

# Keysight 909A/D Coaxial Terminations

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### CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

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## Waste Electrical and Electronic Equipment (WEEE) Directive

This instrument complies with the WEEE Directive marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

### Product category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

## Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- [www.keysight.com/find/mta](http://www.keysight.com/find/mta)  
(product-specific information and support, software and documentation updates)
- [www.keysight.com/find/assist](http://www.keysight.com/find/assist)  
(worldwide contact information for repair and service)

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# 1 Introduction

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This chapter provides you the overview of Keysight 909A and 909D Coaxial Termination.

## Product Overview

The Keysight 909A and 909D terminations are low-reflection loads for terminating 50  $\Omega$  coaxial systems in their characteristic impedance. The Keysight 909A is extremely broadband, covering the frequency range from DC to 18 GHz. The Keysight 909D is specified to 26.5 GHz, and mode free to 34 GHz. Both terminations find wide use as accessories for broadband measuring instrument and for coaxial instrumentation.

### 909A coaxial termination

The Keysight 909A is furnished with a Precision 7 mm connector. This is a sexless connector with low RF leakage and clearly defined reference plane. As an option, the Keysight 909A can be furnished with either male or female Type-N connector interfaces per IEEE standard 287 GPC. The outer conductors of these Type-N interfaces are made of passivated stainless steel.



**Figure 1-1** Keysight 909A with male and female Type-N connector

## 909D coaxial termination

The Keysight 909D has Precision 3.5 mm connector interfaces per IEEE standard 287 GPC.



**Figure 1-2** Keysight 909D coaxial terminations

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## 2 Specifications

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This chapter provides you the specifications of Keysight 909A and 909D coaxial terminations.

## Product Specifications

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**Table 2-1** Product specifications

Model number	909A	909D
Frequency range	DC to 18 GHz	DC to 26.5 GHz
Impedance	50 $\Omega$	50 $\Omega$
Connectors	Option 701 Precision 7 mm Option 012 Type N (m) Option 013 Type N (f)	Option 011 3.5 mm (f) Option 301 3.5 mm (m) Option 040 3.5 mm (m)
Reflection coefficient	Option 701 – DC to 4 GHz: 0.024 (1.05 SWR) – 4 to 12.4 GHz: 0.048 (1.10 SWR) – 12.4 to 18 GHz: 0.110 (1.25 SWR)	Option 011 and 301 – DC to 3 GHz: 0.01 (1.02 SWR) – 3 to 6 GHz: 0.02 (1.04 SWR) – 6 to 26.5 GHz: 0.06 (1.12 SWR)
	Option 012 and 013 – DC to 4 GHz: 0.029 (1.06 SWR) – 4 to 12.4 GHz: 0.052 (1.11 SWR) – 12.4 to 18 GHz: 0.130 (1.30 SWR)	Option 040 – DC to 4 GHz: 0.01 (1.02 SWR) – 4 to 6 GHz: 0.02 (1.04 SWR) – 6 to 26.5 GHz: 0.06 (1.12 SWR)
Power rating	2 W average 300 W peak	2 W average <sup>[a]</sup> 100 W peak (10 ps max. pulse width) at 20 °C

[a] Derated to 1 W average at 75 °C



## Physical Specifications

**Table 2-2** Keysight 909A physical specifications

	Option 701	Option 012	Option 013
Length	45 mm (1.77 in)	52 mm (2.05 in)	52 mm (2.05 in)
Diameter	22 mm (0.87 in)	21 mm (0.83 in)	18 mm (0.71 in)
Weight	59 g (2.08 oz)	52 g (1.83 oz)	50 g (1.76 oz)
Shipping weight	0.45 kg (0.99 lb)	0.45 kg (0.99 lb)	0.45 kg (0.99 lb)

