



DAM50

Differential Amplifier



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INSTRUCTION MANUAL

Serial No. _____

082208

World Precision Instruments



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DECLARATION OF CONFORMITY

We: World Precision Instruments, Inc.
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USA

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

Title: DAM 50

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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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.*

Specifications

Input Resistance.....	>10 ¹² Ohms, common mode and differential
Input Leakage Current.....	50 picoamperes, max.
Amplification.....	100×, 1000×, 10,000× (AC) 10×, 100×, 1000× (DC)
Common Mode Rejection Ratio (CMRR)	100 dB typ. @ 50/60 Hz, 80 dB typ. @ 1 KHz
Equivalent Noise Signal Input (ENSI)	
AC amplifier (typ.).....	0.4 μV rms (2.0 μV p/p), 0.1-100 Hz 2.0 μV rms (10 μVp/p), 1 Hz-10 kHz
DC Amplifier.....	6.0 μV rms (30 μV p/p), 3-10 kHz
Bandwidth Filter Settings	
AC	low frequency 0.1, 1, 10, 300 Hz AC
and DC	high frequency 100 Hz, 1, 3, 10 KHz
Output Voltage Swing	± 8 volts
Output Resistance.....	470 Ohms
Battery Test.....	1 second audible tone
Calibrator Signal	10 Hz square wave, amplitude 100 microvolts (at 1000× and 10,000×), 1 mV (at 100×) and 10× DC.
Power	2 nine-volt alkaline batteries, supplied
Input Cables	2 miniature flat strip cables with connectors are provided.



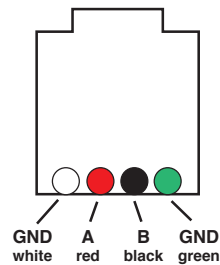
Differential Amplification

Differential amplification is of great importance in bioelectric recording to reduce the ever present effect of noise interference from power line induction. A well designed differential amplifier will significantly diminish power line (mains) noise. It is most essential that the preparation be connected with an electrode to a good electrical ground as well as to the grounding wire of the DAM50 itself. This should have the effect of greatly reducing electrostatically induced potential. In addition to the preparation ground, two differential input connections must be made via appropriate electrodes applied to the recording site so as to optimally record a bioelectric potential difference.

The Amplifier

INPUT to the DAM50 amplifier is made via a flexible, flat, 4-wire cable terminated in a miniature telephone-style plug. Individual wires can easily be peeled from the cable strip and attached by the user to the style of electrode best suited to the particular application. The length of the cable should be cut as short as possible to minimize shunt capacity (see discussion below). Designation of the four wires is indicated on the mating panel receptacle. The INPUT SELECT switch allows the user to choose A,B (inverting) or differential A-B. It is recommended that, while the electrodes are being connected, amplifier inputs should be grounded with the INPUT SELECT switch to avoid input overload which may result in excessive recovery time as described below. Further, inputs A and -B must be connected to a ground return path. In A-B mode, if either input is not placed on the preparation, it must be connected to ground. Note that in A or -B INPUT SELECT modes, the input not selected is grounded internally. The recorder or oscilloscope is connected via the cable provided to the OUTPUT connector on the right side of the amplifier case.

#3517 Cable



Amplification is controlled by the GAIN selector switch. Note that amplification is ten times larger in the AC mode than in the DC mode.

Electrode Impedance

If electrodes of very high impedance are used, electrostatic induction will induce objectionably large noise signals. It may then be necessary to enclose the electrode and cable with an electrostatic shield (keep the cable length short) or alternatively to shield the entire recording area (The DAM80, a companion instrument in the DAM amplifier series, is especially designed for high impedance electrode recording).

Filters

The LOW FILTER selector switch determines the lower cut off frequency when the user is in the AC MODE. 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 artifact. 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.

Testing the Amplifier

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. An additional function that the BAT/CAL switch performs is to provide a low frequency square wave test signal which is applied to the amplifier input. The amplitude of this signal is 100 microvolts when operating in either of the two highest GAIN positions and 1 millivolt in the lowest GAIN position.

Mode	Gain	Cal signal	Output
DC	10×	1 mV	10 mV
DC	100×	1 mV	100 mV
DC	1000×	100 μV	100 mV
AC	100×	1 mV	100 mV
AC	1000×	1 mV	1000 mV
AC	10,000×	100 μV	1000 mV

To test the amplifier with this signal, switch the INPUT SELECT switch to GND. Press the BAT/CAL switch. After the audible tone ceases, observe the resulting output signal on an oscilloscope or pen recorder. The resulting wave shape will depend upon the LOW and HIGH FILTER bandwidth settings and will appear more “flat topped” at the 0.1 Hz setting.

AC or DC recording?

It should be noted that DC recording with metal electrodes will invariably result in excessively large galvanic potentials being applied to the amplifier’s input terminals. This can result in overdriving the amplifier so that the POSITION control will not be able to restore the operating baseline’s position. In this case, use Calomel or Ag-AgCl electrodes, or use an external variable bucking potential; alternatively, resort to AC recording.

Batteries

Changing the batteries is easily accomplished. Remove the four small screws which secure the FRONT panel to the enclosure of the instrument. Replace the two old batteries with fresh ones. Secure the FRONT panel to the enclosure. 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 needed. These batteries are available world wide.