

LEBANON CAMERA CLUB

**Taking Control of Your
Digital Camera:
Metering**

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9/5/2023

See last slide for Fair
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Taking Control: Metering

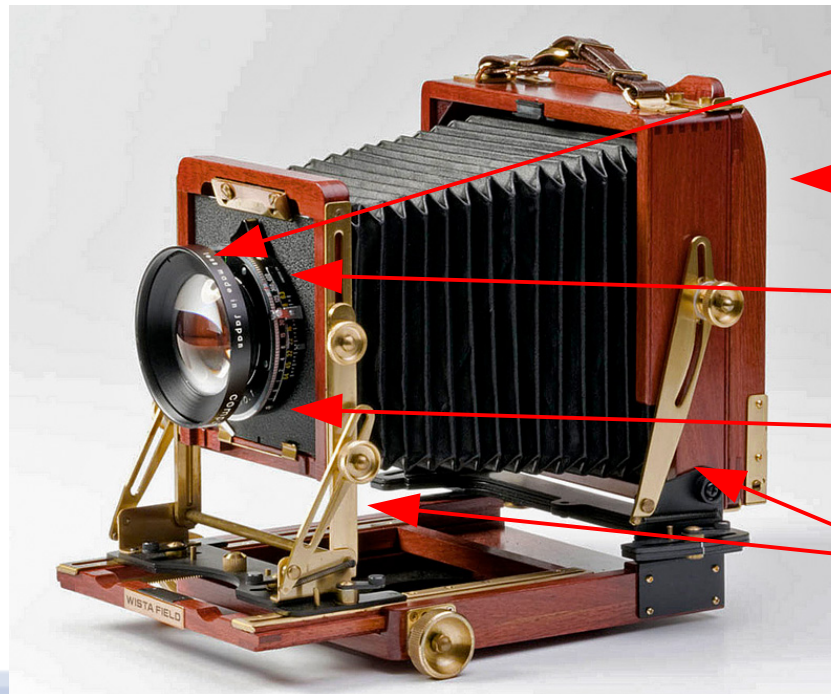
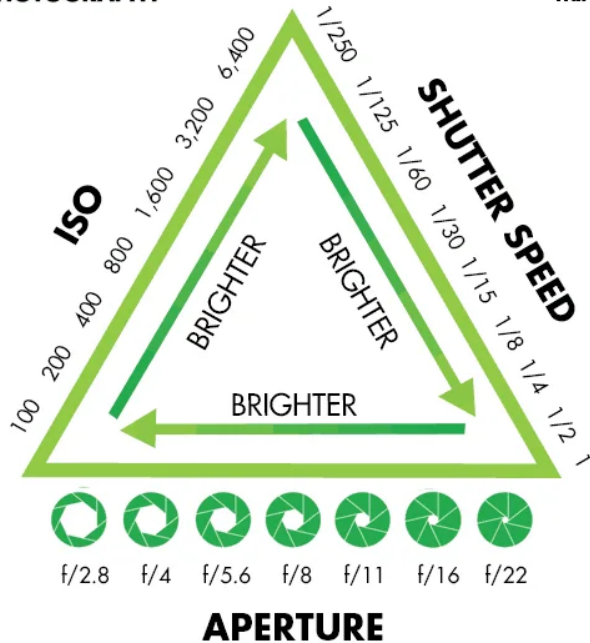
Taking Control series

Note: On early cameras there was no timed shutter → exposures times were long, so it was held open as long as needed

- Digital cameras → complex, many pages of settings
 - ◆ Early cameras were simple, and all controls were manual
- Modern automatic modes reduce complexity...
 - ◆ ...but also reduce creative control
 - Manual operation can help achieve a photographer's vision

EXPERT PHOTOGRAPHY

EXPOSURE TRIANGLE



focus

film (ISO)

aperture

shutter speed

movements (tilt, shift)

Taking Control: Metering

Taking Control series

1. Metering → determining the amount of light in scene
 - ♦ Modes → center weighted, spot, average, matrix; histogram
2. Exposure → correct amount of light recorded
 - ♦ Modes → **M, A, S, P, AUTO**, Scenes (landscape, portrait, etc.)
3. Focus → making sure the image is in focus
 - ♦ Autofocus → single, continuous, spot selection, eye focus
4. Drive → how shots are taken
 - ♦ Single, sequential, timer, silent (electronic shutter)
5. White balance → correct colors for various lighting
 - ♦ Preset, custom, auto

