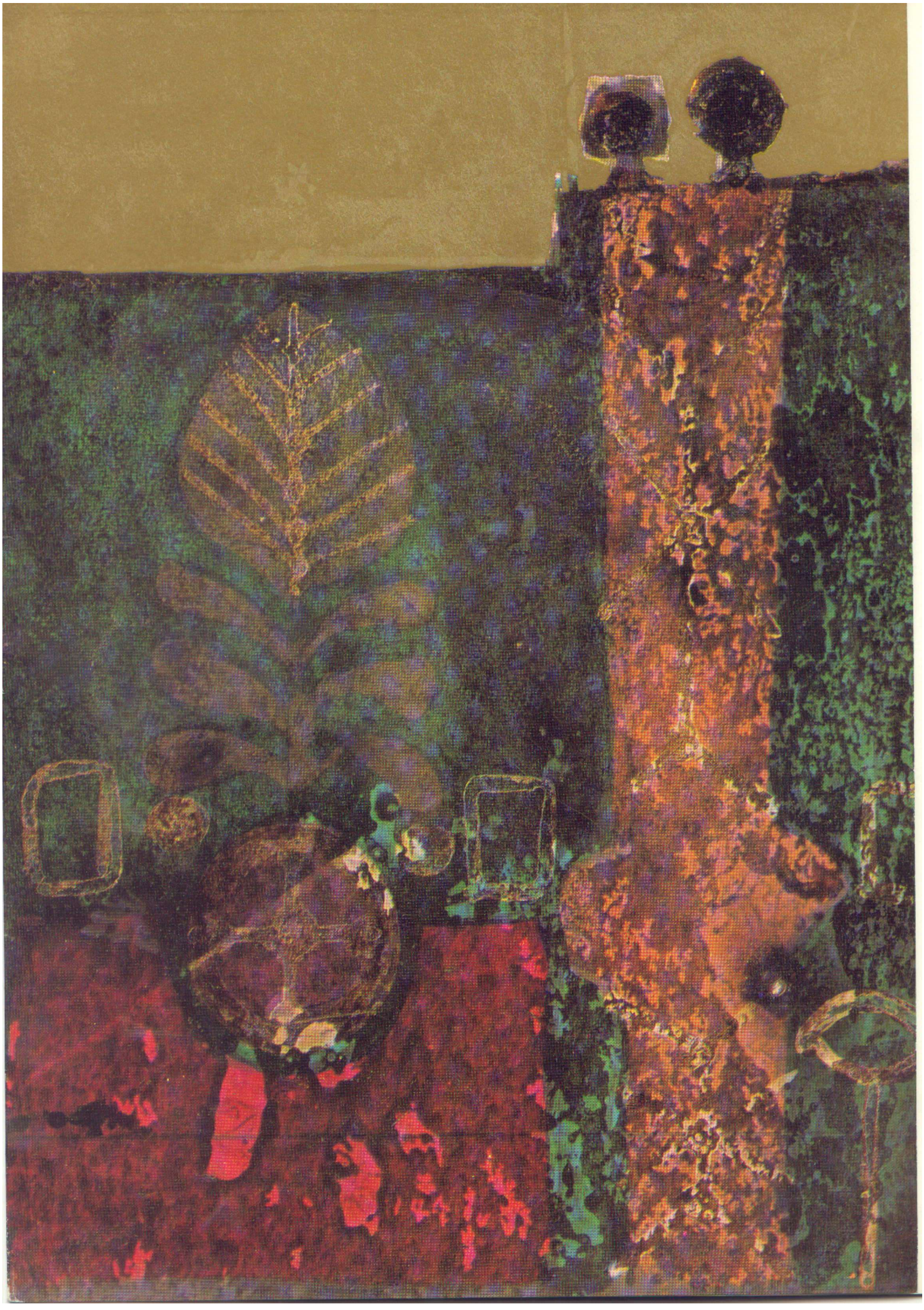

UnivaR



UnivaR

REICHERT

AUSTRIA

UnivaR

The new Reichert research microscope is the reply to this challenge.

An instrument which adopts a fresh approach!

An instrument for all the methods known today to which any 4 of the light sources available today and 3 different cameras can be mounted simultaneously and used alternatively. A mechanical replacement of individual elements is no longer required, the change of technique, light source or camera is limited to the operation of controls.

The exceptional optical performance extends to all components of this instrument. The objective performance as well as the large field of view 28 are available without restriction at all magnifications and with all examination methods.

Because of this new approach, microscope operation is much simpler than on conventional instruments. Many adjustments are either made automatically, completely omitted, or at least more convenient and more rapid to make. Even the basic adjustment for bright field illumination has been simplified by providing the red dot setting.

Sitting position, manual operation, viewing height and the clear layout and marking of all controls have been determined by extensive user trials. This optimum ergonomic design results in completely universal application together with simple operation and freedom from fatigue.

The instrument performance can be adapted to the extent and type of work involved by fitting the appropriate elements. At every stage all the additional elements are fully integrated in the instrument both for operation and for external form.

UnivaR—an instrument which represents today's highest technical development, and whose basic approach offers free play to the new methods of the future. It combines virtually all the advantages available separately on different instruments, and in addition offers a large number of novel solutions.


REICHERT
UnivaR

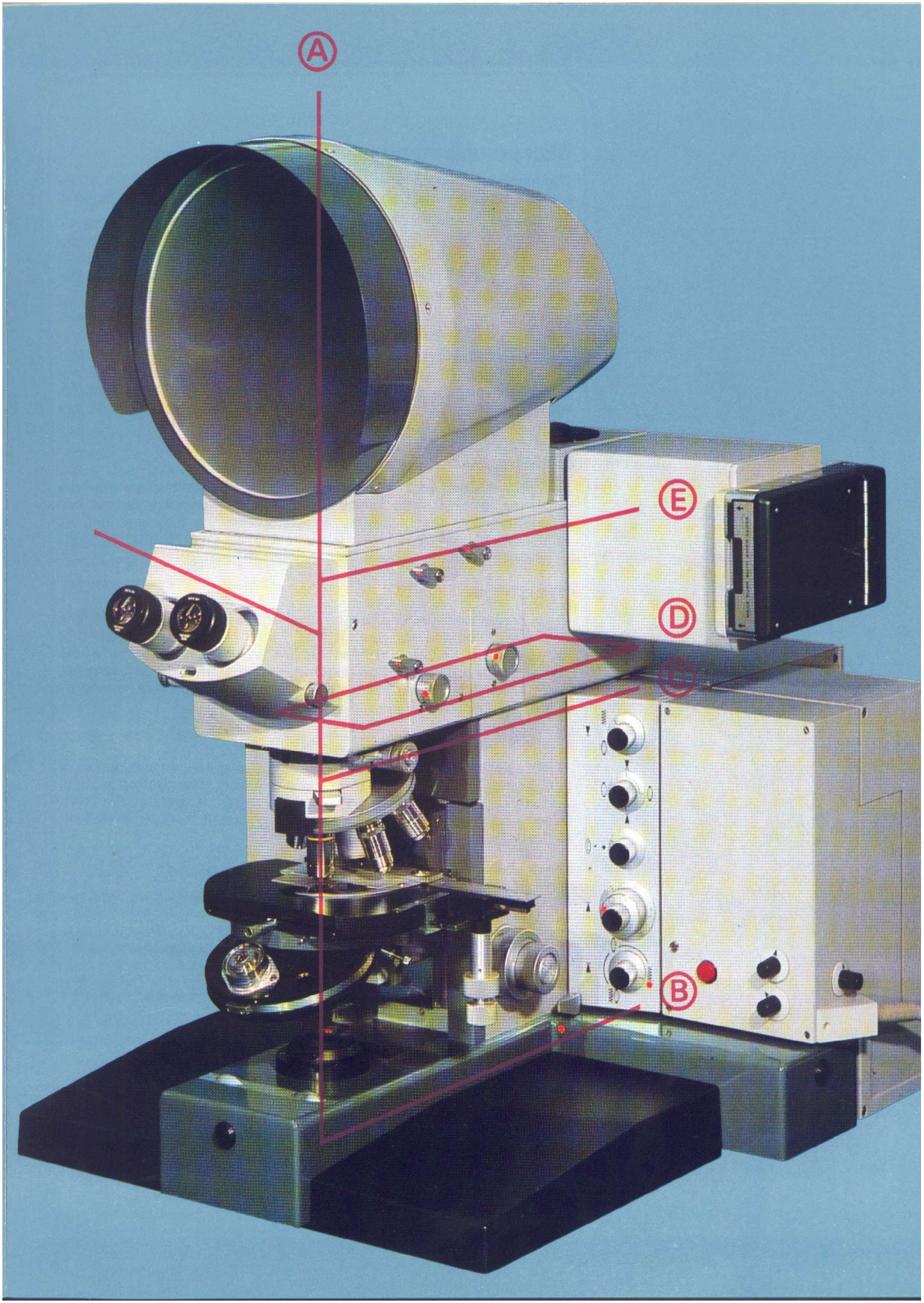
UnivaR

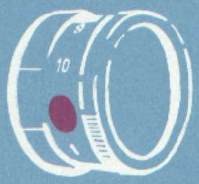
The instrument is of compact construction. For the first time the important optical components and the additional elements can be assembled by means of a new modular system.

The main vertical axis A contains the usual interchangeable arrangement of objectives, condensers and eyepieces.

Four additional horizontal axes contain groups of elements which are fitted into the stand as complete and fully adjusted assemblies. According to the specification selected they combine precisely with each other to form the complete optical system of the microscope. Servicing and the supply and retrofitting of individual assemblies are greatly simplified by this arrangement.

	Axis	Page
Image formation		
1 set of objectives for 17 methods	A	14
1 pair of eyepieces for all magnifications and all forms of measurement	A	16
1 relay system (with magnification changer) for contrast methods and measuring graticules	D	17
Illumination		
1 condenser system for 16 methods	A	22
1 automatic illumination system with zoom optics	B	24
1 illuminator for incident-light fluorescence and at the same time for all transmitted-light methods	C	25
Photo and lamps		
1 automatic photographic system with free choice of 3 cameras	E	30
1 lamp system with choice of 4 light sources for incident, transmitted and mixed illumination	B/C	32
Design and operation		38


A
E
D
C
B



Microscope stand

The stand is made up of welded steel elements to give the instrument extreme rigidity. The image remains stationary and accurately focused during all manipulations on the microscope.

The stand is 59 cm wide, 75 cm deep and 50 cm high; in the basic outfit it weighs approximately 55 kg. Antivibration mountings, correct positioning of the centre of gravity and large mass prevent the transfer of building vibrations and ensure undisturbed use.

Red dot setting

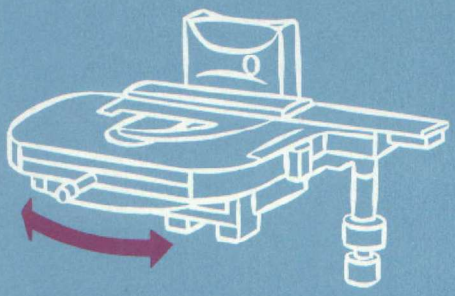
A number of controls on stand, optics and lamp housing are marked with a red dot. Adjusting the controls to these dots leads immediately to correct imaging of the specimen in bright-field transmitted light. All adjustment errors are completely excluded, all other methods can easily be adjusted from this starting point.

Coarse and fine focusing

Ball bearings and ball bearing tracks ensure precise and service-free operation of this rigid mechanical system. Operation is by low coaxial controls which carry a μm scale for depth measurement. An adjustable coarse focus stop permits reproducible setting of stage height and prevents damage to specimen or optics.

Substage

Exact height adjustment of the condenser is provided for the first time by a coaxial coarse and fine control. Together with the correction of the achromatic-aplanatic condensers this fine adjustment improves the image quality with immersion condensers and in interference contrast. The working position of the condenser can readily be reproduced by an adjustable focus stop.



Rotating mechanical stage

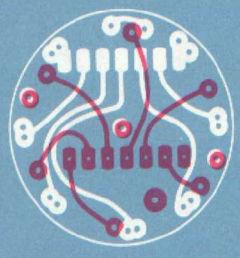
The stage area measures 150 X 120 mm, the specimen movement of 50 X 75 mm is controlled by low coaxial controls. The centred rotation through 180° permits convenient orientation of the specimen in interference contrast or selecting a suitable specimen position in relation to the camera frame.

