Errata

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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 Technologies

HP 85062A
3.5 mm
Electronic Calibration Kit

Operating and Service Manual

SERIAL NUMBERS

This manual applies directly to any HP 85062A Calibration Kit having serial prefix US3444 and above.

HEWLETT PACKARD

HP Part Number: 85062-90001
Printed in USA 1995
First Edition

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time ***of*** *shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST, formerly NBS), to the extent allowed by the institutes calibration facility, and to the calibration facilities of other International Standards Organization members.*

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Chapter 1 General Information

Chapter 2 Specifications and Characteristics

Chapter 3 User Information

Chapter 4 Preparation For Use - Gaging and Making Connections

Chapter 5 Performance Verification

Chapter 6 Troubleshooting

Chapter 7 Replaceable Parts

Chapter 1 General Information

CALIBRATION KIT OVERVIEW

The HP 85062A 3.5 mm Electronic Calibration Kit is designed to work with the HP 85060C Electronic Calibration (ECal) Control Unit to calibrate network analyzer systems (such as the HP 8510) for measurement of components with 3.5 mm connectors up to 26.5 GHz. See the Operating, Programming, and Service Manual for the HP 85060C control unit for specific network analyzer models.

The calibration kit consists of the following:

- A 1 to 26.5 GHz Calibration Module (Option 001 adds a 45 MHz to 2 GHz Calibration Module)
- A Specification / Verification Program Disk
- An Operating and Service Manual
- A 5/16 inch, 90 N–cm (8 in–lb) torque wrench for use on the 3.5 mm connectors
- A Female-to-Female Adapter (not included with Option 00F or Option 00M)
- A Male-to-Male Adapter (not included with Option 00F or Option 00M)

This manual describes the HP 85062A Electronic Calibration Kit and provides replacement part numbers, specifications, and procedures for using, maintaining, and troubleshooting the kit. The available calibration types, the best application for each type, and the associated calibration procedures are found in the Operating, Programming, and Service Manual for the HP 85060C control unit.

Note

This manual assumes you know proper connector care. If not, refer to "Principles of Microwave Connector Care-Quick Reference Card", located in the back of this manual. Refer to Chapter 7, "Replaceable Parts", for the HP part number if another copy is needed.

Or, contact your nearest HP sales office for the customer training course: "Understanding Connectors Used With Network Analyzers".

- HP 85050A + 24A (on-site)
- HP 85050A + 24D (at HP sales office)

Available Options

- Option 001 adds a low band (45 MHz to 2 GHz) calibration module.
- Option 00M replaces the standard 3.5 mm insertable module with a non-insertable male module.
- Option 00F replaces the standard 3.5 mm insertable module with a non-insertable female module.

Options may be combined. For example, ordering Option 001 with Option 00F would provide both a high band and a low band calibration module with non-insertable female connectors.

EQUIPMENT REQUIRED BUT NOT SUPPLIED

Connector gage sets are required for measuring connector pin depth. Gages and various connector cleaning supplies are not provided in this kit. Refer to Chapter 7, "Replaceable Parts", for ordering information.

SERIAL NUMBERS

A serial number label is attached to this calibration kit. The serial number is in the form; 0000000000. The first six digits form the serial number prefix (the first two digits are a country code, the next four are a year/ week designation). The last four digits form the suffix (a simple counting sequence).

The contents of this manual apply directly to calibration kits having the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

A typical serial number label is shown in Figure 1-1.

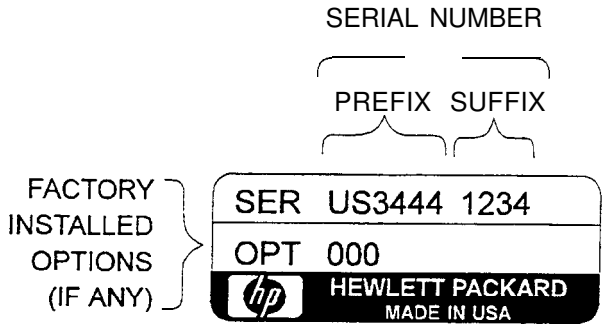


Figure I-1. Typical Calibration Kit Serial Number Label

In addition to the kit serial number, the calibration modules in the HP 85062A calibration kit are individually serialized. These serial numbers should be recorded in Table 1-1 when the kit is first received. The purpose of this is to help maintain the integrity of your kit. Kit integrity is one important part of compliance with U.S. MIL-STD-45662A, should your compliance be required.

Table I-I. Serial Numbers of Individual Calibration Devices

Serialized Device	Serial Number (to be recorded by user)
HP 85062A 3.5 mm Electronic Calibration Kit	
HP 85062-6000 1 Electronic Calibration Module (low band, insertable, Option 001)	
HP 85062-60002 Electronic Calibration Module (high band, insertable, standard)	
HP 85062-60003 Electronic Calibration Module (low band, non-insertable male, Option 001 and Option 00M)	
HP 85062-60004 Electronic Calibration Module (high band, non-insertable male, Option 00M)	
HP 85062-60005 Electronic Calibration Module (low band, non-insertable female, Option 001 and Option 00F)	
HP 85062-60006 Electronic Calibration Module (high band, non-insertable female, Option 00F)	

INCOMING INSPECTION

Refer to Figure 7-1, Figure 7-2, or Figure 7-3 (depending on your calibration kit options) to verify a complete shipment. Record the serial numbers of all serialized devices in your kit using Table 1-1. To verify electrical performance of the devices in this kit, refer to Chapter 5, "Performance Verification." The foam-lined storage case provides protection during shipping. If the case or any device appears damaged, contact the nearest Hewlett-Packard sales and service office (see inside the back cover of this manual). Hewlett-Packard will arrange for repair or replacement of incomplete or damaged shipments without waiting for settlement from the transportation company.

If the instrument is being returned to Hewlett-Packard for service, please include service information as described in "Returning a Kit or Device to HP" in Chapter 6, "Troubleshooting" (attach to the instrument if possible).

PREVENTIVE MAINTENANCE

The best techniques for maintaining the integrity of the devices in this kit include routine visual inspection and cleaning, and proper gaging and connection techniques. Failure to detect and remove dirt or metallic particles on a connector mating plane surface can degrade repeatability and accuracy and can damage any connector mated to it. Improper connections resulting from pin depth values being out of the observed limits (see Table 2-2) or from using poor connection techniques can also damage these devices.

Visual inspection, cleaning and connection techniques, and proper gaging for pin depth are all described in Chapter 4, "Preparation for Use - Gaging and Making Connections."

Chapter 2 Specifications and Characteristics

SPECIFICATIONS TERMINOLOGY

Definitions

The definitions explained here help to clarify the terms used in the remainder of this chapter. These definitions refer to the HP 85062A 3.5 mm Electronic Calibration Kit only and are not necessarily valid definitions for other HP products.

Operating Temperature Range. This is the temperature range over which the calibration standards maintain performance to their specifications.

Accuracy-Enhanced Temperature Range. This is the allowable network analyzer ambient temperature drift during measurement calibration and during measurements when the network analyzer correction is turned on. It is also the range over which the network analyzer maintains its specified performance while correction is turned on. If this temperature range is exceeded, the accuracy-enhanced performance of the network analyzer will be degraded.

Measurement Calibration. This is the calibration performed to determine the corrections necessary for accuracy-enhanced (correction on) measurements.

Connector Pin Depth Values. Refer to Figure 2-1 and Table 2-2. Pin depth is a relative measurement between the center conductor and outer conductor mating surfaces. All references to pin depth in this manual treat positive (+) values as protrusions, and negative (-) values as recessions.

References to Connector Sex

In this manual, adapters, calibration modules, and gage masters are referred to by the sex of their connector. For example, a male adapter has a male connector. A gage is referred to by the sex of the connector that it measures. For example, a male gage *measures* male connectors; a male gage has a female connector.

ENVIRONMENTAL SPECIFICATIONS

Table 2-1 lists the environmental specifications for the modules in the HP 85062 Calibration Kit.

