SECTION 1

GETTING STARTED

1-1. INTRODUCTION

This section provides the information necessary for receiving, performing an incoming inspection, preparing for use, and setting up your HP 4195A.

The **WARNING**s, **CAUTION**s, and **NOTE**s given throughout this document must be carefully followed to ensure the operator's safety and to maintain the 4195A's serviceability.

1-2. INCOMING INSPECTION

This instrument has been carefully inspected both electrically and mechanically before being shipped from the factory. It should be in perfect condition, no scratches, dents or the like, and it should be perfect electrical condition. To verify this, carefully perform an incoming inspection to check the instrument for signs of physical damage, missing contents, or if this instrument does not pass the electrical performance test as follows and if any discrepancy is found, notify the carrier and Hewlett-Packard. The HP sales office will arrange for repair and replacement without waiting for the claim to be settled.

1. Inspect the shipping container for damage, and keep the shipping materials until the inspection is completed.

2. Verify that the shipping container contains everything shown in Figure 1-1.

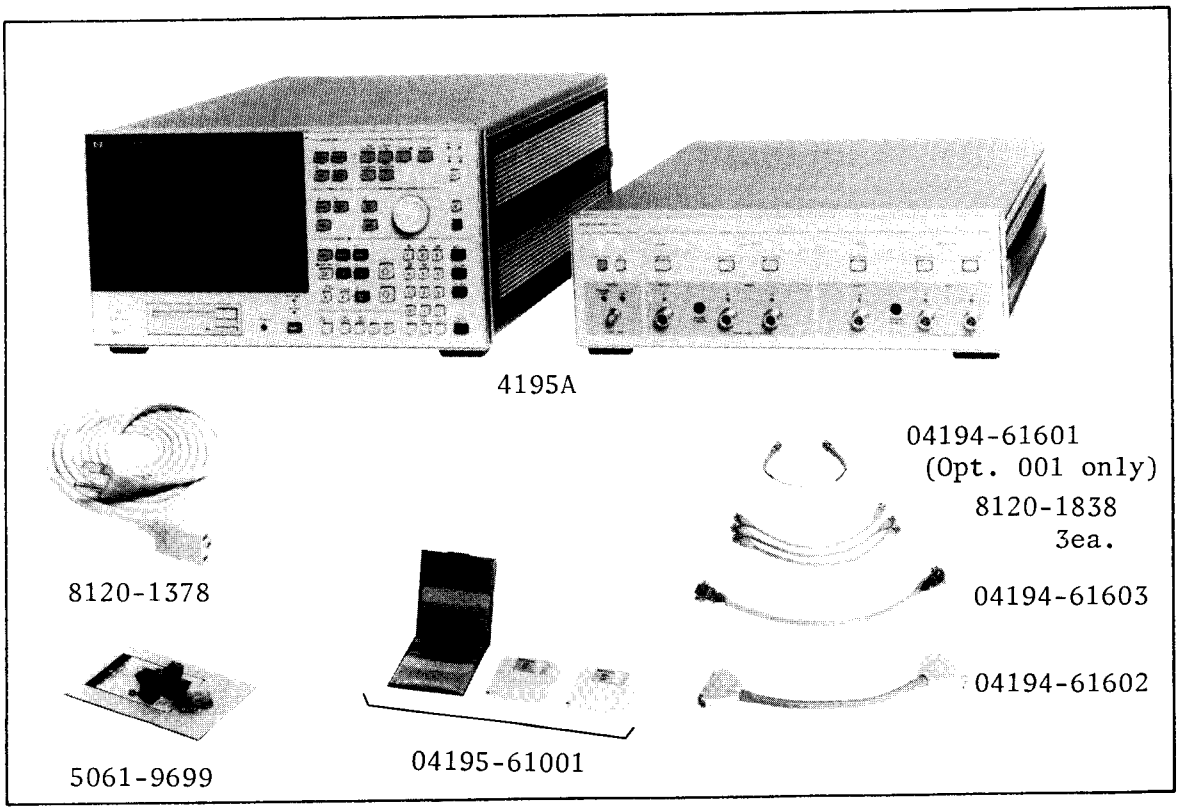


Figure 1-1. HP 4195A and Furnished Accessories

3. Inspect the exterior of the 4195A for any signs of damage.

4. Verify that the 4195A is equipped with the Options you ordered.

5. Complete the **PREPARATION FOR USE** procedures described in paragraph 1-3.

6. Perform the **Performance Test** described in the Maintenance Manual to verify the 4195A's electrical performance.

1-3. PREPARATION FOR USE

1-3-1. UPPER/LOWER UNIT LINKING/CONTROLLING

1. Interconnecting Units

The 4195A consists of two modules which must be electrically and mechanically interconnected using the supplied cables and Rear Panel Lock Foot Kit (Full Modules, PN 5061-9699) to facilitate handling and to allow proper connection between the two units. The procedure for mounting the control unit on top of the measurement unit is as follows.

1. Remove the feet from the bottom cover of the Control Unit by:

   (1) Lifting the tab of the bottom foot.

   (2) Sliding the bottom foot in the direction of the tab.

2. Install the Rear Panel Lock Foot Kit. Follow the instructions provided with the kit. Once the kit has been installed, the two units will be firmly secured to each other allowing you to pick up the 4195A without having to disconnect the rear cables.

2. Interconnection Cables

Connect the following cables between the rear panels of the control and measurement units as shown in Figure 1-2.

Cable (1). Connect the 9-pin cable assembly (PN 04194-61603) between J6 of the Control Unit and J6 of the Measurement Unit. Use a small standard screwdriver to tighten the screws on the cable connectors.

Cable (2). Connect the 50-pin cable assembly (PN 04194-61602) between J5 of the Control Unit and J5 of the Measurement Unit. Lock the cable connectors with the spring clips.

Cable (3). Connect three BNC cables (PN 8120-1838) between J2, J3, and J4 of the Control and Measurement Units.

Cable (4). **Option 001** equipped instruments only. Connect a BNC cable (PN 04194-61601) between the '**EXT REFERENCE**' connector on the Control Unit and the '**REFERENCE OVEN**' connector on the Measurement Unit.

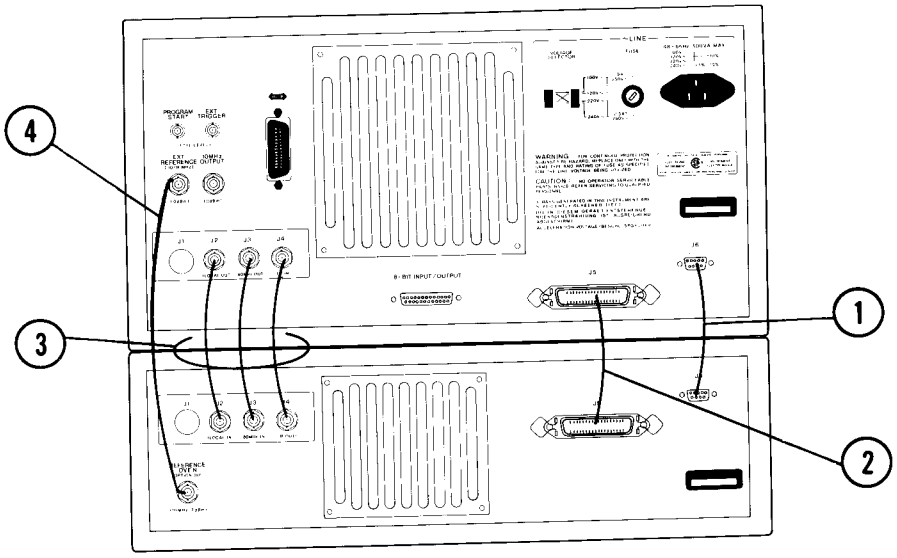


Figure 1-2. Cable Interconnections

1-3-2. POWER REQUIREMENTS

The 4195A requires an AC power source of 100, 120, 220 V ±10%, or 240 V +5% -10%, 48 to 66 Hz single phase, power consumption is 500 VA maximum.

