



# INSTRUCTION MANUAL

**DAM80**

Differential Amplifier



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## 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.



Metal microelectrode adapter #5469 included.

Fig. 1—Dam80 with low-noise headstage DAM80P

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## INTRODUCTION

WPI's DAM series amplifier's are designed to amplify extracellular biopotentials. These battery powered bio-amplifiers incorporate a compact chassis profile that allows the units to be located close to the preparation, which helps minimize long lead lengths that often contribute to noise. The amplifiers are equipped with selectable high and low filters, and a position control to offset galvanic potentials which may develop during recording.

The **DAM80** is an AC-only amplifier that features a remote, low-noise headstage probe which can be mounted in a micromanipulator for up-close, in vivo, cortical recording, tissue slice or other extracellular recording applications using high impedance glass or metal microelectrodes. Some of the other features of the **DAM80** include:

- Externally gated or on-board, manual current generation for histological marking, or limited iontophoresis and cell stimulation.
- Built-in battery test.
- Standalone or ringstand mount with optional clamp-mounting hardware (WPI #3485) to locate it conveniently within the work area. Alternatively, a pair of amplifiers can be mounted into a standard equipment rack with a rack mount kit (WPI #3484).

## Features

|                               |                           |
|-------------------------------|---------------------------|
| Input Mode                    | AC                        |
| Input Configuration           | Differential              |
| Gain Range                    | 100-10,000 (AC)           |
| High/Low Filters              | Yes                       |
| Offset Position Control       | Yes                       |
| Current Generator             | Yes                       |
| Remote Active Headstage       | Yes                       |
| Output Connection             | 3.5mm mini phone          |
| Input Connection to Headstage | Mini banana               |
| Power supply                  | 9V alkaline batteries (2) |

## INSTRUMENT DESCRIPTION

### Parts List

- **DAM80** Base Unit
- **DAM80P** probe with low-noise, active headstage
- Startup Kit (Pictured in Fig. 2) includes:
  - (1) pkg. of four 0.031" to wire Electrode adapters (#**5470**)
  - (2) 6-foot, BNC to 3.5mm plug cables (#**CBL102**)
  - (2) Electrode holders (#**M3301EH**)
  - (2) 0.031" Electrode adapters (#**5469**)
  - (2) mini-banana to 2mm socket adapters (#**13388**)
  - (2) uninsulated mini-banana plugs with solderable turrents (#**2035**)
  - (1) Black insulated mini-banana plug (#**2033**)
  - (1) Red Insulated mini-banana plug (#**2034**)
  - (1) 3-foot cable with ground clip (#**3294**)
  - (1) 1mm Ag/AgCl Electrode on 70mm wire (#**EP1**)
- (1) Instruction Manual

