BENCHMARK 16H
OWNERS MANUAL

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CONTENTS

Manual valid from S/N 0205/845 forward

	Section No..
Introduction	1 . 0
Location	1 . 1
Operating Conditions	1 . 2
Electrical supply Information	1 . 3
Un-Packing Instructions	1 . 4
Machine Installation and Setup	2 . 0
Heidenhain Setup Instructions	2 . 1
Metlogix Setup Instructions	2 . 2
Installation and Setup Continued	2 . 3
Fitting Projection Lenses	2 . 4
Fitting Work holding Accessories	2 . 5
Fitting Work holding Accessories	2 . 4
Safety	3 . 0
Operating	4 . 0
Switching On	4 . 1
Pre Run Checks	4 . 2
Focusing	4 . 3
Profile Projection Intensity	4 . 4
Surface Illumination	4 . 5
Manual Table Adjustment	4 . 6
Helix Adjustment	4 . 7
Vertical Stage Adjustment	4 . 8
Angular Screen Measurement	4 . 9
Electronic Rotary Protractor	4 . 10
Additional Electrical Information	5 . 0
Connecting Electrical Supply	5 . 1

CONTENTS

Maintenance	6 . 0
Cleaning the lenses, screen and mirrors	6 . 1
Lamps replacement and adjustment	6 . 2
Fuse replacement	6 . 3
Magnification and Measuring Accuracy check	6 . 4
Readout Accuracy	6 . 5
Lubrication	6 . 6
Technical Specifications	7 . 0
Lens Specifications for 16” machines	7 . 1
Footprint	7 . 2
Wiring Diagram	7 . 3
System Configuration Checklist	8 . 0
Limited Warranty Policy	9 . 0
Registration / RMA Form	9 . 1

1.0 INTRODUCTION

The Benchmark 16H Optical Comparator is a compact bench mounted unit with a horizontal lens axis and a two mirror optical system, projecting the “industry standard” erect and reversed image on the screen.

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 viewing area.

The comparator in standard form includes a screen with cross lines, reticle marks (to easy verify magnification), protractor markings and rotary vernier scale. It is equipped with a quick change lens mount for lens magnifications from 10X to 100X, Note: 5X lens has special mounting

Bright 250 Watt duel fiber optic surface illumination is also standard equipment. Standard stage travel is 10” in the X Axis. With optional extended travel to 24”. Standard Y Axis travel is 6” with travel limited to 5” for the thicker extended X Axis travel stages. Focus travel is 2”.

Please visit “DorseyMetrology.com” to see our optical comparator sales catalog for further information on options. Or contact your local sales representative.

1.1 LOCATION

- **1 . 2 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 that could interfere with the screen image.

  This unit should be placed on a strong sturdy bench capable of securely supporting a minimum of 550lbs/250Kg. 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

- **1 . 3 Electrical Supply Information**
  The standard Benchmark 16H is supplied to accept 110-120VAC, 50-60 Hz main power. It may also be configured to accept either 220-240VAC, 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 10 A and must <u>not be operated without an adequate ground connection.</u>

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1.4 UNPACKING INSTRUCTIONS Benchmark 16H

Inspect for shipping damage

Please follow the instructions listed below to properly unpack 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 the cardboard outer box and pallet 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) **Important:** Your optical comparator packaging has been engineered to both preserve the machine from corrosion and protect it from damage during transportation. For this reason three of the four moving axes have been locked. They must not be unlocked until the machine is in its place of use on a workbench. Moving or tilting the machine with any of the three axes unlocked will cause damage to the machine. Please read the unpacking instructions **before removing the machine wrapping material.**

3) Remove the outer banding material and protective cardboard carton from the pallet.

3a) Do not unlock any of the tagged machine locks at this time. Do not cut the banding material located inside the plastic wrap. It is locking the Y Axis.

4) Remove the plastic moisture and corrosion barrier wrap. This material is treated with a metal corrosion inhibitor. Again inspect for obvious shipping damage. Immediately contact Dorsey Metrology if damage is present.

5) Any accessories or equipment is either under the plastic wrap or in the foam tray that the machine is sitting in. Remove all accessories and place aside. Use the packing list and the "system configuration checklist" to verify that you have all of the contents **prior to throwing away any packing material.**

Caution:

The comparator must be lifted by the base handles or base. *Under no circumstances should the stage or the lamphouse be used to lift **or position** the comparator. Serious damage to the stage or lamphouse will result if they are mishandled.*

6) **Warning! – placing the machine on a table or stand requires the machine to be Lifted from the foam shipping tray. This is a 4 (strong) person operation. Please exercise caution when performing this task. If lifting equipment is used. Please ensure it has been certified to support a minimum of 500lbs./227Kg.**

7) Place the comparator on a sturdy table. The table should be approximately 27"-29" high and be capable of securely withstanding a combined load of at least 550 lbs./250Kg. with 4 point pressure capability of approximately 165 PSI. **Proceed to "Installation and Setup"**

2.0 Machine Installation and Setup

Section One

1) Once the machine is in place on the workbench (See “Unpacking Instructions”) cut and remove the Y-Axis shipping lock. It is a strap wrapped around the machine preventing the **Y-Axis** from moving.

1a) Level the machine front to back and side to side, using a standard quality level placed on the stage. Be sure all four feet have pressure on them so the machine will not wobble when in use. To adjust the feet, Use a19MM open end wrench or large adjustable wrench to loosen the M12 lock nut if needed. Then use a M10 open end wrench (or small adjustable) and place it on the bottom of the foot near the pad. You will see a flat section for the wrench. Tighten or loosen as needed. When the machine is level lock the feet in position by tightening the M12 lock nuts.

2) Remove the small yellow **Focus axis** lock plate and two retaining screws. Then replace the screws with the two large flat head screws. They are provided in the packaging along with the X axis hand knob..

3) Remove the two **X axis** locks. They are <u>located under the stage</u> one on each end with a paper tag attached to each. Use a 10MM deep socket or a M10 wrench to break the nut loose, Then unscrew the set screw and remove it completely. **Caution:** Do not tighten the setscrew as this will lift the stage and can cause damage.

