

What are Electrostatic Discharge (ESD) damages?



The electronic components of all electrical devices are vulnerable to the influence of external electromagnetic fields. This is especially true for high-precision measuring devices such as the NeuroAmp, because it's function is the acquisition of EEG-signals, which means measurement of tiny voltage signals in the range of microvolts. Therefore, the electronics of the NeuroAmp are electrically connected to a person that is connected to the device via electrodes.

The NeuroAmp is an approved medical device and is equipped with a galvanic isolation that electrically decouples all connected persons, protecting against electrical voltages up to 8000 V. Primarily the aim is to protect persons against electric shock from the computer connected to the local power grid. However, the galvanic protection also works in the other direction. It protects the electronics of the NeuroAmp against electric shocks that come from therapists or neurofeedback clients if these have previously (usually unnoticed) electrostatically charged themselves and then touch the NeuroAmp or electrodes. However, people can become electrostatically charged to 30000 V and more. In such a case, extremely high discharge currents can flow when the person touches the NeuroAmp or the electrodes so that the galvanic isolation and possibly also other electronic components of the NeuroAmp are destroyed. The NeuroAmp is designed so that in such a case any electrical connection to the electrodes is interrupted permanently. This protects any person connected to the NeuroAmp via electrodes but the NeuroAmp then has to be repaired.

Damage caused by electrostatic discharge - so-called ESD damage - can be easily avoided with a little care. Below we give you all the information you need.

Where and how can I become electrostatically charged?

Every material contains positive and negative electrical charge that normally equalizes. With intensive contact and following separation or with friction (e.g. walking over a carpet) parts of the negative charge are torn out of one friction partner and are absorbed by the other. This leads to a buildup of unequal electrical potentials on the surfaces of both partners. Initially these stay there and are called "dormant" or "static". Electrostatic charges arise almost everywhere in everyday life.



For example, in very dry air, the body of a human being can „rub“ against the air such that it causes electrostatic charging. The power of the electrostatic charge can reach extremely high levels. The friction while walking with plastic shoe soles on a synthetic carpet can lead to potential differences of 35000 Volt.

Activity	Relative humidity	
	10-25%	65-90%
Walk across carpet	35000 V	1500 V
Walk across vinyl floor	12000 V	250 V
Sitting on a chair with PE-foam	18000 V	1500 V

Sources of static electricity are:

- Dry ambient air
- Waxed or painted surfaces and those made of plastic, polystyrene or glass
- Waxed or PVC / vinyl flooring or carpets made from synthetic materials
- Clothing made from synthetic materials (e.g. nylon) or wool, non-conductive shoes (e.g. those with rubber soles)
- Friction of different materials between each other (e.g. emptying of plastic garbage bags or the transferring of liquids from one packaging to another)

What happens during an electrostatic discharge?

If a person is strongly charged, which means that he or she has a high potential difference compared to the environment, a direct contact or even a short distance to an object can lead to a “breakdown”. The currents that flow during such a short electromagnetic pulse can destroy electronic components of the NeuroAmp so that a costly repair is required.



Are electrostatic discharges harmful?

Low electrostatic discharges are often not even noticed, at higher potential differences, however, sparks can appear and a clear, sometimes painful electric shock can be perceived. However, the energy of the discharge currents is so low that there is no direct health risk for humans in a normal environment for neurofeedback therapy.

The NeuroAmp is an approved medical device with a galvanic isolation and therefore protects all connected persons against electric shocks from the computer in case of a damage to the device caused by electrostatic discharge.

What can I do to prevent ESD damage?

ESD damage can be prevented very effectively if:

- The buildup of electrostatic charges is prevented
- Therapist and client are electrically grounded before they touch neurofeedback devices (NeuroAmp, tactile feedback, QIK, pIRx3, etc.) or electrodes



Fig. 1: Symbol of an ESD-protection component

The following recommendations are given for the practical implementation of these preventive measures:

- Take care when furnishing a new practice that furniture, devices, and floors/carpets have surfaces made out of antistatic materials or carry the symbol of an ESD protection component
- Place grounding mats on the working surface (therapist) and the seat (client). Such mats are also available for floors
- Therapist and client can ground themselves by means of ground straps. Where this is not possible, an electrostatic discharge can be established by touching a grounded metal surface (such as a heater or the metal housing of a computer that is connected to the power grid)
- Wear shoes with conductive soles in your practice. Perfect are shoes that carry the symbol of an ESD protection component
- If you have dry ambient air, then use a humidifier to moisturize it. Air conditioners can also moisturize the air. These measures are particularly important in wintertime because cold air cannot carry as much moisture and the air is additionally dried by heating



Fig. 2: Antistatic mat and ground strap are connected together via a special plug to the ground of the household power grid.