



GOSSEN[®] Luna-Pro sbc

Instruction Manual

7909-1057Y0

This Luna-Pro sbc Instruction Manual is more than just an instruction book – it is actually a short course in the creative use of an exposure meter.

Section I offers “Basic Operating Instructions”. To use your Luna-Pro sbc properly you need only read and follow the simple instructions in this section.

Section II, however, moves a step forward – to “Getting the Most Out Of Your Luna-Pro sbc.” Here you can really find out how to put the unique versatility of your Luna-Pro sbc to work for you.

Section III gives you “Helpful Hints” for special shootings – action, snow and sand, sunsets, night, and more – the type of information you need for that extra creativity.

And Section IV provides you with full details on the “Accessories” for your Luna-Pro sbc – to turn it into a true exposure system.

We sincerely hope that this manual will be of help to you and will answer most of your exposure measurement questions. If it does not, feel free to contact your specialist dealer. In addition, our Consumer Service Department is available for help with special requests.

Congratulations!

You now own one of the most advanced exposure meter, the heart of the Luna-Pro sbc System.

The new Luna-Pro sbc System is the most flexible, versatile and adaptable photographic light measuring system ever devised, while at the same time being very simple to use. In order to get maximum benefit from the quality design and operating features of this precision instrument, please take a few minutes to read this instruction manual.

Your new Luna-Pro sbc utilizes the latest advances in silicon cell sensors and also high performance electronic circuitry including integrated circuits to provide fast, accurate, repeatable readings under the most difficult professional conditions.

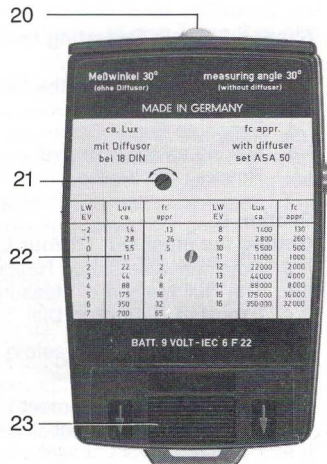
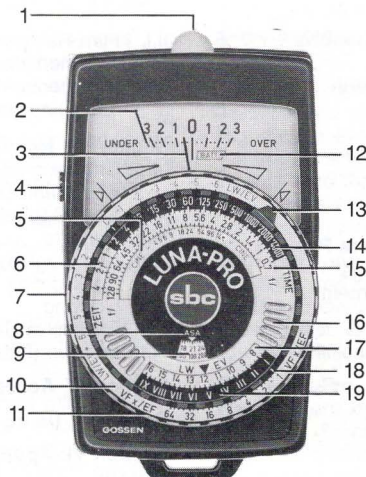
The Luna-Pro sbc represents a most significant development by Gossen GmbH, Erlangen, West Germany, Europe's largest manufacturer of precision electrical instruments since 1919, and one of the outstanding pioneers in exposure meter design since 1932.

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Operating Parts & Scales

1. Spherical Diffuser
2. Green Zero Check Point
3. Meter Needle
4. Power Switch
5. Cine Scale
6. Electronic Flash Reference Mark
7. Battery Test Button
8. ASA Index Triangle
9. Film Speed Scale
10. Exposure Correction Dial
11. Computer Dial
12. Battery Test Zone
13. Exposure Correction Signal
14. Exposure Time Scale
15. Aperture Scale
16. Film Speed Setting Disk
17. Exposure Value Scale
18. Exposure Factor Scale
19. Index Mark
20. Zone System Scale
21. Measuring Cell Window (under diffuser)
22. Zero Adjusting Screw
23. Table of Footcandle and Lux Values

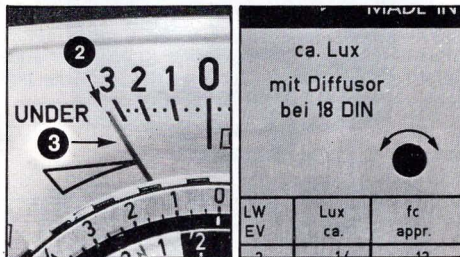


Basic Operating Instructions

The following instructions are a quick operating guide to the Luna-Pro sbc. For best results, also read the additional sections describing in more detail the different functions of the Luna-Pro sbc.

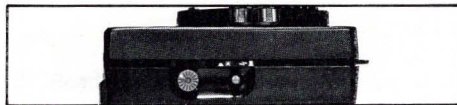
I.a. Zeroing the Meter

With the battery removed, check to see that the meter needle (3) rests on the green zero check point (2). If not, turn the zero adjusting screw (21) until the needle rests on the zero mark.



I.b. Inserting & Changing the Battery

Your Luna-Pro sbc is supplied with a 9-volt battery which fits into the battery compartment at the bottom of the meter. Slide the battery compartment lid (23) off and attach the battery to the battery clip inside. Note that the battery can only be connected one way. Insert the battery into the battery compartment and slide the lid back on. Check the battery by pushing and releasing the power switch (4) and then pushing in and holding the battery test switch (7). The meter needle should be well within the battery test zone (12).

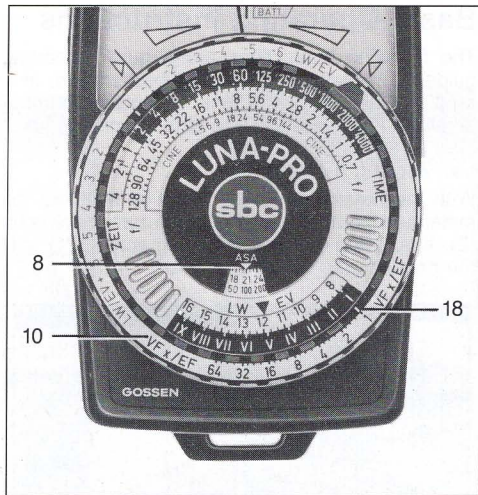


I.c. Setting the Film Speed

Determine the ASA speed from the data supplied by the film manufacturer. Rotate the clear film speed setting disc (16) by the raised bars until the ASA speed number is opposite the white ASA index triangle (8). A detailed ASA film speed table is on page 36.

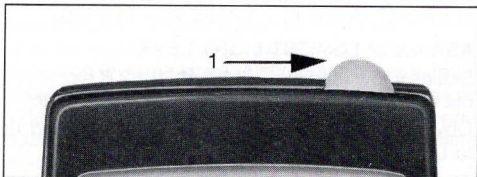
I.d. Exposure Factor Scale

Check to make sure that the exposure factor scale (10) index mark (18) is at 1. A more detailed explanation of this useful scale is on page 9.

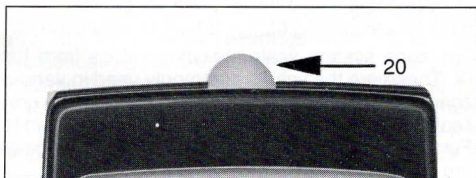


I.e. Making a Measurement

Select the method of measurement desired, either reflected or incident. (For details on incident vs. reflected measurements, see section II.f. For reflected readings slide the spherical diffuser (1) to



either side of the meter. For incident readings, slide the spherical diffuser in front of the measuring cell window (20) until it "snaps" into the detent.



