

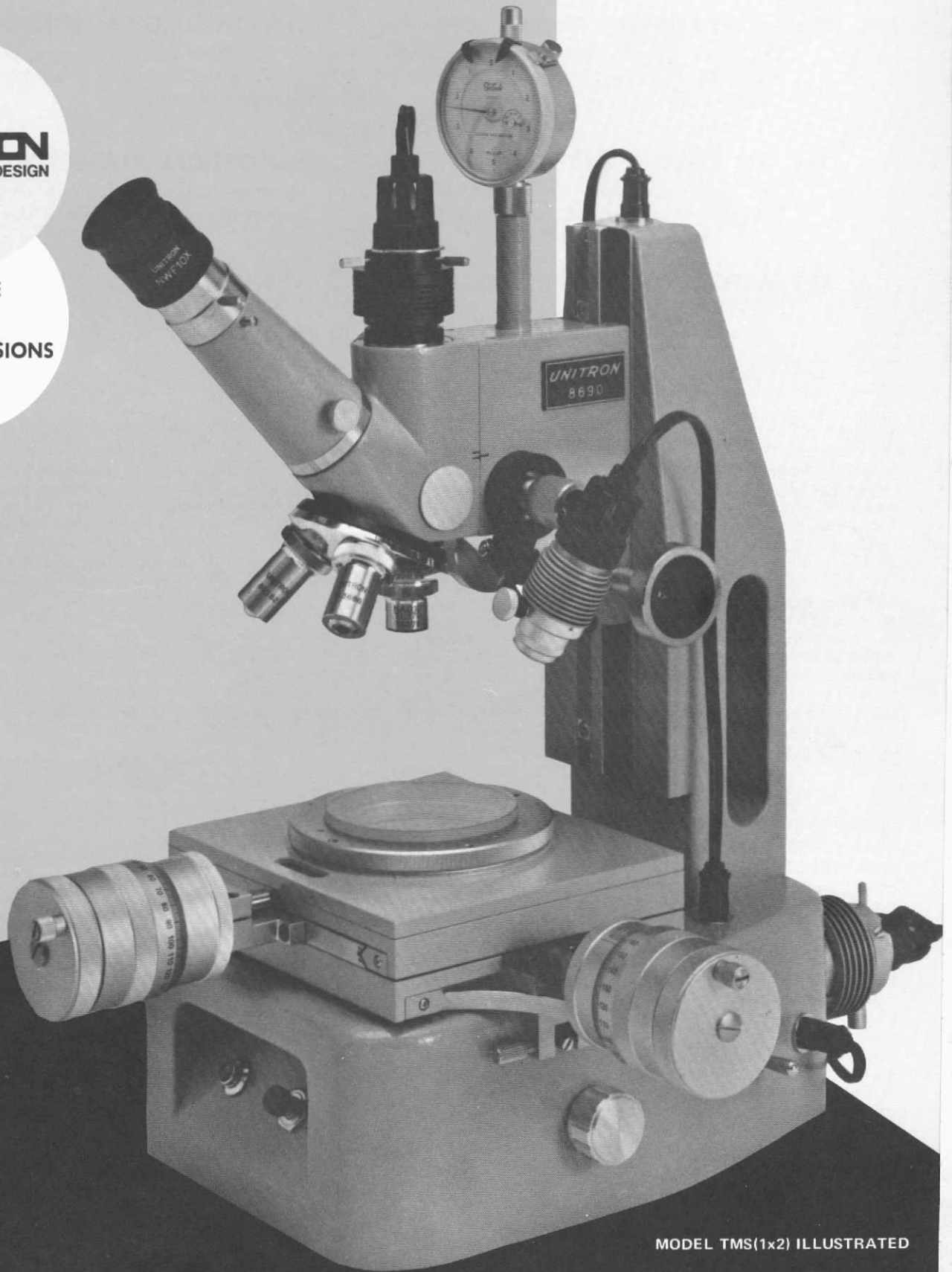
TM SERIES

UNITRON

UNIVERSAL MEASURING MICROSCOPE

UNITRON
EXCELLENCE BY DESIGN

MEASURE
in
THREE DIMENSIONS
to
0.0001"



MODEL TMS(1x2) ILLUSTRATED

Much More than Merely a Measuring Microscope . . .

The UNITRON UNIVERSAL MEASURING MICROSCOPE is SIX Instruments in ONE

- 1 A MEASURING MICROSCOPE**
for rectangular coordinate measurements to 0.0001", and angular measurements to 5 minutes of arc.
- 2 AN OPTICAL DEPTHSCOPE**
for measuring depth to 0.0001" without physical contact with the specimen.
- 3 A TOOLMAKERS' MICROSCOPE**
for detecting and measuring errors in cutting tools and optical gaging of screw threads.
- 4 A METALLURGICAL MICROSCOPE**
for examining microstructure at powers up to 2000X and measuring to tolerances of 10 millionths of an inch.
- 5 AN OPTICAL PROJECTOR**
for screen examination, group viewing and inspection of parts by optical comparison.
- 6 A PHOTO-MICROSCOPE**
for making permanent photographic records of quality control tests for future reference.

MODERN DESIGN IS EASY TO USE

UNITRON Series TM Microscopes have been human-engineered for comfortable operation. Measurements can be made for long periods of time without danger that operator fatigue will introduce errors. Eyepieces give a wide field of view, with a high eye relief, comfortable even for wearers of glasses. The inclined eyepiece tube allows restful posture. Control knobs are positioned low, within easy reach.

The three standard objectives are on a revolving nosepiece to allow rapid alternation between low and high magnification. All of the standard electrical equipment is built-in to eliminate the clutter of external transformers and make it easy to move the instrument for on-the-spot inspection. It takes but a moment to set up for any special application. The large number of UNITRONS in use in assembly line work has proven by test that even relatively unskilled technicians have no difficulty in obtaining perfect results every time.

WIDE RANGE OF ILLUMINATING SYSTEMS

The UNITRON Universal Measuring Microscopes offer the widest possible range of illuminating systems to meet every application. Standard equipment includes a vertical incident illuminator for shadow-free lighting and high-power examination of opaque objects, a substage illuminator providing collimated light for viewing contours and transparent specimens, and an oblique spotlight illuminator for surface lighting of samples with relief structure. Provision is made to attach a second, accessory oblique illuminator to obtain contrasting "duo-color" lighting of scribe marks and reference holes.

