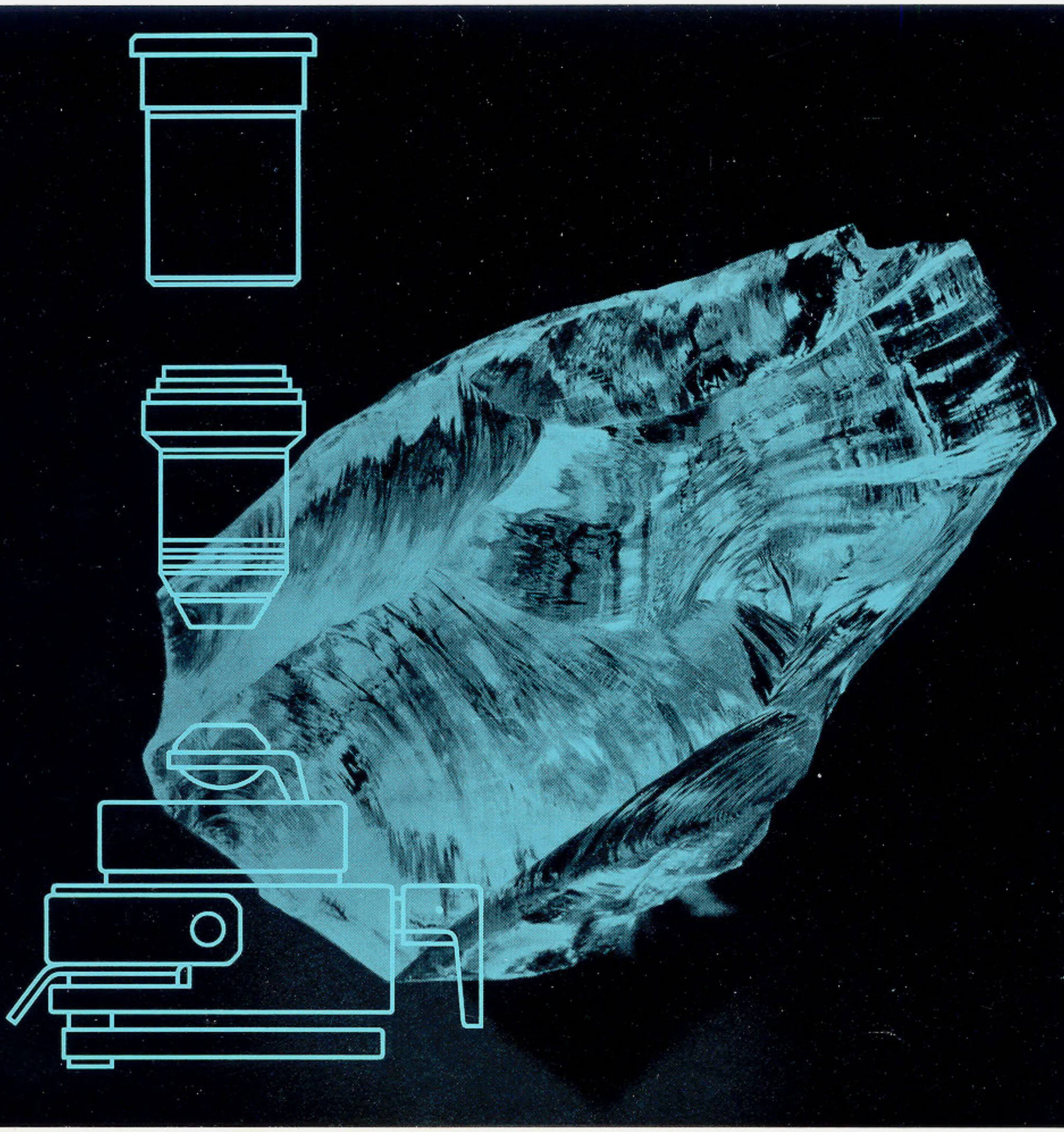
# Microscope Optics

## The most important part of the instrument . . .

WILD
HEERBRUGG
Switzerland



## Introduction

Mechanical considerations apart, the performance of a microscope depends largely on its optical outfit. In a compound microscope this essentially comprises three parts: objectives, eyepieces and condensers. The combination of these which is selected depends on the type and degree of refinement of the work envisaged, and on the financial considerations of the purchaser.

## Wild Objectives

Broadly speaking, microscope objectives can be grouped according to their degree of colour correction and the flatness of their image. The following types of objectives are manufactured by Wild:

| Type of objective | Method | Means of identification |
|---|---|---|
| | **a) Transmitted light:** | |
| Wild Achromats | Bright field, dark field, phase contrast | Oil immersion versions have a black ring<br>Phase contrast versions are marked "Ph" |
| Wild Fluotars | Bright field, dark field, phase contrast | Single ring, of colour according to magnification<br>Phase contrast versions are marked "Ph" |
| Wild Plan-Fluotars | Bright field, dark field<br>one for phase contrast | Double ring, of colour according to magnification<br>Phase contrast versions are marked "Ph" |
| Wild Polarisation-Achromats | Polarisation | «Pol.». Oil immersion versions also have a black ring |
| | **b) Incident and transmitted light** | |
| Wild EPI-Achromats | For uncovered specimens<br>Incident light can only be used for bright field | «EPI» |
| Wild EPI-Plan-Fluotars | For uncovered specimens<br>Incident light can only be used for bright field | «EPI», and double ring of colour according to magnification |
| Wild Universal EPI-Achromats | For uncovered specimens | «EPI» |

Wild objectives are designed for optimum performance with a mechanical tube length of 160 mm. Transmitted light dry systems (i.e. without immersion oil) are computed for use with a specimen cover glass of thickness 0.17 mm. «EPI» objectives are for use with uncovered specimens. Specific magnification, resolving power and working distance are all logically related to one another. All objectives of medium and high magnification are spring-mounted for the protection of the specimen and the objective.

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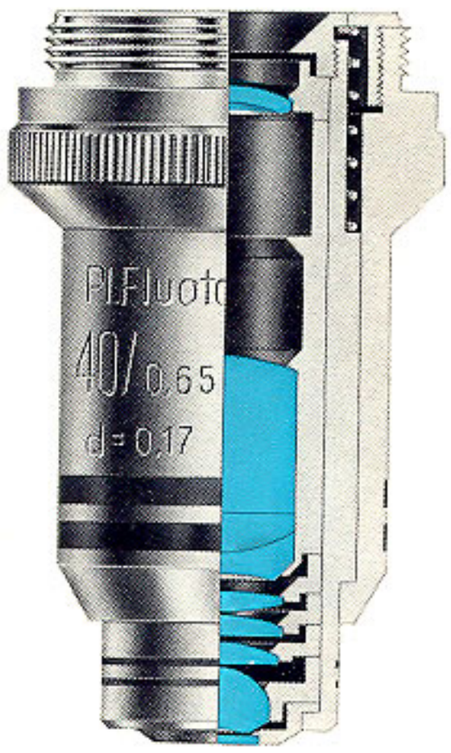
# A. Wild Objectives




Section through a Plan-Fluotar objective

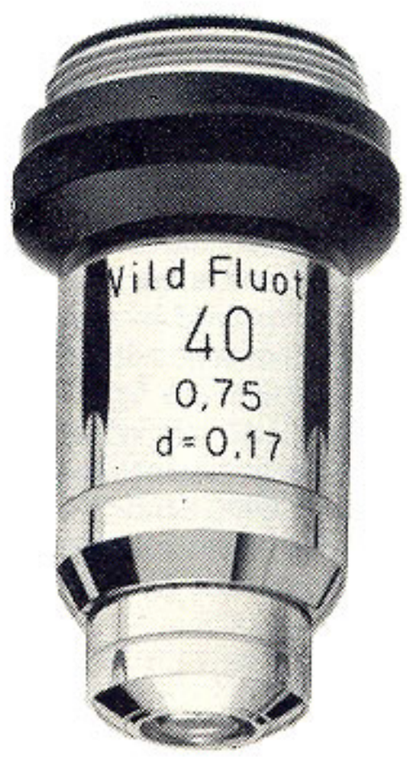
**Wild Achromats**
Achromats are spherically and chromatically corrected objectives in which the chromatic aberration has been fully removed for two specific colours. These colours are red and green-blue, and correspond to the Fraunhofer C and F lines respectively.
The colours intermediate between them are consequently largely corrected over the full aperture of the objective.
The image quality is particularly good in the green to yellow portion of the spectrum, to which the eye is particularly sensitive. The use of green-yellow filters is particularly advantageous for black-and-white photomicrography, since these filters absorb violet radiation to which the photographic material is sensitive but which does not focus in the plane of the image.

