# Spotting lightmeter “RAPRI E-201”

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Determining conditions in order to get a good quality photographic image, in particular when shooting slides, means setting proper exposition values. Any enhancement in the method of light measurement helps improving picture quality, provided that later, during the film processing, no irregularities happen. Different cameras with built-in light-meters do not always guarantee light metering accuracy in the case of a range of themes that differ from "normal" conditions in distribution and proportions of luminosity on the object. That's why in some of the automatic cameras there is a possibility to correct the exposition manually. In the field of professional photography the majority of light measuring tasks are performed by measuring brightness on a limited part of the object. In these cases, when a usual light-meter is used, brightness measurement is made using the close-proximity method. This often entails an utter discomfort and sometimes is found impossible due to the distance of the object, or when it is practically out of reach. The same measurement action of the limited part of the suite can be accomplished using a so-called spotting light-meter with a small angle of perception. Spotting light-meters found a practical function at professional movie shooting, at theatre and sport photography. Spot mode of light metering also appeared in some of the modern automatic cameras.

The designers of "spotting" light-meter RAPRI E-201* were faced with the task of creating a simple equipment which does not require any special preparations on the photographer’s part. The equipment had to be inexpensive, that is, it must not contain costly constructing parts, while at the same time it should be reliable in practice. Therefore, the concept of visual photometry has been taken as a design principle, also bearing in mind the scale of luminosity symbols. ** The exterior of the light-meter is represented on fig. 1, while a functional diagram is shown on fig. 2.

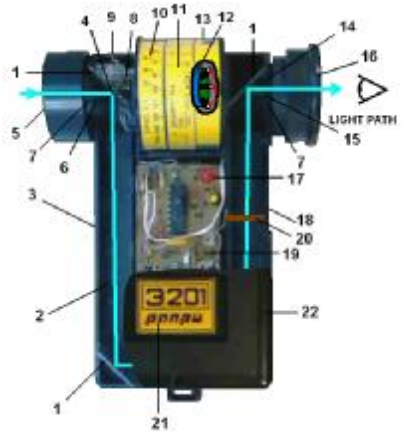


Fig. 1. STRUCTURE OF THE LIGHT-METER

1 - MIRROR;
2 - LIGHT PATH CHAMBER;
3 - BODY;
4 - COMPARATION ELEMENT;
5 - VIEWFINDER;
6 - PROTECTING GLASS;
7 - COLOUR FILTER;
8 - HOLDER;
9 - INCANDESCENT LAMP;
10 – TIME-VALUE RING;
11 - RING WITH SPEED OF PHOTOSENSITIVE MATERIALS AND APERTURE NUMBERS;
12 - VARIABLE RESISTOR;
13 - CALCULATOR BODY;
14 - COLOUR FILTER;
15 - PROTECTING GLASS;
16 - OCULAR;
17 - LED;
18 - PUSHBUTTON (KEY);
19 - PRINTED CIRCUIT BOARD WITH ELECTRONIC PARTS;
20 - SPACER FRAME;
21 - POWER SOURCE DRAWER;
22 - TOP COVER

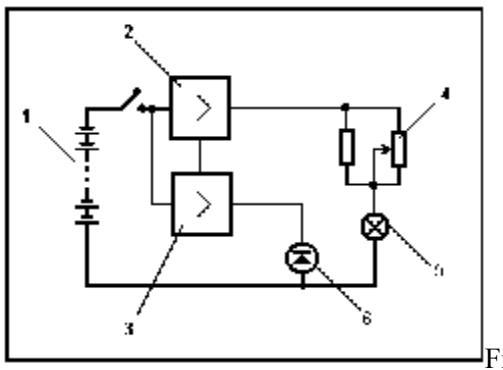

Fig. 2. FUNCTIONAL DIAGRAM OF THE LIGHT-METER

1 - POWER SOURCE;
2 - VOLTAGE STABILIZER;
3 - BATTERY DISCHARGE INDICATOR CIRCUIT;
4 - VARIABLE RESISTOR ;
5 - INCANDESCENT LAMP;
6 – LED

