

**CP200/300  
Operating Manual  
OMP-0449**



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## **MANUAL REVISION INFORMATION**

The document (OMP) number and the applicable revision letter for this manual appear on the title page. The publication date appears below.

<b>Revision</b>	<b>Publication Date</b>	<b>Revision</b>	<b>Publication Date</b>
A (original)	December 2001		

## **MANUAL NOTATIONS**

**▲ Warning**

Denotes a hazard that could cause injury to personnel, and can also cause damage to the equipment.

**Note:** Provides helpful information.

**NOTICE:** The descriptions, drawings, and specifications contained herein are subject to change. Zygo is not responsible for errors or omissions herein or for incidental damages in connection with the furnishing or use of this information. This document shall not be reproduced, photocopied, or duplicated, in whole or in part, without prior written approval of Zygo Corp.

## **ZYGO Statement of Warranty and Product Support**

Zygo Corporation provides this warranty to protect its customers from defects in product workmanship or product materials. This warranty covers all products manufactured by Zygo Corporation. Zygo warrants that the equipment purchased will be free from any defects in material and/or workmanship under normal operating conditions for a period of one year from the date of shipment.

In addition, being committed to providing our customers with superior service, Zygo will support all standard products for a period of five years after the sale of the last newly-manufactured unit. Beyond this five-year period, we will continue to support these products on a "best-effort" basis.

### **WARRANTY SERVICE**

Zygo's responsibility under this warranty shall be limited to the repair or replacement (at Zygo's option) of defective equipment at no cost to the buyer, except for transportation, cleaning, and recalibration charges.

Zygo will perform warranty service by: (1) sending replacement parts with appropriate installation instructions to the buyer, the buyer returning his defective part to Zygo or; (2) repairing the product at a Zygo repair facility after it has been returned freight prepaid, or; (3) at the buyer's request, dispatching a service representative to the buyer's facility. The buyer shall pay Zygo's travel and living expenses as well as travel time.

Defective products or parts will be repaired or replaced with new or like-new parts. These replacement parts will be warranted for a period of 90 days after they are shipped, or for the remainder of the original warranty period, whichever is longer. Warranty service will be performed only if the buyer notifies Zygo within 14 days of discovering any defects. Equipment or parts that are to be returned to Zygo must be issued a Return Authorization number. This number can be obtained by contacting the Zygo Service Department. Should Zygo's subsequent inspection reveal that the parts were not defective, all expenses incurred by Zygo shall be charged back to the buyer. Defective equipment that is replaced shall become the property of Zygo.

Warranty period begins when the product is shipped from Zygo. Replacement parts, service workmanship, used equipment, and refurbished equipment are warranted for a period of 90 days.

### **RETURNS**

Unused and undamaged products, in their original shipping containers, may be returned for credit within 30 days of receipt. All such products will be subject to a restocking fee equal to 20 percent of the purchase price. Custom products are not returnable.

### **EXCLUSIONS**

The above warranty and product support statement applies only to equipment that is an integral part of a Zygo manufactured product. It does not apply to peripheral equipment manufactured by others, such as: computers, printers, vibration isolation tables, etc. In such cases, the warranty and the support that the original manufacturer supplies will apply.

In addition, warranty service does not include or apply to any product or part which, in Zygo's judgment:

- a. Has been repaired by others, improperly installed, altered, modified, or damaged in any way.
- b. Malfunctions because the customer has failed to perform maintenance, calibration checks or good operating procedures.
- c. Is expendable or consumable (such as panel lights, fuses, batteries, windows, and filters) if such items were operable at the time of initial use.
- d. Requires replacement because of decomposition due to chemical action.
- e. Fails because of poor facility, operating conditions, or utilities.

Other than expressly described above, Zygo makes no express or implied warranties, including any regarding merchantability or fitness for a particular purpose relating to the use or performance of the equipment. Zygo will not be liable for personal injury or property damage (unless caused solely by its own negligence), loss of profit or other incidental or consequential damages arising out of the use or inability to use the equipment. Nor does this warranty apply to any equipment which has been subject to misuse, neglect or accident; or repaired or altered by other than service representatives qualified by Zygo.

01/96

## **CE Notice**

Marking by the **CE** symbol indicates compliance of this Zygo instrument to the EMC (electromagnetic compatibility) Directive and the Low Voltage Directive of the European Union. Such marking is indicative that this system meets the following technical standards:

- EN 55011 – “Limits and methods of measurements of radio disturbance characteristics of ISM (Industrial Scientific & Medical) radio frequency equipment.” Class A, for use in typical commercial environments.
- EN 55022 – “Limits and methods of measurements of radio disturbance characteristics of ITE (Information Technology Equipment).” Class A, for use in typical commercial environments.
- EN 50082-1 1992 – “Electromagnetic compatibility generic immunity standard for the residential, commercial and light industrial environments.”
- EN 61010-1 1993/A2: 1995 – “Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements.”

A Declaration of Conformity in accordance with the preceding directives and standards has been made and is on file at Zygo Corporation, Middlefield, Connecticut, USA.

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# System Overview

## Chapter 1

### *In This Chapter*

- The CP200/300 Wafer Metrology System
  - Options
  - Theory of Operation
- CP200/300 Components
- Computer Components
- CP200/300 Specifications
- Safety Labels

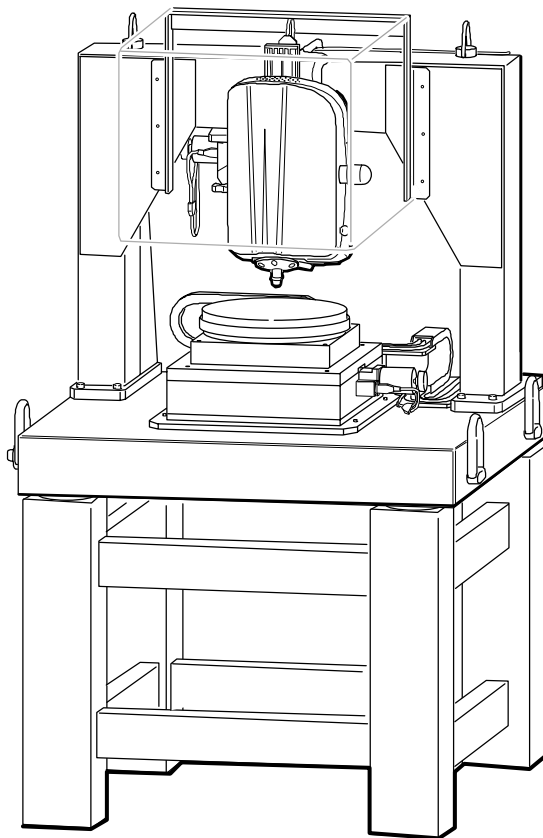
## The CP200/300 Wafer Metrology System

The Zygo CP200/300 Wafer Metrology System<sup>(1)</sup> is a gantry mounted Zygo NewView 5000 series interference microscope specially designed for measuring polished wafers. The CP200 has 200 millimeters of X-Y stage travel. The CP300 has 300 millimeters of X-Y stage travel.

Like the NewView, the CP200/300 uses scanning white light interferometry to image and measure the micro structure and topography of surfaces in three dimensions. It provides fast, high resolution, 3D area surface mapping of test parts, all without contacting the part or destructive testing.

Specialized standard components include: motorized tip/tilt in the measurement head, motorized X, Y, and theta stages, and comprehensive metrology software.

All systems come with a granite base, a stable gantry column, motorized focus (z-axis) control, and manual image zoom with a range from 0.4 to 2.0. Options include objectives, turrets, and a vacuum wafer chuck.



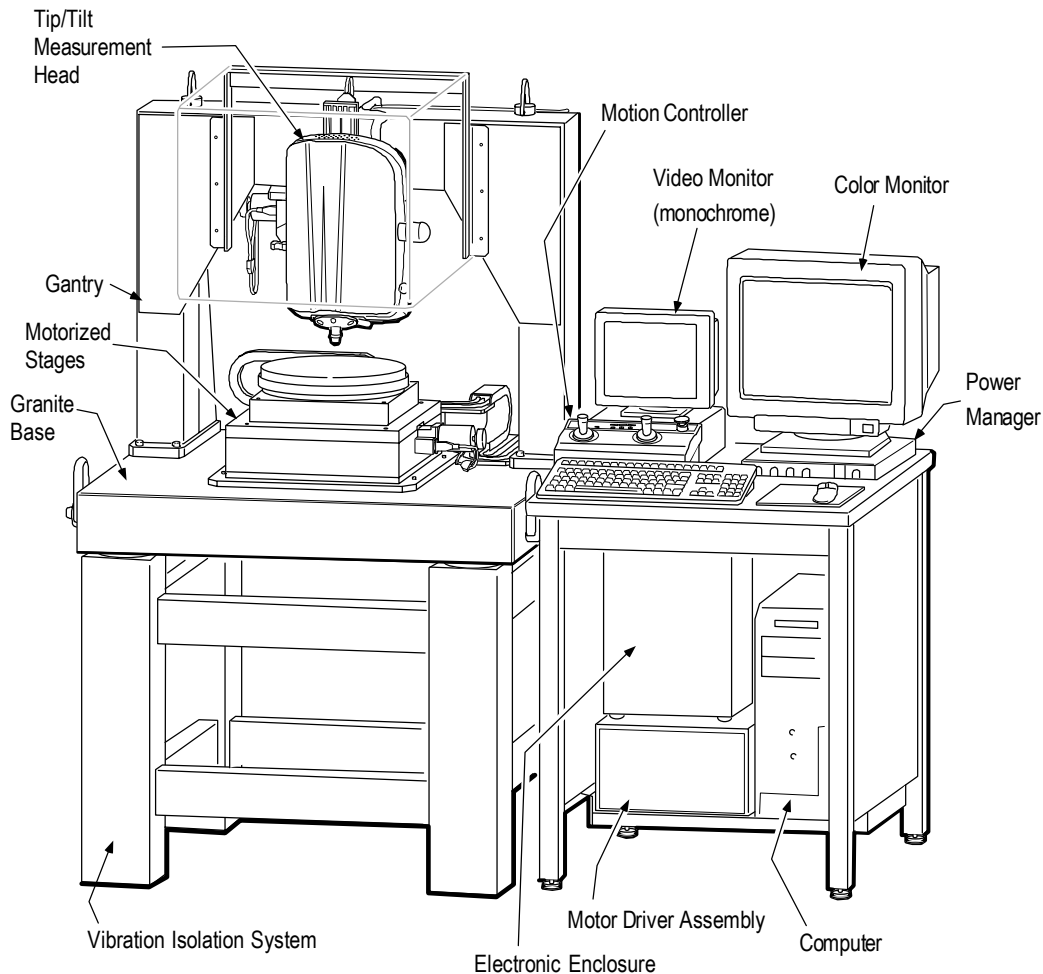
<sup>(1)</sup> U.S. patent numbers 5,402,234, 5,398,113, and 5,558,003; U.S. and foreign patents pending.

## Options

Component	Options
Objectives	1X, 2.5X and 5X Michelson objectives. 10X, 20X, 50X, 100X Mirau objectives. Long working distance objectives.
Turrets	Manual or motorized 5 position turret.
Wafer Chuck	200 millimeter diameter high precision wafer chuck. (CP200/300) 300 millimeter high precision wafer chuck. (CP300 only)

The CP200/300 system can be broken down into two basic subsystems - the CP200/300 and the computer. The CP200/300 provides the raw data needed for analysis; it includes the NewView microscope head on a motorized tip/tilt stage, objectives, motorized stages, video monitor, electronics, and a vibration isolation system. The computer controls the measurement process, performs calculations, and displays measurement results on a color monitor.

**Typical CP200/300 System**



The CP200/300 is designed to be easy to use, even by an operator without computer and microscope experience. Focusing on a test part is guided by a real-time display of the surface and optical focus aids. A motorized stage simplifies aligning the test part. Making a measurement is a single button operation.

The real power to analyze measurement data lies in its MetroPro™ analysis and control software. MetroPro runs in a window environment and has a graphical user interface. MetroPro performs image reconstruction and analyzes entire areas as well as profiles, and provides numerous surface structure results. Additional software options provide specialized testing capabilities.

### Theory of Operation

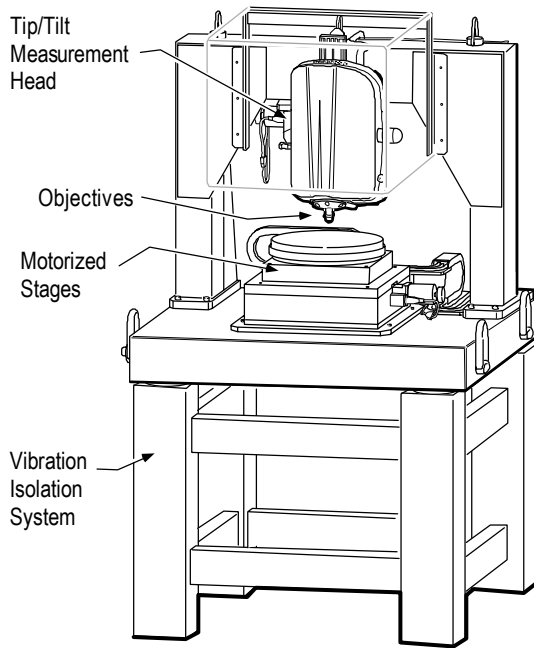
At the heart of the CP200/300 system is a NewView microscope head. The NewView uses scanning white light interferometry to image and measure test part surfaces and provide surface structure analysis without contacting the surface. Light from the microscope divides within the interferometric objective; one portion reflects from the test surface and another portion reflects from an internal, high quality reference surface in the objective. Both portions are then directed onto a solid-state camera.

Interference between the two light wavefronts results in an image of light and dark bands, called fringes, that indicate the surface structure of the part being tested. The test part is scanned by vertically moving the objective with a piezoelectric transducer (PZT) (or Pifoc). As the objective scans, a video system captures intensities at each camera pixel. These intensities are converted into images by MetroPro software. In addition, surface images are displayed on a video monitor, which magnifies the camera image 26 times.

Measurements are three dimensional. Vertical measurements, normal to the surface, are performed interferometrically. Lateral measurements, in the plane of the surface, are performed by calculating the pixel size from the field of view of the objective in use. The instrument analyzes and quantifies the surface topography of test parts. The CP200/300 has a vertical resolution of 0.1 nanometer (0.0039  $\mu\text{in.}$ ), and an objective dependent lateral resolution range from 0.45 to 11.8 micrometers (17.7 to 465  $\mu\text{in.}$ ). It has a standard vertical scan range of 150 micrometers (5906  $\mu\text{in.}$ ). Results are displayed on a color display as solid images, plots, and numeric representations of the surface.

## CP200/300 Components

Actual equipment may vary; see specification pages for more detail. Items not to scale.



### *Tip/Tilt Measurement Head*

Provides three dimensional measurement data of the surface under test. It is a scanning white light interferometric microscope.

### *Interferometric Objectives*

Gather light from the test part and form a real image of it. An interferometric objective divides the light into a measurement and reference beam and recombines them to form an interference pattern, which denotes part irregularities.

### *Motorized Stages*

Holds the part under test and provides for positioning under the objective.

### *Vibration Isolation System*

Isolates the system from environmental vibrations that degrade measurements.

### *Video Monitor*

Displays a monochrome live image of the part under test.

### *Motion Controller*

Drives and controls the motorized stages.

### *Electronic Enclosure*

Houses system electronics; it provides power to the head and interfaces to the computer.

### *Motor Driver Assembly*

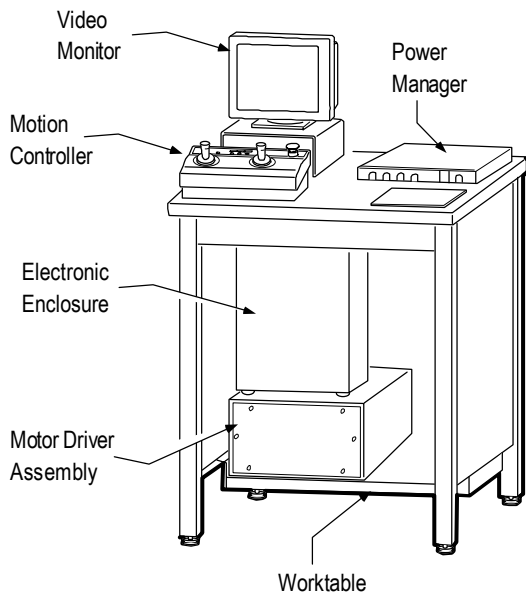
Provides power and control for the motorized stages.

### *Worktable*

Holds system components and provides a user workstation.

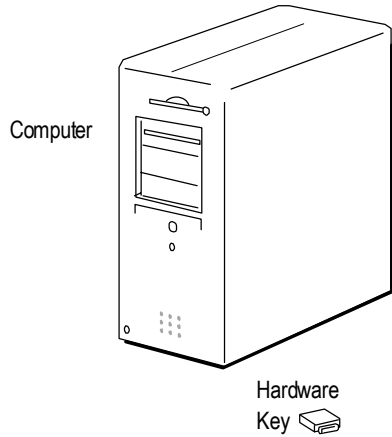
### *Power Manager*

Provides electrical noise and surge protection, and on/off switches for the entire system.



## Computer Components

*Actual equipment may vary. Refer to the documentation supplied by the original equipment manufacturer for details.*

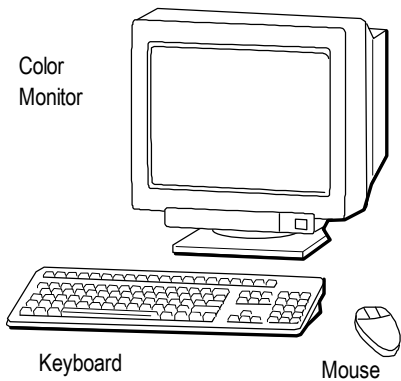


### *Computer*

For system control and data storage.