NOTE: <u>Do not</u> remove the M8 socket head cap screws from under the stage top section! (two in the front and two in the back.) **<u>They are not stage locks.</u>**

4) With the X axis locks removed and the leadscrew quick release lever to the right (dis engaged from the leadscrew). Push the stage top, gently to the left and then to the right to center the bearings along the travel. You will feel some resistance as the bearings are being pushed into the correct position for the first time. After that the stage will glide freely.

5) Center the stage and flip the quick release lever to the left to lock the leadscrew nut onto the threads of the leadscrew. Then install the X axis hand knob provided in the packing. To secure the knob in place, use a 2.5MM hex wrench to tighten the knob setscrews against the flats of the leadscrew end. Do not over tighten. **Note:** there are no hand knobs on motorized machines.

5a) If you have a motorized machine connect the joystick cable and place the joystick on the tray.

6) Depending on what type of readout you have purchased follow either the,

“Heidenhain Setup Instructions” 7 Thru 11

or the

“Metlogix M2 Setup Instructions” 12 Thru 14

Machine Installation and Setup

Section Two

2 .1 “Heidenhain Setup Instructions”

7) Attach the Digital Readout mounting arm to the right side of the comparator using four M4 socket head cap screws provided. 3MM hex wrench needed.

8) Mount the Digital Readout onto the DRO base using the four 10-32 X 3/8” socket head cap screws provided. Then attach the DRO base to the DRO arm.

9) Connect the scale cables (marked) to the proper connector of the readout. Then connect the fiber optic cables if equipped with edge detection.

10) Connect the special power cord to the comparator right side outlet then to the DRO.

11) Connect the power cord to the power module on the back of the comparator and then plug it into the correct power supply. **Please see the “Electrical Information” page for power requirements.** Turn on the comparator Main power switch (red) then turn on the DRO. Move each axis to verify the scale connectors are on the proper axes. **Proceed to Step 15.**

2 . 2 “Metlogix M2 Setup Instructions”

12) Remove the “All In One” computer from the box and clamp the ball on the back of the computer into the arm mounted on the side of the comparator. Adjust the monitor to the correct position. Then tighten the arm clamp to hold it in place.

13) Locate the small round computer power cable and the USB cable from the right side of the comparator and connect them to the back of the computer.

NOTE: The computer is a touch screen type. You do not need to connect the keyboard and mouse that are supplied with it. They can be connected at a later date for custom DRO settings or to use the computer for other than a DRO.

14) Connect the machine power cord from the power module on the back of the comparator to the power supply. **Please see the “Additional Electrical Information” page for power requirements.** Turn on the comparator Main power switch (red). Then turn on the computer and launch the M2 measurement software by double clicking on the M2 icon. The DRO screen will appear and you can move the X, Y , and Q (if equipped) Axes to test the function of the machine.

NOTE: When the M2 software is opened it looks for the control box containing the software license. The control box is located inside the comparator. Therefore the comparator power must be on **BEFORE** the M2 software is opened or you will see a red message stating that “M2 has lost communication with the box” (or other warning alerts) If this happens or the M2 readout software is not working properly. Close the M2 software, cycle the power for the comparator off for 10 seconds then switch the power back on. Re-launch the M2 software. If you are still having problems restart the computer. Then repeat the start up sequence. Machine power first then launch the M2 software. To avoid getting a error massage close the M2 software before shutting off the comparator. Other programs on the computer can be used regardless of machine power switch position. **Proceed to Step 15.**

2. Machine Installation and Setup

Section Three

2 . 3 Installation and Setup Continued

15) With the main (Red) power switch on and the cardboard cover removed from the lens opening, test the profile light switch by briefly switching to high and low. Center position is off.

CAUTION: without a lens in the machine the screen will be very bright. Do not look directly at the screen when testing the lamp on high. Test the surface lighting by switching the surface light on then off. It either light does not work properly please refer to the “Troubleshooting” section of this manual.

16) With the main power switch on and no lens in the machine switch the profile illumination to low. Note the position of the bulb element on the screen. It should be centered up and down and left and right. If it is out of position either reseat the bulb in the socket or adjust the socket position in the lamphouse using a 3MM hex wrench. **CAUTION:** The bulb is very hot.

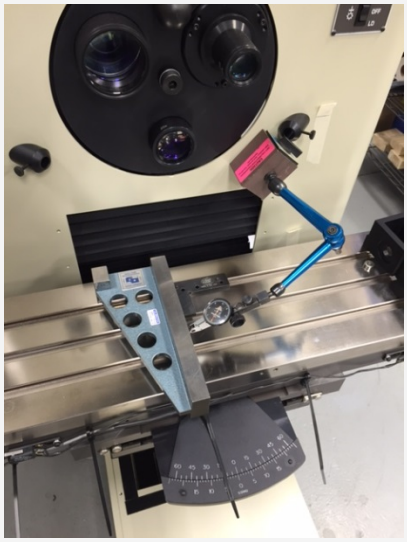
I7) Insert a lens into the lens opening with the red dot of the lens ring aligned with the red dot on the face of the machine. Then apply slight pressure uniformly around the lens ring while twisting to the right (clockwise). The lens will twist to the right and stop with the lens red dot slightly to the right at about the one O’clock position. To remove the lens turn left (counter clockwise) until the red dots are aligned then remove the lens.

18) If the stage was bumped during installation it could be skewed. Check the stage helix vernier (located under the X axis cover) it should indicate 0. If adjustment is needed. Loosen the two helix clamps under the stage and place a magnetic indicator on the stage. Indicate from one side of the lens ring to the other and twist the stage as needed. Lock the helix locks when done.

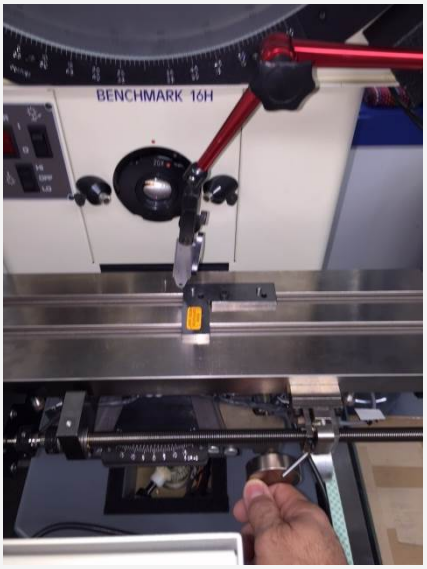
A more accurate alignment method would be to place a 3” to 4” square or straight edge on the stage perpendicular to one of the stage vees’ then place a magnetic .00005” indicator on the face of the machine. With the contact point of the indicator against the side of the square or straight edge. Move the focus forward and back while indicating along the side of the square or straight edge. With the two locks loose, twist the stage as needed to adjust. For best results obtain .00005” or better over the focal distance. Then tighten the stage locks. See “squaring the focus axis” Pictures on the following page.