Aim the meter at the subject for a reflected light reading or at the camera for a incident reading. Depress and release the power switch (4). Rotate the computer dial (11) until the meter needle is over the "0" null line. Read the desired combination of f/stops and shutter speeds on the computer scales.

NOTE: When you release the power switch, the value measured at that moment will be automatically read, and electronically stored by the Luna-Pro sbc. To conserve battery life, the meter switches itself off automatically after 30 seconds, and your measurement set on the computer dial remains for convenient and repeated reference. For continuous measurements, see page 10.

I.f. Reading the Scales

The Luna-Pro sbc has six scales used to give you information on ASA index, aperture, shutter speed, cine speed, exposure value (EV), and exposure factor (EF). In addition, accessory clip-on scales are available for direct reading of other light measuring values such as footcandles.

The time, or shutter speed scale is calibrated from 1/4000 of a second to 8 hours and indicates values as follows:

Hours are indicated 8h, 4h, etc.

Minutes are indicated 30m, 15m, etc.

Seconds are indicated 30, 15, etc.

Fractional seconds are indicated '2, '4, etc.

Note that each section is alternately colored from the adjacent sections for ease of reading. The red // indicates the proper reading point when using the electronic flash attachment. See page 34.

The ASA scale is calibrated in standard ASA values from 0.8 to 100,000 (100K). Intermediate values are shown by short lines. A complete table listing these intermediate values is on page 38.

CAUTION: Because of the extreme measuring range of the Luna-Pro sbc, it is possible – under exceptional conditions of very high or low light levels combined with a very high or low ASA index – that the computer displays both ends of the exposure time scale (8h and 1/4000 sec.) When this occurs, **the CORRECT reading will be the UPPER part of the scales!**

EXAMPLES:

ASA 25,000 at HIGHEST LIGHT LEVEL:

Scales show (above) 1/4000 sec. at f/128

but also (below) 8 hours at f/5.6 etc.

Obviously, HIGH ASA and HIGH light level add up to SHORT exposure – **1/4000 sec. at f/128.**

ASA 0.8 at LOWEST LIGHT LEVEL:

Scales show (above) 8 hours at f/2.8 etc.

but also (below) 1/4000 sec. at f/64 etc.

Obviously LOW ASA and LOW light level add up to LONG exposure – **8 hours at f/2.8.**

The aperture or f/stop scale is calibrated from f/128 to f/0.7. Numerical values are shown on the scale at full f/stop increments. Intermediate values are indicated by short lines at 1/3 stop increments. A table of intermediate values and the mathematical formula for calculating f/stops are given in section III.

The zone system scale indicates values from I to IX. These are the values commonly used in various zone systems and represent a continuous grey scale of print values ranging from black to white. Further explanation on use of zone system scales are given in Section II.k.

The cine scale allows direct reading of apertures for various cine speeds (frames per second). These speeds correspond to actual exposure times on the exposure time scale only for cameras having standard shutter angles. For XL cameras or those with adjustable shutter angles, consult the camera's instruction book for the equivalent shutter speeds and read your exposure opposite that speed on the time scale. Also note that some reflex viewing movie cameras use beam splitters to provide a light path to the viewing screen. These beam splitters reduce the light intensity to the film plane, so that a correction factor must be applied to the indicated f/stop. Once determined, the correction can be programmed into the exposure correction dial.

An EV (exposure value) scale (17) is provided for cameras with shutters calibrated in EV. The Luna-Pro sbc EV scale is calibrated from -8 to $+24$. Numerical values are shown for full EV values with intermediate values indicated by short lines at $1/3$ EV intervals. Exposure values are used elsewhere on several scales which will be explained later. It is important to remember that a change of 1 EV is equivalent to a change of 1 f/stop.

An EF (exposure factor) scale is included for making exposure corrections when using filters, bellows, extension tubes, etc. It is calibrated for exposure factors up to 64. Detailed information on this scale is in section II.c.



Section II

Getting the Most Out of Your Luna-Pro sbc

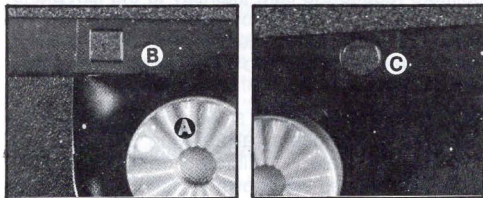
The preceding condensed instructions gave you information on the basic operating procedures for your Luna-Pro sbc. However, this meter is extremely versatile, and the following information will acquaint you with the many creative possibilities available to you when using your Luna-Pro sbc.

II.a. Continuous or Stored Readings

The Luna-Pro sbc is capable of either continuously reading or storing light values. For simplicity of operation, the read and hold method is used. For evaluation of different lighting levels such as when using zone systems, the continuous method is used. Both methods are activated by the same power switch.

To operate the meter in the read and hold mode, the power switch ON/OFF button index mark (a) must be aligned with the square switch position indicator (b). Simply depress and release the power switch. The meter will automatically read

and electronically hold the value of the light level present at the moment when the button was released. Because advanced electronic circuitry and a silicon blue cell are used in the Luna-Pro sbc, the measurement is instantaneous with no memory or lag. This reading will be stored and available for a period of 30 seconds after the button is released. After the one minute period, the meter automatically turns itself off, prolonging battery life. Additional readings can be taken at any time by repeating the above sequence.



To operate the meter in the continuous mode, simply depress and hold the ON/OFF button in. The meter will now respond to all changes in light values. For long term measurements, the ON/OFF

switch has a lock position which is indicated by the round switch position indicator (c). To activate and lock the meter on:

- 1) Depress and hold the power switch in.
- 2) Rotate the switch button clockwise until the index mark is aligned opposite the round switch position indicator.

The meter will now remain on for constant readings until the switch button is rotated counterclockwise opposite the square position indicator where the read and hold mode will go into operation for one minute, after which the meter will again turn itself off.

NOTE: Be sure to return the switch button to the read and hold position (square mark) after using. Failure to do so will result in short battery life.

II.b. The Null Method of Measurement

Laboratory instruments have long used the null method of measurement for obtaining precise readings. This method has been incorporated into your Luna-Pro sbc for maximum accuracy and ease of reading.

The basic operating difference between the Luna-Pro sbc and a conventional meter is that, instead of using various points along a complete scale length, only one position (the null point) is used for all readings and at all light levels. This results in greater accuracy and ease of operation. There is no need to change scale ranges or to read different scales. When the needle is set at the null point, the computer instantly shows a complete read-out of the measurement.

