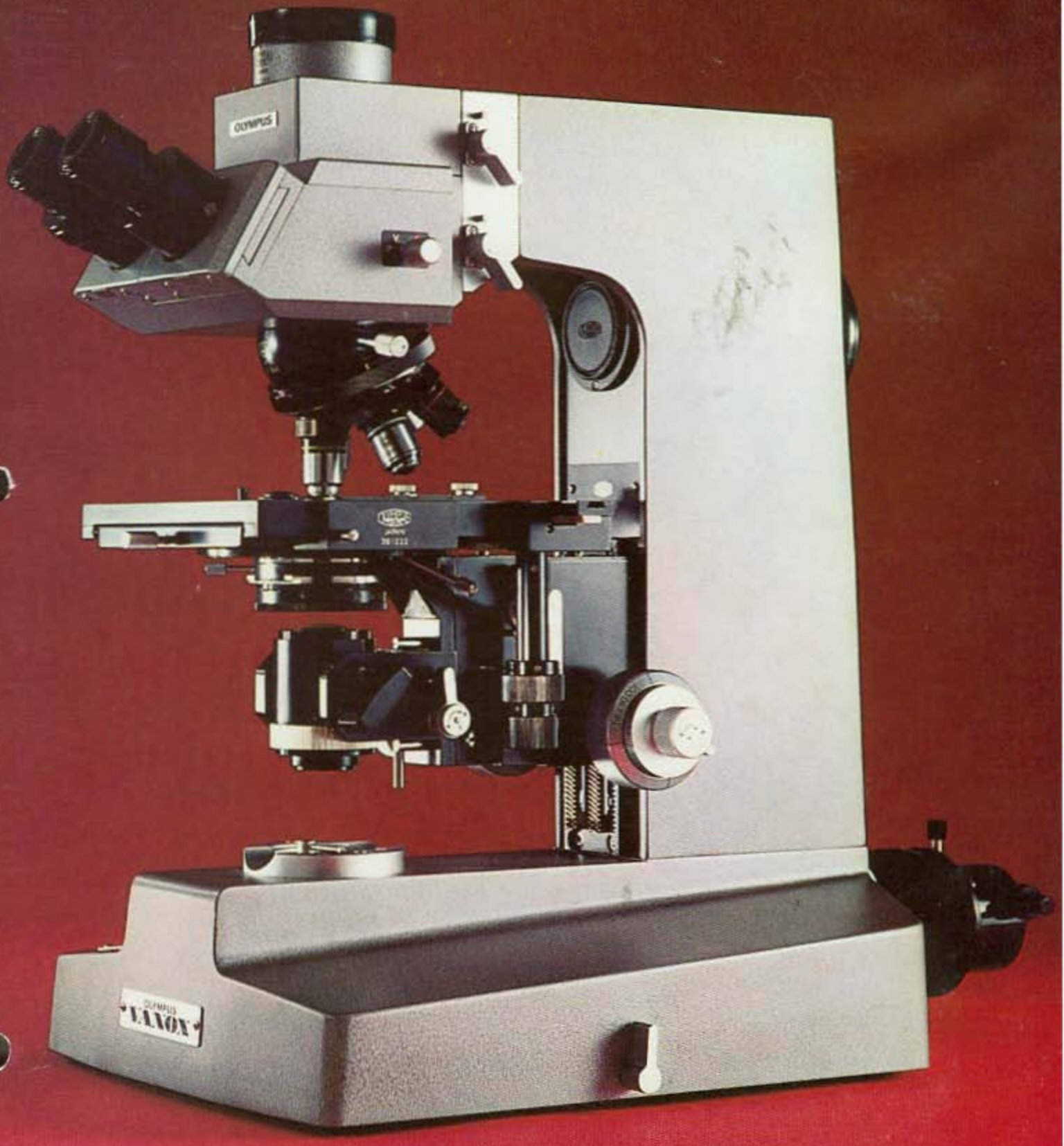
OLYMPUS VANOX

Universal Research Microscope



OLYMPUS UNIVERSAL RESEARCH MICROSCOPE

VANOX

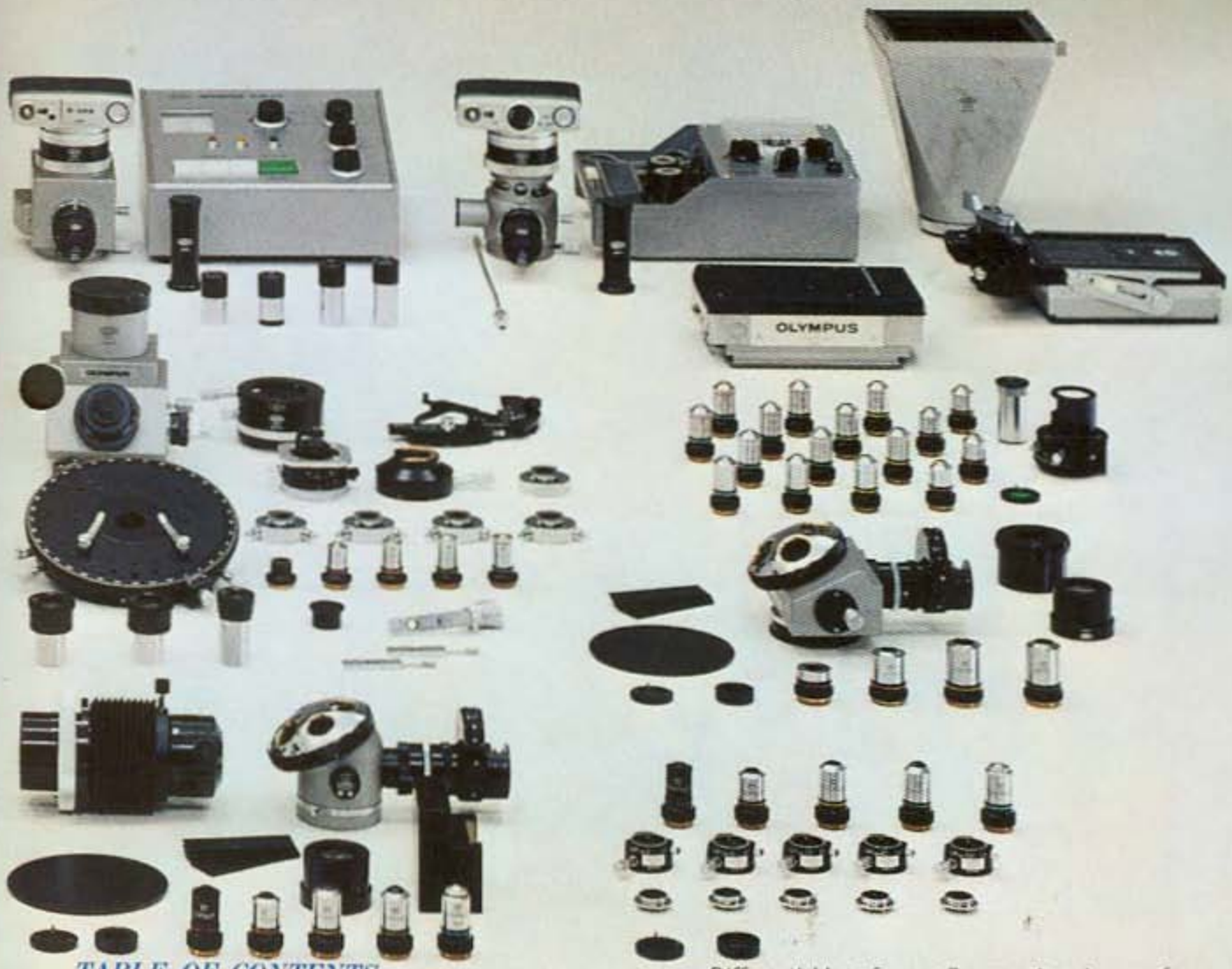
Olympus

The combined efforts of Olympus research, design and engineering talent, backed by over 50 years of experience in the manufacture of optical precision instruments resulted in the realization of the Universal Research Microscope Model VANOX.

Prior to designing this modular, building-block system research microscope, Olympus closely analyzed the requirements of the scientific community. Based on this analysis a wide range of components and accessories were conceived to fit on a basic stand, either permanently or as interchangeable attachments. This modular concept allows the user to meet the most exacting demands in a wide range of scientific disciplines.

A fully extended range of components and accessories for various applications not only in observation but also in photomicrography makes the Model VANOX one of the most versatile research microscopes available. The technician, the pathologist, the metallurgist, as well as the research scientist with the most exacting requirements, are thus able to equip their microscope precisely according to their needs.

Universal Research Microscope Model VANOX



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System Chart of Various Units

The various units in the chart below are based on the modular building-block system of interchangeable accessories for widely extended applications of the Model VANOX.

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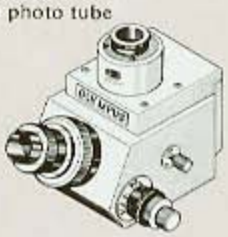
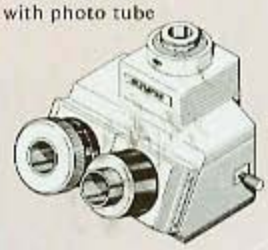
Projection screen

Polarizing monocular tube with photo tube

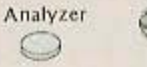

Binocular tube with photo tube



Polarizing attachment

Super widefield binocular tube with photo tube

Analyzer



Centerable single mount nosepiece

Magnification changer

Barrier filter attachment

Revolving nosepiece

Vertical illuminator for bright and darkfield

Vertical illuminator for brightfield

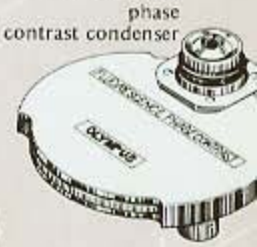
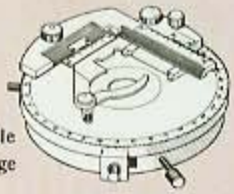
Filter turret

Differential interference contrast attachment after Nomarski for transmitted light

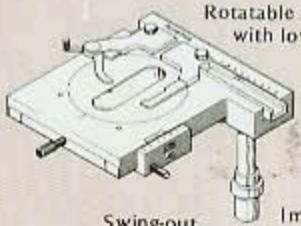
Differential interference contrast attachment after Nomarski* for reflected light

Incident light phase contrast attachment

Fluorescence phase contrast condenser



Circular rotatable polarizing stage

Rotatable square mechanical stage with low drive controls


Phase contrast turret condenser

Polarizing condenser

Achromatic/ aplanatic condenser

Dry darkfield condenser

Swing-out condenser

Immersion darkfield condenser

Auxiliary lens

Super widefield condenser

35mm camera back with manual film advance

3¼" x 4¼" Polaroid® camera back

4" x 5" Polaroid film holder

Photomicrographic exposure meter

35mm camera back with automatic film advance

Adapter with relay lens for large format backs

Manual exposure body for photomicrographic system camera

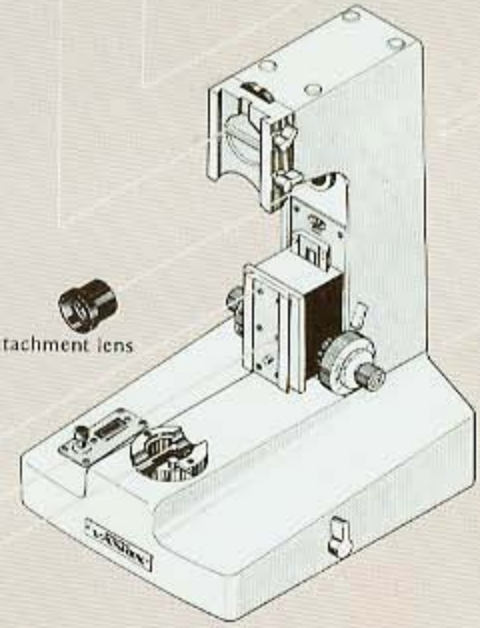
Control unit for fully automatic system camera

Vertical illuminator for fluorescence

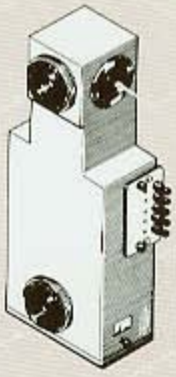
Automatic exposure body for photomicrographic system camera

Fluorescence lamp house

Differential interference contrast attachment after Nomarski for transmitted light



Attachment lens



Fluorescence illuminator

Condenser mount

Halogen light source for transmitted and reflected light

Microscope stand

Polarizer

Counter-weight

Tungsten light source for transmitted and reflected light

Camera Ring Dovetail Mount
Eyepiece
Diopter Adjustment
Binocular Observation Tube with Photo Tube
Revolving Nosepiece
Stage
Clamping Screw for Stage Rotation
Condenser
Auxiliary Lens System
Lens Rotating Knob
Lever for Swing-out Frosted Glass
Light Exit
Main Switch (with built-in pilot lamp)
Microscope Stand
Light Path Selector Knob
Opening for Incident Light Source
Objective
Condenser Centering Knob
Coarse Adjustment Knob
Fine Adjustment Knob
Light Source
Swing-out Auxiliary Lens Lever
Coaxial Specimen Control Kn
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Functional Design

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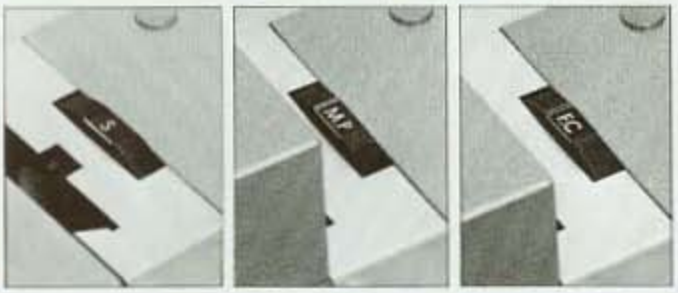
Painstaking research in human engineering has resulted in a microscope design where knobs, levers and other operational elements are located on the instrument for maximum operator comfort.

