MF200

Microforge with 40× long working distance objective

INSTRUCTION MANUAL

Serial No._____

111412

World Precision Instruments

CONTENTS

DISCLAIMER: The intent of this document is to provide a thorough discussion of the operation of the MF200 Microforge, however, it is not intended to instruct in the complex field of intracellular experimentation.

ABOUT THIS MANUAL

The following symbols are used in this guide:

This symbol indicates a CAUTION. Cautions warn against actions that can cause damage to equipment. Please read these carefully.

This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.

NOTES and TIPS contain helpful information.

Fig. 1—MF200 System

INTRODUCTION

The MF200 Microforge is a versatile device designed specifically for the fabrication of glass micropipettes and other related tools. Originally designed by Dr. Ming Li of the Department of Pharmacology, University of South Alabama, it has been extensively improved to provide greater accuracy and ease of use. It is simple, durable and reliable. Ideal for patch pipette polishing, it can also be used for other fabrication procedures such as pipette tip size reduction, contact stretching to sharpen large bore pipettes, carbon fiber electrode sealing and the production of a variety of pipette configurations including those for in vitro fertilization. Its simplicity and ease of use result from two key features:

- Utilization of a microscope to manipulate the pipette
- Unique design of the filament holder that permits attachment of the heating element directly to the microscope objective.

These features enable precise fabrication specifications to be easily met.

CAUTION: The Microforge Control Unit (power) and the heating filaments have been carefully matched to provide rapid filament response at optimum heat intensity. Use of either of these components with alternate power units or heating filaments may result in severe damage to any or all of these components.

Fig. 2—MF200 Startup Kit

INSTRUMENT DESCRIPTION

Parts List

After unpacking, verify that there is no visible damage to the instrument. Verify that all items are included:

MF200-1/2 Complete Microforge 110V/220V (includes microscope):

(1) **W30S** Microscope (See **W30S** Instruction Manual included for set-up, assembly and operating instructions.)

(1) **MF200** Microforge (See parts list below.)

MF200-M1/M2 Microforge 110V/220V (microscope not included):

(1) **MF200** Microforge Control Unit
(1) **14470** AC to 12VDC converter with power cord (USA only)
(1) **Man-MF200** MF200 Instruction Manual
(1) **75006** MF-200 Start-Up Kit, including:
- (1) **800292** 40× long-working distance objective
- (1) **75050** Lucite and glass pipette holder
- (1) **75090** Filament Adjustment Assembly for 40× and 25× LWD objectives
- (1) **75040** One pair of heating filament connecting cables
- (1) **800003** 3/16 hex wrench
- (1) **MF200-H2** H2 Heating Filament
- (1) **MF200-H3** H3 Heating Filament
- (1) **MF200-H4** H4 Heating Filament
- (1) **503513** Eyepiece with Linear Reticle
- (1) **300497** Spacer Ring for mounting on the 10X objective with 22mm OD
- (1) **75027** Spacer Ring for mounting on the 10X objective with 21mm OD

NOTE: The spacer ring (WPI #**300497** may not be necessary for objectives with larger outside diameters. It is use with objectives smaller than 23.0mm.

Unpacking

Upon receipt of this instrument, make a thorough inspection of the contents and check for possible damage. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed damage should be reported at once to the carrier and an inspection requested. Please read the section entitled "Claims and Returns" on page 23 of this manual. Please contact WPI Customer Service if any parts are missing at 941.371.1003 or customerservice@wpiinc.com.

Returns: Do not return any goods to WPI without obtaining prior approval (RMA # required) and instructions from WPI's Returns Department. Goods returned (unauthorized) by collect freight may be refused. If a return shipment is necessary, use the original container, if possible. If the original container is not available, use a suitable substitute that is rigid and of adequate size. Wrap the instrument in paper or plastic surrounded with at least 100mm (four inches) of shock absorbing material.

For further details, please read the section entitled "Claims and Returns" on page 23 of this manual.

Description

The complete **MF200-1** (110V) and **MF200-2** (220V) systems include both the Microforge and matched microscope (WPI Model **W30S**); the **MF200–M1** (110V) and **MF200-M2** (220V) include the Microforge only.

Optics

The MF200 is the only commercial microforge that includes a 40X long-working distance objective (LWD). This LWD objective is the most powerful currently available on any commercially produced microforge. Its 40X magnification is essential when polishing pipettes as small as half a micron (0.5μm) in diameter. A linear eyepiece reticle is provided with this system for measureing pipette tip dimensions. An optional angular reticle is available. See page 19 for details. Optional accessories (including a 25X LWD objective for the **W30S** microscope) further expand the **MF200** system functionality.