**Table 2-3** Keysight 909D physical specifications

	Option 011	Option 301 and 040
Length	23 mm (0.91 in)	24 mm (0.94 in)
Diameter	8 mm (0.16 in)	9 mm (0.35 in)
Weight	7 g (0.25 oz)	7 g (0.25 oz)
Shipping weight	0.45 kg (0.99 lb)	0.45 kg (0.99 lb)

## Pin Depth Specifications

**Table 2-4** Keysight 909A pin depth in micrometers ( $10^{-4}$  inches)

Option 701	Option 012	Option 013
-7.9 to -98.4 (-2 to -25)	0 to -157.5 (0 to -40)	0 to -118.1 (0 to -30)

**Table 2-5** Keysight 909D pin depth in micrometers ( $10^{-4}$  inches)

Option 701	Option 012	Option 013
0 to -78.8 (0 to -20)	0 to -78.8 (0 to -20)	0 to -78.8 (0 to -20)

## Environmental Specifications

**Table 2-6** Environmental specifications

Parameter	Required values/ranges
Temperature	
Operation	+15 °C to +35 °C (+59 °F to +95 °F)
Storage	-40 °C to +75 °C (-40 °F to +167 °F)
Temperature	
Operation	< 4,500 m (15,000 ft)
Storage	< 15,000 m (50,000 ft)
Temperature	Always non-condensing
Operation	0% to 80% (26 °C maximum dry bulb)
Storage	0% to 95%
Vibration	0.015", 5-55-5 Hz, 15 min, 3 axes
Shock	100 g, 1-2 ms, 3 times each plane

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This chapter provides you installation and service information.

## Installation

### Initial Inspection

- 1** Unpack and inspect the shipping container and its contents thoroughly to ensure that nothing was damaged during shipment. If the shipping container or cushioning material is damaged, the contents should be checked both mechanically and electrically.
- 2** If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, contact the nearest Keysight Technologies Sales and Service office. Refer to the Service and Support information in page 3. Keysight Technologies will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier's inspection.
- 3** If you are returning the instrument under warranty or for service, repackaging the instrument requires original shipping containers and materials or their equivalents. Keysight Technologies can provide packaging materials identical to the original materials. Refer to Service and Support information in page 3 for the Keysight Technologies nearest to you. Attach a tag indicating the type of service required, return address, model number, and serial number. Mark the container **FRAGILE** to insure careful handling. In any correspondence, refer to the instrument by model number and serial number.

## Service

The 909A/D does not have internal adjustments and should not be opened; it should only be repaired by service-trained personnel. Should it become necessary to return the 909A/D for repair or service, contact your nearest Keysight Sales and Service Center. Refer to “Sales and Technical Support” on page 3 of this manual.

## Maintenance

The connectors, particularly the connector faces, must be kept clean. Keysight recommends that the connectors be periodically inspected and cleaned if necessary.

### Cleaning connectors

Clean connectors are essential for ensuring the integrity of RF and microwave coaxial connectors.

#### 1 Use compressed air or nitrogen

#### WARNING

Always use protective eyewear when using compressed air or nitrogen.

Use compressed air (or nitrogen) to loosen particles on the connector mating plane surfaces.

You can use any source of clean, dry, low-pressure compressed air or nitrogen that has an effective oil-vapor filter and liquid condensation trap placed just before the outlet hose.

Ground the hose nozzle to prevent electrostatic discharge, and set the air pressure to less than 414 kPa (60 psi) to control the velocity of the air stream. High-velocity streams of compressed air can cause electrostatic effects when directed into a connector. These electrostatic effects can damage the device.

#### 2 Clean the connector threads

#### WARNING

Keep isopropyl alcohol away from heat, sparks and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical or carbon dioxide; water may be ineffective.

Use isopropyl alcohol with adequate ventilation and avoid contact with eyes, skin and clothing. It causes skin irritation, may cause eye damage and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling.

In case of spill, soak up with sand or earth. Flush spill area with water.

Dispose of isopropyl alcohol in accordance with all applicable federal, state and local environmental regulations.