WARNING

THIS IS A SAFETY CLASS 1 PRODUCT (PROVIDED WITH A PROTECTIVE EARTH TERMINAL). A NONINTERRUPTABLE SAFETY EARTH GROUND MUST BE PROVIDED FROM THE MAINTAIN POWER SOURCE TO THE INSTRUMENT'S POWER INPUT TERMINALS, POWER CORD, OR SUPPLIED POWER CORD SET. WHENEVER THE SAFETY EARTH GROUNDED HAS BEEN IMPAIRED, THE INSTRUMENT MUST BE MADE INOPERATIVE AND SECURED AGAINST ANY UNINTENDED OPERATION. IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTOTRANSFORMER (NOT RECOMMENDED) FOR VOLTAGE REDUCTION, MAKE SURE THAT THE COMMON TERMINAL IS CONNECTED TO THE EARTH POLE OF THE POWER SOURCE.

1-3-3. LINE VOLTAGE AND FUSE SELECTION

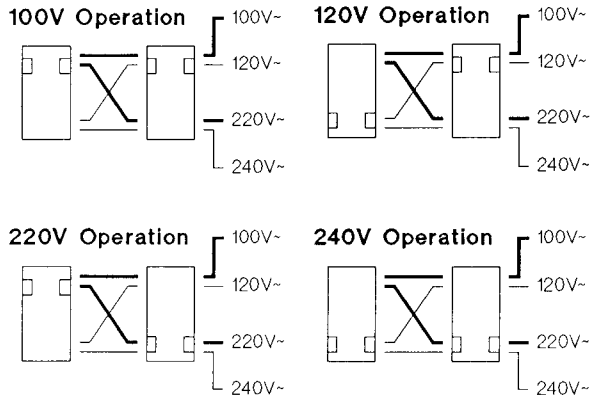
CAUTION

Before connecting the instrument to the power source, make sure that the correct fuse has been installed and the Line Voltage Selection Switch is correctly set.

Figure 1-3 illustrates the line voltage selection switch and fuse-holder on the instrument's rear-panel, instructions for line voltage and fuse selection, and the line voltage range for line voltage selection. Current ratings for the fuse are printed under the fuse-holder on the rear-panel and are listed, along with the fuse's HP part number, in Figure 1-3.

CAUTION

Use the proper fuse for the line voltage selected. Make sure that only fuses with the required current rating and of the specified type are used as replacements. DO NOT use a mended fuse or short-circuit the fuse-holder in order to by-pass the fuse.



Line Voltage Selection

Voltage Selector	Line Voltage
100V	90 - 110V, 48 - 66Hz
120V	108 - 132V, 48 - 66Hz
220V	198 - 242V, 48 - 66Hz
240V	216 - 252V, 48 - 66Hz

Line Voltage Selector:

Set the Line Voltage Selector switch.

Fuse Removal:

Turn the fuse holder counterclockwise until the fuse pops out.

Fuse Selection

Operating Voltage	Fuse Rating	Fuse Part No.
100V 120V	5A, 250V, Normal Blow	2110-0010
220V 240V	3A, 250V, Slow Blow	2110-0381

Figure 1-3. Line Voltage and Fuse Selection

1-3-4. POWER CABLE

To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. The 4195A is equipped with a three-conductor power cable, which, when plugged into an appropriate AC power receptacle, grounds the instrument. The offset pin on the power cable is the ground wire.

To preserve the protection feature when operating the instrument from a two contact outlet, use a three-prong to two-prong adapter (PN 1251-8196) and connect the adapter's green pigtail to power-line ground.

CAUTION

The power plug must be inserted into an outlet that provides a protective earth connection. You must not use an extension cord or power cable without a protective conductor (ground).

Figure 1-4 shows the power cords used in various countries. Also shown is the standard power cord furnished with the instrument. HP Part Numbers, applicable standards for power plugs, electrical characteristics, and the countries using each power cord are listed in Figure 1-4. For assistance in selecting the correct power cable, contact the nearest Hewlett-Packard sales office.

1-4. OPERATION ENVIRONMENT

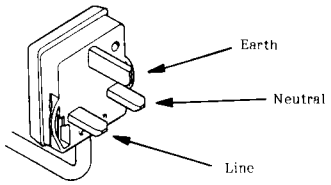
The 4195A must be operated under within the following environment conditions, and sufficient space must be kept behind the 4195A to avoid obstructing the air flow of the cooling fans.

Temperature: 0 °C to 55 °C
Humidity: less than 95% RH at 40 °C

NOTE

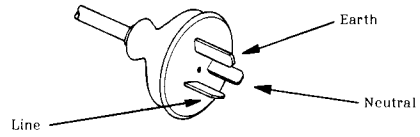
The 4195A must be protected from temperature extremes which could cause condensation within the instrument.

OPTION 900 — United Kingdom



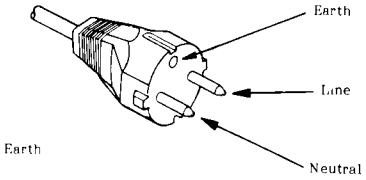
Plug: BS 1363A, 250V
Cable: HP 8120-1351

OPTION 901 — Australia/New Zealand



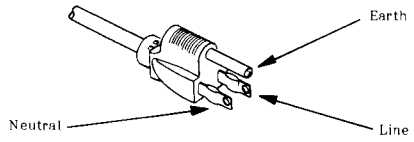
Plug: NZSS 198/AS C112, 250V
Cable: HP 8120-1369

OPTION 902 — European Continent



Plug: CEE-VII, 250V
Cable: HP 8120-1689

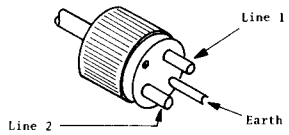
OPTION 903 — U.S./Canada



Plug: NEMA 5-15P, 125V, 15A
Cable: HP 8120-1378C

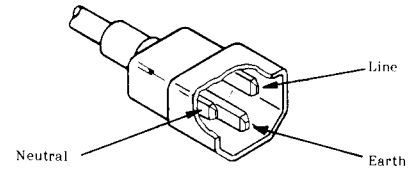
8120-1378C

OPTION 904 — U.S./Canada



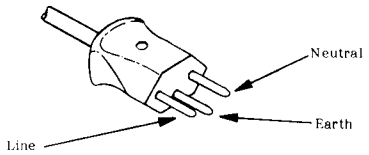
Plug: NEMA 6-15P, 250V, 15A
Cable: HP 8120-0698

OPTION 905* — Any country



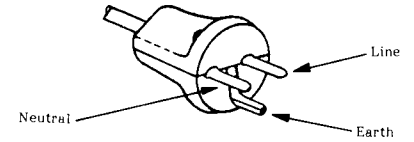
Plug: CEE 22-VI, 250V
Cable: HP 8120-1396

OPTION 906 — Switzerland



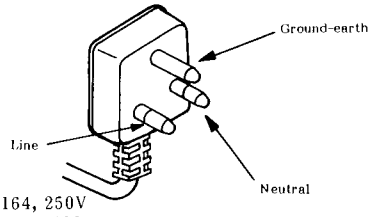
Plug: SEV 1011.1959-24507 Type 12, 250V
Cable: HP 8120-2104

OPTION 912 — Denmark



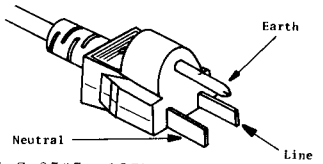
Plug: DHCR 107, 220V
Cable: HP 8120-2956

OPTION 917 — India/Republic of S.Africa



Plug: SABS 164, 250V
Cable: HP 8120-4211

OPTION 918 — Japan



Plug: JIS C 8303, 125V, 15A
Cable: HP 8120-4753

NOTE: Each option number includes a 'family' of cords and connectors of various materials and plug body configurations (straight, 90° etc.).

