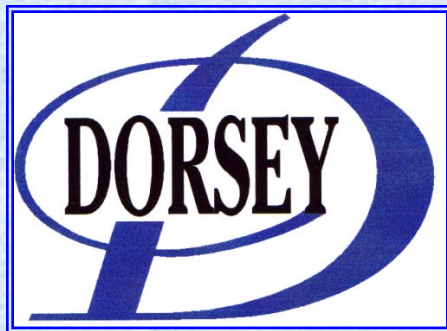




BENCHMARK 14HE/14H OPERATORS MANUAL



**Dorsey Metrology International
Optical Metrology Division**

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1.0 INTRODUCTION

The Benchmark 14HE Optical Projector is a compact bench mounted unit with a horizontal lens axis and a single mirror optical system,

The unit is designed to give the maximum possible screen size and work stage capacity while retaining good operator access to the controls and screen area.

The projector has a choice of lens magnifications from 10X to 100X, with quick change bayonet type fittings.

Fiber optic surface illumination is available as optional equipment.

Please see our optical comparator sales catalog for further information on options or contact your local sales representative.

2.0 PACKING DETAILS

The projector is normally supplied on a pallet with foam packing protection, in a fiber board case.

For local deliveries the projector is sealed in plastic.

For deliveries overseas the projectors are sealed in plastic and packed with desiccant.

Please ensure all loose items of equipment are identified and fully unpacked before the packing material is discarded.

The projector must be lifted by the base. *Under no circumstances should the stage arm be used to lift or position the comparator. Serious damage to the X axis mechanism will result if this cover is mishandled.*

Please ensure all lifting equipment used has been certified to support a minimum of 250lbs/120Kg.

The work stage surface is covered with protective plastic and all unprotected surfaces are coated with a oil based rust preventative. This protection should be removed prior to use.

The projector stands on 4 leveling screws.

3.0 INSTALLATION

■ 3 . 1 Operating Conditions

This precision optical instrument is designed to work in a normal workshop environment but it is important to locate the unit as far as possible from sources of grinding grit, oil mist, and vibrations. Where possible locate the projector with the screen facing away from direct sunlight and overhead lighting.

This unit should be placed on a strong sturdy bench capable of securely supporting a minimum of **250lbs/120Kg.** with a point pressure capability minimum of 165psi. Dorsey Metrology International optionally supplies a cabinet/stand designed for this application. Contact Dorsey Metrology International or your local sales representative for information.

■ 3 . 2 Connecting Electrical Supply

The standard Benchmark 14HE is supplied to accept 110-120VAC, 50-60 Hz main power. It may also be configured to accept either 220-240VAC, 50-60HZ or 100VAC, 50-60Hz. Unless clearly labeled (next to the power input plug) this unit is configured for 110-120VAC,50-60Hz. Listed below are wire color codes

110-120 VAC system	Brown/Black	Hot	
		Blue/White	Neutral
		Green	Ground
220-240 VAC system	Brown/Black	Hot 1	
		Blue/White	Hot 2
		Green	Ground

Note this unit must be plugged into an outlet rated at a minimum of 15A and must not be operated without an adequate ground connection.

■

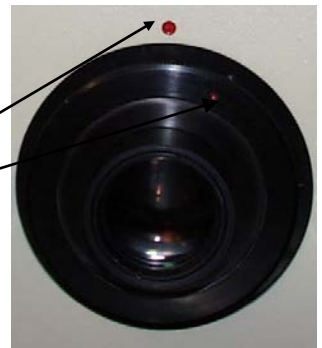
3. INSTALLATION

■ 3 . 3 FITTING PROJECTION LENSES

All lenses are supplied with quick change bayonet type mounts. To mount the lens, install lens in lens barrel and rotate lens clockwise until it clicks into place.

To install the lens: insert the lens with the red dots aligned, rotate the lens clockwise approximately 15 degrees to lock the lens in place

Locking
points



■ 3 . 4 Fitting work holding accessories

Work holding accessories available for the 14HE include combination centers and vees, rotary vice and a vertical glass plate work holder for the projection of small flat components.