Taking Control: Metering

Note: Chart must assume film speed and a standard aperture setting

History

- Exposure tables → mid to late 1800's
 - ◆ List of conditions and appropriate settings
 - There was no way to measure the amount of light in the field
 - Probably the result of trial and error

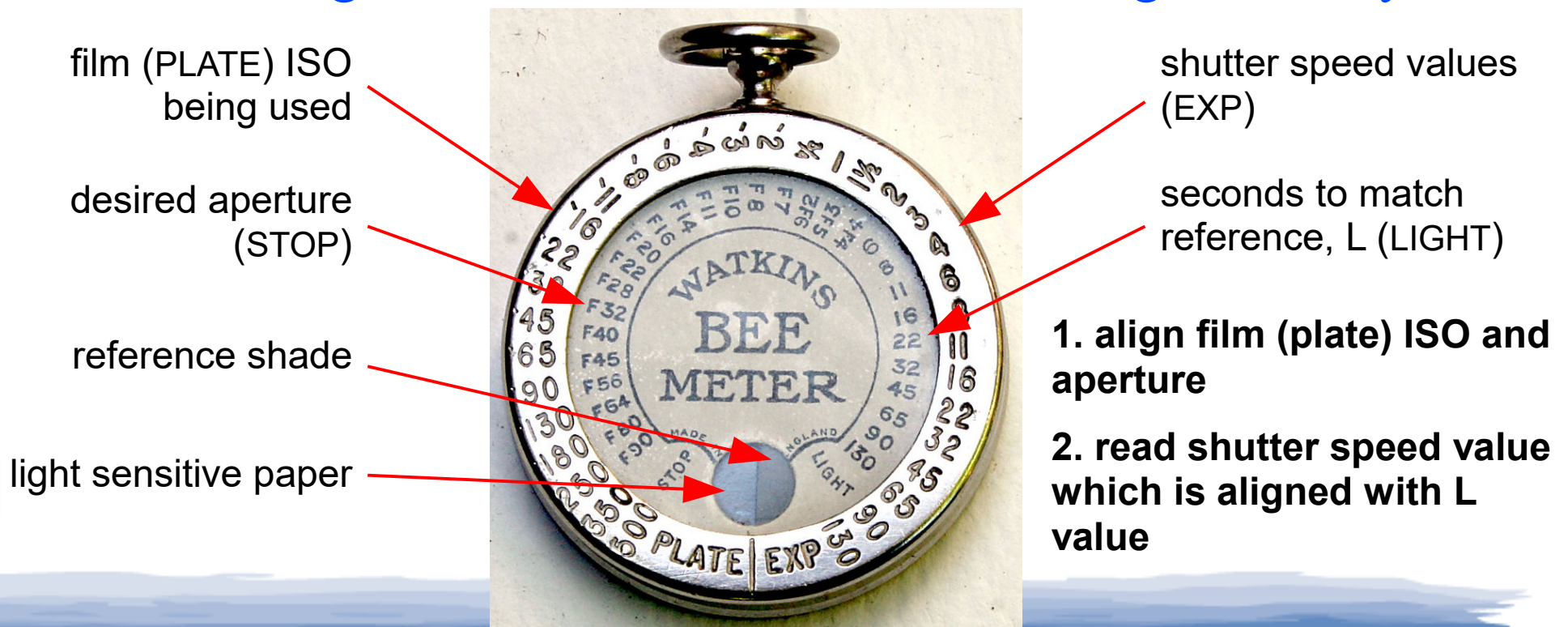
STATE OF THE WEATHER	HOURS OF THE DAY						
	8	9	10	11 to 1	1 to 2	2 to 3	3 and after
	MINUTES.	MINUTES.	MINUTES.	MINUTES.	MINUTES.	MINUTES.	MINUTES.
Very brilliant and clear, wind steady from W. or N.W., very deep blue sky, and absence of red rays at sunrise or sunset. Time employed	15	8	6	5	6	7	12 to 30
Clear, wind from S.W., moderately cold, but a slight perceptible vapor in comparison with above. Time employed....	16	12	7	6	7	8	15 to 40
Sunshine, but rather hazy, shadows not hard, nor clearly defined. Time employed.....	25	18	14	12	14	16	25 to 40