Use a lint-free swab or cleaning cloth moistened with isopropyl alcohol to remove any dirt or stubborn contaminants on a connector that cannot be removed with compressed air or nitrogen.

- a** Apply a small amount of isopropyl alcohol to a lint-free cleaning swab.
- b** Clean the connector threads.
- c** Let the alcohol evaporate, then blow the threads dry with a gentle stream of clean, low-pressure compressed air or nitrogen. Always completely dry a connector before you reassemble or use it.



**3 Clean the mating plane surfaces**

- a** Apply a small amount of isopropyl alcohol to a lint-free cleaning swab.
- b** Clean the center and outer conductor mating plane surfaces. When cleaning a female connector, avoid snagging the swab on the center conductor contact fingers by using short strokes.
- c** Let the alcohol evaporate, then blow the connector dry with a gentle stream of clean, low-pressure compressed air or nitrogen. Always completely dry a connector before you reassemble or use it.

**4 Reinspect**

Inspect the connector again to make sure that no particles or residue are present.

## Connections

Good connections require a skilled operator. The most common cause of measurement error is bad connections. The following procedures illustrate how to make good connections.

### How to make a connection

#### Preliminary connection

- 1 Ground yourself and all devices. Wear a grounded wrist strap and work on a grounded, conductive table mat. Wear a heel strap when working in an area with conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- 2 Visually inspect the connectors.
- 3 If necessary, clean the connectors.
- 4 Use a connector gage to verify that all center conductors are within the observed pin depth values in “[Pin Depth Specifications](#)” on page 18.
- 5 Carefully align the connectors. The male connector center pin must slip concentrically into the contact finger of the female connector.
- 6 Push the connectors straight together.

#### CAUTION

Do not turn the device body. Only turn the connector nut. Damage to the center conductor and outer conductor can occur if the device body is twisted.

Do not twist or screw the connectors together. As the center conductors mate, there is usually a slight resistance.

- 7 The preliminary connection is tight enough when the mating plane surfaces make uniform, light contact. Do not overtighten this connection.  
A connection in which the outer conductors make gentle at all points on both mating surfaces is sufficient. Very light finger pressure is enough to accomplish this.
- 8 Make sure the connectors are properly supported. Relieve any side pressure on the connection from long or heavy devices or cables.

#### Final connection using a torque wrench

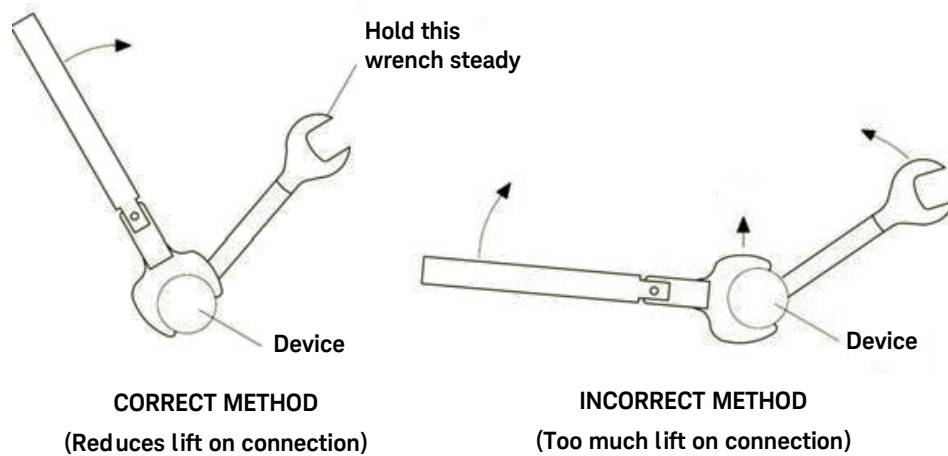
- 1 Use a torque wrench to make a final connection. [Table 3-1](#) provides information about the torque wrench. Using torque wrench guarantees that the connection is not too tight, preventing possible connector damage. It also guaranteed that all connections are equally tight each time.