To expand the capabilities of the Luna-Pro sbc further, its meter face is also calibrated in $1/3$ EV increments from the null position to ± 3 EV for use in scene brightness measurements and zone system applications. Additional information on this extremely useful feature will be found in section II.i. If the meter needle is placed in the "over" or "under" range, the readings on the calculator dial will result in over or underexposure by the value indicated, compared to a standard exposure.

Each numerically indicated major division on the meter face equals one EV (a change of one EV equals a change by one f/stop or one shutter speed setting); the small intermediate dots are equal to $1/3$ EV.

II.c. Exposure Correction Dial

Occasionally, the indicated exposure readings obtained with any light meter must be modified for best results. This is especially true when using filters or when taking close-up pictures where the longer lens to film distance results in reduced light at the film plane. To correct for these effects, commonly called filter factor and bellows (extension) factor, additional exposure must be given to the film. In addition, you may, for various creative reasons, wish to depart from the standard exposure values. For these situations, the Luna-Pro sbc, with its exposure correction dial, is ideal.

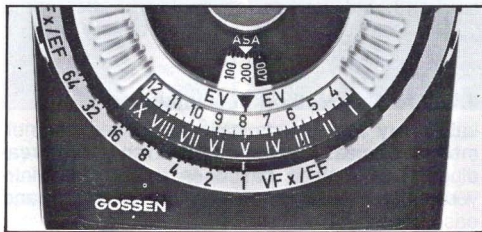
Normally when making exposure corrections, the correction factor must be calculated and applied each time a reading is taken. However, with the Luna-Pro sbc, the exposure change can be programmed into the exposure correction dial. Any readings then will automatically be corrected as taken.

The exposure correction dial is calibrated to work both in EV (exposure value) and EF (exposure factor). Two index marks are provided at the center or normal positions for each correction method. In addition, the red exposure correction signal gives a

visual indication any time the exposure correction dial is in use.

To use the exposure correction feature, determine the correction factor desired, in either EV or EF, and rotate the exposure correction dial while holding the computer ring stationary until the white index mark is opposite the correction value. Any readings now taken will reflect this correction.

For example, assume that a filter with a filter factor of $4\times$ is being used which represents a change of 2 stops. By moving the index mark of the EF ring to a position opposite the number 4, the meter readings will automatically be compensated for the 2 stop difference.



Rotating the exposure correction dial corrects the indicated exposure by changing the shutter speed (and flash symbol), cine speed, and EV scales. Therefore, this feature can be used for still photography using available light and artificial light including flash, motion picture photography, and with cameras calibrated only in EV.

After completing "corrected" measurements, be sure to return the correction dial to its "0" position (red signal will be covered by black tab).

II.d. Footcandle Readings With The Luna-Pro sbc

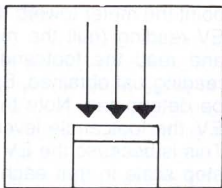
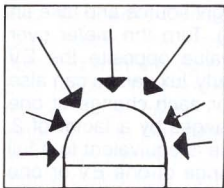
The Luna-Pro sbc is a precision instrument designed to give highly accurate photometric readings specified in readily usable photographic terms. However, footcandle readings can also be obtained with the Luna-Pro sbc, either by converting the photographic reading or by use of an accessory snap-on footcandle scale.

A conversion table of EV to footcandle readings is included on the underside of the meter. To determine the equivalent footcandle reading, set the ASA film speed scale to 50, slide the spherical diffuser over the cell window for incident readings,

point the meter toward the light source and take an EV reading (null the meter). Turn the meter over and read the footcandle value opposite the EV reading just obtained. Similarly, lux values can also be determined. Note that for each change of one EV, the footcandle level changes by a factor of 2. This is because the EV scale is equivalent to a full stop scale in that each change of one EV or one f/stop results in either twice or half the amount of light. A formula suitable for calculating intermediate values of footcandles is given in section III along with pre-calculated values at 1/3 EV increments.

For direct reading of footcandles, an accessory snap-on footcandle scale is supplied with the Studio Attachment. When attached, this scale allows quick, direct read-out of the equivalent footcandle readings without having to change ASA values or using a conversion table. Detailed instructions for its use are included with the scale.

The most precise footcandle readings are obtained by means of a flat diffuser such as the one supplied with the Studio Attachment. When using the spherical diffuser of the Luna-Pro sbc, all the light falling on the diffuser from an angle of approximately 180° is integrated for a final reading. Since most photo-



graphic subjects are three dimensional, this results in more accurate photographic exposures, but can give improper footcandle readings.

When using the spherical diffuser, footcandle readings are most accurate when reading direct light beams such as from spots, are lights, etc.

II.e. Carrying Case

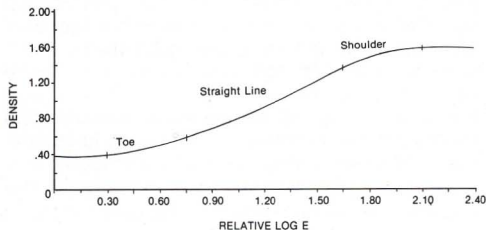
Your Luna-Pro sbc is supplied with an exceptionally practical carrying case. It is made of smooth, sturdy materials for long life and extra protection for the meter. The handy design and a double zipper, as well as the belt loop make this case suitable for professional use.

II.f. Methods of Measurement

There are two basic methods of obtaining measurements with the Luna-Pro sbc, incident and reflected light readings. Both methods are popular and when used properly, both are valid and will give good results. However, to evaluate properly the ways in which these two methods function, it is necessary to discuss briefly how the meter operates and how film responds to light. It is beyond the scope of this manual to get into a detailed discussion of sensitometry, the study of tone reproduction. There are many excellent books available on the subject, some of which are listed in the appendix. This manual will just relate in simple terms, how the Luna-Pro sbc works and under which conditions you may wish to use either incident or reflected light readings.

All films have characteristic responses to light which, although they may vary from film to film and with changes in storage and processing, are relatively predictable. This consistency of response is what allows the use of light meters and other photographic instruments to predict the final outcome of an exposure.

Film responds to only a limited range of illumination levels before its ability to record that light illumination level properly is lost. Any instrument designed to measure or expose film must take that into consideration. The response of the film to light is generally graphically illustrated by what is called a "characteristic curve" or H&D curve, named for Hurter and Driffield who originated its use. Although it is not necessary to use such a curve to determine exposures, using one as an illustration will help in evaluating proper light measuring techniques. A representative sample H&D curve for a film is illustrated below.



This curve shows, among other things, the change of density of the film vs. the log of the exposure. With negative film, as the exposure increases, the negative density increases. It is broken down into three distinct regions, the toe, straight line portion, and shoulder. In order to record detail properly on film, the light values (long exposure) should fall within the range where they intersect the straight line portion of the curve. If the exposure falls into the area of the toe or shoulder, the film will lose shadow or highlight detail respectively. This is because, once those areas are reached, little or no change in film density occurs with a change in exposure, and it is the change of density that produces differentiation and detail. Therefore, your light meter must give you an exposure value that will adjust the measured light so that when it reaches the film, it will fall within the straight line portion of the film's recording ability.

