Instruction Manual
MODEL 200 DIMPLING GRINDER

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Precautions

WARNING: **ELECTRICAL HAZARD and MECHANICAL HAZARD.** Do not operate with covers removed.

Caution: Any of the following may damage the instrument and void the warranty:

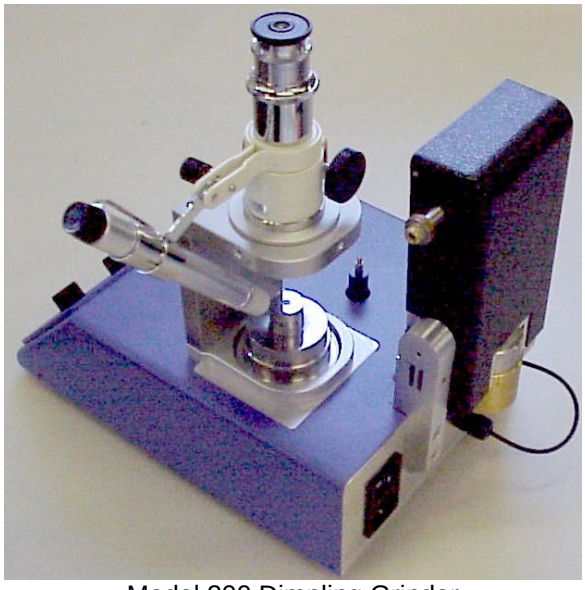
- Do not pinch wires when replacing covers after service.
- Do not restrict a rotating wheel or specimen stage.
- Do not drop the wheel stage onto the electrical contact.
- Do not push down on electrical contact.

To fully use the functions of the Model 200 Dimpling Grinder, please read and understand this instruction manual before operating the instrument.

NOTE: For the sake of simplicity in these instructions, the unit of measurement for all numeric values is microns.

Introduction

High quality specimens for TEM need to have a large electron transparent area for analysis, but yet be rugged. Dimpling is a technique that accomplishes both of these prerequisites. Dimpling involves rotating the specimen about one axis, while in contact with a grinding wheel that rotates about an orthogonal axis, providing a specimen with a central area reduced to a thickness of a few microns. By thinning only the central area of the specimen, a rugged outer rim remains, eliminating the need for special handling techniques for fragile specimens. Material is removed by a slurry of a chosen grinding media.



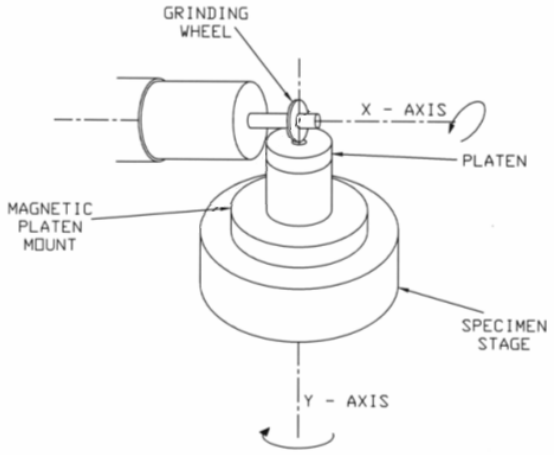
Model 200 Dimpling Grinder

The Model 200 Dimpling Grinder is a mechanical dimpling instrument designed for the complete preparation of high quality TEM specimens. By simply changing tools, the Model 200 can flat grind the specimen, and then dimple polish to electron beam transparency. When ion milling is required as the final specimen thinning step, the Model

200 is indispensable. Because the specimen is readily prethinned to or near electron transparency, ion milling must only remove relatively small amounts of material, minimizing uneven thinning and surface irregularities.

Instrument Description

The Model 200 Dimpling Grinder rotates the specimen on the Y-axis and a grinding wheel on the X-axis, as shown in the following figure. This produces a specimen with the central area reduced to a thickness of a few microns.



Schematic of dimpling action

The specimen is mounted to a specially designed two-piece platen, which is magnetically coupled to the specimen stage.

NOTE: There are two magnetic platen mounts. The Model 200 is shipped with magnetic a platen mount (part number 006-0340) attached to the specimen stage. This is used with the 15 mm wheels. Also provided is another magnetic platen mount (part number 006-0006), which is used with the 25mm wheels.

Sliding the magnetic platen mount allows specimen positioning so that a particular area of interest can be exposed by the preparation procedure. Embedded below the specimen stage is an LED, which is used to illuminate the bottom side of the mounted specimen.

The Model 200 is equipped with a 40X microscope and microscope light used for illumination and magnified inspection of the sample.

All functions of the Model 200 are programmed and activated by a series of commands entered via the touchpad on the front panel.

Specimen Stage

The specimen stage rotates the specimen. The specimen stage is mounted to a precision, single-axis positioning stage.

Grinding Rate Stage

The grinding rate stage incorporates a micrometer head driven by a zero-backlash gear-reduced stepper motor that provides a linear motion resolution of 0.023 microns. The microprocessor controls the stepping of the motor and monitors and retains in memory

the number of steps in relation to a “0” reference point. This number of steps is translated into microns and is displayed on the LCD panel as the actual grinding rate stage height.

The grinding rate stage is equipped with limit switches so that the allowable travel of the micrometer drive is not exceeded. A “limit” condition will occur if an improper diameter grinding wheel is used or if an incorrect sensing of the “0” point has taken place. The LCD panel will indicate whether the upper or lower limit switch was tripped and prompt the user to correct the fault condition.