Revolving nosepiece with programmer

The nosepiece takes 6 objectives which can be changed reproducibly and with extreme accuracy.
Comparative examination is simple and rapid since the specimen remains accurately focused when changing the objective.

The nosepiece carries an interchangeable programmer which automatically adjusts the zoom optics in the illumination system to suit the objective selected.

Analysers, compensators, barrier filter slides and the interference contrast prism can be inserted in the nosepiece carrier.



Magnification indicator

The objective magnification is for the first time shown automatically and clearly visible on an indicator at the base of the stand. It is coupled with the zoom illumination optics and is synchronised electronically to the objective selected.

Projection screen

Characteristics of screen and imaging optics allow comfortable viewing by several observers. Pointers or markers projected into the image are visible on the screen. The image diameter is 240 mm, the illumination is uniform and free from any disturbing flicker.

Camera prism

The light coming from the beam splitter prism is directed either into the camera system (Axis E) or to the vertical light exit.

Binocular body

The eyepiece tubes can be adjusted by a control to suit the inter-pupillary distance of the observer. The tube length remains constant, irrespective of this adjustment, and the objectives therefore remain accurately focused. With the relay in use the image in the body is upright and unreverted, orientation and manipulation of the specimen are very simple.

Beam splitter prisms – binocular body

The ray bundle from the objective is directed through deviating beam -splitter prisms:

Setting Cam/Pro:	20%	to the binocular body, 80% for photography or projection
	. . .	normal working position
Setting Eye:	100%	to the binocular body
	. . .	for observing specimens of extremely low brightness
Setting S:	100%	through the vertical light exit and the photo-meter to the binocular body
	. . .	only for photometry and other special methods.

In the settings Eye and S the camera shutter is automatically blocked.

Microphotometer

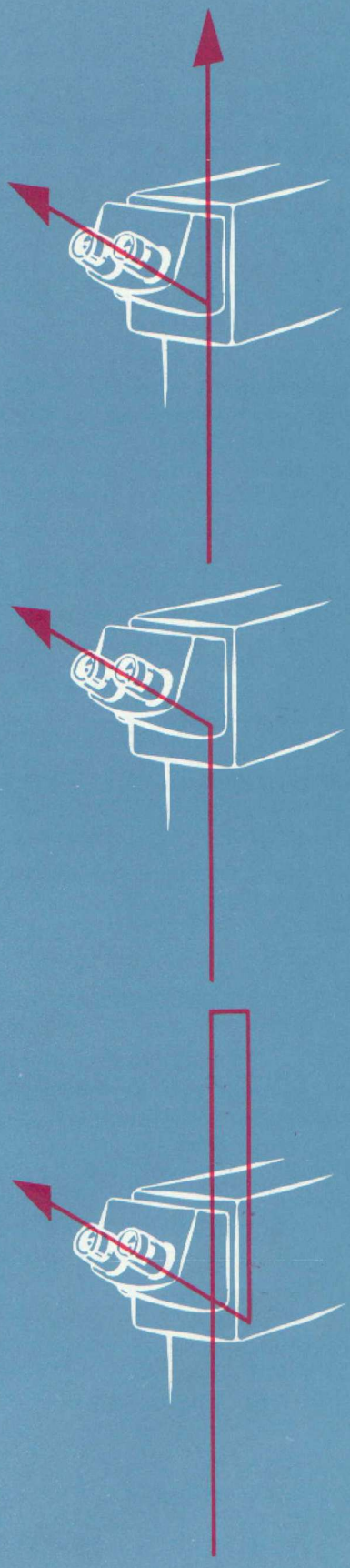
The micro-spectrophotometer can be fitted on the stand in place of the projection screen. With the beam splitter prism set to S the image then passes first through this optical system and is then directly visible in the binocular body together with the parallax-free image of the measuring diaphragm. This ensures fatigue-free photometric evaluation with both eyes combined with a large field of view, in a normal convenient sitting position.

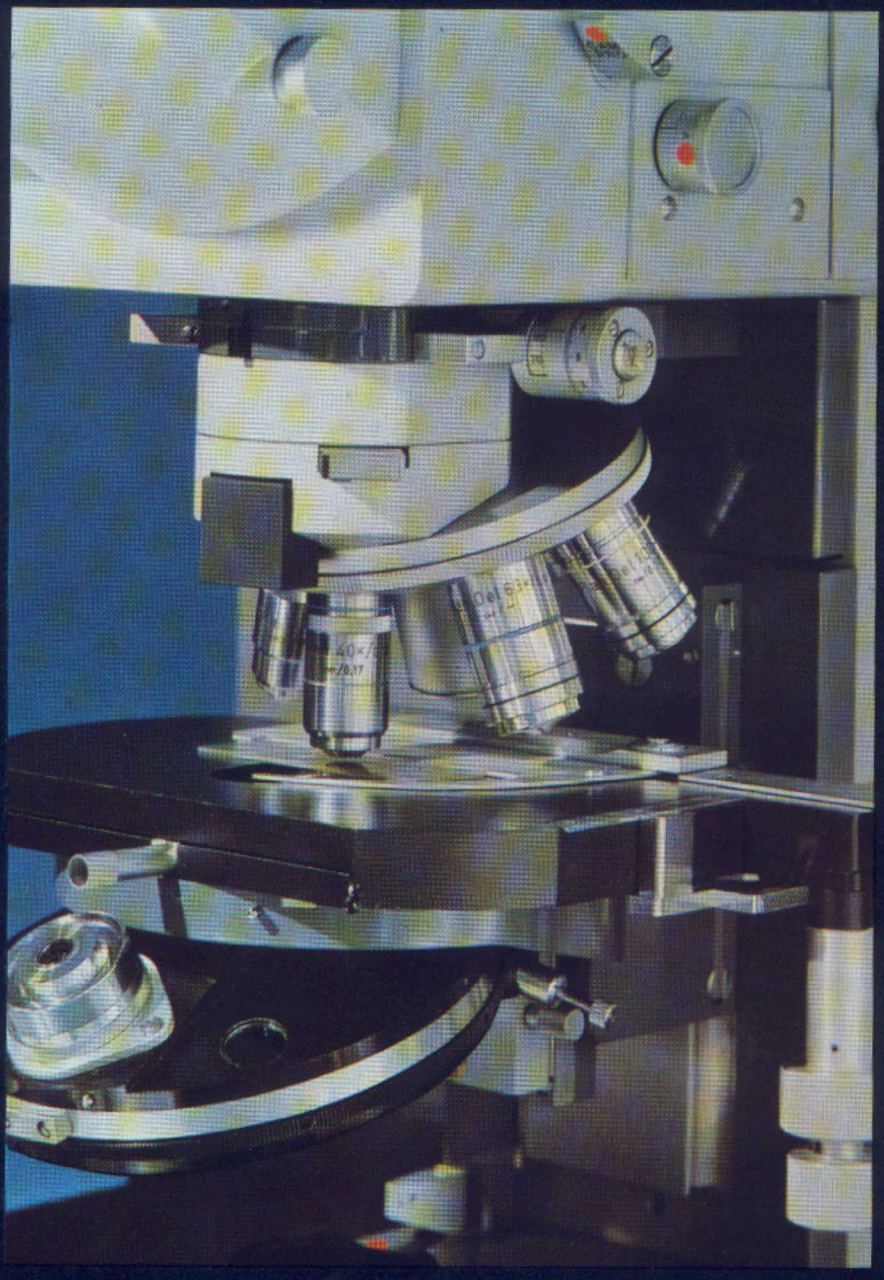
Relay prism

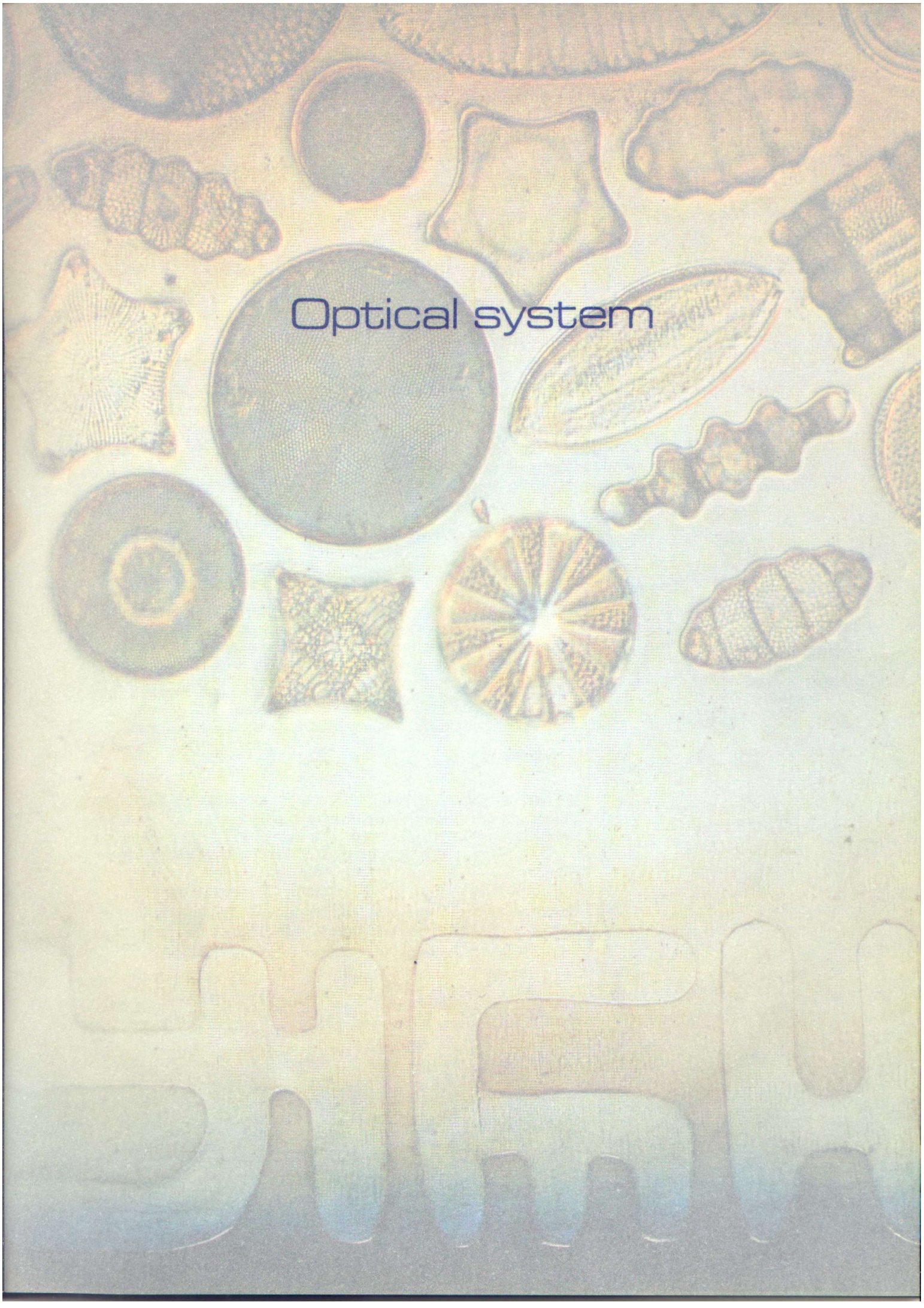
The light from the objective passes through a prism into the imaging relay (axis D) and from there back into the vertical upward beam. The prism may be swung out for certain special investigations.

Incident light illuminator

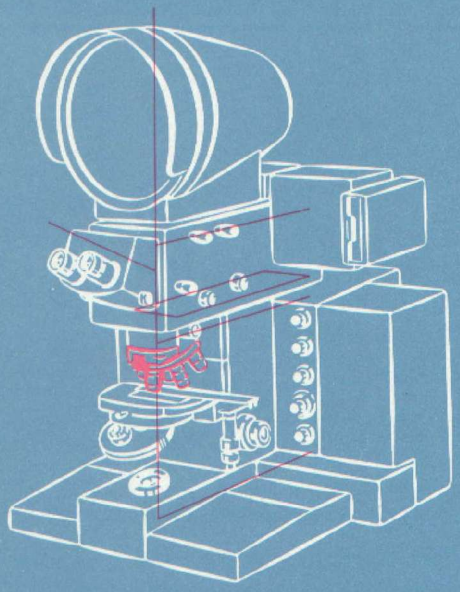
Illuminators are provided on axis C both for short-wave illumination (incident light fluorescence) and for visible light (metallography, mineralogy). Combination with transmitted light methods is possible.