Any two of the illuminators can be operated simultaneously and the light balanced using the individual variable intensity controls. Removable filters are included to provide monochromatic light for greater measuring accuracy, proper background contrast, and to avoid eye fatigue. In addition, omni-directional lighting for objects of low reflectivity is available from the accessory UNIPAK Ring Illuminators which attach directly to the objective lenses. UNIPAK lighting has the special property that it preserves the natural coloration of objects, irrespective of the texture of the surface.

A special High-Intensity Illuminating System is offered for use in conjunction with the accessory projection screen and for photography.

HIGHEST PRECISION—DURABLE CONSTRUCTION

Every mechanical and optical component has been designed and constructed to the severest of tolerances, your guarantee of the highest degree of measuring accuracy. The heavy-duty stand and column have been cast in a single piece to ensure perfect rigidity. The hardened slideways of the micrometer stage move on ball bearings to provide smooth motion, free of any backlash. Stages tested for 200,000 traverses showed wear of less than a quarter micron. The achromatic optical system is highly corrected to provide images free of distortion and anti-reflection coated to enhance contrast. Magnification is maintained to within close tolerances to ensure accurate alignment of comparison scales. All parts are precision machined from the finest materials—there are no die-cast parts and no short cuts. Not only is the UNITRON a precision instrument when you receive it, but it will retain its accuracy even under conditions of hard usage.

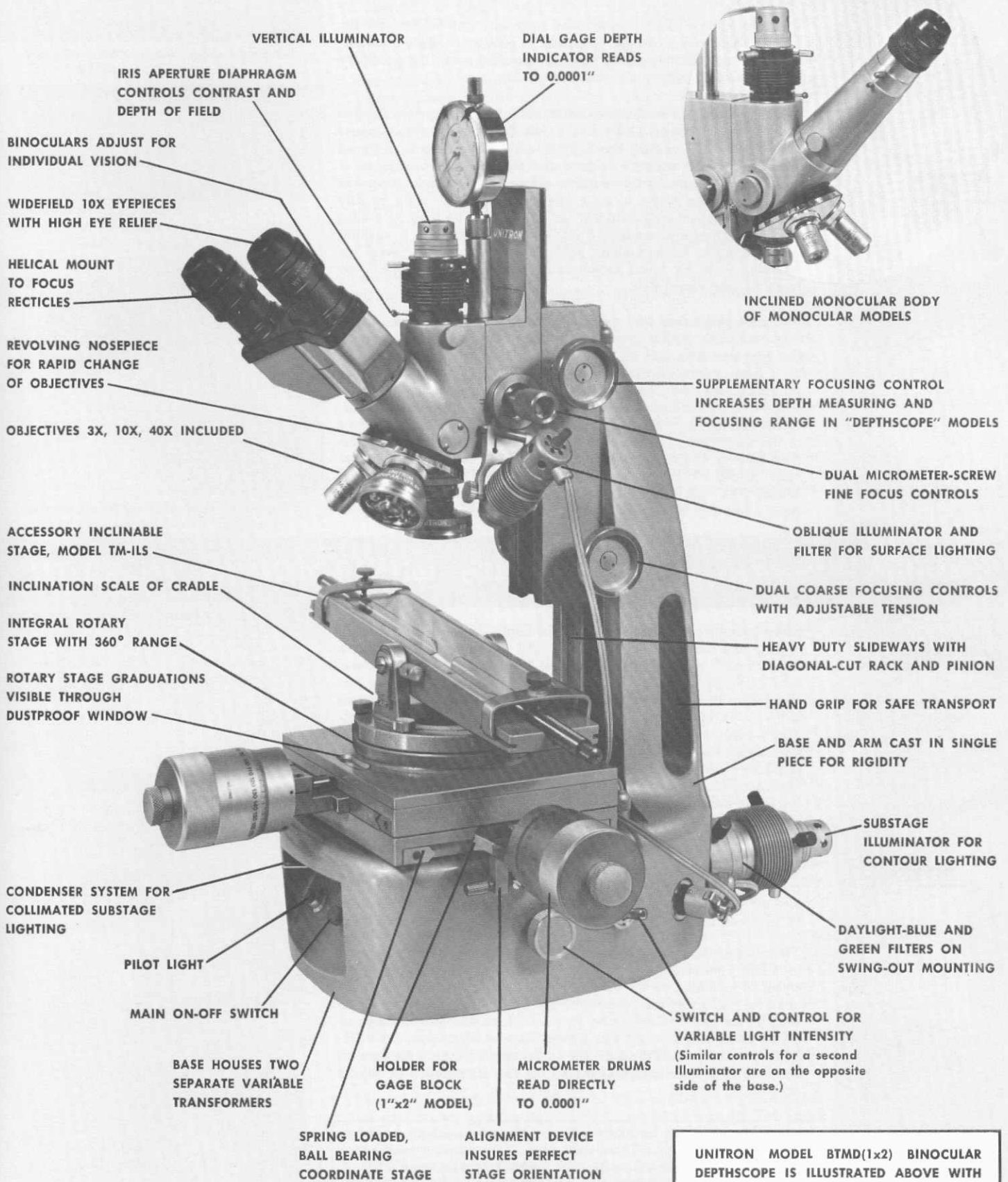
WIDE CHOICE OF MODELS AND ACCESSORIES

The STANDARD Model accommodates a workpiece up to 5" in height and provides for depth measurements over a range of 0.08" (2mm). DEPTHSCOPE Models allow objects up to 7" high to be examined and, in addition, provide for depth measuring over a 2" range (50mm), with measurements made while simultaneously viewing the object. With either model, you have the choice of monocular or binocular eyepiece systems, 1"x1", or 1"x2" stage travel, and the possibility of using the same wide range of accessory equipment for special work. Whatever your application, one of these UNITRONS will do the job efficiently.

