAL indicates manual control. This is set by turning the dial on the camera itself. If you change the setting on the camera, this display will change to inform the user of the mode status.
- Shutter Speed: Currently set to 1/100th of a second.
- Aperture: Set to F11. The values available here will depend what *f*-stops are available for the particular lens used.
- White Balance Setting: Here, the white balance is set for color temperature (the “K” refers to degrees Kelvin).
- Degrees Kelvin: If the white balance is set to “K,” this control become active, allowing the user to choose a precise color temperature in increments of 100 degrees Kelvin. This allows the color balance of the photographs to be finely tuned.
- ISO Setting: In this instance, the ISO is set to 100, the “slowest” setting available. This produces images of the highest quality.
- Metering Mode: For studio photography with flash units, the setting of this control is irrelevant. (It's set to center-weighted metering in this case)
- Image Quality: In this case, it's set to RAW + Large/Fine JPEG
- Preferences Menu: Clicking the Preferences button brings up the preferences window previously described.

Operating any of these controls is easy using this software control panel. First, the user double-clicks on the control she or he wishes to change. The control will change; presenting arrows for the adjustment of the value. Then, the user clicks on the “arrow” buttons to change the selected control up or down. The order in which these settings is made isn't critical. The screenshot above shows settings that were working well for a particular HMML project in Jerusalem. Settings such as the F-stop and color temperature setting will be fine-tuned to obtain ideal results as described below.

Step 5: Take Test Pictures and Fine-Tune Color and Exposure

Finally you get to take a picture! After framing a picture by looking through the camera, positioning the grayscale card in such a way that it is included in the image, you can click the button at the top right of the EOS Utility control panel. The camera will click, the flash lights will flash (did you plug in the synchronization cord?), and a pair of images will appear in the Digital Photo Professional window after a moment.