### *Hardware Key*

Enables MetroPro software and options.  
Connects to the computer's parallel port.



### *Color Monitor*

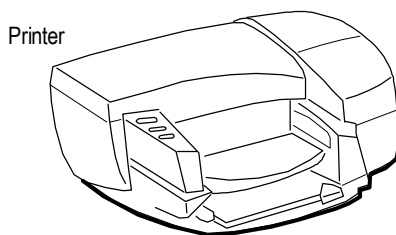
Displays graphics and data.

### *Keyboard*

For data entry.

### *Mouse*

For software control and selecting menus.



### *Printer (Optional)*

Outputs color copies of MetroPro displays.  
Connects to the computer.

## CP200/300 Specifications

### General:

Weight: 1250 lb (567 kg)  
(includes base, gantry, stages, and head)  
Light: filtered white light, tungsten halogen lamp  
Measurement Technique:  
scanning white light interferometry  
Pifoc: closed-loop with capacitive feedback

### Options:

Objectives: see objective specifications  
Objective Mounting: single dovetail objective,  
manual or motorized turret  
Wafer Chuck: 200 mm or 300 mm diameter

### Imaging and Sample Viewing:

Image Zoom: variable 0.4X to 2.0X, with detents  
Viewing: 9 in. (22.8 cm) video monitor  
and on-screen display  
Measurement Array:  
selectable, up to 640 x 480 pixels  
Focus: manual or automatic

### Performance:

Vertical Resolution: 0.1 nm  
Maximum Vertical Step Height:  
150  $\mu\text{m}$  standard, up to 5 mm optional  
Lateral Resolution: see objective specifications

### Z-Drive (Focus):

Motor: DC brushless, microstepper  
Drive: leadscrew  
Range: 4 in. (104 mm)  
Resolution: 4  $\mu\text{in.}$  (0.1  $\mu\text{m}$ )

### Tip/Tilt Stage:

Motor: 23 Frame Stepper (400 SPR)  
Drive Mechanism: worm gear (180:1 GR)  
Range:  $\pm 6$  degrees  
Resolution:  $< 10 \mu\text{rad}$   
Velocity:  $> 0.2 \text{ rad/sec}$

### X/Y Stage:

Motors: DC brushless, microstepper  
Drives: ballscrew  
Travel in X and Y:  
300 mm (12 in.) CP300  
200 mm (8 in.) CP200  
Load Capacity: 254 lb (115 kg)

### Theta Stage:

Motor: DC brushless, microstepper  
Drive: anti-backlash worm gear  
Diameter: 12 in. (30.5 cm)  
Load Capacity: 33 lb (15 kg)

### Utility Requirements:

Electrical (head): power from Electronic Enclosure  
(see applicable specification)  
Electrical (stages): power from Motor Driver  
Assembly (see applicable specification)  
Compressed Air: 80 psi (5.5 bar), clean and dry  
source. Accepts 1/4 in. diameter input hose (user-  
supplied adapters necessary for metric connection)

### Operating Environment:

Temperature: 15° to 30°C (59° to 86° F)  
Rate of Temperature Change:  $< 1.0^\circ\text{C}/15 \text{ min.}$   
Humidity: 5 to 95% relative, noncondensing  
Vibration: Frequency Isolation 1Hz  $< \text{freq} < 120\text{Hz}$

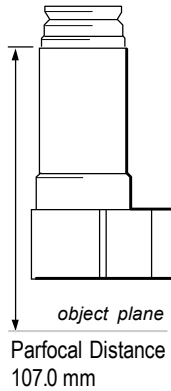
### Sample Specifications:

Size: Up to 300 mm (11.8 in.) diameter  
Type: opaque and transparent surfaces  
Roughness (max.):  $\leq 100 \mu\text{m Rp}$   
Reflectivity: 1 to 100 %

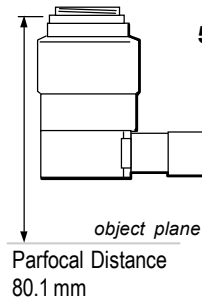
## Interferometric Objectives

**Objective Options:** 1X Michelson, 2.5X Michelson, 5X Michelson, 10X Mirau, 20X Mirau, 50X Mirau, 50X Thermally Compensated Mirau, and 100X Mirau. The 5X, 10X, 20X, and 50X objectives are parfocal. All objectives are turret mountable except the 1X.

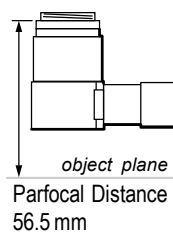
### 1X Michelson



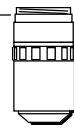
### 2.5X Michelson



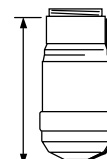
### 5X Michelson



### 10X 20X 50X Mirau



### 100X Mirau



### Turret (manual)



See the next page for mounting adapters.

### Nominal Objective Specifications at 1X (long working distance objectives available)

Power	Sys Mag	NA	Working Distance (mm)	Focus Depth (μm)	Inter Depth (μm)	Lateral Res (μm)	Field of View H x V (mm)	Spatial Samp (μm) 320x240 640x480	Slope (deg)
1X	20X	0.030	8.5	± 322.5	4.0	11.8	7.0 x 5.3	22.00 11.00	0.79
2.5X	50X	0.075	10.3	± 51.6	4.0	4.72	2.82 x 2.11	8.80 4.40	1.97
5X	100X	0.130	9.3	± 17.2	4.0	2.72	1.41 x 1.06	4.40 2.20	3.93
10X	200X	0.300	7.4	± 3.2	4.0	1.18	0.70 x 0.53	2.20 1.10	7.73
20X	400X	0.400	4.7	± 1.8	3.6	0.88	0.35 x 0.26	1.10 0.55	14.56
50X	1000X	0.550	3.4	± 1.0	2.0	0.64	0.14 x 0.11	0.44 0.22	27.65
100X	2000X	0.800	0.55	± 0.5	1.0	0.45	0.070 x 0.053	0.22 0.11	36.25

### Nominal Objective Specifications at Other Zoom Settings

The NA, Working Distance, Focus Depth, Inter Depth, and Lateral Res specifications are the same at all zoom settings. Use the multipliers in the table below for Sys Mag, Field of View, and Spatial Samp specifications; multiply the value in the above chart times the multiplier.


Zoom Setting	0.4	0.5	0.8	1.0	1.3	2.0
Multiplier for Sys Mag	0.4	0.5	0.8	1.0	1.3	2.0
Multiplier for Field of View and Spatial Samp	2.5	2.0	1.25	1.0	0.77	0.5

### Objective Table Notes:

Power	Magnifying power of the objective.
Sys Mag	System magnification, the enlargement of the surface as viewed on the video monitor.
NA	Numerical aperture, a number representing the resolving power of the objective.
Working Distance	The distance from the end of the objective to the test surface when focused.
Focus Depth	Vertical distance within which any specimen detail will simultaneously be in focus. The coherence bandwidth is centered within the depth of focus.
Inter Depth	Interference depth, vertical distance over which interference can occur.
Lateral Res	Lateral resolution, optical resolution of the imaging system.
Field of View	The size of area imaged and measured.
Spatial Samp	Spatial sampling, the apparent pixel size at each magnification; it varies based on the Camera Res.
Slope	Maximum angle of surface feature from one pixel to the next that can be measured.

## Objective Mounting Options

An asterisk (\*) indicates that the item is included with the system or objective; other items optional.

<b>Objective</b>	
<b>Single Objective Mounting</b>	
<b>1X</b>	 <p>Dovetail Mount * P/N 6300-1815-01</p>
<b>2.5X</b>	 <p>Dovetail Mount*, (top half of P/N 1414-100-046)</p>
<b>5X-100X</b>	 <p>Universal Dovetail Mount * P/N 1414-100-046</p> <p>OR</p>  <p>Short Dovetail Mount P/N 6300-1795-01</p>
<b>Manual Turret Objective Mounting</b>	
<b>1X</b>	Not turret mountable
<b>2.5X</b>	 <p>2.5X Mounting Adapter P/N 6300-1824-01</p>
<b>5X-100X</b>	<p>Direct mount, no adapter required</p> <p>OR</p>  <p>Parfocal Kit P/N 6300-1825-01</p>
<b>Motorized Turret Objective Mounting</b>	
<b>1X</b>	Not turret mountable
<b>2.5X</b>	Direct mount, no adapter required
<b>5X-100X</b>	 <p>Mounting Adapter P/N 1414-100-048</p> <p>OR</p>  <p>Parfocal Kit P/N 6300-0453-01</p>

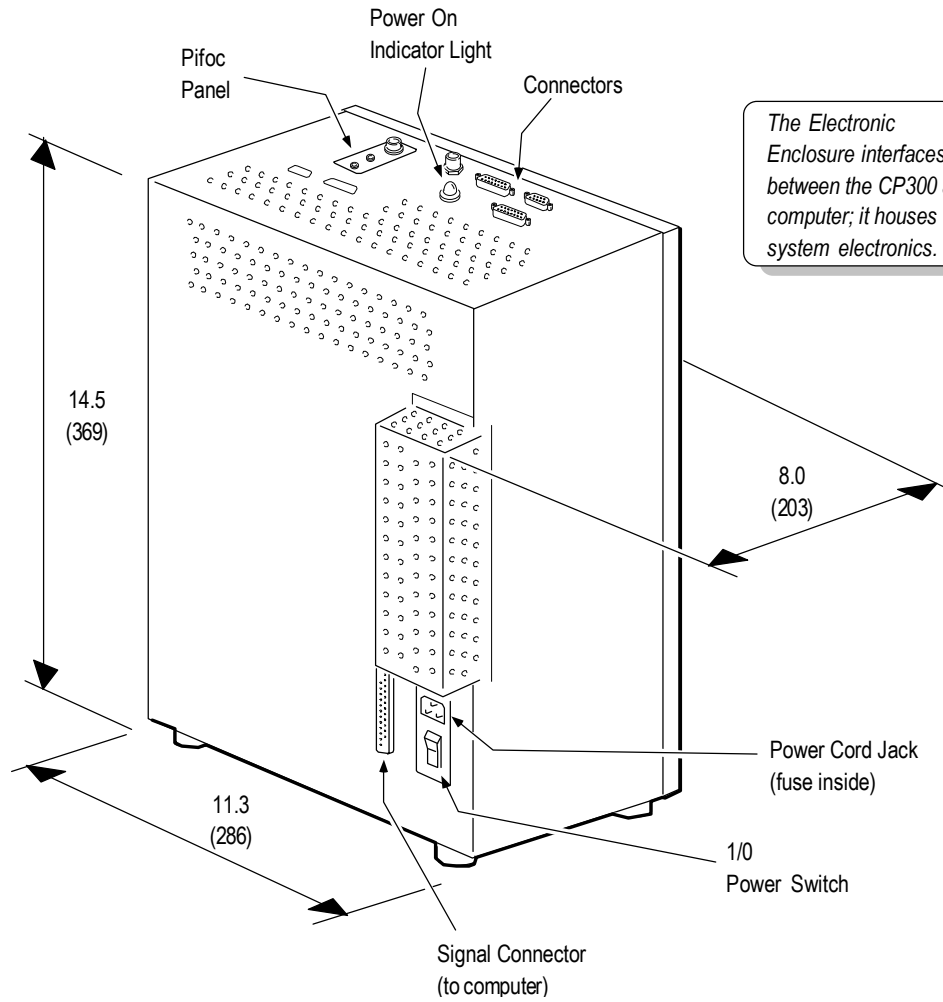
## Electronic Enclosure

**Physical Characteristics:**

Dimensions: See drawing below.  
Weight: 12 lb (5.4 kg)

**Electrical:**

Incoming Power: 100/240 VAC, 50/60 Hz  
Power Dissipation: 50 watts maximum  
Fuse Rating (supply module): 250V 2A



Dimensions shown in inches and (millimeters).

## Motor Driver Assembly

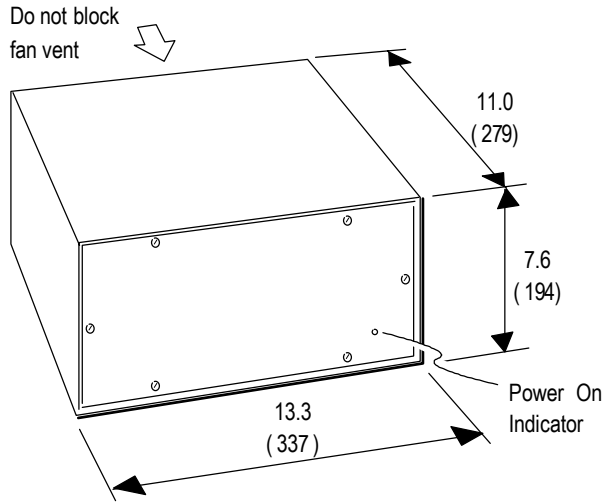
**Physical Characteristics:**

Dimensions: See drawing below.  
 Weight: 16.3 lb (7.4 kg)

**Electrical:**

Incoming Power: 100/240 VAC, 50/60 Hz  
 Power Dissipation: 200 watts maximum  
 Fuse Rating (supply module): 2A 250V

*The Motor Driver Assembly supplies power to the motorized stages and interfaces with the Motion Controller.*



Dimensions shown in inches and (millimeters).

## Motion Controller

**Physical Characteristics:**

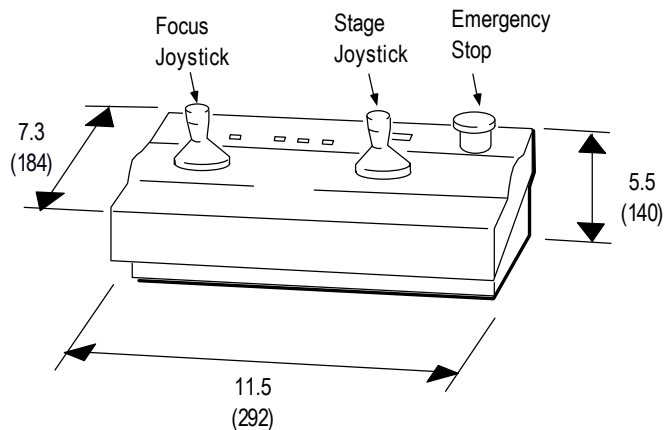
Dimensions: See drawing below.  
 Weight: 6.0 lb (2.7 kg)

**Electrical:** Incoming power and signal from Motor Driver Assembly

**General:**

Controls up to 6 axes: focus (z), tip/tilt (pitch and roll) stage, x/y stage, and theta stage.




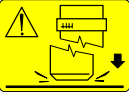
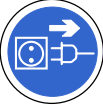



*The Motion Controller controls the motorized stages and the focus motor.*



Dimensions shown in inches and (millimeters).

## Safety Labels

The following table describes the general meaning of safety labels found on the instrument. Specific warnings are covered in the applicable section within this manual. Failure to follow the safety labels and the recommendations in this manual could result in damage to personnel and the instrument, and may void the warranty.

Label	Meaning
	General hazard. Proceed with caution. Refer to the manual for instructions.
	Electrical shock hazard. Proceed with caution, there is a risk of electrical shock.
	Hot surface; possibility of burns. Keep hands and objects away.
	Objective crash warning. Do not drive the objective into the part or stage.
	Disconnect power.
	Refer to the manual for instructions.
	Earth ground.
	Protective conductor terminal.



# Installation

## Chapter 2

### *In This Chapter*

- A Note About Installation
- Preinstallation Considerations
  - Requirements for the Operating Environment
  - Utility Requirements
- Positioning Components
- Installing the Computer
- Installing the CP200/300 System
- Installing Objectives
- Interconnection Diagram
  - Power Connections

## A Note About Installation

This chapter describes the appropriate operating environment, which should be considered before the system is set up. It also provides installation instructions.

Installation instructions for computer equipment are covered separately in documentation provided by the original manufacturers.

### ▲ **Warning**

Installation must be performed by Zygo Corporation trained personnel.

## Preinstallation Considerations

The CP200/300 system is capable of measuring to the sub-Angstrom level, the environment in which it is installed is significant and will have an affect on its overall performance. Before installing your instrument, you should carefully consider the operating location to ensure that the system can be easily installed and operate as designed. The next section describes the appropriate operating environment.

## Requirements for the Operating Environment

**Vibration Isolation** - Vibration is the most significant environmental concern for the system, and the most difficult to control. Vibration can be introduced by any of several sources: floors with insufficient support or rigidity, acoustic noise, other equipment (fans, etc.), human activity, and so on. The vibration isolation table included with the system should minimize vibration effects.

Ideally, the floor of the installation site should be a poured concrete slab at ground level. This greatly reduces large-amplitude vibrations. Small amplitude vibrations transmitted through the ground, such as those caused by human activity, can be eliminated by using a vibration isolation system.

Acoustic vibration (sound) of sufficient amplitude can cause vibration of the instrument, items under test, and even of the vibration isolation table. This is especially true of low-frequency vibrations, which may not be audible even at relatively high amplitude.

Uninsulated walls made are prone to retransmitting acoustic vibration from adjoining areas and suspended ceilings can couple roof mounted air conditioning noise.

Vibration can also be transmitted to the system through connecting cables. Be careful not to run cables where they would be touching sources of vibration or are likely to be jarred or kicked. Don't place the keyboard, mouse, or anything that has moving parts, on the vibration isolation table.

