Light meter for infrared photography

A modified Minolta Auto Meter VF

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Introduction

Your meter is a Minolta Auto Meter VF that has been modified to make highly accurate exposure readings for infrared films. The modifications give the infrared photographer the full range of features provided by visible light exposure meters. The meter offers nearly all of the features as the Minolta Auto Meter VF including flash metering. You will be able to expose infrared films in any situation with the same high degree of confidence as exposures of visible light films. The meter will detect changes in the ambient level of infrared light that would not be seen by the unaided eye. Whether photographing in sunlight, shade, rain, fog, under tungsten light, with electronic flash or any other condition, you will be able to make perfect exposures on a consistent basis.

Important: This meter’s modifications make it unsuitable for visible light photography.

Since there are no standards to measure infrared film speeds and no standardized measurement methods or test conditions, it needs to be understood that the film speed scales used in visible light photography are completely arbitrary in infrared photography. Although your meter has been calibrated under reference conditions, the film speed setting does not indicate the true film speed as established by standards associations such as the ASA and ISO.

There is one feature of the Auto Meter VF that should not be used for infrared photography. The feature calculates shadow and highlight exposures by pressing the S/A/H button. The offsets used in these calculations are not adjustable and will not indicate the correct exposures when used for infrared photography.

If you are unfamiliar with the Minolta Auto Meter VF please be sure to read the Minolta manual.

Metering Method

Your meter came equipped with only the reflected light attachment, rather than the incident metering dome. Metering infrared light requires a slightly different philosophy than visible light because the tones rendered in the final print are not necessarily what the eye sees. An accurate incident light reading requires that you measure the amount of infrared light falling on the subject, but not the amount reflected from the subject. In order to predict the film's exposure, the meter must see what the film will see. The importance of this can be demonstrated by using a video camera in the night-shot mode. This mode produces monochrome images of infrared light. It can clearly be seen that some fabrics that appear black to our eyes appear white in night-shot mode. If an incident reading had been used for such a scene, the tone reproduction would be completely unpredictable. Likewise, if a material that appears white to our eyes (and that we wish to reproduce as white) reflects very little infrared, the subject will be underexposed. By sticking with reflected light readings, these problems can be avoided.

Film speed

Another problem posed by infrared photography is that typically, the images are of higher than normal contrast. This can make things a bit confusing when deciding what to meter from. In visible light photography, the rule of thumb is to expose for the shadows and develop for the highlights. Since visible light meters are calibrated for Zone 5[1], the practice is to meter from a desired Zone 3 area and underexpose by 2 stops. This would work for infrared metering except that most infrared images are closer to N+2 or N+3. Underexposing in this case would be like underexposing by 4 or 6 stops and result in a useless image.

[1] For an excellent discussion of exposure and the Zone system, see Adams and Baker, *The Negative*, Little, Brown and Company, 1995.

Since the normally the desired contrast is far higher than normal black and white photography, it is inappropriate to use 0.10 D density over f_b+f as the speed point[2]. Using this would make life difficult because the standard convention of metering is based on the meter reading indicating the exposure for a Zone 5 density, where a Zone 1 density is 0.10 D. One would have to calculate the offset assuming approximately N+3 development. To save this aggravation, a more appropriate speed point is the Zone 3 density – expose for full shadow detail. This is about .45 D. The only exception to this would be when using a flash and metering the whole scene. In this case, it is better to set the speed point to whichever setting gives a Zone 5 density because as a whole, the negative will be fairly well balanced. When flash metering for a particular object, as in for portrait work; the speed point could be set to whichever setting gives the desired film density for skin tones, usually about 0.90 D (Zone 6).

[2] Film speeds are normally based on the amount of light needed to raise the density of film a specific amount (usually 0.10) above the density of the film base plus background fogging.

In fact, one could use whichever speed point is desired if the settings are known for each Zone density.