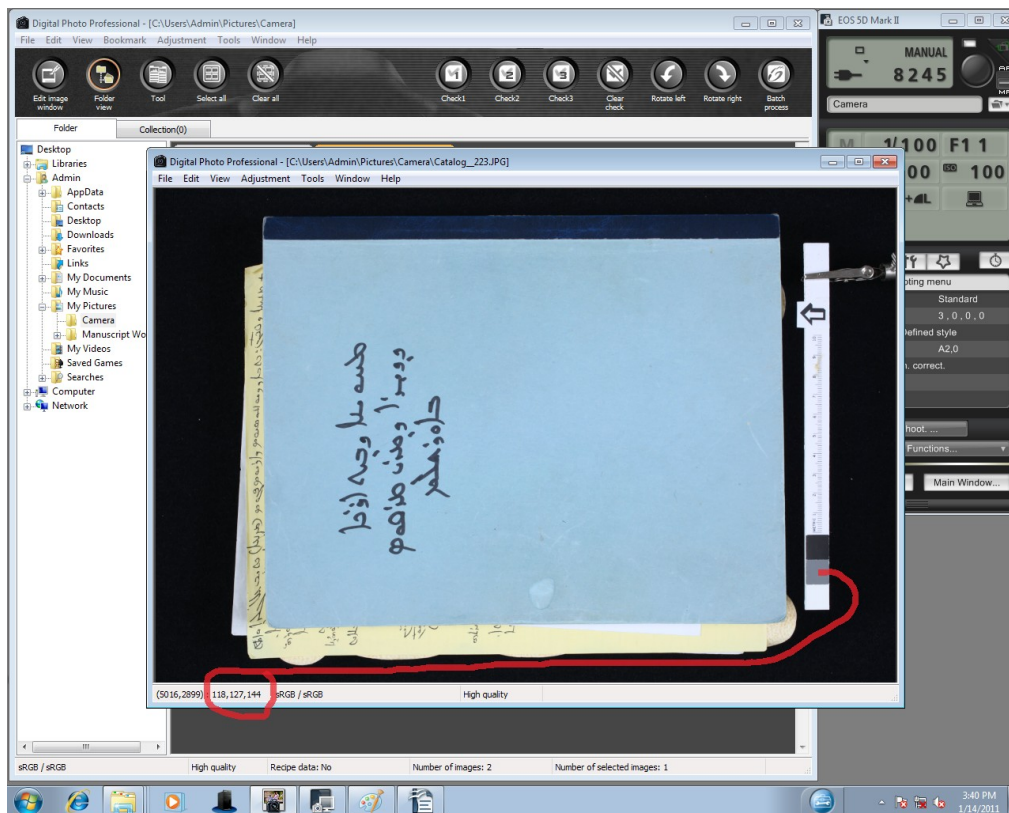


Test Shot in Digital Photo Professional Window. Note that two images appear—the RAW file and the JPEG file. The JPEG file is smaller in byte “weight” than the RAW file, so it’s faster use it to evaluate the exposure and color balance.

Getting the Color Balance Corrected

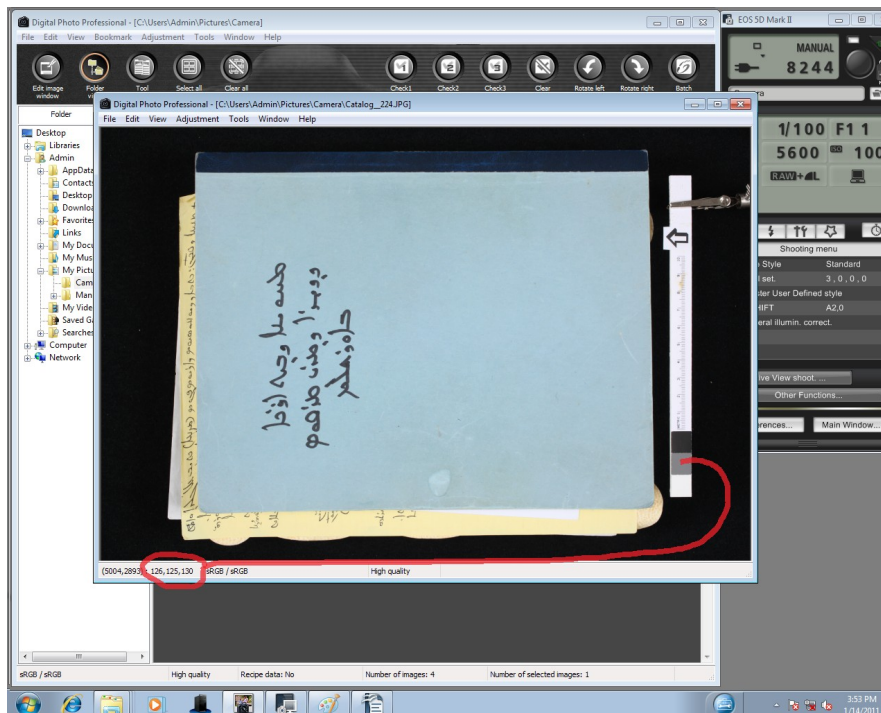
The user can double-click on JPEG image in Digital Photo Professional, causing a new, larger view of the image file to appear in a new window. Once the image is visible in the new window, the user can make certain judgments about the quality of the image. The first and most basic thing is to check the framing and composition of the image. HMML strives for well-framed, square (not crooked) manuscript images that make full use of the camera’s frame (we don’t want to waste pixels!). Equally important is that the small grayscale calibration bar, with white, black, and gray patches (and centimeter scale), is visible in the frame but not overlapping or touching the manuscript itself.

Then, if the user moves the mouse cursor over any area of the image, the red, green, and blue (RGB) values for that particular spot will be displayed at the bottom of the window. The first thing to do is to check the RGB values of the gray patch. Ideally, this should have identical values for red, green, and blue, resulting in a perfect neutral gray tone. In practice, HMML advises its technicians to try to keep the RGB values within a spread of 6 units.