Operating Principles

Zeroing

The Model 200 Dimpling Grinder enables precise setting and control of final specimen thickness (dimple depth). The zeroing procedure and setting of final specimen thickness can be achieved in either of two ways: zeroing on the platen surface, or zeroing on the specimen itself.

The zeroing process sequence of operations is as follows:

Step 1 –

The grinding wheel and specimen stage begin slow rotation. The grinding wheel lowers towards the sample/platen in ten-micron increments until a break in the electrical contact is detected. This break signifies that the diameter of the grinding wheel has come into contact with the specimen/platen.

▼

Step 2 –

The grinding wheel raises fifty microns from the detected point of contact. This ensures that the following step has sufficient accuracy and will not read a false positive break in contact.

▼

Step 3 –

The grinding wheel lowers in 1-micron increments and completes a full rotation of the grinding wheel before lowering again. Any eccentricities or high spots on the grinding wheel will cause a break in the electrical contact and set the zero height of the unit.

▼

Step 4 –

The grinding wheel rises off the specimen platen to a height of 250 microns above the zero point. The grinding wheel and specimen stage cease rotating and the user is now prompted to enter a desired grinding depth or polishing time.

Depth-Based Grinding

When thinning a specimen, it is often useful to remove a predetermined amount of material. The depth-based mode allows the user to set a position-based termination for the grinding process. If the Model 200 was zeroed onto the top of a specimen, then the user would input a negative desired height equal to the amount of material to be removed. If the zeroing took place on the bare platen surface, the user would enter a positive desired height equal to the minimum desired thickness of the dimpled area plus an offset to compensate for the adhesive layer between the sample and the platen surface. With careful sample mounting this glue thickness is typically in the 7-20 micron range.

In the depth-based mode, the Model 200 begins by rotating the grinding wheel and the specimen stage at a predefined rate while lowering the grinding arm to the specimen. Once contact with the specimen is detected, the Model 200 changes the rotation speeds of the grinding wheel and the specimen stage to the user-defined values.

While grinding is in process, the unit will attempt to maximize the surface area of the grinding wheel in contact with the specimen by lowering the grinding rate stage far enough that no electrical contact is detected between the Pin Contact and the grinding wheel stage. Because of this, the value displayed on the LCD panel as the current height is the minimum height of the specimen dimple. However, if the grinding wheel is not perfectly round, eccentricities in the wheel will cause this value to differ from the actual dimple height by several microns. This is normal and will not affect the final accuracy of the dimpled specimen.

When the grinding process reaches the final few microns of material to be removed, the rate of material removal will slow. The unit will not allow the minimum height of the dimple to fall below the user specified termination point so the grinding will be limited to the portions of the grinding wheel with larger radii. Final termination of the grinding process occurs when the grinding rate stage is at the desired dimple depth and the grinding wheel no longer makes contact with the specimen. The unit will then lift the grinding rate stage 250 microns above the zero position.

Time-Based Polishing and Grinding

If a specimen is very thick or contains irregular surface topology is it often desirable to remove large quantities of material rapidly. The Model 200 allows the user to set a time-based termination that will grind the sample for a specific period. During bulk removal of material the use of a flattening wheel is recommended. The time-based mode is also useful after depth-based grinding when a polishing wheel can be used to remove any scratches left by the cutting abrasives.

In the time-based mode, the Model 200 begins by rotating the grinding wheel and the specimen stage at a predefined rate while lowering the grinding arm to the specimen. Once contact with the specimen is detected, the Model 200 begins a timer to control the polishing and changes the rotation speeds of the grinding wheel and the specimen stage to the user defined values.

While polishing is in process, the unit will attempt to maximize the surface of the polishing wheel in contact with the specimen by lowering the grinding rate stage far enough that no electrical contact is detected between the pin contact and the grinding wheel stage. The stage will continue to lower itself as needed to maintain full contact between the polishing wheel and the specimen until the timer expires.

Installation and Setup

1. Open the shipping box and remove the microscope and accessories.

   The Model 200 comes nested on a foam frame that provides shock resistance during shipment.

2. Remove the foam frame.

3. Place the Dimpling Grinder on a rigid, vibration-free surface.

   Caution: Because it is extremely sensitive to minute displacement changes of the grinding wheel stage, the Model 200 Dimpling Grinder must be placed on a rigid, vibration free surface. Vibration, especially during the zeroing operation, could result in erroneous indications of specimen thickness.

4. Plug the power cord into the power entry module located at the rear of the instrument.

5. Attach a 15-mm wheel on the wheel stage and a clean platen in the magnetic base.

6. Lower the wheel stage onto the electrical contact.

Powerup

Caution: Throughout these procedures, do not allow the grinding wheel stage to forcefully impact the specimen or the grinding rate stage pin contact. An impact could cause specimen damage or loss of the electrical contact necessary for accurate control of grinding rate and shut-off accuracy.

1. Turn the power switch to ON.

Note: The power switch is on the power entry module located on the back panel of the grinder.

The LCD panel will momentarily display “E.A. Fischione Instruments, Inc.". While “E.A. Fischione Instruments, Inc.” is visible, all buttons are inactive. The LCD panel will then display “Initializing” while the grinding rate stage rises to its upper limit of travel. Once this movement is complete, the Model 200 Dimpling Grinder will prompt the user to begin the zeroing procedure.

Specimen Mounting

The specimen is affixed to the top half of a specially designed two-piece platen. The platen fits into a magnetic base that is coupled to the specimen stage by means of a rare-earth magnet. This magnetic coupling allows the base to be slid into position so that a particular area of the specimen can be precisely positioned under the grinding wheel.

