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JCHADWICK

OPTICAL DEPTH MICROMETERS

Optical Depth Micrometer

Includes Accessories:

Lab Stand w/ X-Y Stage

Dino-Eye® Digital Camera

Microset® Surface Replication

For Immediate Support:

By email
sales@jchadwickco.com

Over the phone
(626)358-9955

On the web
www.**jchadwickco**.com

Contents

Slides 4 - 10

Optical Depth Micrometer

8400 Series

The Optical Depth Micrometer “Depth Mic” is a visual inspection microscope designed to make quick and repeatable measurements of the depth of small surface features, like pits and scratches.

Slides 11 - 14

Lab Stand w/ X-Y Stage

5500 Series

For situations where the subject’s surface geometry prevents using the hand-held Micrometer on a standard base.

Slide 15

Dino-Eye® Digital Camera

AM7025X

The Dino-Eye connects the Micrometer to a laptop or tablet to create electronic inspection records with detailed notes and high-resolution images.

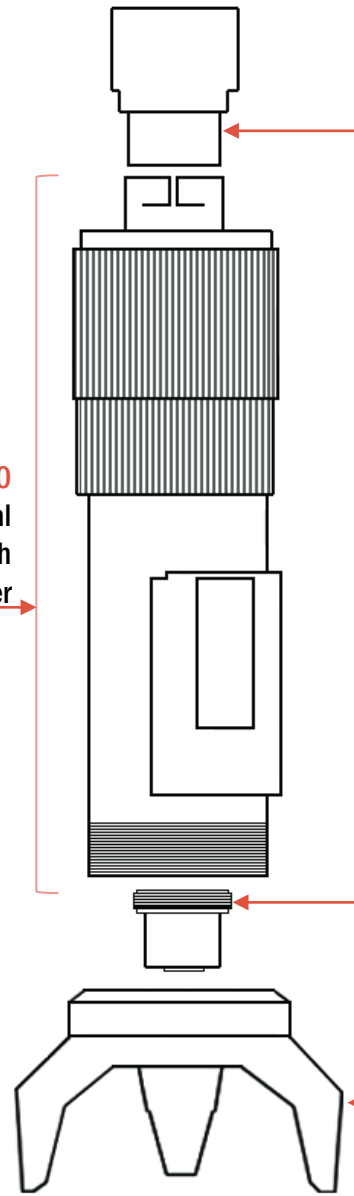
Slides 16 - 19

Microset® Surface Replication

4400 Series

Microset compounds provide a quick and convenient method of obtaining precise measurements of damage in hard-to-reach places.

Parts Diagram



8400-0
Optical
Depth
Micrometer

Interchangeable **EYEPIECE**

FOCUS RING

DIGITAL DISPLAY

Interchangeable **OBJECTIVE**

FLASHLIGHT RING

Interchangeable **BASE**

in/mm

Toggles between standard (in) and metric (mm)

ORIGIN

Sets the absolute zero that the tool will reference from by default. Origin is preset focused on a flat surface at 100X.

ON/OFF

Turns the display on or off.

ZERO/ABS

Sets starting position (temporary zero) for a depth measurements.

SR44/LR44

Button Cell Battery

Handheld Bases

8400-7
Base, 3-Leg

8400-71
Base, 3-Leg w/ Delrin Feet

Tripod bases provide great utility. **Use on all flat and simple curved surfaces.** Delrin-tipped feet protect windshields and other delicate finishes.

8400-8
Base, 4-Leg

The quadpod base can be rotated on **any combination of simple and compound, convex and concave surfaces** until all four legs are resting solidly.

8400-91
Base, Clear V-Block

Use the translucent v-block base for **leading edges, round surfaces and outside angles.** It is also for flat surfaces next to a recessed area.

8400-12
Base, Offset

The offset base was designed to make measurements on surfaces **adjacent to an edge or wall.**

8400-35
Base, Corner

The corner, or wedge, bipod base is used for measurements of **inside angles.**

8400-27 Base, Large 3-Leg
4400-7 Tilting Stage Base

The large tripod base is for inspecting small parts (up to 2”) or use with the tilting stage base for inspection of Microset® replicas.