The first conceptual idiosyncrasy of the light-meter "RAPRI E-201" is the small perception angle, commensurable to the size of the full Moon. The optical system of the light-meter is nothing else than a finder frame with an image of a reference light source as an illuminated mark with a shape of a 2 mm circular spot in the view field. In order to decrease the dimensions of the light-meter the finder frame is constructed in the form of a folded path in a light chamber with mirrors in the corners. The illuminated mark is seen through the ocular opening under an angle as small as approximately 30' of a degree. Since, during measurement the illuminated mark is aimed at the selected part of the surface to be optically measured, effective perception angle of the light-meter can be accepted equal with the angle size of the light mark. The other speciality of this light-meter is the application of the visual photometry. This allowed for getting rid of all the expensive elements, characteristic of this kind of instruments, such as photodetectors, converters with electronic signal processing circuitry; and the built-in optical system consisting of several lenses in order to create the viewfield and to form the perception angle of the light-meter.

The principle used as the base of visual photometry is the utilization of physiologic characteristics of the visual organ for measurement purposes. The eye performs a function of an analyzer comparing the brightness of two overlapping fields. During the photometric process the brightness of the reference field is known and can be varied continually. The photometric process is traced back to finding a visual sensation where brightness of the reference mark is in balance with the brightness of the field to be measured.

The resolving capacity of visual photometry depends essentially on the mutual placement and viewing angle of fields to be matched, on the sharp-sightedness of the operator and the spectral difference of the radiations to be compared. In optimum circumstances the eye can notice a few percents of differences in brightness of the compared fields, which is equivalent to approximately 1/30th of an exposition value. In order to decrease possible errors at comparing the brightness of the light mark to that of a surface having a kind of saturated colour, orange coloured filters are introduced into the viewfinder of the light-meter. The aim of the colour filters is to compensate the differences between the hue of the surface sections chosen for light measurement and hue of the reference light mark. Working accuracy of the reference light source depends on the stability of the supply voltage. For that reason, a highly effective voltage stabilized power supply is present in the circuitry of the instrument, and an indicator lamp, which informs the photographer about the suitability of the power source. For this aim, a microcircuit K157UD2 is utilized in the instrument, one operational amplifier of which is used as an error-detector in the voltage stabilizer. The other amplifier serves as a comparator of the power source voltage with the stabilized supply voltage and controls the circuit of the signal LED. The usage of the regulating operational amplifier in the supply of the instrument assures the stability of the supply with a nominal value of 6 Volts. Voltage stability is supported with single millivolt accuracy in the course of discharge of the power source from 7.5 to 6.05 Volts. If during the long-term use the power source voltage falls under 6.05

Volts the signal LED will not be lit. In this case, the replacement of the power sources becomes necessary, otherwise the stabilizer cannot support working voltage within the given range.

Between the inlet window and the eyepiece of the viewfinder, there is a calculator that has two control rings. The first, in the light path, ribbed ring 10 is mechanically coupled with the shaft of the variable resistor, which serves as a brightness regulator for the light mark. With the help of the second ring the film speed can be adjusted to the marks on the third stationary ring 13, that carries light-value number indexes.

The third peculiarity of the light-meter is its measuring capacity of not only distant surfaces but also closely situated ones (up to touching the entry window). As a consequence, the instrument, beyond its basic goal, can be used as a light-meter for determining exposure time at print, as a density meter for finding the range of optical densities on transparent base and, lastly, as an equipment for light metering the image on the camera ground-glass. Fourthly, another speciality of principle of the light-meter lies in its greyscale on the calculator. It allows for the initiation of the metering of limited parts of the object, with luminosity differing from the average bright or the average grey in their tonality. Having greyscale marks on the light-meter renders it unnecessary to introduce exposition corrections on the indicator of the instrument when light measurements are executed on dim or bright surfaces. The above listed characteristics of the light-meter lead the photographer to a well-considered estimation of luminance of the photo object, and they also ensure a possibility to realize Ansel Adam's zone system light metering method, which takes the "spotting" light-metering, together with the visual observation of the photo object and the forthcoming print process, into consideration at the light metering stage ("Sovietskoye Foto", 1980, Nos 1, 2).

