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TRANSDUCER MODULE EDA100C

NOTE TO GSR100C USERS:

- The term ñGalvanic Skin Responseò (GSR) has been superseded by ñElectrodermal Activityò (EDA).
- GSR units (µmho/V) have been superseded by modern EDA units of µS/V (microsiemens).
- There is no hardware or operational differences between the older GSR100C and the newer EDA100C amplifiers referred to in this document.

The EDA100C electrodermal activity amplifier module is a single-channel, high-gain, differential amplifier designed to measure skin conductance via the constant voltage technique. The EDA100C is designed for use in the following applications:

General eccrine activity measurement Vestibular function analysis

Vertigo and motion sickness studies Psychophysiological investigations

The EDA100C includes a selection switch for lower frequency response.

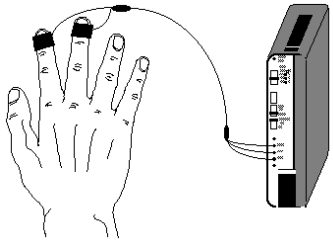
- DCð For **absolute** measures (e.g. skin conductance level)
- 0.05 Hzð For **relative** measures (e.g. skin conductance response)

----------**IMPORTANT**----------

GROUNDING: When using the EDA100C amplifier with other biopotential amplifiers attached to the same subject, itôs not necessary to attach the ground lead from the biopotential amplifier(s) to the subject. The subject is already appropriately referenced (grounded) to the system via the attachment to the EDA100C. If a biopotential ground is attached to the subject, then currents sourced from the EDA100C will be split to the biopotential amplifier ground lead, potentially resulting in measurement errors.

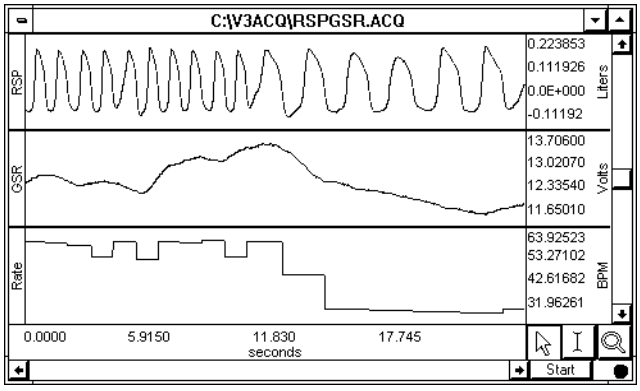
----------**IMPORTANT**----------

The EDA100C is typically used with TSD203 Ag-AgCl finger electrodes.



Skin conductance measurement using EDA100C and TSD203

The following graph shows the relationship between respiration rate and the electrodermal activity response (galvanic skin response). The left half of the graph marks the onset and completion of fast breathing (panting), and the subject begins to breathe normally at the time index corresponding to 12 seconds.



Electrodermal activity response, respiration and respiration rate waveforms

FREQUENCY RESPONSE CHARACTERISTICS

The 0.05 Hz high pass lower frequency response setting is a single pole roll-off filter.

See also: Sample frequency response plots.
1 Hz LP
10 Hz LP

EDA100C CALIBRATION

Note that the EDA100C has scale setting in units of ñµS per volt.ò This is identical to the respective scale setting of µmho or micromho per volt. Namely, 1 µS = 1 µmho.

SETUP INSTRUCTIONS

Lower frequency response at DC:

In the scaling window, set the input voltages so they map to the DC conductance ranges indicated by the sensitivity setting. For example, if the EDA100C is set to a Gain of 5µS/V, then 0 V will map to 0 µS or infinite resistance, and 1 V will map to 5 µS or 200 kohm.

Lower frequency response at 0.05 Hz:

In the scaling window, set the input voltages so they map to the ñ0.05 Hzò conductance ranges indicated by the sensitivity setting. For example if the EDA100C is set to a Gain of 5 µS/V, then 0 V will map to X µSs and 1 V will map to (X+5) µS. Where ñXò is the mean conductance being recorded.

To verify the Gain setting of the EDA100C:

1. Calibrate Acq*Knowledge* as detailed above for lower frequency response at DC.
2. Place the lower frequency response to DC.
3. Set the Gain switch on the EDA100C to 5µS/V.
4. Perform measurement with electrodes disconnected.
   - Acq*Knowledge* should produce a reading of 0 µS.
5. Insulate a 100 kohm resistor and place it from electrode pad to electrode pad (resistor must be insulated from fingers).
6. Perform measurement with electrode-resistor setup.
   - Acq*Knowledge* should produce a reading of 10 µS.

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EDA100C SPECIFICATIONS

Unit Noteð BIOPAC software calculates SCL/SCR in microsiemens. The traditional unit of conductance, Micromho (µmho) is interchangeable with the more current microsiemen (µS). To use Ohm, the traditional measure of resistance, convert as 1 µS equals 1,000,000 ohms.

