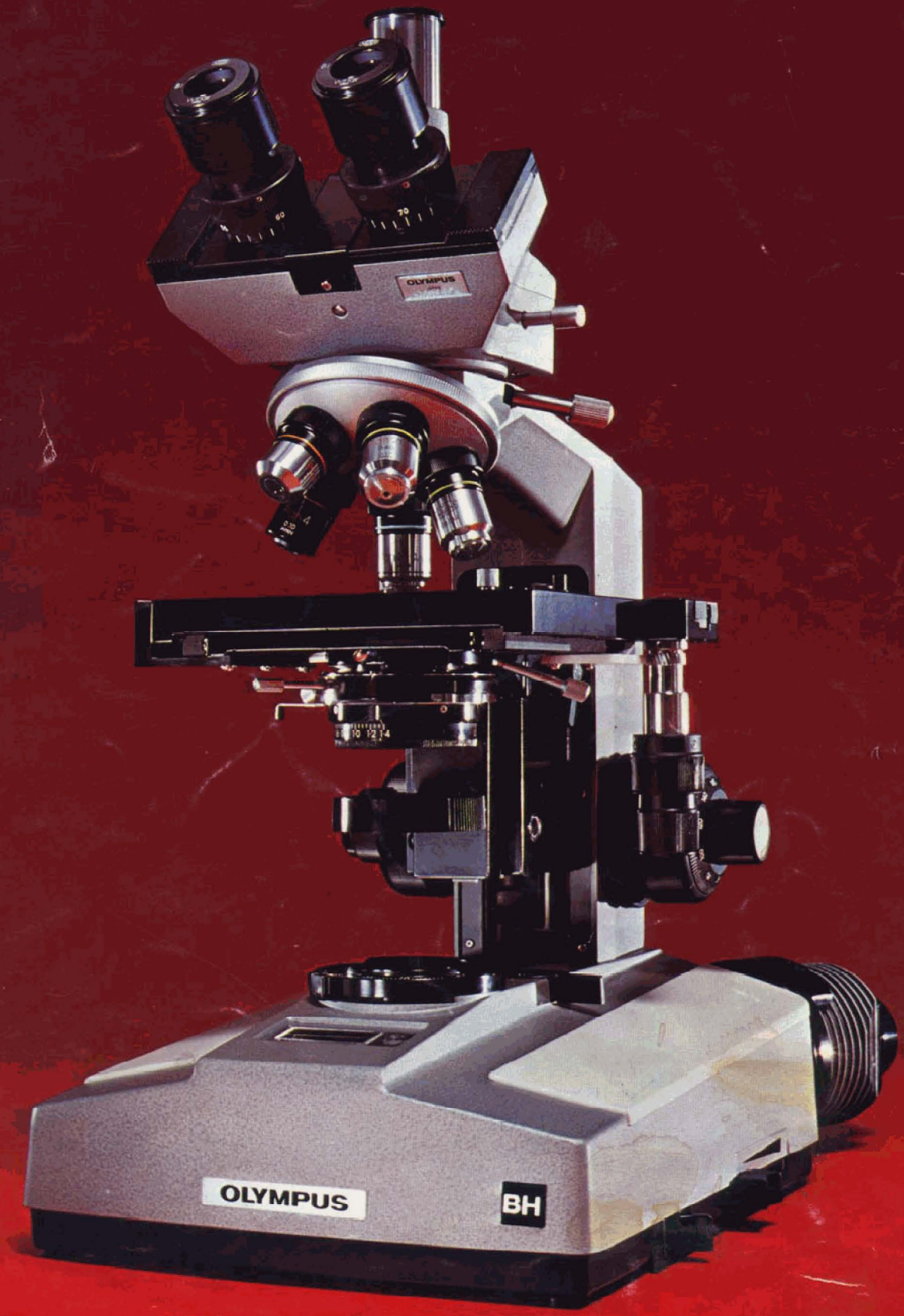
OLYMPUS

SERIES

BH System Microscope



BH

In response to numerous demands from the scientific and industrial communities, OLYMPUS, a leading manufacturer of quality microscopes and other precision instruments, takes great prides in introducing the new System Microscope Series BH.

Development of the Series BH microscopes has been accomplished by the joint efforts of industrial designers and the experienced OLYMPUS optical and mechanical engineering staff, with particular emphasis on advanced design, excellent durability and unsurpassed performance, and profiting from the innovative technology OLYMPUS has applied in the manufacture of the Universal Research Microscope Model VANOX.

The Series BH offers a choice of three basic versions, Models BHA, BHB and BHC. The Model BHA features an interchangeable nosepiece, an interchangeable 30W low voltage light source and a high/low magnification selector, and the Model BHB features an interchangeable 30W low voltage light source and a high/low magnification selector, while the Model BHC has a fixed 15W low voltage light source and no high/low magnification selector.

Olympus System Microscope Series BH

■ CHARACTERISTIC FEATURES

1. Outstanding Interchangeability of System Components

A wide range of principal components such as microscope stands, observation tubes, objectives and eyepieces, stages, condensers and other accessories for various microscopic methods makes the Series BH one of the most versatile system microscopes available.

A broad variety of modular, building-block systems provides an ideal way to select the microscopic and photomicrographic combinations most suitable for your requirements, to keep your budget at a realistic figure, and to further expand the capabilities of the microscope by adding reasonably priced accessories tailored to specific purposes.

2. Excellent Performance and Durability

The unsurpassed performance of the Series BH is based on many innovations such as coarse and fine adjustments on a common guideway throughout the entire focusing range of 40 mm, easy-to-operate Koehler type illumination with a transformer built in the base, a unique coating process applied to the prisms in the observation tube to increase light transmission more than twice as much as in conventional observation tubes, etc.

Every part of the Series BH components and accessories is designed with emphasis on durability; for instance, smooth running, wear resistant ball guides are employed in the focusing and stage operation mechanisms, and the light source built in the base incorporates a thyristor circuit for stabilization of the power supply.

3. Accessories for Expanded Capabilities

Depending upon your requirements for not only general but also specific purposes, various accessories are available for brightfield, darkfield, fluorescene, polarization, phase contrast, differential interference contrast for transmitted and reflected light; super widefield, dual viewing; and photomicrography, automatic and manual.

4. Versatile Camera System

The System Camera Model PM-10-A with automatic film advance facilitates your photomicrographic work, solving the difficult color temperature adjustments often encountered in photomicrography. A unique color temperature metering and regulating device (CTR) balances the color temperature of the film with the color temperature of the light source. A regulation device for ASA speeds, incorporated in the control unit, permits fine adjustment of ASA film speeds in a 4 increment range. This modular system permits rapid interchange of 35 mm, 3¼" x 4¼" and 4" x 5" size films.

5. High Quality Optics

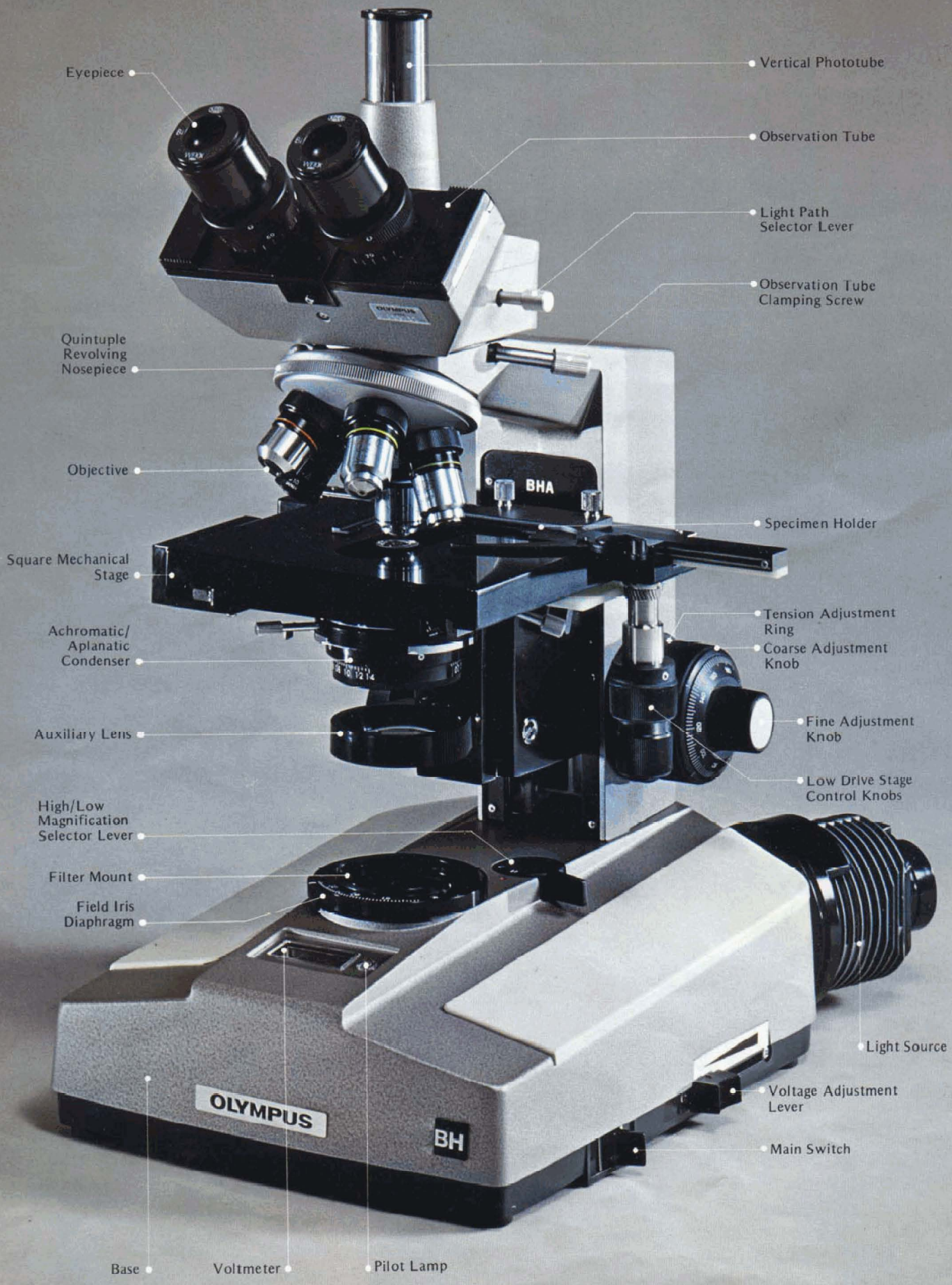
The essential parts of any microscope are its optical elements, a major part of which are the objectives. A choice of Achromats, Fluorites, Apochromats and Plan Apochromats is available.

The eyepieces as well as the objectives, available with the Series BH, standard or optional, cover a wide area of specialized uses for observation and photomicrography. Among the eyepieces designed to further magnify the primary image from the objective, the Photo Eyepieces FK are exclusively computed for photomicrographic application.

6. Modern Functional Design

A "Square-line" silhouette characterizes the external appearance of the Series BH. This design not only provides excellent stability but also permits rigid attachment of accessories without tools. Arm rests cover the base for comfortable operation. Rigidly constructed for long hard work.

■ VARIOUS COMPONENTS OF THE MODEL BHA



Excellent Performance

The Series BH surpasses conventional microscopes in its exceptionally functional design.

■ OBSERVATION TUBE

• A trinocular tube (inclination 45°) is standard for the Model BHA, for observation and photomicrography. The maximum field number is 21. The tube is rotatable through 360°, with clamping screw, permitting fatigue-free observation of an exceptionally large field of view.