Exposition value pairs are to be determined as follows:

1. Analyse the object from the viewpoint of an existence of easily recognised reference luminosity spots that can be securely identified with one of the fields of the luminosity symbols on the calculator scale of the light-meter. Such reference luminosity areas can be white surfaces with opaque structure: white paper, white clothes, snowy field, etc.; bright but not white surfaces, for example human face without tan, other surfaces with similar luminosity; medium bright surfaces, i.e. granite rubble, dry part of asphalt traffic road, green leaves... The reference luminosity for light metering is chosen by the photographer depending on the shooting conditions, on the presence of different luminosities at the object of the shot and also at the conceived image on the print or slide, then a luminosity symbol on the greyscale of the calculator is chosen according to the desired luminosity of the image part on the positive picture. In order to reduce measuring errors bright surfaces are to be preferred to dark ones at finding reference luminosity spots.

2. The field that corresponds with the reference luminosity of the picture is to be found on the luminosity symbols scale of the calculator. By turning ring 11 holding the film speeds number marks align the number, indicating the speed of the used light-sensitive material, with the centre of the field of the chosen luminosity symbol. *[By the example of a sample in his possession the translator believes that instead of symbols in boxes, latter models have a black wedge with marks (supposedly) at the centres of boxes.]*

3. From the shooting place, observing through the viewfinder, aim the light-meter at the photo object until the light mark patch falls on the previously chosen background section, then turn the light-meter on by pushing your thumb on the power key.
Then, revolving the ribbed ring with your object finger equalize the brightness of the light mark with the brightness of the reference luminosity nearly until the mark disappears against the background of the measured surface. Following this, the power key can be released.

4. The appropriate "time - stop" pair should be set on the aperture and exposure time scales and the values are to be set on the time control and on the lens of the camera.

In the vast majority of the cases under non-flash-lighted circumstances and using traditional lenses the full light metering cycle ends here. When using MTO type catadioptric lenses a -2/3$^{rd}$ stops value correcting factor is necessary to be introduced in the indication of the light-meter. Decrease in the speed of a lens, caused by filters or other attachments and also by using extension tubes when shooting from a close distance or macro setting, is compensated by way of widely known methods. [*??: translator*]

The construction of the light-meter makes its application possible in light metering through the taking lens of the camera, directly on the ground-glass image. Atelier cameras, all models of the "FK" and "Rakurs"

series and others, where sharpness adjustment and frame composition are accomplished on a frosted glass put into the film cassette compartment of the camera belong to this group. This kind of light measurement determines only one parameter - the exposition time, since the brightness of the image to be measured on the ground-glass automatically takes into consideration to what extent the lens is stopped down and what shifts or tilts took place, so metering the reference luminosity on the ground-glass image is performed by placing the entry window of the light-meter tightly to the ground-glass. The preparation of the light-meter for this kind of work comprises the revolving of ring 11 on the light-meter in a way that it is the special mark "M" (matte glass) that should be set against the greyscale field of luminosities, corresponding to the reference luminosity of the picture object, and not, like usually, the speed numbers of light sensitive materials. When ring 11 is revolved this way additional speed mark graduations meet the time value scale. Having equalized the brightness of the light mark with the reference luminosity on the ground-glass, time value can be read in front of the speed number of the photo material used.

Technical characteristics of the light-meter:

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| Angle size of viewfield in the viewfinder | 4x5 degrees; |
| Angle of perception | 0.5 degrees; |
| Brightness measurement range (in Exposure Values) | from 2 to 18 EV at GOST/ISO 100; |
| Distance limits of the object to be shot | from 0 to infinity; |
| Time-value range | from 1/1000 sec to 16 min; |
| Aperture number range | from 1 to 32; |
| Film speed range | from 1.5 to 800 in GOST/ISO<br>and from 3 to 30 in DIN; |
| Divisions on luminosity scale calculator | 7 steps; |
| Power source | 6 cells RTs-53 or 6 accumulators D 0.06; |
| Dimensions | 40x90x125 mm; |
| Weight | 50 g |

Notes:

*The name of the light-meter has been derived from the name of the manufacturing factory: "RAdioPRIbor"

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