

AN07: Module, accessory, and instrument general handling

Centellax modules, accessories, and test instruments achieve high levels of performance in part due to a carefully designed interface between external connectors and internal components. As a result, specific handling precautions must be observed for device reliability and optimum performance.

General Information

1. Read and follow the operating instructions. Do not exceed the minimum and maximum specifications, especially RF input power, DC bias, and environmental operating conditions.
2. Use ESD protection at all times. Ensure ESD protection is in place before handling RF input and output connectors. Ground cable conductor pins before use to remove static buildup.
3. Situate the equipment away from heat sources. Do not block airflow around equipment. If equipment will be operated at high ambient temperatures, mount with a good thermal connection to a large thermal mass.
4. Do not allow foreign material into the enclosure. Do not allow contamination to be introduced into the connectors.
5. If applicable, always use the provided AC adaptor. Do not power the unit with a different adaptor. Do not modify the power plug or wall outlet to remove the third (ground) pin.
6. Do not drop or shake the equipment. Minimize vibration and handle with care.
7. There are no user-serviceable parts within. Return damaged equipment for factory-authorized repair. Refer to warranty for more information.

Performance Recommendations

1. Differential connectors may be used single-ended if the second end is terminated with 50Ω.
2. When using differential connections, ensure cables and connectors are phase balanced to minimize skew between channels.

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3. Use connector savers and high-quality cables. Clean connectors regularly. Keep cable lengths short and minimize the number of cable bends and connectors.
4. Terminate all unused RF connectors with 50Ω terminations.

Connector Substitution

Some applications require using a connector that is different from the one provided with the module or accessory. Centellax recommends using external connector adaptors, or specifying the type of connector required before ordering the part. Modifying a Centellax product will void the warranty, and will often lead to device damage or reduced performance.

Centellax PC board products, including evaluation boards and test accessories, are designed and manufactured with close attention to the connector interface. The connector is matched with the board; arbitrary connector substitution may impact the electromagnetic transition and seriously reduce performance.

In addition, the assembly schedule for many products requires that the connectors are attached to the PC board prior to the attachment of active devices. The level of heat required to replace a connector can reflow solder at other locations on the board, breaking connections to components, and can cause the bonding of active devices to become intermittent or to fail entirely.

Any modification of a Centellax product will void the warranty. If alternate connectors are required, the end user should specify the desired connector (or other modification) when ordering the product.

Connector Mating

Centellax products feature many different types of microwave connectors. These products must meet stringent performance specifications despite repeated connector mate/de-mate cycles. Rough or uninformed handling can easily destroy connectors and reduce performance; the end user is expected to ensure that mistreatment does not occur. As a reminder, some general precautions follow.

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Cleaning the Connector Interface

A clean interface will extend the connector life and provide more accurate, repeatable measurements. To clean the connector interface, moisten a clean, lint-free swab using isopropyl alcohol, remove any excess alcohol, wipe both sides of the interface to eliminate debris, then blow-dry with filtered compressed air or nitrogen.

Do not blow into cleaned connectors – breath is moisture laden, and alcohol absorbs moisture. Inspect the connector to verify that the interface is clean and ready for use. If metallic particles are embedded in the dielectric, use a loupe and a sharp pick to dislodge them.

Initial Connector Mating

Never attempt to mate connectors before first aligning their center pins. Due to the necessary play in the coupling mechanism, it is often possible to mate connectors when the pins are not aligned. Mating connectors with misaligned pins will damage the connectors.

Depending on the connector type, you can often ‘feel’ whether or not the pins are aligned. If you are reasonably sure that they are aligned, proceed by gently mating the coupling nut by hand until it bottoms. Do not use a wrench at this stage.

If the coupling nut is difficult to turn, it may be due to one of the following problems:

- The pins are not aligned
- The coupling nut is cross-threaded
- The connector (or its mate) has been damaged by excessive torque
- The connector is dirty

Stop and determine the reason. You can destroy the assembly and/or mating connector if one of these conditions exists.

Never hold a (male) coupling nut stationary while screwing the socket (female) counterpart into it. This will ultimately ruin both connectors: the rotation wears away plating and scores the surfaces of the pins. This is a very common form of damage since it seems to be a natural way to join the connectors.

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Connector Torque

To mate connectors with knurled nuts, or press-on connectors, use only your fingers. ***Never use pliers to tighten any connector.***

When tightening a connector with a torque wrench, firmly grasp the body of the connector to prevent it from rotating. Always use a torque wrench that is permanently set to the correct torque. Tighten slowly until the wrench 'snaps'. Fast tightening overrides the torque-limiting capability of the wrench. To avoid over-torque, do not snap the wrench more than once.

A connector that has been over-torqued or otherwise damaged will damage every connector to which it is mated.

Table 1: Recommended torque values for connectors

Connector Type	Torque: lb-inch (N-cm)	Notes
SMA	5 (56)	Female mates with male 3.5-mm and 2.92-mm. Use the 3.5/2.92-mm torque value to connect precision male connectors to the female SMA (8 lb-inch). Male mates with female 3.5-mm and 2.92-mm, provided the male center pin is chamfered so as to avoid over-insertion into the female pin. Use the SMA torque value to connect male SMA connectors to female precision connectors (5 lb-inch).
Precision 3.5 mm	8 (90)	mates with SMA and 2.92-mm
Precision 2.92 mm (K)	8 (90)	mates with SMA and 3.5-mm
Precision 2.4 mm	8 (90)	mates with 1.85-mm
Precision 1.85 mm (V)	8 (90)	mates with 2.4-mm
GPPO	press-on	very limited number of cycles to failure; should only be used in permanent installations

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ESD Control

Electrostatic Discharge (ESD) is a prevalent and dangerous problem affecting all electronic parts and systems. Industry studies show that 30% of all electronic failures can be attributed to ESD.

The human body or other conductive objects can acquire electrostatic charge if not properly grounded. If this charge comes in contact with an ESD sensitive (ESDS) device, damage can occur. Non-conductive objects, which cannot be grounded, can acquire charge that can be transferred to the ESDS device.

Cathode ray tubes and other high voltage devices create high electric field potentials. Moving an ESDS device through such a field can induce damage due to current flow even if the device doesn't come in contact with a charged surface.

The fundamental ESD control principles to observe when handling all electronic devices, including Centellax products, are:

- A. All conductors in the work area, including personnel, must be grounded so as to maintain equipotential balance.
- B. Necessary non-conductors in the work area must be charge-neutralized through the use of an ionization system.
- C. Potential fields in the work area must be attenuated through the use of shielding.
- D. Transportation of ESDS devices outside a protected work area requires enclosure in static protective materials.

The need for ESD control is widely accepted throughout the industry and is generally achieved in an organization via an ESD control program. There are many other factors that make up a well-designed ESD control program, including employee training, ESD control products designed to protect the corresponding ESD-sensitive devices, management commitment, employee adherence to internal disciplines, and compliance audits. The details of such a program are beyond the scope of this application note but are readily available within the industry.

Centellax considers ESD damage to its products as sufficient grounds to void the warranty. Take care to ensure all products are tested, assembled, and operated in an ESD-protected environment.