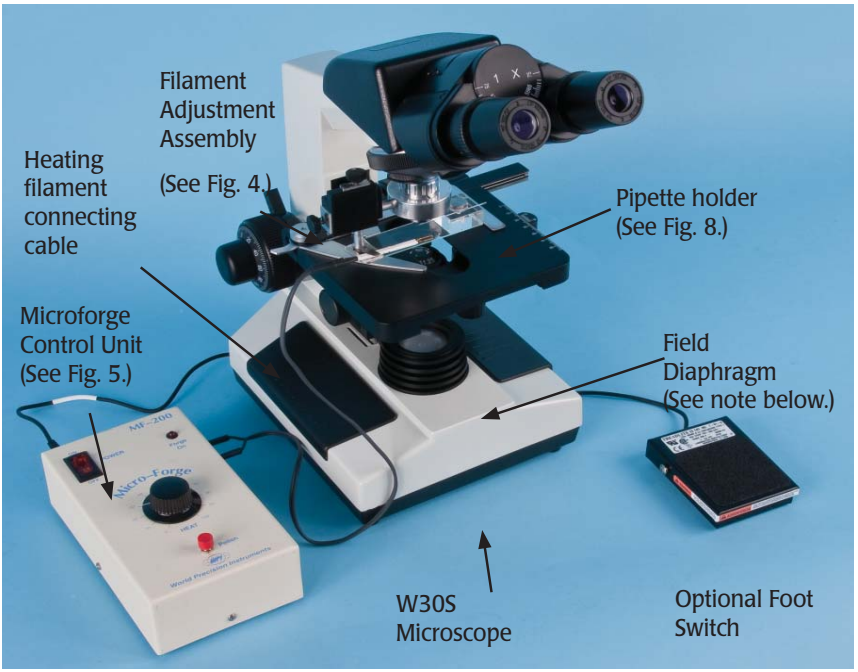


Fig. 3— MF200 System (not shown: 12 V DC power converter for Microforge Control Unit).

Positioning and Focus

Finding and moving the pipette tip under the microscope objective is simple. With a conventional microforge, it is difficult and time-consuming to position both the heating filament and pipette in the viewing area using independent micromanipulators. A unique feature of the **MF200** is the heating filament, inserted into the Filament Adjustment Assembly, which is directly attached to the microscope's objective and (using the horizontal and vertical adjustment knobs of the assembly) can be easily maneuvered to any position within the viewing area. Once the correct focus is obtained, the filament will remain fixed and within focus, and attention can be turned towards positioning the pipette that rests on the microscope stage. The X-Y-Z movements of the microscope stage adjustment controls its position relative to the heating filament. This design makes the positioning and microforging of pipettes extremely easy. The stage of the **MF200 W30S** microscope has a high quality rail that ensures precise, smooth and stable control of the pipette's movement. The **MF200** system configuration eliminates the need and expense of an additional micromanipulator to control pipette movement.

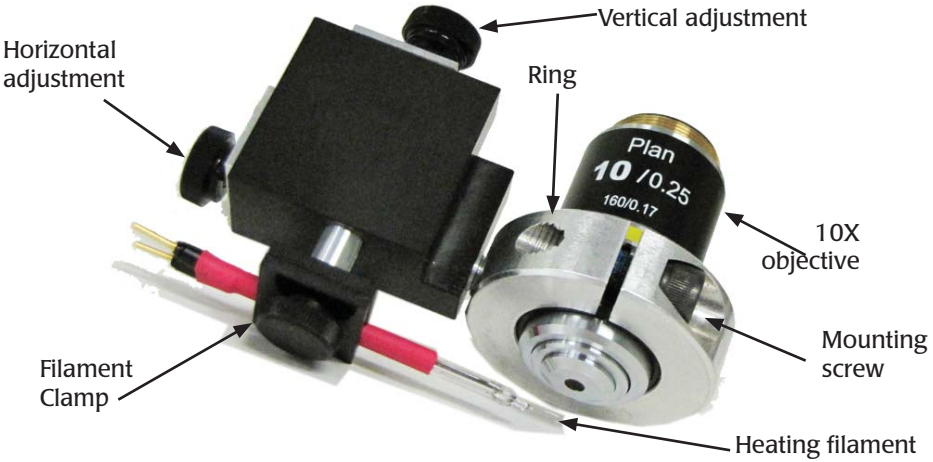


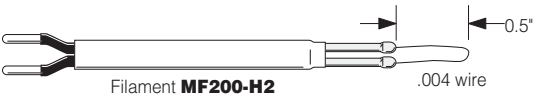
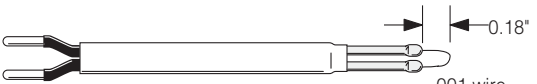
Fig. 4—Filament Adjustment Assembly

Heating Filaments

Low heat capacity and low thermal expansion of the filaments are key design features of the **MF200** Microforge. The low heat capacity of the filament allows it to reach fire-polishing temperatures without excessive heat. This permits the pipette tip to be brought close to the filament during polishing without fear of collapsing

the pipette tip and eliminates the need for an auxiliary air cooling system. The low thermal expansion characteristic of the filament ensures minimal displacement of the filament during heating. This feature takes much of the guesswork out of tip placement in relation to the filament. Three functionally distinct heating filaments are provided to meet diverse application needs.

