



MF200

Complete microforge including microscope with 40x long working distance objective



The MF200 Microforge is a versatile instrument designed specifically for the fabrication of glass micropipettes and other related tools. The system was developed in collaboration with Dr. Ming Li of the Department of Pharmacology, University of South Alabama. It is perfect for patch pipette tip polishing, tip size reduction, contact stretching, *in vitro* fertilization pipette production and a variety of other pipette configurations. The MF200 is priced at about half the price of comparable instruments.

Unique Features of the MF200

The MF200 system includes a specially configured WPI model H602 research grade compound microscope equipped with a 40x long-working distance objective a 10x eyepiece (a 15x eyepiece is optional). It has the most powerful long-working distance objective currently available on any commercially produced microforge. 40x magnification is essential when polishing pipettes as small as half a micron (0.5 mm) in diameter. Compared to a conventional 40x objective, the long working distance objective reduces the danger of damage to the pipette and/or objective lens during the polishing process. It is also the only commercial microforge that use the Kohler illuminator and Abbe condenser for the illumination. This provides less glare and sharper image of the pipette than frosted glass illuminator, which was used on all of the other commercial microforges.

Ease of use

The Heating Filament

With a conventional microforge often the most difficult and time-consuming part of using a high magnification objective is being able to move both the heating filament and the pipette into the same viewing area. Finding and moving both the heating filament and the pipette without collision can be a very difficult. However, this difficulty is eliminated, since one unique feature of MF200 is that the heating filament is directly attached to the



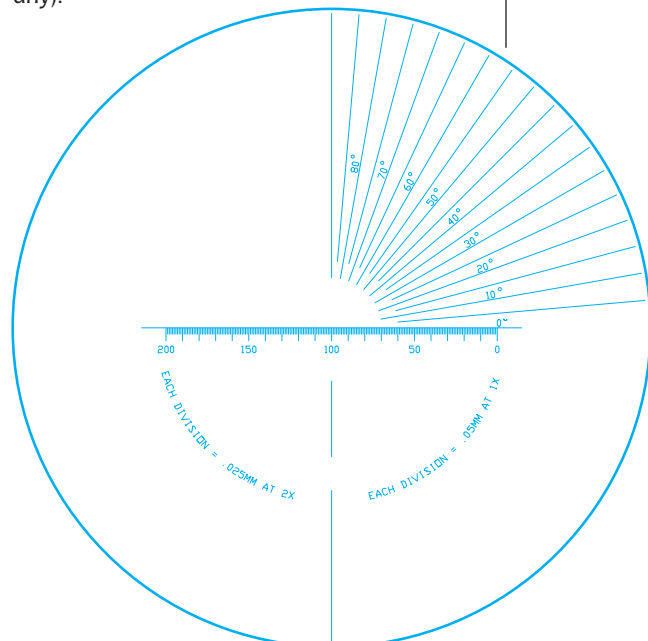
microscope's objective. Hence it can be easily adjusted to any position within the viewing area. Once the correct position is established it will remain fixed.

The pipette and microscope stage

The pipette rests on a specially designed holder that sits on top of the microscope stage. The position of the pipette, relative to the heating filament, is controlled by the (X,Y,Z) adjustment of the stage. This unique design makes locating and polishing the pipette extremely easy. The stage of the microscope has a high quality rail that gives precise, smooth and stable control of the pipette's movement. This configuration also eliminates the need and expense of an additional micromanipulator to control pipette movement.

The eyepiece reticle

A specially designed reticle is supplied with the eyepiece of the microscope. This enables the user to measure pipette tip dimensions and the angle of the bend (if any).



Low heating capacity filament

The unique low heat capacity and low thermal expansion of the filament, are also key design features of the MF200. For example, fire polishing small patch pipettes requires the heating filament to provide a high temperature but have very low heat capacity so that a pipette tip can be polished without collapsing due to excessive heat. Low heating capacity eliminates the need for an auxiliary air cooling system and the low thermal expansion ensures minimal displacement of the filament during heating.

Compact power controller

The MF200 is powered by a 12V DC adapter and uses state-of-the-art electronics to heat the platinum filament. The control box is compact, lightweight and its output power is electrically stable and reproducible. Fluctuations in mains voltage input will not affect the output to the filament. This ensures the same polishing results every day – provided the same control settings are used.

