

Electrocardiogram Amplifier Module

The Electrocardiograph Amplifier Module (ECG100A) is a single channel, high gain, differential input, biopotential amplifier designed specifically for monitoring the heart's electrical activity. The ECG100A is designed for use in the following applications:

- Conventional electrocardiogram (12 lead ECG)
- Einthoven triangle potential measurement (3 lead ECG)
- Transverse-plane ECG measurement (V1 thru V6)
- Vectocardiogram measurement
- Chaos investigations (heart rate variability)
- Heart arrhythmia analysis
- Exercise physiology studies

The ECG100A will connect directly to any of BIOPAC's series of Ag-AgCl lead electrodes. The best choice for electrodes depends on the application, but typically, the EL203 adhesive/disposable snap electrodes are used in conjunction with the LEAD100 pinch lead. Alternatively, if reusable electrodes are required, the EL208 is typically used. Use two unshielded electrodes (LEAD100 or EL208) for the signal inputs and one unshielded electrode (LEAD100 or EL208) for Ground. When using EL208 electrodes, you will also need adhesive disks (ADD208) and electrode gel (GEL100).

The ECG100A has built in drive capability for use with shielded electrode leads. If high bandwidth (resolution) ECG measurements are required, then shielded electrode leads are recommended. When the Interference Filter is switched on, shielded leads are typically not necessary. The ECG100A is designed to pass the ECG signal (P, Q, R, S, T waves) with minimal distortion.

The ECG100A has an additional R wave detector function. When enabled, the output signal will produce a smoothed positive peak every time the R wave is detected. This function is extremely useful for rate calculations when a well defined peak is desired. The R wave detector circuitry consists of a high Q, 17Hz band pass filter followed by a full wave rectifier, followed by a 7.2Hz, two pole, low pass filter.

ECG100A specifications

Input Impedance

Differential 2M Ω

Common Mode 1000M Ω

Maximum Input Voltage $\pm 10V$

Upper Frequency Response

Filter Off 30Hz

Filter On 100Hz

Lower Frequency Response

Hipass Off 0.05Hz

Hipass On 1.0Hz

CMRR 100dB minimum

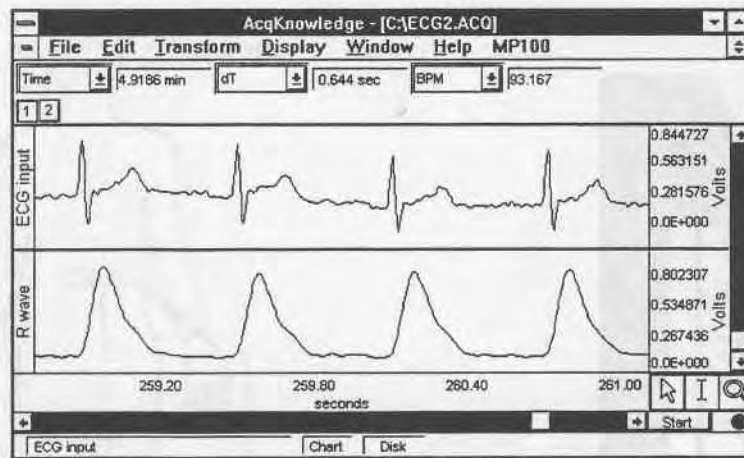
**Noise Voltage
(Shorted Input)**

Filter Off	0.50 μ V (rms)
Filter On	0.22 μ V (rms)

ECG100A Gain Settings

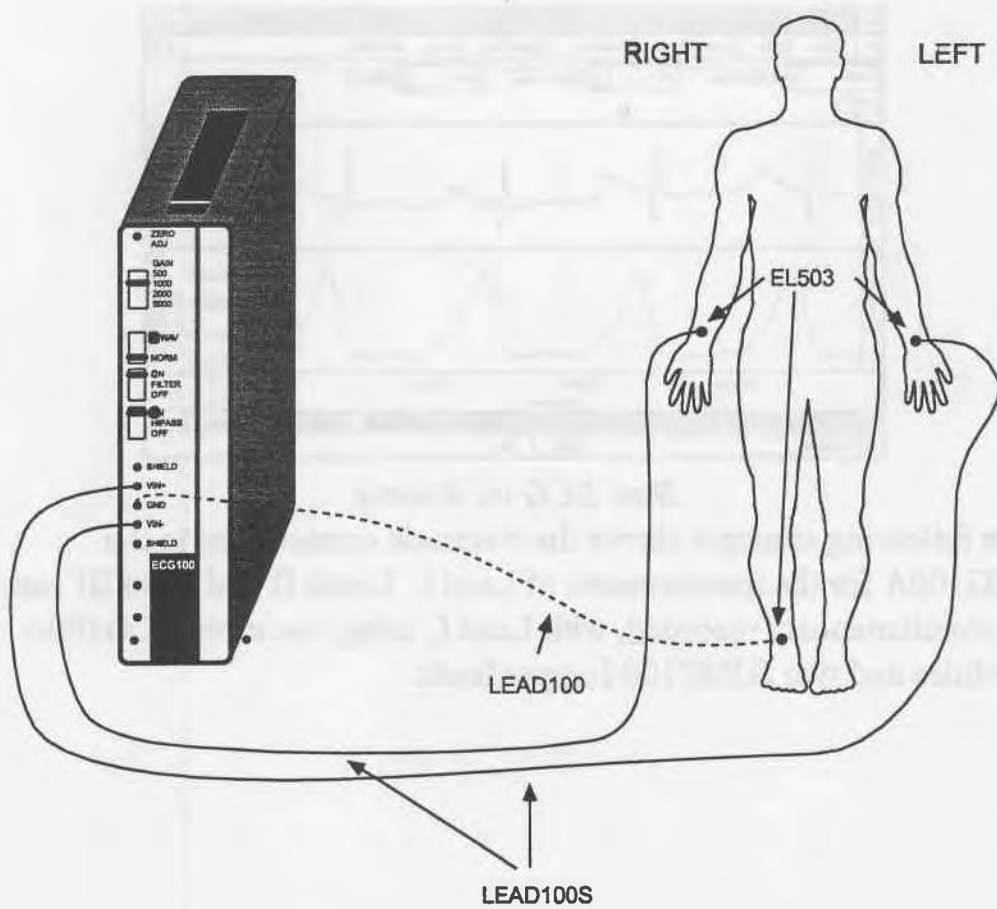
Input Signal Range (pk-pk)	Gain
40 mV	x500
20 mV	x1000
10 mV	x2000
4 mV	x5000

