LEICA FOTOGRAFIE

ENGLISH EDITION SIX ISSUES PER ANNUM No. 2 1972

Exposure determination with the Leica M 5

By D. Brückner and K. D. Schaefer

The latest addition to the Leica family, the new M 5, differs notably, in the way it measures exposure, not only from the earlier Leica models, but also from all other rangefinder cameras. In a word, it is the first rangefinder camera to utilize the principle of selective exposure determination through the camera lens in which the selected exposure value can be seen in the viewfinder. Over and above this, the new Leica offers the facility, so greatly appreciated already in the Leicaflex, of being able to make a measurement on a selected area of the subject, taking into account filter factors and camera extension exposure increase factors, without taking the camera from the eye.

The photocell

The secret of the Leica M 5 lies in the use of a small, movable photoresistor which swings into the light beam as the shutter is wound and measures the light intensity falling on the film from immediately in front of the shutter. When the release is pressed the photocell is instantaneously swung out of the light path before the shutter operates. The same thing happens when the lens is removed, as a precaution against possible damage to the metering system. In order to obtain the picture

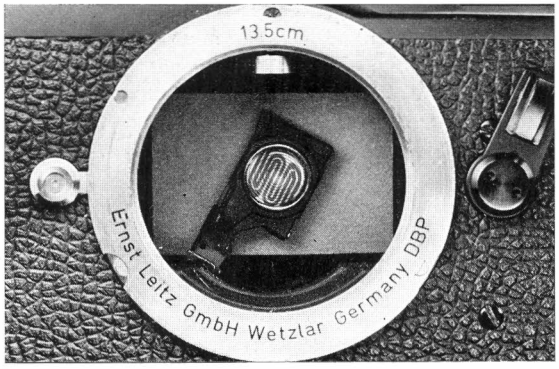


Fig. 1

shown in Fig. 1 which illustrates the arrangement of the photocell in the camera, the swing out was operated by inserting a bayonet adapter. In addition, to show it up more clearly, a piece of light grey card was inserted in place of the black cloth of the focal plane shutter. Normally, the photocell is not visible when the lens is removed.

This location of the photocell immediately in front of the shutter, i.e. between lens and film plane, is unfortunately not an ideal arrangement from the optical point of view. As can be seen from the diagram in

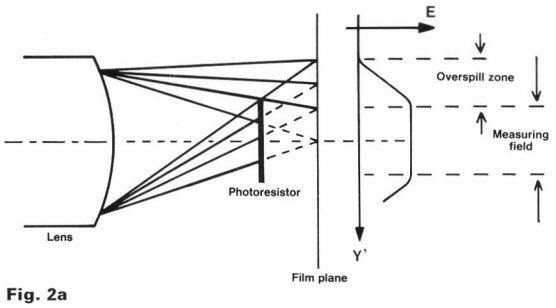


Fig. 2a

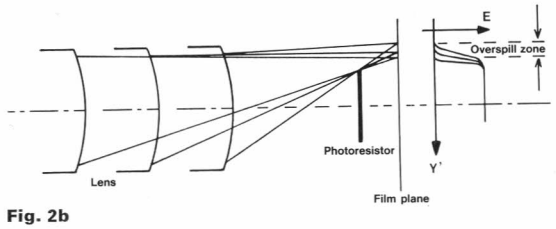


Fig. 2b

Fig. 2:
Effect of position of exit pupil on meter indication.

Fig. 2a, on the one hand, quite an appreciable proportion of the image-forming light outside the measuring field actually falls on the photocell, thereby reducing the degree of selectivity; on the other hand—and this is an even more serious matter—the exposure determination becomes thereby appreciably dependent upon the focal length, the stop in use, and the design of the lens. Fig. 2a shows how the photocell receives an excess of light from areas outside the actual measuring field which increases with the size of the stop used, and with decreasing lens focal length, or—more precisely—with increase in size of what is termed the exit pupil and its nearer approach to the film plane. Since however the required exposure value is calculated from the ratio of the intensity of the incident light and the size of the measuring field, as the focal length of the lens decreases and the relative aperture increases, the meter indication tends more and more to result in underexposure. This is shown graphically in Fig. 3, for a series of Leica lenses, by the dotted line.

