



DAM80

Differential Amplifier

www.wpiinc.com

INSTRUCTION MANUAL

Serial No. _____

032805



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World Precision Instruments

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DECLARATION OF CONFORMITY

We: World Precision Instruments, Inc.
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as the manufacturers of the apparatus listed, declare under sole responsibility that the product(s):

Title: DAM 80

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

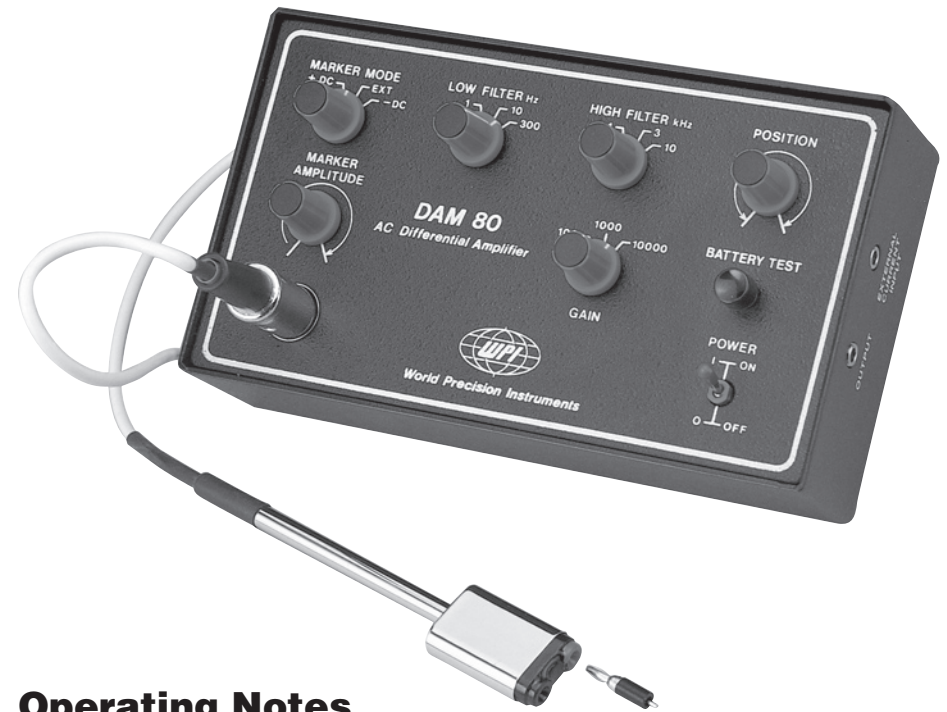
- Safety:** EN 61010-1:1993 (IEC 1010-1:1990)
- EMC:** EN 50081-1:1992
 EN 50082-1:1992

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.

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Operating Notes

Included in DAM80 is a MARKER current generator which can inject current through the input probe's inverting input terminal. **The MARKER MODE switch must be OFF when operating the amplifier**

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 will significantly diminish power line (mains) noise. It is essential that the preparation be connected to a good electrical ground and to the ground of the DAM80 itself. This will have the effect of greatly reducing electrostatically induced potential. In addition to the preparation ground, two differential input connections to the red (non inverting) and black (inverting) probe input connectors must be made via appropriate electrodes applied to the recording site so as to optimally record a bioelectric potential difference.

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

be connected to amplifier circuit ground using the clip and lead wire provided in the accessories package. The clip should be fixed to the probe handle (circuit ground) and the lead wire connected 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.

The Amplifier

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. A recorder or oscilloscope is connected via the cable provided to the OUTPUT connector on the right side of the amplifier case.

The LOW FILTER selector switch determines the lower cut off frequency. **NOTE that at 0.1 Hz setting the amplifier may take a long time to recover if the user inadvertently disconnects an input wire or if the input is exposed to an excessively large electrical signal.** This is a typical property of AC amplifiers set at very low frequency filter settings. For fast recovery from signal overload the user is advised to 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 0.1 Hz setting, while nerve action potential recording allows the use of the 10 Hz LOW FILTER setting without sacrificing signal quality.