Optical system



1 set of objectives

for 17 methods
–therefore no objective change when changing the method.

The objectives of the UnivaR set a new standard of quality in brilliance, contrast and resolution in the research class.

They have been computed by new methods and are designed for infinite tube length, shoulder to object distance of 45 mm and the large field 28. The use of special glass grades and new manufacturing processes has resulted in much wider application than has ever been achieved before.

All objectives can be used: without restriction of the field
without loss of quality at the edge
with all light sources
for all methods known today.

For different methods there is therefore no need to change the objectives. For obtaining the desired contrast method or the required type of illumination, the optical elements mounted on the stand are simply placed into operation. The objectives remain in the working position, the specimen always remains in the field–comparison is therefore rapid and involves no difficulty.

	Magnification	Numerical aperture	Corrected for	Diaphragm	Free working distance	colour ring
Plan	2.5 X	0.075	–		6.1	brown
Plan	4 X	0.12	–		13	red
Plan	10 X	0.25	–		1.9	yellow
Plan	25 X	0.45	0.17		0.60	dark green
Plan	40 X	0.75	0.17	Iris	0.29	light blue
Plan	50 X	0.85	0.17 Öl		0.20	light blue + black
Plan	63 X	1.00	0.17 Öl	Iris	0.23	dark blue + black
Plan	63 X	1.00	0.17 Glyz	Iris	0.22	dark blue + orange
Plan	100 X	1.25	0.17 Öl	Iris	0.13	white + black
Plan	100 X	1.25	0.17 Glyz	Iris	0.10	white + orange
Plan Apo	10 X	0.32	0.17		0.59	yellow
Plan Apo	25 X	0.65	0.17		0.17	dark green
Plan Apo	40 X	1.0	0.17 Öl	Iris	0.23	light blue + black
Plan Apo	100 X	1.32	0.17 Öl	Iris	0.10	white + black

Bright field

As standard outfit we offer our planachromat series. For extreme demands on resolution, colour correction and contrast it is supplemented by the planapochromats and by glycerin immersion objectives for fluorescence microscopy. All these objectives can be freely combined and used for all special methods such as phase contrast, interference contrast etc. The objectives can therefore be chosen solely to suit the requirements of the individual user.

Dark field

All objectives with numerical apertures above 0.75 are fitted with iris diaphragms.

Polarization
Interference contrast

All objectives are made from specially developed glass grades and are produced with extreme care to ensure freedom from strain.

Phase contrast
Anoptral contrast

Contrast methods can be used on all objectives from 10 X. The phase retardation rings are located not in the objective but in the intermediate image of the pupil in the relay system. Centring is checked with a built-in Bertrand lens.

Bright field fluorescence

All objectives are made from fluorescence free glass grades. The use of UV-absorption coverslips is therefore unnecessary. The immersion objectives 63 X and 100 X for glycerin have been developed to provide improved contrast and to simplify the technique.

Dark field fluorescence

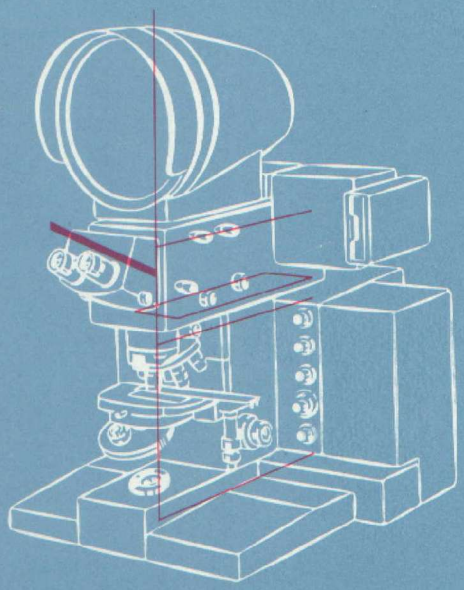
All large-aperture objectives are fitted with iris diaphragms which are also used in fluorescence microscopy to reduce illumination scatter with thick specimens.

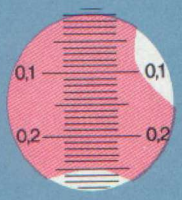
Contrast fluorescence

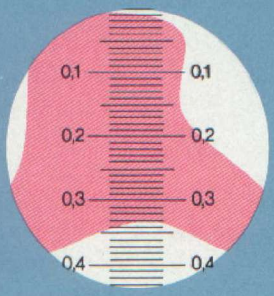
All objectives can be combined with the UV-transmitting ring diaphragms in the condenser; again the phase rings are inserted at the relay.

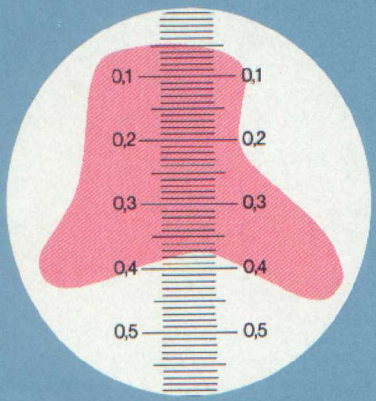
Incident light fluorescence

All dry objectives and in particular the glycerin immersion objectives developed for fluorescence microscopy are made from glass grades with a high UV transmission. Together with the large apertures this results in powerful fluorescence excitation in the selected wavelength ranges.









Conventional microscope
Magnification 400 X
Objective 63 X/Eyepiece 6.3 X/
Field No. 18
Specimen field: 0,082 sq. mm

UnivaR
Magnification 400 X
Objective 63 X/Eyepiece 6.3 X/
Field No. 28
Specimen field 2,4 X larger

UnivaR
Magnification 400 X
Objective 40 X/Eyepiece 10 X/
Field No. 24
Specimen field 4.4 X larger

Eyepieces – for wide field

"... wide field" means a greatly enlarged specimen field and therefore more information from the specimen. Widefield eyepieces are therefore computed so that the proportion of the specimen image actually examined is about 2.4 times larger than with conventional types.

"True ..." means the detailed application of this widefield concept to the entire microscope, from the objective correction through lamp and microscope condensers up to the prisms of the binocular body.

"True wide field" means therefore that, using an eyepiece with field number 28*), all objectives actually produce their optical performance with any method and any of the light sources.

This requirement has been met in full for the first time on the UnivaR.

All eyepieces are 6-lens systems with a novel form of extensive edge correction; they permit convenient examination of the wide fields with the head in the normal position and without interference from edge segments. Owing to the pupil height selected the eyepieces are also suitable for spectacle wearers.

Eyepiece WPK	Pupil height	Viewing angle	Magnification changer					
			Factor 1 X		Factor 1.6 X		Factor 2.5 X	
			Magn.	Field No.	Magn.	Field No.	Magn.	Field No.
6.3 X	17.5	40	6.3 X	28	10 X	17.5	16 X	11
10 X	17.5	51	10 X	24	16 X	15	25 X	9.6
16 X	16	51	16 X	15.5	25 X	9.7	40 X	6.2

**) field dia.* $= \frac{\text{field number}}{\text{objective magn.}}$ *Eyepiece 6,3 X (field number 28) combined with a low-magnification objective gives the maximum specimen field area with minimum total magnification. This is an advantage for both visual examination and photography since the best area can first be selected in the large field and then suitably magnified. In fluorescence microscopy the high light output of this low-power eyepiece is very desirable.*
Eyepiece 10 X (field No. 24) forms the standard for visual observation at the standard magnifications and for image adjustment in photography. For the same total magnification this eyepiece gives even larger fields than the 6.3 X eyepiece.
E. g. for 400 X total magnification:
with 63 X objective, eyepiece 6.3 X (28), field dia.=0.44 mm
with 40 X objective, eyepiece 10 X (24), field dia.=0.6 mm

Relay system

–a new method for simpler operation.
No change of objective when changing to contrast methods!
No change of eyepiece when changing magnification, measuring or counting, or for photographic adjustment.

The relay system consists of transport optics with apochromatically corrected and coated elements which is inserted between objective and eyepiece. Its purpose is to produce freely accessible intermediate images of specimen field and objective pupil. The necessary changes of the microscope optics can then be made here while objectives and eyepieces remain unaffected.

Phase contrast

The retardation rings required for phase and Anoptral contrast are not fitted permanently into special objectives but are inserted as required into the pupil image produced by the relay system, using the normal optics. 10 phase rings are provided to suit objective magnification and type of contrast; they can be changed from the outside with a suitably marked rotating knob.

Magnification changer

Highly corrected optical systems alter the magnification of the eyepieces in the binocular body within the range 1 X to 2.5 X. The following are available:
–magnification changer 1 X – 1.6 X – 2.5 X in steps
–zoom system 1 X to 2.5 X continuous.

Image quality, focusing and the centre of the image remain completely unchanged. The zoom system permits ideal adjustment to specimen size, especially for using the available format in photomicrography.

Photographic adjustment

The frame boundaries required for image adjustment in photography can be projected into the image as illuminated outlines, together with the auxiliary focusing circles.

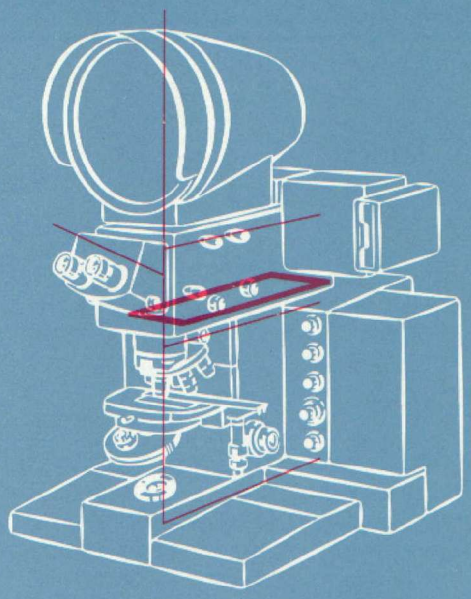
The alternative use of special focusing eyepieces is no longer required.

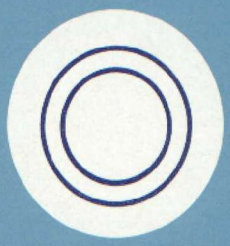
Half-size camera

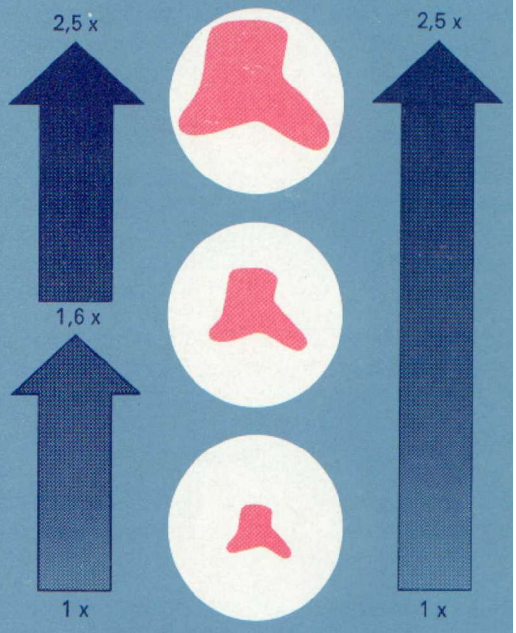
An adjustable diaphragm in the relay system produces two exposures on each frame of the film.