Optics & Other Spares

8400-14
Eyepiece 23mm, 20X

8400-15
Eyepiece 23mm, 10X

To change the eyepiece, grasp the eyepiece with thumb and forefinger and slide in/out of the eyepiece tube at the top end of the Micrometer. There are no threads on the eyepiece.

Always **promptly replace the eyepiece**. Care should be taken to prevent dust or debris from getting into the Micrometer through the exposed eyepiece tube.

8400-16
Objective, 4X

8400-17
Objective, 10X

To change the objective, rotate the focus adjustment counter-clockwise to expose the objective lens threads at the base of the Micrometer. Grip the lens and turn clockwise to remove. Reverse to install. Do not over-tighten.

Overall magnification is calculated by multiplying the magnification of the eyepiece and objective lens; the 10X eyepiece and the 10X objective will produce 100X magnification.

Mag	Eyepc/Obj	Max Depth	Max View
40X	10X/4X	1.150”	0.18” Dia
80X	20X/4X	1.150”	0.10” Dia
100X	10X/10X	0.250”	0.07” Dia
200X	20X/10X	0.250”	0.04” Dia

Note: Dino-Eye camera has 20X magnification.

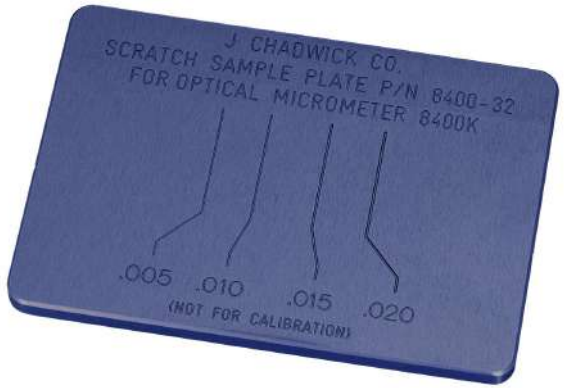
Use 100X and 200X magnification to inspect small features, like scratches and pitting.

Use 40X and 80X magnification for wider features and to measure the thickness of transparent materials.

8400-23
Flashlight

8400-32
Scratch Sample Plate

Use the Scratch Sample Plate to practice positioning and focusing the Optical Micrometer.



Setup Instructions

1 **Install optics** to configure level of magnification.

2 **Install a suitable handheld base or mount on the Lab Stand** (see separate instructions for Lab Stand).

3 **Turn Focus Adjust Ring** so that the bottom of the objective lens will be above the subject by approx. ¼” with the **10X Objective,** or 1” with the **4X Objective** (so that the surface will be roughly in focus).

4 **Position Micrometer** so that objective lens is over the damaged area.

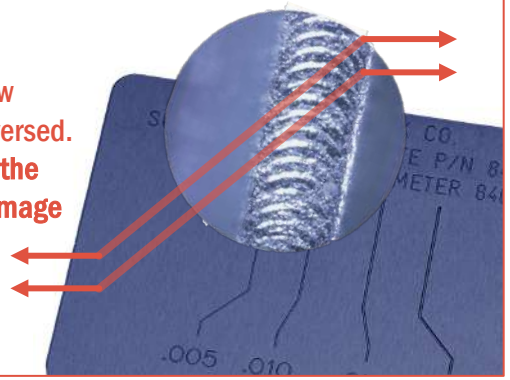
5 **Shine the Flashlight down into the eyepiece.** A bright spot will appear directly below the objective lens, this will be the center of the field of view. **Fine position the Micrometer so that the bright spot is shining directly on the edge of the step height to be measured**, like the edge of a scratch or pit.

6 Once in position, use one hand to hold the Micrometer in place and the other to **insert the Flashlight into the Base Flashlight Ring.**

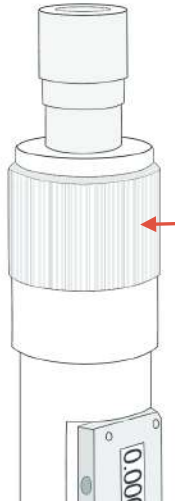
The Optical Depth Micrometer must be directly above the subject.

