





INSTRUCTIONS MODEL

GREENOUGH BINOCULAR STEREOSCOPIC MICROSCOPE

The Greenough Binocular Stereoscopic Microscope is a multi-purpose instrument with many diverse applications, including: plant classification entomology anatomical examination of animals geology stamp and coin inspection, gemology and in the electronic and precision instrument industries.

The new Olympus Model X microscope is highly versatile, and can be adapted for use in every field where binocular stereoscopic observation is required.

SPECIFICATIONS :

1.	Five	different	magnif cations	attainable b)y	magnification-selector	dram.

2.	Paired objectives and binocular eyepieces.	
3.	Magnifications (variable)	6. $3 \times \sim 160 \times$
4.	Inclination of binocular head	45°
	Angle of visual axis	12°
5.	Inter-pupil'ary distance adjustment	50-80mm(w/G10×)
		46-80mm(w/G20×)
6.	Interchangeable objectives	$1 \times$ or $2 \times$
7.	Large working distance	90mm & 47mm
8.	Range of body movement (up & down)	85mm
	Rack & pinion (fine adjustment)	38mm
	Pillar (sliding movement of inner tube)	47mm
9,	Swinging movement of body (pivoted at pillar)	$100 mm(80^{\circ})$
10.	Detachable sub-stage base with reflecting mirror	
11.	Stage plates, clear and smoked glass	
12.	Wide-field eyepieces	
13.	Interchangeable stands	

- 14. Reversible and detachable binocular head
- 15. Epi-illuminator (attachable)

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HANDLING INSTRUCTIONS

Parts of the Model X are stored in several blocks in the cabinet as follows:

- 1. Body (in a corrugated carton)
- 2. Inclined head (in a corrugated carton)
- 3. Stand
- 4. Trans-illuminating stand (in a separate wooden box)
- 5. Eyepieces, 1 pair each of $G10 \times$ and $G20 \times$.
- 6. Objectives, 1 pair of $1 \times (2 \times \text{optional})$.
- 7. Stage Plates, 1 each of clear and smoked glass
- 8. Stage Clips
- 9. Instructions, Certificate of Inspection
- 10. Desiccant
- 11. Eyepiece caps (large)
- 12. Eyeshields







A. OPTICAL SYSTEM

The optical system for Model X consists of objective lenses (hereinafter referred to as objectives), magnification-varying tube lenses (hereinafter referred to as variables), and eyepieces, as shown below. (ILLUSTRATION)



The beams from the specimen proceed into the Prism P_i with an angle of visual axis of 12° , wherein they are turned parallel to each other, further proceeding to the variable lens system (VL and VL₁), the tube lens system (PL and L₁), and to P_2 . Then, still maintaining parallel position they enter porro-prisms at P_3 , at the last facet of which they again assume a 12° angle of visual axis, forming images at the eyepieces.

As described above, the variables are paired on parallel optical axes. Consequently five magnifications are attainable, i. e. two sets of normal and reverse positions plue a blank position. (see page 4)

As to the trans-illumination system the sub-stage base stores a reflecting mirror and a 100V 40W bulb. In addition, special accessories such as an iris apparatus (for field adjustment) and an epi-illuminator are available.

Assemble the instrument in the following order:

- Set the body onto the yoke at the top of the stand, securing it by the screw provided.
- Set the inclined head on the seat at the top of the body, and fasten the clamp screw tightly.
 Place the desired stage plate in the receptacle
- on the stage.

The instrument is now ready for observation by natural light.

For trans-illuminated observation, the whole instrument as assembled above is then set on the illuminating stand. Natural or artificial light will be reflected to the specimen by the mirror. If necessary set the iris equipment on the sub-stage base. Now with attachment of hand-rests to this base, you are all ready for prolonged observation under any conditions.





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A-1 General Features

Following is a table of optical specifications. When using $1 \times$ objectives total magnification will be as indicated on the magnification-selector drum. When using the $2 \times$ objectives, numbers on the drum must be doubled. With the $2 \times$ objectives, do not use positions marked X in the table.