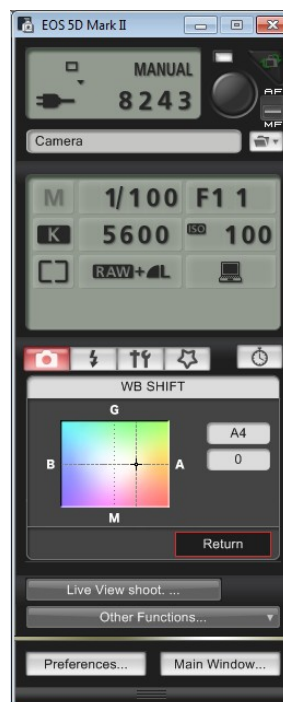
Gray Patch Reading. Moving the mouse over the gray patch causes its RGB reading to appear at bottom of window. Here the reading is R:118 G:127 B:144. Since Blue is the highest reading the gray value is too blue. The goal is to get all three readings within a 6-unit span.

If the RGB readings are too far apart, the user must try a different color temperature setting. Then, a new picture is made and its gray patch checked again. Here’s a hint: if the B (blue channel) reading is too high, set the color temperature (degrees Kelvin) setting to a higher number and try again. If the R and G channels are higher than the B channel, set the temperature to a lower number. It only takes a couple of tries to get an image with a very accurate RGB color balance.



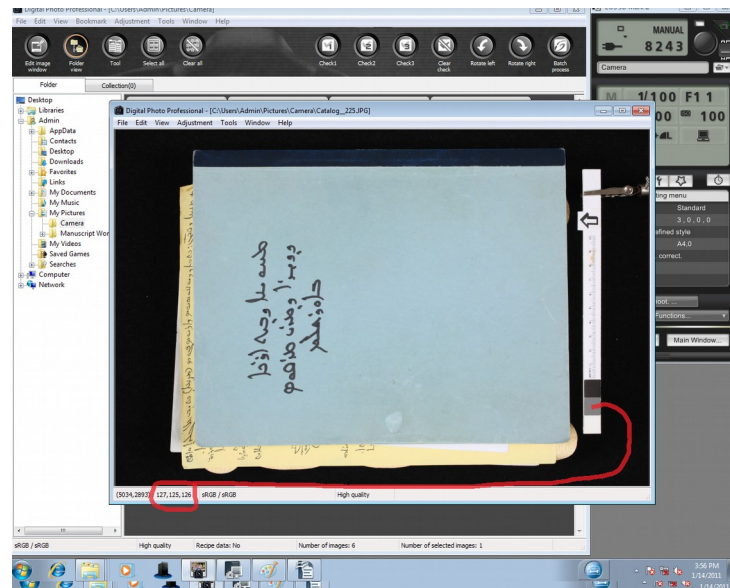
Good Gray Balance. The color temperature setting is adjusted, and more test shots are made and evaluated for RGB readings. Here, the color temperature setting has been raised to 5600 degrees. The resulting test shot shows a gray patch reading of R:126 G:125 B:130. This is a very "tight" gray reading, resulting in a nearly perfect neutral gray tone. It's just a bit blue; see below how to fine-tune the color if the user wishes to.

The RGB spread in the above example is within five units, which is good enough for HMML's needs. If the user wishes to fine-tune the color even further, this is possible. Go to the control panel and click the "WB SHIFT" label to open up the color fine-tuning control; here the slight blue color cast will be corrected.



Color Fine-tuning Control: Here the user has shifted the target point a bit away from blue towards amber to correct the slight blue cast of the previous example.

Reshooting with the fine correction in place results in perfect color balance.