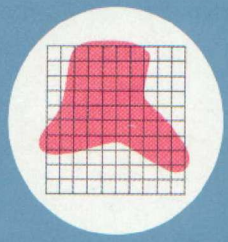
Measuring and counting

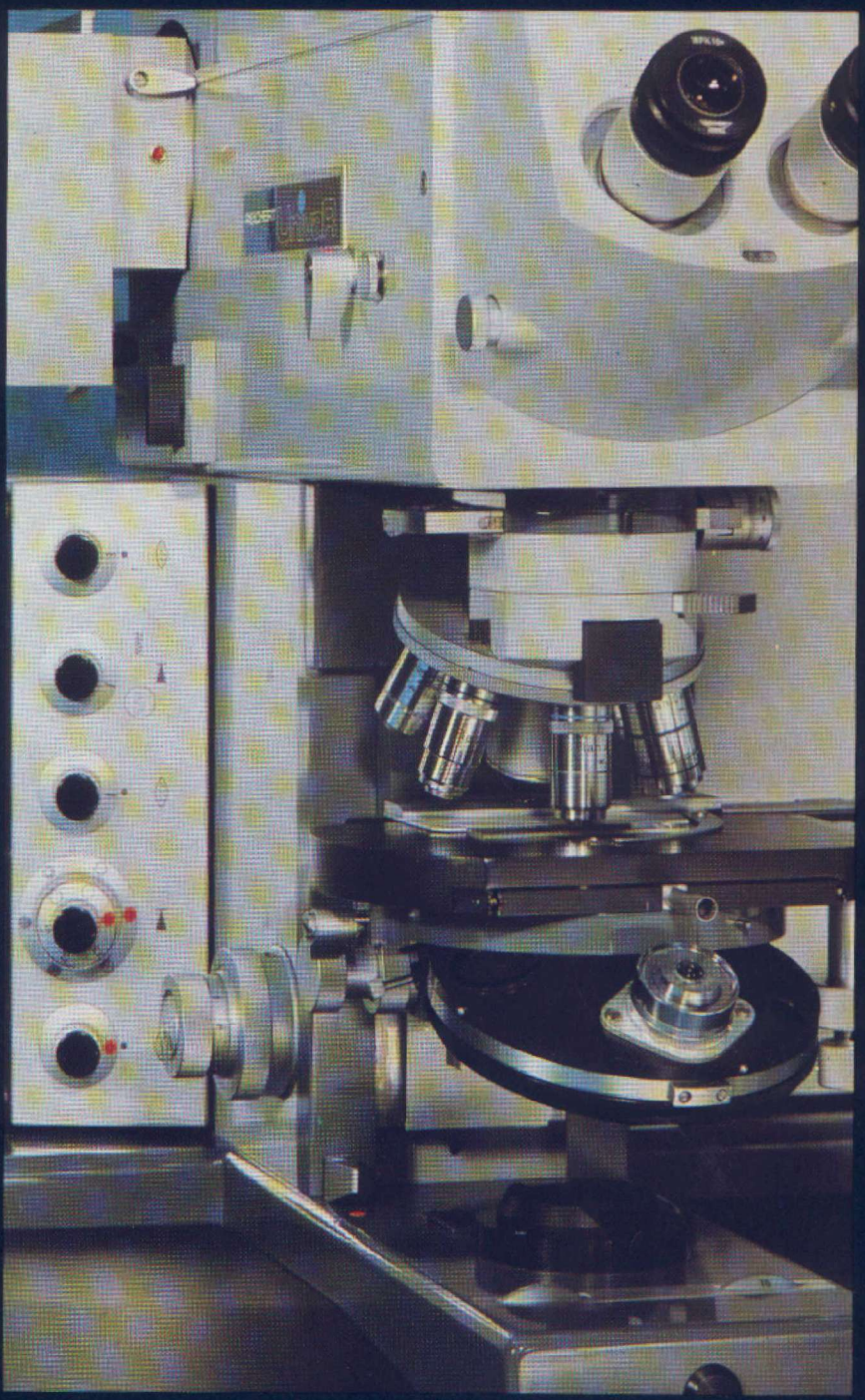
Any type of measuring or counting graticule can be inserted at the point where the intermediate image of the specimen is located; it can be seen in the eyepieces together with the microscopic image.

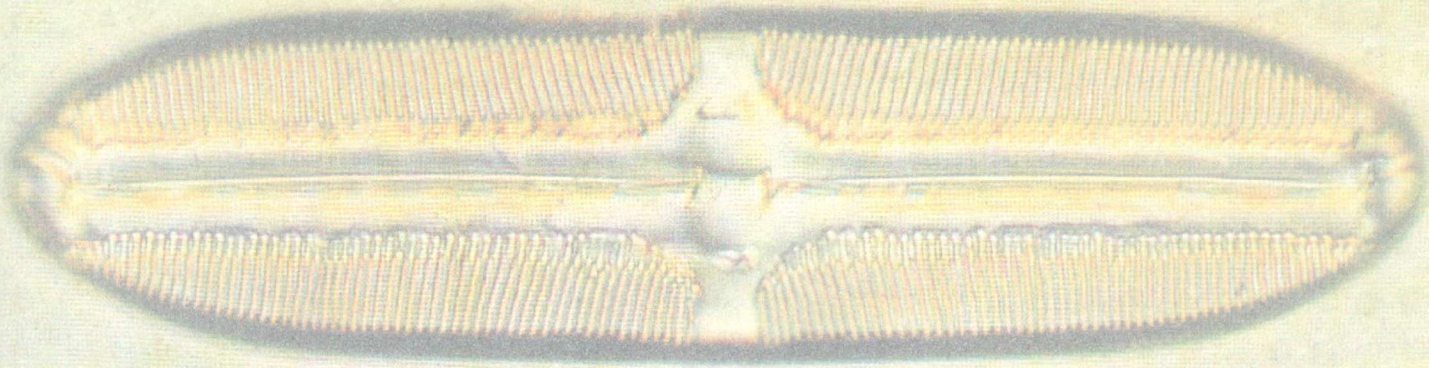




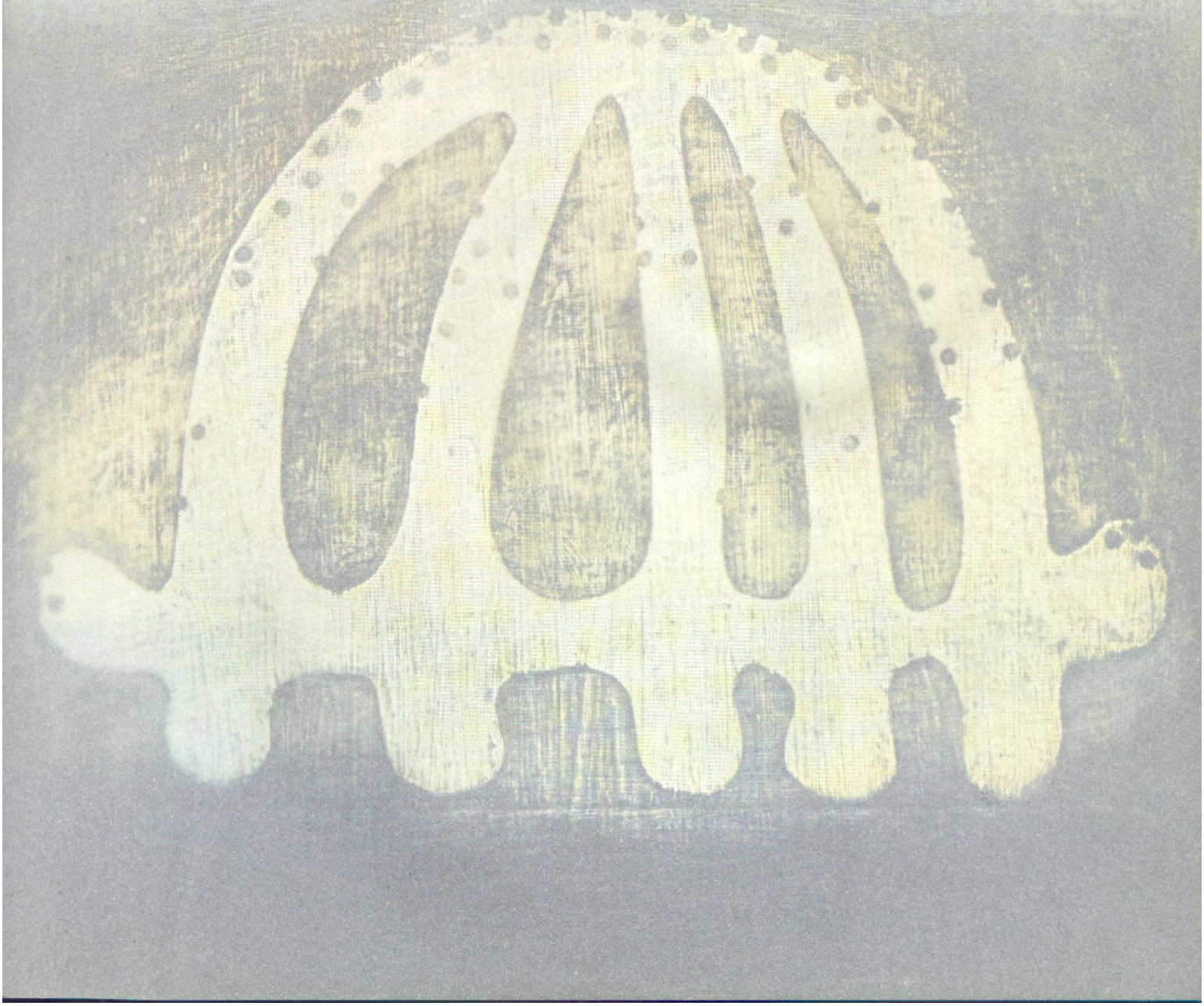


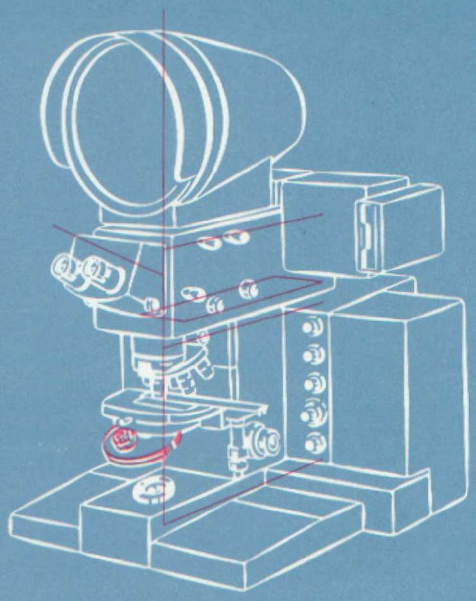






Illumination





1 Condenser system

for 15 examination methods
—therefore no condenser change when changing the method.

All condensers incorporate the optimum design for the entire field 28 and for all light sources. Glass grades and manufacturing methods have been selected to ensure a wide range of application.

All condensers are matched optically and have the same mechanical mounting dimensions. They can therefore be changed rapidly and without readjustment of the illumination where this is required by the method.

Triple condenser

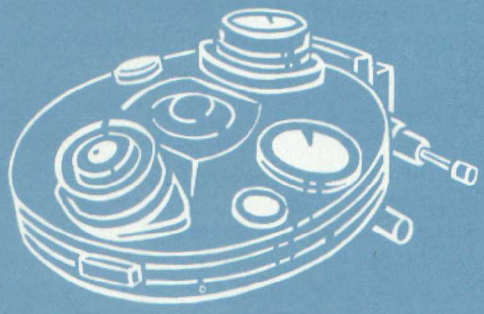
This system provides maximum convenience in the alternative use of 3 condensers and contrast methods. It consists of:
1 turret for the rapid change of 3 condensers
1 turret for the rapid change of 3 contrast methods
1 aperture diaphragm ring
1 window for adjusting the ring turret.

The turret always carries the wide field condenser, any two other condensers can easily be fitted. Application of immersion oil and cleaning of the condensers is a simple matter since they are fully accessible on the cone-shaped turret below the stage.

The ring turret can be equipped as required with the diaphragms for phase and Anoptral contrast, contrast fluorescence, or with interference contrast prisms. Any combination of these elements is possible.

Rapid condenser changer

For simple microscope outfits or as addition to the triple condenser the microscope can also be used with single condensers. Centring and height adjustment with coarse and fine control remain unchanged.



Condenser optics

All bright field condensers have achromatic-aplanatic correction to match the high image quality of the entire optical system. This ensures exact light guidance, uniform illumination and sharp imaging of the field diaphragm even at high magnifications. All condensers are strain-free and suitable for work in polarized light. They are completely interchangeable and can all be supplemented by the same accessories such as phase ring diaphragms, interference contrast prisms etc.

Bright field immersion condenser

Numerical aperture: 1.30 oil.
Free working distance: 0.42 mm (with 1.1 mm slides).
Application: for all objectives between 4 X and 100 X.

