

CAMERA REVIEW

The Exakta System



Part 1: The Camera Reviewed by Geoffrey W. Crawley

IT IS possible to trace the genesis of the modern Exakta back to immediately after the first World War when Ihagee brought out a roll-film box single-lens reflex—the Paff—with Waterhouse stops and a simple shutter. A period of about six years then elapsed before the introduction of an improved camera, with focusing anastigmat and focal-plane shutter. Three years later there appeared an advanced folding single lens-reflex with a full range of shutter-speeds and full professional application. The folding movement was on a lazy tongs action similar to that adopted on the Superfekta—a metal precision $3\frac{1}{2} \times 2\frac{1}{4}$ roll-film folding twin-lens reflex with revolving back—an interesting design experiment which seems to have been a cul-de-sac.

In 1933, Ihagee introduced a lever-wind 'miniature single-lens-reflex'—the Exakta. This took roll-film in the 127 format, then being used in some roll-film stereo cameras. The trapezoid shape of the Exakta, which to date remains unique, can in fact best be related to then existing designs by looking at the Franke & Heidecke Heidoscop or the later Voigtländer Stereoflektoskop, taking away the stereo lens pair to leave the centre reflex focusing lens and hood, and then sloping the

sides back from this to the camera body. Of the Exakta B, the second model camera, the *BJ Almanac* of 1936 said: 'By an ingenious arrangement utilising a mirror, the focusing screen can be viewed either from above or at eye-level, whilst a straight through eye-level finder is also provided. A magnifier springs automatically into position in the hood. In this model the shutter has been still further improved and now gives Time, Bulb and instantaneous exposures from 1/1000 to 1/25 second, and 1/10 to 6 and 12 seconds, all of which, with the exception of the last—12 seconds—can be used in conjunction with a delayed action mechanism. The shutter and film are wound together, rendering double exposures impossible. The price of the camera with Zeiss Tessar f/2.8, 7.5 cm focus, is £27 10s.'

Of this camera four models were produced, the A, B, C, and the Night-Exakta, which was a modified B for use with ultra fast lenses. In addition, there was the Exakta Junior, a camera whose tradition has been carried on in the 35 mm field by the Exa cameras. Last in the line of the roll-film Exaktas came the Exakta 66 for 12 $2\frac{1}{4}$ in. sq pictures on 120 film, this camera appeared shortly before the last war and was discontinued in 1952. At this point, it is

as well to state that there is considerable discrepancy for the dates given for various Exakta models even in sponsored handbooks; the dates quoted here are established by various cross-references, and should be substantially correct.

Kine-Exakta

It seems probable that that the 127 Exakta was an intermediate stage on the way to a 35 mm SLR, since there are indications that Ihagee had in mind the possibility of such a camera from about the time of the appearance of the Leica in 1925. The Kine-Exakta — so-called because it took cinematographic 35 mm film—appeared in 1936, and the 1937 *BJ Almanac* described it as follows: 'The lens of the Kine-Exakta may be interchanged by means of a bayonet catch arrangement, and each lens is in its own helical focusing mount. By means of a locking device, exposures cannot be made before the focusing hood has been opened, and this discloses the focusing screen, which consists of a plano convex lens, the flat side of which is frosted; further, the picture on the screen is larger than that of the negative and is of size 32×43 mm. There is an auxiliary magnifier for critical focusing. The camera is, of course, daylight loading and takes either the usual film cartridges or special cassettes. The back is completely detachable. By means of a built-in cutting knife the exposed film may be cut off and then removed in a dark-room.'

These descriptions of the original two cameras are important, since they remain essentially valid up to the current (July, 1963) model—the Exakta Vorex 11A. The original use of an enlarged focusing image, if correct, is interesting, as it seems a logical point of design with the smallness of the 24×36 mm image. The pre-war Zeiss Contaflex, the twin-lens 35 mm reflex which appeared almost simultaneously with the Kine-Exakta, gave an enlarged finder image by using an 8 in. f/2.8 Sonnar as the reflex lens. At the time Zeiss Ikon stated: 'The reflex principle does not permit sufficiently accurate focusing of miniature cameras if the finder picture is the same size as the negative, because the details are too small and dispersed by the grain of the screen; besides the depth of focus with short focal length lenses makes exact focusing difficult. A special Sonnar f/2.8 of long focal length, constructed to eliminate depth of focus, has been fitted to the Contaflex and provides a finder picture of double the film picture size.'

The magnification of the finder image in SLRs was eventually left to the fold-

ing magnifier in the waist-level finder, but with the introduction of the eye-level pentaprism it became necessary to find means for more rapid accurate focusing of the small image. The post-war Contaflex of 1953 dispensed with the focusing screen and used a clear screen with centre crossed-prism 'range-finder' focusing, thus abandoning the fine ground screen as a means of overall focusing, in favour of the clear screen's greater brilliance. The use of micro-prisms, too, has helped overcome the difficulty of accurate focusing through a pentaprism. There is some debate as to whether a clear fresnel lens, a ground fresnel lens, or a plano-convex condenser with ground under-surface, or some combination of these with centre-crossed prisms or micro-prisms, gives the most convenient combination of viewing qualities.

The condenser type is the most brilliant, but introduces field distortion which may be annoying in some applications, although in others, distortion tends to throw the subject into bold emphasis. The true flat screen is most interesting to return to after a time, when the eye has become accustomed to the curving given by the condenser type. In the matter of screens the Exakta is unique in having what must be an unrivalled interchangeable range, including most of the permutations and combinations possible today.

Post-war models

In 1949 the Model 11 Exakta was introduced, the camera now had a full screen magnifier in an enclosed hood together with other minor improvements. One alteration quoted as an improvement was the abandoning of the 'inching' facility on the lever wind. This model introduced a clip-on pentaprism — the Zeiss Pentagon — which attached to the waist-level hood, thus establishing a claim to pentaprism priority. In fact the great advance that eye-level finding made in practical application, apart from anything else in overcoming the unsuitability of waist-level finders for vertical format pictures was that in 1951 a new model appeared, the Exakta Varex. The prefix Kine was now dropped and the suffix Varex added to denote the then unique advantage of the ability to vary pentaprism and waist-level finder, and types of focusing screen. X type synchronisation was now built-in, the camera always having had FP type for bulbs. Design ideas came rapidly and the next year, 1952, brought the Varex V.X. The camera was now strengthened considerably structurally by being of one casting thus ensuring the utmost precision between the lens

flange, the film plane and the platform on which the finder focusing screens locate. The camera back hinge now had a removable lynch-pin to permit the back being removed, or interchanged if desired, and an indicator now showed whether film was passing through the camera. In addition it became possible to use cassette-to-cassette film transport, and the film counter clicked on automatically as the shutter was released.

