

# **SPECTRA 14**

**Manual Optical Comparator  
Models: M1011, M1021, M1031, M1041**

## ***System Guide***

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# UNPACKING INSTRUCTIONS

## General

The following procedure addresses the unpacking of the MicroVu **SPECTRA 14** Optical Comparator. The unit has been fully assembled, tested and calibrated prior to shipment. All unpainted surfaces have been coated with light oil. Upon receipt, it is important to inspect the packaging for any signs of damage. The machine has been bolted to a pallet and covered with a heavy duty box. Some parts have been removed and packed separately to avoid damage during shipping. Notify the shipper and your MicroVu distributor immediately if shipping damage is detected.

Tools required:

- a. A large hex key set
- b. An adjustable wrench
- c. A spirit level

## Procedure

*The **SPECTRA** is manufactured in two basic designs, the floor model and the bench model. The following procedure applies to both of these models.*

1. Remove the cardboard cover box from the pallet. Remove the plastic wrapping from the machine and discard it. At this point, re-inspect the condition of the machine. If any sign of damage is detected, stop and immediately notify your MicroVu distributor.
2. Using the adjustable wrench, remove the four (4) ½-13 bolts securing the machine to the pallet.
3. Look for the four (4) ½-13 feet which are packed in a separate box. While the machine is still on the pallet and with the help of at least two people, tilt the machine sufficiently to one side to enable installation of two of the feet. Allow the feet to extend far enough to enable the forks of a forklift to be inserted under the machine. Next, tilt the unit in the opposite direction and install the remaining feet.
4. Using a forklift, move the machine to its final, operational location. If space is a critical issue, it is possible to slide the machine on or off the forks. (The weight of the bench model is approximately 200 lbs. and of the floor model approximately 300 lbs.)

5. At this stage, any parts which have been shipped separately may be attached.
  - a. The vertical drive assembly, consisting of a shaft, tube housing, gear, bearings and dial, is inserted in the collar opening just to the right of the periscope. Slide it into the gear box under the base platform until a good gear engagement is achieved. Turn the dial to the right until the stage lifts off the rubber supporting grommets on the platform base. When the gear mesh feels smooth, tighten the locking set screw in the bottom of the drive collar.
  - b. All cables and light guides, if so equipped, are packaged together and extend from a collar on the right side of the machine. The support bracket for the Q16 metrology computer is packaged separately. Remove the protective material from the cables and feed them, individually, through the bracket tube. When all of the cables have been fed through the tube, insert the tube into the collar and align the bracket so that the plate is level. Tighten the two set screws in the collar securely.
  - c. Place the Q16 on the support bracket and install the two 10-32 attaching screws from the bottom. Plug the power cord into the back of the Q16. Plug the X and Y scale cables into the back of the Q16. If the electronic protractor option is provided, attach the Z connector.
  - d. If the optional edge detector is provided, attach the two small fiberoptic light guides to their respective connectors at the back of the ED-50 box. The guides are marked "sensor" and "reference." The ED-50 will not function if these connections are reversed.

If the machine is supplied with InSpec metrology software, the references here to the Q16 and its bracket will not be applicable. In this case, route the computer cables extending from inside the machine to the appropriate ports on the computer. (See Figure 1 in the appendix.) If the unit is supplied with InSpec software and a computer system, attach the computer brackets and monitor to the side of the machine using the holes and bolts that are supplied.

6. Once all loose components have been connected to the main unit, level the machine, as follows.
  - a. Screw the feet in as far as possible.
  - b. Place a spirit level on the table and adjust the feet as necessary to achieve a level state in both directions. Adjustments should eliminate any "rocking" and result in the table being both level and stable.

7. Ensure that all cables are out of the way allowing for full, unrestricted stage travel. With the stage up from its lowest position, remove the rubber shipping grommets. With the stage moved out toward the periscope, remove the grommets which were placed behind the upper table for shipment.
  
8. Locate the main power cord which is packed in a separate box. Plug the cord into the back of the machine and into a 115-volt electrical supply. Switch on the profile lamp and the surface lamp, if the machine is so equipped. Occasionally, a lamp may be jarred from its optimal position during machine shipment. Ensure that the lamps are adjusted correctly. (Refer to the ***ROUTINE MAINTENANCE*** section of this manual for instructions.)





# INSTALLATION AND START-UP

## General information

The **MicroVu SPECTRA 14 Optical Comparator** is a precision measuring machine and is calibrated at the factory prior to shipment. It is ruggedly constructed to withstand normal handling during transportation and operation. With proper handling and minimal service, your instrument will last for many years. The following instructions are designed to make the installation and operation of your instrument easier. Illustrations and graphics have been provided to further assist you. Before attempting to take any readings, refer to the calibration notes in this manual.

Some models are equipped with InSpec software and a computer. If your unit is equipped with a Q16 DRO only, ignore the following references to InSpec and its computer. Refer to the appropriate manual for additional InSpec information and operation instructions.

Stage movement is precisely measured by linear encoders having a standard resolution of .0001 inches with an option of .00005 inches. The staging on the **SPECTRA 14** is a heavy duty system with steel way rods and ball bearing movements. This system is designed to maintain a high degree of accuracy and repeatability. The X, Y and Z axes' movements are adjusted to travel perpendicular to each other.

## Glass screens (Figure 2)

Knurled thumb screws, nuts and fiber washers are provided. The screw is mounted through the hole in the glass screen with a soft protective washer on either side of the glass.

The bottom two screen rollers are fixed and cannot be adjusted. The upper screen guide can be pushed up to enable placing of the screen in the ring and onto the bottom two rollers. The guide is lowered onto the screen just far enough to enable the screen to roll smoothly by turning the right-hand adjustment knob. Do not apply downward force to the screen guide.

## 1-Minute electronic protractor (Figure 2)

The rotary encoder is factory-installed behind the lower left screen roller and plugs into the bottom, Z-axis connector of the Q16 or the InSpec junction box, if so equipped. Mechanically, the rotary encoder is mounted on a block and has a wheel which rolls with the glass screen. Ensure that this roller spins freely.

Access to the encoder is gained by removing first the screen and then the two 4-40 screws which attach the block to the back of the front plate. The wiring is trained around the screen so that it doesn't obscure part of the image. It terminates at the Q16's third-axis connector. Note that if the protractor is retrofit, the existing Q16 may also require resetting for third-axis capability. (Refer to the Q16 metrology computer user's guide for setting of the third axis for the electronic protractor. If the encoder does not read properly, calibrate according to the instructions in the Q16 user's guide, checking for free rotation of the lower left roller and screen.)

## Q16 Metrology computer

*(Refer to the separate Q16 operations manual.)*

The digital readout system (DRO) used with the **SPECTRA 14** consists of two major components: the linear encoders (measuring scales) and the Q16 metrology computer. The encoders come factory-installed and adjusted. The Q16 has been set to match the encoders. The Q16 settings, established at the factory, should not require adjustment.

