Errata

Title & Document Type: 85052A 3.5 mm Calibration Kit Op. & Service Guide

Manual Part Number: 85052-90011

Revision Date: November 1986

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

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Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

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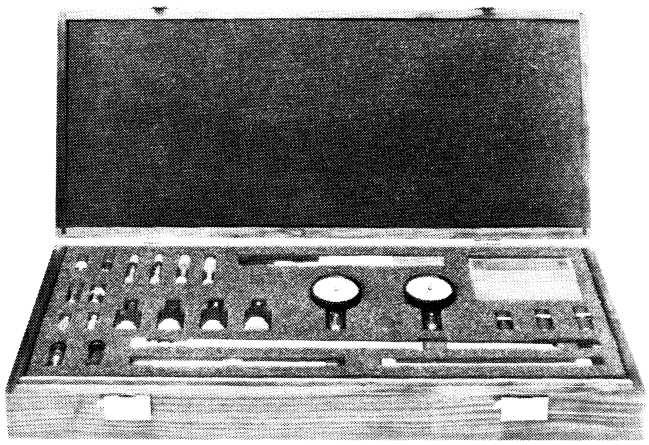
OPERATING AND SERVICE MANUAL

HP 85052A
3.5 mm CALIBRATION KIT

OPTION 010
15 cm BEADLESS AIRLINE



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HP 85052A
3.5 mm CALIBRATION KIT

OPTION 010
15 cm BEADLESS AIRLINE

MANUAL PART NO. 85052-90011
Microfiche Part Number 85052-90012

Printed: NOVEMBER 1986

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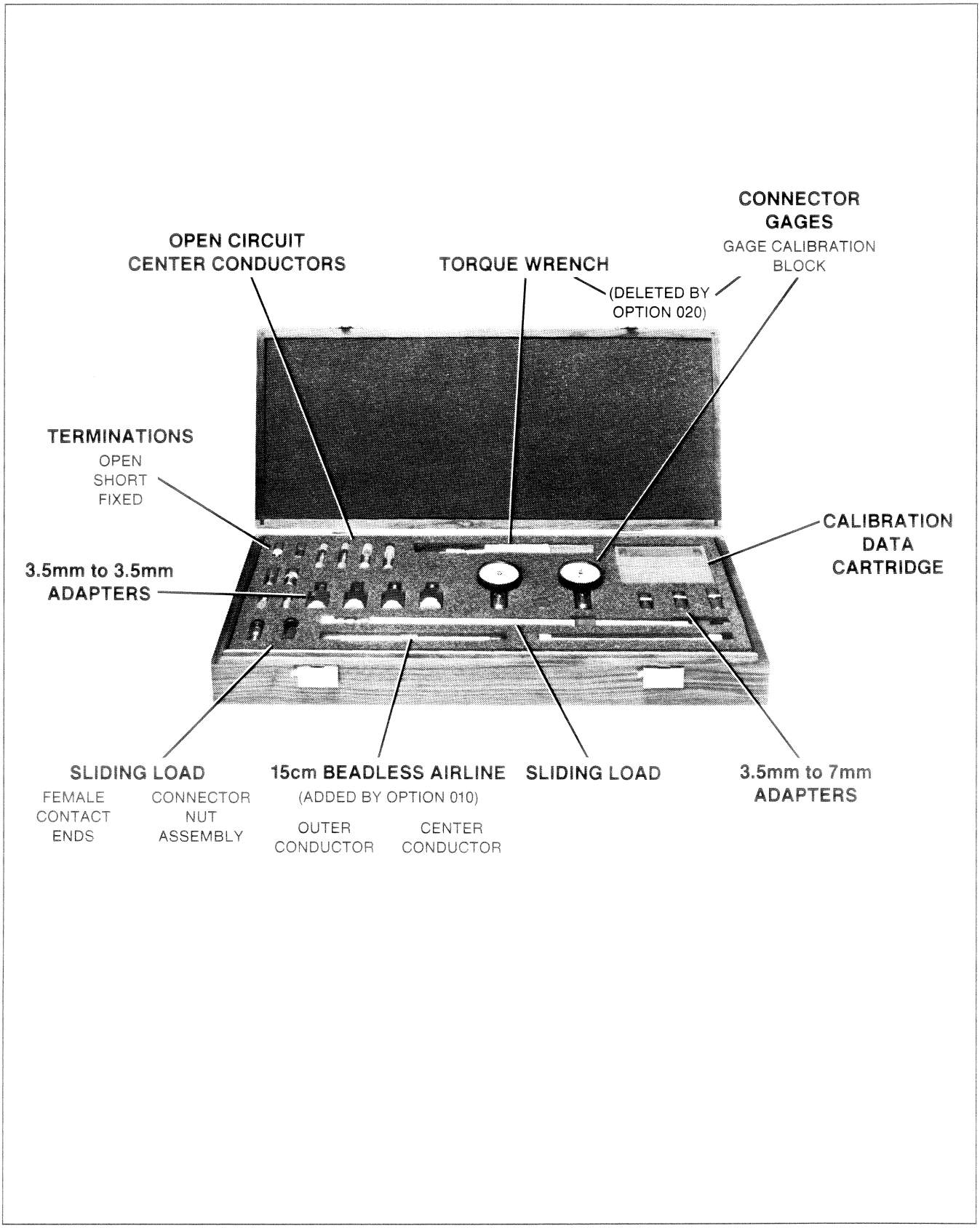


Figure 1-1. HP 85052A 3.5mm Calibration Kit

Section 1. General Information

INTRODUCTION

The Hewlett-Packard 85052A 3.5 mm calibration kit (Figure 1-1) is designed to be used with the HP 8510 network analyzer system. It consists of open, short and fixed load terminations, various adapters, a sliding load termination and a data cartridge containing the calibration constants for the termination devices in the kit. Also included is a 3.5 mm connector gage kit and a 5/16" torque wrench for use on the 3.5 mm connections. Both of these can be deleted by ordering Option 020. Option 010 adds a 15 cm beadless airline.

This manual describes the devices in the HP 85052A 3.5 mm calibration kit, gives their mechanical and electrical specifications and the electrical characteristics of each device. It also shows how to make connections with the open circuit and sliding load terminations and the 15 cm beadless airline.

Complete instructions for performing measurement calibration of the HP 8510 system (in order to make error-corrected measurements) appear in the HP 8510 Operating and Service Manual, section III (Operating and Programming).

NOTE: The content of this manual is limited. It is assumed that proper cleaning, gaging and connection skills are known by the operator. There are two Hewlett-Packard publications available to help you learn these skills:

Microwave Connector Care (HP part number 08510-90064) explains in detail how to care for, inspect, clean, gage and make connections with coaxial microwave connectors. It is designed to be helpful regardless of the application or the kind of measurement being made.

HP Application Note 326, *Principles of microwave connector care,* summarizes the key points in *Microwave Connector Care*. A copy of this publication is included with each calibration kit.

OPTIONS

OPTION 010 *adds* a 15 cm beadless airline, HP part number 1250-1876, which is especially useful for calibrating time-domain applications.

OPTION 020 *deletes* the connector gage kit and the torque wrench. The gages and the torque wrench are essential, and should be deleted only if you already have equivalent tools.

EQUIPMENT REQUIRED BUT NOT SUPPLIED

- 1/4" open end wrench for the wrench flats on 3.5 mm devices (HP part number 8720-0014)
- 5/16" open end wrench for the nuts on the 3.5 mm devices (HP part number 8720-0015)
- 7/16" open end wrench for the wrench flats on the 3.5 mm female short (HP part number 8720-0009)
- Spanner wrench for the test port connectors (HP part number 08513-20014)

Using 3.5 mm to 7 mm Adapters

A 7 mm connector gage, aligning pin, gage calibration block, and a torque wrench for 7 mm connectors are required if you will be using the 3.5 mm to 7 mm adapters included in the HP 85052A 3.5 mm calibration kit. A 7 mm connector gage kit is available as HP part number 1250-1875. A torque wrench for 7 mm connectors (12 lb-in, 136 N-cm) is available as HP part number 1250-1874.