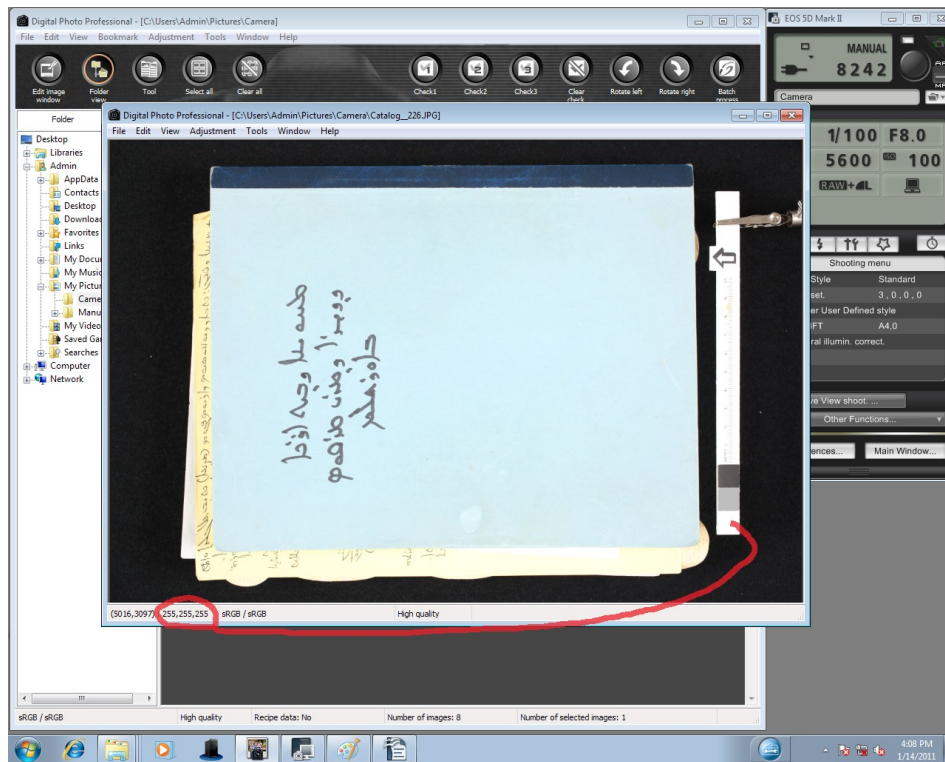


Perfect gray color balance: The RGB values are now R127 G125 B126. This is about as perfect as you can get in general practice.

Getting the Exposure Fine-Tuned

In RGB color codes, a reading of R:0 G:0 B:0 is pure black, no light at all. A reading of R:255 G:255 B:255 is pure white. If the lighter tones in an image are overexposed, they will be pure white, and the tonal information is gone (“blown away”) If we can ensure that the calibration scale’s white patch is a clean white tone without being pure white (over the top), the rest of the tones in the photograph should fall nicely into place.

To get the correct exposure, the user checks the white test patch in the image. This is generally the brightest object in the photograph. The main idea here is that if the white patch isn't overexposed, nothing else in the manuscript image will be blown out either. Move the mouse cursor over the white patch on the grayscale and note the RGB reading at the bottom of the window.

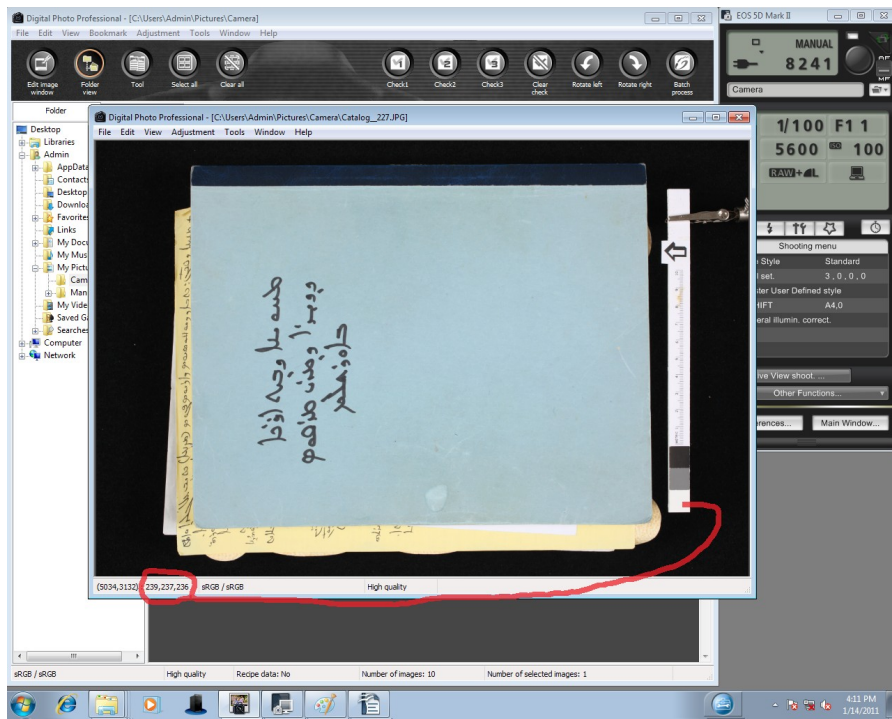


White Test Patch Too Bright. This reading has values of over 250 for red, green and blue. Decrease the exposure by either using a smaller f -stop or decreasing the intensity of the lighting units.