■STAND

• "Sturdy functional design" are the key words for the basic stand of the VANOX. The rugged, modern, square-line stand contains a wide choice of application oriented options that let you modify its configuration to suit your purpose. The VANOX modular concept allows you to build a system around your own requirements by providing a complete range of VANOX accessories.

• Height position of observation tubes is variable. Selector turret for height of observation tube is provided. This turret ensures correct height positioning of the observation tube. It



permits vertical tube adjustment and can be engaged in 3 positions, depending on the choice of accessories, as listed below:

Selector turret	Application
S	Standard microscopy
M.P	Metallurgical and polarized light microscopy
F.C	Fluorescent light microscopy, magnification changer

■FOCUSING ADJUSTMENT

• Large coaxial knobs are provided on both sides of the stand to achieve smooth coarse-and-fine adjustments without fatigue. Equipped with arm rests on base.

• Coarse drive on dovetail slideways, rack-and-pinion type, adjustment range 49mm.

• Fine drive on roller guide, gear train; adjustment range 2.3mm, graduated in increments of 1 micron.

• Automatic pre-focusing lever is provided to prevent possible contact between specimen and objective as well as to simplify coarse focusing. This lever is locked after coarse focus has been accomplished to prevent further upward travel of the stage. This lever does not restrict fine focusing.

■OBSERVATION TUBES

• The standard tube consists of a combination of inclined binocular eyepiece tubes and vertical photo tube. Eyepiece tubes, inclined 30°, accept eyepieces with a field number of 21; eyepoint positioned for maximum observer comfort.

• Constant tube length adjustment automatically maintains correct mechanical tube length for all interpupillary distances, so that the microscope need not be re-focused for photomicrography.

• Interpupillary distance is adjustable from 54mm to 74mm. Diopter adjustment on the left tube compensates for difference in your eye acuity.

• A three-step beam-splitter can be adjusted to pass all light into the eyepiece tubes for observation, all light into the photo tube for photomicrography, or 80% to the photo tube and 20% to the eyepieces, for simultaneous viewing and photomicrography.

• The triocular tube of the VANOX is designed to maintain the same mechanical tube length for both viewing and photographic eyepieces regardless of interpupillary distances.

• It is recommended to use the field of view eyepieces, optionally available, for simultaneous observation and photomicrography. They are computer designed to facilitate accurate focusing on various film planes such as standard 35mm film, 3¼" x 4¼" and 4" x 5" size films.

• Available options, interchangeable with the standard observation tube, include those for super widefield and polarizing observation, as well as intermediate tubes for fluorescence, polarized and reflected light.

■REVOLVING NOSEPIECE

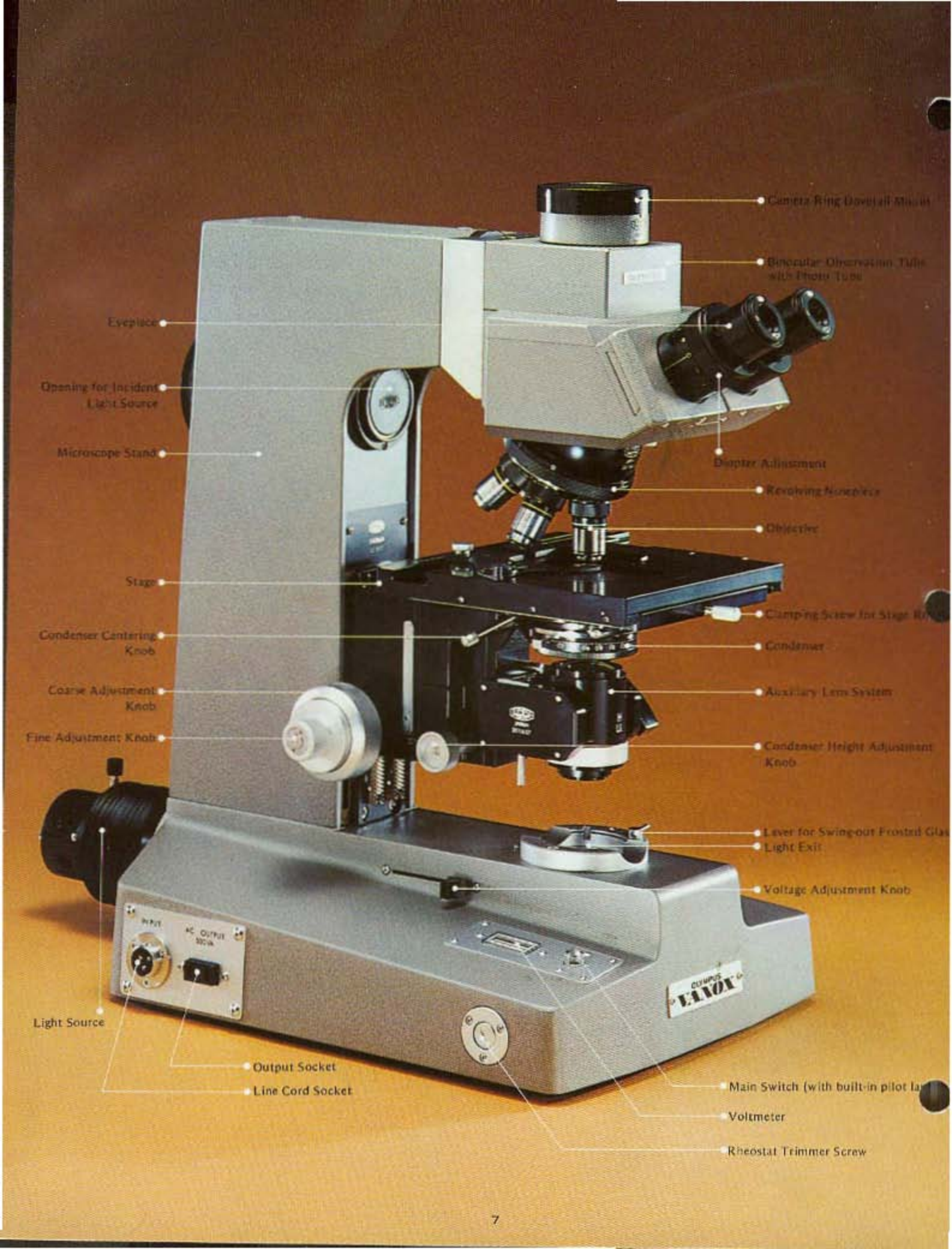
• Quintuple revolving nosepiece on ball races, with dovetail carrier and recess for simple analyzer.

• Letter-coded objective holes with positive click stops.

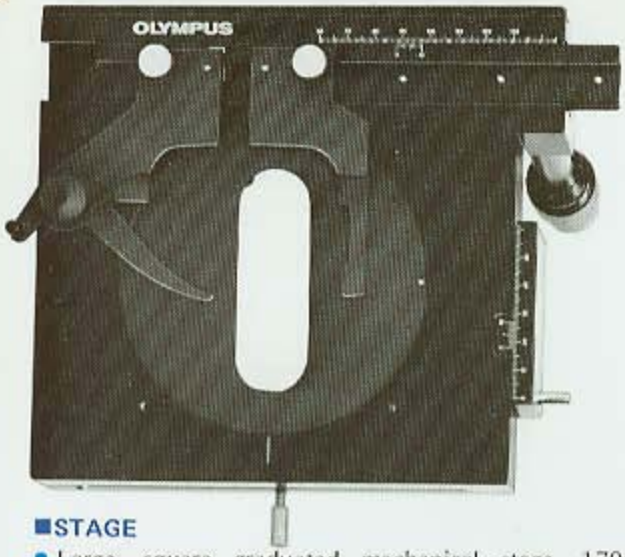
• Dust-proof carrier. Smooth rotation maintains parfocality of all five objectives. The click stop is positive in action, so that each objective comes to a common center when rotated into working position.

• Flat-field, parfocal plan achromats supplied as standard. Other available options include plan apochromats, the highest quality objectives, to assure crispness and flat field of view, with excellent resolution, free from chromatic aberrations and curvature of field for the most demanding visual and photographic requirements.

• Available optionally are nosepieces for incident light vertical illumination in brightfield, darkfield and fluorescent light.


Camera Ring Dovetail Mount
Binocular Observation Tube with Photo Tube
Eyepiece
Opening for Incident Light Source
Microscope Stand
Diopter Adjustment
Revolving Nosepiece
Objective
Stage
Clamping Screw for Stage
Condenser Centering Knob
Condenser
Coarse Adjustment Knob
Auxiliary Lens System
Fine Adjustment Knob
Condenser Height Adjustment Knob
Lever for Swing-out Frosted Glass
Light Exit
Voltage Adjustment Knob
Light Source
Output Socket
Line Cord Socket
Main Switch (with built-in pilot lamp)
Voltmeter
Rheostat Trimmer Screw

Functional Design

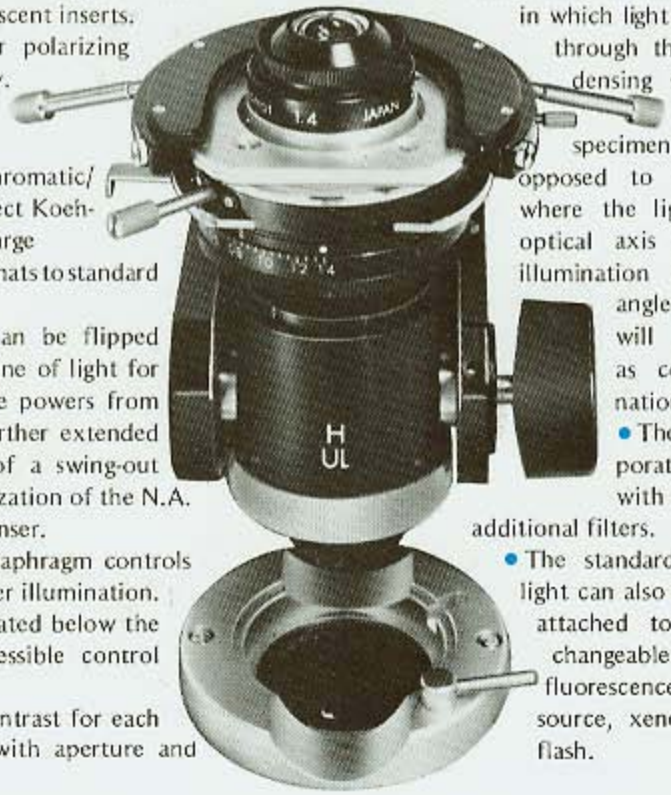


■STAGE

- Large, square graduated mechanical stage, 170mm x 172mm, on dovetail stage bracket, with low positioned coaxial control knobs.
- Traversing area 76mm x 52mm, on ball races; with vernier scales reading to 0.1mm; with paired specimen holders, adjustable, removable.
- The stage, rotatable 300°, permits convenience of operation for trimming and framing of your photographs or for oblique illumination and differential interference contrast.
- Slide holder is adjustable for slides up to 200mm x 72mm. The upper platform of the stage moves horizontally with the slide, preventing drag. Upper platform and mechanical movements may be removed to make a large plain stage.
- Standard stage inserts are interchangeable with optional metallurgical and fluorescent inserts.
- A rotatable circular stage for polarizing microscopy is available optionally.