TABLE

Drum Position	Objectives	Eyepieces	Total Magnification	Field	Working Distance
6.3 10 16 25 40	# 1	10×	$\begin{array}{c} 6.3\times\\ 10 \times\\ 16 \times\\ 25 \times\\ 40 \times\end{array}$	$\begin{array}{cccc} 32 & \phi \\ 20 & \phi \\ 12.5\phi \\ 8 & \phi \\ 5 & \phi \end{array}$	90
12.5 20 31.5 50 80	(f=100)	$20 \times$	$\begin{array}{ccc} 12.5\times\\ 20 & \times\\ 31.5\times\\ 50 & \times\\ 80 & \times \end{array}$	$\begin{array}{ccc} 16 & \phi \\ 10 & \phi \\ 6. \ 3^{\phi} \\ 4 & \phi \\ 2. \ 5^{\phi} \end{array}$	and a fai
\boxtimes 6.3 \boxtimes 10 16 25 40	# 2	10×	$31.5 \times 50 \times 80 \times$	6.3^{ϕ} 4 ϕ 2.5 $^{\phi}$	47
 ⋈ 12.5 ⋈ 20 13.5 50 80 	(f=50)	$20 \times$	$\begin{array}{c} & \\ & \\ 63 \\ 100 \\ \times \\ 160 \\ \times \end{array}$	3.1ϕ 2ϕ 1.2ϕ	



A-2 Variable Lens System

This system is composed of two sets of Galilean telescopic lenses and a blank position. Since the axis of Galilean telescopic lenses are parallel to each other, five different variations can be obtained by their reversal plus the use of the blank position. When forming a telescopic system, variables in the reversed position give a reciprocal magnification, still within the normal focusing range. (ILLUSTRATION)





A-3 Eyepieces

Two types of eyepieces are available $-10 \times$ and $20 \times$. $G10 \times$ is composed of three optical elements, and $G20 \times$ four elements. The field stop for each eyepiece is positioned just below the field lens.



A-4 Objectives

A pair of objectives designed for exclusive use in the Model X is mounted in an interchangeable housing. Available in two types.

	Focal Length	Working Distance	Numerical Aperture
$1 \times$	100mm	90mm	0.08
$2 \times$	50mm	47mm	0.08

 $\begin{array}{cccc} \mbox{Magnification} & \mbox{Focal Length} & \mbox{Field of View with } 1\times \mbox{Objectives} \\ \mbox{G10}\times & 25mm & 20mm \\ \mbox{G20}\times & 12.5mm & 10mm \\ \mbox{Both eyepieces provid extra-wide field of view, and a crisp image is} \\ \mbox{attained over the full area.} \end{array}$





 $20 \times$ Ocular









Using the high magnification objectives $(2\times)$ the edge of the field may be darkened at magnification-dial positions 6.3, 12.5, 10 and 20. This is caused by the fact that both $2\times$ and $1\times$ objectives are made to focus at the same point. If you want these magnifications, use the $1\times$ objectives. The image will be brighter and of the desired magnifications, use the $1\times$ objectives. The image will be brighter and of the desired magnification.

 $1 \times$ Objectives









B. BINOCULAR BODY



The binocular body, the major part of this microscope contains the optical system. Outwardly it is composed of body (B-1) inclined head (B-2), and focusing mechanism (B-3).

B-1 Body

The body is the major part of the instrument, containing a pair of objectives, prisms and a magnification-selector drum (1). This drum is the characteristic feature of the Model X. By rotating the drum (which holds two paired variables (2) and a blank position (6)), perpendicular to the parallel axes, the desired magnification is attained.

Simply rotate the magnification dial (5) to the desired value. At each number (3) it will click firmly, permitting observation at a stabilized magnification. The drum may be rotated in either direction, but it is preferable for the user to form the habit of moving it in a set direction.







At the top of the body is the seat (17) for the inclined head (7), in which the head can be mounted by tightening the head clamp screw (8).

At the lower part of the body is a groove [12] into which the desired objective set [11] is inserted, and secured by the objective clamp screw [10]. Prisms for variation of the angle of visual axes are located in the inclined head, inside the prism housing [22].