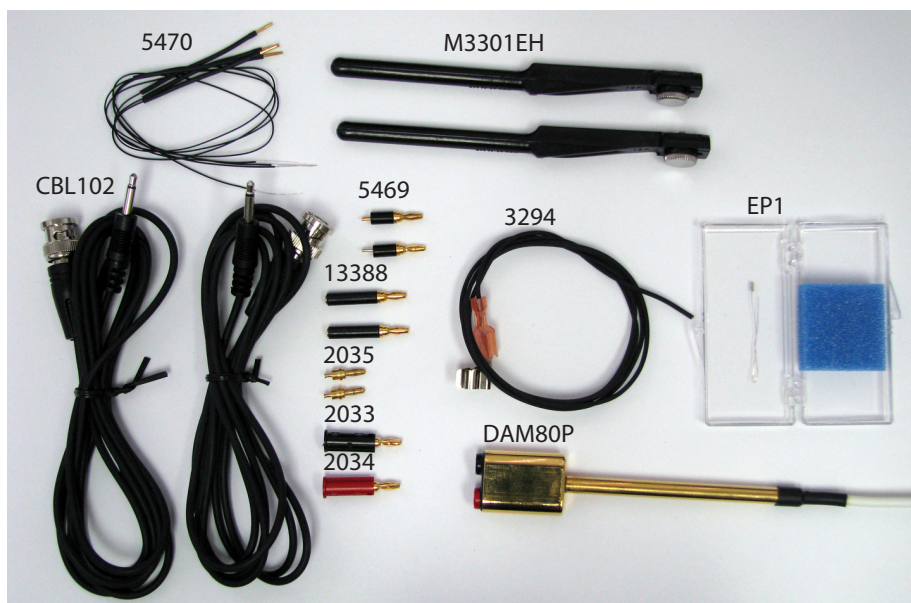


Fig. 2—**DAM80** Startup Kit

# 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 15 of this manual. Please contact WPI Customer Service if any parts are missing at 941.371.1003 or [customerservice@wpiinc.com](mailto: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 15 of this manual.

# Description

## DAM80 Base Unit

Labeled items on Figure 3 are described below.

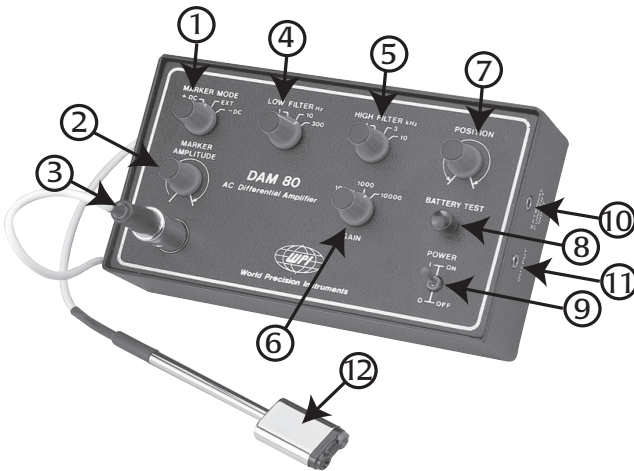


Fig. 3—DAM80

- ① **Marker Mode** toggle switch sets how to inject current. +DC sends positive current through the black terminal of the probe, -DC sends negative current through the black terminal of the probe, and EXT allows current from the external source.
- ② **Marker Amplitude** dial controls the amount of current injected when using the Marker Mode.



- ③ **Probe** port connection for the DAM80P.
- ④ **Low Filter** rotary switch determines the lower cut off frequency.
- ⑤ **High Filter** rotary switch affects the high frequency cutoff.
- ⑥ **Gain** rotary switch selects the magnification of the amplifier.
- ⑦ **Position** knob applies an offset value that can move the baseline output reading up or down as much as 250mV.
- ⑧ **Battery Test** push button tests the battery. When pressed an short, audible tone should sound, indicating that the 9V batteries are good.
- ⑨ **Power** toggle switch turns the amplifier on (I) and off (O).
- ⑩ **External Current Input** port for use with the Marker Mode EXT setting.
- ⑪ **Output** port for connecting the DAM80 with a recorder or oscilloscope.
- ⑫ **DAM80P** probe.

## DAM80P Probe

The probe headstage is epoxy encapsulated within a miniature gold plated metal case. The use of a probe, close to a recording site, minimizes the shunt capacity normally associated with long wire leads from the electrode to the amplifier.



**CAUTION:** The probe headstage is sensitive to static discharge and can be damaged by a high voltage shock.

## OPERATING INSTRUCTIONS

### Mount DAM80

The DAM80 amplifier and most other small WPI instruments with similar metal enclosures may be mounted on a post near the experimental site with Ringstand Mounting Kit (WPI #3485). See Fig. 4.

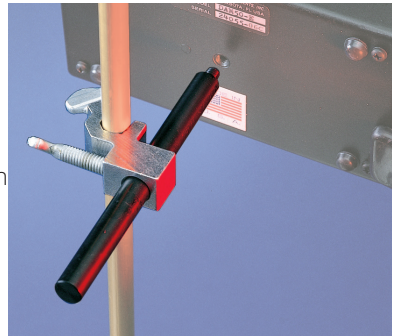


Fig. 4—Mount the DAM80.