Taking Control: Metering

History

Note: A light meter which compares measured light to a reference brightness is called a 'comparison photometer'

- Actinometer → 1890 (mass produced in 1900)
 - ◆ Darkening of light sensitive paper determined exposure values
 - Count number of seconds, L, for the paper to match a reference shade
 - L & ISO & desired f -number → shutter speed
 - ◆ Incident light meter → measures ambient light directly



Taking Control: Metering

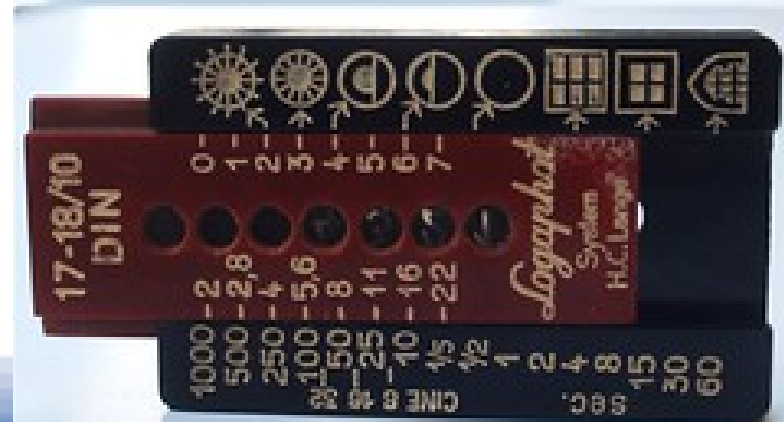
History

- Extinction meter → 1920's
 - ♦ Set of numbers with different strength neutral density filters
 - The first number that is visible determines the amount of light
 - Table then used to determine aperture and shutter speed
 - ♦ Incident light meter

darker filters result in dimmer numbers



slide to align first visible number with reference hole, then read f -number/shutter speed values – unsure how film speed comes into play



Taking Control: Metering

History

Note: Early analog meters → selenium photocell (no battery). Later versions → CdS photoresistor (battery). Some modern versions → amorphous silicon photocell (no battery).

- Analog light meter → 1934
 - ◆ Light sensitive cell determines voltage shown by meter needle
 - Early models indicated a number which indexed into a table
 - Later models displayed *f*-numbers directly
 - ◆ Incident light meter, modern versions also reflective meters



Weston Master II (1946)



Sekonic L-208 (\$129)



Sekonic L-398A (\$229)

Taking Control: Metering

Note: You can still buy a spot meter: the Sekonic L-858D-U, a 1° meter for \$599.

History

- Analog spot meter → 1935 (commercial versions by 1945)
 - ◆ Measure light from a small area of the scene → 3° or 1°
 - Lenses restrict the light sensitive area, viewfinder to point meter



©Øystein Horgmo

SEI Photometer (comparison photometer, ~1945)



Pentax Spotmeter (CdS photoresistor, 1965)

Taking Control: Metering

Note: The spot meter was famously used by Ansel Adams as part of his Zone System to determine optimal exposure.

History

- Analog spot meter → 1935 (commercial versions by 1945)
 - ◆ Measure light from a small area of the scene → 3° or 1°
 - Lenses restrict the light sensitive area, viewfinder to point meter
 - ◆ Reflective light meter → measures light reflected off subject
 - Reflective meters 'expect' a middle gray surface (18% reflectance)
 - Examples of middle gray are lighter grass or foliage, deep blue sky
 - **Metering off non-middle gray → must correct exposure**

11 zones, zone 0 is pure black, zone X is pure white, zone V is middle gray

zones are 1 stop apart → zone VI is one stop brighter than zone V



example: if you meter on zone VIII, then you need to adjust the exposure by +3 stop (changing aperture or shutter speed by 3 stops)

Taking Control: Metering

History

Note: Exposure Value is a way of expressing illuminance with a single number → a single EV is equivalent to several aperture/shutter speed combinations (for a given ISO value).

