Agilent 16190B Performance Test Kit

Operation and Service Manual

Second Edition

Agilent Technologies

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Notices

The information contained in this document is subject to change without notice.

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Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

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Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

Agilent Technologies Company assumes no liability for the customer's failure to comply with these requirements.

NOTE 16190B complies with INSTALLATION CATEGORY I and POLLUTION DEGREE 2 in IEC61010-1. 16190B is an INDOOR USE product.

- DO NOT Substitute Parts Or Modify Instrument

  Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

- Dangerous Procedure Warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

Safety Symbol

General definitions of safety symbols used on the instrument or in manuals are listed below.

Instruction Manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instrument manual.

WARNING **This warning sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.**

CAUTION This Caution sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE Note denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution’s calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period corresponding to the individual warranty periods of its component products. Instruments are warranted for a period of one year. Fixtures and adapters are warranted for a period of 90 days. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated

by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when property installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

IMPORTANT

No other warranty is expressed or implied. Agilent Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office.

Addresses are provided at the back of this manual.

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Contents

1 General Information

This chapter provides the Agilent Technologies 16190B Performance Test Kit description, characteristics and related general information.

Description

Agilent Technologies 16190B is a performance test kit designed to verify the impedance measurement accuracy of impedance analyzers or impedance meters that have a 7 mm measurement terminal.

Kit Contents

The 16190B contents are listed in Table 1-1

Table 1-1 Contents of the 16190B

Description	Agilent Part No.	Qty.
Airline, 50 Ω, 7mm	Not Assigned	1
Cap, Protection	1401-0123	2
50 Ω Termination	Not Assigned	1
Open Termination	Not Assigned	1
Short Termination	Not Assigned	1
Cap, Termination Protection	16190-25011	3
Wrench, 1/2 and 8/15, Open End	8710-1770	1
Carrying Case	16190-60250	1
Floppy Diskette for Calibration Data	Not Assigned	1
Calibration Report	Not Assigned	1
Operation Note (This manual)	16190-90010	1

Initial Inspection

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the shipping contents have been checked for completeness and the performance test kit has been checked mechanically and electrically. The shipping contents should consist of the items shown in Table 1-1. If the shipment is incomplete, or if there is mechanical damage or other defects, notify your nearest Agilent Technologies office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Agilent Technologies office. Keep the shipping materials for the carrier’s inspection.

Repacking for Shipment

This section provides information on how to repackage the performance test kit for shipment.

Agilent Technologies Packing Materials

Containers and materials identical to those used in factory packaging are available from Agilent Technologies. If the instrument is being returned to Agilent Technologies for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the unit by model number and full serial number.

Non-Agilent Packing Materials

The following general instructions should be used for re-packing with commercially available packing materials:

1. If shipping to a Agilent Technologies office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.
2. Use a strong shipping container. A double-walled carton made of 350 pound test material is adequate.
3. se enough shock absorbing material (3- to 4-inch layer) around all sides of the case to provide a firm cushion and to prevent movement inside the container.
4. Seal the shipping container securely.
5. Mark the shipping container FRAGILE to ensure careful handling.
6. In any correspondence, refer to the unit by model number and full serial number.

Characteristics

This section provides the characteristics of the Agilent 16190B performance test kit.

Electrical Characteristic

Table 1-2 list the performance test kit electrical characteristics

Table 1-2 Electrical Characteristics

OPEN Termination	0.63 pF ± 5% at 1 MHz
50 Ω Termination	50 Ω ± 0.5 % at 1 MHz
Airline with OPEN Termination	7.3 pF ± 5 % at 1 MHz
Airline with SHORT Termination	18.0 nH ± 5 % at 1 MHz

Pin Depth

Table 1-3 shows the kit pin depth of the kit.

Table 1-3 Pin Depth

OPEN Termination	0.00 mm to 0.05 mm
50 Ω Termination	0.00 mm to 0.05 mm
Airline, 50 Ω, 7mm	– 0.010 mm to + 0.0025 mm

Operating Conditions

The kit must be operated under the ambient environmental conditions in Table 1-4.

Table 1-4 Operating Conditions

Temperature	23 °C ± 5 °C
Relative Humidity	≤ 70 % at 28 °C
Altitude	0 m to 4500 m

Storage Conditions

The kit must be stored under the ambient environmental conditions in Table 1-5.

Table 1-5 Storage Conditions

Temperature	– 40 °C to + 75 °C
Relative Humidity	≤ 95 % at 40 °C
Altitude	0 m to 15000 m

Carrying Case Dimensions

The carrying case dimensions are;

350 mm (W) × 100 mm (H) × 270 mm (D)

2 Operation

This chapter provides operating information for the Agilent 16190B Performance Test Kit.

