HP 16190A Performance Test Kit

Operation and Service Manual

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CERTIFICATION

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Yokogawa-Hewlett-Packard, LTD.
Kobe Instrument Division
1-3-2, Murotani,Nishi-ku, Kobe-shi,
Hyogo, 651-22 Japan

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How To Use This Manual. This is the Operation and Service Manual for the HP 16190A Performance Test Kit. This contains operation and service information, and consists of the following three chapters.

Chapter 1 General Information Chapter 1 describes the HP 16190A description, specification, and, other general information.

Chapter 2 Service Chapter 2 describes how to use the HP 16190A.

Chapter 3 Service Chapter 3 describes the HP 16190A calibration and repair.

Contents

Tables

1

General Information

Introduction

This chapter provides the HP 16190A Performance Test Kit description, specifications, and related general information.

Note

It is assumed that the operator has the proper cleaning, gaging, and connection skills. There are two Hewlett-Packard publications available to help you learn these skills:

- **Microwave Connector Care** (HP PN 08510-90064) explains in detail how to care for microwave connectors.
- **HP Application Note 326 Coaxial Systems** (HP PN 5954-1516) summarizes microwave connector care. It is available free from the nearest Hewlett-Packard office.

Description

The performance test kit is designed to verify the impedance measurement accuracy of impedance analyzers that have a 7 mm measurement terminal. The performance test kit contents are listed in Table 1-1.

Table 1-1. Performance Test Kit Contents

Description	Qty.	HP Part No.
7 mm, 50 Ω Airline	1	Not Assigned
Cap, Protection	2	1401-0123
50 Ω Termination	1	Not Assigned
Open Termination	1	Not Assigned
Short Termination	1	Not Assigned
Cap, Termination Protection	3	16190-25011
1/2 and 9/15 Open End Wrench	1	8710-1770
Carrying Case	1	16190-60100
Operation and Service Manual	1	16190-90000
Calibration Report	1	Not Assigned
Calibration Data Diskette	1	Not Assigned

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 Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection. Your HP office will arrange for repair or replacement, without waiting for the claim settlement.

Repackaging for Shipment

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

HP Packing Materials

Containers and materials identical to those used in factory packaging are available from Hewlett-Packard. If the instrument is being returned to Hewlett-Packard 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-HP Packing Materials

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

a. If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.

b. Use a strong shipping container. A double-walled carton made of 350 pound test material is adequate.

c. Use 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.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to ensure careful handling.

f. In any correspondence, refer to the unit by model number and full serial number.

Specifications

This section provides the complete specifications for the performance test kit. When the performance test kit is shipped from the factory, it meets the specifications listed in this section.

Electrical Characteristics

Table 1-2 lists the performance test kit electrical characteristics.

Table 1-2. Electrical Characteristics

Device	Nominal Value
Open Termination	0.63 pF±5% at 1 MHz
50 Ω Termination	50 Ω±0.5% at 1 MHz
Airline with Open Termination	7.30 pF±5% at 1 MHz
Airline with Short Termination	18.0 nH±5% at 1 MHz

Pin Depth

Table 1-3 shows the performance test kit pin depth.

Table 1-3. Pin Depth

Device	Nominal Value
Open Termination	0.00 mm to 0.05 mm[1]
50 Ω Termination	0.00 mm to 0.05 mm[1]
7 mm, 50 Ω Airline	−0.010 mm to +0.0025 mm[2]

1 Recession of the center conductor shoulder behind the outer conductor mating plane.

2 Protrusion of the inner conductor from the outer conductor when the center pin is removed.

Operating Conditions

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

Table 1-4. Operating Conditions

Temperature	23 °C ± 5 °C
Relative Humidity	≤ 70% at 28 °C
Altitude	0 m to 4,500 m

Storage Conditions

The performance test kit must be stored or shipped under the ambient environmental conditions listed 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 15,000 m

Carrying Case Dimensions

The carrying case dimensions are:
350 mm (W) × 100 mm (H) × 270 mm (D)

Weight

The performance test kit weight is: 1.8 kg

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Operation

Introduction

This chapter provides operating information for the HP 16190A Performance Test Kit. Step by step operating procedures are provided in the manual of the instrument being tested.

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.

Procedure

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 (HP 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.

1. Hand tighten the connection to be torqued.
2. Hold the torque wrench with your thumb and index finger behind the groove in the handle.
3. 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.

Reverse the above procedure to disconnect the 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 (HP PN 85050-20001). If the inspection shows that the airline center conductor tip needs to be replaced, replace the tip (HP PN 1250-2006). Do not use damaged connectors.

Calibration Data Diskette Format

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

Table 2-1 outlines the calibration data diskette format. Table 2-2 lists the data contents with their data format.

Table 2-1. Diskette Format Outline

Media	3.5 inch Double-sided
Initialize Format	LIF
File Type	Binary
File Name	"16190Annnn"[1]

1 nnnn: least four digits of kit serial number

Table 2-2. File Contents

Contents	Data Type	Array Size[1]
Header	String (20-character)	(10)
Calibration Value	COMPLEX	(5, 12)
$\|Z\|^2$ Uncertainty	REAL	(5, 12)
θ^3 Uncertainty	REAL	(5, 12)

1 OPTION BASE 1

2 Impedance magnitude

3 Impedance phase

Header Details

Table 2-3 lists the header contents in order.

