proAmp-8
Instruction Manual

Read instructions carefully before operating this device.

❶ *This device is not to be used for Human Life Support applications.*

❷ *To avoid possible electrical shock, do not operate this device if is wet or has had liquids spilled onto it.*

❸ *Service or calibration procedures should only be performed by qualified personnel familiar with the electrical hazards of line-powered devices.*

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IF THIS INSTRUMENT FAILS WITHIN A PERIOD OF ONE YEAR FROM THE DATE OF DELIVERY OR INSTALLATION, CWE, INC. WILL, AT ITS OPTION, REPAIR OR REPLACE IT FREE OF CHARGE. THIS WARRANTY EXCLUDES DAMAGE INCURRED THROUGH MISUSE OR ACCIDENT. CWE, INC. DOES NOT ASSUME ANY LIABILITY FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THIS INSTRUMENT.

DEFECTIVE UNITS SHOULD BE RETURNED TO THE FACTORY ALONG WITH A NOTE DESCRIBING THE NATURE OF THE FAULT. THIS WARRANTY IS APPLICABLE TO THE ORIGINAL PURCHASER OF THE INSTRUMENT ONLY, AND IS NOT TRANSFERABLE.

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1.0 INTRODUCTION

The proAmp-8 is a versatile eight-channel amplifier suitable for biopotential recording or transducer signal conditioning. Each primary channel features a wide gain range, sharp cutoff low-pass filters, and independent high-pass (coupling) settings for the (+) and (-) inputs. A built-in notch filter can be set for 50 or 60Hz. Pushbutton auto-zeroing removes small output offset voltages, and can be applied to one channel or all eight simultaneously.

In addition to eight primary amplifier channels, there are two audio channels. These audio channels are independent, and can be set to monitor any of the eight primary channels as well as an external input. The audio channels can function as straight amplifiers (with adjustable baseline thresholds), or as VCO (Voltage Controlled Oscillator) signal processors which produce varying tones proportional to the input signal.

The proAmp-8 can be operated as a completely stand-alone instrument, with all amplifier settings made using the front panel controls. Additionally, built-in remote control functions allow it to be operated by a host PC using a USB port.

Figure 1: proAmp-8 Front Panel

2.0 OPERATION

2.1 SETTING UP THE PRIMARY AMPLIFIER FUNCTIONS

All basic amplifier functions and settings are accessible using the controls at the left-hand side of the front panel (see *Figure 2*, below). The eight pushbuttons select the desired function (**CHANNEL**, **GAIN**, etc.), and the **ADJ** knob is used to change the setting. In most cases, a specific function can be exited, and a new function selected just by pressing a different function pushbutton. A red LED next to each pushbutton indicates which function is currently active. All amplifier settings are made independently for each channel, and are stored in non-volatile memory. The following sections describe each function in detail.

Figure 2: proAmp-8 main control panel and LCD

2.2 CHANNEL SELECT FUNCTION

When the **CHANNEL** pushbutton is pressed, you can select any of the eight channels to be the *current channel*. When the **ADJ** knob is rotated, the current channel will be shown on the display (e.g., CHAN:8). When making any changes to any of the amplifier settings, be sure the desired channel is displayed. Any time a setting is changed, the present channel red LED will blink.

2.3 GAIN SETTING FUNCTION

The overall amplifier gain can be set to any of the following settings:

1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1000, 2500, 5000, 10,000, or 20,000

Be sure to choose an appropriate gain setting for your signal. Too high a gain may result in *clipping* of the signal, where the positive and negative output excursion exceeds the ±12V limits of the amplifier. Too low a gain will result in an output signal too small for accurate digitization if subsequent a/d conversion is performed. The correct gain setting will produce an output consistent with the input requirements of your monitoring or acquisition system (often ±5V or ±10V).

2.4 AUDIO CHANNELS SOURCE SELECT FUNCTION

The **AUD CH** function is used to set the source for each of the two audio amplifier channels. When this function is first selected, rotating the **ADJ** knob selects the source for audio channel 1. When rotating the knob, observe that a green LED will light above the selected amplifier channel, just below the speaker icon. The selected channel will also be displayed on the LCD panel (e.g., AUD1:6).

