Errata

Title & Document Type: **8743B Reflection-Transmission Test Unit Operating and Service Manual**

Manual Part Number: **08743-90041**

Revision Date: **August 1981**

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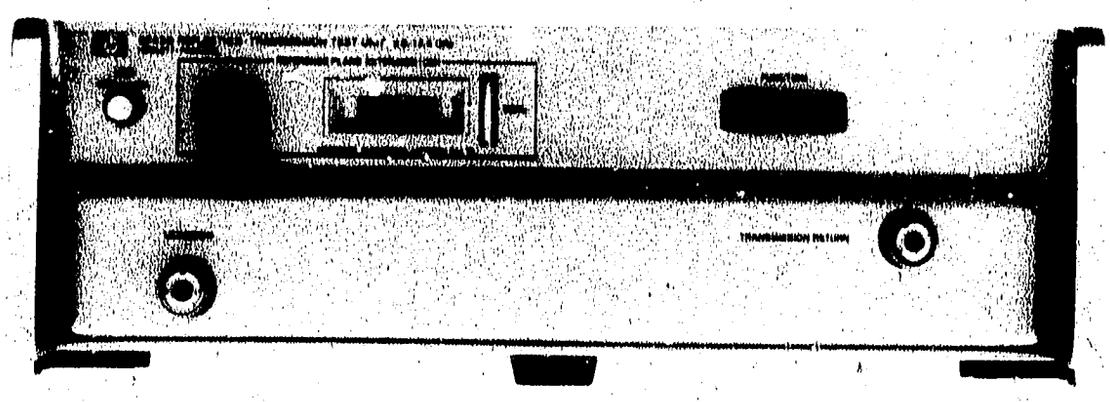
OPERATING AND SERVICE MANUAL

8743B REFLECTION-TRANSMISSION TEST UNIT



PRESS PROOF

HEWLETT PACKARD

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 Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

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8743B
REFLECTION-TRANSMISSION TEST UNIT

SERIALS PREFIX

This manual applies directly to HP Model 8743B Reflection-Transmission Test Units having serial prefix number 2047A.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 2047A, a "Manual Changes" sheet is included with this manual.

MANUAL PART NO. 08743-90040
Microfiche Part No. 08743-90042

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SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

Indicates hazardous voltages.

Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY EARTH GROUND

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an autotransformer, make sure the common terminal is connected to the neutral (grounded) side of mains supply.

SERVICING

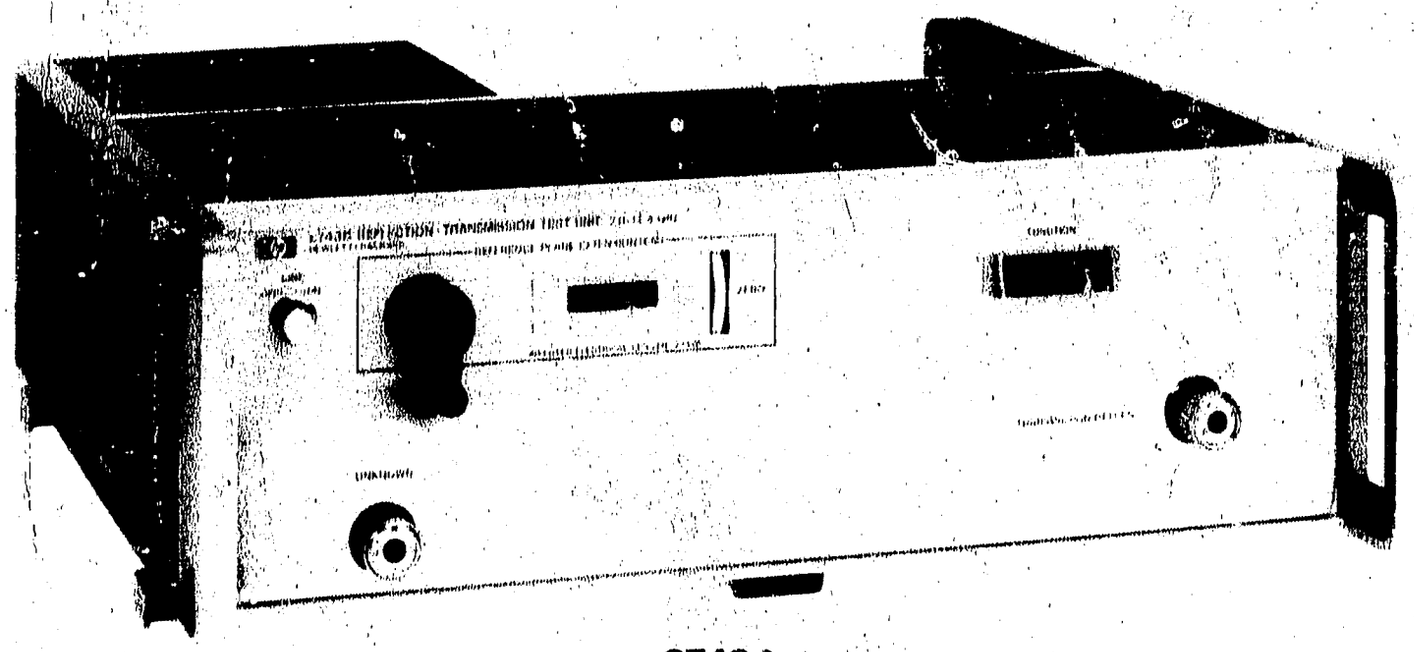
WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.



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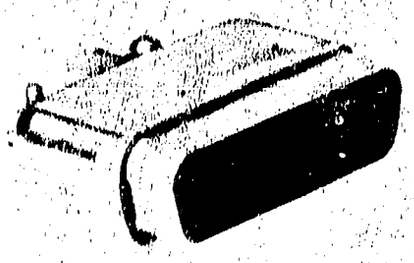
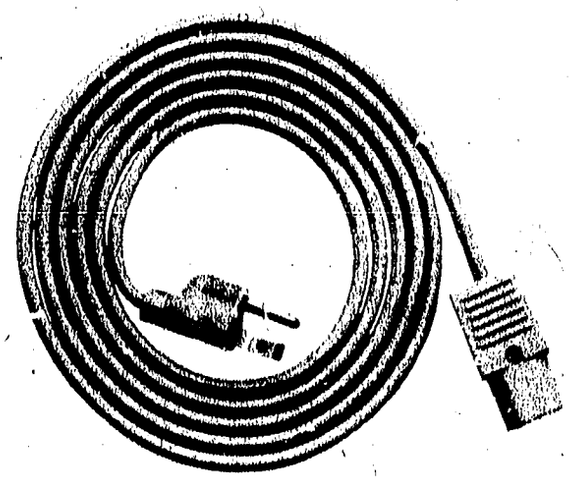


36 PIN
CONNECTOR



POWER CABLE

EXTERNAL
REFERENCE LINE

Figure 1-1. Model 8743B Reflection-Transmission Test Unit

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The Model 8743B Reflection - Transmission Test Unit is a complementary instrument for the HP 8410B Network Analyzer. It contains microwave circuits for making reflection and transmission measurements from 2.0 to 12.4 GHz (2.0 to 18 GHz with Option 018).The Option 018 8743B is a complementary instrument for the 8410B/8411A Option 018 Network Analyzer.The RF circuit for a transmission or a reflection measurement is set up by a front panel pushbutton or with remote contact closures.

1-3. A calibrated internal line stretcher with a high resolution digital indicator compensates for the electrical length of the device under test — up to 15 cm for reflection tests, and up to 30 cm for transmission tests. If more compensation is needed, additional line may be installed in place of the removable rigid coax link on the rear panel.

Table 1-1. Specifications

Frequency Range: 2 to 12.4 GHz.
Option 018: 2 to 18 GHz.[1]

Impedance: 50 ohms nominal.

Maximum RF Input Power: 2 watts.

Source Reflection Coefficient:[2] ≤0.09, 2.0 to 8.0 GHz; ≤0.13, 8.0 to 12.4 GHz; <0.2, 12.4 to 18 GHz

Termination Reflection Coefficient:[3] ≤0.13 in Reflection Mode, 2.0 to 12.4 GHz; ≤0.2 in Transmission Mode, 2.0 to 12.4 GHz; typically <0.2, 12.4 to 18 GHz.

Directivity: ≥30 dB, 2.0 to 12.4 GHz; ≥18 dB 12.4 to 18 GHz.

Frequency Response: (Including 8411A Frequency Converter).

Transmission: Typically <±0.5 dB magnitude, <±5° phase, 2.0 to 12.4 GHz; typically <±1.75 dB magnitude, <15° phase, 12.4 to 18 GHz.[4]

Reflection: Typically <±0.09 magnitude, <±6° phase as read on the 8414A Polar Display with a short on the unknown port from 2.0 to 12.4 GHz; typically <±0.2 magnitude, <±20° phase from 12.4 to 18 GHz.

Insertion Loss: RF Input to Test Port, 20 dB nominal, RF Input to Reference Channel Output, 30 dB nominal.

Reference Plane Extension: 0 to 15 cm for reflection; 0 to 30 cm for transmission; calibrated by digital dial indicator. Indicator is adjustable for initial calibration.

Remote Programming: Remote reflection or transmission selection by closing 2 contacts of 36-pin rear panel connector to ground pin. Contact is at 12 volts and short to ground will draw 12 mA.

Maximum RF Power: 2 watts

Connectors: RF Input, Type N female; all other connectors APC-7®[5]

External Reference Line: HP Part No. 08745-20064 supplied for applications using the 11610B.

Power: 115 or 230 V ac ±10%, 50 to 400 Hz, 15 W.

Weight: net, 13.1 kg (29 lb). Shipping, 15.3 kg (34 lb).

Size: 140 mm H x 425 mm W x 467 mm D (5½" x 16¾" x 18⅜").

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[1] Specifications for the 8743B Option 018 below 12.4 GHz are the same as those of the standard instrument. Specifications above 12.4 GHz apply only to the 018 Option.

[2] Equivalent reflection coefficient of the port used to supply the incident signal to the device under test when used with Network Analyzer.

[3] Reflection coefficient of the port connected to the output of the device under test.

[4] Using 11610B with 10 dB pad.

[5] Amphenol RF Division, Danbury, Connecticut.

1-4. Both the reference and test channels are isolated from the signal source by 20 dB. In addition to padding source mismatch, the attenuation in the test channel permits measurements on small-signal devices.

1-5. ACCESSORIES FURNISHED

1-6. An external reference line (HP part number 08745-20064), a male 36-pin connector (HP part number 1251-0084) and a detachable power cable are furnished with the Model 8743B.

1-7. External Reference Line

1-8. The external reference line mounts on the rear of the 8743B at the connectors labeled REFERENCE LINE. This standard reference line allows the test and reference paths of the 8743B to be phase matched when using the 11610B test cable.

1-9. Thirty-Six Pin Male Connector

1-10. The 36-pin male connector mates with the rear-panel REMOTE INPUT connector, and permits all necessary remote programming connections to be made to the 8743B. (See Table 3-1 for wiring information.)

1-11. ACCESSORIES AVAILABLE

1-12. Semi-Rigid Cable

1-13. The Model 11610B Test Port Extension cable provides a means to connect the unit under test to the front panel ports. It is constructed and tested to provide minimum phase and amplitude change with flexing. The 8743B internal signal paths are matched to the 11610B cable length.

1-14. Rack Mounting Kit

1-15. A Rack Mounting Kit is available to install the instrument in a 19-inch rack. Rack mounting kits may be obtained through your nearest Hewlett-Packard Office by ordering HP Part Number 5060-8740.

1-16. Attenuator

1-17. A 50-ohm coaxial attenuator is recommended for transmission measurements. An attenuator connected between the output of the device under test and the HP 11610B Semi-Rigid Cable reduces the ambiguity due to mismatch between the 11610B, 8743B, and 8411A. A 10-dB low reflection attenuator, such as an HP 8492A Option 10, reduces this ambiguity to essentially that of the attenuator (VSWR $\leq$1.25). In addition to reducing error due to mismatch, the 10-dB attenuator makes the test channel power level during calibration the same for transmission and reflection. Also, the combined electrical lengths of the 8492A and 11610B make the electrical length of the test channel in the transmission mode nearly equal to its length in the reflection mode. This means, that since the difference is small, it is possible to calibrate for one mode of operation and switch to the other without recalibrating.

1-18. APC-7 Short

1-19. The Model 11565A APC-7 Short is useful for establishing a phase and magnitude reference for reflection measurements.

1-20. COMPLEMENTARY EQUIPMENT

1-21. Model 8410B Network Analyzer

1-22. The 8410B Network Analyzer measures relative amplitude and phase of two RF input signals. The instrument is capable of single or swept frequency measurements, in the range of 0.11 to 12.4 GHz (0.11 to 18 GHz when 8743B Option 018 and 8411A Option 018 are used). Three plug-in display units are available. The 8412A plug-in unit displays amplitude and phase simultaneously on a CRT in a rectangular format. The 8413A plug-in unit displays relative amplitude and phase data on a meter. The 8414A plug-in unit displays relative amplitude and phase data in polar coordinates on a 5-inch CRT.

1-23. Signal Source

1-24. The 8620C/86290B or 8350A/83592A Sweep Oscillator provides swept frequency rf signals through the 8743B frequency range. They have several additional output signals. One provides a frequency reference of a 1 Volt/GHz signal to automatically step the 8410B Network Analyzer Frequency Range switch when sweeping multiple bands. Also provided is a sweep output signal to sweep the CRT display, and a blanking signal to blank the CRT display during retrace.

1-25. INSTRUMENTS COVERED BY MANUAL

1-26. Each model 8743B carries a two-section serial number (0000A00000). The first four digits of the number are a prefix. The contents of this manual apply directly to the Model 8743B which has the same serial number prefix(es) as those listed after SERIALS PREFIXED on the title page. The letter designates the country in which the instrument was manufactured. The last five digits form the sequential number that is unique for each instrument.

1-27. Revisions required to adapt this manual to other serial number prefixes are given in a yellow-sheet Manual Changes insert, supplied with the manual. For information concerning serial number prefixes not listed on the title page or in an insert, contact the nearest Hewlett-Packard Office listed at the rear of this manual.

SECTION II
INSTALLATION

2-1. INCOMING INSPECTION

2-2. Inspect the instrument for shipping damage as soon as it is unpacked. Check that all accessories listed in Paragraph 1-6 have been included. Check for broken knobs and connectors; inspect cabinet and panel surfaces for dents and scratches. If the instrument is damaged in any way, or fails to operate properly, notify carrier and your nearest Hewlett-Packard Sales and Service Office. For assistance of any kind, including instruments under warranty, contact the nearest Hewlett-Packard Sales Office listed at the back of this manual.

2-3. REPACKAGING FOR SHIPMENT

2-4. Using Original Packaging

2-5. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard Offices listed at the rear of this manual. Remove the rear-panel coaxial link, wrap it separately and include in shipping container.

2-6. If the Model 8743B is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number and full serial number. Also, mark the container FRAGILE to assure careful handling.

2-7. In any correspondence, refer to the instrument by model number and full serial number.

2-8. Using Other Packaging

2-9. The following general instructions should be used when repackaging with commercially-available materials:

a. Wrap the 8743B and the rear-panel coaxial link separately in heavy paper or plastic. (If shipping to a Hewlett-Packard Service Office or Center, attach a tag indicating the type of service required, the return address, model number, and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 275 pound test material is adequate.

c. Use enough shock-absorbing material (3 to 4 inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely, and mark it FRAGILE to assure careful handling.

e. In any correspondence refer to the instrument by model number and full serial number.

2-10. PREPARATION FOR USE

2-11. Power Requirements

2-12. The Model 8743B requires a power source of 115 or 230 volts ±10%, 50 to 400 Hz, single phase that can supply approximately 15 watts.

2-13. 115/230 Volt Operation

2-14. A two-position slide switch on the rear panel of the Model 8743B permits operation from either a 115- or 230-volt power source. The number showing on the switch slider indicates the voltage for which the instrument is connected. The correct line fuse rating for each line voltage is marked on the plate adjacent to the fuse.

2-15. To prepare the Model 8743B for operation, position the 115-230 volt switch so that the number showing on the slider corresponds to the available line voltage, and install a line fuse of correct rating. "Slo-blo" fuses should be used.

CAUTION

To avoid damage to the instrument, set the 115-230 switch to the line voltage to be used before connecting the power cable.

2-16. Power Cable

2-17. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panels and cabinets be grounded. Accordingly, the Model 8743B is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds panel and cabinet. The offset pin of the three-prong connector is the grounding pin.

2-18. Rear Panel External Reference Line

2-19. The rear panel External Reference Line is packed separate from the 8743B to prevent damage in shipment. Before the 8743B is operational, the reference line must be connected to the two rear panel connectors labeled REFERENCE LINE.

2-20. Bench Operation

2-21. The Model 8743B cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The stand inclines the instrument enough to make the panel features easier to see. The plastic feet provide clearance for air circulation and make the Model 8743B self-aligning when stacked on other Hewlett-Packard full rack-width modular instruments.

2-22. Rack Mounting

2-23. All necessary hardware and instructions are contained in the rack-mounting kit, HP part number 5060-0775. Care must be taken to ensure that the ambient operating temperature does not exceed 55°C (140°F).

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. The combination of the Model 8743B Reflection-Transmission Test Unit with the Model 11610B Semi-Rigid cable, a signal source, and a compatible phase-amplitude ratio indicator, such as the HP Model 8410B Network Analyzer, makes up a system for measuring reflection and transmission, phase and magnitude, from 2.0 to 12.4 GHz (2 to 18 GHz with Option 018).

3-3. The microwave circuit for a reflection or transmission measurement is set up by pressing a front panel pushbutton or with remote contact closures.

3-4. A calibrated line stretcher with a digital indicator is used to equalize the electrical length of the test and reference channels for initial phase calibration. A thumbwheel allows the digital indicator to be set to zero or to any desired reference. For reflection measurements, in cases where the measurement plane is not to be at the UNKNOWN port, the line stretcher can be adjusted to extend the measurement plane up to 15 cm beyond the UNKNOWN port. For transmission measurements, the line stretcher can be used to determine the total electrical length (up to 30 cm) of the device under test. For either function, additional line may be installed in place of the removable rigid coax link (REFERENCE LINE) on the rear panel.

3-5. A special recess for the HP 8410B Network Analyzer's 8411A Harmonic Frequency Converter permits direct connection to the 8743B with no increase in package dimensions.

3-6. DESCRIPTION OF PANEL FEATURES

3-7. Front and rear panel controls, connectors, and indicators are described in Figures 3-1 and 3-2. In these figures, the numbers on the panel illustrations match the description numbers.

3-8. OPERATING PRECAUTIONS

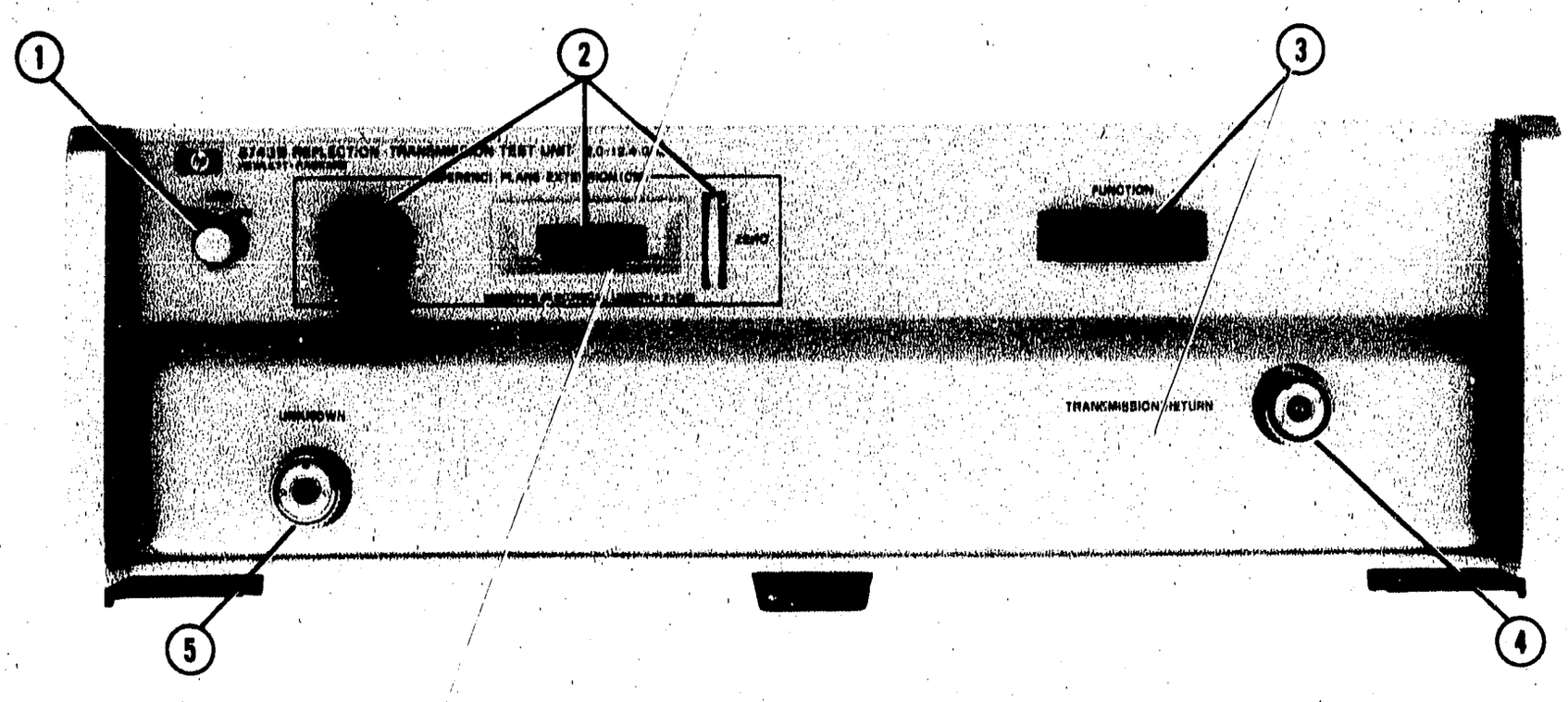
3-9. Maximum RF Power

3-10. Do not apply more than two watts of RF power to the rear-panel RF INPUT. Power in excess of two watts may damage the internal directional couplers. When making transmission measurements using the 8410B Network Analyzer, do not apply more than 50 mW to the 8743B TRANSMISSION RETURN port. More than 50 m W may damage the 8411A Harmonic Frequency Converter.

3-11. MEASUREMENT PROCEDURES

3-12. Procedures for making transmission and reflection measurements using the HP 8743B with the HP 8410B Network Analyzer are included in Figures 3-3 through 3-6.

FRONT PANEL FEATURES



1. POWER. Combination line power switch and power on indicator. Pushbutton glows when instrument is on. Pushbutton retainer unscrews for lamp replacement.

2. REFERENCE PLANE EXTENSION (CM). Crank controls internal line stretcher to equalize the electrical length of the test and reference channels for initial calibration and to compensate for the electrical length of the device under test-up to 15 cm for reflection tests, and up to 30 cm for transmission tests. ZERO thumbwheel is for setting reference indication on counter without changing line length. If more compensation is needed, additional line may be installed in place of the removable rigid coax link on the rear panel.

3. FUNCTION selectors. Set up the internal microwave circuits for making reflection or transmission measurements. Pushbutton glows, indicating function selected.

4. TRANSMISSION RETURN port. Makes RF connection from the device under test for transmission measurements. APC-7 type* 50-ohm precision 7mm sexless connector.

5. UNKNOWN port. Makes RF connections to the device under test for reflection or transmission measurements. APC-7 type* 50-ohm precision 7mm sexless connector.