■ILLUMINATION SYSTEM

- The standard N.A. 1.40 achromatic/aplanatic condenser assures perfect Koehler illumination, ranging from large numerical aperture plan apochromats to standard achromats.
- The auxiliary lens system can be flipped 180°, providing an optimum cone of light for perfect illumination of objective powers from 4X to 100X, which can be further extended from 1.3X to 100X by use of a swing-out condenser, and permits full utilization of the N.A. 1.40 achromatic/aplanatic condenser.
- A unique built-in field iris diaphragm controls the light beam for perfect Koehler illumination. The auxiliary lens system is located below the condenser, with a readily accessible control lever.
- Optimum illumination and contrast for each objective are easily obtained with aperture and field iris diaphragms. Numerical aperture values are engraved on the condenser aperture iris diaphragm.
- This illumination system assures sufficient light intensity for all modes of observation, including darkfield and phase contrast.



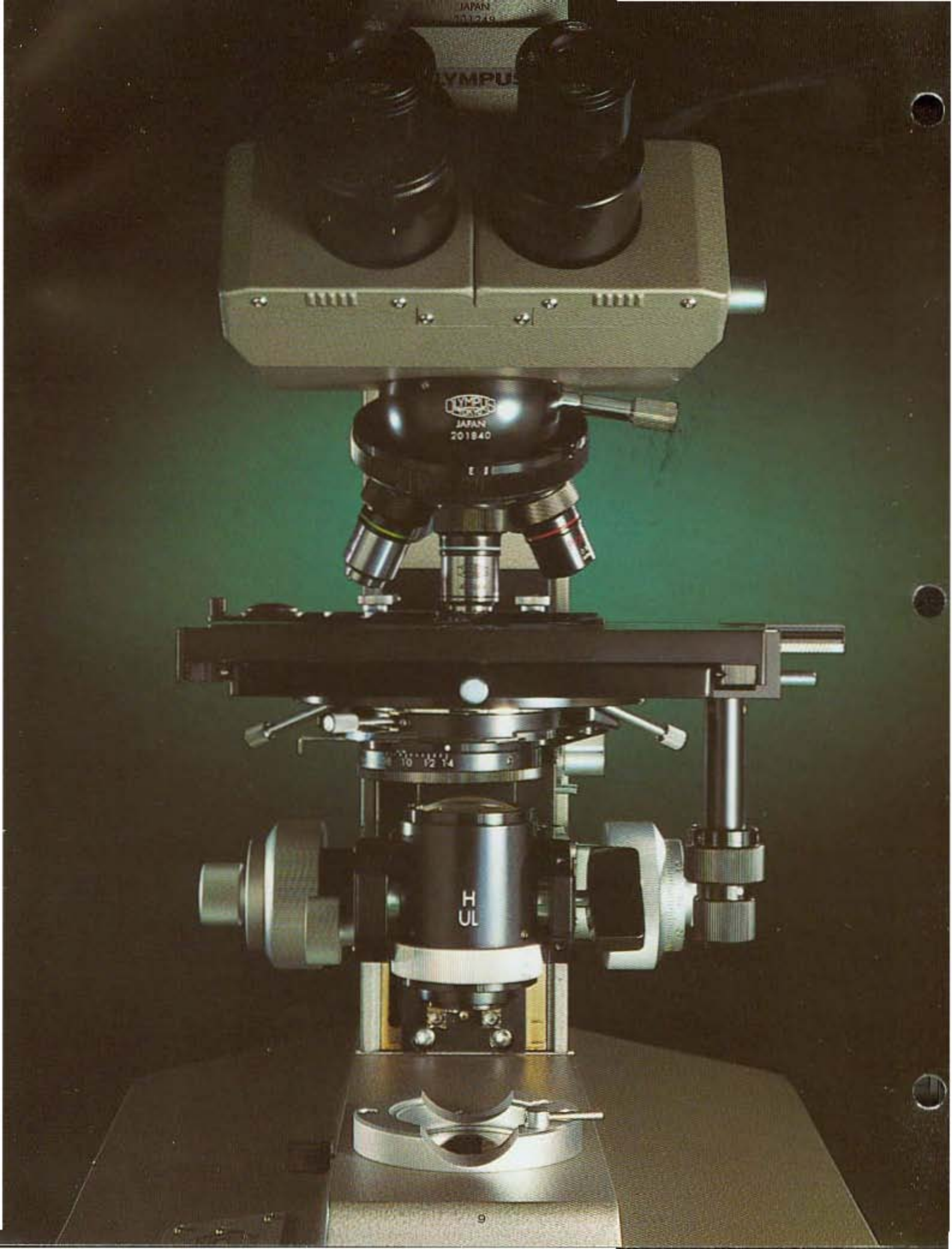
■ADJUSTMENT OF LIGHT INTENSITY

- A variable transformer from 0V to 10V is built in the base and equipped with a push-button switch, voltage adjustment lever and voltmeter, while levers for the swing-out collector lens and swing-out frosted glass are provided on the base for effortless operation.
- The minimum voltage required for the light source can be adjusted with a rheostat trimmer screw at the base plate of the microscope in accordance with line voltage and frequency. A silicon controlled rectifier (SCR) is provided for output voltage control. The SCR has the following advantages over conventional rheostat controls:

1) Extremely fine adjustment of light intensity can be easily achieved.
2) Flickering of the bulb filament is eliminated and light intensity is stabilized.
3) Increased life expectancy of the bulb.

■LIGHT SOURCE

- A tungsten lamp 6V, 30W, with centering device, is provided in the base for transmitted illumination, in which light passes through the condensing system and specimen, and enters the objective. As opposed to central (normal) illumination where the light beams are parallel to the optical axis of the microscope, oblique illumination provides light bundles at an angle to the optical axis. This will double the resolving power as compared with central illumination.
- The standard light source incorporates a collector and heat filter, with provision for attachment of additional filters.
- The standard light source for transmitted light can also be used for incident light, when attached to the microscope limb. Interchangeable light sources available include a fluorescence light source, halogen light source, xenon light source and electronic flash.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Standard Biological Version

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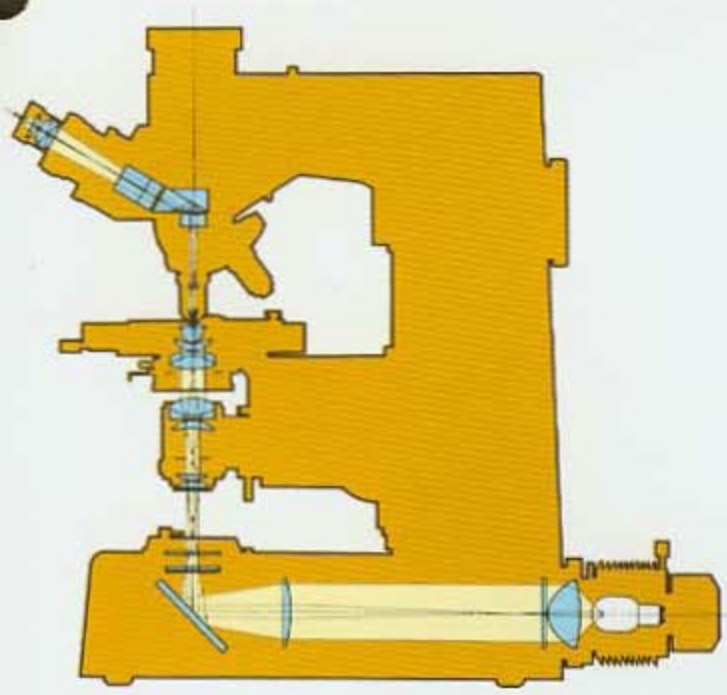

■STANDARD EQUIPMENT (AH-2)

Microscope stand with built-in transformer and rheostat 1
Binocular tube with photo tube 1
Revolving nosepiece 1
Rotatable square mechanical stage with low drive controls 1
Stage insert plate 1
Condenser mount 1
Auxiliary lens system 1
Tungsten lamp house 1
Lamp socket with one lamp bulb 1
Collector (for transmitted light) 1
Achromatic/aplanatic condenser 1
Centering frosted glass 1
Objectives: Plan 4X, Plan 10X, Plan 20X (Spring), Plan 40X (Spring), Plan 100X (Spring, oil) .. 1 ea.
Eyepieces: H.E.P. BiWF10X, paired 1
Filters: Green 45G-533 Yellow 45Y-48 . Blue 45C ..... 1 ea.
Spare bulbs, 6V 5A TB-1 2
Immersion oil, bottled 1
Dust cover 1

■ SPECIFICATIONS

Component	Specifications
Microscope stand	<Focusing adjustment system> · Convenient height positioning dial for interchangeable observation tubes. · Provision for attachment of interchangeable photomicrographic equipment. · Focusing by vertical stage movement with coaxial focus adjustment knobs. · Coarse adjustment on dovetail slideways, rack-and-pinion type; adjustment range 49mm. · Fine adjustment on roller guide, gear train type; adjustment range 2.3mm, graduated in increments of 1 micron. <Illumination system> · Transmitted illuminator and transformer built in the base. · Light source is a tungsten lamp, 6V, 30W, with bulb centering device, interchangeable. · Built-in transformer, variable from 0V to 10V, incorporates a thyristor circuit in its rheostat for smooth fine adjustment of light intensity.
Observation tube	· Triocular tube (inclination 30°), interchangeable with other tubes. · Constant tube length adjustment. · Interpupillary distance adjustment from 54mm to 72mm. · Three-position light path selector knob. · Field of view eyepieces for focusing on the film plane. · Choice of intermediate adapters.
Revolving nosepiece	· Quintuple revolving nosepiece, on ball races, on dovetail slide.

Component	Specifications
Stage	· Square mechanical stage, rotatable, with low drive controls (170mm x 172mm), rack-and-pinion drive. · Adjustable and removable specimen holder. Movements on ball races, for both vertical and horizontal excursions. Working range: vertical 52mm, horizontal 76mm. Vernier scales reading to 0.1mm. · Interchangeable stage inserts. · Mechanical stage interchangeable with a Large, Circular, Rotatable Stage for polarizing microscopy.
Condenser	· Height adjustment by rack-and-pinion drive. · Height displacement 30mm. · Centering device. · Flip-over type auxiliary lens system, with field iris diaphragm. For optimum illumination from low power to oil immersion objectives. · Aplanatic/achromatic condenser, N.A. 1.40, with decenterable aperture iris diaphragm and graduated aperture scale.
Objectives	
Eyepiece	H.E.P. BiWF10X, paired. Field Number 18.

Magnification	N.A.	W.D.	Remarks
Plan Ach. 4X	0.10	5.50mm	
Plan Ach. 10X	0.25	7.18	
Plan Ach. 20X	0.40	0.78	Spring-loaded
Plan Ach. 40X	0.65	0.22	Spring-loaded
Plan Ach. 100X	1.25	0.14	Spring-loaded, oil

Fluorescence Illuminator Attachment / MODEL A-FL-2

This attachment permits fluorescence microscopy in transmitted light for research and routine diagnostic applications in brightfield or darkfield illumination.

■ OUTSTANDING FEATURES

- The optical system includes a powerful aspherical collector lens and a high numerical aperture darkfield condenser, N.A. 1.4–1.2.
- The illuminator always ensures uniform image brightness, a distinct asset in judging the quality of antibody reactions.
- The mirror house is provided with a light path selector lever to permit transmitted or reflected illumination as desired for fluorescence microscopy.
- Using a vertical design for the mirror house allows the use of the A-FL-2 in a smaller space than the previous fluorescence illumination.
- A D.C. operated mercury lamp designated for this attachment eliminates the problem of light flickering, which is characteristic of A.C. operated mercury lamps, resulting in further stabilized excitation radiation and almost redoubled lamp life.
- In addition to the various barrier filters mounted in a turret, an L420 filter is permanently built in the intermediate device for protection of the eyes from UV rays.
- A choice of exciter filters is provided for all types of fluorescence observation especially for fluorescence antigen observation of tissue structure, hormone and enzyme reaction.
- Phase contrast observation is also possible simultaneously with fluorescence.
- Fluorescence observation by blue light excitation is often used together with phase contrast in order to observe not only the fluorescing section but also its boundaries in the specimen. This is referred to as fluorescent phase contrast. To render the same effect, however, an FITC interference filter is widely utilized in place of fluorescent phase contrast today. FITC interference filters can be used in conjunction with a tungsten or halogen lamp as well as a mercury lamp for this method. Optional FITC interference filter sets recommended according to the kind of light source are listed below.

	F-FITC-4	F-FITC-5
BH-FA	1	—
40-FITC-W45	1	1
43-BG14-3W45	1	—
43-BG38-2W45	—	1
43-BG38-4W45	1	—
Barrier filter 20-0515-W	1	—
43-UVC-W45 (UV cut-off)	—	1

The model F-FITC-4 is recommended for use with a tungsten or halogen lamp and the model F-FITC-5 for use with a super pressure mercury burner.