After the source is set for audio channel 1, press the **ADJ** knob. Now, rotating the **ADJ** knob will be used to select the source for audio channel 2. A red LED will light above the selected channel, and the channel will also be displayed on the LCD (e.g., AUD2:7).

Press any function pushbutton or the **ADJ** knob to exit and switch to another function.

Note that the source for the audio channels includes channels 1 – 8, as well as the **EXT AUDIO IN** jack on the rear panel. If the external source is selected, no LED's will light, but the display will show AUD1:EXT.

2.5 HIGH-PASS FILTER (COUPLING) SETTING FUNCTION

The input coupling settings, or high-pass filters, are set separately for the (+) and (-) amplifier inputs. The **HI-PASS +** and **HI-PASS –** pushbuttons are used to make these settings. The available settings are:

GND, DC, 0.1Hz, 0.3Hz, 1Hz, 3Hz, 10Hz, 30Hz, and 100Hz

In most cases, both the (+) and (-) settings should be made the same. An exception to this is the GND setting, which is used to ground the negative amplifier input when using a single-ended input signal via the front panel **IN+** BNC jack.

2.6 LOW-PASS FILTER SETTING FUNCTION

The proAmp-8 is equipped with digitally controlled sharp cutoff, 8^{th}-order low-pass filters. This is used to set the high frequency limit of the amplifier. The available frequency settings are:

5Hz, 10Hz, 30Hz, 50Hz, 100Hz, 300Hz, 1kHz, 3kHz, 5kHz, 10kHz, and 20kHz

This filter should be set to the lowest frequency consistent with the signal being monitored. The low-pass filter in conjunction with the high-pass filter forms a band-pass function to limit the amplifier response to the frequencies of interest.

2.7 NOTCH FILTER SETTING FUNCTION

When the **NOTCH** function is selected, rotating the **ADJ** knob will allow selection of four possible notch filter settings:

N60/OFF -- 60Hz setting, notch filter inactive

N60/ON -- 60Hz setting, notch filter active

N50/OFF -- 50Hz setting, notch filter inactive

N50/ON -- 50Hz setting, notch filter active

The notch filter selectively attenuates the signal at the selected frequency. This is helpful in reducing line-frequency interference from your signal. The frequency to use is determined by your line, or mains frequency.

2.8 AUTO ZERO OUTPUT FUNCTION

Pressing any of the channel **ZERO** pushbuttons causes the following actions:

1. The channel low-pass filter is temporarily set to the lowest setting, 5Hz. This damps out any pulsatile components of the signal and effectively averages it.

2. The DC level of the output signal is monitored by an internal a/d converter.

3. A corrective DC offset voltage is computed and added or subtracted, causing the output voltage to be close to zero volts.

4. The low-pass filter is restored to the previous user setting.

During the zeroing process, the green channel LED will be lit. If the DC offset voltage is too great to be corrected, this LED will turn red and blink. You can press the **ZERO** pushbutton again for another try if this happens, as sometimes the offset may be too great to correct in one pass.

*Note: If you press and hold the **ADJ** knob when pressing any of the channel **ZERO** pushbuttons, the auto zero function will be applied to all eight channels at the same time.*

3.0 SECONDARY AMPLIFIER FUNCTIONS

3.1 FUNCTION PUSHBUTTON

The **FUNCTION** pushbutton on the main control panel brings up a menu of additional lesser-used functions. Rotate the **ADJ** knob until the pointer is adjacent to the desired function. Press the **ADJ** knob to activate that function. Press any of the other function select pushbuttons to exit.

3.11 INTERNAL ZERO ALL FUNCTION

The **INTERNAL ZERO ALL** function corrects the small internal DC offsets in the amplifier circuitry. This is accomplished by internally grounding the amplifier (+) and (-) inputs, monitoring the output voltage, and applying a corrective offset. This offset is stored in non-volatile memory.

*Note: This function is different from the **AUTO ZERO** function, which leaves the input signal connected.*

3.12 SET mV OFFSET FUNCTION

The **SET mV OFFSET** function allows the user to apply a small DC offset to the signal output. Rotate the **ADJ** knob until the pointer is adjacent to the desired function. Press the **ADJ** knob to activate that function.