In 1954-5 some further modifications were made. The lever-wind was changed in shape to its present design; a safety catch for the shutter release was added; the flash contacts were changed to the standard coaxial type; the rewind lever was replaced by a push-button; the frame counter was redesigned; and most of all, the lenses were given automatic diaphragms. Progress in the current model the Exakta V2A introduced in 1961 was the addition of a third flash contact socket giving F, X, M synchronisation; the shutter action noise level, and particularly the sound made by the slow speed and delayed action mechanism, was reduced, and a film reminder ring added under the slow speed dial. In addition improvements were made to many of the accessories.

Exakta Varex IIA

The Varex 11a body measures 153 mm × 49 mm × 102 mm and weighs 755 gm. Although dimensionally not greatly different from other miniature cameras the Exakta contrives, probably owing to its loping shape, to appear less bulky. It is a particularly convenient camera to hold, since the thumb can lie along the back, with the trapezoid shape fitting naturally the space between thumbs and forefingers. The flatness of the camera back with its reinforcing metal frame lying over the area of the pressure plate gives great strength and forms an ideal locating surface for the camera when used in set-ups. The camera is covered in coarse grain material, and the general lines are picked out in glossy chrome. The front plate and the top plate are finished in a sparkling satin silver chrome. The top plate is not of the usual pressed alloy type overlapping the camera frame, but is let into the camera frame and screwed flush with it.

Certain differences in the lay-out of the Exakta from other cameras stem from the essential difference that the film travels from right to left. This means that the feed cassette is placed 'upside down' in the right-hand spool chamber, and the transport sprocket is therefore on the left of the gate. In consequence the lever wind too is on the left of the camera top plate, and the

rewind knob must necessarily be under the camera at the right end of the base plate. The shutter travels from left to right.

Shutter

The right side of the top plate carries the slow speed and delayed action dial, with a film type reminder scale reading from 6 to 400 ASA underneath. The main speed dial takes shutter speeds from 1/25 to 1/1000th and longer speeds are obtained by setting the main dial on T or B, turning the slow speed dial as far as it will go, lifting the outer ring and dropping it in place against the appropriate speed. It is important to wind the slow speed dial very fully to the end of its travel to ensure the mechanism has been readied. The speeds on this dial commence at 1/5th second. This means that there is a gap in the available speeds between 1/25 and 1/5th second. The subsequent settings are 1/2, 1, 2, 3, 4, 5, 6, 8, 10 and 12 sec. It is important to remember that if the finger is lifted from the release before the end of a slow speed exposure, the lens diaphragm of the automatic lenses will return to full aperture before the exposure is complete. It is therefore advisable to turn the lens to manual setting.

In addition to the black index numbers, the dial also bears red index numbers: 1/5th, 1, 2, 3, 4, 5 and 6 sec. These numbers are shutter speed settings for use with delayed action. In other words delayed action can be used with slow speeds up to six seconds. When set to shutter speeds 1/25th to 1/1000th second it makes no matter to which red scale setting the delayed action device is put, the actual delay remains at approximately 12 seconds. The delay cannot be set before the shutter is wound, and cannot be cancelled by re-setting to a black scale number. With delayed action it is once again important to set the lens aperture manually, otherwise on releasing the button the automatic diaphragm will return to full aperture. Intentional double exposures are possible.

The only other device on the right of the finder hood is a small window, visible at the edge of the film type dial. When a loaded cassette is placed in the feed spool chamber, a spring-loaded rubber wheel presses against the protruding core of the cassette. As the film is transported and the core rotates, this friction drive rotates a wheel bearing red spokes which is visible in this window on the top plate. The main shutter speed dial is immediately to the left of the finder hood, with a clearance of only 1 mm. The speeds on this dial at T., B., 1/25th, 1/50th, 1/100th, 1/250th

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1/500th and 1/1000th. Speeds are set by raising the dial and dropping it into the appropriate index number. The dial may be set before or after winding on, as the whole assembly rotates. Full advantage of the available space on the dial has not been made use of for the shutter speed markings, and the more usual white on black would be more easy to read than the present fine black on silver chrome ones. The dial rotates continuously for setting purposes and should be turned in an anti-clockwise direction. The transport release button for rewind is by the side of the speed dial, and pressure must be continuously held during rewinding. The lever wind is placed above the frame counter of which the numbers are visible in a cut-out on a raised panel. The counter is of additive type and flicks forward as the shutter is fired, and is reset by turning a small milled wheel on the forward extremity of the same panel.

The lever wind

The lever-wind travels through about 300° during its action, which is a considerable increase over the usual 180°. This extra distance makes the camera slower in operation than other modern reflex cameras. It is interesting to note too that the design of the wind lever itself was changed in the mid-fifties from the more conventional shape to the present thin metal straight lever with a curved ridged end. However the design of the lever is ideal for waist level operation and can also be quite useful in specialised set ups. Here the ability to inch on the wind lever would be an advantage too. The action of winding on is unique to the camera. The left thumb pad grips the milled end of the lever and in turning it pivots on it, so that at the end of the action the thumb is crooked over the lever and the camera top-plate.

The design and action of this lever wind seems less practicable when using the Exakta as an eye-level camera with pentaprism. If one wishes to keep the camera at eye-level whilst winding on, which is surely desirable on many occasions, the lever, after its movement has been initiated by the thumb, must be transferred to complete its action to the first finger. Since the lever has no fold-away action, it is also a little difficult to take it up at first with the pentaprism in position. The Exakta could be considerably speeded up and become of greater interest to the photo-journalist if the design and movement of the lever wind was altered, in the writer's view.