- Digital light meter → 1994 (unclear if this was first)
 - ◆ Light sensitive cell determines values on LCD display
 - Set ISO and shutter speed → f -number result displayed
 - A different mode displays Exposure Value (EV)
 - Can also be used for flash metering
 - ◆ Incident and reflectance light meter
 - White dome over sensor for illuminance mode
 - White dome moved to the side for reflectance mode

hemispherical dome
over sensor



Taking Control: Metering

History

- Camera light meter → Zeiss Ikon Contaflex, 1935
 - ◆ Twin lens reflex (TLR)
 - ◆ Light meter did not control exposure
 - Basically a hand-held light meter integrated into a camera



©John Wade



©Geoff Harrison

Taking Control: Metering

History

Note: Shutter priority → user sets ISO and shutter speed, camera sets aperture based on metering

- 35mm TTL light meter → Topcon RE Super (1963)
 - ♦ TTL = Through The Lens → metered light through the lens
 - ♦ Quickly followed by the Pentax Spotmatic
 - ♦ Metering still uncoupled → did not affect exposure controls
- 35mm coupled meter → Konica Auto-Reflex (1965)
 - ♦ Shutter priority, non-TTL



©lens-db.com

Taking Control: Metering

History

Note: Aperture priority → user sets ISO and aperture, camera sets shutter speed based on metering

- 35mm coupled TTL light meters
 - ◆ By 1974 many manufacturers had adopted coupled meters
 - Shutter priority → Canon, Konica, Miranda, Petri, Ricoh, Topcon
 - Aperture priority → Pentax, Cosina, Fujica, Minolta, Nikon, Yashica
 - ◆ Minolta XD11 offers both shutter and aperture priority (1977)
 - Can select the best one for the situation



Taking Control: Metering

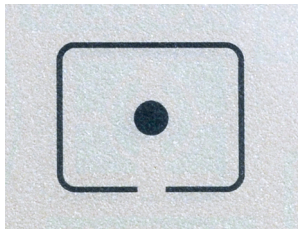
Digital camera metering

Note: Mirrorless cameras are more flexible → main sensor can be used for metering (variable spot size, flexible spot position)

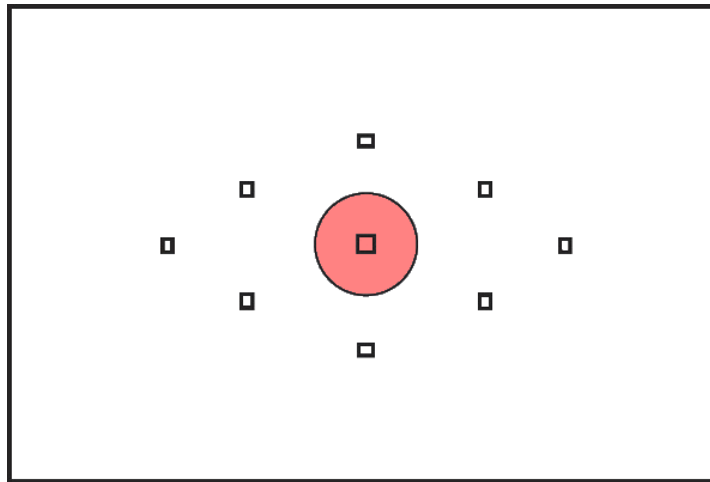
- Multiple metering modes → all reflective

- ◆ Spot

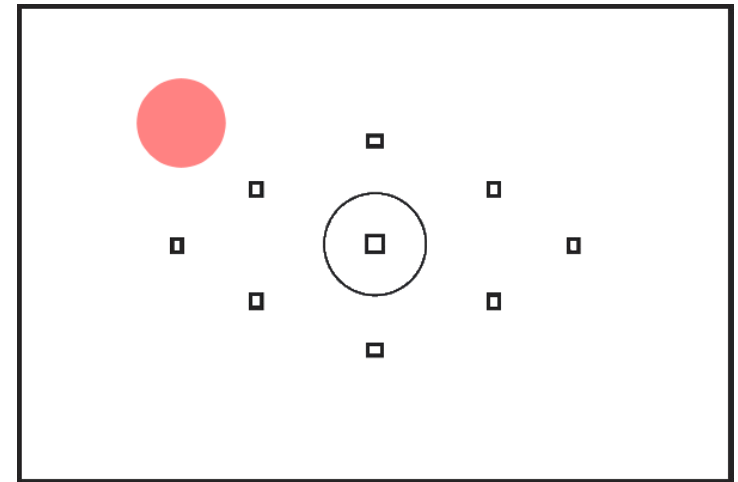
- Similar to hand-held spot meter, but area may not be as small
- Many cameras only do spot metering in the center of the frame
- On some cameras the spot can be moved
- On some cameras the moveable spot can follow the autofocus point