The H&D curve shown above indicates relative log exposure. However, because different films have different light sensitivity ranges which would affect the density vs. log exposure in actual use, the meter must be programmed for these differences. The ASA film speed setting control on the calculator dial of the meter accomplishes this programming.

In order for this ASA value to be meaningful, all meters and other light measuring devices that relate to photographic applications must take into account not only the film speed, but also the reflectivity of the object being photographed. This is because the film does not know what the reflectivity of a particular object is. It only responds to light levels. Therefore, all other conditions being equal, a light subject with a low level of illumination may record on film the same as a dark object with a high level of illumination. To standardize these varying conditions and to allow you to work with different meters and films, a reflectance of 18% value and the understanding that it represents a "typical average" is the basis for readings taken with both reflected and incident methods of measurement, although under the same lighting conditions, different readings for the same scene can be obtained when using both methods, depending on subject reflectivity. This may seem strange at first, but it is true, and sometimes causes confusion. To eliminate this confusion (something no meter or other device can do), you must consider your subject matter and how you want it to appear on the film. For simplicity, the discussion of this evaluation

method will be broken down into a discussion of incident and reflected light measurements.

II.g. Incident Measurement

When reading incident light, the spherical diffuser is placed in front of the measuring cell window and pointed toward the camera, i.e. opposite the subject being photographed, so that the diffuser will receive the same light intensity and distribution as that **falling on** the subject. The reading at this point indicates the strength of the light, but does not indicate the light value **reflected from** the subject into the camera lens and onto the film. It does indicate the light value that would be reflected into the lens from an **18%** average reflective subject. Therefore, when working with subjects that are primarily very light or very dark, the incident exposure reading indicated should be adjusted to compensate for the difference in reflectivity from the 18% standard. When the subject is very light, decrease the exposure by $1/2$ to 1 f/stop. When the subject is very dark, increase the exposure by $1/2$ to 1 stop. The amount of change to the exposure will depend on your judgement as to the degree of variation in subject reflectivity from an average scene.

Situations may arise where you have extremes of light and dark subjects, all of which are important in the same scene. Under these conditions, the meter



should be used in the reflected light method as described under scene brightness range and zone systems.

Incident light readings are most valuable when determining exposures where the subject is inaccessible and receives the same illumination as the meter. They also allow you to determine the individual strengths of multiple light sources striking one subject by reading each source independently. In most cases with average subject matter, the incident method is a fast, simple and accurate way to determine exposure.

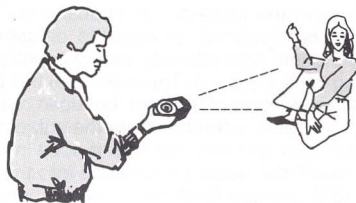
II.h. Reflected Measurement

When reading reflected light, the meter is pointed toward the subject and light reflected from the subject passes through a collecting lens onto the measuring cell. This is the same type of path the light takes when exposing film in your camera. The meter cannot "read" any single element in its field, such as a face or highlight; it integrates **all** the light reflected throughout the measuring field, and indicates an exposure which will record **the total picture** on the basis of an overall 18 % value.

In most cases, you can simply use this reading to get a perfectly exposed picture. However, there are a few situations where the readings should be modified.

The Luna-Pro sbc has a measuring angle of 30° when taking a reflected reading. The light from all objects within that 30° measuring range will be averaged to give you the final reading. If you have one or more objects that are significantly lighter or darker than the rest of the scene, the objects will bias the reading away from the average. In cases such as this, the meter should be moved in closer to the main subjects of interest or one of the accessory spot attachments used to eliminate the effect

of the light or dark areas. As an alternative, an incident reading can be taken.



When measuring a subject that departs significantly from an 18 % reflective surface, you may wish to modify your readings. This is because the reading indicated will make the subject appear on the film as if it were 18 % reflective.

In certain cases, you may not want the subject being measured to fall into that category. For example, if the indicated reading is set in your camera when measuring a brilliant white bridal gown, the resulting image of the gown on the film will appear with the same density as if it were 18 % gray instead of white. Here again, you may wish to use

an incident reading or compensate the reflected reading by increasing exposure. The same is true for very dark objects, i.e., a black tuxedo, except the exposure would be decreased.

Reflected readings are particularly useful when trying to evaluate the relative range of reflected light from various subjects that may have different reflectivity and may be receiving different amounts of light. Because the reflected reading measures the light reaching the lens, differences in reflectivity and level of illumination are accounted for. Therefore, you can determine the extremes and distribution of light from the scene just the way your film will record it. This technique is covered in sections Scene Brightness Range and Zone Systems.

II.i. Scene Brightness Range

In order to assure proper exposures for highlight and shadow detail in scenes with a wide range of light intensity and subject reflectivity, the extent of the lighting range must be determined. The Luna-Pro sbc is ideally suited for this type of measurement because of its null meter design.

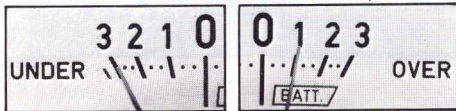
To utilize this function, you must first determine, by testing the limits of exposure change for highlight



Proper metering aids in recording all detail of a scene.

and shadow areas from average that are acceptable to you with your film. Once this is done, the calibrated reference scale on the meter will automatically indicate if you are within acceptable limits of the film.

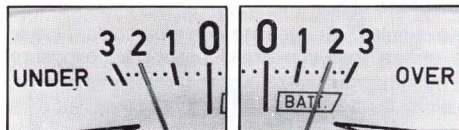
For example, if your testing with a particular type of film shows that you could accept an exposure

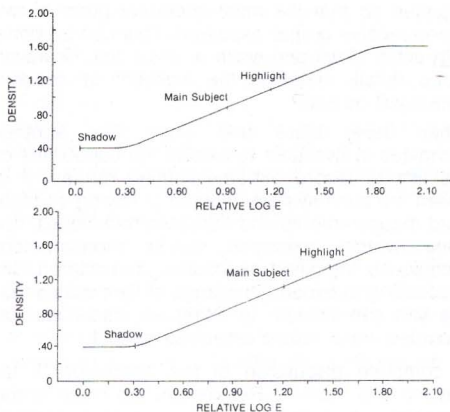


change from average of UNDER (under exposure) 2 to OVER (over exposure) $2\frac{1}{2}$ EV, your total range would be $4\frac{1}{2}$ EV. Using reflected measurement, you could then read the light from the most important area of the scene and then null for that reading. Then, without further adjustment of the calculator dial, you could take light readings from high-light and shadow areas and read the EV variance of these areas. If, in this case, the readings fall within the UNDER 2 to OVER $2\frac{1}{2}$ EV range, your exposures will be good. However if for example, your readings resulted in UNDER 3 and OVER 1, you would lose shadow detail, even though the total range is still only 4 EV. A simple solution would then be to reread the shadow intensity and rotate the computer dial until the meter needle is opposite 2 on the UNDER side which is within the film limits.

