Don Krehbiel: A Major Voice in the World of Minox

Collected Writings, 1990s–2000s

Don Krehbiel was one of the most respected contributors to the subminiature photography community. As a frequent and thoughtful writer on the Submini-L mailing list and elsewhere, Don's articles on Minox cameras and small-format photography were clear, insightful, and often ahead of their time.

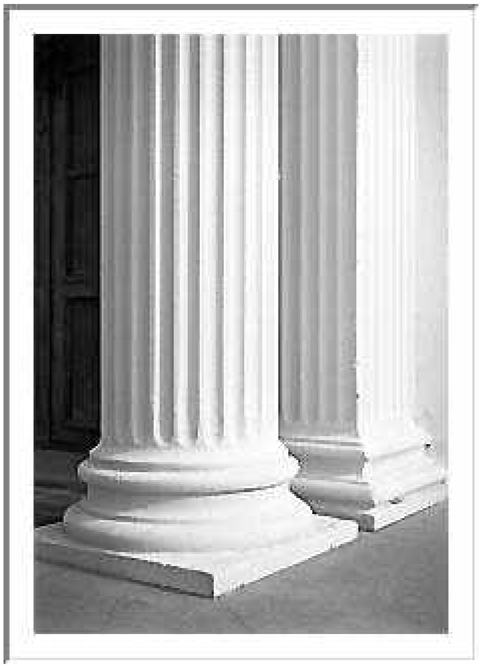
This collection brings together a selection of his writings, originally published online and preserved by members of the Minox community. His work helped shape the understanding and appreciation of Minox cameras for a generation of collectors, users, and historians.

The SubClub, one of the earliest subminiature photography websites, captured his impact well:

> *"Don was the author of many informative and well-written articles about subminiature photography. His efforts brought together a wide community of Minox users and collectors."*

These writings are preserved here with gratitude — not only for what they teach, but for the voice they represent: curious, generous, and deeply committed to the craft.

Compiled and edited by Larry Feldman, listowner of Submini-L



The terms “large”, “medium”, “miniature” and “ultra-miniature” when applied to camera formats, tend to divert attention from the fact that each is an imaging device with its own virtues and liabilities.

Just as an 8 x 10 view camera may not be the best choice for a yacht race, a Minox is not the ideal choice for Yosemite murals. The Minox, however, is unique in that it does provide the best assurance that you will get a quality image in either situation. It may be the only camera which can *always* be carried, provide “photo album” prints equal to any, and, at the same time, make negatives for fine “gallery quality” prints.

But, to just use it as a small, handy 35mm camera is to miss the real —

Charm of the MINOX

- about USING your MINOX
- about the 8x11mm negative size
- about Image Management
- about Depth of Field and Diffraction
- about Lens Focal Length
- about Film Speed (ASA, ISO, DIN, EV etc.)
- about Exposure and Shutter Speed
- about Flash GUIDE NUMBER

Loading the MINOX

Today's automatic cameras are marvels of engineering and do nearly everything for you, at a cost. The 8x11mm Minox cameras are also marvels of craftsmanship, ingenuity, and convenience, BUT also at a cost. The cost is minimal, but important. You must load and unload the film according to a proper procedure!

The cassette, shown without the covers and with white paper for film, shows the film being pulled from the supply chamber at the right and wound onto the take-up spool at the left. The Minox has an ingenious mechanism which maintains equal spacing between the frames, even though the film on the take- up spool is increasing in diameter, requiring less and less rotation of the drum with each film advance.

For the camera to know the rotation needed for the "next" frame, it must be told when a new roll has been loaded. You must provide this information by ALWAYS loading a new cassette in accordance with the instructions in the owners manual. The frame counter (examples shown below) has a "Loading Mark" in the form of a red **DOT** (or red **BAR**), and MUST be so positioned before inserting a new roll of film.

PLEASE NOTE that the new Minocolor PRO film for Minox 8x11mm is packaged in 30 exposure cassettes (a new length), with special counter setting instructions, for each camera style, included with each cassette.

Minox Riga, III, IIIs and B

- Frame counters start at zero and end at 50 (50 exposure film was discontinued in the late 60's).
- Counter indicates the number of EXPOSED frames.
- You must remember the length (exposure count) of the film you have loaded.
- After the last exposure, open and close the camera only twice (see below). Remove the film, THEN advance the counter to the **DOT** in preparation for a new roll of film.

Minox C, BL, LX/TLX and EC

- Frame counters start at 36 and DESCEND to zero.
- Counter indicates the number of frames REMAINING to be exposed.
- 36 exposure film loads must be inserted with the counter set at the red **DOT!**
- Exposing the nominal number of frames should bring the counter to zero.

15 exposure film loads -

- must be inserted with the counter set at the red **BAR!**

If you use less than the nominal number of frames, be sure to advance the frame counter to the **CORRECT POSITION** before loading a new cassette.

***Knowing when to START*.** The "leader" of the film strip is, of course, exposed during manufacture, as is the area between the chambers (with the crescent shaped notch). Closing the camera after inserting the cassette advances the film, BUT not enough to guarantee an unexposed "first" frame. To insure an undamaged first image, YOU MUST OPERATE THE WINDING MECHANISM **ONE MORE TIME,** to get the counter to the zero mark.

The film example shown is AgfaPan APX 25 which was inserted into, and removed from, the camera in very low light. Had it been fast film and subjected to bright light, some leakage through the felt light trap would have damaged the clear area rendering an important image, if placed there, useless.

***Knowing when to STOP*.** It is no accident that the **DOT** is two frames AFTER the end of the film for which your model was designed (36 or 50 exposure). Advancing through two frames at the end of your roll ensures that the last image will be safely protected within the take-up chamber before exposing the cassette to light. It also positions the mechanism for the insertion of a new roll of film, without operating the winding mechanism through a full count to get back to the load point.

The much more dangerous prospect is that advancing the film too far, continuing until the tail of the film is drawn into the take-up chamber, leaving the light trap empty and less effective than designed. Always leave film extending between the chambers to maintain the integrity of the takeup chamber light trap!

