

OPERATION MANUAL

DP-304

DIFFERENTIAL AMPLIFIER 4 CHANNEL

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1.0 DESCRIPTION

The model DP-304 is a line powered ac/dc amplifier offering very low noise, high gain and excellent common mode rejection. DP-304 is designed for amplifying signals such as EEG, EKG and extracellular action potentials. With gain selections of x100, x1000 and x10,000, microvolt level signals are sufficiently amplified for computer signal analysis.

The unit features both high pass and low pass filters, each with 4 switch settings. A front panel calibrate push button effectively applies 1mV pulse to the amplifier input to check intermediate gains and support equipment.

OPERATING CONTROLS

The following is a description of each of the front panel controls.

MODE- Selects whether the amplifier will be AC or DC coupled. Naturally when DC coupling is selected the HIGH PASS FILTER switch is disabled.

(+) (-) INPUT - Turning the input switches to OFF grounds the inputs to the amplifier. To record in the single ended mode, turn (-) INPUT to OFF, (+) INPUT to ON and connect signal to (+) INPUT BNC. To record differentially turn both (+) and (-) input switches to ON and connect signals to (+) and (-) BNCs.

LOW PASS FILTER - This is a 4 position rotary switch used to select the desired frequency response: 0.1, 1.0, 3.0, or 10KHz. The front panel markings indicate the 1/2 power amplitude, (-3dB) $\pm 20\%$.

HIGH PASS FILTER - This is a 4 position rotary switch used to select the desired frequency response: 0.1, 1.0, 10 or 300Hz. The front panel markings indicate the 1/2 power amplitude, (-3dB) $\pm 20\%$. Note that the overload recovery time in the AC mode is somewhat dependent on the HIGH PASS FILTER setting. The 0.1 Hz setting requires the most time to recover, the 300Hz the least.

GAIN - This is a 3 position rotary switch used to select the following gain settings: 100, 1000, 10,000. The accuracy is 2%.

DC LEVEL - Provides up to $\pm 600\text{mV}$ of DC offset at the output BNC, in both the DC and AC modes.

CAL TEST - Produces a 1mV square wave @ 10Hz, (referred to the input) when the button is pushed and held. Both the (+) and (-) input switches must be in the off position to use this feature.

2.0 SPECIFICATIONS

VOLTAGE GAIN	100,1000,10,000 AC and DC $\pm 2\%$
INPUT RESISTANCE	$10^{12}\Omega$, typical
INPUT LEAKAGE CURRENT	50 pA, typical
COMMON MODE REJECTION	100,000 min. @ 60Hz
NOISE LEVEL, 1Hz to 10KHz (input shorted)	10 microvolts (p-p)
HIGH PASS FILTER SETTINGS	-3db @ 0.1, 1, 10, and 300Hz
LOW PASS FILTER SETTINGS	-3db @ 0.1, 1, 3 and 10KHz
MAXIMUM COMMON MODE SIGNAL	± 3 Volts
MAXIMUM ALLOWABLE INPUT VOLTAGE	± 10 Volts
OUTPUT VOLTAGE SWING	± 10 Volts
OUTPUT CURRENT	± 10 mA
OUTPUT RESISTANCE	220 Ohms
INPUT & OUTPUT CONNECTORS	BNC
POWER REQUIREMENTS	100 - 125, 220-240 VAC, 50/60 Hz.
CALIBRATION SIGNAL	1mV peak to peak @ 10Hz, referred to the input.
DC POSITIONING LEVEL	± 600 mV

OPERATING INSTRUCTIONS

TESTING THE DP-304

Before beginning an experiment it may be a good practice to perform this simple test to verify the amplifiers performance.

Set the front panel controls as follows: **MODE** switch to **AC**, **(+) INPUT** and **(-) INPUT** to **OFF**, **HIGH PASS** switch to **0.1Hz**, **LOW PASS** to **10KHz**, **GAIN** to **X1000**. Connect the **OUTPUT BNC** to an oscilloscope, turn the DP-304 power to **ON**. Allow about 15 seconds for the filter capacitors to charge up, then adjust the **DC LEVEL** control to set **OUTPUT** of DP-304 to zero. Push and hold the **CAL** button, there will be a 1 volt peak to peak square wave at approximately 10Hz at the output of the amplifier.

CONNECTIONS TO DP-304

INPUT

When connecting the DP-304 to a signal, the outer shell of the BNC connector (shield of coax cable) is instrument ground and the inner conductor is the input to the amplifier. When recording in the differential mode it is only necessary to use one of the shields from the coax cable to ground the preparation.

OUTPUT

When the DP-304 is connected to a recording device such as an oscilloscope or a chart recorder, the DP-304 circuit and chassis ground are automatically connected to earth ground through the recording device. To avoid this grounding, the recording device should be battery operated or otherwise isolated from earth ground.

NOTE: DP-304 IS NOT INTENDED FOR USE WITH HUMANS.

ELECTRODES & INTERFERENCE

The resistance of the electrode(s) used is a large factor in the amount of noise and interference (line and RF) experienced. As a general rule, electrodes with the lowest possible resistance consistent with the experiment requirements should be employed. The resistance of metal or Ag-AgCl electrodes are usually low and are not a problem. Glass, carbon fiber or other special types can have resistances of 1 megohm or more and will require the use of shielded input cables and shielding of the experimental site. Connection from electrode to the input cable must also be kept as short as possible to achieve good results.

To further minimize interference from machinery and other line powered equipment, it should be located away from the experimental site.

Power cords should be routed away also or shielded. In very difficult situations, a Faraday cage may be required.

AC or DC MODE

The mode of operating will be dictated by the bandwidth requirements of the experiment, and the type of electrodes used. If DC recording is attempted with metal electrodes, the large galvanic potentials inherent with these electrodes can result in overdriving the input making it impossible to zero the amplifier. This can be remedied by introducing an external bucking potential or switching to the AC mode.

FILTERING

The LOW PASS (high frequency) and HIGH PASS (low frequency) filters allow for selection of the desired bandwidth. In the DC mode of operation, the HIGH PASS filter is inoperative.

SERVICE

Questions on service should be referred to our engineering department. Normal business hours 8:30 A.M. to 5:00 P.M. EST, Monday to Friday.

Telephone: 203-776-0664

Fax: 203-776-1278

WARRANTY

Model DP-304 is warranted to be free from defects in materials and workmanship for a period of two years from the date of shipment. If a failure occurs within this period, we will repair or replace the faulty component(s). This warranty does not cover failure or damage caused by physical abuse or electrical stress (exceeding specified input limits).

Shipping charges to the factory are the customer's responsibility. Collect shipments will be refused.

Return shipping of the repaired unit will be paid by WIC.