The amount of possible offset depends on the current channel gain setting, and is automatically limited during the setting operation.

3.13 IMPEDANCE CHECK FUNCTION

<Future function>

4.0 AUDIO CHANNELS

Each of the two audio channels can function as a simple audio amplifier, or as a VCO (Voltage Controlled Oscillator) channel. The outputs are capable of driving external speakers directly, or can be used with powered speakers (i.e., the type that has its own built-in audio amplifier). The input signal to either audio channel can be any of the eight primary amplifier channels, or an external input.

4.1 AMPLIFIER MODE

When the **VCO**/**AMP** switch is set to **AMP**, the audio channel operates as an audio amplifier. The **FREQ**/**SQUELCH** knob is used to set a *threshold*, above which the signal is passed to the amplifier. This threshold can be set above the baseline noise level to pass only spikes (or other signal of interest).

4.2 VCO MODE

When set to **VCO** mode, the output of the amplifier is a frequency (or tone) proportional to the voltage of the input signal. This function is useful for monitoring changing DC levels of the signal. The **FREQ**/**SQUELCH** knob is used to set the baseline frequency.

5.0 REAR PANEL CONNECTIONS

The rear panel contains the amplifier outputs, external audio input, a multi-pin output monitor, USB connector for remote control, and the power supply connection. Each of these is described below.

Figure 3: proAmp-8 rear panel connections

5.1 OUTPUT JACKS

The eight BNC jacks labeled **OUT1** – **OUT8** provide the amplified signal outputs. The maximum range of the output is ±12V @ 10mA.

5.2 EXTERNAL AUDIO INPUT

This BNC jack is used to introduce an external signal to be applied to either of the two audio channels. See section 2.4 for details on selecting this input.

5.3 MULTI OUTPUT PORT

This 25-pin DSUB jack provides all the channel output signals on one connector. These signals are identical to those provided on the BNC output jacks. The mating connector is a DB25P (male). The pin connections are as follows:

Pin 1	OUTPUT1
Pin 2	OUTPUT2
Pin 3	OUTPUT3
Pin 4	OUTPUT4
Pin 5	OUTPUT5
Pin 6	OUTPUT6
Pin 7	OUTPUT7
Pin 8	OUTPUT8
Pin 12	Digital output 2 <future function>
Pin 13	Digital output 1 <future function>
Pin 14	GROUND
Pin 15	GROUND
Pin 16	GROUND

5.4 USB PORT

This standard USB port is used for remote control of all amplifier functions.

<See separate Instructions>

8.0 SPECIFICATIONS

Input type ..... differential
Input impedance ..... 1 megohm
Input connector (differential) ..... 7-pin Amphenol
Input connector (single-ended) ..... BNC
Head-stage power available on input connector ..... ±12V @ 100mA
Input coupling (high-pass filter) ..... DC, 0.1, 0.3, 1, 3, 10, 30, 100Hz, -3dB/octave
Input-referred noise ..... G=1, 2uV P-P; G=1000, 0.4uV P-P
CMMR ..... G=1, 95dB, G=10, 115dB, G=100, 135dB, G=1000, 140dB
Low-pass filter ..... 7, 10, 30, 50, 100, 300, 500Hz, 1K, 3K, 5K, 10K, 20KHz, -24dB/octave
Notch filter ..... 50 or 60Hz, user selectable
Gain settings X1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1K, 2.5K, 5K, 10K, 20K
User-adjustable zero offset ..... ±200mV
Amplifier output jacks ..... BNC
Audio input source ..... internal chan 1-8, external
Audio channel function (2 chan) ..... straight audio amplifier or VCO function
Audio output jacks (2 chan) ..... 3.5mm stereo
Dimensions ..... 17.5W x 3.5H x 10.5D in. (44.5 x 9 x 26.6cm)
Power requirements ..... universal input,120/240V 50/60Hz, 100VA

9.0 ORDERING INFORMATION

PART Nº	MODEL	DESCRIPTION
20-01000	proAmp-8	8-channel programmable bioamplifier, with 8 ICA-400 input cables
09-03112	ICA-400	Spare input cable, 3m long, terminated with three 1.5mm DIN Touch-Proof jacks