PLEASE NOTE

A registration card is packed with each Model 650 Exposure Meter when shipped. Please check the serial number shown on the card with the number above the Light Value scale. This card identifies you as the owner of your meter.

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WESTON MODEL 650

UNIVERSAL EXPOSURE METER

The Guide to
Perfect Exposures

Weston Electrical Instrument Corp.
Newark, N. J.

HOW TO USE YOUR WESTON EXPOSURE METER

First—Film Speed Setting

Slightly lift and turn tab "I" so emulsion speed of film being used appears in window "W". See folder in back of book for film speeds.

Second—Meter Reading

Aim the meter at the scene and note its reading. Turn the large arrow so it points to the same value on the LIGHT dial as at "L".

Third—Camera Settings

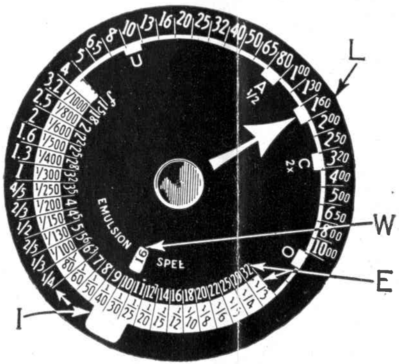
The proper settings for your camera (f stop and shutter speed) now lie directly opposite each other in the two rows of figures as at "E".

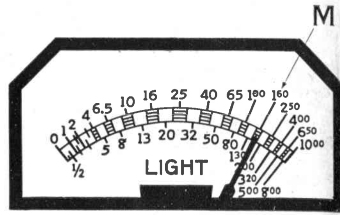
A Typical Example

Assume a scene being photographed in daylight with one of the commonly used films having a speed rating of 16.

1. *The Film speed is* 16*—set this in the window "W".*
2. *Assume the meter pointer indicates* 160 *as at "M".*
3. *Arrow turned to* 160 *as at "L" the figures "E" give a setting of* 1/30 *sec. at f*10 *or* 1/100 *sec. at f*5.6 *etc.*

MOTION PICTURE CAMERAS—The procedure for these cameras is the same as above. Since one shutter speed is generally used, the F value will be found opposite this shutter speed. The normal shutter speed for your particular camera will be found on the folder in the back of this book. In the example above, if your shutter speed were 1/30 of a second, then you would set the lens to f 10, etc.





Due to lack of space some scale lines between 0 & 4 show no figures. The line between 0 & ½ is ¼; the first line between 1 & 2 is 1.3, the second one is 1.6; the first line between 2 & 4 is 2.5 and the second is 3.2.

AIMING THE METER

When aiming the meter, direct it slightly downward so as to include as little sky as possible, especially on cloudy days. No direct sunlight should be permitted to reach the glass lens from any angle. If necessary, shade the meter lens as you would a camera lens. Otherwise an erroneous shutter speed reading will be obtained. The meter measures all light within an angle of 30° above and below the direct line of sight (also 30° each side) which is the angle corresponding to 5 minutes on a watch.

USING YOUR WESTON FOR BEST RESULTS

Can you imagine a photographer painting a film with light? Impossible—you say. And yet that is exactly what you do every time your shutter opens. A painter first decides which part of a scene is of greatest importance and then plans the painting so that your eye is directed toward that particular part. He emphasizes the central point of interest by contrasting it with the remainder of the scene. He may even obscure the background of a portrait so that every detail—every highlight and shadow in the face is clear and lifelike.

A Weston Exposure Meter in the hand of a camera user is comparable to a brush in the hand of a master artist. When properly used, the same effects of contrast and emphasis may be obtained. For then the camera user may concentrate on part of a scene which is of special interest. In the illustration, the background is of no particular importance. The girl's face is definitely the central point of interest.

For this picture the meter reading was taken about ten inches from the girl's face although the film was exposed at a distance of nine feet. The light reflected from the **face only** was used as a basis for exposure settings. The light reflected from the rest of the scene was incidental and was **not** included in the meter reading. Because of the wide latitude of the film the photographer was able to get perfect detail in the central point of interest and yet retain the background in artistic proportion.

The importance of taking readings directly from the girl's face in the above case is illustrated by the following. The meter reading at the camera position was 650. At 10 inches from the girl's face it was 40. If the film were exposed on a basis of 650 the average exposure would be correct but the girl's face would be greatly underexposed. In general, all exposure meter readings should be taken close up to the central point of interest regardless of the camera position.

SELECTING THE f STOP

For each picture a number of different camera settings (f stop and shutter speed) can be used. In the example described on this sheet the dial shows a wide choice of settings to suit all makes of cameras.