1. Loosen the setscrew in the magnetic base and remove the platen.

2. Place the platen in its platen holder.

   If it is required to observe the specimen during the preparation procedure using the integral lamp, be sure to mount the specimen to the glass platen assembly.

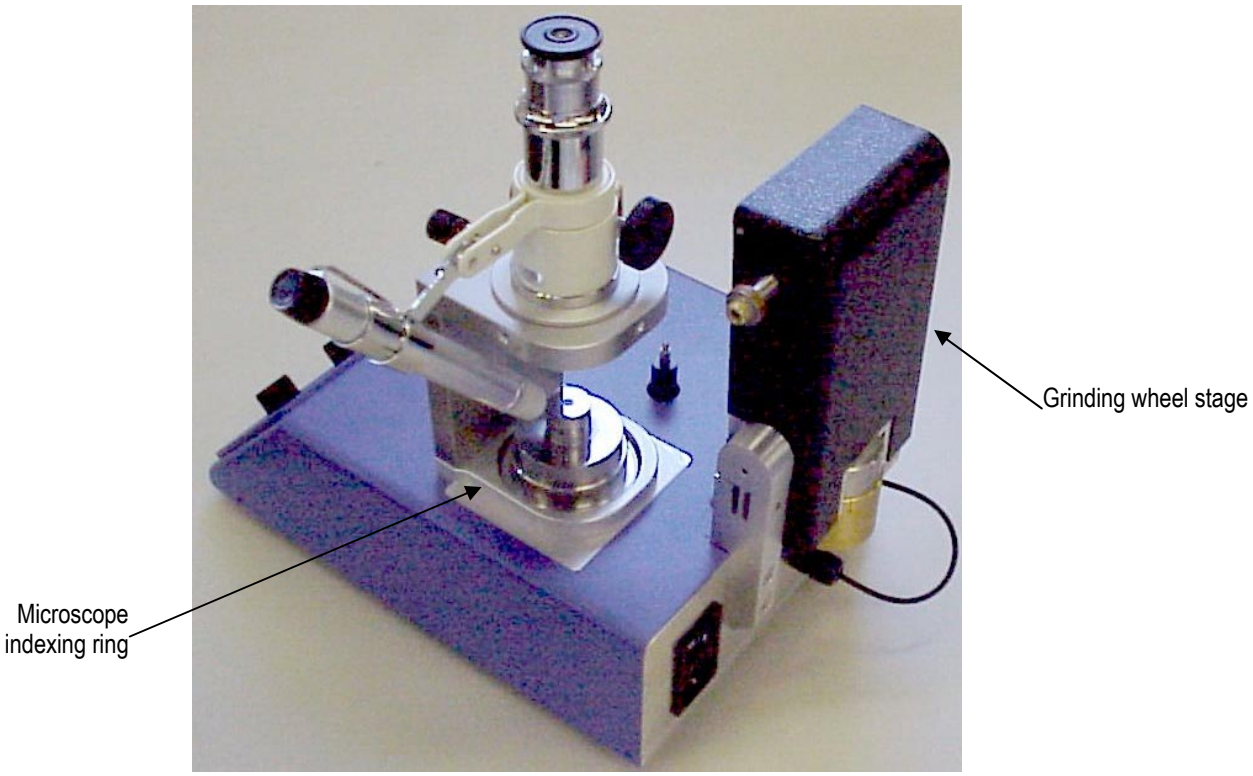
3. Position the platen on a hot plate set at the appropriate temperature in accordance with the adhesive manufacturer's specification.
4. Place a small amount of a low melting point thermoplastic polymer on the platen surface and allow it to melt.
5. Place the specimen over the molten thermoplastic and apply gentle pressure to minimize the adhesive layer thickness.
6. Remove the platen from the hot plate and allow it to cool.
7. Ensure that both the platen and base are completely clean.

   Particles between these two pieces will affect the specimen thickness indication.
8. Install the platen into the magnetic base and tighten the setscrew. For proper indexing, ensure that the setscrew is aligned with the slot in the platen.

Specimen Alignment

The magnetic base and microscope enable the specimen to be precisely located so that a dimple can be produced at any point on the specimen. To align the specimen:

1. Raise the grinding wheel stage to its full vertical position until the spring-loaded detent snaps into position.



Grinding stage in up position

2. Position the microscope attachment onto its indexing ring located at the base of the specimen stage.
3. Focus the microscope on the specimen surface.

4. Slide the magnetic base until the particular area that requires dimpling is centered in the field of view.
5. To rotate the specimen, press and hold the PAUSE button and use the stage rotation-speed potentiometer to change the rate of rotation of the specimen.
6. Remove the microscope attachment.
7. Gently lower the grinding wheel stage to its horizontal position.

Zeroing on the Platen Surface

During the zeroing procedure outlined below, the grinding wheel is automatically lowered by the grinding rate stage until it just contacts the platen surface. This establishes the top platen surface as the “0” point. This “0" position is stored in memory. The final thickness is then set at some value greater than “0”.

Grinding will continue until the actual height above “0" equals the set thickness point. By using this method, no prior knowledge of specimen thickness is required and the specimen thickness can be determined as outlined below. However, some allowance must be made for the thickness of the adhesive used to fasten the specimen onto the platen surface.

