

Purpose

This application note outlines the requirements for an interface between Plessey Semiconductors' Electric Potential Integrated Circuit (EPIC) sensors and a standard USB port.

Introduction

The EPIC sensor's ability to measure spatial potential, charge and electric field makes it ideally suited to a wide range of applications in medical, commercial and industrial applications. Typical applications include body surface electrophysiology (e.g. ECG measurements); movement sensing for security applications; and proximity sensing for non-touch switching and gaming applications.

The high sensitivity and wide frequency response of the sensors mean that most applications will require some post processing of the signals, for instance to remove 50 or 60Hz mains frequencies from the signal, and to generate the differential signal from pairs of sensors. Many applications will also require the signals to be digitised and presented in some standard form such as USB.

Signal Processing Requirements

The basic blocks needed to create a useful interface between a pair of EPIC sensors and a USB port are shown in figure 1. EPIC sensors are mostly utilised in

pairs such that unwanted signals can be reduced by differential amplification with good common mode rejection.

Figure 1 shows the signal from each sensor being passed through input buffer amplifiers before being sampled and digitised by a multiplexed Analog to Digital Converter (ADC). Further signal processing is then performed digitally within an appropriately programmed PIC micro-controller. Depending on the environment, this will usually include some filtering of mains frequency signals before the signals are (digitally) differentially amplified. The precise function of the block labelled "Signal Processing" will very much depend on the application, but will typically include some band-pass filtering. Finally, the signals are passed to USB interface software programmed into the PIC. Figure 2 shows a Bluetooth demonstrator board that uses this basic signal processing architecture.

Figure 3 shows an alternative architecture containing the same basic blocks. In this case the differential amplifier stage is realised using an op amp, the output of this being filtered to remove the mains frequency component before the signal is digitised and processed as described above.

Other configurations of this architecture are, of course, possible. The optimal solution will be mostly dependant on the environment in which the sensors are placed, and the needs of the application.

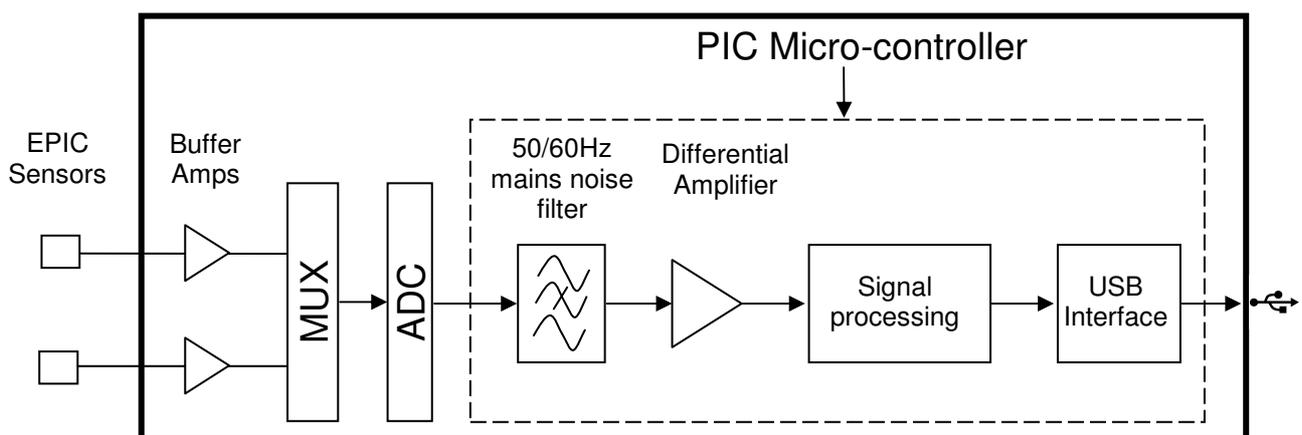


Figure 1. Block diagram showing the stages needed for an interface between EPIC and a USB output, as described in the text. The blocks shown within the dotted lines are realised digitally using a PIC micro-controller.

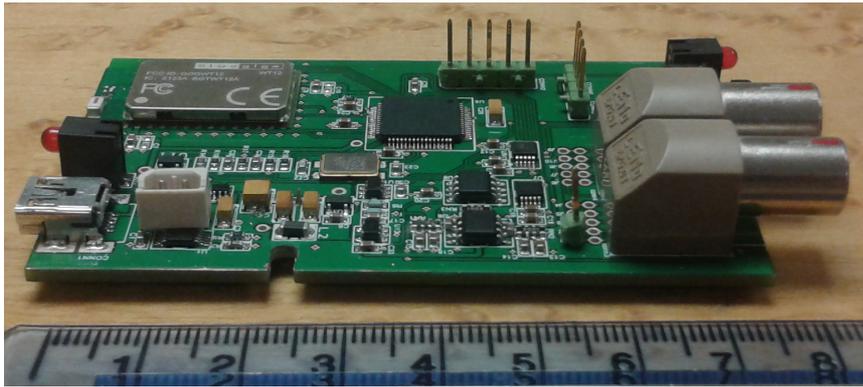


Figure 2. Bluetooth demonstrator board using the basic architecture shown in figure 1. USB application would require some minor layout changes and appropriate coding of the PIC. Scale is in centimetres.

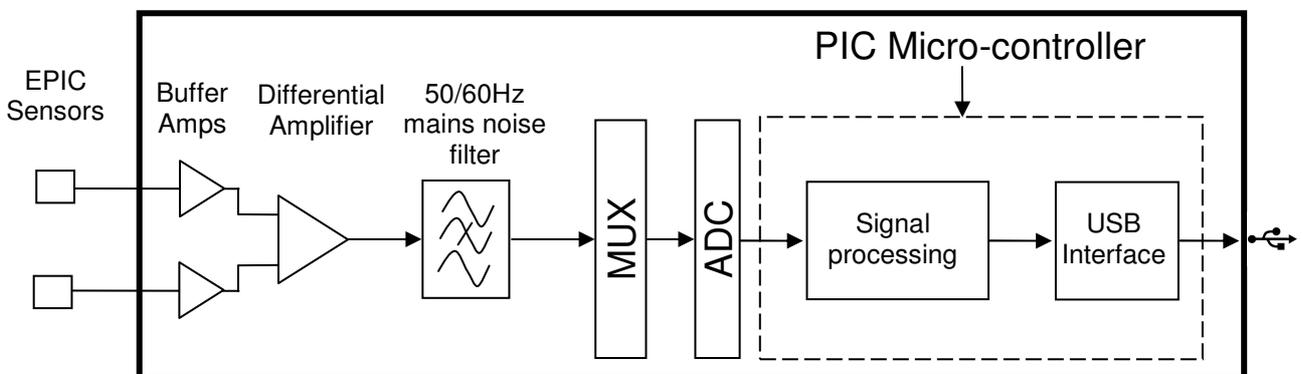


Figure 3. An alternative implementation of the architecture shown in figure 1. The blocks shown within the dotted lines are realised digitally using a PIC micro-controller.

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