

ESD protection for LED systems

1 Introduction

1.1 Definition of electrostatic discharge – ESD

Electrostatic discharge is a spark or sparkover resulting from a large potential difference in an electrically insulating material, which causes a very short, high electrical current pulse. The cause of the potential difference is usually due to static electricity.

1.2 Examples



- Lightning
- Discharge by touching a car door
- Crackling from the many small discharges when removing a sweater

1.3 Typical electrostatic voltages

Many everyday activities cause very high voltages, which are generated in our bodies. A human can feel electrostatic discharges of 3000V and higher. Semiconductor devices, including LEDs and LED drivers, can easily be damaged by electrostatic discharges of a few volts.

Charge by triboelectricity

Activity	Charge voltage (depending on rel. humidity)	
	10–20 %	65–90 %
Walking on a carpet	35 000 V	1 500 V
Walking on a vinyl floor	12 000 V	250 V
Sitting in an office chair (movements in the chair)	6 000 V	100 V
Handling of a plastic bag	20 000 V	1 200 V

2 Damages caused by ESD

LEDs can be damaged by ESD so badly that they fail totally. This means that they neither emit light nor are electrically conductive. If the LED is damaged, but still electrically conductive, it is considered a disturbance.

2.1 Total failure

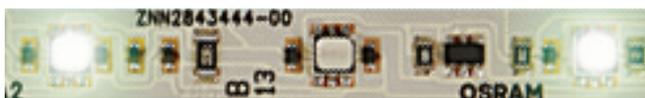
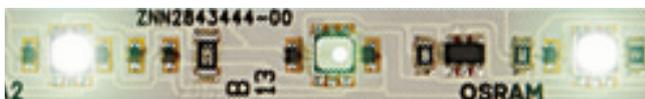
An LED that fails completely due to ESD does not only remain completely dark, but is also no longer electrically conductive. Therefore, all further LEDs in series connection do not emit light, even if they are undamaged. This is immediately visible after the damage.



- Immediately visible
- Several LEDs in one electrical row do not emit light

2.2 Disturbance

In contrast to total failure, LEDs can be damaged in a way that they still emit light initially, but rapidly become dim. Since the damaged components remain electrically conductive, the remaining module continues to emit light normally.



- Damaged LEDs can emit light initially
- They quickly become dim

Most damages become visible after a short period of operation. We therefore recommend a function test of approx. 1 hour, in particular, for installations with difficult access.

3 Prevention of ESD damages

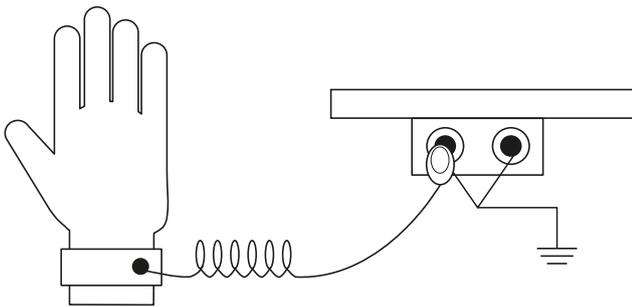
3.1 When do you have to pay attention to ESD?



The pictogram on the left indicates that ESD preventive measures have to be taken. Objects and work areas can be marked with it.

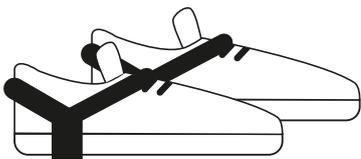
3.2 Basics for static protection

1) Grounding

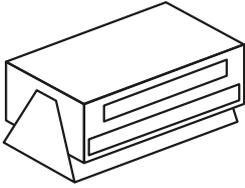


Grounding is a very important measure. The best prevention is to directly connect personnel to the ground with a personal earthing system:

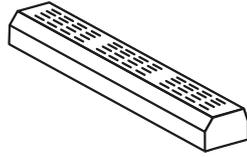
- Grounding with help of a special wrist strap
- Conductive footwear
- Heel straps should be worn on both feet in order to ensure constant contact to the ground



2) Neutralization

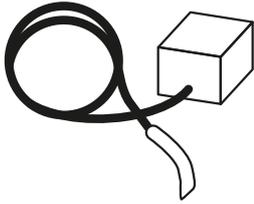


Ionizer mounted on the work desk

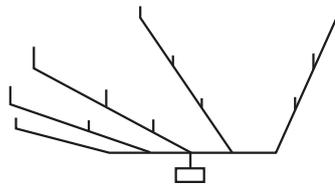


Ionizer mounted over the work desk

If an isolator is statically charged, ESD damage can be caused by contact. In order to reduce this risk, an ionizer can be used. This produces billions of charged particles and thus neutralizes the static charge of the isolator.