**Temperature Change** - Rapid temperature changes degrade system performance because different materials absorb and release heat at different rates, resulting in uneven expansion and contraction of the instrument and components under test. Temperature differences may be caused by air conditioning, heating devices, or vents. Wide concurrent temperature differences in the operating environment also degrade performance because they create air turbulence.

**Air Turbulence** - Air turbulence, or the movement of air, causes uneven air density within small areas, which can refract parts of the measurement beam and alter the measurement. Fans or blowers may help to even out temperature differences in the operating area, but they can introduce air turbulence if positioned improperly.

**Airborne Impurities** - Smoke, dust, and oil impurities can accumulate on optical components; degrading system performance and even ruining optical coatings.

## Utility Requirements

**Electrical** – Supply voltage must be 100/240 V at 50/60 Hz. The system should be connected to an isolated circuit with an earth ground.

### ▲ Warning

The power manager plug is used as the disconnecting device. Ensure that the outlet is accessible.

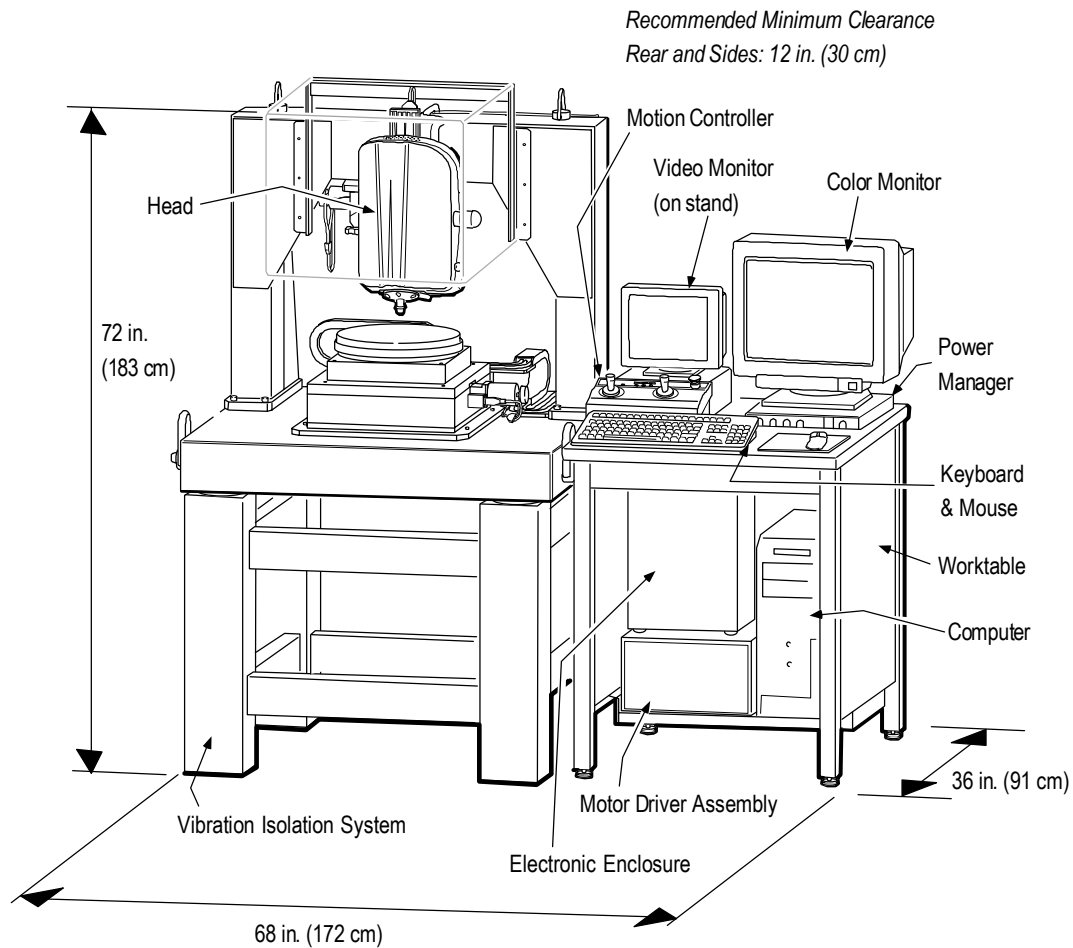
**Compressed Air** – Air is required for the Vibration Isolation Table and the air cylinders in measurement head. Operation at maximum load requires a supply line pressure of approximately 80 psi (5.5 bar), although typical operation pressure is less. The flow rate for the table is negligible once the isolator is pressurized.

The air supply should be filtered and oil and water free. The system accepts a 1/4 in. diameter input hose. To adapt for metric hoses the user must provide appropriate fittings, such as those available from SMC Pneumatics.

## Positioning Components

The recommended locations for components are shown in the following figure. The system is isolated from vibrations from the working surface by the vibration isolation system. The computer, Electronic Enclosure and other electronics are placed on the worktable shelf.

### Suggested System Layout



## Installing the Computer

Most of the computer components are simply unpacked, set in position, and then interconnected with cables. For specific installation information refer to the documentation supplied by the original equipment manufacturer.

## Installing the CP200/300 System

### Preinstallation

1. Inspect all packages for signs of shipping damage. Report any damage to the carrier.
2. Check that the shipment is complete.
3. Ensure that the worksite has the required operating environment and utilities.
4. Contact your Zygo representative to make arrangements for installation and training.
5. Move all shipping containers to the worksite. Allow the equipment to acclimate for at least 24 hours. Zygo recommends that you save the shipping containers for future transport of the equipment.

**▲ Warning**

When lifting or moving equipment or pallets, contact the appropriate local and national agencies in your country for proper lifting recommendations.

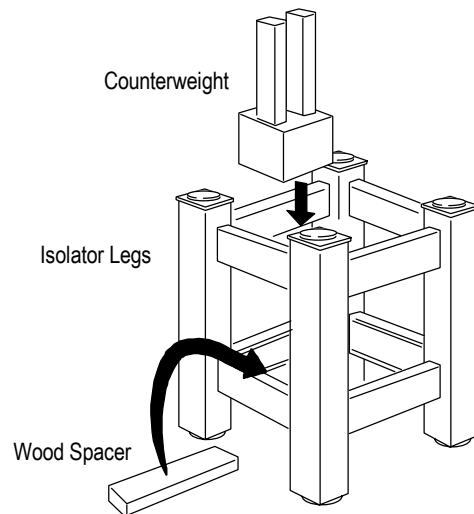
### Installing the Vibration Isolation Table

**▲ Warning**

When moving and installing the Vibration Isolation Table have several helpers and use a forklift or hoist with lifting straps. Contact the appropriate agencies in your country for proper lifting recommendations.

1. Open the box containing the Vibration Isolation Table.
2. Move the isolator legs (weight 300 lb, 136 kg) into position at the installation location.
3. Place the counterweight (weight 180 lb, 82 kg) on the wood spacer inside the legs.

**Note:** Follow the original manufacturer's instructions for information on leveling the air isolators and connecting the air supply.



**Installing the CP200/300****▲ Warning**

When moving and installing the CP200/300 have several helpers and use a forklift or hoist with lifting straps. Contact the appropriate agencies in your country for proper lifting recommendations.

The granite base, gantry and stages weigh about 1200 lb (544 kg). Lift with straps through the four lifting hooks on the granite base.

1. Lift the CP200/300 and place it on top of the vibration isolation table legs. Remove shipping stops from X and Y stages.
2. Attach the Vibration Isolation Table counterweight to the bottom of the granite base with the included bolts.

**▲ Warning**

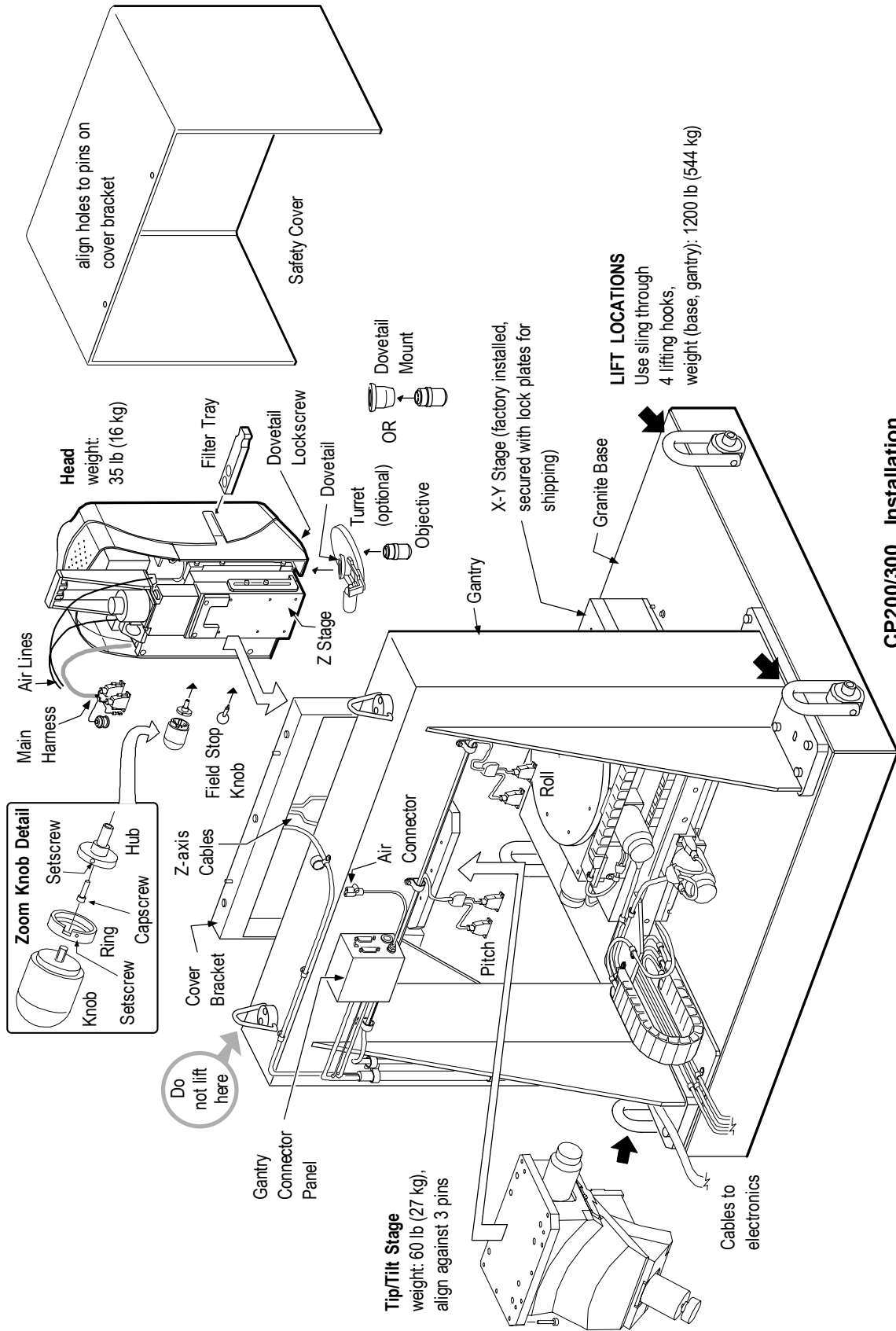
The Tip/Tilt Stage weighs about 60 lb (27 kg). Exercise care when lifting the stage into position.

3. From the rear of the granite base, lift the Tip/Tilt Stage into position under the gantry, aligning it against the three dowel pins. Secure in place with capscrews. Connect the pitch and roll connectors to the stage.

**▲ Warning**

Handle the microscope head with care; it contains precision optics. Do not touch any glass surfaces.

4. Place the microscope head onto the Tip/Tilt Stage; a bracket will hold it in position. Thread four Allen head capscrews into the z-stage, but do not completely tighten the capscrews. Push the z-stage as far to the left as it will go (as viewed from the front). Tighten the four capscrews. Remove the z-stage shipping stop.
5. Connect the cables from the head to the gantry connector panel. Connect the z-axis motor and limit connectors to the microscope. Connect the air lines from the head to the air connector on the rear of the gantry. To connect the air hoses just push the air hose into the quick-connect fitting.
6. Remove the shipping tape from the microscope head's filter tray slot and the knob locations.
7. Slide the Filter Tray into the slot in the head. Screw the field stop knob onto the head.
8. Attach the zoom knob. Slide the knob hub onto the square shaft on the head and secure the hub with a capscrew. Place the zoom knob and ring over the hub; align the slot in the zoom ring and tighten the setscrew on the hub underneath. Turn the knob counter-clockwise to the last detent; align the ring's 2X marking to the indicator line on the head; and secure the ring setscrew.
9. Loosen the dovetail lockscrew and remove the shipping plug from the underside of the head.
10. If you are using a turret, align the slot in the turret dovetail to the pin on the microscope head. Tighten the dovetail lockscrew. If it is a motorized turret, connect the turret connector.



**CP200/300 Installation**

**Finishing the Installation**

1. Unpack the worktable and move it into position next to the Vibration Isolation Table.
2. Position the computer, Electronic Enclosure, and Motor Driver Assembly on the shelf under the worktable.
3. Connect the power cords through the power manager. See “Cable Connections.”

**Note:** The power manager is for power distribution for the system. Other equipment should not be connected to the power manager.

4. Position the power manager, color monitor, video monitor and stand, keyboard, mouse, and Motion Controller on top of the worktable.
5. Connect signal and power cables to all components routing cables through the holes in the worktable and securing them with the supplied clamps.
6. Attach the air panel to the rear of the isolator legs.
7. Connect air line from the head to the panel. Connect the air line from the panel to the air table isolators. Connect the air panel to incoming compressed air.

**▲ Warning**

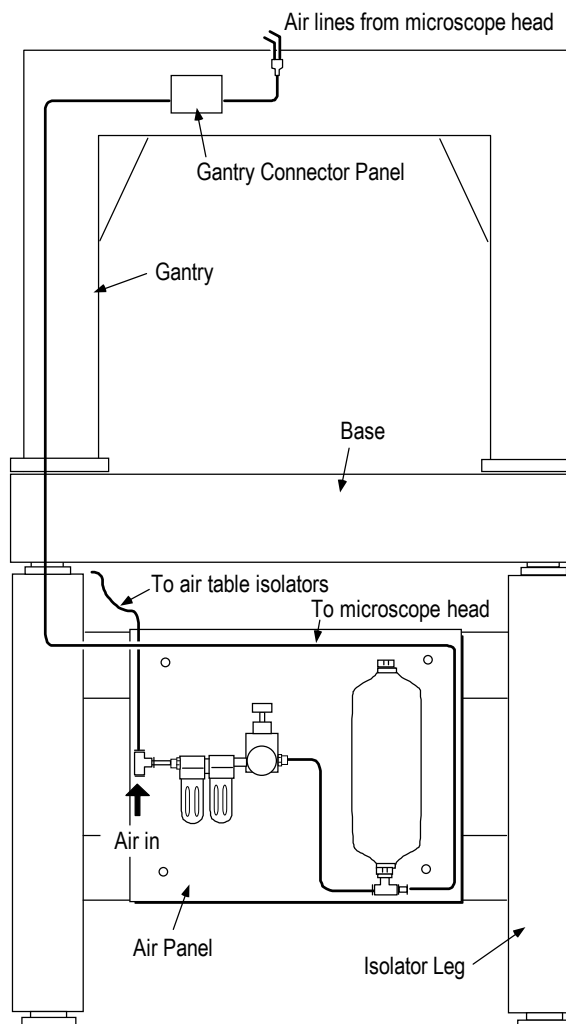
The power manager plug is used as the disconnecting device. Ensure that the outlet is accessible.

8. Connect the power manager to incoming power.

**Note:** The power manager is for power distribution for the system. Other equipment should not be connected to the power manager.

9. Place the safety cover onto the gantry cover bracket. Align the holes in the cover to the pins on the bracket. To remove the safety cover, simply lift it off the pins.

**Air Line Connections - Rear View of CP200/300**



## Installing Objectives

**▲ Warning**

Do not touch the objective lenses. Dust, dirt, and fingerprints can impair the imaging capability and harm optical coatings. Unused objectives should be stored in their protective cases. Do not over-tighten objectives; finger tight only.

Remove the objective from its protective case. Follow the procedure that matches your system configuration. Objective mounting adapters are shown in Chapter 1.

*For single objective mount.*

Screw the appropriate dovetail adapter onto the objective. Align the slot on the objective dovetail to the pin on the microscope head. Tighten the dovetail lock screw.

*For Manual Turret.*

Thread the objective clockwise into a hole in the turret. A mount adapter is required for the 2.5X objective.

*For Motorized Turret.*

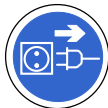
Thread the objective clockwise into a hole in the turret. A mount adapter is required to mount the 5X, 10X, 20X, 50X, and 100X objectives.

## Interconnection Diagram

The computer connections shown in the following figure are for reference only; always consult the original equipment manufacturer's documentation.

**▲ Warning**

Also follow the precautions under “Power Connections.”