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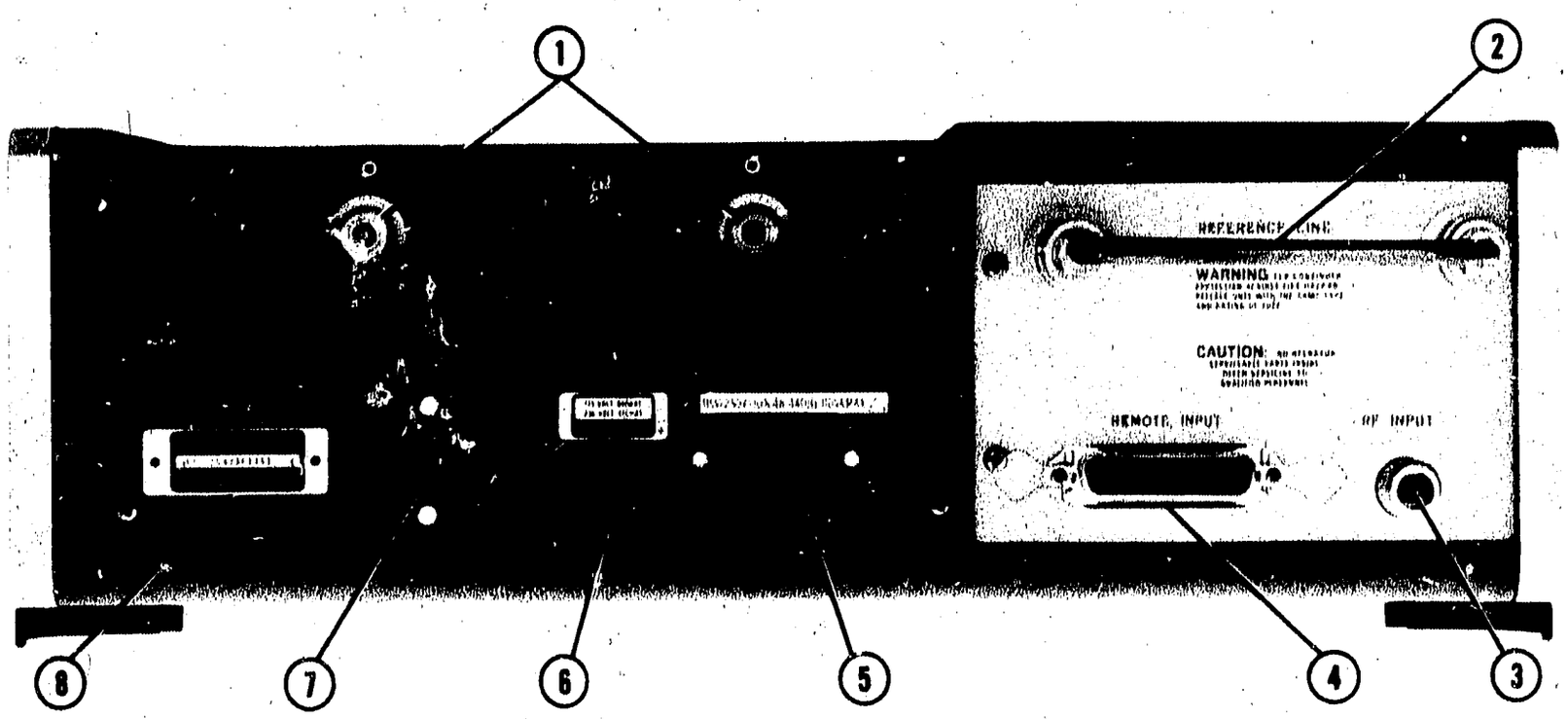
* Amphenol RF Division, Danbury, Connecticut. See Figure 3-11 for important information about use and care of APC-7 connectors.

Figure 3-1. Front Panel Features

REAR PANEL FEATURES

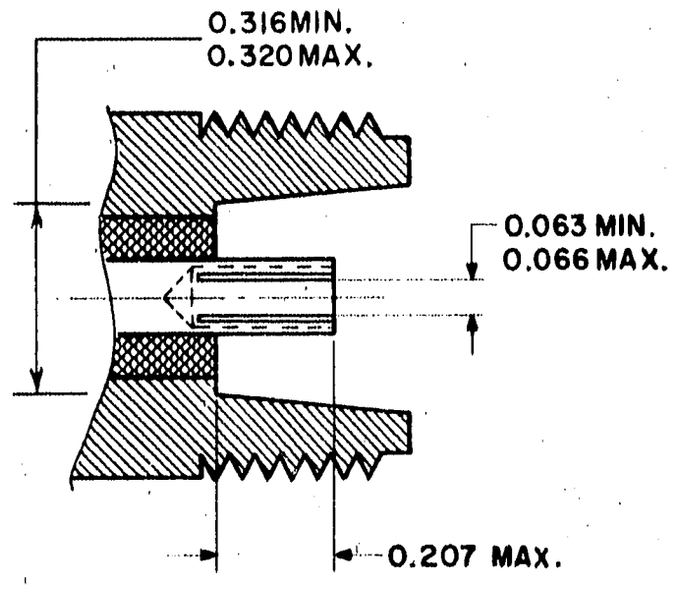


1. REFERENCE and TEST output ports. Reference and Test channel outputs to phase-amplitude indicator. Mate with APC-7* style 50-ohm precision 7mm connectors. The REFERENCE channel connector is mechanically floating to assure alignment with 8411A Harmonic Frequency Converter of HP 8410B Network Analyzer.

2. REFERENCE LINE. May be replaced with a longer section of rigid coax cable to extend the range of the REFERENCE PLANE EXTENSION to any desired length.

3. RF INPUT. Input for RF signal that is applied to the device under test. Frequency range is 2.0 to 12.4 GHz (2.0 to 18 GHz with Option 018). Maximum RF power level is 2 watts. Connector is 50-ohm type N and mates compatibly with type N connectors whose dimensions conform to MIL-C-39012 and MIL-C-7 (see dimension drawing).

4. REMOTE INPUT. Accepts contact closure type remote programming to select the function to be measured. Nominal voltage from the 8743B when the contact is open is 12 Vdc. Maximum current from the 8743B when the contact is short circuited is 12 mA.



5. Power Cable Connector. NEMA type with offset pin connected to 8743B cabinet. Power requirements: 115 or 230 V ac ±10%, 50 to 400 Hz, approximately 15 watts.

6. Power Line Fuse Holder. "Slo-blo" fuse rating for 115 and 230 Vac on adjacent plate.

7. Line Voltage Selector. Permits operation from 115 to 230 Vac. Number showing on slider is the selected operating voltage. Correct line fuse rating is on plate adjacent to fuse holder.

8. Serial Number Plate. The nine digit and one letter serial number should be included in any correspondence concerning the 8743B.

Figure 3-2. Rear Panel Features

REFLECTION MEASUREMENTS

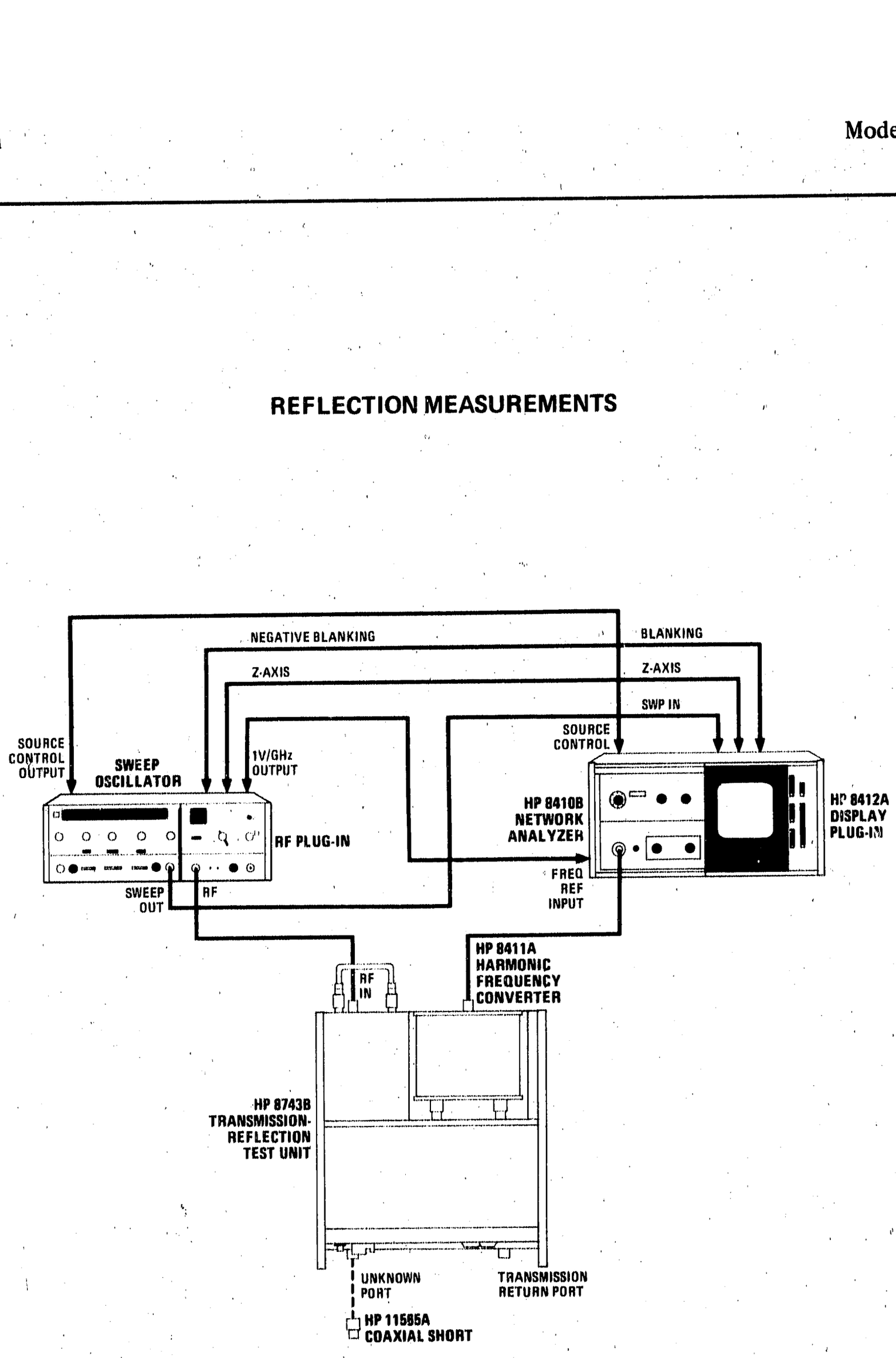


Figure 3-3. Reflection Measurement Using Network Analyzer with 8412A Display (1 of 4)

CALIBRATION DESCRIPTION

Calibration consists of adjusting the 8743B REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference magnitude and phase indications using a coaxial short to produce a reflection coefficient indication of 1 at 180 degrees.

Because of system frequency response errors, the most accurate system calibration and measurement are done in CW mode, therefore both swept and CW modes are described. If greater resolution in swept mode is desired, an 8750A Storage/Normalizer may be added to the 8412A display.

PROCEDURES FOR SWEPT MEASUREMENT

Calibration for Reflection Phase

1. Connect equipment as shown in the test setup.

2. Connect a coaxial short such as the HP 11565A to the 8743B UNKNOWN port and depress the REFL pushbutton. On the 8412A, set MODE switch to PHASE and PHASE DEG/DIV switch to 90.

3. Adjust 8412A phase offset DEGREES to 180 degrees offset (either polarity).

4. Set the Sweep Oscillator to automatic sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the frequency band of interest. The swept phase output should be displayed on the 8412A CRT.

5. Obtain equal reference and test channel electrical lengths by adjusting the 8743B REFERENCE PLANE EXTENSION for a horizontal phase trace on the 8412A CRT. The digital counter should be set to zero so that it can be used to set any required extension accurately. A convenient way to do this is as follows:

   a. Adjust REFERENCE PLANE EXTENSION crank until counter reads all zeros.

   b. Hold thumbwheel to retain zero indication and readjust REFERENCE PLANE EXTENSION for a horizontal trace on the 8412A CRT.

6. Adjust the 8410B PHASE VERNIER control to position 8412A phase trace on the center graticule line. Alternately increase the 8412A PHASE DEG/DIV sensitivity and adjust the 8410B PHASE VERNIER until the phase trace is at the center graticule line with the PHASE DEG/DIV set at 1.0 DEG/DIV.

7. On 8412A, set PHASE OFFSET to zero and set PHASE DEG/DIV to 90. The 8410B/8412A/8743B is now calibrated for phase. Do not adjust the 8410B PHASE VERNIER or 8743B REFERENCE PLANE EXTENSION during subsequent tests or the phase calibration will be invalid.

Figure 3-3. Reflection Measurement Using Network Analyzer with 8412A Display (2 of 4)

Calibration for Reflection Magnitude

1. At 8412A, set MODE switch to AMPL and AMPL DB/DIV switch to 10.

2. Adjust the 8410B TEST CHANNEL GAIN and AMPL VERNIER controls to place the 8412A trace on the center graticule line.

3. Alternately increase the 8412A AMPL DB/DIV sensitivity and adjust the 8410B AMPL VERNIER and TEST CHANNEL GAIN until the 8412A AMPL DB/DIV switch is on 0.25 and the magnitude trace is at the center graticule line.

4. On the 8412A, set AMPL DB/DIV switch to 10. The 8410B/8412A/8743B is now calibrated for magnitude. Do not adjust the 8410B AMPL VERNIER during subsequent tests or the magnitude calibration will be invalid. Also, the 8410B TEST CHANNEL GAIN setting should be noted since measurements will be made referenced to this calibration setting.

Reflection Magnitude Test

1. Connect the device under test to the 8743B UNKNOWN port.

2. At the 8412A, set the MODE switch to AMPL.

3. At the 8410B, adjust the TEST CHANNEL GAIN to center the trace on the CRT. Set the AMPL DB/DIV switch for the best resolution that will allow the trace to remain on the CRT.

4. Select a point on the CRT trace to measure. Calculate the difference setting of the TEST CHANNEL GAIN from the calibration value noted at the end of the calibration procedure. Add this TEST CHANNEL GAIN change to the value of the trace at the selected spot. If the spot is below the center graticule line, add the value to the TEST CHANNEL GAIN change, or if the spot is above the center graticule line, subtract that value from the TEST CHANNEL GAIN change. This value is the reflection magnitude in return loss of the device under test.

Reflection Phase Test

1. Connect the device under test to the 8743B UNKNOWN port.

2. At the 8412A, set the MODE switch to PHASE.

3. Select a point on the CRT phase trace to measure. Move that spot as close to the center graticule line as possible with the 8412A PHASE OFFSET controls. Set PHASE DEG/DIV switch to the best resolution and still keep the trace on the screen.

4. Calculate the phase of the selected point by adding algebraically the DEGREES PHASE OFFSET setting to the value of the trace above or below the center graticule line. If the selected point on the trace is above the center line, add the CRT value to the DEGREES PHASE OFFSET value, and if the selected point on the trace is below the center line, subtract the CRT value. The total value is the phase of the reflection from the device under test at the UNKNOWN port.

Figure 3-3. Reflection Measurement Using Network Analyzer with 8412A Display (3 of 4)

PROCEDURES FOR CW MEASUREMENTS

Calibration for Reflection Phase

1. Connect equipment as shown in the test setup.

2. Connect a coaxial short such as the HP 11565A to the 8743B UNKNOWN port and depress the REFL pushbutton. On the 8412A, set MODE switch to PHASE and PHASE DEG/DIV switch to 90.

3. Adjust 8412A phase offset DEGREES to 180 degrees offset (either polarity).

4. Set the Sweep Oscillator to CW operation. Adjust the Network Analyzer to obtain phase lock. A phase dot indication should be present on the 8412A CRT.

5. Adjust the 8410B PHASE VERNIER and the 8743B REFERENCE PLANE EXTENSION to position the phase dot on the center graticule line. Alternately increase the 8412A PHASE DEG/DIV sensitivity and adjust 8410B PHASE VERNIER until the phase dot is at the center graticule line with the PHASE DEG/DIV set at 1.0 DEG/DIV.

6. On the 8412A, set PHASE DEG/DIV to 90. The 8410B/8412A/8743B is now calibrated for phase in CW mode. Do not adjust the 8410B PHASE VERNIER, the 8743B REFERENCE PLANE EXTENSION, or the Sweeper frequency during subsequent tests or the phase calibration will be invalid.

Calibration for Reflection Magnitude

The calibration adjustments for CW magnitude is the same as previously described for swept magnitude.

Reflection Magnitude and Phase Tests in CW Mode

Tests in CW mode are the same as previously described in swept mode.

Figure 3-3. Reflection Measurement Using Network Analyzer with 8412A Display (4 of 4)

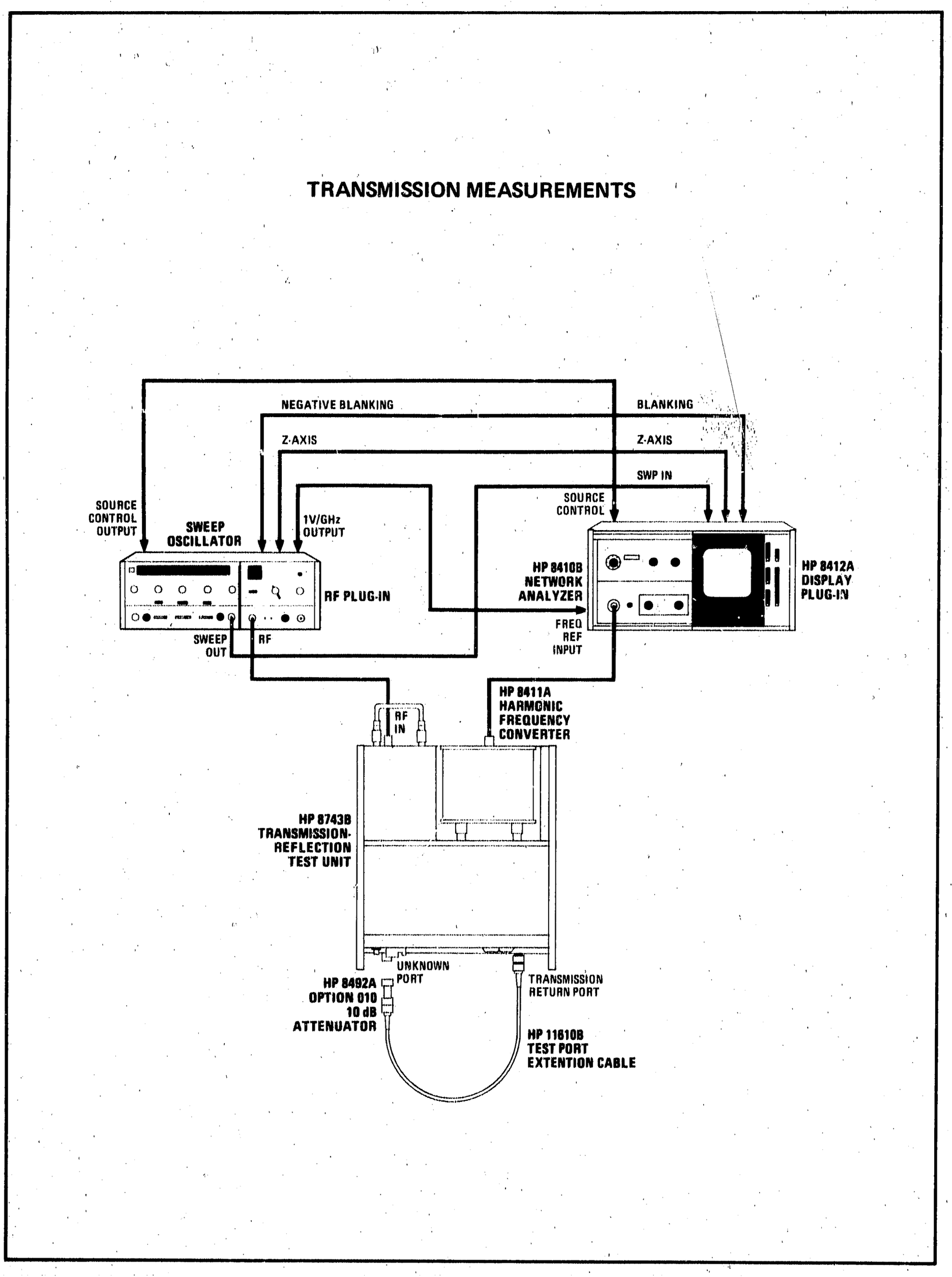


Figure 3-4. Transmission Measurement Using Network Analyzer with 8412A Display (1 of 4)

CALIBRATION DESCRIPTION

Calibration consists of adjusting the 8743B REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference magnitude and phase indications using a "thru".

Because of system frequency response errors, the most accurate system calibration and measurement is done in CW mode, therefore both swept and CW modes are described. If greater resolution in swept mode is desired, an 8750A Storage/Normalizer may be added to the 8412A display.

PROCEDURES FOR SWEPT MEASUREMENT

Calibration for Transmission Phase

1. Connect equipment as shown in the test setup.

2. Connect the 10 dB attenuator to the 8743B UNKNOWN port to form a "thru", and depress the TRANS pushbutton. On the 8412A, set MODE switch to PHASE and PHASE DEG/DIV switch to 90.

3. Adjust 8412A phase offset DEGREES to zero degree offset (either polarity).

4. Set the Sweep Oscillator to automatic sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the frequency band of interest. The swept phase output should be displayed on the 8412A CRT.

5. Obtain equal reference and test channel electrical lengths by adjusting the 8743B REFERENCE PLANE EXTENSION for a horizontal phase trace on the 8412A CRT. The digital counter should be set to zero if it is to be used to determine the electrical length of the device under test. A convenient way to do this is as follows:

   a. Adjust REFERENCE PLANE EXTENSION crank until counter reads all zeros.

   b. Hold thumbwheel to retain zero indication and readjust REFERENCE PLANE EXTENSION for a horizontal trace on the 8412A CRT.

6. Adjust the 8410B PHASE VERNIER control to position 8412A phase trace on the center graticule line. Alternately increase the 8412A PHASE DEG/DIV sensitivity and adjust the 8410B PHASE VERNIER until the phase trace is at the center graticule line with the PHASE DEG/DIV set at 1.0 DEG/DIV.

7. On 8412A, set PHASE DEG/DIV to 90. The 8410B/8412A/8743B is now calibrated for phase. Do not adjust the 8410B PHASE VERNIER or 8743B REFERENCE PLANE EXTENSION during subsequent tests or the phase calibration will be invalid.

Calibration for Transmission Magnitude

1. At 8412A, set MODE switch to AMPL and AMPL DB/DIV switch to 10.

Figure 3-4. Transmission Measurement Using Network Analyzer with 8412A Display (2 of 4)

2. Adjust the 8410B TEST CHANNEL GAIN and AMPL VERNIER controls to place the 8412A trace on the center graticule line.

3. Alternately increase the 8412A AMPL DB/DIV sensitivity and adjust the 8410B AMPL VERNIER and TEST CHANNEL GAIN until the 8412A AMPL DB/DIV switch is on 0.25 and the magnitude trace is at the center graticule line.

4. On the 8412A, set AMPL DB/DIV switch to 10. The 8410B/8412A/8743B is now calibrated for magnitude. Do not adjust the 8410B AMPL VERNIER during subsequent tests or the magnitude calibration will be invalid. Also, the 8410B TEST CHANNEL GAIN setting should be noted since measurements will be made referenced to this calibration setting.

Transmission Magnitude Test

1. Connect the device under test between the 8743B UNKNOWN port and the 10 dB attenuator that together with the 11610B cable forms the Transmission Return path.

