



WORLD  
PRECISION  
INSTRUMENTS  
*Instrumenting scientific ideas*

## Metal Microelectrodes

# INSTRUCTION MANUAL

### ACCESSORIES

- 5483** 0.031" Gold-plated female connectors (pkg. of 50)  
**5470** 0.031" Female connectors with 12" wire attached, 28 ga. (pkg of 4)  
**M3301EH** Replacement electrode holder

### WARRANTY

WPI (World Precision Instruments) 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 30 days 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.**

### WORLD PRECISION INSTRUMENTS

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**Metal Microelectrodes**  
*Superior microelectrodes for outstanding  
extracellular recording — tungsten, iridium,  
platinum-iridium and Elgiloy®*

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\* Parylene is a trade mark of Union Carbide. Kapton is a trade mark of DuPont. Elgiloy is a trade mark of Elgiloy Ltd.



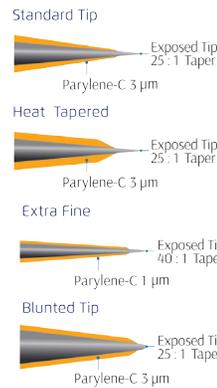
Our metal microelectrodes are available in Tungsten, Platinum/Iridium, Elgiloy and Pure Iridium. They are insulated with a thin film of vapor-deposited Parylene-C. Four different tip profiles are available (Standard, Heat, Blunt, and Fine tips). They have a high corrosion resistance for consistent long-term performance.

Our **heat treated electrode tips** are ideal for penetrating tough membrane (not for chronic implantation). This process is performed using a microforge in which the heating element is positioned in close proximity to the tip in order to melt the Parylene-C distal to the exposed metal. It provides a smooth transition and produces better adherence of the Parylene-C to the metal.

**Kapton tubing**, indicated by "KT" in our part number, extends from the connector to within 5 mm of the tip, providing stiffness and additional insulation to the electrode shaft. Kapton-clad electrodes are recommended when the electrode is inserted through a cannula for deep penetration.

**Concentric Bipolar Electrodes** are excellent for shielded macro recording, as well as evoked potentials. They are especially well suited for bipolar stimulation. The tungsten electrode is sharpened to a point and is 75 µm in diameter. The outer stainless steel conductor is insulated with Polyimide tubing to within 0.2 mm of the end of the stainless steel tube. It is also available without the outer Polyimide insulation.

EXPOSED TIP DIMENSIONS (nominal)				
Nominal Impedance	Tungsten	Elgiloy	Platinum Iridium	Pure Iridium
10 kΩ	250 µm	—	—	—
50 kΩ	200 µm	—	—	—
0.1 MΩ	100 µm	120 µm	60 µm	45 µm
0.5 MΩ	55 µm	66 µm	18 µm	14 µm
1.0 MΩ	30 µm	36 µm	10 µm	10 µm
2.0 MΩ	12 µm	15 µm	6 µm	5 µm
5.0 MΩ	5 µm	6 µm	3 µm	2.5 µm



## UNPACKING MICROELECTRODES

The electrodes are nested in foam slits for safe shipment and storage. To remove:

- Grasp the electrode near the connector end.
- Part the foam slit with your other hand.
- Gently lift the electrode out of the slit, being careful to not allow the tip to touch any surface.

Inspect the electrode, and, if damage is suspected, examine the tip under a light microscope with at least x100 power. Please note that the insulation is resilient enough that if the tip was bent, the electrode could still read the correct impedance value.

## STERILIZING THE ELECTRODE

While microelectrodes intended for acute and non-critical applications can be cleaned and disinfected using a 70% alcohol rinse for 2 to 3 minutes, this is not recommended as a primary sterilization method for critical applications or chronic implantation. Our microelectrodes are compatible with a number of common primary sterilization methods, including autoclave and gas (EtO), as long as they are not exposed to a temperature greater than 150° C. Take care to protect the electrode tips during sterilization. A common solution is to construct a container for use in gas sterilization by drilling holes into or otherwise propping open a plastic holding box, inside of which the electrodes are mounted using clips or tape.

## CONNECTING TO THE MICROELECTRODES

The miniature male pin connector integrated with the end of the electrode mates with the female connector which is provided with each box ordered. If the male connector must be removed to connect to the experimenter's micro-drive system, the Parylene-C insulation may be removed by either scraping it off with a scalpel blade or melting it using a small flame. WPI offers different connector options to hold the metal microelectrode. They can be connected into most systems.

## CLEANING AND REUSE

After removing the electrode from tissue, the electrode should be thoroughly cleaned by sonication in a 50% sodium hypochlorite (bleach) solution for 2 to 3 minutes. The electrode should then be sonicated in distilled water for 2 minutes followed by 1 minute in 70% alcohol. If a sonic cleaner is not available, increase the soaking time for each step to 5–10 minutes. Once cleaned, the electrode can be reused or re-sterilized as normal. We recommend testing the electrode impedance before reuse to verify proper function. If you have trouble reproducing the measured impedance values as noted on the box (which may be the case after sterilization or prolonged storage), we recommend electrolytic cleaning of the surface using the following protocol:

- Prepare a bath of saline or PBS and affix the microelectrode into the bath alongside an appropriate ground electrode.
- Connect the microelectrode to the negative pole of a potentiostat, stimulator, battery or some other device capable of delivering precise DC voltage. Connect the ground to the positive pole.

**CAUTION:** It is critical that the electrode be properly attached to the negative polarity (not positive). Positive current can drive the electrode metal to dissolve and further increase in impedance.

- Apply 2–3 V DC across the electrode while it is immersed in a saline bath for a period of between 5–10 seconds. Do not apply voltage continuously for longer than 10 seconds, because bubbling and heat can damage the microelectrode.

**CAUTION:** High impedance microelectrodes with impedance greater than 2.5 MΩ should not be continuously cleaned for longer than 5 seconds.

Electrode impedance can be measured using a potentiostat or a low-current AC 1 kHz impedance meter such as the **Omega-Tip-Z** meter (with adapter part # 5468). If an AC impedance tester that is accurate in this range is not available, use a sine wave generator with a large series resistance (1 MΩ) and blocking capacitor (0.1 µF) to generate a constant current sine wave. If you start with 10 V p-p @ 1 kHz, the signal across the electrode will be 10 mV/kΩ.

If damage is suspected along the electrode shaft, test by slowly lowering the electrode into the saline bath and observing any abrupt drop in impedance value. It is normal to observe a steady lowering of impedance as the electrode is immersed more deeply, due to the shunt capacitance associated with the electrode's thin insulation. However, an abrupt decrease can be indicative of damaged insulation.

**CAUTION:** In applications where higher impedance microelectrodes, typically above 2 MΩ, will be immersed more than 4 or 5 mm into a conductive medium, consider adding additional insulation to minimize shunting. We recommend polyimide tubing, which is used in our PT electrode models.

