Zygo Corporation
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USA

NewView™ 9000 Operating Manual

OMP-0617

AMETEK®
ULTRA PRECISION TECHNOLOGIES

Warnings and Notes

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

Note, provides helpful information.

Notices

If equipment has CE Marking it indicates compliance to safety requirements established by the European Union. The directives and standards in compliance are listed in a Declaration of Conformity, which is on file at Zygo Corporation, Middlefield, Connecticut, USA.

Do not dispose of this product as household waste. Use an approved organization that collects and/or recycles waste electrical and electronic equipment. For more information, contact ZYGO Customer Service or your local government office.

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Introduction

Chapter 1

Safety Precautions

Failure to follow safety precautions could result in damage to personnel and the instrument, and may void the warranty.

WARNINGS!

- **Disconnect Power During Installation.** Ensure that all power is off during installation, when connecting cables, or when servicing equipment.
- **Ground the Instrument.** To minimize shock hazard, the equipment must be properly connected to an electrical ground through the power outlet.
- **Use Care When Moving Equipment.** It is recommended that several helpers work together when moving or lifting the instrument. Contact the appropriate agencies in your country for proper lifting recommendations.
- **Do Not Crash Objectives.** Do not crash the objectives or optical profiler into the test part or part stage. Use caution when focusing and driving the z-axis.
- **Keep Fingers and Objects Away from Moving Components**. Motorized components, such as the sensor, part stages, and turret, move during operation. Keep hands, fingers, and other objects away from moving components. For emergencies, press the Joystick Emergency Stop button to stop all stage motion.
- **Handle Objectives with Care.** Objectives are delicate and should not be mishandled or dropped. Do not touch exposed glass surfaces. Unused objectives should be stored in supplied containers.
- **Clean Optics Only When Necessary.** Do not clean optical surfaces unless necessary. Improper and unnecessary cleaning may damage optical coatings.
- **Do Not Modify Equipment.** Do not install substitute parts or perform any unauthorized modification of the equipment.

Safety Labels

Failure to follow the safety labels on the equipment 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.
	Do not crash the objective or optical profiler into the test part or stage. Use caution when focusing and driving the z-axis.
	Disconnect power before performing the specified procedure.
	Refer to the manual for complete instructions on performing a specified procedure.

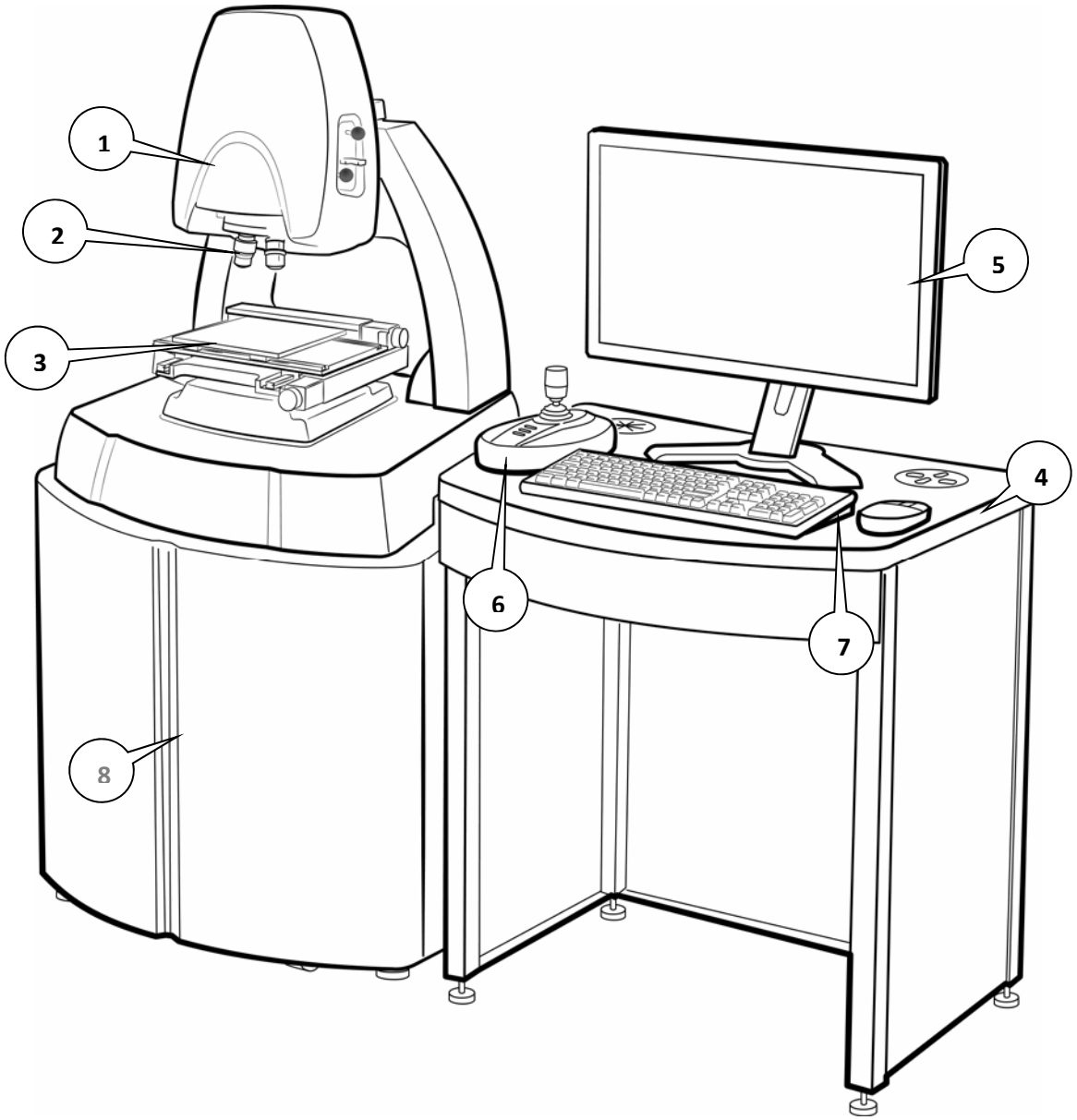
The NewView 9000(1) Optical Profiler

The ZYGO NewView 9000 optical profiler is a general purpose, three-dimensional, surface structure analyzer. It provides graphic images and high resolution numerical analysis to accurately characterize the surface structure of test parts. The profiler uses coherence scanning interferometry to image and measure the micro structure and topography of surfaces in three dimensions. A wide variety of surfaces can be measured.

The profiler is configured with a stable base and gantry design with built-in vibration isolation. It features motorized focus control and optional motorized part positioning.

(1) U.S. patent numbers 5,784,164, 6,775,006, 6,822,745, 6,989,905, 7,068,376, 7,324,210, 7,889,355; U.S. and foreign patents pending.

NewView 9000 Components



Item	Component	Description
1	Optical Profiler (also known as Sensor)	The NewView is a coherence scanning interferometric optical profiler and provides three-dimensional measurement data of the test part surface. Focus is performed by driving the sensor up or down with the Z-axis motorized stage. It features built-in vibration isolation. Shown above on optional support table.
2	Interferometric Objective(s)	An interferometric objective gathers light from the test part and forms a real image of it, creating an interference pattern representative of the test part surface.

Item	Component	Description
3	Part Stage	Provides a platform for placing test parts and attaching user-provided custom part fixturing. It is used to position the test part under the objective. The stage provides ±3 degrees of Pitch/Roll motion and up to 150 mm of X/Y travel.
4	Worktable	(Optional) Used as a work surface; it holds the Joystick, monitor, keyboard, and mouse. Complements the support table design and includes a USB hub and a storage drawer.
5	Monitor	Displays Mx graphics and data. An on-screen live display is used to display a live image of the part under test; this serves as visual feedback when adjusting focus and part positioning.
6	Joystick	Controls the motorized stages (including focus), z-stop settings, and provides an emergency motion stop.
7	Keyboard/Mouse	For data entry and software operation.
8	Computer and Electronics Enclosure	In the arrangement shown previously, the computer and Electronics Enclosure are inside the optional support table. The support table doors have push-to-open latches. The computer runs Mx software and provides system control. The Electronics Enclosure provides power to the NewView and stages and interfaces to the computer.

NewView 9000 Options

Option	Description
Field Zoom Lens	High-quality discrete field zoom lenses provide superior image magnification. The profiler accepts up to three field zoom lenses automatically selected via software. Zoom lenses are available in the following powers: 0.5X, 0.75X, 1.0X (standard), 1.5X, and 2.0X.
Objectives	Interferometric infinite conjugate objectives provide sharp images of the part under test. ZYGO offers standard and long working distance objectives in magnifications ranging from 1X to 100X.
Objective Mounting	Single objective dovetail (standard). 4-position manual encoded turret (optional). 4-position motorized turret (optional).
Stages	1-axis stage; Motorized Z (focus), Manual Pitch/Roll and X/Y. 3-axis stage; Motorized Z (focus) and X/Y, Manual Pitch/Roll. 5-axis stage; Motorized Z (focus), Pitch/Roll, and X/Y.  The number of stage axes indicates the total number of motorized axes in the configuration. The motorized Z stage and motorized X/Y stages are also available in a closed loop (encoded) configuration.

Principle of Operation

The NewView uses coherence scanning interferometry (CSI) to image and measure test part surfaces and provide surface structure analysis without contacting the surface. Light from the optical profiler 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. Due to surface irregularities the measurement wavefront travels different distances than the reference wavefront. When the two wavefronts are recombined, the waves are out of phase and form an interference pattern. The light and dark bands that make up the interference pattern are called “fringes.”

The interference pattern indicates the surface structure of the part being tested. The test part is scanned by vertically moving the objective with respect to the stationary test part, either with a piezoelectric transducer (PZT) that scans just the objective or with the z-stage that scans the entire sensor. As the objective scans, a video system captures intensities at each camera pixel. These intensities are converted into height maps by Mx software.

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. Using these techniques, the NewView 9000 analyzes and quantifies the surface topography of parts. Results are displayed on the monitor as solid models, plots, and numeric representations of the surface.

Installation

Chapter 2

A Note About Installation

This chapter describes the site and utility requirements, which should be considered before the system is set up. It also provides installation instructions for equipment manufactured by ZYGO. Installation instructions for other components are covered in documentation provided by the original manufacturers.

Warning!
Installation must be performed by ZYGO trained personnel or the warranty may be void.

Site Requirements

Consideration	Description
Vibration	The site should meet vibration criterion curve VC-C or better for best instrument performance.
Floor	The floor should be as stable as possible to avoid transmission of vibrations into the system. A ground level, poured concrete slab is recommended. The integral vibration isolation system effectively minimizes most vibration effects.
Acoustic Noise	Acoustic (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 are prone to retransmitting acoustic vibration from adjoining areas and suspended ceilings can couple roof mounted air conditioning noise.
Air Turbulence	The site should be free of air movement. Air turbulence causes uneven air density within small areas, which can refract portions of the measurement beam and alter the measurement. Air turbulence can also cause motion of small, thin, or light samples on the measurement stages. Fans, heaters, and air conditioners should not blow air onto the instrument.

Consideration	Description
Temperature	Operating temperature range is 15-30°C. Stability of temperature around set point is ±1°C. This means the instrument can operate at 16 ±1°C to 29 ±1°C and meet performance specifications. System performance is validated at 22 ±1°C. Rapid temperature changes degrade performance by causing uneven expansion and contraction of the instrument and parts under test. Air conditioning, heating devices, or vents, in the nearby area, can cause temperature differences.
Cleanliness	Keep the work environment clean. Over time, dust, smoke, and oil can accumulate on the optics and degrade performance. Keeping the site clean and periodically cleaning the instrument will minimize this concern.

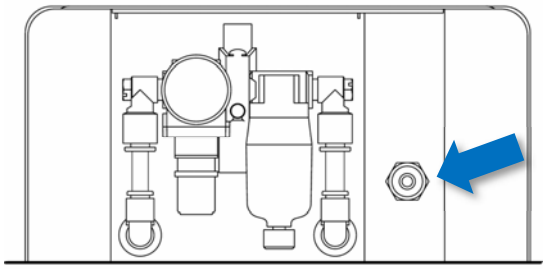
Utility Requirements

Requirement	Description
Electrical	100/120/220/240 VAC at 50/60 Hz User to provide an isolated 15-amp circuit with an earth ground.
Compressed Air	90 PSI (6.2 bar) maximum, 5 µm dry filtered source For integral vibration isolation. The vibration isolation table accepts a 6 mm OD input hose. For other diameter hoses, the user must supply the appropriate adapter. ZYGO recommends using adapters from SMC Pneumatics.

Warning!
The equipment must be electrically grounded through the supply outlet. Any interruption in the ground circuit can cause a shock hazard and could result in personal injury.

If the power strip has an On/Off switch, it can function as a master disconnect switch. To remove power from all components, perform the shutdown procedure and then turn the power strip power switch to Off. If the power strip does not have an On/Off switch, pull the plug from the power outlet to disconnect.