Using SMA Connectors

The 3.5 mm connector gages can be used to measure SMA connectors if the dielectric in the SMA connector does not protrude beyond the shoulder of the outer conductor. Protrusion of the dielectric can give false gage readings and damage the 3.5 mm connector.

CAUTION

SMA connectors will mate with precision 3.5 mm connectors if extreme caution is used. Damaged or worn SMA connectors can destroy 3.5 mm connectors the first time they are mated. Hewlett Packard recommends that you keep two points in mind when you mate SMA and precision 3.5 mm connectors.

1. SMA connectors are not precision mechanical devices. They are not designed for repeated connections and disconnections and they are susceptible to mechanical wear.

   Before mating SMA and 3.5 mm connectors inspect the SMA connector carefully (visually and mechanically).

2. Important structural and dimensional differences exist between these two types of connectors (Figure 1-2). Precision 3.5 mm connectors are air dielectric devices. Only air exists between the center and outer conductors. The male and female center conductor is supported by a plastic "bead" within the connector body. In SMA connectors a plastic dielectric supports the entire length of the center conductor. The diameters of both the center and the outer conductors differ between SMA and precision 3.5 mm connectors. Because of these structural and dimensional differences the connection will exhibit a discontinuity mismatch (SWR).

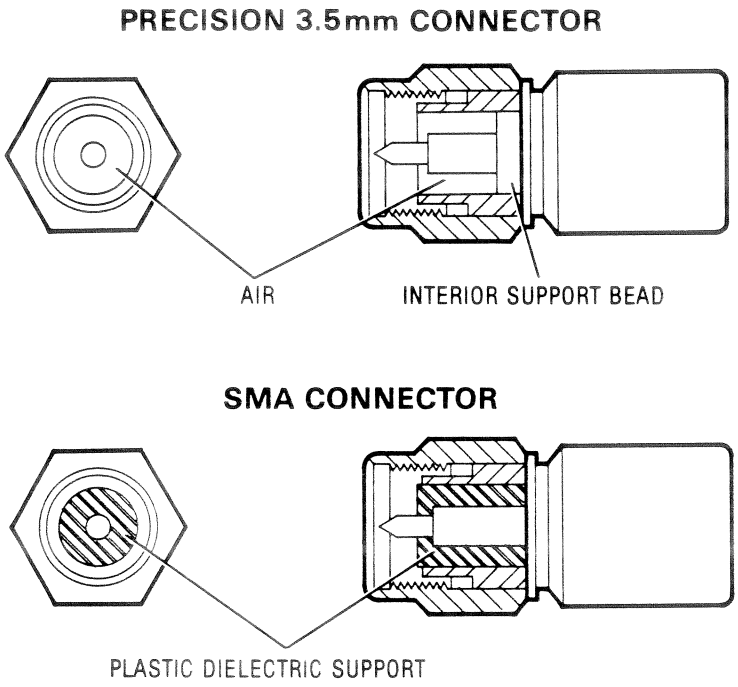


Figure 1-2. Precision 3.5 mm and SMA Connectors

SERIAL NUMBERS

A serial number label is attached to this calibration kit. A typical serial number label is shown in Figure 1-3. The serial number is in two parts: the first four digits followed by a letter comprise the serial number prefix; the last five digits are the sequential suffix unique to each calibration kit.

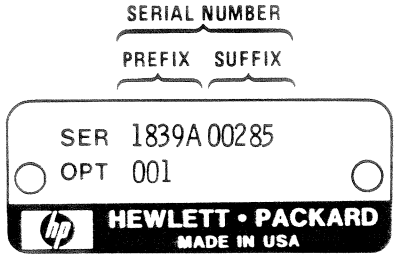


Figure 1-3. Typical Serial Number Label

The fixed load terminations, the sliding load termination and the airline also have individual Hewlett-Packard or Maury Microwave Corporation serial number labels attached to them.

INCOMING INSPECTION

Use Table 1-1 and Figure 1-4 to verify that your shipment is complete. Some of the devices in this kit do not have HP part numbers on them. In these instances, use Figure 1-4 to verify that the correct items were received.

The foam-lined storage case provides protection for the calibration kit devices during shipping. If the case or devices are damaged, set aside the calibration kit and all packaging materials and contact the nearest Hewlett-Packard office listed inside the back cover of this manual.

Hewlett-Packard will arrange for repair or replacement of incomplete or damaged shipments without waiting for a settlement from the transportation company.

REPLACEABLE PARTS

Table 1-1 gives the individual Hewlett-Packard or Maury Microwave Corporation part numbers for all of the components of the HP 85052A 3.5 mm calibration kit. Maury Microwave is the original equipment manufacturer of some of the items in this calibration kit.

When ordering replacement parts, use the part numbers given in Table 1-1. This will expedite your order and assure that you receive the correct replacement part.

To order an HP part, list the description, HP part number and quantity desired. Telephone or send your order to the nearest Hewlett-Packard office listed inside the back cover of this manual.

To order a Maury Microwave part, list the description, Maury Microwave part number and quantity desired. Indicate that these parts are for use in an HP 85052A 3.5 mm calibration kit. Telephone or send your order to:

Maury Microwave Corporation
8610 Helms Avenue
Cucamonga, California 91730
Telephone 714-987-4715; TWX 910-581-3408.

Table 1-1. HP 85052A Calibration Kit Replaceable Parts

Description	Quantity Per Kit	HP Replacement Part Number
Terminations		
Short Circuit, Male, 3.5 mm	1	1250-1768
Open Circuit with Male Center Conductor Element, 3.5 mm	1	1250-1766
Center Conductor Element, Male	1	1250-1784
Fixed Load, Male, 3.5 mm	1	85052-60001
Short Circuit, Female, 3.5 mm	1	1250-1769
Open Circuit with Female Center Conductor Element, 3.5 mm	1	1250-1767
Center Conductor Element, Female	1	1250-1785
Fixed Load, Female, 3.5 mm	1	85052-60002
Sliding Load	1	1250-1891
Center Conductor	1	1250-2017
Contact End, Male	1	1250-2008
Contact End, Female	1	1250-2007
Connector Nut Assembly, Male	1	1250-2029
Connector Nut Assembly, Female	1	1250-2028
Protective End Cap	1	1250-2027
Adapters		
7 mm to 3.5 mm (Male) Adapter	2	85052-60004
7 mm to 3.5 mm (Female) Adapter	2	85052-60003
3. 5mm (Male) to 3.5 mm (Male) Adapter	1	1250-1864
3.5 mm (Female) to 3.5 mm (Female) 1 Adapter	1	1250-1865
3.5 mm (Male) to 3.5 mm (Female) Adapter	1	1250-1866
Options		
15 cm Beadless Airline (added by ordering Option 010)	1	1250-1876
Connector Gage Kit (deleted by ordering Option 020)	1	1250-1862
3.5 mm Connector Gage, Male	1	Maury A034B-M
3.5 mm Connector Gage, Female	1	Maury A034B-F
3.5 mm Gage Calibration Block	1	Maury 027-3
3.5 mm Connector Torque Wrench (deleted by ordering Option 020)	1	1250-1863
Miscellaneous Items		
3.5 mm Calibration Constants Tape	1	85052-90001
Operating and Service Manual	1	85052-90011
Calibration Kit Storage Case	1	85052-80006
3.5 mm Protective End Cap, Male	10	1401-0208
3.5 mm Protective End Cap, Female	10	1401-0202
7 mm Protective End Cap	4	1401-0123
Additional Items — Not Supplied With Kit		
7 mm Connector Gage Kit		1250-1875
7 mm Connector Torque Wrench		1250-1874
7 mm Center Collets, 6 slot		85050-20001
Foam Swabs		9300-1270
Grounding Wrist Strap		9300-0970
Conductive Bench Mat		9300-0797