All the accessories locate in the universal dove tail slot in the table and are angular clamped in place with clamping screws. This type of clamping accessory can be placed directly onto the table without having to thread locating nuts in from the end of the table.

Dorsey Metrology International is also able to offer advice and manufacturing facilities for special custom work-holding fixtures and or trace units. Contact us for details.

4.0 SAFETY

This equipment has been designed and manufactured so far as is reasonably practical to allow its safe operation when used in accordance with the following instructions.

The equipment must be used in position that does not constitute a hazard, where the operator and maintenance staff have free access to the control and maintenance of the equipment, and are not subject to any external hazards.

Services should be conducted by an authorized person, to approved safety standards.

The electrical supply should be taken from a correctly rated source.

WARNING The equipment MUST NOT be operated without a secure earth terminal connection.

Before connecting to a mains supply or attempting to use the equipment all packaging must be removed including the transportation strap. Do not connect or attempt to use any equipment showing obvious signs of damage or deterioration and take extra care when switching on for the first time.

A responsible person should examine the equipment for operator safety and determine the training requirement by the operator for its safe and correct use.

5.0 OPERATING

■ 5 . 1 Switching On

Ensure that the projector is connected to the power source as detailed in 3 .2.

The projector lamps are controlled by rocker switches on the lower right hand side of the lamphousing. Separate switches control the profile and surface illumination lamps. The profile lamp uses a 2 position switch: down is low intensity, while up is high intensity.

NOTE: If equipped, Please refer to the separate operating instruction manual for the various digital readout units available.

■ 5 . 2 Pre-Run Checks

Ensure that the projector is secure on its stand or on a substantial bench. Having selected a lens of the required magnification and locked it securely in position, locate the component to be inspected in a suitable work holding fixture which must be securely clamped to the table, the projector is now ready for use, proceed as follows:

■ 5 . 3 Focusing

Focus is achieved by rotating the small hand wheel on the right hand side of the stage knee. The lens focal plane is approximately mid-way along the focus traverse, central to the dovetail slot in the table.

■ 5 . 4 Profile Projection Intensity

There are two profile light intensity levels, high or low, selected from the rocker switch on the panel below the screen. Select the level that gives the most comfortable viewing, according to the object projected and the external lighting conditions prevailing.

Profile lighting is provided by a 24V 150W tungsten halogen lamp.

An iris diaphragm and or green filter is available as an optional extra which may be fitted direct onto the lamp house to reduce the level of reflection from brightly polished surfaces e.g. ground threads, etc.

5. OPERATING

■ 5 . 5 Surface Illumination

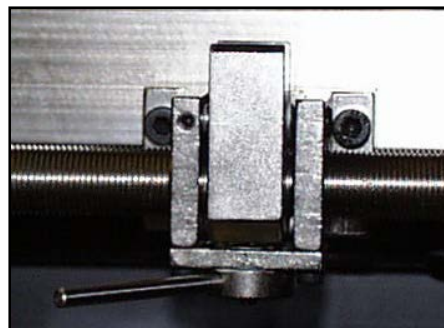
Illumination of surface features on solid objects is achieved through the use of high intensity LED optics.

For the brightest reflected image, place the light source as close as possible to the face of the component to be inspected. Where components have a directional surface finish, e.g. ground faces, the surface texture should be placed at right angles to the table, this will give the brightest reflected image on the screen.

■ 5 . 6 Manual Table Adjustment

The X axis of the stage has a quick release for coarse motion. This feature should not be used to move the stage during a measuring routine. Also, when the quick release is engaged, the control knob of the X axis is disabled.

To engage the quick release, rotate the lever to the furthest position to the right. To re-engage the control knob rotate the lever to the furthest left position. (see the picture below)



ON ← → OFF

5. OPERATING

- **5 . 7 Vertical Stage Adjustment**

Vertical adjustment of the work stage is by means of the large hand wheel on the left below the work stage knee.

- **5 . 8 Screen Angular Measurement**

The venire protractor screen, consists of a frosted glass screen divided into four equal quadrants by precision cross lines. The screen is rotated by means of a small hand wheel on the right of the screen. The standard venire protractor can then be used to determine angles with 1 minute resolution.