Operating Precautions

There are several precautions that must be observed to protect the devices in this kit and the instruments being tested.

Handling and Storage

Handle and store the devices in this kit with great care. Their continued performance and accuracy depend on maintaining very precise mechanical tolerances.

When not in use, place the airline center conductor in its tube, replace the airline outer conductor and the termination's protection caps, and store the devices in the carrying case.

Connection Techniques

Extreme care should be taken when making connections or disconnections with the performance test kit devices, because the mechanical tolerances and electrical performance of their connectors are better than those of most other 7 mm connectors.

Checking Before Connection

Visual Inspection

Visually inspect and, if necessary, clean all connectors each time a connection is made. Metal particles from the connector threads may find their way onto the mating plane surfaces when a connection is disconnected. If the inspection shows that the center collet needs to be replaced, use only precision 6-slot collets (PN 85050-20001). If the inspection shows that the airline center conductor tip needs to be replaced, replace the tip (PN 1250-2006). Do not use damaged connectors.

NOTE Document "Microwave Connector Care" (PN 08510-90064) explains in detail how to care for microwave connectors.

Cleaning Connectors

Clean connectors are essential for ensuring the integrity of RF coaxial connections. Use the following procedure to clean the connectors.

1. Use compressed air or nitrogen

   Use compressed air (or nitrogen) to loosen particles on the connector mating plane surfaces. Clean air can't damage a connector, or leave particles or residues behind.

WARNING **Always use protective eywear when using compressed air or nitrogen.**

   You can use any source of clean, dry low-pressure compressed air or nitrogen that has an effective oil-vapor filter 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 to control the velocity of the air stream. High-Velocity streams of compressed air can cause electrostatic effects when directed into a connector.

2. Clean the connector threads

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

   a. Apply a small amount of isopropyl alcohol to the 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.

3. Clean the mating plane surfaces

   Apply a small amount of isopropyl alcohol to a new swab and clean the center and outer conductor mating plane surfaces.

4. Dry the connector

   After cleaning, blow the connector dry with a gentle stream of clean compressed air or nitrogen. Always completely dry a connector before you reassemble or use it.

5. Reinspect

   Inspect the connector again to be sure that no particles or residue.

Making Connection

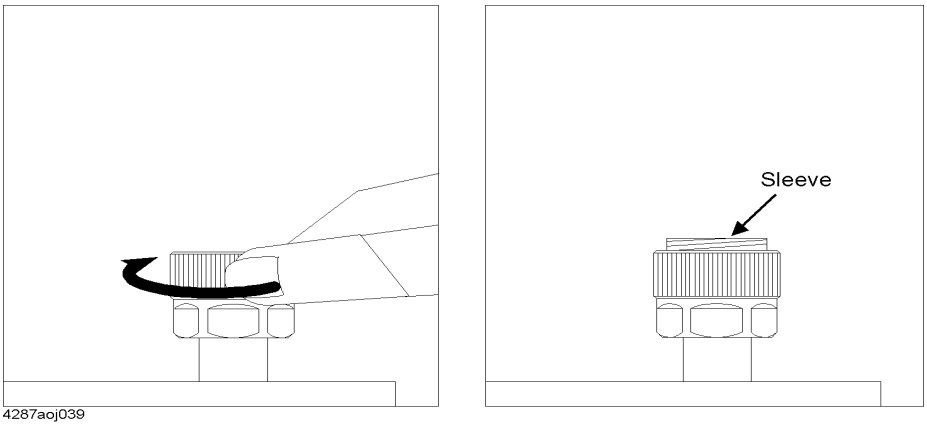
CAUTION When making connections with the verification devices, turn the nut on the device, never turn the device itself. Doing so can cause damage to the device or to the attaching connector.

NOTE When making connections, a 3/4 inch, 136 N-cm torque wrench (PN 8710-1766) is necessary. A 1/2 inch open end wrench may also be necessary to hold one device stationary while torquing the nut on the other device.

Connecting terminations directory

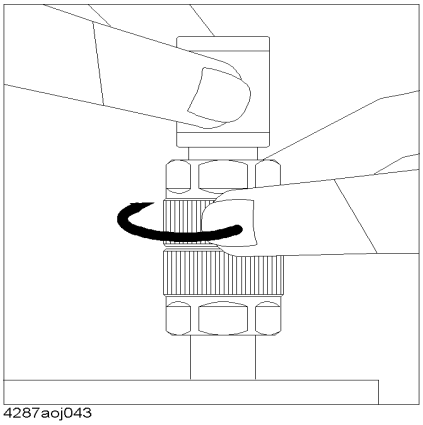
1. The connector nut outside the 7-mm connector on the test head mounted on the top of the test fixture stand should be turned clockwise viewed from the top, then lift connector sleeve completely out.