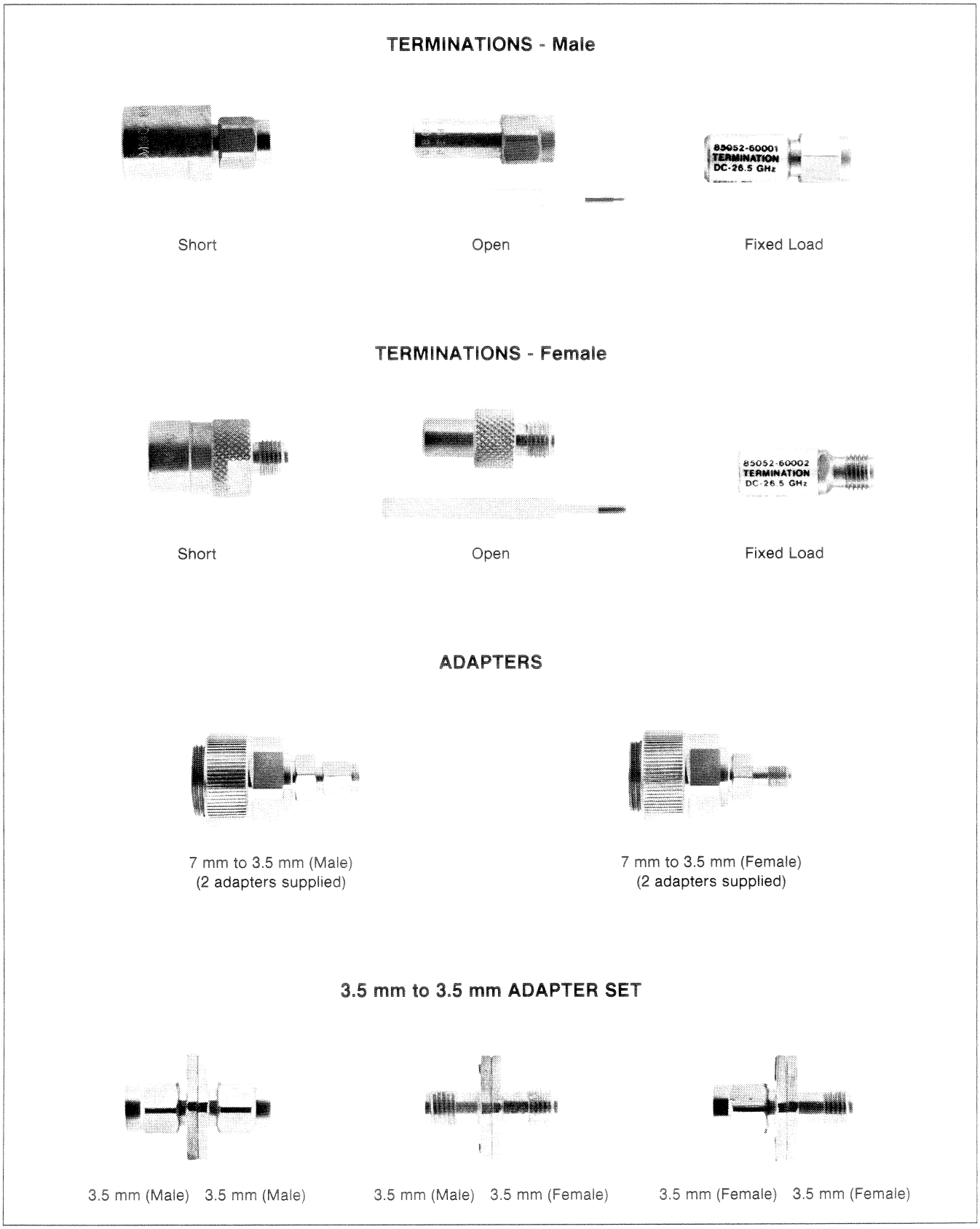
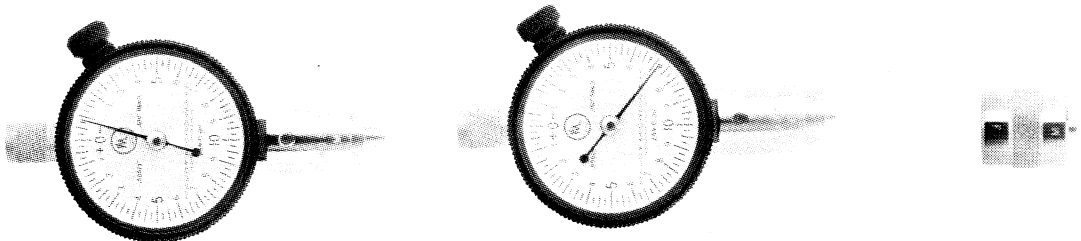


Figure 1-4. HP 85052A Calibration Kit Replaceable Parts (1 of 2)

SLIDING LOAD
(Added by Option 010)

15cm BEADLESS AIRLINE
(Deleted by Option 020)

3.5mm CONNECTOR TORQUE WRENCH
(Deleted by Option 020)



CONNECTOR GAGE KIT

NOT SHOWN: Calibration Constants Tape, Operating and Service Manual, Calibration Kit Storage Case

Figure 1-4. HP 85052A Calibration Kit Replaceable Parts (2 of 2)

Section 2. Specifications

This section provides the environmental, mechanical and electrical specifications for the devices in the HP 85052A 3.5 mm calibration kit.

ENVIRONMENT

Table 2-1 lists the environmental specifications for the devices in the HP 85052A 3.5 mm calibration kit.

Table 2-1. Environmental Specifications

Calibration Temperature	+20° to +26° (+68° to +79°F)
Accuracy Enhanced Operating Temperature	Calibration Temperature ±1°C (1.8°F)
Barometric Pressure Operation Storage	 <4,500 metres (15,000 feet) <15,000 metres (50,000 feet)
Relative Humidity Operation Storage	Non-Condensing at All Times 20-80% (26°C maximum dry bulb temperature) 5 to 95%

Temperature

Temperature of the calibration devices is critical because device dimensions (and therefore electrical characteristics) change with temperature. The temperature of the calibration devices and all connectors must be stable before use.

After measurement calibration, performance verification and actual device measurements must be made within the accuracy enhanced operating temperature specification. This is true even if the accuracy enhanced operating temperature falls outside of the calibration temperature window.

Example. If measurement calibration is performed at +20°C (+68°F), verification and measurements must be made between +19°C (+66.2°F) and +21°C (+69.8°F). Also, if the accuracy enhanced operating temperature deviates from the allowable range a new measurement calibration must be performed to assure optimum accuracy.

Remember that your fingers are a heat source, so avoid unnecessary handling of the devices during calibration.

Barometric Pressure and Relative Humidity

Barometric pressure and relative humidity also affect device performance. Air exists between the inner and outer conductors of these devices and the dielectric constant of air depends on pressure and humidity.

MECHANICAL SPECIFICATIONS

Table 2-2 lists and Figure 2-1 shows the allowable center conductor recessions for the devices in the HP 85052A 3.5 mm calibration kit.

Table 2-2. Mechanical Specifications

3.5 mm Connectors	Allowable Recession
Devices and adapters (unless stated otherwise)	0.000 to +0.003 in 0.000 to +0.08 mm
Sliding Load	set by user
15 cm Airline* (Option 010)	0.0000 to +0.0005 in 0.000 to +0.013 mm
*The recession of the airline is predetermined from the relationship between the length of the outer conductor to the length of the inner conductor.	

No protrusion of the shoulder of the male conductor pin or of the tip of the female contact fingers in front of the outer conductor mating plane is allowable on *any* 3.5 mm connectors.

Note that a positive number shows a recession for 3.5 mm connectors while a negative number shows a recession for 7 mm connectors.