■ STANDARD COMPONENTS

① Fluorescence illuminator (A-FL-B-2) 1
② Fluorescence lamp house (A-RFL-LH-2) 1
③ Barrier filter attachment with filters 20Y500, 200-515, 200-530 and 20R-610 in turret (A-FA) 1
④ Filter slide with 20AFC mounted 1
⑤ Darkfield condenser N.A. 1.4 — 1.2 (glycerin immersion) (A-DC-6) 1
⑥ Stage insert plate (A-FSN) 1
⑦ UV protective tube (A-AFS) 1
⑧ Frosted glass filter for tungsten light source (45WF-W55) 1
⑨ Centering frosted glass (SG) . . 1
⑩ Exciter filters: 50UG1 1
50BG12 . . . 2
⑪ Filters: 50G533 . . . 1
50ND25 . . . 1
Mercury lamps (HBO-200W/2) 2
• Power supply unit (BHF-T) . . 1

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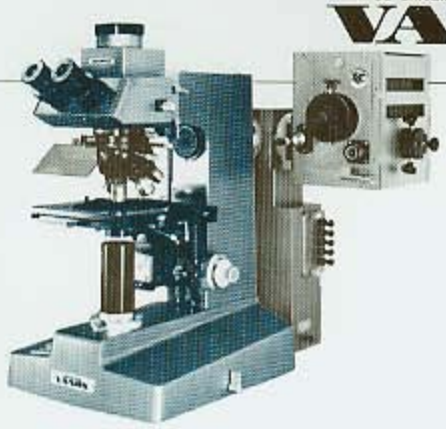
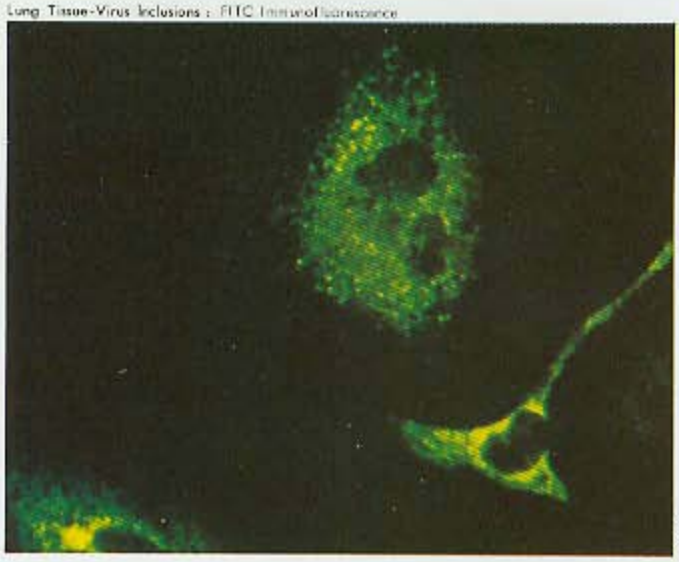
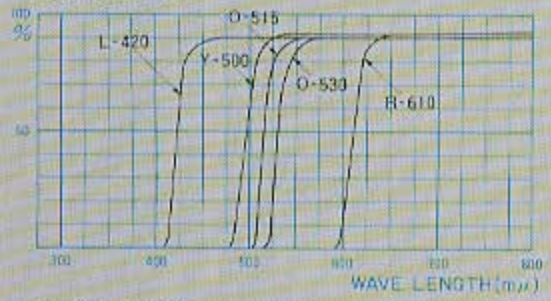


Lung Tissue-Virus Inclusions : FITC Immunofluorescence

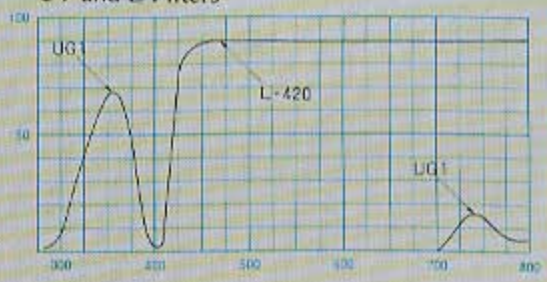


Courtesy of Dr. R. Nordquist,
Oklahoma Medical Foundation,
Oklahoma City, Oklahoma.

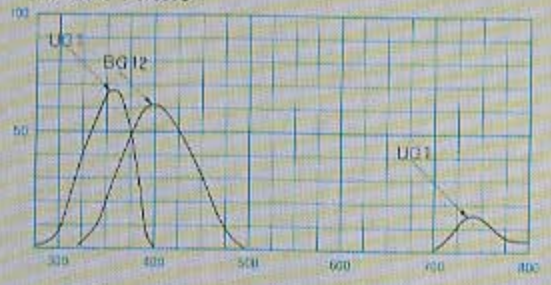
Barrier Filters



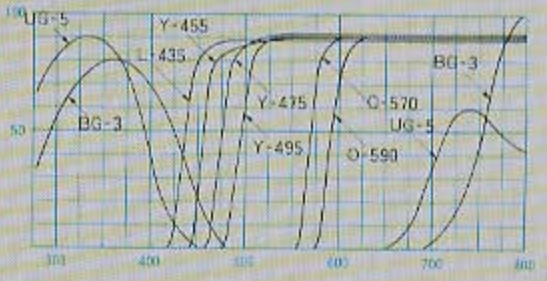
UV and L Filters



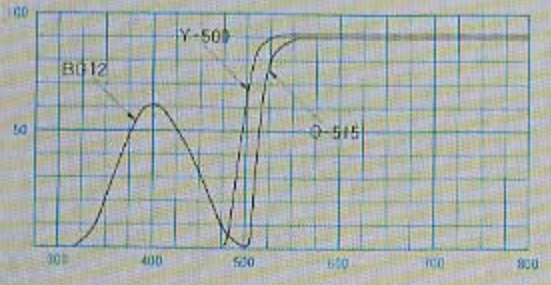
Exciter Filters



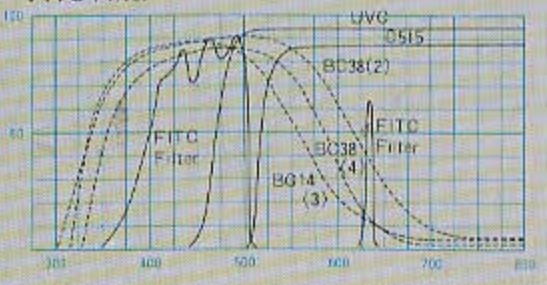
Other Filters



BV and Yellow Filters



FITC Filter



Some Uses of Filters

Application	Exciter Filter	Barrier Filter
Violet Excitation	BG-3, UG-5	Y-475
FITC Darkfield	UVC	O-515
Congo Red		L-435

Vertical Fluorescence Illuminator Attachment (after Ploem) / MODEL A-RFL-2

The Model A-RFL-2 comprises a vertical illuminator designed to further extend the versatility of the VANOX for incident light fluorescence microscopy. The Model A-RFL-2 incorporates a high pressure mercury burner, 4 exciter filters in mount, and 10 barrier filters in mount, in addition to 5 exciter filters in a turret and 4 dichroic mirrors with 4 matched barrier filters.

The dichroic mirrors, originated by Dr. J. S. Ploem, are built in a slider for selection of desired wavelengths for excitation of the specimen, by simple lever operation. UV and blue radiation emitted from a powerful 200W 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. A barrier filter between objective and eyepiece passes the emitted light from the specimen and blocks out unwanted wavelengths to obtain a black background.

■OUTSTANDING FEATURES

- The objective of the microscope serves as both condenser and objective, so that only the viewing area will be irradiated, which prevents rapid photodecomposition in the areas not observed. Also, delicate darkfield condenser manipulation and immersion are avoided.
- The incident light path adopted in this method directs the excitation beam onto the surface of the objective along the optical axis. Therefore, a bright, clear fluorescent formation against a dark background is ensured, particularly convenient in high magnification up to 1000X total.
- The exciting light does not pass through the specimen, as is the case with transmitted light, so that the full emission intensity of the specimen can be utilized.
- The Model A-RFL-2 can be used in conjunction with the transmitted light fluorescence illuminator Model A-FL-2 for incident and transmitted light fluorescence microscopy.
- Objectives available in this method are all non-fluorescing, flat-field, with excellent resolution.

Objective	N.A.	W.D.	Remarks
Plan 10X-F	0.25	7.18	No-fluorescing
Plan Apo 20X-F	0.65	0.14	No-fluorescing
SI Apo 40X-F	1.0	0.19	No-fluorescing, oil
SI FLS 100X-F	1.25	0.10	No-fluorescing, oil

- Dichroic mirrors built in a slider are matched with barrier filters in mount as below:

Dichroic mirror	Barrier filter
U = DM-400	L-410
V = DM-455	Y-455
B = DM-500	O-515
G = DM-580	O-590

* Since the lamp house (A-RFL-LH-2) and power supply unit (BHF-T) are common to the A-FL-2 and A-RFL-2, the owner of the A-FL-2 need not buy these two components when purchaing the A-RFL-2, or vice versa.

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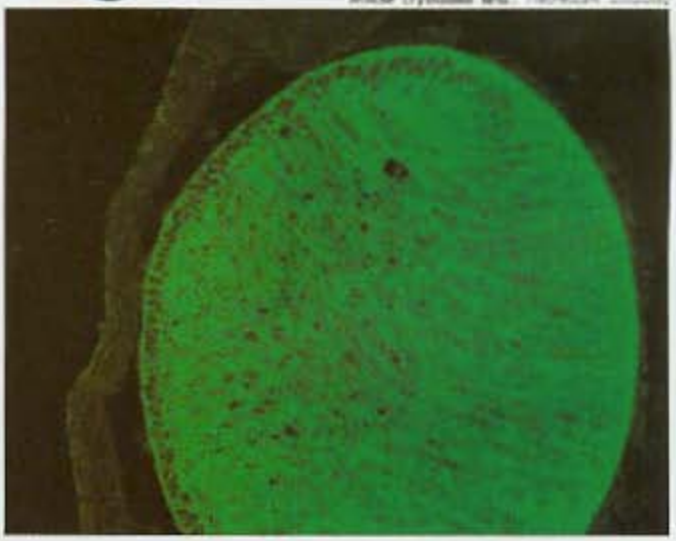
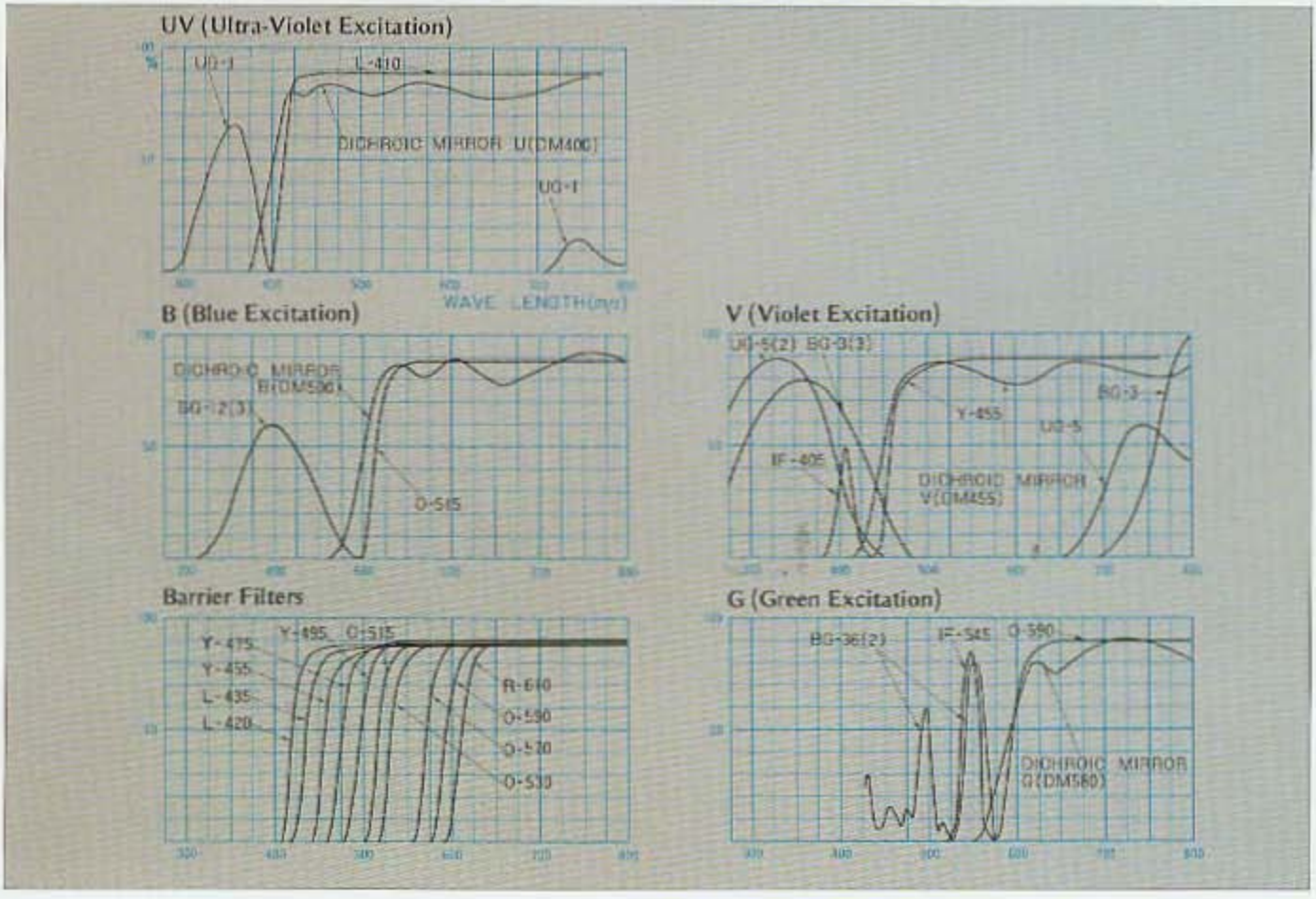
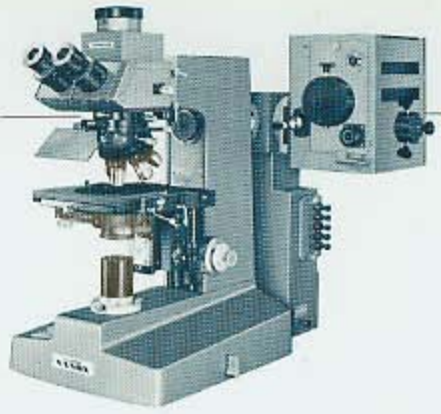
■STANDARD EQUIPMENT