The shutter release is on the Exakta front plate, on the left at about '2

o'clock' in relation to the lens flange. A pivoted lever shield can be turned round over it to prevent accidental release. It is interesting to note that on the new EXA 1 the safety catch is at the rear of the camera leaving the front plate free and enhancing the appearance. The shutter release on the Vorex IIa is rarely operated by the finger. All the lenses with automatic diaphragms have a tilting or lever extension button actuating the one on the camera body. The safety catch is still operable with these lenses, since it is thin enough to turn between the lens release button and that on the body. The Exakta VX IIa carries three flash contacts, X and F type on the right and M on the left, looking at the camera from the front. The M contact is used at speeds from 1/50th to 1/1000th second for slow burning bulbs such as the PF24 and 45, whilst electronic flash is used on the X contact with the shutter at 1/50th second. The F contact is used at a shutter setting of 1/25th of a second for short burning bulbs; with the PF1 the exposure speed is 100th second and with the PF5 approximately 1/80th.

The tripod bush of the Exakta is directly under the optical axis and 13 mm in from the front of the camera body. This forward placing of the bush is helpful with a camera which is often used with extension fittings. The bush is on a pedestal 7.5 mm high on the camera base. This pedestal together with the rewind knob and camera back opening knob provide a three-point standing facility for the camera, which will stand up on them at least with the standard lenses. The rewind knob operates when its centre is pushed in against spring-loading, so that a fork engages in the bar in the cassette core. It would be helpful to have a catch to keep the fork extended since when the film is being rewound, it is necessary at the same time to keep the rewind button on the top plate depressed, and the maintenance of the two holds up the job.

Double cassette loading

Next to the rewind knob assembly, there is the well-known cutter of the Exakta, a facility apparently reserved to this camera and the 'Peggy', although a Russian camera, the Start, has a similar device. The cutter, which is fully efficient, has a safety guard screw, and has two main purposes. Firstly it may be used to cut a part-used film for processing, this being particularly effective if cassette-to-cassette transport is used, since two 'exposures' will then take the film into the take-up cassette. Thus no loss of film will occur, apart

from that necessitated in making a new leader of course. Secondly, when cassette-to-cassette loading is used, and the film is finished, it may not be desirable to lose the last two frames, or alternatively pull the trailer off the feed cassette core by force. Here again use of the cutter is essential, and two transport cycles then take the film into the take-up cassette. Any standard cassettes can be used in the spool chambers, it was found.

A film can be attached to a take-up cassette and the two cassettes left lip-to-lip until required.

When the film is finished, it is cut, or if using a home reload with the film trailer only lightly sticky-taped on, it can be drawn right off without excessive force, if in a hurry. Both cassettes are then removed and another pair reloaded as before. In this way it is possible to change films in the Exakta in about 25 seconds, if the camera is used on a neck strap out of the ever-ready-case, that is. The Exakta take-up spool will accept film with or without tongue, and has also a special fitting for 'tailed' film.

Camera interior

The camera back is opened by withdrawing the milled knob on the left end of the base-plate, which pulls down a bar catch against strong spring-loading. A turn of the withdrawn milled knob then retains it in the out position, until it is wished to reclose the back. The method, although effective, does seem a little cumbersome. The whole camera back can be removed by taking out the lynch-pin in the hinge, which has a milled knob at its upper end. The pressure plate in the Exakta is of a special embossed design with four air vents and fairly lightly sprung. The back also has four polished lugs on the take-up side which bear the film down over the transport sprocket and prevents any rise in the film level at the edge of the gate because of the sprocket. There is another single lug on the feed cassette side which bears on the cassette lip by the point at which the knife starts to cut the film.

It should be superfluous to comment on the precision engineering of the film track. Although in passing it may be mentioned as a point of design interest that there are no machined lateral tracking guides raised slightly higher than the film plane tracks, as is the case in most 35 mm cameras. There are, however, sidewalls in between which the pressure plate itself lies when the back is closed.

The dark chamber of the Vorex 11a is roomy and entirely free of mechanism. It has a deep well which must help considerably as a protection against internal reflections from skylight. This well is in part possible due to the automatic diaphragm action being on the lens mounts themselves presumably. The sides and the underneath of the mirror flap are anti-reflection ribbed.

Viewing system

The mirror corresponds in size almost precisely with the 35 mm format— 36×24 mm. This is shorter than that on the Edixamat—27 mm or the SR 1 and 7—30 mm, which are the longest of all, but the same as the Pentax. The width is greater than the Pentax and the Edixamat, but equalled by the SR 1 and 7. The exceptional length of the Minolta SR mirrors is possibly due to their dual Viroflex type movement, Cut-off on the Exakta screen commences at about 180 mm focal length and naturally depends on the maximum aperture of the actual lens.

The 180 mm f/2.8 is free at full aperture and the f/3.5 of the same focal length just shows a darkening at the top edge.

The interchangeable waist-level and pentaprism finders for the Exakta are pushed into a well over the mirror. This well has a locating surface for the underside of the focusing screens. There are a number of screens available for the Exakta and these clip into the base of the waist-level, pentaprism or Magnear finders. As the finder is pressed into place, a spring clip engages it and spring pressure holds the screen in position against the locating aperture. In practice, it seems possible for a small amount of play to remain, so that the screen can rise fractionally if the finder assembly itself is disturbed a little. With the camera in a horizontal position this is unlikely to occur. To remove a finder, a spring clip just in front of the name plate is pushed down, and the finder can then be lifted straight out. Since the screens are merely clipped in for quick interchangeability it is best to take care

when changing finders, when out and about, but the rapidity with which they can be changed is of immense value in applied photography of course.

The frame area for the reflex viewing systems shows a format of fractionally under 36×24 mm it can be taken as 35.5×23.5 mm effective dimensions. This approximates to the dimensions of a transparency when mounted in a slide mount. For a camera which is designed with scientific work in mind, this absence of a safety factor in the viewfinder is essential. The Exakta is thus one of the few SLRs which really fulfil the prime function of a reflex camera, which, surely, is to show the photographer precisely what he is going to get in the picture. This is particularly important in pictorial colour work, quite apart from scientific purposes. The intrusion of an unwanted feature at the edge of a transparency despite the care of the photographer is quite a frequently heard complaint nowadays amongst SLR users.

