

Warner Instruments 4 – Channel Differential Amplifier Model DP-304A



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The **DP-304A** is designed for amplifying signals such as EEG, EKG and extracellular action potentials. With gain selections of x10, x100, x1000 and x10,000, μV level signals are sufficiently amplified for computer signal analysis. The input impedance is typically $10^{12} \Omega$ and the input leakage is typically 1 pA.

The unit features high pass and low pass filters, plus a DC operation mode. An input-offset control nulls potentials present at the input, which can be seen at the output in DC mode. Each channel features a test mode that applies 1 mV pulses to the input to check operation of the entire system.

The **DP-304A** is powered by AC line power and contains no batteries. The line voltage covers a range of 100-130 or 220-240 VAC at 50 or 60 Hz.

Principal features of the **DP-304A** include:

- Low noise
- Gains to x10,000
- Bandwidth to 50 KHz
- Excellent common mode rejection
- Internal 2-pole low-pass Bessel filter
- Internal 2-pole high-pass filter
- Compact design

**THIS EQUIPMENT IS NOT DESIGNED NOR INTENDED
FOR USE ON HUMAN SUBJECTS**

NOMENCLATURE

Text conventions

This manual refers to amplifier controls at two functional levels; specific controls and the settings of these controls. To minimize the potential for confusion, we have employed the following text conventions.

- Product numbers are presented using bold type.
- References to a specific control are specified using CAPS.
- References to individual control settings are specified using italic type.
- Special comments and warnings are presented in highlighted text.
- Any other formatting should be apparent from context.

Since it is our goal to provide clarity rather than complexity, we welcome any feedback you may wish to provide.

CONTROL DESCRIPTION

The front panel of the **DP-304A** houses the TEST SWITCHES, an INPUT OFFSET CONTROL, the HIGH PASS FILTER and LOW PASS FILTER controls, a GAIN CONTROL, OUTPUT BNC, and POWER SWITCH.

The CIRCUIT and CHASSIS GROUNDS are located on the rear panel of the **DP-304A**. The power cord attachment and fuse are also located on the rear panel.

Front panel



Offset Control

The INPUT OFFSET CONTROL provides DC offset to the amplifier inputs. The instrument is capable of providing offsets up to ± 600 mV in DC mode.

CLIPPING LIGHTS indicate clipping of the amplifier output. Two LEDs are provided to indicate clipping high or clipping low. Clipping offsets can be adjusted using the OFFSET CONTROL. The OUTPUT BNC is also located in this section and provides connection to a chart recorder, oscilloscope or data acquisition system.

High-pass filter

The **HIGH-PASS FILTER** sets the low frequency limit of the amplifier from DC to 300 Hz in 6 steps of DC, 0.1, 1, 10, 100, and 300 Hz.

While placing the amplifier in DC mode disables the high-pass filter, all other controls remain active.

Low-pass Bessel filter

The 2-Pole LOW-PASS BESSEL FILTER sets the high frequency limit of the amplifier from 100 Hz to 50 kHz in 6 steps of 100, 500, 1000, 5000, 10,000, and 50,000 Hz.

Gain Control

The gain control sets the overall system gain from 10 to 10,000 in 4 steps.

Compliance

Compliance is ± 10 volts.

Power

The power section contains an ON – OFF switch and LED which indicates when power is applied to the unit.

Rear Panel

The rear panel of the **DP-304A** houses the FUSE/POWER ENTRY MODULE, CIRCUIT and CHASSIS GROUNDING JACKS.

SETUP AND TEST

Setup

Setup of the **DP-304A** is simple. Place the amplifier near your experiment and connect the power cable to the rear of the instrument. Run a BNC from the OUTPUT of the **DP-304A** to your data collecting apparatus (e.g. data acquisition system). Connect the input cables to your electrodes, (+) only for single ended recording and both (+) and (-) cables for differential recordings. Setup is complete.

NOTE: Be sure the POWER SWITCH is off before plugging the amplifier in.

Test

Before beginning an experiment, it's a good practice to perform a simple test to verify that the **DP-304A** is functioning properly.

1. With the power off set the front panel controls as follows:

HIGH-PASS (Hz)	DC
LOW-PASS (Hz)	10 kHz
GAIN	1000

2. Connect the **DP-304A** OUTPUT BNC to an oscilloscope or your data acquisition system.

3. Adjust the OFFSET CONTROL for a zero-volt baseline on the oscilloscope.

4. Set the HIGH-PASS FILTER control to 0.1 Hz

5. Allow time for the baseline to return to zero.

6. Set the input select toggle switch to the OFF position and push and hold in the TEST button. When the TEST BUTTON is depressed, the TEST INDICATOR LED will be on and the amplifier will enter test mode.

7. In test mode, the input is connected to a 1 mV p-p square wave at 100 Hz. This signal will appear as a 1 V p-p square wave at the OUTPUT BNC when the instrument gain is at 1000. Note that both CLIPPING INDICATORS are off.

OPERATION

The amplifier can be placed in either AC or DC modes and can be used for either differential or single-ended recordings. Therefore, four configurations are possible.