Position Grinding Wheel Stage

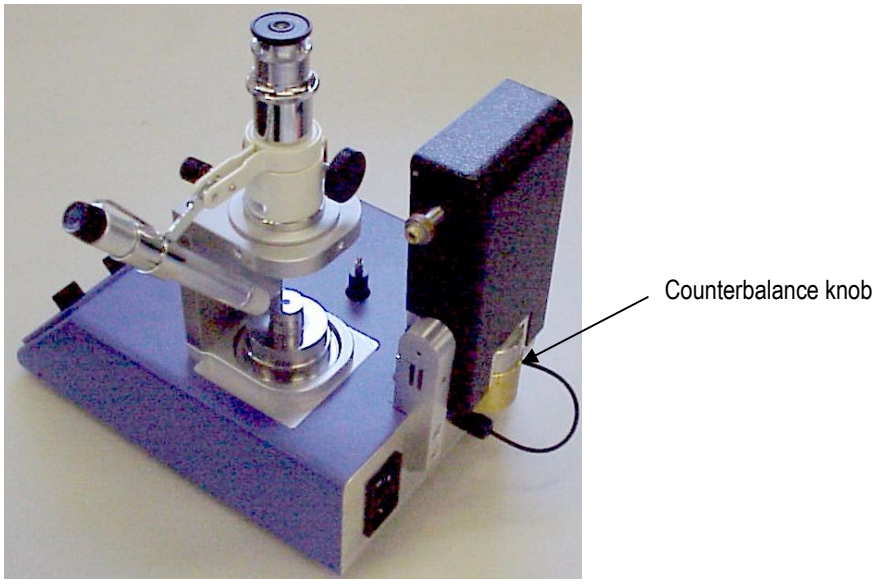
1. Before continuing, ensure that the magnetic base/platen assembly is attached to the rotating component of the specimen stage.
2. To zero on the platen, either
   a. Place a platen without specimen under the grinding wheel, or
   b. Slide the magnetic base holding the platen off center, so that the grinding wheel will contact the platen and not the specimen.
3. Gently lower the grinding wheel stage to its horizontal position.

   At this point, the circular contact located on the bottom of the grinding wheel stage will be resting on the pin contact located on the grinding rate stage.

   Caution: Always take extreme care when raising and lowering the grinding wheel stage to avoid damaging the contacts. Damage to the contacts could result in incorrect specimen thickness indications.

Adjust Grinding Force

The Model 200 Dimpling Grinder is equipped with a micrometer type counterbalance system, which provides accurate and repeatable grinding forces. Even though the grinding rate stage supports and lowers the grinding wheel stage, the force created by the weight of the grinding wheel stage is exerted onto the specimen. The counterbalance both reduces this force to an allowable level and makes it adjustable for various specimen-grinding requirements.



Counterbalance knob

1. To adjust the grinding force, rotate the counterbalance.

The counterbalance is calibrated so that one revolution is equal to approximately 5 grams of grinding force.

Zeroing Process

Before beginning the zeroing process, it is important to make sure the following conditions are met:

- The platen must be mounted securely in the magnetic base and the base mounted onto the unit.
- The grinding wheel to be used for specimen preparation should be fastened to the grinding wheel shaft and cleaned of all grinding paste and residual debris.
- The grinding wheel stage should be lowered into the horizontal position so that it rests on the electrical pin contact of the grinding rate stage. This will allow the Model 200 to accurately sense the zero height.

1. To activate the automatic zeroing process, press the ZERO button.

Zeroing on the Specimen Surface

This method requires precise knowledge of the specimen thickness and the amount of specimen material that must be removed.

1. Mount the specimen onto the platen using techniques outlined on page 7.
2. Position the platen with the sample centered on the stage.
3. Press the ZERO button.

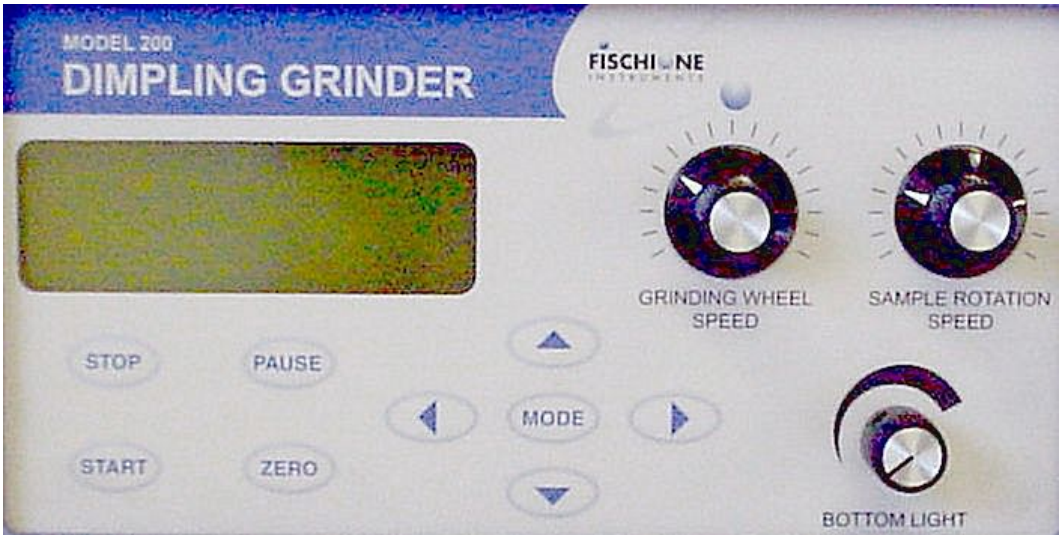
   This activates the automatic zeroing process and establishes the “0” point (the point at which the grinding wheel contacts the specimen).
4. Enter the set thickness point as a negative number corresponding to the amount of material that must be removed.

Programming Grinding Parameters

The Model 200 can be run in either time- or depth-based mode. It does not allow both types of termination to be accessed simultaneously.