Exakta 11B

The Camera described in the preceding report is the Exakta Model 11A; there is now, since the writing of the review, a fresh model on the market—the 11B. There are no substantial differences between the two models, they are in fact identical throughout in construction except at two points. On the Exakta 11B it is no longer necessary

to push a sliding catch on the camera front plate to release the interchangeable finder—waist-level or pentaprism. Finders are now removed simply by pulling up and out from a spring catch retaining device. The alternative finder is then inserted merely by pushing down until it clicks into place. This method is also used on the Exa 1.

The second modification concerns the shutter speeds. The Exakta 11B has the so called doubling series—1/1000th, 1/500th, 1/250th, 1/125th, 1/60th, 1/30th, etc., rather than the 1/1000th, 1/500th, 1/250th, 1/100th, 1/50th, 1/25th, etc., of the Exakta 11A.

All lenses, accessories, etc., fit the 11B in precisely the same way as the 11A.

Exa 11A

This camera replaces the Exa 11, briefly mentioned in the preceding report. In actual differences there is not a great deal to mention. The camera retains its built-in pentaprism and the appearance overall and construction are identical all but the one or two points detailed as follows.

The rewind knob has been replaced

by a fold away crank, and the film speed and type reminder dial has been removed from the centre of the shutter speed dial on the left of the top plate to a ring lying under the frame counter on the right. In addition, the shutter release safety-catch is now similar to that on the Exa 1 being in the form of a lever on the camera back, to the left of the viewfinder eye piece.

The Exa 11A will accept the whole range of Exakta lenses and accessories. It forms a most useful adjunct to the Exakta itself, particularly as a second camera for the worker who already has an Exakta with a range of lenses. It is also a most interesting camera for the user who requires more advanced features than the Exa 1 gives still at a reasonable price.

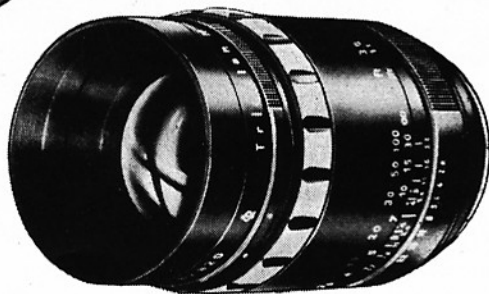
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Exakta with 200 mm
f/4 Flektogon

100 mm f/2.8 Trioplan



25 mm f/4 Flektogon

Exakta with 120 mm
f/2.8 Biometar and
waist-level finder



**Part 2: Finders and Lenses
Reviewed by Geoffrey W. Crawley**

THIS system report continues with an examination of the finders, focusing screen types and objectives available for the Exakta.

The interchangeable viewfinder

(a) *Eye-level Hood.* There are three types of finders available for the Exakta camera each of which will take any one of the focusing screens. The basic finder is the waist-level type. A push-button catch at the back releases the hood which is self-erecting. Closing the hood automatically shuts down the magnifier, so there is no need to poke at it with one finger. If the magnifier is not required, pressure on a lip near the hinge folds it away. The focusing screen is extremely well protected from outside light by the height of the hood, which is 45 mm at the back and 60 mm at the front. The magnifier gives a clear view of the whole screen without difficulty and the magnification is about two times.

(b) *Magnifier Hood.*—Magnear. This finder is fundamentally the same as the ordinary waist-level hood in fitting but on the top there is an Exakta bayonet lens flange fitting. This enables any Exakta objective to be fitted, and used as a high-grade magnifier. Probably the most important advantage is absence of colour fringing in very precise applications such as photomicrography. If the objective is more than 50 mm in focal length, the whole focusing screen area will be covered, but the shorter focal lengths merely enlarge the centre of the screen. The magnification given by the various lenses used in this way is as follows:

35 mm lens—	8.1 x,
50 mm lens—	5.7 x,
80 mm lens—	3.6 x,
100 mm lens—	2.8 x,
135 mm lens—	2.1 x.

The use of camera lenses as magnifiers was not found wholly satisfactory since with the lenses which covered a reasonably wide area of the field, the image appeared very remote. However, for photomicrography the standard 50 mm lens is quite useful in covering the microscope field on the 35 mm format, and in this application the standard lens will not be on the camera in any case, so that advantage may as well be taken of it as a magnifier in this way.

A more satisfactory device is the top lens supplied by Ihagee. This is a well corrected magnifier giving an enlargement of five times covering the whole frame area.

(c) *Pentaprism Hood.* The pentaprism finder is designed on the same principle as the other Exakta finders, in that it has the fitting for interchange-

able screens in its base. Pentaprism viewing, as a supplementary over a screen rather than with the under-surface itself forming the focusing plane, involves some loss of light, but with the Exakta pentaprism this is at a minimum. The advantage of being able to interchange the type of screen used in conjunction with the pentaprism in technical and scientific application, is especially useful, although in many such applications, waist-level viewing is usually employed.

Finder screens

A wide variety of interchangeable screens is available for the Exakta. Twenty screens are listed and other types can be made to order. There are four main types of screen:

(1) *Standard Screens.* The standard screen type consists basically of a plano-convex lens, with the plane surface fine ground. This screen can then be modified in certain ways advantageous to particular applications. The most useful variant is probably that with a clear centre spot and a hair line cross. This permits aerial image focusing, with the hair-line cross serving as an eye focus point to prevent accommodation. Thus the peripheral ground glass facilitates general viewing, whilst focusing is done on the aerial image. This screen variant is made with 3 mm or 10 mm clear centre circle and each may be obtained with or without hair-line cross. In addition the standard screen may be obtained with hair-line cross from edge to edge and top to bottom. This version can be supplied with $\frac{1}{8}$ -in. or 1 mm divisions. The latter millimetre divided hair-line cross screen is particularly useful in dividing up the 24 × 36 mm format, and can be used for a variety of general photographic measurements apart from technical applications. Screens with sub-divisions would also be helpful. Another variant of the standard screen is that with ruled squares, this is available with $\frac{1}{8}$ -in. or 5 mm squares. The idea is prevalent that the 35 mm single lens reflex is by nature useful for photomicrography, using merely a simple linkage to the microscope. In fact very few SLRs are of much use for critical photomicrography. The aerial image must be available for focusing, and a means of magnifying and focusing on the cross-line for individual eye sight likewise.