This condenser for the first time fully illuminates the large field of the 4 X objective when the front lens is already immersed, and thus permits both overall observation and examination of the finest structural details. Instead of a swing-out front lens an extra optics mounted in the ring turret of the triple condenser is inserted.

Dry bright field condenser

Numerical aperture: 0.90 dry. Free working distance: 0.29 mm.
Application: for all objectives between 4 X and 100 X.
Recommended for all applications (also in contrast methods) where the large aperture of the 1.30 condenser cannot be utilised so that immersion can be avoided.

Bright field condenser with long working distance

Numerical aperture: 0.65. Free working distance: 5.1 mm.
Application: for examining specimens in thick-walled vessels, on petri dishes or special slides.

Wide field condenser

Numerical aperture: 0.12. Free working distance: 43.7 mm.
Application: for all objectives between 2.5 X and 10 X. Recommended when the normal illumination by the additional optics is no longer sufficient and exact Köhler illumination is required for photomicrography or maximum light output for micro projection.

Immersion fluorescence condenser

Numerical aperture: 1.35 oil. Free working distance: 0.37 mm.
Application: for fluorescence microscopy in bright field where optimum performance in brightness and image contrast is required.

For normal work in fluorescence microscopy and for contrast fluorescence it is possible to use the normal bright field immersion condenser which gives only a slightly coloured image background.

Immersion dark field condenser

Numerical aperture: 1.20–1.40 oil. Free working distance: 0.38 mm.
A cardioid condenser with an extremely high light output. Illumination of the wide field for objectives 40 X to 100 X, entirely suitable for fluorescence work.

Dry dark field condenser

Numerical aperture: 0.6–0.9 dry. Free working distance: 5.0 mm.
Dark ground condenser for use with objectives 10 X to 40 X, entirely suitable for fluorescence work.

Contrast fluorescence condenser

The triple condenser system is fitted with UV transmitting annular diaphragms, the immersion condensers 1.30 and 1.35 can be used as the optics. Here again the choice of interference contrast or dark field elements depends on the application.

Incident light fluorescence

An incident-light illuminator is used in this method, the objective also acts as the condenser. In the numerous combinations of incident-light fluorescence with the usual transmitted-light methods the incident-light illuminator is used in conjunction with the triple condenser with its many different facilities.

Simple methods

1 TL bright ground
2 TL dark ground
3 TL phase contrast
4 TL anoptral contrast
5 TL polarization
6 TL interference contrast
7 TL bright ground fluorescence
8 TL dark ground fluorescence
9 IL fluorescence

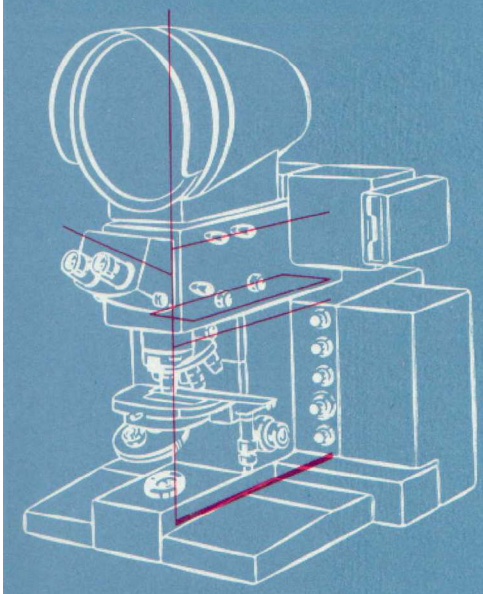
Simultaneous methods

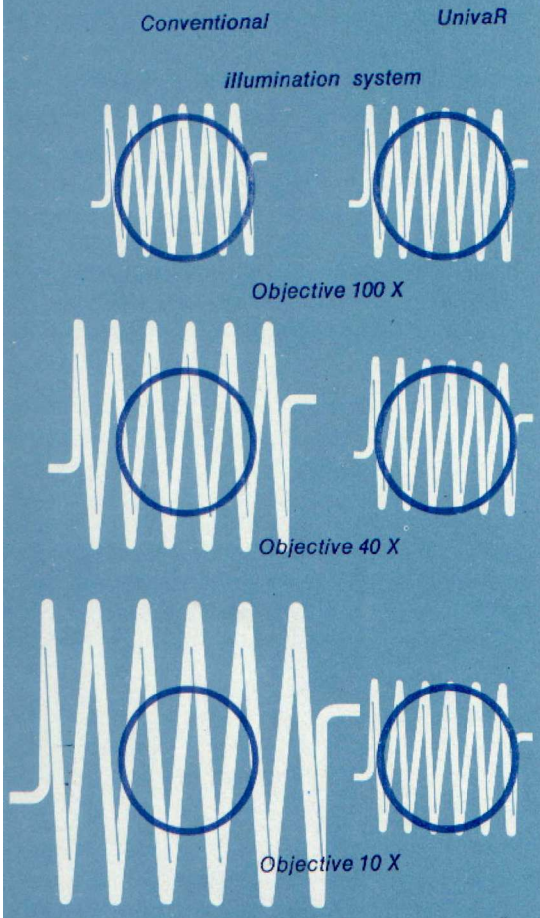
10 Contrast fluorescence (3+7)
11 Simult. dark ground fluorescence (2+8)

Combined methods

12 IL fluorescence+ TL dark ground (9+2)
13 IL fluorescence+ TL phase contrast (9+3)
14 IL fluorescence+ TL anoptral contrast (9+4)
15 IL fluorescence+ TL polarization (9+5)
16 IL fluorescence+ TL interference contrast (9+6)
17 IL fluorescence+ TL fluorescence (9+7)

TL=transmitted light IL=incident light





Automatic illumination system (zoom)

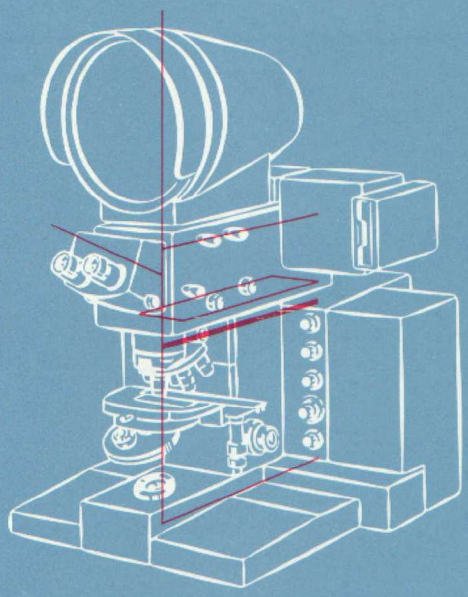
Permanent adjustment of the illumination setting achieves with all condensers, light sources, contrast methods and magnifications:
–uniform illumination of the field
–increased image brightness by full illumination of the objective pupil
–correct adjustment of the field diaphragm.

The illumination zoom is located between collector and condenser. Once adjusted it can therefore be used also for special high-performance condensers and for fluorescence microscopy.
After the nosepiece position has been selected the zoom setting is automatically adjusted by a servomotor to suit the individual objective; the adjustment is programmed according to the objectives mounted on the nosepiece. For special applications the zoom can be adjusted manually.

The zoom illumination ensures optimum utilisation of the light output from the lamp and maintains a constant light factor, i. e. the product of illuminated field and aperture. Compared with conventional optics this provides much more uniform objective illumination at low apertures and large fields. With large apertures and small fields, on the other hand, there is complete and uniform illumination of the objective pupil with an appreciable gain in brightness. When using gas discharge lamps, e. g. in fluorescence microscopy, approximately fourfold brightness is obtained with the 100 X objective compared with the conventional system.

The zoom illumination images a fixed diaphragm into the specimen plane and adjusts its size automatically to field 28. Together with the illumination adjustment this system thus meets the desire for automatic Köhler illumination.

For subtle work or when using high-power eyepieces with a smaller field the built-in field iris diaphragm is used and adjusted manually for each objective in the usual way.



Incident-light fluorescence illuminator

1 illumination system for 17 methods–
therefore no change of accessories when changing the method!

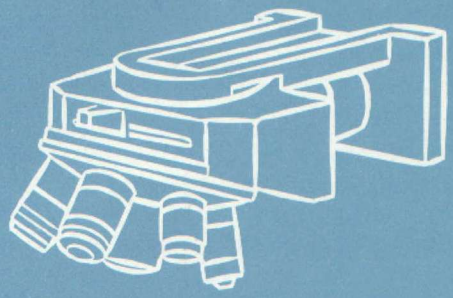
For the first time an incident-light illuminator is of such universal design that it is not only suitable for fluorescence excitation but also takes the accessories required for the various transmitted light methods in visible light.

Incident-light fluorescence illumination

In this method the light does not pass through the specimen; instead fluorescence is excited from above by UV, blue or green light. The objective thus acts also as condenser, the illumination is provided through a special incident-light illuminator fitted with 4 interference splitter mirrors. These mirrors have different reflexion maxima in the short-wave range and, together with the exciter filters, serve to select the appropriate wavelength. The splitter mirrors and the corresponding barrier filters are mounted together on a slide and coupled to the exciter filters. Different filter combinations can be selected to suit the specimen staining and interchanged quickly for comparison.

All objectives for incident-light fluorescence on the UnivaR combine a large aperture with very high UV transmission. In addition the glycerin immersion objectives 63 X and 100 X are available as special objectives for maximum light output and brilliance.

To protect the specimen during focusing and to obtain defined measuring times in fluorescence photometry an electronically controlled shutter can be added to the illuminator. A field iris diaphragm and suitably dimensioned illumination diaphragms are also provided for the photometer.

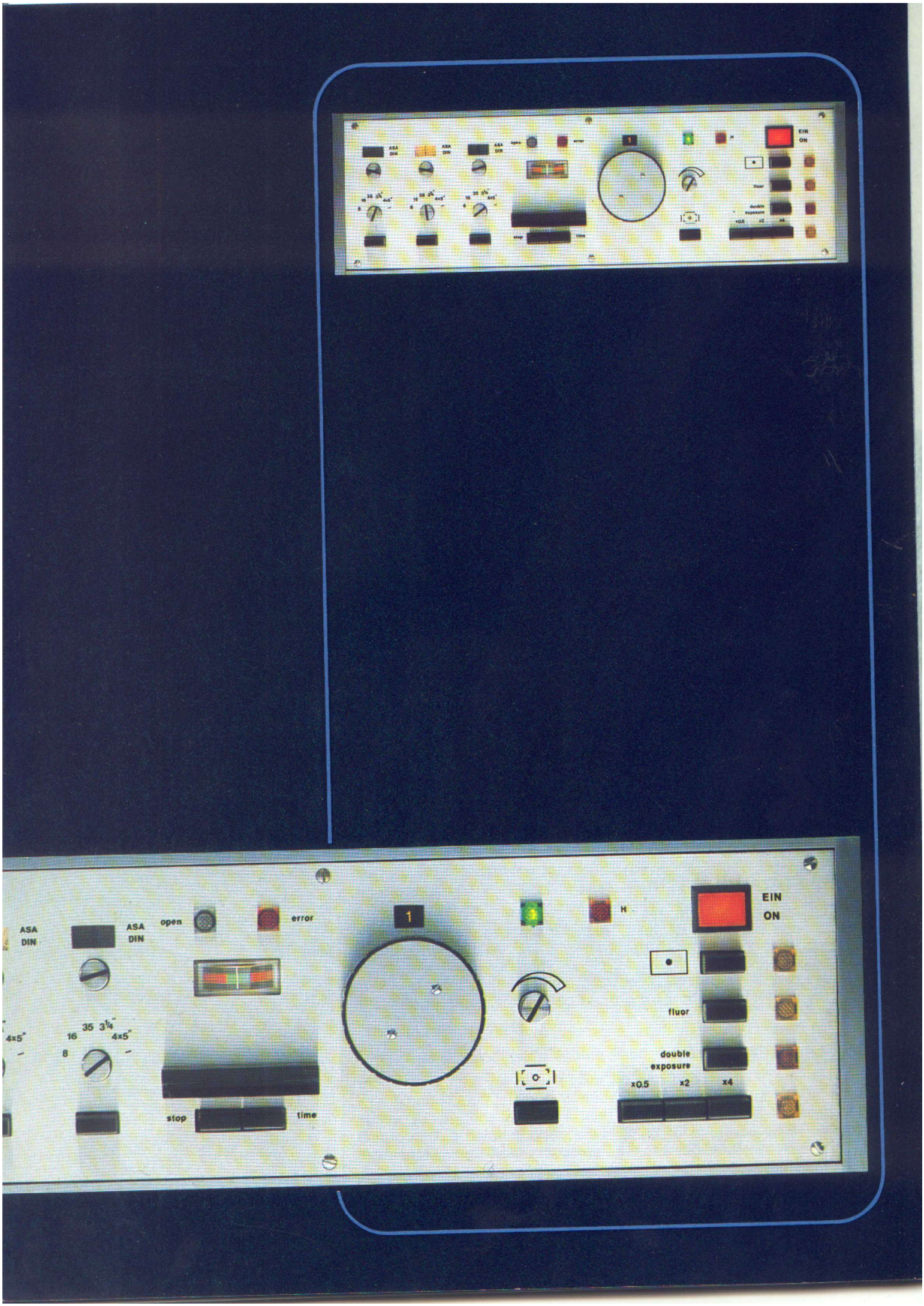


Transmitted-light illumination

The optics mounted on the illuminator turret for incident-light fluorescence can also be fully utilised for transmitted-light work. The incident-light splitter mirror transmits the visible light coming from below without any change in colour. The necessary accessories such as analyser, interference contrast prism or image relay take over their normal function just as the triple condenser in the illumination system.