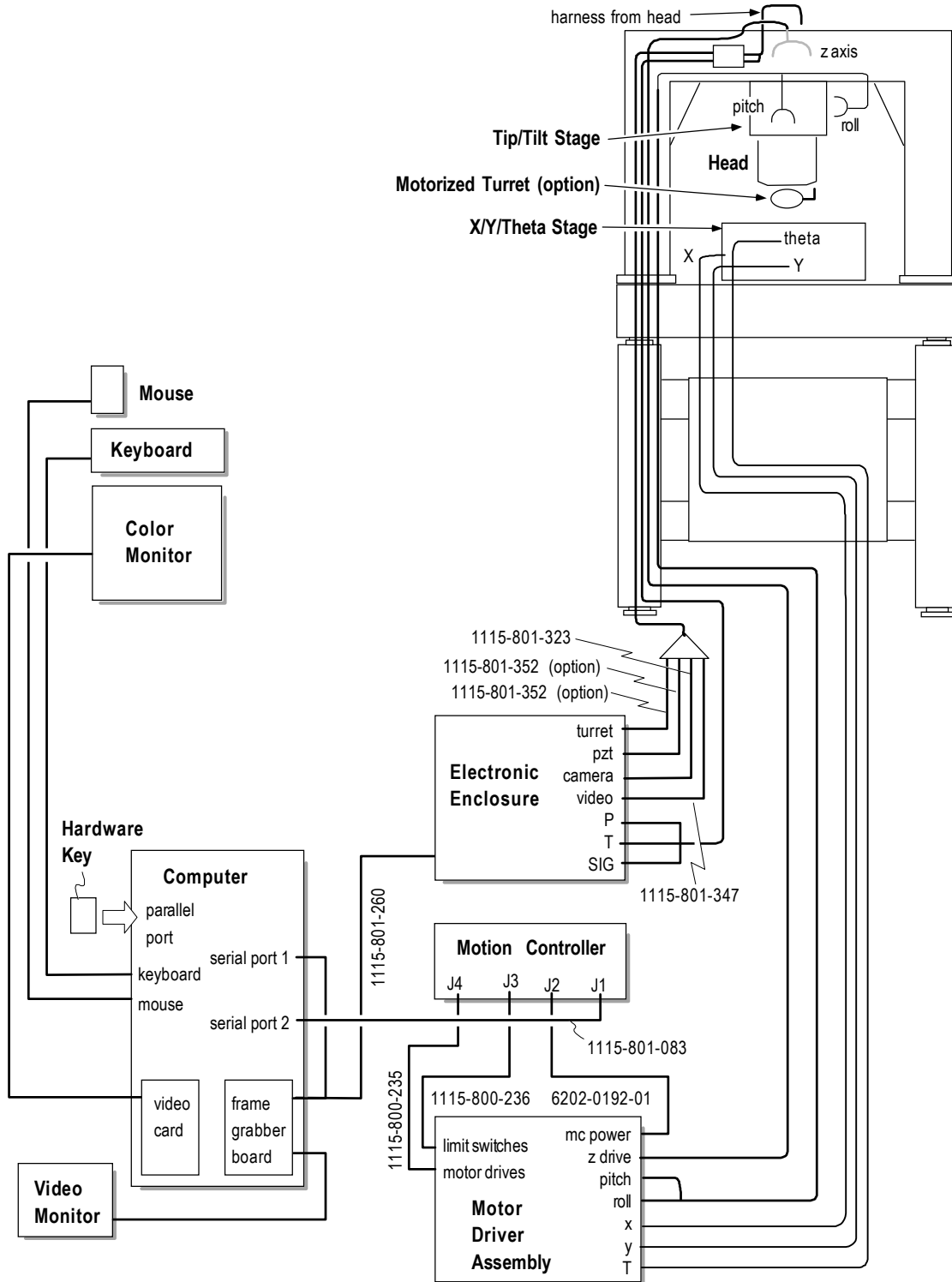


Disconnect equipment from power when connecting cables.



The SIG and PZT connectors on the Electronic Enclosure may contain live voltage. Use only as intended.

CP200/300 System Cable Connections



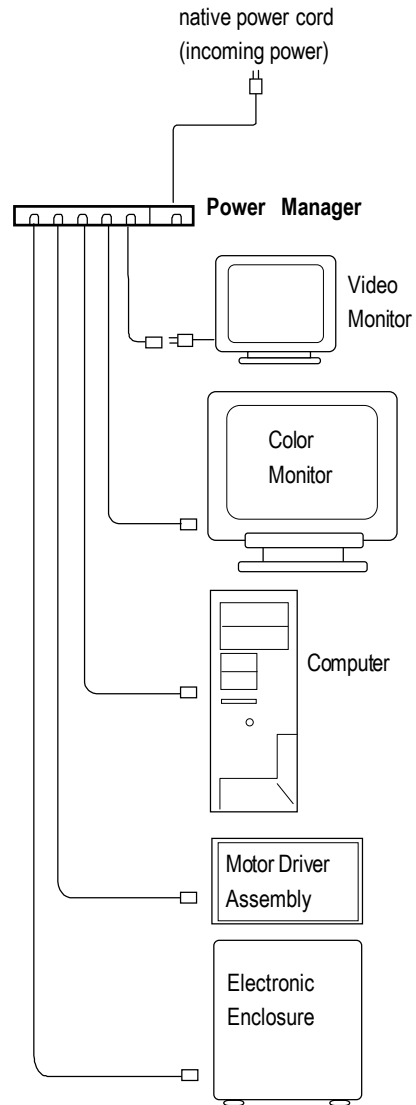
**Power Connections**

**▲ Warning**

The equipment must be electrically grounded through the supply outlet.

The Power Manager is for power distribution for the system. Other equipment should not be connected to the Power Manager.

The Power Manager plug is used as the disconnecting device. Ensure that the outlet is accessible



# Making Measurements

## Chapter

# 3

### *In This Chapter*

- A Note About Operation
- Start-up
- Shutdown
- CP200/300 Controls
- Electronic Enclosure Controls
- Motor Driver Assembly Controls
- Motion Controller Controls
  - Using the Motion Controller
- Light Level Controls
- Measurement Overview
  - 1. Setup
  - 2. Focus
  - 3. Null
- Measurement Flowchart
- Operation Hints
  - Using System Error Files
  - Selecting the Right Objective
  - Using 2.5X and 5X Michelson Objectives
  - Using 1X Michelson Objective
  - MetroPro Controls Used Most Often
  - Technical Details: FDA Res, Scan Length, and Camera Mode
- Using Auto Focus
- Using the Motorized Turret
- The Lateral Calibrator

## A Note About Operation

### ▲ **Warning**

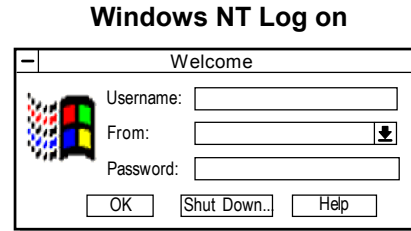
The operator must be trained before operating the system.  
Read all operation instructions before starting the equipment.  
The equipment should only be used in the manner in which it is intended.

## Start-up

### ▲ Warning

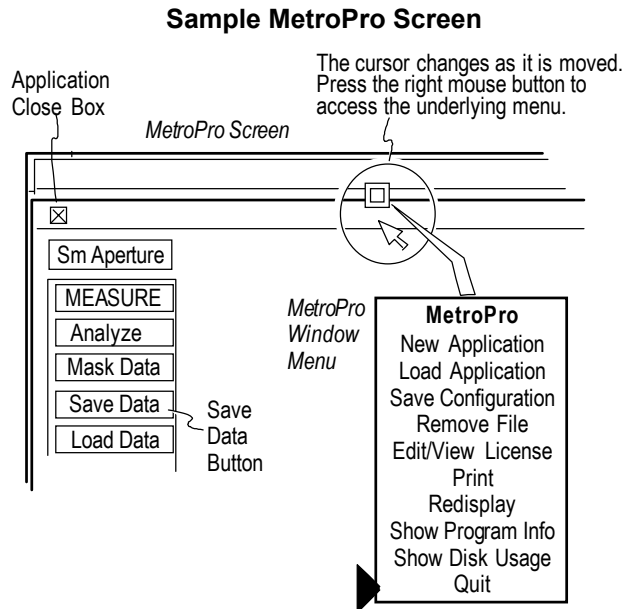
The operator is responsible to make sure the joysticks are not activated when the system is first started. People and objects must be clear from the stage area. For emergencies press the Motion Stop button to stop all stage motion.

1. Turn on all components with the master switch on the Power Manager.
2. After the welcome message appears, press Ctrl-Alt-Del to log on.  
In the Welcome dialog box type a username and password. If you do not have a username, enter “zygo” and press the Enter key. Locate the MetroPro program icon and double-click it.

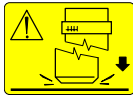


## Shutdown

1. Save data and other files.
2. Close open applications by clicking the close box in the upper left corner. Press and hold the right mouse button; choose Quit from the MetroPro Window menu.
3. From Windows, use the Start menu and select the Shutdown command.
4. Turn off all components with the master switch on the Power Manager.



### CP200/300 Controls



Do not crash the objective or microscope into the test part or stage. Use caution when focusing and driving the z-axis.



Hot surface; possibility of burns. Keep hands and objects away from lamp housing.

#### Light Centering Controls

Use to adjust bulb position in the lamp housing for proper illumination when replacing the bulb.

#### Filter Tray

Two position: MEAS for taking measurements, FOCUS to aid focusing.

#### Dovetail Lockscrew

Secures the turret or objective dovetail in position.

#### Turret (optional)

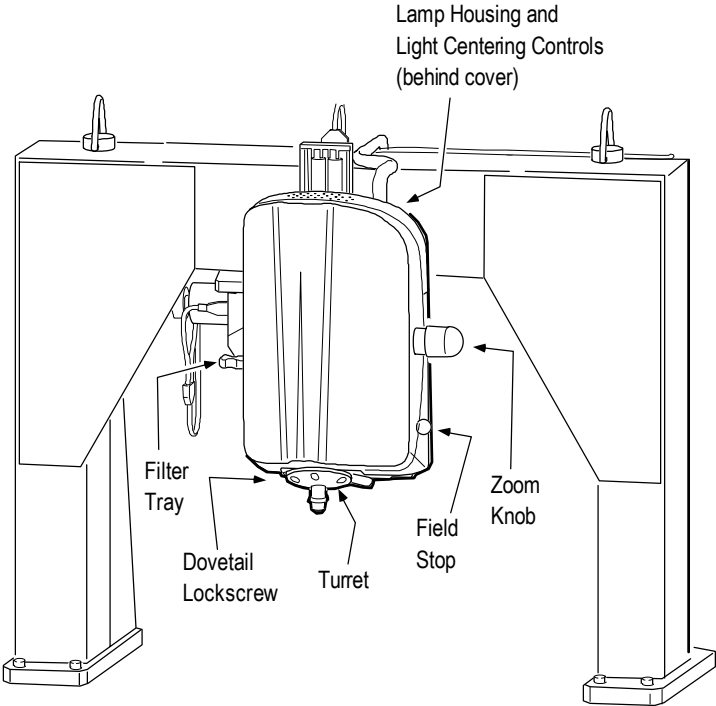
Holds multiple objectives for quick change of magnification.

#### Field Stop

Use to minimize stray light at zoom settings above 1X.

#### Zoom Knob

Changes magnification, detents at 0.4, 0.5, 0.8, 1.0, 1.3, and 2.0X.



## Electronic Enclosure Controls



The SIG and PZT connectors on the Electronic Enclosure may contain live voltage. Use only as intended.

### Connector Panel

Provides for connection to the microscope.

### Power On Indicator

When lit, the enclosure is receiving power.

### Pifoc Panel

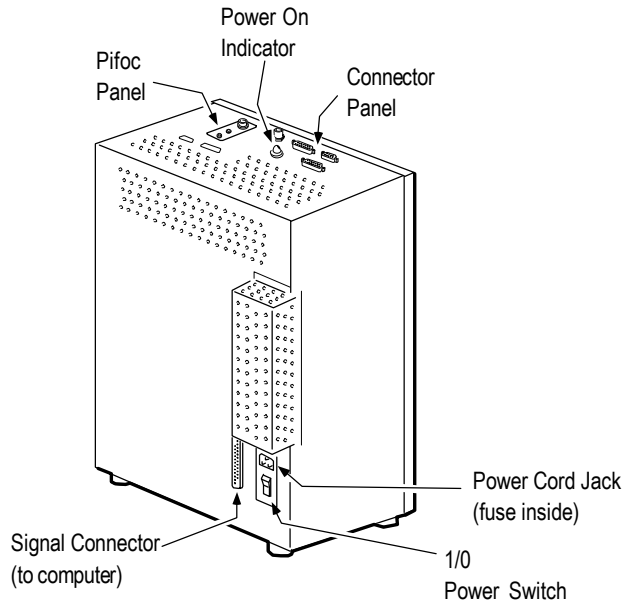
Provides for connection to the microscope pifoc (varies per option).

### 1/0 Power Switch

Turns on power for the enclosure and the microscope.

### Power Cord Jack

Connects the assembly to incoming power.



## Motor Driver Assembly Controls

### Connectors

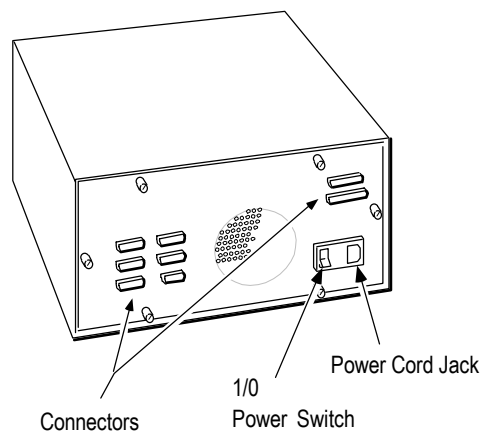
Provides for connection to stage motors, z-axis (focus) motor, and the Motion Controller.

### 1/0 Power Switch

Turns on power for the assembly.

### Power Cord Jack

Connects the assembly to incoming power.



## Motion Controller Controls



Do not crash the objective or microscope into the test part or stage. Use caution when focusing and driving the z-axis.

### ▲ Warning

The operator is responsible to make sure the joysticks are not activated when the system is first started. People and objects must be clear from the stage area. For emergencies press the Motion Stop button to stop all stage motion.

### Focus Joystick

Drives the Z-axis up or down when pushed forward and backward.

### Z Stop Controls

Set button makes present position the Z stop location. Indicator displays status of Z stop: red flashing - not set; red on - head at stop, stop set; green on - head above stop, stop set.

### Z Axis Speed Controls

Number of lights indicate relative speed. Slow/Fast buttons decrease or increase z axis (focus) speed.

### Function Buttons

Perform various software functions, such as: 1 - measure, 2 - run stage pattern.

### Axis Select Button

Selects which stage axes are controlled by the stage joystick.

### LED Display

Shows the setting of the Axis Select button or the status of the motion system.

### Motion Stop (Emergency) Button

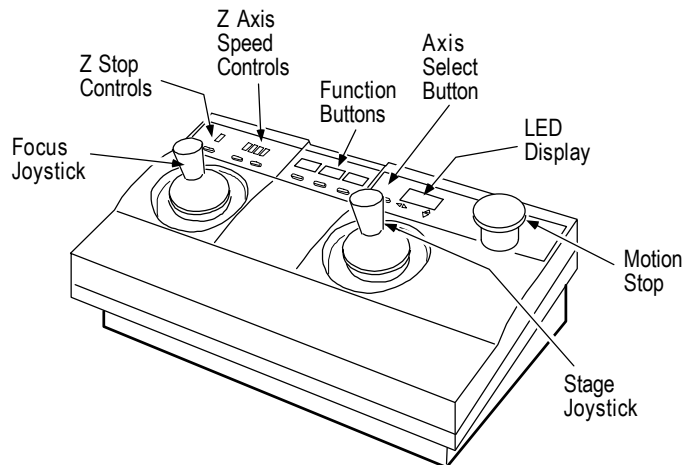
Stops all motion and disables joysticks.

### Stage Joystick

Drives the stage in X/Y or roll/pitch, based on the setting of the Axis Select button.

### Connector Panel (hidden from view)

Provides connection to the Motor Driver Assembly and computer.

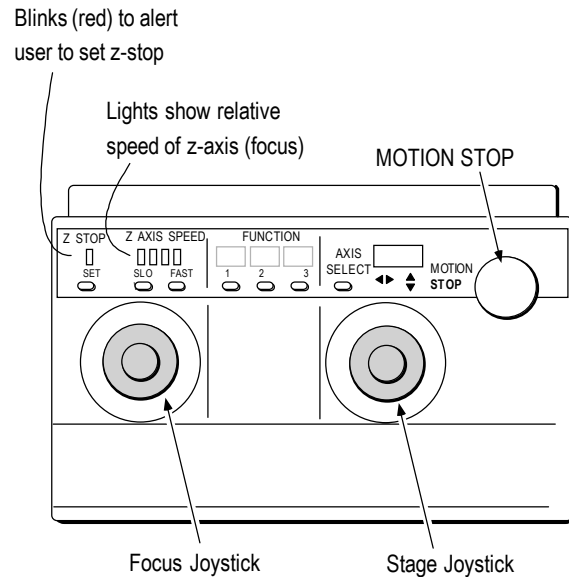


## Using The Motion Controller

The Motion Controller is used for manually focusing the CP200/300 and driving the stage motors. The table below summarizes how to use the Motion Controller.



Do not crash the objective or microscope into the test part or stage. Use caution when focusing and driving the z-axis. Set the Z Stop on the Motion Controller to prevent crashes.