PROVEN PERFORMANCE AT LOW COST

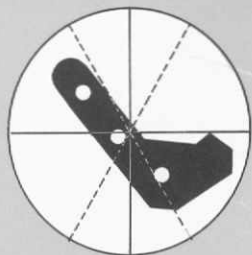
Compare the features and prices of the UNITRON TM Series with those of other measuring or toolmakers' microscopes. Note the greater versatility of the UNITRON, how many of its accessories come as standard equipment included in the purchase price, and how many of its features are exclusive. Yet, even with these advantages, the UNITRON models are priced in the same range as many of the very simplest toolmakers' microscopes with restricted range of applications. If you make this comparison, you will find it easy to understand why UNITRON Measuring Microscopes are chosen by America's largest industrial firms, as well as by small shops where budgets are limited. Orders and repeat orders prove our claim of outstanding quality and value.

OUTSTANDING FEATURES OF UNITRON SERIES TM MICROSCOPES

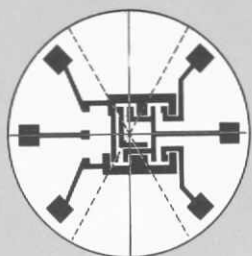


UNITRON MODEL BTMD(1x2) BINOCULAR DEPTHSCOPE IS ILLUSTRATED ABOVE WITH ACCESSORY INCLINABLE STAGE TM-ILS

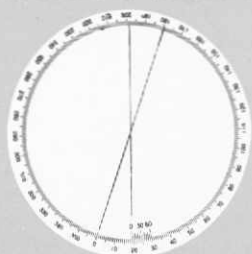
Using UNITRON Model TM as a MEASURING MICROSCOPE



Measure dimensions, angles, and hole diameter.



Checking dimensions in a microelectronics photomask.

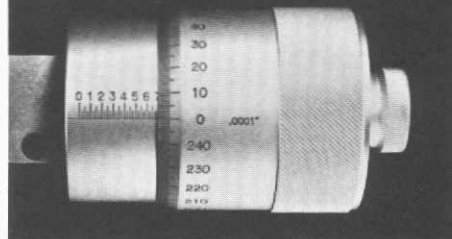


Angular scale of the PTV Protractor Ocular.

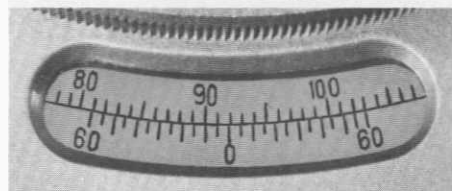
The microscope eyepiece contains a crossline reference system which is seen superimposed on a magnified image of the workpiece. Rectangular coordinate measurements are made by moving the work with respect to the reference lines using the ball bearing stage. The travel is measured by large micrometer drums which read directly in units of 0.0001" (without the need to refer to a vernier). Stages are available with a range of either 1"x1" or 1"x2"; the additional inch of the latter model is obtained by inserting a gage block between the stage and micrometer spindle. Larger areas may easily be measured in sections. Linear measurements to ten-millionths of an inch are possible using the accessory Filar Micrometer Eyepiece described below.

Angular or polar coordinate measurements can be made using the integral rotary stage which has a full 360° range. To measure angles which lie within the field of view, the stage is centered using the drums and the apex of the angle on the workpiece is placed at the center of the eyepiece crosslines. The angle generated by rotating the stage is read from an engraved scale readily visible through a small window on the stage. The scale is graduated in degrees and reads to 5' by vernier. In addition to making simple angular measurements, the rotary stage is also useful for orienting work for linear measurement and measuring objects too large for the visual field.

For most convenient and rapid measurement of angles, the accessory Protractor Ocular is recommended. In use, a knurled collar on the eyepiece is turned to rotate a movable diameter with respect to a fixed reference diameter, both visible in the field of view simultaneously with the object itself. Since measurements are made without need to center or rotate the stage, the stage motions themselves may be used to bring the apex of the angle on the workpiece to the exact center of the field. The rotation is read from a graduated scale in the visual field, without need to refer to an external scale. Model PT Protractor Ocular is graduated in units of 1° and Model PTV has, in addition, a vernier for readings to 5'. Both types allow full 360° measurement.



Precision drums with 0.0001" calibration. Tolerance is better than 0.00005".

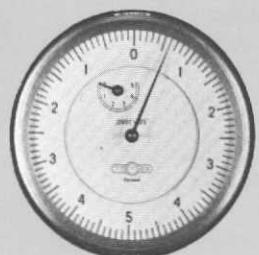


Rotatable stage calibrations are easily read through dustproof window.

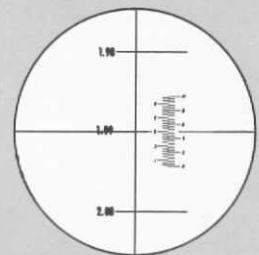


Protractor Ocular for rapid measurement of angles.

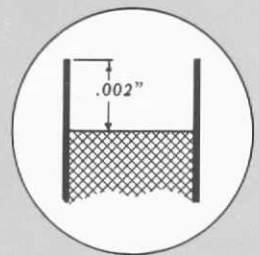
Making DEPTH MEASUREMENTS with UNITRON Model TM



Dial gage reads directly in units of 0.0001".



Optical depth scale of the DEPTHSCOPE Models.



Measuring the undercutting of chemical blanking.

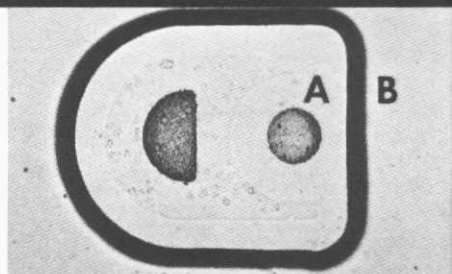
Since measurements may be made in depth—as well as in length, width, and angle—the UNITRON TM Series are truly "three dimensional" measuring microscopes. Both the STANDARD and DEPTHSCOPE models have a 0.0001" dial gage mechanism coupled to the fine focus control. By focusing successively on two levels of an object, and subtracting the corresponding gage readings, a measure of the distance between the levels is obtained. The high measuring accuracy of 0.0001" in depth is possible because standard optical equipment includes high powered objectives (of high numerical aperture) which necessarily have limited depth of focus—as well as the vertical illuminating system and micrometer-screw fine focusing adjustment required for their use.

Since measurements are made by optical means, without physical contact with the specimen, it is possible to determine the height of cavities of small diameter, the depth of pits and etched areas, the elevation of tiny burrs and to measure other objects which because of inaccessibility or fragility could never be tested mechanically.