So, load film at the "load point" and stop at the proper "end point".

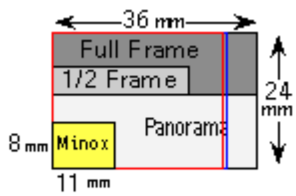
A Hug and a Squeeze

All of the fine engineering and precision manufacture will be for naught if you move the camera during exposure.
The assumption that fast shutter speeds will negate camera movement has merit, but for the increased enlargements needed with the very small negatives, less movement is better. The Minox is perfectly designed for steady operation. If you love your Minox, remember to give it "a hug and a squeeze." Hug the camera TO something, your forehead, cheek, Minox tripod against your chest, wall, table, anything solid. If you are using your body to support the camera, lean against something if possible.

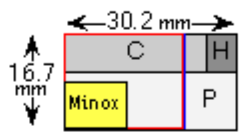
Once you are hugging your Minox, learn to squeeze it with equal pressure on both sides to depress the shutter release. If you allow the edge of your finger to spread onto, and depress, the release, you can increase the pressure in a gradual and steady manner, ultimately releasing the shutter without moving the camera. This need not be a slow process, just smooth and steady. Practice will pay rich dividends. Practice will also reveal the problem of "the finger in front of the lens". We have all done this and lost important images because of it. Rolf Kasemeier, in his book small minox, BIG PICTURES, suggests practicing in front of a mirror. Good advice!

Negative Format *(Size and Shape)*

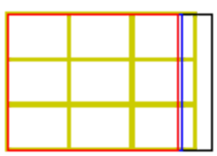
Enlargement in this discussion refers to <u>linear</u> enlargement. An 8" x 10" print from a 4" x 5" negative is described as "2x". Admittedly it has <u>four</u> times the area, <u>four</u> times the silver content, <u>four</u> times the pixel count, AND <u>four</u> times the area NOT covered by silver. Arguments can rage between the usefulness of linear vs areal measurement of enlargement, but as a photographer, not a physicist, and since linear measurement is the basis for "lines per inch", "pixels per inch" and "dots per inch", I will use "linear" measurement to describe enlargement.



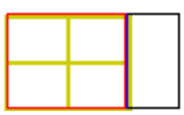
To produce an 8"x10" print, the image of the 35mm negative must be enlarged 8.467 times, while the image of the Minox negative requires an enlargement factor of 25.4. Thus, to produce the same size prints, the enlargement factor for a Minox negative must be 3 times as great as that needed with a 35mm negative.



The Advanced Photo System image format is approximately 2/3 the size of the 35mm format. Thus, to produce the same size 8:10 ratio prints, the enlargement factor for a Minox negative must be <u>only twice</u> as great as that needed with an APS negative.



Advances in film technology, designed to produce APS results comparable with that of the 35mm format, will mean better film for Minox



The red outline represents the effect of cropping to the "classic" 4x5 ratio. The blue line represents the shape of an 11x14 inch print. The Minox negative shape closely approximates these two formats resulting in minimum data loss.

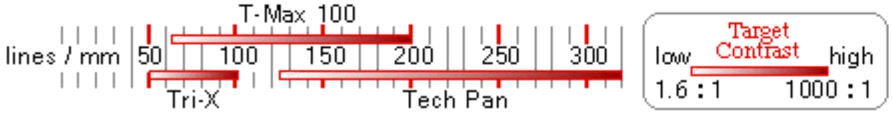
Ranging from the square 1:1, through 4:5, 35mm, and the "Golden Section", to panoramic, the aspect ratio of the final image has a significant impact on the degree of enlargement required. Higher aspect ratios favor the 35mm, APS, and panorama formats, while lower ratios favor "medium format" square negatives. Since each image has its own "best" shape, which rarely matches the shape of the negative, comparisons of one format with another are risky.

The following table shows various formats with the enlargement factor necessary to produce 3.5 inch high prints. Some loss of data in the final print is always present when producing standardized print sizes.

	Negative Ratio	Negative Size (mm)	Print Size (inches) Theoretical	Delivered	Enlargement factor
35 mm	2 : 3	24 x 36	3.5 x 5.3	3.5 x 5	3.70
35mm Panoramic	1 : 3	12 x 36	3.5 x 10.5	3.5 x 10	7.41
APS Classic	2 : 3	16.7 x 25.1	3.5 x 5.3	3.5 x 5	5.32
APS HDTV	9 : 16	16.7 x 30.2	3.5 x 6.2	3.5 x 6	5.32
APS Panoramic	1 : 3	10.1 x 30.2	3.5 x 10.5	3.5 x 10	8.83
Minox	**8 : 11**	**8 x 11**	**3.5 x 4.8**	**3.5 x 5**	**11.11**

The resolving power and grain pattern of a film combine with the quality of the optics to establish the maximum capability of the total system. Comparing resolving power of three prominent Kodak products for which technical data is available, it is apparent that film selection has a significant influence on image quality. It is important to note the difference between resolving power with low contrast and high contrast subjects. For low contrast subjects the difference between Tri-X and Tech Pan is 75 lines per millimeter, seemingly minimal, until you notice that the high contrast value for Tri-X is lower than the low contrast value for Tech Pan, and that the ratio is 2.5 : 1. It should also be noted that these are linear measurements and the quality of the image is influenced by the "information density" which is a function of the area, and beyond the scope of this discussion.

These values are for properly exposed negatives, over and under exposure significantly affecting the results. There is a lesson here somewhere.



Prints of pictorial scenes made from Kodak Technical Pan negatives show greater sharpness and detail than those from other films. Prints of pictorial scenes made from the discontinued Kodak High Contrast Copy Film negatives show greater sharpness and detail than those from Kodak Technical Pan negatives. It appears that the Minox can still benefit from future film improvements.

Caveat : Resolution is NOT the only characteristic of importance when evaluating the utility of a film/developer combination. To be sure it is a factor in film selection for very small negatives from which sharp prints are desired. The response to light AND to color (even for black and white), as well as the slope and shape of the characteristic curve, greatly affect the image quality and to some degree dictate the type of subject.