<i>Operation</i>	<i>How To</i>
<b>Focus</b> (drive z-axis)	Push focus (left) joystick to raise, pull to lower. The greater the deflection the faster the motion.
<b>Focus speed</b>	Press SLOW (decrease) or FAST (increase).
<b>Set Z Stop</b>	Lower head with focus joystick to slightly less than objective working distance; press SET.
<b>Unset Z Stop</b>	Raise head with focus (left) joystick until the Z STOP indicator is green, then press SET.
<b>Select stage axes</b>	Press AXIS SELECT repeatedly. Selected axes shown in display: [X Y] for X/Y stage [R P] for roll/pitch (or tip/tilt measurement head) [ T] for Theta stage.
<b>Drive stage</b>	Move the stage (right) joystick. Up/Down for y-axis or pitch. Left/Right for x-axis, roll, or theta. The greater the deflection the faster the motion.
<b>Emergency Stop</b>	Press MOTION STOP to stop stage motion. For emergency stop only.
<b>Reset after MOTION STOP pressed</b>	Press and hold AXIS SELECT, turn MOTION STOP knob clockwise until it pops back up, and then release the AXIS SELECT button. Also click the Reset MC button in MetroPro.
<b>MetroPro shortcuts</b>	Press 1 to Measure, Press 2 to Run Pattern, Press 3 to Focus.

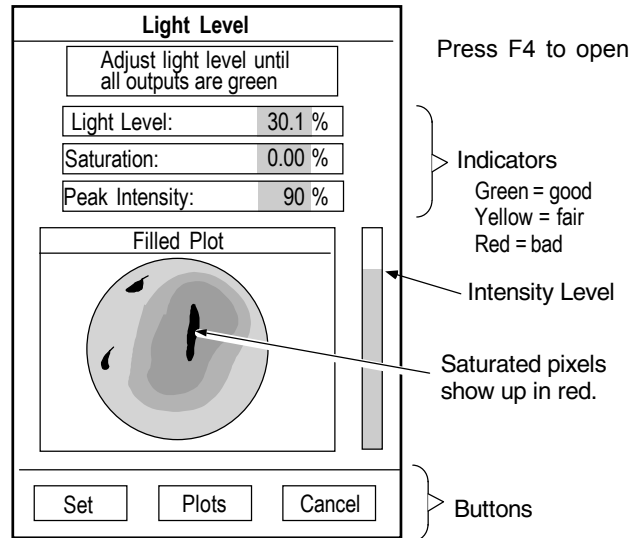
## Light Level Controls

The proper light level is critical to obtaining an accurate measurement.

<b>Key</b>	<b>Function</b>
F4	Open Light Level Window to manually set light level.
F5	Automatically set light level.

### The Light Level Window

1. Adjust the instrument for proper focus.
2. Press the F4 key to open the Light Level window.
3. Use the numeric keypad to adjust levels until all indicators are green. Saturation causes data dropout.
4. Click the Set button or press the Enter key to change the light level for measure. To cancel light level adjustment, click the Cancel button or press the Esc key.



### Light Level Keys

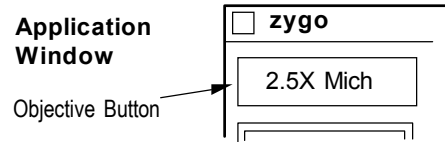
These keys adjust the light level for the instrument. To set the light level, use the Light Level window, press F5 for automatic control, or enter a value in the Light Level Pct control.

<b>Key</b>	<b>Function</b>
* /	Coarse up and down.
+ -	Fine up and down.
1 2 3 ...	Adjust level in 10% steps, 1 = 10%, 3 = 30%, 9 = 90%
Tab	Toggle between last two light settings.
Esc	Cancel current action and abort measurement.

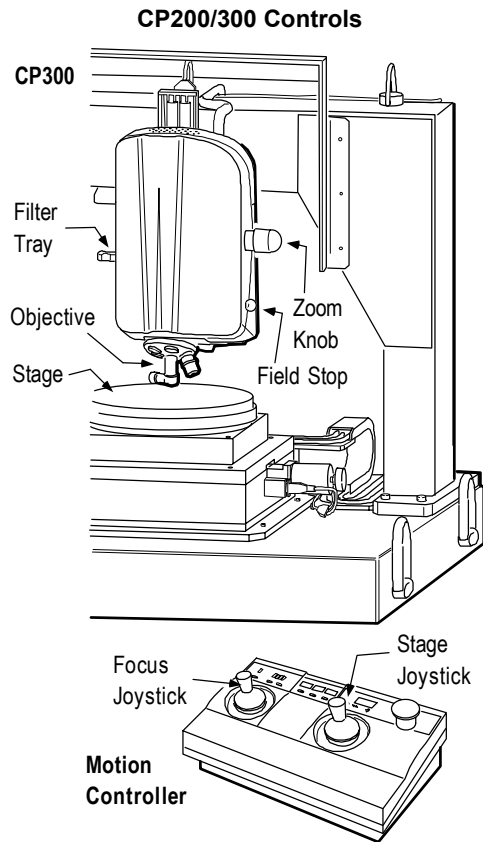
## Measurement Overview

Details on setup, focusing, and nulling are provided over the next few pages.

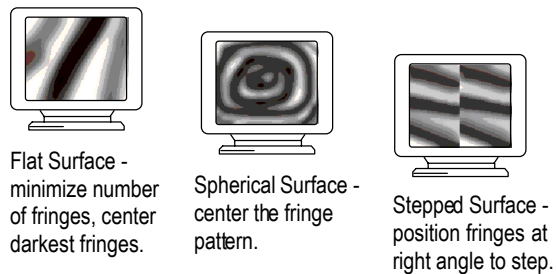
1. Power-up the instrument, start MetroPro, and click the application icon to open it.
2. Click the Objective button until it displays the objective in use.
3. Place the test part on the stage under the objective. Position the objective at its working distance from the part. *Don't crash the objective into the part or the stage.*
4. Set the Zoom knob to the desired setting; ensure that the software Image Zoom control is set to match. Position the filter tray to FOCUS. Press the **F5** key to adjust the light level. Focus the microscope for a sharp image; there should be visible fringes.
5. If there are not visible fringes, adjust for tilt in the part. To do this, press the **F4** key to open the Light Level window, adjust the stage tip and tilt until the Peak Intensity readout is maximized, and press Enter to close the window.
6. Adjust the stage to center the area of interest in view. Place the filter tray to MEAS, press **F5** again to adjust the light level. Refocus for high contrast fringes.
7. Fine-tune focus and stage tip and tilt for surface detail, to null or minimize the number of fringes, and to center the darkest fringe.
8. Press the **F1** key or click the MEASURE button to measure. **Note:** Part must be in focus with fringes to measure.



Objective Working Distance (in mm)					
2.5X	5X	10X	20X	50X	100X
10.3	9.3	7.4	4.7	3.4	0.55

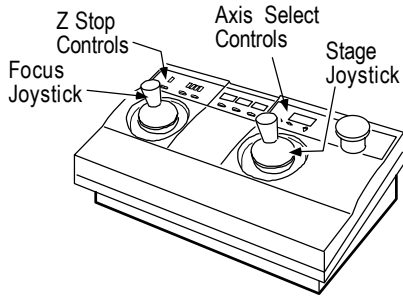


### Sample Video Monitor Images



# 1 Setup

## Z-Stop Setup - Motion Controller

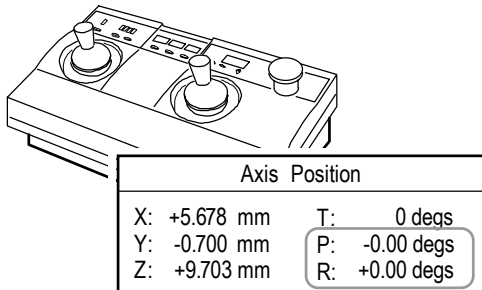


1. Move the Motion Controller's focus joystick to drive the objective to slightly closer to the part than its working distance.

Objective	2.5X	5X	10X	20X	50X	100X
Distance (mm)	10.3	9.3	7.4	4.7	3.4	0.55

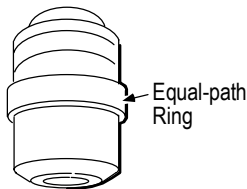
2. Press the Z Stop button, it should turn green and stop blinking.

## Part Setup - Motorized Stage



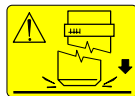
1. Press the Motion Controller's Axis Select button so the display is "R P". Move the joystick to level the head. The R (roll) and P (pitch) readouts in the Axis Positions dialog box should be 0.
2. Press the Axis Select button so the display is "X Y". Move the joystick to locate the part under the objective.

## Objective Setup - 50X and 100X Mirau Only



The 50X and 100X objectives are sensitive to temperature changes. Adjust the equal-path ring so focus is synchronous with fringes.

1. Focus on the test part.
2. Turn the ring to obtain fringes at focus. If the part is rough, adjust the ring to center the fringes halfway between the highest and lowest points.



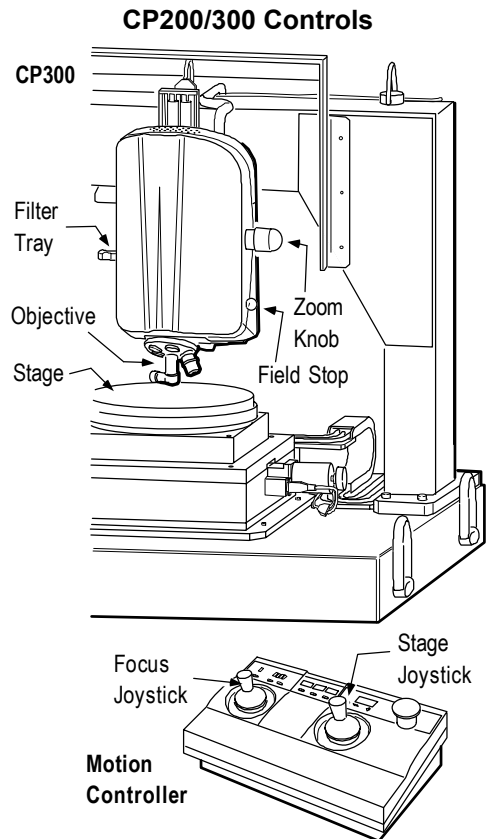
Do not crash the objective or microscope into the test part or stage. Use caution when focusing and driving the z-axis. The 100X Objective has a very short (0.55 mm) working distance.

## 2 Focus

1. **Set software controls.**  
Set the *Scan Length* control to a length slightly greater than the peak to valley height in the test part. Click the *Objective button* until it displays the objective in use. Set the *Image Zoom* control to match the setting of the Zoom knob.
2. **Set the microscope to starting point.**
  - Place the filter tray to MEAS.
  - Position the objective at its working distance from the test part.
  - Press F5 to adjust the light level.
3. **Adjust coarse focus.**
  - Focus for part detail and fringes. If you can't find focus, look for a flash of light as you focus, this flash is the part surface going into and out of focus.
  - Press F5 again.

**Note:** For 2.5X and 5X objectives only.  
If you can't see fringes, try setting the filter to FOCUS.
4. **If no fringes, adjust the tip/tilt stage.**
  - Press F4 to open the Light Level window.
  - Adjust stage tip and tilt to maximize the Peak Intensity readout.
  - Click Set to close the window.
5. **Adjust fine focus.**
  - At Zoom settings above 1X, position the Field Stop to just larger than the field of view to minimize light scatter.
  - Ensure the filter is set to MEAS.
  - Press F5 to adjust the light level again.
  - If necessary, adjust the stage X and Y position to locate the area of interest under the objective.
  - Adjust focus for high contrast visible fringes.

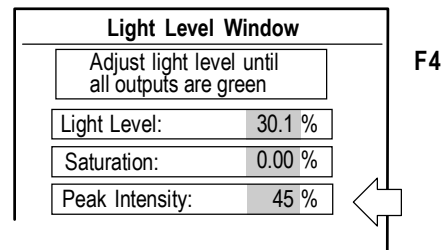
**Important - Null Fringes !!** See next page.



Objective	2.5X	5X	10X	20X	50X
Work Dist. (mm)	10.3	9.3	7.4	4.7	3.4

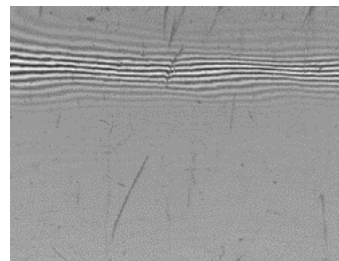
### Light Level Window

use to help find fringes



### Sample Video Image

surface details and fringes



### 3 Null

*Nulling* means to minimize the number of fringes; it varies depending on the shape and roughness of the test surface. *Fringes* are the various light and dark bands produced by the interference of light.

**Note:** The fringes vary depending on the part surface being measured.

For flat surfaces, reduce the number of fringes to as few as possible.

For spherical surfaces, center the fringe pattern.

For stepped surfaces, fringes should be positioned at right angles to the step.

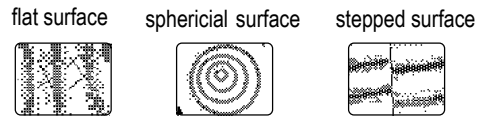
**1. Adjust coarse null.**

- Adjust stage tip and tilt to minimize the number of fringes.
- Readjust focus and part positioning if needed.

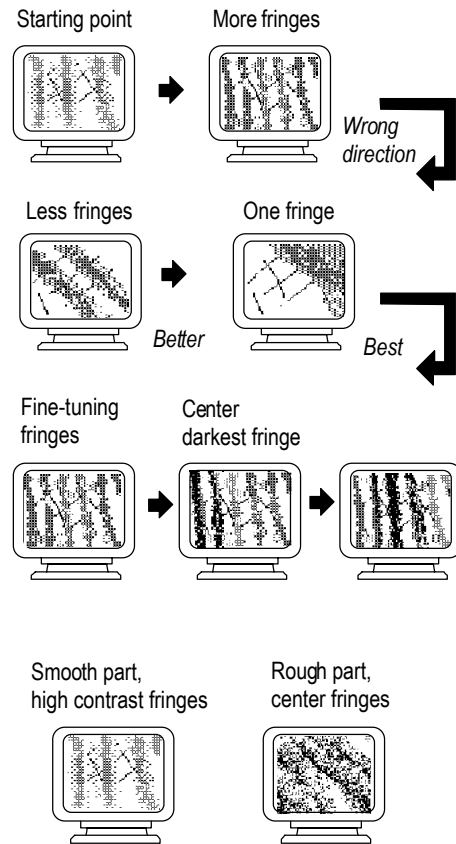
**2. Adjust fine null.**

- Continue to fine-tune stage tip and tilt to center the darkest fringe.
- For smooth parts, adjust the focus for high contrast fringes.
- For rough parts or parts with steps, center the focus between the high and low fringes.

**Fringe Patterns of Different Surfaces**



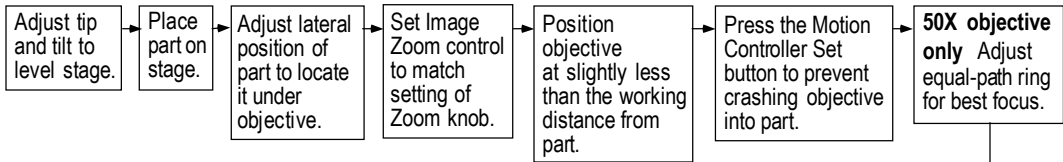
**Video Monitor Images**



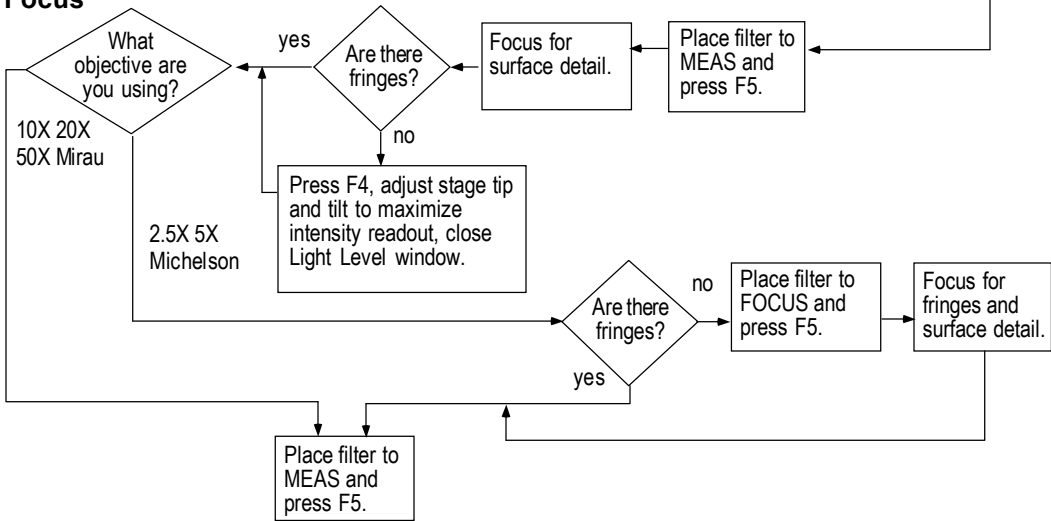
**Measure - Press F1**

# Measurement Flowchart

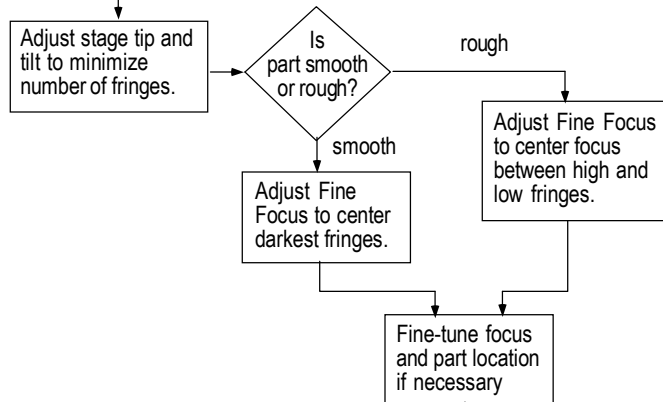
## Setup



## Focus

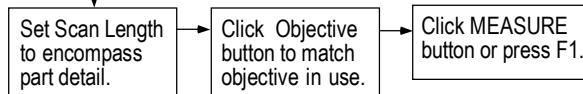


## Null



## Software

To stop a scan press the space bar.  
 To abort a measurement process press the ESC key.



