All about camera lenses

Leitz Leica

E. LEITZ, INC.

CONTENTS

ALL ABOUT CAMERA LENSES

In the first part of this review, subjects concerning camera lenses in general are discussed. The second part outlines the optical design, performance and application of individual lenses in the LEICA (rangefinder) and LEICAFLEX SL (single lens reflex) camera systems.

(1) IMAGE QUALITY

Optimum correction of a photographic lens is possible only for a specific focusing range which depends on the principal use to which the lens is applied. Normally, photographic lenses are corrected for long focusing distances (=∞). Depending on the type of lens, a slight deterioration of performance will be noticed in the close-focusing range. However, performance can be considerably improved if the lens is appropriately stopped down in the close-focusing range.

Special lenses for process work, enlargers and macrophotography have optimum corrections for their main fields of application.

In addition, optimum correction for a specific focusing range can be obtained for infinity-corrected lenses by the use of matched close-focusing attachments (e.g., the Leitz ELPRO achromatic attachments for the LEICAFLEX).

The lens and its associated close-focusing attachment will then become a new optical system of optimum correction for the focusing range required.

(2) LENS DESIGN

In a lens of conventional design, the intercept distance (distance between the vertex of the rear lens and the focal plane) is always shorter than the focal length. The exceptions to this rule are as follows:

a) So-called Retro-focus Types:
Wide-angle lenses for the LEICAFLEX are members of this class. The intercept distance is considerably longer than the focal length, making possible a longer free distance between the rear element of the lens and the film plane. . . necessary for single lens reflex cameras because of the mirror function. The optical design is more complicated than in conventional lenses.

b) So-called Genuine Telephoto Lens Types:
Their intercept distance is considerably shorter than the focal length (e.g., 90mm TELE-ELMARIT compared with 90mm ELMARIT). This results in a shorter total length of the lens.

Here too, the optical design is more complicated than in conventional cases. It must be remembered that not all so-called telephoto lenses are really true telephoto types.

c) An even shorter overall length than that of the telephoto types can be achieved with mirror lenses. They are, therefore, used for extremely long focal lengths, but their diameter is larger and they have the disadvantage that they cannot be stopped down. Gray filters have to be used to allow for different object brightness. As a result, depth of field cannot be influenced.

Mirror lenses, therefore, only form a sharp image of the object plane focused within the depth of field range corresponding to their rated aperture. Objects outside the depth of field zone exhibit annular figures of confusion instead of point-shaped circles of confusion. This constitutes a further disadvantage of such lenses.

(3) ANGLE OF FIELD

The angles of field of lenses in the Leitz product line refer to the format diagonal when a lens is focused on infinity. Field coverage becomes narrower when the object approaches the camera (reduction of the field).

The image outlines in the LEICA viewfinder are always matched for the minimum focusing distance:

	35mm frame	50mm frame	90mm frame	135mm frame
LEICA M2/M4	28″	39″	39″	5′
M3	39″	39″	39″	5′

The LEICAFLEX viewfinder outlines a format of 23 x 35mm. This means that the cardboard-mounted slide format is fully covered.

(4) COLOR RENDERING

Types of glass, number of elements, cementing and lens coating all affect the spectral transmission and, therefore, the color rendition of a lens.

Because they incorporate modern, highly refractive glasses, Leitz lenses transmit hardly any UV radiation. In addition, we use an UV-attenuating Absorban film coating, enabling us to standardize the color reproduction in all Leitz lenses.

A UVA filter for current Leitz lenses merely has the function of protecting the front member. It should not be used when light sources are in the picture area (e.g., night pictures) because of the increased risk of reflection.

(5) PROGRESS IN LENS DESIGN

The present high level of performance of Leitz lenses has been made possible by the introduction of new optical glasses of extremely high refractive indices. Using these new glass formulations, we can reduce the number of necessary elements while increasing performance (e.g., the new SUMMICRON lens has one element less than its predecessor). Another important point is that when highly refractive glasses are used, the length of the lens can be reduced; as a result, the risk of vignetting is slighter (see point 16).

(6) QUALITY RATING

The performance of a lens must be judged from many points of view. Publications of resolving power ratings have no generally valid significance, since final picture quality is affected by the contrast of the subject photographed, by the type of film used and its processing. Resolving power ratings merely give relations within a test and are not accepted by experts as valid performance criteria.

To form a reasonably reliable judgement of lens quality, a number of facts must be known:

a) Intended uses of the lens, e.g., for general photography, enlargement, reproduction, macrophotography, etc.

b) General contrast rendering. This determines the brilliance of the picture as a whole, and, in color photography, color saturation and color differentiation. Contrast rendering is also responsible for the sharpness of the entire picture.

c) Resolving power. This indicates the rendering of fine detail, but also depends on contrast rendering: only the contrast decides whether the eye can resolve the boundaries between bright and dark lines.

(7) INFRA-RED INDEX

For infra-red pictures, a lens must not be focused on the engraved distance index. The long-wave, infra-red rays have a more distant focal point than the visible rays, so that the helical mount of a lens must be turned out slightly further.

In the past, the focusing scale of lenses included an infra-red index. Today this is no longer so, because infra-red materials are sensitized and filters are designed for different wavelengths – so that a generally valid infra-red index can no longer be used.

(8) CLOSE-FOCUSING RANGE – EXPOSURE FACTORS

The close-focusing range can be covered by two factors:

a) Lens extension. The film plane to lens extension determines the scale of reproduction based on optical laws. Additional extension reduces the effective lens speed. In practice, exposure factors must therefore be allowed from the ratio of 1:5 onwards. With conventional lenses (entry: exit pupil ratio = 1:1 – see point 10), the exposure factor is calculated according to the formula:

$$(\text{Reproduction Ratio} + 1)^2$$

b) Optical attachments. In principle, a close-up attachment works like a magnifier, forming an enlarged image of the object from a shorter viewing distance without introducing an exposure factor.

Simple front lens attachments adversely affect the performance of a lens. The Leitz ELPRO front lens attachments consist of two cemented elements matched for the camera lenses with which they are to be used and maintain image quality even within the close-up range.

(9) OPTIMUM APERTURE

This is the lens stop at which lens performance is at its best. It is judged above all according to contrast and uniform sharpness distribution. The uses for which the lens is designed play a decisive part. In available-light photography, for instance, contrast certainly plays the more important part, whereas for reproduction work, stress is on optimum detail rendering. Performance deteriorates when diffraction effects become significant, from f/16 and smaller stops.

