
PRIORITY: Normal

DATE: March 28, 2000

TITLE: Guidelines for Controlling Electrostatic Discharge (ESD) Damage.

ECO REFERENCE: N/A

**PRODUCT(S)
AFFECTED:** All

SUMMARY:

Owners of Adaptive products should understand the danger of electrostatic discharge damage and use appropriate precautions whenever integrated circuits are exposed.



Guidelines for controlling electrostatic discharge damage

Semiconductors are protected from damaging static surges during normal operation but you should take precautions any time the inside of a unit is exposed. If at all possible, every service procedure performed on electronic assemblies should be carried out at an approved ESD-protected work station. (See illustration, following page.) ESD-work stations have a common ground-point between the static-protected work surface and the personal-grounding protection (wrist-straps, heel straps, and/or floor mats) that effectively limits ESD.

If this type of work station isn't available, observe the following 5-step grounding procedure *before* you open up a unit or handle the bags that contain replacement parts:

5-Step grounding procedure:

1. Disconnect the display's power cord from the outlet socket, to safely remove power from the unit and prevent any risk of electric shock.
2. Put on a grounded, anti-static wristband or heel strap. These are available through Radio Shack, Newark, Grainger, or similar electronic supply outlets. For infrequent use or one-time only projects, disposable wristbands or straps are an inexpensive alternative to those intended for every day in, day out use. If no personal body protection is available, touch your finger to a grounded metal surface each time you get ready to touch the assembly.
3. Using alligator clips and a jumper wire, connect the circuit board or other assembly you're working with to the same grounded anti-static band or strap you're connected to. Touch something metal, again, before you begin handling ESD-sensitive parts.
4. If you have a component that's been stored in an anti-static bag – before opening the bag to take out the part – hold the bag in one hand while touching a grounded metal surface with the other hand. This dissipates any charge on the *outside* of the bag, which can build up over time. That is especially likely to occur if the bag's been packed in styrofoam peanuts, or other materials with a strong tendency to collect static charge.

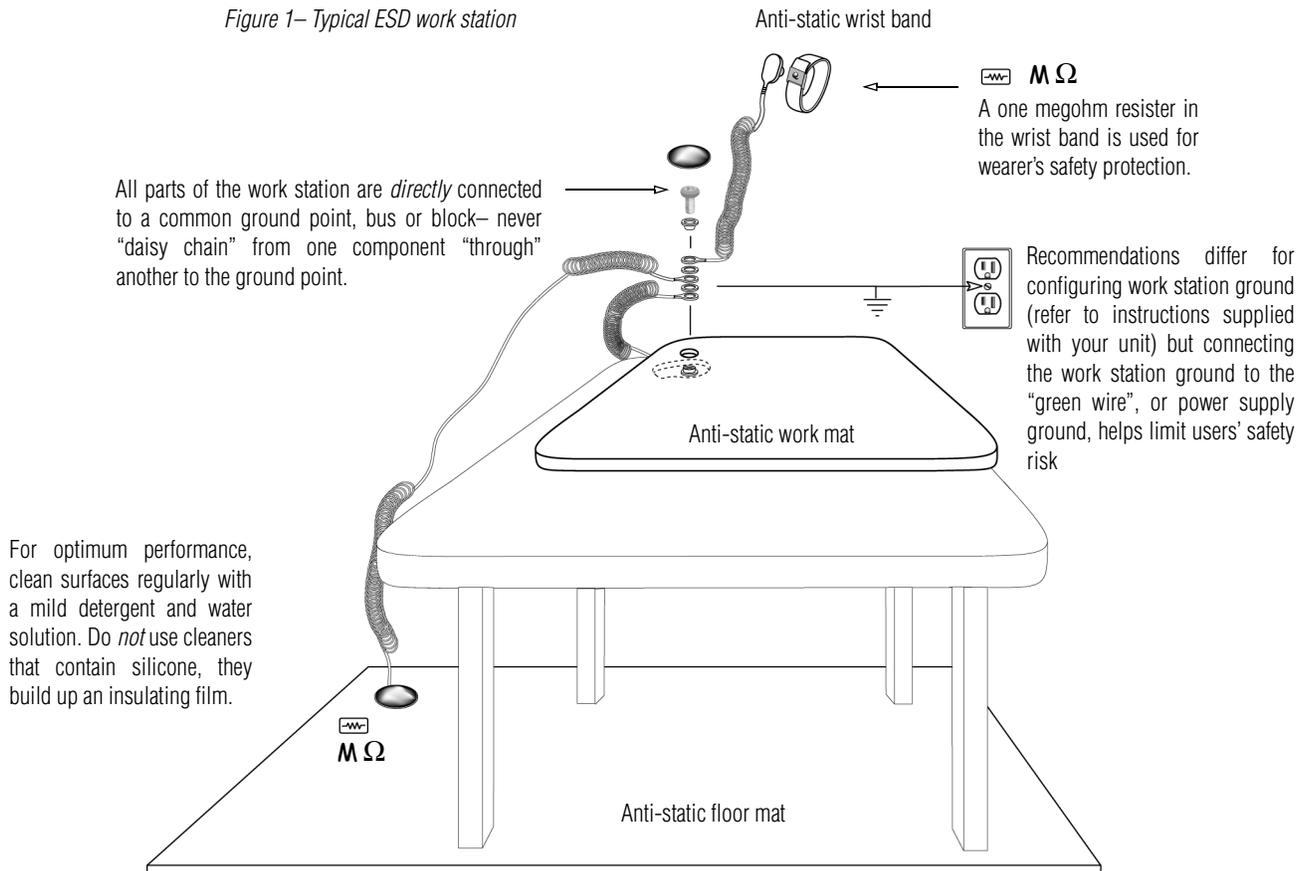
Guidelines for controlling electrostatic discharge damage (continued)