• A unique coating process of the prisms in the observation tube reduces light loss to a negligible amount, thus increasing light transmission by more than twice as much as with conventional observation tubes.

• Interpupillary distance adjustment from 53mm to 72mm. A diopter adjustment ring is provided on both eyepiece tubes to maintain objective parfocality at different interpupillary distances.

• A light path selector lever directs either 100% of the light to the observation tube, or 80% to the phototube and 20% to the observation tube.

• A circular dovetail mount permits interchange of other observation tubes with ease. A binocular tube and a super widefield observation tube are available optionally.

■ REVOLVING NOSEPIECE

• Quintuple revolving nosepiece on ball races with dust-proof carrier. Smooth rotation maintains parfocality of all five objectives. The click stop is positive in action, so that each objective comes to a common center when rotated into working position.

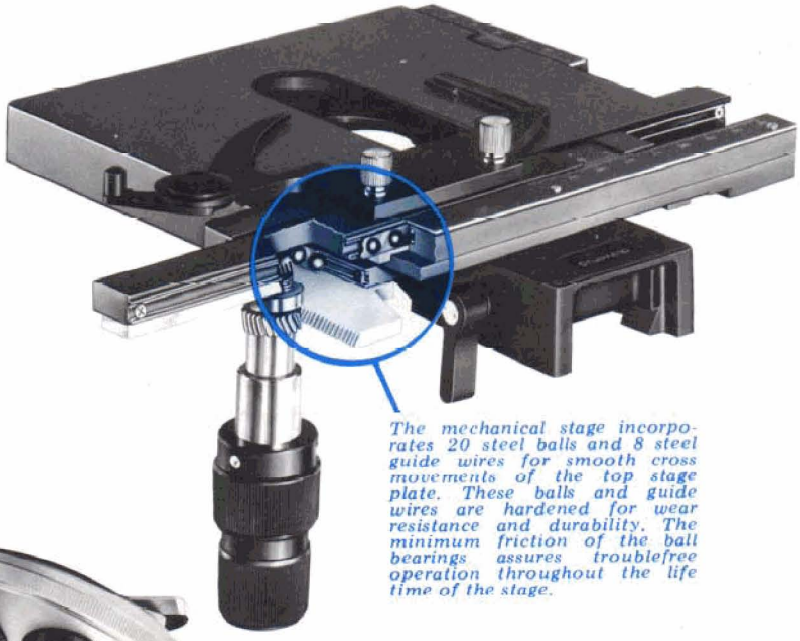
• A dovetail slide mount of the microscope stand Model BHA-F permits removal of the quintuple nosepiece which facilitates interchange of the standard objective set with optional objectives or vice versa, according to various microscopic applications, without removal of the objectives from the nosepiece.

• Objectives for different methods of microscopic observation can easily be mounted on the extra nosepiece in accordance with your specific requirements. These objectives include plan apochromatic, phase contrast, metallurgical, and differential interference contrast objectives.

■ STAGE

• The standard stage is a large, graduated, square mechanical stage, 142mm x 140mm, on dovetail stage bracket, with clamping lever and large coaxial low drive controls on the right hand side.

• The traversing area is 52mmx 76mm, with low positioned, coaxial control knobs. Traversing movements on ball guides, with verniers reading to 0.1mm.



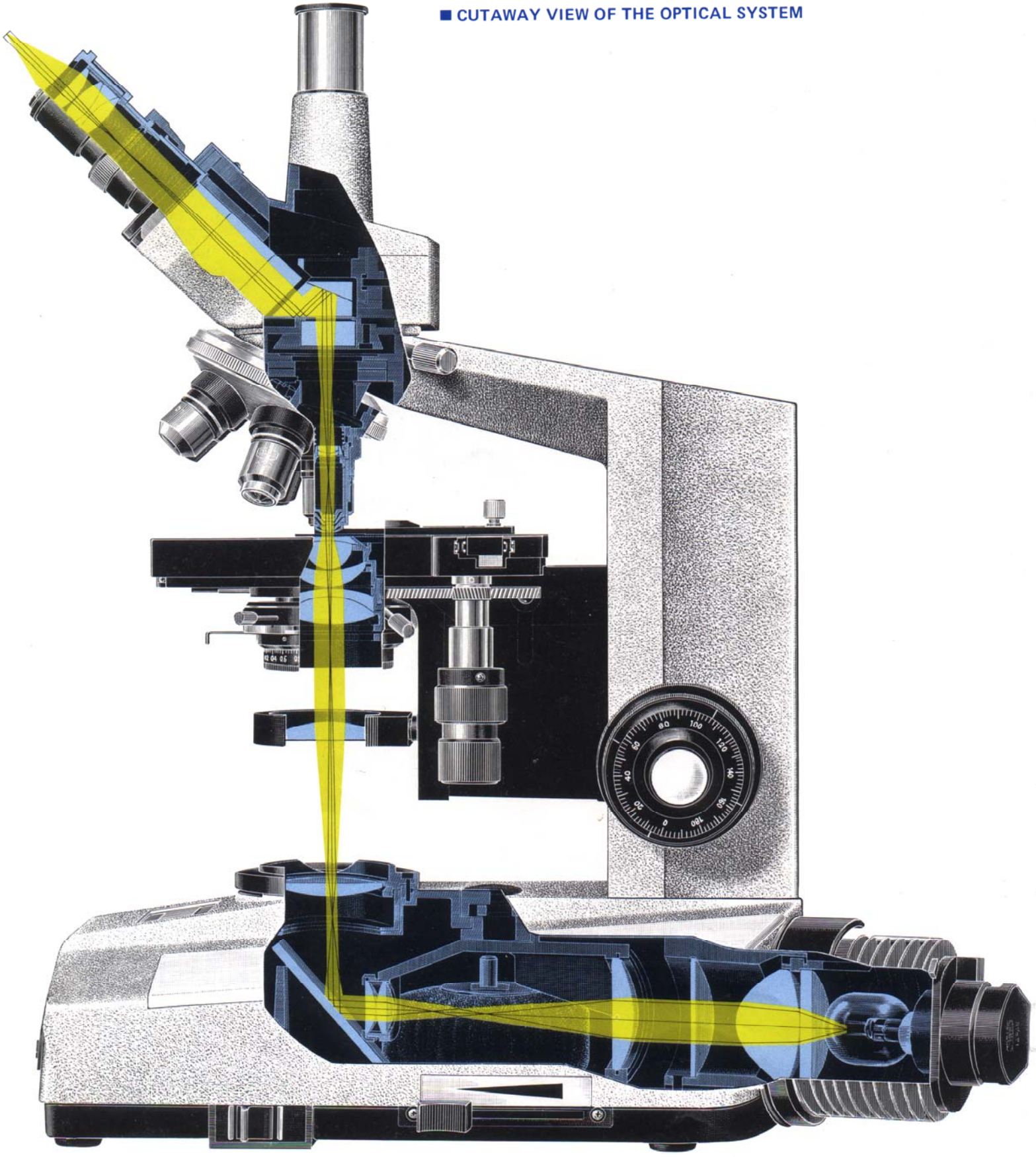
The mechanical stage incorporates 20 steel balls and 8 steel guide wires for smooth cross movements of the top stage plate. These balls and guide wires are hardened for wear resistance and durability. The minimum friction of the ball bearings assures troublefree operation throughout the life time of the stage.

• Large specimen holder, capable of simultaneous use of two 26mm x 76mm specimen slides, is removable to obtain a large unobstructed stage surface.

• The dovetail stage bracket permits easy attachment or removal of the stage. The horizontal dovetail mount facilitates interchange of optional stages in accordance with various observation methods.

Excellent Performance

■ CUTAWAY VIEW OF THE OPTICAL SYSTEM



■FOCUSING ADJUSTMENTS

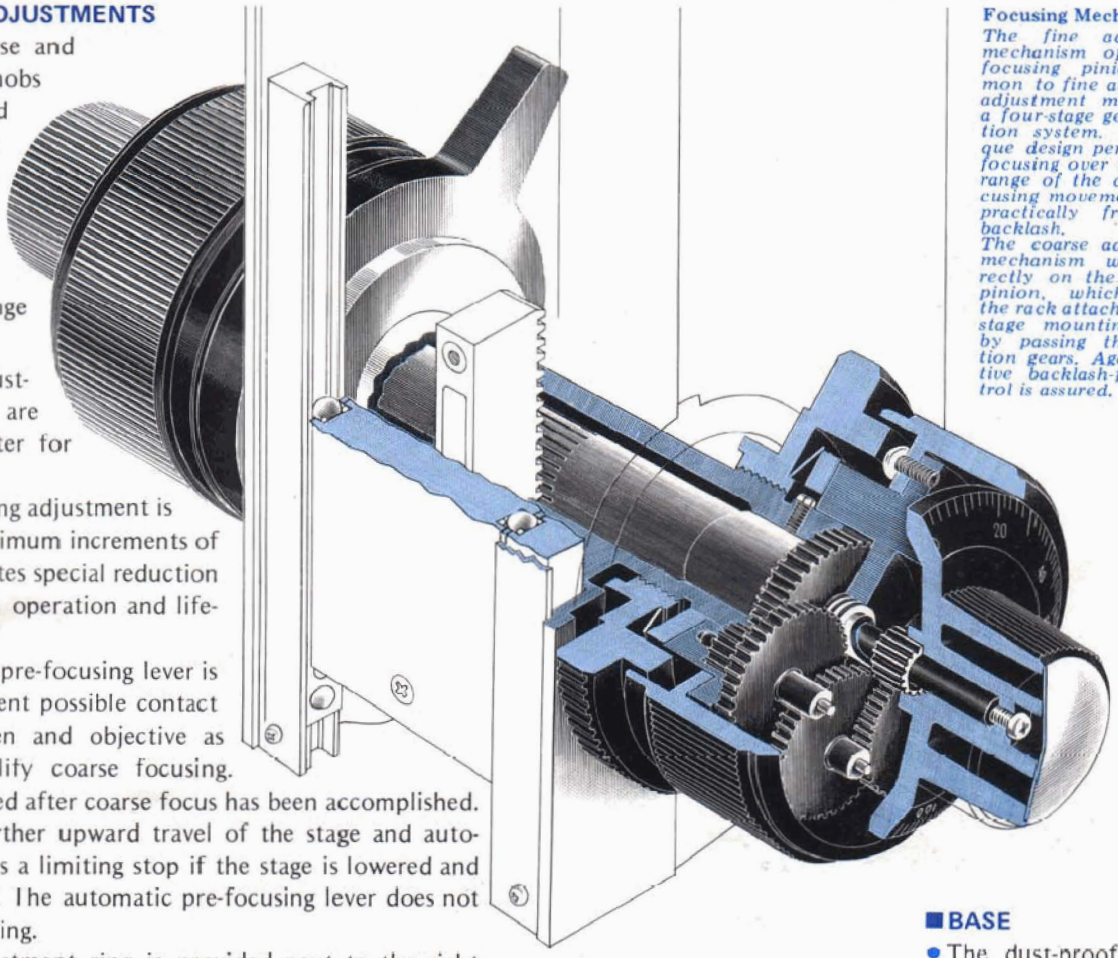
• The dual coarse and fine focusing knobs are coaxial and designed to share a common guide-way to give a smooth, even motion throughout the whole range of 40mm.

• The coarse adjustment knobs are 56mm in diameter for easy operation.