1. Press the MODE button on the control panel until the desired parameter input screen appears on the LCD.

Grinding mode	Depth based
Polishing mode	Time based



Control panel

2. To change the cursor position or values, press the arrow buttons.

Left and right arrow buttons	Change the cursor position for the position or time field
Up and down arrow buttons	Increment or decrement the value at the cursor position

NOTE: The time entered must always be a positive value but the grinding depth may be either positive or negative to accommodate for zeroing on the bare platen or the top of the sample, respectively.

Grinding Force

1. Adjust the counterbalance knob on the side of the grinder to the desired setting.

For removing large amounts of material or for dimpling rugged materials	Set the grinding force in the 35 to 50 gram range.
For dimpling very fragile specimens or for final grinding and polishing	Set the grinding force in the 5 to 15 gram range.

Grinding Compound

1. Select an appropriate grinding compound, depending on initial specimen thickness and the surface finish required.

   If it is necessary to remove a large amount of material, a 6- to-9 micron grit may be needed. However, a coarse grit may produce scratches in the specimen surface up to three times the grit size. In some cases, it may be beneficial to begin with a relatively

fine compound (3 to 6 micron) and continue its use until the remaining specimen thickness is in the 20 to 40 micron range. At that point, for finish grinding, a 0.5-micron or 1-micron polishing compound is recommended.

2. Place the grinding compound onto the specimen.
3. Be sure to thoroughly clean the grinding wheel and specimen when changing grinding compounds.

Flattening

WARNING: ELECTRICAL HAZARD and MECHANICAL HAZARD. Do not operate without covers in place.

For preparing TEM specimens by dimpling methods or for preparing specimens for SEM, SIMS, or Auger analysis, it may be necessary to remove relatively large amounts of material from the specimen's surface. This is accomplished by installing the flattening wheel onto the Model 200. Because the flattening wheel is significantly wider (3.5mm) than a normal grinding wheel (1mm) and spans the entire specimen (3mm disk) surface, a specimen with a flat top surface is produced. (See page 20 for wheel details.) If so desired, the specimen may be turned over and the flattening process repeated to produce a specimen with two parallel surfaces.

1. To change from the grinding to the flattening wheel,
   a. Remove the knurled wheel locking nut.
   b. Slide the grinding wheel off of the shaft.
   c. Replace with the flattening wheel.
   d. Close the cover.
2. To begin time based flattening,
   a. Press the mode button until the time screen appears.
   b. Use the arrows to select the desired time.
   c. Press the Start button.
3. Following the flattening process, change back to the grinding wheel and proceed with dimpling.

Dimpling

Starting a Run

WARNING: ELECTRICAL HAZARD and MECHANICAL HAZARD. Do not operate without covers in place.

1. Close the cover.
2. To begin grinding or polishing of the specimen, press the START button on the control panel.

The Model 200 will then begin a depth-based run if the grinding mode was selected or a time-based run if the polishing mode.

Pausing a Run

NOTE: Do not change wheels at any point during the grinding process. Doing so may adversely effect specimen thickness indications.

To pause the grinding or polishing process,

1. Press the PAUSE button on the front control panel.

   The unit will lift the grinding rate stage off the specimen a distance of 50 microns and wait there for user input.

2. During this pause the user may,

   a. Inspect the specimen using the alignment microscope.

   b. Clean the grinding wheel and specimen of excess debris and cutting fluid.

   c. Adjust the rate of material removal by changing the specimen stage or grinding wheel rotation speeds or the force applied by the counterbalance.

3. To resume either the polishing or grinding process, press the PAUSE button.

NOTE: All grinding parameters will be retained in memory as long as the grinder remains powered up. If the power switch is turned off or the power to the grinder is interrupted, the grinding parameters must be reprogrammed.

Aborting a Run

1. To abort the grinding or polishing process, press the STOP button on the front control panel.

The unit stop the process and lift the grinding rate stage 250 microns above the “0” position.

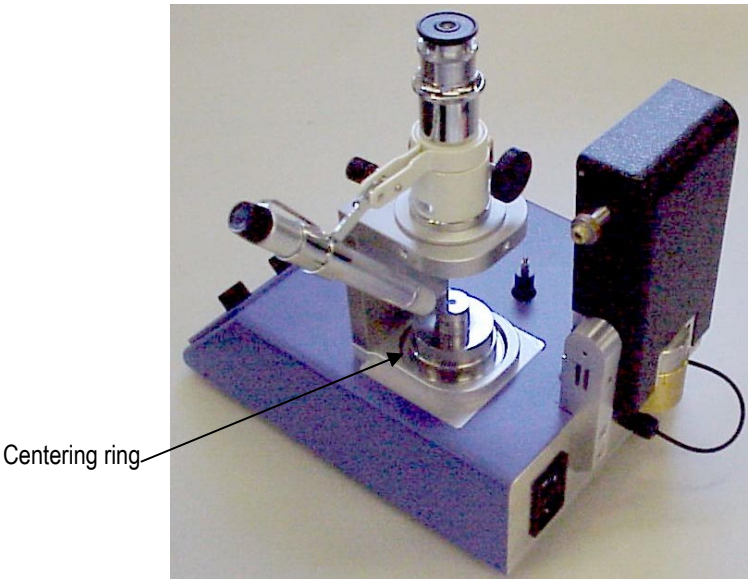
Observing the Specimen

To observe the specimen during preparation,

1. Pause the run (see above).
2. Lock the grinding wheel stage in its vertical position.

   Positioning the grinding wheel stage in the vertical position will cause a spring detent to engage and hold the stage in that position.

3. Clean the specimen.
4. Install the microscope attachment by placing it over the centering ring at the base of the sample stage.