Important: When using the handheld Micrometer, always hold the base steady with one hand to prevent movement and use the other hand to focus the Micrometer.

The Micrometer is not stereomicroscopic, the view through the eyepiece is reversed. This means that that when the subject is moved left, the image moves right.



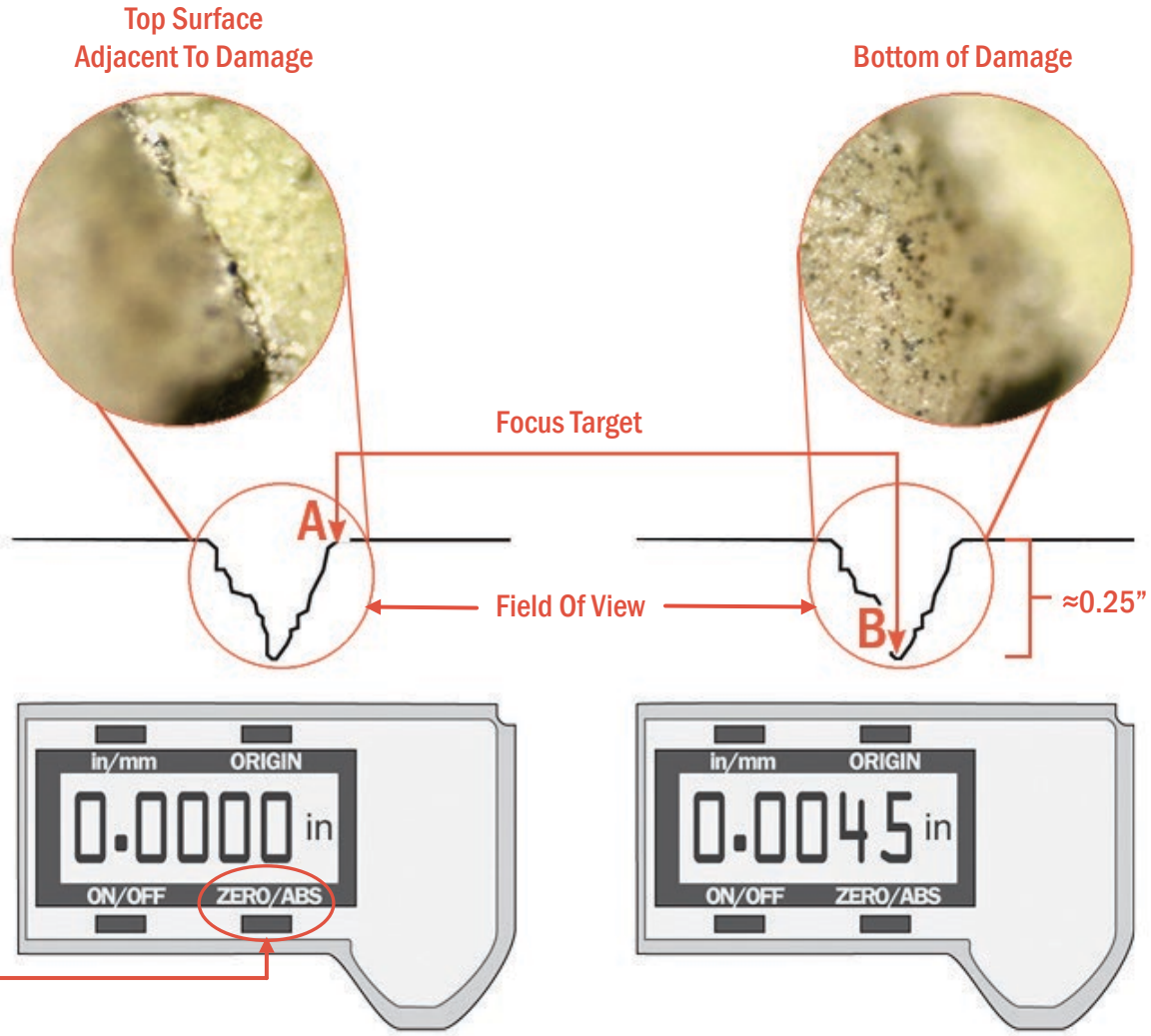
Measuring Depth



Basic Principle

The Micrometer uses focus to measure the distance between two points on different surfaces (at different heights). **Features at the same depth will appear in focus and features above or below appear blurry.**

Turning the Focus Adjust Ring moves the focus up and down.