• The fine focusing adjustment is graduated in minimum increments of 2μ and incorporates special reduction gears for smooth operation and lifetime reliability.

• The automatic pre-focusing lever is provided to prevent possible contact between specimen and objective as well as to simplify coarse focusing. The lever is locked after coarse focus has been accomplished. This prevents further upward travel of the stage and automatically provides a limiting stop if the stage is lowered and then raised again. The automatic pre-focusing lever does not restrict fine focusing.

• A tension adjustment ring is provided next to the right hand coarse adjustment knob. With this device the tension of the coarse adjustment is freely adjustable for either heavy or light movement depending on operator preference.



Focusing Mechanisms
The fine adjustment mechanism operates a focusing pinion common to fine and coarse adjustment motion via a four-stage gear reduction system. This unique design permits fine focusing over the entire range of the coarse focusing movement and is practically free from backlash.
The coarse adjustment mechanism works directly on the focusing pinion, which moves the rack attached to the stage mounting block, by passing the reduction gears. Again, positive backlash-free control is assured.

■CONDENSERS

• A ring mount with clamping screw and centering device accepts interchangeable condensers, standard or optional. Rack and pinion height adjustment, with condenser height displacement up to 32mm.

• The standard condensers include the achromatic/aplanatic condenser N.A. 1.40, the Abbe condenser N.A. 1.25, and the super widefield condenser N.A. 0.95, depending on the model of your choice, for optimum illumination of the specimen from low power 4X to oil immersion 100X objectives. Furthermore, the achromatic/aplanatic condenser is corrected for chromatic aberration, spherical aberration and curvature of field, and is provided with a graduated aperture iris diaphragm, decenterable for oblique illumination. It is recommended for work with high quality apochromats and plan apochromats.

• Either one of the condensers, above, is easily replaceable with other condensers such as darkfield, phase contrast, etc.

■BASE

• The dust-proof square base incorporates a high/low magnification selector system and a low voltage transformer. The "on-off" switch, voltmeter and sliding control lever for continuously variable light intensitiy are built in the base for effortless operation.

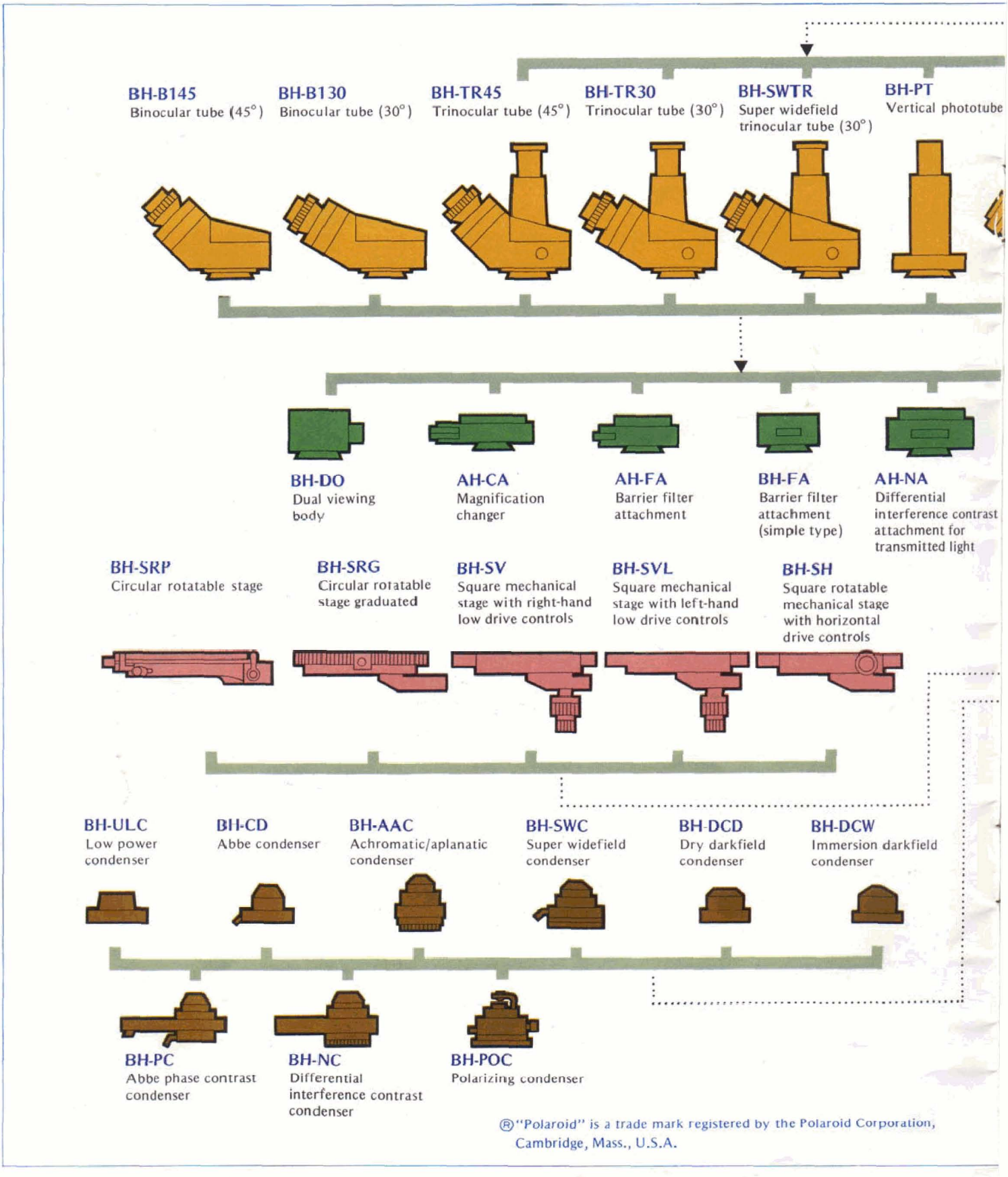
• The high/low magnification selector lever enables Koehler type illumination throughout the whole range of objective powers, from 4X to 100X, without manipulation of the auxiliary lens or interchange of condensers.

• The in-base illuminator serves to direct light of the appropriate quality and intensity, emitted from a pre-centered tungsten bulb, towards the microscopic object to ensure even illumination of the field. This in turn results in photomicrographic negatives of optimum contrast, brilliance and uniformity.

• The built-in transformer, variable from 0 V to 10 V, incorporates a thyristor circuit in its rheostat for smooth fine adjustment of light intensity.

• The standard light source incorporates a 30 watt pre-centered tungsten filament bulb, provided with a socket for positive contact, eliminating the problems of defective contact and over-heating. Interchangeable with optional light sources such as high intensity halogen bulbs, mercury burners and electronic flash bulbs.

System Chart of Interchangeable Components



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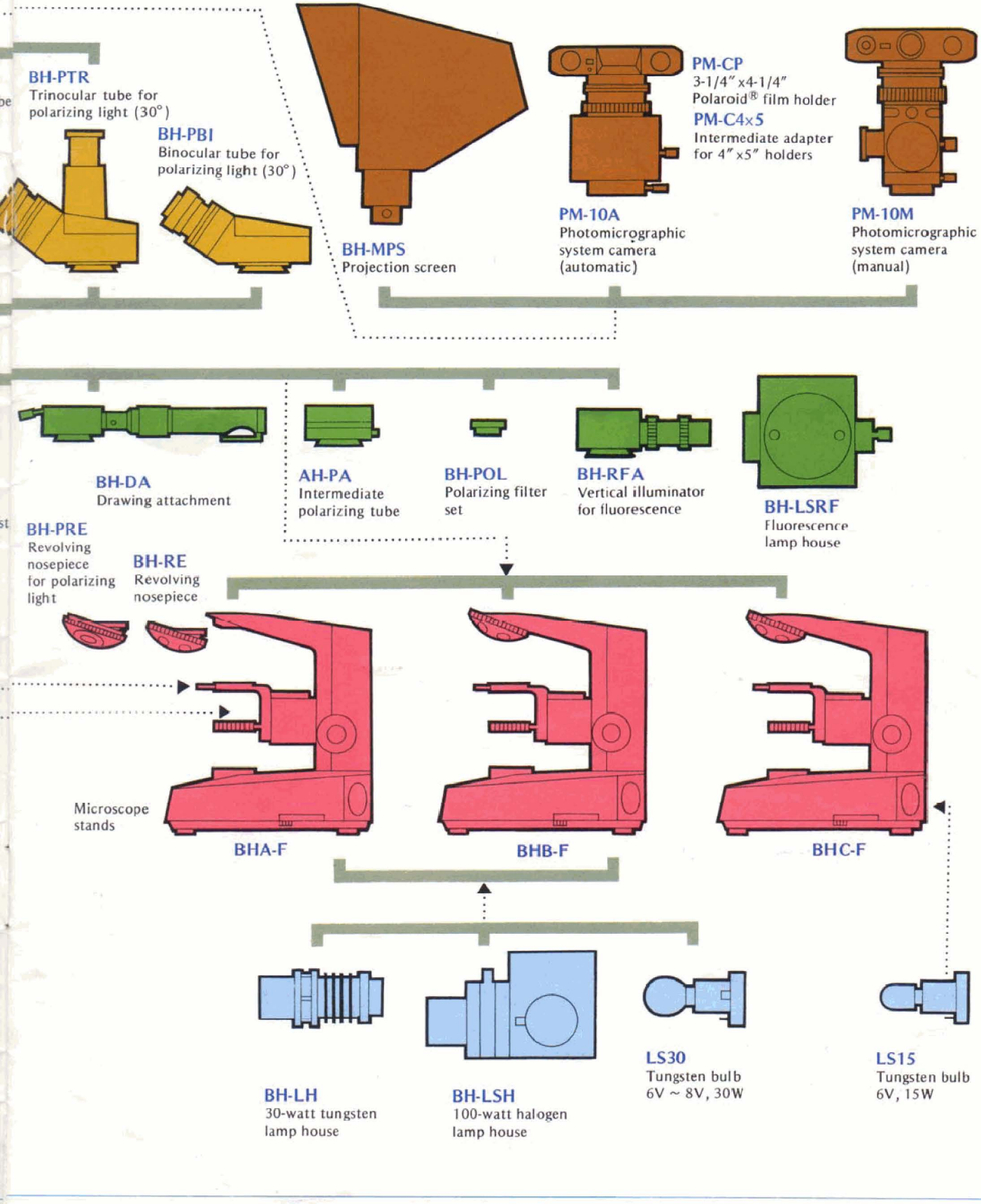
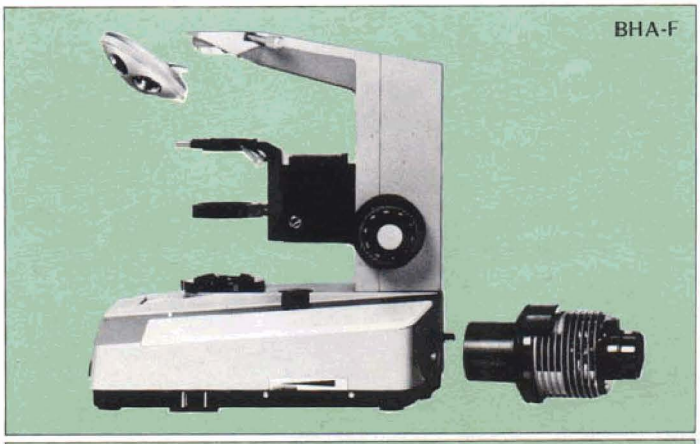
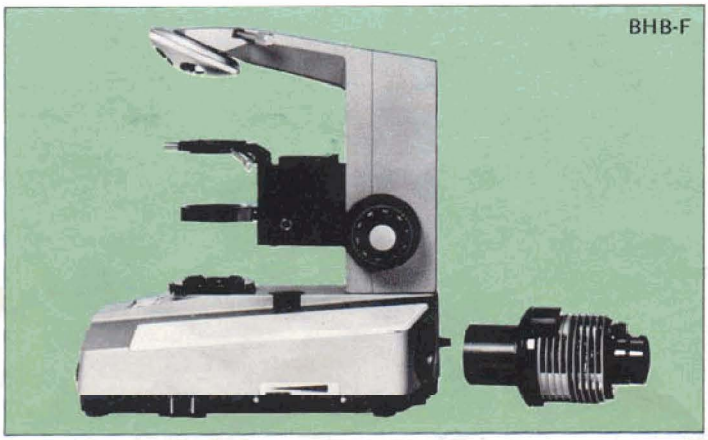

