Model II
PROJECTED SCALE MICROMETER

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OPERATION and MAINTENANCE MANUAL

BAUSCH & LOMB INCORPORATED
ROCHESTER, NEW YORK 14602

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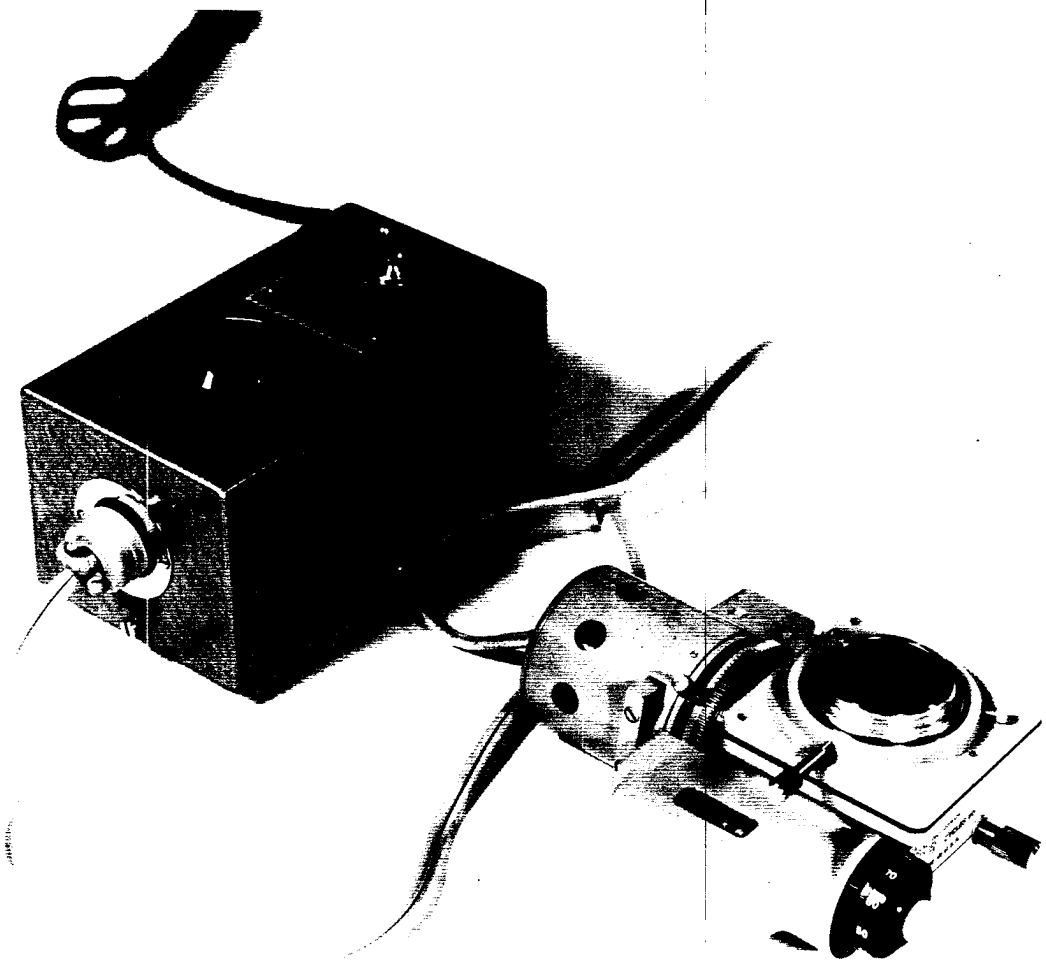
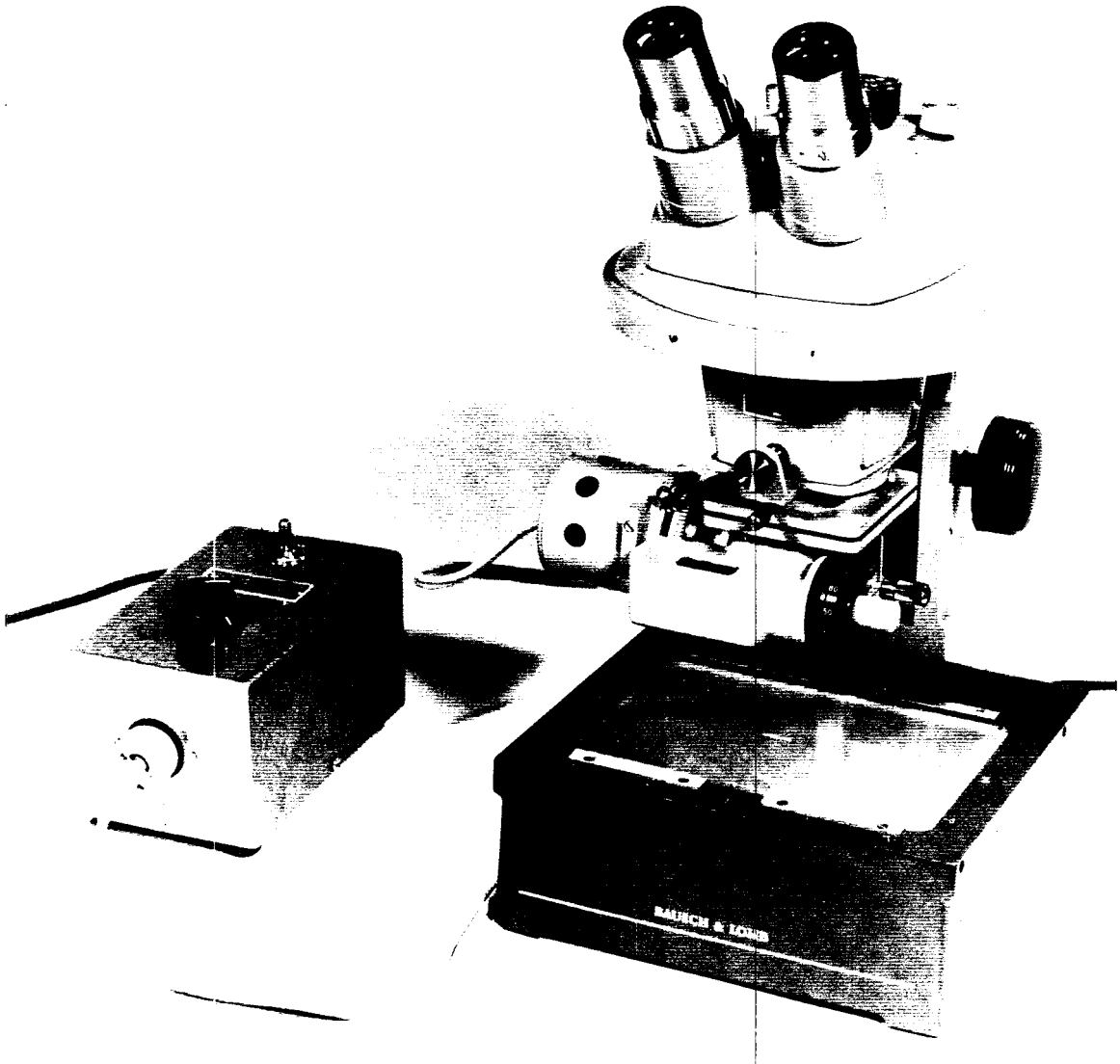