(10) ENTRY-EXIT PUPIL RATIO

Normally, the slightly closed diaphragm of a lens appears at equal size when it is viewed from the front (entry pupil) and the back (exit pupil). Here then, the entry-exit pupil ratio will be 1:1.

Depending on the design and position of the diaphragm within a lens, the entry-exit pupil ratio may assume different values. If the diameter of the entry pupil is clearly larger than the exit pupil, the lens will be a telephoto type. If it is smaller, it will be a retro-focus type.

The entry-exit pupil ratio enters the formula for the calculation of the exposure factors in the close-focusing range and must, therefore, be allowed for when its value strongly diverges from 1. Here is the precise formula:

$$EF = \left(\frac{\text{Reproduction Ratio}}{PM} + 1\right)^2$$

EF = Exposure factor PM = Pupillary Magnification

(11) DEPTH OF FIELD

The highest definition of a lens will always be found in the focusing plane. In addition, the eye sees the foreground and background in sharp focus as long as the circle of confusion does not exceed a certain diameter, i.e., as long as a point is still seen by the eye as a point.

Leitz depth of field tables are based on a circle of confusion of 1/750" diameter. This value is based on an assumed subsequent enlargement up to 4.8" x 7.2" viewed from a distance of about 10". If the demands are more exacting, e.g., for giant enlargements or projection, a smaller circle of confusion is to be used. Its diameter is reduced to 1/1500" if the lens is stopped down two stops more than indicated in the table or on the depth of field ring. (e.g., stop down to f/11 if the reading is f/5.6).

The extent of the depth of field depends on the focal length of the lens and the distance (reproduction ratio). It increases as the lens is stopped down. Stops smaller than f/16 are not recommended because general sharpness will suffer from diffraction effects. In the close-focusing range, smaller stops are often used because depth of field is more important than ultimate resolution.

(12) ZOOM LENSES

The main advantage of these systems is in the continuous adjustment of their focal length. This is most evident with color reversal film (frame-filling treatment of the subject). In black and white techniques, this can partly be compensated for in an enlarger. But performance of zoom lenses as we know them today is not considered equal to that of good lenses of fixed focal length. To improve their quality would require more complicated designs, and therefore larger dimensions.

(13) ENLARGEMENT QUALITY

A 2.8" x 4" enlargement is not very strong evidence of the performance of a lens. A better method is inspection of the negative with a 5x magnifier (any 50mm camera lens is suitable for this purpose). For fully valid comparisons, at least good 8" x 10" enlargements are necessary.

Many unsharp pictures are the result of faulty handling and camera motion. A poor or old lens in an enlarger also produces bad results. The same applies to the assessment of color transparencies. The quality of a lens can be utilized fully only if the enlargements, too, are made with first-class lenses, or if transparencies are projected on a first-class projector.

(14) LENS COATING

Coating improves contrast rendering, light transmission and the color character (see color rendering) of a lens.

Reflections from the surfaces of the various elements (and therefore loss of light), as well as color degradation and contrast reduction are largely eliminated.

A coated lens surface is recognized by a slight tint, with certain color shifts depending on the thickness of the evaporated film (see point 4).

(15) DISTORTION – CONVERGING LINES – PERSPECTIVES

a) Distortion is the change of a geometrical form by the lens which can be recognized in the picture, e.g., the pincushion or barrel deformation of an oblong. The larger the angle of field of a lens, the more complicated measures have to be taken to reduce these optical aberrations to a tolerable level. All Leitz wide-angle lenses are corrected so that they are practically free from distortion for the purpose for which they are intended.

b) Converging lines occur whenever the camera is tilted upwards or downwards during the exposure and are particularly prominent with short focal length lenses. Pictures containing converging lines can, however, be corrected in the enlarger.

c) Perspective distortion has nothing to do with lens correction. It occurs when wide-angle lenses are used at short camera distances. According to the laws of central projection, the perspective is perfect, but the eye is completely unaccustomed to this effect.

(16) VIGNETTING

Vignetting is the more or less pronounced darkening of a picture towards the corners. The extent of vignetting depends, among other things, on the exposure and the exposure latitude of the film material used. We distinguish between:

a) Natural vignetting. This occurs above all with wide-angle lenses, due to physical laws, and depends on the angle of field of the lens. With standard lenses (angle of field 45°), this natural loss of light will not be noticeable; however, it becomes more and more prominent as the angle of field increases. New design features of current Leitz lenses have considerably reduced this phenomenon.

b) Artificial vignetting (lens mount vignetting).
This occurs with lenses of wide maximum apertures, and is caused by their large number of elements and the corresponding increase in lens length required. To reduce this effect, large front and rear elements are used and the number of elements reduced as much as possible through the introduction of highly refracting glasses.

Artificial vignetting quickly decreases as the lens is stopped down. For many purposes, such as available-light photography, residual vignetting at large maximum apertures is not particularly disturbing.

Artificial vignetting must be distinguished from that caused by the wrong type of lens hood or other parts mounted in front of the lens. Such vignetting will become more prominent as the lens is stopped down.

It is possible to counteract vignetting in ultra-wide angle lenses (21mm) by using graduated gray filters. Their gray density is stronger in the central field than towards the edges. But, since the degree of vignetting is affected by the aperture, such a graduated filter will be suitable only for a limited range of f/stops.

(17) OPTICAL ATTACHMENTS AND INTERMEDIATE MEMBERS

If a simple front lens, a filter that is not optically corrected, or one-half of a binocular that is not corrected for photographic purposes is mounted on the lens, image quality will be effected. If specially computed optical attachments are used, however, the optical performance of the lens is maintained for the focusing range for which these attachments are designed (as in the ELPRO close-focusing achromats for the LEICAFLEX).

In this context, the lens converter must also be briefly mentioned. The following points should be observed when this accessory is used:

a) The f/numbers of a lens are no longer valid: with a 2x converter – doubling of the focal length – the light loss amounts to two stops.

b) Since a converter cannot have the best possible correction for each camera lens, the lens must be stopped down more in order to ensure satisfactory image quality (f/11 to f/16). As a result, hand-held exposures are generally no longer possible.

LENSES for the LEICA® Rangefinder and LEICAFLEX® Single Lens Reflex Cameras

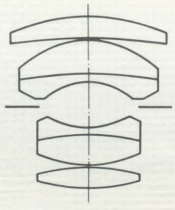
NORMAL FOCAL LENGTH LENSES

The traditional standard focal length for 35mm photography is 50mm. This has a valid reason: When 35mm negatives are enlarged 4 to 5x (i.e., about postcard size to 4.8" x 7.2"), the resulting picture shows natural perspective when viewed from a distance of 10".