Table 1: Filaments

Filament	Gauge	Material	Application
H2	0.004″	Platinum/iridium wire  Filament **MF200-H2**	Large gauge, long: can be formed into a variety of shapes (reformed) for fabrication of pipettes up through the 100-200μm range. Reforming the filament can result in a greater heated surface area to present to the pipette tip. For large pipettes, it is best used with the 10X standard objective on the model **W30S** microscope (optional Filament Adjustment Assembly required) or the optional 25X LWD objective.
H3	0.002″	Platinum/iridium wire  Filament **MF200-H3**	Medium gauge, short: for polishing patch clamp pipettes or larger pipettes up to 3-5μm.
H4	0.001″	Platinum/iridium wire  Filament **MF200-H4**	Small gauge: for polishing patch clamp pipettes.

Microscope

The microforge has been matched with WPI research-grade microscope model **W30S** to provide an uncomplicated and complete system with excellent performance. The Filament Adjustment Assembly supplied with the microforge has been designed to fit both the 40X LWD objective (included) and the optional 25X LWD objective for the **W30S** microscope. The Filament Adjustment Assembly will fit most other microscopes with a focal length of 160mm. The optional Filament Adjustment Assembly for the 10X objective is, however, designed specifically to fit the model **W30S** 10X objective.

Power Controller (Control Unit)

The **MF200** is powered by a 12VDC adapter to supply power to the Control Unit. The Control Unit is compact and lightweight, and its output power is electrically stable and reproducible. Fluctuations in the mains voltage input will not affect the output to the filament. This ensures the same polishing results day to day at the same settings. A push-button polish switch on the Control Unit turns the heating filament on and off.

An optional foot switch is available for complex fire polishing. Use of the optional foot switch leaves the hands free to move the pipette and control the variable heat adjustment on the Control Unit.

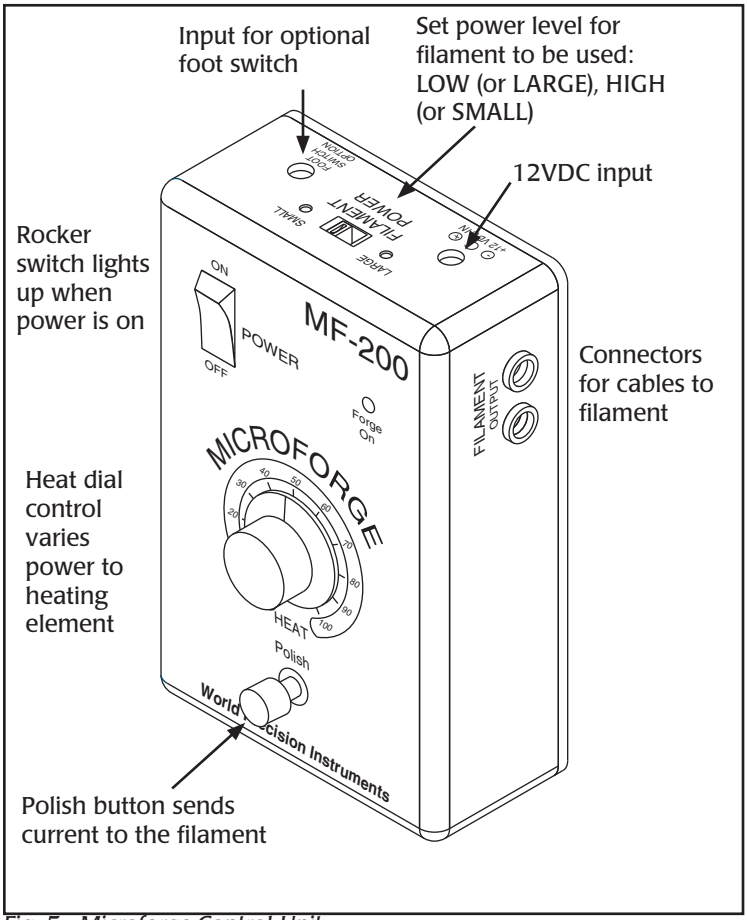


Fig. 5—Microforge Control Unit

OPERATING INSTRUCTIONS

Setting up the MF200

Four steps are required to set up the **MF200.** First, mount the Filament Adjustment Assembly to the microscope. Position the micropipette holder on the microscope stage. Finally, install the heating filament.

Fig. 6—Slide the Spacing Ring over the objective tip

Mounting the LWD to the Microscope

1. Mount the long-working distance (LWD) objective to an available position on the microscope.
2. Lower the microscope stage as far it will go.
3. When using the 10X LWD, slide the Spacer Ring (WPI #**300497**) over the tip of the objective as shown in Figure 6. This Filament Adjustment Assembly slides over the Spacer Ring for a snug fit.

NOTE: The spacer ring (WPI #**300497)** may not be necessary for objectives with larger outside diameters. It is use with objectives smaller than 23.0mm. To determine if you need a spacer, measure the outside diameter of your objective and refer to the chart below.