## SPECTRA 14 without linear encoders or Q16

The non-DRO comparator is equipped with a .001" resolution dial for measuring in the vertical direction. For horizontal measuring, a bracket is provided on the right-hand side of the lower table for mounting a standard 1" or 2" dial indicator. A sliding indicator stop, adjustable for differently sized work pieces, is mounted in a T-slot on the upper table. When mounting dial indicators, care should be taken to ensure that the shaft of the indicator has been placed parallel to the line of travel. For best results, use a gauge block of known dimension. Focus in sharply and use the indicators for measurement, verifying that the indicator readings agree with the known dimensions of the part.

## Power-on and system verification

The profile and surface lamps are operated by switches mounted in the base. Since the lamps have a fixed life span, it is wise to turn them off when they are not being used. In models featuring InSpec, the computer and monitor are powered separately.

Verify that the peripherals (optional InSpec metrology software, ED-50 edge detector, etc.) function properly. Please refer to the appropriate manual for details.

Test the travels of all three axes. They should travel smoothly through their full movements. Ensure that all linear encoders are reading throughout full travels.

# OPERATION

## General information

The **SPECTRA 14** optical comparator is a versatile, non-contact, precision measuring system. X/Y measuring can be accomplished in two ways, i.e. both “on-screen” and “stage” measurement.

## Stage measurement (point-to-point)

Stage measuring, sometimes referred to as “point-to-point” measuring, is accomplished utilizing linear encoders and digital displays. The positions of X and Y movements are captured through the use of linear encoders mounted on each axis. The signal from these is transmitted to the displays on the Q16 or the computer monitor. With this technique, the feature is lined up with the crosshair, display zeroed, stage moved to the next point being measured and the distance noted. This point-to-point system also enables many other metrology functions, such as radius, angle, hole center distance, memory, etc. The speed of these functions is greatly increased through the use of the optional edge detector.

## On-screen measurement

A wide variety of screens are available for measuring distance, radii, angles and other parameters of magnified objects. Angles can be measured by rotating the screen with its 1-degree graduations in conjunction with the 5-minute vernier. An optional electronic protractor (see **1-Minute Electronic Protractor** in the **Installation and Start-up** section of this manual) speeds this up considerably by simply displaying the angle of screen rotation directly on the Q16 **Z** display or on the InSpec monitor, if so equipped.

Overlay charts can be made of any clear, transparent material. It should be noted that a comparator image must be projected on a frosted surface. In the case of overlay measurement, *either* the overlay or the screen must be frosted, but not both. Either frosted or clear, blank, glass screens are available for this purpose. Optional spring clips can be provided to hold the charts on the glass screen. A blank screen is preferable for this purpose. Overlays may be used to match any magnified parameter on the screen. Go and no-go overlays are a commonly used approach.

## 1-Minute electronic protractor

The 1-minute electronic protractor is read on the Q16 metrology computer Z-axis display. Press the Z-axis key (LED will light) to activate the 1-minute

electronic protractor. To determine whether the Q16 is set up for the electronic protractor, press **F**, **-**, and **5** on the keypad. The Z display toggles between **rotary** and **linear** with these three keys. When set for rotary mode, turning the screen will read on the third display. Pressing the **Z RESET** key will zero the display. The **ABSOLUTE/INCREMENTAL** key will enable zeroing in both modes. The Z axis can be toggled **ON** or **OFF** in most modes on the Q16. Refer to the Q16 metrology computer user's guide for detailed instructions.

## Profile light aperture

Some parts, such as the end of a round shaft or grooves in round shafts, do not present a sharp edge to the optical system. The image may be out of focus or appear with shadows. To reduce such visual problems, a sliding light aperture device is provided between the periscope and the profile condenser mount. The light aperture assembly may be manually positioned to select a smaller aperture. While this adjustment may not completely alleviate the problem, it will permit viewing of the edge with greater definition.

## MEASURING WITH THE MACHINE

The **SPECTRA 14** Optical Comparator is a sophisticated, non-contact measuring machine. The optional InSpec software provides greater flexibility. The optional ED-50 edge detector provides faster, more consistent measuring.

The essential companion guides for reference regarding the process of measuring are:

- ***InSpec Metrology Software User's Guide***  
(including tutorial)
- ***Q16/ED-50 User's Guide***

### Applications

The **SPECTRA 14** Optical Comparator can facilitate many applications. By selecting the correct magnification and illumination, most measurements can be accomplished accurately and quickly.

The first objective in applying the MicroVu **SPECTRA** system to your measurement task is to determine the size of the measuring area for a given part. A very large part may be treated by adjusting its position on the stage to allow for a series of measurement views. Thus, by using a combination of software features and stage fixtures, a wide range of part sizes may be determined.

Various standard fixtures are available to assist in measuring a part. A *helix* fixture is used to rotate a screw thread to the correct helix angle, thereby enabling the measurement of thread forms. A *vertical* fixture is generally used for positioning small, flat parts. A *vise* fixture is used to orient a part correctly.

The key to selection of the correct magnification lens and illumination is *if you can see it, you can measure it*. The magnification must be such that the feature to be measured is large enough that edges can be found but not so large that there is a loss of clarity or contrast. In some cases the highest magnification may not be the best selection.

When measuring a part, the outer edges or through holes may be viewed using the profile light. In some applications the surface light can be used in conjunction with profile light to help define the uppermost edge.

Determining the optimum illumination for a specific application can involve a trial-and-error process. Don't hesitate to try different approaches. Be creative.

## Profile illumination

Illumination is provided by a halogen lamp which is used for all applications allowing profile (shadow) illumination. For lamp adjustment, refer to Figure 4.

## Optional surface illumination (*thru-the-lens*)

Illumination is provided by a halogen light source and 50/50 reflective mirror. The light is transmitted through the magnification lens and is coaxial to the optical system. (Refer to Figure 3.)

## Illumination strategies

The key to proper illumination is in lighting the part so that it can be measured quickly and accurately. Surface finishes, roughness in edges or dimensional variance may all play a role in successful part measurement. Surface illumination works well only with highly reflective parts. It is not effective with magnifications greater than 20-power.

Profile illumination is the preferred choice when the part being measured is two-dimensional and there are no problems with flash on outer edges or through holes. With profile-only illumination, the surface of the part is all black and only the outside edges and through holes can be measured.

When an edge is rounded, the image of the edge may be blurred. It may be difficult to find a sharp edge especially when the part is round and large. When a round part is so large that the surfaces come into contact with the lens and do not allow focusing on its O.D. (outside diameter), a reduction in magnification can lengthen the distance between the lens and the part O.D.

Surface illumination is the best choice for measuring features on the *surface* of a part. **Note:** The ED-50 edge detector functions only with the profile lighting. Surface features must be measured manually.

Contrast and shadows can reduce the sharpness of an edge. To increase the visibility of an edge, a combination of surface and profile lighting can sometimes be used to advantage.

