Advanced Evidence Photography Workshop

for the Incident Scene Investigator

Presented by: Imprimus Forensic Services, LLC
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Advanced Evidence Photography Contents

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Camera Operation

Professional quality crime scene photography dictates that the photos take provide an accurate and fair depiction of the scene as well as any evidence items that are present. Following some simple procedures can help the investigator obtain quality photos that will be acceptable in court.

The components of the imaging system are

- Camera
- Lens
- Film / Imaging chip
- Flash

Camera Types

The two types of cameras most commonly used are the Single Lens Reflex (SLR) and Point and Shoot. Both types are available in either film or digital formats. For forensic/crime scene work, the best and most versatile camera is the SLR. The SLR has several distinct advantages over the Point and Shoot style including

- Through the lens viewing
- Interchangeable lenses
- Off-camera flash capabilities
- Easier to use manual controls
- Wider choice of accessories
- Greater durability

Single Lens Reflex (SLR)

Point and Shoot

The SLR is the only type of camera that should be considered for this type of work.

Cameras Mode - Terminology

Many of today's cameras let the operator choose between several modes of camera operation. Typically these are

- Manual (M)
- Program (P)
- Aperture Priority (A)
- Shutter Priority (S)

When these types of cameras are being used, the authors recommend setting the camera to Aperture Priority. This will allow the photographer to have the most control over depth of field.

One problem with using the camera in the Program mode is that the camera will typically select "middle of the road" settings. This usually results in an aperture selection of f5.6 or f8. While these settings may provide acceptable depth of field in overall photos, the photographer will experience problems with close-up shooting situations.

Selecting a Lens

All imaging systems have what is called a "normal" lens for the system. A "normal" lens is a lens that provides an image without distortion that is very similar to the view of the human eye. What is a "normal" lens is determined by comparing the focal length of a lens to the diagonal measurement of the surface receiving the image (film or digital chip). When the focal length of the lens closely matches the diagonal of the imaging surface, that lens is considered normal for that particular system.

In 35mm film photography, a 50mm focal length lens is considered normal. With an SLR style digital camera, a 35mm focal length lens will generally be considered normal. This can vary however depending on the size of the imaging chip, so refer to the camera's Owner's Manual for more information on this issue.

With digital cameras, what constitutes a "normal" lens focal length is dependent on the size of the digital chip. Most digital SLR cameras use an APS size CCD chip resulting in a focal length magnification factor of 1.5x to 1.6x. This means that on these cameras, a 35mm focal length is considered "normal" (35 x 1.5= 52.5mm film equivalent). Digital cameras using a full frame size CMOS sensor will still use a 50mm lens as a "normal" lens. Check the manufacturer's specs for your camera to determine what type of sensor you have.

Whenever possible, photos taken of scenes and objects within the scene should be taken with a normal focal length lens. Most scenes however will require the photographer to switch between focal length settings to get proper coverage of the area being photographed.

Photos taken with lenses having focal lengths longer or shorter that normal will distort the spatial relationship between objects within the scene. Refer to Appendix A for additional information on proper print sizes and viewing distances for various focal length lenses.

Technical Note: Any type of pattern evidence that is documented for forensic examination purposes (fingerprint, footwear impression, bite mark, etc.) MUST be photographed using a "normal" lens and the imaging plane (film plane) of the camera must be positioned parallel to the surface bearing the impression. Appropriate scales also need to be included in the photo.

Metering Systems

Historically, cameras used what was referred to as a center weighted metering system. This system analyzed the light in the image but placed the most emphasis on light at the center of the image. Today's cameras typically have several types of metering systems that the photographer can choose from – matrix or evaluative; center weighted and spot. The icons below are generally used to designate which metering system the camera is in.


Matrix or Evaluative


Center Weighted


Spot

For most general shooting situations, the photographer should choose the Matrix or Evaluative system. This system generally gives the best exposure by considering the quality of light from various areas of the image.

Reciprocity

There is a direct relationship that exists between the amount of exposure, the exposure time (shutter speed) and the intensity of the illumination (aperture opening) falling on the film or imaging surface. (E=T x I).

This relationship allows the same exposure to be obtained even though the exposure time (shutter speed) and light intensity (f-stop) are manipulated.