Outside Diameter of Objective	Spacer Required	Objectives Affected
21.0mm	WPI #**75027**	Some 10X
22.0mm	WPI #**300497**	Some 10X
23.0mm	none	Some 10X
23.5mm	none	40X LWD

Mounting the Filament Adjustment Assembly to the Microscope

1. Using the 3/16 hex wrench provided, loosen the mounting screw on the Filament Adjustment Assembly to open the ring so that it will fit comfortably over the objective and the Spacing Ring (Fig. 7).
2. Swing the objective to an outside position. It should not pointed directly down. Mount the Filament Adjustment Assembly onto the objective by carefully placing the ring around the objective and then sliding it up until it stops.
3. While maintaining the Filament Adjustment Assembly in position on the objective, slowly swing the objective down into the viewing position. Once in place, position the horizontal adjustment slider to the left of the microscope objective and parallel to the long edge of the microscope stage (Fig. 7). With the 3/16 hex wrench, tighten the mounting screw on the ring to secure the Filament Adjustment Assembly to the objective.

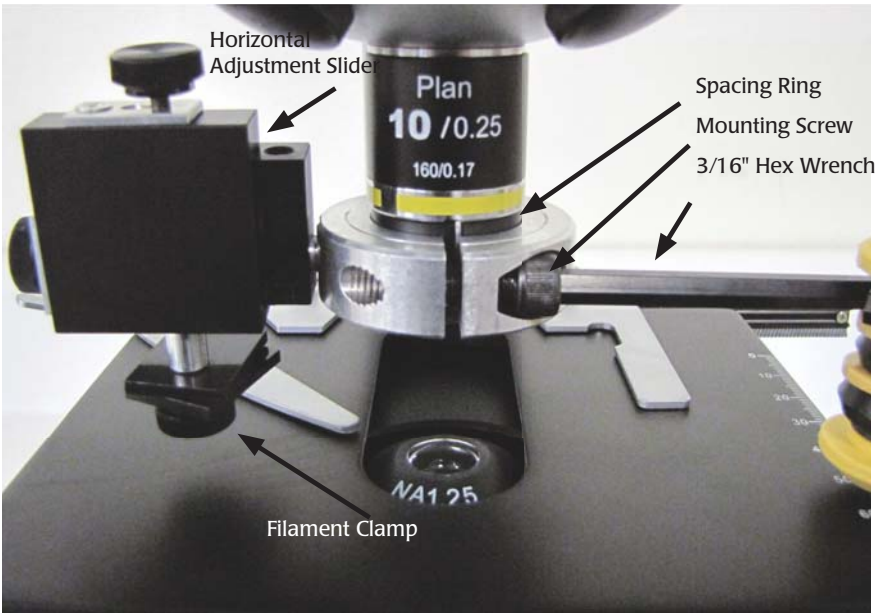


Fig. 7—Mounting screw and proper orientation of the filament adjustment assembly

CAUTION: Do not overtighten the mounting screw. Too much force can damage the objective.

NOTE: The filament clamp and base plate attached to the vertical filament adjustment is angled slightly inward. This is normal. Do not attempt to straighten it. This angle facilitates viewing of the filament under the microscope.

4. Connect the appropriate plug from the AC/DC converter into the 12VDC receptacle on the Microforge Control Unit, and then plug the converter into a wall outlet.

Positioning the Micropipette Holder

Position the Pipette Holder on the microscope stage as if it were a slide. Orient the Lucite block of the pipette holder as shown in Figure 8.

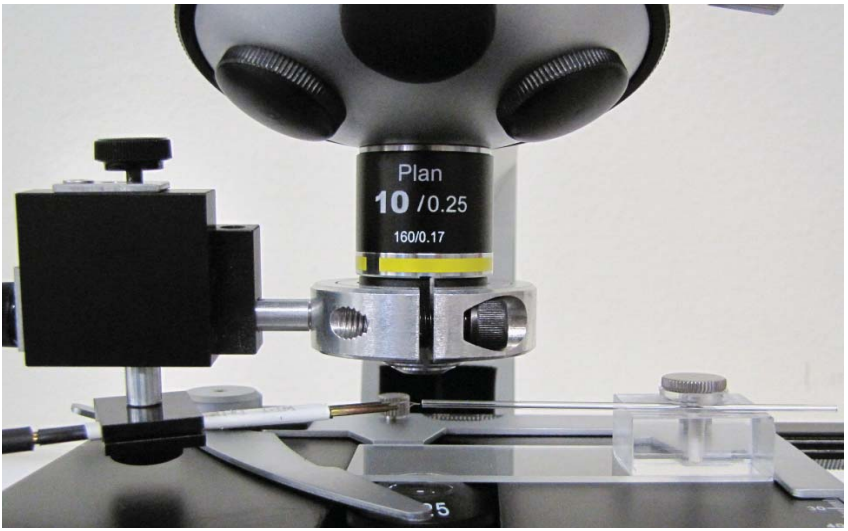


Fig. 8—Micropipette positioned on the microscope stage

Mounting the Heating Filament

1. Position the heating filament in the filament clamp and tighten the knob on the bottom of the filament holder.
2. Attach both of the microforge connecting cables to the filament by fitting the socket end of each cable into the filament plugs. The cables are interchangeable and can be used for either plug.
3. Take the free end of each cable and insert each into one of the two Filament Output receptacles located on the side of the Microforge Control Unit. Again, it does not matter which cable is connected to each receptacle. The connecting cable wires from the Microforge Control Unit are not polarized, so reversing these cables will do no harm.