The recorder or oscilloscope must be in the DC mode so that the DAM80's LOW FILTER settings will be as indicated. It is then necessary to use the POSITION knob to set the DAM80 output to zero or any convenient value so as to position the recording baseline.

The HIGH FILTER selector switch affects the amplifier's speed of response. The 10 kHz setting (widest band setting) enables the amplifier to respond most quickly to rapid signals. However, intrinsic and extrinsic amplifier noise is also enhanced by wideband operation. The user should therefore use the lowest band setting consistent with minimal degradation of the required bio-signal. For ECG and EEG 0.1 kHz will be adequate. For muscle potentials, HIGH FILTER settings of 3 to 10 kHz will be appropriate. Amplification is controlled by the GAIN selector switch.

Instrument POWER is provided by two alkaline 9-volt batteries. Battery operation results in lower internal noise level. Batteries can be tested by activating the BAT/CAL switch. If a short tone is heard, the batteries are functional. Conversely if the tone is absent, the batteries must be replaced.

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.*

The Current Generator

It is useful to be able to inject current via the input electrodes for the following possible reasons:

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

Note that the application of large currents through recording electrodes will often result in driving the amplifier output off scale until both electrodes and amplifier can recover.

Located at the left hand side of the DAM80 front panel are the controls for an on-board MARKER current source. This source allows the user to inject current through the inverting input (black) electrode. Note that this current flows through the electrode to preparation ground. The electrode can be an anode or cathode by selecting +DC or - DC respectively on the MARKER MODE switch. Rotating the magnitude of the MARKER AMPLITUDE control clockwise will increase the current, but the actual magnitude and time course of current flow will be determined by electrode geometry and polarization effects. The actual current flow can be monitored by placing a standard microampere current meter or a resistor* connected between the preparation ground electrode and the circuit ground (probe handle). The EXTERNAL CURRENT INPUT connector on the right side of the instrument case is provided so that timed or larger currents can be applied. The MARKER AMPLITUDE control is not functional in the EXT mode. Signals applied to this connector should not exceed ± 20 volts.

**An oscilloscope or recorder connected so as to view the voltage across this resistor will display the time course and magnitude of the current flowing from the electrode to ground. Note that the resistor must be as small as possible so as not to impair the effectiveness of preparation grounding. For example, a 1 K Ohm resistor will display 1 mV per microampere of electrode current. If only DC current is to be monitored, a large capacitor (for example, 10 microfarad, non-polar) across the monitor resistor is recommended to reduce possible noise.*

Changing the batteries

Remove the two small screws which secure the rear panel of the instrument. Replace the two old batteries with fresh ones. Secure the rear panel. Turn the POWER switch on and press the BAT/CAL switch for the audible "battery ok" signal. Although any of the common 9 volt transistor batteries will work well, alkaline cells are recommended for longer life. Replace batteries annually or as required.

Specifications

Input Resistance.....	>10 ¹² Ohms, common mode and differential
Input Leakage Current	50 picoamperes, max.
Amplification.....	100x, 1000x, 104x
Common Mode Rejection Ratio (CMRR).....	100 dB typ. @ 50/60 Hz
Equivalent Noise Signal Input (ENSI)	0.4 μV rms (2.0 μV p/p), 0.1-100 Hz 2.0 μV rms (10 μV p/p), 1 Hz-10 kHz
Bandwidth Filter Settings	
low frequency.....	0.1, 1, 10, 300 Hz
high frequency	100 Hz, 1, 3, 10 kHz
Output Voltage Swing.....	± 8 volts
Output Resistance.....	470 Ohms
Battery Test.....	1 second audible tone
Marker Current Source	D.C. current, variable, 0 to ±90 μA. External control voltage range of ±10 volts commands proportional current flow.
Power	2 nine-volt alkaline batteries, supplied
Input Probe.....	provided