### Differential Amplification

Differential amplification is of great importance in bioelectric recording to reduce the ever present effect of noise induction from power lines. A well-designed differential amplifier significantly diminishes power line (mains) noise. Thread size is 1/4"-20.

### Preparation Ground

The preparation **MUST** be connected to a good electrical ground and to the ground of the **DAM80** itself. This greatly reduce electrostatically-induced potential.

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The preparation may be connected to amplifier circuit ground using the clip and lead wire (WPI #3294) provided in the startup kit. Fix the clip to the probe handle (circuit ground) and connect the lead wire to the preparation ground electrode. If the probe is used in a monopolar (single electrode) mode, the second electrode (preferably the red, noninverting, input) should be connected to the preparation nearby, or to ground. See Appendix A (page 10) for sample wiring configurations.

## Differential Input Connections

In addition to the preparation ground, make differential input connections to the red (non-inverting) and black (inverting) probe input connectors using the appropriate electrodes applied to the recording site. This allows for optimal recording of a bioelectric potential difference.

**NOTE:** Both input terminals on the probe headstage must be connected to have a conductive return path to the preparation ground.

## Connect a Recorder or Oscilloscope

A recorder or oscilloscope may be connected using one of the **CBL102** cables (provided) to the OUTPUT connector on the right side of the **DAM80** case.

## The Amplifier

### Marker Mode

The **DAM80** has a MARKER MODE current generator which can inject current through the input probe's inverting (black) input terminal. Injecting current through the input electrodes is useful for the following possible reasons:

- To mark tissues by electrolytic deposition of ferrous stains or with current induced lesions.
- Ionophoresis of drugs or other bio-active agents.
- Stimulation of nerve cells.

**NOTE:** The application of large currents through recording electrodes will often result in driving the amplifier output into saturation. The amplifier will recover over time. The time required for amplifier recovery will vary depending upon the current applied and discharge characteristics of the preparation.

Controls for the on-board MARKER current source are located on the left side of the **DAM80** front panel. Use this source to inject current through the inverting input (black) electrode. This current flows through the electrode to the preparation ground. The electrode can be an anode or cathode by selecting +DC or - DC respectively on the MARKER MODE switch.

The EXT setting allows the DAM80 to accept an external voltage source that is connected to the EXTERNAL CURRENT INPUT connector on the right side of the **DAM80** case.

**NOTE:** The MARKER MODE switch must be OFF when recording with the amplifier.

## Marker Amplitude

To increase the current, rotate the MARKER AMPLITUDE knob clockwise. The actual magnitude and time course of current flow are determined by the electrode impedance geometry and polarization effects. Timed or larger currents may be applied using the EXTERNAL CURRENT INPUT connector on the right side of the **DAM80** case.

**NOTE:** When the MARKER MODE is set to EXT, the MARKER AMPLITUDE control is not functional. Signals applied to this connector should not exceed  $\pm 20V$ .

## Low Filter

The LOW FILTER selector switch determines the lower cut off frequency.

**NOTE:** At the 0.1Hz setting, the **DAM80** may take a long time to recover if the input wire is inadvertently disconnected or if the input is exposed to an excessively large electrical signal. This is typical of AC amplifiers set at low frequency filter settings. For fast recovery from signal overload, operate at the highest frequency setting of the low frequency filter consistent with the application. Generally, slow signals such as ECG and EEG require the 0.1Hz setting, while nerve action potential recording allow a 10Hz LOW FILTER setting without sacrificing signal quality.

## Position

The POSITION knob applies an offset value that can move the baseline output reading up or down as much as 250mV.

## High Filter

The HIGH FILTER selector switch affects the **DAM80** response speed. The 10kHz setting (widest band setting) enables the **DAM80** to respond most quickly to rapid signals. However, noise is more prominent in wideband operation. Therefore, use the lowest HIGH FILTER setting consistent with minimal degradation of the required bio-signal. For ECG and EEG 0.1kHz will be adequate. For muscle potentials, HIGH FILTER settings of 3-10kHz is appropriate.