Basic Operations for Using the MF200

This section describes the final preparations and general instructions for using the **MF200.** Specific instructions are detailed for some of the **MF200** common uses in "Applications" on page 14.

NOTE: Remember that (because of microscope optics) any object seen through the microscope objective is a reverse image of the object and will appear reversed in orientation. For example, the heating filament (attached to the left side of the objective) will appear through the microscope as coming from the right.

1. Turn on the power to the microscope.
2. Choose the desired filament. See "Heating Filaments" on page 5.
3. Mount and connect the heating filament. See "Mounting the Heating Filament" on page 10.
4. Bring the filament into focus:

   Without using the microscope, adjust the position of the filament by moving it in or out and side to side until the filament wire is centered approximately 3mm below the objective.

   Looking through the microscope, move the filament in the filament clamp until its shadow appears. Some vertical adjustment may also be required to bring the shadow into the field.

   Using the Vertical Adjustment, bring the filament into clearer view. With the Horizontal Adjustment, position the end loop of the filament to the far right side of the visual field.

5. Power up the **MF200** unit. To do this, connect the AC/DC converter to the power input jack on the Microforge Control Unit and the wall socket. A light in the POWER switch indicates that the unit is powered up.
   - Pressing the Polish push-button switch sends current through the filament and turns on the Forge On lamp.
   - Turning the HEAT dial from 0 to 100 (an arbitrary numbering scale) varies the amount of power applied to the filament.
   - An optional foot switch (WPI #**MF200-FS**) leaves the hands free to vary the filament heat intensity while positioning the pipette. Some microforging techniques will require this two-handed approach.

CAUTION: Since the working distance of the 40X LWD objective is only 3mm, the objective lens may be damaged by prolonged exposure to the heat produced by the heating filaments. If, for example, the heat is set to 99%, the larger filament should be used in short bursts. For longer exposure times, lower heat settings should be used.

NOTE: The underside of the Microforge Control Unit and the AC/DC converter become warm to the touch during use. This is normal and no action is required.

6. Position the heating filament and the pipette:

   With the Power on, depress the Polish button several times at various heat settings to see the expansion of the filament loop and determine approximately where the pipette should be positioned in relation to it.

   Position a pipette by first adjusting the stage of the microscope down and away from the objective to provide sufficient room for mounting the pipette safely on the pipette holder.

   Place the pipette in the Pipette Holder.

   Position the pipette using the horizontal adjustment on the microscope stage so that the pipette tip is slightly past the center of the objective.

   Raise the stage until the filament is a few millimeters from the objective. (Fig. 8.)

   Slowly move the pipette back and forth, in and out, while looking through the microscope until the shadow of the pipette is observed.

   Adjust the vertical position of the stage until the pipette is clearly visible and in focus.

   Position the pipette tip in relation to the heating filament as required by the application.

7. Adjust the Filament Power Select switch and Heat dial.

CAUTION: It is not necessary to operate the unit at high power with the Heat dial set at 100 if the system is used properly. This can cause the filaments to burn out prematurely.

NOTE: Whenever changing filaments, turn off the power. When switching power levels, always set the Heat dial to 0.

The Filament Select slide switch on the side of the Control Unit is marked LARGE (or LOW) and SMALL (or HIGH). It controls the maximum power to the filament. The Heat dial provides a range of power up to the maximum as determined by the Filament Select switch. Always begin with the dial at the low end of the range and increase the heat only as necessary and by small increments. The lowest power and heat setting that can be used to accomplish a task should be used. Higher heat than necessary may shorten filament life, as well as increase the possibility of overheating the pipette tip.

Table 2: Filament Power Switch

Filament	LARGE (or LOW) Power Position	SMALL (or HIGH) Power Position
H2	When polishing large pipette tips, the H2 filament works best. In most cases LOW power will perform satisfactorily. Tips of 100μm and larger may require switching the power to HIGH. See "Fire Polishing Large Bore Pipettes" on page 16.	**Will *rapidly* decrease filament life as the Heat dial approaches 100.** Restrict time at high heat to a minimum.
H3 *and* **H4**	Best for polishing patch pipettes.	HIGH power may be required for pipettes above 0.5μm.

Applications

Choice of filaments, power and heat settings for each application vary with the use. If the desired result is achieved, the choice of parameters is acceptable. Always use the least amount of heat possible in order to prolong the life of the filaments.