Table 2-1. Environmental Specifications

Specifications	Limits
Operating Temperature Range	+20 to +26 °C (+68 to +79 ° F)
Error-Corrected Temperature Range	±1 °C of measurement calibration temperature
Storage Temperature	-40 to +75 °C (-40 to +167 °F)
Barometric Pressure (Altitude) Operation Storage	 <4,500 meters (15,000 feet) <15,000 meters (50,000 feet)
Relative Humidity Operation Storage	Non-condensing at all times 0 to 80% (26 °C maximum dry bulb) 0 to 95%
EMI Conducted Susceptibility Radiated Susceptibility Radiated Emissions Magnetic Emissions	 CETM 765 EN 50082-1/IEC 801-3 CISPR11 CETM 765

Operating Temperature and Accuracy Enhancement

Temperature of the calibration modules is important because device dimensions (and therefore electrical characteristics) change with temperature. The temperature of the calibration devices and all connectors must be stable before use and within the operating limits shown above.

A measurement calibration of the network analyzer can be made at any temperature within the operating temperature range of the calibration kit. The measurement calibration temperature of the network analyzer must be maintained within the error corrected temperature range of the network analyzer. The error corrected operating temperature range for most HP network analyzers is the initial measurement calibration temperature ±1 °C (±1.8 °F). See the appropriate network analyzer User's Manual.

Measurement calibration, performance verification, and actual device measurements must be made within the error corrected operating temperature range specification of the network analyzer. Part of the error corrected operating temperature range can fall outside of the calibration temperature window. For 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 network analyzer ambient operating temperature drift exceeds the allowable error corrected temperature range, a new measurement calibration must be performed to assure optimum accuracy.

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

Barometric Pressure and Relative Humidity

Barometric pressure and relative humidity also effect device performance. Air exists between the inner and outer conductors of these devices and the dielectric constant of air varies as pressure and humidity change. Refer to Table 2-1 for environmental specifications including barometric pressure.

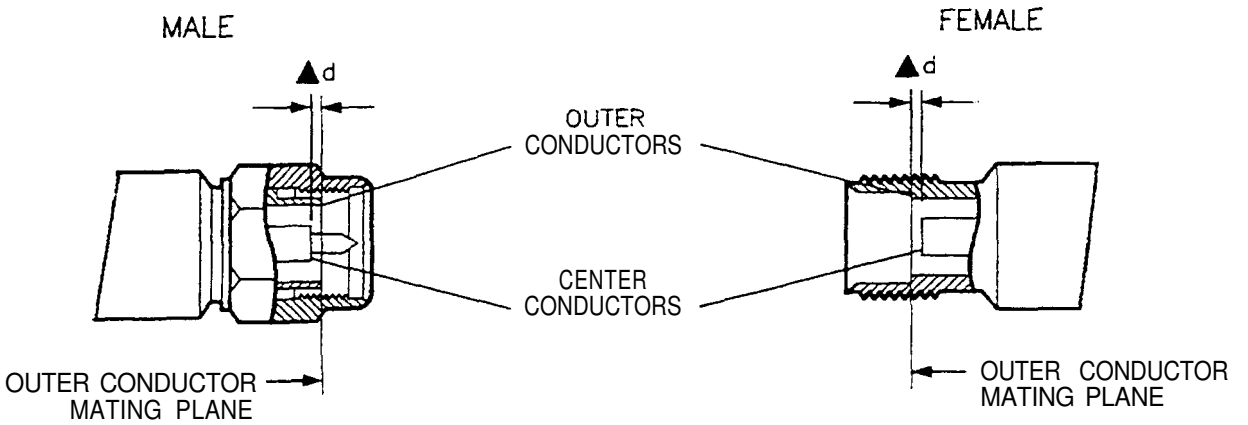
MECHANICAL CHARACTERISTICS

Center Conductor Protrusion and Pin Depth

Mechanical characteristics such as center conductor protrusion and pin depths are not performance specifications. They are, however, important supplemental characteristics related to electrical performance. Hewlett-Packard verifies the mechanical characteristics of the devices in this kit with special gaging processes and electrical testing. This ensures that the device connectors do not exhibit any center conductor protrusion and have proper pin depth when the kit leaves the factory.

Note that center conductor protrusion or recession is referenced to the connector mating surface.

Chapter 4, "Preparation for Use - Gaging and Making Connections", explains how to use gages to determine if the kit devices have maintained their mechanical integrity (refer to Table 2-2 for typical pin depth limits).



Zero pin depth is when Δd = zero.
A protruding center conductor is when Δd is a positive (+) value.
A recessed center conductor is when Δd is a negative (-) value.

Figure 2-I. Connector Protrusion and Recession

Table 2-2. 3.5 mm Connector Pin Depth Limits

Device	Typical Pin Depth micrometers (10^{-4} inches)	Measurement Uncertainty[a] micrometers (10^{-4} inches)	Observed Pin Depth Limits micrometers (10^{-4} inches)
3.5 mm Electronic Calibration Module	-25.4 to -50.8 (-10.0 to -20.0)	+1.3 to -1.3 (+0.5 to -0.5)	-24.1 to -52.1 (-9.5 to -20.5)
3.5 mm Adapter	-2.5 to -13.0 (-1.0 to -5.0)	+1.3 to -1.3 (+0.5 to -0.5)	-1.2 to -14.3 (-0.5 to -5.5)

a. Approximately +2 sigma to -2 sigma of gage uncertainty based on studies performed at the factory using analog gages according to recommended procedures.

Connector Torque

Torque all 3.5 mm connectors to 90 N–cm (8 in–lb). Accuracy of the torque wrench supplied in this kit is 90 N–cm ±10% (±9.0 N–cm).

SUPPLEMENTAL CHARACTERISTICS

Table 2-3. Electrical Characteristics

Characteristic	Limit
Frequency Range	
Standard	1-26.5 GHz
Option 001	0.045-2 GHz
Maximum RF Input Power	+20 dBm

Table 2-4. Mechanical Characteristics

Characteristic	Limit
Net Weight	
Standard	1,172 grams (2.6 lbs)
Option 001	1,623 grams (3.6 lbs)
Shipping Weight	
Standard	1,893 grams (4.2 lbs)
Option 001	2,360 grams (5.2 lbs)
Dimensions (length x width x height)	350 x 200 x67 mm (13.8 x 7.9 x 2.6 inches)

Chapter 3 User Information

THE CALIBRATION DEVICES AND THEIR USE

The HP 85062A 3.5 mm Electronic Calibration Kit contains a high band (1 to 26.5 GHz) electronic calibration module, Option 001 adds a low band (45 MHz to 2 GHz) electronic calibration module. Other options are described in Chapter 1.

The following briefly describes the design, construction, and functionality of an electronic calibration module.

Design, Construction, and Functionality

Electronic calibration is achieved using a two part system consisting of an HP 85060C Electronic Calibration Control Unit and various two-port electronic calibration modules. The control unit houses a computer with built-in firmware and controls the entire calibration process. The calibration modules are solid-state devices with programmable repeatable impedance states. These modules are characterized at Hewlett-Packard and are used to transfer the factory calibration accuracy to the customer.

The microwave circuitry in the module uses semiconductor PIN diode switches which shunt the transmission lines to ground. The number of diodes, and their location, vary depending upon the frequency requirements. A multitude of reflection coefficients are generated by applying various combinations of the shunts. Without shunts, the network acts as a low-loss transmission line. High isolation between the ports is obtained by driving several of the PIN diode shunts simultaneously. Control logic within the module is programmed to drive the PIN diodes to their various states.

The factory measured S-parameter data of each of the various impedance states is stored inside of the module. This factory data is compared to the measured data, collected during the calibration process, and error terms are calculated.

CALIBRATION CONSTANTS

The HP 85062A Electronic Calibration Kit is unlike our standard mechanical calibration kits. There are no calibration constants to be loaded into the network analyzer. All of the calibration data for each individual electronic calibration module is stored within the module, and is traceable to NIST (National Institute of Standards and Technology). This calibration data is read by the HP 85060C Electronic Calibration Control Unit each time a calibration is performed.

PERFORMING CALIBRATIONS

The calibration type and procedure to be used depends on the type and accuracy of measurement required for the device-under-test. The operating, programming, and service manual for the HP 85060C Electronic Calibration Control Unit provides information regarding the available calibration types, the best application for each type, and describes the calibration procedures in detail.

For information regarding specific network analyzers, refer to the appropriate network analyzer user's manual or Hewlett-Packard application notes.

CHANGING THE CALIBRATION DATA

The calibration data stored in each electronic calibration module is unique to that module and can only be changed when the module is recertified or repaired. This recertification or repair can only be performed at Hewlett-Packard or at Hewlett-Packard authorized service centers.