(2) *Clear Screens.* The clear screens are identical in shape to the standard type, being plano-convex lenses, but in this case as the name implies, there is no ground plane surface. These screens are for use in photomicrography, micro-photography and macro-photography. It is a matter largely of individual pre-

ference whether the total area of the finder screen is clear or part ground. The Exakta ground screens are, at least, as fine ground as any available, but may still break up resolution a little in extreme close-ups. With the clear screens and ground screens with clear centre circle, the parallax method of focusing can be used. By this method the focus point has been found when the hair-lines do not move across the subject detail when the head is moved from side to side—at right angles to the optical axis, that is. A magnifier is naturally of assistance with this method, but it need not be focused for individual eye sight directly on the cross line as for true aerial image focusing. The ordinary waist-level finder magnifier suffices in other words.

(3) *Flat Screens.* These screens are not of plano-convex lens type, but are of flat glass ground on one side. They can be obtained without rulings, with hair-line crosses, with hair-line crosses divided in mm, etc., and with squaring of different sizes. The use of the flat screens is particularly profitable with the Magnear and 5 × magnifier, since there is no apparent distortion and extremely accurate settings at a required repro ratio or for photogrammetric purposes can be made.

(4) *Distance Meter Screen.* This screen, made by Zeiss Jena, is of the well-known crossed wedges type. It is therefore particularly suitable for general photographic purposes, especially as a standard screen for the pentaprism. Focusing of long focus lenses of fairly wide aperture is much facilitated, and the surrounding ground glass area enables depth of field to be assessed easily. It can also be used for rapid focusing when the subject is not in the centre of the picture.

The Exakta lenses

The Lens Fitting. The lens fitting on the Exakta is the well-known triple-clutch bayonet type, the lens being rotated, after facing up red dot to red dot, until a latch lever on the left side of the flange engages on a pin on the lens mount. To release the lens, the lever is pushed away, the pin is freed and the lens turned back and removed. There is in fact an inner and outer bayonet fitting. The shorter focal length lenses attach to the inner and the longer lenses to the outer. This permits the fullest diameter of the camera throat to be utilised for the long focal length lenses to avoid vignetting.

The narrowness of the Exakta throat—38 mm—poses some problems for the lens designer with the long back extension of the single lens-reflex, particularly with wide aperture and long lenses.

The problems seem to have been overcome, however, although $f/2$ is the limiting aperture except for the 75 mm $f/1.5$ Biotar. The catch used to lock the lenses seems a little flimsy for the weight of some of the longer lenses, but in practice there is no trouble. All lenses attach and interchange rapidly and with certainty.

The total of lenses available for the Exakta cameras is exceedingly large, for apart from the manufacturer's recommended ranges, it is a standard fitting for interflex mount lenses of various origins. The lenses listed by Ihagee for their cameras are, however, from two manufacturers—Carl Zeiss Jena and Meyer-Optik Gorlitz. The Jena lenses are mounted differently from the Meyer.

Jena Lenses. The Carl Zeiss Jena objectives have anodised shiny black mounts with the front rims and diaphragm setting rings in glossy silver chrome. The barrel forward of the distance scale is usually covered in coarse grained material to provide a good finger grip. The distance scales are in both feet and metres, with the former picked out in orange and the latter in white. The aperture setting ring works in click half-stops and the markings are in orange. There is a depth of field scale and an infra-red setting. The mounts are of lightweight type and mechanically the moving parts work smoothly and reliably. The finish is excellent and these lenses are undoubtedly the best mounted and finished that the writer has seen of East European manufacture.

Exakta lenses with automatic diaphragms have an extension shutter actuating release attached to the barrel, the type used differs in the Jena and Meyer lenses. The Zeiss Jena lenses have a push-button device on a flange protruding from the side of the barrel, and the button itself, which is cable-release threaded, is surrounded by an outer shank with a ridged front rim. When it is wished that the lens automatically stops down at exposure to the set aperture, the outer shank actuates the iris diaphragm and the inner button acts as the shutter release. As the finger depresses the button, the outer shank moves with it and begins to shut down the iris diaphragm to the set aperture. When this aperture is reached, a definite inertia is felt since it coincides with the point at which the button contacts the camera body shutter release. Further pressure fires the shutter. It is therefore very easy to use the initial travel of the release on the lens as a depth of field preview. To switch to 'manual' operation, the outer shank is pressed down and turned anti-clockwise through

TABLE OF EXAKTA LENSES EXAMINED IN THIS REPORT

Lens	Focal Length	Apertures	Overall Barrel Diameter	Front Rim to Lens Flange at 00	Front-glass Diameter	Rear-glass Diameter	Back Extension at 00	Closest Focused Distance	Diaphragm Type	Glasses	View Angle	Weight
Flektogon	20 mm	4-22	80 mm	50 mm	55 mm	10.3 mm	38 mm	6 in.	Auto	7	93°	11 oz.
Flektogon	25	4-22	80	52.5	55	9	38	8 in. (0.2 m)	Auto	7	82°	12 oz.
Flektogon	35	2.8-22	61.5	48	40.5	18.5	37	0.6 ft. (0.18 m)	Auto	6	62°	7½ oz.
Meritar	50	2.9-22	53	31	19	16	42	2.6 ft. (0.8 m)	Pre-set	3	45°	3½ oz.
Tessar	50	2.8-22	61.7	35.5	19	16.5	41.7	1.7 ft. (0.5 m)	Auto	4	45°	5 oz.
Domiron	50	2-22	68.5	52	30	24.5	39	1.1 ft. (0.34 m)	Auto	6	47°	10½ oz.
Pancolar	50	2-22	61.7	35.5	30	24.5	38	1.6 ft. (0.5 m)	Auto	6	47°	6½ oz.
Meyer Trioplan	100	2.8-22	63.5	96	36.5	32	80	3.6 ft. (1.1 m)	Auto	3	24°	14 oz.
Sonnar	135	4-22	57.5	86.5	35	22	62.5	4 ft. (1.2 m)	Manual	4	18°	13 oz.
Sonnar	135	4-22	66.5	86.5	35	22	62	3.3 ft. (1 m)	Auto	4	18°	13½ oz.
Sonnar	180	2.8-22	99	132	70	33	89	7 ft. (2.2 m)	Auto	5	14°	3 lb. 3 oz.
Meyer Primotar	180	3.5-22	79	190	52	51	146	7 ft. (2.2 m)	Pre set	4	14°	2½ lb.
Meyer Telemegor	400	5.5-32	92	280	72	51	200	19.5 ft. (6 m)	Pre set	4	6°	4 lb.