Table 2-3. Header Contents

Description	Format
Model Number	"HP 16190A"
Kit Serial Number	"xxxxxxxxxx"
Calibration Date	"DDMMMYY"
Spare	" "
Calibration Number	"xxxxxx"
Open Serial Number	"xxxxxxxxxx"
Short Serial Number	"xxxxxxxxxx"
Airline Serial Number	"xxxxx"
50 Ω Serial Number	"xxxxx"
Spare	" "

Calibration Value Details

Calibration values are stored as COMPLEX 5×12 array data. The data unit is Ω, except for the short termination data expressed in S. The first dimension of the data array shows the calibrated device and the second dimension shows the calibration frequency as follows:

First Dimension: 1: Open, 2: Short, 3: 50 Ω,
4: Airline with Open, 5: Airline with Short

Second Dimension: 1: 1 MHz, 2: 10 MHz, 3: 100 MHz, 4: 200 MHz,
5: 300 MHz, 6: 500 MHz, 7: 600 MHz,
8: 800 MHz, 9: 1 GHz, 10: 1.3 GHz,
11: 1.6 GHz, 12: 1.8 GHz

Calibration values for the airline with an open at 1.3 GHz and the airline with a short at 800 MHz are invalid.

|Z| Measurement Uncertainty Details

The impedance magnitude (|Z|) measurement uncertainties are stored as REAL 5×12 array data. The data is the value of measurement uncertainty divided by the calibration value. (For example, if the airline with an open measurement uncertainty is 0.3 ohm and the calibration value is 30 ohm at 1.8 GHz, the |Z| uncertainty data is 0.01.). This is true except for the short termination data. The short termination data is the measurement uncertainty expressed in Ω. The data array meaning is the same as that of calibration value.

Measurement Uncertainties for the airline with an open at 1.3 GHz and the airline with a short at 800 MHz are invalid.

θ Measurement Uncertainty Details

The impedance phase (θ) measurement uncertainties are stored as REAL 5×12 array data. The data unit is rad. The data array meaning is the same as that of the calibration value.

Measurement Uncertainties for the open, short, airline with an open at 1.3 GHz, and the airline with a short at 800 MHz are invalid.

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Service

Introduction

This chapter provides the calibration and repair information for the HP 16190A Performance Test Kit.

Calibration

The performance test kit is calibrated as shown in Table 3-1 and Table 3-2 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. Hewlett-Packard's calibration laboratories satisfy all of these calibration uncertainties. For complete information on calibration, contact your nearest Hewlett-Packard sales and service office.

The performance test kit recommended calibration interval is one year.

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

Frequency [MHz]	|Z| (|Y|)[1] Calibration Uncertainty				
	Open	Short	50 Ω	Airline with Open	Airline with Short
1	±0.85%	±1.8 mΩ	± 0.18%	±0.2%	±1.5%
10	±0.85%	±2 mΩ	± 0.18%	±0.2%	±0.4%
100	±0.85%	±10 mΩ	± 0.2%	±0.2%	±0.25%
200	±0.85%	±20 mΩ	± 0.25%	±0.25%	±0.3%
300	±0.85%	±30 mΩ	± 0.3%	±0.3%	±0.3%
500	±0.85%	±40 mΩ	± 0.4%	±0.4%	±0.35%
600	±0.9%	±50 mΩ	± 0.5%	±0.9%	±0.5%
800	±0.9%	±70 mΩ	± 0.5%	±0.9%	No Calibration
1000	±0.9%	±80 mΩ	± 0.5%	±0.6%	±0.6%
1300	±0.9%	±100 mΩ	± 0.5%	No Calibration	±1.0%
1600	±1.0%	±120 mΩ	± 0.5%	±1.0%	±1.5%
1800	±1.0%	±130 mΩ	± 0.5%	±1.0%	±1.0%

1 |Y| applies to Open Termination, and |Z| applies to the other devices.

Table 3-2.
Impedance Phase θ Calibration Uncertainty

Frequency [MHz]	θ Calibration Uncertainty [mrad]		
	50 Ω	Airline with Open	Airline with Short
1	± 1.8	±2.0	±15
10	± 1.8	±2.0	±4.0
100	± 2.0	±2.0	±2.5
200	± 2.5	±2.5	±3.0
300	± 3.0	±3.0	±3.0
500	± 4.0	±4.0	±3.5
600	± 5.0	±9.0	±5.0
800	± 5.0	±9.0	No Calibration
1000	± 5.0	±6.0	±6.0
1300	± 5.0	No Calibration	±10
1600	± 5.0	±10	±15
1800	± 5.0	±10	±10

Repair

The performance test kit can be repaired only at Hewlett-Packard facilities. For complete information on repair, contact your nearest Hewlett-Packard Sales and Service Office.