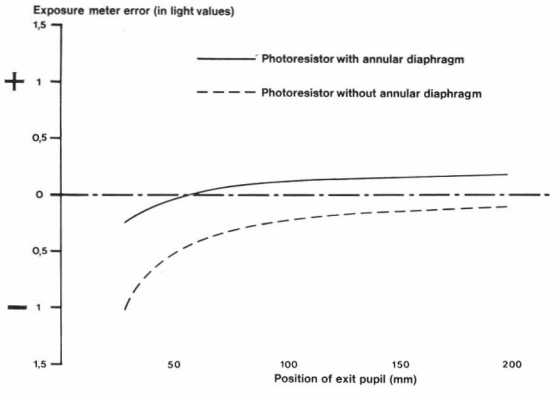


Fig. 3

Starting from a standard 50 mm f/2 lens, this curve shows that at longer focal lengths overexposure reaches a maximum of half a stop, whilst the use of extremely short focus lenses may result in as much as a whole stop underexposure. This means that if no additional precautions were taken only lenses between about 35 and 90 mm focus could be employed, while it must also be borne in mind that the effect on accuracy of exposure determination rapidly falls off with stopping down or increased camera extension in close-up work, and in the macro range.

Correction at all focal lengths

Since any possibility of a lateral arrangement of the photocell, wherein the measuring beam is reflected out of the image forming beam as in the Leicaflex, was ruled out on grounds of space because of the considerably smaller dimensions of the Leica, other means had to be sought to reduce the unavoidable measurement errors inherent in this design of the meter system to the point where they could in practice be neglected. This problem was the more difficult of solution in that it had so far as possible to cover all Leitz lenses—even those of older design.

In the end a surprisingly simple solution was arrived at in the shape of an annular venetian blind form of diaphragm placed directly in front of the photocell as can be seen clearly in the sectional view in Fig. 4 behind the dust-proof plate. The effect of this arrangement is shown diagrammatically in Fig. 5, and rests upon the fact that the light which enters under conditions of excessively wide angle, and which would otherwise result in false indications, is blocked by the depth of the venetian slats, and so prevented from reaching the photoresistor. The separation and dimensions of the diaphragm elements are so designed that residual exposure errors, over the entire lens programme of the Leica system, is less than half a stop, and can accordingly be neglected in comparison with the effects of variations of film speed and of development conditions. This likewise is illustrated graphically by one of the curves in Fig. 3.

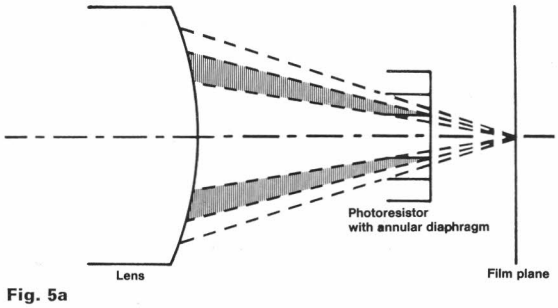


Fig. 5a

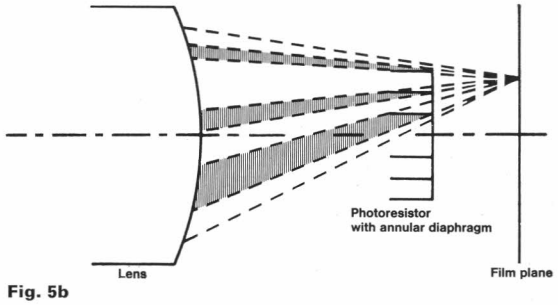
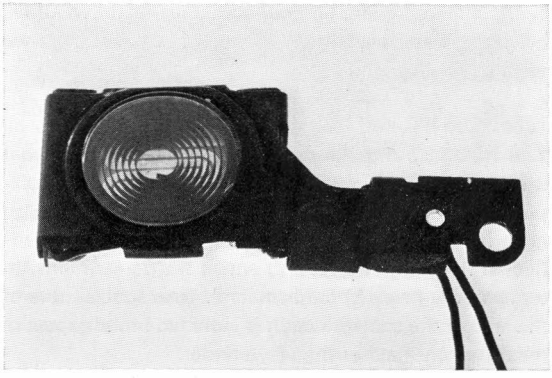


Fig. 5b

Fig. 5:
Vignetting of individual beams of light by annular diaphragm in front of the photoresistor.