Then recheck the highlights which should now read OVER 2. You would then use the new exposure setting indicated on the computer dial. The scene brightness range has not changed, but the meter has adjusted to your exposure so that you are working within the range of the film. To see this graphically in terms of film response see the H&D curves to the right.

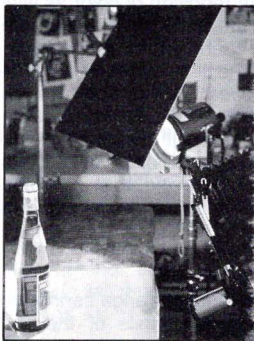
It is important to note that this exposure adjustment method works best when using negative films because different density levels can be adjusted for in printing. With transparency films, this type of exposure adjustment should be used very carefully because you are viewing the original without the benefit of printing correction.





With transparencies, about 1 EV is the largest practical shift if your main subject is close to 18% reflectance.

Situations may arise where the meter shows a range of light intensity that is beyond the total range of film acceptance. In these cases, the use of fill light to lighten shadows or a "gobo" (a device to block or modify light such as a dark card) to soften highlights may be indicated. When the proper corrective action is taken, the scene brightness



range can again be checked to be sure the limits of the film are not exceeded. Modifying the lighting can also be used instead of shifting the exposure as mentioned above if so desired, as in the case of transparency film where the main subject is close to 18% reflectance such as with some skin tones.

II.j. Color Crossover

The preceding discussion concentrated on the effects that lighting can have on film, either black and white or color. However, with color, three separate emulsions are on the film each of whose individual response may be different. In normal exposure situations all three layers will track reasonably well, resulting in accurate rendition of color as well as density. However, at the extremes of exposure levels, deviations in the characteristic response of individual color layers of the film can result in a condition called color crossover. This condition results in a color shift in an area of under or over exposure that cannot be corrected without affecting the colors of the properly exposed areas of the scene. It is therefore very important to avoid this condition which shows itself as color shifts in the shadows and highlights.

II.k. Zone System

There are times when the lighting range cannot be brought within the acceptable limits of the film because of an inability to use fill or use "gobos" such as when photographing landscapes. When these situations arise, the exposure levels can be

adjusted so that the most important parts of the scene receive proper exposure. This can be done with either black and white or color film. However, some detail, either in the highlight or shadow areas, will be lost.

When using black and white film, another technique is available to extend the capabilities of the film to record extreme lighting ranges. It is called the zone system. Instead of relying on standard measurements and exposure techniques, the zone system combines special measurement techniques, modified exposures, and altered film processing to expand the range of light values that the film can accept. In doing so, detail can be recorded which would otherwise be lost.

A complete discussion of this technique is far beyond this manual. References are given in the appendix which should help you become familiar with this very useful photographic tool.

The Luna-Pro sbc is well suited for use with most zone systems because of its null meter principle of operation and the zone system scale (15). Most systems are based on a central zone, representing a certain lighting level, called Zone 5. From this

level the range of light from highlight to shadow is measured and referred to this central zone. The level of variance from the central zone determines the amount of exposure correction and processing modification, if any, that is needed. With most meters, the zone equivalents must be marked on the face of the meter or transferred to a sheet of paper to correlate with changes in light level. However, the Luna-Pro sbc has a zone system scale incorporated in the meter readout.

To use the zone system scales of the Luna-Pro sbc, you would take a measurement of a central zone (Zone V), noting the corresponding EV values for each zone value. Using the EV scale as a reference point, measurements of highlight and shadow areas can then be translated into zone values.

Example:

Take a reading of a central zone or mid-tone (i.e., Zone V) and null the meter. Assume the EV indicated for Zone V is '8'. Note the EV values indicated for the other zone values. In this example:

Zone I = EV 4	Zone VI = EV 9
Zone II = EV 5	Zone VII = EV 10
Zone III = EV 6	Zone VIII = EV 11

Zone IV = EV 7
Zone V = EV 8

Zone IX = EV 12

Now you can take a reading of a highlight area, null the meter and note the EV indicated. Assuming the highlight reading corresponds to an EV 12, the zone value would then be Zone IX (see chart above). Now, take a shadow reading, null the meter and note the EV indicated. Assuming the EV value is '5' the corresponding zone value would be a Zone II.

In the example above, Zone V (a mid-tone) is used as a reference point; however, with a Luna-Pro sbc you can select any zone or light level as a reference. A reading is taken of a particular area, the meter is nulled and the EV value noted (i.e. EV = 7). If you would like that area to be represented as a Zone III, rotate the computer dial until EV 7 is directly above Zone value III. At this point, a reading of the appropriate apertures and shutter speeds will render the particular area measured as a Zone III.

The zone system scale of the Luna-Pro sbc enables you to easily measure zone system values and establish information regarding tonal range in a scene.

With a little practice, you will be amazed at the ease of obtaining this specialized information.

II.1. Film Reciprocity Failure

All photographic exposure meters rely on a principle of film exposure called reciprocity, to function properly. Basically, the film integrates or adds up light during exposure to produce the latent image. Within certain limits, the same image density is achieved for short exposures of high intensity as with long exposures of low intensity, as long as the product of intensity times time is constant. When the exposure times get very long or very short, however, this reciprocity effect is lost, and an accurate prediction of exposure, and color balance with color films, cannot be determined solely by the meter reading. It is therefore important to check the instructions supplied with the film in use to determine when reciprocity failure can be expected, how severe it will be, and how to correct for it. Here again the Luna-Pro sbc greatly assists in exposure

determination because the corrective filters suggested by film manufacturers to adjust color shifts from reciprocity failure have an effect on exposure. These filter factors can be programmed into the Luna-Pro sbc, and the new, corrected f/stop read directly.

II.m. Intermediate f/stops

The Luna-Pro sbc is calibrated in 1/3 stop increments with numerical indications at full stops. A table is included below with the actual numerical values of the 1/3 stop increments listed for levels from f/0.7 to f/128. Values not listed can be calculated from the formula that follows.

New f/stop = (old f/stop) ($\sqrt[3]{2}$ ^(f/stop change))

For example, if you wish to stop down 1/4 stop from f/4, take the $\sqrt[3]{2}$ which equals 1.414 and raise it to the power .25 which is the decimal equivalent of 1/4 stop.

$$(\sqrt[3]{2})^{.25} = (1.414)^{.25} = 1.09$$

Next multiply 4 times 1.09

$$(4) (1.09) = 4.36$$

Your next f/stop is approximately 4.4.

II.n. Intermediate Footcandle Values and Exposure Times

Calculation of intermediate values of footcandles and exposure times is basically the same as calculation of intermediate values of f/stops except that the value $\sqrt{2}$ is replaced by 2 in the formula.