Film speed chart

Meter for Zone	Get Film Density	Daylight ASA	Flash ASA
3	0.45	640	400
4	0.60	400	250
5	0.75	320	200
6	0.90	200	125
7	1.05	160	80
8	1.20	100	50

Note: These values were established for **Kodak HIE film** and developing in **Kodak HC-110 at 70-degrees F for 5 minutes**, as described in the section entitled *Calibration* and are not guaranteed to 100% accurate. Using this as a starting point, it is recommended that you do your own testing. **Other films and developers may require different film speed settings.**

Making ambient light measurements

Set the meter’s film speed according to the film speed chart. If you wish to meter for Zone 3, such as for dark stone or tree bark, set the meter to ASA 640. If you wish to meter for Zone 7, such as for foliage or a wedding dress, set the meter to ASA 160. Meter off the subject and set the camera accordingly. If you normally measure the highlights and shadows of a scene to determine the subject’s range, remember that infrared images are developed and printed to about N+2 to N+3. A 2 stop difference between a paved sidewalk and green grass will be a 4 stop difference in the print.

The reflected light attachment has a 40-degree angle of view, which approximates that of a normal lens. Minolta also offers 10-degree and 5-degree spot meter attachments. The 10-degree attachment requires an *addition* of 2.6 EV to the preset exposure compensation value. Please refer to the Minolta manual for instructions.

Making flash measurements

When making measurements for infrared flash photography, set the meter to ASA 200. This will render the scene as Zone 5, similar to visible light metering. With experience, you may find that a different ASA is better for you. Also, it may be wise to measure a specific part of the image when exposure is especially critical, such as when photographing a bride and groom. It is paramount that the bride's dress is correctly exposed, so you may want to set the ASA to 160 and meter from the dress. By using one of the available spot attachments, you can even spot-meter the dress. For portrait work, the skin tones are usually the most important. To achieve a Zone 6 density, set the meter to ASA 125 and take a reading from the subject's face. Experiment with different settings to achieve the desired look.

Calibration

Provided that your camera is using the same filter as in the IR meter (Wratten #25, #29, #89B, #87 or #87C), the following densities will be achieved with Kodak HIE film:

Reflected flash:	0.75 D	Zone 5	(18% gray card)	use	ASA 200
Reflected ambient	0.45 D	Zone 3	(full shadow detail)	use	ASA 640

Test conditions:

Film: Kodak HIE

Development: HC-110 dilution B @ 70 degrees F for 5 min.

1st minute constant agitation, then 5 sec. every 30 sec.

Note: If needed, adjustments can be made to the calibration by adjusting the exposure compensation setting. This adjustment has been preset in order to calibrate the meter. The value has been recorded for you inside the meter's battery compartment. To change this value, please refer to the Minolta manual for instructions.

IR metering, pre-visualization and reciprocity failure

If you are familiar with infrared photography, you've learned that various films and filters give different amounts of "infrared effects". This effect can be subtle, as with the #25 filter or stronger, as with the #87. Not only do the different filters provide different amounts of the Wood effect (green foliage rendered white), but they also alter the overall contrast of the scene. The red filters will result in lower contrast while the black opaque filters yield higher contrast. It is important to note that this is *not* due to the filter's effect on the film, but rather the filter's effect on the amount of light reaching the film. The film has a characteristic contrast curve which is mostly dependent on exposure time and development and only minimally on wavelength.

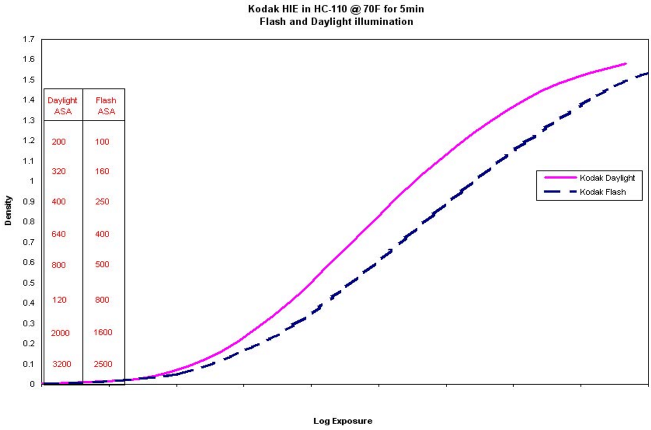
It is best to use the same filter in the camera as is in the meter. The meter will indicate the subject brightness range very accurately allowing you to determine what the final image will look like. A good rule of thumb is to assume N+2 exposure and development. Within the most important tonal range, between Zones 3 and 8, there will be *a 2 Zone difference for every 1 stop brightness difference*. This is helpful to know for Zone system photographers who measure multiple areas of a scene to determine subject brightness range.