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B-3 Focusing Mechanism

To focus on a given specimen, first loosen the pillar clamp screw 30 sliding the body on the spring-tension pillar until rough focus is attained. Fine adjustment is then made by the rack and pinion focusing knobs 25. - 12 -

The focusing knobs provide a maximum range of vertical movement of 38mm.

Tension on the focusing knobs may be adjusted to the user's preference. Tension is adjusted by both focusing knobs securely and simultaneously turning them clockwise to tighten, counter- clockwise to loosen. If set too loosely, the body may slip down by its own weight; reasonably firm tention will avoid this.



The entire binocular body can be freely attached to or detached from the stand by the body support block 29 at the sliding section of the rack. To secure the body to the stand, tighten the body clamp screw 24.



Clamp Screw

Adjustment of Interpupillary Distance

The range of adjustment, when using the $G10 \times$ eyepieces, is 50-80mm. Rotats only one of the prism housing tubes [22], since the other will synchronize and adjust to the desired distance. Do not force the adjustment beyond the maximum or minimum distance, nor turn each tube in a different direction, or damage may result.

Eye-Refraction Difference Adjustment

Focus correctly on the specimen through the right eyepiece then turn the diopter ring to focus the left eyepiece. The setting on the diopter scale will be constant, with any specimen, for the individual.



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B-2 Inclined Head

The head is inclined at an optimum angle of 45° from horizontal, and at a 12° angle of visual axes for comfort, so that the user can maintain a natural position during prolonged observation, thus avoiding fatigue. Also the 12° angle of visual axes facilitates coincidence of the two images into one.

The head can be attached either in normal or reversed position as desired. When mounting it, be sure the locating stud [18] is seated in the appropriate locating hole [14] then tighten the head clamp screw (8).







(Attaching)





Firmly Loosen the Screw (Ready for Detachment)

t)

(Detaching)

The stand mamtsins the body at a set position and holds the specimen in a suitable manner for observation. It is composed of a stage and a pillar (C-1 and C-2).

C-1 Stage

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The stage is composed of a base 28 and a stage plate. The base supports the binocular body assuring stability whether the head is mounted in the normal or reversed position.

On the underside of the base, leather pads are located at three points of contact to prevent marking the desk. A female thecad is provided on the underside, into which a screw fits to secure the stand to the storage cabinet.

The stage plate is mounted in the circular receptacle in the base. A prepared specimen can be examined on this plate. The specimen can also be dissected, disassembled or assembled on the plate. Interchangeable plates of clear glass (for trans-illumination) smoked glass (for epi-illumination) or a metal non-transparent plate (optional accessory), are available. The plates are secured by the stage clamp screw 26.

Slides and small specimens can be held by the stage clips 27).

C. STAND

If the size of the specimen does not allow placement on the stage plate, the whole instrument can be set on the surface of the specimen to be examined. In this case, it must be focused on the lower plane of the stage.





C-2 Pillar

This part holds the binocular body. The pillar can be moved within a maximum range of 47mm vertically, and can be rotated within an angle of 80°. The supporting section is composed of the pillar and the yoke 83. The pillar consists of outer and inner tubes. Assisted by the built-in balancing spring, the inner tube 62 firmly holds the yoke and the binocular body affixed to it slides up and down in the outer tube 61 and can be stabilized at a desired position by the pillar clamp screw 80. The inner tube can swing horizontally as much as 80°, enabling the body to move to the fullest extent over the stage plate, for examining large specimens. - 14 -



D. TRANS-ILLUMINATING STAND



This device provides trans-illumination from below the specimen, when positioned under the stage. It is composed of a sub-stage base (D-1), an illuminating lamp (D-2), and a pair of hand rests (D-3). An iris apparatus is also available as a special accessory.

D-1 Sub-Stage Base

Inside the base is a reflecting mirror 38 and at the back an illuminating lamp sleeve 42. Turn the mirror knob 37 as required to reflect natural or artificial light to the desired portion of the specimen. One side of the mirror is silvered and the other side is white. The silvered side is used for contrasty and intense lighting and the white side for soft lighting.