* Plug option 905 is frequently used for interconnecting system components and peripherals.

Figure 1-4. Power Cables Supplied

SECTION 2

PRODUCT OVERVIEW

2-1. INTRODUCTION

This section contains the information you need to know before operating the Hewlett-Packard Model 4195A Network/Spectrum Analyzer. Before using the 4195A, read through this section first so you can quickly and efficiently learn how to operate the HP 4195A.

2-2. PRODUCT INTRODUCTION

The HP 4195A is an intelligent Network, Spectrum, and Impedance analyzer combined into a single instrument. This combination creates a very powerful evaluation and analysis tool for evaluating **Circuits** and **Components**.

The 4195A consists of a **Control Unit** and a **Measurement Unit**. The control unit is mounted on top of, and is locked to the measurement unit when in use. The control unit contains a color graphics **CRT** for displaying the measurement results, and a 3-1/2 inch micro flexible **disc drive** for storing/recalling data and internally stored user programs. The measurement unit has two channels, each of which has its own source output, reference, and test receiver input on the front panel. Using two channels allows you to setup a wide variety of network/spectrum measurement and sequentially making the measurements without disconnecting and reconnecting measurement setups.

Multiple parameters are easily identified and discriminated on the Color Graphics Display. The display scale and format are independent of the measurement circuit settings, so the scale and format can be selected to precisely observe small measurement changes.

The **USER MATH** function gives you the ability to define parameters, mathematically manipulate measurement data, and to view the results in graphic format on the color CRT. The **USER DEFINED FUNCTION** gives you the ability to perform user defined control/analysis sequences with just a single key stroke. The **USER PROGRAM** function provides you with the ability to program all operations of the 4195A for automating measurement.

The 4195A can control three test parameters: frequency, test signal amplitude, and dc bias voltage. Any one of the three test parameters can be swept while the other two parameters are held at a fixed value.

2-3. A TOUR OF THE FRONT PANEL

Appendix H contains a fold-out illustration of the 4195A's front panel for you to look at while reading this manual. Open the fold-out page of Appendix H so you can look at the front panel layout while reading the following brief description of the keys, rotary knob, connectors, etc. on the front panel. The numbers in parenthesis correspond to the numbers the front panel illustration in Appendix H.

(1) The **LINE ON/OFF** push switch turns the 4195A on/off. This switch applies AC line power to the 4195A when set to the ON position (**in**) and removes AC line power to the 4195A when set to the OFF position (**out**).

(2) The color **CRT** Screen displays the measurement results, measurement settings, etc.

(3) **Softkeys** are located next to the CRT screen, and their functions (given by the softkey label) are displayed on the right hand side of the screen. A softkey is a combination of a key and the label displayed next to it at any given time.

(4) The **TRACE** area contains three keys for selecting the display format and scale.

The **DISPLAY** Key displays the softkeys used to select the display format.

The **SCALE REF** Key displays the softkeys used to change the display scales.

The **VIEW** Key displays the softkeys used to superimpose images on the display.

(5) The **MEASURE** area contains four keys used to select the measurement parameters.

The **CONFIG** Key displays the softkeys used to select the 4195A's measurement configuration -- Network, Spectrum, Impedance and S-Parameter (S11, S21, S12, S22) configurations.

The **FORMAT** Key displays the softkeys used to select the 4195A's measurement format (parameter or unit).

The **CAL** key displays the softkeys used to select and execute the 4195A's measurement calibration and compensation functions.

The **DEFINE MATH** Key displays the softkeys used to define and select User Math functions (user defined parameter or unit) derived using predefined functions and measured data.

(6) The **SPECIAL FUNCTION** area contains the following six keys.

The **USER DEFINE** Key displays the softkeys used to define and execute user defined key sequences which can then be executed with a single key stroke.

The **SAVE/GET** Key displays the softkeys used in the operation of the micro flexible disc drive.

The **COPY** Key displays the softkeys used to make hard copy printouts, plots, dumps of the screen contents. The **COPY Indicator** is **ON** while hard copy data is being transferred via HP-IB.

The **MORE** Key displays the softkeys for functions of Equivalent Circuit Analysis, Partial Analysis, IF Range Selection, and HP-IB Definition.

The **PROGRAM** Key displays softkeys used to edit and run User Programs (**ASP**).

The **MATH OPERATOR** Key displays the softkeys used to enter math operations.

(7) The **HP-IB** area includes four indicators and the **LCL** key.

The **RMT** indicator is **ON** while the 4195A is in the HP-IB remote mode. Except for the LCL key, the front panel keys are disabled while this indicator is **ON**.

The **LTN** indicator is **ON** while the 4195A is communicating via the HP-IB bus as a listener.

The **TLK** indicator is **ON** while the 4195A is communicating via the HP-IB bus as a talker.

The **SRQ** indicator is **ON** while the 4195A is asserting the HP-IB service request line.

The **LCL** Key is used to return the 4195A to the manual mode from the HP-IB remote mode.

(8) The **MARKER/LINE CURSOR** area includes two keys and a knob which are used to select and read measurement data, and to search for specific measurement points.

The **MKR** → Key displays the softkeys used to move/control the marker and line cursors.

The **MODE** Key displays the softkeys used to select the marker or line cursor.

The rotary **Knob** is used to continuously move the displayed marker or line cursor.

(9) The **Blue** shift key is used to shift a front panel key's function to its blue labeled function (alphabetical characters). When the blue shift key is pressed and active, the blue key indicator will be **ON**. For some functions the blue shift key will automatically be activated, for some functions it will stay active until pressed a second time, and for other functions it will automatically turn off to facilitate further user keyboard entries.

(10) The **Green** shift key is used to shift front panel key functions to their **green** labeled function. This key must be pressed each time a **green** labeled key function is used, because this key is active for only one key press after the **green** shift key is pressed.

(11) The **ENTRY** area includes number keys, and unit keys, etc. used for numeric entry.

The **Number** Keys are used to type in numbers.

The **Decimal Point (.)** Key is used to type in a decimal point.

The **Minus (-)** Key types in the minus sign.

The **Equal (=)** Key types in the equal symbol.

The **EEX** Key types in the exponent symbol (**E**) on the display.

The **SPACE** Key types in a character space.

The **MHz/V** Key adds a "**MHZ**" or a "**V**" to the value previously typed in, and terminates the input.

The **kHz/dBm** Key adds a "**KHZ**" or a "**DBM**" to the value previously typed in, and terminates the input.

The **Hz/dBμV** Key adds a "**HZ**" or a "**DBUV**" to the value previously typed in, and terminates the input.

The **ENTER/EXECUTE** Key terminates keyboard input and executes the command.