spot metering symbol (may look different on some cameras)



fixed spot in center of frame

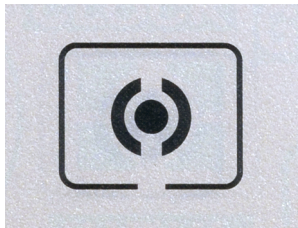


flexible spot → may be restricted to certain points (DSLR) or moved to any location in the frame (mirrorless)

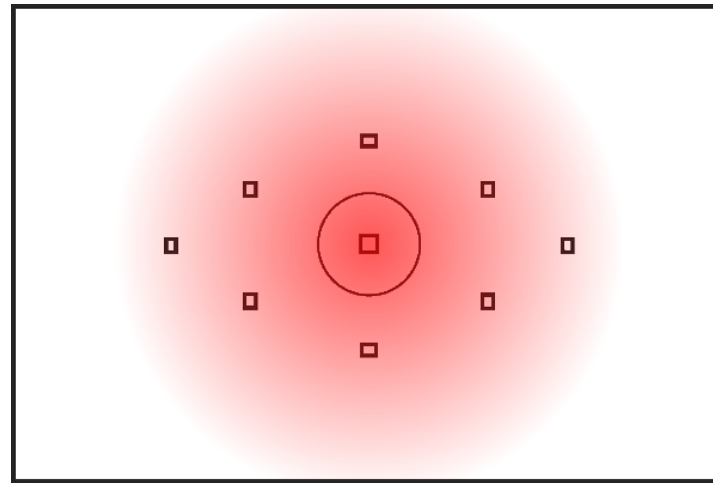
Taking Control: Metering

Digital camera metering

- Multiple metering modes → all reflective
 - ◆ Center weighted
 - Center of frame gets more metering influence
 - Can be useful since subjects tend to be in the center of the frame



center weighted
metering symbol
(may look different
on some cameras)



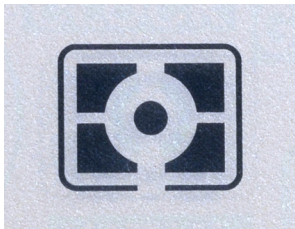
center weighted zone gets
more weight when metering

Taking Control: Metering

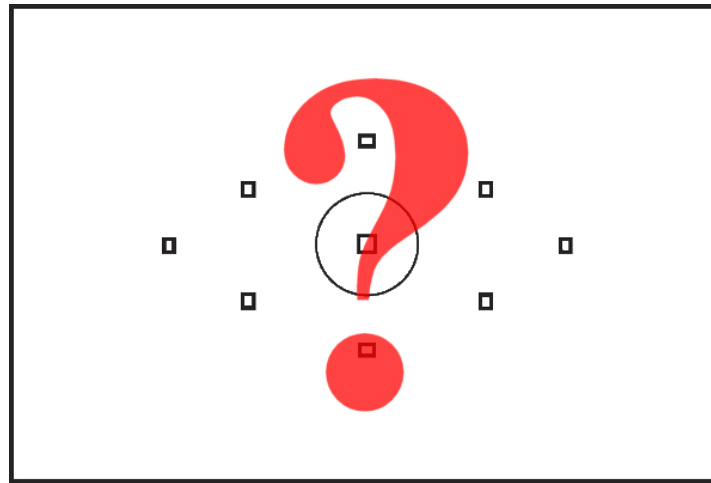
Digital camera metering

Note: Matrix metering can be considered an automatic mode, because the camera is controlling the metering.