Image Management

Exploiting the "Minox Personality"

Simplify. It **is** a small camera, with a small negative, so don't try to capture everything in one image! Emphasize form and light, fine detail and subtile tonality is for large and medium format! Identify a central theme. Find and isolate small images within the bigger picture.

Fill the Frame

As one is often advised with 35mm photography, so to this is good advice with the Minox!

Near - Far

Create a feeling of intimacy, allowing the near features to dominate, while retaining sharpness and clarity in distant objects. The feeling of "presence", easily attainable with the Minox's exceptional depth of field, is one of the most important factors in a successful photograph, and is discussed fully by Ansel Adams in his Basic Photo One series Camera and Lens.

Light - Dark

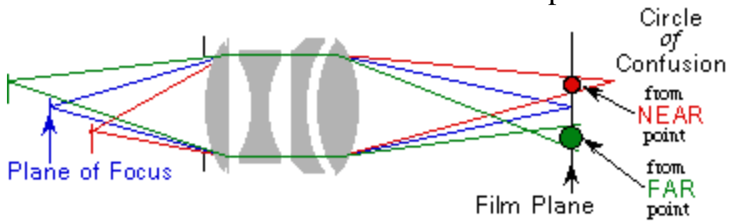
Esthetics aside, film records greater resolution, and we perceive greater sharpness, with higher contrast subjects. The subtile tonal values, so inviting in prints from large format negatives, are lost with the greater enlargement of very small negatives. Worse yet, the granularity associated with greater enlargement is overwhelming in the middle gray tones. Light and dark tones tend to mask grain patterns because of less clumping in the former and fusion in the latter.

Large - Small

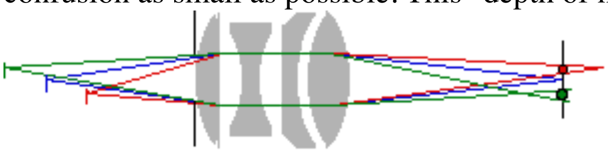
This is an esthetic value and lends scale to the image. When combined with the near-far and light-dark elements, the results can be most gratifying. With the small Minox negative, a large center of interest can be an asset.

Depth of Field

The New Leica Manual , Morgan & Lester, 1951, states that the average eye, at a viewing distance of 10 inches, can distinguish individual lines when they are no less than about 1/100 inch apart.. Thus, in the final print viewed from a distance of 10 inches, "any detail 1/100 inch in size or smaller will be acceptably sharp." This observation forms the basis for the calculation of most depth of field tables.

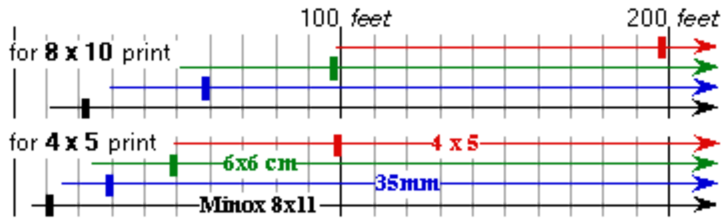


BUT! A lens focuses at precisely ONE distance. Everything on either side of that distance is out of focus, PERIOD! Points more distant than the plane of focus are resolved as points in front of the film, becoming fuzzy circles by the time they reach the film. Points closer to the camera would be resolved as points behind the film, so they are also fuzzy circles when they reach the film. These fuzzy circles are called CIRCLES OF CONFUSION. Unless various degrees of sharpness are used intentionally as part of the image, it is the task of the photographer to make the print appear as if the lens is focused over a wide range from near to far, to make the circles of confusion as small as possible. This "depth of field" can to some degree be controlled.



If the size of the opening is reduced, narrowing the light passage, the size of the CIRCLES OF CONFUSION are reduced **on the negative**. Enlarging the negative enlarges the circles of confusion, hence even smaller apertures are required as the enlargement factor increases. Remember we are striving for 1/100th inch **on the print!**

The table below shows the focal length of a "normal" lens for each of five formats. The f/stop settings shown produce equivalent depths of field. Thus, f/64 with a 324mm lens, and f/3.5 with a Minox, yield the same depth of field! "*Group f/64*", made famous by Ansel Adams, Edward Weston, et.al. derived it's name from the need for a very small apertures to achieve sharp images with 8 x 10 cameras. Perhaps we should have a "*Group f/3.5*".



All values are for *f*/3.5 with the camera's NORMAL lens.

Note that doubling the print size also doubles the hyperfocal distance and the point of nearest sharpness.

If the above cameras were all set at f/3.5, the following diagram illustrates the depth-of-field (range of adequate sharpness) when including infinity, and the point at which the camera needs to be focused to achieve this depth-of-field (hyperfocal distance)

Depth of field scales engraved on lenses assume some chosen enlargement factor, for example an 8 x 10 print viewed from 10 inches for 35mm cameras, and 4x5 prints for a Minox. It is assumed that larger prints will be viewed from greater distances

f stop	Blue light 400 nm l/mm	Blue light 400 nm Max x	Red light 700 nm l/mm	Red light 700 nm Max x
2	1250	318	714	181
2.8	884	225	505	128
3.5	**722**	**183**	**412**	**105**
4	625	159	357	91
5.6	**442**	**112**	**253**	**64**
8	313	79	179	45
11	221	56	126	32
16	156	40	89	23
22	110	28	63	16
32	78	20	45	11
45	55	14	32	8
64	39	10	22	6

The following tables can be used to assess the depth of field for critical work in which the potential print size is to be greater than the nominal 4 x 5 range for which the depth of field scale on the Minox is calibrated. They are also theoretical in that they ignore the effects of diffraction.

