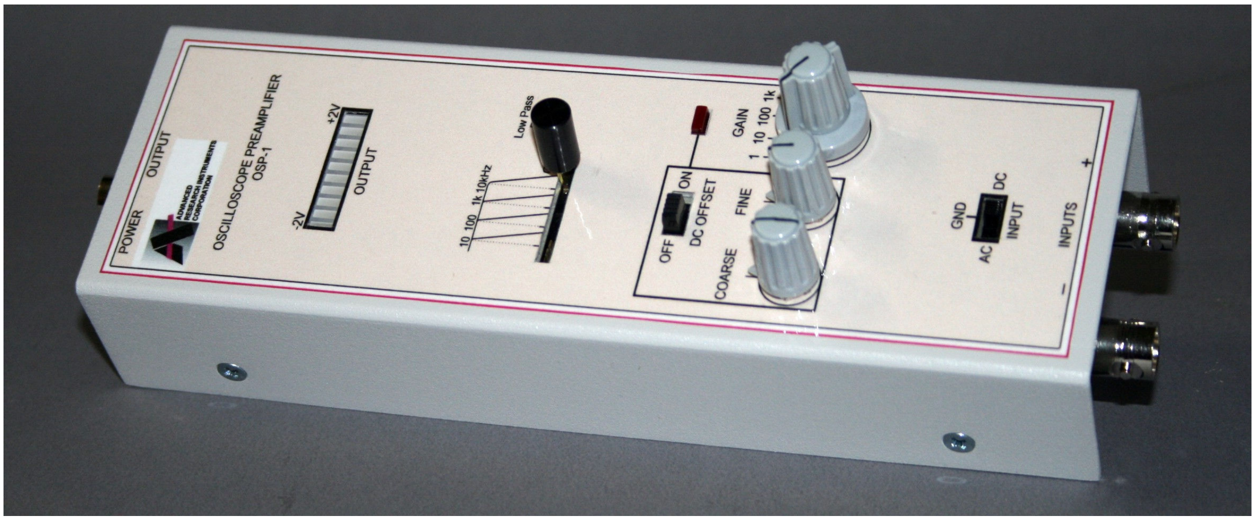
Model OSP-1



Oscilloscope Preamplifier
with Low Pass Filter

USER MANUAL

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Revision V1

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Specifications:

Amplifier Type	AC/ DC Coupled Amplifier
Gain	1X, 10X, 100X, 1000X
Input and DC Offset	±1.5VDC at 1X Gain
Bandwidth	1.5 MHz at 1X Gain
AC input Low Frequency	1.5 Hz [-3dB]
Common Mode Rejection	90-100 dB Typical
Input Equivalent Noise	<0.5 μV RMS at DC –10Hz Bandwidth
Low Pass Filter	Full Bandwidth, 10kHz, 1kHz, 100Hz, and 10Hz
Input Impedance	1MΩ each input
Input Probes	Two Oscilloscope Probes [attenuated to 1X or 10X]
Input Overload Protection	±100V max.
Output Overload Monitor	10 element LED Bar Graph
Power	+12DC Wall Power Supply [50mA]
Output	±3V
Size	2.3” wide X 2.0” high X 8.0” long
Weight	9 oz [250 g]

Features:

- High Gain [1000X]
- Difference Input
- High Common Mode Rejection
- AC/DC Input Coupling
- Variable Low Pass Filter
- DC Offset Control
- Output Overload Monitor
- Power Supply Included
- Low Noise
- Wide Bandwidth
- Input Overload Protection

Applications:

- Sub-millivolt signals monitoring
- Noise measurement at different bandwidths using the Low Pass Filter!
- Assistance for low noise circuit design and troubleshooting.
- Signal recovery from H.F. noise at high common mode voltages.
- Monitoring true difference voltage between probe 1 and probe 2.
- Sensor evaluation.
- Sensitive amplifier for experiments in physics, chemistry or biology.

INTRODUCTION

Accuracy and precision of all measurements are limited by the ever present noise. Although there are typically a number of other limitations present as well, the noise is the single limiting parameter always present. Noise can be reduced but not eliminated. The noise reduction techniques are many but the following two are the most popular: a. filtering and b. signal averaging. Intuitively you can call them as related. The OSP-1 uses multi-order active low pass filters. In addition to the LP filter the high gain and the difference input, the OSP-1 provides us with a sophisticated tool for measuring signals between any two points in a circuit. This helps to understand the circuits behavior better than a single point referenced to ground [typical oscilloscope measurement].

The purpose of the Oscilloscope Preamplifier is threefold:

1. Amplify sub-millivolt signals for presentation to an oscilloscope with a typical sensitivity of 10 mV/division.
2. Amplify sub-millivolt difference signals in the presence of high DC bias (such as the voltage drop or ripple between two points on a 5V power distribution line) by utilizing the high common mode rejection of the difference input.
3. Extract low level signals from within high frequency interference by using a low pass filter which presents a clear waveform to the oscilloscope.

SPECIFIC APPLICATIONS.

Circuit Design Verification.

A perfectly correct electronic circuit on paper may not perform well as a finished printed circuit board. The reason is either a poor layout by an inexperienced board designer or a layout mistake that can degrade the performance of the circuit to an unacceptable level. The difference between an ideal circuit (a schematic) and the real circuit (a PC board) may be difficult to pinpoint. The OSP-1 amplifier may be the only device that can be helpful in tracing the signals, ground returns, and interference between traces since here we are dealing typically with such minute signals that an oscilloscope alone tends to be useless.