Occasionally, especially at higher magnifications, ambient light may interfere with the image on the screen. In this situation, it may be helpful to dim room lighting. A darkening canopy is also available from MicroVu.

# CALIBRATION AND CERTIFICATION

## Original manufacturing

MicroVu measuring machines are factory-calibrated in compliance with the following standard:

**ANSI/NCSL Z540-1-1994**

Meeting the requirements of this standard complies with relevant requirements of:

**ISO 9000 Series standards**

**ISO/IEC Guide 25 (1990)**

**MIL-Std 45662A**

Calibration in compliance with this standard requires measurement standards which are traceable to NIST (National Institute of Standards).

## Distributor installation

An authorized MicroVu distributor is factory trained and qualified to install MicroVu measuring machines. This installation is in accordance with appropriate factory procedures and guarantees the integrity of the initial factory calibration and certification.

## Recalibration and certification

It is recommended that MicroVu measuring machines be recalibrated and recertified annually. This recalibration should be performed by a factory trained metrologist in accordance with the ANSI/NCSL Z540-1-1994 standard.

## Calibration requirements

**Measuring stage:** X and Y axes linear accuracy  
X and Y axes repeatability  
X to Y axes perpendicularity  
Z to X/Y axes perpendicularity

**Optical calibration:** Lens magnification, lens distortion, optical perpendicularity





## ROUTINE MAINTENANCE

The **SPECTRA** is designed to be relatively maintenance free. However, as with any precision instrument, proper care and use will prolong the life and accuracy of the product. Reasonable care in this area will result in years of trouble-free service.

### Protection from dust

When not in use, the unit should be covered to reduce the amount of dust accumulation in the bearings and linear encoders. As a practical safeguard, use of the provided dust cover is recommended.

### Bearing lubrication

#### ***Bearing ways***

The X, Y, and Z axes utilize ways and balls. Wipe the rails with a cloth soaked in a very light oil. Next, wipe on a very *thin* coat of light grease. Recommended frequency of lubrication depends on ambient conditions and usage. Under normal use, semiannual applications should be adequate.

#### ***Drive screws***

If inspection reveals that the shafts are dry or dusty, clean them with a cloth soaked in solvent or a very light lubricant. Next, apply a very *light* coating of light grease. This procedure should be followed semiannually, depending on the amount of usage and dust levels.

### Lamp replacement

The profile lamp is designed to provide long life. The surface lamp has a shorter life. Both lamps should be turned off whenever possible for maximum economy.

It is recommended that a supply of lamps be kept on hand for replacement. In any lamp replacement, allow time for the lamp to cool before attempting to replace. Additionally, use a soft cloth or tissue when handling the new lamp as oil from your skin will shorten lamp life.

**CAUTION: To avoid the possibility of personal injury, unplug the unit before attempting to service it. Do not attempt to remove a lamp until it has had sufficient time to cool.**

#### ***Profile lamp***

To replace the profile lamp, remove the periscope cover and heat shield. The lamp is pulled straight up and replaced using the opposite motion. Use the protective tube which is included with the new lamp to protect it from skin oils during installation. Each time a new lamp is installed, it must be readjusted for optimum screen contrast and sharpness. (Refer to Figure 4 and the following procedure.)

## Profile lamp adjustment

To ensure that extremely sharp, clear, high-contrast images are achieved, proper adjustment of the profile lighting is essential. All adjustments may be made with the heat shield and periscope cover in place. (Note the access holes in the periscope and cover.)

First, determine that the light rays being emitted from the profile condenser assembly are collimated, i.e. parallel to each other. This may be accomplished by holding a sheet of paper near the condensing lens and noting the size of the ring of light which is projected onto the paper. Moving the paper to a position immediately in front of the objective lens, the light ring should be the same size or slightly smaller. If adjustment of the collimation is necessary, move the lamp closer or farther from the condenser assembly by adjusting the spring-loaded screw located in the periscope, next to the condenser assembly. At this point, optimum screen brightness will be realized and the next steps will be easier to achieve. This phase of adjustment will not require repeating in the normal course of lamp replacement. This is because the lamps' filaments are fairly consistent in this direction and the position of the lamp is not as critical as in the other two directions.

Due to the variation in filaments from lamp to lamp and the difficulty in repeating lamp position placement, the next part of this procedure must be followed whenever the lamp is replaced. Remove the objective lens and adjust the two spring-loaded screws – one on top of the periscope and one on the right side – until the image of the filament is roughly centered on the screen. If the screws should appear to run out of travel before the image becomes centered, ensure that the lamp is vertical in its socket. If vertical correction is necessary, remove the periscope cover and heat shield and push up on the lamp slightly. This method of adjustment is approximate.

Referring to Figure 4, place the 2", 3" and 4" gauge blocks on the table, as shown. Focus on each of the four edges of the 3" gauge block in sequence. Make any necessary adjustments using the two spring-loaded screws located on top and on the right side of the periscope. Avoid over correcting the focus on any single edge as this may cause shadows to appear on the opposite side. Time invested in careful profile lamp adjustment will yield good, sharp, high-contrast images as well as increased measuring accuracy and repeatability.

## Surface lamp

Using fingers to pry the spring clip loose from the lamp (see Figure 3), remove the lamp/socket assembly from the optic mount. Install the new lamp in the socket and reinstall the lamp/socket assembly. The lamp must be seated properly in the optic mount but will require no other adjustment.

## Glass screen

The glass screen used with the **SPECTRA 14** Optical Comparator is manufactured using a special, photo-etching process. It is ground to precise dimensions to ensure accurate concentricity between radius lines, cross lines, protractor degrees and the outside edge of the glass. The glass may be carefully cleaned using mild soap, detergent or a glass cleaner. **Caution:** Do not use acetone or solvents as they will remove the dye from the glass. Except under extreme conditions, the inside, etched surface will require little maintenance.

## Glass mirrors

Mirrors are constructed of glass with front surfaces aluminized. They can carry a heavy coat of dust without light reflection being impaired. Because their surfaces are delicate, these mirrors should be cleaned as infrequently as possible. When cleaning becomes necessary, wipe lightly with alcohol or a mild glass cleaner using cotton or a soft cloth. All mirrors are accessed by removing the screen and reaching into the unit.

**Caution:** The mirrors have been carefully aligned at the factory and locked into place with silicone. Unless a mirror is damaged and requires replacement, no adjustment should be attempted. Mirror replacement should be performed by a factory-trained technician.



# MECHANICAL ADJUSTMENTS

Certain adjustments can be made, as required, by the user. Such adjustments will not affect the calibration or certification of the machine. Perform the following checks in sequence.

## Linear encoder (scale) alignment

Ensure that the X and Y displays register the movement of the stage and exhibit no unexpected characters. These symptoms may be caused by a faulty scale. To check for a faulty scale, switch the scale connectors on the Q16 or InSpec junction box. If this change results in the error appearing in the opposite display, the scale is at fault. Next, check the alignment of the scale in question per the illustration. Note that these dimensions must be held throughout full travel of the stage. For a general calibration check and for routine calibration and certification, contact your local MicroVu distributor.