Most cameras, however, have the same f stops and shutter speeds and for this group the illustration shows that any of the following can be used:

f:5.6 at 1/100 sec.	f:16 at 1/12 sec.
f:8 at 1/50 sec.	f:22 at 1/6 sec.
f:11 at 1/25 sec.	f:32 at 1/3 sec.

If the scene contains objects in motion, select a shutter speed fast enough to stop all action and use the f stop shown directly opposite.

If the scene has no moving objects you can use a slower shutter speed with a smaller stop opening. Remember that the larger the f number the smaller the stop. Bear in mind that as the stop opening is reduced more of the objects will be in sharp focus. Small stops also help to correct errors in judging the distance of objects from the camera.

NOTE—Shutter speeds on most cameras cannot be changed from their marked values by setting the index between the numbers but the aperture index may be placed between numbers when desired to subdivide them.

Cameras fitted with single achromatic lenses generally have four stops, marked 1, 2, 3 and 4. In this case No. 1 is usually f14, No. 2 f16, No. 3 f22, No. 4 f32. In V. P. K. single lens cameras, stops are No. 1 f11, No. 2 f16, No. 3 f22, but usually when three stops only are marked on any camera they should be taken as f14, f22, f32.

NOTE—For filter data see page 32.

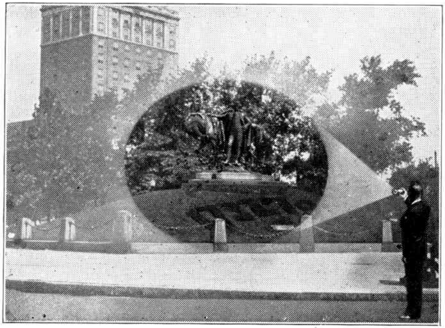
THE FOLLOWING PAGES
CONTAIN INFORMATION
FOR ADVANCED AMATEURS

THEORY OF EXPOSURE

AND

ADDITIONAL EXPOSURE METHODS

WHAT THE METER "SEES"



The "field of vision" of the Model 650 is restricted to an angle of 60°. In other words, it has practically the same scene coverage as the average still camera. In the above scene the meter is about 30 ft. from the point of interest and the area covered has approximately a 30 ft. diameter.

In order to expose accurately for a particular object in a scene, go close enough so that no light reaches the cell from unimportant objects. If the subject is 2 feet square, hold the meter at a distance of 2 feet. See Page 17.

SCENE CLASSIFICATION

Normal average exposure is obtained when camera settings are made using the arrow as described in the fore part of this book. This method is correct for average scenes of normal contrasts uniformly distributed throughout the scene. When, however, the light indication is relatively low owing to large bodies of shadow, in an otherwise bright scene, or relatively high resulting from abnormally brilliant high lights, in an otherwise normal scene, then a departure from the arrow position gives better exposure.

It will simplify classification of scenes to remember that the exposure meter measures the average value of the light coming from the entire scene and the illustrations on pages 10 and 11 will show how this is applied.

Views through arches, doors, windows, or other dark openings with dark walls forming a large portion of the picture, merely as a frame-work, as scene E, will result in a lower average light value when the meter is held at the camera position than would result if measured outside, so that 1/2 the normal average exposure should be given by using dial position "A" instead of the arrow, in order not to overexpose the high lights outside. On the other hand, where a scene has dark objects or shadows in which detail is desired, and the indicated light value is unduly influenced by comparatively unimportant high lights, such as scenes K and H then double normal exposure should be given, by using the dial position "C" instead of the arrow.

In the snow scene, J, where the dark objects are important, the light value indications are unduly increased by the intense reflection from the snow, so that to compensate for this, twice the normal exposure ("C" position) should be given. If, however, it is desired to obtain the delicate details in the snow itself, such as paths, foot prints, etc., and the other objects are only incidental, then 1/2 normal exposure ("A" position) should be given.

Distant scenes where the nearest important object is 1/2 mile or more away, which are usually lacking in contrast, will give flat dense negatives if given full normal exposure, and frequently lack sharpness due to halation. In these scenes, such as F and G, use 1/2 normal exposure by using the "A" position instead of the arrow to reduce negative density.

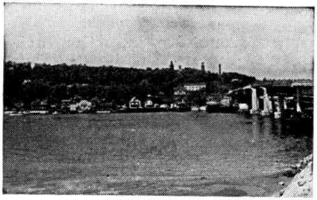
When in doubt regarding the classification of any scene, use the arrow position.

TYPICAL SCENES REQUIRING "A" OR "C" DIAL POSITIONS

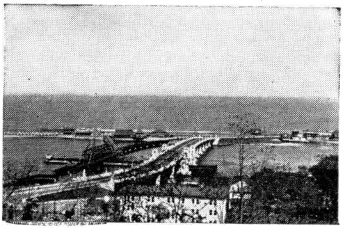
SEE DESCRIPTION ON PAGES 8 AND 9

Scene E

These types of scenes will be bettered if given 1/2 normal exposure. Use the dial "A" position instead of the normal arrow.