Microscope attachment and centering ring

5. To illuminate a specimen material such as silicon (which changes color as its thickness is decreased), turn the BOTTOM LIGHT knob clockwise.

   Provided the glass platen assembly has been used, light will transmit through the specimen when its thickness has been sufficiently reduced.

Additional Grinding

If further grinding is required,

1. Change the desired thickness point.
2. Restart the grinding process.

Final Polishing

A final polish may be conducted using a clean wheel and a polishing paste such as Syton (colloidal silica). This is the only time during the preparation process where it is permissible to change wheels. At this point the final specimen thickness has been achieved. Because polishing removes small amounts of material, the specimen thickness will not be affected.

1. Install a clean wheel and new grinding compound.
2. Set a desired time to polish in time based mode.
3. Press the mode button to view the time based display.
4. Press the START button.

Removing the Specimen

Caution: When removing the dimpled specimen from the Model 200, be extremely careful to avoid any damage to the specimen.

1. Manually lift and lock the grinding wheel stage to its vertical position.

2. Loosen the setscrew in the magnetic base and remove the platen.
3. Gently remove the specimen from the platen surface by soaking in a suitable solvent.

Dimpling the Reverse Side

If necessary, the specimen can be turned over and the dimpling process repeated on the opposite side.

Maintenance and Adjustments

Wheel Wear

Because the grinding wheel is supported by the grinding rate stage during the preparation procedure, much of the eccentric wheel wear that is a characteristic of conventional dimpling techniques is reduced. As a “high spot” develops on the grinding wheel, the grinding compound actually works to remove the “high spot” restoring the wheel to a concentric state.

However, should a grinding wheel become excessively worn or if severe flat spots exist due to the wheel impacting the specimen or platen surface, it is necessary to change wheels. The continued use of substandard wheels may result in vibration that can be detrimental to the specimen.

Wheel Size

The Model 200 is shipped with standard 15-mm and 25-mm wheels and accessories. Should the use of other diameter wheels be required, the platen height must be adjusted accordingly. Contact E. A. Fischione Instruments for specific guidelines.

NOTE: Should oversize or undersize wheels be used, the Model 200 may experience problems finding the zero height or grinding the specimen. If this occurs, the LCD panel will inform the user that one of the limit switches has tripped. These are indications that the effective range of the micrometer drive employed in the grinding rate stage has being exceeded.

Cleaning

It is important to remove any grinding compound or other contamination after specimen preparation procedures to prevent premature wear of moving components.

Caution: Never permit any liquid to enter into the instrument.

1. At the conclusion of the specimen preparation process, wipe the specimen stage using a clean cloth dampened by a small amount of water or isopropyl alcohol.

   Caution: Do not use any solvent to clean the plastic grinding wheel stage cover or display lens. The use of solvents is only recommended for use on the specimen stage.

Alignments

For the grinder to function properly, all of its components must be properly aligned.

All alignments have been factory set with an accuracy of 0.05mm. Should the alignments change for any reason, the following procedures will restore the instrument to an optimum performance condition.

Microscope Assembly Alignment
The microscope assembly is used throughout all of the alignment procedures; therefore, it is necessary to ensure that the assembly itself is properly aligned.

To align the microscope:

1. Cycle the power and let the grinder go through the start-up initialization.
2. After initialization, press the mode button until MANUAL is displayed.

   In this mode, the right arrow key will allow the sample stage to rotate.
3. Lock the grinding wheel stage in its vertical position.
4. Place a platen into the magnetic base.
5. Position the magnetic base on the specimen stage.
6. Center the magnetic base using the centering ring (part number 006-0035) provided in the accessories kit.
7. Mount the microscope assembly on the indexing ring located at the base of the specimen stage.
8. Focus the microscope on the platen surface. Press the right arrow key to spin the sample stage
9. Adjust the four setscrews that fasten the microscope to the microscope assembly until the circular indentation in the platen surface is precisely centered in the cross hairs of the microscope reticule.

   If the circular indentation is slightly off center, the crosshairs should be aligned with the center of the indentation orbit.
10. Tighten the setscrews, ensuring that the circular indentation remains centered.

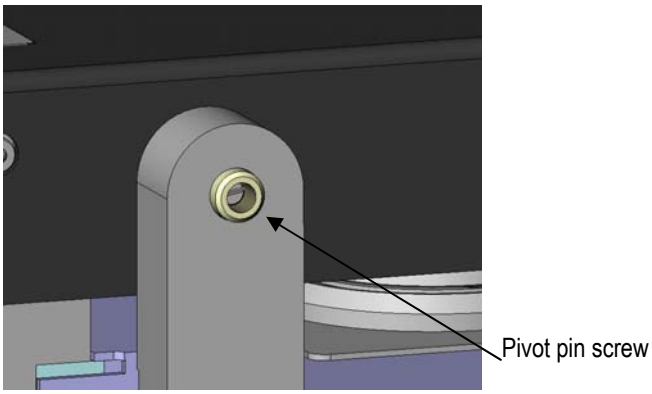
Grinding Wheel Stage Alignment
The Model 200 is designed with precision mechanical adjustment features that allow the grinding wheel stage (grinding wheel axis) to be accurately aligned to the sample stage center-of-rotation.

Side-to-Side Alignment
The grinding wheel stage is supported by two pivot uprights that house both a screw-adjustable pin and a spring-loaded pin. These pins are pushed into angular contact bearings that reside in the grinding wheel stage housing.