2. Machine Installation and Setup

Section Four



Squaring the focus axis example one



Squaring the focus axis example two

19) Verify screen magnification, adjust as required. Qualified personnel only

20) Verify DRO error compensation, adjust as required. Qualified personnel only

21) Your comparator was fully inspected and calibrated to a high degree of accuracy before it left the factory. Please refer to the accompanying Calibration Certificate. To be sure there has been no changes due to shipping, setup or environment. A qualified service person should inspect the machine and issue a new certificate or validate the existing certificate.

2. Machine Installation and Setup

Section Five

- **2 . 4 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

- **2 . 5 Fitting work holding accessories**

  Work holding accessories available for the 16H include combination centers and vees, vertical glass plate work holder for the projection of small flat components, rotary vice, and a wide selection of other items.

  All of the accessories mount 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 slide locking 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 custom options. Please Contact us with your requirements.

3.0 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 a location 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 a qualified 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 power 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 person qualified for training should examine the equipment for operator safety and provide training as needed by the operator for its safe and correct use.

4.0 OPERATING

Section one

- **4 . 1 Switching On**
  Ensure that the projector is connected to the proper power supply. (Refer to the “Additional Electrical Information” page for help).
- The lamps are controlled by rocker switches located on the front panel of the comparator body. 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: Please refer to the separate operating instruction manual for the various digital readout units available.

- **4 . 2 Pre-Run Checks**

  Ensure that the comparator 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:
- **4 . 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.

- **4 . 4 Profile Projection Intensity**
  Profile lighting is provided by a 24V 150W tungsten halogen lamp.
  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.

  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.

4. OPERATING

Section two

- **4 . 5 Surface Illumination**
  Illumination of surface features on solid objects is achieved through the use of high intensity fiber optic light guides. These guides are adjustable and can be extended by pulling on the cable ends protruding from either side of the lens mount. They may be secured in place with the clamping screws on the side of each of the guide blocks.

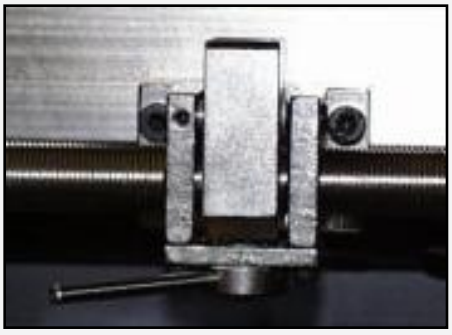
  For the brightest reflected image, place the light guides as close as possible to the face of the component to be inspected. Where components have a directional surface finish, e.g. ground faces, the surface texture should be placed at right angles to the table, this will give the brightest reflected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

  As the fiber optic cable is a “cold light” source, the heat radiated to the component under test is minimal.

- **4 . 6 Manual Table Adjustment “Quick Release”**
  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 in use, the control knob of the X axis is disabled.

  To use the quick release, rotate the lever to the furthest position to the right. To re-engage the control knob, first make sure the stage is not moving then rotate the lever to the furthest left position. (see the picture below)

NOTE: Motorized machines do not require a “Quick Release “ and can use the high speed joystick setting for quick traverse and part positioning.



Engaged on threads, for measuring

Not engaged on threads, for fast positioning.

4. OPERATING

Section three

- **4 . 7 Stage Helix Adjustment**
  The top of the focus slide has a stage helix adjustment, which allows the stage to be rotated horizontally. To do this the 2 locking clamps located beneath the stage must first be loosened. The stage can now be rotated +/- 15 degrees. The helix indicator (located under the X axis cover shows the amount of rotation in 5' increments. Once the desired helix is indicated, tighten the locking clamps to hold this position.

  To restore the helix to the zero (0) position, loosen the locking clamps and rotate the helix adjustment to zero. Or for a more precise zeroing, use one of the techniques in the "Machine Installation and Setup" section.

- **4 . 8 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. Or joystick control for motorized machines.

- **4 . 9 Mechanical Screen Angular Measurement**
  The screen vernier and protractor consists of a frosted glass screen divided into four equal quadrants by precision cross lines and 360 Deg. protractor markings. The screen is rotated by means of a small hand wheel on the right of the screen. The mechanical venire protractor can then be used to determine angles with 1 minute resolution.

4 . 10 Electronic Rotary Protractor (Optional)

The electronic rotary screen protractor is a screen encoder that sends screen rotation information to the digital readout. The readout displays the current rotary position of the screen .The readout can display rotary position in either degrees and minutes or degrees decimal. (1/100 of a degree)

Please refer to the readout manual for instructions on how to change the display mode or re-calibrate the rotary axis.

5.0 ADDITIONAL ELECTRICAL INFORMATION

- **5 . 1 Connecting Electrical Supply**

  The standard Benchmark 16H is supplied to accept 110-120VAC, 50-60 Hz main power. (NOTE: See section 1.4 for power requirements). It may also be configured to accept 220-240VAC main power.

  Use the following procedure to convert the machine power module for alternative power input.

