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Plessey PS25502PAD – EPIC 6-sensor Seat Pad.
Instruction Manual

Standard Components

PS25502PAD
- 1 x PS25502PAD seat pad.
- 1 x Detachable automotive grade leather cover
- 1 x Detachable cotton cover

Figure 1 – PS25502PAD seat pad, with leather cover, in place on a car seat

User Guide Contents

1.0 Introduction

The Plessey PS25502PAD is a seat pad containing 6 EPIC sensors and a ground plane, designed for use as part of a non-contact capacitive ECG (c-ECG) monitoring system. The sensors are located on the upright part of the seat back, with the ground plane being situated on the base.

When used along with the PS25006 multiplex box and one of the EPIC demonstration kits (PS25000, PS25001 or PS25003), the PS25502PAD forms a system for non-contact monitoring of single lead c-ECG. The system is designed to enable straightforward evaluation of Plessey's EPIC technology for measuring non-contact c-ECG through a variety of materials, particularly in automotive applications.

2.0 The PS25502PAD

The PS25502PAD contains 6 x PS25203 EPIC sensors mounted on PS25012A3 application boards. The sensors have x10 internal voltage gain. Data sheets for both the sensors and application boards are published separately and may be found on Plessey Semiconductors' website, www.plesseysemi.com. Note that the sensors do not include the dielectric capping material that is used on standard PS25203s, since the seat cover acts as the dielectric.

The 6 sensors are positioned as shown in figure 2, enabling pairs of sensors at a variety of heights and offsets from the centre of the user's back to be selected. This provides close-to-optimum sensing positions for the majority of users, regardless of size and physique.

The pad also contains a piece of conductive fabric, concealed under the cotton cover on the seat base, which serves as the electrode for the driven ground plane. It should be connected to a *Driven Right Leg* (DRL) circuit such as the one contained within the PS25006 box, for noise cancellation.

Figure 2 – Showing locations of the 6 sensors and the DRL fabric electrode

The sensor array is concealed under a removable cover. Two types of covers are provided, one in 100% cotton material, and the other in automotive grade leather. The covers are held in place by Velcro hook and loop fasteners. The covers may – of course – be replaced by any other material of the user's choice for evaluation purposes.

The areas of electrodes 2 to 5 are increased over the standard 100mm^2 area of the PS25203 sensor by the addition of conductive fabric. This is to enable evaluation of the benefits of increased sensing area when using covering or clothing materials that have a lower coupling capacitance per unit area due to their thickness or dielectric properties.

3.0   Operation

1. Position the seat pad on the chair or car seat.
    Ensure that the upright part of the seat back rests correctly against the back of the chair as shown in figure 3:

Figure 3 – Correct positioning of the seat pad

The pad must not be placed as shown in figure 4, as the sensors will not be in the correct position and will not make good contact to the occupant's back:


Figure 4 – Incorrect positioning of the seat pad.

2. Secure the elastic strap behind the seat.

3. Fit the appropriate cover (cotton or leather) to the seat pad. The pads are secured using Velcro hook and loop fastener strips. Ensure that the Velcro is not preventing the cover from making good contact with any of the sensor electrodes.

4. Insert the 6 numbered LEMO connectors from the PS25502PAD cable harness into the 6 numbered LEMO sockets on the front panel of the PS25006 box.

5. Insert the blue DRL plug into the socket on the rear panel of the PS25006 box.

6. Using 2xPS25013 cables (4 pin DIN to 5 pin LEMO), connect the outputs form the PS25006 box to the A and B inputs on the Control and Interface Box.

7. Connect the Control and Interface Box to the USB port of a computer, and switch on the Control and Interface Box. The red LED indicators on both boxes should light.
   Due to the sensitivity of the DRL circuit to power supply noise, it is recommended that the system is either run from a battery-powered laptop, or from a PC whose power supply includes a mains ground connection. Using a computer that is powered by a power supply with no external ground can lead to very noisy signals from which it is impossible to extract the c-ECG signal.

8. Sit on the pad, being careful to ensure that the positioning as described in step 1 is maintained. Lean back against the pad/chair back such that good mechanical contact is made between the occupant's back and the sensor electrodes.

9. It is recommended that after sitting down the user touches the 0V potential of the system (e.g. the metal of one of the LEMO connectors) for a few seconds to discharge any electrostatic build up. This may not be necessary under all conditions, but will often aid in getting the best signal in the shortest possible settling time.

10. Use the "Channel Select" knobs to select the pair of sensors that you wish to view. For further details, and for information on how to set the DRL gain, see the manual for the PS25006 box. Note that although the best signal will often be obtained by using two sensors at the same height (e.g. 1 & 6 or 2 & 5), in some cases a better result can be obtained by using sensors at different heights.

4.0   Electrical connectors

The LEMO connectors are wired as below (viewed looking into plug from front):

Pin 1   Output (red dot on top of plug housing)
Pin 2   Gnd
Pin 3   Supply
Pin 4   Gnd
Pin 5   Not used (no pin)
Case   Gnd
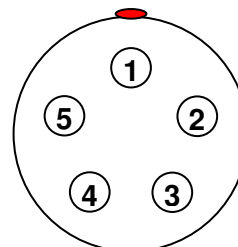
5.0   Related documents

The following documents pertaining to non-contact capacitive ECG measurements using EPIC, and the sensors used in the PS25502PAD are all available from Plessey Semiconductor's website at www.plesseysemi.com.

a) Application Note #291566 - Non-contact ECG measurement using EPIC.

b) Datasheet #292012 - Plessey PS25006 - EPIC 6:2 Multiplex box Instruction Manual.

c) Datasheet #291540 - Plessey PS25000A and PS25001A EPIC Demonstration Kit

d) Datasheet #291839 - PS25203B EPIC Ultra High Impedance Electrophysiological Sensor

e) Datasheet #291503 - PS25012A3, PS25012B3 Application Boards for EPIC sensor PS25203

A video demonstrating the use of a capacitive ECG monitoring system using EPIC in a moving car can also be found on the Plessey website.

6.0   Disclaimer

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(b) that the PS25502PAD is suitable for monitoring or diagnosing any physiological function, condition or illness;
(c) that the PS25502PAD has been manufactured or tested in accordance with applicable laws and regulations governing the manufacture and testing of medical devices;

The PS25502PAD must not, in any circumstances be used, nor data arising from its use be used to inform any decision about the health, welfare, monitoring or treatment of any human being.

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