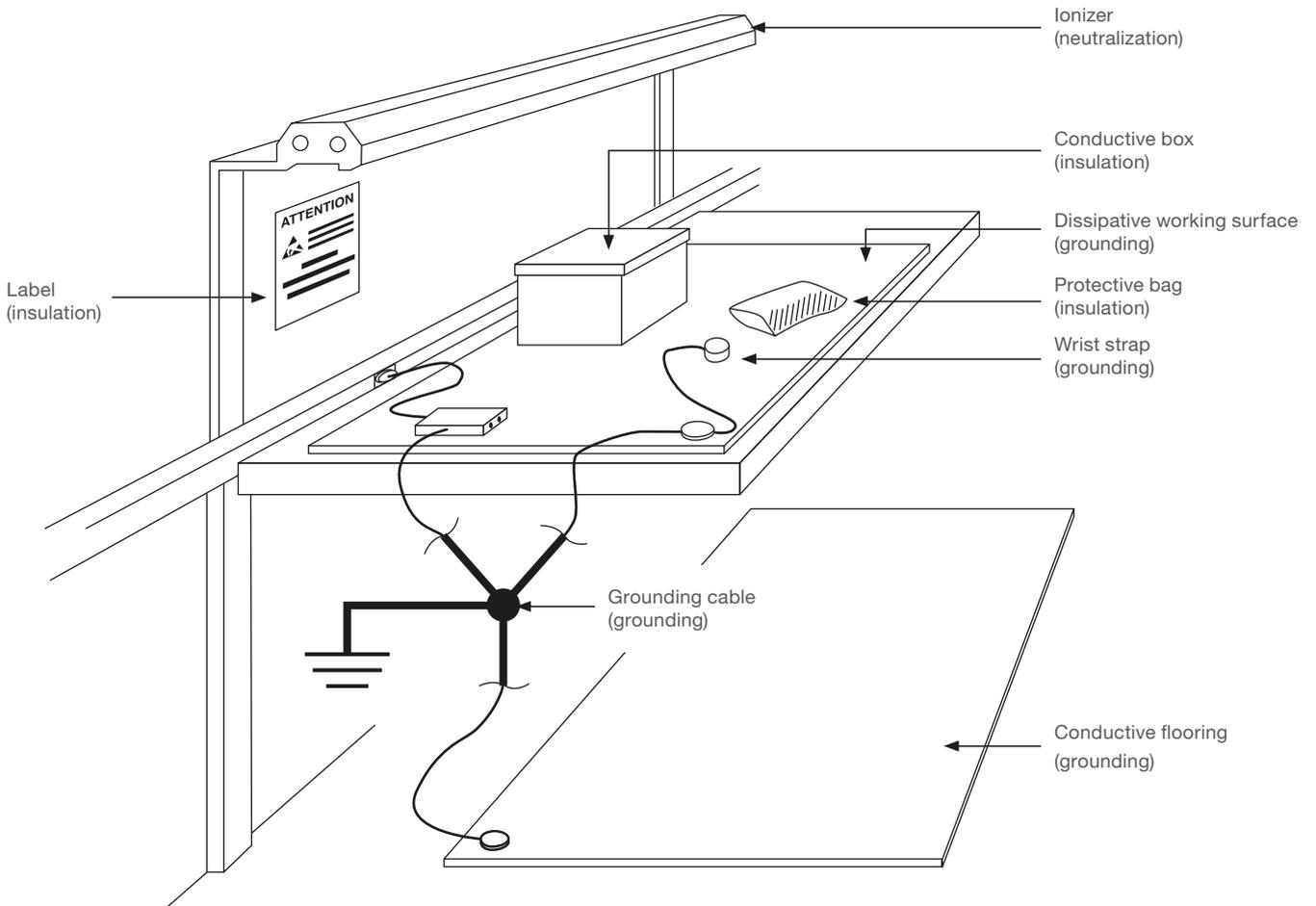
Pistol for the delivery of ionized air



Complete room ionization system

Neutralization replaces neither grounding nor prophylaxis!

Example of a static-safe workplace



3) Prophylaxis

a) In general



Never enter an ESD-protected area without following the appropriate safety precautions.



- On an ESD-protected work desk, there should be no unnecessary objects, e.g. coffee cups or other insulators
- Soldering irons, screwdrivers and other tools should be ESD-certified, as indicated by the pictogram on the left
- Test grounding devices daily

b) Confinement of LED systems

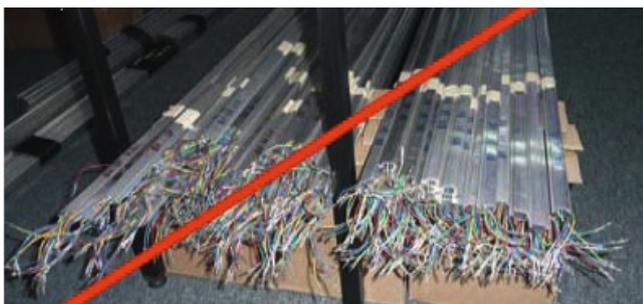


For handling the modules, also wear cotton grounding gloves. This also applies to the handover of modules from one person to another.

Avoid touching the metallic contacts.



For ESD-safe lacquering of the modules, we recommend the use of spray lacquer. If you apply the lacquer with a brush (not recommended), do not use a brush with plastic fibers.



The modules must be kept separated during storage and transport in such a way that they cannot touch each other. Also avoid components or modules coming into contact with clothes, hair or other insulators (e.g. carpet).

The observance of these measures reduces the occurrence of ESD damages, but can not exclude them completely.