- Once electrical potential has been equalized (between the assembly and yourself) begin the service procedure but try to limit direct hand contact – hold circuit boards by their edges, use handling tools to pry IC's from their sockets, never touch IC's/EEPROMS. You can further minimize the potential for ESD damage by observing the following guidelines to protect your work area:

Work area safety guidelines

- Keep styrofoam, plastics, and other static generating material away from your work area. Generally, any non-conductive (non-metal) material can be static-generating.
- Always turn off power before removing or inserting an EPROM.
- Until you're ready for them, keep static-sensitive parts in an anti-static container.
- Do your work on a static-free surface. If you don't have access to an ESD work station, an aerosol can of household "static guard" spray *will* help to protect your work area. (But don't spray directly on components or circuits.)
- Never slide static-sensitive devices across any type of surface – friction creates static.
- Do NOT touch EPROM leads. If they become bent, use a tool to straighten them.
- Use grounded soldering, test and assembly equipment.
- If you stop work, get up and walk around, repeat steps 1 through 5 (starting with step 1 on the preceding page).

Figure 1– Typical ESD work station



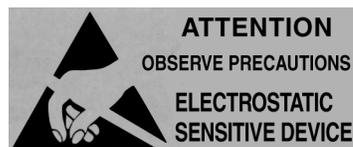
Understanding electrostatic discharge damage

ALPHA signs contain electronic components that may be harmed by electrostatic discharge (ESD). “Static charges” can cause undetected, sometimes critical, weakening of integrated circuits. These circuits may continue to operate more or less normally but the physical harm done is very likely to be irreparable, irreversible and permanent; whether or not it results in immediate failure or fails later, beyond the product warranty period. This can happen even when the voltage of the static discharge is below the sensory threshold of the person causing the damage, who remains unaware of what may have just taken place.

Any type of ESD damage can result from incidental “contact” that isn’t felt or sensed by the person creating the damage. This is because static discharges below 3,000 or 4,000 volts are “invisible” – people don’t feel them at all. On the other hand, in dry air, a person walking across a carpet can build up a static charge in the 35,000 to 40,000 volt range. When this type of charge is present, crippling discharges can occur with no actual “contact” at all, if electronic components are brought too close to a person’s clothing or hair. Because they are designed to operate with carefully regulated power-supply voltage in the range of 5 to 12 volts, some very sensitive circuits can be damaged by static discharges below 50 volts.

“Invisible” ESD damage can range from subtle weakening of semiconductor junctions, causing intermittent corruption of digital memory, to “latent overstress failure”, or delayed-action mishaps in which the consequences of damage occur some days, weeks, or months after the event. As electronic components become smaller and more sophisticated, their internal circuits show a corresponding decrease in size. Critical semiconductor junctions may be a fraction of the diameter of the typical human hair, less than 30 microns across. The smaller these parts get, the more susceptible they are to ESD damage that can turn a vital area of a sub-miniature circuit to a scorched, blackened – and non-conductive – “dead spot”.

“Static charges” are inherently unbalanced. They cause miniature lightning bolts of static charge, releasing current that can damage or destroy the oxides, metalizations, and junctions of critical circuits. If your facility does any appreciable volume of work on exposed electrical circuits, the purchase of an ESD-control work station should be considered seriously. If you have any doubts about the exposure risk of ESD, you can pick up or rent a static field meter to measure the actual static charge levels in your work environment. People in warm, humid climates are typically least at risk but if you live in a cold or dry ambient environment, it’s easy to remain completely unaware of ESD hazards that can be all too prevalent at certain times of the year.



Follow protection guidelines whenever you see the ESD symbol but never assume the assembly is “safe” if it’s not present. ESD can damage circuit traces on any circuit board. Follow ESD guidelines any time the inside of an electronic unit is exposed.