## Gain

Amplification of the **DAM80** is controlled by the GAIN selector switch. The amount of signal magnification can be set to 100x, 1,000x or 10,000x.

## Battery Test

The **DAM80** is powered by two 9V alkaline batteries. (Battery power offers lower internal noise level for electronic devices.) Test the batteries by pressing the BATTERY TEST push button. If a short tone is heard, the batteries are functional. If no tone sounds, the batteries must be replaced.

# INSTRUMENT MAINTENANCE

## Change the Batteries

Replace batteries annually or as required. Although any of the common 9V transistor batteries will work well, alkaline cells are recommended for longer life.

1. Remove the four small, Phillips screws securing the rear panel of the instrument.
2. Remove the clips that secure the batteries.
3. Replace the two 9V batteries with fresh ones.
4. Reinsert the battery clips.
5. Secure the rear panel with the screws.
6. Turn the POWER switch on and press the BATTERY TEST button. Listen for the audible signal.

## Replacement Parts

Replacement parts can be ordered using the part numbers below. For additional accessories, refer to Accessories.

| Part Number | Description                            |
|-------------|--|
| DAM80P      | Replacement Probe*                     |
| 2101        | 9V Alkaline Battery, each (2 required) |

\*IF THIS ITEM IS SOLD AS A REPLACEMENT PROBE, THE CUSTOMER MUST RETURN THE DAM80 UNIT TO BE CALIBRATED WITH THE PROBE.

## ACCESSORIES

| Part Number | Description   |
|-------------|---|
| CBL102      | 3.5 mm Phone plug-to-BNC Cable  |
| EP1         | Ag/AgCl pellet (70mm wire)  |
| MEH1S       | 1mm Pipette holder (2mm pin)  |
| MEH7W       | Microelectrode Holder, right angle  |
| MEH8        | Microelectrode holder, right angle  |
| M3301EH     | 2mm skt. to 0.031 skt. adapter  |
| 2851        | BNC-to-BNC Cable  |
| 2033        | Black Insulated Mini-Banana Plug  |
| 2034        | Red Insulated Mini-Banana Plug  |
| 2035        | Uninsulated Mini-Banana Plug  |
| 2505        | Electrode handle, 6.3mm   |
| 3294        | Ground clip with wire, 3' cable   |
| 3484        | Rack Mount Kit (for 2 DAM preamps)  |
| 3485        | Ringstand Mounting Kit  |
| 5371        | Cable, Low Noise (2mm pin to 2mm pin)   |
| 5469        | Metal Microelectrode Adapter for DAM80 (mini-banana plug to 0.031 in. (0.79 mm) socket) |

| Part Number | Description   |
|-------------|---|
| 5470        | 2" Cable to 0.031 skt. (pkg. of 4)                          |
| 13388       | Adapter, mini-banana plug to 2mm socket                     |
| 13620       | Low-noise cable for microelectrode holder                   |
| 300040      | 2mm skt. to 2mm skt. Manipulator holder                     |
| 300102      | Electrode Extension, 4-inch, 2mm to 0.031" metal electrode. |

