

# Recording GSR

This application note describes the use of the ML116 GSR Amp along with the Chart software to measure and record the Galvanic Skin Response.

Kellie Forrester, ADInstruments

## Introduction

Galvanic Skin Response is a measure of the skin's conductance between two electrodes. Skin conductance is typically measured by applying a small AC signal through two electrodes, placed on the fingers or toes, and the response is seen as an change in conductance (decrease in resistance) of the skin with time.

The change in conductance is a function of sweat gland activity and the skin's pore size. An increase in conductivity arises through increased skin moisture, pre-secretory activity of the sweat gland cell membranes or both. Skin conductance can vary because of activity of the subjects autonomic nervous system, or more specifically, their sympathetic nervous system.

There are two principal components of skin conductivity:

- Galvanic Skin Response: changes in resistance of a short duration which typically reach a peak in two or three seconds.
- Skin Conductance Level (SCL): a baseline conductivity level which may change slowly (drift) with time.

## Equipment needed

- ML116 GSR Amp; The GSR Amp is a fully isolated, 75Hz, constant voltage Galvanic Skin Response amplifier with low voltage AC excitation and automatic zeroing. Supplied with finger electrodes.
- Any PowerLab unit connected to a computer running either the Chart for Windows or Chart for Macintosh software can be used to record the data.

## Procedure

Connect the GSR amplifier to the PowerLab unit as described in the GSR Amp Owners Guide. Start the Chart program and select the GSR Amplifier command from the Channel pop-up menu. (See Figure 1)

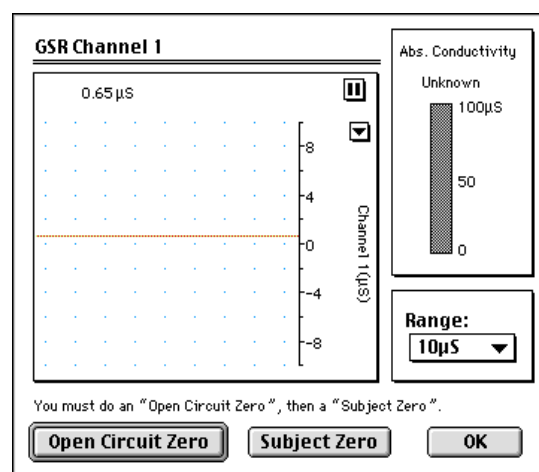


Figure 1. GSR Amplifier dialog box.

Before measurements can be made, the GSR Amp must be zeroed. First perform an Open Circuit Zero making sure that the finger electrodes are not attached to the subject. Then firmly attach the electrodes to the palmar surfaces of the fingers of one hand (usually the middle segments (phalanges) of the first and second fingers) avoiding cutting off circulation. Clicking the Subject Zero button will move the signal to zero. This is an absolute measure of the skin conductivity, which will be displayed at the top right of the dialog box (Figure 2).

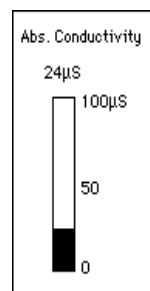


Figure 2. Absolute conductivity after Subject Zero. Baseline conductivity levels are usually in the range 10 to 50 $\mu$ S.

## Trademarks

MacLab and PowerLab are registered trademarks, and Chart and Scope are trademarks, of ADInstruments Pty Ltd. Other trademarks are the properties of their respective owners.

## Addresses

International:  
ADInstruments Pty Ltd  
Unit 6, 4 Gladstone Road  
Castle Hill, NSW 2154  
AUSTRALIA  
Phone:+61 (2) 9899 5455  
Fax:+61 (2) 9899 5847  
Email:enquiries@adi.com.au  
Web:  
http://www.adinstruments.com

North America  
ADInstruments Inc.  
1949 Landings Dr  
Mountain View CA 94043  
U.S.A.  
Phone:+1 (650) 965 9292  
Fax: +1 (650) 965 9293  
Email:  
info@adinstruments.com

Europe  
ADInstruments Ltd  
Grove House  
Grove Road, Hastings  
East Sussex, TN35 4JS  
UNITED KINGDOM  
Phone: +44 (1424) 424 342  
Fax: +44 (1424) 460 303  
Email:  
enquiries@adi-europe.com

Japan  
ADInstruments Japan Inc.  
Okajima Bldg 2-10-1  
Iwamoto-cho  
Chiyoda-ku, 101 Tokyo  
JAPAN  
Phone:+81 (3) 5820 7556  
Fax:+81 (3) 3861 7022  
Email:adjapan@po.ijnet.or.jp

Your local distributor:

Copyright. All rights reserved.