Another application in system design is a verification of a given sensor [transducer] signal level. Since many sensors produce sub-millivolt signals, the oscilloscope alone is pretty much useless. With the OSP-1 and an oscilloscope we can confirm the specifications of a given sensor and even verify the function of the input signal conditioning network when applicable. Then the circuit designer can proceed with the design based on real measured data of the actual input circuit rather than be totally dependent on published specifications. This prevents bad surprises and leads to a speedy and reliable design.

Troubleshooting.

The high sensitivity [down to 10 µV for 10 mV/div oscilloscope display] allows us to determine the source of malfunction of a system by tracing the signal from the transducer, where the signal is below the sensitivity of an oscilloscope, to the output of the given system. This example may resolve the question, “what is not working?” Is it the sensor itself (microphone, transducer etc.) or the preamplifier?

Although the above example may be resolved by trial and error, [replace one unit at a time and see what happens] a potential noise problem must be resolved by a more systematic approach; i.e. tracing the signal from the source to the output. Here again, the typically low sensitivity of oscilloscopes prevents us from monitoring anything below a few millivolts and we may be limited to examining high level signals only.

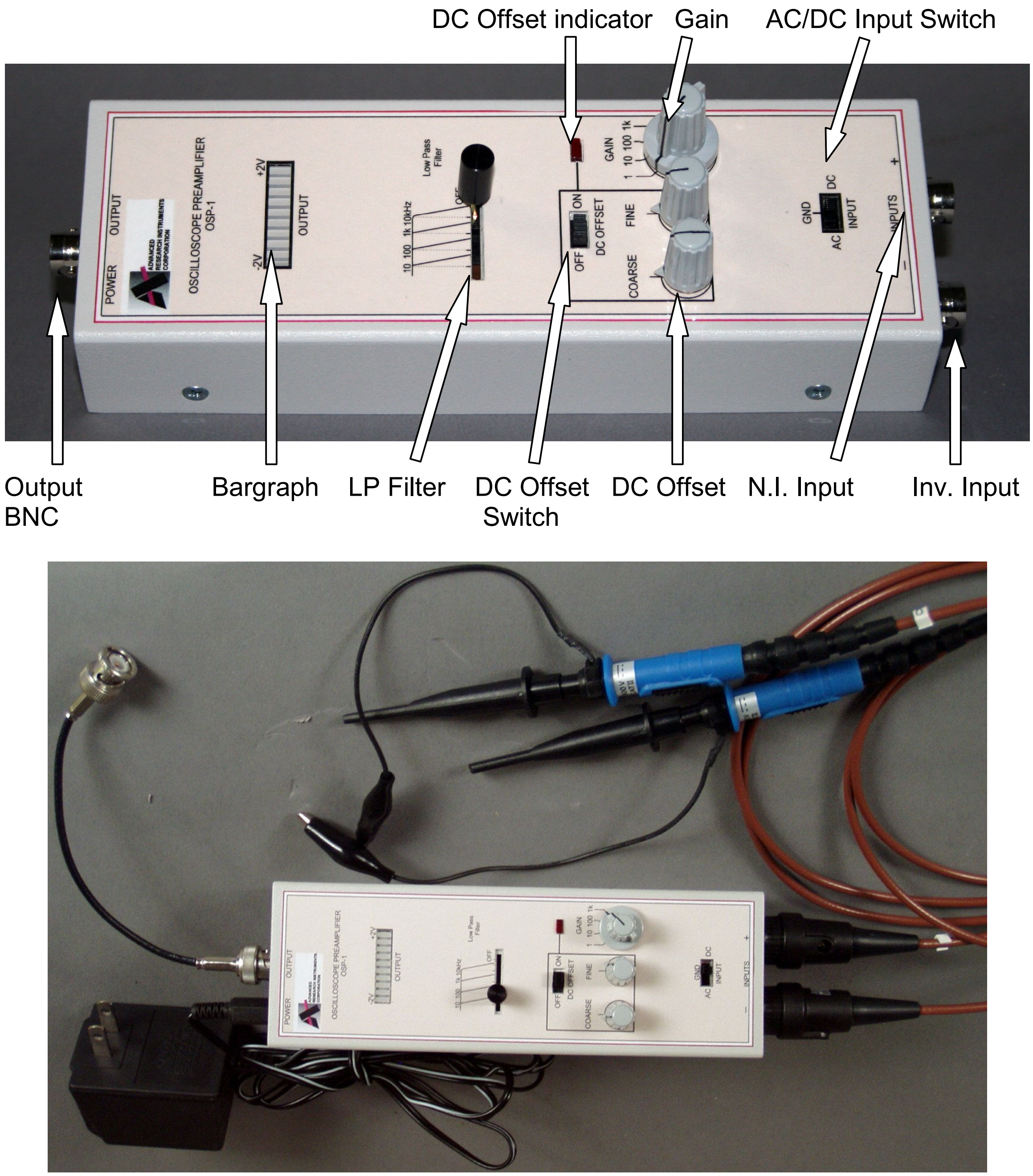

Fig. 1. OSP-1 Controls and Accessories.