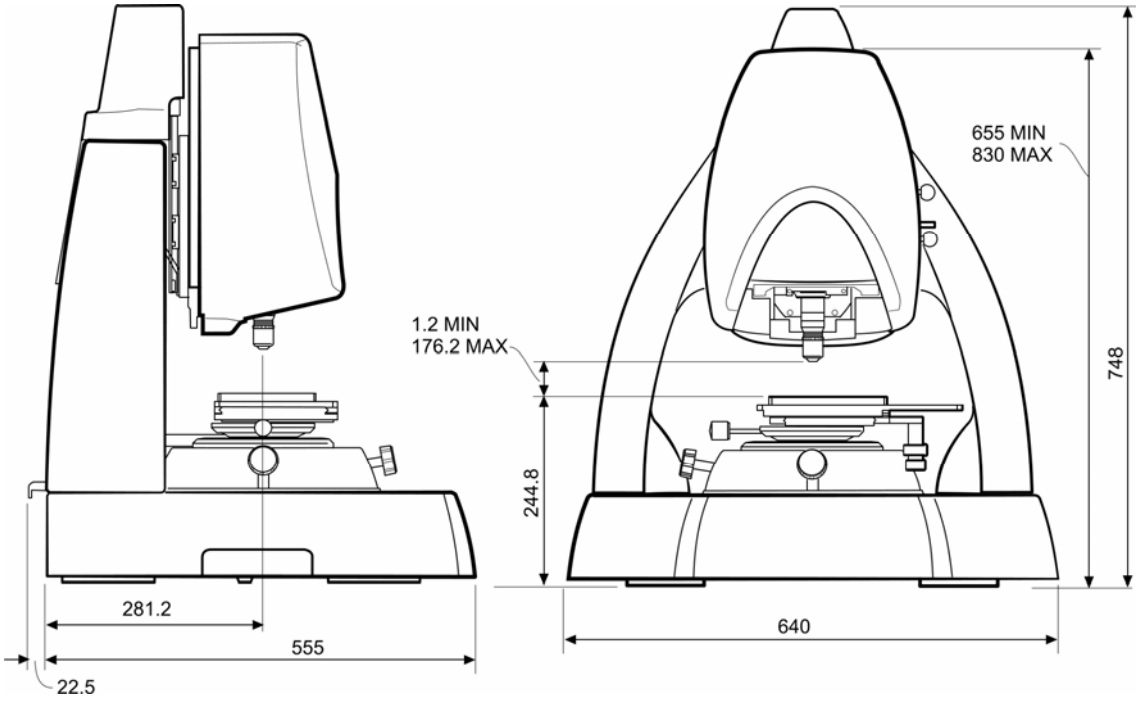
Location of Compressed Air Fitting (Center Rear of Profiler Base)



NewView Layout

Shown with manual stage and single dovetail mounted objective.

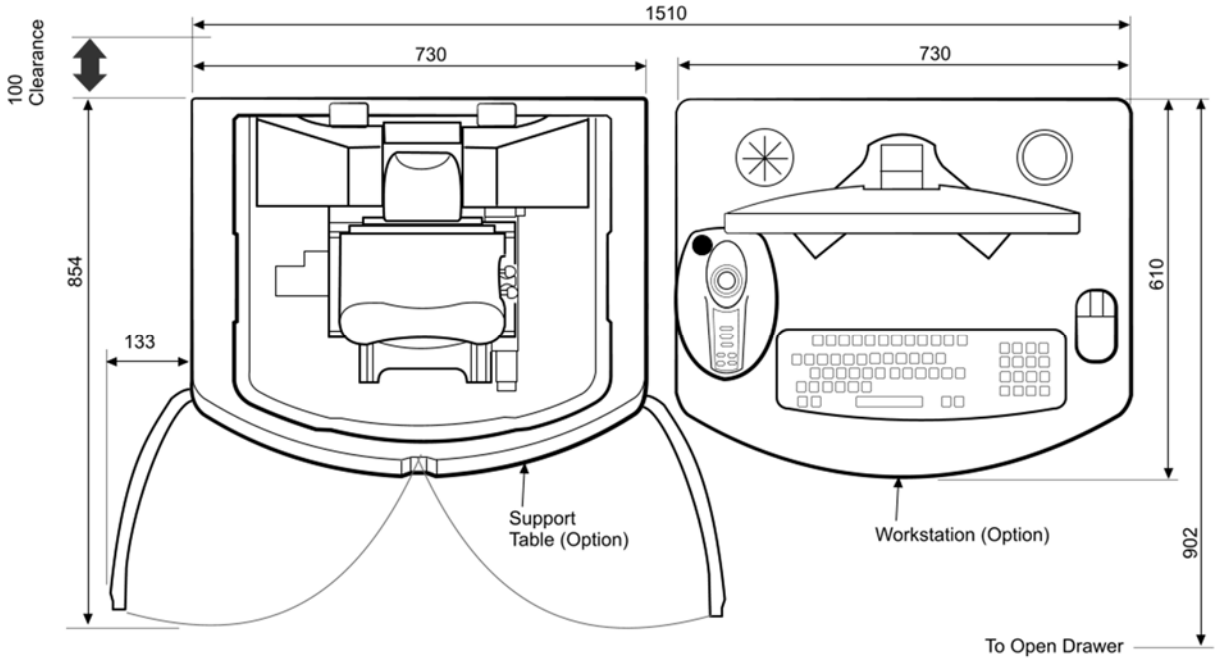
NewView Profiler Footprint

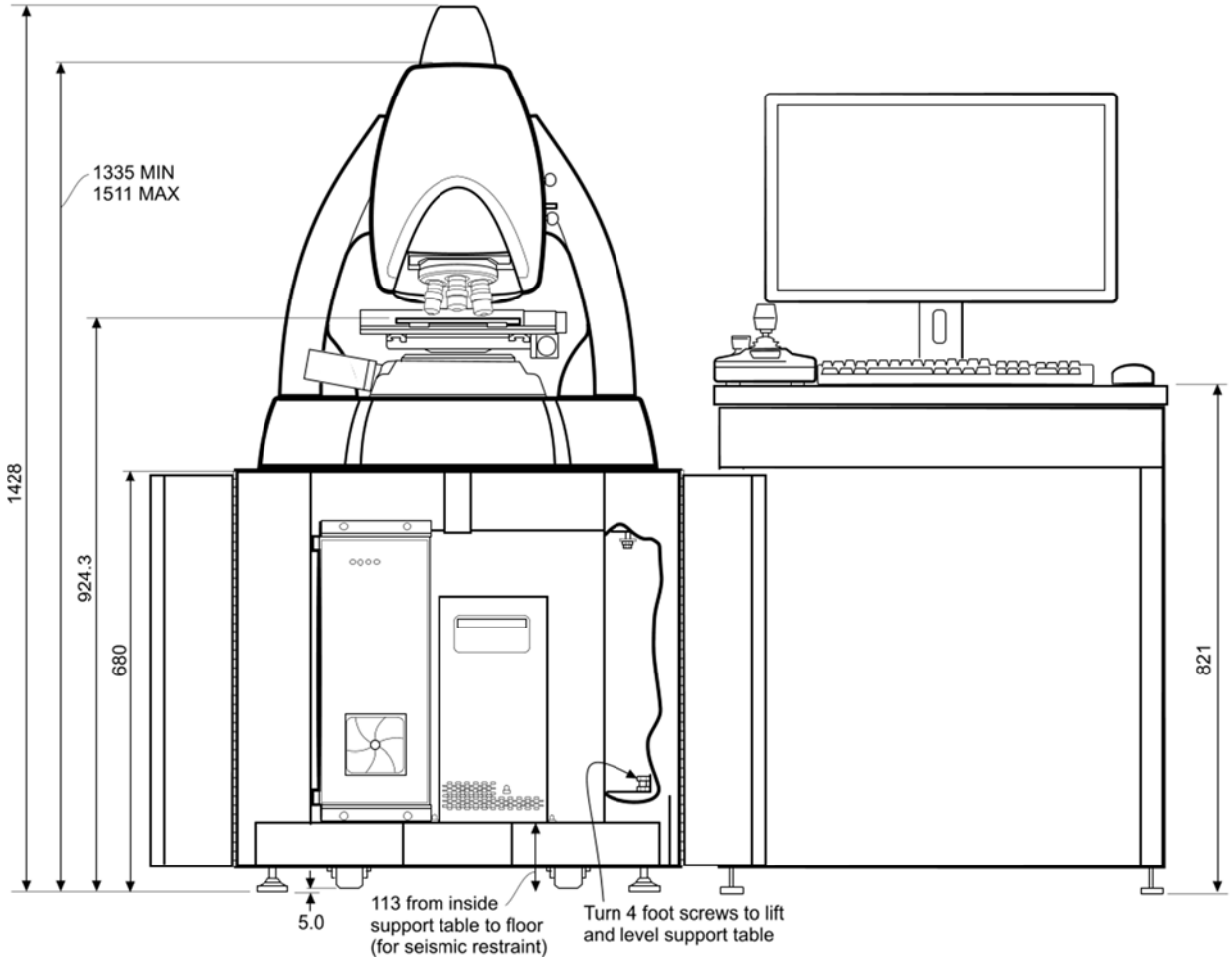


Dimensions in millimeters

System Layout (with optional support table and workstation)

System Footprint





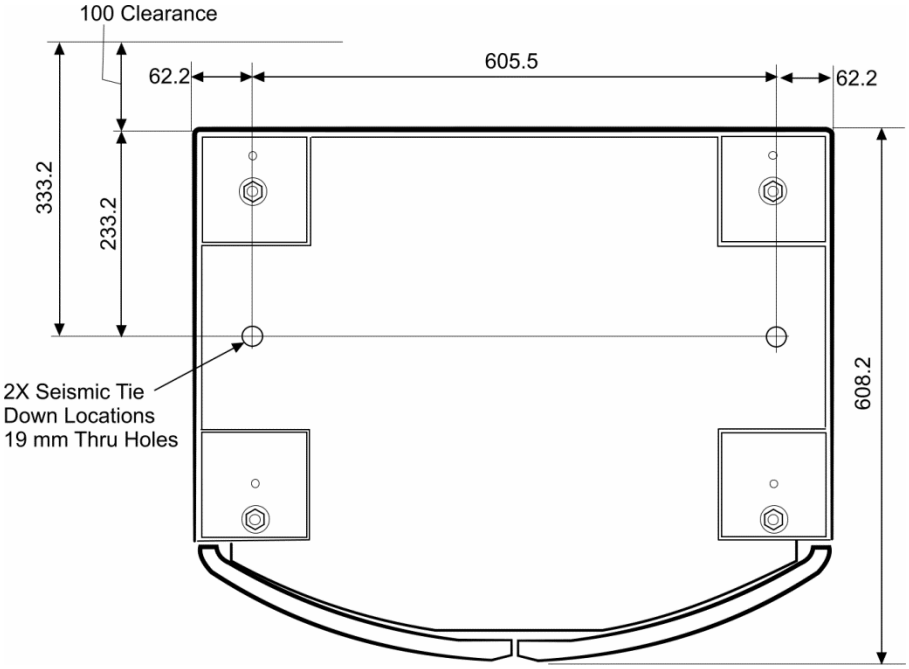
Dimensions in millimeters

Seismic Restraint (Support Table)

Use seismic restraint in geographical locations where requirements or regulations dictate the equipment should be secured against seismic movement. Secure the support table to the floor with appropriate user-supplied fasteners.

If securing the support table to a concrete slab, use ½-inch (13 mm) diameter concrete wedge anchors for each of the two holes located on the inside bottom of the support table. A cross section view of the optional support table with dimensions is provided below.