## Operation Hints

The following useful operating hints are covered:

- Using System Error Files
- Selecting the Right Objective
- Using 2.5X and 5X Michelson Objectives
- Using the 1X Michelson Objective
- MetroPro Controls Used Most Often
- Technical Details: FDA, Scan Length, and Camera Mode

### Using System Error Files

To eliminate optical artifacts and obtain optimum performance, create a system reference file for each objective and subtract this file from each measurement. Note that if the objective is taken out and put back in, or if the reference leg of Michelson objective is rotated, that the error file must be remade. Refer to the *Zygo Microscope System Error Application* booklet, OMP-0361.

### Selecting the Right Objective

Its up to you to determine what parameters of the test sample you want to measure and then select the best objective for that task. Here are some considerations:

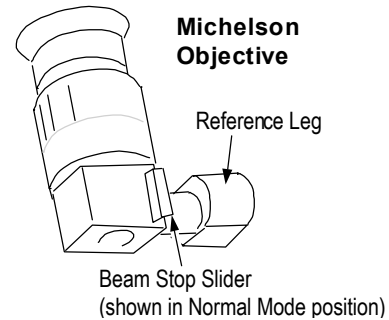
- *Power*  
Match the objective field size to the area of interest you want to measure. Low magnification objectives measure widely spaced surface characteristics; high magnification measure finer detail.
- *Lateral Resolution*  
There is a tradeoff between objective power and lateral resolution. The higher the magnification, the greater the lateral resolution, but the smaller the field of view. Vertical resolution is constant, regardless of the objective.
- *Multiple Objectives*  
Multiple objectives provide maximum flexibility. Some objectives are parfocal allowing you to switch between objectives with minimal refocusing.
- *Work Smart*  
Use a low magnification objective to locate an area of interest before switching to a higher power. Use a high magnification objective to help you focus a part that may be difficult to focus with a low power objective.
- *See Chapter 1 for Objective Specifications.*

## Using 2.5X and 5X Michelson Objectives

### ▲ Warning

Handle objectives with care; they are precision devices. Do not touch any glass surfaces.

The 2.5X and 5X Michelson objectives have a right-angle reference leg with a beam stop slider. For normal focusing and measuring, the beam stop slider *must* be all the way in. Pulling the beam stop slider out to the detent blocks a reference beam. The beam stop slider provides for two modes of operation - Normal or Focus Aid.

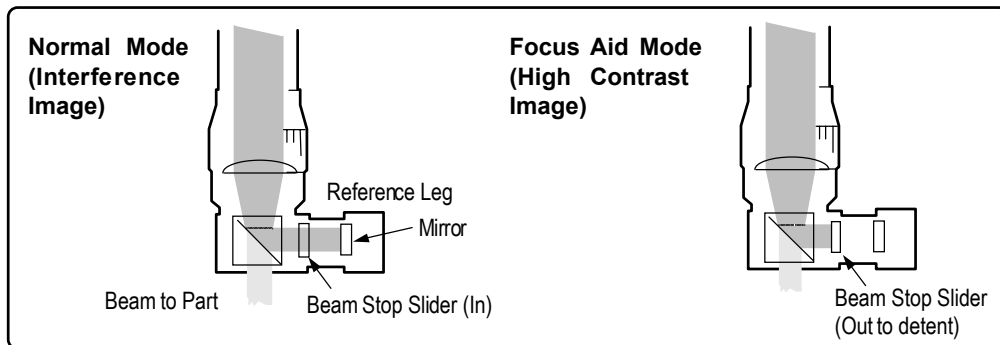


**Note:** If the beam stop slider is removed, dust may enter into the objective and impair its performance.

**Normal Mode** Beam stop slider IN. This permits a reference beam to reflect off an internal reference surface and provide an interference image with fringes. Fringes are required in order to measure.

**Focus Aid Mode** Beam stop slider OUT to detent. The reference beam is blocked from reaching the reference surface. This makes the instrument act like a standard microscope and enhances surface detail imaging. This serves as an advantage when focusing on a low reflective part or a part with little surface detail. After the part is in focus, push the beam stop slider back in before measuring.

**Note:** If fringes can not be obtained, check that the beam stop slider is in.



## Using the 1X Michelson Objective

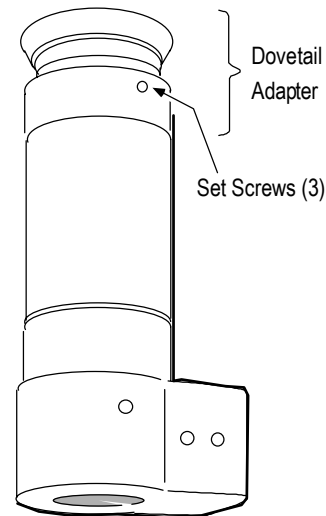
### ▲ Warning

Handle objectives with care; they are precision devices. Do not touch any glass surfaces.

The 1X Michelson Objective provides a large field of view, allowing large areas to be measured.

However, it can be difficult to obtain fringes on especially rough and low reflective parts because of its large focus depth compared to its fringe depth.

The 1X Michelson Objective includes a large and small dovetail mount incorporated into the dovetail adapter, so the objective can be mounted on the CP200/300 and models of the NewView. The 1X objective is not turret mountable.



### ***Focusing and Finding Fringes***

1. Position the objective at its working distance (10 mm) from the part surface.
2. Adjust the tip and tilt of the part to maximize light return to the objective. To do this, press F4 to open the Light Level window, adjust the stage tip and tilt until the Peak Intensity readout is maximized, then press Enter to close the window.
3. Use the FOCUS filter to increase the coherence length and enhance the ability to find fringes.
4. Focus the objective on the part surface. Keeping the part in focus, position the objective as close to the part as the depth of field allows.
5. Slowly adjust the position of the objective by focusing upward. For the Motion Controller, set the speed to three lights, and intermittently toggle the joystick. Watch for fringes to appear in the image.
6. When fringes appear, switch the filter to MEAS and fine-tune focus and null the fringes as previously described in this chapter.

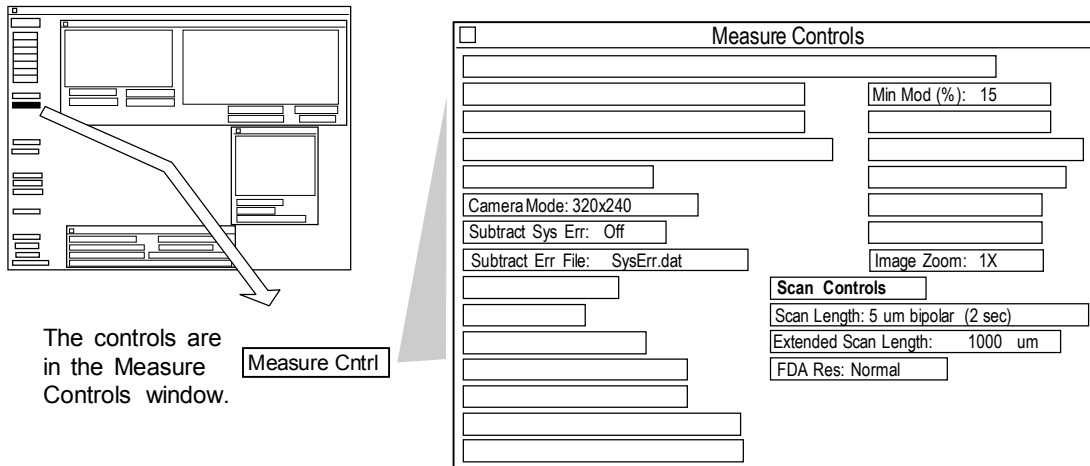
### ***Mounting the 1X Objective***

The 1X Objective mounts directly on the CP200/300 pifoc using the dovetail mount. It can not mount to the turret.

1. Align the slot on the objective dovetail to the pin on the microscope head. Tighten the dovetail lockscrew on the microscope head.

## MetroPro Controls Used Most Often

*MetroPro Microscope Application Screen*



### Camera Mode

Camera Mode selects the effective camera size in pixels. More pixels resolve smaller details, but increase processing time. The choices vary per microscope model. Click to change.

### Subtract Sys Err

Subtract Sys Err activates an error correction function that subtracts instrument aberrations during the analysis cycle.

### Sys Err File

Specifies the name of a data file to subtract. System error files should be made for each objective and each time the objective is installed. The data file is made by measuring a high quality reference flat.

### Min Mod (%)

Min Mod (%) specifies the minimal percentage of full modulation for each camera pixel to be accepted as a valid data point. Lower the setting when there are data dropouts and the roughness looks okay. Click to enter a numeric value.

### Image Zoom

Image Zoom should be set to match the setting of the microscope's zoom knob to ensure proper lateral resolution. Click to change.

### Scan Length

Scan Length selects the length of the scan. The choices are: 5, 10, 20, 40, and 100  $\mu\text{m}$ . Select the shortest length that encompasses the details you are measuring. Click to change.

### FDA Res

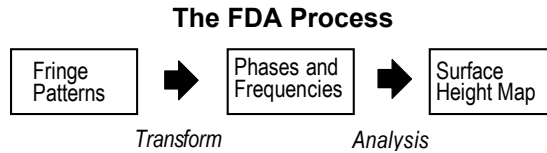
FDA Res selects the resolution used during analysis. Use the Normal setting when measuring rough surfaces. Use the High setting when measuring smooth surfaces and steps. Click to change. Low, Phase 1, and Phase 2 settings are for specialized conditions.

## Technical Details: FDA Res, Scan Length, and Camera Mode

### Frequency Domain Analysis (FDA)

The NewView is a scanning white-light interferometer that uses frequency domain analysis (FDA) to generate quantitative 3D images of surfaces. FDA is a mathematical method for processing

complex interferograms in terms of phases and spatial frequencies. FDA transforms data to the frequency domain, where it is analyzed to calculate surface height.



The objective is mechanically scanned to generate a sequence of interferograms, which are transformed to get phase information. Fourier Analysis is used to extract a range of phases for each color or wavelength in the spectrum of the white-light source. The source spectrum together with the corresponding phases is a frequency domain representation of an interferogram. The particular combination of phases found by FDA uniquely defines the surface height map.

In traditional, single-wavelength, phase shift interferometry, the interference pattern is transformed into a matrix of phase values with an algorithm, such as the “five-bucket” method. With FDA, it is as if the five-bucket algorithm is applied for every one of the wavelengths in the source spectrum. The resulting phase measurements would be different for each wavelength. Having this type of data resolves the slope  $2\pi$  ambiguity problem common to single-wavelength, phase shift interferometry.

The essential idea behind FDA is that it examines interference phase, not the original intensity data measured by the detector. To change intensity data to the frequency domain, the data is transformed using a Fast Fourier Transform. Distance is calculated by determining the slope of the line showing the rate of change of interferometric phase with spatial frequency. The NewView uses a simple linear least-squares fit to several phase values having high signal-to-noise ratio. The final distance calculation is done in either one of two ways, depending on whether or not a phase offset is included.

The settings of the FDA Res control determine the resolution of the analysis as shown in the following table.

## FDA Res Control - Summary of Selections

FDA Res	Technique	Vert. Res.	Conditions of use
<i>High</i>	Centroid detection of envelope peak, uses least squares slope result and phase offset, with FFT. Equivalent to phase shifting interferometry without $2\pi$ phase ambiguity.	~0.1 nm	Maximum vertical resolution.
<i>Normal</i>	Centroid detection of envelope peak, uses least squares slope result, with FFT.	~3 nm	Rough surfaces, typically > 75 nm Ra
<i>Low</i>	Fast centroid detection of envelope peak, without FFT.	~20 nm	Extended scan option, Scan Length control set to Extended.
<i>Phase 1</i>	Hybrid approach, combines vertical scanning interferometry and phase shifting interferometry techniques in a single measurement. Data is acquired at optimal focus.	~0.1 nm	80 nm bandwidth filter required, general purpose for scans <150 nm.
<i>Phase 2</i>	Hybrid approach, combines vertical scanning interferometry and phase shifting interferometry techniques in a single measurement. Data is almost instantaneously acquired at optimal focus.	~0.1 nm	40 nm bandwidth filter required, for step heights from 0 – 5 $\mu\text{m}$ and low magnification objectives.

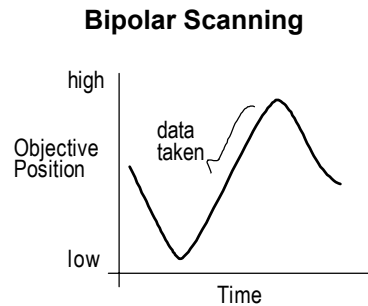
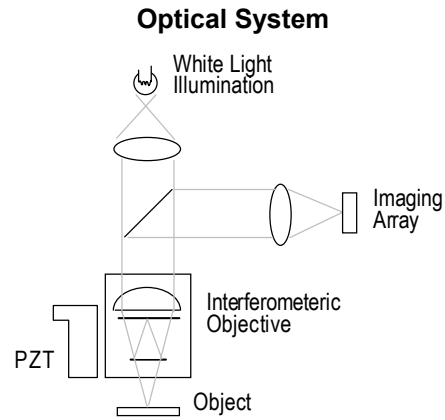
### Scan Length

The NewView is a scanning white-light interferometer. The instrument includes optics for imaging an object surface and a reference surface together onto a solid-state imaging array, resulting in an interference intensity pattern that is read electronically into a digital computer. A series of interferograms are generated as the objective is scanned perpendicular to the illuminated surface, while recording detector data in digital memory.

The data acquired in this way consists of an array of interferograms, representing the variation in intensity as a function of scan position. The interferograms stored in the computer are individually processed by FDA, and the final step is the creation of a complete three-dimensional image constructed from the height data and corresponding image plane coordinates.

The Scan Length control determines the actual length of the scan. The longer the scan, the more time required for acquiring data. The time for scanning is displayed within the choices in the Scan Length control.

The NewView uses a bipolar scan; it starts in the center of the scan envelope and moves the objective down and then up. During the upward scanning of the objective data is collected. Because data is collected in this manner, the microscope should be focused in the midpoint between the high and low fringes before making your measurement. The Scan Length control should be set to the shortest length that includes this detail.



### Camera Mode

The Camera Mode control selects the measurement resolution in pixels.

Camera Mode	Max. Pixels	Aperture	Pixel Spacing (µm)	Scan Speed (µm/sec)
160 x 120 120 Hz	19,200	full	44	9.72
320 x 240 120 Hz	76,800	full	22	9.72
640 x 200 130 Hz	128,000	limited*	11	10.53
640 x 480 60 Hz	307,200	limited*	11	4.86
640 x 480 20 Hz	307,200	full	11	1.62

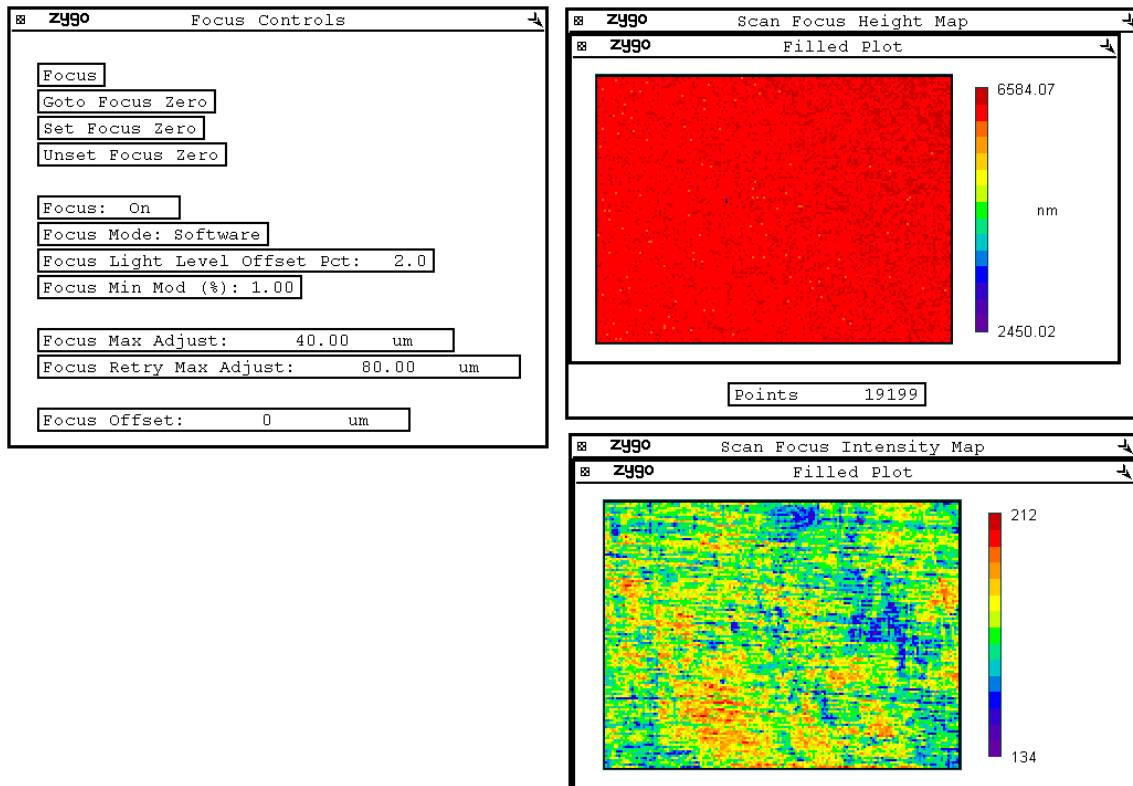
\* The full aperture may be acquired for short scans by setting the software Discriminator Mode control to Ram, or limit the area by creating an Acquisition mask with the Mask Editor.