2. At the 8412A, set the MODE switch to AMPL.

3. At the 8410B, adjust the TEST CHANNEL GAIN to center the trace on the CRT. Set the AMPL DB/DIV switch for the best resolution that will allow the trace to remain on the CRT.

4. Select a point on the CRT trace to measure. To calculate Transmission Magnitude at that point, first determine if the device under test has exhibited gain or loss. Loss is indicated by an 8410B TEST CHANNEL GAIN setting greater than the calibration value noted at the end of the calibration procedure. Gain through the device is indicated by TEST CHANNEL GAIN setting less than the calibration value.

   Loss is calculated by the difference in TEST CHANNEL GAIN setting plus the value of the 8412A trace below the center graticule line (or minus the value above the line).

   Gain is calculated by the difference in TEST CHANNEL GAIN setting plus the value of the 8412A trace above the center graticule line (or minus the value below the line).

Transmission Phase Test

1. Connect the device under test between the 8743B UNKNOWN port and the 10 dB attenuator that together with the 11610B cable forms the Transmission Return path.

2. At the 8412A, set the MODE switch to PHASE.

3. Select a point on the CRT phase trace to measure. Move that spot as close to the center graticule line as possible with the 8412A PHASE OFFSET controls. Set PHASE DEG/DIV switch to the best resolution and still keep the trace on the screen.

Figure 3-4. Transmission Measurement Using Network Analyzer with 8412A Display (3 of 4)

4. Calculate the phase of the selected point by adding algebraically the DEGREES PHASE OFFSET setting to the value of the trace above or below the center graticule line. If the selected point on the trace is above the center line, add the CRT value to the DEGREES PHASE OFFSET value, and if the selected point on the trace is below the center line, subtract the CRT value. The total value is the transmission phase of the device under test at the UNKNOWN port.

PROCEDURES FOR CW MEASUREMENTS

Calibration for Transmission Phase

1. Connect equipment as shown in the test setup.

2. Connect the 10 dB attenuator to the 8743B UNKNOWN port to form a "thru", and depress the TRANS pushbutton. On the 8412A, set MODE switch to PHASE and PHASE DEG/DIV switch to 90.

3. Adjust 8412A phase offset DEGREES to zero degree offset (either polarity).

4. Set the Sweep Oscillator to CW operation. Adjust the Network Analyzer to obtain phase lock. A phase dot indication should be present on the 8412A CRT.

5. Adjust the 8410B PHASE VERNIER and the 843B REFERENCE PLANE EXTENSION to position the phase dot on the center graticule line. Alternately increase the 8412A PHASE DEG/DIV sensitivity and adjust 8410B PHASE VERNIER until the phase dot is at the center graticule line with the PHASE DEG/DIV set at 1.0 DEG/DIV.

6. On the 8412A, set PHASE DEG/DIV to 90. The 8410B/8412A/8743B is now calibrated for phase in CW mode. Do not adjust the 8410B Sweeper frequency during subsequent tests or the phase calibration will be invalid.

Calibration for Transmission Magnitude

The calibration adjustments for CW magnitude is the same as previously described for swept magnitude.

Magnitude and Phase Tests in CW Mode

Tests in CW mode are the same as previously described in swept mode.

Figure 3-4. Transmission Measurement Using Network Analyzer with 8412A Display (4 of 4)

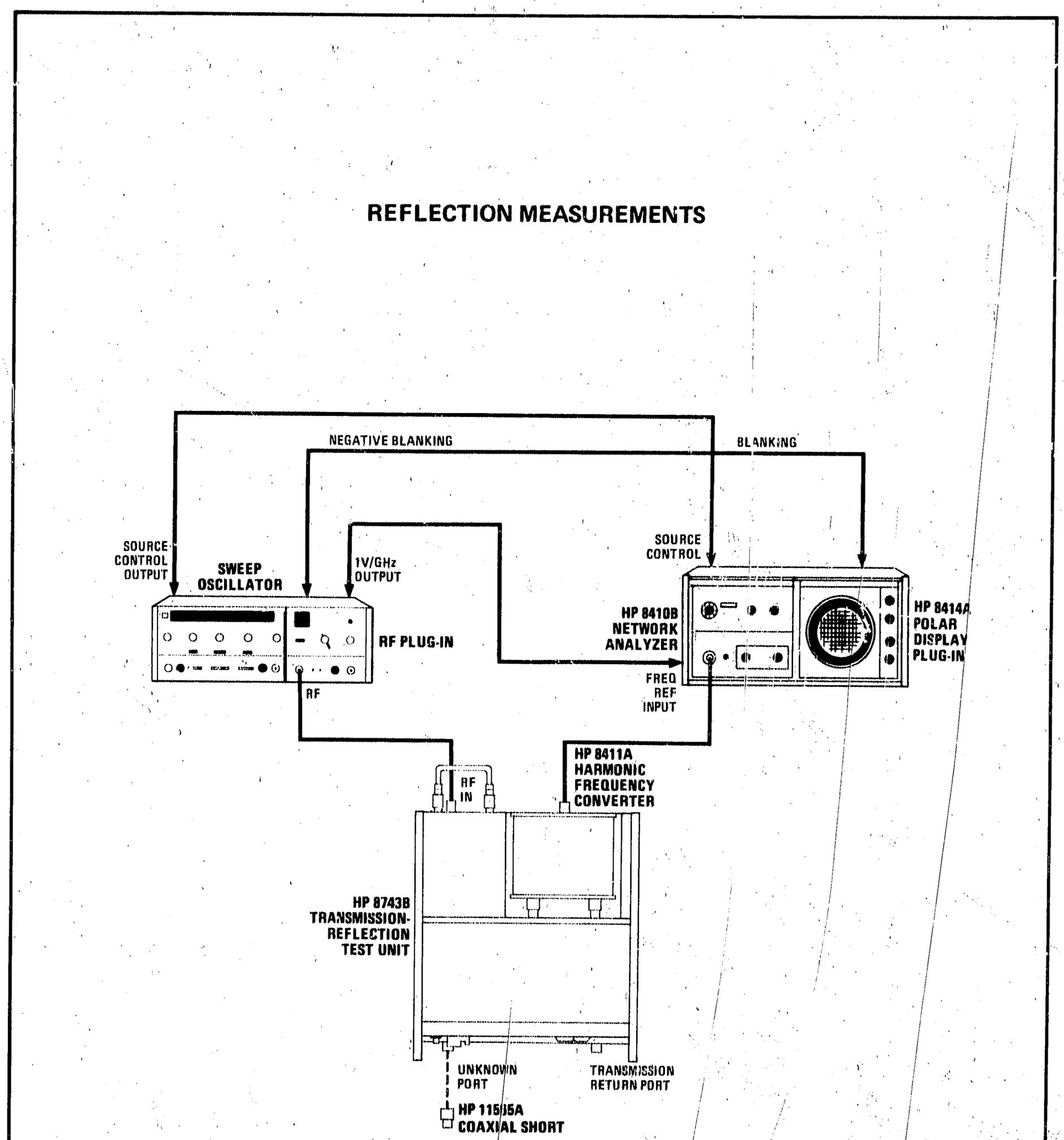


Figure 3-5. Reflection Measurements, Using Network Analyzer with 8414A Polar Display (1 of 2)

CALIBRATION DESCRIPTION

Calibration consists of adjusting the 8743B REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference magnitude and phase indications, using a coaxial short to produce a reflection coefficient of 1 at 180 degrees.

CALIBRATION PROCEDURE

1. Connect equipment as shown in setup.

2. Connect a coaxial short such as the HP 11565A to the 8743B UNKNOWN port and depress the REFL pushbutton.

3. Set the Sweep Oscillator to automatic sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the frequency band of interest and obtain a trace on the 8414A.

4. Momentarily push and hold the 8414A BEAM CTR pushbutton and adjust the centering controls to place the dot in the center of the polar display.

5. Obtain equal reference and test channel electrical lengths by adjusting the REFERENCE PLANE EXTENSION to collapse the trace to a dot or smallest cluster. The digital counter should be set to zero so that it can be used to set a required extension accurately. A convenient way to do this is as follows:

   a. Adjust REFERENCE PLANE EXTENSION crank until counter reads all zeros.

   b. Hold thumbwheel to retain zero indication and readjust REFERENCE PLANE EXTENSION to collapse the trace to a dot or smallest cluster.

6. Adjust the 8410B PHASE VERNIER, TEST CHANNEL GAIN and AMPL VERNIER controls to place the dot or cluster for a reference indication of $\Gamma = 1 \angle 180°$ The 8410B/8414A/8743B system is now calibrated for phase and magnitude. Do not adjust the controls used in the preceding steps or the calibration will be invalid.

NOTE

Calibration for greater accuracy is discussed in Paragraphs 3-14 and 3-15.

MEASUREMENT

1. Remove the coaxial short and connect the device to be tested to the 8743B UNKNOWN port.

2. Read the reflection coefficient, magnitude and phase, (or impedance using a Smith Chart overlay) from the 8414A display.

NOTE

For small reflection coefficients, the 8414A resolution can be improved by increasing the 8410B TEST CHANNEL GAIN. For example, increasing the TEST CHANNEL GAIN by 20 dB changes the full scale reflection-coefficient calibration from 1.0 to 0.1 at the outer circle.

Figure 3-5. Reflection Measurement, Using Network Analyzer with 8414A Polar Display (2 of 2)

TRANSMISSION MEASUREMENTS

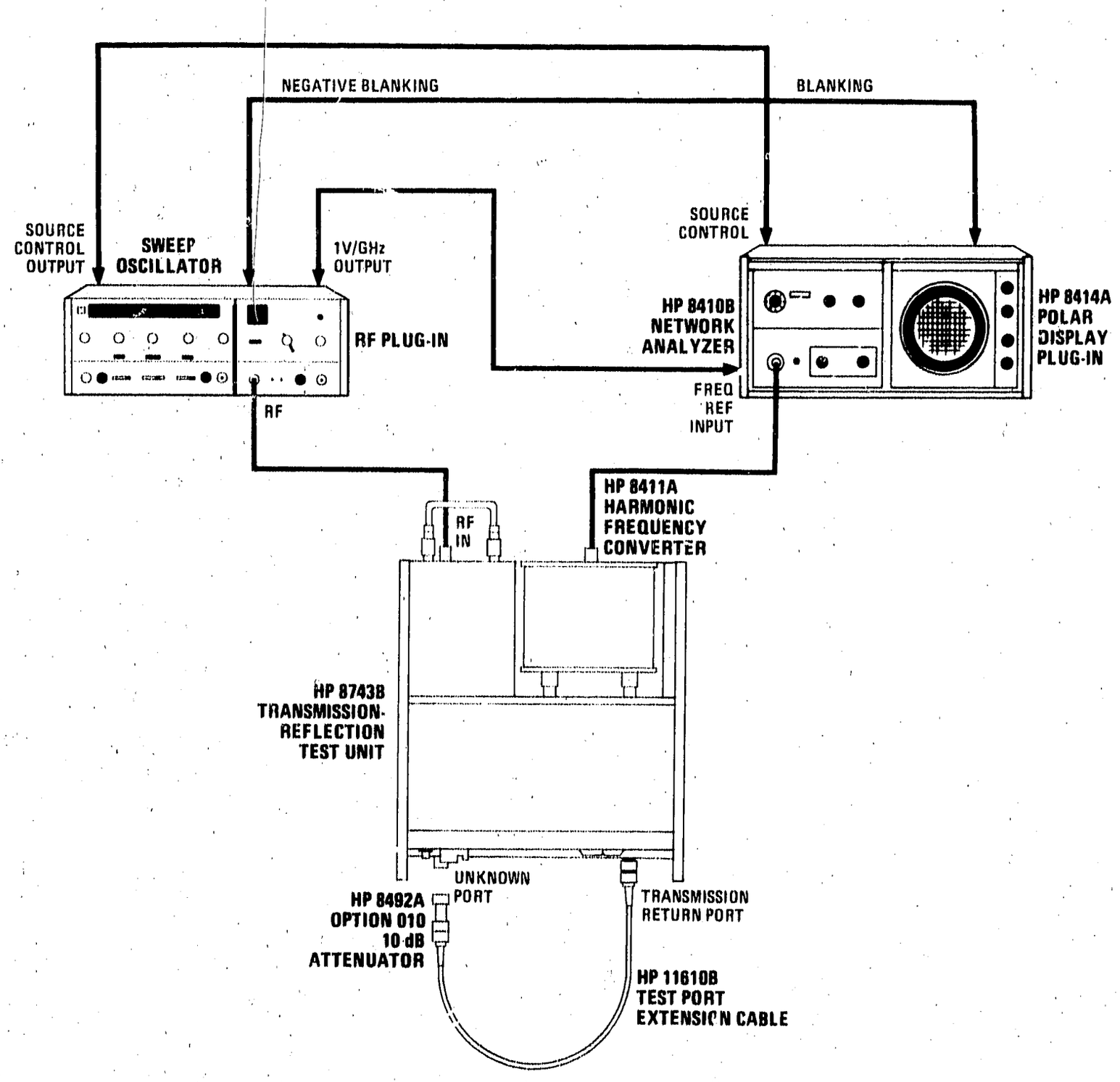


Figure 3-6. Transmission Measurements, Using Network Analyzer with 8414A Polar Display (1 of 2)

CALIBRATION DESCRIPTION

Calibration consists of adjusting the 8743B REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference, magnitude and phase indications using a "thru."

CALIBRATION PROCEDURE

1. Connect equipment as shown in setup. Connect a 10-dB attenuator, such as the HP 8492A Option 010, to the 11610B semi-rigid cable (see Paragraph 3-17) and connect the attentuator to the 8743B UNKNOWN port forming a "thru."

2. Depress the 8743B TRANS pushbutton.

3. Set the Sweep Oscillator to automatic-sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the frequency band of interest, and obtain a trace on the 8414A.

4. Momentarily push and hold the 8414A beam center pushbutton and adjust the centering controls to place the dot in the center of the polar display.

5. Obtain equal reference and test channel electrical lengths by adjusting the REFERENCE PLANE EXTENSION to collapse the trace to a dot or smallest cluster. The digital counter should be set to zero. A convenient way to do this is as follows:

   a. Adjust REFERENCE PLANE EXTENSION crank until counter reads all zeros.

   b. Hold thumbwheel to retain zero indication and readjust REFERENCE PLANE EXTENSION to collapse the trace to a dot or smallest cluster.

6. Adjust the 8410B phase and amplitude controls to place the dot or cluster for a reference indication of $\Gamma = 1\angle 0°$

The 8410B/8414A/8743B system is now calibrated for phase and magnitude. Do not adjust the controls used in the preceding steps or the calibration will be invalid.

MEASUREMENT

1. Insert the device to be tested between the UNKNOWN port and the 10-dB attenuator.

2. Note the 8410B TEST CHANNEL GAIN setting. This is the calibrated gain setting. Adjust the TEST CHANNEL GAIN to locate the CRT display on the outside ring. The difference in TEST CHANNEL GAIN settings is the magnitude of the transmission gain or loss of the device under test.

Figure 3-6. Transmission Measurements, Using Network Analyzer with 8414A Polar Display (2 of 2)

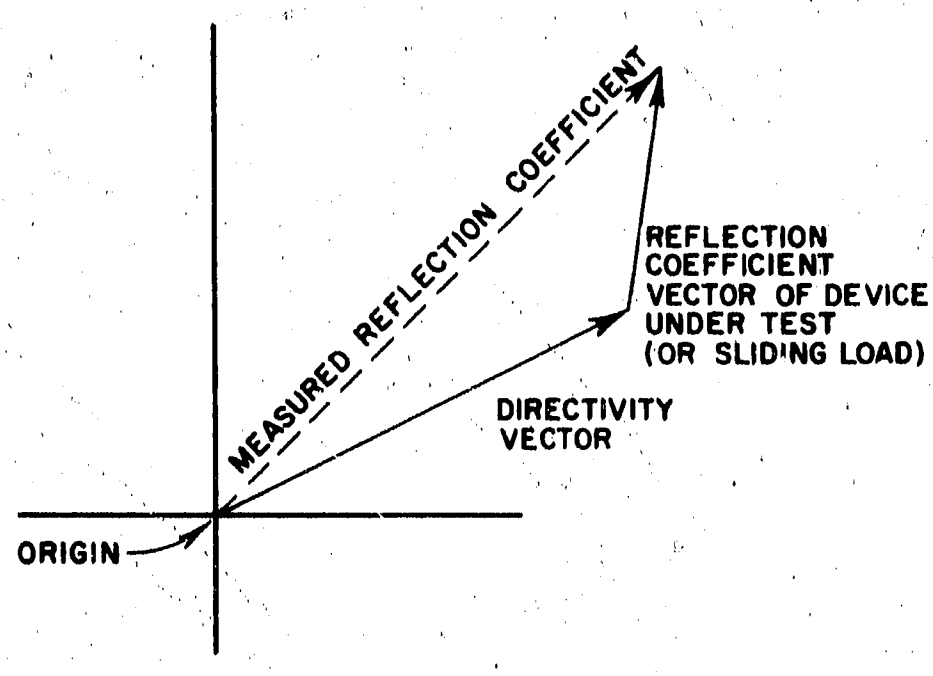


Figure 3.7. Measured Reflection Coefficient.

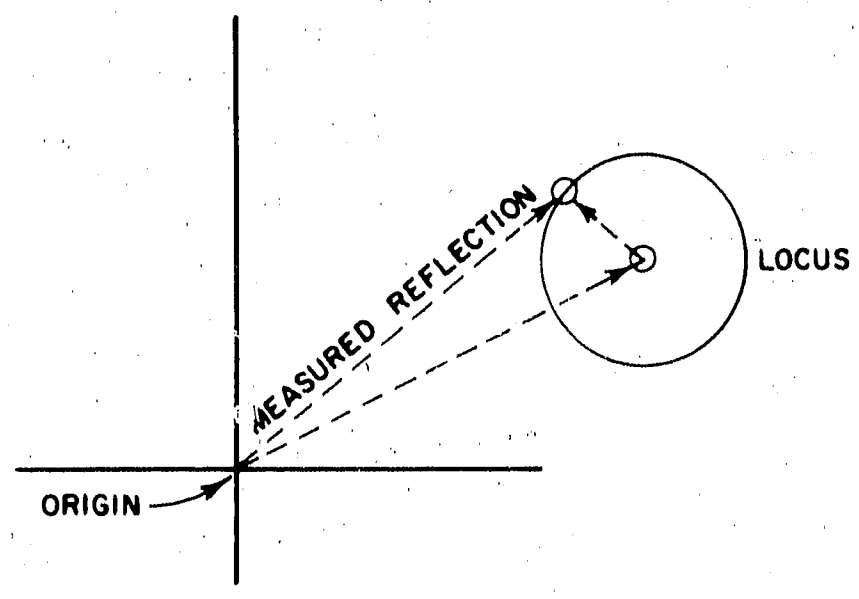


Figure 3-8. Locus of Measured Reflection when Load is Moved.

3-13. Increased Accuracy for Reflection Measurements by Minimizing Directivity Errors.

3-14. The 8743B internal coupler's directivity errors become significant when measuring small reflection coefficients, but the error can be cancelled at single frequencies. The measured reflection is the vector sum of the directivity vector plus the reflection coefficient of the device under test. (See Figure 3-7.) The error is calibrated out with a sliding load. Figure 3-8 depicts the sliding load in one position at a single-frequency. As the sliding load is moved, the magnitude of its reflection coefficient remains constant but the phase of the coefficient changes. As the load is moved its reflection coefficient indication rotates in a circle of constant magnitude about the directivity vector. The center of this circle is the tip of the directivity vector. If the magnitude of the directivity was zero, the locus circle would be centered about the origin as shown in Figure 3-9. The directivity vector goes from the origin to the center of the locus circle. When the location of the center of the circle is known, the directivity vector can be subtracted from the measured reflection. The resultant is the reflection coefficient of the device under test.

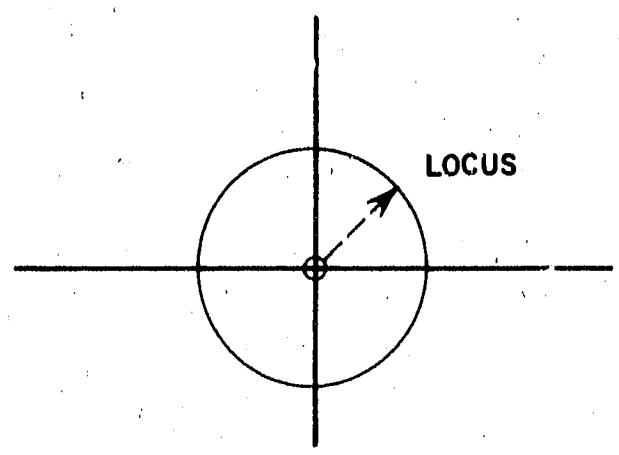


Figure 3-9. Locus of Measured Reflection with Directivity Cancelled.

3-15. The vector subtraction can be performed directly with the horizontal and vertical controls on the 8414A polar display. Increase the 8410B TEST CHANNEL GAIN so full scale reflection on the polar display is suitable for the component you wish to measure. Attach a sliding load such as the HP 905A to the 8743B UNKNOWN port. Slide the load and adjust the horizontal and vertical controls until the circle rotates about the center of the CRT. The effect of directivity is now cancelled for this frequency and this test channel gain on the Network Analyzer. The vector subtraction must be done manually with the 8413A. Put the sliding load on the 8743B and measure reflection, phase and magnitude, for three positions of the sliding load. Plot these three points on graph paper and find the center of the circle that goes through these points. The vector from the origin of the graph to this center must be vectorically subtracted from any reflection measurement at this frequency.

3-16. Increased Accuracy For Transmission Measurements by Reducing Mismatch Ambiguity

3-17. A 50-ohm coaxial attenuator is recommended for transmission measurements. An attenuator connected between the output of the device under test and the HP 11610B Semi-rigid Cable

Table 3-1. Contact Closures for Remote Operation

J1 Pin No.	Function
1 thru 16	No connection
17	Remote-Manual Select
18	Remote Control Common
19 thru 23	No Connection
24	Remote TRANS-REFL Select
25	No Connection
36	Remote Control Common

reduces the ambiguity due to mismatch between the 11610B, 8743B and 8411A. A 10-dB low-reflection attenuator, such as a HP 8492A Option 10 reduces the ambiguity to essentially that due to the mismatch of the attenuator (VSWR <1.25). Other values of attenuation may be used; however, values greater than 10 dB will not reduce the mismatch below that of the attenuator. For values less than 10 dB the multiple mismatch between the 11610B, 8743B and 8411A should be taken into consideration. In addition to reducing ambiguity due to mismatch, the 10-dB attenuator makes the test channel power level during calibration the same for transmission and reflection. Also, the combined electrical lengths of the 8492A and the 11610B makes the electrical length of the test channel in the transmission mode nearly equal to its length in the reflection mode. This means that, since the difference is small, it is possible to calibrate for one mode of operation, and switch to the other without recalibrating.

3-18. REMOTE OPERATION

3-19. A thirty-six pin connector on the rear panel of the 8743B provides contacts for remote selection of transmission or reflection measurements. Only four of the thirty-six pins are used. The pins and their uses are given in Table 3-1. When remote-manual select pin 17 is open and not connected to a remote control common (pin 18 or 36), the 8743B is in the manual or front panel mode. In this mode of operation, the front-panel pushbuttons are enabled and remote TRANS-REFL select pin 24 is disabled. When remote-manual select pin 17 is connected to a remote control common (pin 18 or 36), the 8743B is in the remote mode. In this mode of operation the front-panel pushbuttons are disabled and remote TRANS-REFL select pin 24 is enabled, allowing selection of transmission or reflection measurements only through the remote input pin 24. Table 3-2 shows the signal requirements for remote operation. A typical transistor remote control circuit is shown in Figure 3-10. The 8743A supplies approximately +12 Vdc for the open-circuit condition and 12 mA of current for the short-circuit condition.