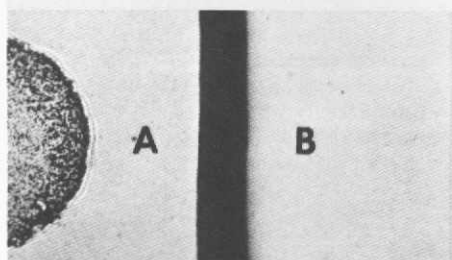
The total depth which can be measured with the dial gage is equal to 2mm. However, in the DEPTHSCOPE Models, the range of travel is extended to 2" (50mm) and readings can be made by observing a scale seen through the eyepiece, without need to refer to an external indicator. In addition to the longer range of depth measurement, and the greater ease of operation, DEPTHSCOPE Models with their double track coarse focusing mechanism have the added advantage of permitting the examination of objects up to 7" in height.

EXAMPLE OF THE USE OF THE DEPTH GAGE (photos on right). **PROBLEM:** to measure the depth of mesa etch on a silicon transistor wafer. Top photo: one of the approximately 800 elements formed on a single 1" diameter wafer, as seen using the 10X objective. Using the 40X objective, the microscope is focused sharply on one level (middle photo) and the depth gage is set to zero. By focusing on the second level (bottom photo), an etch depth of 0.0006" is measured.

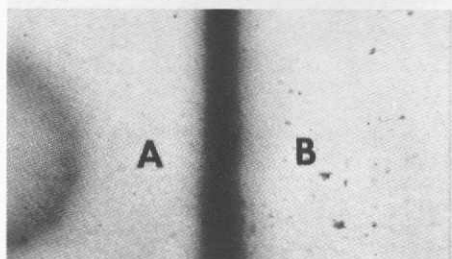
All specifications subject to change without prior notice.



In this diffused transistor element, areas A and B differ in height by 0.0006".



When A is focused with the high powered objective, area B is seen out of focus.

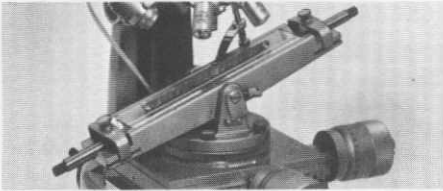


When B is in sharp focus, area A is blurred. (See explanatory text to left.)

Using UNITRON Model TM as a TOOLMAKERS' MICROSCOPE



Checking a tap with Model TM-IS Inclinable Stage and Workholder.



Checking a diagonal-cut rack with Model TM-ILS Inclinable Stage and Workholder.



Turret Screw Thread Ocular, Model TM-TAN, attaches to divisible eyepiece tube.

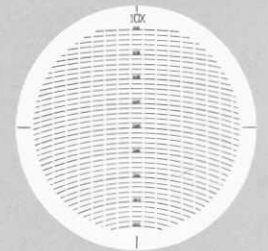
In addition to the standard equipment for linear and angular measurements, a variety of special accessories are available to facilitate toolmakers' applications. The Inclinable Stages and Workholders are provided with adjustable spindles to accommodate screws, taps, hobs, millers and other cutting tools as well as a glass stage plate to hold rack and other types of gears. In use, the cradle is inclined to the helix angle to provide a sharp contour which can be measured or compared with a standard pattern. The cradle inclines $\pm 15^\circ$ and has a scale calibrated in degrees.

Threads may be checked for form, angle, depth, lead, diameter, etc. using the micrometer and rotary stage. However, it is more convenient to compare the thread outline directly with a master pattern. Screw Thread Reticles are available which attach to the back of the standard NWF10X eyepiece. Each reticle contains a series of thread outlines (in one of the principal thread systems) which is seen in the visual field simultaneously with the outline of the thread being gaged. By means of the stage motions, the tool is moved to test its thread for coincidence with any of the patterns.

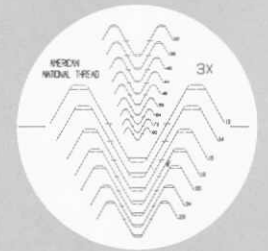
Where frequent checking of threads is required, faster results can be obtained using the Turret Screw Thread Ocular. In use, a knurled ring is turned to bring each of the thread patterns into the field of view in succession with only a minimum amount of adjustment of the stage required. The Turret Ocular has, in addition, a special scale to measure the angular deviation of drunken threads.

Accessory eyepiece reticles are also available for measuring radius of curvature and for other special applications. Furthermore, the design of the standard eyepiece is such that custom-made scales, to meet individual requirements, may readily be used.

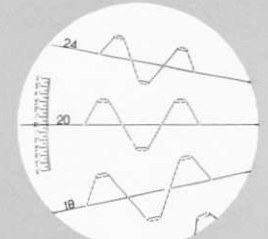
Three special Stage Insert Fixtures are offered to facilitate the holding of small parts for rapid examination and measurement: Clamping Jaws, Center Holder, and a Collet Chuck. While these are of special interest to the watch and miniature components industries, the nature of the fixtures is such that they can easily be modified for special applications. The fixtures are illustrated on the back page of the catalog.



Scale of the R2ES Radius of Curvature Reticle.

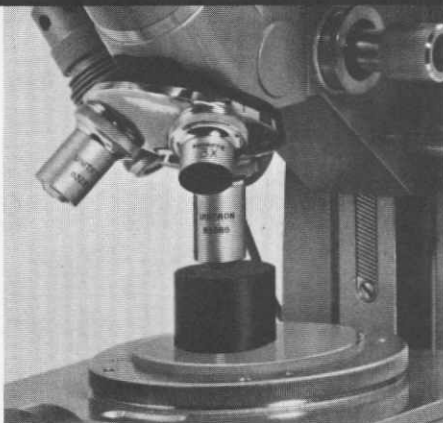


Scale of the TIES Screw Thread Reticle.

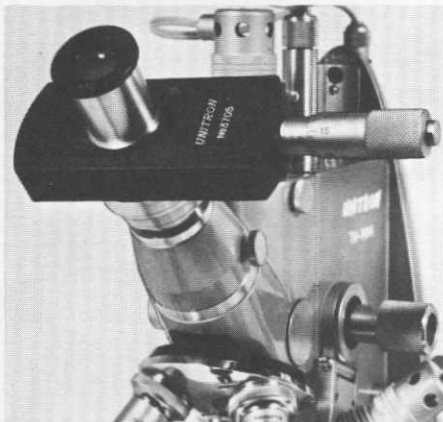


Typical patterns of Turret Screw Thread Ocular.