Chapter 4 Preparation For Use - Gaging and Making Connections

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 of the connectors.

When the calibration modules are not in use, replace their protective end caps and store them in the foam lined storage case. The storage case lid is detachable so that the case can be stored in a shallow drawer.

Electrostatic Discharge

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 static discharge shock is approximately 3,000 volts. ESD as low as 60 volts can destroy sensitive microcircuits. Always wear a grounding wrist strap connected to a conductive bench mat when working near this and other sensitive equipment.

When you clean or inspect connectors attached to any static sensitive circuits, either on the calibration module or on any instruments, it is essential to protect against electrostatic discharge (ESD). Static electricity builds up on the body and can easily damage sensitive internal circuit elements when discharged by contact with the center conductor of the RF connector or the center contacts of the 25 pin D-Sub connector.

- Always have a grounded antistatic mat in front of your test equipment and wear a grounded wrist strap attached to it.
- Ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port briefly to discharge static from your body.
- Discharge static electricity from a device before connecting it: touch the device briefly (through a resistor of at least 1 megohm) to either the outer shell of the test port connector or to another exposed ground. This discharges static electricity and protects test equipment circuitry.

Refer to Chapter 7, "Replaceable Parts", for information about ordering supplies for ESD protection.

VISUAL INSPECTION

Visual inspection and, if necessary, cleaning should be done every time a connection is made. Metal particles from the connector threads may fall into the connector when it is disconnected. One connection made with a dirty or damaged connector can damage both connectors beyond repair.

In some cases, magnification is necessary to see damage on a connector. The use of a microscope with a magnification of 10x or more is recommended to detect this type of damage. Not all defects that are visible under magnification will affect the electrical performance of the connector. Use the following guidelines when evaluating the integrity of a connector.

Obvious Defects or Damage

Examine the connectors first for obvious defects or damage: badly worn plating, deformed threads or bent, broken, or misaligned center conductors. Connector nuts should move smoothly and be free of burrs, loose metal particles, and rough spots.

Any connector that has obvious defects should be discarded or repaired before continuing.

Mating Plane Surfaces

Flat contact between the connectors at all points on their mating plane surfaces is required for a good connection. Look especially for deep scratches or dents, and for dirt and metal particles on the connector mating plane surfaces.

Also, look for bent or rounded edges on the mating plane surfaces of the center and outer conductors and for signs of damage due to excessive or uneven wear or misalignment.

Light burnishing of the mating plane surface is normal, and is evident as light scratches or shallow circular marks distributed more or less uniformly over the mating plane surfaces. Other small defects and cosmetic imperfections are also normal. None of these affect electrical or mechanical performance.

If a connector shows deep scratches or dents, particles clinging to the mating plane surfaces, or uneven wear, clean and inspect it again. Damaged connectors should be discarded or sent for repair. Try to determine the cause of damage before connecting a new, undamaged connector in the same configuration.

Connector Wear

Connector wear eventually degrades performance. The more use a connector gets, the faster it wears and degrades. This is especially true with electrically characterized devices such as ECal modules. The wear is greatly accelerated when connectors are not kept clean. Calibration devices should have a long life if their use is on the order of a few times per week. The test port connectors on the network analyzer test set may have many connections each day, and are therefore more subject to wear. It is recommended that an adapter be used as a test port saver to minimize the wear on the test set's test port connectors. Replace all worn connectors.

CLEANING CONNECTORS

For long, reliable connector life, carefully clean all connectors. Refer to Chapter 7, "Replaceable Parts", for information on ordering recommended cleaning supplies.

Periodically Check for Alcohol Contamination

1. Let a few drops of your cleaning alcohol evaporate on a clean glass plate or microscope slide.
2. Examine the glass in reflected light. It should be perfectly clean and free of residue. If not, do not use alcohol from that container.

To keep your main supply of alcohol free from contamination, pour a small amount into a clean container and use that as your cleaning supply. Safely discard any remaining alcohol in the small container and clean the container.

CAUTION If you must use a solvent, use only isopropyl alcohol. Use the least amount of alcohol possible, and avoid wetting any plastic parts in the connectors.

GENERAL CLEANING PROCEDURES

Warning Always use protective eyewear when using compressed air or nitrogen. This procedure assumes you have taken the necessary ESD precautions.

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1. Use Compressed Air or Nitrogen. Use compressed air or nitrogen to loosen particles on the connector mating plane surfaces. Clean air cannot damage a connector, or leave particles or residues behind.

   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 a very low velocity; 60 psi or less. High velocity air can cause electrostatic effects when directed into a connector.

2. Clean the Connector Threads. For dirt or stubborn contaminants on a connector that you cannot remove with compressed air or nitrogen, try a cleaning swab or lint-free cleaning cloth moistened with isopropyl alcohol:
   a. Apply a small amount of isopropyl alcohol to a cleaning swab or lint-free cleaning cloth.
   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 and Interior Surfaces. Apply a small amount of isopropyl alcohol to a new cleaning swab and clean the mating plane and interior surfaces.

   If the connector has a center conductor, use very short horizontal or vertical strokes (across the connector), and the least pressure possible, especially when cleaning a female connector (to avoid snagging the swab on the center conductor contact fingers). An illuminated magnifying glass helps.
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 under a magnifying glass to be sure that no particles or residues remain.

GAGING DEVICES IN THIS KIT

Gage Intent

Gages are intended for preventive maintenance and troubleshooting purposes only. They are effective in detecting center conductor protrusion or excessive recession and preventing connector damage on DUT's, test accessories, and the calibration kit devices. Do not use gages for precise pin depth measurements.

Note

While performing pin depth measurements, use different orientations of the gage within the connector. Averaging a minimum of three readings, each taken after a quarter-turn rotation of the gage, reduces measurement variations that result from the gage or the connector face not being exactly perpendicular to the center axis.

Gage Accuracy

Connector gages are only capable of performing coarse measurements. They do not provide the degree of accuracy necessary to precisely measure the pin depth of the kit devices. This is partially due to the repeatability uncertainties that are associated with the measurement. Only the factory, through special gaging processes and electrical testing, can accurately verify the mechanical characteristics of the devices.

With proper technique, however, the gages are useful in detecting gross pin depth errors on device connectors. To achieve maximum accuracy, random errors must be reduced by taking the average of at least three measurements having different gage orientations on the connector. Even then, the resultant average can be in error by as much as ±0.0001 inch due to systematic (biasing) errors usually resulting from worn gages and gage masters, therefore, these systematic errors were not included in the uncertainty analysis. As the gages endure more use, the systematic errors could become more significant in the accuracy of the measurement.

When to Gage Connectors

Gage a connector at the following times:

- Before you use it for the first time. It is recommended that you record the initial pin depth measurement of your device to compare with future readings. This serves as a good troubleshooting tool when you suspect damage may have occurred to the device.
- If either visual inspection or electrical performance suggests that the connector interface may be out of typical range (due to wear or damage, for example).
- If a calibration device is used by someone else or on another system or piece of equipment.
- As a matter of routine: initially after every 100 connections, and after that as often as experience suggests.

CONNECTOR GAGES

Types

Each type of connector uses a different connector gage.

- There are push-on type gages and screw-on type gages
- Every connector gage requires a gage calibration block (to zero the gage).
- A gage is referred to by the sex of the connector it measures. For example, a male gage *measures* male connectors; a male gage has a female connector.

Figure 4-1 shows a typical 3.5 mm connector gage.