Mixed illumination

Incident-light fluorescence can be mixed routinely with the various forms of transmitted-light illumination in visible light without any conversion of the instrument and thus without change in the image setting. This is essential for rapid and routine location of fluorescing details, their distribution on the specimen, and for comparative examination.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8
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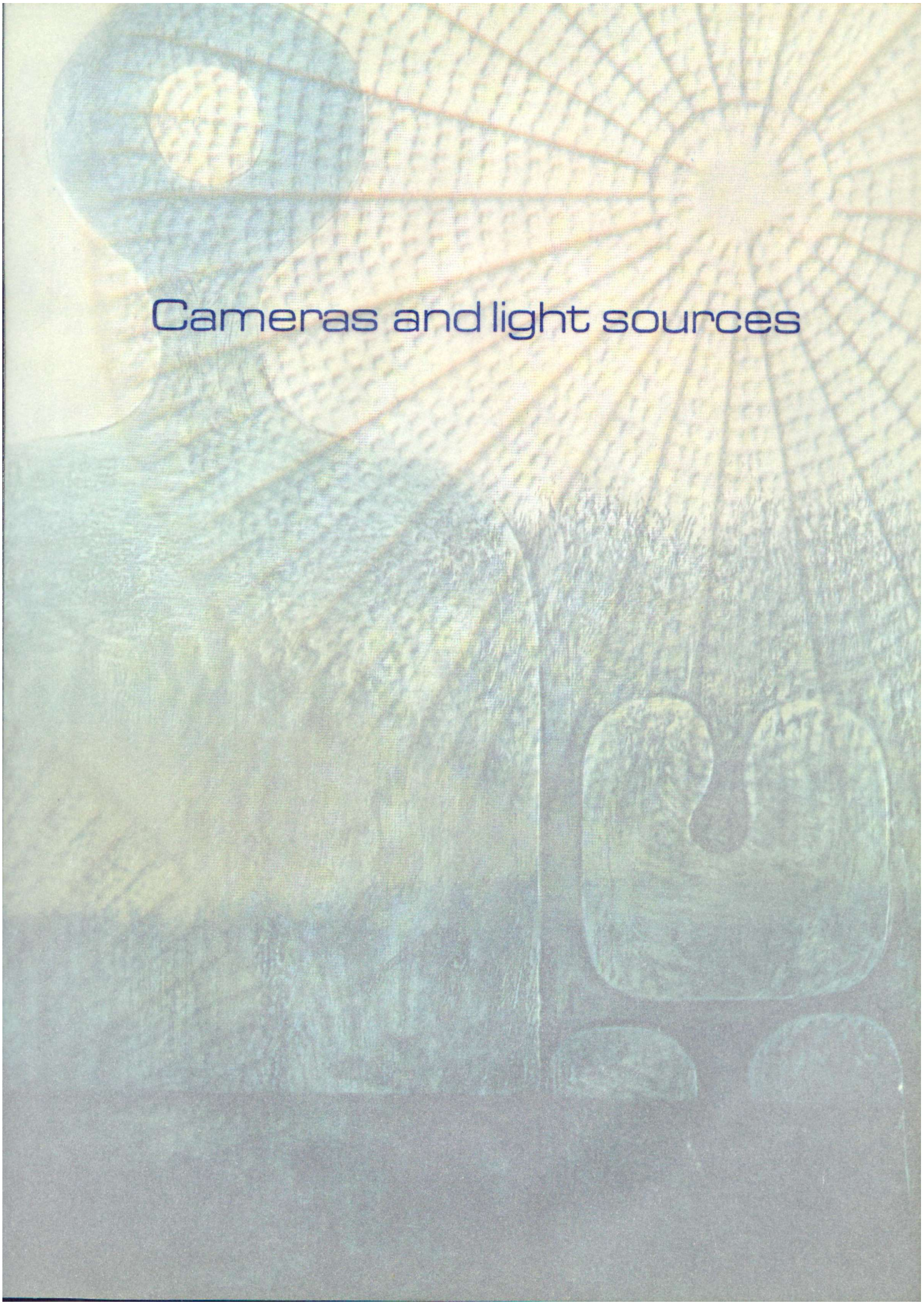
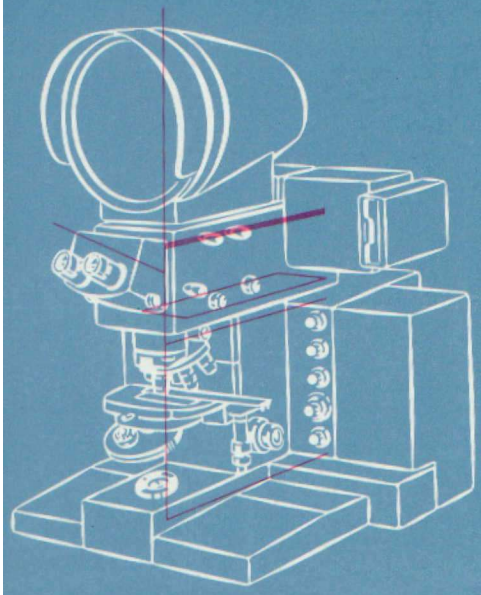


Cameras and light sources



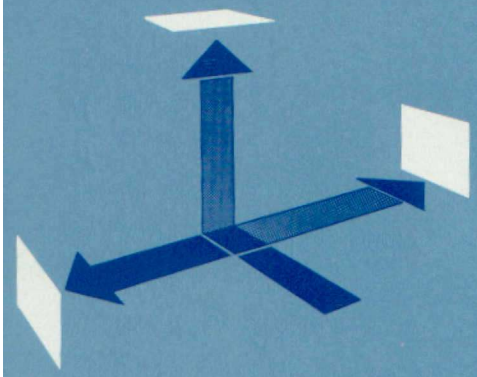
1 Photo system – 3 cameras

–mounted simultaneously on the instrument
–automatically controlled over the range $^{1}/_{125}$ sec to 8 hours
–parfocal to the binocular body
–for the same field (field 24)

This permits: without any instrument conversion
in rapid sequence
the alternative use of
different camera types
with any film grades
in different formats.

Principle

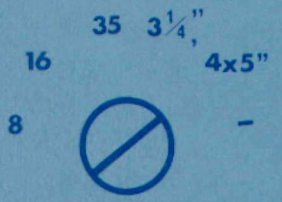
In the horizontal photo beam E the light from the photographic eyepiece is directed by the shutter mirror to the exposure meter. The shutter is formed by a small mirror which is swung out to make the exposure. When it is closed this mirror throws the light without loss on the measuring photocell and avoids the light losses caused in all other automatic systems by the splitter mirror. The combination of this measuring principle with a high-sensitivity photomultiplier results in the extremely wide range of exact exposure measurement and shutter control.

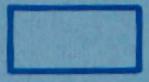


Camera mounting

Up to 3 cameras can be mounted on the instrument in any combination. Frame size and film speed are adjusted on the control unit separately for each camera. These values serve as input for an automatic calculator determining the exposure time.

ASA
DIN





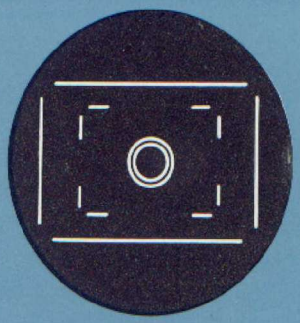
Choice of camera

The camera is selected by pressing a key, the diverting prism is rotated by a servomotor and directs the light into the pre-focused camera.

Camera sizes

The following are available:
–24 X 36 cm miniature camera with automatic film transport
–$3^{1}/_{4}$ X $4^{1}/_{4}$" camera housing with fixed Polaroid film pack adapter
–4 X 5" camera housing with international camera back for: change cassettes for 4 X 5" or 9 X 12 cm, Polaroid cassettes, adapter for roll film and 70 mm film
–commercially available cine cameras for 16 mm and 8 mm as well as television cameras

–half-size cameras are unnecessary. They are replaced by the relay diaphragm which applies the half-size technique to all cameras.



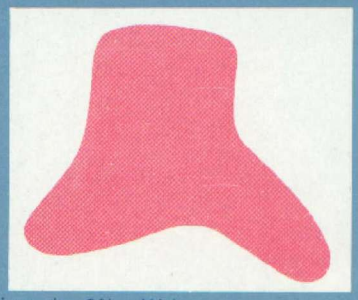
Focusing

Frame outlines and the double ring for focusing are projected into the image. The brightness of the markings can be adjusted to suit the image brightness. The system is switched automatically through the camera control unit.

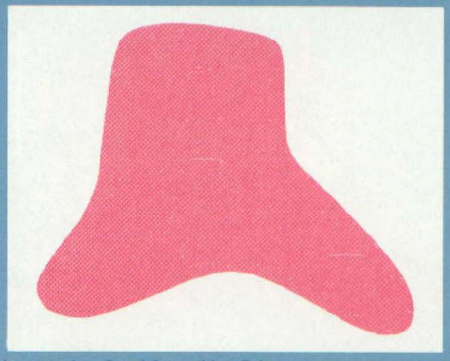
Photographic field

For the first time the same field is reproduced on all frame sizes. Parallel exposures for reproduction (e. g. 4 X 5") and for colour projection have the same image content. A 2-position photographic eyepiece produces in its normal position the specimen image in field 24 to fill the entire frame area. In the second position the magnification is increased by 1.6 X.

Small size 24 × 36 mm



Medium size 3¼ × 4¼ in.



Large size 9 × 12 cm/4 × 5 in.

Exposure measurement and time indication

The exposure meter is balanced with the control knob which also programmes the electronic shutter. The exposure time obtained is at the same time displayed in digital form. This is essential for selecting correction factors before the actual exposure: on moving specimens, for example, the need for using high-power light sources or the microflash, with long exposures to allow for the Schwarzschild correction.

Factor keys

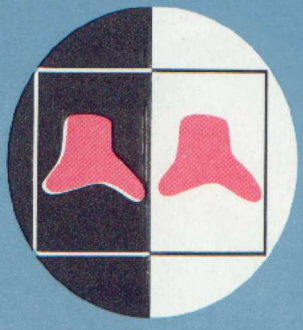
In special cases the exposure time of the automatic system can be varied from the measured value by the factors 0.5 X, 2 X, 4 X.

Point and integrated measurement

Under normal conditions the measurement of the light intensity covers the entire frame area. With large brightness variations, e. g. with dark field and especially in fluorescence microscopy, it is possible to limit the measurement to a point covering only 1.5% of this area. As long as it is visible in the eyepiece, the extremely sensitive measuring system responds even in this case and indicates the exposure time corresponding to this detail.