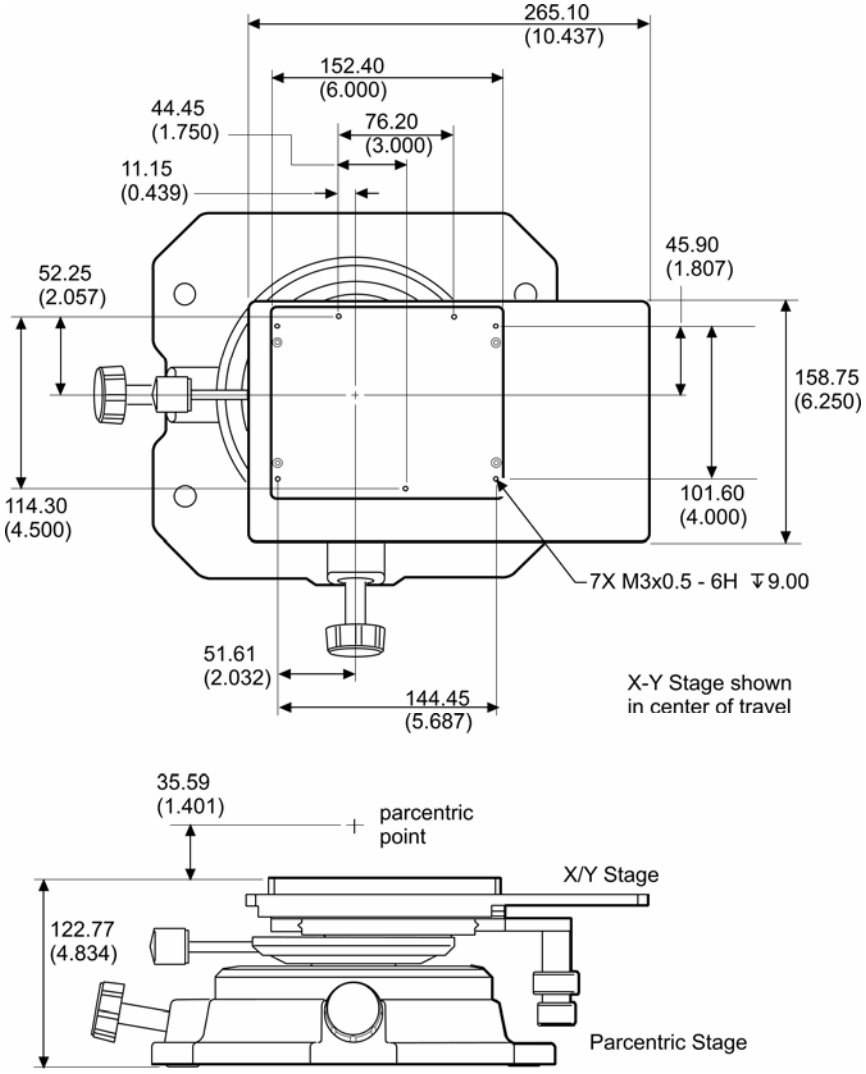
Seismic Restraint Tie Down Locations (Inside Support Table)



Dimensions in millimeters

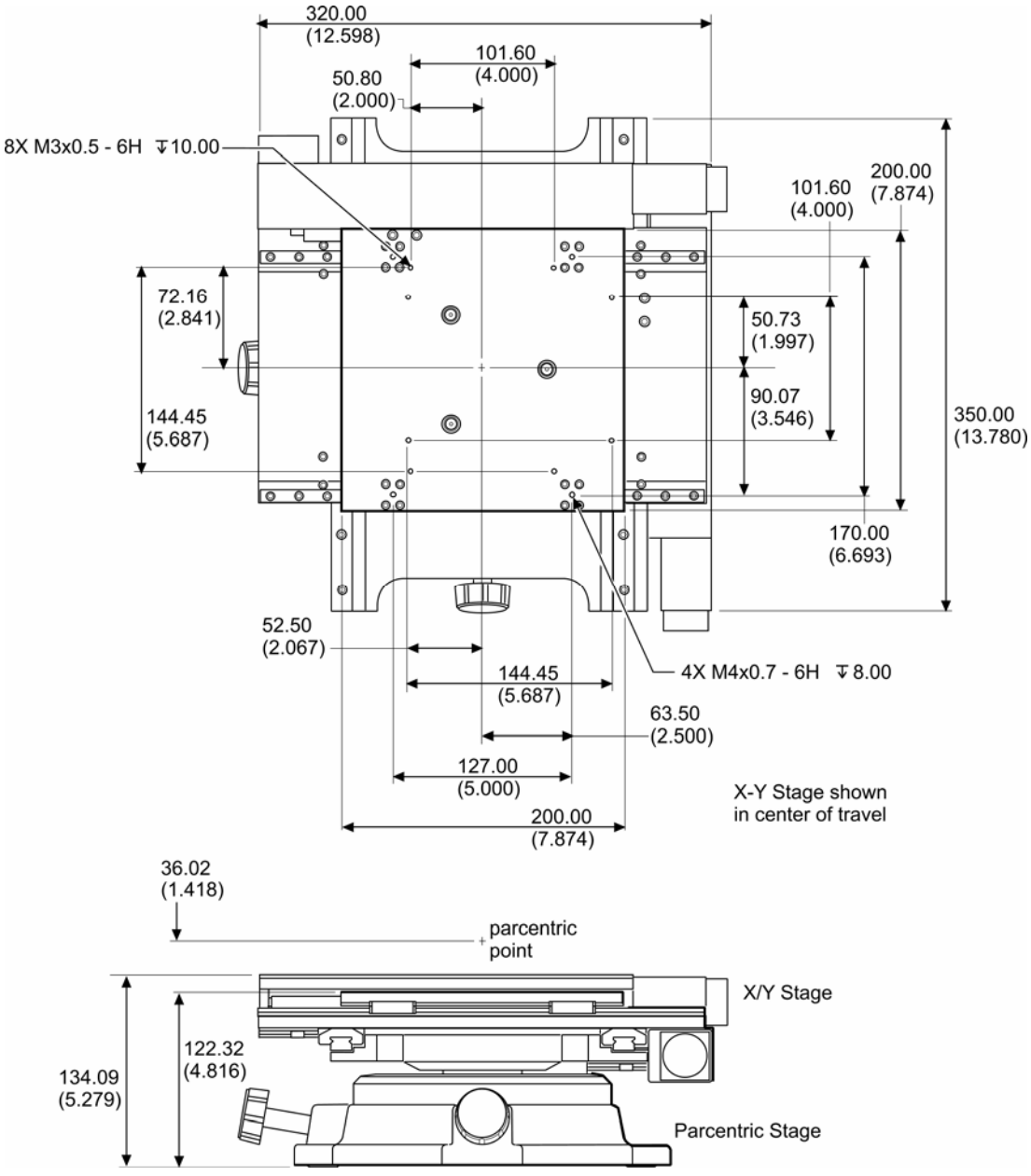
Part Stage Dimensions

Manual X/Y Stage Dimensions



Dimensions in millimeters and (inches)

Motorized X/Y Stage Dimensions



Dimensions in millimeters and (inches)

Custom Part Stage Fixturing

User-designed fixturing may be attached to the top of X/Y Stage.

Warning!
Do not attach fixtures to the stage top plate using screws exceeding 6-millimeter thread depth.

Fixture Considerations

- Threaded screw holes (M3x0.5x6) are provided to attach fixturing.
- Use registration pins or guides to assist in aligning similar parts.
- Some test parts may need to be held firmly in place, so they don't move during the measurement.

For x/y stage interface dimensions refer to "Part Stage Dimensions", in this chapter.

Preinstallation Checklist

- ☑ Inspect all packages for signs of shipping damage. Report any damage to the carrier.
- ☑ Check that the shipment is complete.
- ☑ Ensure that the worksite has the required operating environment and utilities.
- ☑ Contact your ZYGO representative to make arrangements for installation and training.
- ☑ 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!
Contact the appropriate local and national agencies for proper recommendations when lifting or moving equipment or pallets.

Installation Summary (when shipped with optional support table)

1. Move shipping crates to installation site.
2. Remove the spacer strap at the bottom of the hinged door on the instrument crate.

   The spacer strap protects the hinged portion of the ramp/front wall of the crate during shipping. The ramp will not fold down without this section being removed.
3. Remove the two hold-down screws from the hinged ramp at the top of the instrument crate.
4. Open instrument crate by turning the twist locks.
5. Open the front door/ramp.
6. Remove the screws on the sides of the box holding 3 wooden braces- the arch front, casting front, and instrument support table.
7. Remove the protective bag from the instrument.
8. Remove the 2 bolts located on the inside bottom of the support table securing the table to the crate base.

9. Raise all 4 support table feet completely to provide maximum clearance.
10. Carefully roll the NewView off the crate base unto ramp and then to the floor.
11. Position NewView at the installation site. (Refer to System Layout.)
12. Lower the 4 support table feet to lift the table off the wheels. Adjust the feet to level the profiler.
13. If seismic restraint is required, secure the support table to the floor. (Refer to Seismic Restraint.)
14. Loosen the 3 upper lock nuts protruding from the inside top of the support table until they are a minimum of 10 mm from the inside of the table brace or in contact with the lower nuts. Do not remove the three lower nuts or studs from the system.
15. Remove 2 red shipping locks from the X/Y stage and P/R stage. Do not discard the shipping locks.
16. Remove shipping lock from the Z stage; it is held on with 4 red thumbscrews. Do not discard the shipping lock.
17. Place the computer inside the support table.
18. Position and connect components. (Refer to Connecting Cables.)
19. Connect compressed air supply. (Refer to Utility Requirements.)
20. Install optional turret and objectives. (Refer to procedures later in this chapter.)

Changing the Sensor Height

The sensor height relative to the column and z-stage is set at the factory to match typical measurement conditions. Under some conditions, such as: measuring tall parts, using tall part fixtures, and using long working distance objectives, it may be necessary to raise the sensor height. The upper mounting position is 75 millimeters higher than the standard setting.

1. Remove installed objectives.
2. Remove turret (if installed). Make sure to close the Dovetail Lock Handle.
3. On the back of the main cover, loosen the 4 captive screws, and remove the cover.
4. Remove the small cover over the Z motor.
5. Using an Allen wrench, remove four socket head capscrews in the corners of the riser plate.
6. Lift the sensor along the C-shaped slots until the captive screws are in the lower portion of the C-shaped slot.

Warning!
At this point the sensor can be completely removed from the z stage when the captive screws are at the lowest position on the riser plate. Do not let the sensor fall off the z stage or the sensor can be damaged.

7. Secure the riser plate in position using the four socket head capscrews.

The holes used to secure the riser plate change when moved to the upper position. Use holes that align to threaded holes behind the plate.

8. Reinstall the main cover. The small Z motor cover is not used in this configuration.
9. Reinstall turret and objectives.

Follow the procedures for installing the turret and objectives as provided later in this chapter.

Connecting Cables

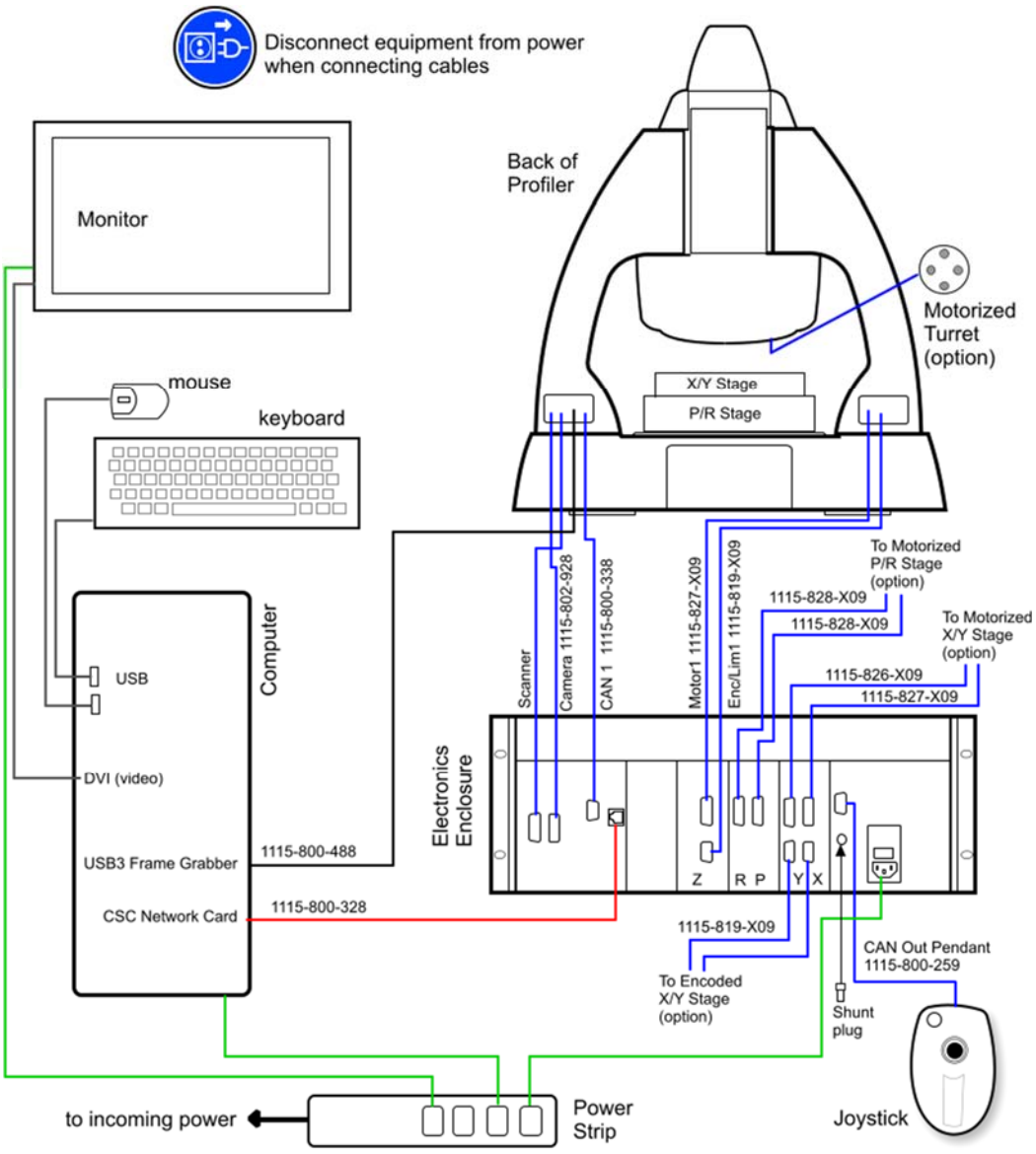
Warnings!