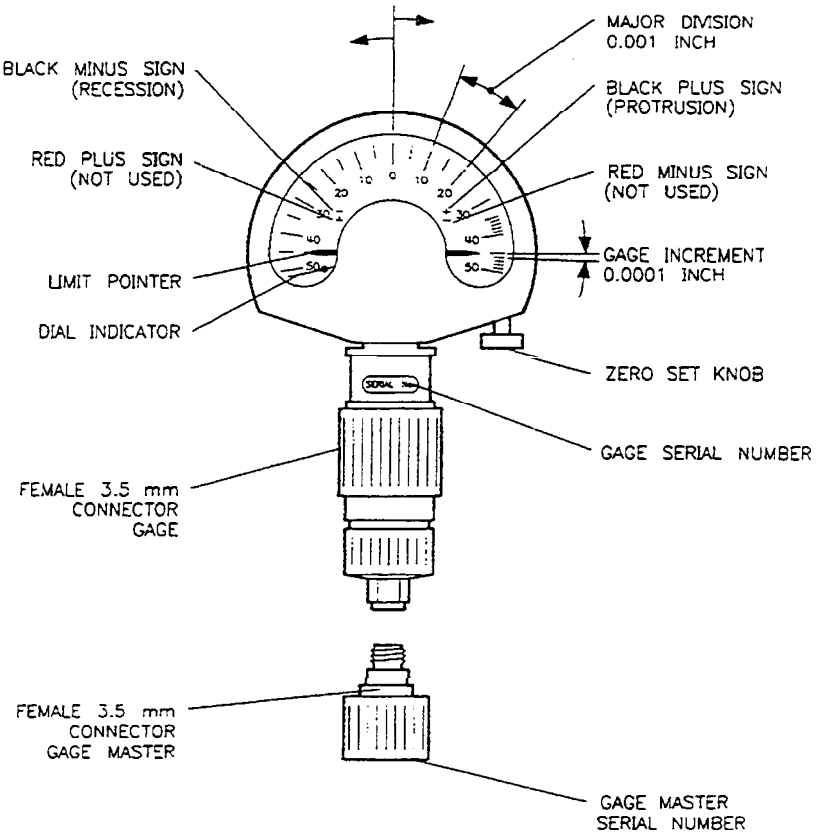


Figure 4-1. Typical 3.5 mm Connector Gage

ZEROING THE CONNECTOR GAGE

Note Hold a connector gage by the gage barrel, below the dial indicator. This gives the best stability, and improves measurement accuracy (cradling the gage in your hand or holding it by the dial applies stress to the gage plunger mechanism through the dial indicator housing).

1. Select the proper gage for your connector. Always use gages which are intended for 3.5 mm pin depth measurements.
2. Inspect and clean the gage:
   a. Inspect the connector gage and gage master carefully, exactly as you inspected the connector itself.
   b. Clean or replace the gage and gage master if necessary. Dirt on either the gage or the gage master makes gage measurements inaccurate, and can damage a connector.
3. Zero the connector gage:
   a. While holding the gage by the plunger barrel, use the connecting knurl to screw on the gage master just until you meet resistance.
   b. Use the torque wrench supplied with the kit to tighten the connecting nut of the gage master.
   c. As you watch the gage pointer, gently tap the barrel of the gage to settle the reading. The gage pointer should line up exactly with the zero mark on the gage. If not, clean and inspect both the gage and gage master. If the gage and gage master are clean and free from defects, adjust the zero set knob until the gage pointer exactly lines up with zero.

Note Check gages often to make sure that the zero setting has not changed. Generally, when the pointer on a recently zeroed gage does not line up exactly with the zero mark, the gage or gage master needs cleaning. Clean both of these carefully and check the zero setting again.

GAGING TECHNIQUES

Male 3.5 mm (Push-on Type Gage)

1. Refer to Figure 4-2. Find the male 3.5 mm connector gage (usually marked M) which has a circular metal bushing surrounding the gage plunger.
2. Use the protruding end of the gage calibration block (also usually marked M).
3. Slip the calibration block into the outer bushing so that the bushing comes to rest on the outer, flat area of the calibration block. When you measure a connector, the gage outer bushing rests on the outer conductor mating plane inside the connector.
4. Follow the instructions as described above for "Zeroing the Connector Gage."
5. Measure the connector:
   a. Carefully center and insert the gage into the male connector; the flat outer part of the gage bushing rests on the outer conductor (the male contact pin slips into the hole in the gage plunger for this purpose).
   b. Gently rock the connector gage within the connector to make sure the gage and the outer conductor mate flatly.
   c. When the gage pointer settles consistently at a reading, read the connector gage dial.

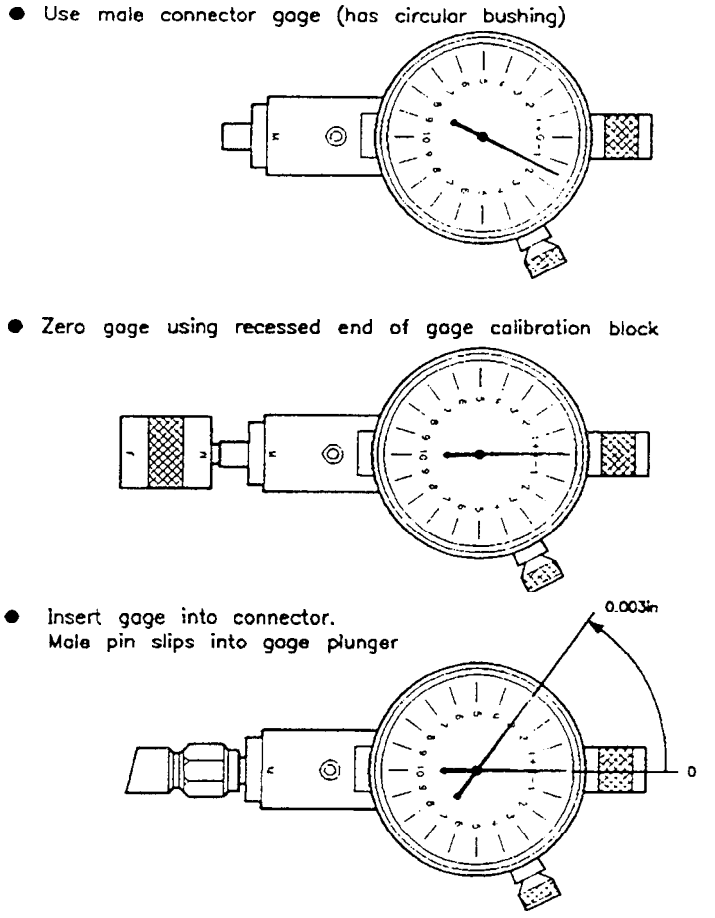


Figure 4-2. Gaging a 3.5 mm Male Connector Using a Push-on Type Gage

Male 3.5 mm (Screw-on Type Gage)

1. Refer to Figure 4-3.
2. Follow the instructions as described above for "Zeroing the Connector Gage."
3. While holding the gage by the barrel, screw on the connector of the calibration module to be measured. Without turning the gage or calibration module, connect the nut finger-tight.
4. Torque the connector onto the gage to 90 N-cm (8 in-lb) using the supplied 5/16 in. torque wrench or equivalent.
5. Gently tap the barrel of the gage with your finger to settle the reading.
6. Read the gage indicator dial.
7. For maximum accuracy, measure the connector a minimum of three times and take an average of the readings.

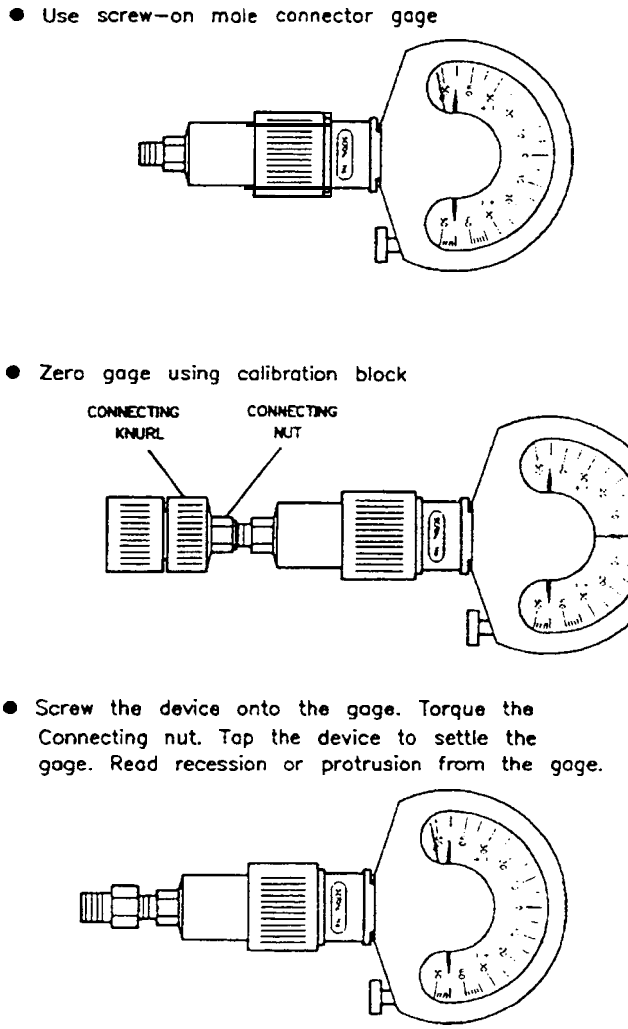


Figure 4-3. Gaging a 3.5 mm Male Connector Using a Screw-on Type Gage

Female 3.5 mm (Push-on Type Gage)

1. Refer to Figure 4-4. Find the female 3.5 mm connector gage (usually marked F).
2. Using the flat end of the gage calibration block (also usually marked F), follow the instructions as described above for "Zeroing the Connector Gage."
3. Measure the connector:
   a. Carefully center and insert the gage into the connector; the gage plunger rests on the outer end of the female contact fingers.
   b. Gently rock the connector gage within the connector to make sure the gage and the outer conductor mate flatly.
   c. When the gage pointer settles consistently at a reading, read the gage indicator dial.