NOTE

The MHz/V, kHz/dBm, Hz/dBμV keys are called the unit keys in this manual.

(12) The **Arrow (Up/Down)** Keys increment or decrement the parameter value displayed on the keyboard input line. When pressed just after the green shift key is pressed, these keys change the alpha numeric display page (such as TABLE displat format, User Program (ASP) editor, file CATalog) to the **next page** or to the **previous page**, respectively.

(13) The **EDIT** area includes five keys that are used to edit alpha numeric keyboard input.

The **CLR LINE** Key erases the input line. When pressed just after the green key is pressed this key **recalls** the last entered/executed command on the keyboard input line.

The **DEL CHAR** Key deletes the character at the cursor position.

The **INS CHAR** Key inserts character(s), at the cursor position, between characters previously typed in. When in the insert mode, the cursor is a box instead of a bar. When not in the insert mode, the cursor is an underline.

The **Arrow (Left/Right)** Keys move the cursor left and right.

14) The **SWEEP** area contains nine keys to select and vary measurement parameters (conditions).

The **SWEEP** indicator is **ON** while the 4195A is performing a sweep measurement.

The **MENU** Key displays the softkeys that select the sweep parameters and sweep type, etc.

The **CENTER** Key displays the current value of the sweep center parameter on the keyboard input line, which you can then change.

The **SPAN** Key displays the current value of the sweep span parameter on the keyboard input line, which you can then change.

The **WAIT TRIG** Indicator is **ON** when the sweep mode is set to SINGLE sweep and the 4195A is waiting for a sweep trigger (pressing the TRIG/RESET key).

The **TRIG/RESET** Key restarts the sweep measurement from the starting point.

The **START** Key displays the current start value of the sweep parameter on the keyboard input line, which can then be changed.

The **STOP** Key displays the current stop value of the sweep parameter on the keyboard input line, which can then be changed.

The **VIDEO FILTER** Key turns the video filter **ON** and **OFF**, the **Indicator** is **ON** when the video filter is enabled.

The **AUTO** Key sets the automatic resolution bandwidth (RBW) and sweep time (ST) selection. The **AUTO** key indicator is **ON** when set to **AUTO**. Once **RES BW** is pressed the **AUTO** indicator turns **OFF**.

The **RES BW** Key displays the current resolution bandwidth value of the selected receiver on the keyboard input line, which can then be changed.

(15) The **PRESET** Key sets the 4195A's controls to their preset initialization values.

(16) The **UNLOCK** indicator turns **ON** if the 4195A is not synchronized to the external signal, or when the internal synthesizer is unlocked.

(17) The **EXT REF** indicator turns **ON** when an external signal is applied to the EXT REFERENCE connector on the 4195A control unit's rear panel and the 4195A is synchronized to the external signal.

(18) The **INTENSITY** Control adjusts the brightness of the CRT.

(19) The 3-1/2 inch **Micro Flexible Disc Drive** stores the 4195A's internal settings, data, and programs for later recall.

(20) The **DC SOURCE** area includes two keys, two indicators and a BNC connector.

The **OFF/ABORT** Key turns **OFF** the dc source output.

The **LEVEL** Key displays the value of the current dc source output voltage on the keyboard input line, which can then be changed.

The **CURRENT LIMIT** indicator turns **ON** when the dc source output is overloaded.

The **ON** indicator turns **ON** when a DC voltage is present at the DC output connector.

The **DC OUTPUT** BNC Connector is the output for the DC bias voltage.

(21) Each **CHANNEL** includes three keys, three indicators, three N-type connectors and a 3-pin jack on the front panel.

The **AMPLITUDE** Keys display the current source output level value on the keyboard input line, which can then be changed.

The respective **S1/S2** indicator will turn **ON** when a signal source is connected to the **S1/S2** output connector.

The **OUTPUT S1/S2** Connectors are used to apply the test signal to the circuit or component under test.

The **PROBE POWER** Jacks supply DC power for active probes.

The **REF ATTEN** Keys display the current reference input attenuation on the keyboard input line, which can then be changed. These keys also display the **IF RANGE** selection softkey.

The **R1/R2** indicators turn **ON** when the respective receiver input is activated.

The **INPUT R1/R2** Connectors are used to input the measurement signal.

The **TEST ATTEN** Keys display the current test input attenuation on the keyboard input line, which can then be changed. These keys also display the **IF RANGE** selection softkey.

The **T1/T2** indicators turn **ON** when the receiver input is activated.

The **INPUT T1/T2** Connectors input the signal to be measured.

NOTE

Remembering that the putty-gray control unit front panel keys call their own softkeys when press will help you to operate the 4195A.

2-4. A TOUR OF THE REAR PANEL

The rear panel illustration is printed on the inside part of the fold-out page next to the front panel illustration in Appendix H. A brief description of the rear panel connectors, switches, etc. follows.

(1) The **10 MHz OUTPUT** Connector supplies a 10 MHz signal to use to synchronize external equipment.

(2) The **EXT REFERENCE** Connector is used to input an external signal to synchronize the 4195A.

(3) The **PROGRAM START** Connector is used to externally start or continue a 4195A user program (ASP).

(4) The **EXT TRIGGER** Connector is used to externally trigger the 4195A to make a single point measurement.

(5) The **HP-IB** Connector interfaces the 4195A to the HP-IB bus.

(6) The ~ **LINE VOLTAGE SELECTOR** Switches are used to set the operating voltage of the 4195A to match the local power line voltage.

(7) The ~ **LINE FUSE** Holder contains the power line fuse.

(8) The ~ **LINE** Power Line Receptacle is used to apply AC power to the 4195A.

(9) The **J6** 9-pin Connectors interconnect the control and measurement units.

(10) The **J5** 50-pin Connectors interconnect the control and measurement units.

(11) The **8-BIT INPUT/OUTPUT** Connector is used for general purpose TTL level input/ output signals.

(12) The **J4** BNC Connectors interconnects the control and measurement units.

(13) The **J3** BNC Connectors interconnect the control and measurement units.

(14) The **J2** BNC Connectors interconnect the control and measurement units.

(15) The **REFERENCE OVEN** Connector (**Option 001** units only) is the output of the crystal oven oscillator. When this output is connected to the **EXT REFERENCE** connector on the control unit's rear panel, the 4195A's frequency accuracy/stability will be improved.

2-5. CRT DISPLAY AREA DEFINITION

The 4195A CRT display is divided by the following areas as shown in Figure 2-1.

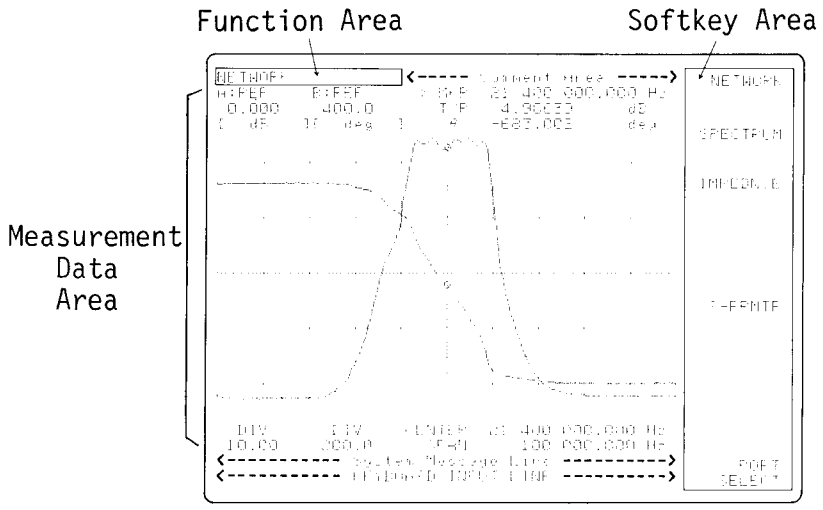


Figure 2-1. CRT Display Area Definition

Function Area:

An eighteen character long line, starting from the upper left corner, is the function area. "**NETWORK**", "**SPECTRUM**", "**IMPEDNCE**", "**S11**", "**S21**", "**S12**", or "**S22**" are displayed depending on the 4195A's configuration.