Disconnect equipment from power before connecting cables. Failure to do so may cause damage to the equipment.

The equipment must be electrically grounded through the supply outlet.

Remove protective caps from connectors before attaching cables.

Typical Cable Connections



Routing Cables

Route cables from the keyboard and mouse on the worktable through holes in the back of the support table. Secure the cables from the optical profiler to the cable clamps at the rear of the profiler base.

Installing an Objective Turret

Warning!
Handle the turret with care. Do not force the turret onto the profiler. Do not drop the turret.

1. Open the dovetail lock handle.
2. Place the turret in your hand with square dovetail farthest away.
3. Align the square dovetail to the rear of the opening at the bottom of the sensor.
4. Push the turret upwards. The dovetail should go upward inside the dovetail receiver.
5. Gently pull the turret toward the front of the profiler as far as possible.

   If the turret is properly positioned in the dovetail receiver, it will stay in place if you relax your grip.
6. Close the dovetail lock handle.

Warning!
Disconnect equipment from power before connecting the motorized turret cable.

7. If the turret is motorized, connect the turret cable to the sensor connector. Secure the turret cable using the extended captive thumbscrews.

Opening the Dovetail Lock Handle

Installing the Turret onto the Profiler

Installing the Motorized Turret Cable

Installing Objectives into a Turret

Warnings!

Do not touch the objective lenses. Dust, dirt, and fingerprints can impair the imaging capability and harm optical coatings. Store unused objectives in a protective case.

Make sure the Joystick is not activated and software controls are not clicked to move motorized stages or the turret. To stop instrument motion in an emergency, press the Joystick Emergency Stop.

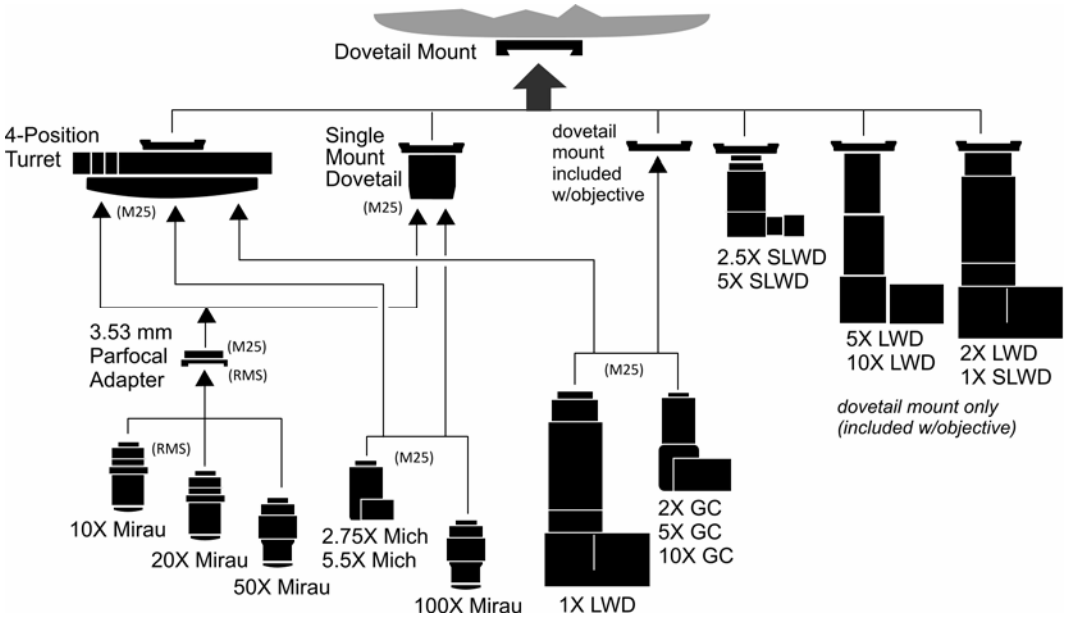
1. Remove the objective from the storage box.
2. If necessary, screw the applicable adapter into the turret. See "Objective Mounting Adapters."

   Some objectives are not turret mountable.
3. Carefully thread the objective clockwise into the turret. Position multiple objectives on the turret to ensure balanced weight distribution.

Installing Objective into a Turret

Do not over-tighten objectives; finger tight only.

Objective Mounting Adapters



Installing a Single Objective

Warning!
Do not touch the objective lenses. Dust, dirt, and fingerprints can impair the imaging capability and harm optical coatings. Keep unused objectives in a protective case.

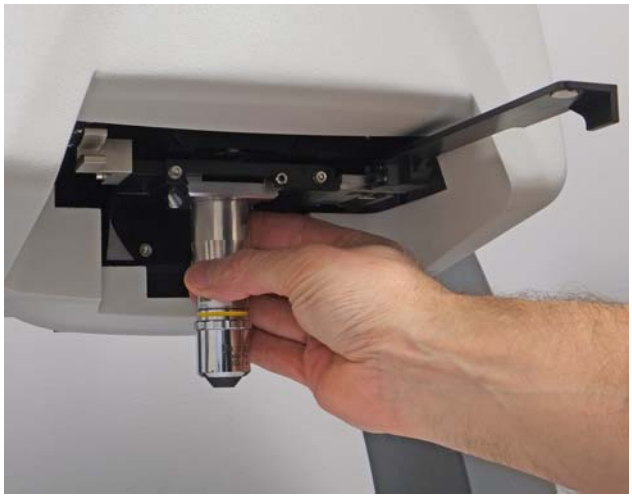
1. Remove the objective from the storage box.
2. If necessary, screw the objective into the Single Mount Dovetail.
3. Hold the objective from the midsection.
4. Pull open the dovetail lock handle.
5. Align the square dovetail to the rear of the opening at the bottom of the sensor. Note the orientation of the single mount dovetail in the photo below.
6. Push the objective upwards. The dovetail should go upward inside the dovetail receiver.
7. Pull the objective toward the front of the sensor as far as possible.

   If the objective is properly positioned in the dovetail it will stay in place if you relax your grip.

10. Close the dovetail lock handle.

Objective with Single Mount Dovetail

Installing a Single Objective



Operation

Chapter 3

Operating the NewView

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 for which it is intended.

Start-up

Warning!
The operator is responsible to make sure the Joystick is not activated when the system is first started. People and objects must be clear from the part stage and sensor. To stop instrument motion in an emergency, press the Emergency Stop button.

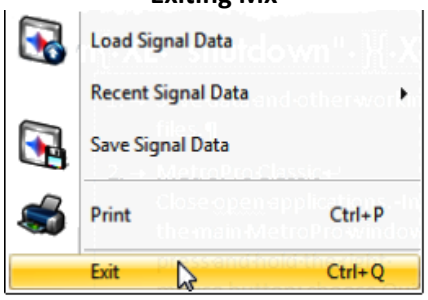
1. Turn on all components.
2. After the Windows welcome message appears, press Ctrl-Alt-Delete to log on.
3. In the Windows log on screen, type the system password.
4. Locate the ZYGO Mx program icon and double-click it to open.

Windows Log On Screen

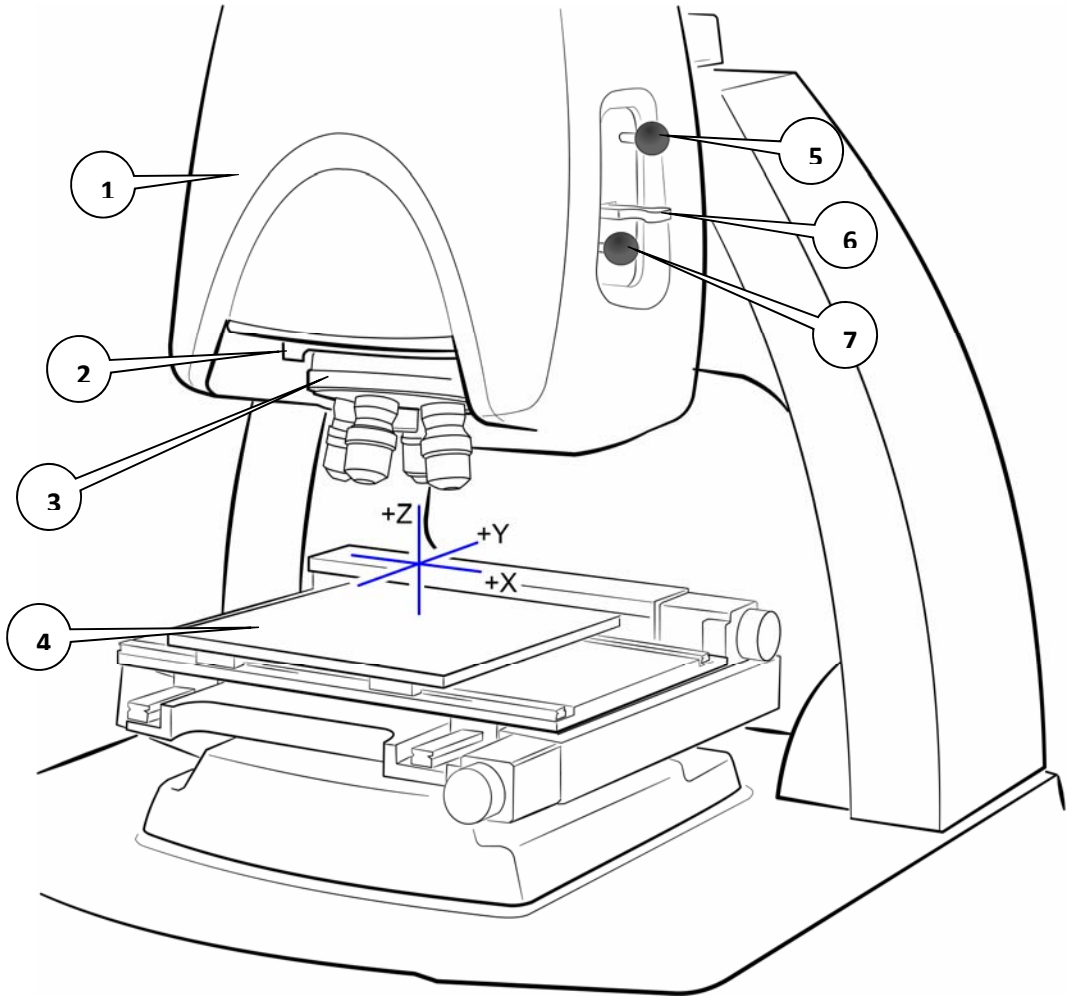
Shutdown

1. Save data and other working files.
2. On the File menu select Exit or press Ctrl+Q.
3. From Windows, use the Start menu and click Shut down.
4. To completely remove the system from power, open the support table door and turn the power strip On/Off switch to Off.

Exiting Mx



NewView 9000 Details



Item	Part	Description
1	Sensor	Houses light source used to illuminate the test part and optical components to capture interferometric data.
2	Dovetail Lock Handle	Secures the turret or objective dovetail in position on the sensor in the square dovetail receiver.
3	Turret (optional)	Holds up to 4 objectives for quick change of magnification.
4	Part Stage	Positions the test part and provides manual or motorized pitch/roll and x/y axes.
5	A-Stop	Aperture Stop. Use to control the amount of light entering the optical system. Typically used for films measurements, or for measurements of high aspect ratio features.
6	Filter Tray	Two position filter set used to change the coherence length of the light to optimize data capture under varying conditions.
7	F-Stop	Field Stop. Use as focus aid, particularly for smooth featureless surfaces. Pull out for focus aid, push in when making a measurement.

Warnings!

Pinch Hazard - Keep hands, fingers, and items away from the sensor and part stage when adjusting the profiler and when making automated measurements.

Crash Warning - Do not crash the NewView onto the part stage or test part. Be observant of the distance between the objective and the test part when adjusting focus or the sensor height.
See the WD (Working Distance) millimeter dimensions printed on the objective. Also refer to the Nexview NX2/NewView 9000 Objective Chart (PDF version available at www.zygo.com).

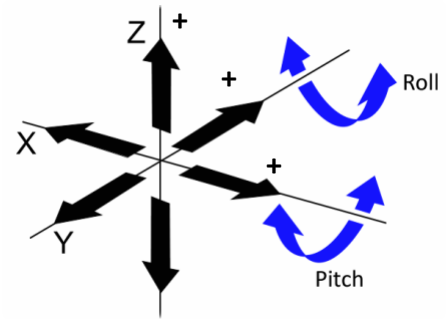
Light Level Adjustment

When focusing and setting up the profiler it is necessary to adjust light level. The following keys manually adjust light level.