1 **Fine position the Micrometer** so the edge of the recessed area, like a scratch, is in the center of the field of view.

2 **Focus** on the top surface directly next to the scratch (A).

3 When the surface area is in sharpest focus, press the ZERO/ABS button on the **Digital Display** to set a starting point for the measurement.

4 Without moving the micrometer, **focus down** to the bottom of the damage (B).

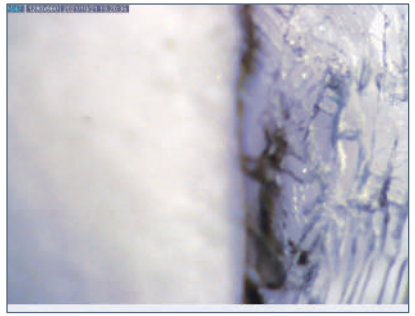
To find the true lowest point, focus down passed what seems to be the last area in focus until nothing else appears in focus below, then come back up to the first area that comes into sharp focus.

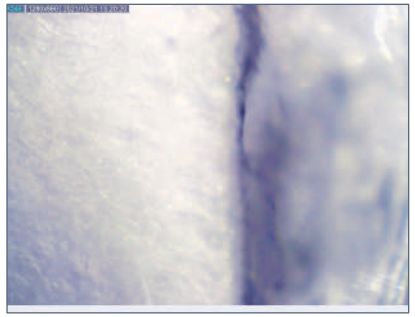
5 **Record** the measurement from the digital display.

6 **Verify** the measurement by **refocusing** up to the top surface (A). The display should show "0.0000“ again.

The entire measurement cycle should be completed by the same person. When switching users, always reset zero or the result may be inaccurate.

Transparent Surfaces





Surface Damage:
Chips, Crazing, Scratches, Scribes, and Strikes

The method for measuring the depth of surface damage on a transparency is the same as any other surface. Focus on the surface next to the damage, zero the display, and focus down into the bottom.

Measuring Overall Thickness

Measuring overall thickness is the same except that, instead of the bottom of a scratch, the second surface is the far side of the glass.

****Very Important****

When measuring overall thickness (only), the initial result on the display is not accurate.

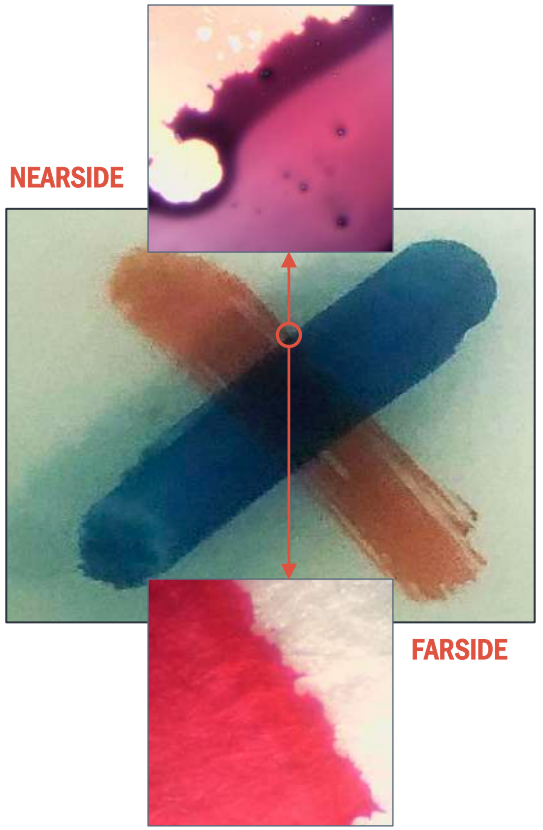
To calculate the overall thickness, **multiply the display result by the refraction index** of the material.