For example, you have a footcandle level 1/2 stop above 1000 as represented on the chart on the back of the Luna-Pro sbc.

$$\begin{aligned}\text{New footcandle level} &= (\text{old level}) (2^{(\text{f/stop change})}) \\ &= (1000) (2^{(.5)}) \\ &= (1000) (1.414) \\ &= 1414\end{aligned}$$

Helpful Hints

III.a. Choosing Between Action Stopping Ability and Depth-of-Field

After taking a light reading with your Luna-Pro sbc, you will have a choice of readings to use which may look like this:

Time:	1/1000	1/500	1/250	1/125
f/	2	2.8	4	5.6
Time:	1/60	1/30	1/15	1/8
f/	8	11	16	22

All of them will give good exposures, but, in terms of photographic results, they are all slightly different.

When shooting action, you generally need a faster shutter speed to get a sharp photograph. Speeds from 1/125 to 1/1000 are generally used, with the choice depending upon the relative speed and direction of travel of the object. Objects moving toward or away from you can be stopped with a lower shutter speed than those moving across your

field. To create a more realistic feeling of motion with objects moving across your field, use a slower shutter speed and pan across the field. When panning, the relative speed between the subject and the camera is decreased while the relative speed between the background and camera is increased. This results in the characteristic action shot with the main subject sharp and the background blurred.

For shutter speeds of 1/60 second and longer, the use of a good tripod or other camera support is suggested to avoid camera shake and blurred pictures.

When subject speed is not a major factor in your pictures, you may wish to choose a longer exposure time and stop down for maximum depth-of-field. This extra depth may be especially important when using long lenses because of their relatively shallow depth-of-field. However, with long lenses, camera shake is accentuated so be careful to use a sturdy support.

Conversely, even when subject speed is not major factor, you may still wish to choose a short shutter speed and a larger lens opening to intentionally limit depth-of-field for selective focus. This is

especially useful for eliminating the distraction of cluttered backgrounds. Portraits lend themselves ideally to this technique.



III. b. Snow & Sand

When photographing with highly reflective surfaces such as snow and sand, extreme care should be used when using reflected readings. In most cases, an incident reading will produce superior results for normal subject in the scene, although the snow or sand may be overexposed. If reflected readings are desired, the main subject should be metered up close or a spot attachment used to minimize the effect of the reflected light, unless the snow or sand is itself the most important part of the scene. This is an ideal time to use scene brightness range measurements.

III. c. Sunsets

Sunsets can present a problem in light measurement because of brightness range. Sometimes, the sun itself is the most important part of the scene, and at other times, light reflecting from clouds or distant mountains may be more important.

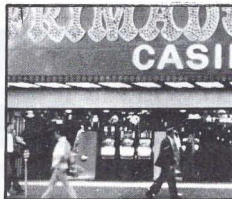
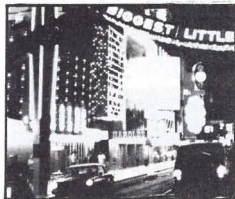


You should first determine what part of the scene is most important. Using an incident reading under these conditions will generally give you poor exposures with washed-out colors. Reflected readings are more accurate, but some compensation is still necessary for the sun or sky. When the sun is present and most important, read the sun directly and use that exposure. If the sky and clouds are most

important, read these areas, being careful not to read direct sunlight. In all cases, if practical, bracket exposures on both sides of those indicated. You may get some very striking results that are not apparent to the unaided eye.

III. d. Night Lighting

Measurement of illumination levels at night presents several problems to good exposures.



Generally, in outdoor scenes, the lighting is not as uniform as with daylight. Bright artificial lights can create multiple highlights and shadows, with a tremendously large brightness range. In addition, direct use of the meter readings will result in a

picture that appears more like a daylight photo than one taken at night.

Generally, night exposures get into the area of film reciprocity failure. It is therefore important to know the characteristics of your film before shooting under these conditions.

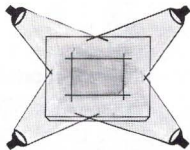
After taking film reciprocity effects into account, decrease your indicated exposures by $1/2$ to 1 stop to preserve the night appearance in your scenes.



III. e. Backlighting

When the main subject of interest is backlit, care should be exercised when taking reflected read-

ings. Light from behind the subject entering directly into the measuring cell of the meter will produce reading errors. To avoid this, take your readings up close to the subject or use one of the spot attachments for more accuracy. An incident reading can also be used, with the meter pointed toward the camera. For the most accurate exposures, measurements should be made as described in the section, Scene Brightness Range.



III. f. Copying

Copying places stringent demands on lighting to make sure that the detail and tonal range of the original is recorded on the copy. Lights are usually placed to the sides of the copyboard to eliminate glare from the surface of the copy. Many people prefer to overlight the corners of the copy to compensate for lens falloff. The exact amount of overlighting varies with the individual situation, but 15-20 % is common.

For copy work, the Luna-Pro sbc can be used with the copy attachment for determining exposure and checking evenness of illumination.



III. g.

Excessive Skylight

When taking reflected readings of scenes where there are large areas of skylight, care should be exercised that the main subject be given the greatest attention either by tilting the meter down taking up-close measurement or by using one of the spot attachments. As an alternative, an incident reading may be used.

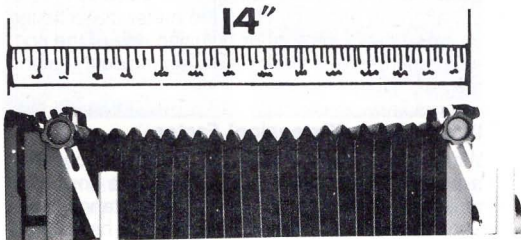
III. h. Bellows [Extension] Factor

When photographs are taken where the focus is at a point other than infinity, an exposure correction must be made. At most working distances, this correction factor is so small that it can be ignored.

However, when working at very close distances, it becomes significant and can result in serious exposure errors if not corrected for. This exposure variance is commonly called extension factor or bellows factor.

There are several ways to correct for this effect. Two of the most commonly used take into account the lens focal length and the lens to film plane distance (bellows extension).

The first method gives you an extension factor which can be programmed into the exposure factor ring of the Luna-Pro sbc for direct readout of corrected exposure values. The second method gives a corrected aperture only.



I. Extension Factor =

$$\frac{(\text{Lens to film plane distance})^2}{(\text{Lens focal length})^2}$$

For example, assume a 210 mm lens (approximately 8") is being used with a lens to film plane distance of 14".

$$\begin{aligned}\text{Extension Factor} &= \frac{(14)^2}{(8)^2} \\ &= \frac{196}{64} \\ &= 3.06 \text{ or approximately } 3\end{aligned}$$

In this case, set the white index mark, of the exposure factor ring opposite the number 3. Note that the exposure factor portion of the ring (numbers in black) should be used, not the EV position. All readings will now be corrected for this extension factor.