Key Combo	Function
Ctrl *	Coarse up.
Ctrl /	Coarse down.
Ctrl +	Fine up.
Ctrl -	Fine down.
Ctrl 1, etc.	Adjust level in 10% increments: 1 = 10%, 2 = 20%, etc.
Ctrl tab	Toggle between last 2 light settings.

For automatic light level adjustment, press the F9 key. To set a specific light level for measuring, enter a value in the Light Level control.

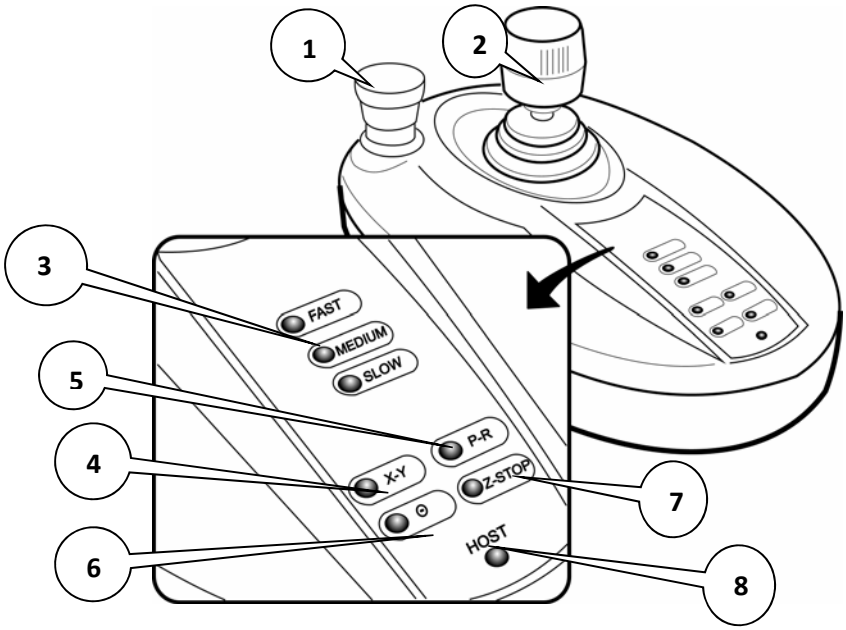
Stage Axes

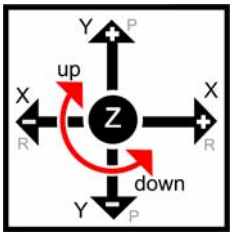


Filter Tray Settings

Filter	Setting (detent)	Bandwidth	Center Wavelength	Description
Standard	F1	125 nm	550 nm	Standard (MEAS) setting for most surfaces.
	F2	40 nm	550 nm	Setting for rougher surfaces or when there is data dropout. Also used with 3x and 5x CSI measurement modes.
Attenuating (MEAS+ND) (option)	F1	125 nm	550 nm	Same as standard F1 plus a neutral density (ND) filter. Use with large field of view objectives for highly reflective parts. Improves light level adjustability under these conditions.
	F2	40 nm	550 nm	Same as standard F2.

Joystick Details





The Joystick is used for focusing (Z) and driving motorized part stages (X/Y or P/R).

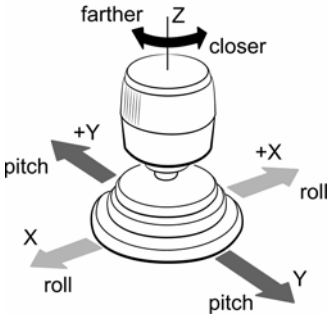
Audible user feedback:
dull click = ok

Repeated beeping during stage motion = z-stop is not set
high pitched beep = warning

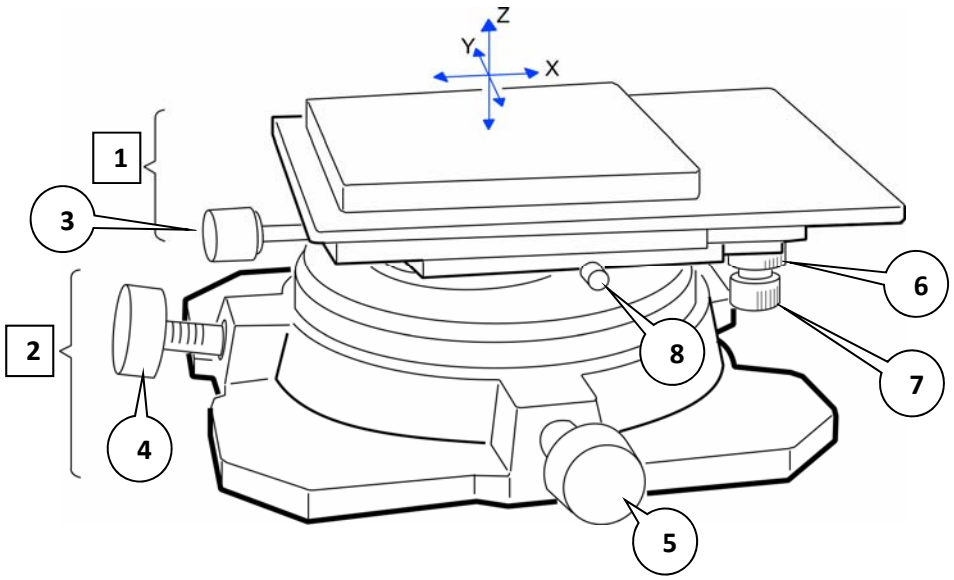
Warnings!

The operator is responsible for ensuring that the Joystick is not deflected when the system is first started. People and objects must be clear of the stage area. Press the Emergency Stop to stop all motion.

Do not drive the instrument into the part stage or test part. Use caution driving the z-axis (focus) stage. Use the Z-Stop function to prevent crashes.

Item	Control	Description
1	Emergency Stop	Emergency Stop button. When pressed it stops all stage motion. It does not remove power from the system. To reset the Emergency Stop turn it clockwise until it pops back up.
2	Joystick	 Twist Knob to drive z-axis (focus) stage away or closer to the part stage: Clockwise- away from stage Counterclockwise- towards stage Push Joystick to drive selected part stages. The greater the deflection the faster the motion. Up/Down for y-axis or pitch. Left/Right for x-axis or roll.
3	Speed buttons	FAST, MEDIUM, SLOW Push button to choose the relative speed of the z-axis (focus) stage. Selected speed is indicated by corresponding green light.
4	X-Y	Push to activate the X/Y stage. The selected stage is indicated by corresponding green light on button. Only one stage type (X-Y, P-R, or θ) can be selected.
5	P-R	Push to activate the Pitch/Roll stage.
6	θ	Push to activate the theta stage (if equipped).
7	Z-STOP control	Controls Z-Stop functions for the z-axis. To set a stop, lower the sensor until it is close to part stage or test part and press Z-STOP. To clear a set stop press Z-STOP again and verify that the LED indicator changes to flashing red. The z-axis must be software homed before the Z-Stop position can be set. Indicator: Red (Flashing)- stop not set Green (On)- stage clear of set stop Red (On, with audible alarm)- stage at set stop
8	HOST	Indicator (Red) On when the motion system is controlled by software.

Manual Part Stage Details

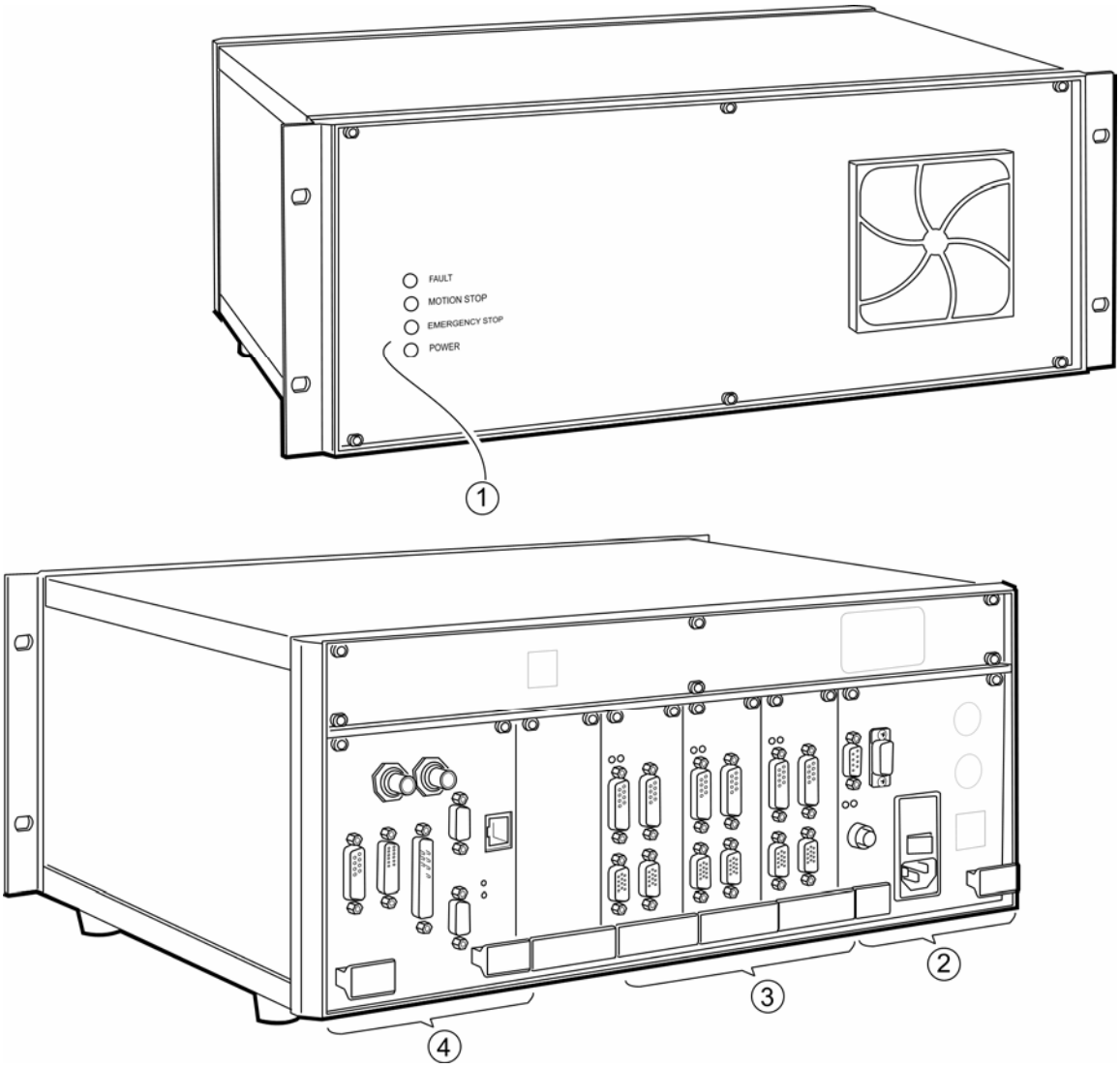


Item	Control	Description
1	n/a	X/Y Stage provides 100 mm travel in X and Y.
2	n/a	Pitch/Roll Stage provides ±3 degrees of tip and tilt adjustment.
3	Theta knob	Allows 230° rotation of the X/Y Stage about the z-axis.
4	Pitch knob	Rotates the X/Y Stage about the x-axis. Also known as Tip.
5	Roll knob	Rotates the X/Y Stage about the y-axis. Also known as Tilt.
6	Y knob	Moves the X/Y Stage front-to-back, 30 mm/turn.
7	X Knob	Moves the X/Y Stage side-to-side, 16 mm/turn.
8	Lockscrew	Secures the X/Y Stage to the Pitch/Roll Stage.

Adjusting the Manual Stage

Lateral	To locate the test part under the objective, turn the X and Y knobs.
Angular	To adjust the angle of the test part relative to the objective, turn the Pitch and Roll knobs. For best possible results the part should be normal to the objective.

Electronics Enclosure Details



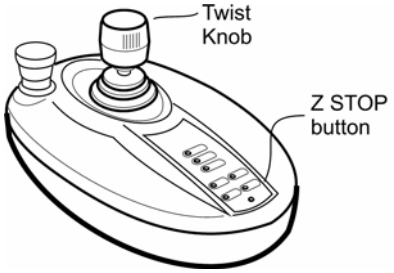
Ref	Item	Description
1	Indicators (front)	FAULT indicator: (Red) On when fault condition exists, or the emergency stop is active. If a specific axis is at fault, the corresponding indicators are lit on the stage driver module. MOTION STOP indicator: (Red) On when a motion stop is active. EMERGENCY STOP indicator: (Red) On when an emergency stop is active. POWER indicator: (Green) On when AC power is applied.