**Table 3-1** Torque wrench information

Connector type	Torque setting	Keysight torque wrench number
7 mm	135 N-cm (12 in-lb)	8710-1766
Type-N <sup>[a]</sup>	135 N-cm (12 in-lb)	8710-1766
3.5 mm	90 N-cm (8 in-lb)	8710-1765

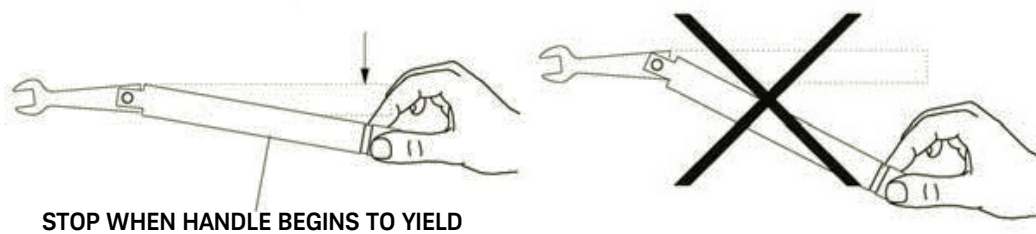
[a] Type-N connectors can be tightened hand tight, but for better repeatability they should be torqued to 135 N-cm (12 in-lb)

- 2 Prevent the rotation of anything other than the connector nut that you are tightening. It may be possible to do this by hand if one of the connectors is fixed (as on a test port). In all situations, however, it is recommended that you use an open-end wrench to keep the body of the device from turning.
- 3 Position both wrenches within 90 degrees of each other before applying force. See [Figure 3-1](#). Wrenches opposing each other (greater than 90 degrees apart) will cause a lifting action which can misalign and stress the connections of the devices involved. This is especially true when several devices are connected together.



**Figure 3-1** Wrench positions

- 4 Hold the torque wrench lightly, at the end of the handle only (beyond the groove). See [Figure 3-2](#).



**Figure 3-2** Using the torque wrench

- 5 Apply downward force perpendicular to the wrench handle. See [Figure 3-2](#). This applies torque to the connection through the wrench. Do not hold the wrench so tightly that you push the handle straight down along its length rather than pivoting it, otherwise you apply an unknown amount of torque.
- 6 Tighten the connection just to the torque wrench break point. The wrench handle gives way at its internal pivot point. See [Figure 3-2](#). Do not tighten the connection further.

**CAUTION**

You don't have to fully break the handle of the torque wrench to reach the specified torque; doing so can cause the handle to kick back and loosen the connection. Any give at all in the handle is sufficient torque.

---

Do not pivot the wrench handle on your thumb or other fingers, otherwise you apply an unknown amount of torque to the connection when the wrench reaches its break point.

Do not twist the head of the wrench relative to the outer conductor mating plane. If you do, you apply more than the recommended torque.

**How to separate a connection**

To avoid lateral (bending) force on the connector mating plane surfaces, always support the devices and connections.

**CAUTION**

Turn the connector nut, not the device body. Major damage to the center conductor can occur if the device body is twisted.

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- 1 Use an open-end wrench to prevent the device body from turning.
- 2 Use another open-end wrench to loosen the connector nut.
- 3 Complete the separation by hand, turning only the connector nut.
- 4 Pull the connectors straight apart without twisting, rocking or bending either of the connectors

### Handling and storage

- Install the protective end caps and store the calibration devices in the foam-lined storage case when not in use.
- Never store connectors loose in a box, desk or bench drawer. This is the most common cause of connector damage during storage.
- Keep connectors clean.
- Do not touch mating plane surfaces. Natural skin oils and microscopic particles of dirt are easily transferred to a connector interface and are very difficult to remove.
- Do not set connectors contact-end down on a hard surface. The plating and the mating plane surfaces can be damaged if the interface comes in contact with any hard surface.



This information is subject to change without notice. Always refer to the Keysight website for the latest revision.

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