II. Effective Aperture =

$$\frac{(\text{Lens to film plane distance}) (\text{Indicated f/stop})}{(\text{Lens focal length})}$$

For example, assume the same conditions as in Example I with an indicated f/stop of f/11

$$\begin{aligned}\text{Effective Aperture} &= \frac{(14) (11)}{8} \\ &= \frac{154}{8} \\ &= 19.3 \text{ or approximately } 20\end{aligned}$$

In this case, if the lens were set to f/8, the exposure level would be the same as if the lens were set to f/20, although, depth-of-field would remain the same as for f/8. Using this method, each time a different f/stop is chosen, the same amount of correction must be recalculated into the exposure. The first method in conjunction with the exposure factor ring of the Luna-Pro sbc is much quicker and more flexible because once the exposure factor is programmed, all subsequent readings are corrected for with additional calculations and in terms of all values, not just f/stops.

Another way to determine extension factor is to measure the magnification of the object size at the film plane. This is especially useful when working with large format cameras where measurement of the image on the ground glass is relatively easy.

To calculate the extension factor, measure both the actual object size and the size of the image on the ground glass. These two measurements are used in the formula below.

$$EF = \left(\frac{\text{Image Size}}{\text{Object Size}} + 1 \right)^2$$

For example, assume an object size of 2 inches and image size of 4 inches.

$$\begin{aligned}EF &= \left(\frac{4}{2} + 1 \right)^2 \\ &= (2 + 1)^2 \\ &= (3)^2 \\ &= 9\end{aligned}$$

Setting 9 in the EF correction ring of the Luna-Pro sbc will give correct exposures for this condition.

Extension and filter factors can be eliminated from exposure reading by using the accessory fiber optics probe and reading on the camera groundglass. Any changes due to these factors will automatically be sensed and compensated for by the meter.

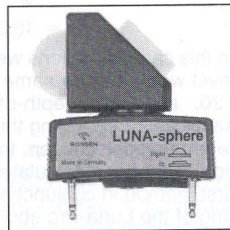
Accessories

All of these excellent features are only the beginning of the Luna-Pro sbc story. The wide range of instantly interchangeable accessories set the Luna-Pro sbc distinctly above any other light measuring instrument. And, to make them even more practical, several of them automatically reprogram the meter response for direct reading. With these accessories, you don't have to match special marks or lines to get the right reading. Just attaching the accessory and proceeding with the reading in a normal manner is all that's necessary!

Luna-Sphere Studio Accessory

When working in the studio or with multiple sources of light, many professionals prefer to measure incident light for exposure determination. This can be done with the basic Luna-Pro sbc, but for greater convenience, the Luna-sphere combines its large

integrating sphere with a 360° swivel head plus capability for a flat plane diffuser into one convenient accessory. For photometrically accurate measurements of footcandles or Lux, readings must be taken on a flat diffused plane. The flat diffuser supplied with the Luna-sphere makes these measurements possible, and without affecting calibration of the instrument. Footcandle measurements are preferred by many cinematographers and lighting engineers. Others prefer to use the flat diffuser simply because it is more directional for incident light than diffusing sphere. The Luna-Sphere automatically adjusts the meter sensitivity when in use.



Spot Measuring Attachments

Because of its unique versatility, the Luna-Pro sbc System can readily cope with situations which make it desirable to use reflected light measuring angles of less than the meter's standard 30°. These are two accessories which will decrease the measuring angle for "spot" readings.

Multibeam Spot Attachment

For even greater selectivity, the Multibeam® Spot Attachment for the Luna-Pro sbc provide not only 10° and 5° measuring angles, but, in addition, a 1° angle for ultra precise exposure measurement. The single lens reflex design permits measuring and viewing through the same lens, eliminating parallax problems which can cause measuring errors with twinlens 1° spot meters.

The Multibeam® Attachment focuses from maximum measuring accuracy, and provision is made for eyepiece



correction. With this attachment, you have the advantages of a separate 1° spot meter for you Luna-Pro sbc, and it automatically adjusts the meter sensitivity when attached.

Variable Angle Attachment

The modestly priced Vari-Angle Attachment locks instantly onto the Luna-Pro sbc (or regular Luna-Pro) and provides convenient selection of either 15° or 7.5° measuring angles. For reflected light readings, the normal measuring area corresponds to a light acceptance angle of 30°. A built-in reflex viewfinder showing the 15° and 7.5° measuring area permits accurate measurements for exposures with telephoto lenses and selective readings of various parts of the scene or subject when normal lenses are used.



Luna-flash 2 Attachment

Electronic flash has become an extremely important source of controlled lighting in the studio as well as on location. Previously, standard meters designed to measure continuous light could not measure the short, extremely bright bursts of light from such flash units. Now, however, the flash attachment converts your Luna-Pro sbc into a high quality electronic flash meter! This accessory can operate either as a cord-connected or cordless meter to measure single or multiple flashes.

Both incident and reflected light readings can be taken with flash.

Accurate readings can be made in the range of 28.8 (as to 7360 lxs. For a film speed setting of 100 ASA you can read f/stops from 2.8 $\frac{2}{3}$ to 45 $\frac{2}{3}$. In addition to that, a 5 stop range extender is provided. The measuring time is 1/125 seconds.

When multiple flashes are required to achieve correct exposure at a desired f/stop (e.g. for greatest depth of field in interiors or other still subjects), the readings of successive flashes are automatically accumulated within the two minute cycle to indicate to you how many flashes are necessary for the desired result.

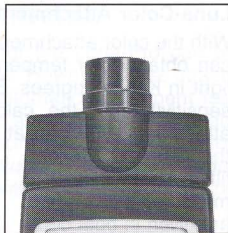
Once the Luna-flash 2 is attached to the meter, the internal circuitry will be automatically programmed.



Microscope Attachment

The Microscope Attachment utilizes the Luna-Pro sbc measuring sensitivity for convenient and reliable exposure measurement when taking photo-

micrographs. The Microscope attachment fits the ocular tube of most microscopes for exact exposure determinations, and is useful in measuring light intensity for fluorescent microscopy. Sensitivity adjustment is automatic.



Repro [Copying Attachment]

With the Repro Attachment on the Luna-Pro sbc, it is possible to obtain exposure values of flat copy such as paintings, documents, and photographic prints.

The illumination on the copy board can be measured for evenness of various points on the material

to be copied. It can also be reversed for measurements of light transmitted through slides or other translucent material being copied.



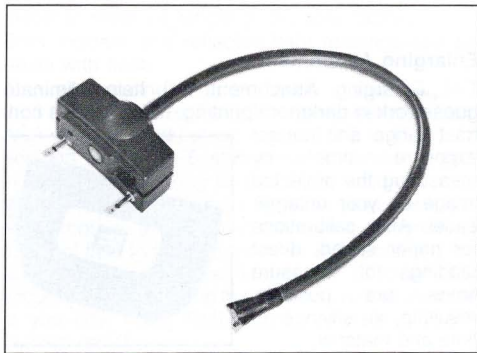
Enlarging Attachment

The Enlarging Attachment will help eliminate guesswork in darkroom printing. It determines contrast range and correct exposure time by measuring the projected image on your enlarger easel. After calibrations for paper speed, direct readings of exposure times are possible, resulting in savings of time and material.