UNITRON Model TM is a Complete METALLURGICAL MICROSCOPE



Examining the microstructure of a polished metal sample with the 40X objective.



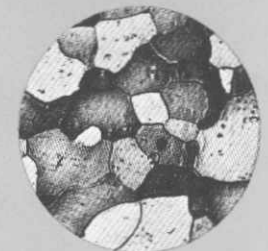
Widefield Filar Micrometer, Model FWE, attached to the Filar Eyepiece Tube.

The total magnification of most measuring microscopes is limited to about 30X, the low power needed to magnify reference points of the object in the field of view. However, with UNITRON Universal Measuring Microscopes, powers of 100X and 400X are also available as standard equipment for metallurgical applications and for accurate depth measurements. In fact, models in the TM Series have *all* of the features customarily found in a standard metallurgical microscope including a vertical illuminating system with iris aperture diaphragm and a micrometer-screw fine focusing adjustment. Consequently, maximum power is not limited to 400X and higher magnifications, up to 2000X, may be obtained with any TM model using accessory optics.

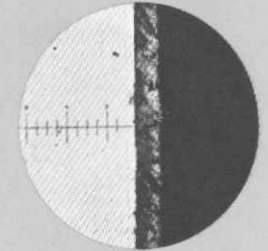
These higher powers are valuable for checking the microstructure of metals before fabrication to avoid costly waste. Grain size evaluation by ASTM Standards is easy with the aid of the accessory Austenite Grain Size Reticle which superimposes a series of grain charts on the specimen image. Measurement of the thickness of plating and anodic films can be made with great accuracy using the accessory Widefield Filar Micrometer Eyepiece. Here, the micrometer drum of the filar is turned to move a reference line across the field of view. The measured travel across the specimen depends on the power of the objective: for example, with the standard 40X objective, each drum division is 25 millionths of an inch and with the accessory 100X objective, 10 millionths. A special monocular tube is used in conjunction with the filar to maintain the optical path length and insure correct magnification.

Many of the tests made with metals find analogous applications in studies of ceramics, crystal structure, etc. Models in the TM Series are routinely used to measure the depth of diffused layers in semiconductor materials and the depth and alignment of etched areas on silicon wafers. Checking of surface finish for all types of materials is facilitated by the wide variety of illuminating systems. The oblique, darkfield illumination provided by the spotlight illuminator is useful in exposing irregularities using the 3X, 5X and 10X objectives.

All specifications subject to change without prior notice.



Metal microstructure at high magnification.



Measuring plating thickness with the filar eyepiece.



Oblique illumination highlights surface finish.

Using UNITRON Model TM for PROJECTION and COMPARISON

Using the accessory screen, it takes but a minute to convert the microscope into an optical projector. Screen viewing is valuable for group examination, quantity inspection of parts, and optical comparison.

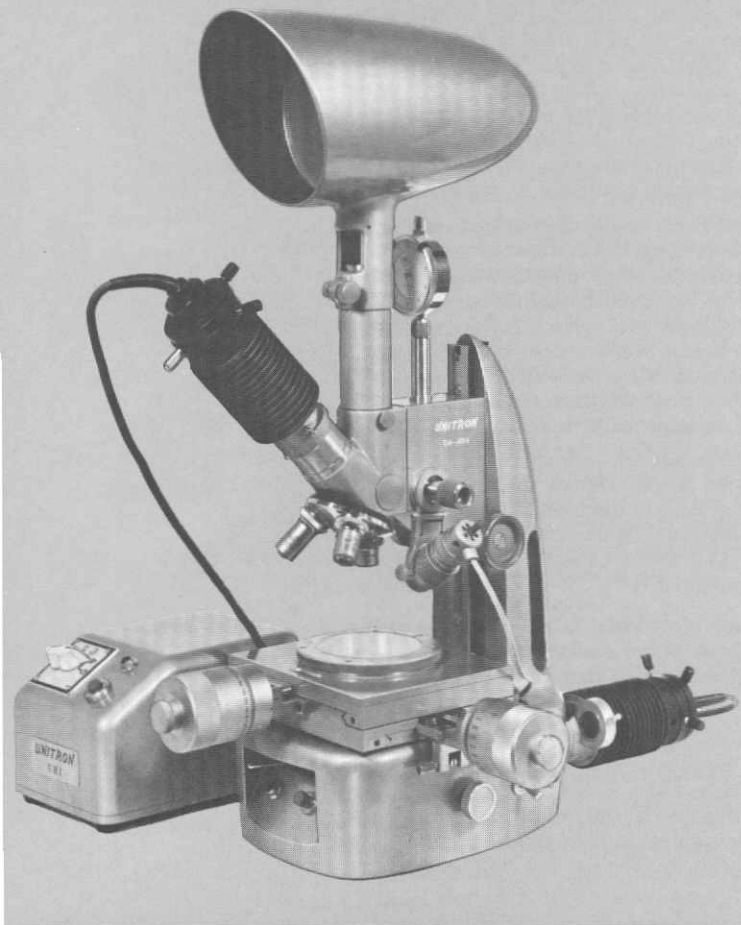
Tracings can be inserted between the layers of the glass screen to serve as a standard against which production pieces can be compared. Outlines may be drawn directly on the ground glass. In addition, eyepiece reticle patterns (crossline, screw thread, circles, grain size scales, etc.) appear on the screen and are in simultaneous focus with the specimen image. Polished metal samples may be projected at magnifications up to 1000X, the same as in large metallographs.

The screen must be used in conjunction with the accessory High Intensity Illuminating System. The illuminator may be used to project profiles by substage lighting or surface details by vertical incident illumination. If two High Intensity Systems are used, both types of illumination may be used simultaneously.