6.0 MAINTENANCE

■ 6 . 1 Cleaning the screen lenses and mirror

Lenses: Any accumulated dust must be removed from the surface of the lenses with a photographic lens brush.

The surface of the inner lens (projection or condenser) must not be touched. The element of the projection lens facing the mirror is most critical in this respect. A single finger mark on this surface will noticeably degrade the quality of the projected image. It should be noted that the projection lens element facing the work piece is far less critical in this respect.

Any grease or finger marks may be removed with a new photographic cleaning tissue. If necessary, the tissue may be moistened with methanol or lens cleaning fluid to assist cleaning.

Mirrors: Access to the mirrors is gained by removing the screen.

To remove grease or finger marks from the mirror surfaces use a surgical cotton wool swab soaked with methanol. Apply the swab very lightly to the mirror surface finally giving a light polish with another clean dry swab. **DO NOT USE FORCE.** All mirror surfaces should be cleaned as **INFREQUENTLY** as possible.

WARNING! - Never use polishes, window cleaning aerosols or liquids when cleaning the mirrors or lenses.

Screens:

All screens are made out of ground glass with printed cross lines. The cross lines can be removed if the screen is not cleaned properly. We recommend that the screens be cleaned only with soap (a mild non-lotion dishwashing solution) and plenty of water. Use a lint free soft cotton cloth to gently clean. Let the screen air dry.

6. MAINTENANCE

■ 6 . 2 Lamp Replacement and Adjustment

WARNING! This must be done with the power switched off.

PROFILE

To change the lamp first flip open the lamp house cover. Remove the bulb by grasping and pulling the bulb directly up. Remove the new replacement bulb from its box, and slide the new bulb in place.

Switch main power on remove the objective lens, and set lamp intensity to low. Verify that the lamp filament projected on the screen is centered over the crosshairs. Re-seat lamp and or adjust holder if required.

If the glass lamp is accidentally marked, remove the marks immediately by swabbing with methanol. The lamp operates at a high temperature and any finger marks will be “fired” into the surface of the quartz reducing the output and life of the lamp.

The lamp operates at a high temperature and any finger marks will be “fired” into the surface of the quartz reducing the output and life of the lamp.

6. MAINTENANCE

■ 6 . 3 Fuse Replacement

The main fuse on the 14HE is located in the power input module. All other fuses are located inside the case and are accessible by removing the rear panel

■ 6 . 4 Accuracy Checking

Magnification Accuracy

NOTE: It must be stressed that the following is not part of the routine installation and servicing procedure.

This inspection instrument is designed to project an image within +/- .10% on profile and +/- .15% on surface illumination over the entire screen. Prior to shipment the unit is calibrated and certified to be well within this specification. If image accuracy of this magnitude is required on a daily basis by you, the customer, then an established calibration interval must be determined to meet your requirements.

Although the generally accepted calibration interval for this type of optical inspection equipment is 1 year; factors such as frequency of use, environment and duty may affect the ability of any instrument to remain in calibration. Calibration intervals must be adjusted up or down to compensate for these factors. If only one lens shows a magnification or distortion error, it is possible that adjustment is required to only the lens. Simply loosen the lens retaining ring and adjust the lens as required.

If magnification is not uniform over the entire screen then mirror adjustment will be required. Consult a qualified/certified individual or organization to perform this task. It is considered to be out of the scope of the average user to maintain the proper calibration equipment and training required to accurately calibrate an optical instrument. Dorsey Metrology International OMD provides this service and also training classes on calibration. Consult us for details.

6. MAINTENANCE

■ 6 . 4 Accuracy Checking (continued)

Readout Accuracy

The accuracy of your digital readout system is dependent on many items. Factors such as stage accuracy and condition, scale accuracy and condition and method of inspection will determine the outcome of any accuracy test. Although this is an operations manual and is not intended to serve as a calibration manual; we have outlined the basics of inspection and compensation below.

Inspect condition of system and repair/ replace as required.