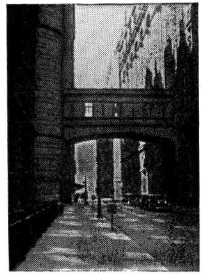


Scene F

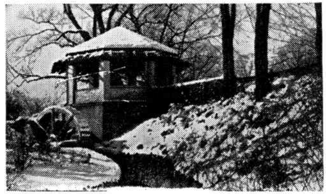


Scene G

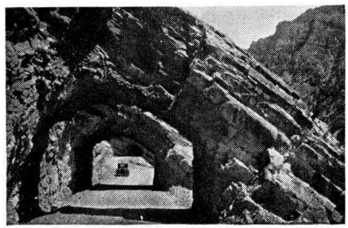
These types of scenes will be bettered if given double normal exposure. Use the dial "C" position instead of the normal arrow.



Scene H



Scene J



Scene K

THE THEORY OF EXPOSURE

The purpose of this chapter is to acquaint the more advanced photographer with additional methods of obtaining exposure by which the scene brightness range can be fitted to the film range or latitude so as to obtain any desired average density in the negative, and special lighting effects.

To obtain these special effects it may be helpful to refer briefly to the theory of exposure and how the meter functions with relation to the H & D exposure curve.

It can be shown mathematically that the brightness of an object (the light reflected from it) is the direct criterion of exposure, and not the intensity of light falling upon the object.

Exposure is the product obtained by multiplying the light on the photographic film by the time it acts. From this action of exposure upon the photographic emulsion it can be shown that there is a direct relation between the brightness of the object to be photographed and the resulting effect in the negative. The exposure meter is therefore calibrated in brightness units, candles per sq. ft.

H & D CURVE

When light falls upon a sensitized film a physical change takes place, and this change depends upon the intensity and color of the light on the film; upon the time it acts; and also upon the sensitivity of the emulsion. When the film or plate is developed, the sensitized silver salts which were acted upon by light are reduced to metallic silver, and the amount of reduction is a function of the exposure and the time of development. This effect was made the subject of scientific investigation by Hurter & Driffield. They found that for a given development, the relation between exposure and film density could be expressed by a curve now known as the H & D curve. A characteristic curve typical of average commercial films is illustrated on pages 22 and 23. This shows the relation between the exposure and the resulting density of the film. The lower end which deviates from the straight line at the point "d" is the region of underexposure, the straight portion between "d" and "b" is the region of correct exposure and the upper portion which extends beyond the straight line at the point "b" is the region of overexposure. This does not mean, however, that the under and over exposure regions are not frequently useful. Darkest objects and the brightest high lights of any scene may well extend into the lower and upper regions, respectively.

FILM RANGE OR LATITUDE

Referring to the characteristic curve it will be noted that the range of the film where correct exposure may be obtained, between the points "d" and "b," represents an exposure ratio of about 128 to 1. This ratio varies for different types of films and with the time of development, but for the purposes of the Weston meter design, this safe average film range value is used.

SCENE BRIGHTNESS RANGE

Any given scene to be photographed consists in general of objects of different degrees of brightness and color, varying from relatively dark to relatively light, and the problem in exposure is to properly fit the range in light values in the scene so that they will lie within the straight line portion of the characteristic curve. If, for example, in a given scene the ratio of the brightest object to the darkest object is say 32, then the brightness range will be only one-fourth of the film range, and the scene will be correctly exposed if it is placed anywhere within the 128 to 1 film range. On the other hand, if the brightness range is about 128 to 1 then there is no choice and the exact exposure must be known.

Modern films have a great latitude or film range, that is, they will faithfully portray a wide range of scene brightness from the darkest object to the brightest object. However the scene brightness range as a whole must be fitted to the film range so that in many cases the actual latitude for any scene is limited.

For instance, in the example given above for a scene brightness range of 32 to 1, if an exposure were selected, placing this at the center of the H & D curve or film range, a scene exposure latitude of 2 to 1 is all that is permissible. It is obvious, therefore, that some means for correlating brightness ranges and film ranges is necessary for the best work, and it is for this purpose that the Weston Universal Exposure Meter was developed.

Referring once again to the characteristic curve on pages 22 and 23 you will note below the characteristic curve that a sensitometer strip representing a developed film appears in which the successive densities are the result of exposure proportional to the figures given for the curve. This strip serves to illustrate that no perceptible density of the negative results until the point "d" is nearly reached — that from point "d" to point "b" the density increases uniformly and that beyond "b" the density no longer increases proportionally. This illustrates the under, correct, and overexposure regions, respectively. You will also note that at the ends of the correct exposure region of uniformly increasing film densities, are two arrows marked "U" and "O" meaning "under" and "overexposure" respectively.