Ref	Item	Description
2	Power Module	CAN IN: DB9 male plug, cable from instrument electronics. CAN OUT/ PENDANT: DB9 female receptacle, cable to Joystick or secondary CAN device. E-STOP M-STOP: M12 connector for optional E-Stop (emergency stop- removes power) or M-Stop (motion stop- halts movement) devices.  If an optional stop is not used, the shunt plug must be installed. Power Switch and Receptacle- On/Off (1/0) switch and plug for incoming power cord; also houses fuse (line and neutral). PWR indicator: (Green) On when AC power is applied. VBUS indicator: (Green) On when DC voltage bus power is applied to stage driver modules. (Off) E-Stop condition present.
3	Stage Driver Module(s)	 Each module is labeled with applicable stage axes: X x-axis, Y y-axis, R roll axis, P pitch axis, T theta (rotary) axis, Z z-axis. The axis label on the handle corresponds to the axis number above the label. There can be from 1 to 4 modules. MOTOR 1: DB15 female receptacle, cable to corresponding motor. MOTOR 2: DB15 female receptacle, cable to corresponding motor. ENC/LIM 1: HD15 female receptacle, cable to corresponding encoder and limit switches. ENC/LIM 2: HD15 female receptacle, cable to corresponding encoder and limit switches. ENABLE/FAULT 2/1 indicators (correspond to module label): (Green) Stage driver enabled. (Amber) Stage driver disabled. (Red) Stage driver fault condition. (Off) Amplifier module is not installed.
4	Sensor Module	AUX IN / OUT: BNC connectors for optional equipment. SCANNER: DB15 female receptacle, connection to PZT scanner. CAMERA: DB15 female receptacle, connection to camera. TRIGGER: DB25 male plug, for PC frame grabber (option, based on camera). CAN1: DB9 male plug, CANbus connector to sensor. CAN2: DB9 male plug, spare CANbus connector. Network connector: RJ45 Ethernet connector, CANbus connection to computer. CAN STATUS indicator: (Green) Communication okay. (Red) Error. POWER indicator: (Green) Power okay. (Off) No power.

Measurement Overview

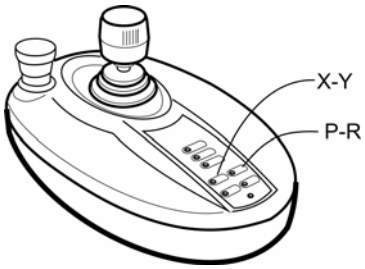
1 Setup

Z-Stop Setup – Joystick



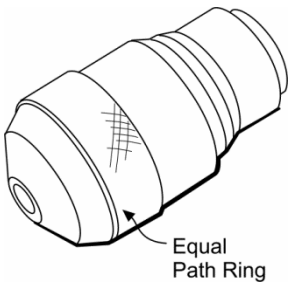
1. Place test part on part stage.
2. Turn the Joystick twist knob to drive the objective to slightly closer to the part than its working distance.
3. Press the Joystick Z-STOP button; the indicator should turn red and then green when you move away from the stop.

Part Setup- Motorized Stage



1. Level the stage in pitch and roll. Press the Joystick P-R button and use the Joystick to level the stage. The P (pitch) and R (roll) readouts should be 0.
2. Press the Joystick X-Y button and use the Joystick to drive the part stage in x and y axes to locate the part under the objective.

Objective Setup - Mirau Objectives with Focusing Ring



The 20X, 50X and 100X objectives have a fairly narrow depth of field. Adjust the equal-path ring so focus is synchronous with fringes.

1. Install objective.
2. Visually focus on the test part. (See next page.)
3. 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.

Warning!
The 100X Objective has a very short (0.5 mm) working distance. Do not crash it into the part or stage.

2 Focus

Mx software now includes measurement setup tools that simplify and speed up the process of finding best focus on a part and automatically calculating scan length.

One of these features is called *Part Finder* and is available on a toolbar button in the *Measurement Setup* section. Part Finder works with all objectives, but is especially helpful when using low numerical aperture, low magnification objectives with a large depth of focus. Many different types of test parts can be challenging to align manually, in particular those with low reflectivity, very smooth, very rough, or featureless surfaces. Part Finder is ideal for these test parts. In most cases it takes less than one minute to focus on most surfaces.

The other feature is called Smart Setup. It is also accessible from a toolbar button labeled *Smart Setup*. This feature builds on Part Finder by automatically calculating an appropriate scan length.

The following guidelines should be followed when using Part Finder and Smart Setup. Click on F1 to open Mx Online Help for additional information.

Guidelines for Using Part Finder and Smart Setup

Part Finder:

- Select an objective, zoom setting, measurement type, and scan length (this will not be necessary if using Smart Setup).
- Use the joystick to drive the stage to locate the test part under the objective.
- Use the joystick focus knob to carefully position the objective focus below the surface of interest. Press the joystick z-stop button to set the software focus stop position.
- Click the Part Finder button.
- Click Measure or press F12.

Smart Setup:

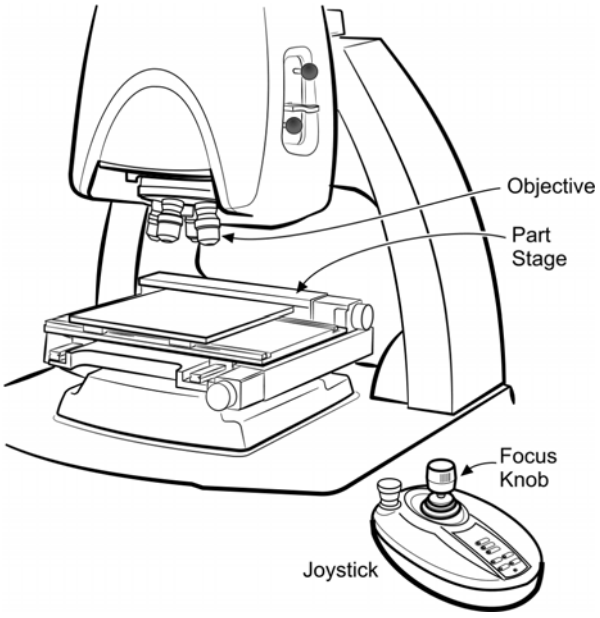
- Select objective, zoom setting, and measurement type.
- Use the joystick to drive the stage to locate the test part under the objective.
- This will place the objective within the working distance. Press the joystick z-stop button to set the software focus stop position.
- Click the Smart Setup button. The system will locate the part, set light level, set scan length, and then make an initial measurement using the settings that were configured.

Traditional Focus

1. Set software controls. Access Mx Measurement Setup.
   - Click to objective button to select the objective in use.
   - Set the *Scan Length* control to a length slightly greater than the test part peak to valley height.

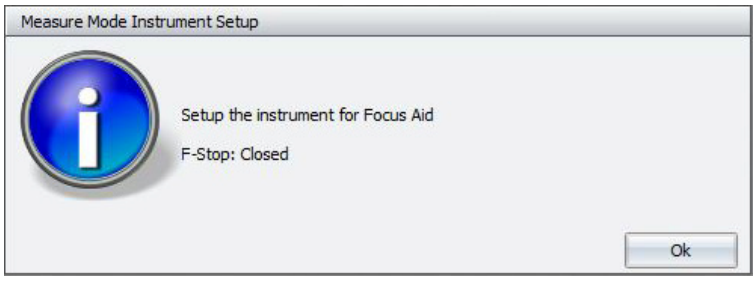
Warning!
Do not crash the objective or optical profiler into the test part or stage. Use caution when focusing and moving the z-axis.

2. Proceed to Assisted Focus (Focus Aid) or Manual Focus.



Assisted Focus (Focus Aid)

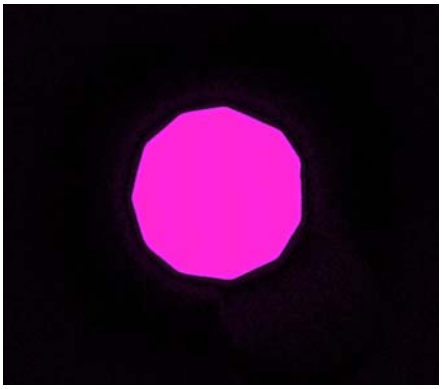
1. Ensure that the objective is well above the part.
2. On the Live Display toolbar, click Focus Aid or press F8.



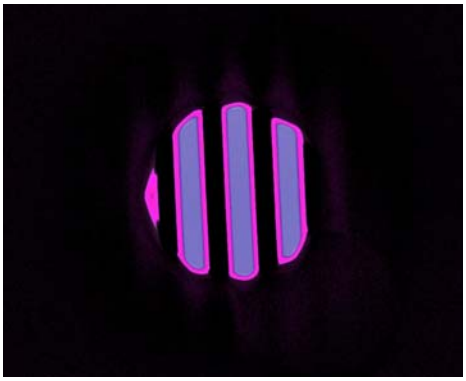
You will be prompted to close the F-Stop slider. Once closed, click OK and wait for the automated routine to complete. The Z-Stage slows down automatically when the spot is first detected.

3. Turn Joystick knob to adjust the instrument z-axis (focus) while watching the Focus Aid. When the objective nears the part, a diffuse image appears near the center of the screen. Moving the z-stage up or down makes the diffuse spot smaller and sharper as it nears focus. Continue to adjust focus so the image edges become as sharp as possible. Depending on the objective and test part, colored fringes may be visible.

Focus Aid- out of focus, diffuse image

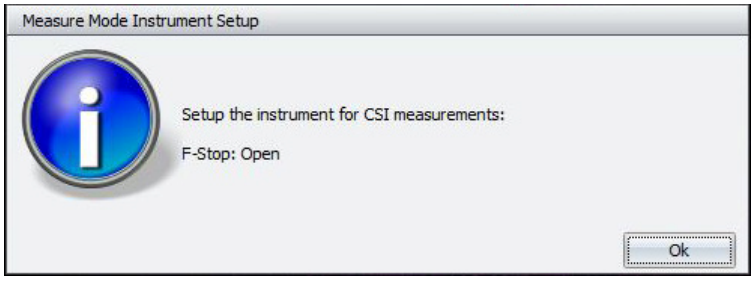


Nearing focus, sharp aperture edges



Part in focus, fringes appear

4. When done, click the [X] button to close the Focus Aid. Open the F-stop as directed. Fringes should be visible or nearly visible on the live display.

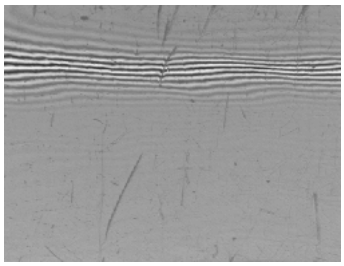


Manual Focus

1. Turn Joystick knob to position the objective near its working distance from the test part.
2. Press the F9 key to adjust 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 the F9 key again.
4. If no fringes are found, adjust stage pitch/roll.
   - Adjust stage pitch and roll to maximize the intensity.
5. Adjust fine focus.
   - Press the F9 key 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 fine focus knob for high contrast visible fringes.

Sample Live Display Image

focus for surface details and fringes



3 Null

Nulling means to minimize the number of fringes. Fringes are the light and dark bands produced by the interference of light. Obtaining properly nulled fringes is recommended for the best metrology.

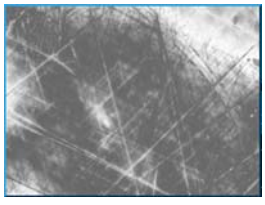
The fringes vary depending on the part surface being measured.

Nulling can be an iterative process. While adjusting the pitch and roll of the part, it may also be necessary to adjust the lateral position of the part, and fine-tuning focus. The NewView 9000 with 5 axis motorized staging can use automated parcentric correction technology to minimize the lateral and focus adjustments during manual and automated nulling operations.

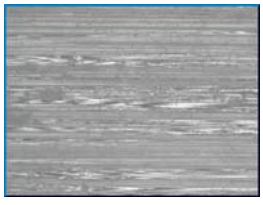
Nulling is Part Dependent

- Flat surface- reduce the number of fringes to as few as possible.
- Rough flat surface- center the fringes between the highest and lowest areas of the part.
- Spherical surface- center the fringe pattern.
- Stepped surface- position fringes at right angles to the step.

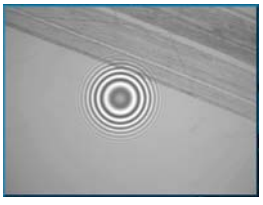
Example of Nulled Parts



Smooth Flat Part
Adjust for high contrast and the least number of fringes.

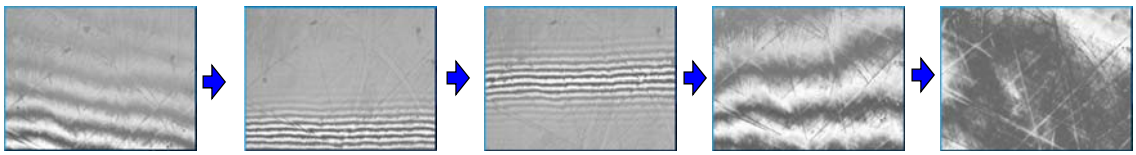


Rough Flat Part
The fringes are in smaller isolated areas. Center the fringes and adjust focus between the high and low fringes.