BH-PTR
Trinocular tube for polarizing light (30°)
BH-PBI
Binocular tube for polarizing light (30°)
BH-MPS
Projection screen
PM-CP
3-1/4″x4-1/4″ Polaroid® film holder
PM-C4x5
Intermediate adapter for 4″x5″ holders
PM-10A
Photomicrographic system camera (automatic)
PM-10M
Photomicrographic system camera (manual)
BH-DA
Drawing attachment
AH-PA
Intermediate polarizing tube
BH-POL
Polarizing filter set
BH-RFA
Vertical illuminator for fluorescence
BH-LSRF
Fluorescence lamp house
BH-PRE
Revolving nosepiece for polarizing light
BH-RE
Revolving nosepiece
Microscope stands
BHA-F
BHB-F
BHC-F
BH-LH
30-watt tungsten lamp house
BH-LSH
100-watt halogen lamp house
LS30
Tungsten bulb 6V ~ 8V, 30W
LS15
Tungsten bulb 6V, 15W

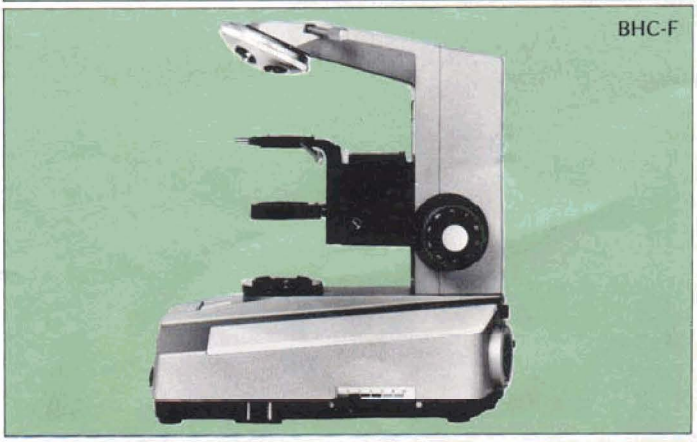
Technical Descriptions

■ MICROSCOPE STANDS

Extremely sturdy construction, functional design, ripple tone finish, acid resistant. The differences between these three stands are the interchangeability of nosepiece and/or light source with the Models BHA and BHB, respectively.







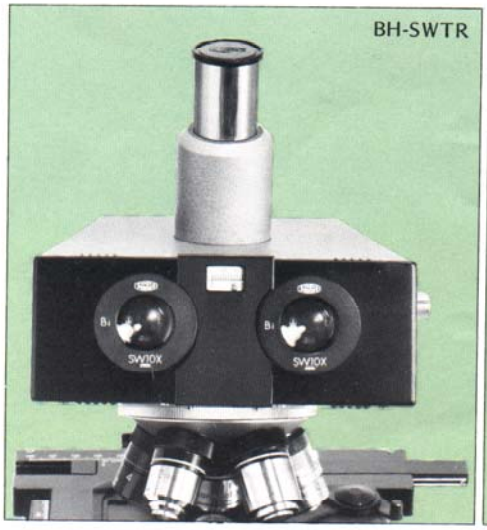
Models	BHA-F	BHB-F	BHC-F
Observation tube mount	Circular dovetail, permitting tube rotation through 360°.		
Revolving nosepiece	Large, quintuple nosepiece, removable.	Large, quintuple nosepiece, not removable.	
Stage mount	Horizontal sliding dovetail.		
Coarse and fine adjustment	· Coaxial adjustment knobs. · Coarse adjustment with rack-and-pinion; fine adjustment with special reduction gear, graduated in increments of 2μ. · Focusing range for both coarse and fine adjustments 40mm, on ball guides. · Automatic pre-focusing lever. · Tension adjustment ring for coarse adjustment.		
Condenser mount	· Condenser height adjustment on rack-and-pinion, range 32mm. · Condenser interchangeable in ring mount. · Centering device. · Auxiliary lens removable.		
Filter mount	45mm diameter filters and a polarizer can be mounted on the light exit on the base. An analyzer can be inserted below the observation tube.		
Illuminating system	· In-base illuminator, with high/low magnification selector.		· In-base illuminator without magnification selector.
	· Objective powers variable from 1.3X to 100X with interchange of condensers. · Maximum field number 29.		
Light source	30 watt pre-centered tungsten filament bulb, interchangeable with various light sources.		15 watt pre-centered tungsten bulb, cordless, not interchangeable.
Transformer built into base	· Incorporates a thyristor circuit for fine voltage adjustment.		
	· Illuminator voltage variable from 0V to 10V.		· Voltage variable from 0V to 8V.
Dimensions	300mm (height) x 215mm (width) x 280mm (length)		
Weights	5.6 kg	5.9 kg	5.7 kg

Remarks: ** Regular size eyepieces can be used in conjunction*

■ OBSERVATION TUBES

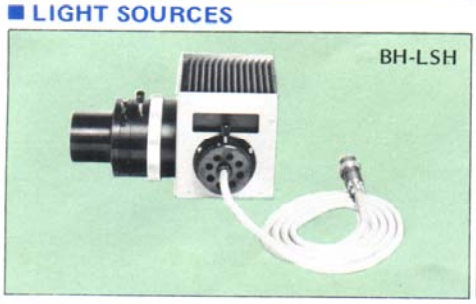
The observation tubes are designed to match the streamlined appearance of the microscope stands for ease of operation, reliable performance and outstanding durability. The binocular and trinocular tubes are available in 30° or 45° inclination.

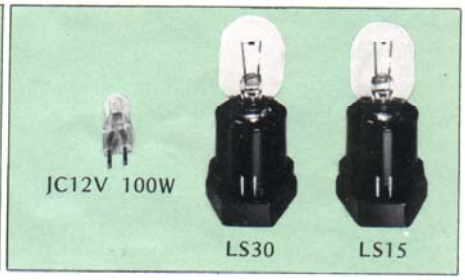
A 30°-inclined super widefield tube is also available to scan a flat field of view 260% larger than with the standard WF widefield eyepieces. This is very convenient in biological research as well as routine work, for it will increase the efficiency and speed of microscopic work without undesirable eyestrain.



Models	SW trinocular tube (30°) BH-SWTR*	Trinocular tube (45°) BH-TR45	Trinocular tube (30°) BH-TR30	Binocular tube (45°) BH-BI45	Binocular tube (30°) BH-BI30	Vertical phototube BH-PT
Maximum field number**	29	21				
Diopter adjustment	Adjustable diopter setting on SW eyepieces.	Both observation eyepiece tubes equipped with variable diopter adjustment, compensating for tube length variations.				–
Convergent angle	0° (parallel optical axes in binocular tubes)					–
Interpupillary distance adjustment	56 – 74mm, graduated.	53 – 72mm, graduated.				–
Light path selection	Two position selector lever; to direct 100% of the light to observation tube or 20% to observation tube and 80% to the phototube.			–	–	–
Attachment	Circular dovetail.					
Rotation	Rotatable through 360°, on circular dovetail.					
Intermediate adapters	Attachable.					

■ LIGHT SOURCES





Light sources	100 watt halogen lamp house Model BH-LSH	30 watt tungsten lamp house Model BH-LH
Centration	Centerable	Pre-centered
Collector	Aspherical lens	
	Focus adjustable	Pre-focused
Filters	Various filters available	Frosted filter built-in

Bulbs	JC12V 100 watt halogen bulb	30 watt pre-centered tungsten filament bulb LS30	15 watt pre-centered tungsten filament bulb LS15
Microscope stands	BHA-F, BHB-F		BHC-F

The light sources available with the stands Models BHA-F and BHB-F are interchangeable.

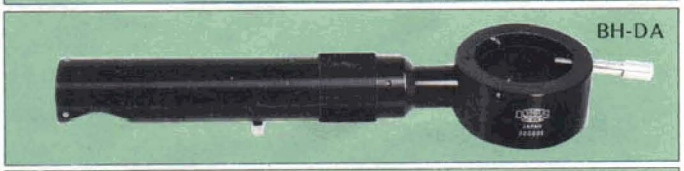
with an eyepiece adapter, provided.

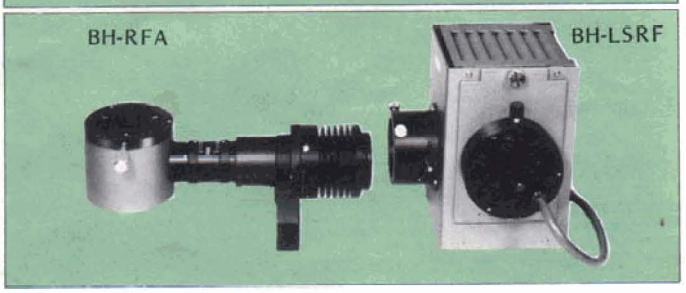
*** The field number is used in the calculation of the visual field diameter:*

$$\text{Field diameter in mm} = \frac{\text{Field number of eyepiece}}{\text{Power of objective in use}}$$

Technical Descriptions

■ INTERMEDIATE ADAPTERS





• MAGNIFICATION CHANGER MODEL AH-CA

The Model AH-CA incorporates 1X, 1.25X, 1.5X and PH (phase contrast) positions to permit magnification changes without change of objectives or eyepieces, as well as easy, accurate alignment of light annulus and phase annulus.
Lenses 1X, 1.25X and 1.5X are provided on a rotating turret. Centering telescope built in "PH" position, focusable.

• BARRIER FILTER ATTACHMENT MODEL AH-FA

Barrier filter attachment, mounted between nosepiece and observation tube, with revolving turret containing five apertures, permanently mounted barrier filters L-420 and AFC on slide, and Y-495, O-515, O-530 and R-610 built in turret.

• BARRIER FILTER ATTACHMENT MODEL BH-FA

This attachment incorporates the barrier filter L-420 permanently, to be mounted between microscope stand and observation tube for fluorescent microscopy with various exciter filters and barrier filters, optionally available. Two slots for insertion of barrier filters, and UV protective shade provided.

• DIFFERENTIAL INTERFERENCE CONTRAST ATTACHMENT MODEL BH-NIC

The interference contrast intermediate tube incorporates the modified Wollaston prism and analyzer with depolarizer for Nomarski differential interference contrast microscopy.

• DUAL OBSERVATION ATTACHMENT MODEL BH-DO

The Model BH-DO was designed with the teacher, the research team and the discussion group in mind, for simultaneous observation with your partner in your research work, education and on-the-spot training, etc., as well as photomicrography.