MODEL II PROJECTED SCALE MICROMETER



MODEL II PROJECTED SCALE MICROMETER ATTACHED TO ZOOM 70

Model II
Projected Scale Micrometer

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General:

The Model II of the Projected Scale Micrometer is a measuring attachment for the Bausch & Lomb Model II Zoom 70 Stereoscope or any Bausch & Lomb StereoZoom Microscope. The application of the Model II is similar to the Model I; however the design and method of obtaining measurements is somewhat different. A digital counter is used in conjunction with a micrometer screw and drum for making measurements. The micrometer screw drive is mounted in a stationing location on the main body.

The principle of operation is based on using a beam splitting cube in association with a Zoom 70 or Stereo-Zoom Microscope such that a reticle may be viewed simultaneously with a photograph. The method of measuring is comparable with placing a reticle directly in contact with the photographic emulsion without physically requiring that it be done. The measurements obtained are independent of the viewing magnification and any distortion in the optical system. The accuracy is dependent solely on the precision of the micrometer screw used.

The Model II of the Projected Scale Micrometer attaches to the base of the StereoZoom pod with the same mount as the Model I. The mount threads into the auxiliary attachment lens adapter and the unit attaches easily to the

mount with one thumb screw. It is designed to be used without the attachment lenses; therefore, the magnification range is 7x to 60x with one interchange of eyepieces (10x and 20x).

The reticle disc is 26mm in diameter. It has a 24mm long line crossing the diameter with a 4mm line bisecting the center of the longer line. The reticle is displaced parallel to the direction of the longer line through ±0.25 inches by a micrometer screw which permits the measuring of distances up to 1/2 inch in length. A negative reticle is used, clear lines with an opaque background, which appear as luminous lines superimposed on the photograph when viewed through the instrument. The short line is used for measuring with the long line giving the direction of the measurement. The reticle is rotatable to permit orienting the long line parallel with the direction of the two image points to be measured.

A counter on the micrometer screw drive registers the number of rotations of the micrometer screw and a drum on the drive subdivides each rotation into 100 parts.

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Illumination for the reticle is provided by a 12 volt, .73 ampere lamp. The brightness of the luminous lines

is regulated by a rheostat control on a transformer provided with the instrument. An opal glass diffuser provides uniform illumination of the reticle. Interchangeable colored filters may be furnished if other than white reticle lines are desired; however, they are not included in the basic instrument. The reticle lines are approximately five microns wide. Increasing the lamp brightness increases the apparent width of the lines. The rheostat provides a 50 per cent variation in lamp voltage which in turn gives approximately a 100 per cent variation in the apparent line width.

There is a total of ±3/16 inches adjustment in the optical path length to the reticle. This adjustment is necessary to accommodate for variation in focus between instruments and observers. A slow motion drive is provided for precisely setting the optical path length to the reticle equal to the path length to the photograph.

The reticle may be rotated through a total angle of 190 degrees, allowing the reticle to be aligned with any direction on the photograph. An azimuth ring attached to the main body of the projected scale micrometer permits the measuring of angles between lines on the photograph.

Attaching to the Zoom 70

An adapter ring is provided for attaching the Projected Scale Micrometer to the Zoom 70. The adapter ring has

the same thread as the auxiliary lenses and attaches in the same manner to the base of the Zoom 70 pod. It should be secured finger tight to the pod before attaching the micrometer.

The Projected Scale Micrometer is held to the adapter ring by three counter acting screws spaced at 120 degrees around the mounting flange. It is necessary to loosen only the screw in the front to attach or remove the unit. It should be attached with the counter to the front and the micrometer and focusing screws to the right.

The main body of the Projected Scale Micrometer is supported in a spherical bearing which permits the orientation of the micrometer such that one face of the beam splitting cube is parallel with the stage. This motion is provided to remove any apparent lack of parallelism between the plane of the reticle and the plane of the photographic imagery being viewed. Three socket head Allen screws clamp the spherical bearing between mounting plates. The reticle is made to appear parallel with the plane of the photograph by loosening and tightening adjacent clamping screws while viewing through the instrument. It is important that the bearing be clamped rigidly between the plates after adjustment to assure a stable setup. Removing and re-attaching the micrometer will not disturb this adjustment; therefore it is necessary to make this adjustment only when initially attaching the Projected Scale Micrometer to an instrument.