Achromat, Fluotar and 6× Plan-Fluotar objectives are also available for **phase contrast work.**

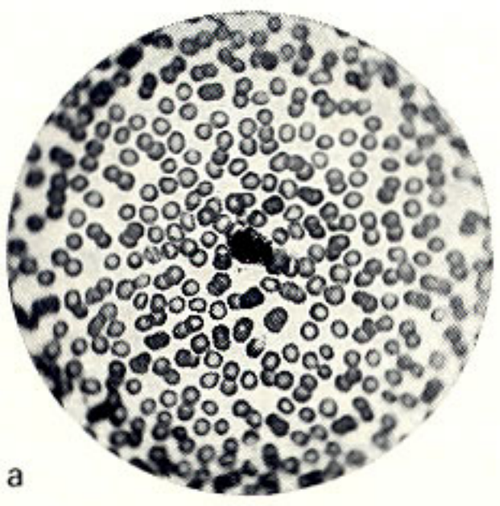
**Wild Fluotars**
These objectives are corrected for an appreciably wider spectral range by the multiple use of fluorite lenses. Their colour correction is almost ideal: they are however appreciably cheaper than full Apochromats. The sharpness, brilliance and contrast of the overall image leaves little to be desired. Their aperture is greater than that of the corresponding Achromats, resulting in greater resolution and image brightness. Wild Fluotars are consequently best suited to research work involving the recognition of finest details, colour photomicrography, and other applications where optimum conditions are required.

**Wild Plan-Fluotars**
Conventional microscope objectives image a plane surface as a curved one. This means that with them a thin section or a flat surface cannot be observed or photographed in uniform focus over the whole area of the field. This phenomenon, which is known as field curvature, is completely eliminated in flat-field objectives.
The superlative resulting image is completely flat and is sharp right to the edges of the field. Plan-Fluotars are of general application in microscopy, but are particularly useful for the investigation of ultra-thin sections and of smears.
Their main field of utilisation is however in photomicrography and projection, where overall sharpness and flatness are outstanding assets.

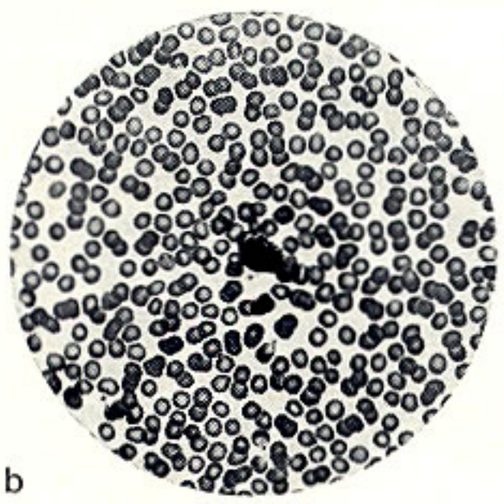




a



b

Plan-Fluotars should be used with Wild wide field eyepieces. The extremely large and flat field of view resulting from this combination is particularly valuable for scanning, an advantage which is well recognised in diagnostic work.

a Blood smear: conventional optics
b Blood smear: Plan-optics

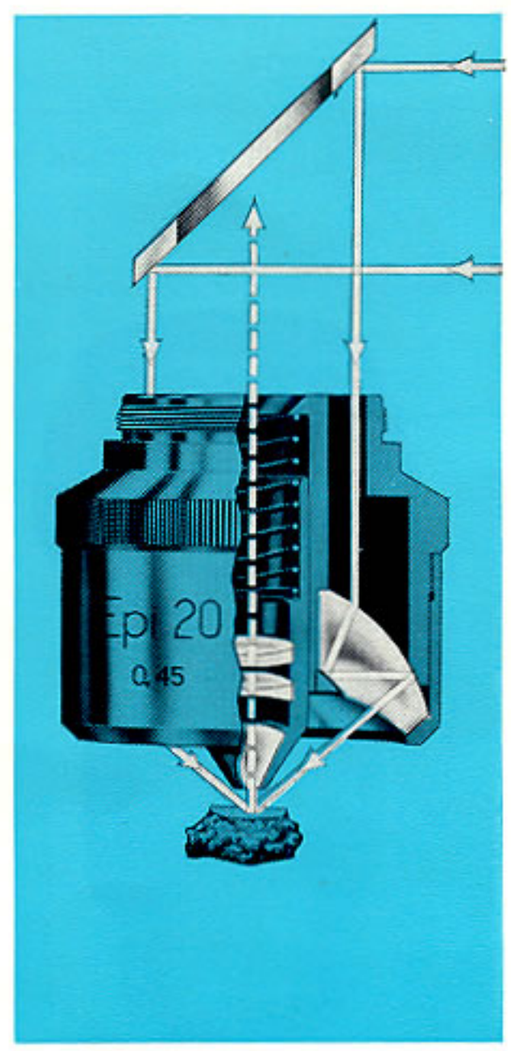



**Wild Polarisation-Achromats**
This type of objective was designed specifically for investigations in polarised light. The difference between normal objectives and those intended for polarisation work is that the latter are absolutely strain-free after mounting, so that the optical system does not itself introduce polarisation effects into the light path. Polarisation-Achromats are consequently supplied in special centring mounts, with centring screws which are light in operation and yet which cannot be accidentally put out of adjustment. Strain-free Achromats without centring mounts are also available.




**Wild EPI (Incident Light) Objectives**
For the examination of opaque specimens, special incident light (Epi) objectives are available. They are for use without a specimen cover glass, and include:
**Epi-Achromats** and **Epi-Plan-Fluotars** (20× and 40× only). For incident light bright field work, but also useful for examining uncovered specimens (smears etc.) in normal transmitted light.
**Universal Epi-Achromats.** For incident light bright and dark field work (see blue diagrams top right and bottom right respectively). Each objective has a special built-in dark field condenser.

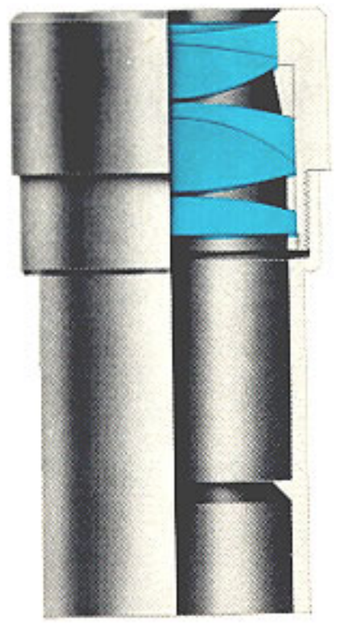


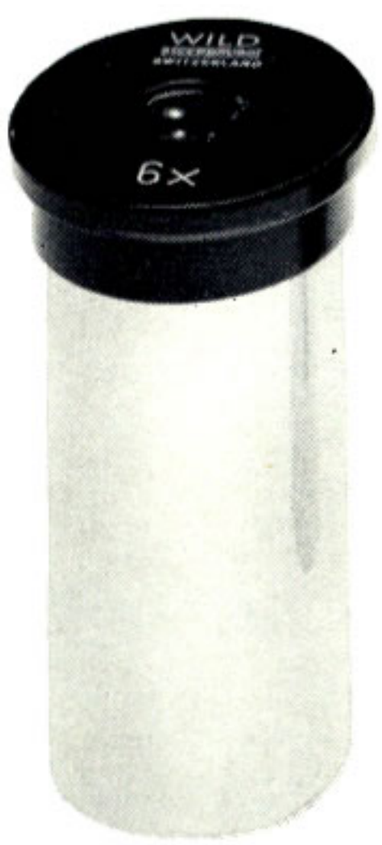
# B. Wild Eyepieces

The following types of eyepiece are provided for use with our objectives:

| **Type of eyepiece** | **Engraved lettering** |
|---|---|
| Huygens eyepieces | Eyepiece magnification |
| Compensating eyepieces | Eyepiece magnification and «K» |
| Wide field eyepieces | Eyepiece magnification, «K» and «W» |
| Polarisation eyepieces | Eyepiece magnification and «Pol»; also «K» or «W» |
| Complanat (photo) eyepieces | Eyepiece magnification, «Kpl» and «Phot» |
| Format-indicating eyepieces | Eyepiece magnification and «BK»; «W» if wide field |
| Measuring eyepieces | Identification as for Huygens, compensating or wide field eyepieces, as appropriate. «S» for filar micrometer eyepiece, «G» for goniometer eyepiece |



Section through a wide field eyepiece




**Huygens eyepieces**
These are computed for use with Wild Achromat objectives. This combination gives a good image.




**Compensating eyepieces**
Compensating eyepieces are computed primarily for use with Wild Fluotar objectives. As a result of corrections for aberration, Fluotars exhibit a chromatic difference in magnification which can be completely balanced out only by the use of compensating eyepieces. Achromat objectives of medium and high powers can however also be used with advantage with this type of eyepiece. Since the combination is also free of astigmatism, it gives an excellent image even away from the centre of the field if the focussing is appropriate.