Test mechanical repeatability and geometry of stage adjust as required

Test repeatability of scale-DRO, adjust, replace or return to step 2.

Inspect accuracy of reading using a certified standard of known dimension

If reading is within specifications the procedure is complete.

If reading is not within specifications, remove all compensation and re-inspect. Compensate as required per instructions with your separate digital readout manual.

■ 6 . 5 Lubrication

All bearings in the unit are pre-lubricated and should not require additional lubricant during the life of the equipment.

A small amount of heavy lithium grease should be applied to the vertical elevating screw and to the lead screw nut assembly under the work stage at yearly intervals. This screw assembly is accessed by pulling down the velcro retaining the bellows assembly.

7.0 TECHNICAL SPECIFICATIONS

Illumination: Built-in 24 volt/150 watt profile and optional LED surface illumination

Screen: 14 inch diameter Ground Glass with etched cross-line, 1 minute 1/100 degree rotary protractor

Stage motion: X axis = 8 inches
Y axis = 4 inches
focus = 1 inches

Linear Scales Resolution: .5 micron/0.0005"

Accuracy: $\pm .004\text{mm} + [(L/20).001]$

Repeatability: ± 2 Scale Count

Dimensions: 40"(L) x 19"(W) x 42"(H)

Weight: 250 lb.

Power Supply 110v or 220 v 50/60 Hz

(required input): AC 110 volt/60 Hz (220V 50Hz)

Accessories included with Benchmark 14HE: Line Power Cord, and Condenser

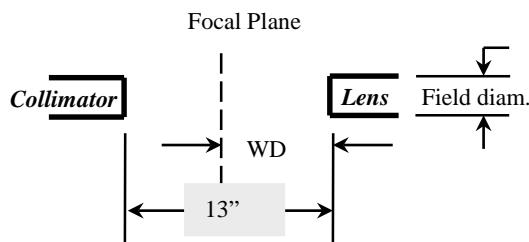
Available accessories: Projection Lenses, Green Filter, Iris Diaphragm, Fixtures

Magnification accuracy: contour = $\pm 0.10\%$, surface = $\pm 0.15\%$

14" Lens Specifications

Projection Lens	Working Distance Max.	Field Work piece	Diameter
5x	5.43"	10"	4.17
10x	3.15	6	2.28
20x	3.23	6	1.57
25x	2.76	5.5	1.57
31.25x	2.20	4.41	1.38
50x	2.09	4	1.12
100x	1.69	3.25	1.12

Optical System Diagram



8.0 System Configuration Checklist

MODEL: _____ Serial No. _____ Dorsey Work Order Number: _____

When unpacking your instrument, insure all items have been included in this shipment. Back ordered items will be noted on the packing slip attached to the shipping container.

STANDARD ACCESSORIES

- ___ Rotary Protractor
- ___ Screen
- ___ Screen Chart Clips (Quantity 4)
- ___ Printed Manual
- ___ Certificates
- ___ Standard lens choice
- ___ Leveling legs

OPTIONAL ITEMS

- ___ Digital Readout type: _____ Serial # _____
- ___ Scale resolution _____
Serial # X _____ Serial # Y _____
- ___ Digital Readout manual
- ___ Digital Readout plug
- ___ Digital readout arm
- ___ Digital readout tray
- ___ Lenses: 10X____ 20X____ 50X____ 100X____
- ___ Condensers: 10x 20X, 25x -51mm
- ___ Condenser for 50X,100X - 38mm
- ___ Green Filter
- ___ Iris
- ___ Surface bulb quantity
- ___ Profile bulb quantity
- ___ Cabinet stand
- ___ Tooling #1 _____
- ___ Tooling #2 _____
- ___ Tooling #3 _____
- ___ Tooling #4 _____

Other Accessories:

- ___ Joystick (Larger models only) Serial # _____
- ___ Motor controller (Larger models only) Serial # _____
- ___ PC (QC4000 series only) Serial # _____
- ___ Monitor (QC4000 series only) Serial # _____
- ___ _____
- ___ _____
- ___ _____

Final Inspection By: _____

UNPACKING & INSTALLATION INSTRUCTIONS

Benchmark 14HE

Please follow the instructions listed below to properly unpack and install your optical comparator. If shipping damage becomes evident or questions arise during installation please call **Dorsey Metrology International at 1-800-549-4243** for immediate assistance.