POSITIONS ON DIAL MARKED "U" AND "O"

The two arrows on the diagram just referred to correspond respectively to the positions on the exposure dial, "U" and "O."

These positions provide the means for properly setting the brightness range of the scene to the film range to produce the best exposure.

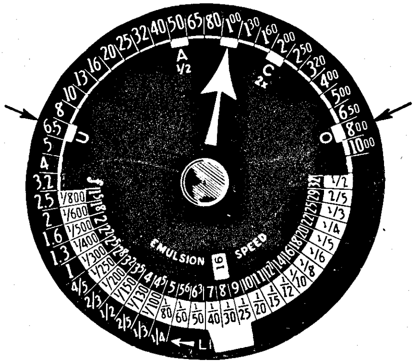


Fig. 1.

When the dial is set for any scene, see Fig. 1, the position "U" shows that objects in the scene having a brightness of 6.5 will produce a density in the film corresponding to the point "d" at the lower end of the charteristic curve, and that any object having a brightness lower than 6.5 will be underex-

posed. Similarly, the position "O" shows that an object having a light value of 800 will produce a film density corresponding to the point "b" at the upper part of the characteristic curve and that objects having light values higher than 800 will be overexposed.

From the foregoing it will be seen that the exposure meter is designed upon sound scientific principles and that with its aid the density of negatives can be readily predetermined. Several methods for accomplishing this result are described as follows.

BRIGHTNESS RANGE METHOD

This is probably the most important and useful of the various methods of using the meter. It not only gives correct exposure, but also provides means by which the photographer may have in the developed film, any desired density within the film exposure range.

In any scene, if you can measure the brightness of the darkest and brightest objects, it is only necessary to set the exposure dial so as to include these extremes of scene light anywhere between the "U" and "O" dial positions and correct exposure will result, if the indicated shutter speed and aperture are used. When making this measurement hold the meter at a distance equal to the minimum dimension of the principal object. For instance, when measuring the brightness of a tree trunk, hold the meter 6 to 10 inches from it—for larger surfaces, such as a building, this distance can be increased to say 10 feet. The body of the photographer should not interfere with the natural illumination of the

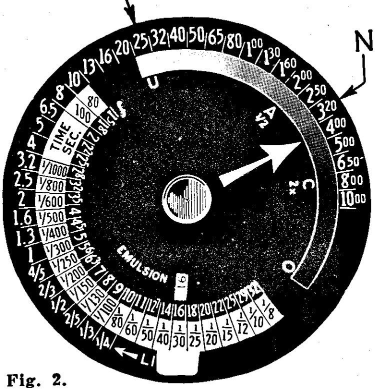


Fig. 2.

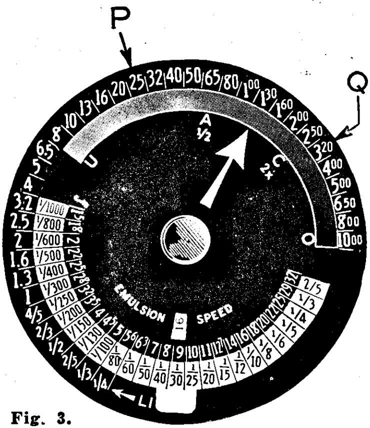


Fig. 3.

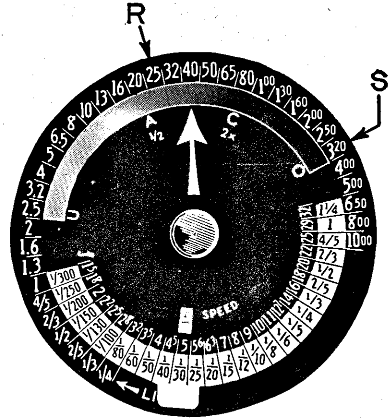


Fig. 4.

object being measured. The meter may be held at any reasonable angle to the object without detriment. A simple method for determining the correct location of the instrument is to move it back and forth slightly, and if the meter is properly located this displacement will not appreciably change its indication.

To illustrate, let us transfer the film strip to the corresponding position on the exposure dial as shown in Figs. 2, 3 and 4. It will be noticed that the correct film range for the indicated shutter speed and aperture lies between the "U" and "O" positions.

Let us assume a scene consisting of a limestone building and a few well lighted trees with grass in the foreground. The brightest object is the stone work in the sun which, let us say, has a brightness of 320 candles per sq. ft. and the darkest object is the trunk of a tree which has a brightness of say 25 candles per sq. ft.