Figure 2-1 Lifting out 7mm connector sleeve



2. While pressing terminations from the top as shown inFigure 2-2, firmly connect it to the 7-mm terminal, clockwise viewed from the top

Figure 2-2 Termination connection

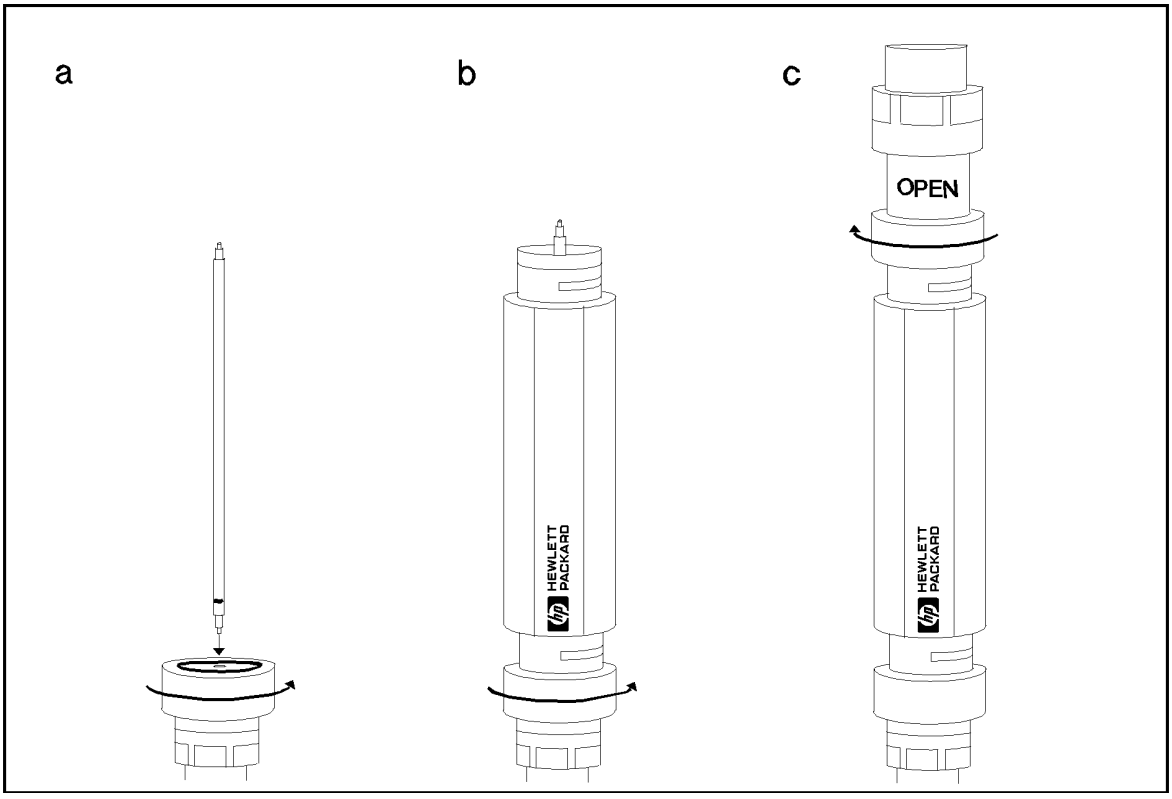


3. Hold the torque wrench with your thumb and index finger behind the groove in the handle.
4. Tighten the connection until the torque wrench handle begins to break. It is not necessary to fully break the handle to reach the specified torque.

Connecting airline and terminations

1. Connect the airline and terminations to the 7mm connector as following procedure;
   a. Fully retract the threads on the 7mm connector. Then insert the marked side tip of the airline center conductor.

Figure 2-3 Airline connection to 7mm connector



   b. Gently cover the airline center conductor with the airline outer conductor, with the logo side down. (To prevent damage, don't let the conductor scrape the edge of the outer conductor.) Mate the outer conductors. then torque the connection to 136 N-cm. (A 1/2 inch open end wrench may be necessary to hold the airline stationary.)
   c. Gently inserts the airline center conductor into termination's center conductor. Mate the outer conductors. Then torque the connection to 136 N-cm

Calibration Data Diskette Format

The performance test kit calibration data is stored in the diskette for automated performance test. This section provides the diskette format information that is necessary to use the diskette.