① Fluorescence vertical illuminator with revolving nosepiece and built-in dichroic mirrors 1
② Fluorescent lamp house 1
③ UV protective shade 1
④ Auxiliary collector lens 1
⑤ Burner centering mirror 1
⑥ Objectives (no fluorescing):
Plan Ach 10X-F 1
Plan Apo 20X-F 1
SI Apo 40X-F (oil) 1
SI FLS 100X-F (oil) 1
⑦ Exciter filters in mount:
UG-1, UG-5, IF-405, BG-12 ..... 1 each
⑧ Barrier filters in mount:
L-420, L-435, Y-455, Y-475, Y-495
O-515, O-530, O-570, O-590, R-610 ..... 1 each
- Power supply unit 1
- Super pressure mercury burner, HBO-200 2
- Immersion oil, bottled (no fluorescing) 1
- Wooden case 1





Fluorescence Phase Contrast Attachment / MODEL A-FLPC



The Model A-FLPC permits simultaneous observation of fluorescent and phase contrast images. The aplanatic condenser, N.A. 1.40, incorporates an aspherical lens and fluorescence phase contrast annuli with centering device, for 10X, 20X, 40X and 100X phase objectives. Aperture iris diaphragm built-in.

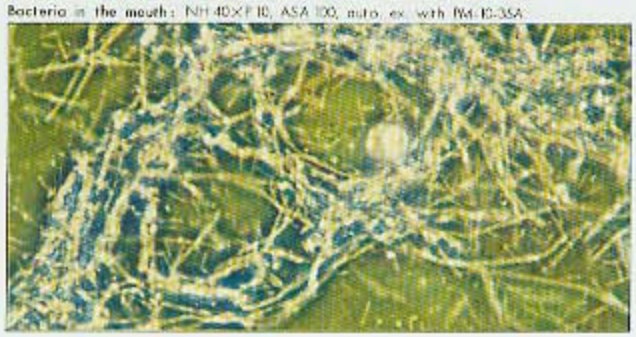
■OUTSTANDING FEATURES

- The combination of fluorescence phase contrast condenser and auxiliary lens system permits general brightfield, phase contrast and darkfield observation with tungsten light.
- Photomicrography in fluorescence phase contrast is possible without additional steps, however it will usually result in a low contrast photograph. Therefore, it is recommended to photograph the fluorescent image and the phase contrast image separately and compare them for further study.
- Fluorescence brightfield, fluorescence darkfield as well as regular brightfield, can be obtained by exchanging auxiliary lenses.

■STANDARD EQUIPMENT

① Fluorescence phase contrast condenser, N.A. 1.40 with phase contrast annuli for 10X, 20X, 40X, and 100X phase objectives, in turret 1
② Fluorescence phase contrast attachment lens 1
③ Fluorescence phase contrast auxiliary lens 1
④ Brightfield auxiliary lens 1
⑤ Darkfield auxiliary lens, for 10X, 20X and 40X objectives 1
⑥ Darkfield auxiliary lens, for 100X objective 1
⑦ Centering telescope 1
⑧ Phase contrast objectives:
PC PL Ach 10X 1
PC PL Ach 20X 1
PC PL FL S-40X (spring) 1
PC PL FL S-100X (spring, oil) 1
⑨ Filter, red frosted 46R60F-W55 1
⑩ Auxiliary clamping wrench 1
• Wooden case 1

Bacteria in the mouth; NH 40×F 10, ASA 100, auto. ex. with PM-10-35A



The Model A-PC is an indispensable instrument to observe the internal structures of cells, nuclei, or minute living objects.

■OUTSTANDING FEATURES

- The Model A-PC permits phase contrast microscopy by means of a phase contrast turret condenser, an auxiliary lens system and phase contrast objectives. Additionally, the attachment permits normal brightfield and darkfield microscopy.
- Equipped with an achromatic/aplanatic phase turret condenser, N.A. 1.40, fitted with aperture iris diaphragm, ring centering device and annular diaphragms for 10X, 20X, 40X and 100X phase objectives, an empty aperture for brightfield observation, and a darkfield stop, N.A. 0.9/1.4.
- Besides the standard PC PL phase objectives, phase contrast objectives with three other contrasts are available – PLL, NH and NM.

These letters designate the following contrast:

N = Negative; P = Positive; H = High
M = Medium; LL = Low-Low

This exceptionally wide selection of contrasts offers a practically unlimited range of combinations to suit the most demanding requirements.

Letters	Contrast	Specimens	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 required, this PLL contrast is used.	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, amounts, and motions of low contrast objects in detail.
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.	

■STANDARD EQUIPMENT

①Phase contrast turret condenser, N.A. 1.40 1
②Centering telescope 1
③Phase contrast objectives:
③-1 *Positive low contrast
PC PL Ach 10X 1
PC PL Ach 20X 1
PC PL FL S-40X (spring) 1
PC PL FL S-100X (spring, oil) 1
③-2 *Positive low low contrast
PC PLL Ach 10X 1
PC OLL Ach 20X 1
PC PLL FL S-40X (spring) 1
PC PLL FL S-100X (spring, oil) 1
③-3 *Negative high contrast
PC NH Ach 10X 1
PC NH Ach 20X 1
PC NH Ach S-40X 1
PC NH Ach S-100X (spring, oil) 1
③-4 *Negative medium contrast
PC NM Ach 10X 1
PC NM Ach 20X 1
PC NM Ach S-40X (spring) 1
PC NM Ach S-100X (spring, oil) 1

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

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

Super Widefield Attachment / MODEL A-SW

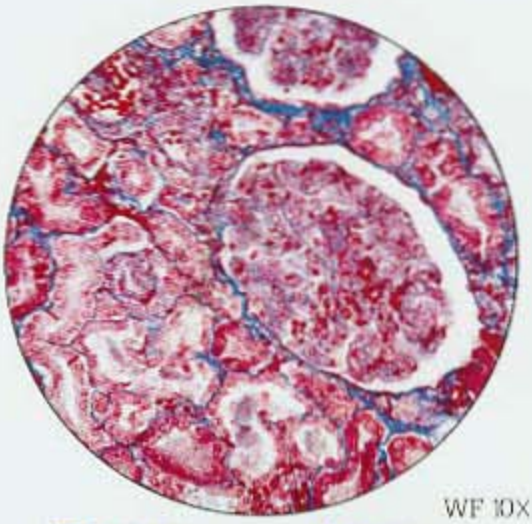
Specially designed for the VANOX, this superb combination of Olympus super widefield observation tube with photo tube, eyepieces, objectives and condenser gives you the widest field diameter in the world. The obvious time-saving benefits in routine and research work increase efficiency and provide a considerable reduction in eyestrain and fatigue.

■OUTSTANDING FEATURES

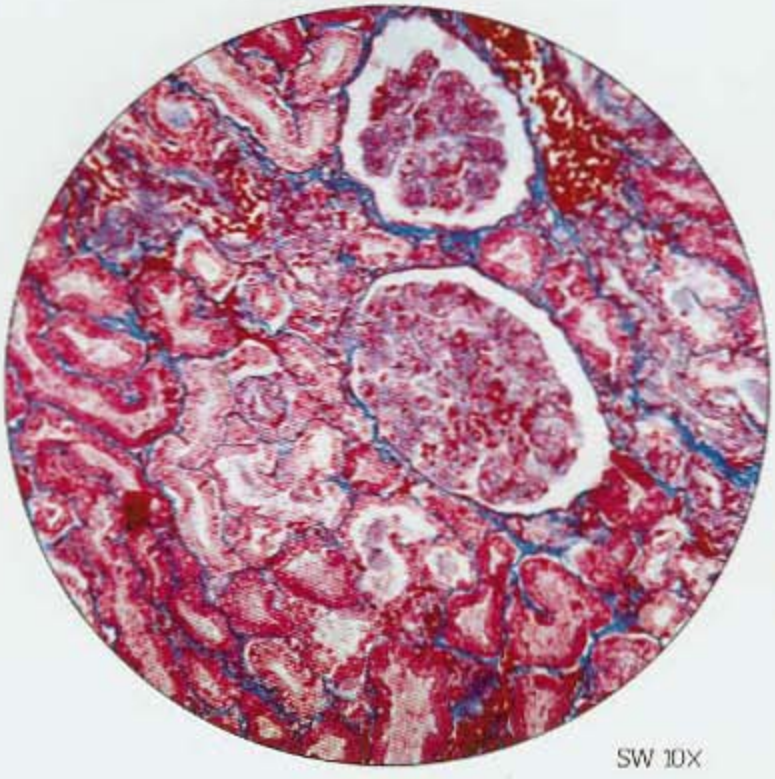
- The eyepieces include SW7X eyepiece (field number 29) and SW10X eyepiece (field number 26.5). The SW7X scans the widest flat field of view in the world, 259% larger than the standard WF10X eyepiece, while the SW10X scans a 217% larger field than the WF10X.
- Each eyepiece is provided with diopter adjustment. Interpupillary distance is variable from 56mm to 74mm.
- The super widefield objective SW Plan 100X enables you 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

① Super widefield binocular tube with photo tube 1
② Super widefield condenser 1
③ Objective SW Plan 100X (oil, spring) 1
④ Eyepieces: BiSW7X, paired 1
BiSW10X, paired 1
⑤ Eyepiece adapters for standard eyepieces, paired 1



WF 10X



SW 10X

Differential Interference Contrast Attachment after Nomarski (for Transmitted Light) / MODEL

A-NIC

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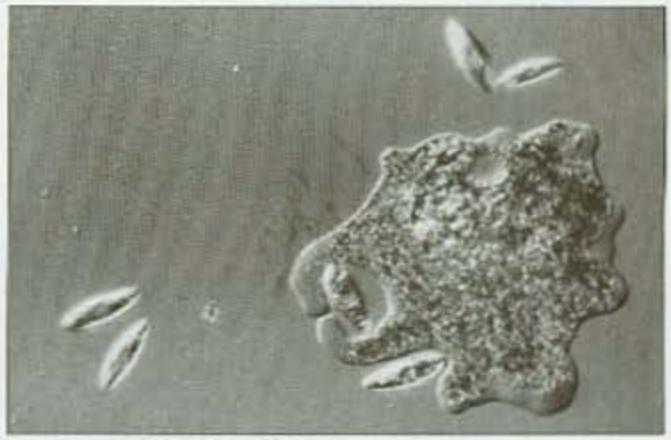
The Model A-NIC is designed for the qualitative study of transmitted light phase objects with the Universal Research Microscope Model VANOX. This differential interference contrast device incorporates a pair of birefringent crystal prisms as beam-splitters, with a shear between the two interfering beams 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 Model VANOX, this attachment permits detection of minute difference of thickness and changes of internal refractive indices 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.



An amoeba, engulfing a paramecium.

■ OUTSTANDING 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.
- The differential interference contrast turret condenser, N. A. features 3 modified Wollaston prisms for Plan Achromats 10X, 40X, and 100X, 3 light annuli for phase contrast objectives PC PL Plan 10X, 40X, and 100X, as well as a full opening for brightfield microscopy.