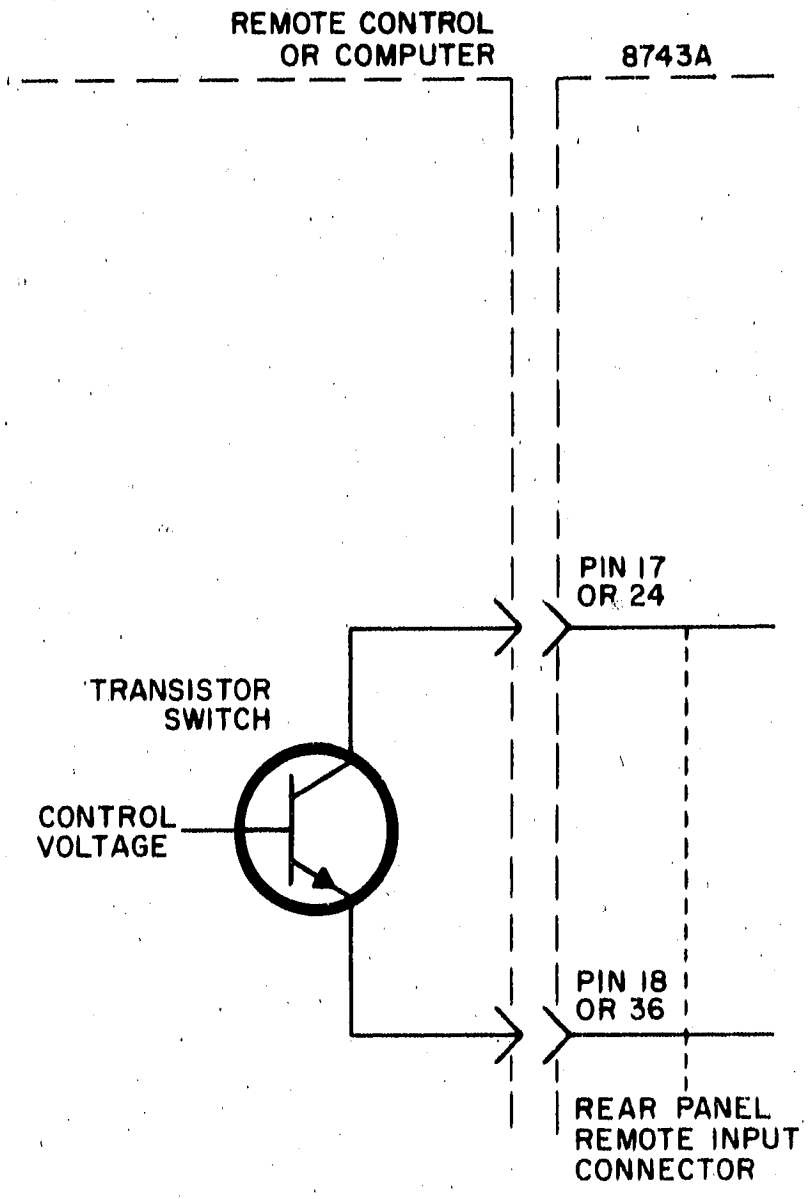


Figure 3-10. Typical Transistor Remote Control Circuit.

Table 3-2. Signal Requirements for Remote Operation.

Measurement	Pin 18 or 36 to:	
	Pin 17	Pin 24
Transmission	shorted	shorted
Reflection	shorted	open

3-20. Care of APC-7 Connectors

3-21. RF connections to and from the device under test and to the phase-amplitude ratio indicator are made with APC-7 style 50-ohm 7 mm sexless connectors. These connectors should be handled with particular care for two reasons:

a. Continuity through APC-7 connectors is obtained by end-to-end contact of the inner and outer conductors. Consequently, the electrical performance of the connector is largely dependent upon the condition of these exposed surfaces.

b. The inner conductor of the front-panel UNKNOWN connector is attached to a directional coupler and any rotational force on the inner conductor may result in damage to the coupler.

3-22. Important recommendations about the handling and care of the APC-7 connectors are given in Figure 3-11. The part of an input connector that is most likely to be damaged is the inner conductor contact. Since it protrudes slightly beyond the plane of electrical contact, any wiping action of one connector across the other can damage the contact enough to cause a discontinuity. The risk of this kind of damage can be minimized, as stated in Figure 3-11, by always having the coupling sleeves of the UNKNOWN and TRANSMISSION RETURN connectors fully extended.

3-23. Contact Replacement

3-24. Replacement inner conductor contacts are available from Hewlett-Packard (part number 1250-0907), and from Amphenol RF Division, Danbury, Connecticut (part number 131-129).

3-25. The important precautions that apply to the replacement of inner conductor contact are these:

a. Do not disassemble the connector.

b. Do not apply more than slight inward pressure to the inner conductor.

c. Do not apply ANY twisting force to the inner conductor.

d. Do not attempt to repair contacts.

e. Do not re-use contacts.

CAUTION

Inward pressure or twisting force applied to the inner conductor of the UNKNOWN port connector can render the Model 8743B inoperative.

3-26. Because of the above considerations, contact removal should not be attempted with ordinary hand tools. Only the Hewlett-Packard self-positioning, hypodermic-action contact extractor tool (part number 5060-0236) should be used. This tool exerts no appreciable inward pressure and no twisting force on the inner conductor. Instructions for removing contacts are supplied with the tool.

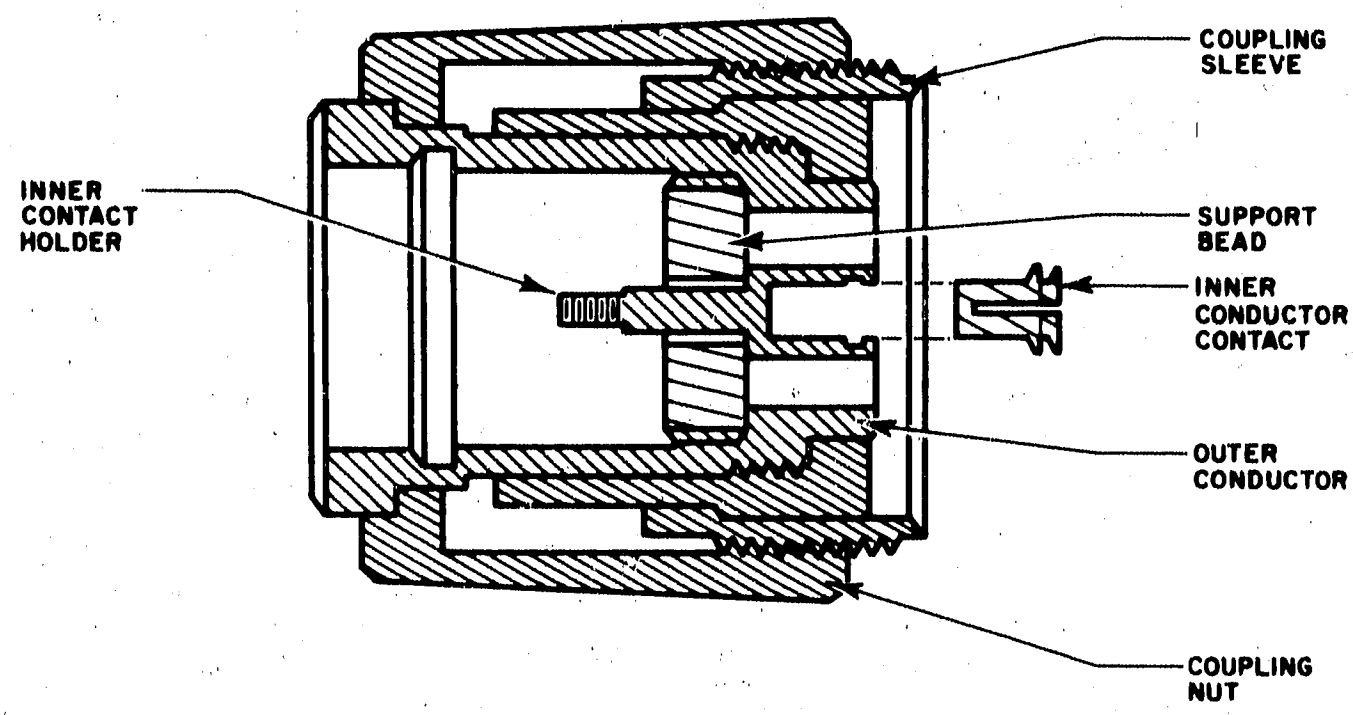
3-27. No tool is required for installing a replacement contact. Insert the contact gently by hand, applying only enough inward pressure to snap it into place. Then check for proper installation by inspecting the contact for even spacing of its four segments. Also, test for normal spring action by applying light inward pressure against the end of the contact with a pencil eraser. As the pressure is released the contact's spring action should cause it to move outward. If not, the contact is defective and should be replaced.

3-28. Switch Lamp Replacement

3-29. Replacement of the bulbs in the FUNCTION switches is shown in Figure 3-12.

3-30. The lamp that indicates line power is applied to the Model 8743B is housed in the POWER switch pushbutton. To replace the lamp, unscrew the retaining ring near the front panel, pull out the pushbutton, and remove the lamp. Replacement lamp part number is HP 2140-0244, LAMP: GLOW.

APC-7 CONNECTORS



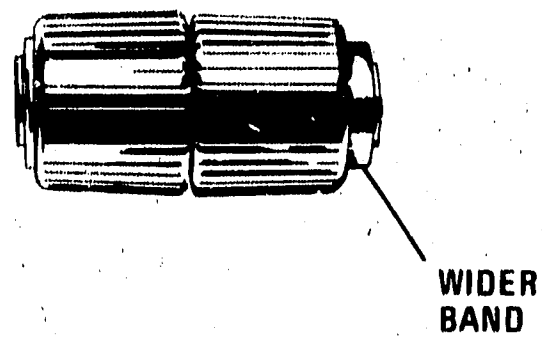
USE

To Connect:

1. On one connector, retract the coupling sleeve by turning the coupling nut counterclockwise until the sleeve and nut disengage.
2. On the other connector, fully extend the coupling sleeve by turning the coupling nut clockwise. To engage coupling sleeve and coupling nut when the sleeve is fully retracted, press back lightly on the nut while turning it clockwise.
3. Push the connectors firmly together, and thread the coupling nut of the connector with retracted sleeve over the extended sleeve. Leave the other coupling nut in the original position; closing the gap between coupling nuts tends to loosen the electrical connection.

To Disconnect:

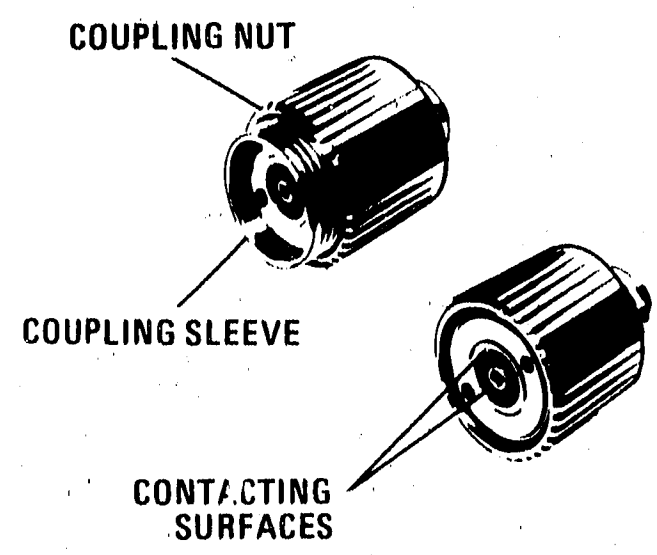
1. Loosen the coupling nut of the connector showing the wider gold band.



2. IMPORTANT: Part the connectors carefully to prevent striking the inner conductor contact.

CARE

1. Keep contacting surfaces smooth and clean. Irregularities and foreign particles can degrade electrical performance.



2. Protect the contacting surfaces when the connector is not in use by leaving the coupling sleeve extended.
3. Use lintless material and/or firm-bristled brush such as tooth brush for cleaning. If a cleaning fluid is needed use isopropyl alcohol. IMPORTANT: Do not use aromatic or chlorinated hydrocarbons, esters, ethers, terpenes, higher alcohols, ketones, or ether-alcohols such as benzene, toluene, turpentine, dioxanne, gasoline, cellosolve acetate, or carbon tetrachloride. Keep exposure of the connectors parts to both the cleaning fluid and its vapors as brief as possible.

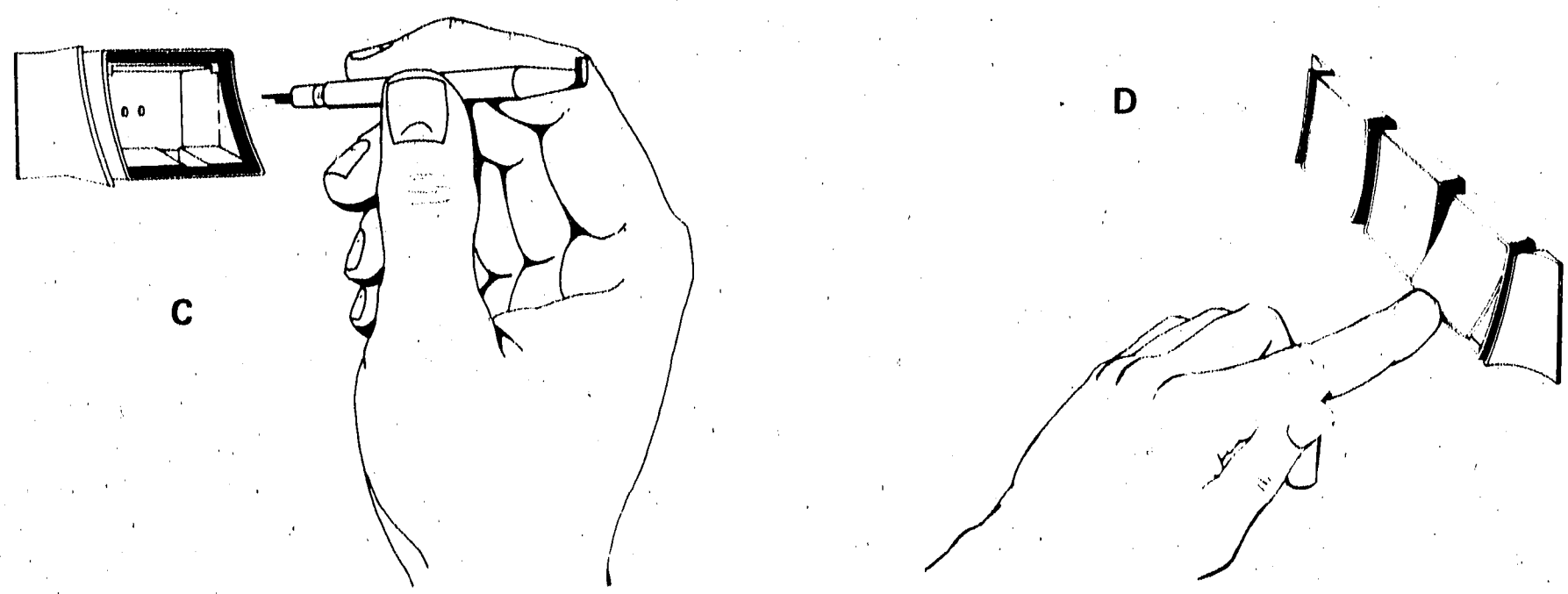
Figure 3-11. APC-7 Connectors

A bulb extractor tool, HP Part No. 4040-0427, has been developed to facilitate bulb replacement for backlighted pushbutton switches of the type shown below.

BULB REPLACEMENT PROCEDURE

1. Place the end of the thumb of one hand over the corner of the pushbutton switch. With the bulb extractor tool in the other hand, place the hooked end of the tool into the front of the slot on the bottom of the pushbutton (A) and gently push up until the lower end of the pushbutton lens pops out as shown in B.

2. Remove the pushbutton lens. Place the hollow end of the bulb extractor tool over the bulb to be replaced and gently pull back. The bulb should stick in the extractor and come out of its socket as the extractor is pulled back as shown in C.



3. Remove the old bulb from the hollow end of the extractor and insert the bulb into the hollow end. Using the extractor to hold the new bulb, insert the new bulb into the socket. To separate bulb and extractor, gently twist until it easily slips off the bulb.
4. Replace the pushbutton lens by first positioning the tabs at the top of the lens into the top of the pushbutton and pressing the bottom of the lens into place as shown in D.

NOTE

Only the pushbutton lens should be removed for bulb replacement. If the pushbutton is inadvertently pulled out during replacement, remove lens from the pushbutton. Re-insert the pushbutton into the front panel and push in until pushbutton snaps in place. Remainder of procedure is the same as previously given.

Figure 3-12. Pushbutton Selector Bulb Replacement

PERFORMANCE CHECK

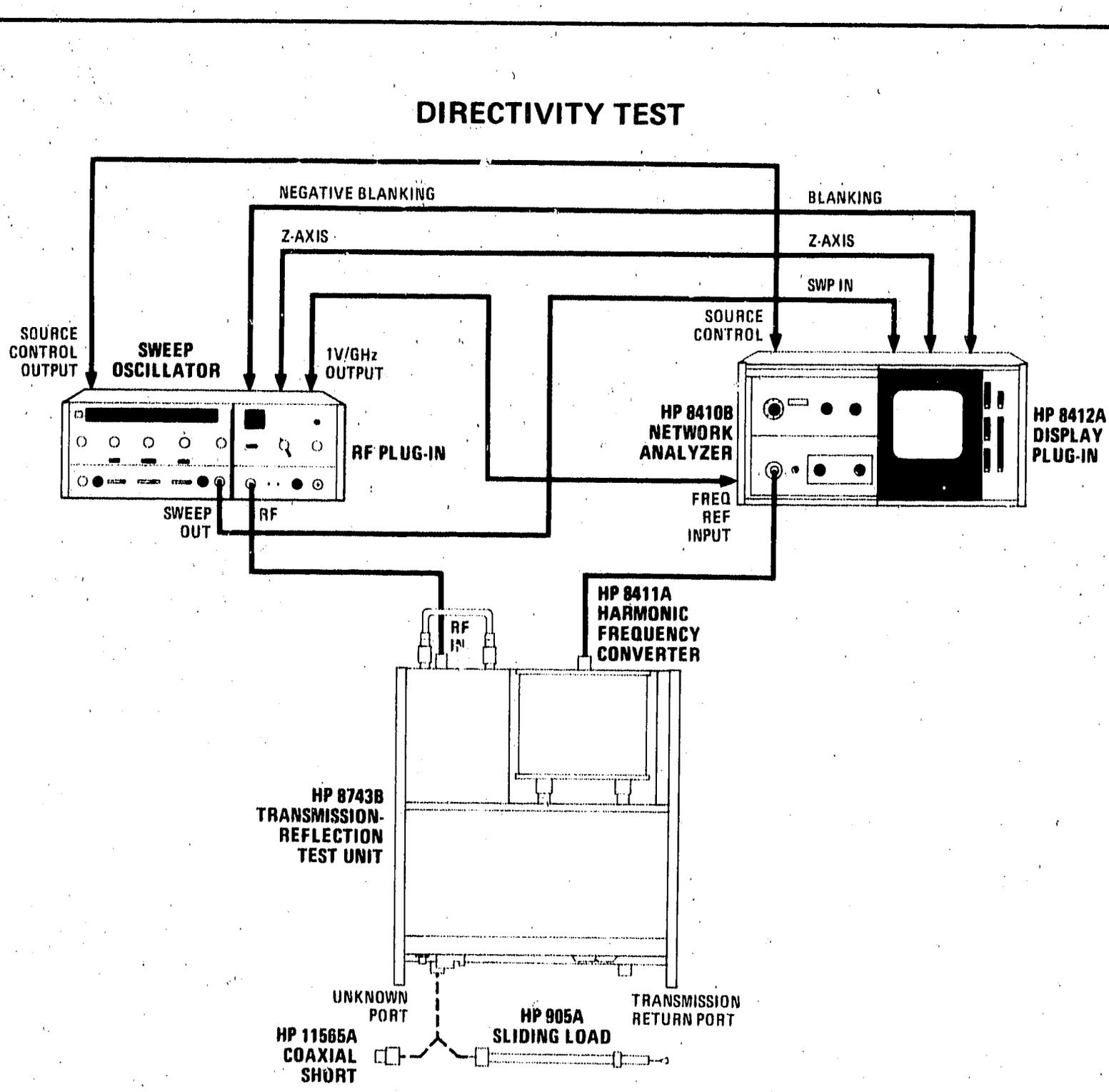
SECTION IV
PERFORMANCE TESTS

4-1. PERFORMANCE TEST PROCEDURES

4-2. The performance test procedures presented in Figure 4-1 are useful for incoming inspection, periodic evaluation, and after repair. The specifications of Table 1-1 are the performance standards. Test equipment required for the procedures is listed in Table 4-1. Instruments other than those recommended may be used, provided their performance equals or exceeds the critical specifications listed in the table.

Table 4-1. Recommended Test Equipment for Performance Test Procedure

Instrument	Critical Specifications	Recommended HP Model
Sweep Oscillator	Frequency Range: 2.0 to 12.4 GHz (2.0 to 18 GHz for Opt. 018). Output Power: 1 mW minimum into 50 ohm Power Variation: ±7 dB VSWR: <3:1	8620C/86290B 8350A/83592A
Network Analyzer	No substitute may be used.	8410B/8411A Opt. 018/8412A and 8414A
Storage Normalizer	No substitute may be used.	8750A
Short	50-ohm short (APC-7 connector)	11565A
50-ohm Coaxial Sliding Load	50-ohm coaxial sliding termination with APC-7 connector. SWR: ≤1.05, 1.8 to 18 GHz	905A
Dual-Directional Coupler	Frequency Range: 2.0 to 18 GHz Directivity: ≥24 dB	11692D
Adapter APC-7 to N (3 Required)	50-ohm adapter	11525A
50-ohm Fixed Load	50-ohm APC-7 connector	909A



DIRECTIVITY TEST

Test Description

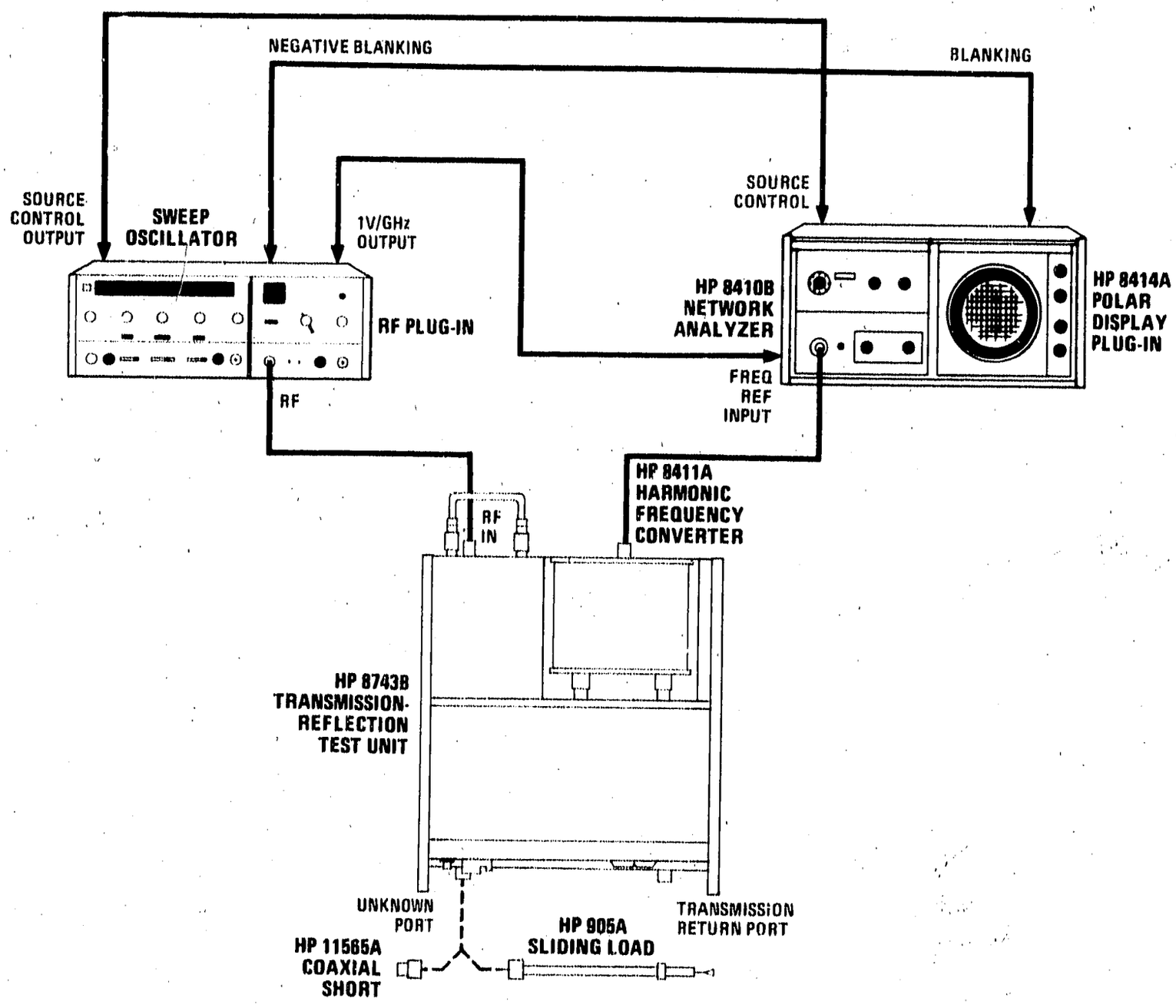
The accuracy of a reflection measurement is affected primarily by the directivity of the coupler monitoring reflected signal. This test measures the directivity of the directional coupler associated with the UNKNOWN port. The test consists of measuring the combination of coupler directivity and load reflection. The load reflection is canceled, and the resultant is directivity. Two procedures are given for making the test. One using the 8412A display unit and the other using the 8414A display unit.