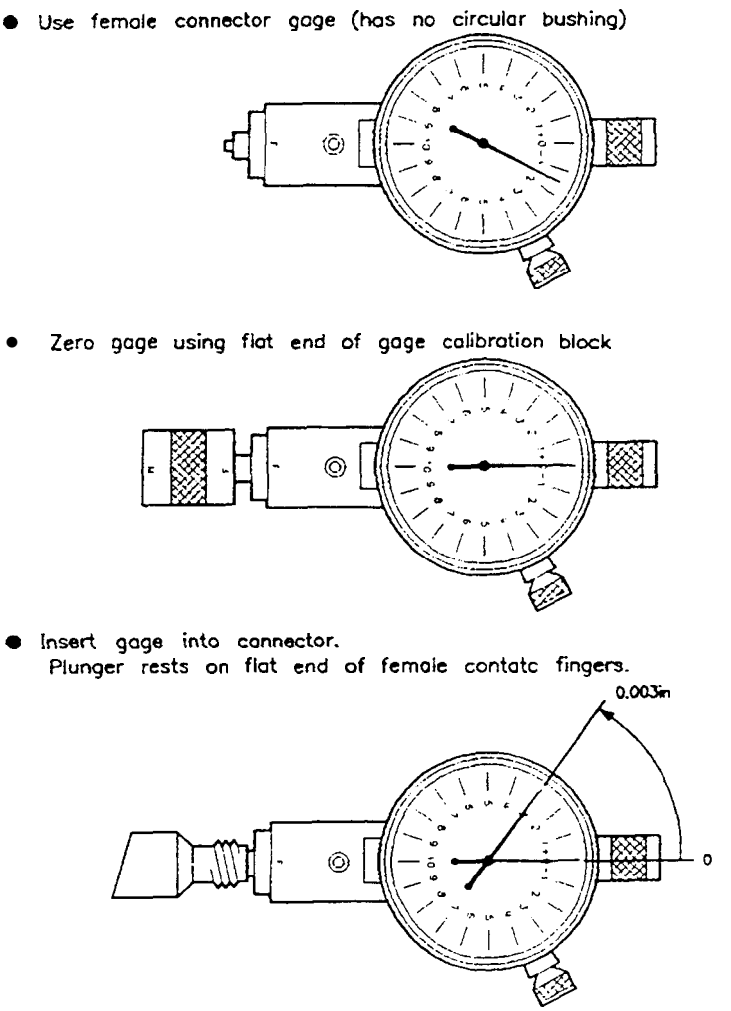


Figure 4-4. Gaging a 3.5 mm Female Connector Using a Push-on Type Gage

Female 3.5 mm (Screw-on Type Gage)

1. Refer to Figure 4-5.
2. Follow the instructions as described above for "Zeroing the Connector Gage."
3. While holding the gage by the barrel, screw on the connector of the calibration module to be measured. Without turning the gage or calibration module, connect the nut finger-tight.
4. Torque the connector onto the gage to 90 N-cm (8 in-lb) using the supplied 5/16 in. torque wrench or equivalent.
5. Gently tap the barrel of the gage with your finger to settle the reading.
6. Read the gage indicator dial.
7. For maximum accuracy, measure the connector a minimum of three times and take an average of the readings.

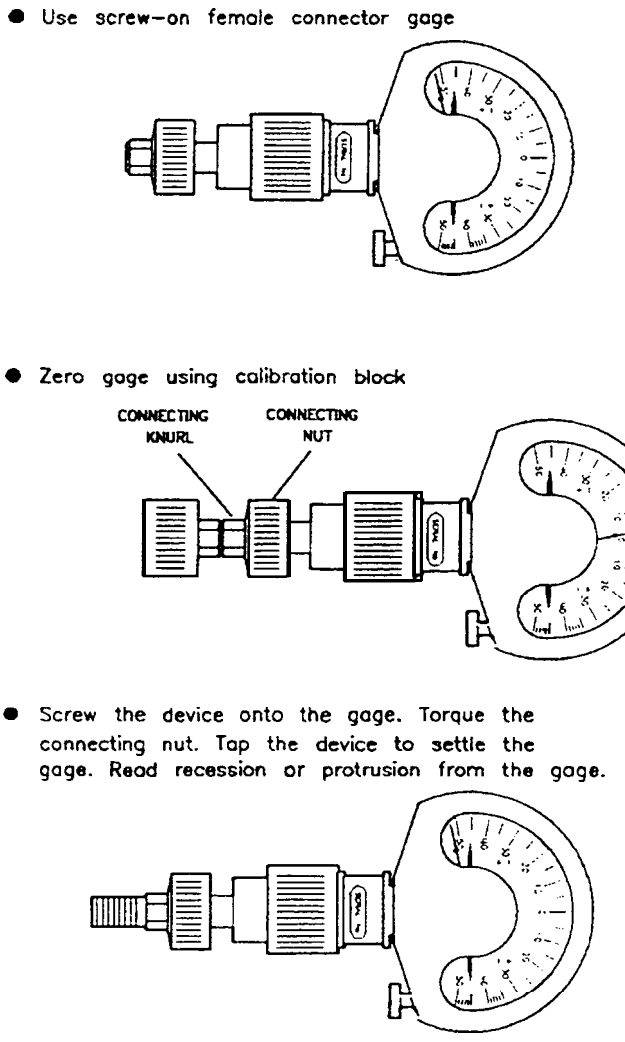


Figure 4-5. Gaging a 3.5 mm Female Connector Using a Screw-on Type Gage

MAKING CONNECTIONS

Good connections require a skilled operator. Because of instrument sensitivity and coaxial connector mechanical tolerances, slight errors in operator technique can significantly affect measurements and measurement uncertainties.

Initial Connection

CAUTION This procedure assumes that you have taken the necessary ESD precautions, and you have already cleaned and inspected (visually and mechanically) the connectors.

1. Carefully align the connectors. As you bring one connector up to the other, and as you make the actual connection, be sure the connectors align perfectly. The male connector center pin must slip concentrically into the contact fingers of the female connector. If not, stop and begin again.
2. Push the connectors straight together. Do not twist or screw them together. As the center conductors mate, you may feel a slight resistance.
3. Engage the connector nut over the threads on the second connector. Turn only the connector nut. Let the connector nut pull the two connectors straight together.

Final Connection

CAUTION When making connections with the calibration modules, turn the nut on the connector, never turn the module itself. Doing so may cause damage to the module or to the attaching connector.

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 handle begins to break loose. It is not necessary to fully break the handle of the torque wrench to reach the specified torque (Figure 4-6).

Note When making connections with these devices, use an open end wrench to hold one device stationary while torquing the nut on the other device/cable connector. Also, remember that the setting of the torque wrench can change with use. Re-calibrate at a schedule appropriate to the amount of use.