Electrical Components

The Projected Scale Micrometer operates on 12 volts. A special transformer with a 115 volt primary and 12.5 volt secondary is supplied with the unit. The transformer has a rheostat for varying the secondary voltage between 6 and 12.5 volts to dim the projection lamp. A main on/off toggle switch is mounted on the transformer housing.

The transformer has a 6 foot cord with a two conductor parallel blade plug for connection to a 115 volt supply. The Projected Scale Micrometer plugs into a twist lock recepticle mounted on the side of the transformer housing.

The projection lamp is a GE 212-1, 12 volt, .73 ampere lamp with a rated life of 500 hours.

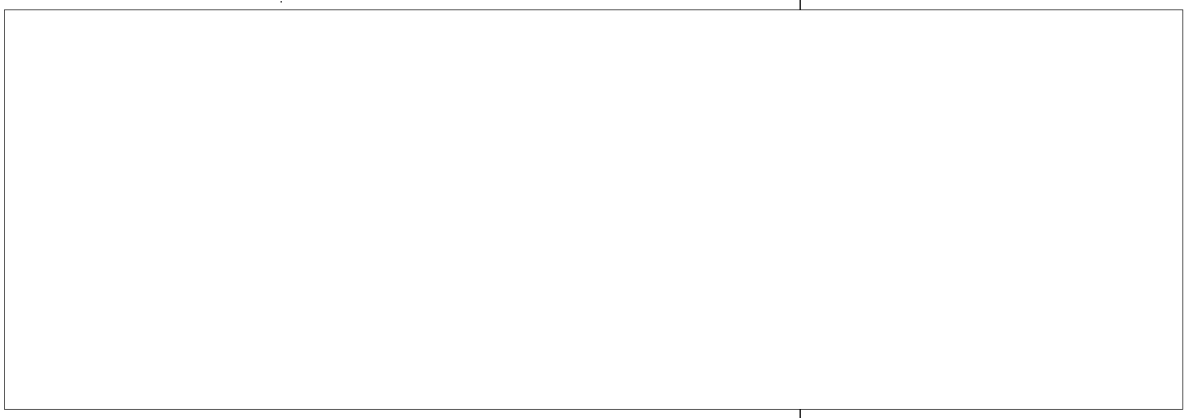
Orienting the Reticle

With the Projected Scale Micrometer attached to the Zoom 70, the Zoom 70 should be focused on the photographic imagery to be viewed. This should be done at the high end of the zoom range.

After focusing the Zoom 70, the reticle should be illuminated to make it visible in the optical system. Using the slow motion screw which projects horizontally to the right at the rear of the instrument, shift the reticle until it appears in sharp focus and superimposed in the plane of the photograph. Rotating the reticle slightly may be helpful in determining if the reticle is in the plane of the photograph.

The reticle may be rotated through a total angle of 190 degrees to align it with any direction to be measured. A clamp screw which projects up at a 45 degree angle from the front of the instrument locks the reticle in any rotational position. To rotate the reticle, loosen the clamp screw and rotate the main body of the micrometer. Reclamp the housing before starting to measure. Do not hold onto the micrometer screw drive knob when rotating the main body.

Procedure for Measuring Distances



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To measure a distance, the long line on the reticle should be aligned with the direction to be measured by loosening the clamp screw and rotating the main housing. Next turn the micrometer screw drive knob, to position the short bisecting line on the reticle such that it is aligned with the left or lower edge of the photographic image to be measured. There is then a choice of methods to be followed in completing the measurement.