Testing has shown that there are significant differences in film speed settings when using a flash as opposed to ambient lighting. The reason is most likely due to the very short exposure times provided by electronic flashes. Kodak specifies that their HIE film exhibits reciprocity failure at a shutter speed of 1/1000 second and requires an additional 25% exposure (1/3 stop). In addition to losing at least 1/3 stop, there is a loss in contrast which indicates a need for greater development. Other black and white films, such as Kodak's Tri-X pan also require 10% additional development for exposures of 1/1000 second. On page 12, a diagram plotting the D vs. log E curves shows these differences. In the deep shadows, there is a 1/3 stop loss in film speed. In the mid-tones it grows to 2/3 stop and in the highlights it is 1 full stop.

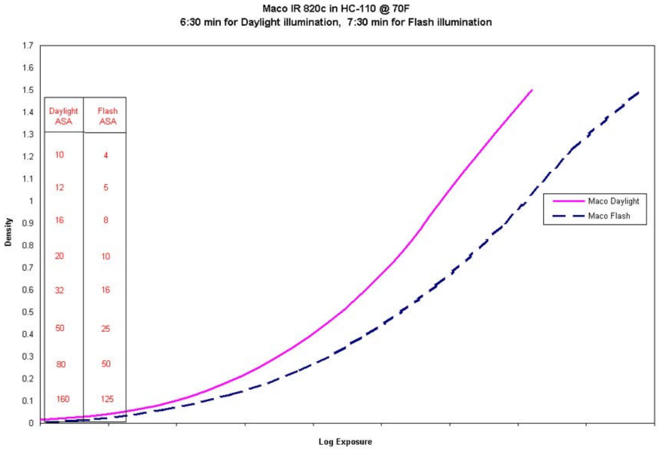
Info at http://kodak.com/global/en/professional/support/techPubs/f13/f13.pdf

Therefore, when using an electronic flash and measuring the subject brightness range, there will be less density range than expected. To minimize variations and reciprocity error during shooting, it is best to have the flash always set at maximum power, at which most professional units have a flash duration of about 1/500 second.

Questions? Please write to david@davidromano.com



Kodak HIE in HC-110 @ 70F for 5min
Flash and Daylight illumination
Density
Log Exposure
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Daylight ASA
Flash ASA
200
100
320
160
400
250
640
400
800
500
120
800
2000
1600
3200
2500
Kodak Daylight
Kodak Flash


Maco IR 820c in HC-110 @ 70F
6:30 min for Daylight illumination, 7:30 min for Flash illumination
Density
Log Exposure
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Daylight ASA
Flash ASA
10
4
12
5
16
8
20
10
32
16
50
25
80
50
160
125
Maco Daylight
Maco Flash

Template for film speed settings

Cut out and tape to the back of your meter for quick reference

Maco IR 820c HC-110		
Zone	**Sun**	**Flash**
3	50	25
4	32	16
5	20	10
6	16	8
7	12	5

Kodak HIE HC-110		
Zone	**Sun**	**Flash**
3	640	400
4	400	250
5	320	200
6	200	125
7	160	80

Template for film speed settings

Cut out and tape to the back of your meter for quick reference

Maco IR 820c		
Zone	**Sun**	**Flash**
3		
4		
5		
6		
7		

Kodak HIE		
Zone	**Sun**	**Flash**
3		
4		
5		
6		
7		