50mm NOCTILUX f/1.2 — Catalog No. 11,820

The NOCTILUX is a 6-element Gauss variant with 4 members. In addition to newly developed highly refracting optical glasses, this system incorporates aspherical lens surfaces as a means of correction – a basic innovation in photographic optics. Contrast rendering is high within the entire field of view. Correction for coma is outstanding and freedom from reflection is superior to that of ultra-fast camera lenses.

The NOCTILUX is a special lens for black and white and color photography with ultra-fast films. Even at full aperture f/1.2 in the most extreme exposure conditions, its optical performance is unequalled.

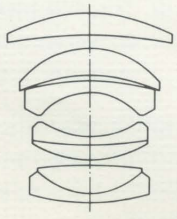


11 820

50mm SUMMILUX f/1.4 — Catalog No. 11,114

The SUMMILUX is a 7-element Gauss variant with 5 members. Excellent correction for coma as well as outstanding contrast rendering and freedom from reflections at full aperture f/1.4 deserve special emphasis.

Although the SUMMILUX is designed above all for exposures in poor lighting conditions, because of its large maximum aperture, it offers excellent general performance, suitable for all purposes within its focusing range. It is not, however, designed for use on close-focusing devices or for reproduction purposes (copy work).



11 114

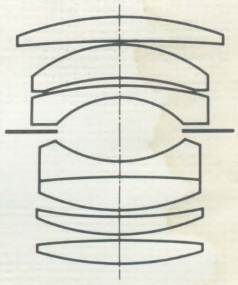
NEW LENS – AVAILABLE EARLY 1971

50mm SUMMILUX-R f/1.4 — Catalog No. 11,875

This is the fastest normal focal length LEICAFLEX lens available. As a standard focal length, it is a universal lens with the additional versatility of extreme maximum aperture. Image performance and contrast are exceptionally high at full aperture and further increase on stopping down to f/2 to 2.8. With its outstanding overall definition in all distance ranges, this should become the preferred lens for sports, feature and available-light photography. In addition, the largest aperture (a real f/1.4) offers special creative scope with selective focusing, i.e., restricted depth of field.

The SUMMILUX-R is remarkably free from flare, so that even strong light sources in the picture itself cause neither ghost images nor loss of background detail. Coma – often a nuisance with high-speed lenses – is practically eliminated.

This lens uses highly refractive glasses and is a 7-element symmetrical Gauss type. As an ultra-speed standard lens for the LEICAFLEX, it is primarily intended for photography in poor light. But in spite of the greater back focus required to accommodate the LEICAFLEX mirror system, lens definition at full aperture is comparable with that of the 50mm SUMMILUX f/1.4 lens for the LEICA.



11 875

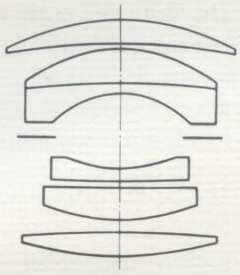
50mm SUMMICRON f/2 (new computation) — Catalog No. 11,817

This lens is a 6-element Gauss variant with 5 members. Although it has one less element than the SUMMICRON manufactured previously, improvement in performance made possible by a new computation is remarkable, above all at full aperture: contrast is greater, curvature of field improved, and vignetting in the corners of the picture is negligible. Within the close-focusing range down to 28" object distance (minimum focusing distance through the measuring viewfinder), the image quality of this new lens is improved at its optimum aperture f/5.6.

Its light weight (approx. 9 ozs.), in spite of its very rugged mount, is very convenient. The 50mm SUMMICRON f/2 is also ideally suitable as an enlarging lens for large-format prints.

Note: "R" indicates lens is for the LEICAFLEX.
Absense of "R" indicates lens is for the LEICA.

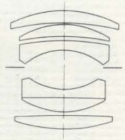
11 817



50mm SUMMICRON-R f/2 — Catalog No. 11,228

This lens is a Gauss variant, consisting of 6 elements and 5 members. High contrast, good resolving power, and excellent flattening of the entire field of view add up to outstanding general performance. High picture quality at full aperture f/2 is particularly fascinating. When Leitz ELPRO close-focusing achromats are attached, performance is preserved within the close-focusing range. The viewfinder magnification of the LEICAFLEX is 0.9x; the viewfinder image is, therefore, almost natural size.

11 228

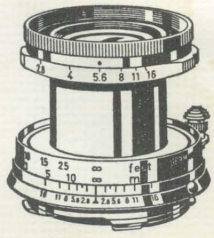


50mm ELMAR f/2.8 — Catalog No. 11,112

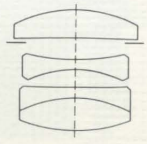
The ELMAR is a 4-element triplet variant. Optimum image quality and contrast are obtained at f/4 to 5.6. When stopped down, it is very applicable for macrophotography.

The cemented Absorban film guarantees color rendering matched to that of Leitz lenses with more elements. It is, therefore, not a "cold lens" like the old types of ELMAR.

Sales figures show that even in this age of ultra-fast lenses, the 50mm ELMAR f/2.8 is still very popular today. Its outstanding advantages are moderate price and light weight. It can also be very successfully used as an enlarging and copying lens.



11 112



65mm ELMAR f/3.5 (new computation) — Catalog No. 11,162

Like the 50mm ELMAR, this lens is a 4-element triplet. Compared with the previous computation, it is slightly shorter and contrast performance and detail rendering are considerably improved. It is a special lens for the VISOFLEX III reflex housing for LEICA M rangefinder cameras, used preferably for subjects within the close-focusing and macro range, but it is also suitable for distances up to infinity. The brilliant image permits rapid and accurate focusing on the VISOFLEX groundglass screen.

Because of its relatively short focal length, it is also ideal for copying in combination with the Leitz copying stand.

11 162

SHORT FOCAL LENGTH LENSES
(Wide-angle Lenses)

The most popular short focal length lens is 35mm. It covers an angle of field which is about 50% wider than that of a normal 50mm lens. A considerable advantage of these systems is their greater depth of field at a given object distance, making them most suitable for dynamic photography (with fixed-focus setting). Sometimes a characteristic of short focal length lenses is vignetting. Because of the wide angle of coverage, a lens hood has only limited effectiveness and it is, therefore, necessary to pay close attention to light sources at the edges of the object field.