4. Reverse the order to disconnect the connection.

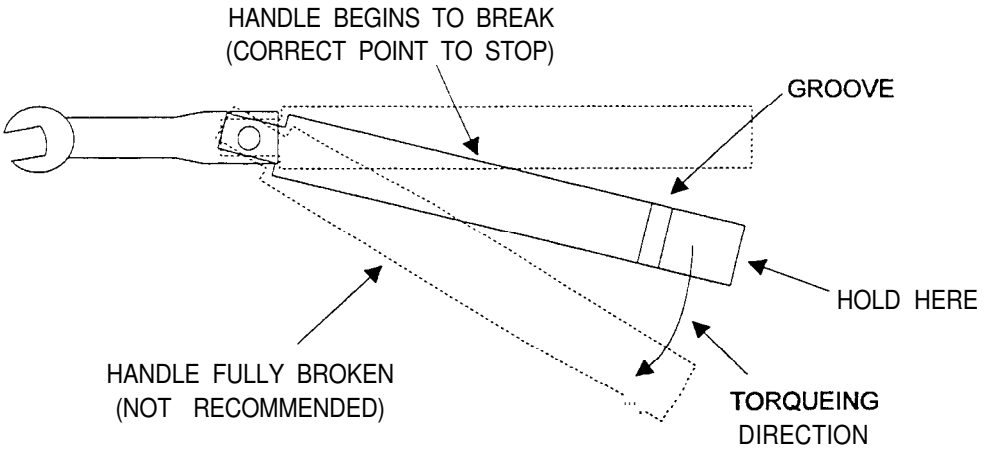


Figure 4-6. Using the Torque Wrench

Chapter 5 Performance Verification

The performance of your calibration kit can only be verified by returning the kit to Hewlett-Packard or at Hewlett-Packard authorized service centers. The equipment and calibration standards required to verify the specification limits of the devices internal to the kit have been specially manufactured and are not commercially available.

Hewlett-Packard recognizes its responsibility to provide you with procedures to reconfirm the published specifications of any product offered. That commitment applies equally to the HP 85062A 3.5 mm Electronic Calibration Kit. If it is imperative that the performance test processes for this kit be explained or made available to you, contact the nearest Hewlett-Packard sales and service office listed inside the back cover of this manual.

WHAT RECERTIFICATION PROVIDES

The following will be provided with a recertified kit:

- New calibration sticker affixed to the case
- Certificate of Calibration
- List of NIST (United States National Institute of Standards and Technology) traceable numbers
- A calibration report for each traceable device in the kit listing values, specifications, and uncertainties
- A new set of S-Parameter data (embedded in module memory)

The following is available on request:

- MIL-STD-45662A or equivalent certification

For more information, contact the nearest Hewlett-Packard sales and service office listed inside the back cover of this manual.

HOW OFTEN TO RECERTIFY

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

Note In some cases, a kit may be not used for some time after the actual recertification date. The recertification interval should begin on the date the kit is first used.

WHERE TO SEND A KIT FOR RECERTIFICATION

Contact the nearest Hewlett-Packard sales and service office listed inside the back cover of this manual for information on where to send your kit for recertification. When you return the kit, please include service information as described in "Returning a Kit or Device to HP" in Section 6, "Troubleshooting" (attach to the instrument if possible).

HOW HEWLETT-PACKARD VERIFIES THE DEVICES IN THIS KIT

Hewlett-Packard verifies the specifications of these devices as follows:

The residual microwave error terms of the test system are verified with precision airlines and shorts, or low frequency resistance. The resistance is traceable to NIST (United States National Institute of Standards and Technology). The airline and short characteristics are developed from mechanical measurements. The mechanical measurements and material properties are carefully modeled to give a very accurate electrical representation. The mechanical measurements are traceable to NIST through various plug and ring gages and other mechanical measurements.

Each calibration device is electrically tested on this test system to the specifications listed in this manual.

These two steps establish a traceable link to NIST for Hewlett-Packard to the extent allowed by the Institute's calibration facility. The devices in this kit are traceable to NIST through Hewlett-Packard.

Chapter 6 Troubleshooting

If you suspect a bad calibration, or if your network analyzer does not pass performance verification, follow the steps in Figure 6-1.

RETURNING A KIT OR DEVICE TO HP

If your calibration kit or device requires service, contact the HP office nearest you for information on where to send it (sales and service offices are listed inside the back cover of this manual).

If the instrument is being returned to HP for service, please include the following service information (attach to the instrument if possible):

a. Company Name
b. Company Address
c. Technical Contact Person
d. Telephone Number and Extension
e. Model Number
f. Serial Number
g. Purchase Order Number
h. Date
i. Accessories Returned With Instrument
j. Type of Service Required. Please describe the problem(s) as specifically as possible.
k. Any Other Applicable Information.

MORE INFORMATION

This manual contains limited information about network analyzer system operation. For complete information, refer to the instrument documentation.

If you need additional information, contact your local Hewlett-Packard representatives. Sales and service offices are listed inside the back cover of this manual.