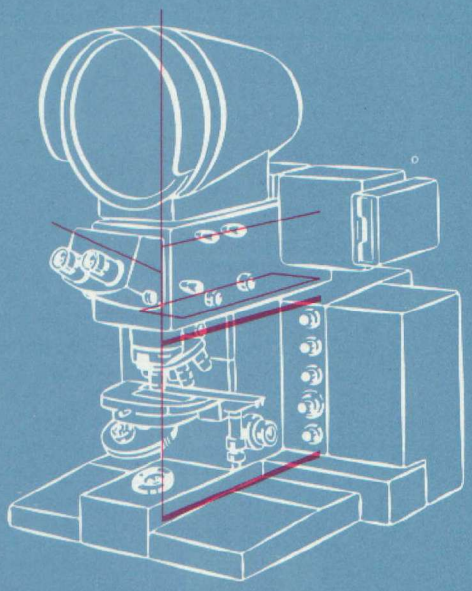
Half-frame camera

A sliding diaphragm in the relay system can be used to position two exposures on a single frame size. Comparative exposures of different specimens or of the same specimen by different methods are therefore easy to produce and involve no subsequent assembly. This facility is available on all camera sizes, there is no longer any need for a half-frame miniature camera.



Double exposure

The film transport of the automatic miniature camera can be blocked so that the same frame can be exposed several times.



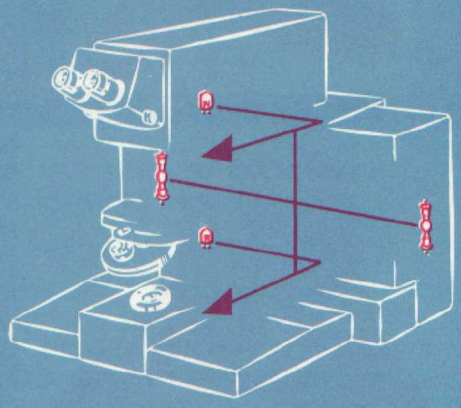
1 Illumination system

4 lamp housings
mounted simultaneously on the instrument
choice of **7 light sources**

with different intensity,
with different spectral distribution,
selected by a mirror system:
for transmitted light
for simultaneous illumination
for incident light
for mixed illumination.

This permits use of the most suitable light source in each case—in rapid sequence—with simple operation.

Aspherical condensers ensure maximum light output, they are aplanatically corrected, have a high UV transmission, and utilise the large aperture of the light beam from the lamp much more effectively than conventional systems. Because of the careful adjustment to the zoom system the image illumination remains uniform when changing magnification and method; the usual continuous correction of the condenser position is now unnecessary.



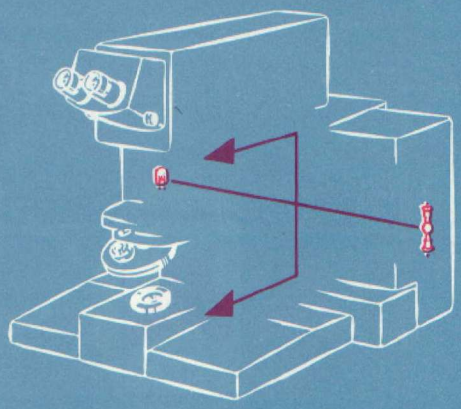
4 Light sources

The mirror housing 4 can be fitted with a halogen lamp for transmitted and incident light, supplemented by any two high-intensity lamps, e. g. a combination of HBO 200 for fluorescence microscopy and XBO 450 for photography, cinemicrography and projection.

The mirror system then provides:

Alternative illumination in transmitted or incident light with any one of 3 lamps.
Mixed illumination in transmitted and incident light.
Simultaneous illumination for transmitted-light contrast fluorescence. Brightness and colour are adjusted by 9 different neutral and colour filters—the spectral selection and contrasting of the light for fluorescence microscopy is achieved with 7 different exciter and contrast filters.

The controls and indicators for light source, mirror position, filters and collectors are laid out clearly and conveniently on the front of the mirror housing.



2 Light sources

The mirror housing 2 offers a choice of 2 light sources.

The mirror system then provides:
Alternative illumination in transmitted or incident light with both lamps.
Mixed illumination in transmitted and incident light.

1 Light source

The lamp housing 10 with collector is mounted directly on the stand without mirror housing. Two lamps are therefore required for alternative or mixed illumination in transmitted and incident light.

Halogen lamp 12 V, 100 W

Colour temperature 3200° K, subjective brightness 3 X LV*)
Lamp housing 10 with centring base, transformer with infinitely variable thyristor control.

Suitable for all examination methods, also for simple blue-light fluorescence and for colour photography with artificial-light film.

Metal iodide short-arc lamp CSI 250 W

Colour temperature 3200° K, subjective brightness 7 X LV*)

Lamp housing 25 with hinged door for convenient access to lamp. Applications as for halogen lamp but much greater light output. Therefore shorter exposure time, very suitable for microprojection and fluorescence work with blue and green excitation.

Xenon lamp XBO 450 W

Colour temperature 6000° K, subjective brightness 20 X LV*)
Lamp housing 50 with hinged door for convenient access. With built-in starter and fan for heat dissipation.
D. C. control unit with voltmeter and ammeter.

Universal application, suitable for all methods in visible light as well as blue and green fluorescence. Through its colour temperature and spectral distribution also suitable for critical colour reproduction, work in polarized light and for colour photography with daylight film. The extreme brightness makes the xenon lamp the ideal light source for microprojection and cinemicrography in colour.

High-pressure mercury-vapour lamp HBO 200 W

Discontinuous spectrum, subjective brightness 15 X LV*)
Lamp housing 25 with hinged door for convenient access. Standard control unit on a. c. operation. Use of d. c. supply gives greatly increased brightness, arc stability and lamp life.

Because of its maximum intensity in UV, blue and green it is used mainly for fluorescence microscopy. In visible light the line spectrum results in poor colour reproduction. This lamp can be recommended as high-power light source only with low-colour specimens and for monochrome photography.

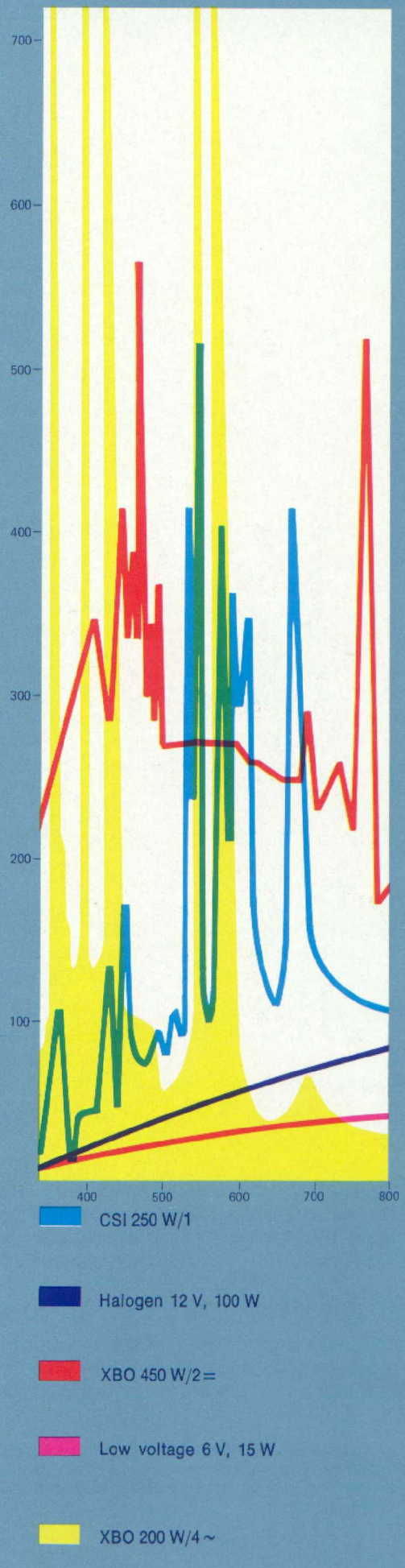
Microflash

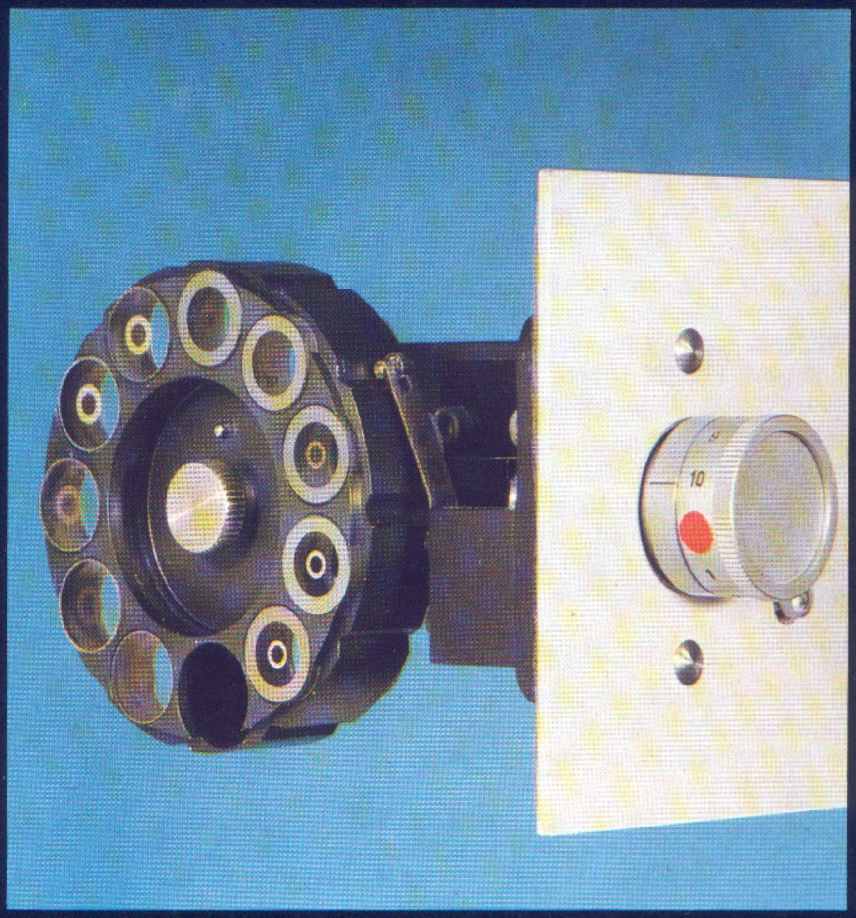
Colour temperature 6000° K, flash energy 18–30 Wsec
Flash duration $^{1}/_{1500}$ sec. It is mounted in lamp housing 25, the specimen is illuminated by a pilot lamp for convenient focusing and exposure measurement for brightness adjustment.

Spectral lamps and monochromators

There is provision for using different spectral lamps of high intensity. Commercially available monochromators can be mounted on the mirror housing to obtain accurately monochromatic light of different wavelengths.