• DRAWING ATTACHMENT MODEL BH-DA

This attachment can be easily attached between microscope stand and observation tube, so that you can simultaneously observe the images of your drawing pen and the contour of the specimen to be traced.

Eyepiece	Total magnification	Drawing size (diameter in mm)
FK2.5X	Objective power x 5	72
FK3.3X	Objective power x 6.6	96
FK5X	Objective power x 10	144

• FLUORESCENCE VERTICAL ILLUMINATOR ATTACHMENT (after Ploem) MODEL BH-RFL

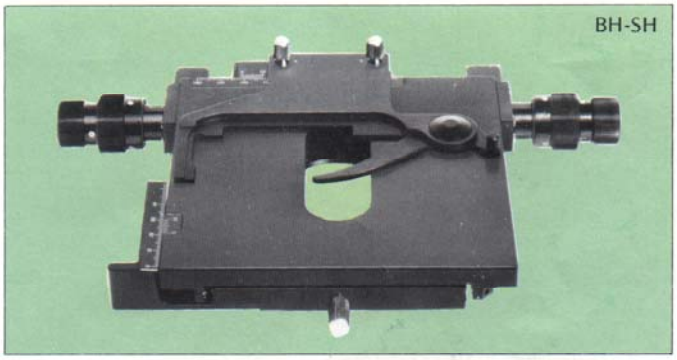
The Model BH-RFL comprises a vertical illuminator with a 100W high pressure mercury burner, to further extend the versatility of the Series BH for incident light fluorescence microscopy.

■ MECHANICAL STAGES

The mechanical stages available with the Series BH include a large square rotatable stage and three non-rotatable square stages. The non-rotatable stages are provided with low drive coaxial controls on ball guides and rack-and-pinion, while the rotatable mechanical stage has horizontal coaxial drive controls on ball guides and rack-and-pinion for north-south movement; dovetail guide and leadscrew for east-west movement, conveniently rotatable for trimming or framing for photomicrography or oblique illumination and differential interference contrast observation.

● POLARIZING FILTER SET MODEL BH-POL

This polarizing set consists of analyzer and polarizer. The analyzer is inserted into the recess of the microscope stand, while the polarizer is placed into the filter mount at the light exit on the microscope base. They are a useful aid to study the optical characteristics of materials in polarized light.



Models	Square rotatable mechanical stage with horizontal drive controls BH-SH	Square mechanical stage with right-hand low drive controls BH-SV	Square mechanical stage with left-hand low drive controls BH-SVL	Square mechanical stage with low drive controls for fluorescence BH-SVF
Size	135 x 134 mm.	142 x 140 mm.		
Traversing area	44 x 76 mm, with verniers reading to 0.1 mm.	52 x 76 mm, with verniers reading to 0.1 mm.		
Drive controls	North-south movement on ball guides and rack-and-pinion; East-west movement on dovetail guide and leadscrew.	North-south and east-west movements on ball guides, and rack-and-pinion.		
Specimen holder	Removable to obtain large unobstructed surface.			
Rotation	Rotatable.	Non-rotatable.		
Mount	Horizontal sliding dovetail mount with clamping lever.			

■ CONDENSERS

The condenser mount is a ring mount equipped with a centering device and rack-and-pinion height adjustment for the interchangeable condensers tabulated below. The condensers are designed to slip into the ring mount and are locked with a clamping knob. They permit rapid interchange for different modes of microscopy, e.g. brightfield, darkfield, immersion or dry, super widefield, phase contrast, from low to high power objectives.

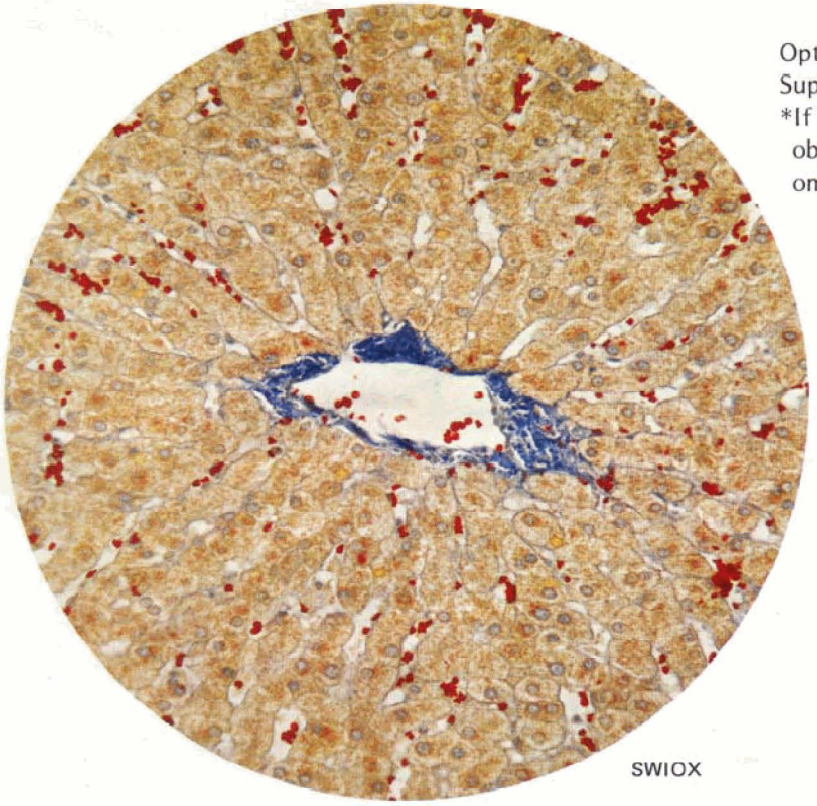
Models	Achromatic/ aplanatic condenser BH-AAC	Abbe condenser BH-CD	Super widefield condenser BH-SWC	Abbe type phase contrast condenser BH-PC	Differential interference contrast condenser BH-NC	Immersion darkfield condenser BH-DCW	Dry darkfield condenser BH-DCD	Low power condenser BH-ULC
Type	Achromatic/ aplanatic type.	Abbe type.			Achromatic/ aplanatic type.	Cardioid type.		Single lens.
Lens assembly	5 elements in 3 groups.	2 elements in 2 groups.			5 elements in 3 groups.	2 elements in 1 group.	1 element.	
N.A.	1.40	1.25	0.95	1.25	1.40	1.40–1.20 (oil)	0.92–0.80 (dry)	0.1
Objective power	4X–100X (SW: 10–100X)	4X–100X	SW: 4X–100X	4X–100X (PC: 10X–100X)	10X–100X (PC & DIC: 10X, 40X, 100X)	10X–100X	10X–40X	1.3X–2X
Aperture iris diaphragm	Numerical aperture scale.	Scale for iris diaphragm diameter.		–	Numerical aperture scale.	–	–	–
Focal length	12 mm.	13 mm.	17.5 mm.	13 mm.	10 mm.	7.8 mm.	12 mm.	37 mm.
Condenser mount	Ring mount. 37.5 mm diameter.							
Others	Oblique illumination.			Centerable annular aperture.	Centrable annular aperture. Polarizer.			

The SW attachment consists of the super widefield observation tube (inclined 30°) with vertical phototube, paired BiSW10X eyepieces, photo eyepiece FK3.3X, Plan Achromats 4X, 10X, 20X, 40X and SW Plan 100X(oil) and SWC condenser, for a field of view more than twice as large as the area previously considered to be the ultimate. The SW10X eyepiece scans a flat field of view 217% larger than the standard WF10X widefield, while an optional SW7X scans a 260% larger field than the WF10X. No more time consuming scanning of small specimen areas with the SW attachment! And what is more important, working with the Model BH-SW will increase the efficiency and speed of microscopic work but will not introduce undesirable eyestrain.

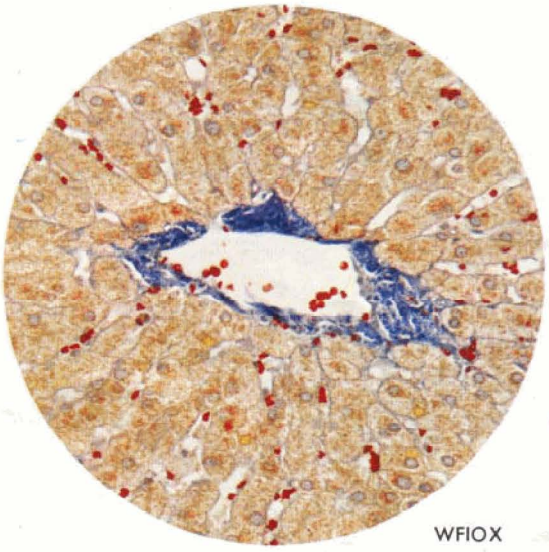
A super widefield condenser N.A. 0.95, for use with SW objectives, eliminates necessity of immersion for use even with 100X objectives. If it is desired to fully utilize the N.A. of the 100X objective, it is recommended to use the achromatic/aplanatic condenser BH-AAC.
Each eyepiece is provided with diopter adjustment. Interpupillary distance is variable from 56mm to 74mm.
The super widefield objective SW Plan 100X enables not only the observation of the widest field of view in conjunction with the SW eyepieces, but also produces a flat image to the edge of the field with excellent resolution.

■ STANDARD EQUIPMENT

Super widefield trinocular tube, inclined 30°, with vertical phototube BH-SWTR 1
Super widefield condenser, N.A.0.95, with graduated aperture iris diaphragm BH-SWC 1
Super widefield eyepieces BiSW10X, paired 1
Photo eyepiece FK3.3X..... 1
*Objectives: Plan 4X, Plan 10X, Plan 20X (spring), Plan 40X (spring), SW Plan 100X (oil, spring) (set of five) 1
Optional Accessory
Super widefield eyepieces SW7X, paired
*If your BH Microscope is equipped with Plan objectives, objectives mentioned above except SW Plan 100X may be omitted.

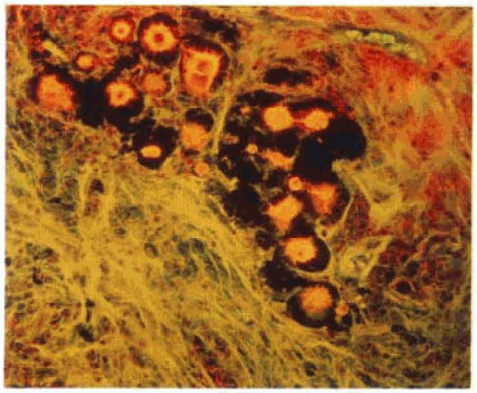


SW10X

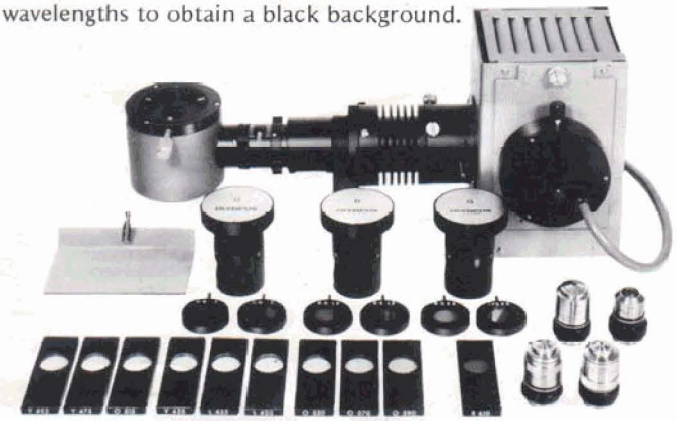


WF10X

The Model BH-RFL incorporates a high pressure mercury burner, a wide range of exciter filters and barrier filters in addition to all or either of 4 dichroic mirrors for ultraviolet, violet, blue and green excitation. The dichroic mirrors, originated by Dr. J. S. Ploem, are built in mounts for selection of the desired wavelengths for excitation of the specimen. Radiation energy emitted from a powerful 100W high-pressure mercury burner is transmitted through collector and exciter filter to the dichroic mirror to excite the fluorochrome in the specimen in the desired wavelength. After irradiation with the excitation wavelengths, the specimen emits a longer visible wavelength, due to Stoke's law. A barrier filter between objective and eyepiece passes the emitted light from the specimen and blocks out unwanted wavelengths to obtain a black background.