Procedure, Using the 8412A Display Unit

1. Connect equipment as shown in setup above.
2. Connect the coaxial short to the 8743B UNKNOWN port and depress the **REFL** pushbutton.
3. Set the Sweep Oscillator to automatic sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the segment of the 8743B frequency range covered by the Sweep Oscillator.
4. Set the 8410B TEST CHANNEL GAIN to 20 dB. Adjust the 8410B AMPLITUDE VERNIER for a convenient amplitude reference on the 8412A. Draw the average of this trace on the CRT with a grease pencil.
5. Remove the coaxial short and replace with the sliding load.
6. Increase the 8410B TEST CHANNEL GAIN by 30 dB. Phase the sliding load, noting the display. At the point where the trace comes nearest to the reference line, the mean value of the trace must be below the reference level established in step 4.
7. Repeat steps 2 through 6 for other frequency segments as necessary to cover the range of 2.0 to 12.4 GHz (or 2.0 to 18 GHz for Opt. 018).

Figure 4-1. Performance Test (1 of 6)

DIRECTIVITY TEST (Cont'd)



Procedure, Using the 8414A Display Unit

1. Connect equipment as shown in setup above.
2. Connect the coaxial short to the 8743B UNKNOWN port and depress the REFL pushbutton.
3. Set the Sweep Oscillator to automatic sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the segment of the 8743B frequency range covered by the Sweep Oscillator. If necessary, adjust 8410B TEST CHANNEL GAIN to place trace on CRT.
4. Push and hold the 8414A BEAM CTR pushbutton and adjust the centering controls to place the dot in the center of the polar display.
5. At the 8743B, adjust the REFERENCE PLANE EXTENSION to collapse the trace to a dot or smallest cluster on the 8414A.
6. Adjust the 8410 TEST CHANNEL GAIN and AMPLITUDE VERNIER controls to place the dot or the center of the cluster at the outer circle of the graticule.
7. Remove the coaxial short and replace with the sliding load.
8. Increase the 8410B TEST CHANNEL GAIN by 30 dB. Phase the sliding load, noting the CRT display. At the point where the trace comes nearest to the outer circle of the graticule, the mean value of the trace must be inside the outer circle.
9. If the swept-display cannot be resolved satisfactorily, make single-frequency measurements as follows:
   a. Set the Sweep Oscillator to single-frequency operation. Select the frequency which corresponds to the point of greatest reflection on the 8414A display.
   b. Adjust the 8414A centering controls, while phasing the load, until the circle rotates about the center of the CRT. (See Figure 3-9.)
   c. Depress the 8414A beam center pushbutton. The dot must be inside the outer circle of the graticule.
10. Repeat steps 2 through 9 for other frequency segments as necessary to cover the range of 2.0 to 12.4 GHz (or 2.0 to 18 GHz for Opt. 018).

Figure 4-1. Performance Test (2 of 6)

TERMINATION REFLECTION COEFFICIENT TEST

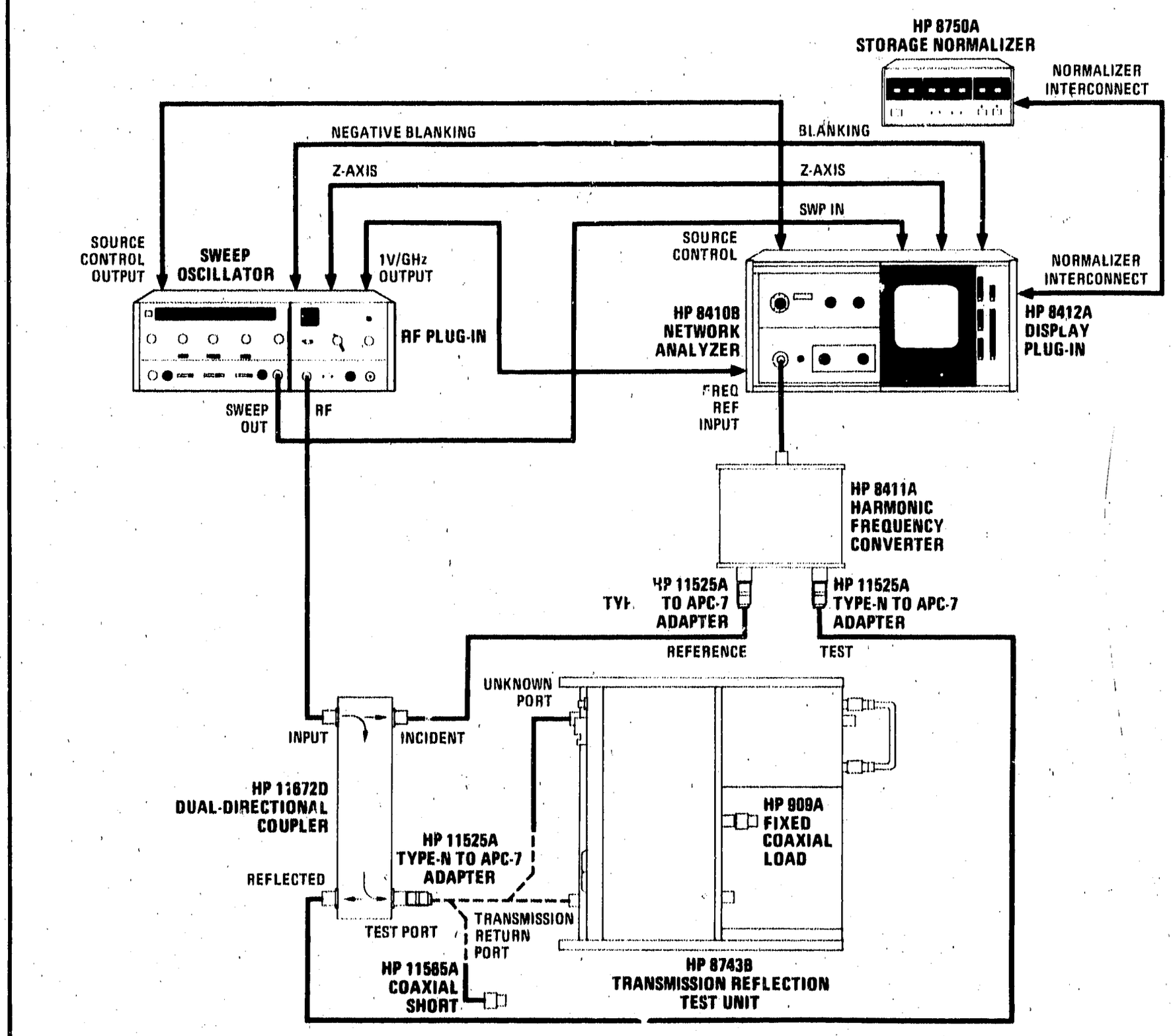


Figure 4-1. Performance Test (3 of 6)

TERMINATION REFLECTION COEFFICIENT TEST

Test Description

The reflection coefficient of the input and return ports are measured with a reflectometer bridge composed of a dual-directional coupler and the 8410B/8411A Network Analyzer.

Procedure

1. Connect equipment as shown in the test setup. Connect HP 909A Fixed Coaxial Load to the 8743B TEST port.

2. At Sweep Oscillator, set START frequency to 2 GHz and STOP frequency to 12.4 GHz. At 8743B, press REFL pushbutton.

3. Connect coaxial short to TEST port of Dual–Directional Coupler through the adapter. At 8410B, adjust TEST CHANNEL GAIN and AMPL VERNIER to place the 8412A trace on the center graticule line.

4. On 8750A, press CH1, Display INPUT, Reference Memory STORE INPUT, then Display INPUT–MEM in that order.

5. At the 8410B, adjust AMPL VERNIER to place the trace on the center line of the 8412A display. Do not adjust the 8410B AMPL VERNIER during subsequent tests or the magnitude calibration will be invalid. Also, the 8410B TEST CHANNEL GAIN setting should be noted as the reference value for measurements.

6. Remove short from Dual–Directional Coupler TEST port adapter and connect the TEST port through the adapter to the 8743B UNKNOWN port.

7. At the 8410B, adjust TEST CHANNEL GAIN controls to place the highest section of the trace just under the center graticule line. (DO NOT adjust AMPL VERNIER.)

8. Measure return loss of UNKNOWN port by taking the absolute value of the change in TEST CHANNEL GAIN from the reference value in step 5 and adding to it the value between the center graticule line and the closest point of the trace below the center line. The return loss should be =>17.7 dB; this is equal to a reflection coefficient of =<0.13.

9. At the 8743B, press TRANS pushbutton.

10. Repeat steps 7 and 8 above for the transmission mode. The return loss should be =>14 dB; this is equal to a reflection coefficient of =<0.20.

11. Connect TEST port of the Dual-Directional Coupler through the APC-7 to Type-N adapter to the 8743B TRANSMISSION RETURN port.

12. At the 8743B, press REFL pushbutton.

13. Repeat steps 7 and 8 above for the 2 to 12.4 GHz range. The return loss should be =>17.7 dB; this is equal to a reflection coefficient of =<0.13.

14. At the 8743B, press the TRANS pushbutton.

15. Repeat steps 7 and 8 above for transmission mode. The return loss should be =>14 dB; this is equal to a reflection coefficient of =<0.20.

Option 018 Only

16. If the 8743B has Option 018, set Sweep Oscillator START frequency to 12.4 GHz and STOP frequency to 18 GHz. Press 8743B REFL pushbutton.

17. Repeat steps 3 through 8 above for the 12.4 to 18 GHz range except the return loss should be =>14 dB; this is equal to a reflection coefficient of =<0.20.

18. At the 8743B, press TRANS pushbutton. Repeat steps 7 and 8 above. The return loss should be =>14 dB; this is equal to a reflection coefficient of =<0.20.

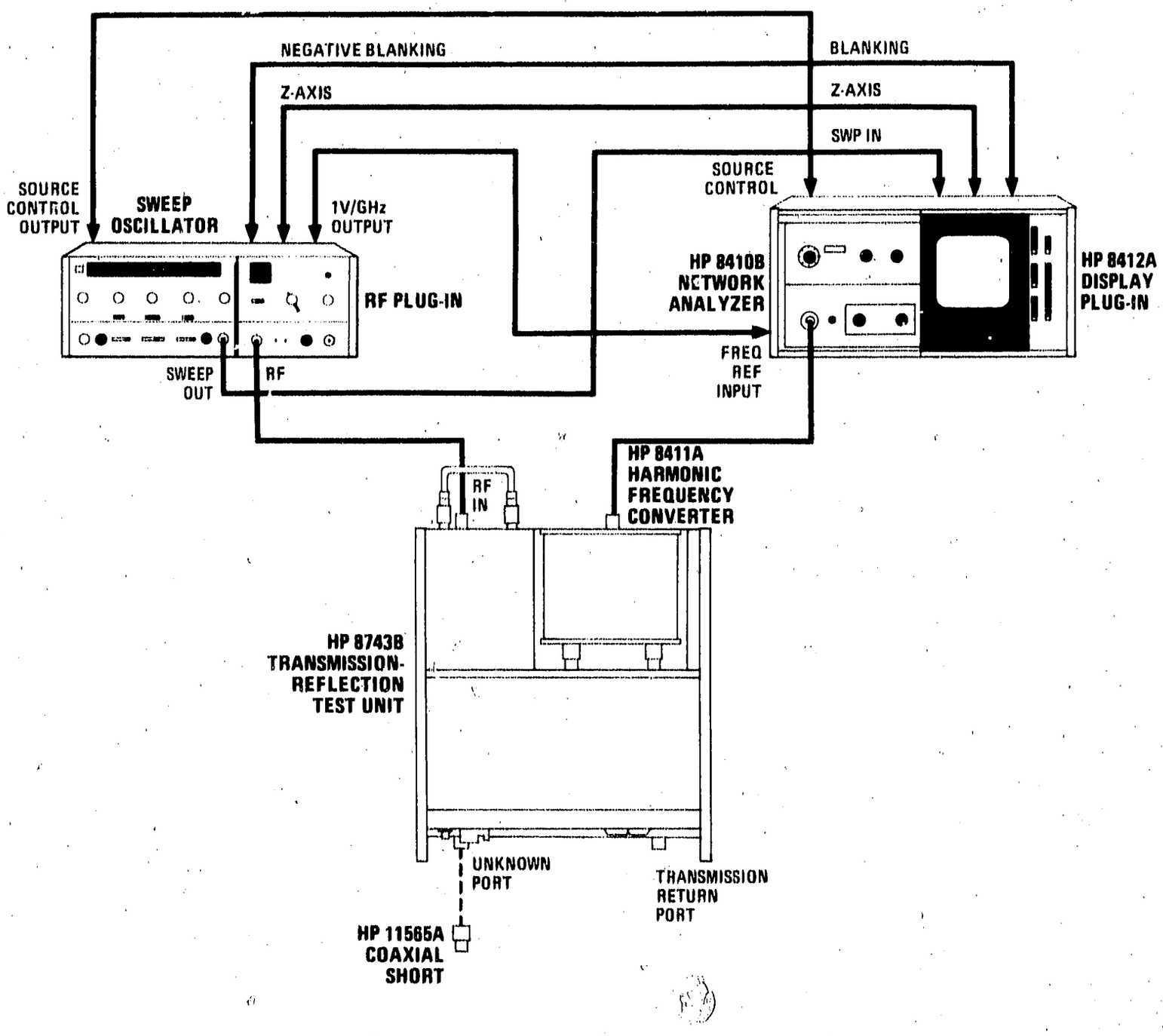
19. Connect TEST port of the Dual-Directional Coupler through the APC-7 to Type-N adapter to the 8743B UNKNOWN port.

20. Repeat steps 7 and 8 above for the 12.4 to 18 GHz range. The return loss should be =>14 dB; this is equal to a reflection coefficient of =<0.20.

21. At the 8743B, press REFL pushbutton. Repeat steps 7 and 8 above. The return loss should be =>14 dB; this is equal to a reflection coefficient of =<0.20.

Figure 4-1. Performance Test (4 of 6)

SOURCE REFLECTION COEFFICIENT TEST



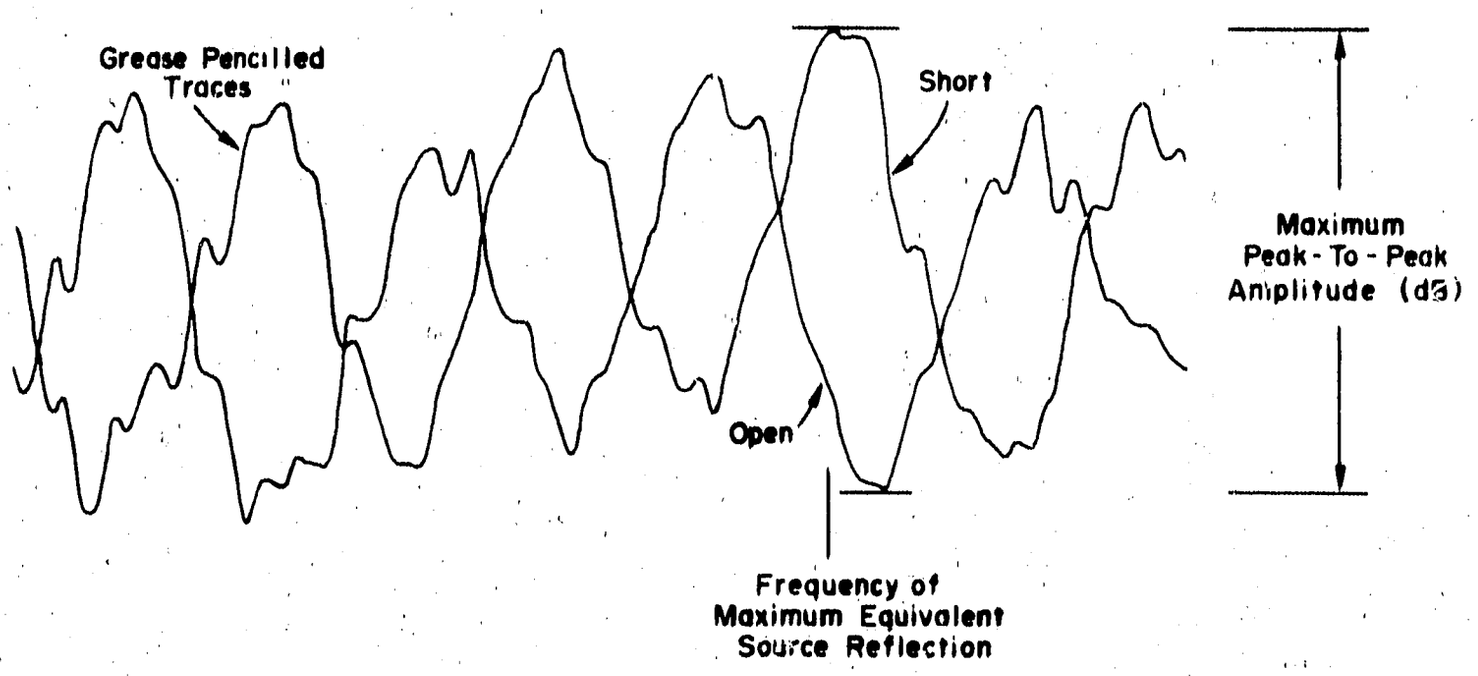


Figure 4-1. Performance Test (5 of 6)

SOURCE REFLECTION COEFFICIENT TEST

Test Description

The equivalent source reflection coefficient is tested by measuring the change in magnitude of a maximum reflection when the phase of the reflection is varied. The measured change in magnitude is the vector sum of coupler directivity and source reflection;therefore, the equivalent source reflection is actually less than specified.

Procedure

1. Connect equipment as shown in test setup.
2. Connect a coaxial short such as the HP 11565A to the 8743B UNKNOWN port and press REFL push-button.
3. Set the Sweep Oscillator to automatic sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over a full octave band in the 2.0 to 12.4 GHz range.
4. Adjust 8410B TEST CHANNEL GAIN and AMPL VERNIER controls so that the average of the trace falls on the center line of the CRT graticule.
5. Increase the 8412A AMPL DB/DIV sensitivity to obtain a maximum amplitude CRT presentation. Draw the trace on the face of the CRT with a grease pencil.
6. Remove the coaxial short from the UNKNOWN port and grease pencil the trace of the open circuit on the CRT.
7. Determine the maximum peak-to-peak amplitude as shown above, and read directly from the 8412A CRT graticule.
8. The maximum peak-to-peak amplitude must not exceed 1.59 dB (reflection coefficient of 0.09) from 2 to 8 GHz, and 2.29 dB (reflection coefficient of 0.13) from 8 to 12.4 GHz.

NOTE

VSWR=antilog 0.05(peak-to-peak amplitude in dB); VSWR=$(1+\rho/1-\rho)$

NOTE

This procedure determines the equivalent source reflection for the frequency at which the maximum peak-to-peak amplitude occurs. To determine the equivalent source reflection at other frequencies, repeat steps 2 through 8 for other relative phase relations of the load, directivity, and source reflection vectors (e.i., offset the coaxial short using various lengths of air line).

9. If the 8743B is Option 018, set Sweep Oscillator START frequency to 12.4 GHz and set STOP frequency to 18 GHz. Repeat steps 2 through 8 for the 12.4 to 18 GHz frequency bands. The maximum peak-to-peak amplitude must not exceed 3.5 dB (reflection coefficient of 0.2).

Figure 4-1. Performance Test (6 of 6)

4-3. RF TROUBLESHOOTING

4-4. Introduction

8743B RF troubles can be divided into two general categories, repeatability and insertion loss. Repeatability problems are generally caused by the RF coaxial switches, and insertion loss problems are generally caused by connectors or cables. Because the troubleshooting approach for each of these problems is different, this section discusses each category separately.

4-5. Repeatability

NOTE

Repeatability is a supplemental performance characteristic and not an instrument specification.

Repeatability is the change in insertion loss when the coaxial switches are cycled and is normally not a factor in measurement accuracy. The change in 8743B insertion loss when the coaxial switches are cycled is typically less than 0.2 dB. When the equipment is calibrated in one mode of operation and reflection and transmission measurements are both made without recalibrating, repeatability can degrade measurement accuracy. For best accuracy the equipment should be calibrated and measurements made in one mode of operation to keep insertion loss the same for both calibration and measurement.

Repeatability problems are generally due to the center conductor flipper inside the switch not making contact with the same pressure each time the switch is cycled. To isolate a repeatability problem to a single switch, use the following procedure.

Transmission Check. Setup the 8743B, Network Analyzer, and Display Unit to calibrate for a transmission measurement (connect a through section between the 8743B UNKNOWN and TRANSMISSION RETURN ports). Cycle the coaxial switches by alternately pressing the TRANS and REFL pushbuttons while observing the transmission display for repeatability.

Reflection Check. Setup the 8743B, Network Analyzer, and Display Unit to calibrate for a reflection measurement (connect a coaxial short to the 8743B UNKNOWN port). Cycle the coaxial switches by alternately pressing the TRANS and REFL pushbuttons while observing the display for repeatability. Determine the faulty switch as follows:

1. If a repeatability problem occurred in both the REFLECTION and TRANSMISSION checks, replace A6 Test Port Relay Assembly (HP Part No. 5080-0301).

2. If a repeatability problem occurred in the REFLECTION check only, replace A5 Unknown Port Relay Assembly (HP Part No. 5080-0303).