**Wide field eyepieces**
This type of eyepiece is provided specially for our Plan-Fluotar objectives. In combination with these it gives a flat image which is sharp to the edge of the field. All wide field eyepieces (10×, 12.5× and 15×) have the abnormally large field number of 18. Owing to their long exit pupil distance, these eyepieces are particularly suitable for use by spectacle wearers.




**Polarisation eyepieces**
The polarisation eyepieces, like the Pol. objectives, are mounted strain-free to eliminate polarisation effects due to strain in the glass. According to the use envisaged, there is a choice of Pol. Huygens, Pol. compensating and Pol. wide field eyepieces. Pol. eyepieces are equipped with an adjustable eyelens and a built-in crosshair.

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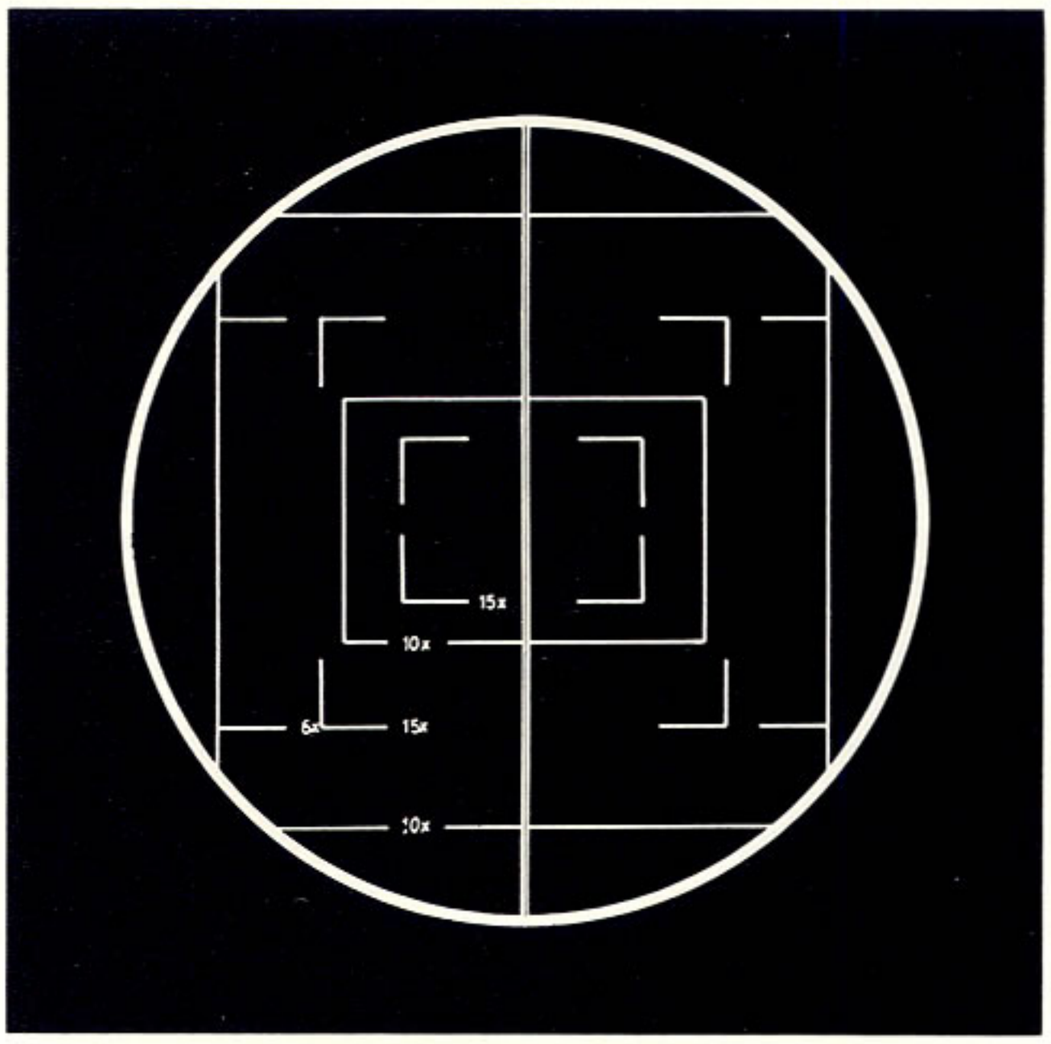
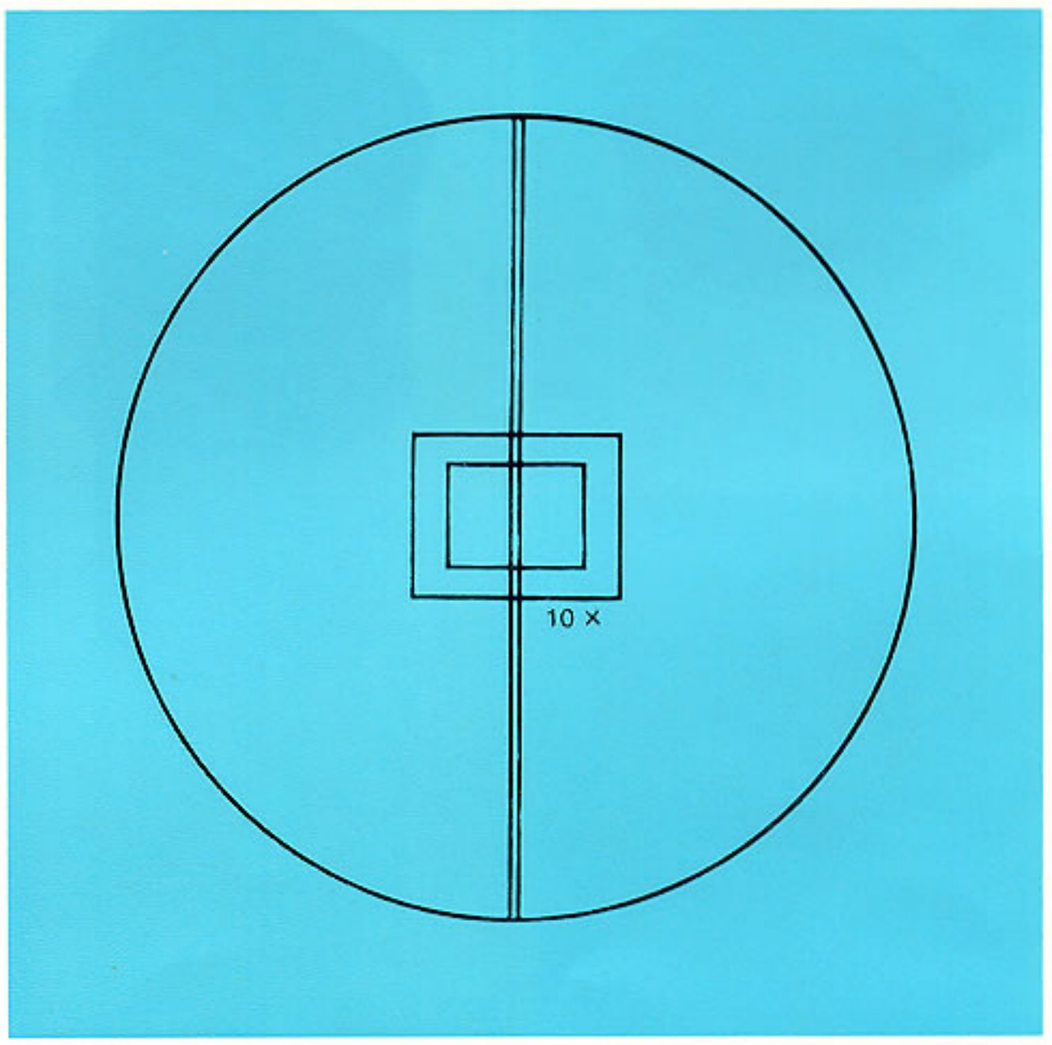
Right:
Graticule for format-indicating eyepiece, with format limits 24×36 mm and 60×60 mm at various eyepiece magnifications










**Complanat (photo) eyepieces**
These are recommended for use in conjunction with Achromat or Fluotar objectives for the purposes of photography, cinemicrography or projection. They are like compensating eyepieces in construction, but the field curvature is better corrected, at the expense of the quality of the astigmatic correction. For the purposes indicated it is advantageous to allow for a slight deterioration in astigmatic correction in return for a better flattening of the meridional image shell. The Complanat eyepieces can also be used to obtain improved field flattening in visual observation. They are available with either fixed or adjustable eyelens, according to whether the camera has optical correction facilities built in or not.