- Multiple metering modes → all reflective
 - ◆ Matrix (Evaluative, Segment, ESP, Multi-Pattern, ...)
 - Light measured at several points, combined for 'best' exposure
 - Number of points can vary from several to thousands
 - Every manufacturer uses a different algorithm
 - Factors: AF point, subject distance, in focus areas, colors in scene



matrix metering symbol (may look different on some cameras)



matrix metering algorithms are a trade secret

Taking Control: Metering

Digital camera metering

- Incident metering
 - ◆ Can be done using a lens accessory → ExpoDisc
 - Designed to be a white balancing tool, it can also be used for metering
 - Attaches to lenses like a filter



ExpoDisc (\$50)

Taking Control: Metering

Digital camera metering

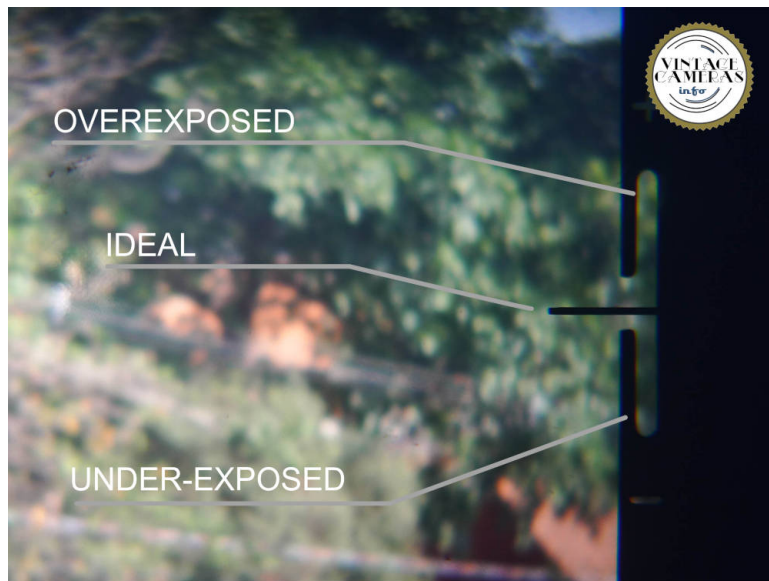
- Metering displays

- ♦ Needle

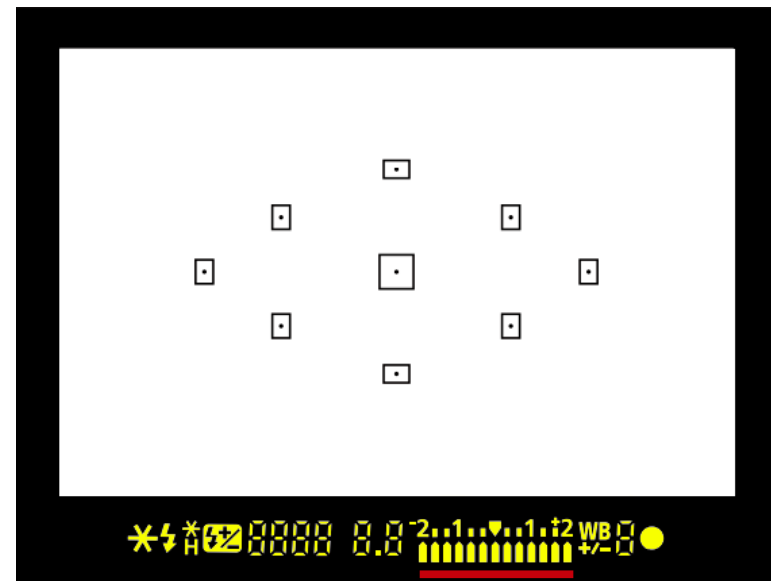
- Earliest display → centered is correct exposure, + = high, - = low