*****CAUTION - READ THROUGH ALL OF THE INSTRUCTIONS BEFORE POWER CONVERSION *****

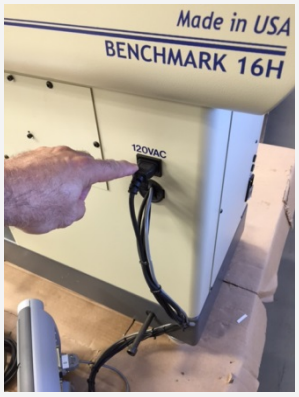
1. Remove the power cord from the power module on the back of the comparator.
2. Slide up the clear plastic fuse cover.
3. On the inside, lift up the lever that says “fuse pull” (fuse ejector) which will eject the fuse.
4. Lift this into the locking position (all the way up) It will eject the fuse and hold the clear slide protector up in place. Remove the fuse and hold the plastic cover up while moving the fuse ejector lever back down to its locking position.
5. Read the side of the circuit board if it says 120 it is set for 110-120 VAC if it says 240 it is set for 220-240 VAC.
6. To change the setting remove the board by first lifting the fuse ejector lever and removing the fuse. Then lift the lever all the way up to the locking position. Insert a small hex wrench or round object into the hole in the printed circuit board and slowly pry it straight out. You can also use needle nose plyers to gently grab the board and pull it straight out. Be careful not to scratch the soldering.

5 . ADDITIONAL ELECTRICAL INFORMATION

CONTINUED

7. Insert the card back in so when the lever is in the down position either **“120”** is showing if your power supply is 110-120 VAC or **“240”** is showing if your power supply is 220-240 VAC.

8. **CAUTION! Do not** use the 100 or 220 side of the printed circuit board. These numbers should **never** show inside the power module with the lever down. **Using the 100 or 220 positions on the board will damage the wiring.**
9. With the board installed correctly for your power supply and the fuse ejector lever pushed all the way down to the lock position. Reinstall the 10 Amp fuse.
10. NOTE: changing the printed circuit board to a new voltage will also change the power output of the “digital readout outlet” on the side of the comparator to the “line voltage” (The same as the voltage going into the machine.) If your readout is plugged into this outlet, Make sure your readout is compatible with the main power supply (line) voltage before turning on the power.



DRO outlet

120V showing in window

Circuit Board

6.0 MAINTENANCE

SECTION ONE

6 . 1 Cleaning the lenses, screen and mirrors

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.

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. Wipe the bulk of water with a (no lotion no oils) plain bathroom tissue paper then let the screen air dry.

6. MAINTENANCE

SECTION TWO

DANGER! - When using methanol or alcohol for cleaning disconnect the comparator from the power source and remove all sources of ignition from the area. Wait for all vapors to thoroughly evaporate before re-connecting the power.

WARNING! – To avoid damage. Never use polishes, window cleaning aerosols, liquids or canned air (canned air can spritz out propellant and damage the mirror.) when cleaning the mirrors. Do not use force.

Mirrors: Access to the mirrors is gained by removing the screen and or side cover

The comparator uses “First Surface Mirrors” These mirrors have the reflective coating on the top surface, unlike normal mirrors. This reflective coating is only a few microns thick and can be easily damaged. Therefore you should only clean the mirrors when the projected screen image has degraded. Do not clean as part of “regular maintenance”. To remove “light oil film or dust” from the mirror surfaces you can spray Methanol or alcohol on plain (no lotion no oils) soft bathroom tissue paper until it is damp, then wipe the mirror once in one direction. Then throw away that tissue and use another wad. Going over the mirror again with the same (now dirty) tissue will cause scratches. Use a new wad of tissue with each pass. Do not wipe back and forth or in circles.

If the Mirror has metal dust or heavy oil or dirt you can flood the mirror with methanol or alcohol. Place a large amount of paper towel under the mirror to be cleaned. Then use a pump sprayer to flood the mirror with Methanol or alcohol. The pressure from the sprayer will help to force the large deposits off of the mirror. After this, immediately discard the wet paper towels and finish cleaning the mirror using the above “light oil film or dust” cleaning technique.

6. MAINTENANCE

SECTION THREE

6 . 2 Lamp Replacement and Adjustment

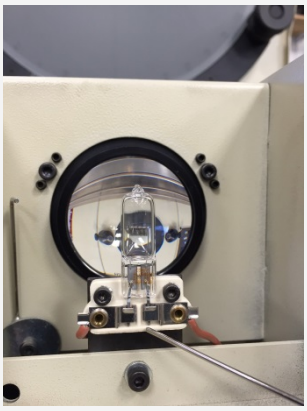
WARNING! This must be done with the power switched off and the lamp cold.

PROFILE LAMP

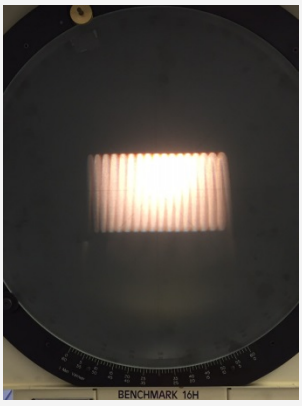
To change the lamp first remove the lamp house cover. Remove the old bulb by grasping and pulling the bulb directly up. Remove the new replacement bulb from its box, With the bulb still in the plastic bag use scissors and cut open the end of the bag near the two metal pins. Slide the bulb out slightly to expose the pins. Use the bag to hold the bulb. Slide the pins of the bulb into place. The ends of the pins should contact the ceramic evenly just below the two metal contacts of the socket. Then remove the plastic bag from the bulb.

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 both up and down and left and right. Re-seat lamp and or adjust the ceramic holder if required.

If the lamp glass is accidentally touched, wipe the bulb 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.



Profile lamp shown in correct position



Bulb element in center of screen no lens in place

6. MAINTENANCE

SECTION FOUR

SURFACE LAMP

To change the surface lamp, first remove the lamp house cover. The bulb is located at the bottom of the lamp house.

To remove the bulb, grasp and lift the bulb ejection wire lever to eject bulb. Remove the new replacement bulb from its box, Do not touch the small bulb inside the reflector housing. Flip the bulb ejector wire back down, line up the two lamp pins with the slots in the socket and slide the new bulb straight down into place.

Switch main power on and set lamp intensity to low.
Verify that the lamp is working and illuminating the fiber optic cables.

If the small glass bulb inside the reflector housing is accidentally touched, wipe the bulb 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.

Use the ejector lever when removing the lamp to avoid twisting the lamp and cracking the ceramic socket.

Surface bulb ejector lever

6. MAINTENANCE

SECTION FIVE

- **6 . 3 Fuse Replacement**
- The main fuse on the 16H is located inside the power input module on the back of the machine. It is a 10A 250V “Slo-Blo” ceramic fuse. Remove the power cord and slide the clear plastic cover up to access the fuse. Lift the lever to eject the fuse. Check or replace as needed.

