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10.1109/TBME.2013.2252346.
Epub 2013 Mar 12.

# Design of a portable, intrinsically safe multichannel acquisition system for high-resolution, real-time processing HD-sEMG.

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A compact and portable system for real-time, multichannel, HD-sEMG acquisition is
presented. The device is based on a modular, multiboard approach for scalability

and to optimize power consumption for battery operating mode. The proposed modular approach allows us to configure the number of sEMG channels from 64 to 424. A plastic-optical-fiber-based 10/100 Ethernet link is implemented on a field-programmable gate array (FPGA)-based board for real-time, safety data transmission toward a personal computer or laptop for data storage and offline analysis. The high-performance A/D conversion stage, based on 24-bit ADC, allows

us to automatically serialize the samples and transmits them on a single SPI bus

connecting a sequence of up to 14 ADC chips in chain mode. The prototype is configured to work with 64 channels and a sample frequency of 2.441 ksps (derived
from 25-MHz clock source), corresponding to a real data throughput of 3 Mbps. The
prototype was assembled to demonstrate the available features (e.g., scalability)
and evaluate the expected performances. The analog front end board could be dynamically configured to acquire sEMG signals in monopolar or single differential mode by means of FPGA I/O interface. The system can acquire continuously 64 channels for up to 5 h with a lightweight battery pack of 7.5 Vdc/2200 mAh. A PC-based application was also developed, by means of the open source Qt Development Kit from Nokia, for prototype characterization, sEMG measurements, and real-time visualization of 2-D maps.

PMID: 23508246  [PubMed - indexed for MEDLINE]