In addition to photography of moving objects, short focal length lenses are particularly suitable for large area coverage and for architectural photography. The large foreground gives pictures a good spatial effect (3-dimensional).

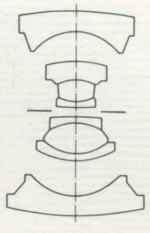
The measuring viewfinder principle of the LEICA rangefinder camera is unsurpassed for critical focusing of wide-angle lenses. On the focusing screen of a single lens reflex camera, however, focusing is not quite as positive as with longer focal length lenses because of the increased depth of field.

The advantages of a wide-angle lens in a single lens reflex camera (LEICAFLEX) compared with in a rangefinder camera (LEICA) are the through-the-lens viewing image and freedom from parallax.

21mm SUPER-ANGULON f/3.4 Catalog No. 11,103

This lens has 8 elements and 4 members. Compared with its predecessor, image illumination is even more uniform at medium f/stops; image quality is also excellent at the close-focusing range. The lens is practically free from distortion. Its applications are the same as those indicated for the corresponding reflex lens above.

11 103



21mm SUPER-ANGULON-R f/4 Catalog No. 11,813

This retro-focus lens for the LEICAFLEX has 10 elements and 8 members. Due to the long intercept distance, the image can be observed through the reflex finder. At full aperture, the image has good contrast and detail rendering.

Quality is improved when the lens is stopped down. At f/22 performance suffers slightly from diffraction effects. Within the close-focusing range from 16" to 9", the lens should be stopped down to at least f/11.

The favorable position of the exit pupil illuminates the picture more evenly at medium apertures than its predecessor did. Strong light sources within the picture area may cause reflections. The lens is free from pincushion and barrel distortion which are often noticeable with other ultra-wide angle lenses.

The SUPER-ANGULON is an ultra-wide angle lens for architectural photography as well as reportages with astonishing impact – provided it is used correctly. The angle of field at 92° is more than twice that of a 50mm lens. Because of this and the extremely great depth of field, pictures of unusual perspective can be obtained. At short camera distances, foreground objects are exaggerated in size in relation to a rapidly diminishing background.

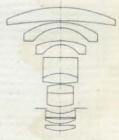
SUPER-ANGULON lenses are eminently suitable for photographing architectural models. The following basic rules should be observed:

a) Extremely powerful light sources in the picture area should be avoided.

b) Attention should be paid to converging lines.

c) The outside lens elements must be kept clean.

d) Perspective distortion at the edges of the picture at close distances should be observed.

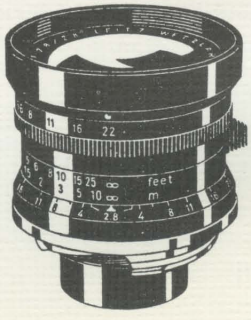


11 813

28mm ELMARIT f/2.8 Catalog No. 11,801
(new from mid-1969)

This wide-angle lens consists of 8 elements and 6 members. It has been newly computed to provide a slightly longer intercept distance. General performance is good throughout its entire range of applications, and from f/4 onwards, contrast increases. Beyond f/16, performance suffers slightly from diffraction effects.

This handy and very powerful special wide-angle lens is also suitable for unusual photography of moving objects. Because of its very wide angle of field and comparatively high speed of f/2.8, it is particularly popular among press photographers, since it covers a large area even within the most confined space. And with its great depth of field, focusing need not be too critical. In addition, of course, this wide-angle lens is most suitable for landscape and architectural photography.



11 801

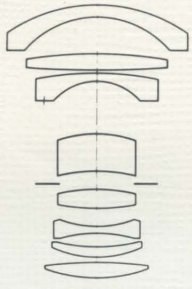
NEW LENS – AVAILABLE EARLY 1971
28mm ELMARIT-R f/2.8 — Catalog No. 11,204

This new ultra-wide angle lens for the LEICAFLEX is not only exceptionally fast for its focal length, but also unusually compact. It is only a little over 1.5'' long and weighs only 9.25 ozs. Image definition is excellent over the whole field and the lens reaches its optimum performance at f/4 to 5.6 for distances between infinity and 3.5'.

It is of special value for feature photography in confined spaces – indoors or out – for architectural photography and for unusual perspective effects in creative publicity. The extreme angle of view with high speed and outstanding performance at full aperture make this lens particularly suitable for all these applications. And its remarkable freedom from vignetting (for an angle of this order) makes the 28mm ELMARIT-R an excellent lens for wide-angle color photography.

The system shows remarkable freedom from flare to yield brilliant and irradiation-free images even with high contrast subjects. In color shots this means more saturated colors and greater color differentiation in the shadows. The lens is, therefore, outstanding for available light photography and for shots with bright light sources in the image field – still at full aperture. All this makes the 28mm ELMARIT-R f/2.8 one of the most important working lenses, not just for the professional but for the amateur as well.

11 204

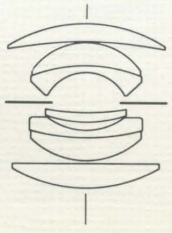


35mm SUMMILUX f/1.4 — Catalog No. 11,870

This lens is a Gauss variant with 7 elements and 5 members. Even at full aperture f/1.4, optical performance is remarkable. Sharpness balanced right to the corners of the picture is striking. When stopped down to medium values, the lens produces good contrast throughout the entire picture.

At given f/stops its performance equals that of the 35mm SUMMICRON f/2. But its larger maximum aperture provides the 35mm SUMMILUX with an additional light reserve for photography in poor lighting conditions. At full aperture, the danger of reflections produced by powerful light sources along the edge of the object field should be observed.

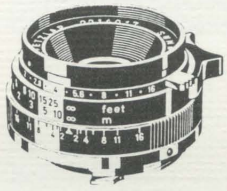
11 870



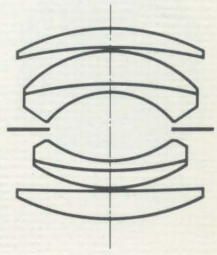
35mm SUMMICRON f/2 — Catalog No. 11,309
(new from mid 1969)

Its shorter length (43.16mm, previously 50.47mm) has made this 6-element modified Gauss lens even handier. It produces a contrastier image than its predecessor even at full aperture throughout the entire focusing range from infinity to 28''. Vignetting at f/2 to f/4 is negligible, which is especially favorable in color photography. Photographs of objects of high luminous density in the center of the picture exhibit hardly any flare.

Together with the 50mm SUMMICRON and one of the 90mm lenses, the 35mm SUMMICRON forms the backbone of the LEICA lens system.