- Two other fuses are located above the input module.
- F1 fuse is a 10A 250V “Slo-Blo” ceramic fuse and is for the Profile lamp.
- F2 fuse is a 15A 250V “Slo-Blo” ceramic fuse and is for the surface lamp.

- To remove F1 or F2 fuse, use a small flat blade screwdriver and insert it into the fuse end cap. **With very slight pressure,** press in and turn one quarter turn to the left. Release the spring pressure to allow the fuse end cap to extend for removal by hand. The fuse will be contained in the end cap.

- Check or replace fuse as needed and replace the end cap by reversing the above procedure.

- **Notice:** too much pressure with the screwdriver when removing or re-installing the fuse end cap, can break the back end of the fuse holder and cause the fuse holder and or fuse to overheat and fail.

6. MAINTENANCE

SECTION SIX

6 . 4 Checking Measuring Accuracy and 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. A qualified person should perform this adjustment.

If magnification is not uniform over the entire screen with more than one lens, then mirror adjustment might 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 Optical Metrology Division (OMD) provides this service and training classes on calibration. Consult us for details.

6. MAINTENANCE

SECTION SEVEN

- **6 . 5 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, method of inspection and operator interpretation. All 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 above steps.

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 readout compensation* and re-inspect. Re-compensate as required per instructions of your separate digital readout manual.

- **6 . 6 Lubrication**

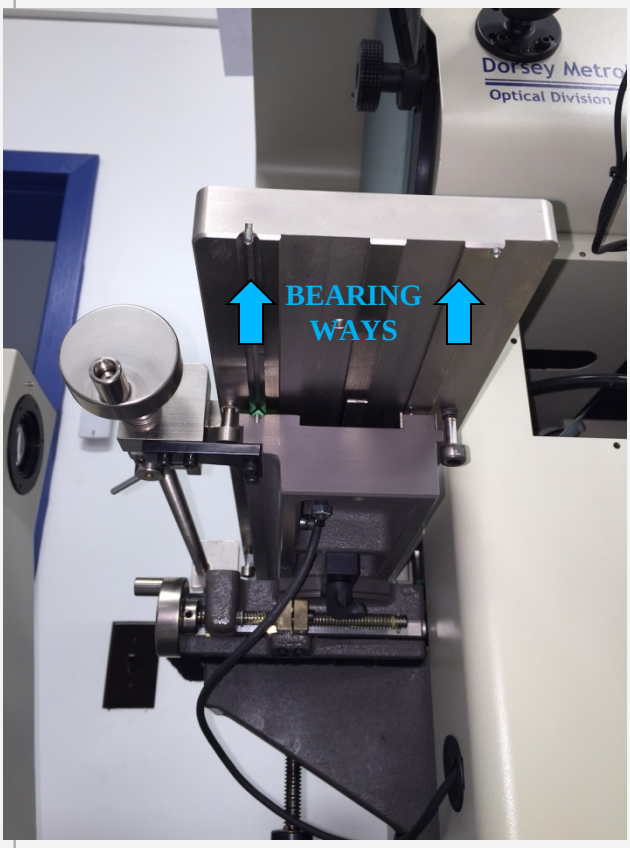
- **Never spray lubricant directly onto the machine. Oil mist can collect on the measuring scales or reading head and affect performance. Lubrication can be performed once a year on most machines. If your machine is in a very dirty environment or is used excessively you should lubricate two times per year.**

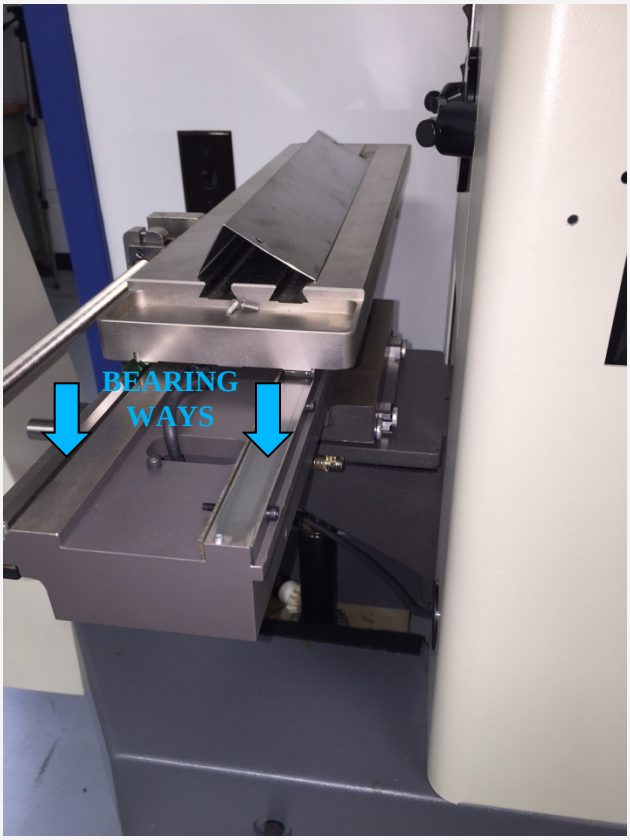
6. MAINTENANCE

SECTION EIGHT

The points of lubrication on the 16H comparator are as follows.