Print Size		**4x5**	**8x10**	**11x14**	**16x20**
Enlargement		12.7x	25.4x	34.9x	50.8x
hyperfocal dist.		10.5'	21.1'	28.7'	42.2'
		5.3' - inf	10.6' - inf	14.4' - inf	21.1' - inf
f/3.5	8"	7.6" - 8.5"	7.8" - 8.2"	7.8" - 8.2"	7.9" - 8.1"
MINOX	10"	9.3" - 10.8"	9.6" - 10.4"	9.7" - 10.3"	9.8" - 10.2"
(Thru LX)	1'	11.0" - 13.2"	11.5" - 12.6"	11.6" - 12.4"	11.7" - 12.3"
	18"	15.8" - 20.9"	16.8" - 19.3"	17.1" - 19.0"	17.4" - 18.6"
15mm	2'	20.3" - 29.4"	22.0" - 26.4"	22.5" - 25.8"	22.9" - 25.2"
Focal length	3'	28.1" - 50.0"	31.6" - 41.9"	32.6" - 40.1"	33.6" - 38.7"
	6'	46.0" - 14'	56.2" - 8'	5.0' - 7.6'	63.1" - 7.0'
	12'		91.9" - 28'	8.5' - 20.6'	9.4' - 16.7'
	24'			13.1' - 145'	15.3' - 56'
MINOX EC					
f/5.7	6.5'	3.3' - inf	4.4' · 13.0'	4.8' - 10.3'	5.2' - 8.7'
15mm					

The Minox EC shares the 15mm lens with its siblings. The lens is stopped down to f/5.6 to increase the depth of field. Focus adjustment is not available. With these design characteristics, the hyperfocal distance, for a 4" x 5" print, is 1.989 meters (6.53 feet). If the lens is permanently focused at 2 meters, the EC table shows the depth of field (range of acceptable sharpness) for the various print sizes.

	EC *f* / 5.6 Max. x = 22	**LX** *f* / 3.5 Max. x = 36	
Enlargement **28x** Print **8.8" x 12.6"**	4.6' - 12'	12' - inf	The EC and LX complement each other almost precisely for prints in the 9 x 12 range. The depth of field figures indicate that with one of each, no focusing would be necessary from 4.6 feet.
Enlargement **21x** Print **6.6" x 9.4"**	4.1' - 16'	9' - inf	My favorite print size provides a 4 to 16 foot range for the EC and 9 feet to infinity for the LX

Diffraction

Limit of Sharpness

A conflicting optical phenomenon is the tendency of light to diffract. *(change in direction and intensity of a group of waves after passing by an obstacle or through an aperture)* . This phenomenon can be witnessed in a stream where ripples deform as they bend around a protruding rock.

The amount of diffraction is dependent on the wavelength, thus varies over the visible spectrum from blue (400 nanometers) to red (700 nanometers). Smaller apertures, and higher frequencies (toward red) increase diffraction and actually <u>decrease resolution</u> and limit the degree of enlargement.

A point of light, composed of various wave-lengths, and greatly magnified, will appear as a circle (Airy disc). Discussions of sharpness or definition generally accept that a circle of 1/200 inch is perceived as "sharp' when viewed from "reading distance".

	Blue light 400 nm		Red light 700 nm	
f stop	1/mm	Max x	1/mm	Max x
2	1250	318	714	181
2.8	884	225	505	128
3.5	**722**	**183**	**412**	**105**
4	625	159	357	91
5.6	**442**	**112**	**253**	**64**
8	313	79	179	45
11	221	56	126	32
16	156	40	89	23
22	110	28	63	16
32	78	20	45	11
45	55	14	32	8
64	39	10	22	6

Leica Manual gives the resolution of a lens as:

"...the spacing between two points just resolved is equal to the wavelength of the light used for the measurement, multiplied by the focal length of the lens divided by the diameter." Since the "focal length divided by the diameter" is equal to the f-stop (f-number) tested, the equation is reduced to **wavelength * f-number**.

So, for f/16 and blue light
400 <u>nanometers</u> *(blue light)* = (400 / 1000000) 0.0004 <u>millimeters</u>,
and
0.0004 * 16 (the f/stop) = 0.0064 (the spacing between two points just resolved),
which is (1 / 0.0064) 156.25 lines per millimeter

The table at the left shows the resolving power of a lens and the largest enlargement possible at specified f/stops, for both BLUE (400 nanometers) and RED light (700 nanometers), while retaining 100 lines/inch <u>on the print</u>.

Note: The table is based on a theoretical calculation of the resolving power of a lens at a specified aperture AND wave length. This is similar to evaluating resolution at maximum contrast, which rarely, if ever, occurs. <u>The values in the table should be at least halved for practical work, and indeed I have seen data to that effect</u>.

<u>Lesson:</u>
Use apertures small enough for the required depth of field, but no smaller!

Lens Focal Length

The "Normal" lens

Using the Leica Manual as a reference, the focal length of a lens is defined as the distance from the principle plane (optical center) of a lens to the film "when the lens is focused on a subject at an infinite distance."

The focal length of a "normal" lens, one which provides approximately the angle of view of the human eye, is equal to the diagonal of the negative. If less than the entire negative is used during printing, the calculations must reflect the new **effective** negative size. The effect can be best seen in the 6X6 cm (Rollei, Hasselblad, etc.) data which reflects the relatively severe (20%) cropping to a 4:5 ratio which leads to a reduction of the effective "normal lens" from 79.9mm to 72.4mm. The result is to shift the standard 75mm Rollei TLR lens from slightly wide-angle to slightly long.

		"Normal" lens (mm)		enlargement factor for print size of		% loss due to cropping to 4x5 ratio
Minox	8 mm x 11 mm	**13.6**	15 mm = 10.3%			
35 mm	24 mm x 36 mm	**43.3**	50 mm = 15.6%			
6x6 cm	57 mm x 57 mm	**79.9**	75 mm = -6.1%			
4x5	102 mm x 127 mm	**162.6**	160 mm = -1.6%			
after 4x5 cropping				*8x10*	*11x14*	
Minox	8 mm x 10 mm	**12.8**	15 mm = 17.1%	25.4 x	34.9 x	9%
35 mm	24 mm x 30 mm	**38.7**	50 mm = 29.1%	8.5 x	11.6 x	15%
6x6 cm	45 mm x 57 mm	**72.4**	75 mm = 3.7%	4.6 x	6.4 x	20%
4x5	102 mm x 127 mm	**162.6**	160 mm = -1.6%	2.0 x	2.8 x	0%

Ever wonder what ASA, ISO, DIN mean and how they are related?