3. If a repeatability problem occurred in the TRANSMISSION check only, replace A7 Transmission Return Port Relay Assembly (HP Part No. 5080-0302).

4-6. Insertion Loss

Insertion loss problems are generally caused by a discontinuity in a connector or cable. The indication that a problem may exist is an increase or decrease in the Network Analyzer's displayed magnitude at one or more frequencies during calibration. The Network Analyzer displays the ratio of reference channel to test channel power; therefore, a loss of power in the reference channel will appear on the display as an increase in test channel power. The direction of a spike in the displayed trace isolates the trouble to either the reference or test channel. Generally a discontinuity will show up at higher frequencies; therefore, troubleshooting should be done in X-band and then the instrument should be checked over the remaining operating range. To isolate an insertion loss problem, perform the troubleshooting procedure in Figure 4-2.

4-7. COAXIAL SWITCH REPLACEMENT PROCEDURE

Removal. To remove the A5, A6, and A7 Assemblies:

1. Remove the 8743B top and bottom covers.

2. Remove circuit board assemblies A1 and A3.

3. Remove cable W7 as follows:

   a. Remove the large thin nut securing the TEST output connector to the sub-deck.

   b. Disconnect W7 from the A6 Assembly using a ¾-inch open-end wrench, and slide as much of the cable as possible through the hole in the sub-deck.

4. Loosen W6 and W9's connectors to the A5 and A7 assemblies using a ¾-inch open-end wrench.

5. Unsolder the white and green wires (which come through the deck) from the A5 Assembly.

6. Remove the six coaxial switch mounting screws accessible from the bottom of the instrument.

7. Remove the A5, A6, and A7 Assemblies from the instrument as one unit.

8. Disconnect the switch to be replaced and unsolder the appropriate white and green wires. Mark the wires so they may be soldered to the proper terminals on the new switch.

Installation. To install the A5, A6, and A7 Assemblies:

1. Assemble the three coaxial switches into one unit.

2. Solder the white and green wires removed in step 8 of the removal procedure.

3. Insert the A5, A6, and A7 Assemblies into the 8743B as one unit. Do not install mounting screws.

4. Connect cables W6 and W9 to the appropriate switches and tighten each connector.

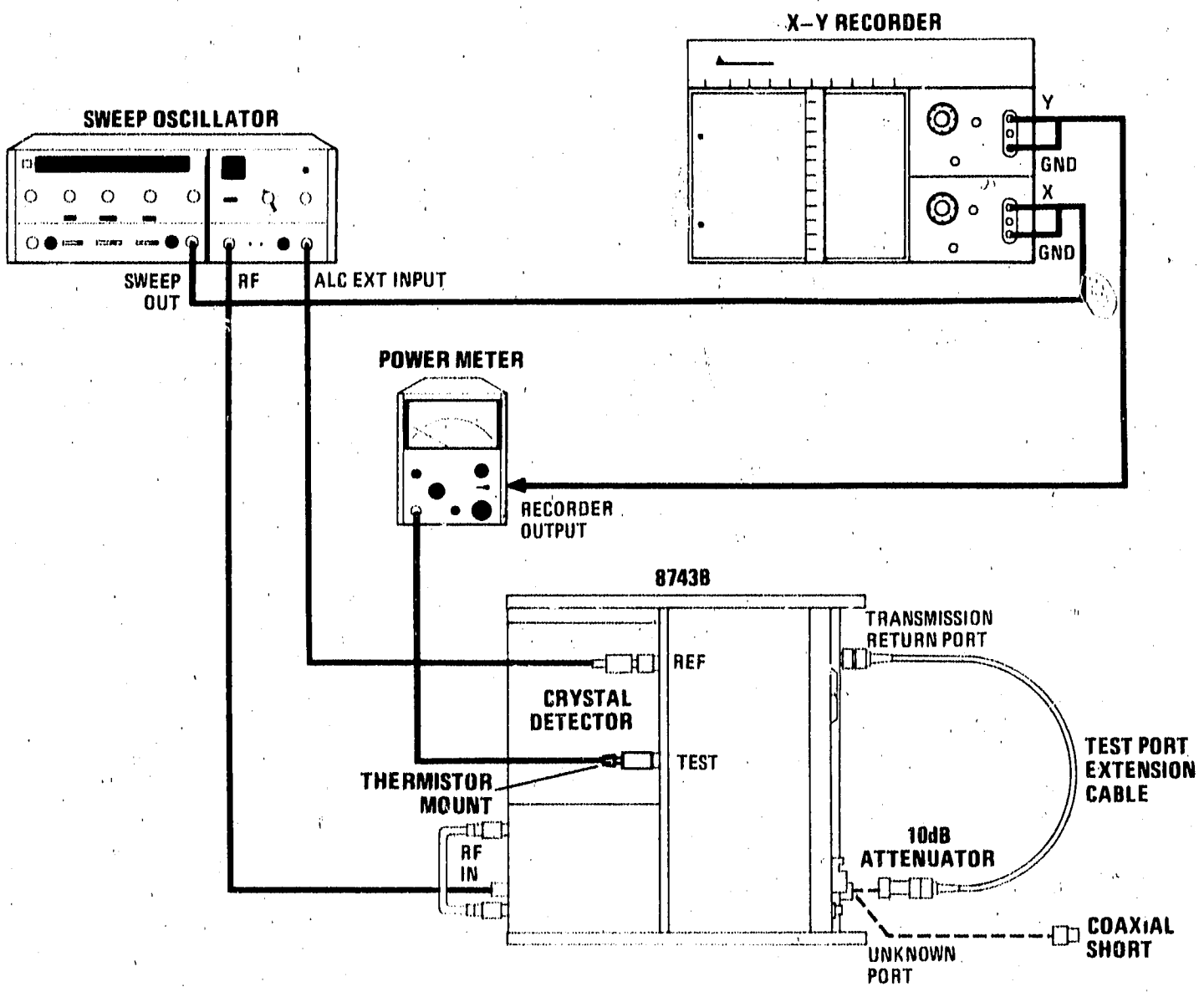
5. Connect cable W7 to the A6 Assembly and tighten connector.

6. Install the large thin securing nut to the TEST output connector.

7. Install the six coaxial switch mounting screws. Insure that green and white wires are not routed or pinched between switches and mounting deck.

8. Solder the wires removed in step 5 of the removal procedure, matching wire colors to the wires previously installed.

9. Perform the insertion loss troubleshooting procedure in Figure 4-2. If sharp power variations occur during any check, vary the torque on each coaxial switch connector, while observing the frequency response curve, until power variation is minimum.



SWEEP OSCILLATOR	HP 8620 Series, or HP 8350 Series with RF unit as required
POWER METER	HP 432A
THERMISTOR MOUNT	HP 8478B, Option 011
X-Y RECORDER	HP 7035B
CRYSTAL DETECTOR	HP 8470A
TEST PORT EXTENSION CABLE	HP 11610B
COAXIAL SHORT	HP 11565A
10 DB ATTENUATOR	HP 8492A Option 010

Figure 4.2. Insertion Loss Troubleshooting (1 of 4)

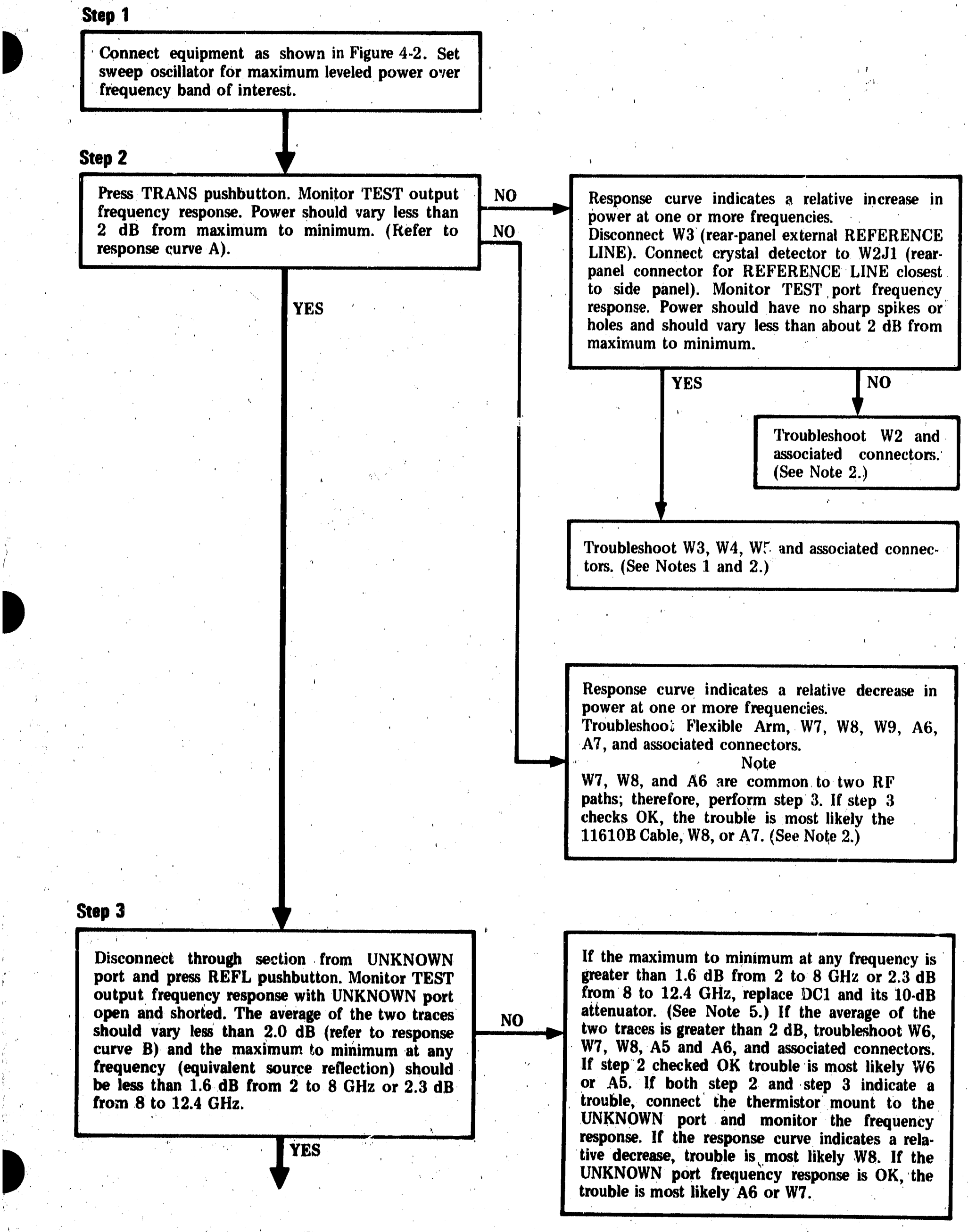
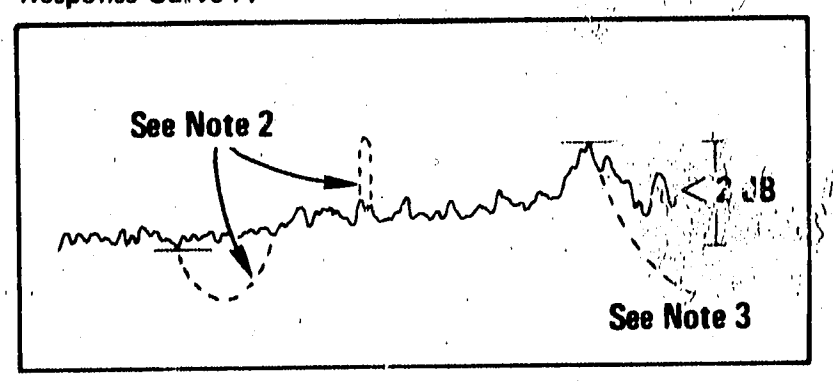
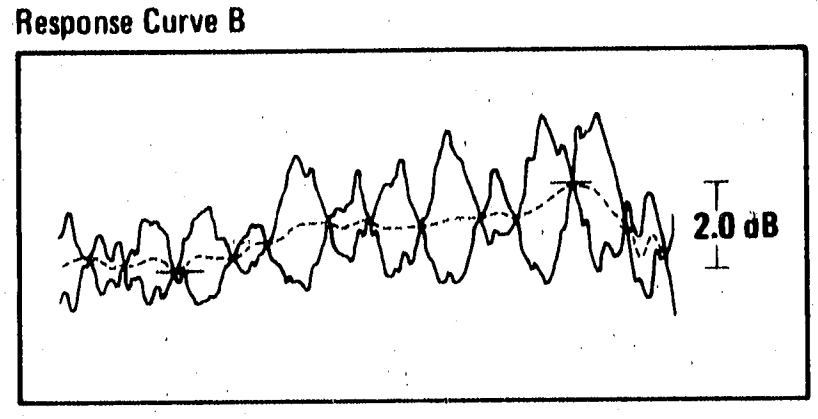


Figure 4.2. Insertion Loss Troubleshooting (2 of 4)

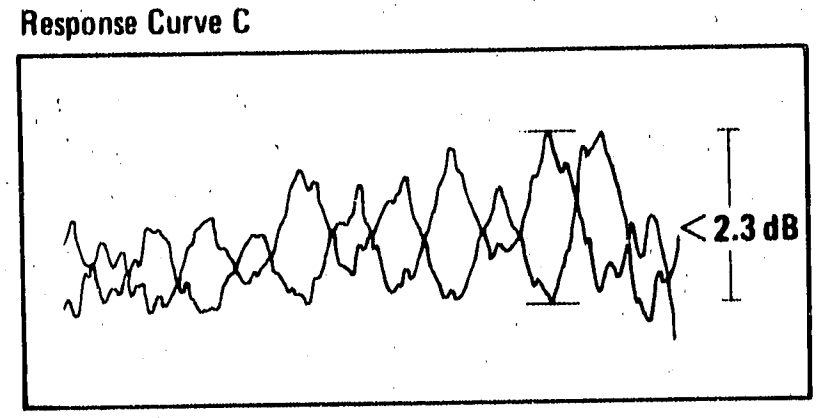
Response Curve A



Response Curve B



Response Curve C



NOTE 1

Reflections from a discontinuity on one side of the line stretcher will combine with reflections in the line stretcher or with reflections from the other side of the line stretcher. The response curve is the resultant of all discontinuities. By changing the line stretcher position, the phase relationship between the sets of reflections changes and the response curve will be altered. Monitor frequency response at several REFERENCE PLANE EXTENSION settings. If the overall power variation is greater than 2 dB at any REFERENCE PLANE EXTENSION setting, the trouble may be in the line stretcher or discontinuities on each side of the line stretcher.

NOTE 2

A relative increase in power indicates a trouble in the reference channel. A relative decrease in power indicates a trouble in the test channel. A narrow spike is most likely caused by poor contact of cable center conductor pins, one finger of a female pin not making contact, or gross outer conductor separation. A power change over a broader frequency range is most likely caused by a cable outer conductor grounding problem. For outer conductor grounding problems on instruments with Serial Numbers 928-00315 and below, disassemble the cable and add a washer (HP Part No. 5000-8676) as shown in Figure 4-3.

Figure 4.2. Insertion Loss Troubleshooting (3 of 4)

NOTE 3

If a cable's center conductor is not centered it may distort a switch's center conductor contact and cause an increase in insertion loss. The increased insertion loss is most likely to occur from 11 to 12.4 GHz (See Response Curve A.)

NOTE 4

Although cable ends appear to be perfect they may still present a discontinuity. Also trimming these cable ends requires special tools. Therefore, if you are unable to eliminate a discontinuity, replace the suspected cable.

NOTE 5

Directional Coupler DC1 (HP Part No. 5080-0316) includes a tuned 10 dB attenuator. If the troubleshooting procedure step 3 indicates a trouble in DC1 the problem could be the 10 dB attenuator. Check the coupler directivity using the Operating and Service Manual Performance Test Procedure. If the directivity is OK the trouble is most likely the 10 dB attenuator. The attenuator may be replaced using the following procedure:

CAUTION

Do not unscrew flat head screws, or brass attenuator housing connector. If the brass parts move, directivity may be degraded.

1. Using a 1/2 inch open end wrench, hold the brass attenuator housing connector to keep it from rotating. Using plastic jawed, or padded vise grip pliers, unscrew the round stainless steel part (not the part with the flats).

2. Remove attenuator cartridge. Do not remove gold plated center conductor contacts. A special tool is required to install these contacts.

3. Install a new attenuator cartridge (HP Part No. 08743-60014) with a washer on each side of the cartridge.

NOTE

The marked end of the cartridge has the lowest reflection and should go into the coupler.

4. Install the round stainless steel part removed in step 1.

Figure 4.2. Insertion Loss Troubleshooting (4 of 4)

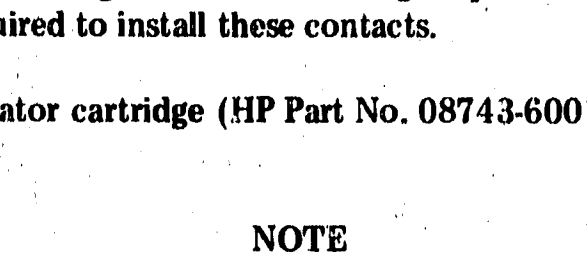


Figure 4-3. Position of Outer Conductor Washer

PARTS LIST

SECTION V
REPLACEABLE PARTS

5-1. INTRODUCTION

5-2. This section contains information for ordering replaceable parts. Parts are listed in alphanumerical order by reference designation together with their HP stock numbers and descriptions.

5-3. ORDERING INFORMATION

5-4. When ordering a replacement part listed in Table 5-2:

a. Quote the Hewlett-Packard stock number for the part.

b. Address the order or inquiry to the nearest Hewlett-Packard Sales and Service Office listed at the rear of this manual.

5-5. To order a part not listed in the tables:

a. Give a complete description of the part including its function and location.

b. Give the instrument model number and complete serial number.

c. Address the order of inquiry to the nearest Hewlett-Packard Sales and Service Office listed at the rear of this manual.

Table 5-1. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A = assembly	F = fuse	MP = mechanical part	V = vacuum, tube, neon bulb, photocell, etc.
B = motor	FL = filter	P = plug	VR = voltage regulator
BT = battery	IC = integrated circuit	Q = transistor	W = cable
C = capacitor	J = jack	R = resistor	X = socket
CP = coupler	K = relay	RT = thermistor	Y = crystal
CR = diode	L = inductor	S = switch	Z = tuned cavity, network
DL = delay line	LS = loud speaker	T = transformer	
DS = device signaling (lamp)	M = meter	TB = terminal board	
E = misc electronic part	MK = microphone	TP = test point	

ABBREVIATIONS

A = amperes	H = henries	N/O = normally open	RMO = rack mount only
AFC = automatic frequency control	HDW = hardware	NPO = negative positive zero (zero temperature coefficient)	RMS = root-mean square
AMPL = amplifier	HEX = hexagonal		RWV = reverse working voltage
	HG = mercury		
BFO = beat frequency oscillator	HR = hour(s)	NPN = negative-positive-negative	S-B = slow-blow
BE CU = beryllium copper	HZ = hertz		SCR = screw
BH = binder head		NRFR = not recommended for field replacement	SE = selenium
BP = bandpass	IF = intermediate freq		SECT = section(s)
BRS = brass	IMPG = impregnated	NSR = not separately replaceable	SEMICON = semiconductor
BWO = backward wave oscillator	INCD = incandescent		SI = silicon
	INCL = include(s)		SIL = silver
CCW = counter-clockwise	INS = insulation(ed)	OBD = order by description	SL = slide
CER = ceramic	INT = internal	OH = oval head	SPG = spring
CMO = cabinet mount only		OX = oxide	SPL = special
COEF = coefficient	K = kilo = 1000		SST = stainless steel
COM = common		P = peak	SR = split ring
COMP = composition	LH = left hand	PC = printed circuit	STL = steel
COMPL = complete	LIN = linear taper	PF = picofarads = 10^{-12} farads	TA = tantalum
CONN = connector	LK WASH = lock washer	PH BRZ = phosphor bronze	TD = time delay
CP = cadmium plate	LOG = logarithmic taper	PHL = Phillips	TGL = toggle
CRT = cathode-ray tube	LPF = low pass filter	PIV = peak inverse voltage	THD = thread
CW = clockwise		PNP = positive-negative-positive	TI = titanium
	M = milli = 10^{-3}		TOL = tolerance
DEPC = deposited carbon	MEG = meg = 10^{6}	P/O = part of	TRIM = trimmer
DR = drive	MET FLM = metal film	POLY = polystyrene	TWT = traveling wave tube
	MET OX = metallic oxide	PORC = porcelain	
ELECT = electrolytic	MFR = manufacturer	POS = position(s)	U = micro = 10^{-6}
ENCAP = encapsulated	MHZ = mega hertz	POT = potentiometer	VAR = variable
EXT = external	MINAT = miniature	PP = peak-to-peak	VDCW = dc working volts
	MOM = momentary	PT = point	
F = farads	MTG = mounting	PWV = peak working voltage	W/ = with
FH = flat head	MY = "mylar"		W = watts
FIL H = fillister head		RECT = rectifier	WIV = working inverse voltage
FXD = fixed	N = nano (10^{-9})	RF = radio frequency	
	N/C = normally closed	RH = round head or right hand	WW = wirewound
G = giga (10^{9})	NE = neon		W/O = without
GE = germanium	NI PL = nickel plate		
GL = glass			
GRD = ground(ed)			