N.B. Other available lenses are listed at the end of the report.

about 60° by means of the ridged front rim grip, and locks in this position, which is the same as for the depth preview of automatic operation. Consequently the diaphragm will now stop down at once to whatever aperture is set.

The total travel necessary to release the shutter on the automatic setting is about 6 mm, and on the manual setting 2.5 mm. Thus the camera is considerably speedier in action on manual. The diaphragm actuating device works equally well on the shorter focal length lenses, and on the long focus lenses such as the new 180 mm Sonnar.

The former click-stop and preset lenses by Zeiss Jena for the Exakta are now being replaced by the fully automatic types or are available, in some cases, concurrently with them.

Meyer Lenses. The Meyer lenses for the Exakta with automatic diaphragms work on a different principle from those of Zeiss Jena. Instead of an extension release button, they have a 'tilting' lever which angles back on to the camera release button to fire the shutter. The travel of the lever tilt necessary to fire the shutter is about 15°, of which the first 3°-5° suffice to shut down the diaphragm to the stop set. This initial movement is also a useful depth of field preview device naturally. To switch the lens to 'manual', the fully automatic Meyer lenses have a ring at the front of the lens barrel, just behind the push-on filter rim, with red and white dot index points. With the white dot at 12 o'clock, the diaphragm sets manually, and turned to the red dot, the lens is on automatic. The ring can naturally be used as a depth preview if desired.

The Meyer lenses up to normal focal length have a predominantly glossy or semi-matt silver chrome finish with interspersed rings of matt black anodising. The longer focus lenses are all matt black anodised, with perhaps one of the handling rings other than the focusing one in matt chrome. The focusing scales are in feet and metres. The former are in red and the latter in white on the long focus lenses, but on the shorter focal lengths some variation in scale styling occurs of necessity if the ring is a chromed one.

It is difficult to say whether the Zeiss Jena release mechanism or the Meyer is the swifter in action, and it will depend slightly on individual response. On the whole, the writer found the Meyer the quicker, but it has to be remembered that with the longer focal lengths, this system may become a little difficult mechanically, owing to the long connecting lever to the diaphragm working from the 15° tilt close to the camera body. The more mechanically positive

movement of the Jena type release should be much easier to incorporate in long focus lenses, in fact the longest focal length on which Meyer provide an automatic diaphragm is at present 100 mm. Both types require a cable release with a long plunger, if the shutter is to be fired by this means.

THE LENSES

The writer critically examined 12 of the 20 or so objectives listed by the makers for the Exakta. The dimensional details, etc., of the lenses described below will be found in the accompanying table. The general details of the mount types and finish have been described above.

20mm f/4 Flektogon-Zeiss Jena

This lens is one of the widest angle types which can be used on a single-lens reflex without the need for locking the mirror in the up position. The lens is remarkable in the size of its front glass as compared to the rear one. The focusing movement is particularly easy to manipulate, as the ring, which is forward on the barrel, has a number of raised grip points around it. One of the features of this lens is the ability to focus down to 6 in., and since this distance is measured from the film plane the front rim of the lens is only some 2½ in. from the object to be photographed. The small size of the rear glass is interesting to compare with the West German Zeiss Oberkochen 21 mm f/4.5 Biogon for the Contarex. The large rear glass in the Biogon—19 mm—is accompanied by a front glass considerably smaller than on the Flektogon however—22 mm—as opposed to the Flektogon's 55 mm. Both lenses are free from vignetting at any aperture, so the different solutions seem equally effective in this respect.

For technical purposes where perfect corner to corner coverage is required, the 20 mm Flektogon needed to be stopped down to f/11, but for less exacting tasks the coverage at f/8 would be found adequate. At f/5.6 image quality at the corners dropped markedly, but was acceptable at the edges of the frame. Stopped down the lens gave brilliant detail. Some barrel distortion was evident which would have to be taken into account in exact work, but the lens is for practical purposes an outstanding design.

25 mm f/4 Flektogon-Zeiss Jena

This lens is of the same general construction as the 20 mm described above. It does not have the ridged focusing grips which are so convenient on the 20 mm, and adheres to the normal Jena

coarse-grained covering material for this purpose. The lens focuses nearly as close as the 20 mm—0.65 feet. Although these working distances of only a few inches are interesting, it has to be remembered that, taking a close-up as beginning at about 12x the focal length of a given lens, these wide-angle designs are thus focusing to the equivalent of about 12 in.—18 in. with a 50 mm lens, so that in theory their corrections should hold reasonably well, as in fact they do.

The performance of the 25 mm Flektogon is excellent, giving crisp fine detail from top to bottom of the frame and just acceptable at the edges at full aperture. F/5.6 brought the edges well in and image quality extended almost to the corners, the ½ stop towards f/8 sufficing to achieve this. There was no fall off on stopping down, but there remained some difference in acutance at the edges over the centre as with many wide-angle systems. A slight trace of the barrel distortion of the 20 mm remained, but was of little practical importance. The lens also worked well at close-up range.

35 mm f/2.8 Flektogon-Zeiss Jena

This is the standard wide-angle lens of the Jena series for the Exakta. The mount does not have the large 'saucer' effect of the extreme wide-angle lenses and is conveniently small and lightweight. In design the focusing ring could be improved, one would suggest, since it is very narrow and has to be gripped with the finger tips only. This is necessary since it has been positioned immediately in front of a larger rim, and it might well be increased in diameter to stand out above this rim, or equal it. In other respects, the lens is elegant in appearance and practical in operation.