Further, assume we are using a high speed Orthochromatic film having a speed value of 16 to which the dial window is set. Then if the brightness range, 25-320, is placed at the low end of the film range, i.e., with the "U" position set to 25 as shown in Fig. 2, and we use any exposure indicated say 1/30 second at f/16, we will obtain a negative having a density variation corresponding to the part of the film strip from "M" to "N," or a negative of low average density.

Again, if we set the brightness range, 25-320, midway in the film range as shown in Fig. 3 and use any exposure indicated, say 1/30 second at f/9 we will obtain a negative having the densities lying between "P" and "Q" on the film strip, which gives a negative of average density. Again, placing the brightness range, 25-320, at the top of the correct film range as shown in Fig. 4 by setting the "O" position at 320 and using any exposure indicated, say 1/25 second at f/5.6, then the film will have the maximum safe density as shown in the film strip from "R" to "S" and a slow printing film will result.

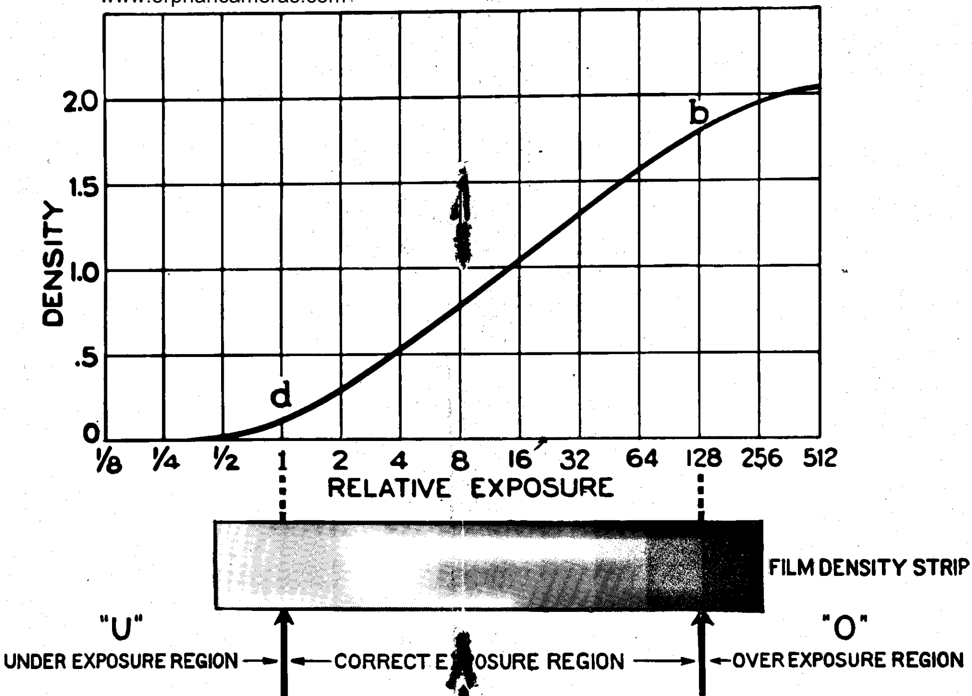
It is preferable to keep the density about average or below as this gives better printing and enlarging properties.

SCENES BEYOND THE FILM RANGE

So far we have discussed scenes in which the brightest range lies well within the film range, that is, less than 128 to 1.

There are many scenes, however, in which the brightness range greatly exceeds the film range and the photographer, without means for determining the facts, wonders why he fails to obtain a pleasing negative. Such scenes are, for example, (1) a road in the woods with patches of sunlight on the road adjacent to deep shadows among the trees where the measured brightness may be 500 candles per sq. ft. and 1 candle per sq. ft. respectively, or (2) a waterfall in a wooded and rocky area, where the foam may reach a brightness of 500 candles per sq. ft. and the shadows on rocks and trees may be as low as 1, or (3) interiors where portions may be lighted by direct sun or skylight and the rest in deep shadow.

It is obvious that since these scenes extend beyond the film range, a theoretically correct exposure cannot be made and the only recourse is a compromise. It must not be assumed, however, that attempts to photograph such scenes are doomed to failure, as it is readily possible to obtain the most pleasing artistic effects if means are available for obtaining accurate data for the exposure. The reason for this is that the human eye cannot



Illustrated above is a typical characteristic film density (H & D) curve. The Positions "U" and "O" are located as indicated on the Exposure Meter dial to include the Correct Exposure Region of the curve when exposures are made using the indicated apertures and shutter speeds.

adapt itself to appreciate detail simultaneously in areas of such great differences in brightness. The exposure data cannot be determined by the eye but are readily furnished by the Weston Exposure Meter and the actual exposure given depends upon the particular lighting effects desired and in this the photographer must exercise his judgment and artistic taste.