The distance that should be maintained between the filament and the pipette tip during microforging varies depending on the tip bore, filament, power, heat settings and application. With the exception of the applications in which a glass bead is formed on the filament, the tip should not come in contact with the filament. In general, it is best to begin with the tip at a safe distance from the filament and move toward it, as necessary.

The formation of a glass bead on the filament is required for certain applications. See "Microforging Beveled Injection Pipettes" on page 17. It is not required for the other applications described in this manual, however, a glass bead on the filament may be used for other applications, if desired.

Fire Polishing the Patch Clamp Pipette

Fire polishing is a two step process, involving coating the pipette and polishing it.

Step 1: Coat the Single-Channel Patch Clamp Pipette.

Coat the single-channel patch clamp pipette with Sylgard 184 before polishing. (A simple and effective coating method has been described by Dr. Li.

WARNING: Always wear safety glasses during this procedure. Never point the pipette at anyone. The pipette can be forcefully shot out of its holder if not tightly secured.

1. Briefly, fit the pipette into a pipette holder, which is connected to a low-pressure, clean air source. Force air through the pipette at a pressure greater than 20PSI (for an 0.5 ID pipette) in order to prevent the Sylgard from entering the pipette tip during the coating process.
2. After mixing the Sylgard, dip the pipette tip into the coating and remove it.
3. With the low-pressure air supply still applied, place the pipette tip over a heat gun for two seconds in order to cure the Sylgard.
4. Remove the air supply from the pipette. The pipette is now coated and the tip is ready to be polished following the procedure for the whole cell patch clamp pipette as described in Step 2.

Step 2: Fire Polish the Single-Channel and Whole Cell Patch Clamp Pipette

1. Choose and install the desired filament. (See "Table 2: Filament Power Switch" on page 13.)
2. Turn on the Control Unit power.
3. Hold down the Polish button and adjust the Heat Dial from low to high while observing the expansion of the filament under the microscope. A slight movement of the filament indicates that it has sufficient heat and will provide excellent polishing results in most cases.

   NOTE: A red-hot filament is unnecessary and undesirable and will decrease the life of the filament. It also heats the tip too quickly, making it difficult to control the degree of polishing. In addition, a red-hot large filament could permanently damage the 40X objective.
4. Place the pipette to be polished in the pipette holder.
5. Adjust the microscope stage until the pipette is in position with sufficient distance to account for filament expansion (Fig. 9).

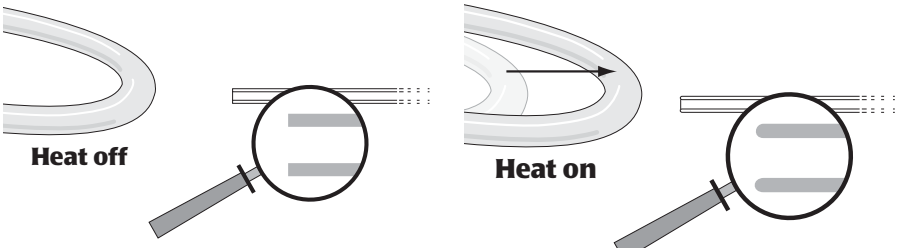


Fig. 9—(Left)Untreated tip

Fig. 10—(Right) Fire polished tip

6. Press Polish and observe the expansion movement of the filament (Fig. 10).
7. Determine the appropriate Heat dial setting and then fine-tune the position of the tip. A minimal change in the shape of the tip typically yields good polishing results.

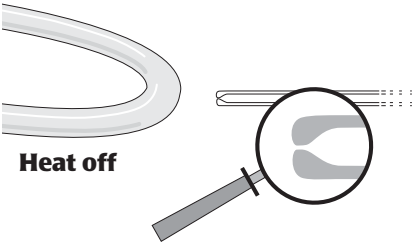
Fire Polishing a Pipette Tip

To fire polish a pipette tip, follow the instructions under "Step 2: Fire Polish the Single-Channel and Whole Cell Patch Clamp Pipette" on page 15.

Tip Size Reduction

Tip size reduction creates a holding pipette by rounding the tip ends and reducing the length of the pipette tip (Fig. 11).

Fig. 11—(Right) Tip size reduction



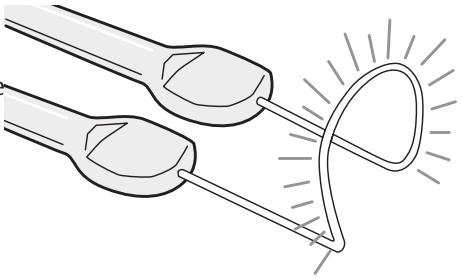
1. Choose and install the desired filament. (See "Table 2: Filament Power Switch" on page 13.)
2. Turn on the Control Unit power.
3. Select the appropriate Filament power.
4. Press the Polish button and set the Heat dial to a setting at which the filament just starts to glow red. Release the Polish button.
5. Place the pipette to be reduced in the pipette holder. Adjust the microscope stage until the pipette is in position with sufficient distance to account for filament expansion.
6. Turn on the heat by pressing the Polish button and observe the melting of the tip. Maintain the heat until the desired opening size is obtained.