The optical performance of the lens is outstandingly good giving perfect coverage all but to the edges at full aperture. At f/4 contrast of detail rises a little with coverage to the edges, and at f/8 acutance is even across the whole frame. There is no fall off on stopping down and the lens can be accounted distortion free. The objective must certainly be amongst the best of its specification available.

50 mm f/2.8 Tessar-Zeiss Jena

This is one of the standard lenses supplied for the Exakta, and this design has been available for the camera in earlier forms for much of the camera's history. The mount conforms exactly to the Jena style, described above, and the lens is beautifully lightweight and easy to manipulate. The front glass is well-recessed, but not quite to the extent

of forming a really efficient lens hood in adverse conditions.

The optical performance of the lens shows how far the four-glass modified Cooke triplet has progressed with the aid of modern glasses and coating techniques. Quantitatively, i.e. from the resolution point of view, there is little to choose between the performance of this lens at full aperture and that of the f/2 lenses described below at their full aperture; although there is a greater qualitative difference over the frame area, and as usual contrast is slightly less to the edges. In field flatness, improvements have been made over the old type four-glass cemented triplet. The brilliance of the type remains and the reputation for extreme clarity in the focused plane is still justified. Although performance is improved overall, the lens reaches its modern optimum at around f/8 as before. The finest detail does not quite reach the clarity more complex constructions give but the difference has narrowed. The lens is an outstanding example of the modern four-glass design, and makes an excellent medium price standard lens for the Exakta.

50 mm f/2 Pancolar-Zeiss Jena

This lens is a remarkably compact unit conforming exactly to the Jena style described above. As will be seen from the accompanying table, it is in fact identical in overall mount dimensions to the f/2.8 Jena Tessar, and the writer's records do not so far indicate a more compact and lightweight f/2 standard lens for single lens-reflex, with fully automatic diaphragm. Although the aperture scale is click half-stopped to f/22, there was no change in the aspect of the iris after the half stop before f/22 on manual or auto on the review sample. This fault, hardly of great significance, is far more prevalent with automatic lenses irrespective of price than is perhaps usually realised. It occurs only at the smallest stop. The Pancolar from the handling point of view is remarkably convenient.

The optical performance is outstandingly good and the lens covers extremely well at full aperture with only slight corner fall off in resolution. At f/2.8 there is a rise in acutance of detail all over the frame, with still further improvement at f/4 and f/5.6 with brilliant fine detail. The lens can then be stopped right down without loss of quality. The Pancolar is virtually distortion free. It is interesting to note that the Exakta has not gone in for the increasingly frequent use of 55 mm or 58 mm lenses as standard, which gives the designer a little more scope. The Pancolar is an outstanding modern objec-

tive of a very high standard of performance.

50 mm f/2 Domiron-Meyer

This lens is in a completely different mounting to the Pancolar and differs too from the general Meyer styling for the Exakta. The focusing scale and aperture setting rings are in a semi-glossy chrome; the metre markings are picked out in black and the feet in red, whilst the aperture settings are in black. All the markings are in rather small figures and more use might have been made of the available space to enlarge them in the interests of visibility. Settings are in click half-stops: the last half-stop down to f/22 worked a little intermittently on 'manual' (compare the notes on the Pancolar above). The front glass is well recessed in the mount, which then forms a thoroughly efficient lens hood for all purposes. The auto/manual switch is made by turning the front rim of the lens barrel, which is milled appropriately. The lens has a quite impressive appearance, and for this reason probably has more eye-appeal for the lens snob than the Pancolar. The front flap of the ever-ready case of the Exakta will just slide over the barrel of the Domiron when set to Infinity. The focusing movement worked smoothly over the whole range and the lens handled as easily as the Pancolar, despite the size and weight increase. There is a close similarity between the dimensions of the optical systems of the two lenses, as can be seen in the table.

The optical performance of the Domiron is outstanding, it covers excellently at full aperture but with a shade less acutance than the Pancolar. The performance stop for stop very much resembled that lens, with a marginally lower acutance. On the other hand certain areas of lower image quality just off axis was noticeable in both lenses (and many other modern lenses too), were corrected at f/8 in the review sample of the Domiron, but needed f/11 with that of the Pancolar. The field was flat. The Domiron like the Pancolar is an outstanding modern lens suited to the most critical work. The difference in price between this and the Jena f/2 is not great, but the Pancolar has a slight acutance gain if this is thought important. Both lenses work well in close-up.

100 mm f/2.8-Meyer Trioplan

This lens conforms in mounting to the general plan of the Meyer Exakta lenses, and a useful feature is the very convenient focusing ring with grooved grips. The ability to focus down to 3 ft 6 in. is also an advantage and the

lens is a convenient portable objective in a focal length very versatile in uses. The tube is well anti-flare ridged.

The optical performance is excellent. Coverage at full aperture is all but to the edges with a faint softness which is corrected, except at the corners, at f/4. At f/5.6, there is even coverage to the corners, although central acutance remains slightly higher than the marginal. As usual with three-glass types further improvements can be noted down to f/11, and there is no marked fall off to f/22. The objective is excellent modern design with a wide field of applications, at a reasonable price.

135 mm f/4 Sonnar-Zeiss Jena

This lens is available in two forms, the older all-chrome mounted manual diaphragm type and the new fully-automatic lens in the Jena type of mount already described. The optical construction is identical in both lenses and no practical difference in performance was found. The new automatic lens handled beautifully, it has a broad focusing ring covered, Jena style, in coarse-grained material, and the balance on the camera is excellent. This famous telephoto construction continues to appear in various metamorphoses in East and West, and this automatic version is one of the best mounted of them. There was a slight difference in back extension between the two versions (see table) and the auto model focuses a little closer.

The performance of the lenses in the two mount types tested was good, but like other samples from elsewhere in East and West Europe, showed a little softness at full aperture, although definition was equal across the whole frame. By f/8 the lens is really crisp, with a trace of fall-off at f/22. There was no distortion of practical importance. Lenses of this focal length seem to lie at some sort of optical cross-roads, and performance of wide-aperture wide-angle lenses seems to have progressed much beyond the design of the medium-long range. This lens compares favourably with its competitors so far tested, although there appears to be a new wave coming, including some f/2.8 designs from well-known makers.