11 309

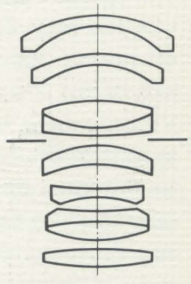


NEW LENS – AVAILABLE EARLY 1971
35mm SUMMICRON-R f/2 — Catalog No. 11,227

The new SUMMICRON-R f/2 is the fastest wide-angle lens for the LEICAFLEX and is especially suitable for live color shots in poor light. It is an excellent lens for night shots. Strong light sources in the field of view cause no trouble, because it is flare-free even at maximum aperture. Performance is fully on a par with the SUMMICRON lenses for the LEICA, with outstanding definition and image quality. Image illumination is very uniform – important for color shots of large subject areas.

This is the top lens among fast wide-angle systems for single lens reflex cameras.

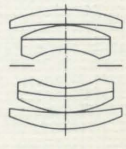
11 227



35mm SUMMARON f/2.8 — Catalog No. 11,306

This Gauss type of short length has 6 elements and 4 members. The slight fall off towards the picture corners at full aperture disappears when the lens is stopped down. Optimum image quality is obtained between f/5.6 and 8.

11 306

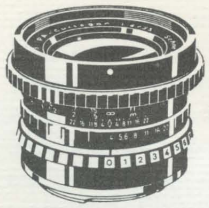


35mm ELMARIT-R f/2.8 Catalog No. 11,201

The ELMARIT-R is a retro-focus type consisting of 7 elements and 5 members. The viewfinder magnification in the LEICAFLEX is 0.6x (LEICA M4 - 0.7x). The lens illuminates the viewfinder image of the camera perfectly, and already at full aperture shows good contrast and good resolving power in the central picture area. When the lens is stopped down, image quality in the corners will be improved. In practice, for the close-focusing range below 40", the lens should be stopped down, if possible, to f/11.

Like all retro-focus systems, this lens is less suitable for copy work.

11 201



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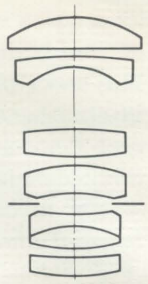


NEW LENS – AVAILABLE EARLY 1971

35mm PA-CURTAGON-R f/4 Catalog No. 11,202

This is a special wide-angle lens with parallel displacement to avoid converging verticals. It gives the LEICAFLEX some of the scope of a viewfinder camera with lens displacements and is, therefore, particularly useful for architectural photography and similar applications. It is, in fact, a lens with a built-in "rising front" in any direction.

The optical "secret" behind the PA-CURTAGON-R is that the lens has been corrected to cover a larger angle than required for normal 35mm lenses. With this extra coverage, the optical axis of the lens can be decentered in any direction up to 7mm. You mount it on the camera like any other interchangeable lens; then the front part can be moved up, down or sideways. In this way, the LEICAFLEX can take in tall buildings without having to tilt the camera, while you avoid converging verticals and eliminate undesirable foreground subjects. In effect, it is an ultra-wide angle lens with an even bigger angle than the 28mm ELMARIT-R; you cover any part of the ultra-wide angle view you want to by laterally moving the lens.

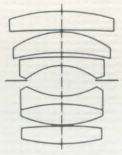
In addition to architectural and industrial photography, this displaceable lens also offers many possibilities for perspective control. The field of view, including the change in the image field obtained by displacing the optical axis, is directly observable through the LEICAFLEX viewfinder. With its focal length of 35mm and an image field of 57mm diameter, the PA-CURTAGON-R has an effective image angle of 78°. The optical system is built into a helical focusing mount to cover distances from infinity to 12", measured from the film plane!

LONG FOCAL LENGTH LENSES

In 35mm photography, the long focal length starts at 90mm. Long focal length lenses "pull the picture in." This means at the same ratio of reproduction the longer the focal length, the shorter will be the distance between foreground and background in the picture. Longer focal lengths concentrate the eye on the important features of a picture. This is of particular significance for color transparencies, where picture area cannot be subsequently corrected. With ultra-long focal lengths, picture quality may suffer due to atmospheric conditions and under certain weather conditions.

90mm SUMMICRON f/2 — Catalog No. 11,123

This lens is a variant of the Gauss type. It has 6 elements and 5 members. Excellent sharpness rendering and good contrast even at full aperture are remarkable. It is practically free from flare. When stopped down to f/2.8, detail rendering in the entire picture area is further improved and excellent total performance obtained.

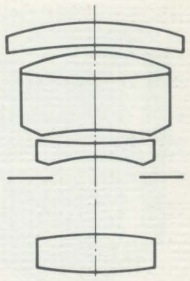


11 123

NEW LENS – AVAILABLE EARLY 1971
90mm SUMMICRON-R f/2 — Catalog No. 11,219

The 90mm SUMMICRON-R f/2 brings high lens speed into the medium long focus LEICAFLEX lens range. At the same time, it is a high performance lens of remarkably handy dimensions – with an overall length of approximately 2.4" it is hardly larger than the standard 50mm SUMMICRON-R. In performance, it closely resembles the famous LEICA lens of the same focal length, with outstanding resolving power and high contrast reproduction (i.e., a very favorable contrast transfer function, in terms of current scientific criterion). It goes without saying that this makes the lens particularly useful for available light photography.

The 90mm SUMMICRON-R is a 5-element system and focuses down to 28" with the smallest subject field of approximately 5.75" x 8.5".

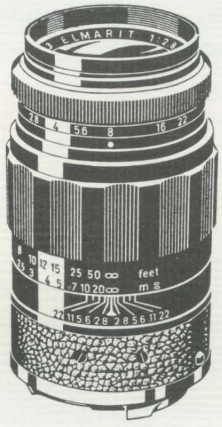


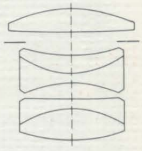
11 219

90mm ELMARIT f/2.8 — Catalog No. 11,129

This triplet variant has 5 elements and 3 members. It is characterized by good resolving power at full aperture and optimum brilliance at f/4. At close distances, in order to have sufficient depth of field, the lens should be stopped down.

The ELMARIT is the most universal 90mm lens in the M system. It is handy, light (11 ozs.) and moderately priced. It can be used on the VISOFLEX and the Universal Focusing Bellows II and produces brilliant pictures within the entire working range. It is a popular portrait lens at full aperture.