Table 5-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	08743-60001	7	1	POWER SUPPLY ASSEMBLY	28480	08743-60001
A1C1	0160-2930	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2930
A1C2	0180-0141	2	1	CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A1CR1	1901-0026	3	4	DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A1CR2	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A1CR3	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A1CR4	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A1CR5	1901-0200	5	1	DIODE-PWR RECT 100V 1.5A	28480	1901-0200
A1CR6	1902-3193	3	1	DIODE-ZNR 13.3V 5% DO-35 PD=.4W	28480	1902-3193
A1Q1	1854-0071	7	7	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q2	1854-0039	7	3	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	01928	2N3053S
A1Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1R1	0698-3640	9	1	RESISTOR 1.8K 5% 2W MO TC=0+-200	27167	FP42-2-T00-1801-J
A1R2	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A1R3	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A1R4	0811-1672	5	1	RESISTOR 3.3 5% 2W PW TC=0+-400	75042	BWH2-3R3-J
A1R5	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A1R6	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R7	2100-1758	3	1	RESISTOR-TRMR 1K 5% WW SIDE-ADJ 1-TRN	28480	2100-1758
A2	08743-60002	8	1	SWITCH ASSEMBLY	28480	08743-60002
A2CR1	1901-0025	2	12	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A2CR2	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A2DS1	2140-0213	7	2	LAMP-INCAND 7387 28VDC 40MA T-1 3/4 BULB	0000J	7387
A2DS2	2140-0213	7		LAMP-INCAND 7387 28VDC 40MA T-1-3/4 BULB	0000J	7387
A2Q1	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2R1	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A2R2	0698-3450	9	2	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A2R3	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A2R4	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A2R5	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A2R6	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A2R7	0757-1000	7	1	RESISTOR 51.1 1% .5W F TC=0+-100	28480	0757-1000
A2S1				NOT SEPARATELY REPLACEABLE		
A2S2				NOT SEPARATELY REPLACEABLE		
A3	08743-60038	0	1	RELAY DRIVER ASSEMBLY	28480	08743-60030
A3C1	0150-0121	5	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A3CR1	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR2	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR4	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR5	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR6	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR7	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR8	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR9	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR10	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A3CR11	1902-0551	1	1	DIODE-ZNR 6.19V 5% DO-15 PD=1W TC=+.022%	28480	1902-0551
A3Q1	1854-0039	7		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	01928	2N3053S
A3Q2	1854-0039	7		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	01928	2N3053S
A3Q3	1853-0012	4	2	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A3Q4	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A3Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q6	1853-0020	4	2	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A3Q7	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A3Q8	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3R1	0698-3408	7	2	RESISTOR 2.15K 1% .5W F TC=0+-100	28480	0698-3408
A3R2	0698-3408	7		RESISTOR 2.15K 1% .5W F TC=0+-100	28480	0698-3408
A3R3	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A3R4	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3R5	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 5-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R6	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R7	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R9	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A3R10	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A3R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8 T0-1002-F
A3R12	0757-1078	9	1	RESISTOR 1.47K 1% .5W F TC=0+-100	28480	0757-1078
A3R13	0698-3406	5	2	RESISTOR 1.33K 1% .5W F TC=0+-100	28480	0698-3406
A3R14	0698-3406	5		RESISTOR 1.33K 1% .5W F TC=0+-100	28480	0698-3406
A3R15	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A4	00741-60004	0	1	LINE STRETCHER ASSEMBLY NOTE IF A5, A6, OR A7 NEEDS TO BE REPLACED THE RECOMMENDED PROCEDURE IS TO REPLACE ALL THREE WITH A MATCHED SET OF THREE, HP PART NUMBER 5080-0310. FOR OPTION 18, THE RECOMMENDED REPLACEMENT IS HP PART NUMBER 5080-0289.	28480	00741-60004
A5	5080-0303	1	1	RELAY ASSEMBLY-UNKNOWN PORT	28480	5080-0303
A6	5080-9301	9	1	RELAY ASSEMBLY-TEST PORT	28480	5080-0301
A7	5080-0302	0	1	RELAY ASSEMBLY-TRANSMISSION RETURN PORT	28480	5080-0302
C1	0180-0190	9	1	CAPACITOR-FXD 1500UF+100-10% 50VDC AL	28480	0180-0190
DC1	5080-0316	6	1	DIRECTIONAL COUPLER (TEST)	28480	5080-0316
DC1	5080-0288	1	1	DIRECTIONAL COUPLER (TEST) OPTION 010	28480	5080-0288
DC2	5080-0300	8	1	DIRECTIONAL COUPLER (INPUT)	28480	5080-0300
DS1	2140-0244	4	1	LAMP-GLOW ATH 135/105VDC 1.2MA T-2-BULB	00466	411
F1	2110-0336	2	1	FUSE .8A 250V TD 1.25X.25 UL (FOR 115V OPERATION)	28480	2110-0336
F1	2110-0340	8	1	FUSE .4A 250V TD 1.25X.25 UL (FOR 230V OPERATION)	75915	313.400
J1	1251-0085	5	1	CONNECTOR 36-PIN F MICRO RIBBON	28480	1251-0085
J2	1251-2357	8	1	CONNECTOR-AC PWR MP-2 MALE FLG-MTG	28480	1251-2357
Q1	1854-0072	8	1	TRANSISTOR NPN 2N3054 SI TO-66 PD=25W	01928	2N3054
R1	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
S1	3101-2195	7	1	SWITCH-SLIDE DPST (PILOT LIGHT)	28480	3101-2195
S2	3101-1235	4	1	SWITCH-SLIDE DPDT (115/230V AC)	28480	3101-1235
T1	9100-2728	6	1	TRANSFORMER-24.4V	28480	9100-2728
W1	0120-1348	5	1	CABLE ASSY 18AWG 3-CNDCT BLK-JKT	28480	0120-1348
W2	00743-20054	6	1	CABLE ASSEMBLY-DC2 TO W3	28480	00743-20054
W3	00745-20064	0	1	CABLE ASSEMBLY-EXT REF LINE	28480	00745-20064
W4	00743-20023	9	1	CABLE ASSEMBLY-W3 TO A4	28480	00743-20023
W5	00743-20024	0	1	CABLE ASSEMBLY-A4 TO A8	28480	00743-20024
W6	00743-20053	5	1	CABLE ASSEMBLY-A5 TO DC1	28480	00743-20053
W7	00743-20026	2	1	CABLE ASSEMBLY-A6 TO TEST OUTPUT	28480	00743-20026
W8	00743-20027	3	1	CABLE ASSEMBLY-DC2 TO UNKNOWN PORT	28480	00743-20027
W9	00743-20035	3	1	CABLE ASSEMBLY-A7 TO TRANS RETURN PORT	28480	00743-20035
XF1	2110-0470	5	1	FUSEHOLDER BODY EXTR PST; BAYONET; TND (RECOMMENDED REPLACEMENT)	75915	345003-010
				MISCELLANEOUS PARTS		
	0370-0770	6	1	KNOB	28480	0370-0770
	5000-6469	4	1	LABEL-PUSHBUTTON "TRANS"	28480	5000-6469
	5000-6470	7	1	LABEL-PUSHBUTTON "REFL"	28480	5000-6470
	00743-60014	2	1	10DB ATTENUATOR CARTRIDGE	28480	00743-60014
	0370-0974	2	1	PUSHBUTTON .602X.730X.410 IN HT JADE	28480	0370-0974
	0370-0975	3	1	END CAP .218X.545X.479 IN HT LH	28480	0370-0975
	0370-0976	4	1	END CAP .218X.545X.479 IN HT RH	28480	0370-0976
	5000-8705	5	1	SIDE COVER-REAR, OLIVE GRAY	28480	5000-8705
	5000-8707	7	1	SIDE COVER-FRONT, OLIVE GRAY	28480	5000-8707
	5040-0351	5	1	BEZEL-COUNTER, MINT GRAY	28480	5040-0351
	5060-0268	5	1	COVER ASSEMBLY-BOTTOM, OLIVE GRAY	28480	5060-0268
	5060-8737	9	1	RETAINER-HANDLE ASSY, OLIVE GRAY	28480	5060-8737
	00743-00010	0	1	PANEL-REAR, MINT GRAY	28480	00743-00010
	00743-00019	1	1	COVER ASSEMBLY-TOP, OLIVE GRAY	28480	00743-00019
	00743-00020	4	1	TOP COVER REAR CORNER, OLIVE GRAY	28480	00743-00020

See introduction to this section for ordering information
*Indicates factory selected value

Table 5-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	08743-00021	5	1	FILLER PLATE-CENTER, OLIVE GRAY	28480	08743-00021
	08743-00022	6	1	FILLER PLATE-SIDE, OLIVE GRAY	28480	08743-00022
	08743-00031	7	1	PANEL-FRONT, MINT GRAY (STD)	28480	08743-00031
	08743-00032	8	1	PANEL-FRONT, MINT GRAY (OPT. 018)	28480	08743-00032
	08743-00023	7	1	SUB-DECK,OLIVE GRAY	28480	08743-00023
	08743-20055	7	1	TRIM-LOWER FRAME, MINT GRAY	28480	08743-20055
	08743-20069	3	1	TRIM-UPPER FRAME, MINT GRAY	28480	08743-20069

See introduction to this section for ordering information
*Indicates factory selected value

Table 5-3. Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
0000J	GTE SYLVANIA MINIATURE LT PROD	HILLSBORO	NH	03244
0046G	NORELCO NORTH AMER PHILIPS LTG CORP	LOS ANGELES	CA	90021
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
0192B	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	08876
19701	MEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON	NC	28401
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA	PA	19108
75915	LITTELFUSE INC	DES PLAINES	IL	60016

SERVICE INFORMATION

SECTION VI
SERVICE

6-1. INTRODUCTION

6-2. This section contains repair procedures for the APC-7 connectors as well as schematic diagrams and major assemblies and component parts locations.

6-3. SCHEMATIC DIAGRAMS

6-4. The schematic diagrams in this section represent the circuits electrically. They are not wiring diagrams, though wire colors are given where practical.

6-5. The circuits are arranged according to signal flow, consequently, some switch and circuit assemblies may be shown in part on more than one diagram. If so, the reference designation is preceded by P/O, for "Part Of", and is followed by a notation of the number of parts into which the assembly has been divided.

6-6. Some of the general information obtainable from the schematic diagrams is shown in Figure 6-1. Notes and explanations of symbols pertaining to all the diagrams are contained in figure 6-2. Notes about specific components, circuits, or conditions are given on the diagram to which they apply.

6-7. As an aid to finding components and assemblies in the set of diagrams, each diagram has a box labeled Reference Designations that contains all the reference designations appearing on the diagram.

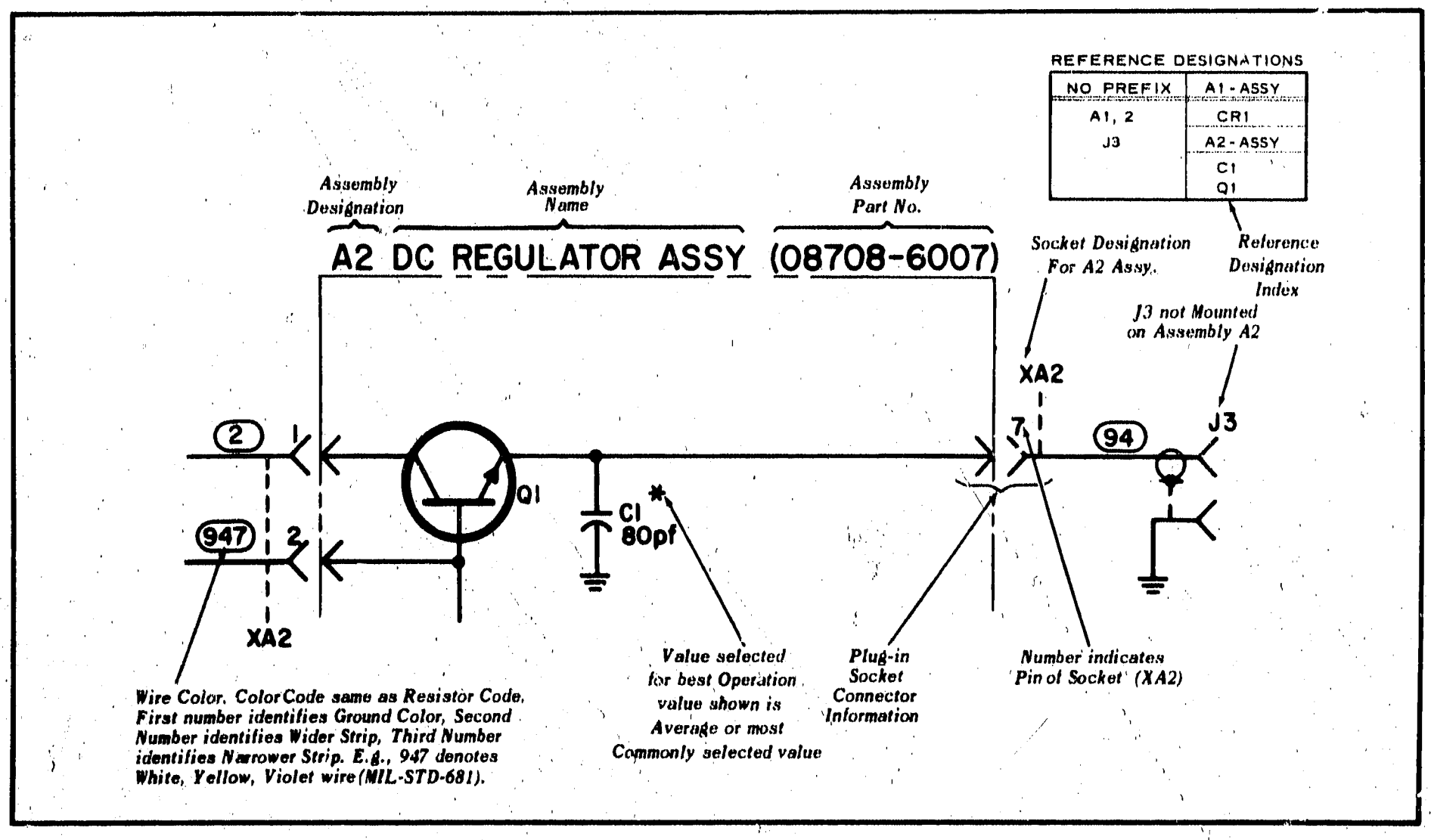


Figure 6-1. General Information on Schematic Diagrams

6-8. DISASSEMBLY PROCEDURES

6-9. Front Panel Removal

6-10. In order to remove the front panel from the 8743B, perform the following:

1. Remove the REFERENCE PLANE EXTENSION knob using an allen wrench.
2. Remove three screws holding the bottom rail and remove the bottom rail.
3. Tilt the front panel out at the bottom.
4. Slide the front panel out and down.
5. Disconnect the wires and power switch from the panel.

6-11. Connector Coupling Replacement

6-12. The coupling mechanism on either the UNKNOWN or TRANSMISSION RETURN port (Figure 3-11), may be replaced. A special spanner wrench, HP Part Number 5060-0237[1], and a 1/2-inch open end wrench are required.

CAUTION

The UNKNOWN port connector is part of a directional coupler. When tightening or loosening the coupling sleeve assembly on this connector, be sure to hold the flats of the gold section with a ½-inch open end wrench to prevent the turning torque from being transmitted into the directional coupler.

To remove a coupling mechanism:

1. Remove the front panel as described in Paragraph 6-9.
2. Fully extend the coupling sleeve to provide a guide for the spanner wrench.
3. Align the wrench so both pegs engage the holes in the end of the coupling sleeve assembly.
4. Hold the gold section with a 1/2-inch open end wrench to prevent torque from reaching the directional coupler while unscrewing the sleeve assembly by turning the spanner wrench counterclockwise.

6-13. When installing a coupling mechanism, set the coupling nut in place on the connector first, then thread on the coupling sleeve assembly. Hold the gold section with a 1/2-inch open end wrench while tightening the coupling firmly with the spanner wrench. Extending the coupling sleeve helps to keep the spanner in position during the final tightening.

6-14. Connector Center Conductor Contact

6-15. The center conductor contacts of the UNKNOWN and TRANSMISSION RETURN APC-7 connectors can be replaced. If any of the fingers of the center conductor contact get scratched or bent, the contact must be replaced. Procedures for replacing this contact are given in Paragraph 3-23.

[1] Part of APC-7 Connector Tool Kit 11591A.

1. Resistance in ohms, capacitance in microfarads unless otherwise noted.

2. Voltages shown on schematic diagrams taken with HP 414A AUTOVOLTMETER: input resistance 100 M Ω, accuracy ±(1% of reading +0.5% of full scale).

3. Unless otherwise indicated on schematic, voltages taken with negative terminal of voltmeter connected to A7TP2.

4. * Asterisk denotes a factory-selected value. Value shown is typical. Part may be omitted.

5. P/O = Part Of.

6. Encloses front panel designations.

   Encloses rear panel designation.

7. ——— Circuit assembly borderline.

   - - - - - - - Other assembly borderline.

8. (1) Numbers in circles on circuit assemblies show locations of test points. Matching numbers are etched on the circuit assemblies.

9. Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the ground color, second number the wider stripe, and the third number identifies the narrower stripe. E.G., (947) denotes white ground, yellow wide stripe, violet narrow stripe.