180 mm f/2.8 Sonnar-Zeiss Jena

This lens is of wide-aperture for its focal length and as such will be of special interest in reportage. The shape is a little unusual, but this is predetermined by the parameters dictated by the Exakta itself. Firstly the necessity for the extension shutter release button to be on the lens mount near the body enforces a considerable narrowing of the barrel at the camera flange end. Despite this, the design and finish of the lens

mount are very good and when fitted to the camera the assembly maintains an elegant appearance sometimes lost with telephoto lenses. The automatic diaphragm works as easily as those on the shorter focus Zeiss Jena lenses, despite its length. There is a depth of field preview lever on the right looking from the back of the camera, and this conveniently travels through a very short distance to stop down the diaphragm. A very practical feature is the method used for swivelling the camera+lens for vertical format use when fixed to a tripod. The bush is on a collar flush with the lens barrel, avoiding the ungainly appearance of the outside collar usually seen and which always looks, and may well be, an after-thought. A lever on the left of the barrel frees the rotating collar, and will lock it again at once in any position as required. The focusing movement is easy to operate and the ring gives a good grip. The lens attaches to the outside bayonet fitting on the camera body, thus allowing the maximum diameter of the throat to be used. There is no cut off in the viewfinder with this lens at any aperture.

The optical performance was outstandingly good. At full aperture, coverage was complete with fine detail resolved across the frame. In distance shots there was a faint trace of flare, but this disappeared at the $\frac{1}{2}$ stop towards f/4. At f/4 contrast of detail improved a little, and for all practical purposes the lens could be said to have reached its optimum, recording very fine detail to the corners. At f/16 and f/22 there was a slight fall-off in central detail. The lens has, practically speaking, a flat field although under critical inspection the faint trace of curvature that the Sonnar construction seems to bring is just detectable. Zeiss Oberkochen have also brought out a lens of this specification in a quite different mount, and it will be most interesting to compare the optical performance of the two lenses separately developed. The Jena 180 mm f/2.8 is, mechanically and optically, in the first rank of modern objectives.

180 mm f/3.5 Meyer Primotar

This lens is of the manual preset type, but retains the Exakta feature of click half-stops. The aperture scale is non-linear. The mount type has the subdued matt-black of the Meyer Exakta lenses with white distance scaling for metres and red for feet. The swivel mechanism is of the outside collar type, and the locking screw is unobtrusive and flush with the flange on which it is mounted thus preserving the lines of the barrel. The collar looks as if it might well be

removable to lighten the lens for hand-held use. There is a short but efficient built-on lens hood.

The performance optically was not quite equal to the $f/2.8$ lens of this focal length examined above, but bearing in mind that the $f/3.5$ is 1/3rd the price, was very good comparatively. Coverage was not quite complete at full aperture, and a slight softness was noticeable. The small shutting down to $f/4$ made a detectable difference in detail contrast improvement, and at $f/5.6$ edge-to-edge coverage was perfect, although acutance of fine detail improved to the corners further, down to $f/11$. There was no fall off on stopping down to $f/22$. Interestingly, the field was faintly flatter than that of the $f/2.8$, but as regards practical performance this would be rather splitting hairs. In distance shots, there was a faint flare trace very similar to that on the $f/2.8$, but contrast was definitely lower. Considering the difference in purchase price between the two lenses, the Meyer gives an excellent performance comparatively, and compares well, too, in its price range.

400 mm $f/5.5$ Meyer Tele-Megor

This lens is in the standard Meyer Exakta styling, and is an enlarged version of the 180 mm as regards the arrangement of controls. It is manually preset on a non-linear click whole stop scale and stops down to $f/32$. The vertical format swivel is in the form of an outside collar with a flush locking

screw. The lens itself can be removed as an optical head complete with diaphragm. The weight is fairly high, but with care the lens can be used in the hand. The focusing movement has quite a lot of inertia but it can be operated quite swiftly, a 300° turn sufficing to focus the lens from Infinity to 20 feet. There is a built-on lens hood.

The optical performance was good with hardly noticeable flare in distance shots at full aperture with good contrast. Detail, however, was a trifle soft, and stopping down to $f/8$ gave a marked improvement. Further improvement occurred down to $f/16$, on critical inspection. The field was flat. The lens compares favourably within its price range.

The optical equipment available for the Exakta is particularly interesting, in that there is virtually a selection throughout the range of higher and lower priced lenses recommended by the makers. The lower priced lenses have an excellent performance by any standards, but may have a smaller maximum aperture or perhaps a mount with less eye-appeal, and in some cases without automatic diaphragm. The higher price ranges have a performance competitive with lenses of their specification from any other source. On the whole, such enhanced optical performance is found in Zeiss Jena and Meyer lenses with fully automatic diaphragms, and these lenses represent a mid-point

between the high contrast of the West German Zeiss Gauss and Sonnar type lenses, and the more medium contrast of the Leitz Gauss type lenses, in the writer's view. For example, the 21 mm Zeiss Oberkachen Biogon is an extreme contrast lens sometimes requiring a decrease in development time if subject contrast is even slightly above average, but with the 20 mm Flektogon this is unnecessary. The modern objectives for the Exakta bring it optically to the forefront of modern cameras, and the correction style offers a useful alternative and an excellently balanced compromise of image qualities.

In addition to the above lenses, there are available in the Exakta list: 35 mm $f/4.5$ Meyer Primagon, Preset; 75 mm $f/1.5$ Zeiss Jena Biotar, Preset; 80 mm $f/2.8$ Zeiss Jena Biometar, Auto; 120 mm $f/2.8$ Zeiss Jena Biometar; 180 mm $f/5.5$ Meyer Primotar, Preset; 250 mm $f/5.5$ Meyer Tele-megor, Preset; 300 mm $f/4$ Zeiss Jena Sonnar, Preset; 300 mm $f/4.5$ Meyer Tele-megor, Preset; 500 mm $f/8$ Zeiss Jena Mirror Lens.

The long focus lenses up to 100 mm and the telephoto construction up to 135 mm can be used with the Exa 1 camera, but focal lengths longer than 135 mm will vignette owing to the special shutter type used on this camera.

This system will continue next week with the examination of the Exakta specialised equipment.