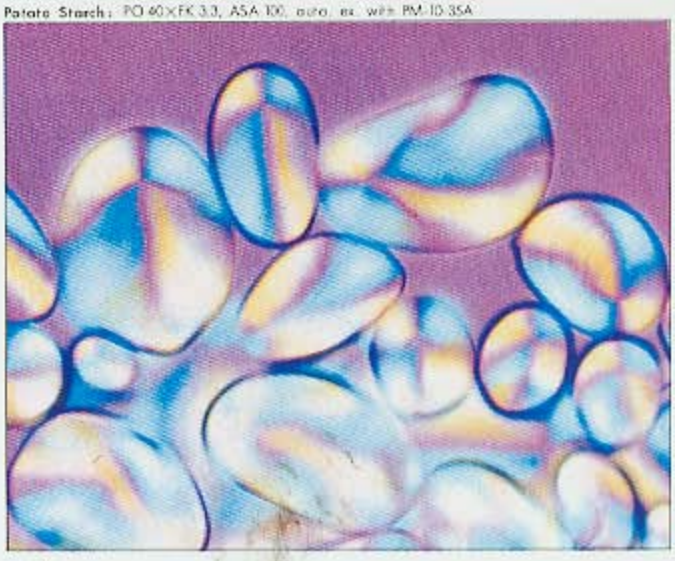
■ STANDARD EQUIPMENT

① Differential interference contrast intermediate tube AH-NA 1
② Differential interference contrast condenser AH-NC 1
③ Phase contrast objectives PC PL Plan 10X 1
PC PL Plan 40X 1
PC PL Plan 100X (oil) 1
④ Centering telescope CT 1
• Filter 45G533 1

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

These polarizing attachments are designed to convert your VANOX to a high quality polarizing microscope without special tools. They are a useful aid to study the optical characteristics of materials in the ever-expanding field of polarizing microscopy in orthoscopic or conoscopic observation. Even extremely minute specimen details can be made objects for microscopic work in polarized light.
Each of the attachments permits microscopy in polarized light not only in mineralogy and petrography, but also in chemistry, pharmacology, biology, medical science and ceramics, as well as in the chemical and textile industries. The difference between the A-P-1 and A-P-2 is that the latter includes a polarizing monocular tube and a set of objective centering devices in addition to the standard equipment provided for both models, with the exception of eyepieces BiK5X and AH-WF10X.

Potato Starch : PO 40×FK 3.3, ASA 100, auto. ex. with PM-10-35A



Peridotite

■ OUTSTANDING FEATURES

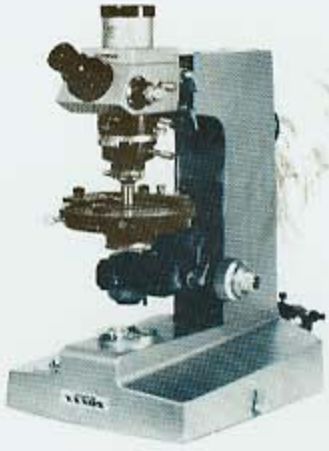
- The polarizing monocular tube is inclined 30°, and is provided with a vertical photo tube and a centerable, focusable Bertrand lens. A light path selector knob permits light passage to the observation tube or photomicrographic attachment. Iris diaphragm for single crystal work.
- The 1.25X intermediate polarizing tube accepts various compensators. A focusable Bertrand lens is mounted on a turret to place it into the light path.
- Built-in analyzer is rotatable 90°.
- The 170mm-dia. circular stage is rotatable through 360° on ball bearings, and provides click stops in increments of 45° from any position, preset by a click stop lever; two centering screws. Mechanical stage is attachable to the circular stage; working range of 30mm x 30mm, with vernier scales.
- The swing-out polarizing condenser, N.A. 0.9/0.25 is provided with aperture iris diaphragm. Click stop at position "0".

MODEL A-P-1

■STANDARD EQUIPMENT

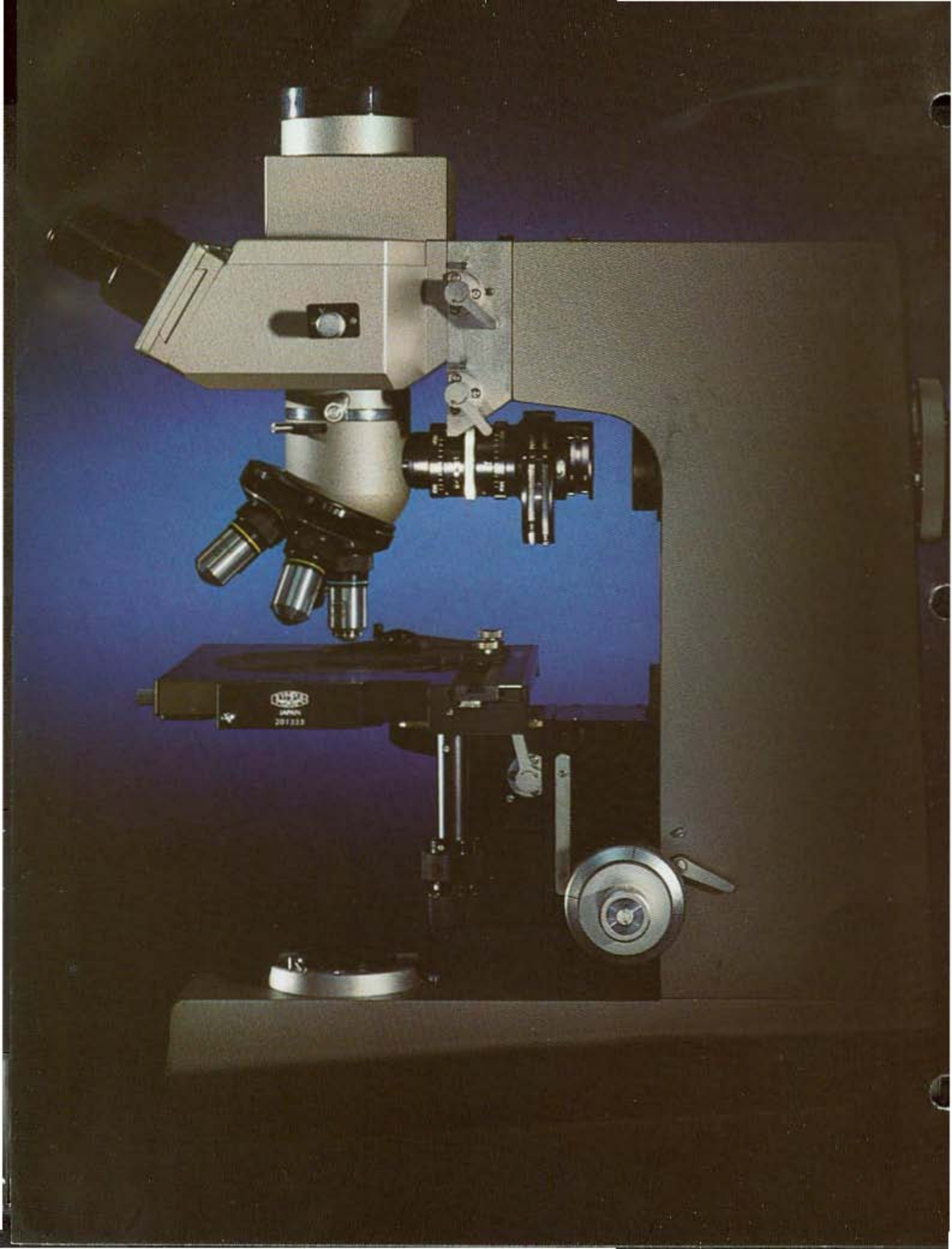
	A-P-1	A-P-2
① Polarizing monocular tube with Bertrand lens	—	1
② Single objective adapter	—	1
③ Objective mount, non-centering	—	1
④ Objective mounts, centering	—	4
⑤ Polarizing intermediate tube with analyzer & Bertrand lens	1	1
⑥ Swing-out condenser N.A. 0.9/0.25 with polarizer and iris diaphragm	1	1
⑦ Circular rotatable stage	1	1
⑧ Cross-movement graduated mechanical stage	1	1
⑨ Compensator plate, 530mμ, first order red	1	1
⑩ Compensator plate, 1/4 wavelength retardation	1	1
⑪ Berek compensator, I–III orders	1	1
⑫ Eyepieces: BiK5X	1	—
K5X, with cross hairs	1	1
WF10X, with 10/100mm micrometer	1	1
WF10X, with cross hairs	1	1
AH-WF10X	1	—
⑬ Objectives: (strain free) PO 4X	1	1
PO 10X	1	1
PO 20X	1	1
PO 40X	1	1
PO 100X, oil	1	1
⑭ Pin hole cap	1	1
• Wooden case	1	2

A-P-1



A-P-2

MODEL A-P-2



Standard Metallurgical Version

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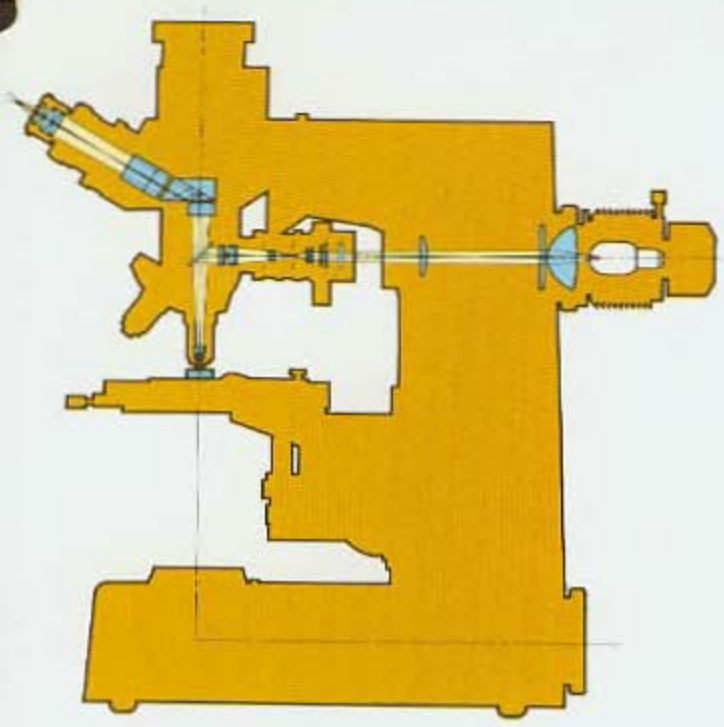

■STANDARD EQUIPMENT (AH-M)

	AH-M-1	AH-M-2
Microscope stand with built-in transformer and rheostat	1	1
Binocular tube with photo tube	1	1
Rotatable square mechanical stage with low drive controls	1	1
Vertical illuminator with revolving nosepiece, including filters Y, G, C, LB-45, LB-100, LB-145 & ND-6, mounted in turrets	1	1
Attachment lens	1	1
Tungsten lamp house	1	1
Lamp socket with one bulb	1	1
Collector lens	1	1
Polarizing set (polarizer and analyzer)	1	1
Metal stage insert	1	1
Slide plates (set of five)	1	1
Objectives: M 5X 10X, 20X, 40X, 100X (oil)	1 ea.	—
M Plan 5X, 10X, 20X, 40X, 100X (oil)	—	1 ea.
Eyepieces, H.E.P. BiWF 10X, paired	1	1
Spare lamp bulbs, 6V 30WTB-1	2	2
Counter-weight block	1	1
Immersion oil	1	1
Dust cover	1	1

■SPECIFICATIONS

Component	Specifications
Microscope stand	<Focusing adjustment system> • Height positioning dial for interchangeable observation tubes. • Provision for attachment of interchangeable photomicrographic equipment. • Focusing by vertical stage movement with coaxial focus adjustment knobs. • Coarse adjustment on dovetail slideways, rack-and-pinion type; adjustment range 49mm. • Fine adjustment on roller guide, gear train type; adjustment range 2.3mm, graduated in increments of 1 micron. <Illumination system> • Transmitted illuminator and transformer built in the base. • Vertical illuminator provided with quintuple revolving nosepiece, field and aperture iris diaphragms. Detachable filter turret unit. Provision for attachment of a polarizing set. • Light source is a tungsten lamp, 6V 30W, with bulb centering device, interchangeable. • Built-in transformer, variable from 0V to 10V, incorporates a thyristor circuit in its rheostat for smooth fine adjustment of light intensity.
Observation tube	• Trioculer tube (inclination 30°), interchangeable with other tubes. • Constant tube length adjustment. • Interpupillary distance adjustment from 54mm to 72mm. • Three-position light path selector knob. • Field of view eyepieces for focusing on the film plane. • Choice of intermediate adapters.