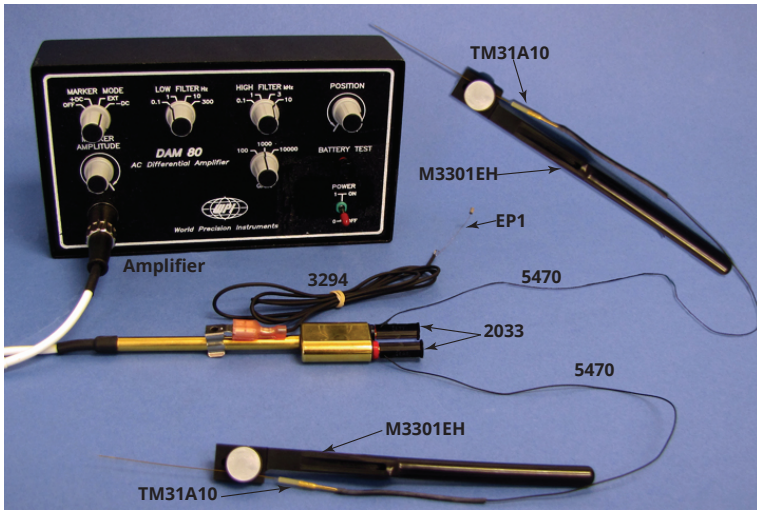
## SPECIFICATIONS

|                           |  |
|---------------------------|--|
| Input Impedance           | $10^{12} \Omega$ , Common mode and differential                            |
| Input Leakage Current     | 50pA (Typical)   |
| Gain                      | Ac: 100X, 1000X, 10000X<br>Common Mode Rejection Ratio<br>100dB At 50/60Hz |
| Input Capacitance         | 20pF   |
| AC Mode Noise             | 0.4 $\mu$ V RMS (2 $\mu$ V P-P) 0.1-100Hz AC                               |
| Mode Noise                | 2.6 $\mu$ V RMS (10 $\mu$ V P-P) 1Hz-10KHz DC                              |
| Bandwidth Filter Settings |  |
| AC Mode                   | Low frequency, 0.1, 1, 10, 300Hz   |
| AC Mode                   | High frequency, 0.1, 1, 3, 10KHz   |
| Output Connectors         | 3.5mm Miniphone connector  |
| Output Voltage Swing      | $\pm 8V$   |
| Output Impedance          | 470 $\Omega$   |
| Battery Test              | Audible tone   |
| Calibrator Signal         | 10Hz square wave   |
| Position                  | Approximately 250mV  |
| Current Source            |  |
| DC Generator              | 0 To $\pm 50\mu A$ , variable  |
| External Command          | Input voltage $\pm 10V$ commands   |
| AC or DC Current Waveform | $\pm 50\mu A$ max. amplitude at 200K $\Omega$                              |
| Batteries                 | 2 X 9V Alkaline (included)   |
| Typical Battery Life      | 500-700 hours continuous   |
| Dimensions                | 7 X 4 X 1.75in. (17.8 X 10.2 X 4.4cm)                                      |
| Shipping Weight           | 3.5lb (1.6kg)  |
| Filter Type               | Single-pole butterworth  |

# APPENDIX A: WIRING CONFIGURATIONS

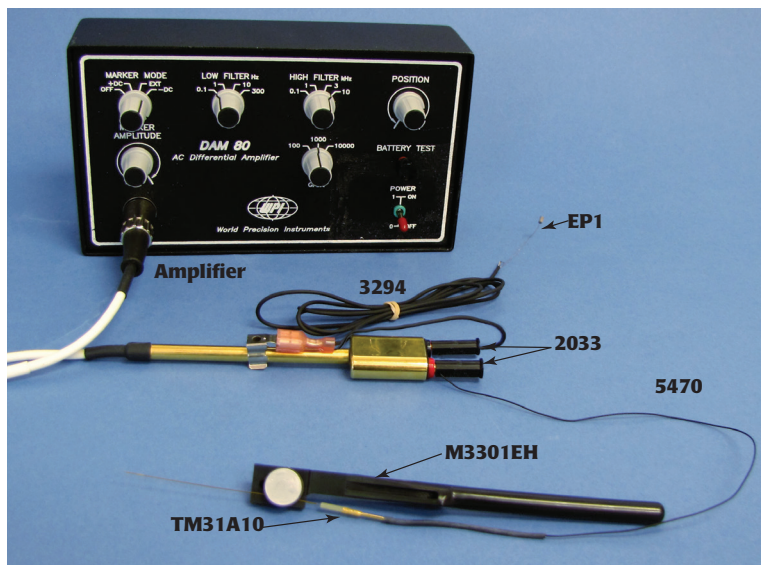
The following wiring configurations are for use on one or two micromanipulators such as WPI's M3301R/L. These configurations may require parts not included in the DAM80 startup kit. Parts not included are marked with an asterisk (\*).