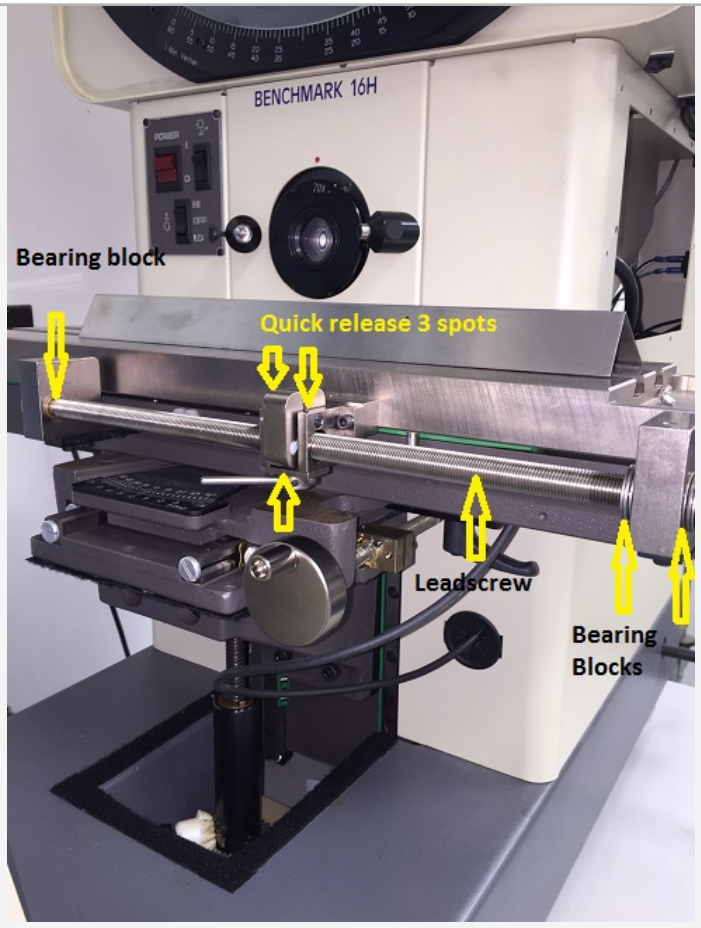
- **X Axis stage bearing rollers and ways.** Clean bearing ways with a lint free cloth dampened with WD40. Wipe dry with a clean lint free cloth. Leaving just a small amount of residual lubrication.





6. MAINTENANCE

SECTION NINE

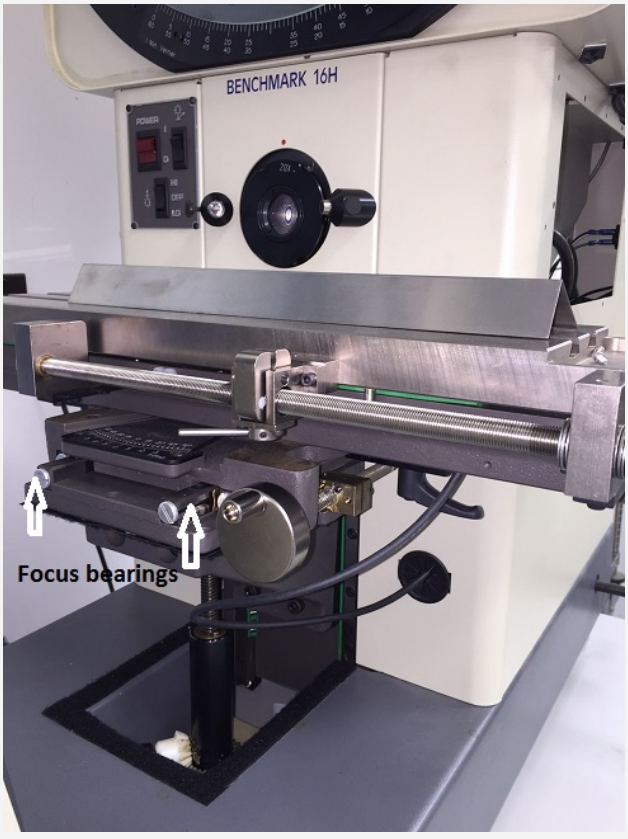


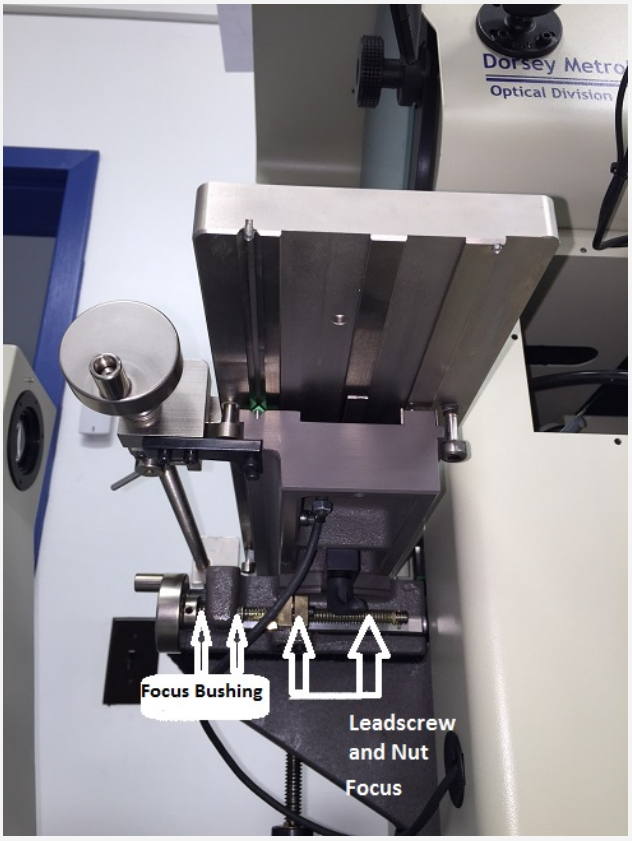
X Axis leadscrew and leadscrew bearing blocks. Isolate the X axis leadscrew with rags and spray the leadscrew with WD-40 to remove built up dirt. Wipe to clean with a clean lint free cloth or soft brush (like a tooth brush). You can leave WD-40 on the leadscrew for lubrication or oil the leadscrew and bearing blocks with a high viscosity oil like spindle oil. (Do not use “three in one” oil. It will dry to a sticky buildup.)