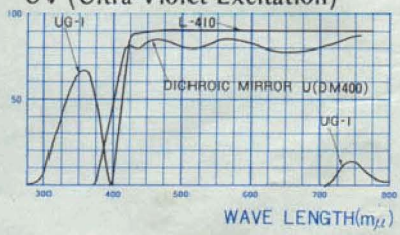
Cat Brain, Acridine Orange



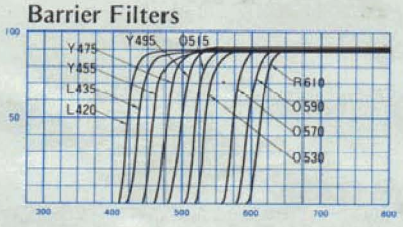
■ STANDARD EQUIPMENT

Component		BH-RFL				
		-U	-V	-B	-G	-A
Fluorescence vertical illuminator	BH-RFA	1	1	1	1	1
Lamp house	BH-LSRF	1	1	1	1	1
Power supply unit	BH-RFL-T	1	1	1	1	1
Dichroic mirrors	With two UG-1 for UV excitation BH-DMU	1	—	—	—	1
	With UG-5, BG-3 & IF-405 for V excitation BH-DMV	—	1	—	—	1
	With two BG-12 for blue excitation BH-DMB	—	—	1	—	1
	With IF-545 & BG-36 for green excitation BH-DMG	—	—	—	1	1
Barrier filters	L-420, L-435, Y-455 (set of three)	1	—	—	—	1
	Y-475, Y-495, O-515 (set of three)	—	1	—	—	1
	O-530, O-570, O-590 (set of three)	—	—	1	—	1
	R-610	—	—	—	1	1
Objectives (set of four): Non-fluorescing Plan 10X-F, Plan Apo 20X-F, SI Apo 40X-F, SI SFL 100X-F		1	1	—	—	1

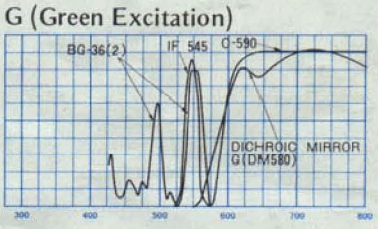
UV (Ultra-Violet Excitation)



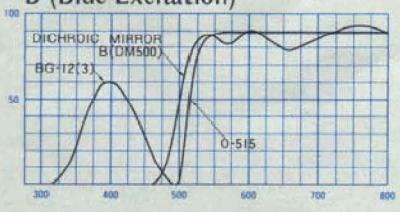
Barrier Filters



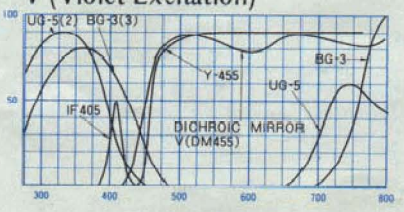
G (Green Excitation)



B (Blue Excitation)



V (Violet Excitation)

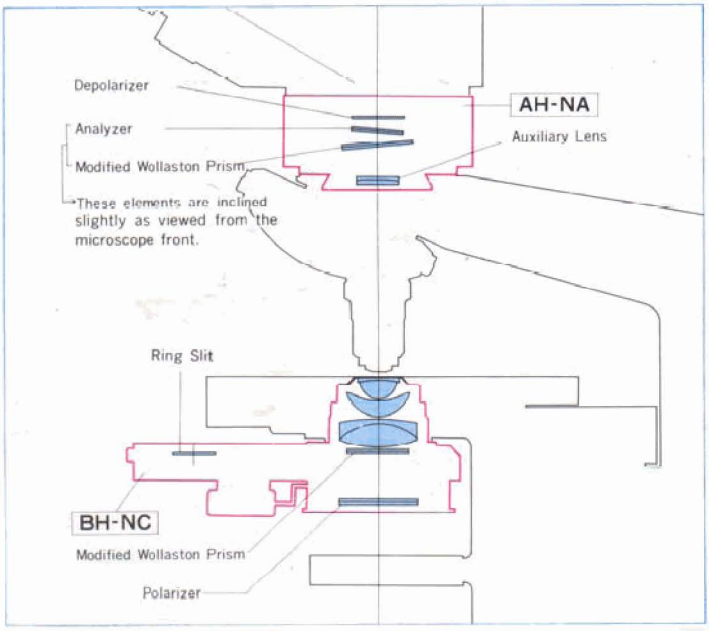


The Model BH-NIC is designed for the qualitative study of transmitted light phase objects with the System Microscopes Series BH. This differential interference contrast device incorporates a pair of birefringent crystal prisms as beam-splitters, with a shear between the two interfering beams smaller than the resolution limit of the objective used in the microscope, so that no double image is observed.

The interference contrast method renders a sharply defined, relief-like image with excellent contrast in a wide range of interference colors. This method permits observation of unstained transparent objects like phase contrast, which makes it useful for observation in histology, cytology, biology, anatomy, etc. Furthermore, when used with the Series BH, this attachment permits detection of minute differences of thickness and changes of internal refractive indexes of unstained, transparent specimens. By operating the birefringent crystal prism built in the intermediate tube, a most suitable contrast color can be chosen in accordance with purpose and specimen. The background color can be continuously changed in the order from dark to yellow, to purplish red, to blue or in the reversed order.

Features

- Generally the larger the phase difference, the more conspicuous the halos, which is a drawback of the ordinary phase contrast method, making distinct observation of contours more difficult. The Nomarski method does not cause halos, so that a clear definition of image details is obtained.
- The Nomarski method permits utilization of the full numerical aperture of the objective, which results in exceptional image brightness and resolution almost double that of phase contrast.
- The depth of focus is smaller in differential interference contrast than in phase contrast. This prevents disturbing out-of-focus effects, and permits layer by layer scanning of specimens, commonly called "optical sectioning".
- Interference colors, or grey shadings, can be seen in proportion with the gradient of path differences of the specimen. Phase contrast helps to determine a high or low refractive index of a specimen detail by the appearance of halos, according to the positive or negative contrast of the objective in use.
- As the shearing direction is restricted in accordance with the sliding direction of the Wollaston prism, it is preferable to use a rotatable stage to orient the specimen in the direction best suited for optimum resolution.
- For the observation of anisotropic objects, it is recommended to apply phase contrast rather than interference contrast for better results.



Development egg of Sea-urchin, Hemicentrotus Pulcherrimus.
: fixed with 2% formalin and mounted in 30% glycerin. Plan 40x FK3. 3x.

■STANDARD EQUIPMENT

Differential interference contrast intermediate tube AH-NA 1
Differential interference contrast condenser BH-NC 1
Phase contrast objectives: PC PL Plan 10X 1
PC PL Plan 40X 1
PC PL Plan 100X (oil) 1
Centering telescope CT 1
Filter 45G533 1

Phase Contrast Attachment/MODEL BH-PC

BH

Indispensable to observe the internal structures of cells, nuclei, or minute living objects with various contrasts as desired, the Model BH-PC permits phase contrast microscopy by means of phase contrast objectives and a phase contrast condenser. Additionally, the attachment permits normal brightfield and darkfield microscopy.
The Model BH-PC is equipped with an Abbe type phase turret condenser, N.A.1.25, with graduated aperture iris diaphragm, a ring centering device, and annular diaphragms for 10X, 20X, 40X and 100X phase objectives, which are available in 4 contrasts, PLL, PL, NM, NH, and an empty aperture for brightfield observation.
These letters designate the following contrasts: N = Negative; P = Positive; M = Medium; L = Low; LL = Low-Low; H = High.
This exceptionally wide selection of combinations is certain to suit the most demanding requirements.

■STANDARD EQUIPMENT

Phase contrast turret condenser, N.A.1.25 1
Centering telescope 1
Phase contrast objectives:
*Positive low contrast
PC PL Ach 10X, PC PL Ach 20X, PC PL FL S-40X (spring) PC PL FL S-100X (spring, oil) ..... 1 ea.
*Positive low low contrast
PC PLL Ach 10X, PC PLL Ach 20X, PC PLL FL S-40X (spring), PC PL FL S-100X (spring, oil) ..... 1 ea.
*Negative high contrast
PC NH Ach 10X, PC NH Ach 20X,. PC NH Ach S-40X (spring), PC NH Ach S-100X (spring, oil) ..... 1 ea.
*Negative medium contrast
PC NM Ach 10X, PC NM Ach 20X, PC NM Ach S-40X (spring), PC NM Ach S-100X (spring, oil)..... 1 ea.

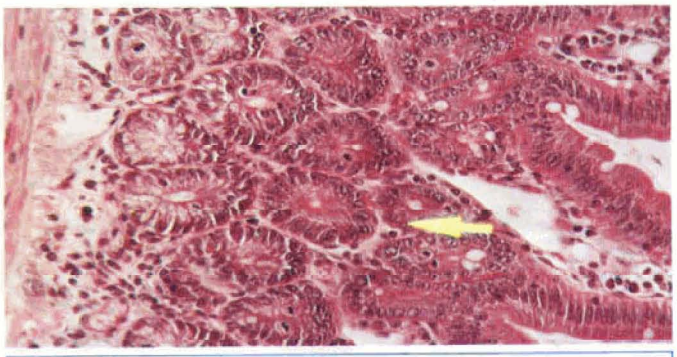
* The Model A-PC-PA consists of all the 4 contrasts as listed above, while one contrast combination can also be available as follows:

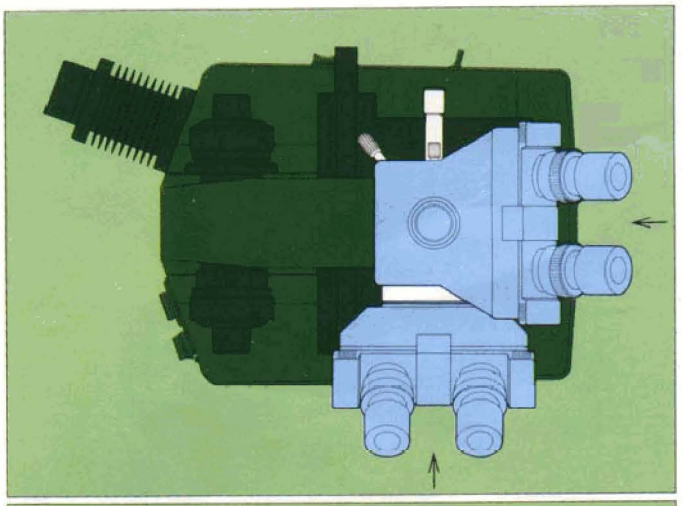
B-PC-PB-PL (positive low contrast)
B-PC-PB-PLL (positive low low contrast)
B-PC-PB-NH (negative high contrast)
B-PC-PB-NM (negative medium contrast)