   TIP: If the process is too slow, move the tip closer to the filament. (It is better to do this operation very slowly in stages, in order to avoid making the tip too small.)

Fire Polishing Large Bore Pipettes

To fire polish large bore tips (100–200µm), the **H2** filament can be shaped or re-formed to be slightly larger than the pipette tip. (See Fig. 12 and 13.)

Fig. 12—(Right) Reshaped filament



This effectively provides an increase in the heated surface area presented to the tip with a resulting increase in the heat directed to the large bore tip. This is necessary to melt the thicker glass of a large bore pipette. Larger bore tips generally require the use of the 10X objective.

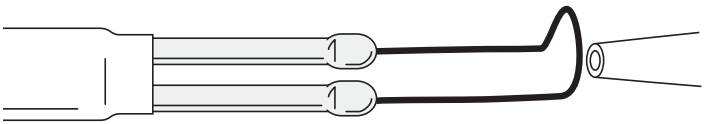


Fig. 13—Reshaped filament with large bore tip

Under some circumstance, it may be possible to use the 25X LWD objective. After re-forming the filament, proceed to microforge as described in "Fire Polishing a Pipette Tip" on page 15.

Tip Reduction of Large Bore Pipettes

The re-formed **H2** filament described in "Fire Polishing Large Bore Pipettes" can also be used for tip size reduction of large bore pipettes. To reshape the tip end and reduce its size, re-form the filament so that the tip will fit inside the filament outline (Fig. 14) and proceed to microforge, described in "Tip Size Reduction" on page 16.

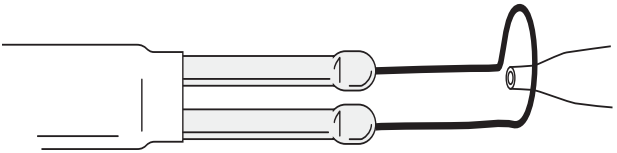


Fig. 14—Reshaped filament reduces large bore tip

Reducing Overall Filament Expansion

Re-forming or shaping the **H2** filament as shown in Figure 15 can also be used as a means to reduce overall filament expansion.

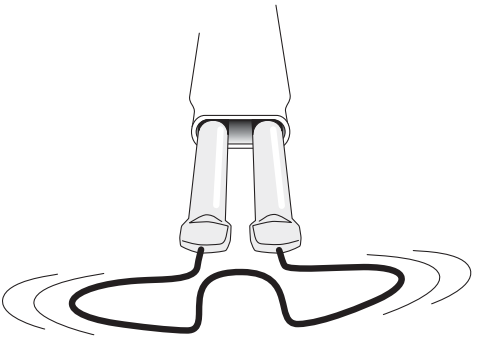


Fig. 15—Alternate filament shape

Microforging Beveled Injection Pipettes

Frequently, a beveled large bore pipette is not sharp enough to penetrate a cell without causing damage to the surrounding area. With the **MF200** and the **H2** heating filament, a sharp point can be formed on a beveled tip to assist in the penetration of the cell with minimal damage, using a two step process. First form a glass bead on the filament, and then sharpen the beveled edge of the pipette.

Step 1: Form Glass Bead on the Filament

For this application, first form a glass bead around the filament by coating the midpoint of the filament with a small amount of glass.

1. Position a small scrap pipette in the pipette holder.
2. Adjust the microscope stage until the pipette is in position to allow the tip to touch the filament during expansion.
3. Set the dial so the filament starts to glow red. Press Polish and coat the center of the filament with glass until a bead about twice the diameter of the filament is formed.
4. Release the Polish button. Remove the scrap pipette from the holder.

Step 2: Sharpen the Beveled Edge of the Pipette

1. Place the beveled pipette in the pipette holder. With the pipette tip far from the heat, press Polish and adjust the heat until the glass bead is molten (Fig. 16).

Fig. 16—(Left) Glass bead formed on filament

Fig. 17—(Right) Pipette tip close to glass bead

2. With heat off, move the tip very close to the glass bead (Fig. 17).
3. Press the Polish button. The filament expands, touching the tip of the beveled glass. As glass the bead becomes molten and the beveled tip makes contact with the bead, quickly pull the tip away and simultaneously release the Polish button to turn off the heat. (Fig. 18).

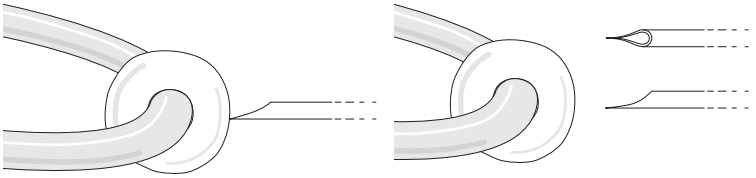


Fig. 18— (Left) Filament expands and contacts the tip

Fig. 19—(Right) Pipette has a sharp tip

4. The resulting tip (Fig. 19) has a very sharp point for clean cell penetration.

INSTRUMENT MAINTENANCE

The requirements for the maintenance and storage of the **MF200** are minimal. Care should be taken to protect the filaments. Store them in their original container when not in use. In general, it is advisable to keep the **MF200** in an area with minimal dust and particulates as would be appropriate for any microscope or similar apparatus.