X Axis quick release. Oil the quick release with just one drop of a high viscosity oil, like spindle oil on each of the moving parts

6. MAINTENANCE

SECTION TEN



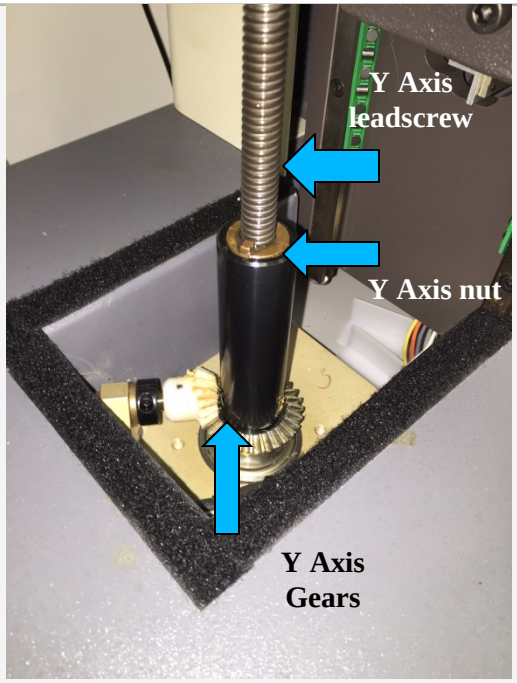


Focus axis

- Lubricate the focus bearing rollers and ways the same as the above X Axis bearings. Lubricate the focus leadscrew, and lead nut with “high pressure Acme screw grease” or white lithium grease. The focus bushing is a permanently lubricated bronze type. It can be lubricated with high viscosity oil if needed.

6. MAINTENANCE

SECTION ELEVEN



- **Y axis bearing rollers and ways** are located under two bellows protectors and under normal conditions do not need any lubrication.
- **Lubricate the Y axis leadscrew and nut** with high pressure acme screw grease. (about one table spoon of grease spread along the leadscrew.) This screw assembly is accessed by pulling down the Velcro retaining the bellows assembly.
- **NOTE:** “High Pressure Acme Screw Grease” is important for the above application due to the heavy load on the Y axis leadscrew.

- **Lubricate the Y axis gears** with approximately one table spoon of high pressure acme screw grease or white lithium grease. The Y axis handle shaft is mounted in permanently lubricated bronze bushings and needs no lubrication.

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7.0 TECHNICAL SPECIFICATIONS

SECTION ONE

Illumination:

Built-in 24 VAC/150 watt profile lamp with two position light level switch. As standard Equipment.

Extra Bright 24 VAC/250W halogen surface lighting via bifurcated fiber optic cable.

Screen: 16 inch diameter Ground Glass with etched cross-line, 1 minute 1/100 degree electronic rotary protractor (optional)

Stage working surface dimensions 5" X 18" Plus a 1.62" pocket built into each side of the work surface for a total stage surface of 21.5"

Stage motion: X axis = 10 inch travel
Y axis = 6 inch travel
Focus = 2 inch travel
Helix rotation = ± 15º, 5' resolution

Linear Scales Resolution: .25 micron / 0.000010"

Accuracy: MM =(3+(L/45))/1000
Repeatability: ±2 Micron
Magnification accuracy: contour = ± 0.10%, surface = ± 0.15%

Dimensions: 42"(L) x 22"(W) x 43"(H) **(**Add 16" to right side for readout.)
Weight: 375 Lbs. Standard model. 445 Lbs. Extended Stage model.

Power Supply (required input): AC 110 volt 50/60 Hz (Can convert to 220V 50/60Hz)
Accessories included with Benchmark 16H: Line Power Cord, Readout Power Cord, Condenser Lens, Lifting handles.

Lens system : 1/8 turn "Quick Change" type

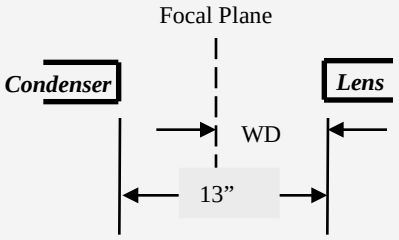
Optical System Diagram

7. TECHNICAL SPECIFICATIONS

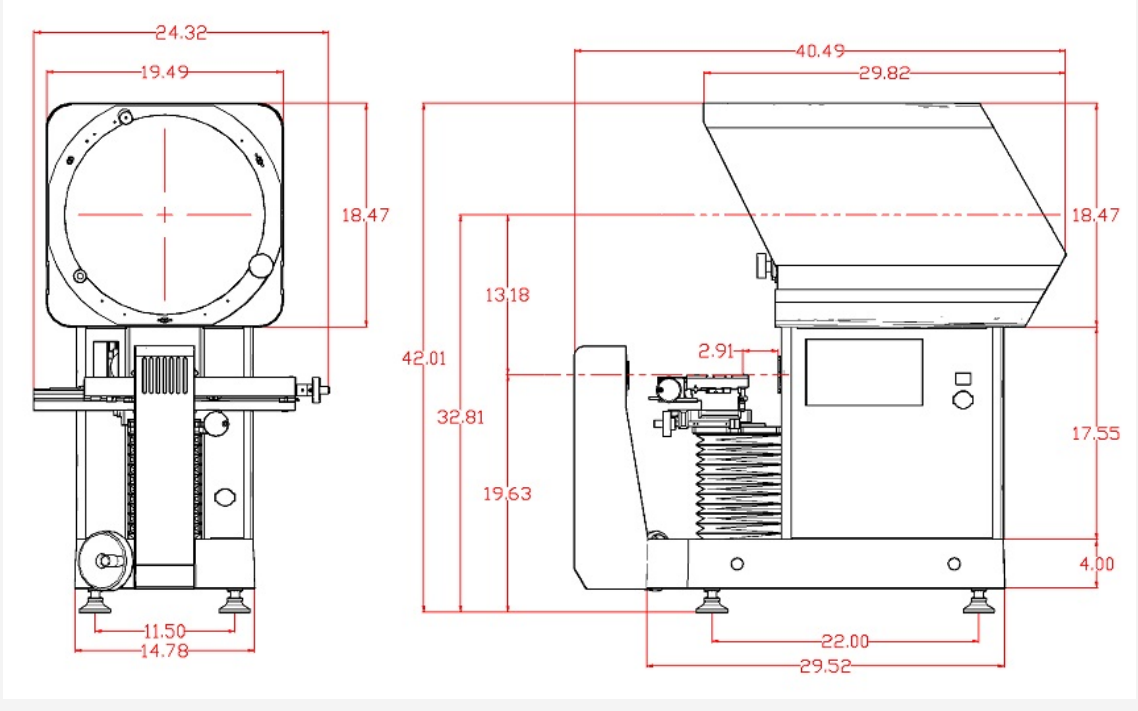
SECTION TWO

7 . 1 Lens Specifications for 16” Machines

Projection Lens	Working Distance	Max Workpiece Diameter
5x	5.43”	10”
10x	3.25	6
20x	3.22	6
25x	2.75	5.4
31.25x	2.20	4.35
50x	2.00	3.9
100x	1.69	3.25