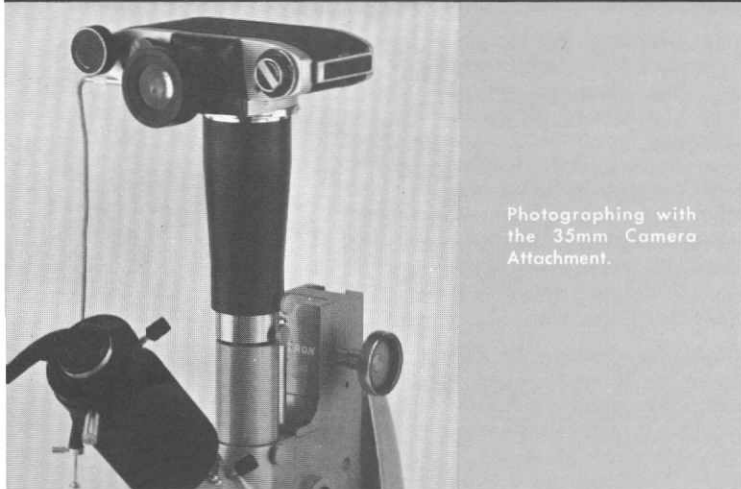
SPECIFICATIONS

PROJECTION SCREEN, Model TM-PR: Screen diameter, 4 $\frac{1}{4}$ ". Supplied with supporting collar and eyepiece holder, ready to attach to microscope stand. A tool to disassemble the glass for inserting tracings and a fitted wooden storage cabinet are included.

HIGH INTENSITY ILLUMINATING SYSTEM, Model TM-HI: For substage lighting, the lamphouse mounts in the rear of the base in place of the standard illuminator. For vertical illumination, the lamphouse attaches to the front of the stand, replacing the eyepiece tube. Equipment includes large, ventilated lamphouse with condenser system, focusable and centerable bulb holder, green and daylight-blue filters on swing-out mountings; adapters for vertical incident and substage illumination; heavy-duty transformer with 5-position intensity control, on-off switch, pilot light, 115 volt line and bulb cord; spare bulbs.



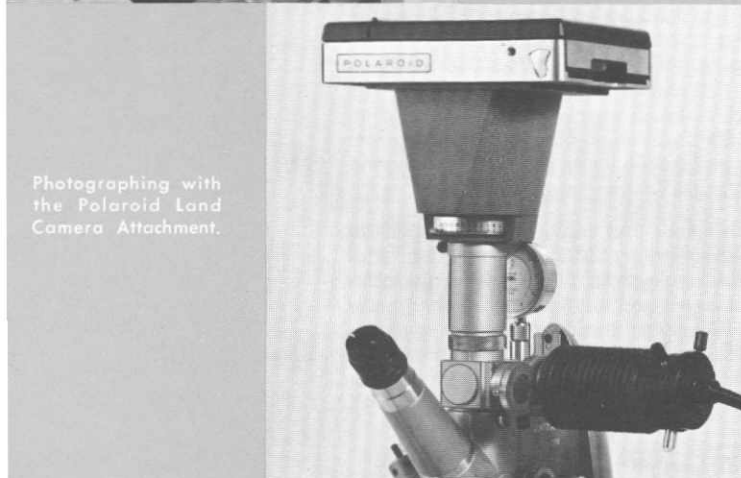
Making PHOTOMICROGRAPHS with UNITRON Model TM



Photographing with the 35mm Camera Attachment.

Many laboratories and shops routinely make photographic records. Photomicrographs are useful not only for illustrating technical reports, but also provide valuable and legal protection in the event of disputes involving the results of quality control tests. Contour outlines may be photographed by transmitted light using the standard substage illuminator. However, for opaque surfaces, the High Intensity Illuminating System (described above) is required.

35MM CAMERA ATTACHMENT: The 35mm camera attachment as illustrated, has been discontinued. A new design is pending and details will be made available as promptly as possible.

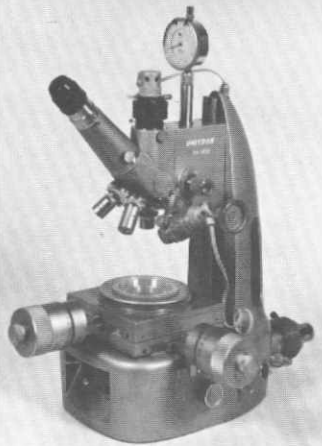


Photographing with the Polaroid Land Camera Attachment.

POLAROID ATTACHMENT, Model TM-POL: For "10 second" photography. Focusing and composing the photograph is done while observing the object through the microscope in the usual manner. A "finder" reticle placed in the microscope eyepiece outlines the area recorded. The optical system contains a "photo-printer" reticle which superimposes a micrometer scale on the finished print. Equipment includes Polaroid Land camera back using the new 3 $\frac{1}{4}$ " x 4 $\frac{1}{4}$ " film pack; compur-type shutter with speeds 1-1/200 sec., bulb, and time; cable release; built-in 10X photo-projection lens and "photo-printer" reticle; "finder" reticle; camera coupling tube mechanism with integral plane glass reflector, condenser system, and provision for attaching the High Intensity illuminator to provide vertical illumination.

All specifications subject to change without prior notice.

SPECIFICATIONS and PRICE LIST for UNITRON UNIVERSAL MEASURING MICROSCOPES



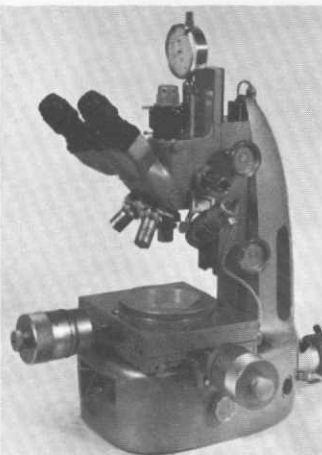
STANDARD MONOCULAR TMS



STANDARD BINOCULAR BTMS



DEPTHSCOPE MONOCULAR TMD



DEPTHSCOPE BINOCULAR BTMD

STAND—Base and column cast in one piece for maximum rigidity; provided with hand holds for portability. Coarse focusing mechanism with heavy-duty dovetail slideway, diagonal-cut rack and pinion gears, adjustable gib and locking lever, low positioned dual focusing control knobs with tension adjustable by counter-rotation. Fine focusing by precision micrometer-screw mechanism with dual controls. Dial gage for measuring depth over a 2mm range, reading direct in units of 0.0001".