What values are correct for the white patch? Generally RGB brightness numbers of between 230 and 240 units are considered ideal. With these readings, nothing is going to be so bright as to lose valuable detail. The user can adjust exposure by:

- Changing the camera's aperture. Larger f -stop numbers let less light into the camera lens, smaller f -stop numbers increase the amount of light gathered.
- Change the intensity of the light falling on the subject matter. This can be done by changing the power settings on the flash units or physically moving the lights closer or farther away from the subject.

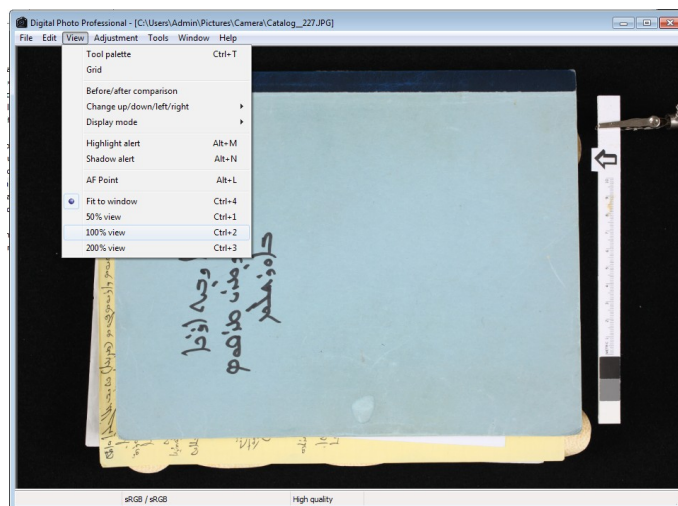
Keeping in mind that HMML generally photographs manuscripts at an f -stop of between $f/11$ and $f/16$, it may be necessary to adjust both the aperture and the lighting intensity to arrive at the proper exposure.



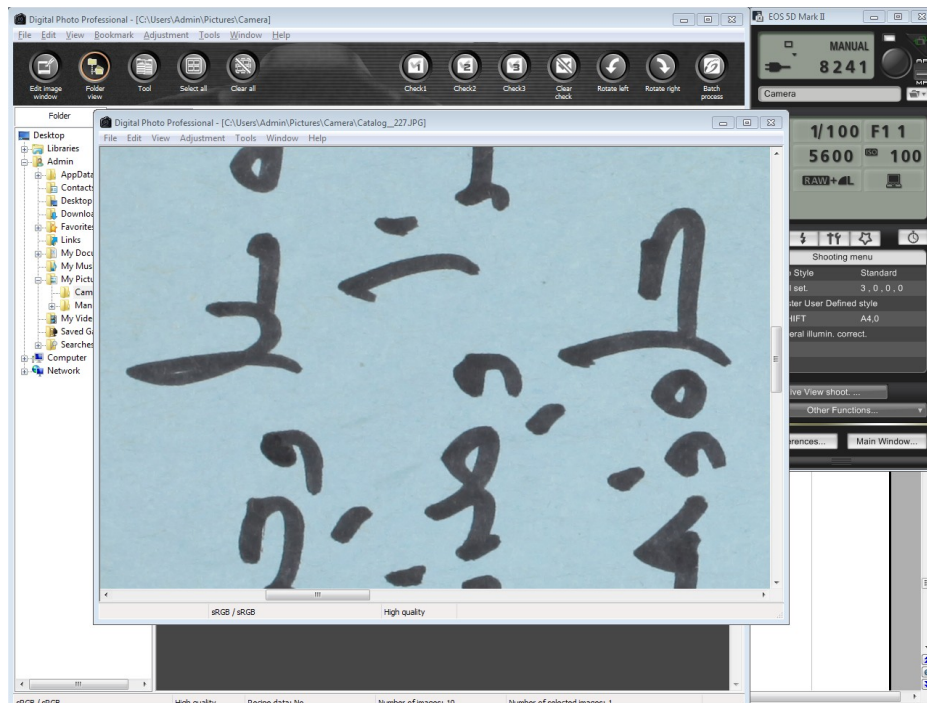
Proper White Patch Reading. The RGB values for red, green and blue are between 235 and 240. Here they are R239 G238 B234.