## Vertical lead screw gear adjustments

If the Y axis, vertical movement seems rough or irregular, the gear mesh may require adjustment. Both gears are formed of nylon material and are identical in size. The position of the drive gear may be moved forward or backward to attain an even mesh with the driven gear. The drive shaft is anchored with a set screw just behind the handwheel. With the set screw loose, the drive gear and shaft can be adjusted axially to provide the proper mesh. This is the only adjustment necessary to achieve smooth vertical movement.

## Setting magnification

### ***Calibration***

Check the lens by projecting gauge pins onto the screen with the following allowable errors:

<b>10X lens</b>	<b>.500" pin</b>	<b>error <math>\pm</math> .0005"</b>
<b>20X lens</b>	<b>.200" pin</b>	<b>error <math>\pm</math> .0004"</b>
<b>50X lens</b>	<b>.100" pin</b>	<b>error <math>\pm</math> .0005"</b>

The image size displayed on the screen is checked with either a graduated screen or with a separate, certified glass scale.

## Adjustment

The lenses furnished with your machine include a steel inserted collar which matches up to a series of magnets in the optic mount. The collar is factory set for proper magnification. Therefore, it is necessary only to insert the lens assembly until the collar mates with the optic mount. No set screws require loosening or tightening in order to switch the lenses.

If resetting is necessary, loosen the set screws in the lens collar. The lenses can then be slid in or out. **IN** will make the image smaller; **OUT** will yield a larger image. Once this has been accomplished, no future adjustment will be necessary.

## Surface illumination split mirror adjustment (Figure 3)

A thumbscrew is located inside the machine, under the optic mount and behind the screen. Using the thumbscrew as a handle, position the split mirror in the optic mount until the surface image is consistent throughout the screen. **Note:** Use a highly reflective object (such as a shiny gauge block or the blade of a square) on the stage for this test.

## Q16 and 1-minute electronic protractor

Refer to the Q16 manual for service and detailed calibration instructions.

### **Lead screws**

The **SPECTRA** uses three types of lead screws and nuts:

**X** = *a fast pitch acme screw with a self-adjusting acetal nut. This nut has the capability of being readjusted for additional spring tension in case backlash is ever experienced.*

**Y** = *a fine pitch acme screw with a simple acetal nut*

**Z** = *a ball thread screw with a proprietary split and adjustable acetal nut. This nut provides an adjustment for wear.*

# PRODUCT SPECIFICATION

## General

This specification defines the minimum requirements for your MicroVu **SPECTRA 14** optical comparator. The machine shall be constructed in accordance with existing industry standards of materials and workmanship.

Normally, inspection machines of this type are used in relatively “friendly” environments. For this reason, and in order to achieve the following performance specifications, the ambient temperature range must be from 68° F to 72° F (20° C to 22° C). The degree of operator experience and expertise also plays a significant role in accuracy and repeatability.

## X-Y-Z Performance

### Linear accuracy

X overall: .....00075"

Y overall: .....0005"

**X-Y Repeatability**.....0001"

### Perpendicularity

X to Y axis overall:.....0005"

Z to X/Y axis overall:.....0005"

## Optical performance

### Distortion

Profile illumination:.....± 0.1%

Surface illumination: .....± 0.1%

## Focal Lengths

C9131	10x lens	4.5"
C9132	20x lens	2.0"
C9133	30.25x lens	1.25"
C9134	40x lens	1.25"
C9135	50x lens	1.25"

## Features

### OPTICS

<b>Image</b> .....	14" Erected
<b>Lens</b> .....	10X, 20X, 31¼X, 40X, 50X, 62½X, 100X
<b>Lens focal distances</b> .....	10X: 4.8", 20X: 2.4", 40X: 1.2", 50X: 1.0"
<b>Profile light</b> .....	#L7390 (MicroVu part #7347), 100 watt halogen, 2,000 hours
<b>Surface light</b> (all models) .....	#ELS (MicroVu part #7341), 50 watt, 200 hours

### Q16 controls

- 16-bit Processor
- 100 Memory locations (battery backup)
- RS232 Computer interface
- RS232 Printer interface

### InSpec controls

- InSpec 3D Metrology Software (requires, as a minimum, a 486-based computer with a *Pentium 100* computer recommended) featuring:
  - > Ability to measure part; store and recall part programs for prompting
  - > Tolerancing and editing
  - > Data export
- Inch/metric operation with instant conversion capability
- Zero reset at any position
- Resolution to .0001" (.002 mm)
- Serial RS232 dual output

### Special metrology features

- Skew calibration and mode for part alignment
- Radius, center find and polar coordinates from 3 points to 9
- Angle and vertex calculation from 4 points to 18
- Memory storage for 100 sets of X and Y points
- Polar/Cartesian conversion; preset; incremental/absolute conversion (recall of current X and Y distance between current position and all stored points; recall of all 100 stored points; recall of direct polar distance between current position and all stored points)
- Absolute and incremental measurement capability

*The preceding features apply to the basic manual **SPECTRA** system. Following is a list of options which may be included with your order.*



## Options

- Programmable Q16
- Electronic protractor
- Surface illumination
- InSpec metrology software
- ED-50 edge detector
- CAD interface software
- Impact printer
- Overlay clips
- Footswitch
- .00005 Resolution encoders
- *Pentium 100* computer system with mounting bracket
- Miscellaneous fixtures
- Extra lenses: 10X, 20X, 25X, 31¼X, 40X, 50X, 62½X, 80X, 100X
- Extra screens
- Spare lamps

## Physical specifications

	<b>Floor-standing model</b>	<b>Bench model</b>
<b>Width</b>	20" (+ 15" for Q16)	20" (+ 15" for Q16)
<b>Depth</b>	42½"	42½"
<b>Height</b>	69"	40½"
<b>Weight</b>	325 lbs.	250 lbs.
<b>Power</b>	110 vac, 5 amps, 50 - 60 Hz	110 vac, 5 amps, 50 - 60 Hz

*For additional data on the **InSpec software, ED-50 Edge Detector or the Q16**, please refer to the specific manuals for those features.*



## SERVICING: General

If the **SPECTRA 14** Optical Comparator requires service, this guide is intended to enable users to evaluate electrical problems. If a problem is not clearly understood, it should be brought to the attention of factory trained and authorized MicroVu service personnel.

Your manual **SPECTRA 14** Optical Comparator may be configured in three ways, as follows:

- 1> With the Q16 metrology computer
- 2> With InSpec metrology software which involves a PC, monitor, keyboard, etc.
- 3> Using both of the above systems with the option of switching between them via an A/B switch box

The *Problem Solving* sections which follow address each of these configurations. Please note that, in Q16 applications, factory procedure has been to treat that component as a modular unit which is serviced as such by the factory.

The user should refer specifically to the manuals which are packaged with the **SPECTRA** such as those for the Q16, ED-50 and InSpec.