For example, take the road in the woods. If the picture is intended simply as a general scene then it is desirable to show detail in the trees and allow the sun spots to extend in the overexposed regions. The "U" position may be set at 1 candle per sq. ft. which means that all objects above 130 candles per sq. ft. will be overexposed. This may give an unpleasant chalky effect to the high lights in prints and a compromise may be made by setting the "U" position to 2.5, underexposing all objects having a lower brightness, and overexposing all objects higher than 320 candles per sq. ft.

On the other hand, if the object is to take a portrait of a person on the wood's road, for example a girl in a white dress, then all other parts of the scene must be subordinate to this object. In such a case it is preferable to measure directly the brightness of the dress and if the "O" position is set to this value, say 320 candles per sq. ft. one must be content with underexposure for all objects lower than 2.5 candles per sq. ft.

Attention should be called to the fact that when the method just described is used where very strong contrast exists such as a white

dress against a dark background, and it is set to the "O" position, an undesirably great density and halation may result. The latter may sometimes produce the desirable artistic effect of brilliance, but where it is undesirable then it is preferable to place the white object at a lower density on the film range. For example, the "O" position may be set to say 800, placing the dress at a lower density and allowing all objects under 6.5 candles per sq. ft. to be underexposed. One can judge the effect of these compromises by exploring for objects having a brightness less than 6.5 candles per sq. ft., that is, the object brightness indicated by the "U" position.

EFFECT OF COLOR

In determining the brightness of objects, some consideration must be given to the kind of film used. Orthochromatic film such as Verichrome and Plenachrome are not sensitive to yellow, orange and red, so that for such films, objects of these colors, while possibly bright to the eye, will be dark to the film. This, however, is not very troublesome in practice for out-of-door scenes for the reason that most objects have colors mixed with considerable gray, due to weathering, which reflects enough white light to give a reasonable density on the film.

It is better, however, in measuring the darkest and brightest objects in a scene when using these films to select, if possible, objects of a gray or neutral color.

When using Panchromatic film, which is sensitive to all colors, it is not necessary to give much consideration to the colors of objects, although this emulsion is somewhat more sensitive to blue and green than it is to yellow and red.

DARKEST OBJECT METHOD

It is usually quite sufficient in ordinary scenes to measure the brightness of the darkest object or darkest shadow in which detail is desired if these can be approached sufficiently close to be measured, and then set the "U" position to this measured light value and adjust the camera to the indicated shutter speed and aperture.

All objects in the scene will then be correctly exposed up to the brightest objects, provided the brightness of these objects does not exceed the limit of the film range, which is about 128 times that of the measured light value of the darkest object. For example, if a building is to be photographed and it is desired to obtain details in the shadows, which are found by measurement to be say 4 candles per sq. ft. then, setting the "U" position to 4, it will be observed by referring to the dial that all objects in the scene having a brightness up to 500 candles per sq. ft. will be correctly exposed if the indicated exposure is used. This upper value is greater than is usually found in such a scene. When the brightness of the brightest object is considerably lower than that indicated by the "O" position, then as referred to above, the general

density level of the film may safely be increased, if desired. This can be accomplished by increasing the exposure, provided the brightness of the brightest object in the scene does not exceed the value indicated on the dial by the "O" position.

SUBSTITUTION METHOD

When the brightness of a dark colored object in the shade is very low so that it cannot be measured with accuracy on the instrument, or possibly not at all, its approximate value may often be determined by the following substitution method.

The object, as for example the trunk of a tree in the woods, or the side of a dark colored building, usually has one side or a part well illuminated, and if not, similar objects in the vicinity may have. Measure the brightness of the lighter side, then place a white or a light colored surface, such as a sheet of paper of ordinary letter size or white handkerchief at the same spot and measure its brightness. The ratio of the two readings gives the ratio of the reflection coefficients of the paper and the object. Then place the paper on the dark side, the brightness of which is desired, and measure its brightness. The brightness of the dark object can then be computed by dividing the paper brightness just measured by the ratio found in the first measurement. For example, assume a scene under trees and the darkest object is the trunk of a tree where it is desired to get detail in the bark. As is often the case, spots of sunlight illuminate parts of the trunk, or that of some similar tree. Measurement of this bright spot gives say 40 candles per sq. ft. Placing a sheet of white paper on the same spot gives a brightness of say 400. The ratio, or the reflection coefficient is then 10. Now, placing the sheet of paper on the dark side, it is found to measure say 2.5 candles per sq. ft., it follows that the brightness of the dark side is 2.5 divided by 10 or 1/4 candle per sq. ft. Now complete the meter setting.