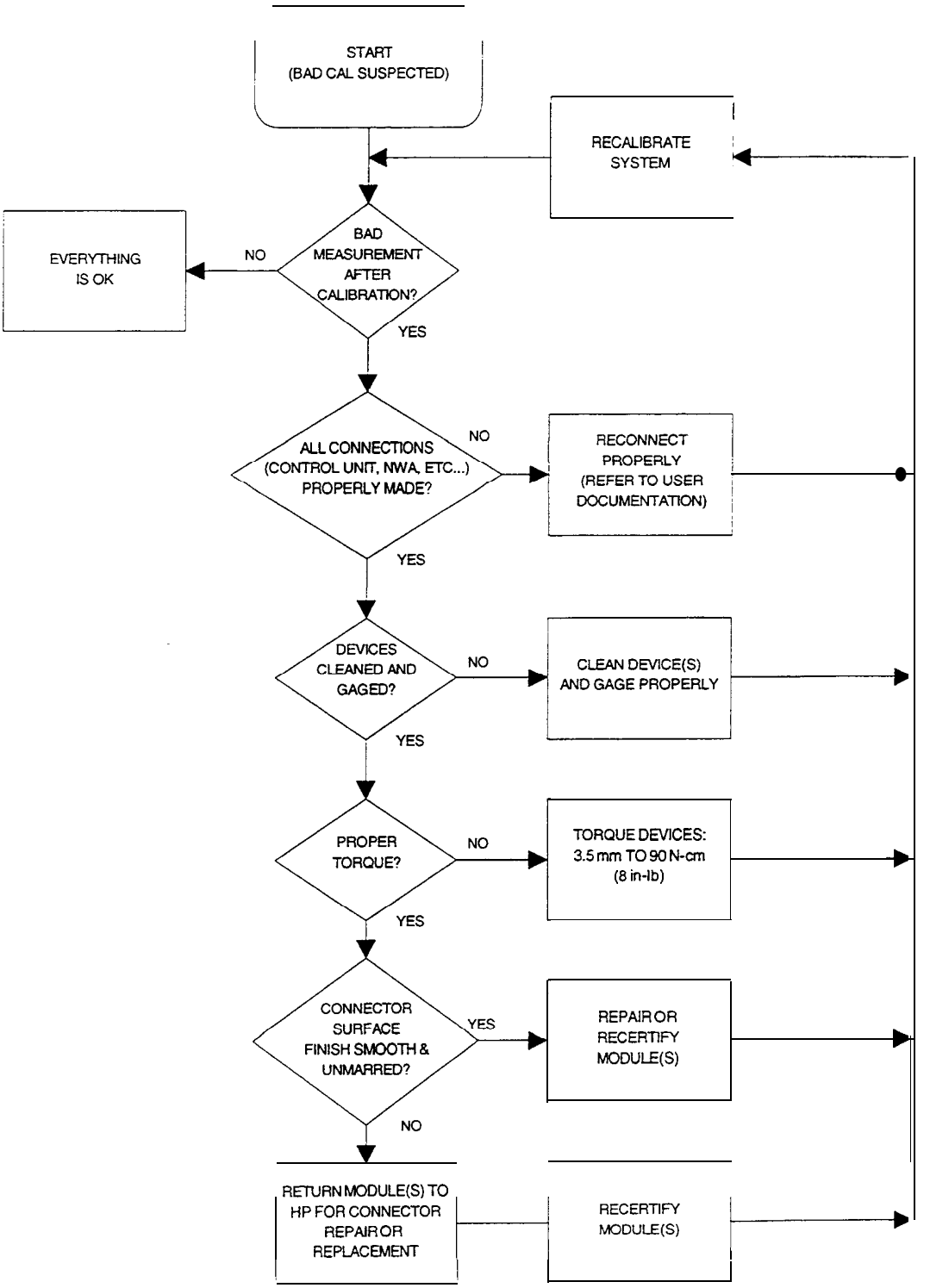


Figure 6-1. Troubleshooting Flow Diagram

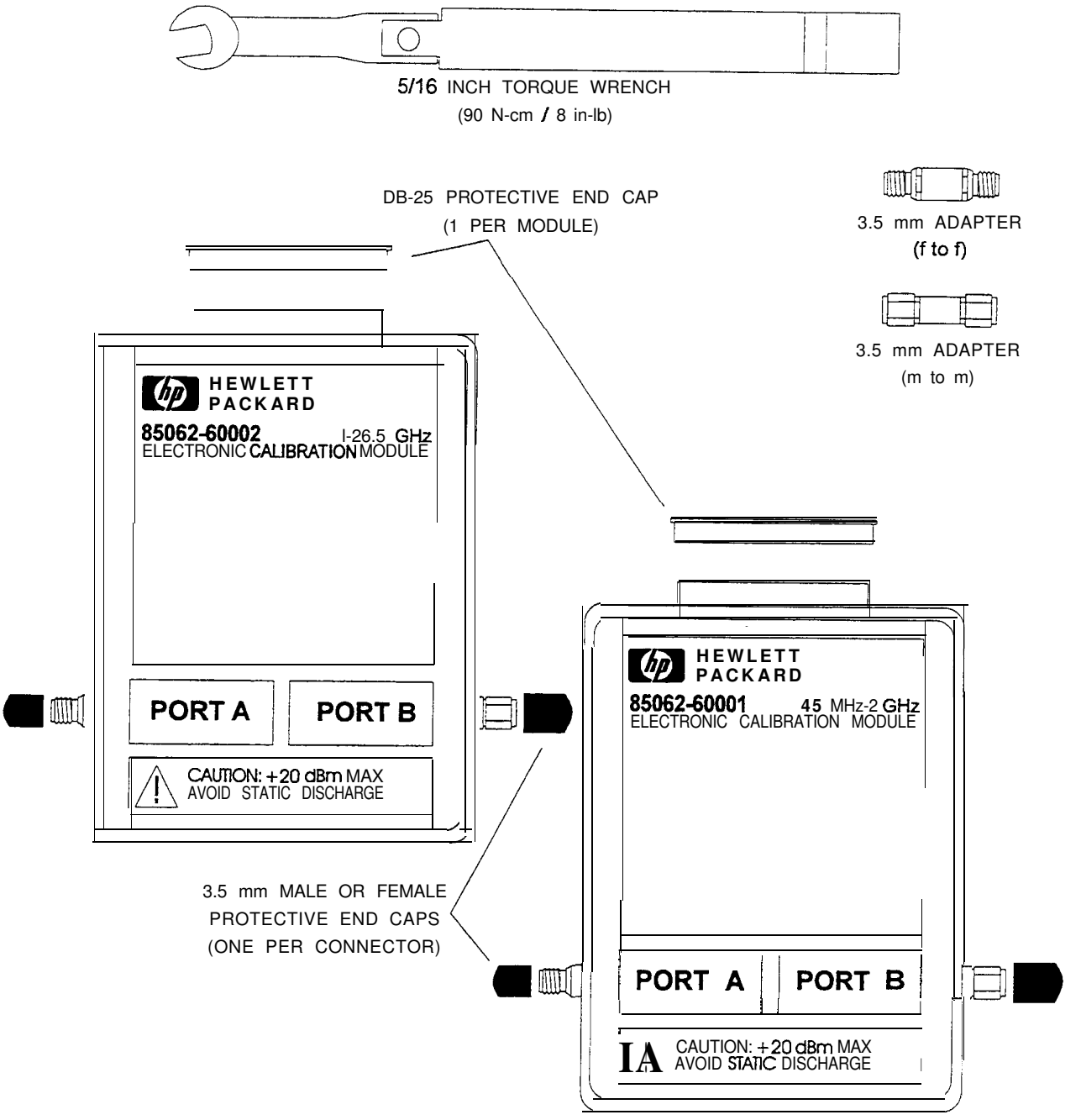
Chapter 7 Replaceable Parts

Table 7-1 lists the replacement part numbers for the contents of the HP 85062A calibration kit and for other parts which are not included in the kit. To order a listed part, note the description, HP part number, and the quantity desired. Telephone or send your order to the HP office nearest you (sales and service offices are listed inside the back cover of this manual).

Table 7-1. Replaceable Pans

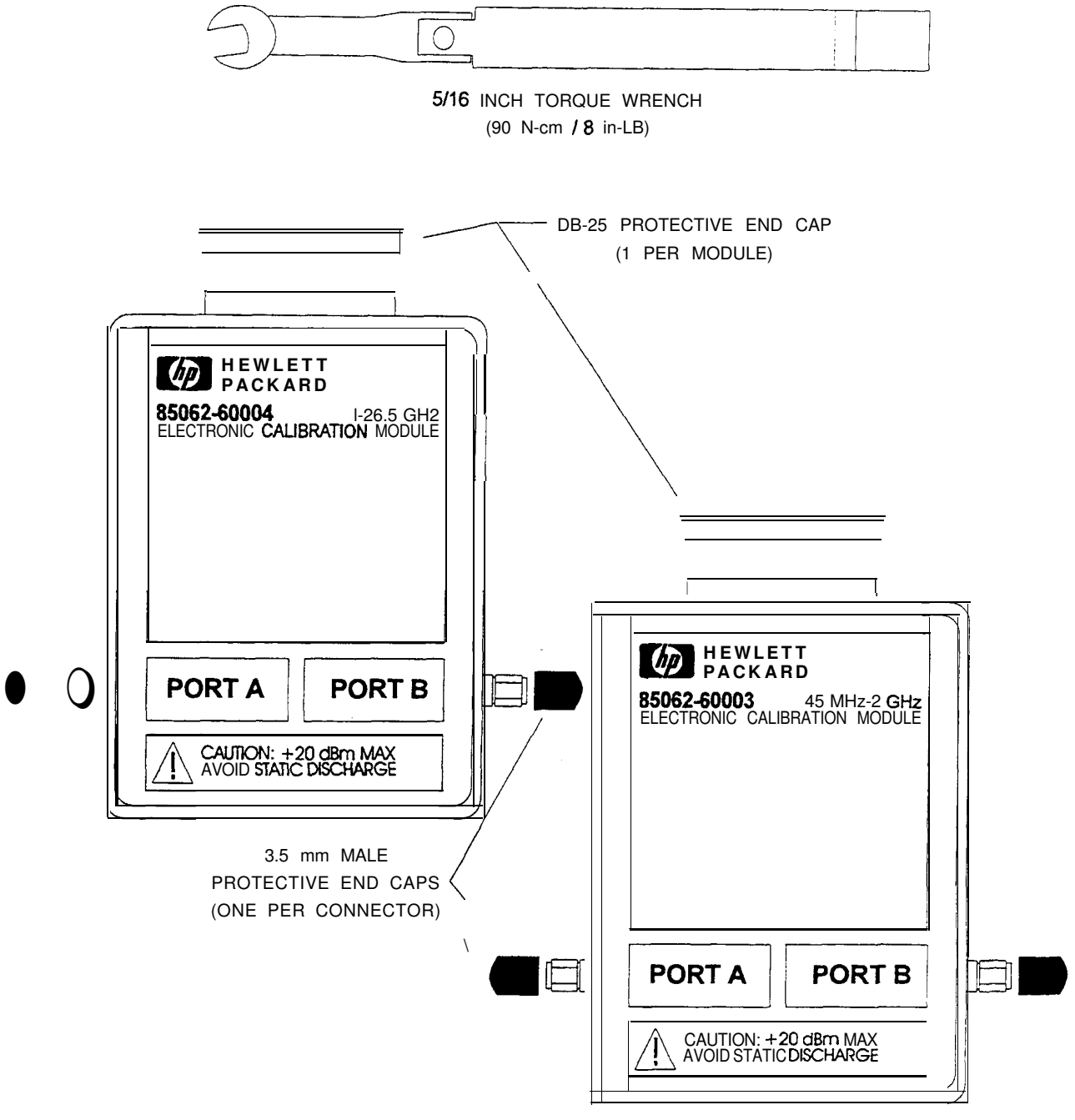
DESCRIPTION	QTY	HP PART NUMBER
High Band Calibration Modules		
Insertable (Standard)	1	85062-60002
Non-Insertable Male (Option OOM)	1	**85062-60004**
Non-Insertable Female (Option OOF)	1	**85062-60006**
Low Band Calibration Modules		
Insertable (Option 001)	1	85062-60001
Non-Insertable Male (Option 001 and Option 00M)	1	**85062-60003**
Non-Insertable Female (Option 001 and Option 00F)	1	**85062-60005**
Adapter?		
3.5 mm Female-to-Female Adapter	1	85052-60012
3.5 mm Male-to-Male Adapter	1	85052-60014
Protective End Caps		
DB-25 Multi-pin Connector	1 per	1252-4690
3.5 mm Female Connector	connector	1401-0245
3.5 mm Male Connector		1401-0246
Cleaning Supplies		
Compressed Air	1	8500-5262
99.5% Isopropyl Alcohol (8 oz.)	8 oz.	8500-0559
99.5% Isopropyl Alcohol (30 ml)	30 ml	8500-5344
Cleaning Swabs	100	9300-1243
Alcohol Wipes	1 box	92193N
Lint-free Cleaning Cloth	1	9310-4242
ESD Supplies		
Grounding Wrist Strap	1	9300-1367
5 ft. Wrist-strap to Table-mat Grounding Cord	1	9300-0980
2 x 4 ft. Conductive Table Mat with 15 ft. Ground Wire	1	9300-0797
ESD Heel Strap	1	9300-1126
Hard-surface Conductive Floor Mat		
4 x 5 ft.	1	92175A
3 x 4 ft.	1	92175C
Soft Surface Conductive Floor Mat (4 x 8 ft.)	1	92175B
Other		
Specification / Verification Program Disk	1	08510-10033
Operating and Service Manual	1	85062-90001
5/16 in., 90 N-cm (8 in-lb) Torque Wrench	1	8710-1765
Connector Care Quick Reference Card	1	08510-90360