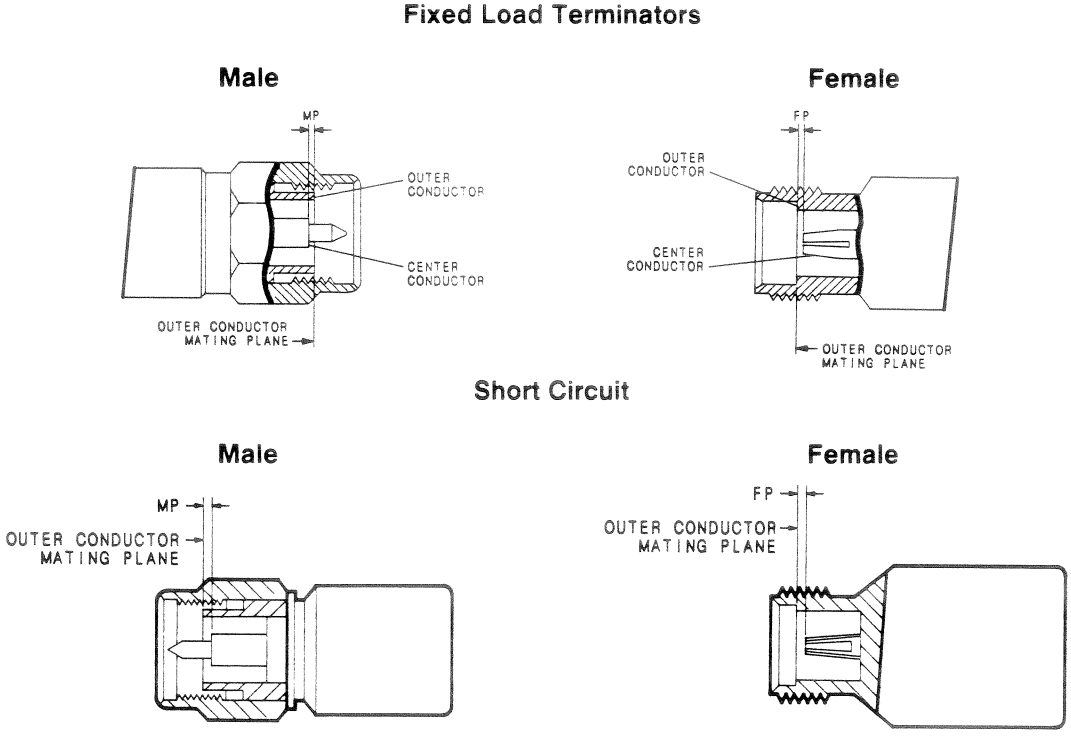


Figure 2-1. 3.5 mm Short Circuit and Fixed Load Terminations

MP = recession of the male contact pin shoulder behind the outer conductor mating plane.

FP = recession of the end of female center pin behind the outer conductor mating plane.

Figures 2-2 and 2-3 illustrate the mechanical dimensions of the open circuit termination, the sliding load termination and the 15 cm beadless airline that are included in the HP 85052A 3.5 mm calibration kit.

If you wish to make the measurements shown in Figures 2-2 or 2-3, the expected electrical performance of the devices can be calculated from the equations in these two publications:

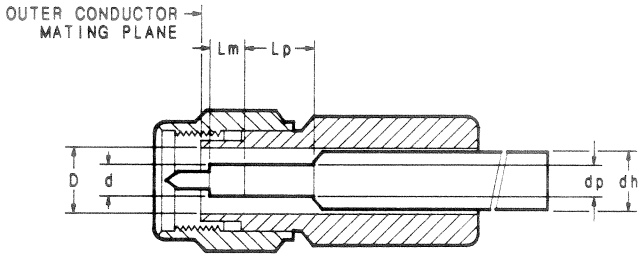
Nelson, Robert E., and Marlene R. Coryell, "Electrical Parameters of Precision, Coaxial, Air-Dielectric Transmission Lines", U.S. National Bureau of Standards Monograph No. 96.

Somlo, P.I., "The Computation of Coaxial Line Step Capacitances", IEEE Transactions on Microwave Theory and Techniques, Volume MTT-15, No. 1, January, 1967.

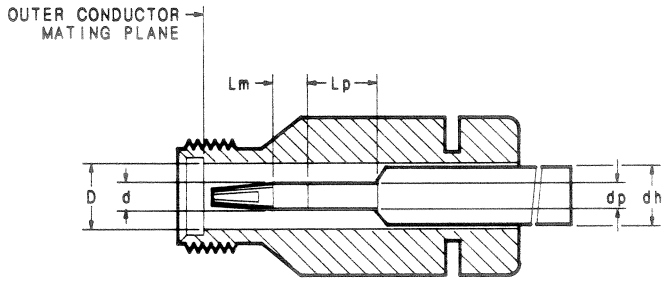
This measurement method may be used for a general idea of the expected device characteristic impedance. Variations in connector interfaces can have a large effect on your actual electrical measurements.

Open Circuit

Male



Female



Mechanical Dimensions			
D =	0.1378 ± 0.0003 in 0.500 ± 0.008 mm	Lm =	0.171 ± 0.001 in 4.343 ± 0.025 mm
d =	0.05984 ± 0.0003 in 1.520 ± 0.008 mm		
dp =	0.060 ± 0.002 in 1.52 ± 0.05 mm	Lp =	0.250 ± 0.005 in 6.35 ± 0.13 mm
dh =	0.1370 $^{+\ 0.0000}_{-\ 0.0010}$ in 3.480 $^{+\ 0.000}_{-\ 0.025}$ mm	Concentricity<0.003 FIM(TIR)	

Figure 2-2. Open Circuit Termination

SLIDING LOAD (HP 1250-1891)

Diameters

D (outer conductor)	0.1378 ± 0.0003 in 3.500 ± 0.008 mm
d (center conductor)	0.05984 ± 0.0002 in 1.520 ± 0.005 mm

Straightness

D (outer conductor)	0.0002/in	0.002 mm/cm
d (center conductor)	0.0003/in	0.003 mm/cm

15 cm BEADLESS AIRLINE (HP 1250-1876)

Diameters

D (outer conductor)	0.1378 ± 0.00025 in 3.500 ± 0.008 mm
d (center conductor)	0.05984 ± 0.0002 in 1.520 ± 0.005 mm

Outer Conductor Length

Length	5.899 ± 0.0005 in 149.83 ± 0.013 mm

Straightness

D (outer conductor)	0.0002/in	0.002 mm/cm
d (center conductor)	0.0003/in	0.003 mm/cm

Length Difference

Length of center conductor in relation to outer conductor	0.0000 to +0.0005 in 0.000 to +0.013 mm

Figure 2-3. Sliding Load and Airline Dimensions

ELECTRICAL SPECIFICATIONS

The electrical specifications of the devices in the HP 85052A 3.5 mm calibration kit are listed in Table 2-3. Note that the specifications for the 15 cm airline and the sliding load termination include the airline portions *only*.

Table 2-3. Electrical Specifications

Device	Specification
Fixed Loads	> 36 dB Return Loss, DC to 2 GHz
Sliding Load	> 42 dB Return Loss, 2 to 26.5 GHz airline portion *only**
15 cm Airline (Option 010)	> 44 dB Return Loss, 2 to 26.5 GHz airline portion *only**
Short Circuit	± 2.6 degrees, DC to 26.5 GHz ± 1° average deviation
Open Circuit	± 2.6 degrees, DC to 26.5 GHz ± 1° average deviation
* The connector interfaces on the sliding load termination and the airline, and the sliding load element on the sliding load are excluded from these specifications.	

Section 3. Preparation for Use

This section provides some of the information necessary to perform measurement calibration of your HP 8510 network analyzer. Refer to section III (Operating and Programming) in the HP 8510 Operating and Service Manual for the complete measurement calibration procedure.

OPERATING PRECAUTIONS

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

Handling and Storage

Handle and store these calibration devices with great care; their continued performance and accuracy depend on maintaining very precise mechanical tolerances.

When the calibration devices are not in use, replace their protective end caps and store them in the foam lined storage case. As shown in Figure 3-1, the storage case lid is detachable so that the case can be stored in a shallow drawer.