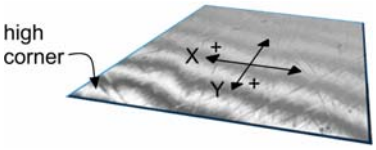
Spherical Part
Adjust the stage and focus to center the circular fringe pattern.

Example Sequence of Nulling a Flat Surface



After focusing for part detail, move z-axis upward until fringes just disappear. Then focus downward to find best high contrast fringes.	Adjust the part stage pitch and roll to make the fringes either straight across or up and down.	Adjust the fine-focus and lateral position as the part is tilted to keep the fringes in view.	Adjust the fine-focus to minimize the number of fringes.	Correctly nulled image of a smooth flat surface.

Observe where the first fringes appear; this gives an indication of the tilt in the part. In the above example, the lower left corner is the highest portion of the part. Adjust the part stage to lower the highest corner.



After Nulling- Click Measure (or F12)

Operational Hints

Perform Lateral Calibration

To designate what objectives appear in software, specify the actual magnification of each objective, establish the accuracy of lateral measurements, and create coordinates for turret mounted objectives, use the Mx software Lateral Calibrator tool. A ZYGO Lateral Calibration Standard is required.

Use System Reference Files

To eliminate optical artifacts and obtain optimum performance, create a system reference file in Mx software specific to each objective and zoom lens combination and then subtract this file from subsequent measurements. To use a system error file, perform a 3D reference calibration (located under the Calibrate tab). Activate this function by selecting the Subtract System Reference checkbox in the Measurement Setup controller.

3D reference calibration should be repeated whenever the objective is removed or replaced, if the reference leg of a Michelson objective is rotated, when another zoom lens is used, when the Camera Mode control is changed, or when the environmental conditions change. 3D reference calibration does not need to be repeated when objectives are changed by rotating the turret.

Select the Right Objective

It's 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 measures finer detail.

Lateral Resolution — There is a tradeoff between field of view 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. Parfocal objectives let you switch magnifications 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 on a part that may be difficult to focus with a low power objective.

Using the 1X LWD Objective

Warning!

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

The 1X LWD 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.

Depending upon the specific 1X objective, it either mounts directly to the optical profiler dovetail mount or screws into the turret.

Be careful when using the 1X objective on a turret along with other objectives. The 1X objective is greater in length and subject to hitting or crashing into the stage or test part when the turret is rotated.

Part Finder and Smart Setup Features

Mx software now includes measurement setup tools that simplify and speed up the process of finding best focus on a part and automatically calculating scan length.

Refer to the section of this chapter entitled, ***2 Focus,*** *for usage guidelines.*

Focusing and Finding Fringes

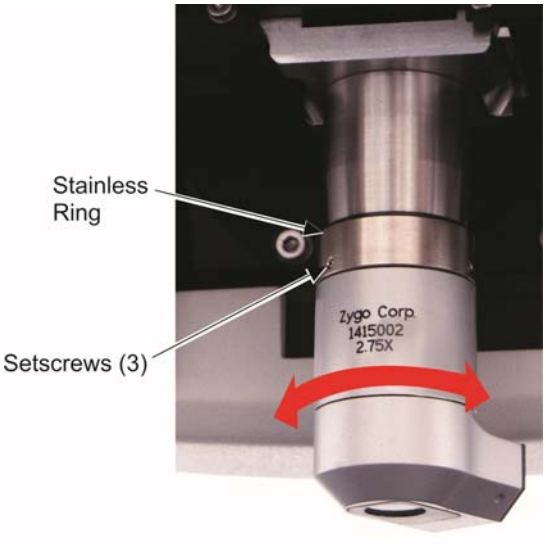
1. Position the objective at its working distance from the part surface.
2. Adjust the pitch and roll of the part to maximize light return to the objective. To do this, adjust the stage pitch and roll until the intensity is maximized.
3. Slide the filter to the F2 position to increase the coherence length 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. Watch for fringes to appear in the image.

6. When fringes appear, slide the filter to the F1 position and fine-tune focus and null the fringes as previously described in this chapter.

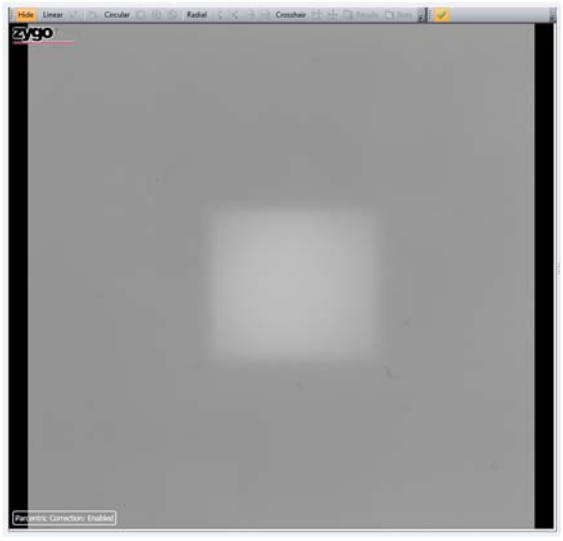
1X, 1.4X, and 2.75X Objective Phase Adjustment

Perform this procedure when installing or reinstalling the 1X, 1.4X, and 2.75X objectives to maximize imaging.

1. Power-up the profiler and open the Mx micro application.
2. Tightly screw the objective onto the Single Dovetail Mount or turret. If necessary, install the Single Dovetail Mount or turret onto the profiler.
3. Slightly loosen (a quarter turn) the 3 setscrews on the objective's stainless steel ring using the supplied 1.5 mm Allen wrench.
4. Under the Mx Measure tab, observe the Live Display as the lower portion of the objective is rotated. No sample below the objective is necessary.



5. Adjust intensity to near saturation. Rotate the objective ±180° until the return light is maximized and the central hot spot is minimized as much as possible.



Live Display showing a hot spot
Objective Requires Adjustment

Live Display showing a uniform response
Objective Adjustment Complete

6. Tighten the 3 setscrews.

Using the Motorized Turret

Warning!

When an objective is selected in Mx software the motorized turret will rotate; no warning is given. Make sure that nothing is in the way of the rotating turret and objectives. Check that any objective with a leg is positioned such that it will not hit anything when the turret is rotated.

The motorized turret is typically used for automating measurements, or 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 calibration containing x, y, z, tip, and tilt position offsets should be created. This calibration, called "TRC", for Turret Reference Coordinates, contains coordinate offset data for each objective. The information is used by the software to adjust for the fine variation between each objective's focus, center, and null position. The calibration is set and cleared for each objective and zoom combination using the Mx Lateral Calibrator window.

Setting Up a Motorized Turret

- If only two objectives are screwed into the turret, position objectives opposite each other to balance weight distribution on the turret.
- Make a note of the numbered turret position in which each objective is mounted. (This is needed this when using the Lateral Calibrator.)
- Make sure objectives with Michelson legs do not hit anything when the turret is rotated.

When using RMS-threaded (0.8 in, 36 TPI) objectives (10X, 20X, 50X) with M25 threaded objectives, be sure to use a 3.53 mm Parfocal Adapter on each RMS-threaded objective. This makes all 2.75X to 100X standard working distance objectives parfocal.

Moving the Motorized Turret

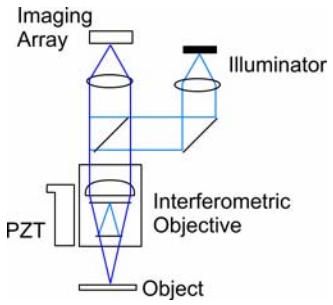
To select an objective or move the motorized turret, click an Objective button in Mx software. For the Objective button to work, selections must be made beforehand in the Mx Lateral Calibrator tool.

Setting the Scan Length Control

The NewView uses optics for imaging an object surface and a reference surface together onto an imaging array, resulting in an interference intensity pattern that is read electronically into a computer. A series of interferograms are generated as the objective is scanned perpendicular to the illuminated surface, while recording detector data in 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 processed to create a complete three-dimensional image corresponding to the object height at each pixel.

Optical System



The Mx software Scan Length control determines the actual vertical length of the scan. The longer the scan, the more time required for acquiring data. The estimated time for scanning is displayed within the Measurement Setup panel. The Scan Length control should be set to the shortest length that includes test part detail.

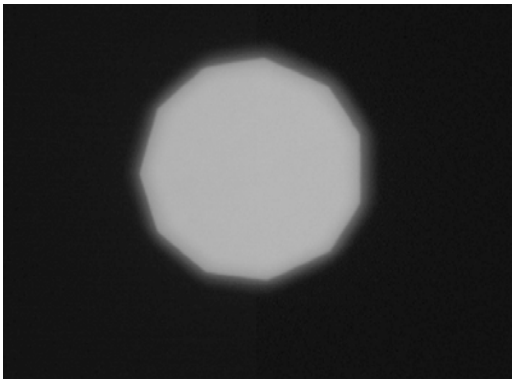
The Scan Origin can be selected as top, center, or bottom. A typical bipolar scan starts in the center of the scan envelope. During the scanning of the objective, data is collected. The profiler should be focused based the selected Scan Origin. When "Center" (default), focus midpoint between the high and low points on the surface under test. When "Top", focus at the top of the surface under test. When "Bottom" focus at the bottom of the surface under test.

Using the F−Stop

The F-Stop (Field Stop) controls the diameter of the illuminated region on the part. Because it is conjugate to the optical profiler object and image planes, *the field stop can also be used as a focus aid.* It is especially useful for focusing on smooth, featureless parts.

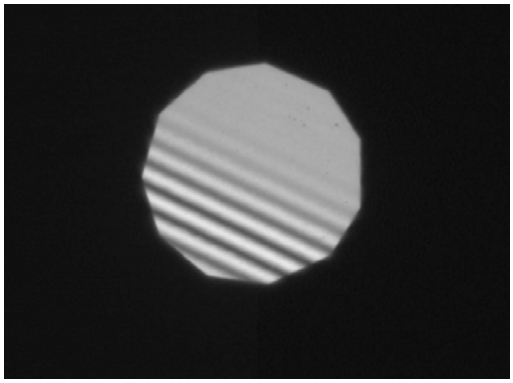
When the field stop is pulled closed and the system is near focus, there are two images of the iris on the Live Display. One image from the reference mirror of the interference objective is always in focus. The second, fainter image is from the part. This image will go in and out of focus as the z-stage is moved, but it will not be visible if the system is far from focus. When the two images of the field stop overlap exactly, the system is in focus and fringes should be visible. The sensitivity of this focusing technique increases with objective magnification. Using the Assisted Focus Aid described earlier enhances the sensitivity of this focus method even further.

F-Stop- System Out of Focus



When the F-Stop is pulled closed and the system is near focus, the two images of the field stop are both visible on the Live Display. The image from the reference mirror is always in-focus while the image from the part changes as the z-stage is moved.

F-Stop- System In Focus



When the F-Stop is pulled closed and the system is in-focus, the two images of the field stop exactly overlap on the Live Display. When this occurs, fringes should be visible. This sensitivity of this technique increases with objective magnification.

Using the A-Stop

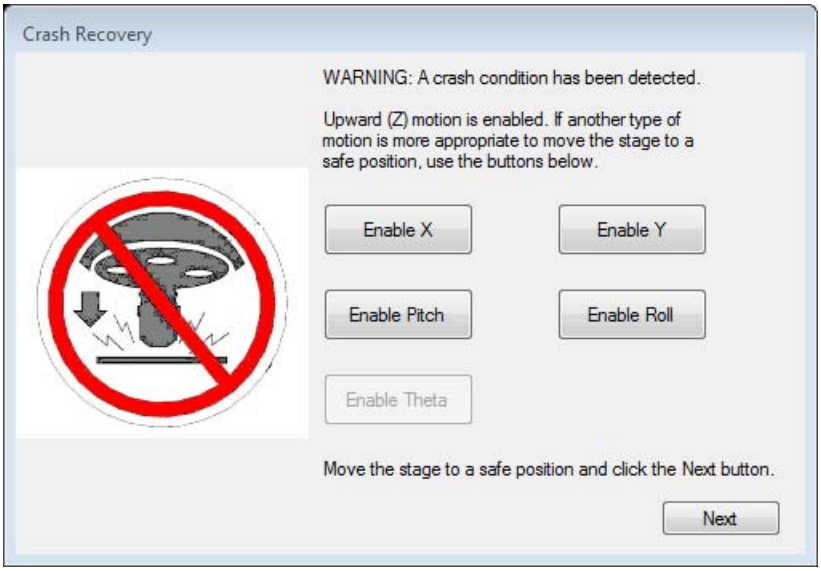
The A-Stop (Aperture Stop) is used as an illumination aid. The A-Stop controls the size of the source image formed in the entrance pupil of the objective lens; this determines the maximum angle of incidence of the illumination at the part. The aperture stop is conjugate to the light source and the objective entrance pupil.

For general use, the aperture stop should be pushed in to the full open position. When measuring thin films or parts with deep, narrow features, the aperture stop may be pulled out (stopped down) to reduce the maximum angle of the illumination.

Do not use the A-Stop to adjust the light level on the part.