Comment Area:

The rest of the line at the top of the screen (except for the function area) is the comment area. The comment area is where you enter your own display comments. Entering a comment is a useful way to identify hard copies of the screen, entering the name of signal to be measured or the measurement setup as a comment is one way to identify hard copies.

System Message Line:

The second line from the bottom of the screen is the system message line. Usually the receiver settings (Resolution Bandwidth setting, etc.) will be displayed on the system message line. If you try to perform an illegal operation, an error message is displayed on the system message line. When certain keys are pressed, the 4195A will display an instruction on the system message line to help you perform the next operation.

Keyboard Input Line:

The bottom line of the screen is the keyboard input line on which the parameter values are entered and on which commands from the front panel keyboard are entered to be executed.

Softkey Area:

A six character wide area on the right side of the screen is the softkey area which is used to display the softkey labels.

Measurement Data Area:

The rest of the screen is the measurement data area, where measured data, measurement setting, analysis data, etc. are displayed. The contents of the Measurement Data Area are determined by the selected measurement function and display format.

NOTES

SECTION 3

BASIC MEASUREMENT EXAMPLES

3-1. INTRODUCTION

This section gives examples of the HP 4195A's basic measurement operation. The examples in this section are designed so you can perform them to familiarize yourself with the 4195A. These examples are a guide to help you to learn the operation of the 4195A, they may not apply directly to your application. For more practical information on making accurate measurements, and for more examples, read Section 4.

The **WARNING**s, **CAUTION**s, and **NOTE**s given throughout this document must be carefully followed to ensure the operator's safety and the serviceability of the 4195A.

WARNING

BEFORE TURNING THE 4195A ON, ALL PROTECTIVE EARTH TERMINALS, EXTENSION CORDS, AUTOTRANSFORMERS, AND DEVICES CONNECTED TO THE 4195A MUST BE CONNECTED TO EARTH GROUND. ANY INTERRUPTION OF EARTH GROUND CONSTITUTES A SHOCK HAZARD WHICH MAY RESULT IN PERSONAL INJURY.

ONLY FUSES WITH THE REQUIRED CURRENT RATING AND OF THE SPECIFIED TYPE CAN BE USED. DO NOT USE A SUBSTITUTE FOR THE PROPER FUSE AND NEVER SHORT CIRCUIT THE FUSE-HOLDER. DOING SO CONSTITUTES A SHOCK HAZARD.

CAUTION

Before you turn your 4195A on, be sure to set the voltage selector to the line voltage to be used, or the instrument will be damaged.

3-2. NETWORK MEASUREMENT EXAMPLE

In this example you are going to observe the transmission frequency response of a Band-pass Filter. Prepare a bandpass filter with the following specifications, and then follow the given procedure.

Center Frequency	100 MHz or higher, and 400 MHz or lower
Input/Output Impedance	50Ω or 75Ω

Recommended Accessories Used In The Following Example:

For 50Ω device measurement:

50Ω N(m)-N(m) Cable	11851B (4 cables included)
Power Splitter	11667A (two-way) or 11850C (three-way)

For 75Ω device measurement:

75Ω N(m)-N(m) Cable	11857B (2 cables included)
50Ω N(m)-N(m) Cable	11851B (4 cables included)
Power Splitter	11850D (three-way)
50Ω-75Ω Minimum Loss Pad	11852B (furnished with the 11850D)

Procedure:

1. Leave all front panel **OUTPUT/INPUT** connectors open.

2. Press the **CONFIG** key.

   The **CONFIG** key is located in the **MEASURE** section of the control unit (upper unit of the 4195A) front panel.

   You will see the softkey labels that includes **'NETWORK'**, **'SPECTRUM'**, etc. The 4195A measurement configuration can be selected on this page.

3. Press the **'NETWORK'** softkey.

   The **'NETWORK'** softkey is located at the first key from the top at the right hand edge of the CRT. When the **'NETWORK'** softkey is pressed, the softkey label will change to **green**.

   NETWORK will be displayed in the Function Area (the upper left corner of the CRT). This indicates that the 4195A is in network configuration.

4. Press the **PRESET** key.

   The **PRESET** key is located at the lower center of the control unit front panel. The **PRESET** key will clear most of the previous control settings and return them to the default settings. The **PRESET** key will not clear control settings that are unique to unselected configurations.

5. Connect the bandpass filter as shown in Figure 3-1.

6. Press the **CENTER** key.

   CENTER= 250000000.000 HZ will be displayed on the keyboard input line.

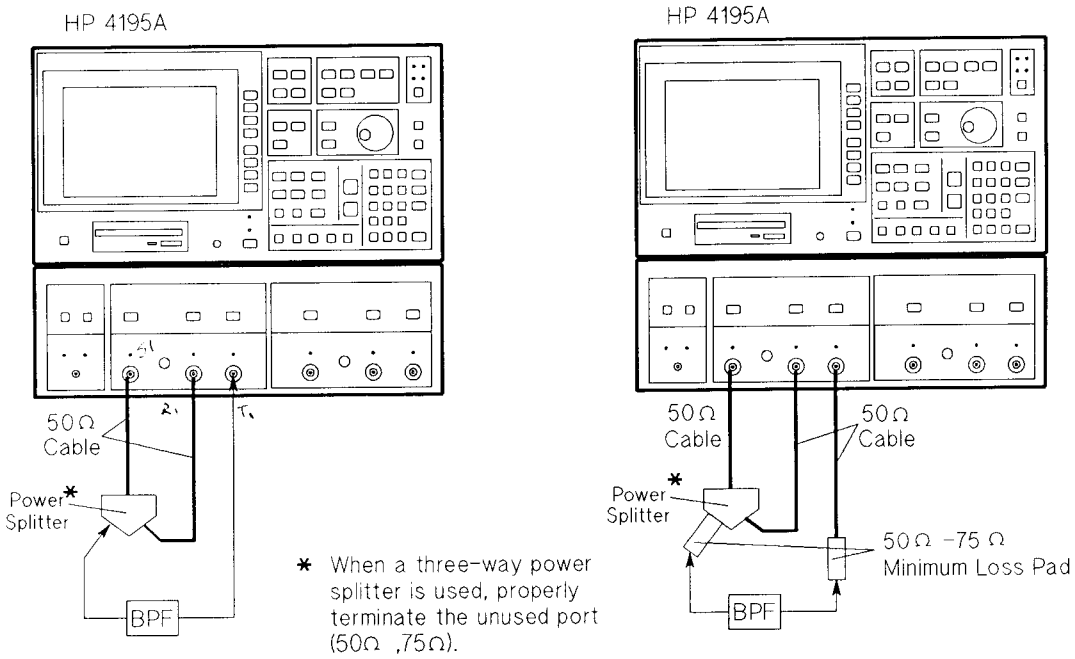


Figure 3-1. Network Measurement Example Setup

7. Enter the center frequency of your bandpass filter using the numeric and unit keys.

   The center frequency can be changed using the **arrow up** and **arrow down** keys instead of numeric and unit keys.