## Safety precautions

The **SPECTRA 14** system is a precision instrument. It does not require high voltage for operation. Incoming voltage is 110v AC. Electrical voltage can be dangerous at any time. When servicing the **SPECTRA 14** system, it is important to know the voltage potentials in the areas being serviced.

## Tools and equipment

No special tools are required for maintaining the **SPECTRA 14** system. The tools required are simple hand tools including:

- screw drivers
- combination wrench set (English)
- hex key wrench set (English)
- digital multimeter

Because the **SPECTRA** system is manufactured in the United States, most fasteners are English.

Servicing the electrical components will require that the service personnel are familiar with hand held digital multimeters and common electronic hand tools.

## Fault diagnosis

Should the **SPECTRA 14** system develop problems, record the conditions leading up to the failure. Next, determine whether the failure can be resolved easily with existing technical staff or if an authorized MicroVu distributor should be called for service. The authorized distributor for your area has been trained at the MicroVu factory to assist you with technical and applications questions.

Certain failures that occur are intermittent or are caused by a specific sequence of events. When an intermittent failure occurs, the best process to follow is to record the events preceding the failure.

## PROBLEM SOLVING: Lighting system

### Problem: No surface illumination

- Check the ELS lamp which is inside the machine below the screen. The filament may be broken. Test the lamp with an ohmmeter for continuity across the filament. Test the output across the lamp base with a voltmeter. The voltage should vary between zero and 16 vAC approximately.
- Verify that the primary (input) and secondary (output) of the transformer have continuity with the ohmmeter. Transformers for both surface and profile illumination are located under the toggle switch plate.
- Use a voltmeter to verify that the voltage to the transformer is present.

### Problem: No profile illumination

- Check the profile lamp (#7390, 12 vAC) per the preceding procedure. Replace, if necessary.
- Check the voltage at input and output of the profile transformer.



## PROBLEM SOLVING: Q16

### Problem: No power or display

- Check power cord connection.
- Check fuse (located in power module drawer below power cord IN).
- Turn off the power and open the top cover of the Q16. A spare fuse is provided in the power module drawer.
  - > Check the cable connections (see *Q16 Connections, Figure 6*).
  - > Disconnect and reconnect the cables to remove corrosion (the cables are self cleaning).
  - > Check power to logic PCB 15103 at C1, C2, C3 (they should read 12vDC, 12vDC, and 5vDC).

### Problem: PI light on constantly

- Disconnect scales & foot switch
  - > If the PI light is still on, turn off the power and open the top cover of the Q16.
    - > Check the cable connections (see *Q16 Connections, Figure 6*).
    - > Disconnect P2, P3 from 15102 display PCB & P3, P4, P5, P6 from the 15103 logic PCB.
    - > If this fixes the PI light lockup, reconnect until the source of the lockup is located.
    - > If the PI light is still locked up or lights intermittently, please contact your authorized MicroVu dealer.

***Warning: Error correction is set as part of the calibration process and should be changed only by qualified personnel. If it is necessary to change the dip switch settings, record the settings as set at the factory so that they may be reset, if needed.***

### Problem: Scales (linear encoders) not reading

- Check linear encoder connections. If any axis is working, swap

the good and bad linear encoder inputs to see if the problem follows the encoder input or stays with the display axis.

- > If the problem is with the scale, check the scale alignment (see *Linear Encoder Alignment* section of this manual).
- > If the problem is with the display, check linear encoder connections P4, P5, and P6 on the 15102 logic PCB (see *Q16 Connections, Figure 6*).

**Problem: Scale reading incorrectly**

- Check the scale resolution setting and error correction on the 15104 switch PCB (see *Q16 Connections, Figure 6*)
- Check the 40-pin ribbon cable from the 15104 switch to the 15103 logic connection

**Problem: Error 60, 61 or 62 (scale error)**

- Check the connection and alignment of the scales (see *Q16 Connections, Figure 6* and the *Linear Encoder Alignment* section of this manual))

**Problem: Keys not responding**

- Check the amount of wear of the keyboard. Worn keys without tactile response (bubble effect) will prevent the keyboard from responding.
- Disconnect the foot switch and try the keys again. (*possible bad foot switch*)
  - > Check P2 and P3 on the 15102 display.

**Problem: Printer prints random characters**

- Check baud rate and Q16-to-printer cable direction.

**Problem: Z axis angle/units reading wrong**

- Check the calibration of the rotary encoder, referring to the Q16



manual for the correct method.

- Check toggle modes, referring to the Q16 manual for the correct method. (*possible wrong modes*)

Decimal-degrees:	Degrees, minutes, seconds	<b>F9</b>
360° minus angle:	subject angle	<b>F2</b>
180° minus angle:	supplementary/subject angle	<b>F3</b>
90° minus angle:	complementary/subject angle	<b>F4</b>
Rotary:	linear encoder	<b>F5</b>

- Enter memory before recalling it.
- Check battery on 15103 logic.

**Error message: Error 3, 28, 29** (duplicate points entered)

- Check points' location and ensure that scales are reading.



## PROBLEM SOLVING: ED-50

**Problem: No power or key response**

- Check the power connection to the Q16
- Check the ribbon connections between the ED-50 box and the Q16. To clean, remove and reconnect them.

**Problem: Edge not calibrating (E40, E41 error).**

- Check that the light is being transmitted through the fiber optic cables and that they are hooked up properly by disconnecting them at the ED-50 box and observing the light that is emitted. If the SCREEN INPUT fiber optic light guide is determined to be faulty, the REFERENCE fiber optic light guide may be substituted as a temporary remedy.
- Check the jumper P4 setting (video/optical) on the edge

detector

15122 analog board.

**Problem: Edge detector not beeping at correct times**

- Check the light-to-dark ratio by pressing **S1** on the edge

detector.

*(The light to dark ratio is the percentage of gray at which the edge detector will beep when moving from total light to total shadow. For example, 50% is halfway and is the default setting.)*

- Check the gain for calibration by pressing **S1** and then **F**. The calibration and gains will display.

The relationship of these numbers is the important factor. The gain should be greater than 2 and less than 15; the raw numbers should be (in descending order) REFERENCE, LIGHT, DARK. If they are not, check that portion of your edge detection system for a problem.



## PROBLEM SOLVING: InSpec

Following is a list of possible problem scenarios. Note: It is advised that the procedures suggested below be attempted only by personnel who are appropriately trained in electrical troubleshooting. Please contact your local distributor for further technical assistance. Also, note that most of the following information pertains to the optional InSpec system.

### 1.0 Problem: System does not activate on power-up:

- 1.1 If the lamps do not light
  - 1.11 Ensure that the main power cord IN to the system is plugged in firmly.
  - 1.12 Ensure that the main power cord IN is plugged in firmly at the wall outlet.
  - 1.13 Check the 6-amp fuse in the back of the machine near the power cord.
  - 1.14 Using a voltmeter, check the power at the wall outlet. It should be 110v/60hz in the U.S.; generally 220v/50hz outside the U.S.
  - 1.15 Using a digital multimeter, follow the power flow until the point at which it stops is located
  - 1.16. If the preceding checks have not resolved the problem, the power switch may be faulty.
  