For example, using a starting exposure setting of 1/60 sec @ f-8, we can change the shutter speed and aperture without affecting the exposure of the final image. To do this, changes to the shutter speed and aperture must be made at the same exposure value (stop value), but in opposite directions. Some shutter speed/aperture combinations that would result in the same exposure are:

1/30 @ f-11; 1/125 @ f-5.6; 1/250 @ f-4

In other words, if you slow your shutter speed by one exposure stop to let in more light (1/60 -> 1/30) the you must close your aperture by one exposure stop to let in less light (f-8 -> f-11). The chart below should help you see this relationship.

Shutter Speed & Aperture Scale

MORE LIGHT									LESS LIGHT
Shutter:	1/8	1/15	1/30	1/60	1/125	1/250	1/500	1/1000	
Stops:	2.8	4	5.6	8	11	16	22	32	

Orange & Yellow Filters

When using an alternate light source to fluoresce fingerprints or biological fluids, these filters are used with either color or B&W film to photograph that evidence. Just like the goggles that the ALS operator wears to block unwanted light and better visualize the fluorescence, these filters will block excess light and enhance the image. The photographer should match the color of the filter to the goggles that produce the best visualization of the evidence.

U.V. and blue light wavelengths are the most frequently used for visualizing evidence by fluorescence. The filters most commonly used with these lights are –

Medium Yellow - #28 or Y2

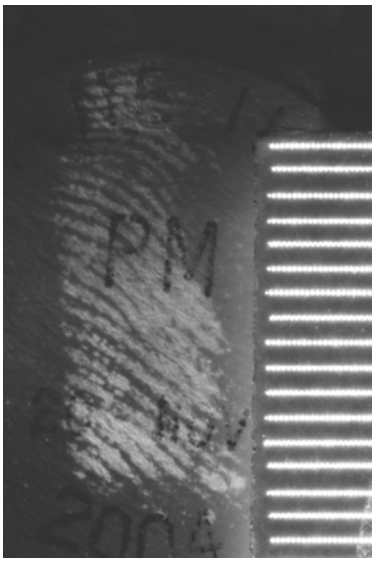
This filter will help block some blue light, yet will still allow the fluorescence of biological stains, which many times show up as a weak yellow glow, to be viewed.

Orange - #21 (Dark Orange)

This filter will block excess blue light when working with fluorescing fingerprints developed with red or orange fluorescent powders.

Red #23A

This filter can help block excess light in the blue and blue-green range and can be useful when using an ALS to examine items treated with fluorescing reagents like DFO.



Example of DFO developed fingerprint on a paper envelope, illuminated with an ALS at 455 nm and photographed on B&W film using a 23A red filter.

Manufacturer Specific Exposure Controls

Canon

Examples of Canon rear LCD screens. When a camera set to shoot in P, Av or Tv modes has had the exposure compensation set to over or under expose every photo, the bar on the exposure scale will show how much every photo will be over or under exposed. Generally, for most forensic work, the exposure should be set so the black marker is at the "0" point.

The blue circle in the left image above marks the exposure compensation adjustment button.

The left image above shows a menu setting for exposure control and the image on the right shows another view of a Canon LCD screen.

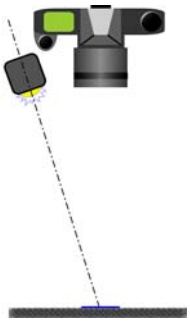
Nikon

In addition to the LCD screen on Nikon cameras showing the +/- graphic when the over/under exposure has been set, Nikon cameras without top mounted LCD screens will show the +/- exposure graphics on the rear LCD panel. The numbers next to each +/- graphic will show how much over/under exposure has been set. Normally these numbers should show "0.0"

Lighting Techniques

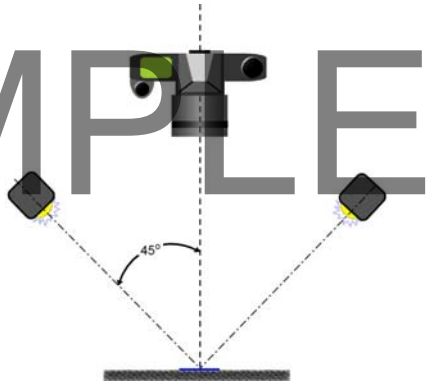
Reflected Light

This is the most common type of lighting technique used. The light source is positioned along or nearly along the camera axis. The drawback to using this technique is that it will produce hot spots or glare with reflective surfaces. This technique can also flatten the appearance of 3-dimensional evidence such as footwear impressions.