**Compensating eyepiece 2.5×** (stock no. 184 586)
This eyepiece (illustrated above) is used with television or ciné cameras employing a long focal length zoom system as photo-objective. It has an extremely long exit pupil distance of 180 mm. The exit pupil distance of normal eyepieces is so short that under these conditions of use they give a small circular image which does not fill the field.

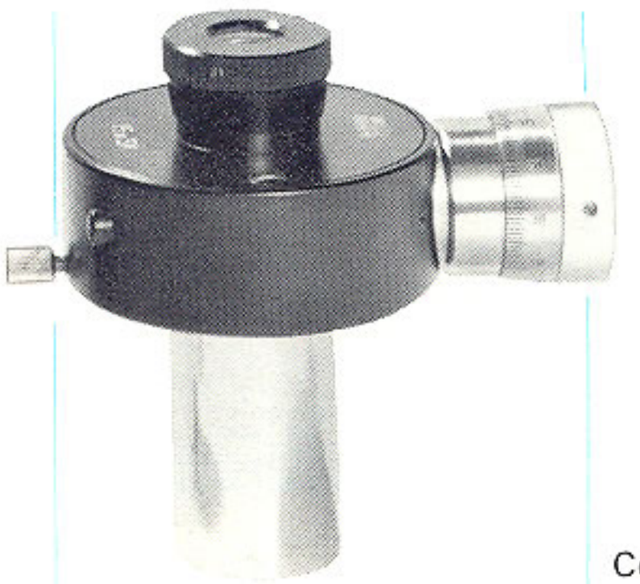
**Compensating eyepiece 2.5×** (stock no. 273 665)
This eyepiece, which is smaller than the one described above, is designed for image projection over large distances, and has the necessary low magnification. The diameter of the projected image is 18 cm for each metre of projection distance.

**Format-indicating eyepieces**
Format-indicating eyepieces, which have adjustable eyelenses, are available as either compensating or wide-field versions. They are used with special tubes for the trinocular assembly in conjunction with the Wild photomicrography cameras or cinemicrographic assemblies. They are placed in the binocular observation tube, and serve for inspection of the format limits of the area being photographed, and for its focussing.

Above:
Graticule for BK3 format-indicating ciné/TV eyepiece, with format limits for f = 50 mm and f = 75 mm camera lenses

Below:
Wide-field format-indicating eyepiece

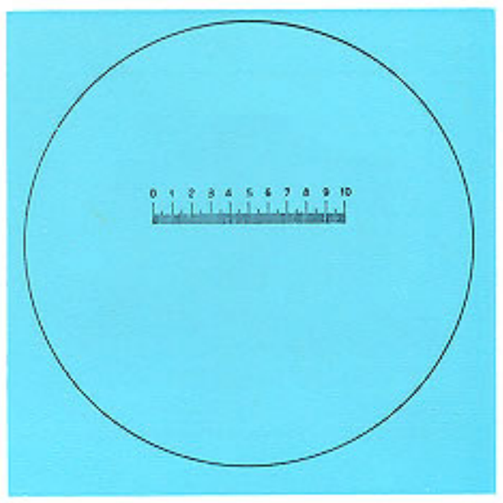




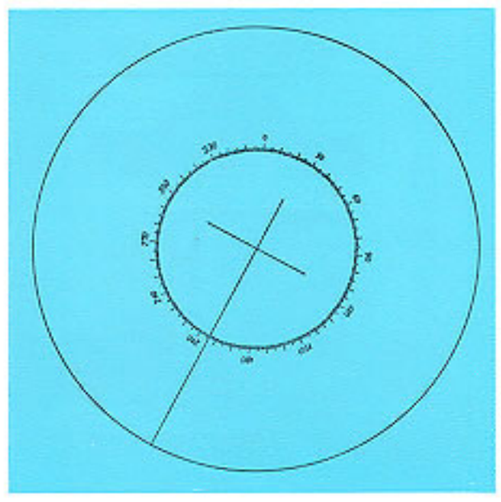
Compensating filar micrometer eyepiece 15×




Compensating measuring eyepiece.
Note adjustable eyelens

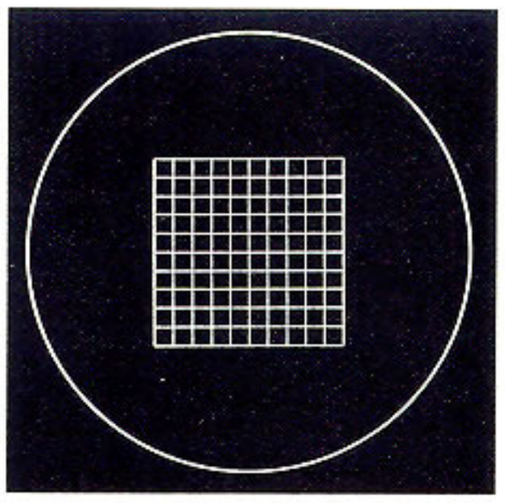



Graticule with scale
10 mm:100

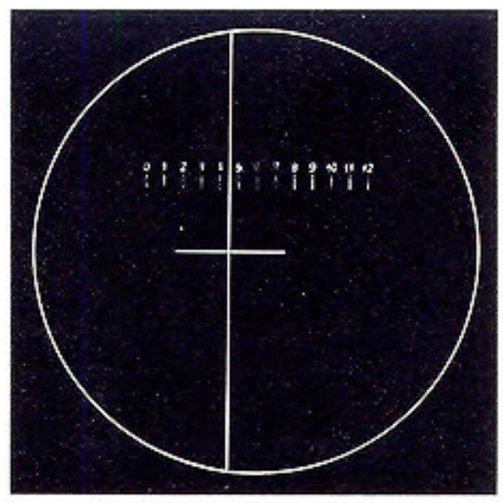


Graticule of compensating goniometer eyepiece 15×

**Measuring eyepieces**
These are available as Huygens, compensating or wide-field versions. They are of various types, and are used for the measurement of lengths, surfaces and angles. The graticules are generally interchangeable according to requirements, and can be sharply focussed by means of the adjustable eyelens. Accessory equipment for measurements in microscopy is described in detail in prospectus M1 510e.



Graticule with grid
100 × 1 mm²



Graticule of compensating filar micrometer eyepiece 15×

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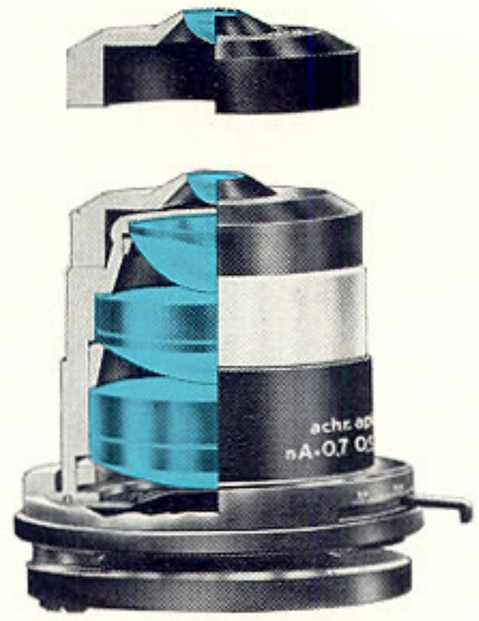
# C. Wild Condensers

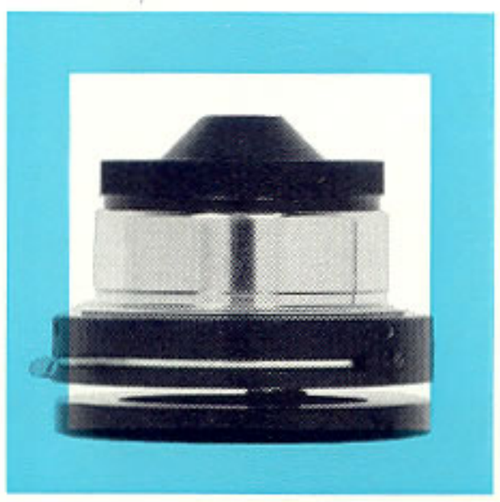
The condenser is chosen according to the eyepiece/ objective combination selected and takes account also of the level and requirements of the work to be undertaken.