Crash Detection

- Crash detection is active when there is joystick or application-commanded motion (x/y/z/p/r /turret).
- Crash detection can help to protect the objective, part, and scanner in the event of a crash, but it cannot guarantee that damage will not occur.
- If a crash condition is sensed, all motion is immediately stopped, the PZT scanner is automatically retracted, and a Crash Recovery dialog is displayed (see below). Only upward (Z) motion stays active to allow for recovery from the crash condition.
- Follow the prompts in the Crash Recovery dialog to recover. If possible, the user should move the objective to a safe position. If the objective cannot be moved up without hitting something, enable the applicable axis and move the stage for clearance before raising the objective.



Maintenance and Service

Chapter 4

Maintaining the NewView

The general maintenance procedures covered in this chapter include equipment cleaning and cleaning optical components. A regimen of good general care will prolong the life of the equipment.

For maintenance and service on the computer components refer to the original manufacturer's documentation.

Replacement of any non-ZYGO components, such as a keyboard, monitor, or printer, must be done with CE compliant components.

General Care

The components used in your ZYGO 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 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

It is recommended that a ZYGO service representative perform the maintenance procedures in this chapter at least once a year to ensure optimum performance from your instrument.

Item	Interval	Comments
Clean exterior surfaces of equipment	Only when needed	The interval depends upon the cleanliness of work environment.
Clean Electronics Enclosure Fan Filter	Only when needed	The interval depends upon the cleanliness of work environment.
Clean Optical Components	Only when needed	Optical surfaces of the objectives should only be cleaned when dirt or dust is noticeable.
Lubricate motorized Pitch/Roll Stage	Every 3 months	Use Magnalube-G Teflon grease.
Lubricate motorized Z Stage	Every 12 months	Use mineral oil-based lubricant for the carriages and appropriate grease for the ballscrew.
Lubricate motorized X/Y Stage	Every 12 months	Use mineral oil-based lubricant for the carriages and appropriate grease for the ballscrew.

Recommended Spare Parts List

Item	Description	ZYGO P/N
Fuse	Electronics Enclosure fuse: 2A 250V Fuse (for 100/120V) 2A 250V Fuse 5x20 mm (for 220/240V)	 1343-000-026 1343-000-205
Line Cord	Electronics Enclosure local power cord: 100/120V United States and Japan 220V German/French 240V United Kingdom	 1115-800-005 1115-800-042 1115-800-224
Pitch/Roll Stage Grease	Magnalube-G Teflon grease for Motorized Pitch/Roll (Parcentric) Stage only.	1376-000-003
X, Y, Z Stage Oil	Mineral oil-based lubricant for carriages on X, Y, and Z stages; an example is 3-IN-ONE Motor Oil.	N/A
X, Y, Z Stage Grease	Kyodo Yushi Multemp PS No. 2 grease (or Lubriplate Aero grease) for ball screws on X, Y, and Z stages.	N/A

Recommended Maintenance Supplies

Item	Comments
Polyethylene lab gloves	Wear to prevent contamination of surfaces and to protect the skin against harsh chemicals.
Compressed gas with blower nozzle	Use to blow off dust and lint from objectives and reference optics.
Lens tissue	Use when it is necessary to clean an optical surface. The lens tissue must 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 solvents.
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.

Cleaning 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.

Cleaning the Electronics Enclosure Fan Filter

Occasionally clean the fan filter on the front of the Electronics Enclosure using a vacuum cleaner to remove dust from the filter element.

Cleaning Optics

Cleaning a precision optical component can actually degrade the surface. Many of the optics used with the interferometer are coated. Coated optics are easily damaged by improper or unnecessary cleaning. The need for cleaning can be minimized by proper handling techniques; returning objectives to their protective boxes when not in use, and keeping the environment clean.

Never attempt to clean optics within the instrument since system performance may be impaired.

Precautions When Cleaning Optics

Warnings!

Personnel cleaning the interferometer optics must be properly trained. It is the user's responsibility to ensure that optics are cleaned in a proper manner.

Whenever a precision optic is cleaned, the high-quality surface coating may be damaged. Improper or unnecessary cleaning may damage the optic.

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 wear lab gloves.

Consult the local agency in your area for requirements concerning proper disposal of cleaning waste.

Cleaning Dust or Light Dirt

1. Blow off loose particles.
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.
3. Dampen the tissue with isopropyl alcohol or methanol.
4. Wipe the lens straight across once. If it needs additional wiping, use a new swab or tissue.

Cleaning Fingerprints, Oil, and Water Spots

If an optic is touched clean the surface immediately; skin acids attack lens coatings.

1. Blow off loose particles.
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.
3. Dampen it with 1% soap solution.
4. Wipe the lens straight across once. If it needs additional wiping, use a new swab or tissue.
5. Repeat steps 2 and 4 with tissue dampened with distilled water to remove soap residue.
6. Repeat steps 2 and 4 with tissue dampened with isopropyl alcohol or methanol.

Lubricate the Motorized Pitch/Roll Stage

Frequency: 3 months

Tools/Supplies: Allen wrench, Magnalube-G Teflon grease, swabs

1. Using the Joystick, drive the right front corner of the stage down so you have clearance to reach the parcentric stage's pitch and roll motors.

   Disconnect the NewView from power before continuing.

2. Disconnect the cable going to one motor. Using an 1/8-inch Allen wrench, loosen the motor setscrew. Pull the motor assembly out of the parcentric stage.

   Do not interchange the parcentric stage motors; they are different. Lubricate one motor at a time to avoid confusion.

3. Remove four motor cover screws and two connector screws and washers. Remove the motor cover.
4. Put a 1/4-inch (6 mm) long bead of Magnalube-G grease on the leadscrew, as close as possible to the motor. Put a small amount of grease on the coupling end of the motor.
5. Install the motor cover and screws. Insert the motor assembly into the stage and secure the motor setscrew. Reconnect the cable.
6. Perform steps 2 through 5 for the other motor.

Lubricate Z Stage

Frequency: 12 months

Tools/Supplies: Allen wrench, mineral oil, Lubriplate Aero grease, plastic syringe, swabs

1. Remove any installed objectives (procedure in Chapter 2).
2. Use the Joystick to drive the Z stage as high as it can go for easiest access to the Z stage carriage end plates.
3. Apply a couple of drops of mineral oil-based lubricant into both holes on the two red carriage end plates.

   It is only necessary to lubricate both carriage end plates on one side of the stage. It is not necessary to lubricate all end plates for the four carriages.

4. Drive the Z stage as low as it can go for easiest access to the ball screw.
5. Put a small dab of grease onto a long swab. Using the swab, wipe the grease along a section of the stage ball screw, being careful not to get the grease on other components.
6. Drive the Z stage up and down a few times to distribute the lubricant.

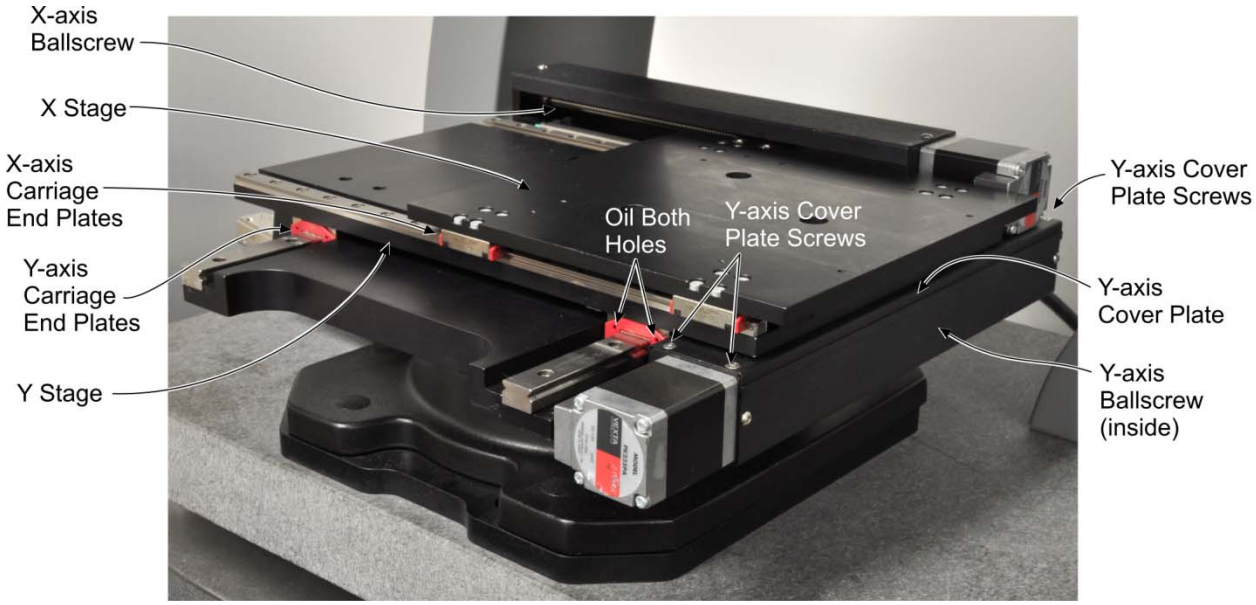
Lubricate the Motorized X/Y Stage

Frequency: 12 months

Tools/Supplies: screw driver, mineral oil, Lubriplate Aero grease, plastic syringe, swabs

1. Use the Joystick to drive the part stage Y-axis to gain access to the four y-axis cover plate screws.

Motorized X/Y Stage Lubrication Details



2. Remove the four y-axis cover plate screws and then slide the cover out from under the stage and remove it.

   It may be necessary to drive the y-axis stage for enough clearance to remove and install the cover.

3. Apply a couple of drops of mineral oil-based lubricant into both holes on two Y-axis red carriage end plates.

   Apply oil in both holes on each red carriage end plate. It is only necessary to lubricate both carriage end plates on one side of each axis. It is not necessary to lubricate all carriage end plates. Refer to the carriage lubrication illustration in the previous procedure.

4. Put a small dab of grease onto a long swab. Using the swab, wipe the grease along a section of the Y stage ball screw, being careful not to get the grease on other components.
5. Install the Y-axis cover plate and screws.
6. Drive the X stage all the way to the right for best access.
7. Apply a couple of drops of mineral oil-based lubricant into both holes on two x-axis red carriage end plates.
8. Put a small dab of grease onto a long swab. Using the swab, wipe the grease along a section of the X stage ball screw, being careful not to get the grease on other components.
9. Drive the X/Y stage back and forth a few times to distribute the lubricant.

Getting Service

Warning!

The equipment does not have any user-serviceable components. Service must be performed by ZYGO trained service personnel. Any attempt to service or repair equipment may void the warranty. Please contact ZYGO Customer Support.

Returning Equipment for Service

To return equipment to ZYGO, it is necessary to have a RA (return authorization) number. Contact ZYGO Customer Support for an RA number and instructions on packing and shipping equipment.

Do not return equipment to ZYGO without a RA Number. Equipment returned without a RA number will not be accepted.

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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.

A. STANDARD PRODUCTS.

WARRANTY PERIOD 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.

POST WARRANTY TO 5 YEARS ZYGO will support all standard products for a period of five years after the sale of the last newly manufactured unit. As vendor supplied material components become unavailable during this period, ZYGO will create upgrade paths to replace obsolete components with more current replacements. These upgrades can include internal components, computers, and software.

5 TO 10 YEARS ZYGO will continue to support older products. Service methods may include modifying units when parts become available, upgrading a unit to allow peripherals in a more supportable configuration, or providing a current product that meets or exceeds the original units functionality.

GREATER THAN 10 YEARS Product is obsolete. Service and support will be performed on a best-efforts basis.

B. NON-STANDARD / CUSTOM PRODUCTS.

WARRANTY PERIOD ZYGO warrants that the products 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 cases of customer supplied materials, ZYGO warrants only the workmanship.

POST WARRANTY ZYGO will continue to support non-standard / custom products on a best effort basis after the new product warranty expires.

C. WARRANTY SERVICE.

ZYGO will provide service to return malfunctioning products to as shipped condition by repair or replacement (at ZYGO's option) of defective equipment at no cost to the Buyer. 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 that 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.

D. RETURNS.

Unused and undamaged products, in their original shipping containers, may be returned for credit within 30 days of receipt. All such returned products will be subject to a restocking fee equal to 35% of the purchase price. Custom products are not returnable.

E. EXCLUSIONS.

Warranty service does not include or apply to any product or part which, in ZYGO's judgment:

i. Has been repaired by others, improperly installed, altered, modified or damaged in any way.
ii. Malfunctions because the Buyer has failed to perform maintenance, calibration checks or use good operating procedures.
iii. Is expendable or consumable (such as panel lights, fuses, batteries, windows and filters) if such items were operable at the time of initial use.
iv. Requires replacement because of decomposition due to chemical action.
v. 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, ACCIDENT, REPAIRED OR ALTERED BY OTHER THAN SERVICE REPRESENTATIVES QUALIFIED BY ZYGO.

11/2002

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