A normal refraction index for transparent materials is approximately 1.5:

PMMA (acrylic, Lucite) 1.49
Plate/Window Glass 1.52
Polycarbonate (Lexan) 1.58

Tables of refraction indexes of other materials are readily available online.

Note: Surface and embedded damage are air space and therefore are <u>not</u> subject to the refraction index.



Transparencies usually have extremely shallow surface marks, like polishing lines and micro-scratches, that allows for easy focus on either surface.

If it difficult to locate either side, use 2 different colored markers, like Sharpies or highlighters, to make a line on each side of the transparency. The lines should cross to create a target to position in the center of the field of view.

Specs & Calibration

Specifications

Mag	Accuracy	Max Depth	Field of View
40X	+/- 0.001”	1.150”	0.18” Dia
80X	+/- 0.001”	1.150”	0.10” Dia
100X	+/- 0.001”	0.250”	0.07” Dia
200X	+/- 0.001”	0.250”	0.04” Dia

Calibration

The Micrometer can be returned for certification, or any ISO/IEC 17025 accredited calibration lab should be able to provide a certificate using this procedure.

The Micrometer can be calibrated in-house. The calibration procedure is a verification of accuracy against standards (gage blocks). No user adjustment to the tool is needed.

Note: Alternate calibration procedures are approved for the Air Force PMEL and Army Calibration.

Any unit found out of tolerance (not measuring correctly) must be returned to the manufacturer.

Warranty

All products manufactured by J Chadwick Co are covered by a limited lifetime warranty.

Calibration Procedure

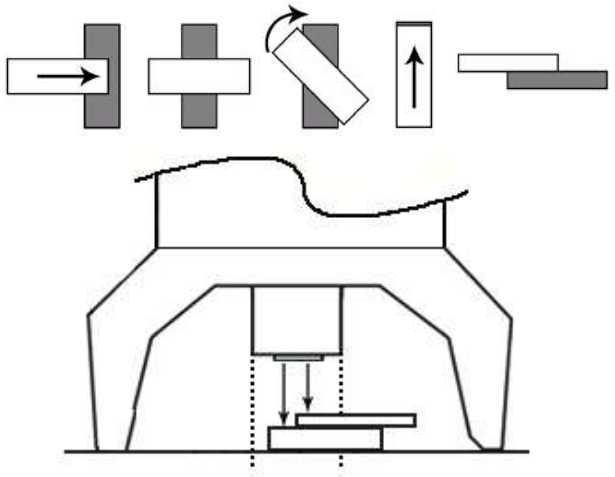
Recommended Cycle**: 1 Year**

Equipment

4x Rectangular Gauge Blocks (0.005”-0.200”),
Grade 0, ASME B89.1.9, NIST traceable, **CALIBRATED** (ISO/IEC 17025:2005).
Size Range: 0.005” – 0.200”

Instructions

Wring two gage blocks together by sliding one block perpendicularly across the top of the other, then rotate lengthwise and slide to create a step.



Position Micrometer so the step between the blocks is in the center of the field of view.

Focus on the surface of the upper gage block. Zero “0.0000” digital display.

Refocus on the surface of the lower block. Read display and record result.

If the Micrometer is measuring properly, the display will show the exact thickness of the upper gage block.

Repeat steps 1-5, using the each of the 2 remaining blocks as the upper block.

