Noise Characteristics of Readout Electronics for 64-channel DROS Magnetocardiogram System

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We have developed control electronics to regulate flux-locked loop, and analog signal filter to process output signals for 64-channel Double Relaxation Oscillation SQUID (DROS) magnetocardiogram (MCG) system. Control electronics consist of very compact electronics, a preamplifier with LT1128s, an integrator, and a feedback electronics, which can be achieved due to larger swing voltage and flux-to-voltage transfer coefficients of DROS than those of dc SQUID. Analog signal filter (ASF) is serially chained with a high-pass filter having cut-off frequency of 0.1 Hz, an amplifier having a gain of 100, a low-pass filter of 100 Hz, and a notch filter of 60 Hz. Control electronics have the noise of 7 nV/$\sqrt{\text{Hz}}$ at 1 Hz, 1.5 nV/$\sqrt{\text{Hz}}$ at 100 Hz in a preamplifier of FLL electronics, and ASF electronics the noise of below 100 μV/$\sqrt{\text{Hz}}$ within the range of 1–100 Hz. When DROSs are connected to readout electronics inside a magnetically shielded room, the noise of 64-channel DROS system is 10 fT/$\sqrt{\text{Hz}}$ at 1 Hz, 5 fT/$\sqrt{\text{Hz}}$ at 100 Hz on the average, low enough to measure MCG of a human.

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