## Dual Metal Electrode *(Add two metal electrodes)*



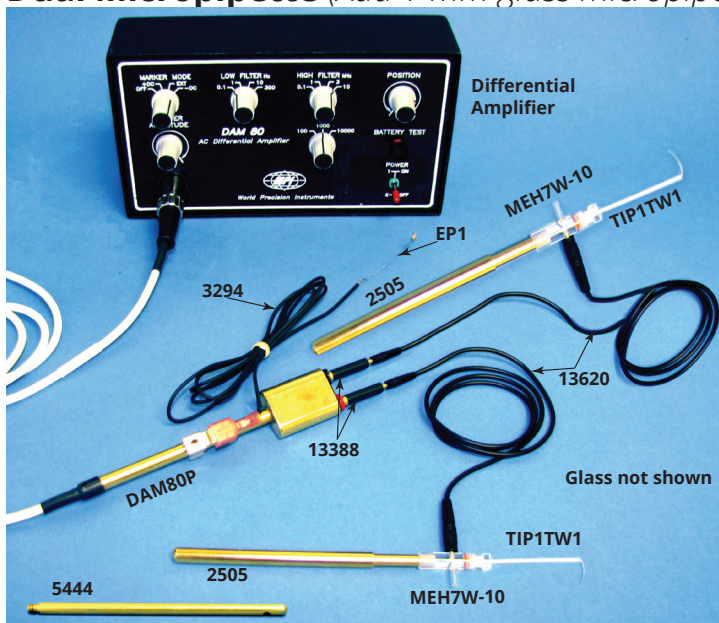
| Qty | Order No. | Description  |
|-----|-----------|--|
| 2   | 2033/2034 | Mini banana to wire turret (black/red)   |
| 2   | M3301EH   | 2mm skt. to 0.031 socket adaptor   |
| 1   | 5470      | 2" cable to 0.031 socket (pkg. of 4)   |
| 1   | 3294      | 3' cable with ground clip  |
| 1   | EP1       | Ag/AgCl pellet (70mm wire)   |
| 2   | TM31A10*  | Metal electrode (pkg. of 10). Any suitable metal electrode can be used. This one is just an example. |

## Single Metal Electrode *(Add single metal electrode)*



| Qty | Order No. | Description  |
|-----|-----------|--|
| 2   | 2033      | Mini banana plug black   |
| 1   | M3301EH   | 2mm skt. to 0.031 socket Adaptor   |
| 1   | 5470      | 2" cable to 0.031 socket   |
| 1   | EP1       | Ag/AgCl pellet (70mm wire)   |
| 1   | 3294      | Ground clip to wire 3' cable   |
| 1   | TM31A10*  | Metal electrode (pkg. of 10). Any suitable metal electrode can be used. This one is just an example. |

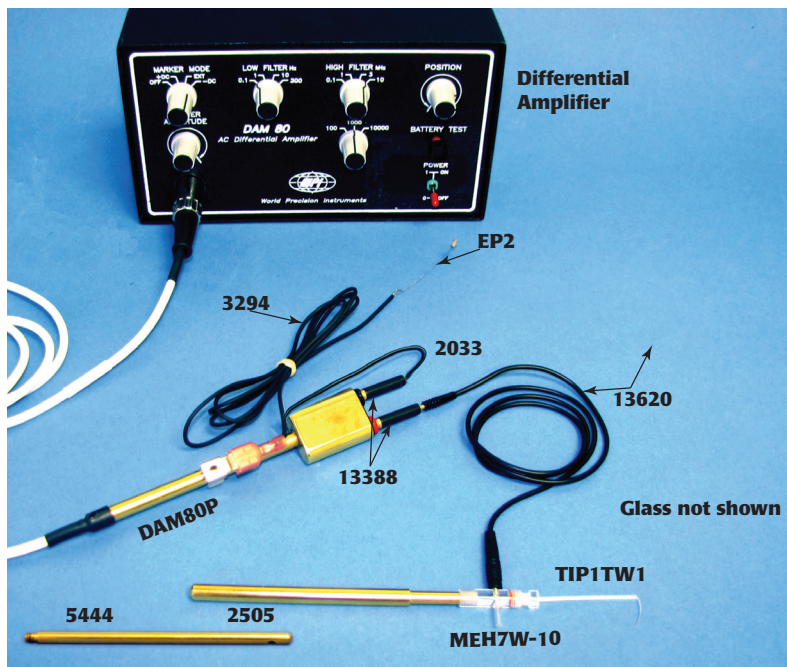
## Dual Micropipette *(Add 1 mm glass micropipettes)*