- ♦ Exposure meter

- -2 stop to +2 stop display, with 1/3 stop increments



Pentax K1000 viewfinder



Canon 400D viewfinder

Taking Control: Metering

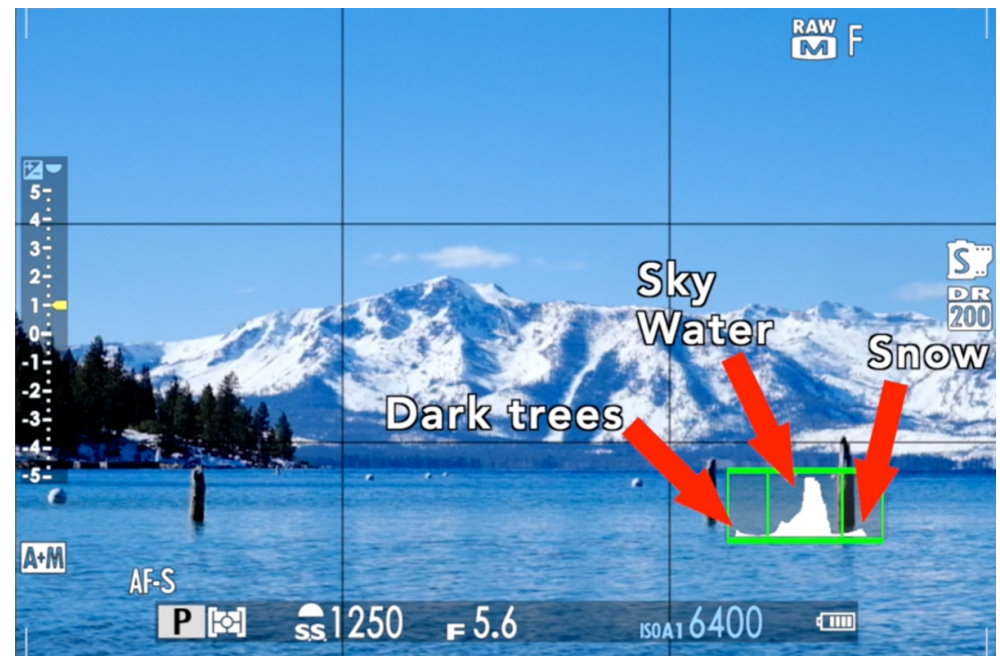
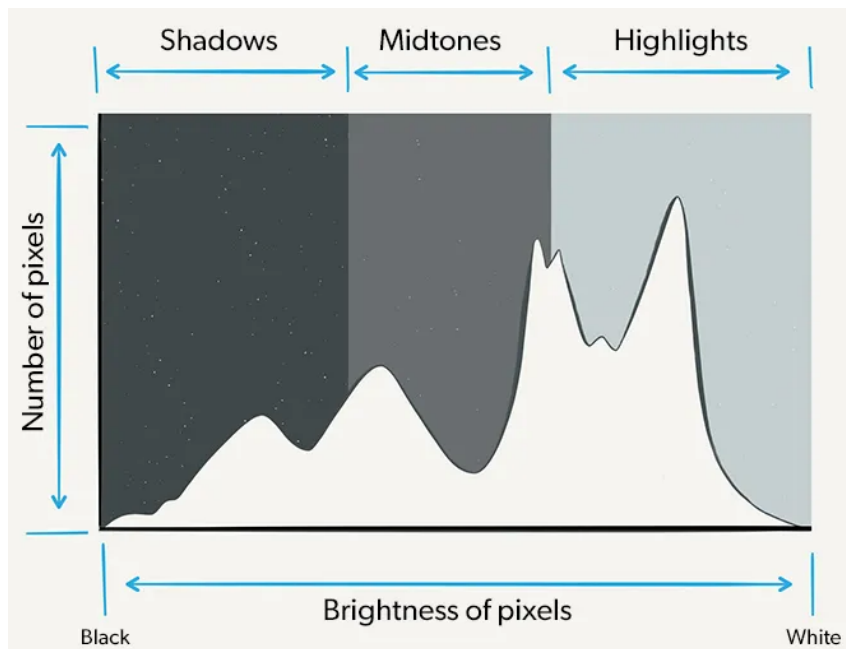
Digital camera metering

- Metering displays

- ◆ Histogram

- Graph of the number of pixels at each brightness level
- Left side is dark, right side is bright
- **Pixels in the left-most and right-most columns are probably 'clipped'**

Note: A clipped pixel value represents scene data that is outside the range the sensor can capture → clipped (blown) highlights result in featureless white areas that cannot be recovered