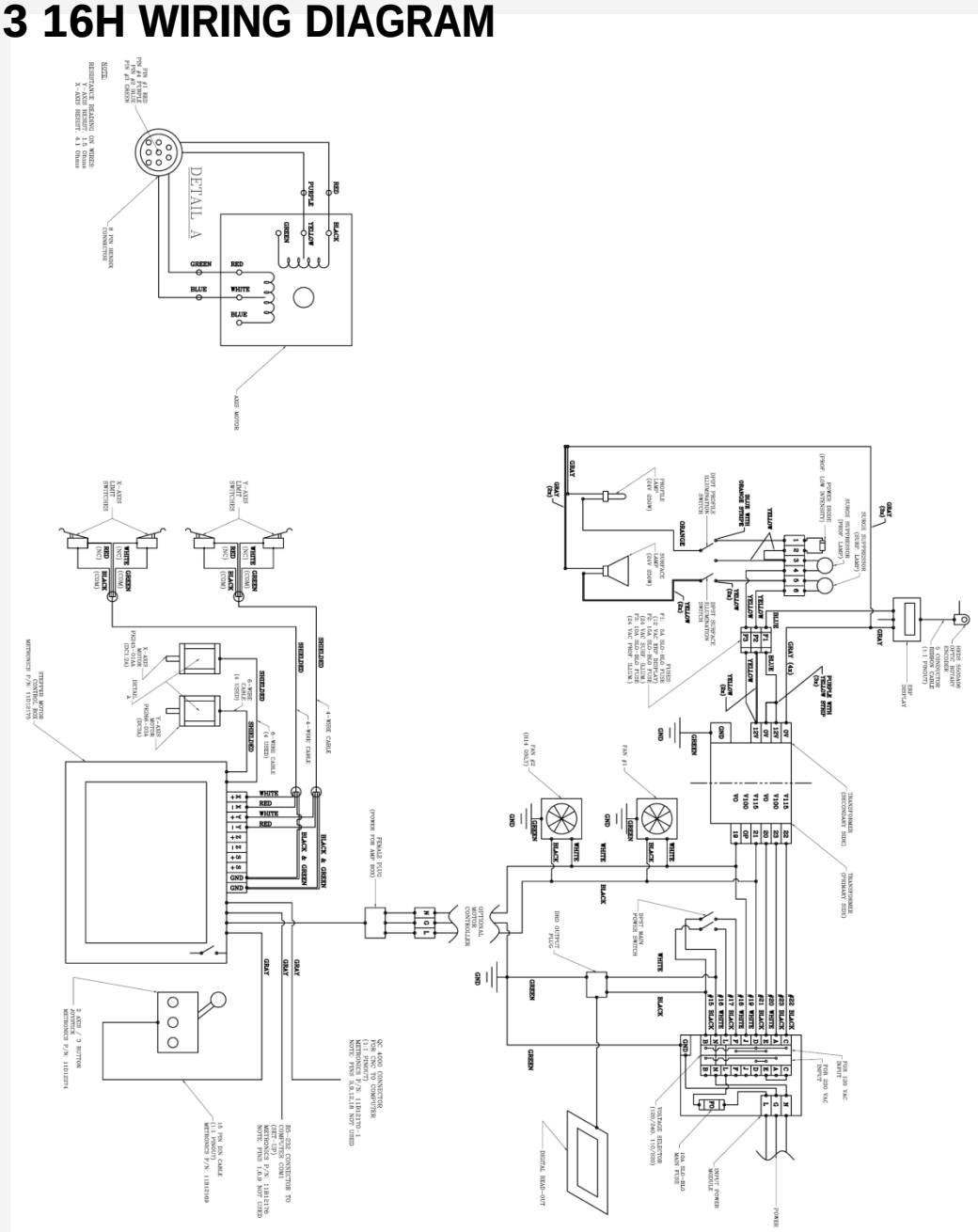


7 . 2 FOOT PRINT



7. TECHNICAL SPECIFICATIONS

7.3 16H WIRING DIAGRAM



8.0 System Configuration Checklist

Important!

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

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

STANDARD ACCESSORIES

___ Screen
___ Screen Chart Clips (Quantity 4)
___ Printed Manual
___ Certificates
___ Standard condenser lens
___ Leveling legs
___ Lifting handles

OPTIONAL ITEMS

___ Electronic Rotary Protractor
___ Digital Readout type: _____ Serial # _____
___ Digital Readout manual or instructions for downloading.
___ Digital Readout power cord
___ Comparator power cord
___ Digital readout arm (check one) Metlogix _____ Heidenhain_____
___ Digital readout base (Heidenhain readout only)
___ Edge Detector package: External_____ Internal_____
___ Lenses: 10X___ 20X____ 25X____ 31.25____ 50X___ 62.5X____ 100X___
___ Condenser: 51mm For 10x to 50X
___ Condenser: 38mm For 50X to 100X
___ Green Filter
___ Iris
___ Surface bulb quantity
___ Profile bulb quantity
___ Cabinet stand: (Indicate model) ACC-Cab 27_____ACC-Cab 36_____
___ Tooling #1_____
___ Tooling #2_____
___ Tooling #3_____
___ Tooling #4_____

Other Accessories:

___ Joystick (Motorized models only) Serial # _____
___ Motor amplifier (Heidenhain) Serial#_____
___ PC (If equipped) Serial # _____
___ _____
___ _____
___ _____

Final Inspection By:_____ Date_____

9.0 Limited Warranty Policy

DORSEY Metrology International
Optical Metrology Division
53 Oakley Street, Poughkeepsie, New York 12601
TEL: 845-454-3111 FAX: 845-454-3888

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 of 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.

9. Limited Warranty Policy
REGISTRATION / RMA FORM

Dorsey Metrology International 53 Oakley Street, Poughkeepsie, New York 12601
Optical Metrology Division TEL: 845-454-3111 FAX: 845-454-3888

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.

9 . 1 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 #: _____