Remember that an individual's baseline skin conductance can vary for many reasons, including diet, skin type and gender.

## Recording

Suitable sampling rates are 4/s or 10/s.

The subject should relax for a few minutes to allow the baseline conductivity to settle. If the signal begins to drift, you may need to wait until it settles again, and then perform a second Subject Zero.

Observe what happens to the signal, as you try to remain calm, breath normally and remain 'emotionally passive'. The signal may present small fluctuations, or may increase slowly, depending on the the level of arousal of your sympathetic nervous system. (Note that the harder you try to remain calm, the more aroused your sympathetic nervous system may become!) As you become mentally and physically relaxed the conductance generally decreases. As you become more alert and anxious, or perhaps take some deep breaths, the conductivity level will increase, indicating that your sympathetic nervous system is becoming more aroused.

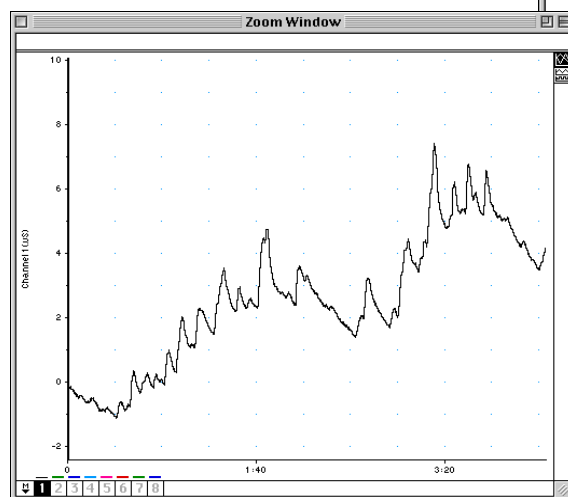


Figure 3. Typical GSR recording, indicating different levels of sympathetic nervous system activity

## Things to Remember

- Don't use recording gel with the electrodes. This will tend to give higher basal readings since skin resistance is lowered by gel.
- Avoid measuring skin conductance if the subject is perspiring.

## Startle Response

The startle response is a simple response to reproduce. When a subject is startled, there will be a rapid increase in the skin's conductance, due to heightened sympathetic nervous system arousal. This results in increased activity of the sweat glands which will generally occur over a period of seconds.

The 'startle' event may come in the form of a visual, auditory or somatosensory stimulus. In the case of Figure 4 below, an auditory stimulus was used (banging a ruler on a desk). Notice that the response occurred over a period of about 5 seconds. The response reaches a peak, and starts to decrease when there is no longer a possibility of further increasing skin conductance. A 'saturation point' is reached once the sweat gland duct is full. The GSR level will then decrease naturally due to reabsorption of moisture.

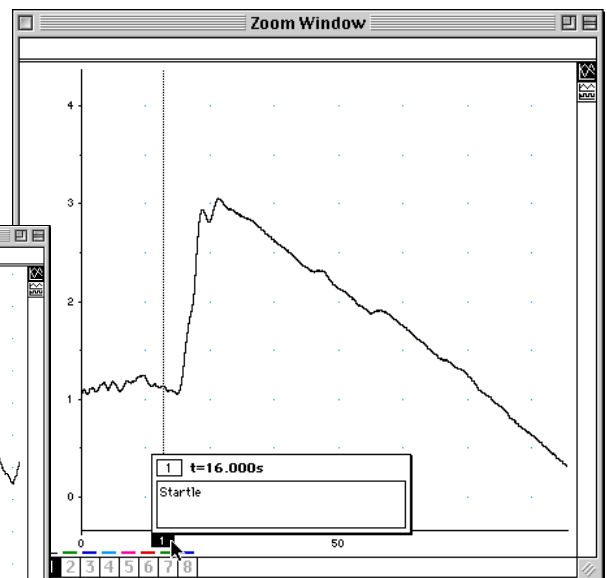


Figure 4. GSR startle response

## References

1. G.I. Kositsky, 'Human Physiology' (Mir Publishers, Moscow, 1990) pp224-32
2. GSR Amp Owner's Guide, (ADInstruments 1997), pp12-15