STAGE—Combination rectangular and rotary stage. Linear motions by spring loaded, ball bearing mechanism with hardened and ground raceways. Large 45mm precision micrometer drums read directly in units of 0.0001" without the need for a vernier. Rotary stage graduated in degrees, reading to 5 min. by vernier through dustproof window. Removable glass stage insert plate interchangeable with accessory stage fixtures. Stage clamps and clips included. Stage drilled and tapped for accessory inclinable stage and workholder. Available with 4.7"x4.7" stage with 1"x1" travel or with 5"x6" stage with 1"x2" travel. The 1"x2" models have provision for inserting a gage block (not supplied).

ILLUMINATING SYSTEM—Vertical illuminator with coated plane glass reflector and path selector knob for projection screen, iris aperture diaphragm, removable green filter in holder, bulb centering mechanism. Substage illuminator with collimating condenser, green and daylight-blue filters on swing-out mountings, bulb centering mechanism. Oblique, spotlight-type surface illuminator, adjustable in direction and position, with removable green filter in holder. Two variable transformers built into microscope base with individual variable intensity controls. Individual outlets and switches for the illuminators, main-on-off switch, and pilot light. Line cord for 115 V. A.C. Provision for attaching a second oblique illuminator for duo-color lighting, and the high-intensity vertical and substage illuminators for screen projection and photography.

OPTICS—Three coated achromatic objectives: Measuring 3X, Metallurgical M10X (N.A. 0.30) and M40X (N.A. 0.65), with triple revolving nosepiece for convenient interchange NWF10X Widefield, High-Eyepoint, Measuring Eyepiece with reticle holder, provision for rapid change of reticles, helical focusing mount, coated lenses and removable eyecaps. Crossline reticle with 90°, 60°, 30° angles.



FOR MONOCULAR MODELS ONLY—Inclined monocular body. Interchangeable with accessory binocular body, special filar eyepiece tube, and other accessories. Eyepiece holder divisible to accommodate turret-type eyepieces.

FOR BINOCULAR MODELS ONLY—Inclined binocular body, unit magnification, with coated prism system, interpupillary distance adjustment, diopter sleeve. Supplied with paired eyepieces, one containing the crossline reticle. Eyepiece scales maintain their orientation even when the interpupillary distance is altered to accommodate different users. The monocular body (described above) is included with binocular models as standard equipment.

STANDARD SERIES

- Model TMS(1x1): Basic Specifications, with monocular body and 1"x1" stage travel.
- Model TMS(1x2): Basic Specifications, with monocular body and 1"x2" stage travel.
- Model BTMS(1x1): Basic Specifications, with binocular body and 1"x1" stage travel.
- Model BTMS(1x2): Basic Specifications, with binocular body and 1"x2" stage travel.

DEPTHSCOPE SERIES

DEPTHSCOPE SPECIFICATIONS: All features of the Standard Series (including the dial gage system) and *in addition:* optical depth reading system allowing depth measurements over a 2" range, calibrated in units of 0.0002", with readings made directly through the eyepiece; two-track focusing slideway with a supplementary focusing control permitting examination of objects up to 7" tall.

- Model TMD(1x1): Depthscope Specifications, with monocular body and 1"x1" travel.
- Model TMD(1x2): Depthscope Specifications, with monocular body and 1"x2" stage travel.
- Model BTMD(1x1): Depthscope Specifications, with binocular body and 1"x1" stage travel.
- Model BTMD(1x2): Depthscope Specifications, with binocular body and 1"x2" stage travel.

MODELS WITH METRIC CALIBRATION

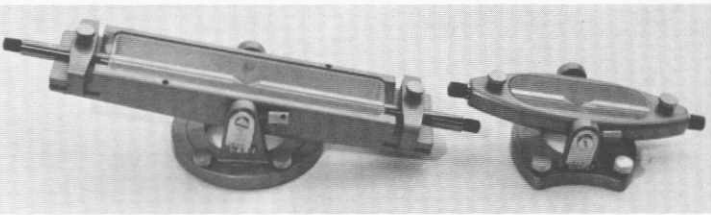
Both the Standard and Depthscope Series TM Microscopes are also offered with metric calibration. In these cases the dial depth indicator is calibrated in 0.002mm (2 micron) divisions. Micrometer drums are offered reading in either 0.005mm (5 microns) or 0.001mm (1 micron) divisions. Refer to price list.

DIGITAL READOUT SYSTEMS

Digital Readout Systems for X-Y linear, and depth measurements, are offered as optional accessories. They attach easily to TM Microscopes in place of the usual micrometer drums and depth dial indicator. The accessories include easy to read digital displays calibrated to 0.0001" (or 0.001mm and 0.0001"). See separate literature.

All specifications subject to change without prior notice.

INCLINABLE STAGES AND WORKHOLDERS

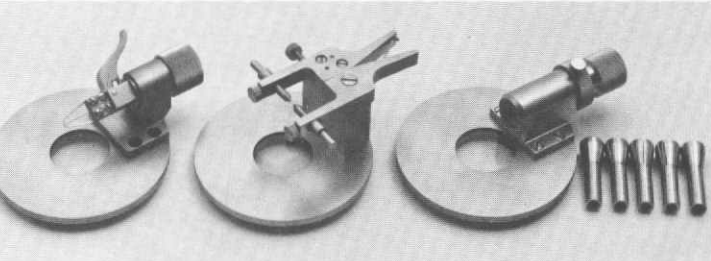


Easily installed on the rotatable stage of the microscope by tightening two thumbscrews. The cradle inclines $\pm 15^\circ$ and is provided with a scale graduated in degrees as well as a locking device. When used as an inclinable stage for measuring diagonal-cut gears, etc., a glass insert plate is placed on top of the cradle. Holes accommodate the standard clamps for holding the workpiece firmly. Taps, threads, and tools are inserted between adjustable centers for inspection and gaging. Openings in the base of the support plate allow the use of transmitted as well as surface illumination. Two models are available—either type may be used with the 1"x1" or 1"x2" stage.

MEDIUM INCLINABLE STAGE AND WORKHOLDER, MODEL TM-IS: Maximum stage area, approx. 3.5"x1.3". Maximum distance between centers, 3". Max. diam. accommodated by centers, 1.2"

LARGE INCLINABLE STAGE AND WORKHOLDER, MODEL TM-ILS: Maximum stage area, approx. 7"x1.8". Maximum distance between centers, 6.5". Max. diam. accommodated by centers, 1.4".....