AC mode

In AC mode, the internal amplifiers are capacitive coupled (AC coupled) through a DC blocking capacitor. This prevents pure DC from entering the amplifier. As a result, the amplifier output will return to baseline in the presence of a constant potential difference at the headstage inputs.

The amplifier is placed in AC mode by selecting a cut off frequency other than DC (e.g., 0.1, 1.0, 10, 100, or 300 Hz) using the HIGH PASS FILTER control. AC mode is useful for recording biopotential signals such as EEG, EMG, and ECG.

DC mode

In DC mode, the internal amplifiers are direct coupled (DC coupled). As a result, a constant potential difference at the inputs will be passed to the amplifier output.

DC mode is useful for making measurements through high impedance fluid filled microelectrodes. Warner Instruments manufactures a complete line of microelectrode holders useful in connecting microelectrodes to the **DP-304A** inputs.

The following electrode holders are recommended for use with **DP-304A** :

Holder	Model	Order #
for 1.0 mm OD glass	E45P-F10NH	64-1023
for 1.2 mm OD glass	E45P-F12NH	64-1024
for 1.5 mm OD glass	E45P-F15NH	64-1025
for 2.0 mm OD glass	E45P-F20NH	64-1026

Input Connections

The BNC's on the front panel represent the positive and negative inputs of a differential amplifier and the outer shell of these BNC's are connected to the system ground.

For differential recordings, use both the (+) and (-) inputs and one or both of the BNC outer shells for ground. Set the input toggle switch to the DIFF position.

For single-ended recordings, use the (+) input and one of the BNC outer shells for ground.

Set the input toggle switch to the center position, this automatically grounds the (-) input, leaving the (+) input BNC active.

Output Connection

The OUTPUT BNC connector on the front panel is the output of the amplifier. It is used to tie the **DP-304A** to an oscilloscope or recording device. If a data acquisition system is used, it must be capable of resolving a ± 10 V signal.

When the OUTPUT BNC of the **DP-304A** is connected to an oscilloscope (or recording device), the ground of the oscilloscope will be carried through to the input via the common ground.

Consequently, any part of the experiment that is tied also to the input ground will be connected to the oscilloscope ground.

NOTE: Under these conditions, any additional grounds connected to the input will create a ground loop in the system.

APPENDIX

Specifications

Voltage Gain:	x10, x100, x1000, x10,000
Input Resistance:	$10^{12} \Omega$ typical
Input Leakage Current:	1.0 pA typical
Common-mode Rejection:	120 dB minimum @ 60 Hz
Noise, input shorted:	< 10 μ V p-p, 1.0 Hz to 10 kHz
Front-panel test signal:	1.0 mV p-p @ 100 Hz square wave

Filters

Low-frequency (high pass):	DC, 0.1, 1, 10, 100, 300 Hz
High-frequency (low pass):	100, 500, 1k, 5k, 10k, 50k Hz
Maximum Common-mode signal:	± 10 V
Output voltage swing (10k load):	± 10 V
Offset control range:	± 600 mV at output (DC mode), any gain
Output Resistance:	50 Ω
Input connectors:	two BNC
Output connector:	BNC
Power Requirements:	100-130 or 220-240 VAC, 50/60 Hz (selector switch)

Operating Conditions:

Equipment is intended to be operated in a controlled laboratory environment.

Temperature: 0-40 °C Altitude: sea level to 2000 m Relative humidity: 0-95%

Warranty

The **DP-304A** is covered by our Warranty to be free from defects in materials and workmanship for a period of one year from the date of shipment. If a failure occurs within this period, we will either repair or replace the faulty component(s). This warranty does not cover failure or damage caused by physical abuse or electrical stress (e.g., inputs exceeding specified limits).

In the event that repairs are necessary, shipping charges to the factory are the customer's responsibility. Return charges will be paid by Warner Instruments.

Service

We recommend that all questions regarding service be referred to our Technical Support Department. We are located at 1125 Dixwell Avenue, Hamden, CT 06514. Normal business hours are Monday through Friday, 8:30 AM to 5:00 PM (EST). We can be reached by phone at (800) 599-4203 or (203) 776-0664. Our fax number is (203) 776-1278.

E-mail us at support@warneronline.com or through the contact section of our website at <http://www.warneronline.com>.

WEEE/RoHS Compliance Statement

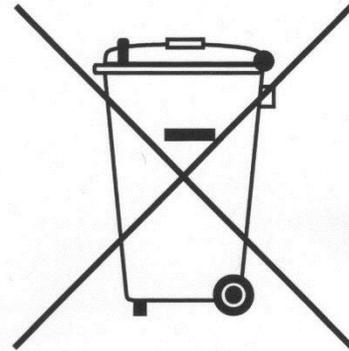
EU Directives WEEE and RoHS

To Our Valued Customers:

Harvard Apparatus is committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for those Harvard Apparatus products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive - Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of Harvard Apparatus' products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. Harvard Apparatus will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.



- Do Not Dispose Product with Municipal Waste.
- Special Collection/Disposal Required.