ACCESSORIES

Table 3: Accessories

Part Number	Description
———————	Optional Angular Reticle*
300497	Delrin Spacing Ring for 10X objective (0.86″)
75027	Delrin Spacing Ring for 21mm 10X objective
500292	15× Eyepieces (pair)
13142	MF200 optional foot switch
500329	25× Long-Working Distance objective (5mm): fits most microscopes with a 160 mm Focal Length

*Optional angular reticle (19mm) is available. Contact Technical support for details at 941.371.1003 or technicalsupport@wpiinc.com.

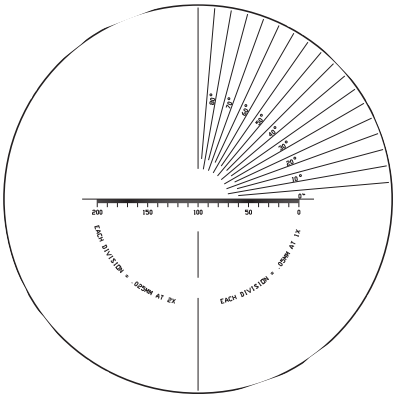


Fig. 20—Optional angular eyepiece reticle

SPECIFICATIONS

AC POWER MODULE	100-240 VAC 50/60Hz
FILAMENTS (3)	**H2, H3, H4**
FILAMENT "ON" CONTROL	Push button or Optional Foot Switch
FILAMENT ADJUSTMENT ASSEMBLY	Mounts on 40× and 25× Long-Working Distance Objectives
OBJECTIVE	40× Long-Working Distance (3 mm)
EYEPIECE	10× (pair)
RETICLE (10× eyepiece for W30S only)	1.25µm/division (at 40×): 0-90° angle at 5°/division (optional)
GLASS HOLDER	Mounts on microscope stage
DIMENSIONS (Control Unit)	10.2 × 17.8 × 4.8cm (4 × 7 × $1\frac{7}{8}$in.)
SHIPPING WEIGHT	1.4kg (3lb.)
MICROSCOPE	See Model **W30S** Instruction Manual
SHIPPING WEIGHT	7.3kg (16lb.)

For W30S microscope specifications, refer to the W30S Instruction Manual.

APPENDIX A: MICROSCOPE OBJECTIVE INFORMATION

Table 4: DIN Plan Achromat (160mm) Information

Magnification	Numerical Aperature	Approx. Field of View	Approx. Working Distance	Body Diameter	Approx. Depth of Focus
4X	0.10	4.5mm	17mm	20mm	~90µm
10X	0.25	1.8mm	2mm	20-23mm	~15µm
25X LWD	0.50	0.72mm	5mm	23.4mm	~5µm
40X	0.65	0.45mm	0.65mm	NA	~20µm
40X LWD	0.65	0.45mm	3mm	23.4mm	~20µm
100X (oil)	1.25	0.18mm	contact	NA	<1µm

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DECLARATION OF CONFORMITY

WORLD PRECISION INSTRUMENTS, INC.
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Sarasota, FL 34240-9258 USA
Telephone: (941) 371-1003 Fax: (941) 377-5428
e-mail wpi@wpiinc.com

DECLARATION OF CONFORMITY

We: World Precision Instruments, Inc.
175 Sarasota Center Boulevard
Sarasota FL 34240-9258
USA

as the manufacturers of the apparatus listed, declare under sole responsibility that the product(s):

Title: MF-200

to which this declaration relates is/are in conformity with the following standards or other normative documents:

Safety: EN 61010-1:1993 (IEC 1010-1:1990)

EMC: EN 50081-1:1992
EN 50082-1:1992

and therefore conform(s) with the protection requirements of Council Directive 89/336/EEC relating to electromagnetic compatibility and Council Directive 73/23/EEC relating to safety requirements.

Issued on: 18th February 2000

Dr. Mark P. Broderick
President and COO
World Precision Instruments, Inc.
175 Sarasota Center Boulevard
Sarasota, FL 34240-9258 USA

Mr. Glen Carlquist
Production Manager
World Precision Instruments, Inc.
175 Sarasota Center Boulevard
Sarasota, FL 34240-9258 USA

WARRANTY

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

• Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim settles. In some instances, photographic documentation may be required. Some items are time sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container.

• WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.

• Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.

• Goods returned for repair must be reasonably clean and free of hazardous materials.

• A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.

• Equipment which was built as a special order cannot be returned.

• Always refer to the RMA# when contacting WPI to obtain a status of your returned item.

• For any other issues regarding a claim or return, please contact the RMA department

Warning: This equipment is not designed or intended for use on humans.

** Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*

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