| Qty | Order No.       | Description                        |
|-----|-----------------|------------------------------------|
| 2   | 13388           | Mini banana to 2 mm socket adaptor |
| 2   | 13620*          | 2mm pin to 2mm pin 2' cable        |
| 2   | 2505* or 5444*  | Handle                             |
| 2   | MEH7W*          | Pipette holder                     |
| 1   | 3294            | Ground clip to wire 3' cable       |
| 1   | EP1             | Ag/AgCl pellet (70mm wire)         |
| 2   | MEH7B or MEH8B* | Optimal Handles                    |
| 2   |                 | Glass pipettes                     |



## Single Micropipette *(Add 1 mm glass micropipette)*



| Qty | Order No.         | Description                        |
|-----|-------------------|------------------------------------|
| 1   | 13388             | Mini banana to 2 mm socket adaptor |
| 1   | 13620*            | 2mm pin to 2mm pin 2' cable        |
| 1   | 2505* or<br>5444* | Handle                             |
| 1   | MEH7W*            | Pipette holder                     |
| 1   | 3294              | Ground clip to wire 3' cable       |
| 1   | EP1               | Ag/AgCl pellet (70mm wire)         |
| 1   | 2033              | Mini banana plug, black            |
| 1   |                   | Glass pipette                      |

**NOTE:** When ordering the **MEH7W** or other glass holder, include the appropriate suffix.

- **MEH1S-10** is used when ordering 1.0mm glass
- **MEH1S-12** is used when ordering 1.2mm glass
- **MEH1S-15** is used when ordering 1.5mm glass
- **MEH1S-20** is used when ordering 2.0mm glass

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# DECLARATION OF CONFORMITY



WORLD PRECISION INSTRUMENTS, LLC.  
Telephone: (941) 371-1003 Fax: (941) 377-5428  
e-mail [wpi@wpiinc.com](mailto:wpi@wpiinc.com)

## DECLARATION OF CONFORMITY CE

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

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

### DAM80

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

**Low Voltage Directive (Safety) 2014/35/EU:**

- EN 61010-1:2010+A1:2019

**EMC Directive 2014/30/EU:**

- EN IEC 61326-1:2021
- EN IEC 61326-2-3:2021

  
Cory Boyes, Director of Design and  
Development

**Issued On: December 12, 2022**

**Europe Representative**  
Mr Andrew Waldes  
Managing Director  
World Precision Instruments Germany GmbH,  
Pfungstweide 16, 61169 Friedberg, Germany

F-QC-006 Rev D

## 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 ten (10) days after receipt of shipment. Claims for lost shipments must be made within thirty (30) days of receipt of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim is settled. 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

Do not return any goods to us without obtaining prior approval and instructions from our Returns Department. Goods returned (unauthorized) by collect freight may be refused. Goods accepted for restocking will be exchanged or credited to your WPI account. Goods returned which were ordered by customers in error are subject to a 25% restocking charge. Equipment which was built as a special order cannot be returned.

## Repairs

Contact our Customer Service Department for assistance in the repair of apparatus. Do not return goods until instructions have been received. Returned items must be securely packed to prevent further damage in transit. The Customer is responsible for paying shipping expenses, including adequate insurance on all items returned for repairs. Identification of the item(s) by model number, name, as well as complete description of the difficulties experienced should be written on the repair purchase order and on a tag attached to the item.

*\* 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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