- 1.2 If the profile and surface lamps are illuminated
  - 1.22 Check the computer to determine that power is on  
Note: Ensure that electrostatic discharge (ESD) does not occur to the computer. Damage may result.
    - 1.221 If there are no lights illuminated on the front of the computer
      - Ensure that the computer is plugged in firmly and that the POWER button has been depressed.
      - Check the cards to determine whether they are seated correctly.
      - Remove all cards except I/O and VGA and

retry

- 1.23 Computer will not boot up; no video display:
  - 1.231 Check the cards to determine whether they are seated correctly.
  - 1.232 Ensure that the cables from the I/O to the hard disk and floppy disk drives are connected correctly.
  - 1.233 Ensure that the RAM is seated properly  
Note: Ensure that electrostatic discharge (ESD) does not occur to the computer.
- 1.24 Computer will not boot up but video display is OK:
  - 1.241 Check CMOS settings (see DOS manual).
  - 1.242 Use a boot disk (see DOS manual).
    - If there is no boot disk available, use your DOS install disk 1, supplied with the computer, and EXIT to DOS.

\* \* \* *Possibility of corrupt DOS or system files*

## ERROR MESSAGES: InSpec

*The following is a review of potential error messages and suggested responses*

**Error message:** *Keyboard not detected*

- Check the keyboard connection.
- Check the keylock switch on the front of the computer.

**Error message:** *FDD/HDD error*

- Check the CMOS settings (see DOS manual).
- Check the cable and power connections to the drives and to the I/O card.

**Error message:** Locks up at *Starting MS DOS*

- Use a boot disk (see DOS manual) or press F8 at first display of *Starting MS DOS* message on screen.
  - Check CMOS settings (see DOS manual).
- \* \* \*Possibility of corrupt DOS or system files*

**Error message:** *HIMEM error*

- Use a boot disk (see DOS manual) or press F8 at first display of *Starting MS DOS* message on screen.
  - Check CMOS settings (see DOS manual).
- \* \* \*Possibility of corrupt DOS or system files*

**Error message:** *SMART DRIVE ERROR*

- Use a boot disk (see DOS manual) or press F8 at first display of *Starting MS DOS* message on screen.
- Check AUTOEXEC.BAT and CONFIG.SYS file settings (see DOS manual).

\* \* \**Possibility of corrupt DOS or system files*

**Error message:*****MOUSE NOT FOUND***

- Check mouse connections.
- Reload mouse driver.

**2.0 Problem:   InSpec related hardware errors** (*after* confirmation that all cable connections have been made correctly per Figure 1):

- 2.1 Scale(s) not reading or reading incorrectly:
  - 2.11 Check to determine whether scales are reading correctly: Zero axis and move full travel on stage.
  - 2.12 Check the scale to junction box to InSpec card connection.
  - 2.13 Check the InSpec card seating.
  - 2.14 Check InSpec card address dip switch setting (*see **InSpec Users' Guide***).
  - 2.15 Check that default settings for the scales and the counting direction are correct.
  - 2.16 Check that modes such as mm/inch, polar, etc. are correct.

