

## Purpose

This application note describes how Plessey Semiconductors' Electric Potential Integrated Circuit (EPIC) sensors can be included in a hand rail scale to facilitate simple and effective monitoring of electrocardiograph (ECG) signals.

## Introduction

EPIC is an electrometer capable of sensing ECG signals through insulated sensors in contact with the skin. The sensors are dry-contact, so that the gels or other contact-enhancing substances normally associated with wet-electrode ECG pads are not necessary. As well as offering exciting possibilities for simplified ECG monitoring by medical professionals the device can also be easily integrated into devices such as medical 'handrail' scales or wheelchair scales.

The ECG trace ideally requires two sensors to measure electric signals from parts of the body on opposite sides of the heart. Users familiar with the EPIC demonstration kit will know that this can easily be achieved by touching one sensor electrode with each hand. A typical differential signal is shown in figure 1.



Figure 1: Differential signal from two sensors in contact with the skin showing ECG trace

## Scale mounted sensors

A straightforward extension of the "sensor in each hand" method can be achieved by building (or adding) a sensor to each handrail on a medical 'handrail scale' or 'wheelchair scale'

One electrode is situated in each of the rails so that the subject's palm/hands make natural contact. The frame of the scales provides an excellent common mode ground between the sensors. A representation of this configuration is shown in figure 2.

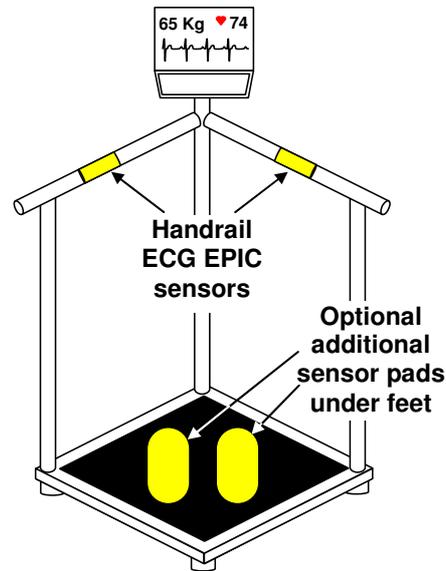


Figure 2: Diagrammatic representation of scale mounted EPIC sensors for Pulse/ECG monitoring.

There are a number of advantages in using this configuration

- Left arm to right is a standard (lead 1) vector.
- Other leads can easily be added by for example incorporating foot contacts.
- The method is as simple as taking a pulse measurement and can give a 'lead 1' ECG
- Signal collection and processing can be performed within a simple single unit.
- Sensors are rigidly mounted and protected from mechanical damage and wear.

## Signal processing

The collected signals are filtered and differentially amplified by simple analogue/digital circuitry within a control box or can easily be integrated into existing scale hardware/software. Full ECG generally requires a bandwidth of 50mHz to 150Hz; basic monitoring – for instance of heart rate – could use a much smaller bandwidth: both can be achieved.

Once the signal has been digitised, numerous methods of analysing, displaying or transmitting the data are obviously possible. These could include

- Data transmission via Bluetooth to a mobile devices (e.g. SmartPhone) for display of the full ECG trace remotely.
- Incorporating the device into a cloud computing network

.The low power requirements of the EPIC sensor allow the biasing for the sensor and the filtering and amplification circuitry to be battery operated.

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