Checking the Image

Using the Canon software, the photographer can also view enlarged images of the photograph taken to check the focus and overall quality of the image recorded. Under the “View” menu of the image viewing windows, the user can choose to view the image at “100%.” In this view, each individual pixel of the digital image takes up one pixel of the viewing device (the computer monitor). This is the most accurate way of evaluating the sharpness, focus, and overall quality of the digital image. At this viewing setting, the image should be quite large and have a very sharp, clean appearance.

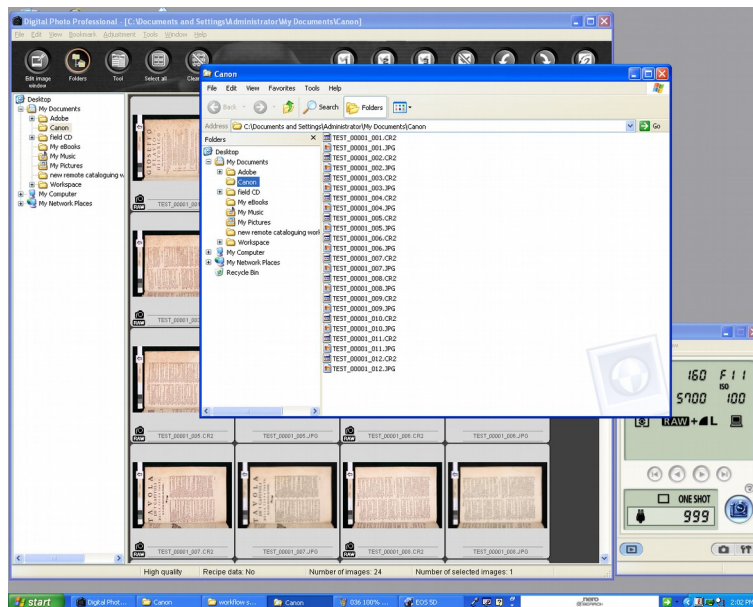


Viewing the Image at 100%. This will magnify the image so that each image pixel takes up a single viewing pixel on the display monitor.



100% View in Image Window. Each pixel of the image is now displayed with one pixel of the computer monitor. The user must scroll around the image window to see all of the picture. This view is handy for checking critical focus and image quality.

After checking the image at 100%, the user can revert to the “fit to window” view to again see the entire page in the viewer. Under the “View” menu there is also an option to see “grid lines” superimposed over the image. This can be useful in getting the image straight and square. Note that it generally isn't necessary (or desired) to have the user check each image like this—it's something done to confirm that all is going well or to check on things at the beginning of each photography session.



Work Progressing. Screen shot shows “Camera” folder filling up with images, Digital Photo Professional in the background with thumbnail images of the files, and EOS Utility camera control panel. NOTE: this is a screenshot from an older version of the software, but the principles are the same.

Step 6: Proceed with Photography

When the color balance and exposure are set correctly, the user can proceed with manuscript photography. All of this preparation can seem somewhat time consuming; in reality, the exposure and white balance tests are usually done only once per workstation. If the camera and lighting setup aren't changed, there should be no changes in these settings. The settings are stored in the Canon camera even after the power is turned off, so the camera "remembers" the settings from day to day.

Generally, once all this is done, the user only has to check a few things at the beginning of each photo session:

- Check the file-naming scheme. This will change for each manuscript, and for manuscripts where the rectos and versos are photographed separately.
- Make sure that the capture folder is ready to accept more images. Generally, once a manuscript is photographed the files are moved to another folder, so the "Camera" folder stays uncluttered.
- Make a test shot to verify that the gray balance and exposure hasn't changed for any reason.
- Proceed with the work.

Other HMML documents outline the workflows and file-naming schemes used by our projects.