- 1) Inspect crate for evidence of shipping damage. If evidence is apparent immediately annotate damage on the receiving documentation and notify Dorsey Metrology International at the number listed above.
- 2) Remove banding material and protective cardboard carton.
- 3) Remove plastic moisture barrier and again inspect for shipping damage.
- 4) Inspect contents of container/s and verify contents against order.
- 5) Remove Lid of cardboard box.
- 6) Loosen rest feet and either remove or swing mounting plates under machine body.
Note : mounting plates are retained by rest/leveling feet-do not discard leveling bolts after removing mounting plates.
**** Warning - removing the mounting plates requires the machine to be lifted or tilted back. This is a 2 person operation. Please exercise caution when performing this task.**
- 7) Place comparator on sturdy table. Table should be approximately 27"-29" high and be capable of securely withstanding a combined load of 450 lbs.. with 4 point pressure capability of approximately 200PSI.
- 8) Remove shipping block located under stage knee bracket. Remove pressure on block by rotating Y axis handle. Install bellows using attached velcro.
- 9) Attach DRO mounting arm to lower right side of comparator base using 4 button head screws provided.
- 10) Attach DRO tray or DRO using 4 bolts provided.
- 11) Connect scale cables.
- 12) Remove shipping locks from X and focus axes.
- 13) Connect power to comparator and DRO.
- 14) Turn DRO on and move stage to verify scale connections on proper axis.
- 15) Turn on main comparator power and then switch profile illumination to high.
- 16) Place object on stage and verify focus while moving X axis left to right. Adjust stage mounting/helix bracket to center focal travel. Indicate to lens mount if required. Tighten stage mount after adjusting.
- 17) Verify screen magnification, adjust as required.
- 18) Verify DRO compensation, adjust as required.

Limited Warranty Policy

Thank you for the purchase of a Dorsey Metrology International, OMD product. So that you receive a full 2 year limited warranty on your system, please read and return the Registration/RMA form immediately upon receipt. You are entitled to a full 2 year limited warranty beginning from the date of receipt of your system. If we do not receive this form within 30 days of shipment, the warranty period begins from the date of shipment from Dorsey Metrology International.

A. Dorsey Metrology International will include, with this system, a limited warranty to the end user. The limited warranty will be that the system and accessories (except those specified below) will be free from defects in material and workmanship for a period of two (2) years from the date you receive your system or as otherwise agreed in writing. Please take the time to properly fill out the warranty card and return it to Dorsey Metrology International

B. This limited warranty will cover all parts, except lamps, electrical components, readouts, scales, calibration, magnification and other consumable items. It will apply only to instruments and accessories which have been installed and operated in accordance with the instructions in Dorsey Metrology International Inc.'s reference manuals. Items which have not been tampered with or modified in any way, misused, damaged through accident, neglect or conditions beyond Dorsey Metrology International's control, and have been serviced only by authorized Dorsey Metrology International service personnel. *Please note that although readouts and electrical components are exempt from this warranty they may be covered by a specific manufacturer 1 year limited warranty. Dorsey Metrology International will coordinate claims on behalf of the customer to resolve any problems that may occur.*

C. We will replace or repair, at our option, free of charge, any part or parts which upon examination we find defective in workmanship or material, provided that, on our request, the product or parts thereof are returned to our plant, postage prepaid, along with satisfactory documentation that the product has been installed, used, and maintained in accordance with the instructions in the product manual and has not been subject to any misuse or abuse.

D. Responsibility for loss in operating performance due to environmental conditions, such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage or other conditions beyond Dorsey Metrology International's control, will not be accepted under this warranty.

E. The Dorsey Metrology International reserves the right to modify its user limited warranty, discontinue the manufacture and sale of any Dorsey Metrology International Product, or to make any change in the design or construction of any such products without any obligation or liability whatsoever to the dealer or end user.