11 129

90mm ELMARIT-R f/2.8 — Catalog No. 11,239

The ELMARIT-R is a variant of the Gauss type; it consists of 5 elements and 4 members. Even at full aperture its performance is excellent. It has good contrast and sharpness into the corners, with an optimum aperture of f/4. In combination with close-focusing achromats, image quality is maintained right into the close-focusing range of 1:3.

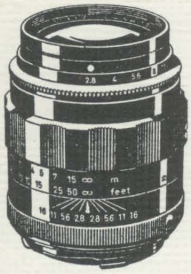
The 90mm ELMARIT-R could be classed as the standard LEICAFLEX lens. It is from this focal length that the single lens reflex camera really comes into its own. If you value a snapshot lens and good pictorial composition in the viewfinder, you should have this lens for your LEICAFLEX. It is handy and can be rapidly and accurately focused because of the larger measuring base. (The viewfinder magnification in the LEICAFLEX is 1.5x; in the M4, 0.7x.) The effective measuring base is 28.5mm (M4, 48mm). Excellent optical performance even at full aperture f/2.8 makes the ELMARIT-R a brilliant reportage lens, even for work in poor lighting conditions.

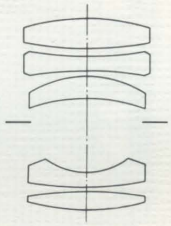
11 239

90mm TELE-ELMARIT f/2.8 Catalog No. 11,800

This true telephoto lens has 5 uncemented elements, and is quite short (only 2.375" compared with 3.75" of the standard 90mm ELMARIT). It can, therefore, be carried in an ever-ready case (without lens hood). From f/4 onwards, a slight fall-off at the corners is no longer noticeable. Like all true telephoto lenses, it is less suitable for work within the close-focusing range (Stop down!). The lens head cannot be unscrewed.

The TELE-ELMARIT is a typical reportage lens of longer focal length. Because of its short construction, it is particularly handy. Even relatively slow shutter speeds can still be used with the camera hand-held.





11 800

100mm MACRO-ELMAR f/4 Catalog No. 11,230

This 4 element, 3 member triplet variant of the ELMAR type has been computed for a reproduction ratio of 1:8. It is, therefore, a macro lens with superior optical performance within a very large working range. In the Universal Focusing Bellows-R, it can be focused from infinity to 1:1. When stopped down to f/5.6 or 8, a further increase in contrast and image quality occurs.

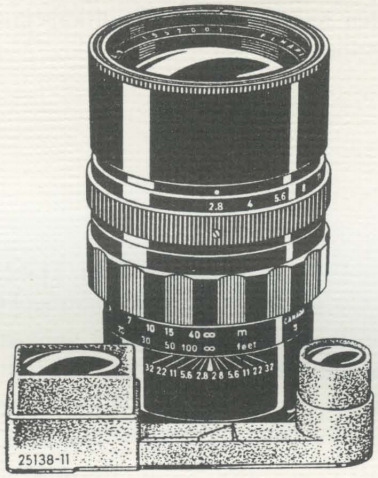
In combination with the Universal Focusing Bellows-R and the semi-automatic diaphragm, this lens is ideal for medium close-ups and macrophotography including live subjects.

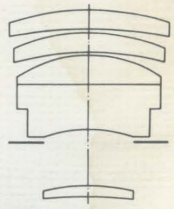
11 230

135mm ELMARIT f/2.8 Catalog No. 11,829

In construction and performance, this lens is like the 135mm ELMARIT-R. The viewfinder attachment not only permits the use of the larger viewfinder frame of the 90mm lens, but also increases the measuring accuracy by a factor of about 1.4x.

The decisive advantages of this lens are the enlarged viewfinder image and increased measuring accuracy, making it possible to work very quickly even in poor lighting conditions.



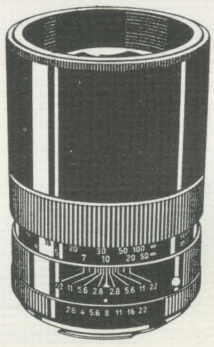


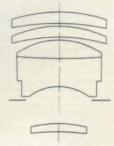
11 829

135mm ELMARIT-R f/2.8 Catalog No. 11,211

This long focal length lens of short design has 5 elements and 4 members. Its very good resolving power at full aperture reaches optimum performance at f/4. Excellent image quality also at close distances and little flare from objects of high luminous density in front of a dark surrounding field are remarkable at full aperture f/2.8.

The viewfinder magnification in the LEICAFLEX is 2.3x (M4 with 135mm ELMARIT f/2.8 with viewfinder attachment - 1x), and the effective measuring base is 64mm (M4 - 67mm). This produces very high focusing reliability in addition to an impressive viewfinder image in the LEICAFLEX. Although compared with the 90mm ELMARIT-R, the 135 ELMARIT-R f/2.8 is slightly larger and heavier, the difference in focal length offers advantages in its application. At close focusing distances, this lens offers a long free working distance which is especially advantageous when photographing small living subjects.

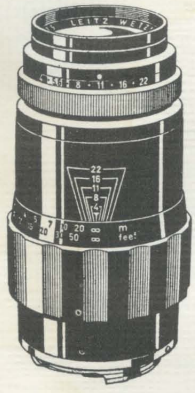


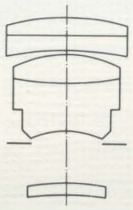


11 211

135mm TELE-ELMAR f/4 — Catalog No. 11,851

Like the R lens, this too is of short design, compared with its focal length (4.25" mechanical length). It has 5 elements and 3 members, and is remarkable for its excellent optical performance right into the corners of the picture. Stopping down does not produce any further improvement. This makes the 135mm TELE-ELMAR a snapshot lens of long focal length, which because of its handy size and light weight, is most convenient to carry about. The lens should be stopped down further only to achieve sufficient depth of field at close distances.



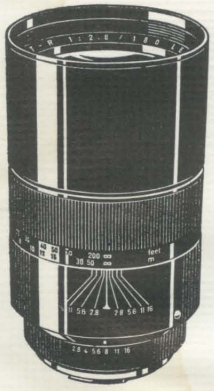


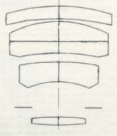
11 851

180mm ELMARIT-R f/2.8 — Catalog No. 11,919

The ELMARIT-R is a telephoto system with 5 elements and 4 members. Even at full aperture f/2.8, it offers uniform performance and very good contrast. When stopped down to f/4, optimum image quality is achieved. The viewfinder magnification is 3x, the effective measuring base 98mm.