To align the stage side-to-side,

1. Slightly lift the microscope assembly and tilt it toward the front of the Model 200.
2. Lower the grinding wheel stage until it rests on the grinding rate stage contact.
3. Focus the microscope on a grinding wheel (preferably the stainless steel narrow wheel provided).
4. Check to verify if the center of the wheel is centered in the field of view.

5. If the wheel is misaligned, use a small flathead screwdriver to adjust the pivot pin screw located on the rear left upright.



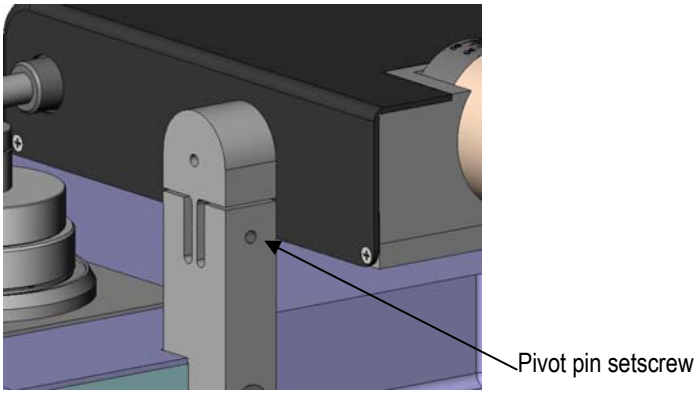
Left pivot upright

Front-to-Back Alignment

The rear right upright is machined with an integral flexible beam that is constrained by two counter-opposed setscrews. The adjustment of these setscrews moves the right stage pivot forward or backward.

To align the stage front-to-back,

1. Slightly lift the microscope assembly and tilt it toward the front of the Model 200.
2. Lower the grinding wheel stage until it rests on the grinding rate stage contact.
3. Remove the wheel from the wheel shaft.
4. Focus the microscope on the top edge of the shaft.
5. Adjust the setscrews in the upright until the shaft is centered in the field of view.

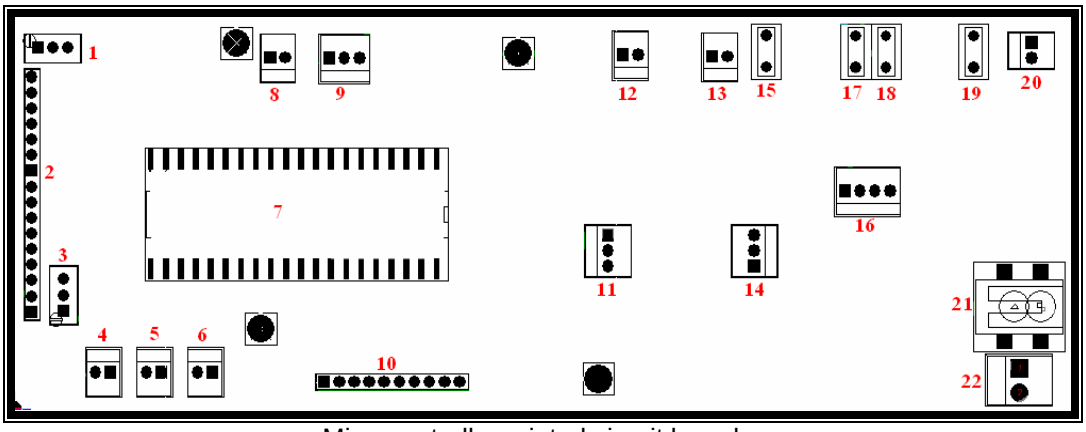


Right pivot upright

Electronics

The electronics for the Model 200 Dimpling Grinder consist of three main components, the microcontroller circuit board, the power supply, and the front panel electronics.

The microcontroller printed circuit board contains all the necessary electronics for sensing and control of the Model 200. It is connected to the rest of the unit through the following cabling points:



Microcontroller printed circuit board

1. LCD backlight brightness control potentiometer
2. LCD driver cable connection
3. LCD contrast control potentiometer
4. Upper limit switch connection
5. Lower limit switch connection
6. Electrical point contact connection
7. Microcontroller IC
8. Bottom light connection
9. Bottom light intensity control connection
10. Membrane button panel connection
11. Sample rotation speed control connection
12. Sample rotation motor connection
13. Grinding wheel motor connection
14. Grinding wheel speed control connection
15. Fuse (100mA; Fast blow; TE5)
16. Grinding rate stage motor connection
17. Fuse (100mA; Fast blow; TE5)
18. Fuse (100mA; Fast blow; TE5)
19. Fuse (100mA; Fast blow; TE5)
20. Electrical contact indication connection (optional)
21. Power supply connection
22. Secondary power connection (optional)

The power supply module converts the incoming AC voltage to DC. It can accept incoming voltages of 47-63Hz and 100-240VAC and translates them into 15VDC at a maximum load of 30 Watts.

The front panel electronics consist of the LCD panel, the membrane button panel, and the three potentiometers for controlling motor speeds and bottom light intensity. The LCD interfaces to the microcontroller through a 16-pin cable. The membrane panel interfaces through a 10-pin cable. The three potentiometers each interface through their own 3-pin connectors.

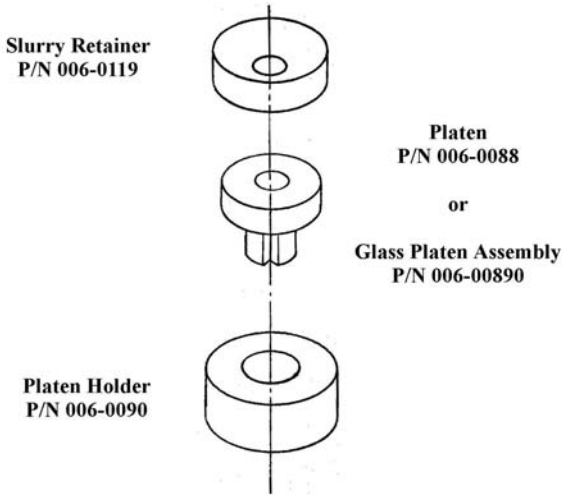
Troubleshooting

The following guide is designed for diagnosing simple problems that may arise with the Model 200 unit. It is not meant to be a comprehensive list.