8. Press the **SPAN** key and change the frequency span as appropriate for measuring your bandpass filter.

9. Press the **RES BW** key.

   RBW= (the currently set resolution bandwidth) will be displayed on the keyboard input line.

10. Press the **arrow down** key.

    Every time you press the **arrow down** key, the resolution bandwidth will be narrowed, the time required for measurement will be increased, and you will observe less fluctuation on the traces.

11. Press the **VIDEO FILTER** key.

    The indicator located at the center of **VIDEO FILTER** turns **ON**. You will observe less fluctuation in the resulting measurement traces on the CRT, and the measurement time will increase.

12. Using the resolution bandwidth filter and the video filter settings, find the best measurement stability and the sweep time for your measurement.

13. Press the **MKR →** key and **'MKR→ MAX'** softkey.

    The marker will move to the maximum value of the yellow trace. The frequency at which the insertion loss of the bandpass filter is minimum, the yellow trace maximum value (insertion loss) and the phase shift at the frequency are displayed above the graph area of the screen.

14. Press the **MODE** key and the **'oMKR & LCURS'** softkey.

15. Press the **'Δmode on off'** softkey so that **on** changes to **green**.

16. Press the **'more 1/2'** and **'WIDTH on off'** softkey to select **on**.

    The difference between the marker and the line cursor in dBs and the frequency width between the two intersection points of the yellow trace and the line cursor will be displayed.

17. Rotate the **knob** in both directions.

    The line cursor will move up and down. You can read the difference between the o marker and the line cursor to determine the bandwidth of the filter.

18. Press the **'ΔVALUE entry'** softkey.

    DLCURS= will be displayed on the keyboard input line.

19. Press the minus (**-**), **3**, and **ENTER/EXECUTE** keys in sequence.

    The line cursor will move to the point which is -3 dB from the insertion loss level, and the -3 dB bandwidth will be displayed.

20. Press the **'Q VALUE'** softkey.

    The quality factor value of the filter at the -3 dB point will be displayed.

21. Press the **MODE** key and **'off'** softkey.

    The marker and the line cursor will disappear.

22. Press the **FORMAT** key and **'T/R-τ (dB)'** softkey.

    The blue trace shows the group delay, not the phase shift.

23. Press the **SCALE REF** key and **'SCALE forA forB'** softkey to select **forB** (change to green).

24. Press the **'B AUTO SCALE'** softkey.

    The display scale for the group delay measurement result will be optimized.

NOTE

This example simply shows measurement operation, the calibration capability of the 4195A was not used. Refer to paragraph 4-8, MEASUREMENT CALIBRATION, for useful techniques when high accuracy measurements are required.

3-3. SPECTRUM MEASUREMENT EXAMPLE

In this example you are going to observe the harmonic distortion of a 10 MHz signal. The 10 MHz signal available from the control unit's rear panel is used for this example.

Recommended Accessories Used In The Following Example:

50Ω BNC(m)-BNC(m) Cable, 122 cm	HP PN 8120-1840
N(m)-BNC(f) Adapter	HP PN 1250-1476

Procedure:

1. Leave all front panel **OUTPUT/INPUT** connectors open.

2. Press the **CONFIG** key.

   The **CONFIG** key is located in the **MEASURE** section of the control unit (upper unit of the 4195A) front panel.

   You will see the softkey labels that includes **'NETWORK'**, **'SPECTRUM'**, etc. The 4195A measurement configuration can be selected on this page.

3. Press the **'SPECTRUM'** softkey.

   The **'SPECTRUM'** softkey is located at the second key from the top of the Soft-key Area (the right hand edge of the CRT). When the **'SPECTRUM'** softkey is pressed, the softkey label will change to **green**.

   SPECTRUM will be displayed in the Function Area (the upper-left corner of the CRT) indicating that the 4195A is in spectrum configuration.

4. Press the **PRESET** key.

   The **PRESET** key is located at the lower center of the control unit front panel. The **PRESET** key will clear most of the previous control settings and return them to the default settings. The **PRESET** key will not clear control settings that are unique to unselected configurations.

5. Press the **CHANNEL 1 RECEIVER REF ATTEN** key.

   ATR1= 10 DB will be displayed on the keyboard input line, and the softkey labels are changed for IF Range selection. The **'IF RNG NORMAL'** softkey label will be change to **green**.

6. Press the **arrow up** key three times.

   The R1 input attenuator will be set to 40 dB and the RANGE display for the R1 input (displayed on the right hand side of the system message line) will change to +20 dBm. This is for measuring a maximum amplitude signal of +20 dBm.

7. Connect the **10 MHz OUTPUT** connector on the control unit rear panel and the **R1** connector on the measurement unit front panel as shown in Figure 3-2.

   You will see the 10 MHz fundamental signal and some spurious signals traces on the CRT. The 10 MHz OUTPUT signal is not a pure sine wave, because the purpose for which this signal is intended does not require high spectral purity.

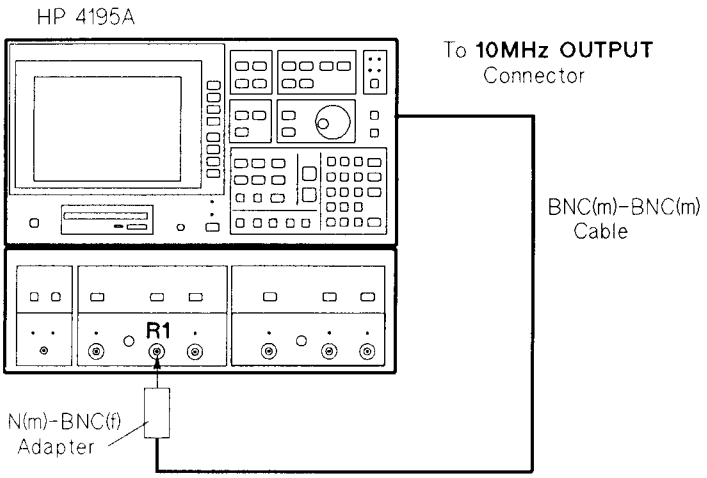


Figure 3-2. Spectrum Measurement Example Setup

8. Press the **SCALE REF** key and the **'A AUTO SCALE'** softkey.

9. Press the **START** key.

   START= 0.001 HZ will be displayed on the keyboard input line. This reports that the currently set **START** frequency (the most left of the measurement trace) is 1 mHz.

10. Press the **5** and **MHz/V** keys.

    When you press the **5** key, the previously displayed **0.001 HZ** will disappear. When you press **MHz/V** key, the start frequency is changed to 5 MHz and **START= 50000000.000 HZ** will be displayed. The currently set **START** and **STOP** frequencies are displayed below the displayed graph.

11. Press the **STOP**, **1**, **0**, **5**, and **MHz/V** keys in sequence.

12. Press the **MKR →** key and the **'MKR→ MAX'** softkey.

    The marker will move to the 10 MHz point on the trace.

13. Press the **'NEXT PEAK'** softkey.

    The marker will move to the next lower peak, each time you press **'NEXT PEAK'.**

14. Disconnect the input signal from the **R1** connector.

15. Press the **'more 1/2'**, and **'NOISE on off'** softkeys to select **on.**

16. Rotate the **knob** to select a frequency at which to read the noise level.

    The noise level (normalized per hertz) will be displayed above the graph area of the CRT.