Because of the bright LEICAFLEX viewfinder and the large maximum aperture, this lens can be used very effectively even in poor lighting conditions. Its long vocal length and automatic diaphragm permit one to photograph unobtrusively from a long distance. High viewfinder magnification and good contrast permit critical and rapid focusing.



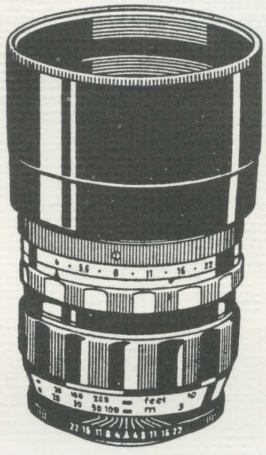


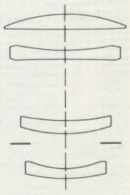
11 919

200mm TELYT f/4 — Catalog No. 11,063

This true telephoto lens has 4 uncemented elements. It produces a very flat field, and at full aperture sharpness distribution is uniform; however, image quality improves when stopped down to f/5.6.

The TELYT is a handy long-distance lens which, together with an adapter ring, can also be used for the close-focusing range. The risk of camera movement is greater with long focal length lenses. At shutter speeds slower than 1/125 sec., the lens should be supported by a tripod or other means of steadying.



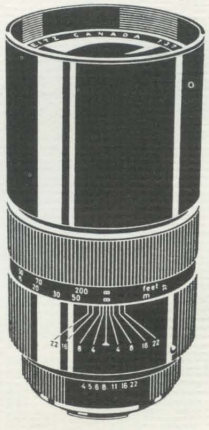


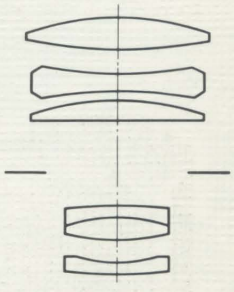
11 063

NEW LENS – AVAILABLE EARLY 1971
250mm TELYT-R f/4 — Catalog No. 11,920

The new 250mm TELYT-R is unique in a number of respects. First, it becomes the longest focal length LEICAFLEX lens with automatic aperture control, and, with the through-the-lens metering system of the LEICAFLEX-SL, offers full aperture readings. Apart from that, it is a comparatively fast long focus lens of true telephoto design. This means a short overall length so that it can still carry automatic aperture preselection.

Its obvious application is in long-distance feature photography, architectural details, wildlife, etc. The image scale is 5 times as large as that of the standard 50mm lens; high image magnification in the finder and high contrast on the brilliant LEICAFLEX reflex screen permit precise and rapid focusing even in poor light. The 250mm TELYT-R performs singularly well at full aperture and reaches optimum at f/5.6.

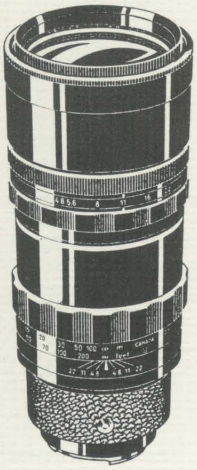


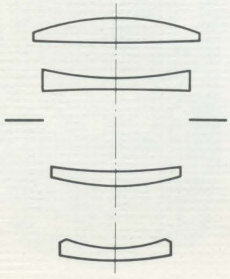


11 920

280mm TELYT f/4.8 — Catalog No. 11,914

This, too, is a true telephoto lens with 4 uncemented elements and pre-set diaphragm. High contrast and excellent definition are evident when focusing on the groundglass screen of the VISOFLEX. Optimum performance is at f/5.6. Quality is outstanding in the close-focusing range. Because of its good contrast rendering, the lens can be rapidly and critically focused.



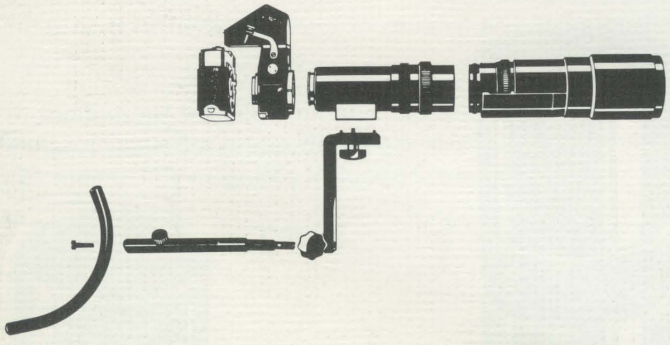


11 914

400mm TELYT f/6.8 for VISOFLEX — Catalog No. 11,966
(Rapid Action Lens) for LEICAFLEX — Catalog No. 11,960

This lens is a modification of the 400mm f/5.6. It is considerably lighter (about 2 lbs.). Its performance equals that of the 400mm TELYT f/5.6 at comparable apertures.

Its advantages lie clearly in its light weight, moderate price and ease of handling. In combination with fast films, it is an ideal reportage lens of ultra-long focal length, which can be carried around conveniently everywhere. If one does not require the versatility of the TELEVIT which accepts 280, 400 and 560mm lenses, the 400mm TELYT f/6.8 is a very practical all-around telephoto lens.

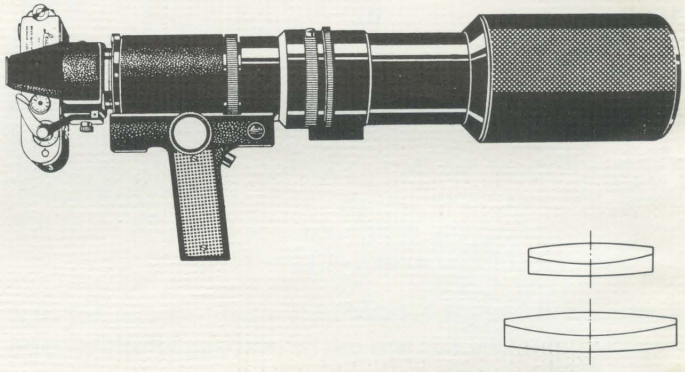


400mm TELYT f/5.6 — Catalog No. 11,866
560mm TELYT f/5.6 — Catalog No. 11,867
(with Televit Rapid Focusing Device)

These lenses are two-element achromats which perform remarkably at full aperture. Contrast and resolving power are very good and improve further as the lenses are stopped down.

Because of their small number of elements, achromats are relatively light and produce very contrasty images. This is important with long distance shots which are usually poor in contrast; it also improves picture quality and speed of focusing. With slower shutter speeds below 1/125 sec., a tripod or other means of support should be used to reduce camera movement. In certain weather conditions, rising heat waves can influence image quality. This has nothing to do with the optical correction of the lens, which is sometimes mistakenly blamed for this effect.