a. Not included in kit with Option OOM or OOF



Not shown:
Operating and Service Manual, Storage Case, Specification / Verification Program Disk.
Notes:
Low band module shown is included only with Option 001.
Serial numbers are located on opposite side of modules.

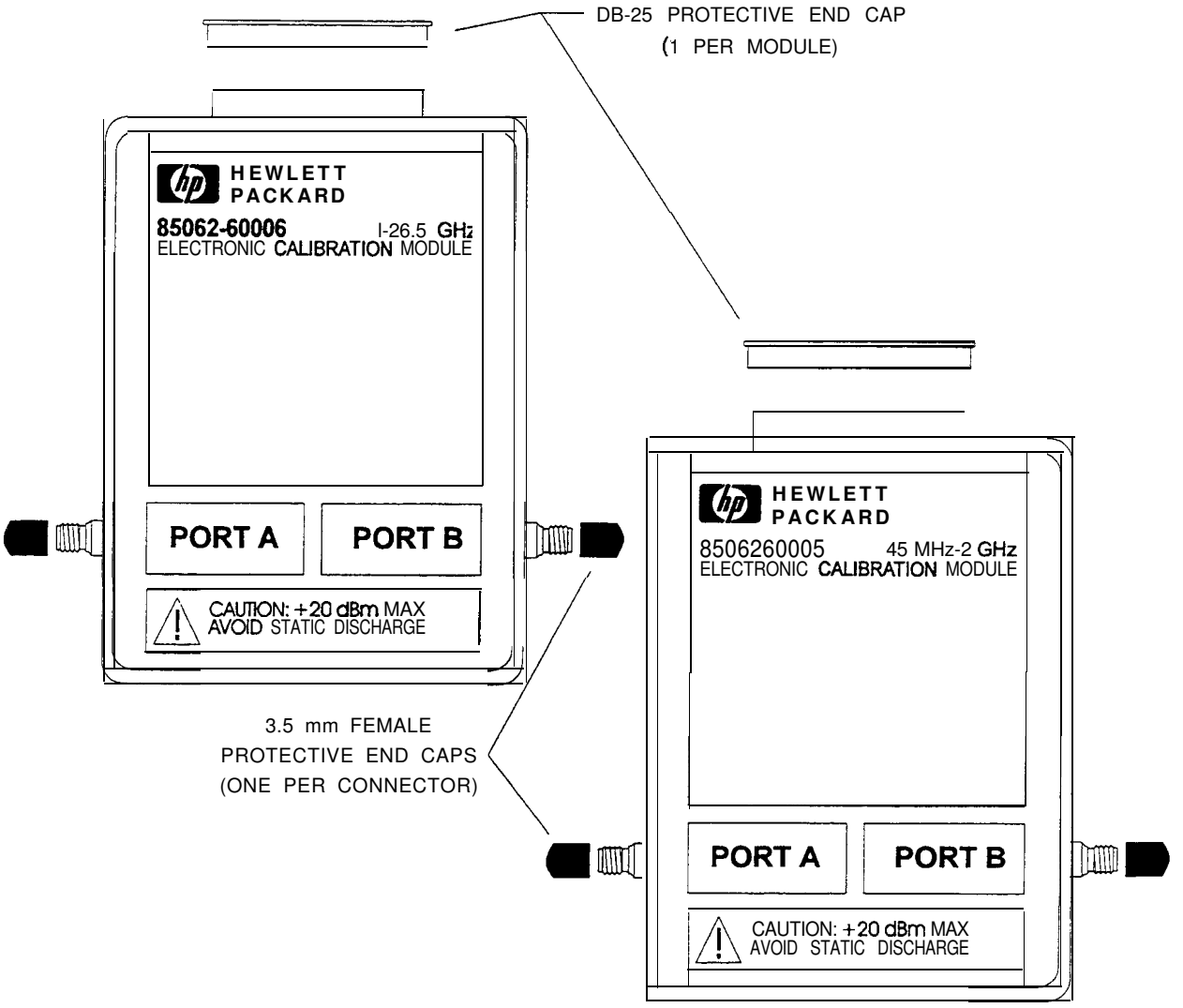
Figure 7-1. HP 85062A, Option 001, Replaceable Parts



Not shown:
Operating and Service Manual, Storage Case, Specification / Verification Program Disk.
Notes:
Low band module shown is included only with Option 001.
Serial numbers are located on opposite side of modules.

Figure 7-2. HP 85062A, Option 001 and Option OOM, Replaceable Parts

5/16 INCH TORQUE WRENCH
(90 N-cm / 8 in-LB)



Not shown:
Operating and Service Manual, Storage Case, Specification /Verification Program Disk.
Notes:
Low band module shown is included only with Option 001.
Serial numbers are located on opposite side of modules.

Figure 7-3. HP 85062A, Option 001 and Option OOF, Replaceable Parts

NOTE

Before You Start:

Proper connector care and connection techniques are critical for accurate, repeatable measurements.

Refer to the calibration kit documentation for connector care infromation. Prior to making connections to the network analyzer, carefully review the information about inspecting, cleaning, and gaging connectors.

Having good connector care and connection techniques extends the life of these devices. In addition, you obtain the most accurate measurements.

This type of information is typically located in Chapter 3 of the calibration kit manuals.

For additional connector care instruction, contact your local Hewlett-Packard Sales and Service Office about course numbers HP 85050A+24A and HP 85050A+24D.

See the reverse side of this notice for quick reference tips about connector care.

HP 08510-90360 Printed June 1993

Principles of Microwave Connector Care-- Quick Reference Card

Handling and Storage

Do	Do Not
• Keep connectors clean . Extend sleeve or connector nut • Use plastic end caps during storage	• Touch mating-plane surfaces • Set connectors contact-end down

Visual Inspection

Do	Do Not
• Inspect all connectors carefully before every connection • Look for metal particles, scratches, and dents	• Use a damaged connector--ever

Connector Cleaning

Do	Do Not
• Try compressed air first • Use isopropyl alcohol • Clean connector threads	• Use any abrasives • Get liquid into plastic support beads

Gaging Connectors

Do	Do Not
• Clean and zero the gage before use • Use the correct gage type • Use correct end of calibration block • Gage all connectors before first use	• Use an out-of-spec connector

Making Connections

Do	Do Not
• Align connectors carefully • Make preliminary connection lightly • Turn only the connector nut • Use a torque wrench for final connect	• Apply bending force to connection • Overighten preliminary connection • Twist or screw any connection • Tighten past torque wrench “break” point