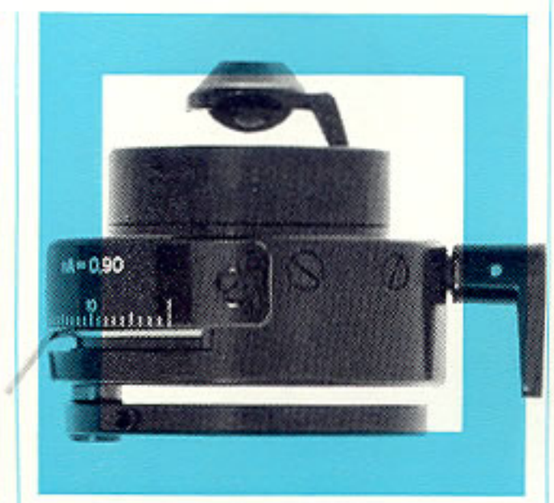
Section through the Achromatic-Aplanatic condenser N.A. 0.70/0.95/1.30



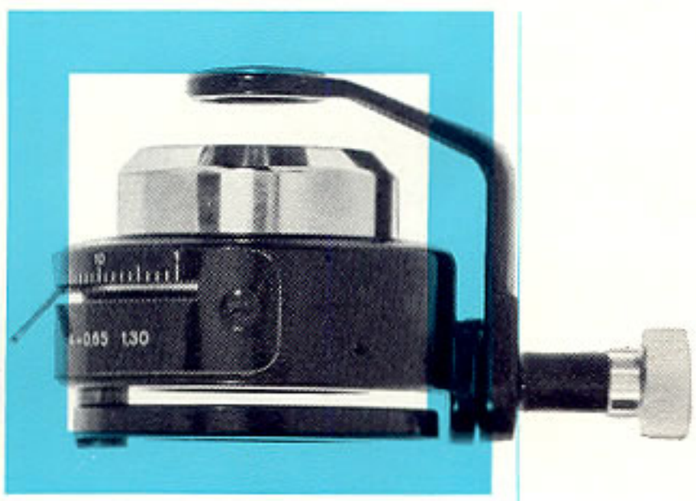
**Single-lens condenser N.A. 0.65, for bright field** (stock no. 250707)
This condenser is intended for elementary microscope outfits. It provides correct illumination at low and medium magnifications and should be employed only for Achromat objectives of up to and including 40×/0.65. (A front lens, stock no. 202793, of N.A. 1.30, can be screwed on if desired.) There is a built-in iris diaphragm.



**Aplanatic condenser N.A. 0.65/1.30, for bright field** (stock no. 250708)
This two-lens condenser suffices for most visual work in microscopy, including oil immersion, particularly if Achromat objectives and simple light sources are employed. The front lens can be removed in order that the lower-power objectives may be correctly illuminated. There is a built-in iris diaphragm.




**Swing-out condenser N.A. 0.3/0.9, for bright field** (stock no. 191051)
The swing-out condenser is noted for the rapidity with which it can be adapted for use at all ranges of magnification. If a high power objective is changed for a low or medium power one, the aperture range of the condenser is simply altered accordingly by swinging out its top lens using a lever. The illuminated area then becomes so large that even objectives of very low magnification (e.g. Plan-Fluotar 3×) can be used. The maximum numerical aperture of the condenser is on the other hand adequate for most optical combinations, including oil immersion objectives. There is a built-in iris diaphragm.



**Swing-out condenser N.A. 0.65/1.30, for bright field** (stock no. 193046)
The mechanical operation of this condenser is rather similar to that of the previous one described, but its higher maximum aperture permits the exploitation of the full aperture of immersion objectives by means of the double immersion technique. The lower limit of numerical aperture if the front lens is swung out will satisfactorily illuminate the 10× objective.
The condenser transmits short-wave light well and can therefore be used to advantage in blue light- and UV-fluorescence. There is a built-in iris diaphragm.

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**Wide field condenser N.A. 0.20, for bright field** (stock no. 192798)
The purpose of this condenser is the correct illumination of the 2×, 3×, 4× and 6× low-power objectives. An iris diaphragm (stock no. 214113) is also available and may be screwed on if required.



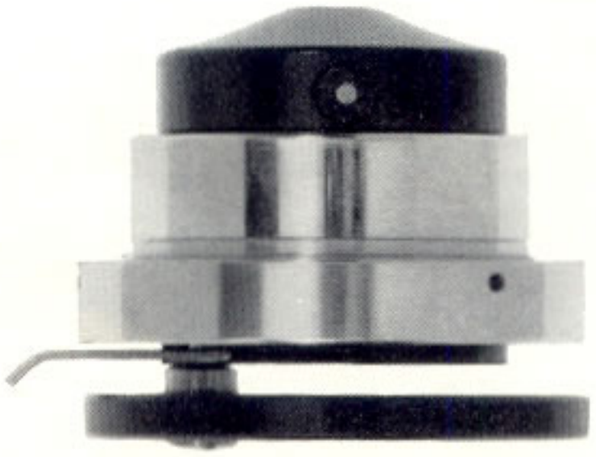

**Achromatic-aplanatic condenser N.A. 0.70/0.95/1.30, for bright field** (stock no. 250709)
This is constructed like a six-lens objective. Owing to its high degree of optical correction, it is designed primarily for use with Fluotar and Plan-Fluotar objectives. Its use is particularly recommended for photomicrography and cine-micrography, both with black-and-white and with colour film. The matching of the condenser aperture range to that of the objective is easily carried out, since the front lenses are interchangeable and are fitted with quick-change mounts. The condenser can also be used for oblique transmitted illumination by means of the sliding and rotating metal shutter provided.




**Long working distance condenser N.A. 0.52, for bright field** (stock no. 250710)
Most conventional condensers have a working distance of only a few millimetres, so that specimens must lie virtually flat on the stage if correct illumination and focussing are to be attained. Since this is often impossible with such things as tissue cultures, plankton chambers and sediment dishes, the long working distance phase condenser was developed. This has a range of adjustment of up to 22 mm, and is particularly useful for the M 40 inverted microscope. It has a built-in iris diaphragm.



**Quartz condenser N.A. 0.40–1.30, for bright field and fluorescence** (stock no. 231963)
Quartz is highly transparent to ultraviolet light, and this condenser is therefore particularly suitable for fluorescence microscopy. The front lens has a quick-change mount and can be rapidly removed in order to reduce the numerical aperture range of the condenser to match that of the low-power objectives. There is a built-in iris diaphragm.



**Polarisation swing-out condenser N.A. 0.65–1.30** (stock no. 243322)
This condenser, like the polarisation eyepieces and polarisation objectives, is mounted strain-free in order to prevent the introduction of polarisation effects due to tensions in the glass. The swing-out front lens and built-in iris diaphragm together facilitate the rapid matching of the aperture of the condenser to that of the objective being used.




**Dark field immersion condenser N.A. 1.40** (stock no. 214057)
Designed specifically for dark field observations, this is a mirror condenser of the best optical correction and with the high numerical aperture of 1.40. It can be used with all types of objective of moderate or high magnification.
The condenser must always be used with oil between it and the slide. Built-in centring screws facilitate correct centring.



**Phase condenser N.A. 0.90** (stock no. 250714)
This is a condenser for observations in either bright field or in phase contrast. The phase diaphragms matching the various phase objectives are in a rotating diaphragm changer. An additional position on the changer is for normal bright-field microscopy; an iris diaphragm is provided for use with it. Built-in centring keys are provided for individual centring of the various phase diaphragms.



**Fluorescence phase condenser N.A. 0.90**
(stock no. 250720)
This is mechanically identical to the phase condenser N.A. 0.90 described above (stock no. 250714), but in order to improve the transmission of the short-wave light necessary for fluorescence the built-in phase diaphragms consist of the same material as the UV-fluorescence exciting filter (UG 1). The condenser is used for phase contrast and fluorescence work in mixed-light procedures.



**Long working distance phase condenser N.A. 0.52 with rotating phase diaphragm changer** (stock no. 198216)
This condenser can be used for observations in bright field and in phase contrast. Its optics are those of the long working distance condenser (stock no. 250710). This is mounted with a rotating diaphragm changer having built-in phase diaphragms. An additional position on the changer is for normal bright-field microscopy; an iris diaphragm is provided for use with it. Built-in centring keys are provided for individual centring of the various phase diaphragms.




**Universal condenser N.A. 0.90** (stock no. 250712)
The Universal condenser N.A. 0.90 has the same mechanical construction as the phase condenser N.A. 0.90, but owing to a different optical construction it can also be used for dark field microscopy. Since however its numerical aperture in dark field is 1.45, oil must be used between condenser lens and slide for dark field work. As a result of the versatility of the condenser for phase contrast, bright field and dark field work, many important microscopy techniques can be quickly and conveniently interchanged.

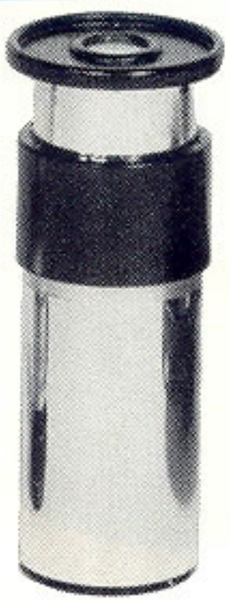


**Long working distance phase condenser N.A. 0.52 with plug-in phase diaphragms** (stock no. 250716)
The long working distance condenser (stock no. 250710) is here set in a centring mount which has two screws for individua lcentring of plug-in phase diaphragms.
The diaphragms are also included in the outfit and are interchangeable to match the particular objective being used.