## Using Auto Focus

Auto focus is a standard feature of the CP200/300. Auto focus works best when measuring identical parts, like that in a production environment. Auto focus is not for measuring many different types of parts, such as in a research setting. Auto focus is generally easier for shiny, smooth parts; and more difficult the rougher and less reflective the part.

In effect, auto focus is a quick, coarse measurement used to determine the best modulation within the scanned data. Because of this, it sometimes requires more light than the actual measurement. Focusing light level is adjusted with the Focus Light Level Offset Pct control. The focus data obtained is determined by the setting of the Focus Min Mod (%) control. This control is usually set to 5 or less. The setting of the Focus Light Level Offset Pct and Focus Min Mod (%) controls are critical for reliable auto focus operation.

To use auto focus, you have to add the auto focus buttons and controls to a Control window. Data windows, available in the Microscope application, called Scan Focus Diagnostics, can also be created with Filled plots, to help fine-tune the settings of the controls. Sample windows are shown below.



## Auto Focus Setup

1. Perform a normal measurement: Manually focus on the part. Set the light level. Measure the part. Ensure that focus and light level are optimally adjusted.
2. Set the Focus Mode control to Scan.
3. Press the Set Focus Zero button. This sets the current z-axis position of the microscope as zero; readout values for Z, displayed on screen, are relative to this position.
4. Define the focus envelope. Enter a value in the Focus Max Adjust control that encompasses the part detail; an initial value can be the same as the Scan Length control setting. Double this value and enter it in Focus Retry Max Adjust.
5. Using the Value Format menu command, change the decimal places of the Focus Min Mod (%) to 2. This increases the sensitivity of the control and allows you change settings by tenths.
6. Click the Focus button and observe the results. Observe the Scan Focus Height Map; if there is not enough data try lowering the Focus Min Mod (%). The goal is to minimize noise and maximize the number of data points. Observe the Scan Focus Intensity Map; if the plot does not resemble the part try adjusting the Focus Light Level Offset Pct.
7. Test the software settings by changing the focus and pressing the Focus button. When the software is able to find focus and obtain sufficient data after a number of tests, the controls are properly set.
8. To activate auto focus for all measurements set the Focus control to On.

## Using the Motorized Turret

### ▲ Warning

When the MetroPro Objective button is clicked the motorized turret will rotate; no warning is given. Make sure that nothing is in the way of the rotating turret and objectives. Examine carefully that the legs on the 2.5X and 5X objectives are positioned such that they will not hit anything when the turret is rotated.

### Overview

The motorized turret is typically used for automating measurements when using a low magnification objective to locate a feature in the part, then switching to a high magnification objective and making the measurement.

In order to maintain the same part positioning and focus between objectives, a coordinate file containing x, y, z, tip, and tilt position offsets should be created. This file, called "TRC", for Turret Reference Coordinates, contains coordinate offset data for each objective. This information is used by MetroPro to adjust for the fine variation between each objective's focus, center, and null position. This file is set and cleared using the Lateral Calibrator window.

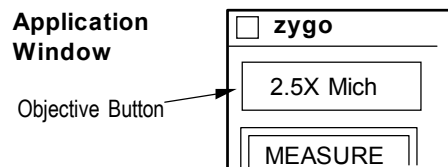
### Setting Up the Motorized Turret

When setting up the motorized turret adhere to the following:

- If only two or three objectives are screwed into the turret, mount the objectives opposite each other so their weight is balanced on the turret.
- The 5X-50X objectives require Mount Adapters to fit into the motorized turret.
- Make a note of the numbered turret position in which each objective is mounted. (You'll need this when using the Lateral Calibrator.)
- Use the Parfocal Adapter for 5X-50X objectives to locate their object plane at the object plane of the 2.5X objective.
- Examine carefully that the legs on the 2.5X and 5X objectives are positioned such that they will not hit anything when the turret is rotated.

### Moving the Motorized Turret

To select an objective or move the motorized turret, click the Objective button in MetroPro. For the Objective button to work, selections must be made beforehand in the Lateral Calibrator window.



## The Lateral Calibrator

The Lateral Calibrator is opened by clicking the MetroPro Calibrate button. Use the Lateral Calibrator to:

- Designate the objectives that are used in the system and appear as the MetroPro Objective button is clicked.
- Calibrate the actual magnification for each objective; this ensures that lateral dimensions and results are based on the actual objective in use and not on a nominal value.
- Establish TRC (Turret Reference Coordinates) for each objective; this ensures automatic sample part centering and focus adjustment as objectives are switched.

### Lateral Calibrator Window

**Image Area**  
Displays a frame of camera data. Data source is selected with Fringes or Data buttons. The image shown is from the Lateral Calibration Standard.  
*Note: an image appears only if the instrument is working.*

**To calibrate an objective** - press and hold the left mouse button and move the mouse to draw a line parallel to the scale. Let go of the mouse button and enter the line's length.

**Fringes** click to display the current fringe pattern.  
**Data** click to display current measurement data.

	Title	N.A.	Nom.	Cal.	TRC	
1	2.5X Mich	0.075	2.5X	2.43X	yes	Fringes
2	5X Mirau	0.130	5.0X	none	no	Data
3	10X Mirau	0.300	10.0X	10.05X	yes	
4	20X Mirau	0.400	20.0X	none	no	Set TRC
5	empty					Clear TRC

**Selection Buttons**  
Click with the left mouse button to choose the objective being calibrated or to move the motorized turret to that position.

**Objective Buttons** (each row)  
Click with the left mouse button to designate objectives; "empty" means an objective is not designated.

**Title** - objective power and type.  
**N.A.** - numerical aperture.  
**Nom.** - nominal objective magnification.  
**Cal.** - (calibrate) the actual objective power; "none" means not calibrated.  
**TRC** - Turret Reference Coordinates; "yes" means stored coordinates, "no" means not stored.

**Set TRC** click to set and store coordinates for selected objective.  
**Clear TRC** click to clear stored coordinates.

## Designating Objectives

This determines the objective choices in the Objective button and associates a particular objective with a turret position.

1. Click on each row in the objective display with the left mouse button until the objective title appearing in the display matches the objective.

**Note:** Make sure the numbered position (1-5) matches the position of the objective in the turret.

2. Select "empty" when there are no objectives to designate.

## Creating TRC (Turret Reference Coordinates)

It is advised to use the TRC function so MetroPro keeps the image of the sample part centered and in focus as objectives are switched. By using the TRC function, MetroPro automatically remembers each objective's coordinates and adjusts positioning in 5 axes (x, y, z, tip, and tilt) when objectives are switched with the Objective button.

**Note:** New TRC reference files must be created if any objective's position is changed. If the objective is turned relative to the turret, removed and remounted, or replaced, or the turret is removed or replaced, create new TRC's for all applicable objectives.

1. Mount all objectives into the motorized turret.
2. Click the MetroPro Calibrate button to open the Lateral Calibrator. Use the calibrator to assign the objectives in the turret to match the objectives specified in the Calibrator window.
3. Select an objective in the Calibrator, and click the Set TRC button.
4. Focus and null the microscope on a feature on a sample part. Move the stage to locate the feature under the on-screen crosshair.
5. After the objective is properly focused and nulled, click Yes.

**Note:** To remove stored coordinates for an objective, select the objective in the Lateral Calibrator and then click Clear TRC.

6. Repeat steps 3 through 5 for other installed objectives.

**Note:** MetroPro expects only small movements of the stage between objectives. The error message: "A turret reference coordinate is out of range. No stage axis was moved." indicates that the objectives TRC's were not properly set up or the objective was switched or replaced.

## Calibration

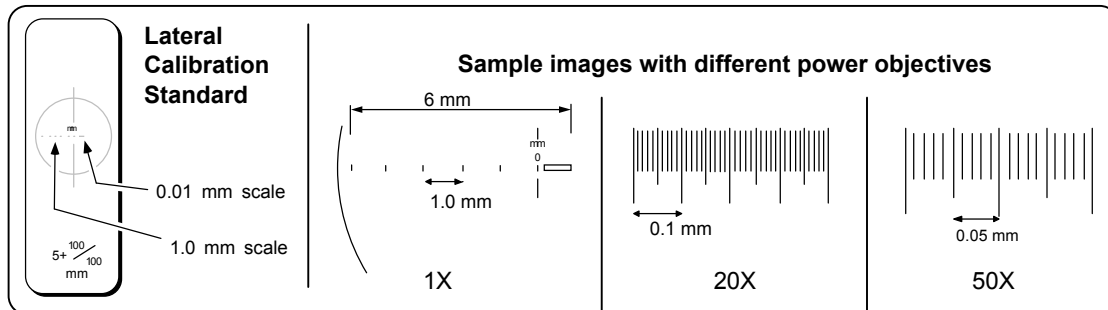
Calibration establishes the lateral measurement resolution of each camera pixel. Calibration specifies the actual magnification for each objective. Calibration should be performed for each objective at the time the system is installed and whenever the Zoom knob is set between detents.

To perform calibration, click the Calibrate button to open the Lateral Calibration window, focus the specific objective on a Lateral Calibration Standard, and specify the dimension of a line drawn across the image.

### Sample Calibration Procedure

For more information refer to the *MetroPro Reference Guide*, OMP-0347.

**Note:** Calibration performed when the Microscope zoom knob is not at a detent is only temporary. If the knob is moved to another free position, the Microscope must be recalibrated. Calibration settings for Image Zoom: Free are not saved. Calibration must be performed every time the instrument is restarted.



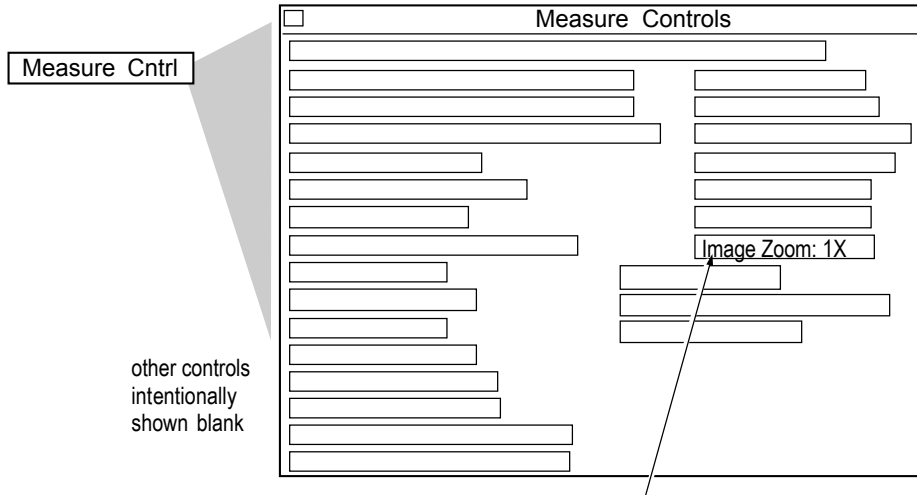
1. Position the Lateral Calibration Standard under the objective. Focus the instrument on the standard's lines and null the fringe pattern.
2. Click the Calibrate button to open the Lateral Calibrator window.
3. Select the objective to calibrate by clicking on the little box to the left of its title.
4. Draw a line across the image. Position the crosshairs over the image and click and hold the left mouse button; move the mouse to draw a line parallel to the Standard's scale; and release the mouse button for the end point.
5. Using the keyboard, enter the length of the drawn line in millimeters, as determined by reading the Calibration Standard scale. Press Return when done.

Enter length (mm)
0.0

6. Close the Lateral Calibrator window and make your measurement.

**Software Calibration and the Image Zoom Control**

The Image Zoom control *must* be set in the Measure Controls window to match the setting selected on the zoom knob. If the setting of the control and the thumbwheel do not match, results will be erroneous. Select Free with the Image Zoom control when the Zoom knob is set between detent positions.



**Image Zoom**  
 Set to match the setting of the zoom thumbwheel. This assures proper lateral results. When set to Free, calibration must be performed.

**Calibrating for “Free” Zoom**

Each time the Image Zoom control is set to Free, you must perform calibration to provide absolute units of measure. Calibration *must* be performed before making measurements. A calibration standard, such as the Zygo Model 5690 Lateral Calibration Standard, makes calibration easier and more accurate. Refer to the previous procedure.

# Maintenance

## Chapter 4

### *In This Chapter*

- A Note About Maintenance
- General Care
- Maintenance Schedule
- Spare Parts
- Cleaning of External Surfaces
- Changing and Aligning the Lamp Bulb
- Cleaning Optics
  - Recommended Optic Cleaning Procedures
- Replacing Fuses

## A Note About Maintenance

### ▲ **Warning**

The user must be trained to perform the maintenance described in this chapter.

The general maintenance procedures covered in this chapter include equipment cleaning, changing the lamp bulb and replacing external fuses. A program of good general care will prolong the life of the equipment.

For maintenance recommendations for the computer components refer to the original manufacturer's documentation. The computer components include the computer, color display, mouse, keyboard, and accessories, such as a printer.

## General Care

The components used in the CP200/300 system will provide many years of service with little maintenance if a few simple guidelines are followed:

- *Keep Things Clean*

The working environment should be as clean, dry, and as dust-free as possible. Occasionally clean painted surfaces and covers by wiping with a cloth dampened with a mild soap solution.
- *Handle Equipment Carefully*

The instrument is designed to provide precision measurements. Objectives are precision optics; handle them only when necessary. Keep unused objectives stored in their protective containers. Clean objectives only when necessary following the procedures in this chapter.

## Maintenance Schedule

Maintenance	Frequency
Clean exterior surfaces of equipment.	As needed, based on the cleanliness of the operating environment.
Change and align lamp bulb.	As needed, when bulb expires.
Clean objectives or filters.	As needed; only when dirty.
Replace Electronic Enclosure fuse.	As needed when fuse blows.

## Spare Parts

Components have been selected for conformance to applicable standards. All replacement parts must be approved by Zygo Corporation. Equivalent parts are generally not available.

Component	Description	Zygo Part Number
Lamp Bulb	BRL 12V - 50W Halogen Bulb	1445-400-042
Fuses	2A 250V Fuse (for 100/120V)	1343-000-026
	2A 250V Fuse 5x20 mm (for 220/240V)	1343-000-205
Line Cord	100/120V Domestic and Japan	1115-800-005
	220V German/French	1115-800-042
	240V United Kingdom	1115-800-224

## Cleaning of External Surfaces

Occasionally clean the painted surfaces of the equipment and covers by wiping with a cloth dampened, but not wet, with a mild soap solution.

## Changing and Aligning the Lamp Bulb



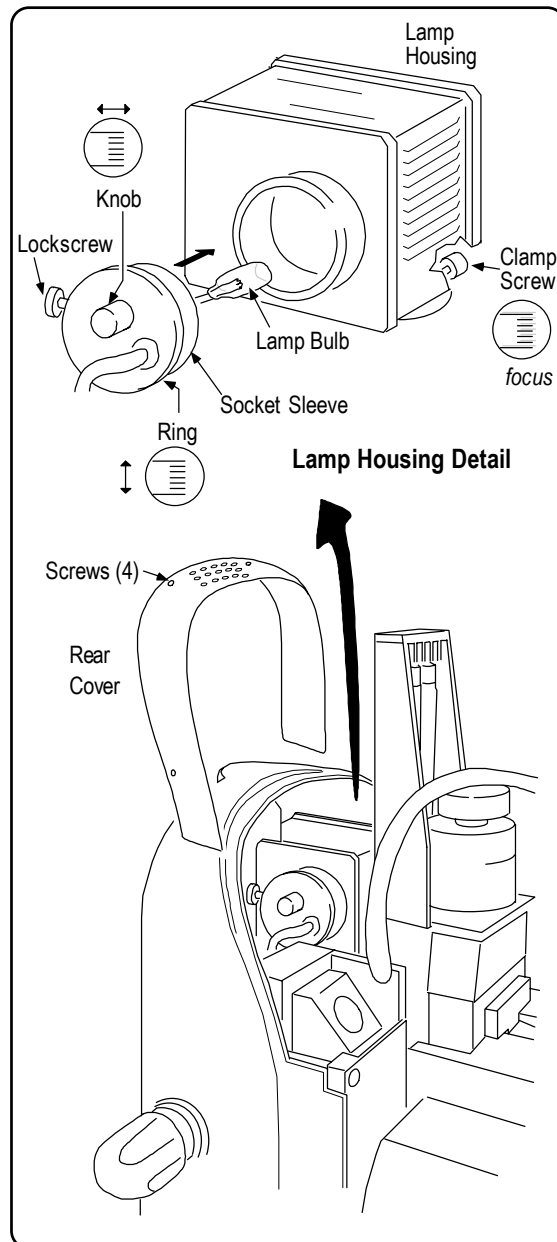
Hot surface; possibility of burns. Keep hands and objects away from lamp housing. Allow the housing and bulb to cool before handling; a minimum of 10 minutes is recommended.

1. Turn off power. Loosen the four rear cover screws and remove the cover.
2. Loosen the clamp screw and slightly raise the entire lamp housing so there is working clearance.
3. Remove the lock screw and pull the socket sleeve from the lamp housing.
4. Remove the old lamp bulb from the socket sleeve.
5. Insert the new lamp bulb, aligning the pins to the holes on the socket.