How about a Weston rating, or Kodak rating, or Scheiner (American or European) rating? There have been many attempts to classify "film speed", even though there is no single way to do so. The objective is to provide the photographer a way to estimate the exposure necessary to achieve the desired negative or transparency. The problem is that film emulsions and developers have widely varying characteristics, making comparison quite complex.

Of all of the various speed rating systems for film, three may still be commonly seen

ASA
(American Standards Association) Most common film speed rating in the U.S. until the conversion to ISO. Only the name has changed.

DIN
(Deutsche Industrie Norm). Based on a logarithmic scale wherein each increase represents 1/3 stop. ISO 800/30 on a recently purchased roll of ISO (ASA) 800 film indicates that the DIN rating is 30. The DIN values are included in table below for comparison with ISO values.

ISO
(International Standards Organization). Most common film speed rating in the U.S. Doubling the value, doubles the film speed. The table below shows the actual computed theoretical values in the scale, while in practice the values are rounded for simplicity.

Col. A Linear Scale	Col. B ISO (ASA) Scale $2^{(col. A)}$	f Stops $\sqrt{\text{Col. B}}$	DIN Scale
0	**1**	**1**	1
0.33	*1.26*	*1.1*	2
0.67	*1.59*	*1.3*	3
1	**2**	**1.4**	4
1.33	*2.52*	*1.6*	5
1.67	*3.17*	*1.8*	6
2	**4**	**2**	7
2.33	*5.04*	*2.2*	8
2.67	*6.35*	*2.5*	9
3	**8**	**2.8**	10
3.33	*10.1*	*3.2*	11
3.67	*12.7*	*3.6*	12
4	**16**	**4**	13
4.33	*20.2*	*4.5*	14
4.67	*25.4*	*5.0*	15
5	**32**	**5.7**	16
5.33	*40.3*	*6.3*	17
5.67	*50.8*	*7.1*	18
6	**64**	**8**	19
6.33	*80.6*	*9.0*	20
6.67	*102*	*10.1*	21
7	**128**	**11.3**	22
7.33	*161*	*12.7*	23
7.67	*203*	*14.3*	24
8	**256**	**16**	25
8.33	*323*	*18.0*	26
8.67	*406*	*20.2*	27
9	**512**	**22.6**	28
9.33	*645*	*25.4*	29
9.67	*813*	*28.5*	30
10	**1024**	**32**	31
10.33	*1290*	*35.9*	32
10.67	*1625*	*40.3*	33
11	**2048**	**45.3**	34
11.33	*2580*	*50.8*	35
11.67	*3251*	*57.0*	36
12	**4096**	**64**	37

Did you ever wonder where f/5.6, f/6.3, f/8, f/11, etc. came from?

The scale used for f stop settings starts with 1 (focal length = diameter of the opening) and doubles in value as the opening gets smaller, cutting in half the amount of light allowed to the film. The basis for the scale is one in which each element has twice the value of the previous member, i.e., the powers of 2 (1, 2, 4, 8, 16, 32, etc.) as shown in the ASA Scale. The scale is therefore a "geometric" progression and the mid-point and 1/3 points cannot be derived by division.

So how do you calculate intermediate stops and ISO values?

It happens that if a linear scale is established, and intermediate steps inserted therein, these values can be used as exponents for 2. The resulting values produce the geometric scale seen as the ISO Scale. Merely taking the square-root of each of these values produces a scale of f/stops. Tricky process for a non-math type, but the result provides valid intermediate values for ISO calculations and f/stops. A piece of cake for a computer spreadsheet. (I remember doing this sort of thing on a Monroe mechanical calculator, ugh!). Those of you who used early European cameras will recognize f/6.3 which is 1/3 stop smaller than f/5.7 (f/5.6)

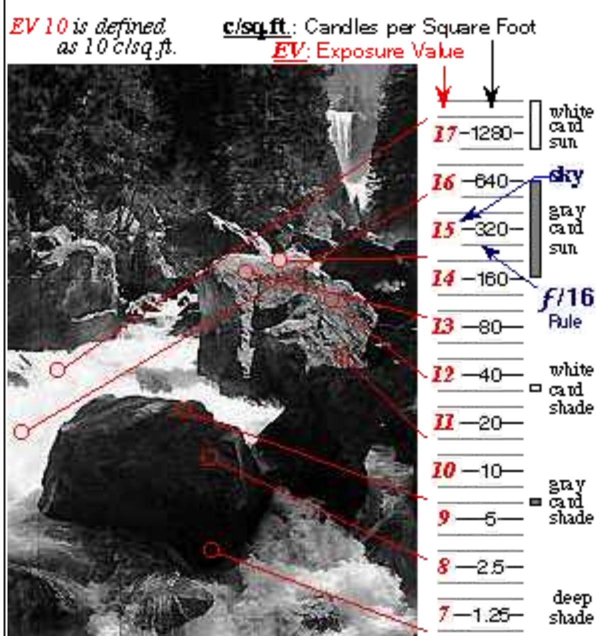
Curiosity Question #1.
If
f/5.6 is really f/5.6568 (square-root of 32), and f/11 is f/11.3137.(sqrt of 32)..
and if
f/11.3137 is rounded to f/11,
shouldn't f/5.65 be rounded to f/5.7 instead of f/5.6?

AND shouldn't f/22.6274 be rounded to f/23 instead of f/22?

Some thoughts about **Exposure**

Expose for the shadows, ...

The image below was made, in the late '70s, from the Vernal Falls Bridge in Yosemite National Park, with a Minox IIIs, and AgfaPan 25 film. It represents a "worst case scenario" with a luminance range of ten plus stops. I have returned with both 35mm and 6x6cm formats and been vexed by the conflict between creating enough depth of field (the foreground is not that far away) and stopping the water. This image illustrates the limitations of the f/16 Rule *("In bright sunlight, normal exposure is 1/ISO at f/16")*.



