

# Keysight Tips to Prevent Unnecessary Repairs

## 1. Ensure proper grounding

- Always use the three-prong AC power cord supplied with the instrument.
- Proper grounding of the instrument will prevent a build-up of electrostatic charge which may be harmful to the instrument and the operator.
- Do not defeat the earth-grounding protection by using an extension cable, power cable, or autotransformer without a protective ground conductor.
- Check AC power quality and set AC voltage input selector according to your line voltage (e.g. 100, 120, 230 volts). Typical expected grounding wire resistance  $< 1 \Omega$ , the voltage between neutral and ground line  $< 1 \text{ V}$ . Install uninterruptible power supply (UPS) if necessary.

## 2. Read the warning labels and specifications

- Do not exceed the values provided in the user guide or as indicated by the yellow warning labels on the instrument.
- Refer to the specifications required to meet with the listed specifications. There will be information regarding stabilization time, instrument settings and calibration/alignment requirements.

For example, the warning label on the E4412A power sensor indicates the maximum RF input power to be applied is  $+23 \text{ dBm} = 200 \text{ mW}$ . Further peak or average voltage limits and fastening torque, as well as ESD precautions are noted:



## 3. Avoid overpowering the instrument

- Avoid front end damage by having some idea of the signal level to be measured with the instrument. Overpowering the front end can cause damage to the front end components. (e.g. for spectrum analyzers the typical maximum RF input signal level is  $30 \text{ dBm}$  resp.  $1 \text{ watt}$ )
- Before turning on or off the connected equipment or the DUT, turn off or reduce the DUT/source power. This will prevent unexpected voltage swell or sag affecting the input or the output of the instrument.
- Properly apply a DC block, limiter or external attenuator as needed. For more info visit: [www.keysight.com/find/mta](http://www.keysight.com/find/mta)

For example, Keysight 11867A RF limiter is available to provide input protection. It will reflect signals up to a level of  $10 \text{ watts}$  average power and  $100 \text{ watts}$  peak power. In addition a whole family of power limiters can be found under the product numbers: N9355A/B/C, N9356B/C.



11742A blocking capacitor blocks DC signals below  $45 \text{ MHz}$  and passes signals up to  $26.5 \text{ GHz}$ . Ideal for use with high frequency oscilloscopes or in biased microwave circuits, it will suppress low frequency signals that can damage expensive measuring equipment.

## 4. Protect the RF input connector

- Be careful not to bend, bump or flex any device under test (DUT) connected to the input of the instrument (such as filters, attenuators, or large cables). This will reduce the amount of strain placed on the input connector and the mounting hardware.
- Ensure externally connected items are properly supported (not freely suspended) from the input.
- Don't mix  $50 \Omega$  and  $75 \Omega$  connectors and cables.



Inspect the connectors prior to using; look for dirt, nicks, and other signs of damage or wear. A bad connector can ruin a good connector instantly. Here are a few examples of damaged connectors.

## 5. Follow proper RF cable and connector care

- Avoid repeated bending of cables; a single sharp bend can damage a cable instantly.
- Limit the number of connections and disconnections to reduce wear.
- Inspect the connectors prior to using; look for dirt, nicks, and other signs of damage or wear. A bad connector can ruin a good connector instantly.
- Always use torque wrench and gauge tools for connecting RF connectors.
- Clean dirty connectors to prevent poor electrical connections or damage to the connector. For more cable and connector care tips refer to the cable care tutorial at [http://na.support.keysight.com/pna/help/WebHelp7\\_5/Tutorials/Connector\\_Care.htm](http://na.support.keysight.com/pna/help/WebHelp7_5/Tutorials/Connector_Care.htm)



## 6. Follow electrostatic discharge precautions

- Electrostatic discharge (ESD) can damage or destroy electronic components. Whenever possible, conduct testing at a static-safe workstation. Keep electrostatic-generating materials at least one meter away from all components. Before connecting any coaxial cable to an instrument, momentarily short the center and outer conductors of the cable together to ground.
- Install ESD protective covers on all RF connectors prior to shipping and moving equipment.
- For more information visit the Electrostatic Discharge Association: <http://www.esda.org>

## 7. Check for proper ventilation and humidity

- Periodically check and clean the cooling vents of the instrument. Inadequate airflow can result in excessive operating temperatures which can lead to instrument failures. Optimal operating temperature is between 20 to 30 °C.
- When installing the product in a cabinet the convection into and out of the instrument must not be restricted. The ambient temperature must be less than the maximum operating temperature of the product by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

## 8. Use proper lifting techniques

- Lift the instrument by the handles when transporting.
- Avoid picking up the instrument with your hand over the front panel. If the instrument slips, damage may occur to the keypad, knob, or input connectors.
- Use a cart or two people to help move heavy instruments.

## 9. Use proper packaging for transport

- Instrument damage can result from using packaging materials other than those specified.
- Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the equipment and can cause equipment damage by generating static electricity or blocking fans.
- If possible, retain the original packaging in order to reuse it when shipping the instrument.

## 10. Check your instrument settings

- Review the measurement procedures and settings needed for a particular application prior to making any measurements (refer to the user guide).
- Depending on the type of repair, the instrument settings may have been reset to the factory defaults.

## 11. Make sure to get the latest information about your product

- Subscribe to the Keysight E-mail updates: [www.keysight.com/find/emailupdates](http://www.keysight.com/find/emailupdates)
- For Worldwide Service Location information visit: [www.keysight.com/find/assist](http://www.keysight.com/find/assist)

Review your previous repairs using Keysight Infoline Web tool at: [www.keysight.com/find/service](http://www.keysight.com/find/service)

### Keysight services

[www.keysight.com/find/keysightservices](http://www.keysight.com/find/keysightservices)  
Flexible service solutions to minimize downtime and reduce the lifetime cost of ownership

### Expert assistance

[www.keysight.com/find/assist](http://www.keysight.com/find/assist)  
View Keysight global service locations and local contacts