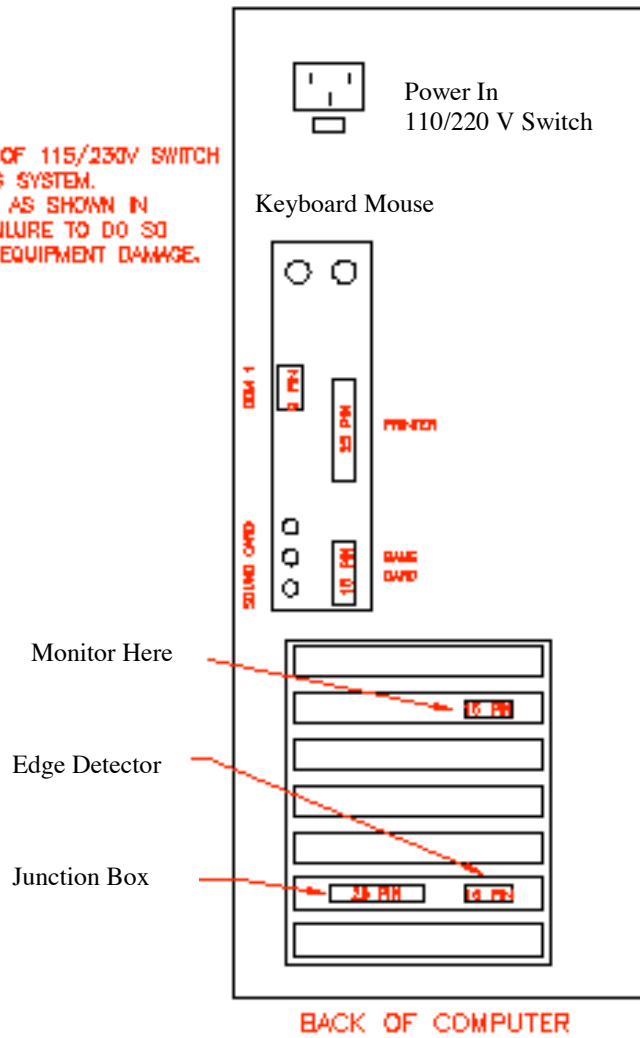


# APPENDIX



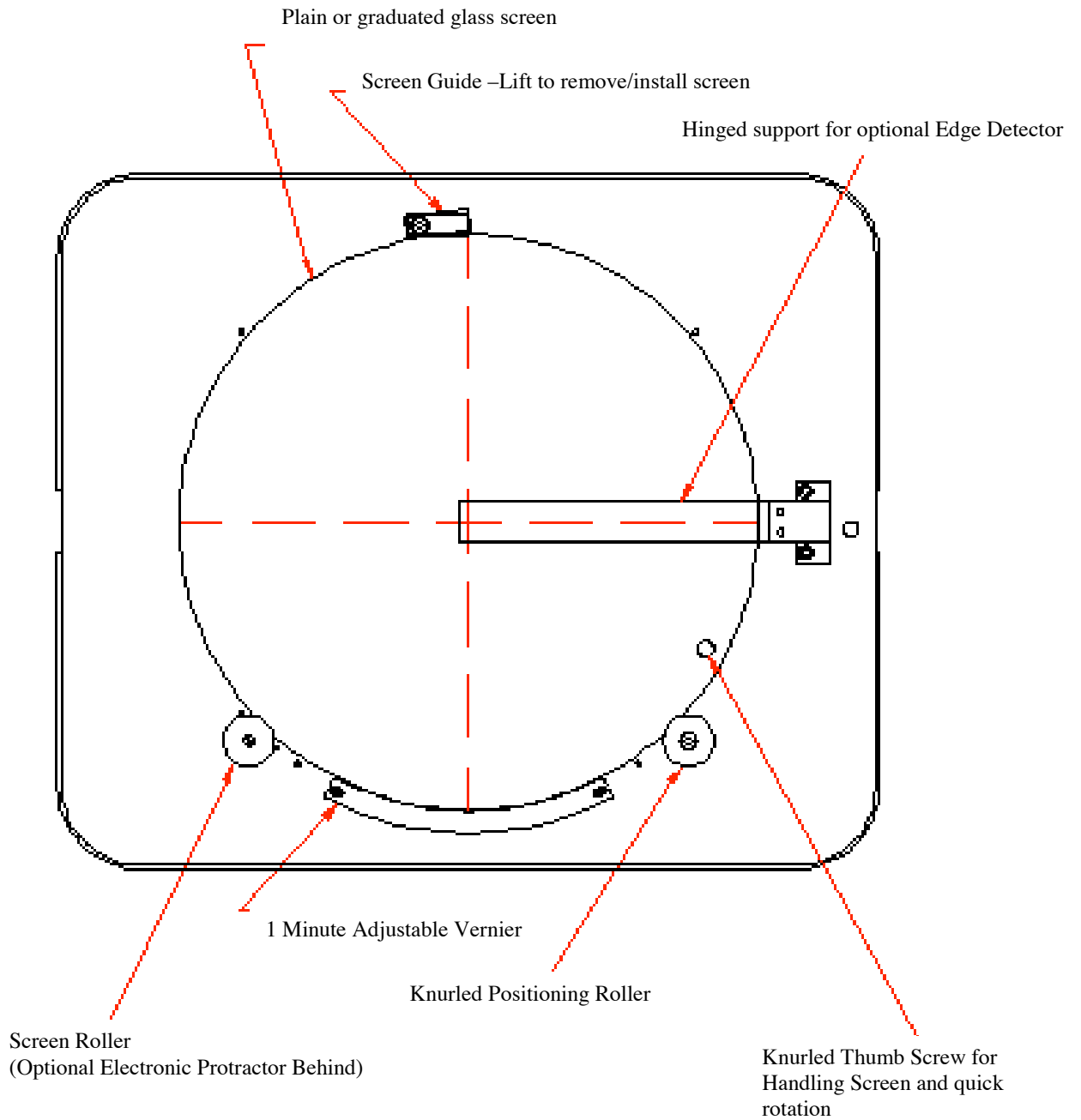
# COMPUTER CONNECTIONS, Figure 1

- 1) CHECK POSITION OF 115/230V SWITCH BEFORE STARTING SYSTEM.
- 2) CONNECT CABLES AS SHOWN IN ILLUSTRATION. FAILURE TO DO SO WILL RESULT IN EQUIPMENT DAMAGE.





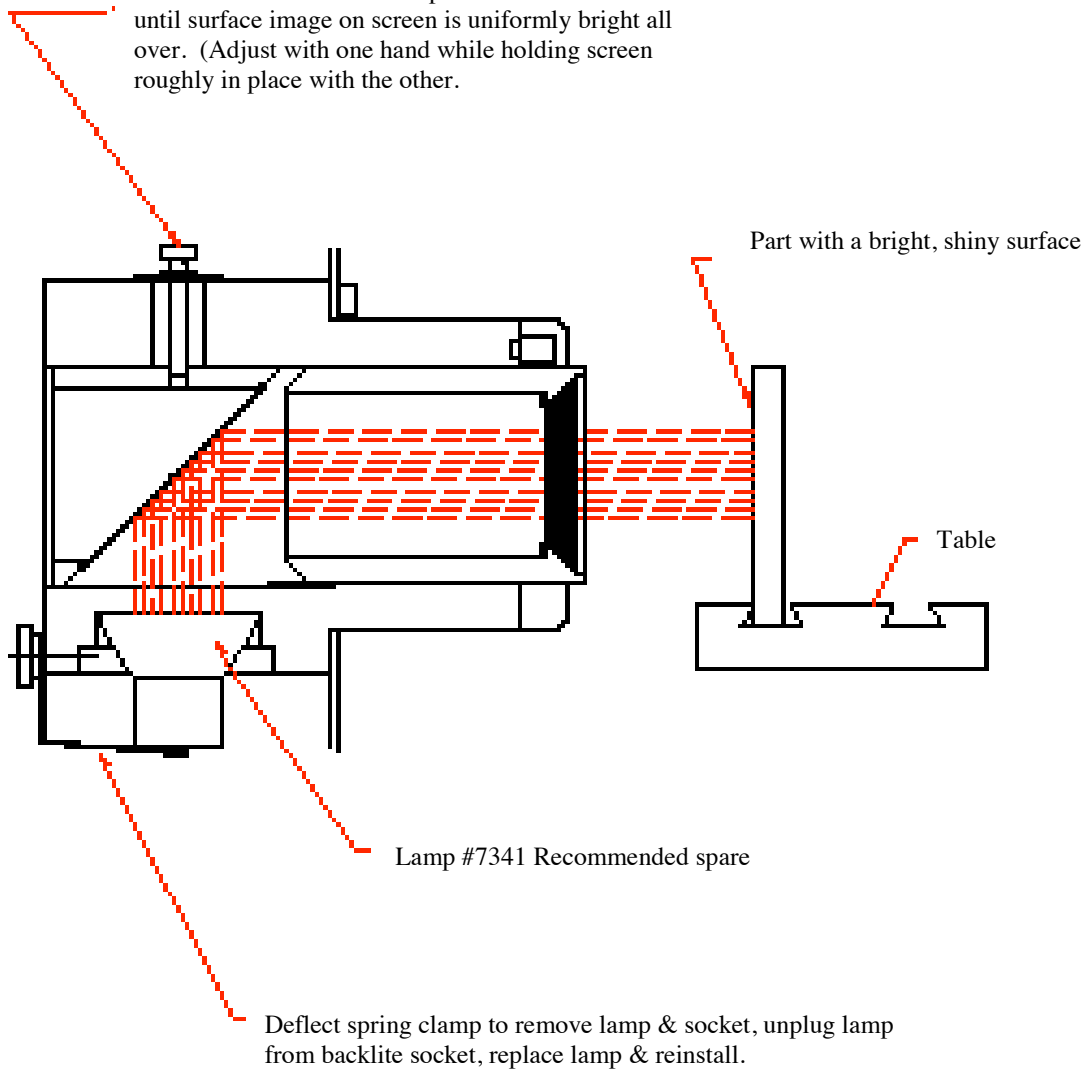
# SCREEN, ROLLER BRACKETS, VERNIER, Figure 2