Fig. 4



This device ensures accuracy of exposure determination with all Leica lenses. But there is one exception: those lenses which penetrate so deeply into the camera body that they prevent the movement of the photocell. In the case of such collapsible lenses a spacing collar

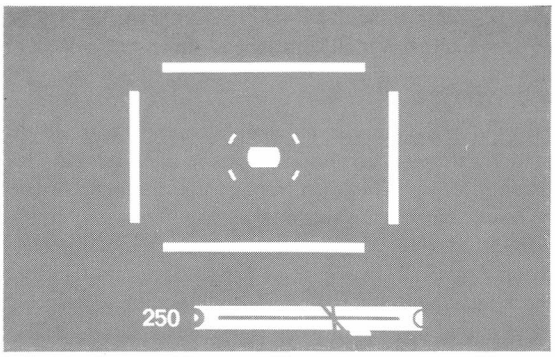


Fig. 6

must be provided to limit the collapsing movement to the permissible amount (see Leica-Fotografie No. 6/71, p. 249).

Practical application

How, in practice, is the exposure determined with the M 5? Operating the film transport lever winds on the film and tensions the shutter, and simultaneously switches on the meter circuit, which is powered by a small HgO battery. In the viewfinder will now be seen, beneath the actual picture image, the shutter speed at which the camera is at the moment set (e.g. 250 = $^1/_{250}$ sec.) and a bright band over which moves the pointer of the built-in exposure meter (see Fig. 6). As the iris diaphragm is adjusted, the pointer alters in position, and as the shutter speed is varied the index line moves along the light band. By joint adjustment of both stop and shutter speed, the pointer and index must be brought into coincidence on the light band to ensure accurate setting of exposure. At the same time the position of this intersection on the light band affords a qualitative indication of the aperture in use.

As the aperture is opened up, the intersection moves to the right; on closing down, to the left, as indicated by the semi-circular symbols of different sizes at the two ends of the light band.

The field under measurement by the exposure meter is automatically reflected into the finder for all focal lengths from 28 to 135 mm. In Fig. 6 for example (showing the viewfinder field with 50 mm lens mounted in the camera) the acceptance angle is indicated by the curved marks at the four corners around the focusing field.

Sensitivity

To return once more to the technical data: the range of the meter is from 200,000 asb to 0.4 asb. This is a very considerable range, and leaves little to be desired. Thus the bathing enthusiast can capture any pretty nymph on his film in the most brilliant midday sunshine, while in the evening, at theatre or restaurant, he can equally safely measure exposure and take his snapshots—so long as his hand is steady enough to cope with the relatively slow shutter speeds that will be called for.

There is one special aspect which needs to be stressed: it frequently happens that, say, a white house is photographed in glaring sunshine and in accordance with the meter indication comes out in the transparency a medium grey. Similarly a picture which often finishes up in the waste paper basket is that of some black object. Here again, because the measurement has been made on the object itself and the exposure made accordingly, the subject comes out grey instead of black. The evidence in each case would seem to point to the exposure meter giving "grey" results, even though the photographer is satisfied that the measurement was correctly made. The natural conclusion to be drawn is that since all the other pictures taken seem more or less satisfactory the fault must lie with the exposure meter. This is not so. All the meter has done is to make us aware of an error in our own procedure. We have in fact not taken account of the assumption made, in calibrating all exposure meters, as to the distribution of light and dark areas in the normal subject; i.e. that every subject on the average reflects 17% of the light which falls upon it. This proportion results in a medium grey tone rendering. Kodak do in fact supply a standard grey card with just this reflection factor.

Exposure meters are all calibrated to the same standard: i.e. they all give the same exposure indication for any given subject luminosity. To ensure this, the calibration conditions have been standardized. Naturally, as soon as we are confronted with a subject which departs palpably from these standard conditions, the response of the meter must be manually compensated. We can either make a correction to the exposure as indicated by the meter, or alternatively in making the measurement we can direct the meter on to some object which exhibits the standard reflection characterisitic while receiving the same level of illumination as the subject we wish to photograph.

In making a measurement, always bear in mind what it is that you are actually wanting to measure. The exposure meter cannot be expected to know what you have in mind. It merely measures whatever light is reflected from the subject and enters the camera lens. In terms of the Leica M 5 this means: Take special note of the area of the subject which is included in the exposure measurement field of the viewefinder.