Gain: 20, 10, 5, 2 micro-siemens/volt (i.e., micro-umhos/volt)

Input conductance range			
DC	0.05 Hz	*Minimum Resistance*	*Sensitivity*
0 to 200 µS/V	±200 µS/V	5,000 Ω	20 µS/V
0 to 100 µS/V	±100 µS/V	10,000 Ω	10 µS/V
0 to 50 µS/V	±50 µS/V	20,000 Ω	5 µS/V
0 to 20 µS/V	±20 µS/V	50,000 Ω	2 µS/V

Note: Normal human range is 1-50 µS

Output Range: 0-10 V nominal, ±10 V full (analog)

Frequency Response

Low Pass Filter: 1 Hz, 10 Hz

High Pass Filter: DC, 0.05 Hz, 0.5 Hz

Sensitivity: 0.7 nano-mhos ï with MP System

Excitation: Vex = 0.5 VDC (Constant Voltage)

Signal Source: TSD203

Weight: 350 grams

Dimensions: 4 cm (wide) x 11 cm (deep) x 19 cm (high)

Input Connectors: Three 1.5 mm male Touchproof sockets (VIN+, Ground, VIN-)

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AMPLIFIER MODULES

100C series modules

The 100C series biopotential/transducer amplifier modules are single channel, differential input, linear amplifiers with adjustable offset and gain. These modules are used to amplify smaller voltage signals coming from raw electrodes and transducers (typically less than ±0.01 volt). In addition to amplifying signals, most of the 100C series modules include selectable signal conditioning ability so that data may be filtered or transformed as it is being collected.

- **Biopotential modules**: ECG100C, EEG100C, EGG100C, EMG100C, EOG100C, ERS100C
- **Transducer modules**: EDA100C; PPG100C; RSP100C; SKT100C
- **MRI Smart modules**ð advanced signal processing circuitry removes spurious MRI artifact from the source physiological data: ECG100C-MRI; EDA100C-MRI; EEG100C-MRI; EMG100C-MRI; PPG100C-MRI.

Modules can be cascaded by snapping the modules together. Up to sixteen 100C series modules can be connected to the MP System at any one time.

IMPORTANT

When cascading modules, it is important to remember that **no two amplifiers may be set to the same channel**. If two connected amplifier modules are left on the same channel, then contention will result and both amplifier outputs will give erroneous readings.

Amplifier offset Set by the zero adjust control trim potentiometer near the top of the module. The offset control can be used to adjust the zero point or ñbaselineò of a signal.

Gain Switch The four-position slide Gain switch controls sensitivity. Lower gain settings will amplify the signal to a lesser extent than higher gain settings. If the signal plotted on the screen appears to be very small for a given channel, increase the Gain for that particular channel. Conversely, if the signal seems to be ñcroppedò at +10 Volts or –10 Volts, decrease the Gain.

Connections Transducers and electrodes connect to the amplifiers using 1.5 mm female Touchproof connectors.

Electrodes The biopotential amplifier modules use a three-electrode arrangement (VIN+, GND, VIN–). Although certain applications may require different arrangements of electrodes and/or transducers, some generalizations about electrode and transducer connections can be made. Electrodes measure the electrical activity at the surface of the skin, and since electricity flows from ï to +, measuring the flow of a signal requires that there be (at least) one ñ-ò electrode and (at least) one ñ+ò electrode. An additional electrode, a ñgroundò (or earth) electrode is used to control for the general level of electrical activity in the body.

Leads Typically, electrode leads are used to connect individual electrodes to the *xxx*100C amplifier. Most electrode leads are shielded, which means they introduce less noise than an unshielded lead. A shielded electrode lead has an extra jack on one end that plugs into the SHIELD input on the amplifier modules. A standard electrode lead configuration consists of two LEAD110S electrode leads (one connected to the VIN + input and one to the VIN ï input on the amplifier) and a single LEAD110 (connected to the GND input on a biopotential amplifier).

Transducers Transducers, on the other hand, are not designed to measure electrical activity directly and usually involve simpler connections. The transducers discussed in this manual translate physical changes (in temperature, for instance) into electrical signals. Connections for individual transducers are discussed in each section.

Channel The active channel is selected using the channel select switch on the top of the module. The channel select switch can direct the amplifier output to one of sixteen possible MP System input channels. *Remember to make sure that each amplifier module is set to a unique channel.*

Zero Adjust On input signals, a limited range in baseline level (DC offset) can be ñzeroed outò using the zero adjust potentiometer. Typically, the zero adjust will not have to be used (as it is preset at the factory). However, some of the 100C series modules can measure DC signals and, in certain circumstances, signal ñzeroingò may be required.

Setup All 100C Series biopotential or transducer amplifiers incorporate specific gain, coupling and filtering options that are appropriate for the biopotential type or transducer signal that requires measurement. Generally, when an electrode or transducer is inserted into the corresponding 100C series module, the amplifier will immediately produce a useful output, with no user adjustments necessary.

Certain functionality is added to each module to optimize its performance with its intended signal measurement. For example, all 100C series biopotential amplifiers incorporate a selectable interference filter. When the interference filter is on, 50/60 Hz interfering signals are suppressed.

Filters All 100C series amplifiers are constructed with filters that have a high degree of phase linearity. This means the 100C series modules will filter signals with as little distortion as possible. These modules also incorporate protection circuitry to limit input current in the event of input signal overload. Notch and bandstop filters have the potential to cause distortion, especially in the form of "ringing" in the data stream; biopotential hardware notch filters are implemented in conjunction with LP or HP functions to minimize distortion.

Line Freq Line Frequency is set using the recessed switch boxes on the left panel of the amplifier module (50 Hz = all switches down, 60 Hz = all switches up). It is important to select the correct line frequency for your geographical region. Typically, U.S. line frequency is 60 Hz; Europe and China 50 Hz. Contact BIOPAC for additional line frequency information. All MP biopotential amplifier modules which contain a 50/60 Hz notch filter only engage the filter when the pass filter is also ON:

- ECG100C, EEG100C, EOG100C amplifiers: the 50/60 Hz notch is only engaged when the 35 Hz LPN low pass notch filter switch is set to ON.
- EMG100C, ERS100C amplifiers: the 50/60 HZ notch is only engaged when the 100 Hz HPN high pass notch filter switch is set to ON.

See individual module sections for details.