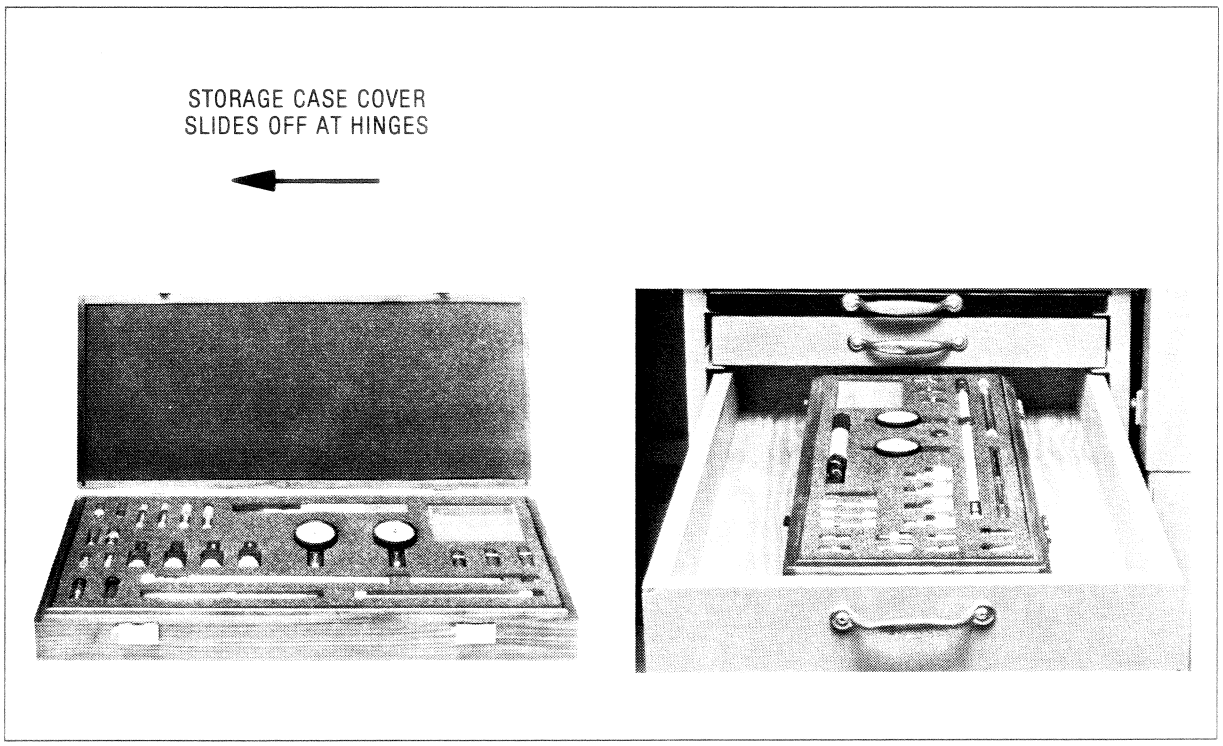


Figure 3-1. Removing Storage Case Cover

Electrostatic Discharge

When you clean or inspect connectors attached to any static sensitive circuits (such as test port connectors), protect against electrostatic discharge (ESD) by wearing a grounding strap connected to a conductive bench mat.

CAUTION

The human body almost always has some static charge. You are usually not aware of this charge because the human threshold for the perception of a static discharge shock is approximately 3,000 volts. ESD as low as 60 volts can destroy sensitive microcircuits. Always protect against ESD when working near sensitive equipment.

Connection Techniques

The mechanical tolerances of the connectors in this calibration kit, and their electrical performance, are better than most other 3.5 mm connectors. Because of this, slight errors in technique that would not be noticeable with other connectors can appear when these precision connectors are used. Extreme care should be taken when making connections or disconnections with these devices.

Wear

Connector wear eventually degrades performance. The calibration devices, which may be used only a few times each day, should have a long life. The connectors to the network analyzer test set may have many connections each day, and are therefore more subject to wear.

VISUAL AND MECHANICAL INSPECTION

Visually inspect and, if necessary, clean all connectors each time a connection is made. Metal and metal by-product particles from the connector threads often find their way onto the mating plane surfaces when a connection is disconnected. Do not use damaged connectors.

Inspect the end of the connector gage and the gage calibration block visually before any mechanical measurements of the connectors are made.

USING THE PRECISION ADAPTERS

The 3.5 mm to 7 mm adapters supplied with the HP 85052A 3.5 mm calibration kit are supplied in order to use the calibration standards in this kit on test sets with 7 mm test port connectors (e.g. the HP 8512A or 8514A). They are *not* suitable for the opposite purpose: to use calibration standards that have 7 mm connectors (e.g. from the HP 85050A 7 mm calibration kit) on test sets with 3.5 mm test port connectors (e.g. the HP 8513A or 8515A).

3.5 mm CALIBRATION CONSTANTS TAPE

The calibration constants tape includes the calibration coefficients for the devices in the HP 85052A 3.5 mm calibration kit. Hewlett-Packard recommends that you load the coefficients on this tape into the HP 8510A memory because they may be more refined than those already in the HP 8510A. Use the following procedure to load the calibration constants tape.

1. Insert the calibration tape from the HP 85052A calibration kit into the HP 85101A tape drive.

2. Press the following keys:

   [TAPE]
   LOAD softkey
   The prompt SELECT DATA TYPE TO LOAD is displayed on the CRT.
   CAL KIT 1 — 2 softkey
   CAL KIT *2 softkey*
   The prompt SELECT CAL KIT FILE TO LOAD is displayed on the CRT.

* FILE 1 softkey	**if** this is the ONLY file # that has an asterisk (*) next to it,
	OR press
* FILE 2 softkey	**if** there is more than one file # that has an asterisk (*) next to it.

   This loads the 3.5 mm calibration kit constants from the tape into HP 8510A memory. Remove the tape from the HP 85101A tape drive and store it in the plastic case provided.

* For the computer controlled performance verification test the 3.5 mm calibration constants must be loaded into "CAL KIT 2".

Section 4. Connecting the Calibration Devices

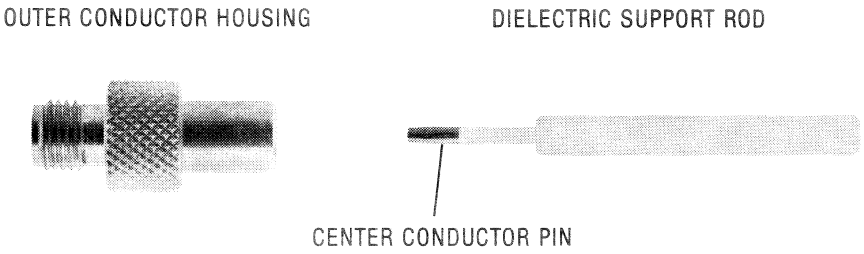
This section of the manual provides step-by-step procedures for connecting the open circuit termination, the sliding load termination and the 15 cm airline. A brief description of the electrical characteristics and the actual calibration coefficient values of the devices in the HP 85052A 3.5 mm calibration kit is also given here.

Before making any connections to the test set, be sure that bias power to the test set is OFF. Avoid electrostatic discharge by wearing a grounded wrist strap. Also, it is good practice to grasp the outer shell of the test port just before you make any connection to the test set. This discharges any static electricity on your body by providing a conductive path to an earth ground.

When connecting these devices, always turn the nut on the device. Do *not* turn the device. This rule also applies to torquing the devices. Hold the device stationary by placing an open end wrench on the wrench flats of the device and torque the nut of the attaching device.

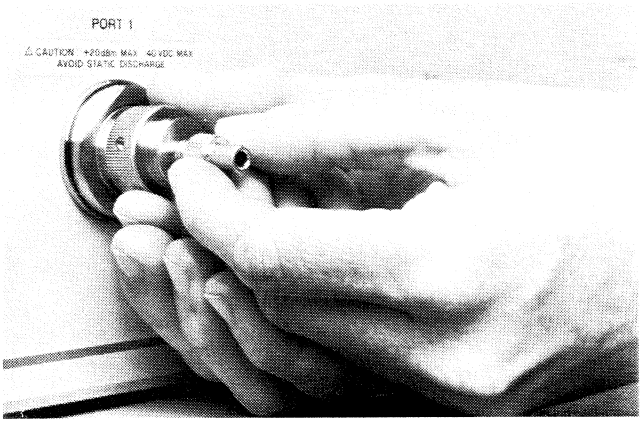
OPEN CIRCUIT TERMINATIONS

The open circuit terminations in the HP 85052A 3.5 mm calibration kit have two parts: the outer conductor housing and the center conductor dielectric support rod with the center conductor mounted at one end. Both parts of the open circuit termination *must* be used for measurement calibration. Use of only the outer conductor may cause performance verification failure.