BE WARY OF SUNLIT READINGS OF GRAY CARDS! Only a small change in the angle, WILL alter the reading **SIGNIFICANTLY!** As can be seen, a full 2 stop range was recorded by only slightly moving the card. Reflectivity from the surface of the paper is the culprit! Notice that the overhead clear blue sky gives about the same result as the sunlit Gray Card, as will an incident light meter, ...and the f/16 Rule.

In the scene at the left, dark base of the rock meters EV 7 while sunlit white water highlights show EV 17 1/3. If the exposure is made using the f/16 Rule, placing Zone V at EV 14 2/3, everything below EV 11 2/3 (Zone II) will show no texture in the negative and print as pure black. This is fine for scenes with a 6 to 7 stop range and little important shadow detail and is ideal for color reversal film, where overexposure is the worst evil. With negative film, and especially black-and-white, the best, and equally antique, rule is "Expose for the shadows, develop for the highlights." If texture is desired in the dark rocks in the Yosemite scene, an exposure placing Zone V in the EV 11-12 range is required. This is nearly 4 stops more exposure than suggested by the f/16 Rule! Zone V placement will be conditioned by the expanded or, in this case, compressed (minus) development.

It does add a whole new challenge in that -
-- the high values now are hopefully not beyond the shoulder of the film (as here), and
-- control over the appearance of the water is severely limited, and
-- exposure AND development become critical, the latter affecting the former.

Some thoughts about 'AUTO' Exposure

Four typical lighting conditions

The exposures below were made with a Minox LX, shutter speed set to "A", and Minox tripod when necessary. It has been my experience that my LX produces the best overall negatives, in automatic exposure mode, when the ASA is set one stop higher than the Zone I film speed, thus the LX is set to ASA 50 for film with a nominal speed of ASA 25.

In a "point and shoot" mode, without serious metering, it is hard to imagine better exposures than those obtained in a variety of situations, some difficult. All shown below were from a single roll, in this case Fuji Super HR film, which I rate at ASA 3, with the LX "fudged" to approximately ASA 6 (see description at bottom of page).

Considering the wide range of luminance conditions, it is amazing that the automatic exposure system of the Minox LX (and C) produces near optimal results in each.

Relatively uniform light distribution with little important shadow detail is a situation in which excellent results are provided by -

- the "f/16 Rule"
- metering a "gray card"
- using an incident light meter, or
- an automatic exposure camera

Extreme luminance range, with exposure influenced by a predominance of one extreme, to the disadvantage of the other. If the camera's meter sees relatively equal amounts of each, neither may be optimally exposed. In this case the ceiling needs more exposure, and the "outside" high values, less. I suspect the high values are too far up on the shoulder of this particular film to provide good local contrast, so giving the ceiling more exposure would only worsen the situation. Lowering the density of the high values with "minus" negative development will lower the overall contrast, producing a muddy effect.

With an automatic exposure camera, slight changes in the position of the camera will significantly affect the overall exposure.

Wide luminance range in very low light situation. A long time exposure which increases the probability of reciprocity failure affecting the contrast. As with the above illustration, the position of the camera has a bearing on what the meter "sees" and is a major factor in the overall density of the negative. This exposure was probably as long as the LX permits, requiring, of course, the Minox tripod. (I carry, in my pocket, three little plastic "shoes" for the Minox tripod, so as not to mar sensitive surfaces.)

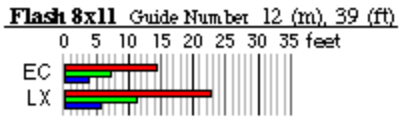
Diffused, soft, relatively low level light (EV 4 to 10). The automatic exposure reacted to the dominance of lighter values and underexposed the dark and poorly illuminated beams. Knowing that significant shadow detail was present, and that the camera metering system would react to the dominant white walls, setting the camera for a one stop longer exposure (lower ASA film speed - remember I had intentionally set the film ASA one stop higher) would have provided near perfect exposure for the dark beams, while hopefully not pushing the walls "over the shoulder". Situations like this generally benefit from spot metering and careful exposure calculation, so it is a pleasant surprise to see such good results from an "automatic" exposure.

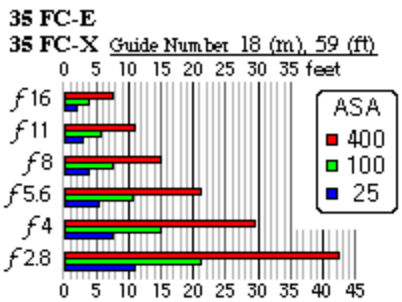
Although the ASA/DIN dial of the Minox LX shows a speed range between 12 and 400, I have had some success in "fudging" it a bit. My guess is that it can be set below ASA 12 toward the vicinity of ASA 6, and above ASA 400 to the vicinity of ASA 540, which happens to be good for Kodak Ektapress PJM color film. I have found it useful to set the dial in very low light and "Auto" mode where one can experiment and hear the time difference in long exposures. The Minox C does not permit this type of creative exercise.

Flash Guide Numbers

Each flash unit has a "GUIDE NUMBER" which describes the amount of light produced. The question answered by the GUIDE NUMBER is "What aperture (f/stop) must I use to illuminate an object at a specified distance?"

To determine the f/stop needed, divide the **GUIDE NUMBER** by the desired distance.
- or -
To determine the distance that can be illuminated, divide the **GUIDE NUMBER** by the selected f/stop.





Manufacturers usually specify a GUIDE NUMBER for ISO 100 speed film. Faster film will react to less light, allowing proper exposure at greater distances, thus necessitating a different GUIDE NUMBER for each film speed. As can be seen from the table below, increasing the ISO film speed by a factor of 4 will double the GUIDE NUMBER.

The GUIDE NUMBERs for the Minox flash units at the left are given, in the descriptive material for the meters, for a film speed of ISO 100. The GUIDE NUMBER for film speeds other than those provided in the meter documentation may be computed by a technique like one shown in the table below.

Note in the illustration at the left for the **Flash 8x11**, that a GUIDE NUMBER of 12, when using **meters** as a unit of measure, is equivalent to a GUIDE NUMBER of 39 when using **feet** as a unit of measure. **Be sure you know upon which units of measure the GUIDE NUMBER is based!**

If the GUIDE NUMBER is known for a specific film speed, a Guide Factor may be calculated by dividing the known GUIDE NUMBER by the square-root of the known film speed (ISO).