**Auxiliary microscope** (stock no. 175127)
This somewhat resembles an eyepiece externally, but optically is a 12× telescope. It can be focussed at varying distances by means of its adjustable eyelens.

**Use**
Centring the condenser phase diaphragm relative to the objective phase ring. Conoscopic observation in polarisation microscopy. Checking the centring of illumination. Centring the two diaphragm images in the setting up of incident light interference. Aid for the focussing of the graticule in the format-indicating eyepiece.

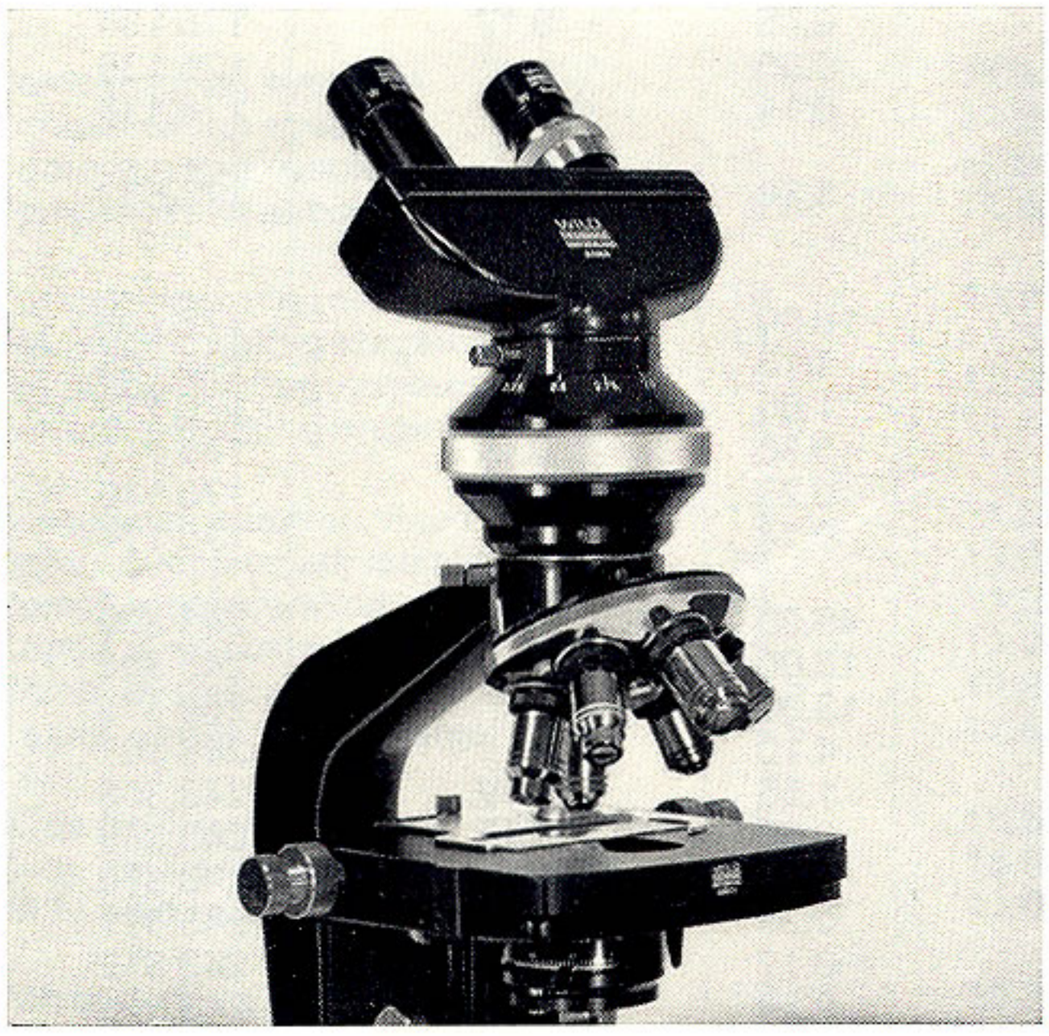


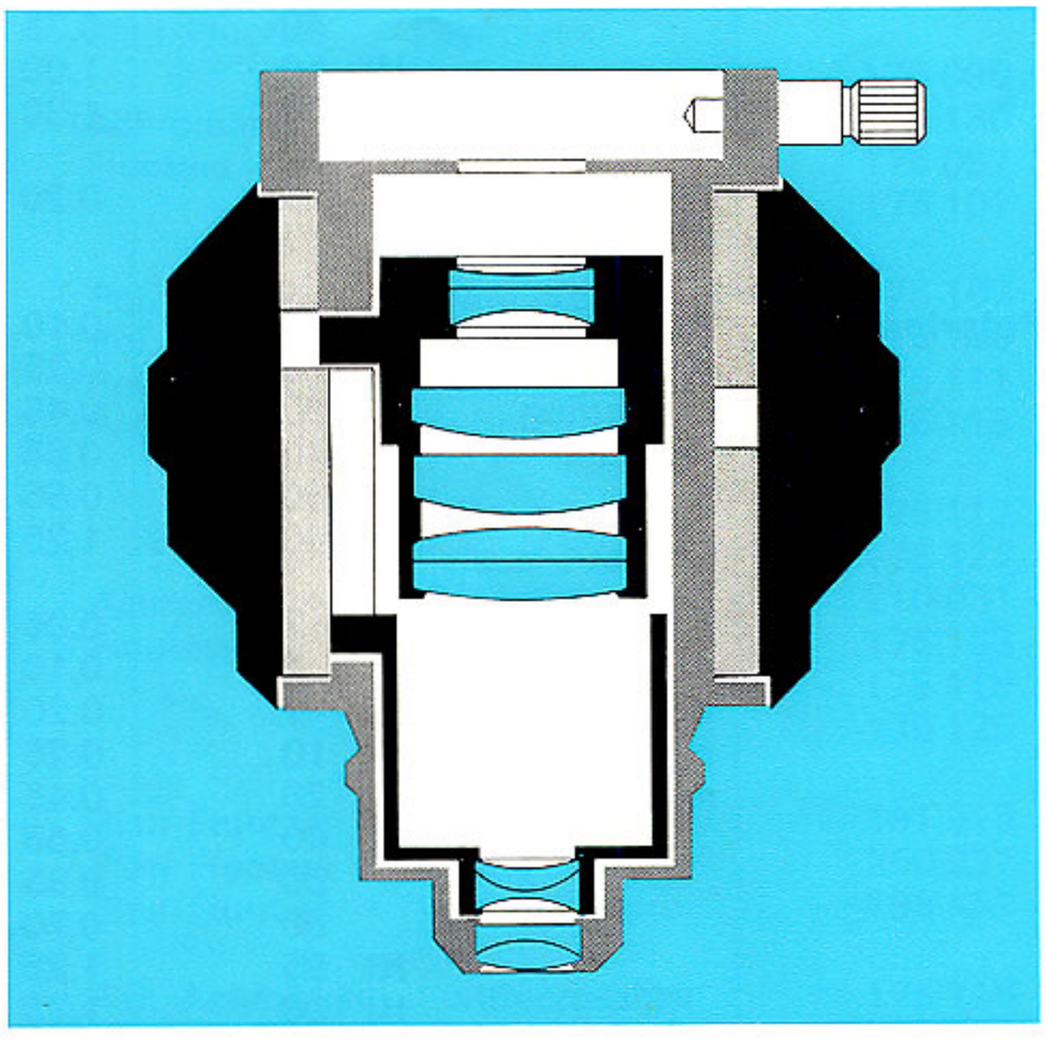
# Wild Variomag Zoom Adapter

Wild Heerbrugg has recently introduced the Variomag, an advanced optimally-corrected zoom adapter having a magnification factor continuously variable in the range 3:1, and which can be immediately fitted to any Wild M 12 or M 20 microscope. It consists of a 10-lens system, by means of which the relative positions of two optical units are altered.
The ingenious mechanical construction has succeeded in making the Variomag compact and convenient to use. The variable units are ball-bearing mounted in spiral grooves, so that an absolutely precise setting can be obtained. The Variomag fits between the microscope limb and the tube. Magnification variation is obtained by turning a knurled horizontal ring and the magnification is read off a scale. The Variomag can be used with all Wild microscope eyepieces and objectives, but the eyepieces of low to medium magnification (6× to 10×) are the most suitable.
All of the Wild accessories having an interchangeable dovetail type of mount can be used, with the exception of the incident light equipment. In addition to its use for visual observations, the Variomag is exceedingly valuable for micro-reproduction purposes (photomicrography, cinemicrography, television microscopy, projection, and drawing) because of the continuous variability of the magnification and of the format limits.