3-4. IMPEDANCE MEASUREMENT EXAMPLE

This example shows how to measure the impedance characteristics of a chip type component under the following measurement conditions.

Test Frequency	100 kHz to 500 MHz (log sweep)
Output Level	0 dBm

Recommended Accessories Used In The Following Example:

Impedance Test Kit	41951A
Test Fixture	16092A

Procedure:

1. Connect the impedance test adapter from the HP 41951A to the front panel of the 4195A.

   Figure 3-3 shows the impedance test adapter connected to the 4195A.

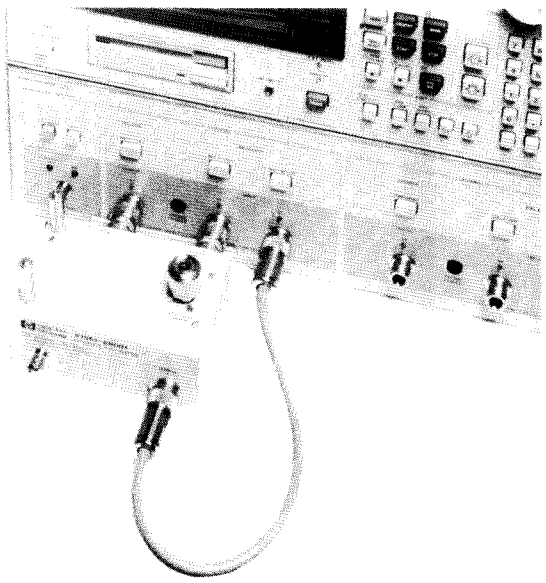


Figure 3-3. Impedance Test Adapter Connection

2. Press the **CONFIG** key and **'IMPEDNCE'** softkey, then press the **PRESET** key.

3. Press the **START** key.

   START= 0.001 HZ will be displayed on the keyboard input line. This reports that the currently set **START** frequency (the most left of the measurement trace) is 1 mHz.

4. Press the **1**, **0**, **0**, and **kHz/dBm** keys.

   When you press the **1** key, the previously displayed **0.001 HZ** will disappear. When you finaly press the **kHz/dBm** key, the start frequency is changed to 100 kHz and **START= 100000.000 HZ** will be displayed. The currently set **START** and **STOP** frequencies are displayed below the displayed graph.

5. Press the **MENU** key and the **'TYPE lin log'** softkey.

   When you press the **'TYPE lin log'** softkey, the **'log'** of the **'TYPE lin log'**softkey label will change to intensified **green**, and log sweep is set.

NOTE

Steps 10 and 11 set the 4195A's output level to 12 dBm so that the output level at the 41951A impedance test adapter's measurement terminal will be 0 dBm (insertion loss of the 41951A is approximately 12 dB). Steps 6 to 9 set the input attenuators to 20 dB so that the input ports will not be overloaded by the 12 dBm input level.

6. Press the **CHANNEL 1 RECEIVER REF ATTEN** key on the lower unit's front panel.

   ATR1= 10 DB will be displayed on the keyboard input line.

7. Press the **arrow up** key once.

   The R1 input attenuator will be set to 20 dB.

8. Press the **CHANNEL 1 RECEIVER TEST ATTEN** key on the lower unit's front panel.

   ATT1= 10 DB will be displayed on the keyboard input line.

9. Press the **arrow up** key once.

   The T1 input attenuator will be set to 20 dB.

10. Press the **CHANNEL 1 SOURCE AMPLITUDE** key on the lower unit's front panel.

    OSC1= 0.0 DBM will be displayed on the keyboard input line.

11. Press the **1**, **2** and **kHz/dBm** keys.

    The output level value displayed on the keyboard input line will be changed to **OSC1= 12.0 DBM**.

12. Press the **CAL** key and the **'CAL menu'** softkey.

13. Press the **'ONE PORT FULL CAL'** softkey.

14. Connect the **OPEN** termination furnished with the 41951A (labeled as OS) atop the APC-7 connector of the Impedance Test Adapter.

    Rotate the coupling nut of the APC-7 connector CW (clockwise) so that the coupling sleeve protrudes fully. **Do not touch the terminal contact surface with your fingers (to maintain optimum contact cleanliness).** Place the **OPEN** termination on the APC-7 connector. Hold the center brass part of the termination so it will not rotate, and rotate the termination cap nut CW (clockwise) until fully tightened, **DON'T OVER TIGHTEN**.

15. Press the **'OPEN'** softkey and the **ENTER/EXECUTE** key.

    Measuring OPEN will be displayed, and **SHORT CAL required** will be displayed after a short time.

16. Disconnect the **OPEN** termination and connect the **SHORT** termination furnished with the 41951A (labeled as 0Ω) atop the APC-7 connector of the Impedance Test Adapter.

    Place the **SHORT** termination on the APC-7 connector. **Carefully handle the termination so as not to damage or contaminate its precision contact surface.** Hold the center brass part of the termination so it will not rotate, and rotate the termination cap nut CW (clockwise) until fully tightened, **DON'T OVER TIGHTEN.**

17. Press the **'SHORT'** softkey and the **ENTER/EXECUTE** key.

    Measuring SHORT will be displayed, and **LOAD CAL required** will be displayed after a short time.

18. Disconnect the **SHORT** termination and connect the **LOAD** termination furnished with the 41951A (labeled as 50Ω) atop the APC-7 connector of the Impedance Test Adapter.

    Rotate the coupling nut of the 50Ω termination so that the coupling sleeve of the termination is at its innermost free position. Place the 50Ω termination on the APC-7 connector. Hold the termination body so it will not rotate, and rotate the outer nut of the termination CW (clockwise) until fully tightened, **DON'T OVER TIGHTEN.**

19. Press the **'LOAD'** softkey and the **ENTER/EXECUTE** key.

    Measuring LOAD will be displayed, and **Calculating CAL coefficient** will then be displayed after a short time.

NOTE

To confirm that calibration is being perfomed properly, press the **'CORRCTN on off'** softkey to set calibration function to on, and the **TRIG/RESET** key to measure the 50Ω termination. If measurement result is approximately 50Ω, calibration is being perfomed properly, and you can proceed to step 20 after the **CAL** key is pressed.

20. Disconnect the 50Ω termination and place the test fixture atop the Impedance Test Adapter as shown in Figure 3-4.

    After use, leave the 50Ω termination coupling sleeve screw protruding to prevent possible impairment to the termination surface.

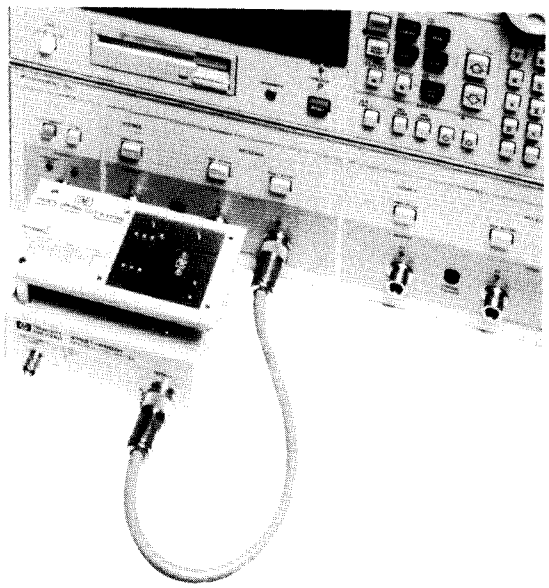


Figure 3-4. Test Fixture Connection

21. Press the **'COMPEN menu'** softkey and **'0S&0Ω OFFSET'** softkey.

22. Open the measurement terminal of the test fixture.

    Set the attachment as shown in Figure 3-5 open position so that the center conductor does not short to the outer conductor.