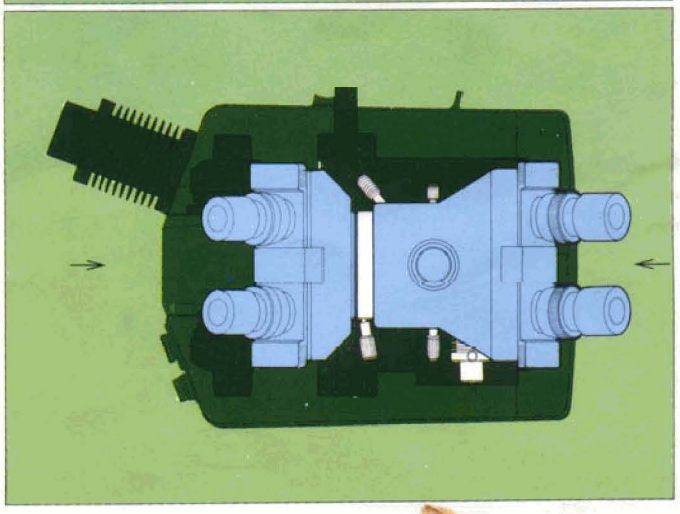
Letter	Contrast	Specimen	Purpose
PLL	Positive-low-low	If the aperture diaphragm is stopped down slightly more than the objective N.A., image contrast may be increased. If further contrast is needed, this PLL contrast is recommended.	Observation of forms and internal structures of specimens with relatively high contrast.
PL	Positive-low	When specimens require definite observation of their internal structure more than at slightly stopped down aperture diaphragm of brightfield.	
NM	Negative-medium	When more contrast is necessary for observation of objects so small that the extremely stopped-down aperture diaphragm can barely detect their existence.	Observation of forms, details, and motions of low contrast objects.
NH	Negative-high	When darkfield observation is preferable to brightfield, since the objects are very low in contrast and can hardly be observed in brightfield.	

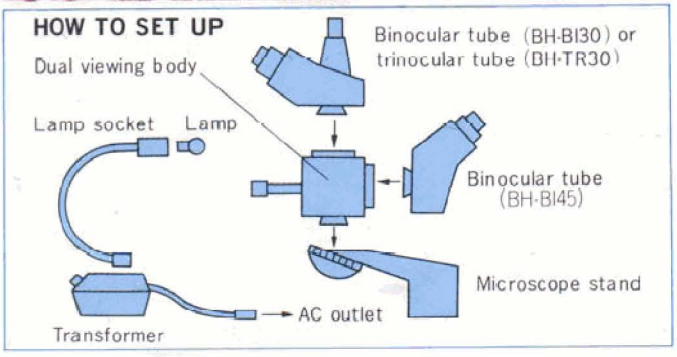
Dual Observation Attachment/MODEL BH-DO

Specially designed for the demands of teaching and discussion, the Model BH-DO has two binocular tubes. Both tubes have adjustable interpupillary distances and all four eyepiece tubes have diopter adjustments for individual comfort.
The entire dual observation assembly rotates through 360°. Discussion is facilitated by a built-in illuminated pointer, which orients or rotates at the tough of a manipulator, with yellow and green filters to intensify pointer contrast. High eyepoint widefield eyepieces WF10X are supplied for maximum observer comfort, without standing color correction and field flatness.









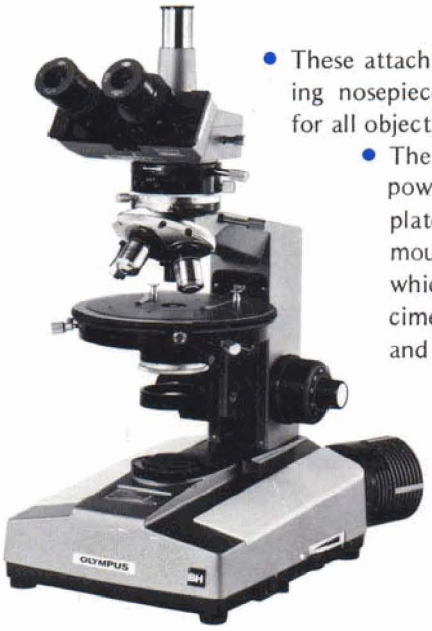
■STANDARD EQUIPMENT

TYPE		1	2	3	4
Dual viewing body with integral pointer and pointer manipulator	BH-DO	1	1	1	1
Binocular tube, inclined 30°	BH-BI30	1	—	—	—
Binocular tube, inclined 45°	BH-BI45	—	1	—	1
Trinocular tube, inclined 30°	BH-TR30	—	—	1	1
Eyepieces, H.E.P. paired	BiWF10X	1	1	1	2
Photo eyepieces	FK3.3X	—	—	1	1
Transformer, voltage variable at 2V-4V-6V	TDO	1	1	1	1
Tungsten bulbs	6V 10WGE	3	3	3	3

For those who wish to use the standard observation tube of the microscope Series BH, type 1, 2 or 3 is recommended.

Polarizing Attachment/MODEL BH-P-1 / BH-P-2

The Polarizing Attachments Models BH-P-1 and BH-P-2 are designed to enable the user of the System Microscope Model BHA to microscopically observe the optical characteristics of a suitably prepared object in polarized light. As tabulated below, the Model BH-P-1 includes a binocular tube for polarizing observation, while the Model BH-P-2 includes a trinocular tube for both polarizing observation and photomicrography, in addition to the standard equipment commonly shared between them.
Each of these attachments facilitates microscopic work in polarized light not only in the fields of mineralogy and petrography, but also in chemistry, pharmacology, biology, medical science and ceramics, as well as in the chemical and textile industries.



- These attachments feature a removable quadruple revolving nosepiece which is provided with centering devices for all objectives except the 4X objective.
- The polarizing intermediate tube (magnification power 1.0X), compatible with various test plates, incorporates a focusable Bertrand lens mounted in a rotating turret, with a depolarizer which makes the binocular vision of the specimen evenly black between crossed analyzer and polarizer.
- The multi-layer coating applied to the optical elements in the observation tubes BH-PBI and BH-PTR assures exceptionally bright binocular vision.
To those who do not yet own the BHA microscope, the Models BHA-651-P or BHA-751-P are recommended.

Components		Polarizing Attachment		Polarizing Microscope	
		BH-P-1	BH-P-2	BHA-651-P	BHA-751-P
Microscope stand	BHA-F			○	○
30 watt tungsten lamp house	BH-LH			○	○
Tungsten bulb 6V, 30W	L530			○	○
Binocular tube for polarizing light (30°)	BH-PBI	○		○	
Trinocular tube for polarizing light (30°)	BH-PTR		○		○
Centering revolving nosepiece for polarizing light	BH-PRE	○	○	○	○
Intermediate polarizing tube	AH-PA	○	○	○	○
Tint plate	AH-TP530	○	○	○	○
1/4 wavelength retardation plate	AH-TP147	○	○	○	○
Circular rotatable stage	BH-SRP	○	○	○	○
Polarizing condenser	BH-POC	○	○	○	○
Polarizing objectives (stainfree)	PO4X	○	○	○	○
	PO10X	○	○	○	○
	PO40X (spring)	○	○	○	○
	PO100X (spring), oil	○	○	○	○
Eyepieces	K5X with cross hair disc	○	○	○	○
	BK5X	○	○	○	○
	WF10X with cross hair disc	○	○	○	○
	WF10X with micrometer disc	○	○	○	○
	AHWF10X	○	○	○	○
Photo eyepiece	FK5X		○		○
Spare fuses (2pcs.)				○	○
Filter 45C				○	○
Immersion oil				○	○
Vinyl dust cover				○	○

OPTIONAL ACCESSORIES: Cross-movement graduated mechanical stage Model A-HMP, Objective PO20X, Berek compensator A-CTP-2

Projection Screen/MODEL BH-MPS

A trinocular microscope can be fitted with this projection screen. It projects the magnified image of a specimen onto a 155 mm diam. screen for group viewing, consultation, etc.
The image magnification on screen equals
objective power x photo eyepiece power x 3.

■ STANDARD EQUIPMENT

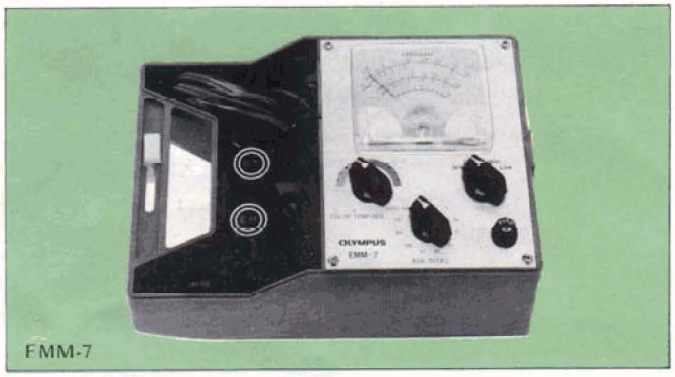
Projection screen AH-MPS 1
Photo eyepiece adapter PM-ADF 1

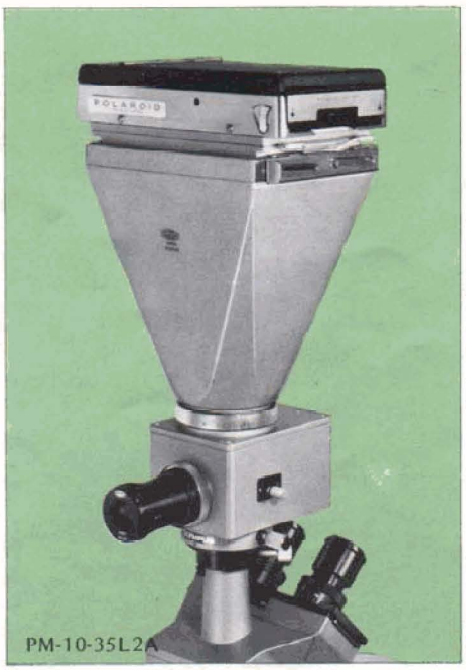
The PM-10 System Camera combines the features and advantages of many separate conventional attachment cameras, ranging from 35 mm camera back to 4" x 5" film holders. The Model PM-10 consists of two basic units—a fully automatic version Model PM-10-A and a popular manual version Model PM-10-M.

The modular design concept of the system camera permits easy interchangeability of many accessories. When these modular accessories are attached to the automatic or manual photomicrographic bodies in accordance with your requirements, sharply focused pictures on standard 35 mm film, 3¼" x 4¼" Polaroid film or 4" x 5" size film can easily be obtained. The data imprinting 35 mm camera back can be easily attached on the exposure body. Once in place, the back enables the user to imprint information such as numbers, symbols, etc., on the film.