F. There are no other warranties, either expressed or implied, and Dorsey Metrology International shall not be liable under any circumstances for consequential damage.

Limited Warranty Policy

REGISTRATION / RMA FORM

To obtain service, the purchaser must first contact Dorsey Metrology International via phone or fax who will at their discretion determine which of two procedures must be followed.

RMA Procedure

Return this Dorsey Metrology International product to the Technical Support Department of Dorsey Metrology International, located at 53 Oakley Street, Poughkeepsie, NY 12601 and the following procedure must be followed:

Procedure For Returning Merchandise

The product must be returned through an authorized Dorsey Metrology International Dealer. The customer must contact the Dorsey Metrology International Dealer who the product was purchased from to receive a Return Materials Authorization (RMA) number. The RMA number must be clearly marked on the outside of the shipping container.

The customer must provide a concise description of the problem and the circumstances under which it exists.

The customer must prepay all postage, insurance and delivery fees to Dorsey Metrology International.

Goods received without a valid RMA number will not be accepted from the carrier and will be returned freight collect to the sender. Freight for the return of all repaired goods is not under warranty and will be the responsibility of the customer.

REGISTRATION / RMA FORM (please circle one):

Please fill out form completely and return via mail or fax to (845) 454-3888.

Model Number: _____ Serial Number: _____

Date of shipment: _____ Date of receipt: _____

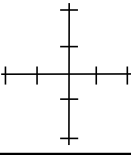
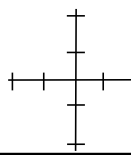
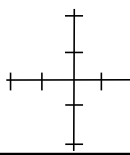
Customer Name and Address: _____ RMA#(REQUIRED): _____

Customer Telephone # (end user) :: _____

Date Installed: _____ Installed by: _____

Installer Telephone #: _____

Certificate of Calibration

Customer Name:								Date:								
Instrument Model:								Serial No:								
1.	Total magnification accuracy with Contour Illuminator (units in inches)														±0.1%	
10X					20X					50X						
SERIAL#				SERIAL #				SERIAL #								
X scale Model # and Serial#																
Y scale Model # and Serial#																
2.	Digital Readout Model# and Serial#															
3.	Squareness of X axis and Y axis Spec: 100µin. / 1in.													µin.		
3.A	Squareness of Y to focus plane Spec: 500µin./1 in													µin.		
4.	X axis stage linear traveling accuracy Spec: ±(150+L / .02) µin													µin.		
Displacement	0 _{in.}	1 _{in.}	2 _{in.}	3 _{in.}	4 _{in.}	5 _{in.}	6 _{in.}	7 _{in.}	8 _{in.}	9 _{in.}	10 _{in.}	11 _{in.}	12 _{in.}	13 _{in.}	14 _{in.}	15 _{in.}
Δ Nominal																
	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.
Displacement	16 _{in.}	17 _{in.}	18 _{in.}	19 _{in.}	20 _{in.}	21 _{in.}	22 _{in.}	23 _{in.}	24 _{in.}	25 _{in.}	26 _{in.}	27 _{in.}	28 _{in.}	29 _{in.}	30 _{in.}	31 _{in.}
Δ Nominal																
	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.
Remarks:																
5.	Y Axis stage linear traveling accuracy													+/- (150+L / .02) µin		
Displacement	0 _{in.}	1 _{in.}	2 _{in.}	3 _{in.}	4 _{in.}	5 _{in.}	6 _{in.}	7 _{in.}	8 _{in.}	9 _{in.}	10 _{in.}	11 _{in.}	12 _{in.}	13 _{in.}	14 _{in.}	15 _{in.}
Δ Nominal																
	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.	µin.
Remarks:																
6.	ERP calibration counts															
6.a.	ERP Repeatability													±0.5°		

OVERALL UNCERTAINTY +/- 2 SCALE COUNTS, +/- .002MM

The referenced optical comparator was calibrated using standards that are certified by, or traceable to, the National Institute of Standards and Technology per ANSI – Z540-1
 Standard Due Date _____ Standard Serial #137 _____ NIST Traceability #: 821/25351594__

INSPECTOR: _____ DATE: _____