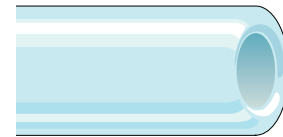
Typical applications of the MF200

Polishing the Patch Pipettes

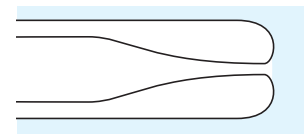
It is well known that the proper fire polishing of patch pipettes is the single most important factor for forming a stable giga-seal in patch clamp recording. This is even more important than the type of glass capillary used. Difficulties often arise in forming giga-seals because the polishing of patch pipettes using a conventional low magnification microforge is inadequate. However, since the MF200 uses a 40× long-working distance objective, pipette polishing is much more accurately controlled. Pipettes polished using the MF200 allow excellent stable giga-seals with a wide variety of cells. Both whole cell patch pipettes and single channel patch pipettes can be conveniently polished with the MF200 to the highest quality and reproducibility achievable with any microforge.

For the single-channel patch clamp

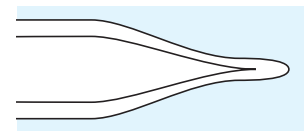
Filament	Gauge	Material	Application
H2	Large	Platinum/iridium	Can be formed into a variety of shapes (reformed) for fabrication of pipettes up through the 100-200 micron range. Reforming the filament can result in a greater heated surface area to present to the pipette tip. For large pipettes, it is best used with the 10× standard objective on the model H602 microscope (optional Filament Adjustment Assembly required) or the optional 25× LWD objective.
H3	Medium	Platinum/iridium	For polishing patch clamp pipettes or larger pipettes up to 3-5 micron.
H4	Small	Platinum/iridium	For polishing patch clamp pipettes.



Fire Polishing



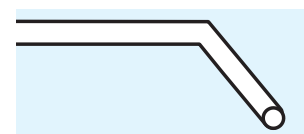
Tip Reducing (holding pipettes)



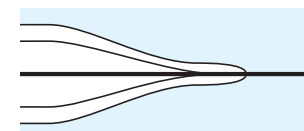
Tip Sealing



Large Tip Sharpening (contact stretching)



Tip Bending



Carbon Fiber Sealing in Plastic Sensor



MF200

MF200 SPECIFICATIONS

AC POWER MODULE	100-240 VAC 50/60 Hz
FILAMENTS (3)	H2, H3, H4
FILAMENT ON	Pushbutton Controlled or Optional Foot Switch Controlled
FILAMENT ADJUSTMENT ASSEMBLY	For 40× & 25× Long-Working Distance Objectives: mounts on objective
OPTIONAL	Filament Holder for standard 10× Objective (Model H602 microscope)
OBJECTIVE	40× Long-Working Distance (3 mm)
OPTIONAL	25× Long-Working Distance (5 mm)
EYEPIECE	10× (pair)
RETICLE (10× eyepiece only)	1.25 µm/division (at 40×)
0-90° Angle at 5°/division	
OPTIONAL EYEPIECE	15× (pair)
GLASS HOLDER	Mounts on Microscope Stage
DIMENSIONS: Control Unit	10.2 × 17.8 × 4.8 cm (4 × 7 × 1 7/8 in.)
SHIPPING WEIGHT	1.4 kg (3 lb.)
MICROSCOPE	H602
SHIPPING WEIGHT	7.3 kg (16 lb.)

pipettes the pipette needs to be pre-coated with Sylgard 184 before polishing. For this procedure the user can follow a simple and effective coating method described previously (Dr. Li, [1999] *American Journal of Physiology*, 259 pp. C295-C301).

Microforging Holding Pipettes

Holding pipettes have large blunt tips with a small opening. These are used to hold a floating cell in place prior to microinjection by applying suction to the rear of the pipette. The procedure for making holding pipettes involves three steps: squaring off, large bore flame polishing, and tip reducing. These steps are accomplished with a larger heating filament.

Microforging Beveled Injection Pipettes

Sometimes, a beveled large bore pipette is not sharp enough to penetrate a cell without damaging the area around the pipette. With the MF200 and the large heating filament, a sharp point can be formed on the beveled tip to assist the penetration of the cell. This process is referred to as "contact stretching".

Ordering information

MF200-1 Complete Microforge System, incl. H602 Microscope (110 v)

MF200-2 Complete Microforge System, incl. H602 Microscope (220 v)

MF200-M1 MF 200 without microscope (110v)

MF200-M2 MF 200 without microscope (220v)

500292 Optional 15× Eyepieces (pair) for H600 Series Microscopes

Note: No reticle available for 15× eyepieces.

500329 25× Long-Working Distance Objective
(fits most microscopes with a 160 mm Focal Length)

MF200-H2 Replacement heating filament (large gauge)

MF200-H3 Replacement heating filament (medium gauge)

MF200-H4 Replacement heating filament (small gauge)

75070 Filament Adjustment Assembly for 10× Standard Objective
(fits microscope model H602 only)

MF200-FS Optional foot switch

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