Wild Variomag Zoom adapter (250390)





# Catalogue References and Technical Data

## Wild Objectives

| Method | Type of component | Magnification (160 mm tube length) | Numerical aperture | Working distance to cover glass (mm) | Cover glass thickness (mm) | Stock no. |
|---|---|---|---|---|---|---|
| **Transmitted light bright or dark field** | Achromats | 2 | 0.06 | 49.00 | – | 175 090 |
| | | 4 | 0.10 | 16.00 | – | 203 586 |
| | | 7 | 0.20 | 13.90 | – | 217 331 |
| | | 10 | 0.25 | 4.10 | – | 184 541 |
| | | 20 | 0.45 | 1.55 | 0.17 | 175 092 |
| | | 40 | 0.65 | 0.58 | 0.17 | 209 023 |
| | | 50 | 0.85 | 0.22 | 0.17 | 175 098 |
| | | 60 | 0.70 | 0.29 | 0.17 | 207 781 |
| | | HI 85 | 1.25 | 0.17 | – | 175 094 |
| | | HI 100 | 1.25 | 0.14 | – | 188 374 |
| | | HI 100 Iris | 1.25 | 0.14 | – | 175 096 |
| | Fluotars | 10 | 0.40 | 4.90 | – | 175 124 |
| | | 20 | 0.60 | 1.26 | 0.17 | 184 662 |
| | | 40 | 0.75 | 0.45 | 0.17 | 207 786 |
| | | HI 50 | 1.00 | 0.20 | – | 175 126 |
| | | HI 100 | 1.30 | 0.14 | – | 175 128 |
| | | HI 100 Iris | 1.30 | 0.14 | – | 175 130 |
| | Plan-Fluotars | 3 | 0.10 | 8.75 | – | 106 017 |
| | | 6 | 0.20 | 5.50 | – | 217 342 |
| | | 10 | 0.25 | 3.00 | – | 198 282 |
| | | 20 | 0.45 | 1.05 | 0.17 | 184 902 |
| | | 40 | 0.65 | 0.35 | 0.17 | 183 281 |
| | | HI 100 | 1.30 | 0.35 | – | 217 350 |
| **Phase contrast** | Phase-Achromats | 10 | 0.25 | 4.10 | – | 198 129 |
| | | 20 | 0.45 | 1.55 | 0.17 | 175 100 |
| | | 40 | 0.65 | 0.58 | 0.17 | 175 102 |
| | | HI 100 | 1.25 | 0.14 | – | 175 104 |
| | Phase-Fluotars | 10 | 0.40 | 4.90 | – | 209 017 |
| | | 20 | 0.60 | 1.26 | 0.17 | 217 336 |
| | | 40 | 0.75 | 0.45 | 0.17 | 175 134 |
| | | HI 50 | 1.00 | 0.20 | – | 175 136 |
| | | HI 100 | 1.30 | 0.14 | – | 175 138 |
| | Phase-Plan Fluotars | 6 | 0.20 | 5.50 | – | 273 530 |
| **Polarisation** | Pol.-Achromats in centring mount | 4 | 0.10 | 16.00 | – | 175 106 |
| | | 10 | 0.25 | 4.10 | – | 175 108 |
| | | 20 | 0.45 | 1.55 | 0.17 | 175 110 |
| | | 40 | 0.65 | 0.58 | 0.17 | 175 112 |
| | | 50 | 0.85 | 0.22 | 0.17 | 175 116 |
| | | HI 100 | 1.25 | 0.14 | – | 175 114 |
| | Pol.-Achromats without centring mount | 2 | 0.06 | 49.00 | – | 243 305 |
| | | 4 | 0.10 | 16.00 | – | 243 306 |
| | | 7 | 0.20 | 13.90 | – | 255 575 |
| | | 10 | 0.25 | 4.10 | – | 243 307 |
| | | 20 | 0.45 | 1.55 | 0.17 | 243 308 |
| | | 40 | 0.65 | 0.58 | 0.17 | 243 309 |
| | | 50 | 0.85 | 0.22 | 0.17 | 243 310 |
| | | 60 | 0.70 | 0.29 | 0.17 | 243 311 |
| | | HI 85 | 1.25 | 0.17 | – | 243 312 |
| | | HI 100 | 1.25 | 0.14 | – | 243 313 |

| Method | Type of component | Magnification (160 mm tube length) | Numerical aperture | Working distance to cover glass (mm) | Cover glass thickness (mm) | Stock no. |
|---|---|---|---|---|---|---|
| **Incident light (bright field only)** | Epi-Achromats | 20 | 0.45 | 1.55* | 0 | 175 118 |
| | | 40 | 0.65 | 0.58* | 0 | 175 120 |
| | Epi-Plan-Fluotars | 20 | 0.45 | 1.05* | 0 | 105 928 |
| | | 40 | 0.65 | 0.35* | 0 | 105 933 |
| **Incident light (bright or dark field)** | Universal-Epi-Achromats | 4 | 0.10 | 16.00* | 0 | 188 511 |
| | | 10 | 0.25 | 5.10* | 0 | 201 149 |
| | | 20 | 0.45 | 1.55* | 0 | 196 521 |
| | | 40 | 0.65 | 0.58* | 0 | 202 465 |
| | | HI 100 | 1.25 | 0.14* | 0 | 175 122 |

Working distance = distance from mount of front lens to upper surface of cover glass
* In practice, the cover glass is not used

## Wild Eyepieces

| Type of component | Eyepiece magnification (at 250 mm) | Field number (mm) | Exit pupil distance (mm) | Used with | Remarks | Stock no. |
|---|---|---|---|---|---|---|
| Huygens eyepiece | 6× | 18 | 11.6 | Achromats | – | 175 153 |
| Huygens eyepiece | 10× | 14 | 7.6 | Achromats | – | 197 722 |
| Huygens pointer eyepiece | 10× | 14 | 7.6 | Achromats | adjustable pointer | 209 035 |
| Pol. Huygens eyepiece | 6× | 18 | 11.6 | Pol.-Achromats | with crosshair | 175 103 |
| Pol. Huygens eyepiece | 10× | 14 | 7.6 | Pol.-Achromats | with crosshair | 175 105 |
| Compensating eyepiece | 2.5× | 18 | 180.0 | Fluotars + Plan-Fluotars | as photo-eyepiece for zoom camera obj. | 184 586 |
| Compensating eyepiece | 2.5× | 18 | 50.0 | Fluotars + Plan-Fluotars | as projection eyepiece | 273 665 |
| Compensating eyepiece | 6× | 18 | 11.9 | Achromats + Fluotars | – | 175 095 |
| Compensating eyepiece | 10× | 14 | 11.3 | | | 198 130 |
| Compensating eyepiece | 15× | 11 | 12.9 | | | 175 097 |
| Compensating eyepiece | 25× | 6.5 | 11.5 | | | 175 101 |
| Pol. compensating eyepiece | 6× | 18 | 11.9 | Pol.-Achromats | with crosshair | 175 107 |
| Pol. compensating eyepiece | 10× | 14 | 11.3 | Pol.-Achromats | with crosshair | 175 109 |
| Pol. compensating eyepiece | 15× | 11 | 12.9 | Pol.-Achromats | with crosshair | 175 111 |
| Pol. compensating eyepiece | 20× | 8.5 | 11.5 | Pol.-Achromats | with crosshair | 175 113 |
| Complanat eyepiece, fixed | 6× | 18 | 11.8 | Achromats + Fluotars | visual / repro | 175 117 |
| Compl. eyepiece, adjustable | 6× | 18 | 11.8 | | visual / repro | 175 121 |
| Compl. eyepiece, fixed | 10× | 14 | 11.2 | | visual / repro | 210 031 |
| Compl. eyepiece, adjustable | 10× | 14 | 11.2 | | visual / repro | 175 123 |
| Compl. eyepiece, fixed | 15× | 9.5 | 12.8 | | visual / repro | 175 119 |
| Compl. eyepiece, adjustable | 15× | 9.5 | 12.8 | | visual / repro | 175 125 |
| Wide field eyepiece | 10× | 18 | 15.5 | Plan-Fluotars | visual / repro | 191 915 |
| Wide field eyepiece | 12.5× | 18 | 15.5 | Plan-Fluotars | visual / repro | 250 237 |
| Wide field eyepiece | 15× | 18 | 17.0 | Plan-Fluotars | visual / repro | 198 451 |
| Pol. wide field eyepiece | 10× | 18 | 15.5 | Pol.-Achromats | with crosshair | 175 115 |