(1) The first three digits on the counter are recorded followed by the two digits from the drum reading. The decimal point is to the left of the extreme left digit on the counter. Then the reticle is driven to the opposite end of the image to be measured

and the counter and drum are read again. The difference between the readings is the distance

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(2) The second method is to note the last three digits of the counter reading. The decimal point to the left of the right digit. The extreme left digit or the counter will always be zero. The right counter wheel is the opposite in color to the others and indicates the decimal part of a 360 degree rotation of the micrometer screw. Next the drum should be indexed to zero without moving the reticle off the left or lower end of the object. The reticle is then driven to the right end of the object to be measured. The last three digits on the counter are noted and the first counter reading is subtracted from it. The difference represents the number of rotations of the micrometer screw.

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The advantages of the first method of reading are that it doesn't matter in which direction the distance is measured and the readings are made directly from the counter and dial without indexing; therefore it is less subject to making an error in the reading. The second method would probably be faster for an experienced operator since it does not require the writing down of

two five digit numbers and the subraction of one from the other. A mental subtraction of the two counter readings could be made to determine the number of thousandths to which would be added the drum reading, giving the distance directly.

Regardless of which method is used, the image points should be approached from the same direction with the reticle drive to avoid errors due to the possible backlash in the drive linkage. Also, it is recommended that the intensity of the lamp for illuminating the reticle not be increased beyond what is required to make the reticle readily visible on the photograph. The greater the intensity of the illumination the greater will be the apparent line width which will decrease the pointing accuracy. Less dense photographic imagery will require higher intensities of illumination.

Procedure for Measuring Angles

The azimuth ring permits the measuring of angles up to 190 degrees. The ring is mounted on the main body; however it may be rotated independent of the main body to align with a stationary index mark. It is subdivided in degrees with every two degrees graduated and every 10 degrees numbered throughout 360 degrees.

To measure an angle the reticle should be in the center of its adjustable range such that the intersection of the reticle lines has the least apparent motion when the reticle is rotated. Place the intersection of the

reticle lines at the junction of the images forming the angle to be measured and align the long reticle line with one of the directions. Rotate the azimuth ring to index to zero or record the angle reading for the one direction. Next align the reticle with the other direction. If the first direction was indexed to zero, the angle is read directly or is obtained by subtracting the reading from 360 degrees. If the first direction was not indexed to zero, the difference between the two directions will give the angle.

Colored Filters

Colored filters may be provided if it is desired that the luminous lines appear as a color other than white. The colored filters are inserted between the lamp house and the diffusing plate. The lamp house is unscrewed from the instrument to install or remove the filter.

Replacing the Lamp

The lamp should be replaced by a GE 212-1 12 volt, .73 Amp lamp. It is accessable by unscrewing the rear section of the main body. It is not necessary to remove the plate on the back of the lamp house that is held in place with two screws. The lamp is held in a fuse clip type mount with a terminal at either end.

Care and Cleaning of Optics

The optical components should receive the same care as the optics in the Zoom 70. Care should be taken to

avoid contact with the exposed faces of the beam splitting prism. The faces may be cleaned with a cotton swab and acetone or ether.

The diffusing plate is accessable by removing the lamp housing that screws onto the end of the main body tube. It is held in a metal mount that is retained in the main body tube by two opposite acting set screws in the tube. The mount may be removed by loosening the set screws, tipping the tube portion of the housing down and tapping on the palm of the hand until the mount slides out of the tube.

Removal of the diffusing plate mount provides access to the reticle disc and its mount. The reticle disc is held in the mount by a retaining ring. Under no circumstances should the reticle be cleaned with any solvent. Since the reticle is opaque with cleared scale graduations the only cleaning that should be required is dusting lightly with a camel hair brush.

Mechanical Maintenance

The only routine mechanical maintenance required is to keep dust and grit from accummulating on the exposed moving parts of the instrument. No lubrication is required. Teflon thrust faces have been used on bearing surfaces to reduce friction. The micrometer screw has been lubricated with a light grease in assembly and is protected from dirt and grit for normal operating environments. It should not require additional lubrication for

long periods. Under no circumstances should the micrometer screw be disassembled in the field since the alignment of the drum linkage is critical for smooth operation. The instrument should be stored in its carrying case when not in use.