This Guide Factor will be the same REGARDLESS of the film speed.

A new GUIDE NUMBER may now be computed for any film speed by multiplying the square-root of the new ISO by the Guide Factor.

ISO	Square Root of ISO	Guide Number	Guide Factor
100	10	39	3.9
400	20	78	3.9
64	8	31.2	3.9
25	5	19.5	3.9

Shutter Speed

While the extended depth of field and normal field of view of the 15mm lens is one of the most frequently cited advantage of the Minox, the additional shutter speed provided by the fixed f/3.5 aperture is certainly an equally important asset.

	asa	25	100	400
Minox	Bright Sun	504	2016	8063
15mm	Hazy Sun	252	1008	4032
f/3.5	Cloudy Bright	126	504	2016
	Cloudy Dull	63	252	1008
35mm	Bright Sun	63	252	1008
43mm	Hazy Sun	31	126	504
f/9.7	Cloudy Bright	16	63	252
	Cloudy Dull	8	31	126
6x6cm	Bright Sun	25	100	400
75mm	Hazy Sun	13	50	200
f/16	Cloudy Bright	6	25	100
	Cloudy Dull	3	13	50

The table at left is based on the age-old "f/16 Rule" which states that a bright daylight exposure can be made at f/16 and a shutter speed of 1 / ASA. Thus, for ASA 25 film, the setting of f/16 and 1/25 second should provide adequate exposure. This frequently provides inadequate shadow detail for black-and-white negatives, and every photographer has personalized it to suit. But, it is a good basis for highlighting the virtue of the Minox f/3.5 lens.

The chart compares three formats, each with a lens of "normal" focal length, and an aperture setting which provides a hyperfocal distance and depth of field equal to that of the others.

The Minox f/3.5 lens provides 4 1/3 stops more light than the f/16 setting, and almost 3 stops more light than f/9.7.

When working with 35mm, and even more with 6x6cm, and "normal" or longer focal length lenses, shutter speed can become a serious consideration, frequently adding a tripod to the equation. It is rarely of concern with the Minox. My personal Minox shutter speed formula is simply to multiply the film speed (ASA) by 10 for normal bright sunlight, which is about one stop more exposure than given by the f/16 Rule. I often carry a spot meter in the woods, but at the airport, pier, or general open country, my "10x" rule works well. This means a normal shutter speed, with Tech Pan (ASA 25), of 1/250 second, which, with "a hug and a squeeze", produces very little blurring on the negative.

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*A bit about .. **Setting Shutter Speeds***

The electronic cameras, C and LX, do not have intermediate shutter speeds. Only the values on the dial are implemented. If the dial is set between two marked times, the shutter operates at the nearest adjacent speed.

The A (II, III, & IIIs), B, BL, AX provide approximate intermediate speeds. The cam that is attached to the shutter speed dial moves the entire timing mechanism thereby altering the resistance on a segmented gear which controls the speed of the lever with the pins that release the shutter blades. The cam provides a somewhat linear resistance movement which provides the approximate intermediate speeds.

> Remember, on the the speed selection dial, distances do NOT represent a linear increase in shutter speed, so when setting the dial half-way between two speeds, the resulting speed will be slightly slower than one might expect.

Actually the spot half-way (50% of the way) between two values on the dial produces a speed increase of only 41%, not 50%, the setting shown will provide a shutter speed of 1/71 second, rather than 1/75.

To get a shutter speed of 1/75 second, you must rotate the dial so that the index mark (black dot) is slightly closer to the 100, approximately 59% of the way from 50 to 100.

This may seem a bit picky, and with shutter speeds probably so, but it is the same phenomenon you experience with the distance dial when focusing, and there you are well advised to be precise!