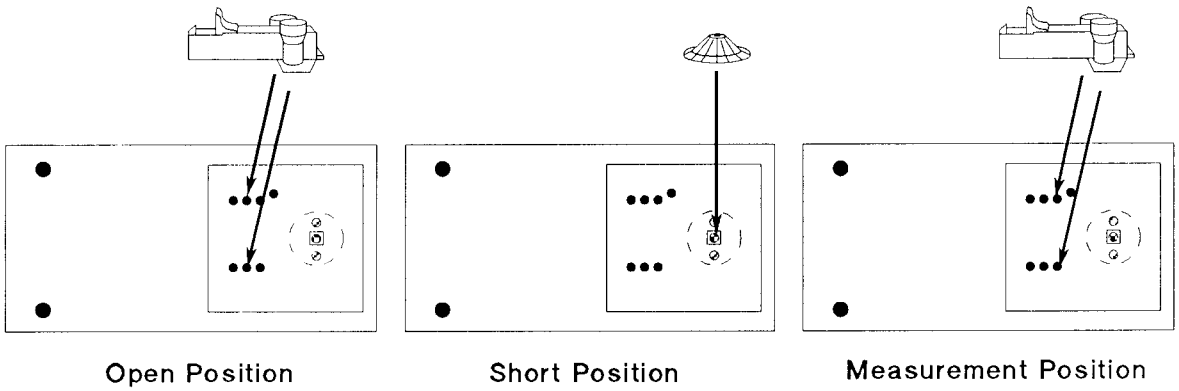


Figure 3-5. Attachment Connection

23. Press the **'0S'** softkey and the **ENTER/EXECUTE** key.

    Measuring 0S will be displayed, and **0Ω compen required** will be displayed after a short time.

24. Short the measurement terminal of the test fixture.

    Remove the attachment from the 16092A, and set the short ring (furnished with the 16092A) to the 16092A's center conductor as shown in Figure 3-5 short position.

25. Press the '**0Ω**'softkey and the **ENTER/EXECUTE** key.

    Measuring 0Ω will be displayed, and **Compen completed (TURN ON "CORR" KEY)** will be displayed after a short time.

26. Press the **'CORRECTN on off'** softkey.

    Calculating CAL coefficient will be displayed, and the **'on'** of the **'CORRECTN on off'** softkey label will changed to green after a short time.

NOTE

Refer to paragraph 4-8, for details about Calibration.

27. Connect the component to be measured to the test fixture.

    Set the attachment on the 16092A as shown in Figure 3-5 measurement position, and connect the component to the attachment.

28. Press the **TRIG/RESET** key to measure the device under test.

3-5. S-PARAMETER MEASUREMENT EXAMPLE

In this example you will measure the S-Parameters of a network.

Recommended Accessories Used In The Following Example:

For 50Ω device measurement:

Transmission/Reflection Test Set	41952A, 2 set

For 75Ω device measurement:

Transmission/Reflection Test Set	41952B, 2 set

Procedure:

1. Connect two Transmission/Reflection Test Sets (two HP 41952A/Bs) to the 4195A's front panel output/input connectors as shown in Figure 3-6.

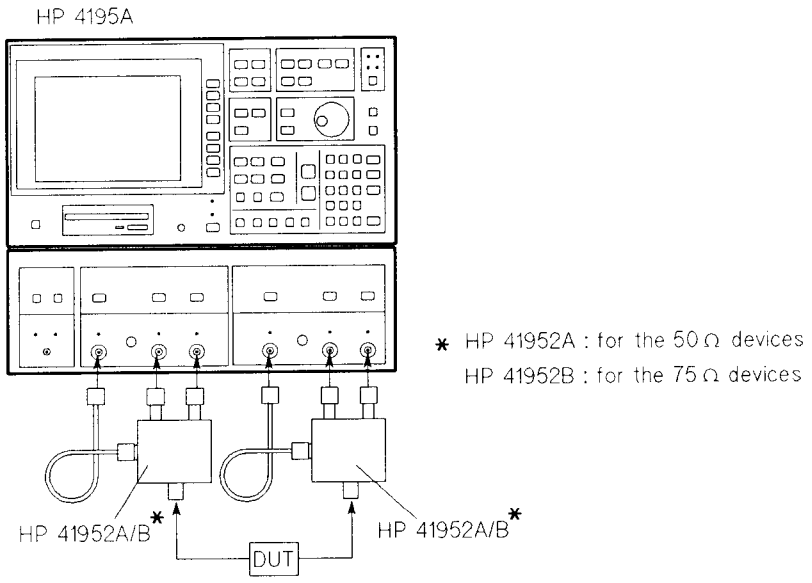


Figure 3-6. S-Parameter Configuration Setup Example

2. Connect the network under test between the TEST PORTs of the two HP 41952A/Bs.
3. Press the **CONFIG** key and **'S-PRMTR'** softkey, then press the **'S11'** softkey.
4. Press the **PRESET** key.

   The yellow LED indicators at connectors **S1**, **R1**, and **T1** will turn **ON**.

5. Press the **DISPLAY** key and **'SMITH'** softkey.

   The measurement **FORMAT** (parameter) is automatically changed to Γx-Γy. Now the 4195A displays S11 (forward reflection) on the Smith chart.

6. Press the **CONFIG** key and **'S21'** softkey, then press the **PRESET** key.

   The yellow LED indicators at connectors **S1**, **R1**, and **T2** will turn **ON**. Now the 4195A displays S21 (forward transmission) frequency response characteristics.

7. Press the **FORMAT** key and the **'T/R-τ (dB)'** softkey.

   Now the 4195A displays S21 (forward transmission) group-delay frequency response characteristics.

8. Press the **SCALE REF** key, and the **'SCALE forA forB'** and **'B AUTO SCALE'** softkeys.

   The display scale for the group delay measurement result will be optimized.

9. Press the **CONFIG** key and the **'S12'** softkey, then press the **PRESET** key.

   The yellow LED indicators at the **T1**, **S2**, and **R2** connectors will turn **ON**. Now the 4195A displays S12 (reversed transmission) frequency response characteristics.

10. Press the **CONFIG** key and the **'S22'** softkey, then press the **PRESET** key.

    The yellow LED indicators at connectors **S2**, **R2**, and **T2** will turn **ON**.

11. Press the **DISPLAY** key and **'POLAR'** softkey.

    The measurement **FORMAT** (parameter) is automatically changed to Γx-Γy. Now the 4195A displays S22 (reversed reflection) on the polar chart.

12. Press the **SCALE REF** key and the **'AUTO SCALE'** softkey.

13. Press the **CONFIG** key. Then press **'S11'**, **'S21'**, **'S12'**, and **'S22'** softkeys in sequence.

    As you can see, the 4195A remembers the measurement format (parameter) and the display format for each S-parameter configuration.

14. Select the measurement conditions (frequency range, resolution bandwidth, etc.).

    You can measure all four S-parameters by just selecting the **'S11'**, **'S21'**, **'S12'**, and **'S22'** softkeys.

NOTE

This example simply shows measurement operation, the calibration capability was not used. Refer to paragraph 4-8, MEASUREMENT CALIBRATION, for techniques you can use to make more accurate measurements.

NOTES