The Model PM-10-M and the Attachment Camera Model PM-6 incorporate a light measuring port to accept the exposure and color temperature probes of the Exposure Meter Model EMM-7

PM-10-35A


EMM-7

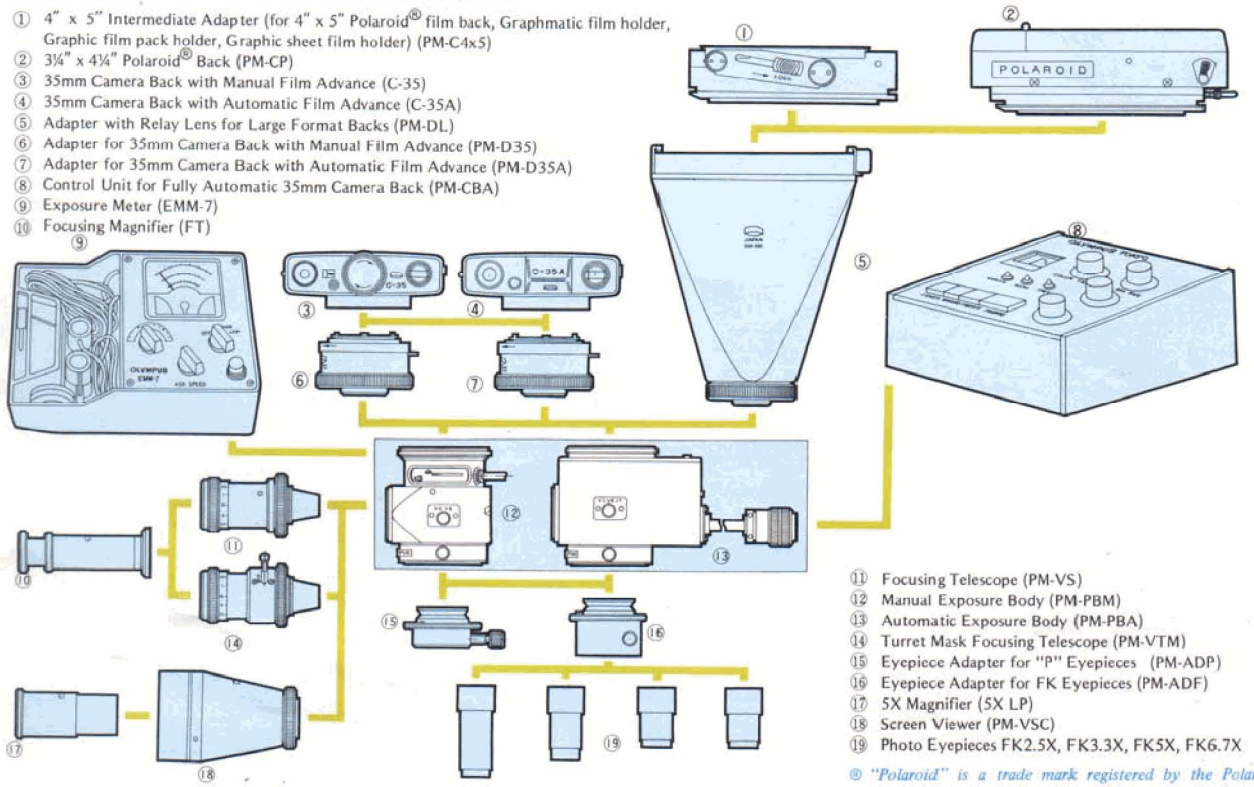

PM-10-35L2A

PM-10-35-M

PM-6

System Chart of Modular Camera Units

① 4" x 5" Intermediate Adapter (for 4" x 5" Polaroid® film back, Graphmatic film holder, Graphic film pack holder, Graphic sheet film holder) (PM-C4x5)
② 3¼" x 4¼" Polaroid® Back (PM-CP)
③ 35mm Camera Back with Manual Film Advance (C-35)
④ 35mm Camera Back with Automatic Film Advance (C-35A)
⑤ Adapter with Relay Lens for Large Format Backs (PM-DL)
⑥ Adapter for 35mm Camera Back with Manual Film Advance (PM-D35)
⑦ Adapter for 35mm Camera Back with Automatic Film Advance (PM-D35A)
⑧ Control Unit for Fully Automatic 35mm Camera Back (PM-CBA)
⑨ Exposure Meter (EMM-7)
⑩ Focusing Magnifier (FT)



⑪ Focusing Telescope (PM-VS)
⑫ Manual Exposure Body (PM-PBM)
⑬ Automatic Exposure Body (PM-PBA)
⑭ Turret Mask Focusing Telescope (PM-VTM)
⑮ Eyepiece Adapter for "P" Eyepieces (PM-ADP)
⑯ Eyepiece Adapter for FK Eyepieces (PM-ADF)
⑰ 5X Magnifier (5X LP)
⑱ Screen Viewer (PM-VSC)
⑲ Photo Eyepieces FK2.5X, FK3.3X, FK5X, FK6.7X

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Models	PM-10-35A	PM-10-35M	PM-6
Components	• Automatic exposure body **PM-PBA.** • Adapter for 35mm camera back with automatic film advance **PM-D35A.** • 35mm camera back with automatic film advance **C-35A.** • Control unit for fully automatic 35mm camera back **PM CBA.** • Others: Focusing telescope, Focusing magnifier, Eyepiece adapters, Filters.	• Manual exposure body **PM-PBM.** • Adapter for 35mm camara back with manual film advance **PM-D35.** • 35mm camera back with manual film advance **C-35.** • Others: Focusing telescope, Focusing magnifier, Eyepiece adapters, Filters.	• 35mm attachment camera, comprising manual exposure body.
35mm camera back	Automatic film advance with built-in motor.	Manual film advance.	
	Information imprinting device, self-setting frame counter, rewinding knob, film size 24mm x 36mm.		
Light path selection	3-position light path selector knob for observation, observation-and-photography, and exposure measurement.		
Exposure & color temperature controls	• The control unit is a console type with switches for automatic exposure, time exposure and flash synchronization; ASA film speed selector dial for different films from ASA 6 to ASA 3200; ASA fine regulation dial, and zero-resetting color temperature meter. Fine adjustment of ASA film speed 0.75, 0.85, 1, 1.2, 1.5. • Automatic compensation for reciprocity failure.	• The manual exposure body is provided with a light measuring port to accept the exposure meter Model EMM-7 which facilitates the determination of correct exposure time and color temperature. • The exposure meter Model EMM-7 with direct reading scales for 35mm exposure measurements (High: 1/250—1/2 sec. Low: 1/2—32 sec.); for large formats (High: 1/30—4 sec. Low: 4—128 sec.) Color temperature meter for light balancing.	
Shutter times	Automatic exposure range 32 min. to 1/100 sec. Push button for automatic shutter release, to eliminate shutter vibration.	B and 1 sec. to 1/250 sec. with integrated mechanical shutter in vibration proof rubber mount.	
Large format attachments	Polaroid 3¼" x 4¼", 4" x 5" sheet film holders, film pack holder.		Not available.

Optical Characteristics

In keeping with the varied requirements of the users, Olympus makes available objectives of high resolution from 1.3X to 100X magnifications. They include Achromats, Plan Achromats, Fluorites, Apochromats, Plan Apochromats and Super Widefield Plan Achromats. Especially, the Plan Apochromats are capable of producing a flat image to the edge of the field, with excellent resolution, free of field curvature. Chromatic aberration is corrected for three colors, spherical aberration for two colors. The best objectives suitable for the most sophisticated demands.
All eyepieces are computed to match the objectives for full chromatic and distortion correction. They are Compensating, Flat Field High-Eyepoint, Super Widefield, Photo Eyepieces, etc.

■ EYEPIECES

Type	Initial Magnification	Field Number
Compensating	BiK5X	21
	K20X	7.5
	BiK20X	7.5
Widefield	WF 10X	18
	WF 10XMicro (with micrometer 10/100mm)	18
	WF 15X	12
	BiWF 10X	18
	BiWF 15X	12
High Eyepoint Widefield	H.E.P. WF 10X	18
	H.E.P. BiWF 10X	18
Super Widefield	BiSW 7X	29
	BiSW 10X	26.5
Photo	FK 2.5X, FK 3.3X	
	FK 5X, FK 6.7X	

■ OBJECTIVES

Type		Initial Magnification	Numerical Aperture	Free Working Distance
Achromats		4X	0.10	19.87 mm
		10X	0.25	5.40
		20X	0.40	1.58
		40X	0.65	0.39
		60X	0.80	0.26
		100X (oil)	1.30	0.11
		S-40X (spring)	0.65	0.39
		S-60X (spring)	0.80	0.26
		S-100X (spring, oil)	1.30	0.11
		I-100X (iris diaphragm)	1.30	0.11
		No cover Ach 40X (for use without cover glass)	0.65	0.71
Fluorities (Semi apochromats)		FL S-40X (spring)	0.75	0.49
		FL S-60X (spring, dry, correcting collar)	0.95	0.15
		FL S-100X (spring, oil)	1.30	0.10
		No cover FL 40X (for use without cover glass)	0.75	0.53
Phase Contrast	Achromats	10X	0.25	5.78
		20X	0.40	1.60
		S-40X (spring)	0.65	0.39
		S-100X (spring, oil)	1.30	0.11
	Fluorites (Semi apochromats)	FL S-40X (spring)	0.75	0.49
		FL S-100X (spring, oil)	1.30	0.11
Apochromats		Apo 40X (spring, dry, correcting collar)	0.80	0.23
		Apo 40X (spring, oil, iris diaphragm)	1.00	0.19
Plan Achromats		Plan 1.3X	0.03	19.92
		Plan 2X	0.05	18.29
	Super Widefield	Plan 4X	0.10	5.50
		Plan 10X	0.25	7.18
		Plan 20X (spring)	0.40	0.78
		Plan 40X (spring)	0.65	0.22
		SW Plan 100X (spring, oil)	1.25	0.08
		Plan 100X (spring, oil)	1.25	0.14
Plan Apochromats		Plan Apo 4X	0.16	4.35
		Plan Apo 10X (spring)	0.32	0.16
		Plan Apo 20X (spring)	0.65	0.14
		Plan Apo 40X (spring, correcting collar)	0.95	0.10
		Plan Apo 100X (spring, oil)	1.30	0.09

Combinations of Various Components

BH

Components \ Models			BHA				BHB				BHC	
			413	213	411	211	413	213	411	211	411	211
Microscope stand		BHA-F	●	●	●	●						
		BHB-F					●	●	●	●		
		BHC-F									●	●
Quintuple revolving nosepiece		BH-RE	●	●	●	●						
30 watt tungsten lamp house		BH-LH	●	●	●	●	●	●	●	●		
Tungsten bulb 6V, 30W		LS30	●	●	●	●	●	●	●	●		
Tungsten bulb 6V, 15W		LS15									●	●
Binocular tube (45°)		BH-BI45		●		●		●		●		●
Trinocular tube (45°)		BH-TR45	●		●		●		●		●	
Mechanical stage		BH-SV	●	●	●	●	●	●	●	●	●	●
Abbe condenser		BH-CD			●	●	●	●	●	●	●	●
Ach/Apla. condenser		BH-AAC	●	●								
Objectives	Achromat 4X				●	●			●	●	●	●
	Achromat 10X				●	●			●	●	●	●
	Achromat S-40X (spring)				●	●			●	●	●	●
	Achromat S-100X (spring, oil)				●	●			●	●	●	●
	Plan Achromat 4X		●	●			●	●				
	Plan Achromat 10X		●	●			●	●				
	Plan Achromat 20X (spring)		●	●								
	Plan Achromat 40X (spring)		●	●			●	●				
	Plan Achromat 100X (spring, oil)		●	●			●	●				
Eyepieces, H.E.P. BiWF10X, paired			●	●	●	●	●	●	●	●	●	●
Photo eyepiece FK5X			●		●		●		●		●	
Filter (45C)			●	●	●	●	●	●	●	●	●	●
Spare bulbs and fuses, 2 pieces each			●	●	●	●	●	●	●	●	●	●
Immersion oil and vinyl dust cover			●	●	●	●	●	●	●	●	●	●

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