The Photographs of Don Krehbiel

The Blue Max

Bradley Gas

Breakfast at Curry

Cannon

Columns

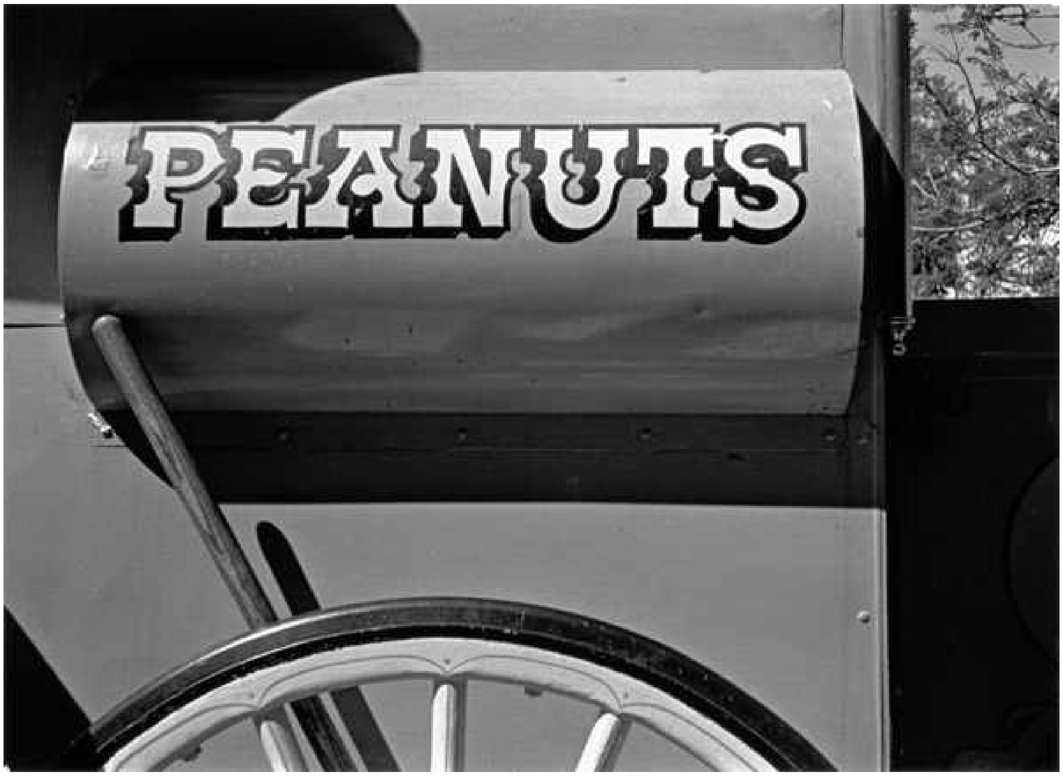
DOR ANN

Fog

For Sale

Just Fishin

Luscombe Silvaire



Olvera Street

Primer

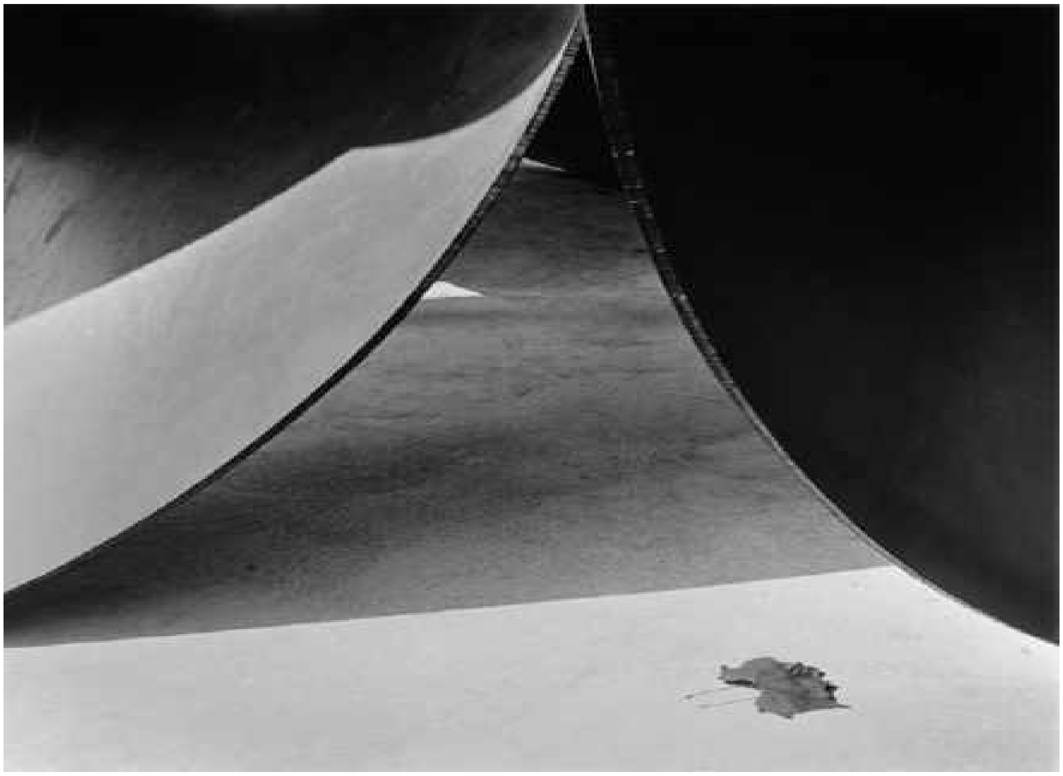
Rail

Santa Ynez

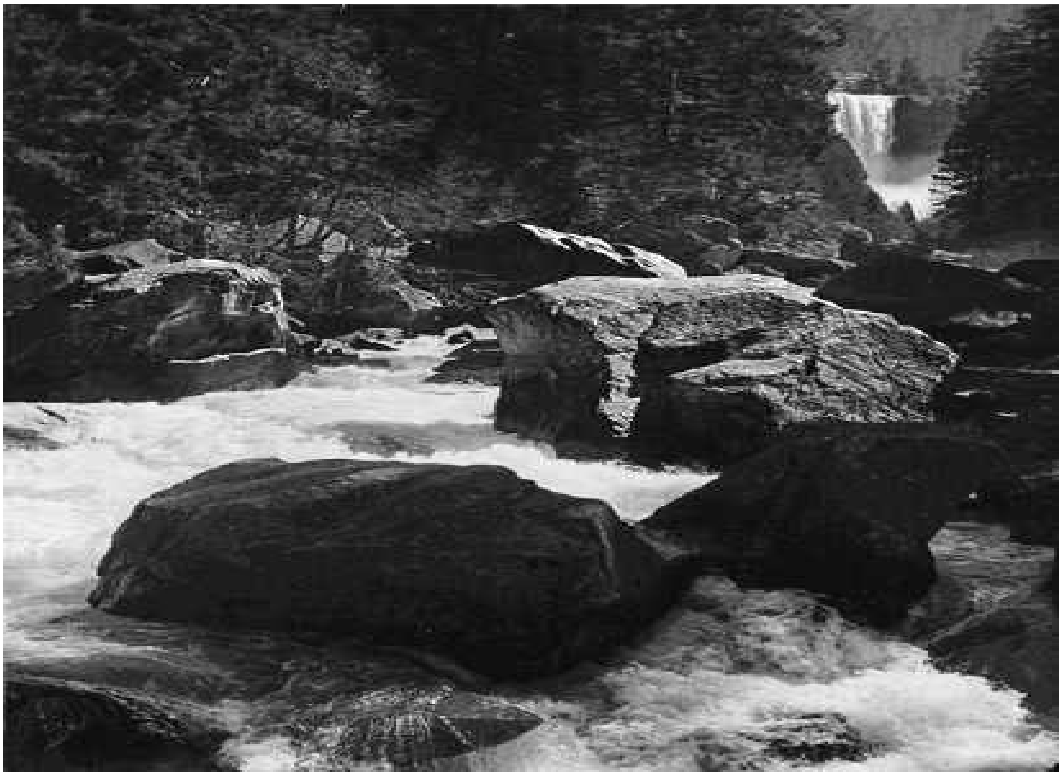
Sebastian

Sentimental Journey

Stearman



Tubes



Vernal Falls

Round