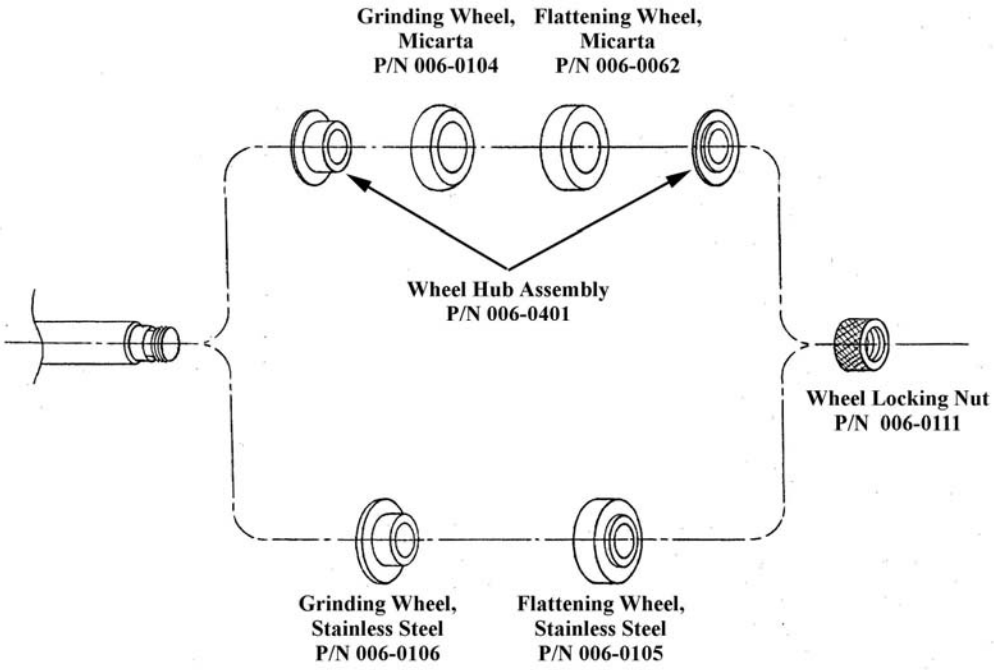
Problem	Verify	Action
LCD is dark.	Verify that unit is plugged in and turned on.	Plug unit into acceptable outlet and move the power switch to the ON position.
	Verify that power entry fuse is intact.	Replace fuse.
	Verify +15 volts at power supply output.	Replace power supply.
	Verify power and LCD cables are connected to the circuit card.	Reattach connectors per diagram.
Motor will not rotate.	Verify that connectors are securely plugged into the circuit card.	Reattach connectors per diagram.
	Verify speed control knobs on front panel are at a non-zero value.	Turn speed control knobs clockwise to increase speed.
	Verify that control software is trying to rotate motors.	Advance program to a portion that actively runs the motors.
Zero cycle stops prematurely.		Clean stage contact. Move Model 200 to an area with less vibration.
Unit does not respond to button presses.	Verify that the button panel bale is plugged into the circuit card.	Reattach connectors per diagram on page 17.
Consistently poor samples	Inspect condition of wheel being used.	Replace wheel if worn.
	Check alignment of wheel to specimen stage	Re-align wheel to specimen stage using instructions in grinding wheel alignment section (See page 9.)

Spare Parts and Accessories

Item	Part number	No. per assy.
Base; Magnetic Platen	006- 0006	1
Aligning Ring; Magnetic Base	006- 0035	1
Flattening Wheel; Micarta (see page 21)	006- 0062	1
Grinding Wheel; Wood	006- 0063	1
Platen; 0.750" Diameter (see page 21)	006- 0088	3
Platen Assembly; Glass (see page 21)	006- 0089	1
Platen Holder (see page 21)	006- 0090	1
Grinding Wheel; Micarta (see page 21)	006- 0104	3
Flattening Wheel; Stainless Steel (see page 21)	006- 0105	1
Grinding Wheel; Stainless Steel (see page 21)	006- 0106	2
Grinding Wheel; Phosphor Bronze	006- 0107	1
Wheel Locking Nut	006- 0111	1
Slurry Retainer Assembly (see page 21)	006- 0119	1
Lamp Beam Block	006- 0120	1
Wheel Hub Assembly	006- 0141	1
Wheel; Polishing Assembly	006- 0232	1
Grinding Wheel; Wood; 25mm	006- 0364	1
Grinding Wheel; Micarta; 25mm	006- 0365	3
Grinding Wheel; S. S.; 25mm	006- 0366	2
Grinding Wheel; Phosphor Bronze	006- 0367	1
Flattening Wheel; Micarta; 25mm	006- 0368	1
Flattening Wheel; S. S.; 25mm	006- 0369	1
Wrench; Ball End Hex Key; 1/ 16"	438- 0112	1



Platens and accessories



15-mm grinding and flattening wheels
(25 mm wheels and other listed accessories are not shown)

NOTE: Always conduct the zeroing procedure after changing wheels. Slight variations in wheel diameters may result in erroneous specimen thickness indications.

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