## SURFACE LAMP REPLACEMENT AND SPLIT MIRROR ADJUSTMENT, Figure 3

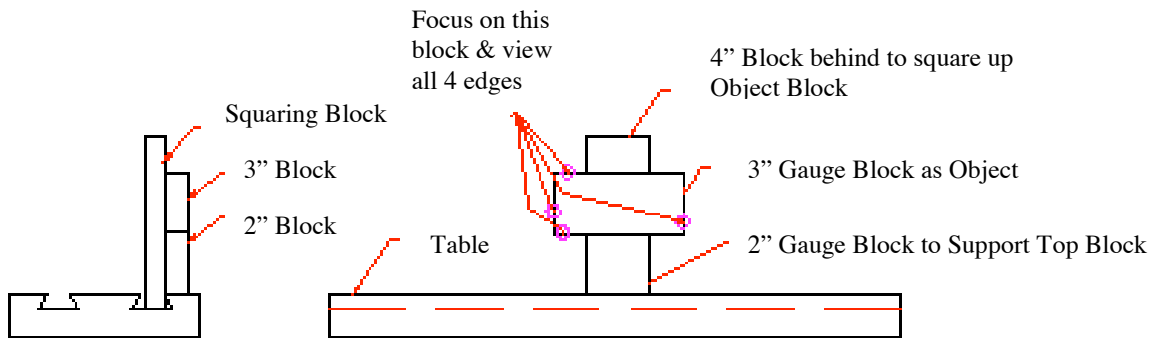
To set Split Mirror, focus on shiny surface, loosen this thumbscrew and move split mirror mount around until surface image on screen is uniformly bright all over. (Adjust with one hand while holding screen roughly in place with the other.





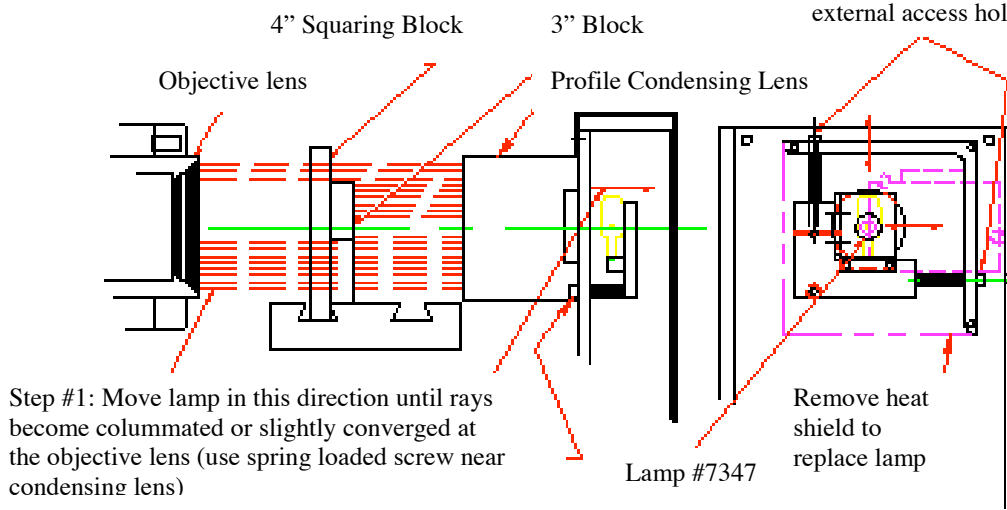


# PROFILE LAMP ADJUSTMENT, Figure 4



## LAMP ALIGNMENT SET-UP

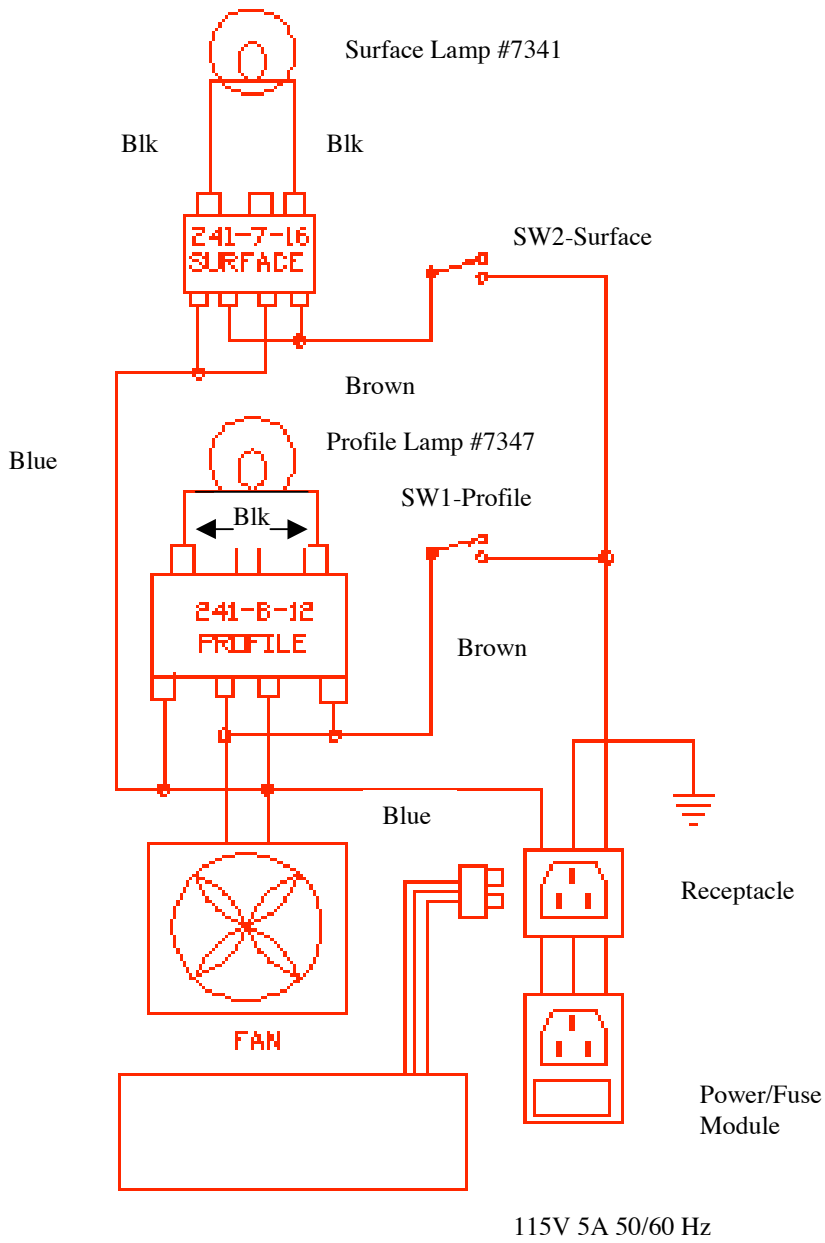
Step #2: Move lamp side-side or up-down to remove shadows on all 4 edges of 3" Block. Use 2 #1032 spring loaded screws holding lamp bracket external access holes provided



## LAMP ADJUSTMENT PROCEDURE



# WIRING DIAGRAM, Figure 5





# Q16 CONNECTIONS, Figure 6