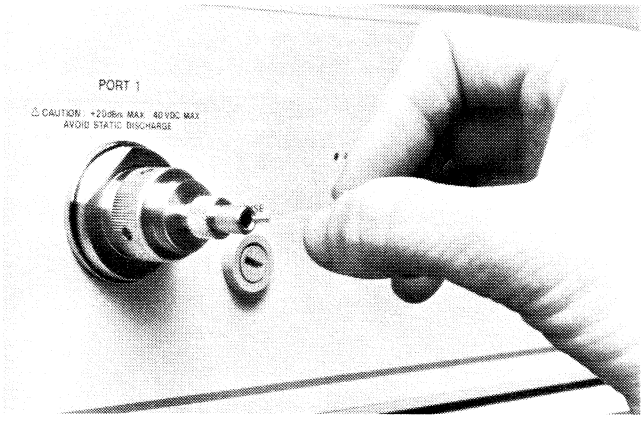
Connecting the Outer Conductor Housing

1. Connect the outer conductor housing of the open circuit termination to the test port connector (or cable). Turn the test port or cable nut to connect the device. Do not turn the device.

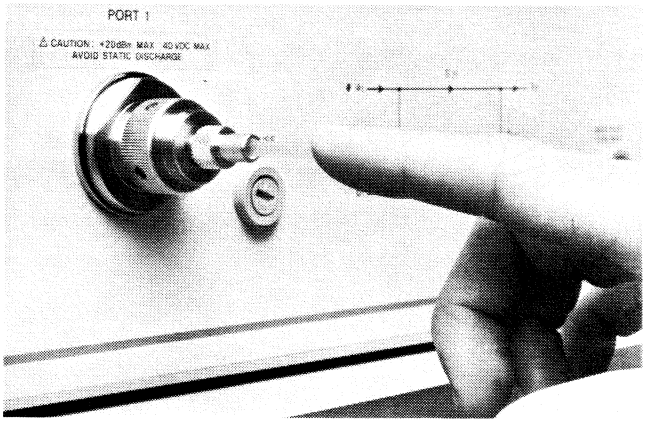


Connecting the Center Conductor Support Rod

2. Insert the center conductor end of the dielectric support rod into the bore of the outer conductor housing. Slide the support rod inward until you feel the ends of the contact pins engage.



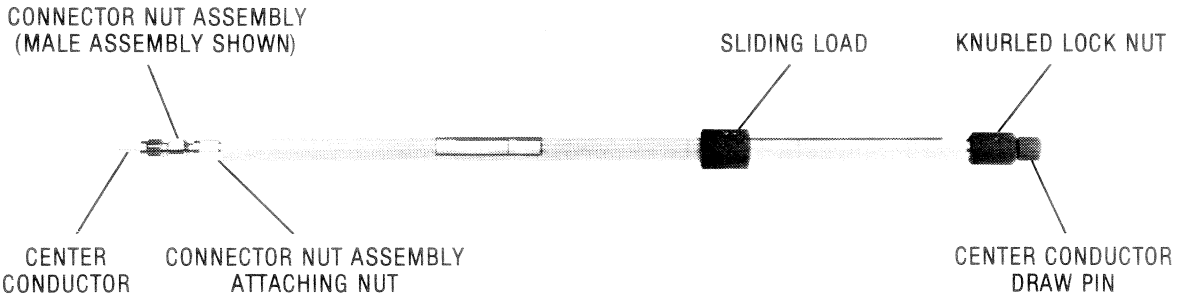
3. Gently mate the two center conductors by slowly pushing the support rod straight in. You will feel a slight resistance as the center conductors mate.



To disconnect the open circuit termination, reverse the above procedure. Be careful not to twist either the center conductor or the outer conductor housing.

SLIDING LOAD TERMINATION

Before connecting the sliding load, verify that the contact end of the sliding load center conductor is of the type (male or female) that you wish to use. If it is not, change the contact end and the connector nut assembly as shown below.

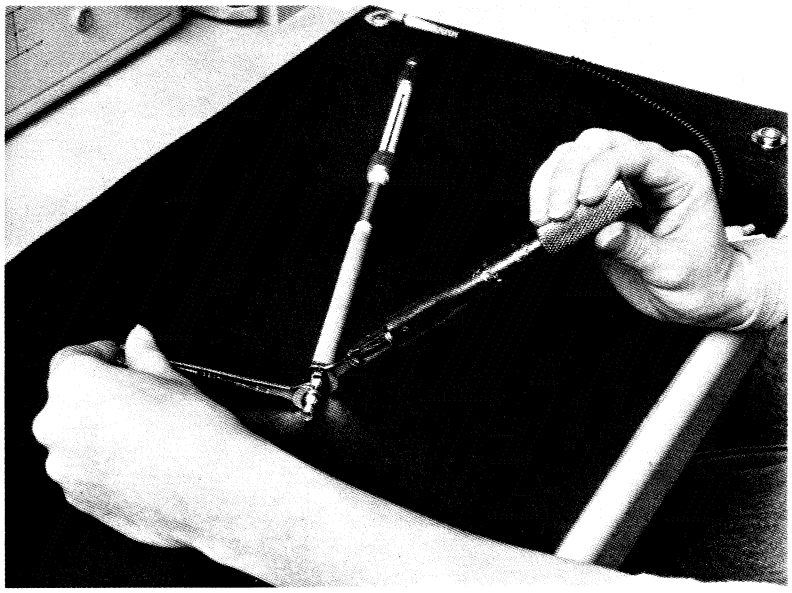


Changing the Contact End

1. Loosen the knurled lock nut and push the center conductor out as far as it will go, using the draw pin.
2. Gently retighten the knurled lock nut and unscrew the contact end from the center conductor. (Wear a lint-free glove or finger cots to protect the center conductor/contact end from dirt and corrosion).
3. Put the opposite-sexed contact end in its place. Finger tighten. *Do not* use pliers.

Changing the Connector Nut Assembly

1. Retract the center conductor 2 inches, using the center conductor draw pin.



2. Hold the sliding load with a 5/16" open end wrench and use a 3.5 mm torque wrench (8 lb-in, 90 N-cm) to loosen the connector nut assembly attaching nut. Finish unscrewing the attaching nut by hand and remove the connector nut assembly.

3. Replace the connector nut with the assembly desired and re-connect the attaching nut finger tight. Use a 5/16" open end wrench and a 3.5 mm torque wrench (8 lb-in, 90 N-cm) on the connector nut assembly for the final connection. Refer to the picture in step 2.

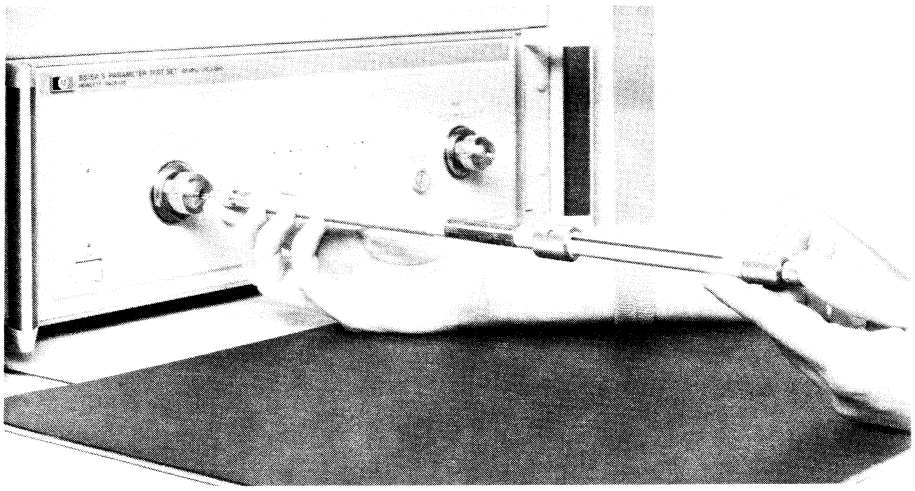
Because the sliding load is longer than the other terminations, special care should be taken to avoid applying lateral or vertical force to the connectors. Hold the sliding load by *both* ends when you are making connections and disconnections.