Direct Lighting – Copy

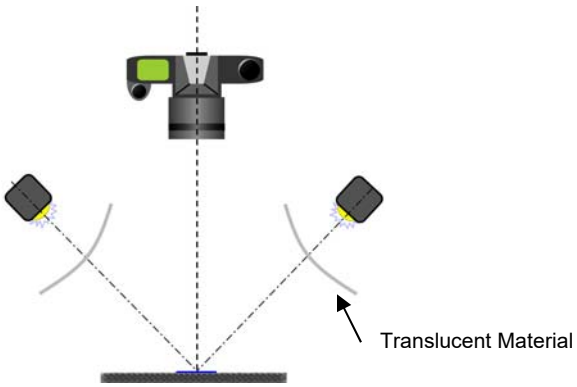
Direct lighting when using a copy stand to photograph small objects involves placing either one or two light sources at a 45º angle to the camera axis.



Moving the light sources off at this angle helps reduce glare. The same technique can be used when photographing reflective surfaces with a hand-held flash.

Diffused Lighting

A translucent material is placed between the light source and the subject to diffuse and soften the light. This material can include white tissue, white coffee filters, white paper or white plastic. There are many sources of commercially made diffusers available. Using this technique will provide more even lighting, soften shadow lines and help reduce glare.



Oblique Lighting

Description	Degrees Kelvin
Clear Blue Sky	8000 to 27,000
Rainy, Misty Daylight	7200 to 8500
Overcast Daylight	6500 to 7200
Direct Sun + Clear Blue Sky	5700 to 6500
Summer Sunlight (9am to 3pm)	5400 to 5700
Summer Sunlight (before 9am or after 3pm)	4900 to 5600
Electronic Flash (Typical)	6200 to 6800
Description	**Degrees Kelvin**
Xenon Arc (unfiltered)	6000
White Flame Carbon Arc	5000
Yellow Flame Carbon Arc	3200
Description	**Degrees Kelvin**
'True Daylight' Color Match Tubes	6500
'Daylight' Cool White Tubes	4300
'Warm White' Tubes	3000
Description	**Degrees Kelvin**
Photoflood & 3400K Tungsten-Halogen	3400
Tungsten-Halogen and Photolamps	3200
Projection Lamps (500 to 1000 Watts)	2900 to 3000
General Purpose Lamps (200 to 500 Watts)	2900
Household Lamps (100 to 150 Watts)	2850
Household Lamps (60 Watts)	2800
Household Lamps (40 Watts)	2750

Close-Up Lenses & Attachments

Macro or close-up photography is a necessity for documenting both the condition of objects when recovered from a scene as well as for examination quality photos of small evidence items like fingerprints, tool marks and bite marks. Excluding specialty cameras like a one-to-one fingerprint camera, the photographer typically has three options; magnification filters, 1:1 adapters or macro lenses for the camera.

Magnification Filters (Close-up Lenses)

These are specialty attachments that screw onto the front of the camera lens and they are the least expensive close-up option. They look much like the protective UV filter that should be on the front of the lens – except these provide magnification of the image. Typically, these filters are sold three to a set. Each filter provides a certain level of magnification (also referred to as diopter strength; +1, +2, +4) and they can be used in combination.

These filters will allow the photographer to get closer to their subject, but they will not allow one-to-one images to be captured. Their other drawback is that to get to the higher magnification levels, the photographer must stack filters on the front of the camera lens. This filter stacking is undesirable as it results in reduced image quality. If these filters are used, the photographer should first remove the UV filter from the front of the camera lens.

Technical Note: When stacking magnification filters on the front of a lens, they should be placed on in the order of their magnification power (lowest to highest). Ideally, no more than two should be used at any one time.

1:1 Adapters

These are specialty adapters designed to allow items to be photographed at a one-to-one ratio. They look like lens filters with a clear plastic tube that extends from the front of the filter. They screw on to the front of the lens and the photographer places the end of the plastic tube directly against the surface that the impression is on. One of the big benefits of these adapters is that the photographer stabilizes the camera by placing the tube against the surface; there is no need for a tripod. These adapters are slightly more expensive than magnification filters but they do allow a one-to-one image capture.