Component	Specifications
Stage	• Square mechanical stage, rotatable, with low drive controls (170mm x 172mm), rack-and-pinion drive. • Adjustable and removable specimen holder. Movements on ball races, for both vertical and horizontal excursions. Working range: vertical 52mm, horizontal 76mm. • Vernier scales reading to 0.1mm. • Interchangeable stage inserts. • Mechanical stage, interchangeable with a Large, Circular, Rotatable Stage for polarizing microscopy.
Counter-weight block	• Attached on the condenser mount to counter-balance the stage. Removable.
Objectives	AH-M-1

Magnification	N.A.	W.D.
M 5X	0.10	27.00mm
M 10X	0.25	7.60
M 20X	0.40	2.10
M 40X	0.65	0.50
M 100X (oil)	1.30	0.35

AH-M-2

Magnification	N.A.	W.D.
M Plan 5X	0.10	3.30mm
M Plan 10X	0.25	7.10
M Plan 20X	0.40	0.72
M Plan 40X	0.65	0.39
M Plan 100X (oil)	1.25	0.16

Component	Specifications
Eyepiece	H.E.P. BiWF10X, paired. Field Number 18.

Vertical Illuminator Attachment / MODEL A-M

The Model A-M facilitates easy conversion of the VANOX to an outstanding metallurgical microscope by simply mounting it to the observation tube in the same manner as the standard revolving nosepiece.

■ OUTSTANDING FEATURES

- The vertical illuminator body is conveniently equipped with a quintuple revolving nosepiece, semi-transparent mirror, and collector lens.
- An auxiliary lens system for high/low magnifications is incorporated.
- Various filters for color temperature compensation, color balancing and light attenuation are provided.
- Observation in polarized light can be performed by placing polarizer and analyzer into the light path of the microscope. Polarizer and analyzer are supplied as part of the standard equipment.

Special Steel

■ STANDARD EQUIPMENT

① Vertical illuminator with revolving nosepiece, including filters Y, G, C, LB-45, LB-100, LB-145 & ND-6, mounted in turrets 1
② Attachment lens 1
③ Counter-weight block 1
④ Polarizing set (polarizer and analyzer) 1
⑤ Stage insert 1
⑥ Metal slide plates (set of five) 1
⑦ Objectives: M 5X 1
M 10X 1
M 20X 1
M 40X 1
M 100X (oil) 1

Differential Interference Contrast Attachment after Nomarski* (for Reflected Light) / MODEL A-M-NIC

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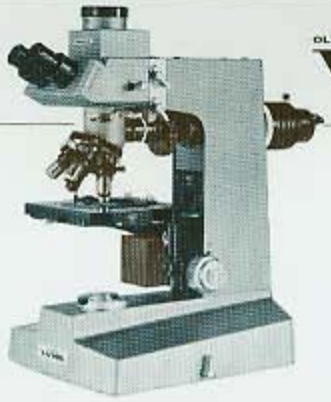
VANOX

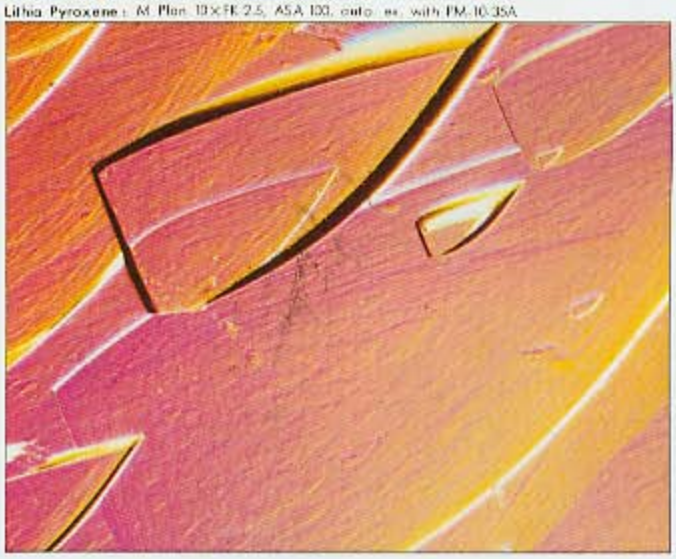


The Model A-M-NIC, based on the Nomarski* interference contrast principle, is used with the VANOX for examination and metallography of opaque specimens in combination with the vertical illuminator Model A-M.

■OUTSTANDING FEATURES

- The Model A-M-NIC enables the microscopist to quickly examine both minute surface differences and inclusions.
- It shows up flaws, stacking faults, slip lines, phase structures and surface inclusions, brilliantly illuminated against a dark background or in various colors.
- A 45° rotation of the analyzer permits rapid transition to ordinary brightfield, for quick comparison purposes.
- This instrument assures a clear image, in apparent relief, with excellent contrast in a wide range of interference colors, from zero order to high sensitive tints.
- The advantages of the Model A-M-NIC are as follows:
  - ○ Differential interference contrast does not cause halos as encountered with ordinary phase contrast.
  - ○ Interference colors can be seen in proportion with the gradient of path differences of the specimen.
  - ○ The Nomarski* method permits utilization of the full numerical aperture of the objective, resulting in exceptional image brilliance and resolution almost twice as high as in phase contrast microscopy.
  - ○ The A-M-NIC provides lateral resolution of specimen surface roughness as fine as 20Å—30Å.
  - ○ The Nomarski* method is very helpful to observe the surface of an object which cannot or should not be etched.
  - ○ The strain-free M Plan objectives up to the M Plan objective 100X, dry, are utilized at their full numerical aperture to give a flat, in-focus image over the entire field of view.

Lithia Pyroxene : M Plan 10×PE 2.5, ASA 100, auto. ex. with PM-10-35A



■STANDARD EQUIPMENT

① Differential interference contrast attachments, with mounts for M Plan objectives 5X, 10X, 20X, 40X and 100X (set of five) 1

② Objectives: M Plan 5X-N 1
M Plan 10X-N 1
M Plan 20X-N 1
M Plan 40X-N 1
M Plan 100X-N (dry) 1

③ Analyzer with depolarizer 1

- Wooden case 1

Note: The polarizer supplied as standard equipment with the vertical illuminator Model A-M should be used with the Model A-M-NIC.

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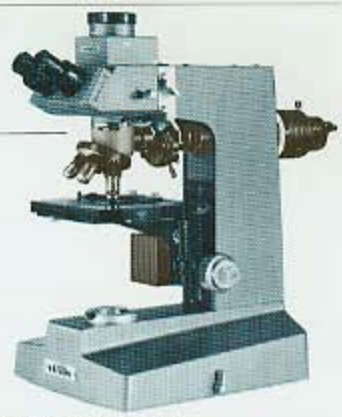
Incident Phase Contrast Attachment / MODEL A-MPC



The Model A-MPC enables you to observe the specimen surface by converting surface roughness into brightness differences, where brightfield observation is not advisable. This method is very helpful to examine the growth phenomena, cleavage planes, cutaway surfaces of crystals, or etch pits.

■OUTSTANDING FEATURES

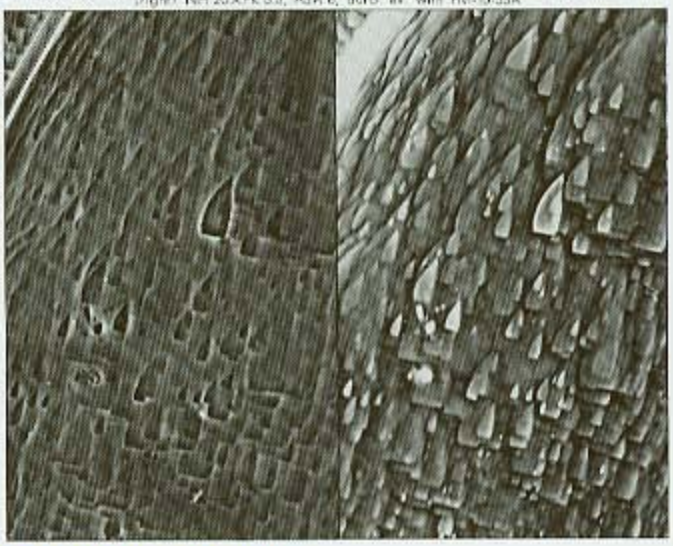
- The Model A-MPC is used in conjunction with the vertical illuminator Model A-M. Reflected light phase contrast objectives comprise objectives MPC10X, MPC20X, MPC40X and MPC100X. Each objective power is available in four contrasts .. PL, PLL, NH and NM.

Letters	Contrast	Purpose
P	Positive	Observation of the apparent structure of opaque objects.
N	Negative	Observation of small details.
H	High	For specimens of relatively low contrast.
M	Medium	For specimens of average contrast.
L	Low	For specimens of relatively high contrast.
LL	Low-Low	For specimens of high contrast.

- The phase contrast turret assembly incorporates centerable light annuli for 10X, 20X, 40X, 100X phase objectives and an aperture iris diaphragm.
- Phase contrast objective data:

Objective	N.A.	W.D.	Focal length	Contrast
MPC 10X	0.25	7.6mm	19.58mm	NH, NM, PL, PLL
MPC 20X	0.40	2.1	10.15	
MPC 40X	0.65	0.5	5.39	
MPC 100X (oil)	1.30	0.35	2.25	

Lithia Pyroxene : (left) PL20xFK 3.3, ASA 12, auto. ex. with PM-10-35A
(right) NH 20xFK 3.3, ASA 6, auto. ex. with PM-10-35A

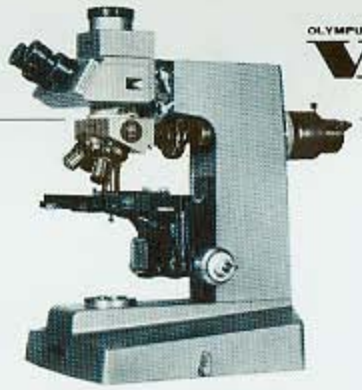


■STANDARD EQUIPMENT

① Phase contrast turret for vertical illuminator 1
② Centering telescope 1
③ Phase contrast objectives (Positive low contrast)
MPC PL Ach 10X 1
MPC PL Ach 20X 1
MPC PL Ach 40X 1
MPC PL Ach 100X 1

Note: 1) This attachment is to be used in conjunction with the vertical illuminator attachment Model A-M.
2) Phase contrast objectives with other contrasts, Positive Low Low (PLL), Negative High (NH) and Negative Medium (NM) are also available at the same price.

Vertical Illuminator Attachment for Bright and Darkfield / MODEL A-RLB



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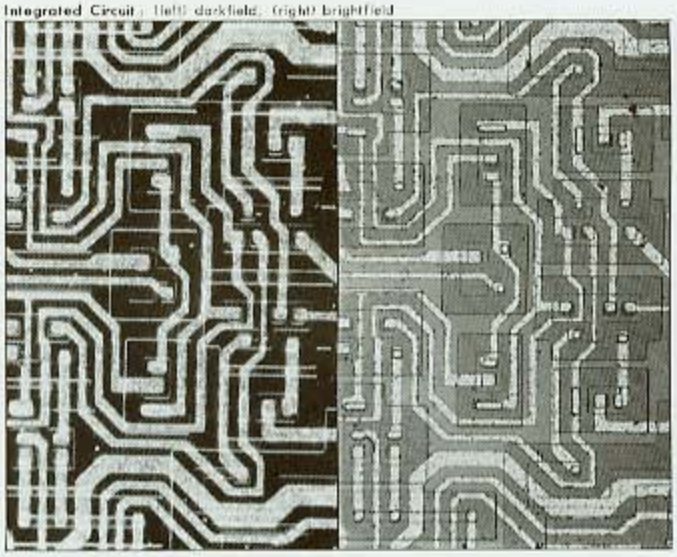
VANOX

The vertical illuminator Model A-RLB permits the VANOX operator a choice of brightfield or darkfield incident illumination at the touch of a lever, for instant comparison of both bright and darkfield images of the same specimen details.
This unique illumination system finds a wide range of applications in many fields such as metallurgy, electronics, chemistry, textiles and ceramics, as well as in biological and medical research work. Designed to observe rough surfaces of objects with utmost clarity, fine scratches on finished surfaces, etc., which are difficult to see with the ordinary metallurgical microscope.

