The CED 2502SA Skin Conductance unit Owners Handbook

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Overview

The CED Model 2502SA is a stand-alone version of the CED 2502 Skin Conductance unit. The 2502SA is designed to take direct measurements of the conductivity between two electrodes attached to the human body. Conductance values up to 100 μmhos can be measured in three ranges. This machine is a simple analogue transducer: it is not controlled by computer. The output from the 2502 is an isolated single-ended high-level signal designed to drive a CED 1401 Intelligent Laboratory Interface or other data acquisition equipment.

The 2502SA includes its own external mains power supply.

WARNING

The 2502SA skin conductance unit must be used only with CED-approved power supplies.

NOTE: The 2502SA is designed to meet standard EN 60601-1 (BS 5724), but has not yet been submitted for approval.

Principle of operation

The CED 2502SA skin conductance unit operates by maintaining a 500 mV DC potential across the skin electrodes, and measuring the current needed to maintain this potential. This current is proportional to the conductance between the electrodes. A voltage output is developed representing a scaled value of the current. No back-off controls are needed to compensate for the 500 mV standing potential.

The conductance ranges are specified in μmho (10^{-6} ohm^{-1}). μmhos are identical to μS (microsiemens).

The measuring current between the electrodes is internally limited to approximately 60 μA.

The output isolation circuit incorporates a 30 Hz 2-pole (12 dB per octave) low-pass filter.

Electrical isolation

The CED 2502SA is safe for use on human subjects for the purposes of research. The conductance-measuring circuit is electrically isolated from mains earth and voltage sources referred to mains earth. The circuit is powered via a DC–DC converter incorporating an isolating transformer, so that energy to drive the circuit is transferred across the isolation gap magnetically. Similarly, the output voltage is conveyed across the isolation gap by an opto-coupled amplifier. Thus there is no conducting path between the isolated and the mains-referenced sections along which electrons may flow. This is known as *galvanic* isolation.

Isolation voltage

The CED 2502SA is designed and constructed to provide a galvanic isolation gap that is safe against voltages of up to 1500 V DC (continuous).

Figure 1: CED 2502SA Front Panel

Front panel controls

The front panel accommodates four electrode input sockets, two rotary switches, the output BNC, and the DC power switch and its LED.

The Power switch & LED

The on/off switch at the right of the panel switches the low-voltage power supplied from the external power supply. All three rails (+15 V, -15 V, +5 V) are switched. A green LED indicator next to the switch shows when power is applied to the unit. The mains power supply should be switched off when not in use, by unplugging the mains inlet cable.

Font-panel sockets

Two pairs of front-panel sockets are provided for connecting the electrodes: a pair of 2mm sockets wired in parallel with a pair of 1.5mm sockets. For each input the 1.5mm socket and the 2mm socket are simply wired together. In the Normal switch position, the socket on the left has a potential 500 mV higher than the socket on the right. In the Reverse position, this is changed round. Note that, since the conductance-measuring circuitry is electrically isolated, this potential is *floating* relative to mains earth, and can neither source nor sink external current.

The Output BNC

The Output socket is a coaxial BNC connector, suitable and convenient for connecting the SA2502 to a CED 1401 data acquisition machine, or other equipment, using standard BNC-BNC coaxial cables. The outer sleeve is at mains-earth potential and is connected to the metalwork of the case and to mains earth via the power supply cable.

The Mode switch The Mode switch has four positions:

- Normal connects the electrode sockets to the conductance measurement circuitry
- Reverse is the same as Normal but with the electrode connections interchanged. Switching between Normal and Reverse gives a check for errors due to polarisation effects
- Zero gives a calibration value for zero conductance
- Full scale connects the measurement circuitry to a calibrated resistor whose value represents full-scale conductance for the selected conductance range

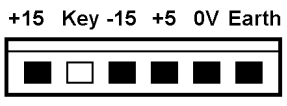
The electrodes are electrically disconnected from the rest of the circuit when the mode switch is in either of the calibrating positions.

The Range switch The Range rotary switch has three positions, giving full-scale conductance ranges of 10 μmho, 25 μmho and 100 μmho. In each range 'zero' represents 0 μmho, i.e. infinite resistance, or open circuit. If the inputs are short-circuited together, presenting effectively infinite conductance, the 60 μA current-limit represents a maximum notional conductance of 120 μmho.

The power inlet

The CED 2502SA has provision for two styles of DC inlet. You may have a Molex-style plug at 0.156" pitch mating with a cable-mounted socket with a retaining ramp. This has six positions, one of which is blanked to provide a polarizing key. Alternatively you may have a 5-pin 180° DIN socket. Note that 0V and earth are tied together inside the 2502SA.

Pinout diagrams The diagrams show the DC inlets as seen from the outside.



6-way Molex plug

5-pin DIN socket

Construction & environment

The CED 2502SA is built on a printed circuit board housed in a folded-steel enclosure. It is uniform in style with the CED 1902 Isolation Amplifier and other CED products. The steel case provides mechanical protection and some shielding against electric and magnetic fields, but it does not protect against ingress of water or dust. The CED 2502SA is suitable for use only in a clean, dry indoor environment such as an office or laboratory.

Use with the CED 1401

The CED 2502SA skin conductance unit is designed for use with a CED Power1401 or Micro1401, or other suitable data acquisition equipment. It produces an output in the range ±5 V.

A BNC-BNC coaxial cable is needed to link the analogue output from the BNC connector on the 2502SA front panel to an analogue input on the CED 1401 (channels 0 - 3 on a Micro1401 or 0 - 7 on a Power1401).

A conductance value of zero (open circuit) results in an output from the 2502SA of –5 V, and a full-scale conductance value for the selected range gives +5 V.

Installation

Connect a BNC cable from the 2502SA front-panel output to the required analogue input of the CED 1401. Apply power to the 2502SA and check that the green power LED lights when the power switch is operated.

Run the data acquisition software, such as the CED *Spike2* program.

Check that with the 2502SA mode switch in the Zero position, the chart trace is at the bottom of its range, and when the switch is in the Full scale position, the trace is at the top of its range. Leave the switch in either the Zero or Full scale positions until the electrodes are prepared and wired.

With the measurement electrodes connected, move the mode switch to the Normal position. Change the range switch to give a conductance reading suitable for the subject and the type of test to be performed. Adjust the *Spike2* axis labelling to correspond to the range selected.

Specifications

Skin conductance ranges	10, 25, and 100 μmho full-scale
Accuracy of reading	±2% of full-scale
Output	±5 V
Frequency response	DC – 30 Hz (-3 dB)
Electrode connections	1.5mm and 2mm sockets in parallel
Electrode driving potential	500 mV DC ±1%
Electrode current limit	60 μA nominal
Power–Electrode isolation	1500 V DC continuous
Output connector	BNC
Mains power supply	100-240 V AC, 50-60 Hz
Case dimensions	241 × 241 × 46 millimetres

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