Micrometer Lab Stand

Upper Pole
Lower Pole
Micrometer Focus Block
Base Plate
Safety Ring
X-Y Stage
Lead Screw (2)

Lab Stand Set Up

1 Remove the **Micrometer Focus Block** from the Base Plate by loosening thumb wheel, set aside

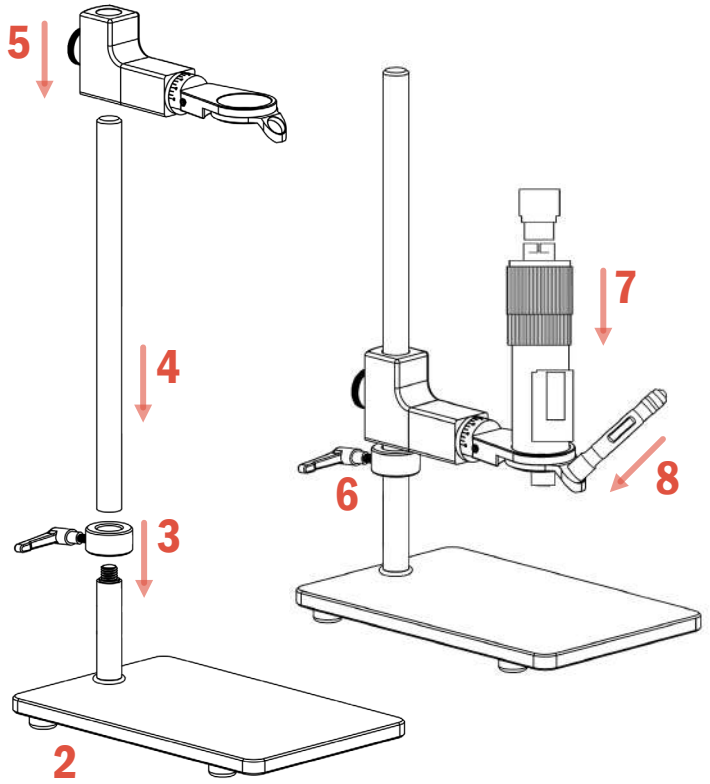
2 Place the **Base Plate** (with Lower Pole and X-Y Stage, if installed) on a flat surface.

3 Slide red **Safety Ring** onto the **Lower Pole** on the **Base Plate**. Do no tighten.

4 Install (thread) the **Upper Pole** on the **Lower Pole** on the **Base Plate**.

5 Slide the **Focus Block** on the **Upper Pole** so the graduated dial points up and the **Flashlight Ring** points down. The **Focus Block** should be approximately1" above the subject.

6 Tighten the **Safety Ring** under the **Focus Block.**



7 Install **Optical Depth Micrometer** (P/N 8400-1) by removing base and threading into the **Micrometer Focus Block**.

8 Install **Flashlight** (P/N 8400-23) by inserting into the **Flashlight Ring** on the **Focus Block**. The **Flashlight Ring** rotates for optimal lighting angle.

Lab Stands with X-Y Stage Installed

9. Use **7/64 Hex Wrench** to loosen the set screw on the **Lead Screw Clamp** on the X-Y Stage. Insert Lead Screw and retighten set screw on clamp

10 Turn both **Lead Screws** evenly until the **X-Y Stage** is approximately centered on the **Base Plate.**

Lab Stand Storage In Case

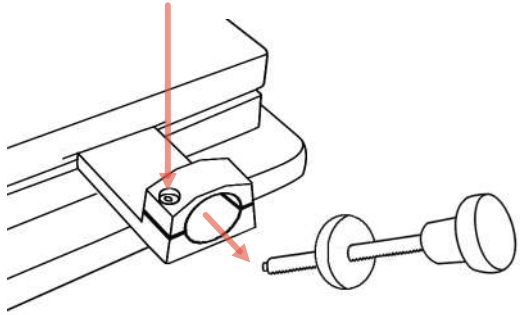
1 Remove Micrometer Focus Block from Pole, set aside.

2 Remove Safety Ring from pole assembly and return to Carrying Case.

3 Remove (unthread) **the Upper Pole** from the Base Plate and return to Case.

Steps 4-5 for Lab Stands with X-Y Stage

4 Use 7/64 Hex Wrench to **loosen the set screw** on the Lead Screw Clamp on the X-Y Stage. **Pull out Lead Screw** and return to case for storage.