BRIGHTEST OBJECT METHOD

In very dark subjects, such as poorly lighted interiors, dark ravines, etc., where the darkest objects are lower than 1/4 candle per sq. ft. so they cannot be measured by the instrument, and where the substitution method is not convenient, then the brightest object in the scene should be measured, and the "O" position set to the measured light value. Then, setting the camera to the indicated stop and shutter speed, all darker objects in the scene down to 1/128th of the brightness of the object measured will be correctly exposed. In using this method, accidental high lights such as windows looking outdoors, or sun spots in ravines, etc , should not be measured as the brightest object. If no object is bright enough to give an indication, then frequently a sheet of white paper may be properly placed and used as a test object.

AVERAGE BRIGHTNESS METHOD

Where it is inconvenient or impossible to measure the light value of the darkest object directly then the average values of the entire scene can be measured by directing the meter

toward the center of the scene. In this measurement it is preferable to have as little sky included as possible. For example, if buildings with reasonable foreground are to be photographed with open sky overhead then the meter should be directed slightly downward so that the imaginary 60° cone area covered by the electric eye does not extend into the sky area.

This method of determining exposure is described in the folded insert in the beginning of this book.

CONTACT PRINTING

The printing time required for a negative depends upon its density, upon the kind of paper used and the intensity of the printing lamp. One soon becomes familiar with the speeds of the paper usually employed, but it is difficult to judge the density of the negative. The exposure meter can be used to eliminate this uncertainty and substitute exact information for guesswork.

To use the meter, place the negative in position on the printing machine, with the printing light on, but without the paper. Then hold the meter over the negative so that the transmitted light enters the electric eye at the back of the meter and read the indication. The larger the negative, the farther the meter should be held away from the film so as to measure the average brightness of the entire negative. The following distances between negative and meter are suggested for good results with various sizes of negatives.

Size of Negative	Distance
2¼ x 3¼	In Contact
3¼ x 4¼	¾ inch
5 x 7	2½ inches
8 x 10	5 inches

To determine once for all the meaning of the meter indication in terms of the time required for printing, take any average negative and note the meter indication when the negative is placed as described above. Now make a few trial prints for various times and after development determine which time gives the best results. This gives the relation between the meter indication and best printing time for the particular paper tested. Thereafter it is only necessary to read the meter and compute the printing time for any negative used. This same procedure can be carried out for all types of paper used. A simple method for carrying this out in practice is to compute various values and arrange them in tabular form for easy reference as shown below. Remember that the printing time decreases in proportion as the light intensity increases.

Sample Table

Meter Indication	Time (Seconds)
18	12
25	8
35	6
50	4
70	3

MISCELLANEOUS INFORMATION

Aperture or f/ Numbers

F numbers are based upon the focal length of the lens, i.e., the distance between the lens and the film when the camera is focused for distant objects. For using the exposure meter, the f values as marked on the camera, are sufficiently close for all scenes located at a distance exceeding 10 times the focal length of the lens. For example, when using a lens of 4 inch focus, the marked f numbers are correct for all scenes at a distance of 40 inches or more from the camera.

For ordinary cameras the effect of distance upon f numbers need not be considered. But for those having cameras with extension bellows or when taking close-ups, enlarging, copying, etc., a multiplying factor, as given in the following table, must be applied to the marked f number to get the actual f number.

Distance Ratio	1½	2	3	4	6	10
Factor	3	2	1.5	1.3	1.2	1.1

For example, if the focal length is 4 inches and the camera lens is 12 inches from the scene and properly focused, then the distance ratio is 12/4 = 3 and the table shows that the multiplying factor is 1.5. Therefore an aperture marked say f/8 actually becomes f/12 (f/8 x 1.5) and should be used as such in connection with the exposure meter. The same reasoning applies to any other f number. Conversely, if the exposure meter calls for an aperture of say f/12, the camera diaphragm should be set to the position marked f/8.

INTERIORS

For photographing interiors the use of photo-flood lamps is suggested to increase and round out the illumination. These lamps give about ten times more light than the ordinary 60 watt lamp.

Use the same plate speeds given in the enclosed folder for Tungsten (Mazda).

VERY LOW FILM OR PLATE SPEEDS

The calculator indicates directly plate speeds down to 1. Lower values than this can be used, however, by simply setting the index to any of the divisions below 1, continuing into the light value scale if necessary. The value of any such position can readily be determined by remembering that the value is divided by two at every third division. For example, the 4/5 division preceding 1 on the light value scale corresponds to plate speed 2; light value position 1.6 corresponds to 1, 3.2 to 1/2, 6.5 to 1/4, 13 to 1/8, etc.

USE OF FILTERS

When photographing with a color filter over the camera lens it is usually necessary to increase the exposure. A simple means of allowing for this is to divide the speed of the film by the filter factor and reset the film speed in the window to this new number and proceed as if no filter were used. For instance, if you are using a film with a speed of 16 in daylight and a 2x filter then, 16 ÷ by 2 = 8—reset the film speed to 8. If you are using a 4x filter then 16 ÷ by 4 = 4—in this case reset the film speed to 4.