The ECG100A also includes a High Pass Filter which is used to stabilize the ECG baseline. When the Hipass is ON, P and T wave amplitudes will be reduced somewhat, but the QRS wave will be virtually unchanged. The Hipass is usually switched on when using the ECG100A for rate measurements only or when monitoring the ECG of an active subject. The following graph illustrates ECG data recorded with the ECG100A. The top waveform is a raw ECG wave, and the bottom waveform is the same signal processed using the R-wave detector in the ECG100A module. Enabling the R-wave detector is useful for calculating BPM and peak detection functions, as it tends to remove any components of the waveform that might be mistaken for peaks.



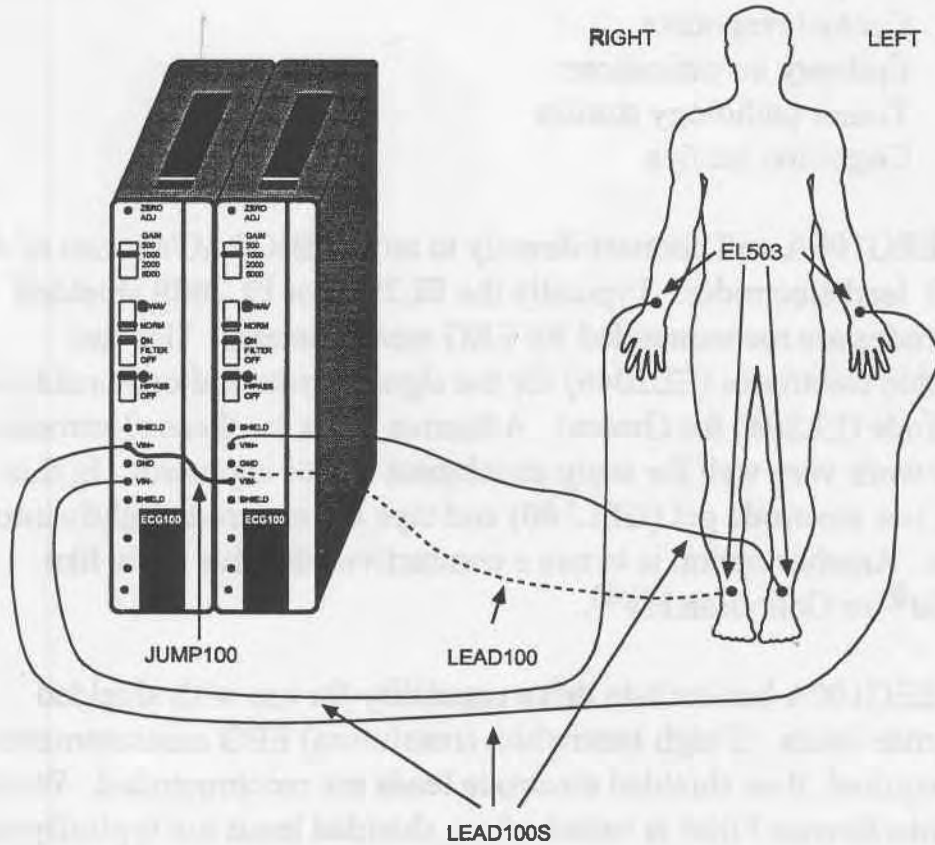
Raw ECG vs. R-wave

The following example shows the electrode connections to the ECG100A for the measurement of Lead I. Leads II and Lead III can be simultaneously recorded, with Lead I, using one more ECG100A modules and two JUMP100 Jumper leads.



ECG Electrode Placement Example

The following example shows the electrode connections to two ECG100A modules for recording the Einthoven's triangle measurement. Note that JUMP100 leads are not required to connect amplifier grounds together. Amplifier grounds are internally connected when modules are snapped together. One JUMP100 lead are used to connect the Lead I GROUND input to the VIN+ input on Lead III, and to connect the VIN+ on Lead I to VIN- on Lead III. Lead II can be calculated either on-line or after the data has been acquired.



Einthoven's triangle measurement