**) The comparison is based on the 15 W low-voltage lamp widely used on conventional microscopes. 3 X LV means three times the subjective brightness compared with this standard. The brightness relationship at different wavelengths can be read off the diagram.*

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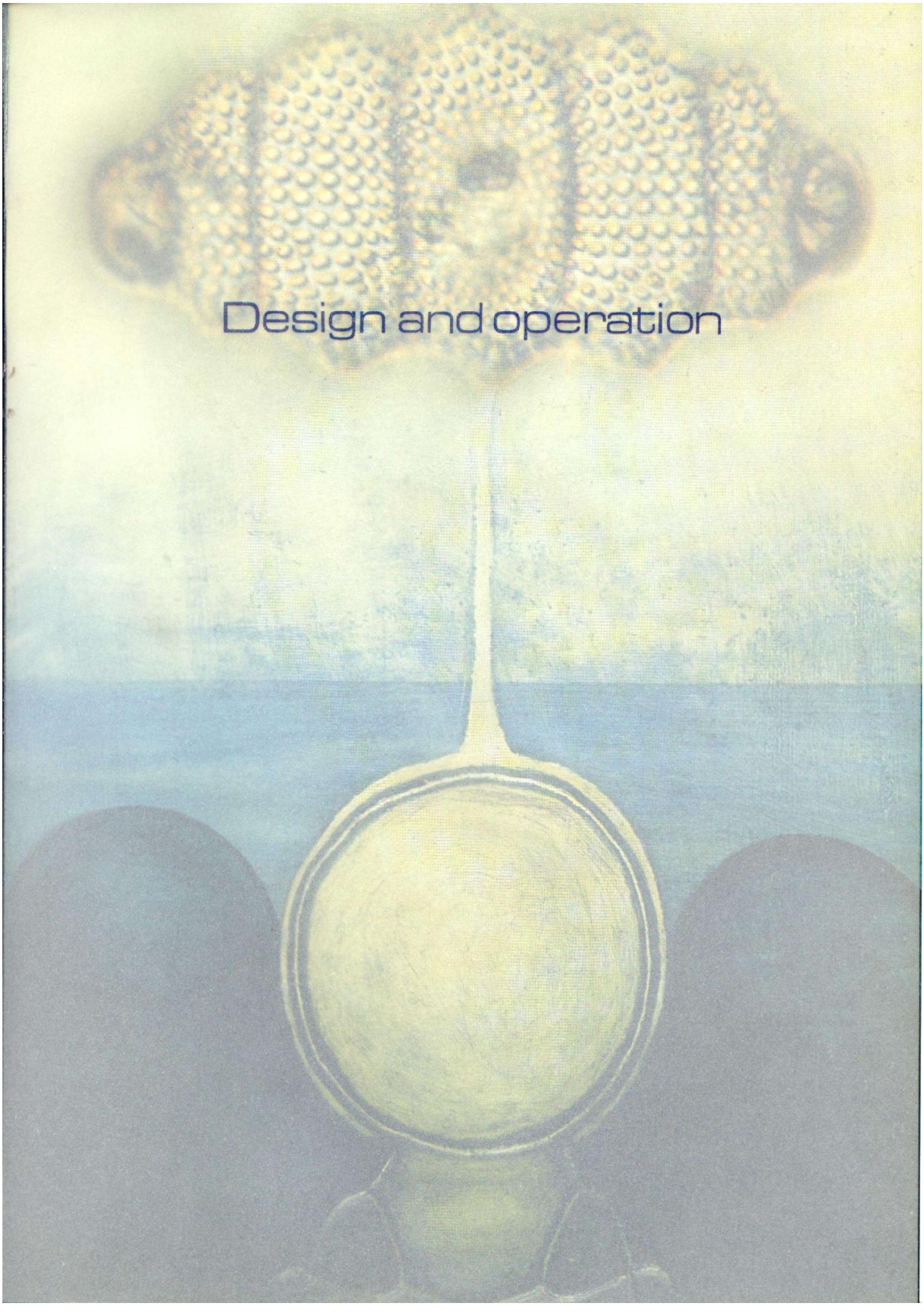
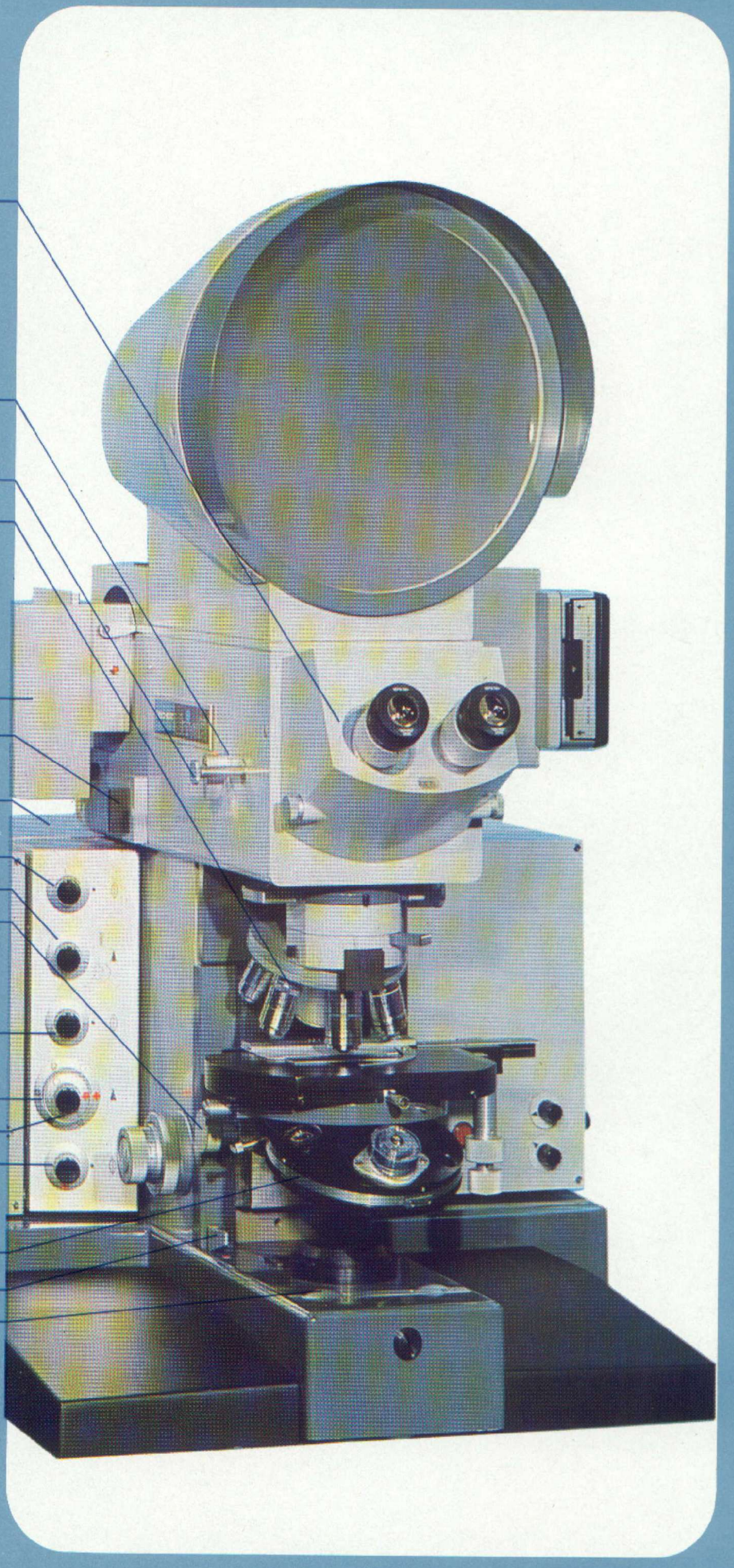


Design and operation

Clear layout – everything in view



Body with constant tube length, image upright and unreverted
Interpupillary distance adjustable by control

Widefield eyepieces up to field 28

Camera adjustment with bright line frame

Relay with magnification changer
Intermediate image of field and pupil

Bertrand lens

Objective outfit with planachromats or planapochromats, corrected for field 28 and all methods

Incident-light fluorescence illuminator suitable for all transmitted light methods

Automatic miniature camera

Graticule projection for measuring and counting

Lamp housing 25 for high-intensity lamps

Collector for incident-light halogen lamp

Swing-out ground glass

Condenser adjustment with coaxial coarse and fine control

Condenser height reproducible with stop

Collector for transmitted and incident light with lamp housing 25

Neutral filters

Colour filters

Collector for transmitted-light halogen lamp

Immersion condensers, full illumination for all objectives from 4 X
Triple system for 3 condensers

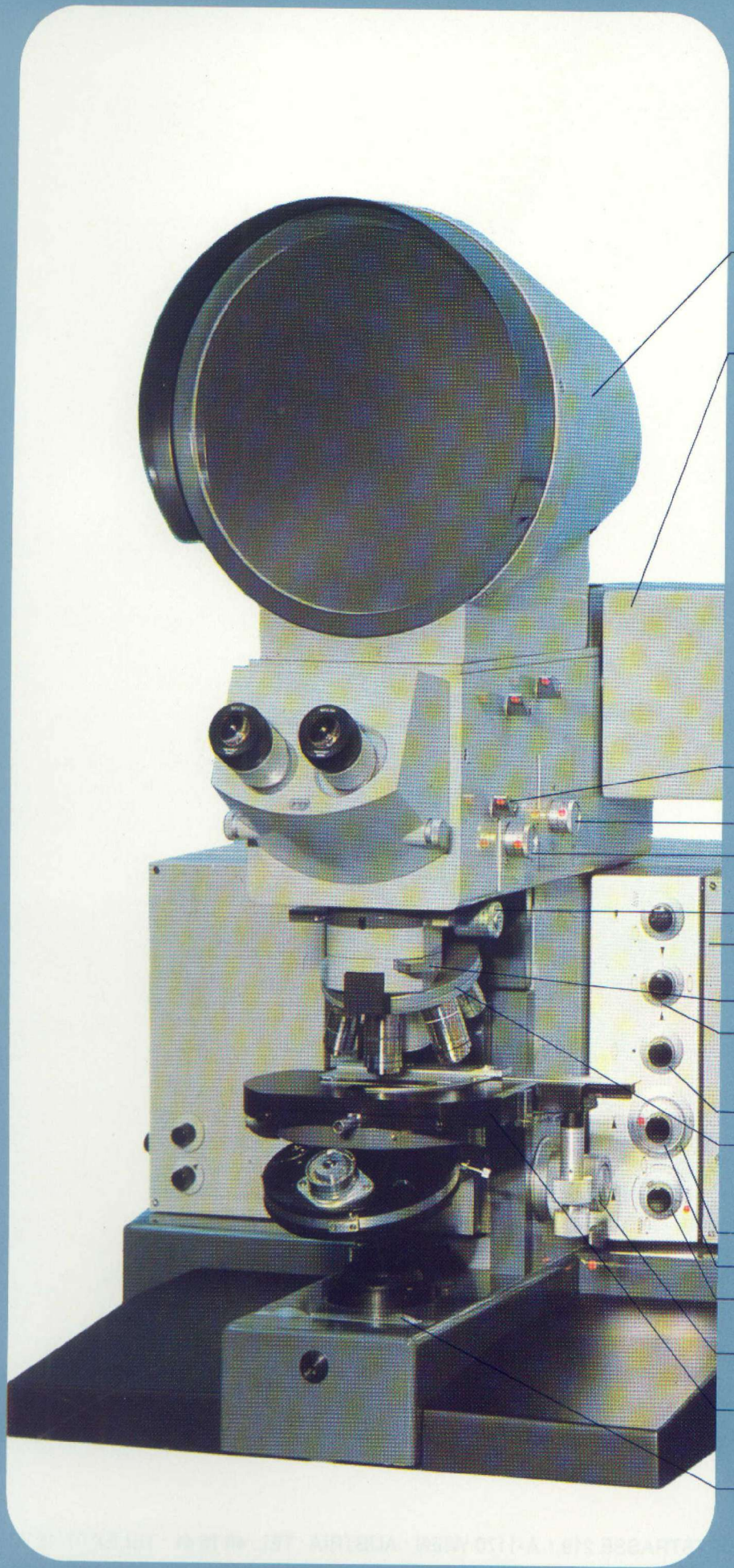
Wide-field optics for objectives below 4 X

Field iris diaphragm

Automatic zoom illumination system controlled by programmer on nosepiece

Automatic Köhler illumination for field 28

Simple operation – every control ready to hand



Projection screen 240 mm dia. Choice of micro-spectrophotometer for binocular image and diaphragm adjustment

Camera $3^1/_4$ X $4^1/_4$" as part of the photo system: camera change by pushbutton control

Exposure measurement and shutter programming for three cameras with automatic calculation of frame size and film grade

Automatic range $^1/_{125}$ sec up to 8 hours
Digital display of exposure time

Identical image content (field 24) for all formats

Half-frame exposure with all camera types
Continuous exposure monitoring during cinemicrography

Splitter prism 20/80–100/0–photometer

Turret with 10 phase rings

Magnification changer 1 X to 2.5 X in 3 steps or continuous

Rotatable analyser, barrier filter slide

Lamp housing 50 for 450 W xenon lamp

Compensator

Selector prism for transmitted and incident light for the high-intensity lamps

Collector for lamp housing 50

Sextuple nosepiece, ball bearing mount

Programmer for automatic illumination zoom

5 exciter filters

3 contrast filters

Sliding mirror for contrast fluorescence

Coarse and fine focusing adjustment with stop

Rotating mechanical stage with low coaxial controls

Indicator for objective magnification

The cover and the pages 13, 21, 29 and 37 are designed by the Austrian painter H. P. Maya, Villach.

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