There are several disadvantages to these adapters. First, they require the photographer to work very close to the impression – in some cases this may make properly lighting the impression difficult. Second, they can only be used on relatively flat surfaces; if the front of the plastic tube cannot be placed on the exact same surface that the impression is on, the resulting image will not be a one-to-one reproduction.

As with the magnification filters, the photographer should remove the UV protective filter (if there is one) from the front of the camera lens before mounting the adapter on the lens.

Technical Note: An image that is reproduced 1:1 (life size) is reproduced at that ratio on the film negative. This means that only impression evidence that is small enough to fit within the parameters of a frame of 35mm film can be reproduced 1:1. Most commonly this will be fingerprints and tool marks. Anything larger than a frame of 35mm film needs to be captured with a scale at less than life-size and then printed at 1:1.

General Requirements

Guidelines

- Photograph the scene in its original state
- Avoid capturing equipment, people, etc. in photos
- Take overall photos from a normal, eye-level viewing perspective
- Whenever practical, use a "normal" lens

Tell the Story

Typically, general scene photos will be the "story telling" documentation photos of the incident and will usually be the first photos taken at a scene. Before starting, the photographer should have a good understanding of the nature of the incident and what has happened within the scene. This understanding can come from a walk-through of the scene and/or conversations with other investigators at the scene. These general scene photos should include documentation of

- Identifying shot establishing the scene location
- Overall conditions of the scene, exterior / interior
- Approach paths to the scene
- Actions of person(s) within the scene (witnesses, victims, first responders or offenders)
- Locations of evidence items within the scene
- Flight paths from the scene

Progressive Photography Technique

General scene photos should be taken in a progressive manner showing overall, mid-range, and close-up views of the scene and objects within.

- *Overall or Orientation* photos will establish the location of evidence items within the scene and set the stage for the viewer. (Also referred to as *establishing* photos.)

- *Mid-range* photos will help maintain the viewer's orientation as they are brought into the scene.

- *Close-up* photos will provide the viewer with the information needed about a specific item.

The scene should always be photographed in its natural state before adding any type of item markers, scales, etc.

(See examples – next page).

Example – Progressive photography technique, overall, mid-range & close-up photos.




In addition to overall, mid-range and close-up photos, the photographer should strive to document the scene with 360^{O} coverage. This is accomplished by taking a series of photos that cover the scene from various angles or at least from four opposing sides. These photos should overlap in their coverage of the area or object. For indoor scenes, these photos can be taken from the four corners of a room. Significant items within a scene, such as a body, should be photographed along the axes from four sides whenever possible. A photographer not having access to a wide angle lens, may have to use more that four photos to achieve the desired coverage.

In addition to photos taken from all angles, pattern evidence located at a scene should be photographed with the camera at a 90^{O} angle to the pattern (film plane parallel to the pattern). This technique provides the most accurate documentation of the pattern. Examples of pattern evidence includes

- Footwear & tire tracks
- Burn patterns
- Bloodstains
- Crash damage to vehicles
- Injuries

(See examples – next pages.)

Forensic Examination Quality Photos

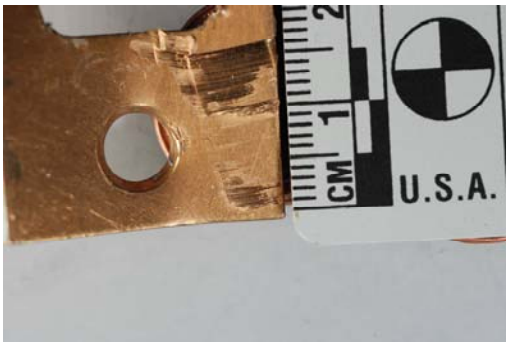
A forensic examination quality photo is defined as any photograph that will be used for comparison and identification purposes. The most common examples being footwear, fingerprint, tool mark and bite mark photos.

The standard requirement for any forensic examination quality photo is that it must include a scale and that scale must be placed at the same level as the detail being photographed. This means that the scale may need to be raised or lowered as appropriate.

Improper Scale Placement

Proper Scale Placement

Sharp focus, good depth of field and proper lighting are also very important. Use a macro lens and get close to capture the fine detail.



90^{O} alignment of the camera's imaging plane to the surface bearing the impression is critical. In the field, a tripod should be used and for work in your lab or office, a copy stand is needed.