At large apertures, long focal length achromats should be focused not on the center of the picture, but should be averaged because of the slight residual curvature of field.



NEW LENS – PROTOTYPE – AVAILABLE 1972
800mm LEITZ f/6.3
(for Extreme Distance Photography)

For a long time, 400mm was the longest focal length in the LEICA and LEICAFLEX lens range; then about three years ago we introduced a 560mm lens. Now we are about to launch an unusually long focus system which is remarkably fast for its focal length: an 800mm f/6.3.

The new prototype will be available in time for the 1972 Olympic Games. Unlike most long focus lenses in this category which are mirror optical units, the 800mm is a glass system, and therefore – unlike mirror lenses – can be stopped down in the normal way with an iris diaphragm with no lost aperture angle or abnormal reproduction of unsharp image areas.

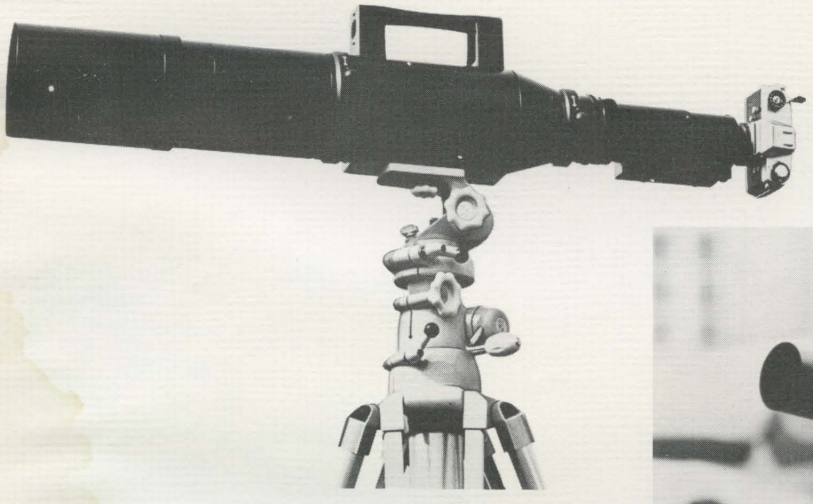
To appreciate this achievement it must be realized that lens systems of extremely long focal length are very difficult to develop. Residual color aberrations become more prominent with increasing focal length and the most modern way of correcting them is to use crystalline optical media. The drawbacks of such crystals is that they are chemically unstable and very sensitive to damage; in particular, their relatively high coefficient of thermal expansion makes them less suitable for large lenses.

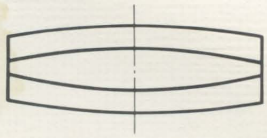
The Ernst Leitz Glass Laboratory in Wetzlar carried on extensive research to produce various glasses of extreme optical characteristics. One result is a special glass closely resembling certain crystalline materials, but without their unfavorable properties. This special glass is mechanically and thermally stable and easy to work. With it, we designed a 3-element, 800mm lens of completely new image performance standard.

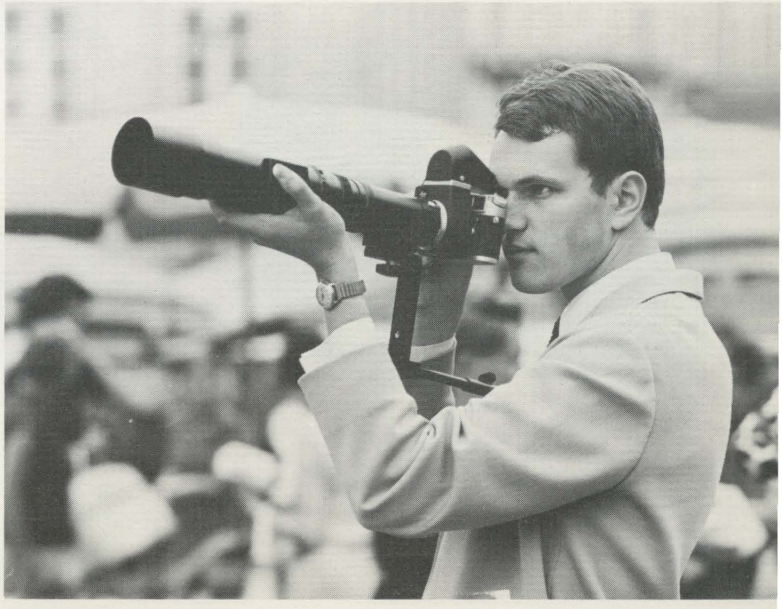
For the technically interested: A greatly reduced secondary spectrum not only gives this lens virtually apochromatic correction (negligible focus deviation in all three main bands of the spectrum), but, in fact, an overall optical performance even superior to normal apochromats. Residual aberrations and unsharpness were reduced to less than one-third of the values which are accepted with normal glasses. The result is improved contrast, detail resolution and color differentiation.

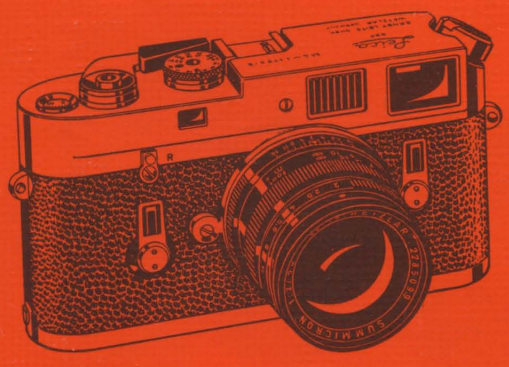
The new 800mm LEITZ prototype f/6.3 consists of 3 cemented lenses, with only 2 glass/air surfaces (coated, of course). As the lenses are relatively thin, light transmission of the system is exceptionally high. This, plus the reduced effect of light scatter, is particularly important when photographing very distant subjects where the image contrast is already reduced by atmospheric effects. The lens construction also uses far less glass than multi-lens systems. This concentration of high image illumination means shorter exposure times than for complex tele lenses with the same nominal aperture.

The 800mm is, of course, not just an experiment, but a development to fill a practical need. It is a special lens for the specialist photographer. With its 16-fold magnification (compared with the standard 50mm lens), it spans extreme distances to bring in picture subjects really close. At the same time, it compresses the image perspective of subjects at different distances – the typical telephoto effect which experienced photographers deliberately use for creative work.









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