**Note:** Do not touch the replacement bulb with bare hands; this can cause premature bulb failure.

6. Reinstall the socket sleeve and lock screw. Realign the lamp housing and secure the clamp screw.
7. Turn on power.
8. Position microscope Field Stop for full aperture and the filter tray to MEAS.
9. If necessary, remove the objective, or turn the turret to a free position.
10. Position a small piece of paper about 1/2-inch (13 mm) away under the opening.
11. Adjust the light level until a filament image shows on the paper.
12. Adjust the filament image for best focus by loosening the clamp screw and moving the lamp housing up and down. When best focus is achieved, tighten the clamp screw.
13. Center the filament image from front to back by loosening the lock screw and rotating the ring. When centered, tighten the lock screw.
14. Center the filament image from side to side by turning the socket sleeve knob.
15. If necessary, reinstall the objective.

### Changing and Aligning the Bulb



## Cleaning Optics

Cleaning of any precision optic risks degrading the surface. All the cleanable objective lens surfaces are coated. Coated optics are easily damaged by improper or unnecessary cleaning. The need for cleaning can be minimized by proper handling techniques, returning the objectives to their plastic case when not in use, and by keeping the environment clean.

Do not attempt to clean optics within the instrument since system performance may be impaired.

### **Recommended Cleaning Materials:**

- *Polyethylene lab gloves*  
Wear to prevent contamination of surfaces and protect the skin against harsh chemicals.
- *Compressed gas with blower nozzle*  
Use to blow off dust and lint from the optic.
- *Lens tissue*  
Use when it is necessary to clean an optical surface. The lens tissue should be optics grade.
- *Cotton swabs*  
Use to clean difficult to reach surfaces. The swabs should have wood or paper stems; plastic stems can dissolve in acetone.
- *Solvents*  
Use spectroscopic grade isopropyl alcohol and methanol to remove contaminants fixed to the optical surface. Use a mild, neutral 1% soap solution or lens cleaner to remove oily contaminants.

## Recommended Optic Cleaning Procedures

### ▲ Warning

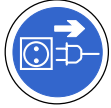
- Be careful when using isopropyl alcohol and methanol; both are flammable and toxic.
- Do not reuse any cleaning tissue or pads, reusing tissues can cause contamination and damage to the optic.
- Before cleaning optics, remove all rings and jewelry from your hands and wrists; wash your hands thoroughly to remove excess skin oils; and put on lab gloves.

### Optics Cleaning Procedures

Contaminant	Procedure
Dust or light dirt	<ol style="list-style-type: none"> <li>1. Blow off loose particles.</li> <li>2. If any dust remains, twist two sheets of lens tissue around a swab or fold a lens tissue so it is just wider than the area you are cleaning.</li> <li>3. Dampen the tissue with alcohol or methanol.</li> <li>4. Wipe the lens straight across once. If it needs wiped again use a new swab or tissue.</li> </ol>
Fingerprints, oil and water spots  <i>Note: Clean surface immediately; skin acids attack lens coatings.</i>	<ol style="list-style-type: none"> <li>1. Blow off loose particles.</li> <li>2. Twist two sheets of lens tissue around a swab or fold a lens tissue so it is just wider than the area you are cleaning.</li> <li>3. Dampen it with 1% soap solution.</li> <li>4. Wipe the lens straight across once. If it needs wiped again use a new swab or tissue.</li> <li>5. Repeat steps 2 and 4 with tissue dampened with distilled water to remove soap residue.</li> <li>6. Repeat steps 2 and 4 with tissue dampened with alcohol or methanol.</li> </ol>

## Replacing Fuses

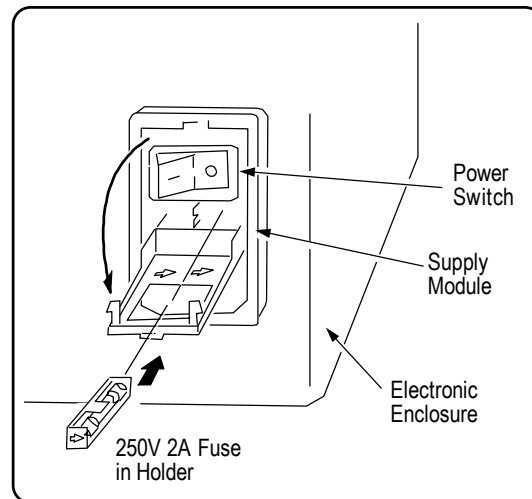
The fuses in the Motor Driver Assembly and the Electronic Enclosure are replaceable. To replace a fuse, follow the procedure outlined here.



Disconnect from power before performing this maintenance procedure.

1. Turn off power.
2. Remove the power cord.
3. Open the supply module door.
4. Pull out the fuse holder and remove the fuse.
5. Place a new 250V 2A fuse into the holder. Then insert the holder, with the arrows aligned, into the supply module.
6. Close the supply module door and connect the power cord.

### Replacing a Fuse



# Service

## Chapter 5

### In This Chapter

- A Note About Service
- Returning Equipment to Zygo
- Troubleshooting Guide

### A Note About Service

#### ▲ Warning

The equipment does not have any user serviceable components. Service must be performed by Zygo Corporation trained service personnel. Any attempt to service or repair equipment may void the warranty.

For service on the computer equipment refer to the original manufacturer's documentation.

### Returning Equipment to Zygo

To return equipment to Zygo Corporation it is necessary to have an RA (return authorization) number. Contact Zygo Corporation for an RA number and instructions on packing and shipping equipment.

**Note:** Do *not* return equipment to Zygo without an RA number. Equipment returned without an RA number is not accepted.

### Troubleshooting Guide

Problem	Possible Cause	Solution
<i>No power.</i>	Equipment not plugged in.	Check power manager.
	Enclosure switch off.	Turn switch on.
	Blown Enclosure fuse.	Replace fuse.
	Disconnected or loose cables.	Check cable connections.
	Defective incoming power.	Check power source.
	Defective Electronic Enclosure.	Contact Zygo.
<i>Enclosure blows fuse.</i>	Defective incoming power.	Check power source.
	Circuit overload.	Isolate system to its own circuit.

*(continued)*

Problem	Possible Cause	Solution
<i>No light.</i>	Filter tray not set at detent.	Check filter position.
	Defective objective.	Try another objective.
	Loss of power.	See “No power”.
	Defective lamp bulb.	Replace bulb (Chapter 4).
	Light level control adjusted low.	Adjust light level.
	Defective Electronic Enclosure.	Contact Zygo.
<i>No video image.</i>	Video Monitor disconnected.	Check Video Monitor connections.
	Video Monitor turned off.	Turn Video Monitor switch on.
	Video Monitor controls set wrong.	Adjust brightness and contrast.
	Part way out of focus.	Adjust focus.
	No light.	See “No light”.
	Computer crash or hang-up.	Restart computer.
<i>Features on part appear to move when focusing.</i>	Improperly aligned lamp bulb.	Align bulb (Chapter 4).
<i>Video image is spotty or partial.</i>	Part way out of focus.	Adjust focus.
	Incorrect part tip/tilt.	Adjust stage tip and tilt.
	Filter tray not set at detent.	Check filter position.
	Part is too rough or irregular.	Check system with known good part.
	Field Stop is limiting aperture.	Put Field Stop to full aperture.
	Dirty objective.	Clean or replace objective.
	Video Monitor controls set wrong.	Adjust brightness and contrast.
	Internal Microscope head optics are dirty.	Contact Zygo.
<i>Part hard to focus.</i>	Part has low reflectivity.	Focus first with high power objective or check system with known good part.
	Part is extremely smooth.	
	Part too rough.	

*(continued)*

Problem	Possible Cause	Solution
<i>Can't obtain an interference or fringe pattern.</i>	Part out of focus.	Adjust focus.
	Incorrect part tip/tilt.	Adjust stage tip and tilt.
	Part is too rough or has low reflectivity.	Check system with known good part.
	Stage improperly aligned.	Align stage.
	Focus filter not used.	Use Focus filter to assist with focusing of 2.5X and 5X objectives.
	Beam block blocking reference path (2.5X and 5X objectives only).	Push the beam block in.
<i>Inconsistent measurement results.</i>	Part out of focus.	Adjust focus.
	Part not secure.	Use fixture to secure part.
	Incorrect part tip tilt.	Adjust stage tip and tilt.
	Dirty part.	Clean part.
	Dirty objective.	Clean objective or try another objective.
	Excessive vibration.	Check fringe stability. Check vibration isolation system.
	Objective switched after making system error file.	Make new error file. (Error files are objective specific.)
<i>Software error message - "Cannot keep up with frame grabber".</i>	Using too large Camera Mode control setting for the computer.	Make an Acquisition mask smaller than the camera image area.
	Reconfiguring or building application fragments memory.	Press the Measure button again.
	Computer performing background functions, like printing.	Wait for the function to end.
	Window size too large for scan length and Camera Res selected.	Make an Acquisition mask smaller than the camera image area.
<i>Instrument cannot be initialized when MetroPro starts.</i>	Instrument not turned on.	Turn on power switch on Electronic Enclosure.
	Defective cable or connector between instrument and computer.	Check and replace cables.
	Improperly connected cables.	Double check the cable routing.
	Frame grabber board not properly seated in the computer.	Reinstall frame grabber board.



# Performance Options

## Chapter 6

### Performance Options

Option	Description
Extended Scan	Extends the vertical scan range from 100 micrometers to 5 millimeters.
Filter Sets	Filter sets to improve measurements of rough surfaces.
Long Distance Objectives	Objectives with long working distance, ideal for measuring step heights and submerged part details.

### Extended Scan Option

The Extended Scan Option extends the standard 100 micrometer vertical scan range of the NewView microscope to 5000 micrometers (5 mm). This option provides increased range for all objectives, limited only by the objective working distance. This enables the NewView to measure a greater variety of parts and up to 5 millimeter steps.

The Z-axis motor precisely drives the objective through the vertical scan envelope as measurement data is collected. The Motion Controller provides joystick control of the z-axis. The Motor Driver Assembly houses the electronics that power and direct the motor.

The Extended Scan Option is available for the Zygo NewView microscope. It is a factory-installed option, available with the original order, or it may be added later. For information on upgrading your NewView, contact your Zygo representative.

MetroPro software version 6.0.20 or later is required for this option. This option requires licensing to activate and use. It is licensed as a separate line item in the Edit/View Licenses window. For information on licensing, see the *Getting Started With MetroPro* manual.

## Using the Extended Scan Option

1. Click on the Meas Cntrl icon to open the Measure Controls window.
2. Click on the Scan Length control until it displays “Extended.” Note that when the Scan Length is set to Extended, that the FDA Res control is ignored.
3. Click on the Extended Scan Length control, and, using the keyboard, enter a value for the length of the scan; then press Enter.  
**Note:** The value should be the approximate range of detail or step height in the test part, plus 10%. Do a manual scan first to determine the length. (Explained in the “Manual Mode” section below.)
4. Focus the NewView on the bottom (lowest) detail of the test part. Adjust the stage orientation to null the fringes. (Focus and null are described in detail in Chapter 3.)  
**Note:** The higher the objective power, the shorter its working distance. Make sure you don’t drive the objective into the upper portion of the part when trying to locate the lowest detail.
5. Adjust the focus (z-axis) to slightly lower the focus below the lowest fringes.  
**Note:** The NewView scans from the bottom up when the Scan Length control is set to Extended. The starting position should be the lowest fringes found in the test part. To lower the focus below the fringes, pull lightly down on the joystick.
6. Press **F1** or click the MEASURE button. Do not touch the instrument, test part, or the work area during the measurement. The measurement takes approximately 8 minutes per millimeter (Camera Mode 320x240).

## Manual Mode - Extended Scan

The NewView with the Extended Scan Option can also be used in a “manual mode”, where the objective is driven from one location to the next and the step difference is read directly from a digital readout in the software.

Manual mode can be used to quickly determine an appropriate scan length before the actual measurement or to derive a simple step height measurement, without the other results in MetroPro.

1. Focus the NewView on the lowest point of interest in the test part.
2. Click the Reset MC button to zero the Z position readout. A Reset MC button can be created in a Control Window by selecting the New Button → Miscellaneous → command.
3. Drive the z-axis upward by pushing the joystick forward. Observe the fringes on video monitor as they move through the test part; stop the z-axis motion when you have scanned to or past the desired location.
4. Read the Z position off the on-screen digital readout. Hint: when using the readout to determine a scan length, increase the Z position length by 20  $\mu\text{m}$  to ensure that the part detail is covered.

Axis Position	
X: -13.685 mm	T: 0 degs
Y: +204.013 mm	P: -0.00 degs
Z: 0.150 mm	R: +0.00 degs

The Axis Position or digital readout displays when the microscope is moving.

Z position

## Software Calibration of the Extended Scan Option

The MetroPro Step Height Application provides the ability to calibrate the vertical step measurement of the NewView to match a traceable standard. To calibrate the Extended Scan Option, follow the procedure supplied in the *Zygo Step Height Application* booklet, under “Step Calibration”.

When performing calibration, be sure to use the same objective you’ll use for measurements, that the Scan Length control is set to Extended and the applicable length is entered in the Extended Scan Length control. For the greatest accuracy, do not remove or even touch the objective after performing calibration.

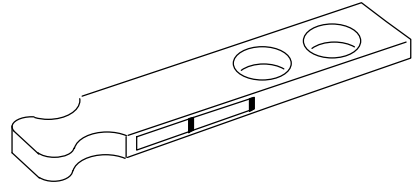
During the process of calibration, a scalar value is modified in the system calibration file that adjusts the vertical scale specifically for the Extended Scan Option.

## Filter Sets

The NewView is a scanning white light interferometer; measurements use a white light filter based on a center wavelength of 600 nanometers, with a bandwidth of 125 nanometers. This gives the instrument a coherence length of 2.9 micrometers. The coherence length of an optical source is the maximum path length distance of the interferometer over which interference is obtained.

For most applications, this coherence length is adequate to attain good data of the surface. However, there is data dropout where there is considerable height variation within one pixel. This may occur when measuring surfaces with low contrast, such as paper or ceramics; or when measuring surfaces with high slopes, such as ball bearings or bumped wafers. The coherence length of the instrument is increased by decreasing the bandwidth of the filter. Using a narrow bandwidth filter improves the measurement capability for rough surfaces and decreases data dropout.

A number of filter sets are available for the CP200/300. They are combinations of the filters shown in the table below. To use any of the filter sets, simply replace the existing filter tray; no software modification is necessary.



**Filter Specifications**

Filter	Bandwidth	Coherence Length	Ra of Surface
MEAS (standard)	125 nm	2.9 $\mu\text{m}$	$\sim < 3.0 \mu\text{m}$
FOCUS (standard)	3 nm	N/A	N/A
F1	80 nm	4.5 $\mu\text{m}$	$\sim 3.0 \text{ to } 6.0 \mu\text{m}$
F2	40 nm	9.0 $\mu\text{m}$	$\sim > 6.0 \mu\text{m}$

**Filter Sets**

Filter Set	Zygo P/N	Included Filters
Standard Filter Set	6300-0487-01	MEAS and FOCUS
Rough Filter Set	6300-0487-02	F1 and F2
Combination Filter Set	6300-0487-04	MEAS and F2

**Note:** For the majority of rough surfaces use the F1 filter; improper use of the F2 filter may cause erroneous results.

## Long Working Distance Objectives

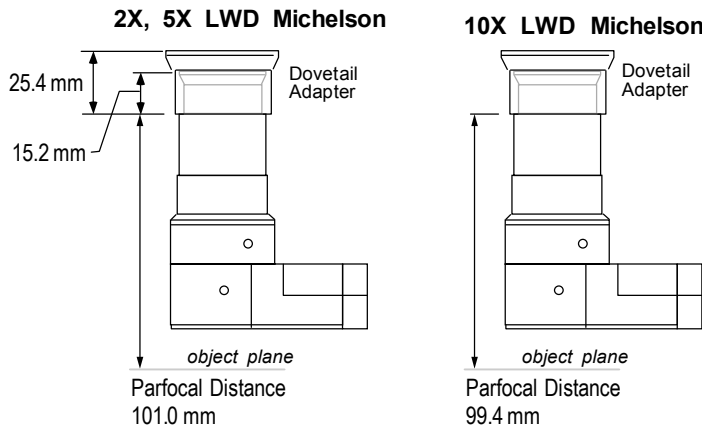
Long working distance objectives are useful when measuring into a recessed area. The longer working distance also minimizes the risk of crashing the objective into the part.

### LWD Objectives

**Magnifications:** 2X, 5X, and 10X

**Type:** Michelson

**Mounting:** Dovetail mounting only, not turret mountable.



**Note:** The reference leg (the lower angled section) of the LWD objectives is fixed in reference to the dovetail slot. Do not rotate the objective.

#### Nominal Objective Specifications at 1X

Power	Sys Mag	NA	Working Distance (mm)	Focus Depth (µm)	Inter Depth (µm)	Lateral Res (µm)	Field of View H x V (mm)	Spatial Samp (µm)		Slope (deg)
								320x240	640x480	
2X	40X	0.055	20.5	± 95.0	4.0	6.43	3.52 x 2.64	11.0	5.50	1.58
5X	100X	0.14	20.5	± 14.8	4.0	2.53	1.41 x 1.06	4.40	2.20	3.93
10X	200X	0.28	18.8	± 3.7	4.0	1.26	0.70 x 0.53	2.20	1.10	7.73

For definitions on terminology and specifications at other zoom settings see page 1-7.

### Mounting LWD Objectives

The LWD objectives include a large and small dovetail mount incorporated into the dovetail adapter, so the objective can be mounted on the CP200/300, plus all NewView 5000 models and the older NewView 200. The LWD objectives are not turret mountable.

- To mount an objective on the CP200/300, align the slot on the objective dovetail to the pin on the microscope head. Then tighten the dovetail lockscrew on the microscope.