STAGE INSERT FIXTURES



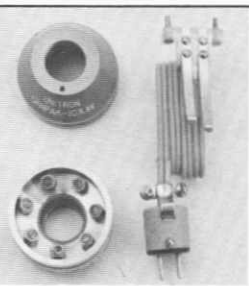
These handy holding devices facilitate the inspection and measurement of small parts. The fixtures fit into the circular recess of the rotary stage, replacing the glass stage plate. Openings in the base allow the use of substage as well as surface illumination. The basic design facilitates special modifications. Adapter TM-SA is needed.

CLAMPING JAWS, MODEL TM-CJ: with lever opening 0.2", rotatable jaws with clickstop at 90° positions.....

CENTER HOLDER, MODEL TM-CH: with pinch-type opening mechanism, adjustable centers with max. opening 0.8"....

COLLET CHUCK, MODEL TM-CC: with rotatable holder, 5 collets to accommodate diameters of 0.02" to 0.06".....

Adapter for Stage, Model TM-SA: (only one required)



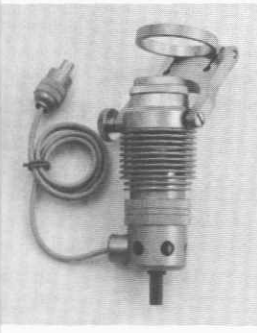
UNIPAK RING ILLUMINATORS

Omni-directional oblique illumination with the 3X, 5X (accessory) and 10X objectives may be obtained using these convenient ring illuminators which attach directly to the objective lenses. Especially effective for samples which are not highly reflective and for objects in which there are adjacent areas composed of different materials (as in printed circuitry). The illuminator contains seven miniature bulbs, the light from which is concentrated by an internal reflector at the focus point of the objective.

Electrical contact to all UNIPAKS is made by a single brush-contact strip which plugs into the microscope body directly behind the nosepiece. The nosepiece can be revolved freely without interference by dangling wires; each UNIPAK will illuminate automatically as soon as the respective objective is moved into the optical axis. The complete UNIPAK Illuminating System includes ring illuminator with seven bulbs installed; spare bulbs and installation wrench; plexiglass contact strip with bulb cord to plug into microscope.

- MODEL UN3C:** UNIPAK for 3X objective, with contact strip....
- MODEL UN10C:** UNIPAK for 5X, 10X objectives, with contact strip
- MODEL UN3:** UNIPAK for 3X objective, without contact strip..
- MODEL UN10:** UNIPAK for 5X, 10X objectives, without strip...

SUPPLEMENTARY OBLIQUE ILLUMINATOR



A single oblique illuminator with a green filter is included as standard equipment. By using a second oblique illuminator with a red filter on the opposite side, contrasting "duo-color" illumination is obtained. Not only is the total light intensity doubled, but surface relief is highlighted with "hills and valleys," punch and scribe marks, etc., seen more easily. Since the intensity of each spotlight illuminator can be individually controlled, any desired balance between the two colors can be obtained. Equipment includes Spotlight Illuminator with removable red filter, bulb cord, bulbs, hinged mounting bracket to attach to microscope.

SUPPLEMENTARY OBLIQUE ILLUMINATOR, MODEL TM-OL

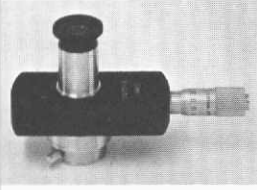
PROTRACTOR OCULARS



For convenient and accurate measurement of angles. The stage motions are available to bring the angle to the center of the field of view. A knurled collar rotates a movable reference line with respect to a fixed line and the resulting angle is read from a scale visible through the 10 power eyepiece. A focusing collar allows adjustment for individual vision. Full 360° range. Humidifier-type protective case.

PROTRACTOR EYEPIECE, MODEL PTV: calibrated in degrees, reads to 5 minutes by vernier.....

WIDEFIELD FILAR MICROMETER EYEPIECE

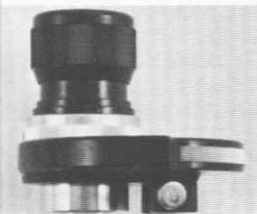


Gives a field of view about one third larger than standard filars, with comfortably-high eye relief. Drum graduations 0.001", with vernier reading to 0.0001". Total travel is 0.5". Eyepiece magnification is 10X. A focusing collar allows adjustment for individual vision. Must be used with Model TM-FT Filar Tube.

WIDEFIELD FILAR MICROMETER, MODEL FWE

FILAR EYEPIECE TUBE, MODEL TM-FT.....

TURRET SCREW THREAD OCULAR



For rapid checking and gaging of screw threads. Any thread pattern can be brought to the center of the visual field by rotating the selector disc. Focusable eyelens insures sharp images for each user. A fixed angular scale graduated $\pm 6^\circ$ for estimating thread drunkenness and a micrometer scale are also included. Presently available only in American National System, 80-9 threads per inch (has sizes 12, 11½, 11, 10, 9 not included in TIES reticle).

MODEL TM-TAN: American National Turret Ocular.....

SCREW THREAD and RADIUS RETICLES

- T1ES:** American National, 80-13 threads per inch
- T2ES:** Unified, 28-12 threads per inch
- T3ES:** Whitworth, 20-10 threads per inch
- T4MS:** Metric Fine, pitch 0.075mm thru 0.225mm
- T5MS:** Metric, pitch 0.2mm thru 2.0mm
- R1ES:** Circles, radii 0.01" thru 0.020" in 0.001" steps
- R2ES:** Arcs, radii 0.020" thru 0.100" in 0.002" steps
- R3MS:** Circles, radii 0.02mm thru 0.5mm in 0.02mm steps
- R4MS:** Arcs, radii 0.5mm thru 2.0mm in 0.05mm steps

Each: (Specify type when ordering).....

ACCESSORY OBJECTIVES and EYEPIECES

- M5X OBJECTIVE:** (50X with NWF10X eyepiece)
- M20X OBJECTIVE:** (200X with NWF10X eyepiece)
- MPL80X:**, Dry: (800X with NWF10X eyepiece)
- M100 OBJECTIVE, oil Immersion:** (1000X with NWF10X eyepiece)
- PlanM100X OBJECTIVE, Dry:** (1000X with NWF10X eyepiece)
- WF20XR EYEPIECE:** with focusable eyelens and reticle cell

All specifications subject to change without prior notice.

TM 05817.5