5 Re-tighten set screw on Lead Screw Clamp after removing Lead Screw to prevent loss.

6 Invert the Focus Block and clamp to the Lower Pole on the Base Plate (by tightening thumb wheel). Return to case.

X-Y Stage Installation

1 Invert the X-Y Stage and place near the edge of a flat surface (like the edge of a table).

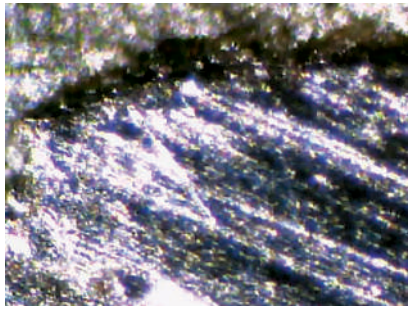
2 Position the Lab Stand Base Plate over the X-Y Stage so that the (4) holes in the Base Plate align with the (4) threaded holes on the underside of the X-Y Stage. Be sure that the **Lead Screw Clamps** are oriented as shown.

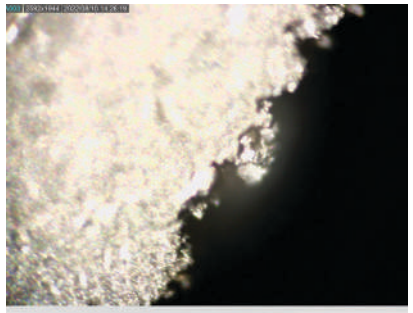
3 Mount the X-Y Stage on the Lab Stand with **(4) ¼-20 x ½" Socket Head Cap Screws** on the underside of the **Base Plate**. Use a 3/16" hex wrench to tighten the screws.

Dino-Lite® Eyepiece Camera

J Chadwick Co is an authorized reseller. For support, visit the official **Dino-Lite®** website:

https://www.dinolite.us/en/products/eyepiece-cameras/am7025x





Software is required to use the use the Dino-Eye eyepiece camera. To install the most current version of DinoCapture and download the user manual:

https://www.dinolite.us/en/downloads

1 Position the computer near the subject. Plug Dino-Eye camera into the USB port and open DinoCapture software. Check that the camera video feed is live on screen.

2 Position Micrometer over the subject and hold steady. **Remove the standard eyepiece and replace with the eyepiece camera.** No adapter is needed, insert the Dino-Eye directly into the Micrometer's 23mm eyepiece tube.

3 The screen will display the live view through the eyepiece. Make measurements as usual by manually turning the focus knob on the Micrometer to bring each surface into sharp focus. Images can be captured, annotated, and saved (refer to software user manual).

Microset® Surface Replication

https://www.microset.co.uk/

J Chadwick Co is an authorized reseller. For more product information and technical support, visit the manufacturer's website.

4400-2*
50ml Replication Compound

4400-1
50ml Compound Dispensing Gun

4400-31
50ml Nozzle (50/PacK)

4400-5
Backing Paper, 70mmX60mm (100/Pack)

4400-4
Backing Slides, 60mmX40mm (50/Pack)

JCC Part#	Microset Grade	Working Life 25°C (mins)	Cure Time 25°C (mins)	Key Features		
4400-2RTG 4400-2RTB	101RT GREY 101RT BLACK	0.5	5	Fast Curing Thixotropic	MICROSET 101 THIXOTROPIC REPLICATING COMPOUNDS are high resolution, two-part silicone polymers designed for replication of metal surfaces. The thixotropic nature of these compounds allows them to be applied on **vertical and overhead surfaces** without the compound dripping or flowing away from the area of interest.	
4400-2RFG 4400-2RFB	101RF GREY 101RF BLACK	0.5	5	Fast Curing Fluid	MICROSET 101 FLUID REPLICATING COMPOUNDS are high resolution, two-part silicone polymers designed for replication of metal surfaces. The free-flowing nature of these compounds minimizes the risk of air entrapment in the replica and makes them easy to apply over large areas. They are suitable for replicating **rough surfaces, cavities, tubes, threaded holes etc**.	