Connecting the Sliding Load

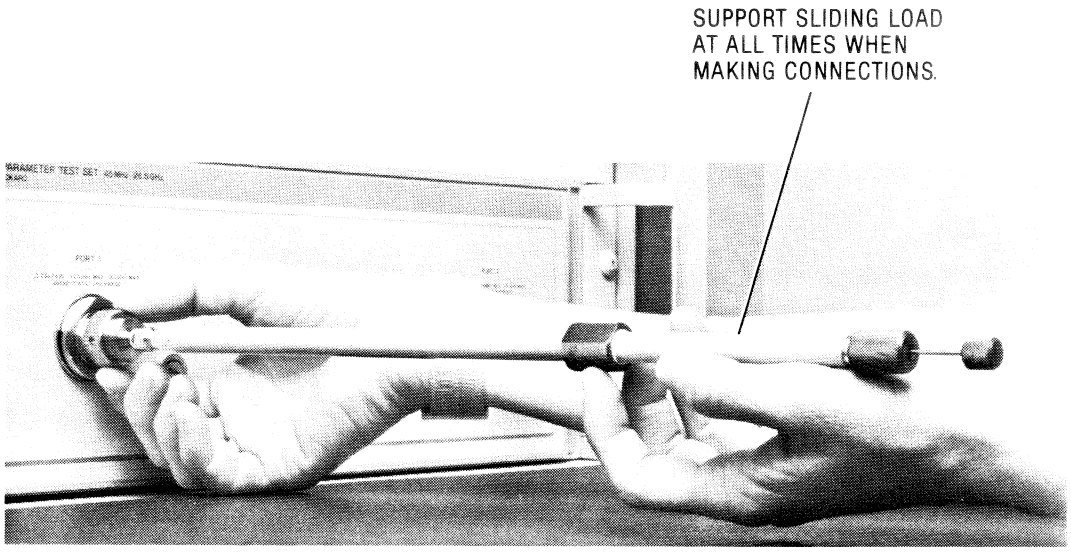
CAUTION

You are touching an exposed center conductor. Ground yourself to prevent electrostatic discharge (ESD).

1. Loosen the knurled lock nut and extend the center conductor as far as it will go by pushing the draw pin.



2. Mate the sliding load center conductor with the center conductor on the test port of the test set. Push the center conductor of the sliding load toward the test set until you feel it make full contact with the test port connector (or cable).



3. Slide the outer conductor of the sliding load toward the test set to mate the outer conductors. Hand tighten the connection.

4. Gently tighten the knurled lock nut.

If you are using the male connector nut assembly connect the sliding load as above but torque the nut on the sliding load with the 3.5 mm torque wrench *before* tightening the knurled lock nut.

5. To disconnect the sliding load, leave the lock nut tight and loosen the sliding load from the test port. As the nut on either the test port connector or the sliding load is loosened, the sliding load body is forced away from the test port and the center conductor is pulled free.

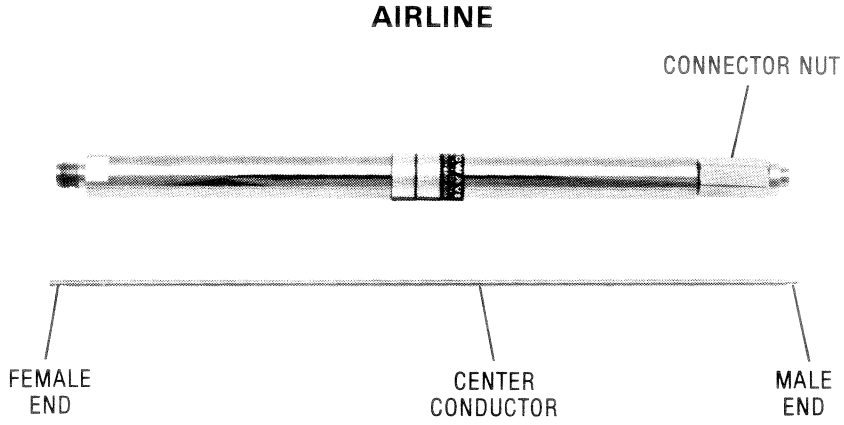
Replace the protective plastic cap over the connector end.

15CM BEADLESS AIRLINE (OPTION 010)

Connecting the 15 cm beadless airline is similar to connecting the sliding load. First verify that the center conductor is installed in the proper orientation: the male end of the center conductor should be installed at the end of the outer conductor which has the connector nut; the female end should be at the end without the nut.

Follow the *exact* sequence of steps when connecting the 15 cm airline.

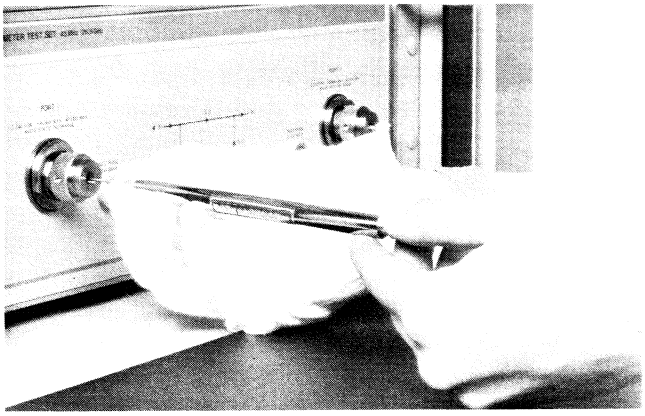
1. Put the center conductor into the airline and verify that the female end of the center conductor emerges from the female end of the outer conductor.



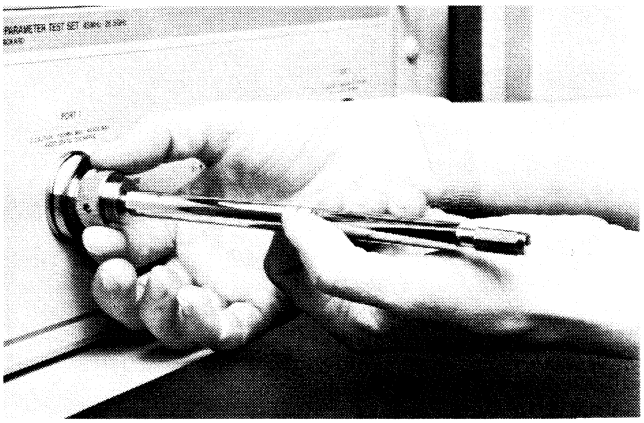
Connect the airline as follows (an active display is recommended).

For male test ports:

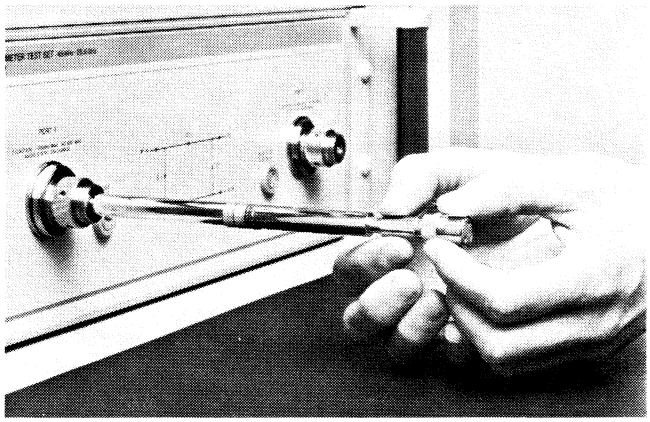
2. Hold the airline and center conductor as shown and bring both the airline and the center conductor to the test port connector. Mate the center conductor of the airline with the center conductor on the test port of the test set.