Taking Control: Metering

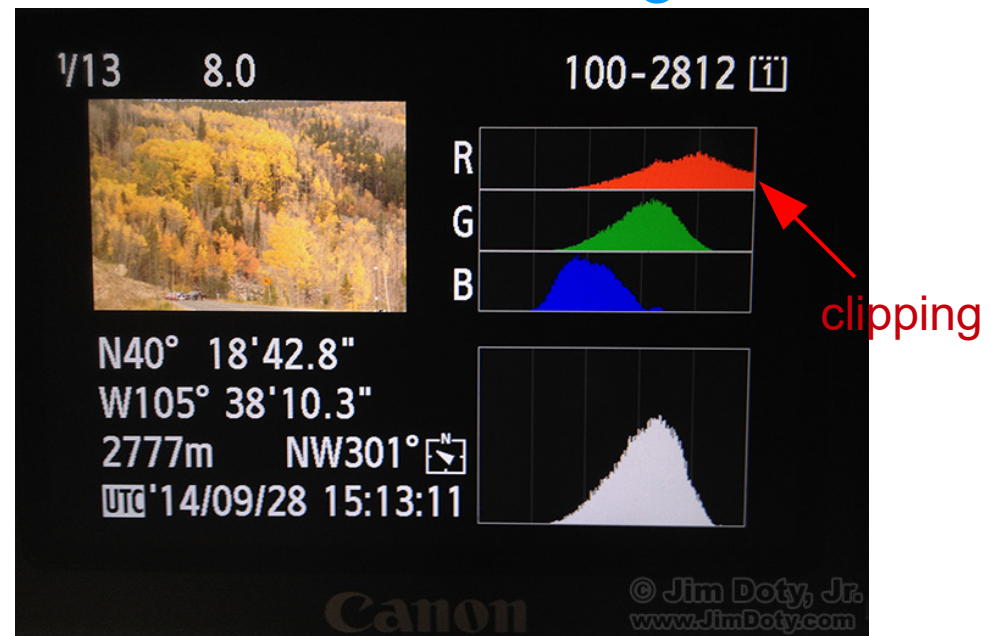
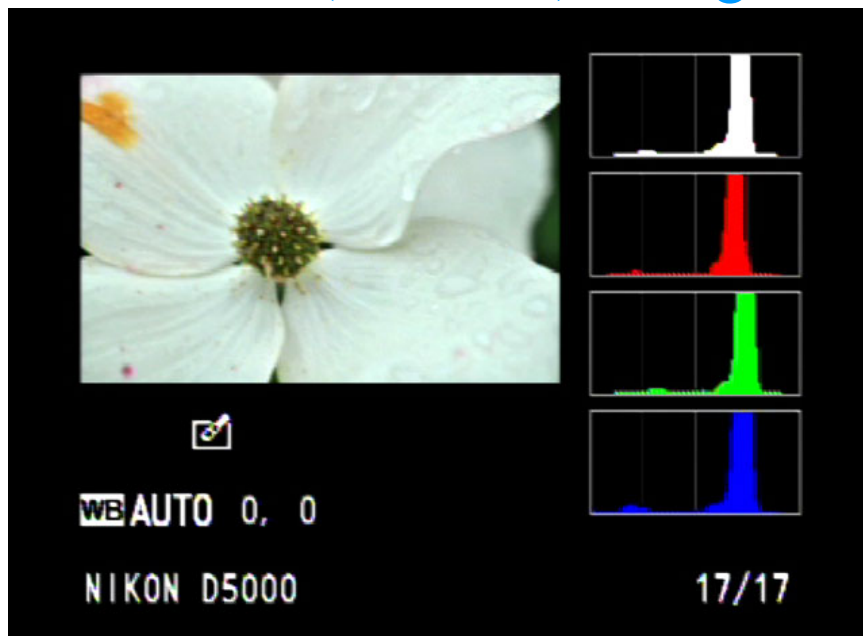
Digital camera metering

Note: The luminance histogram shows a combination of the pixel RGB values, weighted for perception of brightness:
 $L = 0.21R + 0.72G + 0.07B$

- Metering displays

- ◆ Histogram

- Graph of the number of pixels at each brightness level
- Left side is dark, right side is bright
- Pixels in the left-most and right-most columns are probably 'clipped'
- White (luminance) histogram not as accurate as RGB histograms



Taking Control: Metering

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