Integrated Circuit : (left) darkfield, (right) brightfield



■OUTSTANDING FEATURES

- For observation of both the surface and the contours of small opaque specimens, e.g. powders, emulsion, etc., incident darkfield illumination can be performed by using the light source on the VANOX, while polarized light observation may be performed by using analyzer and polarizer.
- Each Neo objective contains both a high quality, fully coated metallurgical achromat objective and a matched annular condenser.
- The brightfield/darkfield knob can direct the light axially, for brightfield illumination, or obliquely through the surrounding annular condenser for darkfield use. It is not necessary to change objectives or accessories, or to re-focus.
- The accessory polarizer and analyzer can be easily mounted without tools for glare reduction, determination of crystal direction, or identification of nonmetallic inclusions.
- The illuminator incorporates spring-loaded mounts for a drop-in polarizer as well as a rotating analyzer, calibrated from 0° to 90° in 10° increments, and at 45°.
- The filter turret unit includes two turrets; one for yellow, cobalt, LB145 and green filters and the other for LB100, LB45 and ND6. Each turret also contains one empty aperture.
- The standard tungsten light source provided for the VANOX can be used with the Model A-RLB illuminator for incident light. The optional halogen light source for incident light can also be used.
- Objective data:

Objective	N.A.	W.D.	Focal Length
Neo 5X	0.10	22.30mm	31.41mm
Neo 10X	0.25	7.50	19.58
Neo 20X	0.40	1.70	10.15
Neo 40X	0.65	0.62	5.39

■STANDARD EQUIPMENT

① Bright and darkfield illuminator with quadruple nosepiece and filter turret 1
② Attachment lens 1
③ Polarizing set (polarizer and analyzer) 1
④ Stage insert (for metallurgical work) 1
⑤ Metal slide plates (set of five) 1
⑥ Objectives: Neo 5X 1
Neo 10X 1
Neo 20X 1
Neo 40X 1
- Wooden case 1

C-35A
OLYMPUS
OLYMPUS

Depending on the scientist's preference or requirements in routine or research photomicrography, the Photomicrographic System Camera PM-10 combines the features and advantages of many separate conventional attachment cameras, ranging from the 35mm camera back to the 4" x 5" Polaroid® film holder.

The PM-10 system consists of two basic units – a fully automatic version, Model PM-10-A and a popular manual version, Model PM-10-M. Both of them are uniquely qualified for use with any microscope by means of adapters. The PM-10 needs no adapter for connection to the VANOX. The modular design concept of the system camera furthermore permits easy interchangeability of many accessories such as motor-driven 35mm camera back, Polaroid backs, 4" x 5" film holder, automatic or manual exposure determination, color temperature regulation, a series of newly computed FK photographic eyepieces, etc.

- The Model PM-10-A is a fully automatic system that assures clear-cut pictures without failure by simply focusing and exposing. Range of automatic exposure control . . . 32 min. to 1/100 sec.
- Advanced color temperature regulation

By introducing color temperature conversion filters into the light path and zero-resetting the meter, color temperature can be regulated completely for exceptional color pictures.

- Data imprinting device

As you write down any information such as specimen names, dates, photographic conditions on an insert card and insert it into a slit provided on the camera back, the information can be imprinted on the 35mm film plane simultaneously with the exposure.

- Provision for attachment of large format cameras

A wide choice of large format camera attachments such as 3¼" x 4¼" Polaroid camera back and 4" x 5" film holder, assures photomicrographs of excellent resolution and contrast with automatic exposure for instant study, contact printing or color slides, or documentation, etc.

- Photo eyepieces FK

These eyepieces are specially designed for photomicrography with the Model PM-10 camera system. The eyepiece powers are 2.5x, 3.3x, 5x and 6.7x. Each magnification is computed to focus a real image at a projection length of 125mm – the same plane as the 35mm film plane, compensating ideally for photomicrographic aberrations.

- Field of view eyepieces

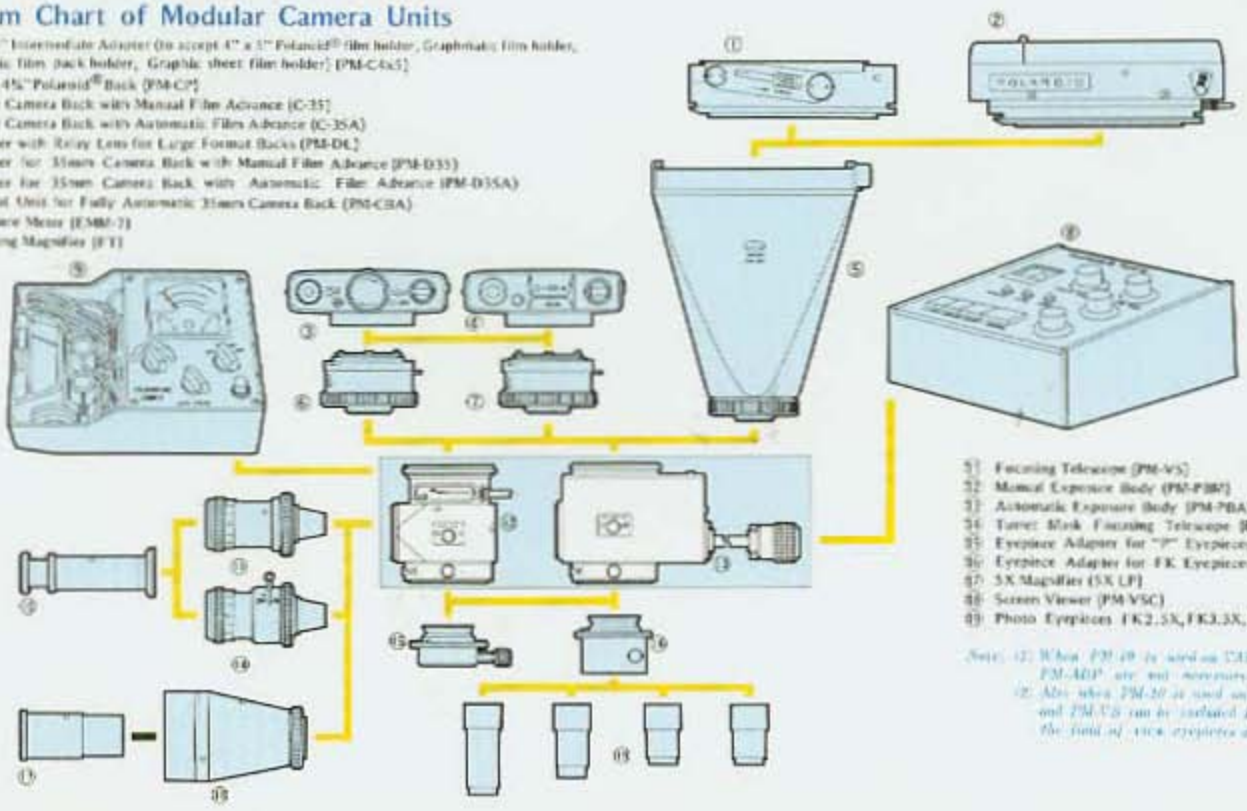
It is recommended to optionally use the field of view eyepieces, each of which has a focusing front lens and a reticle with 4 frames, each frame indicating the area covered by a specific power FK photo eyepiece. Several type field of view eyepieces are available according to the film size employed, as summarized below

Camera attachment	Field of view eyepieces	
35mm back	35-WF10X	AH-WF10X*
3¼"x4¼" Polaroid back	P-WF10X	
4"x5" holder	4X5-WF10X	

* AH-WF 10X is used to be paired with any of the field of view eyepieces.

System Chart of Modular Camera Units

① 4" x 5" Intermediate Adapter (to accept 4" x 5" Polaroid® film holder, Graphmatic film holder, Graphic film back 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 [EM-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

Note: ⑫ When PM-10 is used on VANOX, PM-ADP and PM-ADF are not necessary.
⑬ Also when PM-10 is used on VANOX, PM-VTM and PM-VS can be excluded from order. Instead, the field of view eyepieces are recommended.

Other Optional Accessories

Projection Screen / MODEL A-MPS

Projects an image of the magnified specimen onto a 155 mm diam. screen for group viewing, consultation, etc. Image magnification measured on screen = objective power x photo eyepiece power x 3.

Halogen Light Source for Transmitted & Reflected Light / MODEL A-LSH

This compact light source emits twice as much light as a conventional tungsten lamp (6V, 5A). It is easy to operate, economical, and assures constant color temperature (3,300°K) of the light.

The bulb life span averages 50 hours, with intensity and color temperature kept constant throughout the bulb life. Spectral distribution is the same as for a tungsten lamp.

■STANDARD EQUIPMENT

Lamp house with socket and cord	1
Collector lens	1
Filter 45WF	1
Quartz iodine lamps JC 12V 100W	2
Transformer TH	1

Magnification Changer for Transmitted Light / MODEL A-CA

Variation of total magnification with the Model A-CA: 1X, 1.25X, 1.5X plus PH (as centering telescope)

Swing-out Condenser/ MODEL A-SC

For maximum illumination with objectives from 1.3X (low power) to 100X; N.A. with top lens swung in is 0.85; with calibrated iris diaphragm.

Widefield Darkfield Condenser / MODEL A-DC-W

This cardioid immersion darkfield condenser, N.A. 1.20–1.40, permits observation of low-contrast microscopic objects with the VANOX AHB. Specially recommended for biological use with bacteria, blood, etc. that cannot be stained. It works with widefield eyepieces and objectives from 10X to 100X. Images are contrasty and brilliantly illuminated over a wide area.

Dry Darkfield Condenser / MODEL L-DC-7

When attached on the VANOX, this cardioid type dry darkfield condenser, N.A. 0.80–0.92, eliminates inconvenience of immersion. Illuminates objectives from 10X to 40X.

Polarizing Attachment Set/ MODEL A-POL

Consists of polarizer and analyzer, for use with transmitted light.

Objectives

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VANOX

■BIOLOGICAL USE

The VANOX is provided with plan achromats as standard objectives for their excellent quality of producing a flat image. To mention a few other objectives that are optionally available because of their unique features:

• Fluorites

Particularly recommended is FLS-60X. It boasts the largest N.A. (0.95) of all dry objectives, with excellent resolution at the central field.

• Apochromats

Corrected chromatically and spherically for three colors. Their resolution is superior to those of achromats and fluorites, very suitable to observation of minute structures of microscopic objects.

• Plan apochromats

Extremely corrected for chromatic and spherical aberrations, especially for field curvature, with excellent contrast and resolution. Their flatness of field is invaluable for visual observation and photomicrography of flat objects or sections.

Plan Apo 100X

FLS-60X

Type		Initial magnification	N.A.	W.D.	Focal length
Flourites (Semi-apochromats)		FLS-40X (spring-loaded)	0.75	0.49mm	4.19mm
		FLS-60X (spring-loaded, correction collar)	0.95	0.15	2.90
		FLS-100X (spring-loaded, oil)	1.30	0.10	1.80
Apochromats		Apo 40X (spring-loaded, correction collar)	0.85	0.23	4.33
		Apo 40X (iris diaphragm, spring-loaded, oil)	1.00	0.19	4.38
Plan achromats		Plan 1.3X	0.03	19.92	31.93
		Plan 2X	0.05	18.29	37.91
	Super wide-field	Plan 4X	0.10	5.50	31.31
		Plan 10X	0.25	7.18	17.45
		Plan 20X (spring-loaded)	0.40	0.78	8.11
		Plan 40X (spring-loaded)	0.65	0.22	4.38
		SW Plan 100X (spring-loaded)	1.25	0.08	1.59
		Plan 100X (spring-loaded, oil)	1.25	0.14	1.65
Plan apochromats		Plan Apo 4X	0.16	4.35	27.80
		Plan Apo 10X (spring-loaded)	0.32	0.16	14.18
		Plan Apo 20X (spring-loaded)	0.65	0.14	7.56
		Plan Apo 40X (spring-loaded, correction collar)	0.95	0.10	3.95
		Plan Apo 100X (spring-loaded, oil)	1.30	0.09	1.54

■METALLURGICAL USE

In keeping with the varied requirements for metallurgical routine or research applications, Olympus makes available a full choice of reflected light objectives from 1.3X to 100X magnifications for the metallurgical version of the VANOX.

• Metallurgical objectives available include metallurgical achromats from 5X to 100X and plan achromats from 1.3X to 100X. One of the most unique plan achromats is the M Plan 100X, dry, which requires no oil immersion to facilitate microscopic work at high power magnifications, with its long working distance and outstanding resolution.

Type	Initial magnification	N.A.	W.D.	Focal length
Achromats	M 5X	0.10	27.00mm	31.46mm
	M 10X	0.25	7.60	19.58
	M 20X	0.40	2.10	10.15
	M 40X	0.65	0.50	5.39
	M 50X	0.65	0.68	4.32
	M100X (oil)	1.30	0.35	2.25
Plan achromats	M Plan 1.3X	0.03	48.99	51.45
	M Plan 2.5X	0.05	42.00	48.98
	M Plan 5X	0.10	3.30	33.59
	M Plan 10X	0.25	7.10	21.46
	M Plan 20X	0.40	0.72	9.57
	M Plan 40X	0.63	0.39	5.40
	M Plan100X (oil)	1.25	0.16	2.10
	M Plan100X (dry)	0.90	0.29	2.09
Long working distance	LWD M Plan 20X	0.40	4.60	11.51
	LWD M Plan 40X	0.55	3.42	5.45

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