Microset® Surface Replication

Assemble Dispenser

1 Press up slider release lever, keep raised.

2 Insert slider from opposite side and push in until flush with holes in slot on the dispenser.

3 Release slider release lever.

Install Compound Cartridge

1 Check that slider is installed and pushed in completely.

2 Lift the cartridge clip.

3 Slide cartridge into slot on dispenser.

4 Lower cartridge clip to secure.

Install Mixing Nozzle

1 Remove cap from compound cartridge.

2 Position mixing nozzle on cartridge and rotate clockwise 1/4 turn to lock.

3 For new cartridges only, dispense a small amount of compound on to waste paper (to mix) before applying to subject.

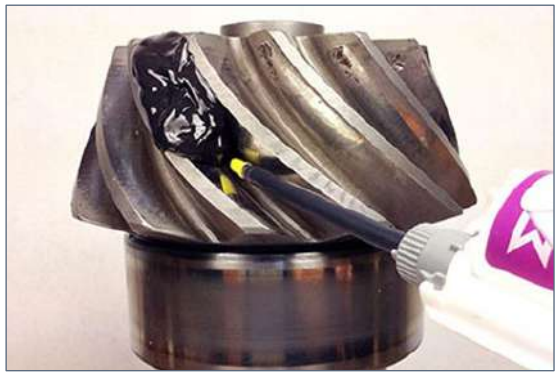
Microset® Surface Replication

Making Microset® Replicas

During application, keep the nozzle touching, or as close as possible, the surface to avoid trapping air in the replica and to push the material into surface features.

Squeeze dispenser handle slowly and steadily to apply compound.

Push and weave the nozzle from side to side to completely cover area. Each push should overlap the previous one, similar to welding.



Apply backing slide or paper to surface of exposed compound. Allow the compound to cure (see curing time on cartridge) and then carefully peel off the cured replica from one side.

When replicating vertical surfaces, apply compound in an upwards direction.

To prevent damage and loss of recorded detail do not touch the replica surface and store the replica in a plastic bag.

Do not stop flow of the material through the nozzle for longer than the working life of the compound grade. Once the working life has been exceeded, a new nozzle must be used.

After use, remove the nozzle and replace the cap on the compound cartridge. To re-use the cartridge, fit a new nozzle.

Microset® Surface Replication

TROUBLE SHOOTING

Dispensing gun fails to pressurize cartridge.
Check slide and replace if necessary.

Compound does not bond to backing paper.
Wrong side of backing paper used. See backing paper instructions.

Material cures in the nozzle.
Stop/Start operation or nozzle attached for a long period before use. Replace nozzle and proceed without delay.

Material does not dispense from the nozzle after replacing previous nozzle.
Cartridge ports have cured over. Remove cured material or discard cartridge. The nozzle can be used as a seal for up to 4 months.

When using a new cartridge the first part of the replica does not cure.
Cartridge not leveled before attaching nozzle. Cartridge will not work satisfactorily with subsequent nozzles. To level the cartridge: prior to fitting nozzle, dispense small amount of material until an even amount issues from both cartridge ports.

Material cures too quickly or too slowly.
Incorrect grade being used for the ambient temperature. Choose a grade appropriate for the conditions. See compound chart.

Air bubble entrapment.
Poor application. Keep the nozzle in contact with the surface. For blind holes place the lip of the nozzle at the bottom of the hole.

Replica distorts and resolution is poor when examined under a microscope.
Replica too soft when removed due to incomplete curing. Extend curing period.

Replica surface does not cure.
Cure inhibited by surface contamination e.g. grease, oil, etc. Clean surface with solvent/ suitable cleaning agent and reapply compound.

Replica breaks during removal.
Severe re-entrant geometry or replica not completely cured. Allow adequate curing time. Remove slowly applying constant pressure.

Excessive voids in replica when using thixotropic materials.
Air entrapment due to poor application. Keep the nozzle in contact with the surface. Overlap runs and use backing paper.

Replica adheres to surface.
Mechanical attachment to fibrous or porous surface. Remove slowly applying constant pressure.

Base piston on cartridge leaks.
Solution: Excessive pressure on dispensing gun due to nozzle blockage. Remove cured material if possible or replace cartridge.

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OPTICAL DEPTH MICROMETERS

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