When placing the instrument on the sub-stage base, the locating stud 34 of the base is engaged in the locating hole under the stage. At the outer sides of the base are grooves 35 into which the hand-rests are inserted and secured by the knurled clamp screws 40 provided.





D-2 Illuminating Lamp

A 100V 40W lamp designed especially for the Model X is supplied in a housing (45), with off-on switch (44). The lamp is attached by inserting it in the sleeve (42) on the base. It is turned on and off alternately by clockwise rotation of the switch; counter-clockwise rotation does not operate the switch.

D-3 Hand-Rests

This device is essential for fatigue free operation during prolonged observation. Loosen the hand-rest clamp screws (40 on the base. Insert the metal lip (46) of the hand-rest into the groove, so that the locating slot (47) on the metal lip engages the locating stud (49) on the base. Now push the hand-rest in the direction of the clamp screw (40), and tighten the screw. Detach by following the opposite procedure. When storing, the hand-rests can be folded in two. They may be attached on either side, but it is normal to let the hand-rest curve face you as shown in the illustration.

D-4 Iris Apparatus (Optional Accessory)

The iris apparatus is an accessory to control the beam of trans-illumination or to provide oblique illumination. It is set underneath the top of the sub-stage base. First set the slide rail and the iris sleeve at the appropriate position, insert the iris frame from below, then tighten the iris clamp screws 51). The iris may be opened or closed by horizontal movement of the aperture lever 53 producing an aperture adjustable from 2mm to 40mm in diameter. By pulling and pushing (not rotating) the iris positioning lever 54, desired oblique illumination can be obtained.

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ILLUMINATION

For optimum observation, conditions for illumination must be considered.

(1) Epi-Illumination



(2) Trans-Illumination

Model	V – A simplified model of the X, with magnificatione 15×~ 120×.
Model	VK- A practical with a pair of fixed objectives (2×)
Model	VA - A practical & simplified model which is attachable to vertical inclined and universal stands.
Model	VT - A new model with a revolv- ing nosepiece for multi- objectives.

- In order to attain a crisp and stereoscopic image of opaque specimens particularly, concentrated light at an angle of 30-60° to the objective axis is appropriate. The Olympus Epi-Illuminator (LSG) is ideal for this purpose. The LSG utilizes a 6V 1.7A illumination lamp and a 6V 5A transformer.
- By soft lighting (natural light from north, an external frosted electric bulb etc.) an image of low contrast is attainable.
- When observing an article in white or of bright colors, use the clear stage plate with a black disc underneath, so that the background field will be darkened, increasing image contrast.

The epi-illuminator (LSG) is conveniently mounted on the front of the body by two clamp screws.

- Adjust the angle of the reflecting mirror so that both ocular fields will be equally bright.
 To obtain an image of the interior of
- 2. To obtain an image of the interior of a specimen, use the Silvered side of the mirror. If only the external surface of the specimen is required, use the white side of the mirror.
- When observing the rim of a specimen or a cilium, it is desirable to employ lighting slightly off the optical axis by closing down tihe irs - oblique illumination (optional accessory).

OPERATING INSTRUCTIONS

In actual observation, two methods are employed – using reflected light or transillumination. The appropriate stage plate must be selected in each case i. e. smoked glass for natural reflected light and clear glass for trans-illumination. For natural reflected light it is not always necessry to use the substage base. Following is the sequence of microscope adjustments for observation:

- Place specimen on the stage plate and hold it with clips if necessary.
- 2. Loosen the pillar clamp screw.
- Set the magnification-selector dial temporarily at 16.
- Looking through eyepieces, move the body vertically or swing horizontally to focus roughly and determine the point of observation on the specimen.
- 5. Firmly tighten the pillar clamp screw.
- Looking through the right eyepiece rotate the focusing knob to obtain precise focus.
- 7. Turn the prism box to adjust the interpupillary distance,
- Adjust eye-refraction difference by rotating the left eyepiece until the image is sharp.
- 9. Rotate the magnification-selector dial to the indication number desired.

By following the above method, a correct image of the specimen will be obtained. To further improve the image, various illuminating method may be used.