| Type of component | Eyepiece magnification (at 250 mm) | Field number (mm) | Exit pupil distance (mm) | Used with | Remarks | Stock no. |
|---|---|---|---|---|---|---|
| Huygens measuring eyepiece | 6× | 18 | 11.6 | Achromats | With scale 10 mm:100 for graticules ⌀ 16 mm | 255 504 |
| Huygens measuring eyepiece | 6× | 18 | 11.6 | Achromats | With scale 10 mm:100 for graticules ⌀ 16 mm | 175 091 |
| Huygens measuring eyepiece | 10× | 14 | 7.6 | Achromats | With scale 5 mm:100 for graticules ⌀ 16 mm | 255 505 |
| Huygens measuring eyepiece | 10× | 14 | 7.6 | Achromats | With scale 5 mm:100 for graticules ⌀ 16 mm | 175 093 |
| Compensating measuring eyepiece | 10× | 14 | 11.3 | Fluotars | With scale 5 mm:100 for graticules ⌀ 16 mm | 255 506 |
| Compensating measuring eyepiece | 10× | 14 | 11.3 | Fluotars | | 250 301 |
| Wide field measuring eyepiece | 10× | 18 | 15.5 | Plan-Fluotars | With scale 12 mm:120 and crosshair for graticules ⌀ 18 mm | 250 793 |
| Wide field measuring eyepiece | 10× | 18 | 15.5 | Plan-Fluotars | With scale 12 mm:120 and crosshair for graticules ⌀ 18 mm | 250 262 |
| Compensating measuring eyepiece | 10× | 14 | 11.3 | | With Weibel graticule for stereological measurements | 255 507 |
| Compensating measuring eyepiece | 10× | 14 | 11.3 | | With Merz graticule for stereological measurements | 284 943 |
| Counting eyepiece | 10× | 14 | 11.3 | | | 256 511 |
| Matching eyepiece for counting eyepiece | 10× | 14 | 11.3 | | Height adjustment for binocular observation with 256 511 | 198 182 |
| Compensating filar micrometer eyepiece | 15× | 11 | 12.9 | | | 256 510 |
| Matching eyepiece for filar micrometer eyepiece | 15× | 11 | 12.9 | | Height adjustment for binocular observation with 256 510 | 250 250 |
| Compensating goniometer eyepiece | 15× | 11 | 12.9 | | | 201 646 |
| **Format-indicating eyep.** | | | | | | |
| Compensating format-indicating eyepiece | 10× BK | 14 | 11.3 | | For cameras MKa 2 and MKa 5 | 184 632 |
| Wide field format-indicating eyepiece | 10× BK | 18 | 15.5 | | For cameras MKa 2 and MKa 5 | 192 986 |
| Format-indicating eyepiece | 10× BK 3 | 14 | 11.3 | | For cine and TV | 105 845 |
| Format-indicating eyepiece | 10× BK 2 | 14 | 11.3 | | For projection attach. | 196 319 |

## Eyepiece graticules

| | Stock no. |
|---|---|
| **Graticules ⌀ 16 mm** | |
| Graticule with scale 5 mm:100 | 127 572 |
| Graticule with scale 10 mm:100 | 128 402 |
| Graticule with grid 25×1 mm² | 175 141 |
| Graticule with grid 100×1 mm² | 175 143 |
| Crosshair graticule | 175 145 |
| Weibel graticule | 105 844 |
| Merz graticule | 250 364 |
| **Graticule ⌀ 18 mm** | |
| Graticule with scale 12 mm:120 and crosshair | 217 579 |
| Graticule with grid 144×1 mm² | 306 706 |
| Weibel graticule | 313 944 |

$$\text{Diameter of field of view} = \frac{\text{field number}}{\text{magnification of objective}}$$

Image diameter at 250 mm projection distance = field number × magnification of eyepiece

## Wild Condensers

| Method | Condenser type | Numerical aperture | Working distance (mm) | Stock no. |
|---|---|---|---|---|
| **Bright field** | Wide field condenser | 0.20 | 1.5 | 192 798 |
| | Iris diaphragm for wide field condenser | | | 214 113 |
| | Long working distance condenser with iris diaphragm | 0.52 | 22.0 | 250 710 |
| | Single-lens condenser with iris diaphragm | 0.65 | 15.0 | 250 707 |
| | Front lens for single-lens condenser | 1.30 | 0.5 | 202 793 |
| | Aplanatic condenser with iris diaphragm | 0.65/1.30 | 15.0/0.5 | 250 708 |
| | Swing-out condenser with iris diaphragm | 0.30/0.90 | 50.0/0.4 | 191 051 |
| | Swing-out condenser with iris diaphragm | 0.65/1.30 | 15.0/0.5 | 193 046 |
| | Achromatic-aplanatic condenser with iris diaphragm | 0.70/0.95 /1.30 | 11.5/1.5 /0.5 | 250 709 |
| **Bright field and fluorescence** | Quartz condenser with iris diaphragm | 0.40/1.30 | 18.0/0.2 | 231 963 |
| **Polarisation** | Pol. swing-out condenser with iris diaphragm | 0.65/1.30 | 15.0/0.5 | 243 322 |
| **Dark field** | Dark field immersion condenser | 1.40 | 0.55 | 214 057 |
| **Phase contrast** | Long working distance phase condenser with plug-in phase diaphragms, comprising: | 0.52 | 22.0 | **250 716** |
| | Long working distance phase condenser | | | 256 598 |
| | Plug-in phase diaphragm for 10× objective | | | 213 806 |
| | Plug-in phase diaphragm for 20×/ 40× objectives | | | 213 807 |
| | Plug-in phase diaphragm for 50×/100× objectives | | | 214 121 |
| | Plug-in phase diaphragm for 6× objective | | | 273 535 |
| **Phase contrast and dark field** | Long working distance phase condenser with rotating phase diaphragm changer and iris diaphragm | 0.52 | 22.0 | 198 216 |
| | Long working distance phase condenser N. A. 0.52 with rotating phase diaphragm changer, 6× phase diaphragm in centring mount, and iris diaphragm | 0.52 | 22.0 | 303 427 |
| | Plug-in phase diaphragm for 6× objective, for 198 216 | | | 313 762 |
| | Phase condenser with rotating diaphragm changer and iris diaphragm | 0.90 | 3.5 | 250 714 |
| **Phase contrast, bright and dark field** | Universal condenser with rotating diaphragm changer and iris diaphragm | 0.90 (DF 1.45) | 3.5 | 250 712 |
| **Phase contrast and fluorescence** | Fluorescence phase condenser with rotating phase diaphragm changer and iris diaphragm | 0.90 | 3.5 | 250 720 |
| | Auxiliary microscope | | | 175 127 |
| | Condensers ordered for use with the M 40 microscope must be designated «for M 40» on the order form. | | | |

## Wild Variomag

| | Stock no. |
|---|---|
| Variomag zoom adapter 3:1, for Wild M12 / M20 microscopes, in case | 250 390 |

**Our manufacturing programme includes**

Wild M4 and M4A stereomicroscopes with interchangeable magnification changer or built-in magnification changer drum. Range: 1.5× to 160×.

Wild M5 stereomicroscope for advanced work. Range: 2× to 200×.

Wild M7 zoom stereomicroscope with 5:1 zoom magnification changer. Range: 3× to 124×.

Wild M11 field, course and laboratory microscope.

Wild M12 advanced laboratory microscope. Modern design, simple and convenient operation. For all techniques.

Wild M20 research microscope. Combines maximum operational convenience with highest precision. The universal instrument for advanced work and special research techniques.

Wild M21 polarising microscope for orthoscopic and conoscopic observations.

Wild M40 inverted biological microscope for tissue culture, plankton and chemical investigations.

Wild M50 inverted metallurgical microscope for investigations in incident light (bright field, dark field and polarisation).

Wild M501 sampling microscope, with stopmotor-driven stage, for systematic scanning and for representative gridding in stereological work. With the aid of mathematical procedures, the instrument is used for quantitative determination of the three-dimensional structure of a body from inspection of sections, and is particularly useful in biology, metallurgy and geology.

Wild image converter unit for investigations in the UV and IR regions of the spectrum. Equally suitable for macro, stereo and micro applications.

Wild interference attachments for the M12 and M20 microscopes. For interferometric measurements and observations in incident light.

Modern microscope lamps: low voltage, halogen, high pressure xenon and mercury vapour sources. Electronic flash outfit.

Transmitted-light illumination bases for Wild microscopes, with one or two lamps for various light sources. Built-in filter sets for fluorescence. Optimum light intensity for microprojection.

Wild objectives of highest quality. For all techniques, including phase contrast, polarisation, incident light and interference.

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Wild condensers for all techniques, including bright and dark field, polarisation, fluorescence and phase contrast.

Electronic micro-length measuring attachments (Wild/Censor for Wild stereomicroscopes and Wild/Tesa for Wild microscopes). Direct readoff for precise and rapid work.

Wild Variomag zoom adapter for M12 and M20 microscopes permits stepless variation of magnification.

Photomicrographic outfits from 35 mm to 4×5 in. formats. Attachable cameras for all stands, including stereomicroscopes.

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