Fiber Optics Probe Attachment

With the flexible Fiber Optics Probe Attachment on the Luna-Pro sbc, measurements can be made in many areas which are usually inaccessible with an exposure meter. It is especially suitable for macrophotography groundglass measurements, density measurements on negatives or transparencies, and for luminous density measurements. Sensitivity adjustment is automatic.



Luna-Color Attachment

With the color attachment on the Luna-Pro sbc you can obtain color temperature readings of incident light in Kelvin degrees. By setting your film's color sensitivity into the calculator supplied with the attachment, you can at the same time determine the value of correction filters for the light being measured. Filter values are given in both decamired values of Kodak[®] equivalents. Ideal for all continuous spectrum sources such as daylight and tungsten. Not suitable for non-continuous sources such as fluorescent lamps.



Kodak[®] is a trademark of Eastman Kodak Co.

These accessories make the Luna-Pro sbc the most versatile and complete systems meter available today. And, because it is a true system meter where the accessories interface with the meter electronics, future advances in light measurement techniques can be accommodated.

Luna-Pro Attachments

All existing attachments for the Luna-Pro can be used with the Luna-Pro sbc. However, these attachments do not have the automatic adjustment feature of the Luna-Pro sbc attachments. For direct reading with proper exposure values, make the following exposure corrections when using your Luna-Pro attachments with your Luna-Pro sbc Exposure Meter.

Variable Angle Attachment

The EV + section of the dial is used. When using the 15° position, set the index mark opposite +1 - 1/3 EV. When using the 7.5° position, set the index mark opposite +3 EV. Readings are then taken normally.

Repro [Copy] Attachment & Filter Optics Probe:

Set the index mark opposite +3 EV on your exposure correction dial.

For complete instructions on how to use these and other attachments with your Luna-Pro sbc, write to Bogen Photo Corp., 17-20 Willow St., P.O. Box 712, Fair Lawn, N.J. 07410-0712.

Appendix

Intermediate ASA & DIN Values

ASA	DIN	ASA	DIN	ASA	DIN
0.8	0	50	18	3,200	36
1	1	64	19	4,000	37
1.2	2	80	20	5,000	38
1.6	3	100	21	6,400	39
2	4	125	22	8,000	40
2.5	5	160	23	10,000	41
3	6	200	24	12,500	42
4	7	250	25	16,000	43
5	8	320	26	20,000	44
6	9	400	27	25,000	45
8	10	500	28	32,000	46
10	11	650	29	40,000	47
12	12	800	30	50,000	48
16	13	1,000	31	64,000	49
20	14	1,250	32	80,000	50
25	15	1,600	33	100,000	51
32	16	2,000	34		
40	17	2,500	35		

Intermediate Footcandle Values

.016	.26	4	65	1,000	16,000
.02	.33	5	82	1,260	20,160
.025	.4	6.3	103	1,590	25,400
.032	.5	8	130	2,000	32,000
.04	.63	10	164	2,500	
.05	.79	12.7	206	3,180	
.065	1	16	260	4,000	
.08	1.26	20	328	5,040	
.1	1.6	25	413	6,350	
.13	2	32	500	8,000	
.16	2.5	40	630	10,800	
.21	3.2	51	794	12,700	

Intermediate F/Stop Values

.7	2.8	11	45
.8	3.2	13	51
.9	3.5	14	57
1	4	16	64
1.1	4.5	18	72
1.3	5	20	81
1.4	5.6	22	90
1.6	6.3	25	101
1.8	7	29	113
2	8	32	128
2.2	9	36	
2.5	10	40	

Your Gossen Luna-Pro sbc

is your valuable precision instrument, made with great care and accurately calibrated. It deserves your good care!

The battery and zero position tests described on page 5 enable you to check the proper functioning of your Luna-Pro sbc. If meter is to be stored for extended periods of time, remove the battery from the meter.

Measuring comparisons of your Luna-Pro sbc with similar or other types of exposure meters cannot be made properly without special laboratory equipment (optical bench).

Do not attempt to open or repair your Luna-Pro sbc. Service information appears below.

Service

Should your Luna-Pro sbc require service, send the meter (directly or through an authorized dealer), in the original packing if possible, prepaid and insured, to:

bogen

Bogen Photo Corp., 565 East Crescent Avenue
P.O. Box 506, Ramsey, NJ 07446-0506
(201) 818-9500
FAX (201) 818-9177

Printed in West Germany

A brief description of the reason for sending the meter should accompany the package.

Specifications

EV Range	ASA 25 - 6 + 15
Photo Cell	Silicon Blue Cell
Angle of Coverage	30° Reflected 180° Incident
Sensitivity	016 to 32,000 footcandles in one range
Power Source	9 volt Eveready Battery or 9 volt Mallory Duracell® Alkaline Battery or equivalent. Battery Type #MN 1604
Dimensions	4 ³ / ₄ × 1 ³ / ₄ × 2 ³ / ₄
Weight	8 ¹ / ₄ oz. with battery

Scale Ranges:

Cine Range	4.5 to 144 fps.
Exposure Value Range	-8 to +24
Shutter Speeds	1/4,000 Sec. to 8 hours
Lens Aperture	f/0.7 to f/128
Exposure Factor Scale	Plus/Minus exposure indicated in EV Plus exposure indicated in Exposure Factor
ASA Range	0.8 to 100,000

Additional Reference Material

Eastman Kodak Co.
Kodak Publications
Rochester, New York 14650

KODAK Professional Photo Guide R-28

KODAK-Professional Black and White Films, 2nd
Ed. F-5

KODAK Color Films, 6th Ed. E-77

Sensitometric and Image Structure Data for
KODAK Color Films E-78

Basic Photographic Sensitometry Workbook
2-22-FD

Lens Extension Tables P-300

KODAK Plates and Films for Scientific Photo-
graphy P-315

KODAK Filters for Scientific and Technical Uses, 1st
Ed. B-3

Stroebe, Leslie; **View Camera Technique**;
Hastings House Publishers, Inc.; New York,
New York 10016

Zakia, Richard and Todd, Hollis; **Photographic
Sensitometry**; Morgan and Morgan, Inc.; Dobbs
Ferry, New York 10522

Sturge, John; **Handbook of Photography and
Reprography Materials, Processes and Systems**;
Seventh Edition; Van Nostrand Reinhold Co.; New
York, New York 10001

Stimson, A.; **Photometry and Radiometry for
Engineers**; John Wiley & Sons, Inc.; New York,
New York 10016

Dowdell, J. III and Zakia, R.; **Zone Systemizer**;
Morgan and Morgan, Inc.; Dobbs Ferry, New York
10522

Saunders, Norman; **Photographic Tone Control**;
Morgan and Morgan, Inc.; Dobbs Ferry, New York
10522

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