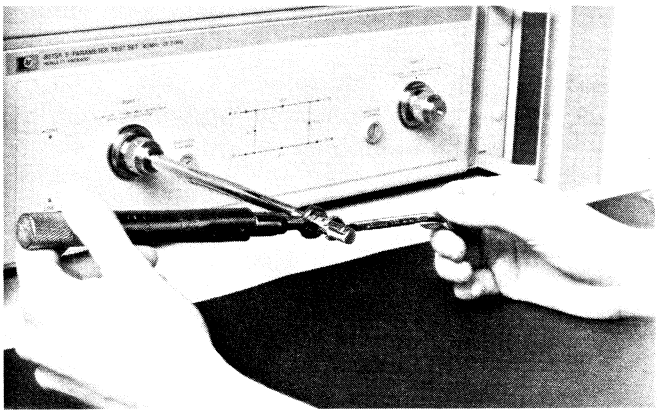
3. Connect the outer conductor of the airline to the test port connector finger tight. Turn the nut on the test port connector. Do not turn the airline.



4. Align and mate the center conductor of the termination device with the male center conductor at the end of the airline.



5. Mate the outer conductor of the airline with the outer conductor of the termination device by sliding the nut on the airline forward. Leave the connection at the test port hand tight. Use a 5/16" or 7/16" open end wrench to hold the termination device and tighten the nut on the male end of the airline with the 3.5 mm torque wrench.



For female test ports:

1. Follow step 1 as above.
2. Connect the airline to the test port adapter as in step 2 above but leave this connection slightly loose. Let the outer conductor sag until the center pin of the airline is centered in the end of the airline. Hold the outer conductor stable and connect the termination device to the airline.
3. Hold the airline with one hand and use a 3.5 mm torque wrench to tighten the airline nut at the test port. Tighten the termination device by holding the airline with a 5/16" open end wrench while torquing the nut on the termination device.

To disconnect the airline, reverse the above procedure. Always store the center conductor in the plastic case provided when it is not in use.

ELECTRICAL CHARACTERISTICS

Standard Definition

Standard Definition is the process of mathematically modeling the electrical characteristics (delay, attenuation and impedance) of each calibration standard. These electrical characteristics can be mathematically derived from the physical dimensions and material of each calibration standard or from its actual measured response. Table 4-1 lists the parameters that are used by the HP 8510A to specify the mathematical model.

Class Assignment

Class Assignment is the process of organizing calibration standards into a format which is compatible with the error models used in measurement calibration. A class or group of classes correspond to the systematic errors which are to be removed from the measured network analyzer response.

In the paragraph above, *Standard Definition,* the characteristics of calibration standards were derived. Class assignment organizes these standards for computation of the various error models used in calibration. Table 4-2 lists the classes that are used by the 8510.

The values given in Tables 4-1 and 4-2 are valid only in the specified temperature range. Alternate characteristics may be generated by the customer for temperatures outside of this specified range. Refer to Product Note 8510-5, *Specifying calibration standards for the HP 8510 network analyzer*, for information on modifying calibration constants and the parameters and classes listed in Tables 4-1 and 4-2. Blank copies of Tables 4-1 and 4-2 are included so that you can record any modified calibration constants.

Examining the Calibration Constants

Follow the procedure below to examine the calibration constants in the 8510A memory.

Press the following keys:
[CAL]
MORE softkey
MODIFY 2 softkey (**If** calibration constants were loaded into CALKIT 2)
DEFINE STANDARD softkey
[1] [X1] (This is the number of the calibration standard). The softkey SHORT should be underlined.

Press:
SHORT softkey
SPECIFY OFFSET softkey
OFFSET DELAY softkey (screen displays the value)
OFFSET LOSS softkey (screen displays the value)
OFFSET Z_o softkey (screen displays the value)
MINIMUM FREQUENCY softkey (screen displays the value)
MAXIMUM FREQUENCY softkey (screen displays the value). The softkey COAX should be underlined.

Press:
[PRIOR MENU]
LABEL STANDARD softkey. The word SHORT should be displayed in upper left corner of the CRT.
[PRIOR MENU] three times. DEFINE STANDARD should be the top softkey.
[ENTRY OFF]

This completes the procedure to examine the calibration coefficients of one standard type. To examine the other standard types, substitute the standard number above (1 for the short) with the standard number of the device you wish to examine. This is the step following "DEFINE STANDARD." For example: Press **[2] [X1]** to examine the calibration coefficients for an open. The standard numbers are located in Table 4-1.

FURTHER INFORMATION

This manual contains limited information about operating the HP 8510 system. For complete information, refer to the HP 8510 Operating and Service Manual.

If you need additional information, contact your local HP representatives or the nearest HP office listed inside the back cover of this manual.

Table 4-1. Standard Definitions

STANDARD DEFINITIONS

CALIBRATION KIT 3.5 mm

TAPE FILE NUMBER _____

STANDARD[1]		C0	C1	C2	C3	FIXED OR	OFFSET			FREQUENCY (GHz)		COAX or	STANDARD
NO.	TYPE	$x10^{-15}$F	$x10^{-27}$F/Hz	$x10^{-36}$F/Hz^2	$x10^{-45}$F/Hz^3	SLIDING[2]	DELAY ps	LOSS[3] MΩ/s	Z_0 Ω	MINIMUM[2]	MAXIMUM	WAVEGUIDE	LABEL
1	SHORT				0		16.684	130	50	0	999	COAX	SHORT
2	OPEN	56.0	200.0	0	0		14.448	130	50	0	999	COAX	OPEN
9	LOAD					FIXED	0	0	50	0	999	COAX	BROADBAND
10	LOAD					SLIDING	0	0	50	1.999	999	COAX	SLIDING
11	THRU						0	0	50	0	999	COAX	THRU
12	LOAD					FIXED	0	0	50	0	2.001	COAX	LOWBAND

1. Open, Short, Load. Only standards 1, 2, 9, 10, and 12 are included in the HP 85052A 3.5mm Calibration Kit.
2. Loads only.
3. Skin loss factor; normalize at 1 GHz.

Table 4-1. Standard Definitions

STANDARD DEFINITIONS

CALIBRATION KIT 3.5 mm

TAPE FILE NUMBER

STANDARD[1]		C0	C1	C2	C3	FIXED OR	OFFSET			FREQUENCY (GHz)		COAX or	STANDARD
NO.	TYPE	x10 − 15F	x10 − 27F/Hz	x10 − 36F/Hz²	x10 − 45F/Hz³	SLIDING[2]	DELAY ps	LOSS[3] MΩ/s	Z_0 Ω	MINIMUM[2]	MAXIMUM	WAVEGUIDE	LABEL
1	SHORT												
2	OPEN												
9	LOAD												
10	LOAD												
11	THRU												
12	LOAD												

1. Open, Short, Load. Only standards 1, 2, 9, 10, and 12 are included in the HP 85052A 3.5mm Calibration Kit.
2. Loads only.
3. Skin loss factor; normalize at 1 GHz.

Table 4-2. Standard Class Assignments

STANDARD CLASS ASSIGNMENTS **CALIBRATION KIT** 3.5 mm

HP 85052A 3.5mm A.1 Calibration Kit **TAPE FILE NUMBER**

	A	B	C	D	E	F	G	STANDARD CLASS LABEL
$S_{11}A$	2							OPEN
$S_{11}B$	1							SHORT
$S_{11}C$	9	10	12					LOADS
$S_{22}A$	2							OPEN
$S_{22}B$	1							SHORT
$S_{22}C$	9	10	12					LOADS
Forward Transmission	11							THRU
Reverse Transmission	11							THRU
Forward Match	11							THRU
Reverse Match	11							THRU
Frequency Response	1	2	11					THRU

Table 4-2A. Standard Class Assignments

STANDARD CLASS ASSIGNMENTS
HP 85052A 3.5mm A.1 Calibration Kit

CALIBRATION KIT 3.5 mm
TAPE FILE NUMBER _____

	A	B	C	D	E	F	G	STANDARD CLASS LABEL
$S_{11}A$								
$S_{11}B$								
$S_{11}C$								
$S_{22}A$								
$S_{22}B$								
$S_{22}C$								
Forward Transmission								
Reverse Transmission								
Forward Match								
Reverse Match								
Frequency Response								

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