FOCAL PLANE SHUTTERS

Cameras of the reflection type, such as the graflex and reflex, and some miniature cameras, are provided with shutters of the focal plane type, as distinguished from the "between lens" type, used in the usual types of camera.

The focal plane shutter admits about 30% more light than "between lens" shutters for the same apertures and total time they are open. The exposure meter is based on average shutters, and ordinarily no change in exposure need be considered for the various types of shutters, since their actual speeds frequently vary more from their marked values than would result from a difference in type. For very exact work with carefully checked shutters (focal plane) the next smaller stop number to that indicated may be used or you can reset the film speed to the next higher number.

PAPER PRINTS AND THEIR LATITUDE

Since tone gradations in a paper print are produced by light reflected from the whitest and darkest portions. The darkest "black" reflects from 2 to 4%, and the whitest portion does not reflect more than about 85%, so that the latitude or total brightness range is only about 30 or 40 to 1, depending upon the paper, whereas the latitude of a film is about 128 to 1.

It is, therefore, not possible to reproduce correctly on a paper print a scene brightness range greater than 30 or 40 to 1 even if the negative has been correctly exposed. This limitation should be considered in composition, and in judging results of exposure.

If the principal object in photographing a scene is to obtain the most correct paper print, the scene should be so composed, if possible, that objects outside the paper print range be excluded or become unimportant.

GLOSSARY OF PHOTOGRAPHIC TERMS

Aperture or Diaphragm Aperture, sometimes called Stop.

This is the adjustable opening in the diaphragm in the lens structure for varying the amount of light which reaches the film through the lens and the smaller the diaphragm opening the sharper the picture.

Brightness

The brightness of an object is the intensity of light reflected from it in a specified direction per unit area as viewed in that direction, and is usually measured in candle power per unit area. In the Weston exposure meter, the brightness scale is calibrated in candles per sq. ft.

Density

The density of a film is a measure of its opaqueness. It is numerically equal to the common logarithm of the opacity. For example, a density of 1 permits 1/10 of incident light to pass through it. A density of 2, 1/100th, and a density of 3, 1/1000th.

Exposure

This is the intensity of the illumination reaching the film multiplied by the time it acts. The value is usually expressed in meter-candle seconds.

Focal Length of Lens

The focal length of a lens, meaning the principal focal length is the distance back of the lens at which the image of a distant object (100 ft. or more) is exactly "in focus."

f/Numbers

These are the numbers marked on lenses which designate the effectiveness of the diaphragm aperture to admit light to the film. They are determined by dividing the focal length of the lens by the diameter of the diaphragm aperture—the larger the **f/ number,** the greater is the exposure time required to produce equal film densities.

The same F number on two lenses should admit equal amounts of light per unit area of film, regardless of focal length.

Shutter

This is the mechanism on a camera which admits the light to the film or plate for definite and adjustable periods of time.

They are of two general types, "between lens" and focal plane types.

"Between lens" Shutter. This is the type ordinarily used on cameras, and as its name implies, it is placed back of the diaphragm, between the two lenses, or back of the lens in a single lens camera.

Focal Plane Shutter. This is the type used in reflection type cameras, such as graflex and reflex, and in some miniature types. It consists of a curtain, having a transverse slit, which passes across the film or plate very near to its surface. The exposure is made through the slit as it passes across the surface of the negative. Both the speed of the curtain and the width of the slit are adjustable for changing the exposure.

Shutter Speed

This designates the effective time the shutter remains open during an exposure, usually for a so-called instantaneous exposure, and is given in seconds or fractions of a second. The reciprocals of the time are usually marked on the shutters, as for example, 5, 10, 25, etc., meaning 1/5, 1/10, 1/25 etc. second.

CAUTION

Keep glass lens over the cell opening clean.

During dry cold weather the glass on the instrument is likely to become electrified by contact with the hands or clothing. This attracts the pointer and gives erroneous readings, but the charge on the glass can be easily eliminated by breathing upon it.

ZERO SETTING OF INSTRUMENT POINTER

When no light reaches the "electric eye" the instrument pointer should rest directly over the zero position on the scale.

If this is not the case, and there is no electrostatic charge on the glass (see paragraph above) then the pointer can be readily set to its zero position by slightly turning the zero corrector located below the light scale.

When making this correction place the meter back downward on a card or a book so as to exclude all light from the photoelectric cell, and hold it at an angle of about 45°.

Conversion of f Stops to US Stops

f	4	4.5	5	5.6	6.3	8	11	16	22	32
U.S.	1	1.4	1.6	2	2.5	4	8	16	32	64

NOTES