Table 2-1 outlines the calibration data diskette format.

Table 2-1 Diskette Format Outline

Media	3.5 inch Double-side
Initialize Format	DOS
ASCII File	Bssss.DAT*1
BINARY File	16190Bssss*1*2

*1. ssss is least 4 digit of the kit's serial number
*2. For backward compatibility of old calibration file.

3 Service

In this chapter, maintenance of 16190B is described.

Calibration

The performance test kit is calibrated when shipped from the factory. The performance test kit must be calibrated at a facility that satisfies the calibration uncertainties given in Table 3-1 and Table 3-2. Agilent Technologies' calibration laboratories satisfy all of these calibration uncertainties. For complete information on calibration, contact your nearest Agilent Technologies office.

Table 3-1 Impedance Magnitude |Z| (Admittance Magnitude |Y|) Calibration Uncertainty*1

Frequency [MHz]	OPEN	SHORT	50 Ω	Airline with OPEN	Airline with SHORT
1	±0.75 %	+2.5 mΩ	±0.15 %	±0.18 %	±1.5 %
10	±0.80 %	+3.5 mΩ	±0.15 %	±0.18 %	±0.40 %
100	±0.80 %	+14 mΩ	±0.15 %	±0.18 %	±0.24 %
200	±0.80 %	+25 mΩ	±0.20 %	±0.20 %	±0.29 %
300	±0.80 %	+30 mΩ	±0.25 %	±0.25 %	±0.29 %
500	±0.80 %	+50 mΩ	±0.35 %	±0.35 %	±0.34 %
600	±0.85 %	+50 mΩ	±0.45 %	±0.85 %	±0.48 %
800	±0.85 %	+50 mΩ	±0.45 %	±0.85 %	No Calibration
1000	±0.85 %	+50 mΩ	±0.45 %	±0.50 %	±0.50 %
1300	±0.85 %	+100 mΩ	±0.45 %	No Calibration	±0.80 %
1600	±0.90 %	+100 mΩ	±0.45 %	±0.80 %	±1.0 %
1800	±0.90 %	+100 mΩ	±0.45 %	±0.80 %	±0.80 %
2000	±1.50 %	+200 mΩ	±1.0 %	±1.2 %	±1.0 %
2200	±1.50 %	+200 mΩ	±1.0 %	±1.2 %	No Calibration
2400	±1.50 %	+200 mΩ	±1.0 %	±1.2 %	±1.3 %
2600	±1.50 %	+200 mΩ	±1.0 %	±1.3 %	±1.3 %
2800	±1.50 %	+200 mΩ	±1.0 %	No Calibration	±1.3 %
3000	±1.50 %	+200 mΩ	±1.0 %	±1.3 %	No Calibration

*1. Calibration uncertainty when shipped from the factory

Table 3-2 Impedance Phase θ(Admittance Phase θ) Calibration Uncertainty*1

Frequency [MHz]	50 Ω	Airline with OPEN	Airline with SHORT
1	±1.5 mrad	±1.8 mrad	±15 mrad
10	±1.5 mrad	±1.8 mrad	±4.0 mrad
100	±1.5 mrad	±1.8 mrad	±2.4 mrad
200	±2.0 mrad	±2.0 mrad	±2.9 mrad
300	±2.5 mrad	±2.5 mrad	±2.9 mrad
500	±3.5 mrad	±3.5 mrad	±3.4 mrad
600	±4.5 mrad	±8.5 mrad	±4.8 mrad
800	±4.5 mrad	±8.5 mrad	No Calibration
1000	±4.5 mrad	±5.0 mrad	±5.0 mrad
1300	±4.5 mrad	No Calibration	±8.0 mrad
1600	±4.5 mrad	±8.0 mrad	±10 mrad
1800	±4.5 mrad	±8.0 mrad	±8.0 mrad
2000	±10 mrad	±12 mrad	±10 mrad
2200	±10 mrad	±12 mrad	No Calibration
2400	±10 mrad	±12 mrad	±13 mrad
2600	±10 mrad	±13 mrad	±13 mrad
2800	±10 mrad	No Calibration	±13 mrad
3000	±10 mrad	±13 mrad	No Calibration

*1. Calibration uncertainty when shipped from the factory

Calibration Period

The suggested initial interval for calibration is 12 months or sooner. The actual need for calibration depends on the use of the kit. After reviewing the results of the initial calibration, you may establish a different calibration interval that reflect the usage and wear of the kit.

Repair

The performance test kit can be repaired only at Agilent Technologies facilities. For complete information on repair, contact your nearest Agilent Technologies office.