10. Voltage regulator (breakdown) diode.

11. Power Supply Common (not chassis ground).

12. Screwdriver adjustment.

13. Panel control.

14. Heavy dashed line indicates feedback path.

15. CW Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.

Figure 6-2. Schematic Diagram Notes

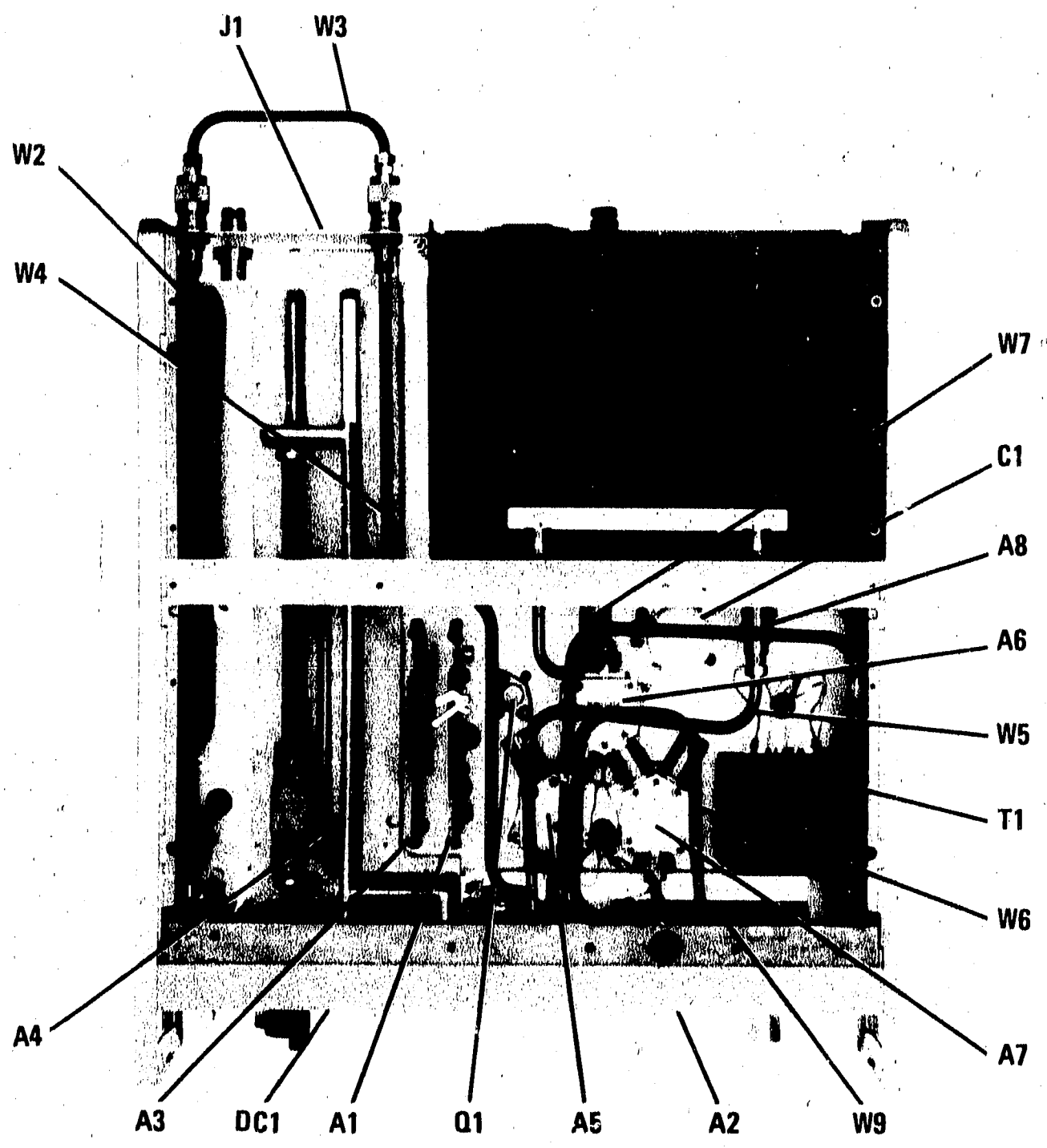


Figure 6-3. 8743B Component Identification, Top View

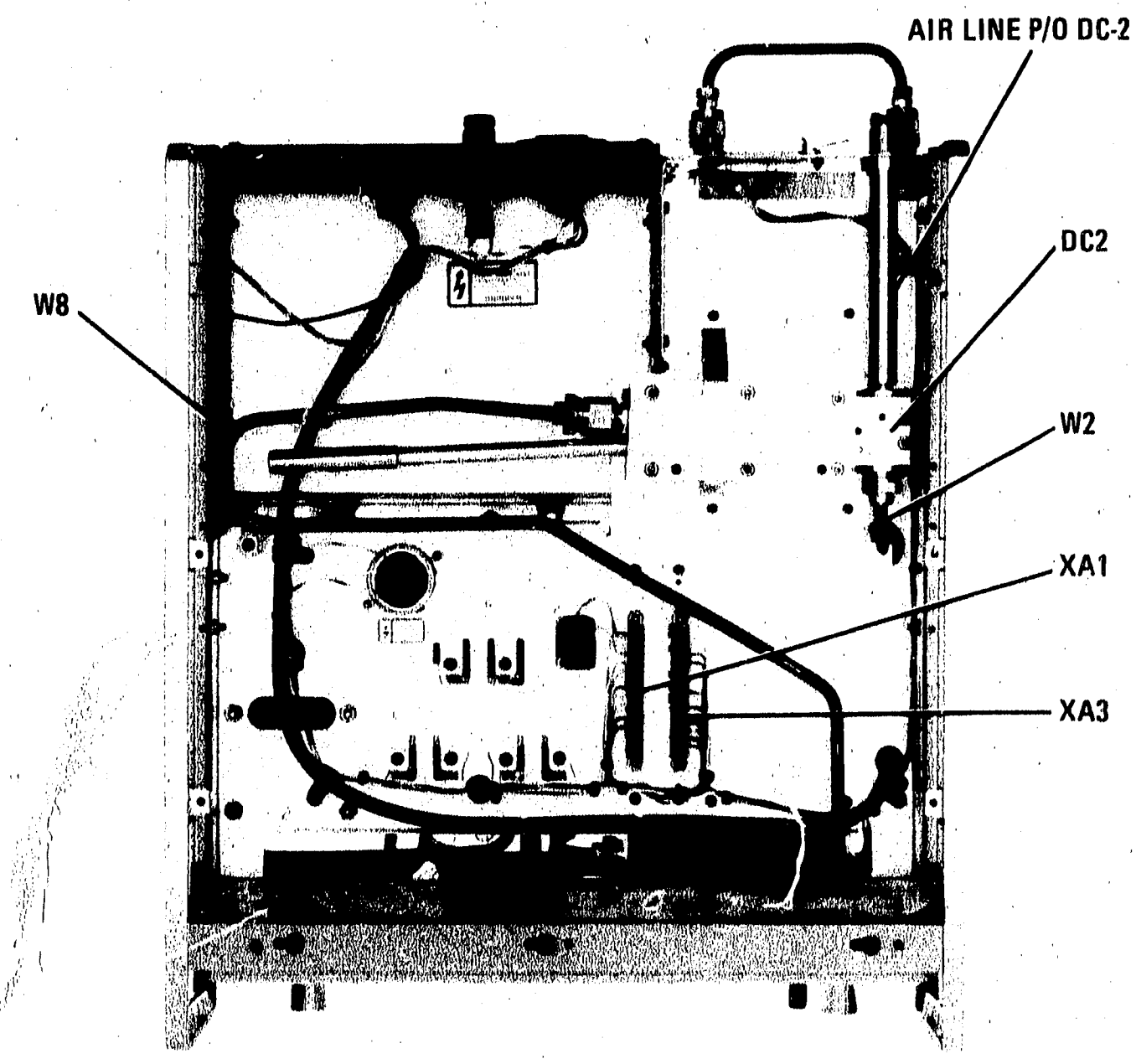


Figure 6-4. 8743B Component Identification, Bottom View

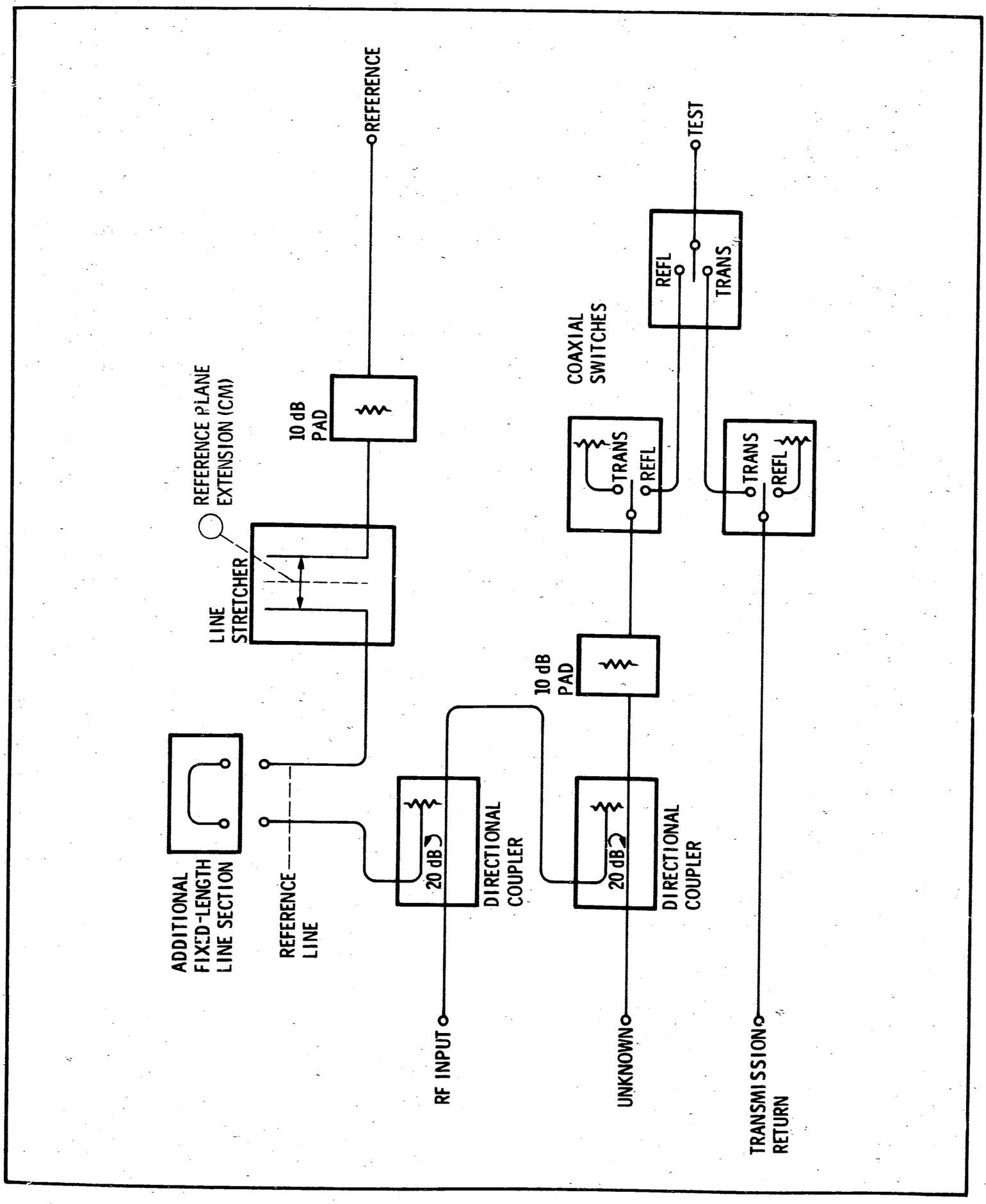


Figure 6-5. Simplified RF Schematic Diagram

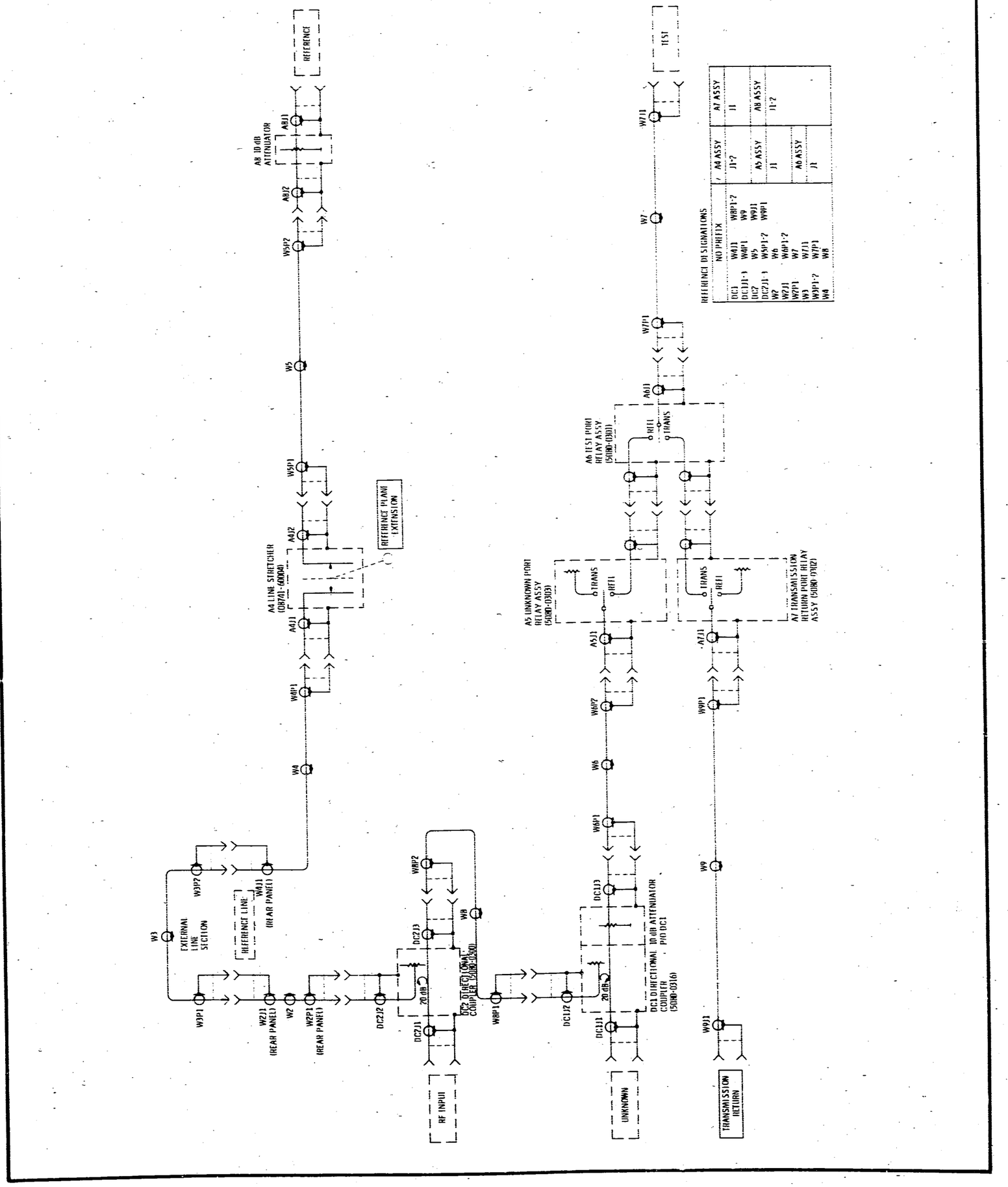


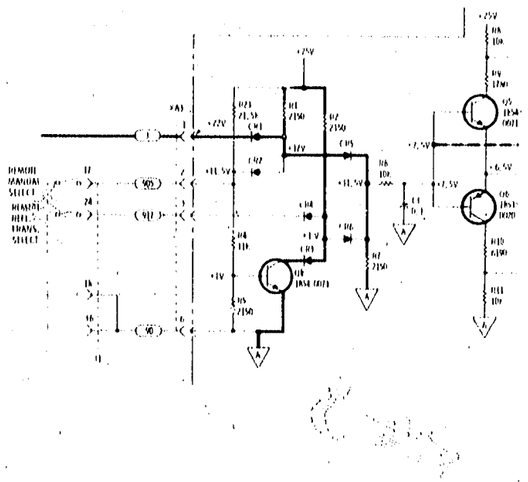
Figure 6-6. RF Schematic Diagram

MANUAL CONTROL

REFLECTION

REFLECTION

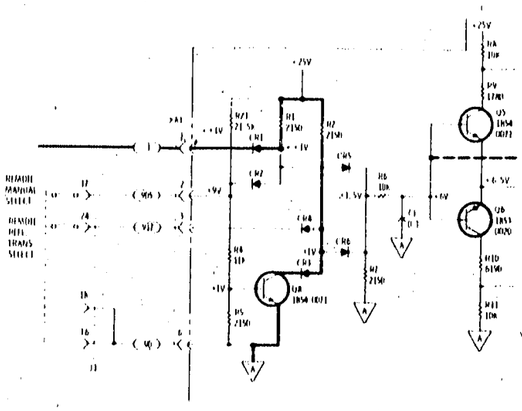
A high output from the flip-flop reverse biases CR1. With CR1 open the majority of current through R1 flows through CR5 and R7. The voltage across R7 is > 6V which turns Q5 on and Q6 off.



TRANSMISSION

TRANSMISSION

A low output from the flip-flop causes CR1 to conduct which reverse biases CR5. The voltage across R7 decreases to < 3V which turns Q5 off and Q6 on.



REMOTE CONTROL

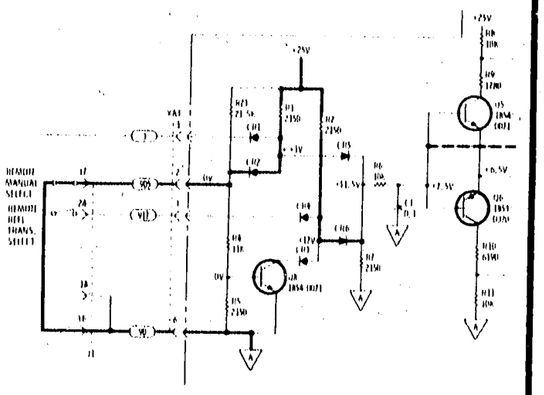
REFLECTION

REMOTE OPERATION SELECT

Shorting pin 17 to pin 18 or 36 of J1 causes CR2 to conduct and clamps R1-CR5 junction to about +1V. With R1-CR5 junction clamped the flip-flop output has no effect, and CR5 is open. Thus manual (front-panel) operation is disabled.

REFLECTION

Shorting pin 17 to pin 18 or 36 of J1 cuts Q9 off by shorting base to emitter. With Q9 cut off CR6 conducts and the voltage across R7 is high (> 6V) which turns Q5 on and Q6 off.



TRANSMISSION

REMOTE OPERATION SELECT

Shorting pin 17 to pin 18 or 36 of J1 causes CR2 to conduct and clamps R1-CR5 junction to about +1V. With R1-CR5 junction clamped the flip-flop output has no effect, and CR5 is open. Thus manual (front-panel) operation is disabled.

TRANSMISSION

Shorting pin 24 to pin 18 or 36 of J1 causes CR4 to conduct and CR6 is open. The voltage across R7 is low (< 3V) which turns Q5 off and Q6 on.

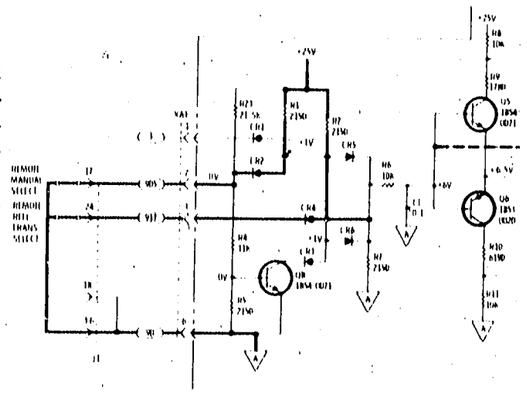
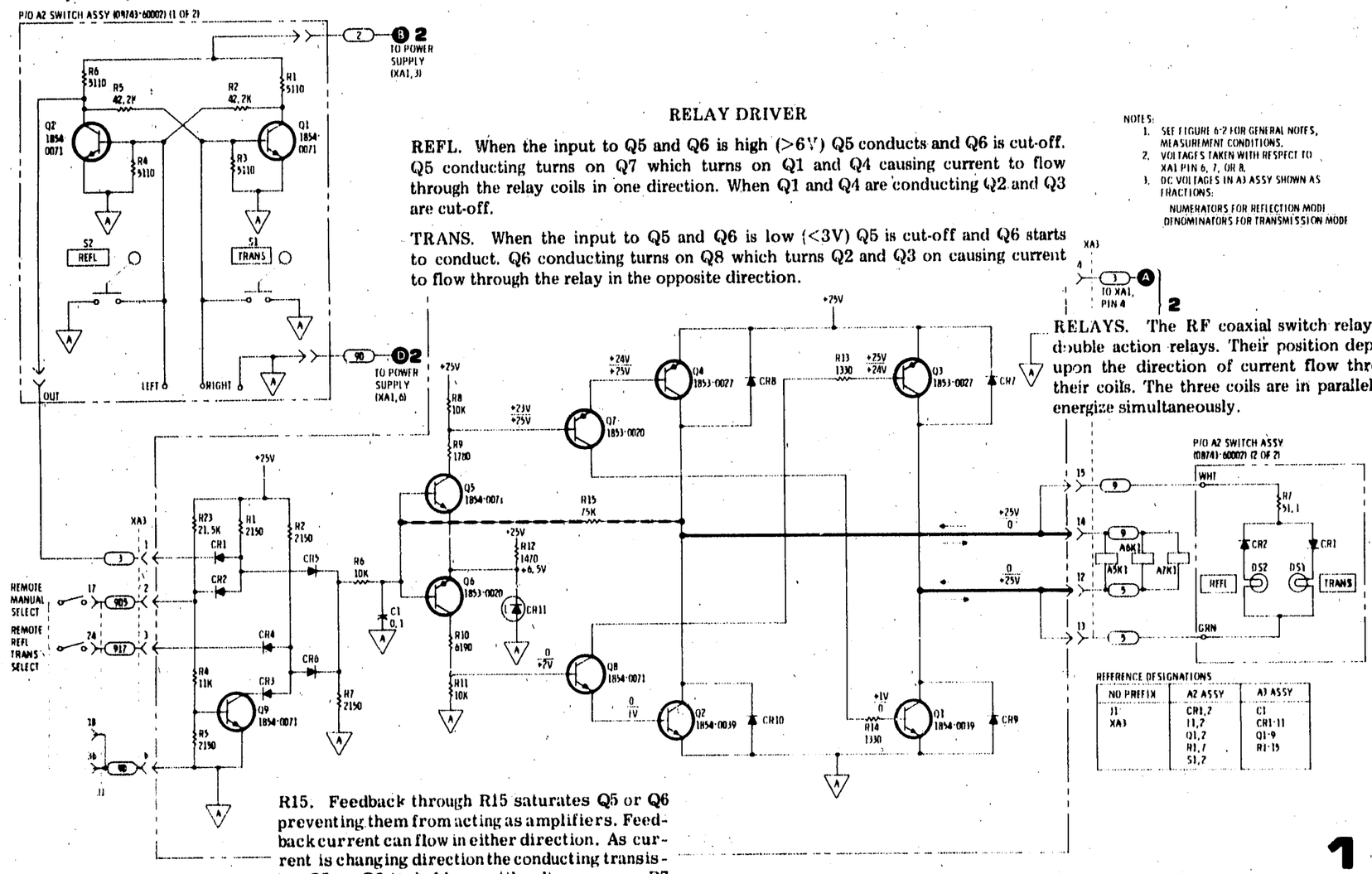


Figure 6-7. Relay Driver Input Circuit Talking Schematic Diagram

FLIP-FLOP. In manual or front panel operation the flip-flop controls the relay driver circuit. The flip-flop output is taken from the collector of Q2. Depressing the REFL pushbutton grounds the base of Q2, cutting Q2 off. The output is then high. Depressing the TRANS pushbutton cuts Q1 off. When Q1 is cut-off its collector is high which causes Q2 to conduct. The output of Q2 is then low.



R15. Feedback through R15 saturates Q5 or Q6 preventing them from acting as amplifiers. Feedback current can flow in either direction. As current is changing direction the conducting transistor Q5 or Q6 is held on until voltage across R7 passes through the range of ≈3V to ≈6V, preventing the relay driver from switching on noise. If the relay driver is in TRANS mode it will not switch to REFL mode until voltage across R7 is above +6V. If the relay driver is in REFL mode, it will not switch to TRANS mode until voltage across R7 is below 3V.

Figure 6-8. Relay Driver Talking Schematic Diagram

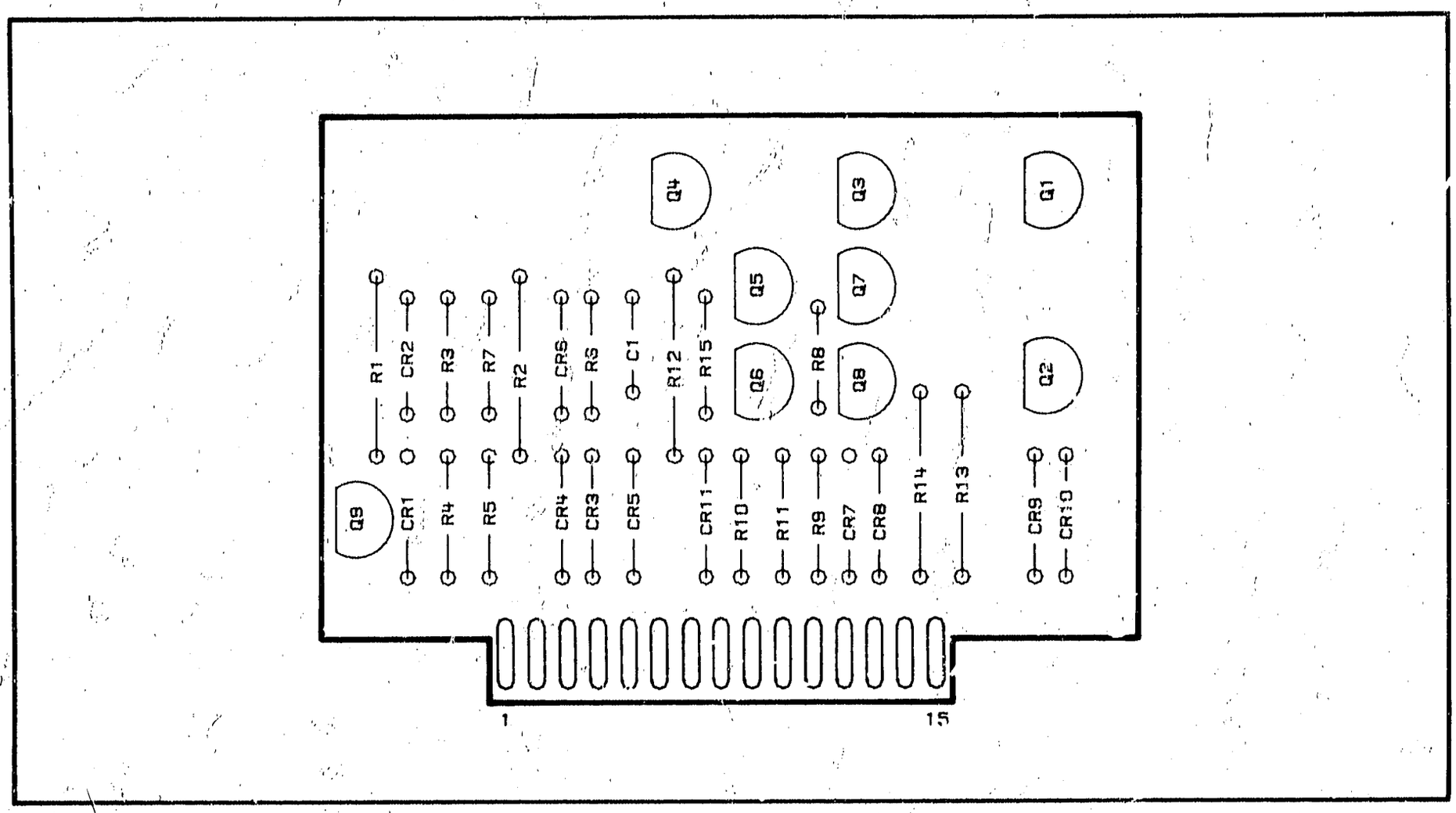


Figure 6-9. Relay Driver Assy Component Identification

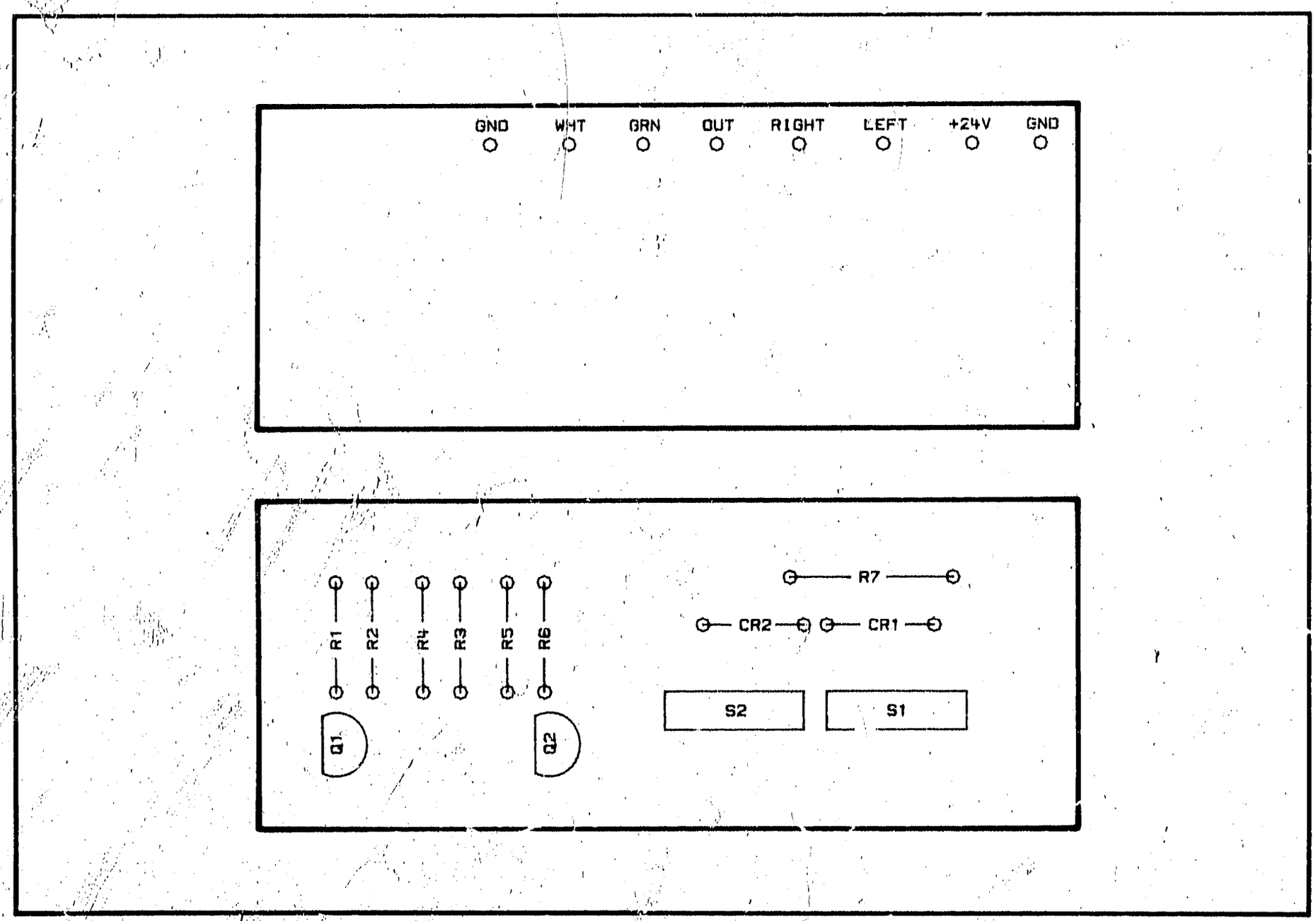


Figure 6-10. Switch Assy Component Identification

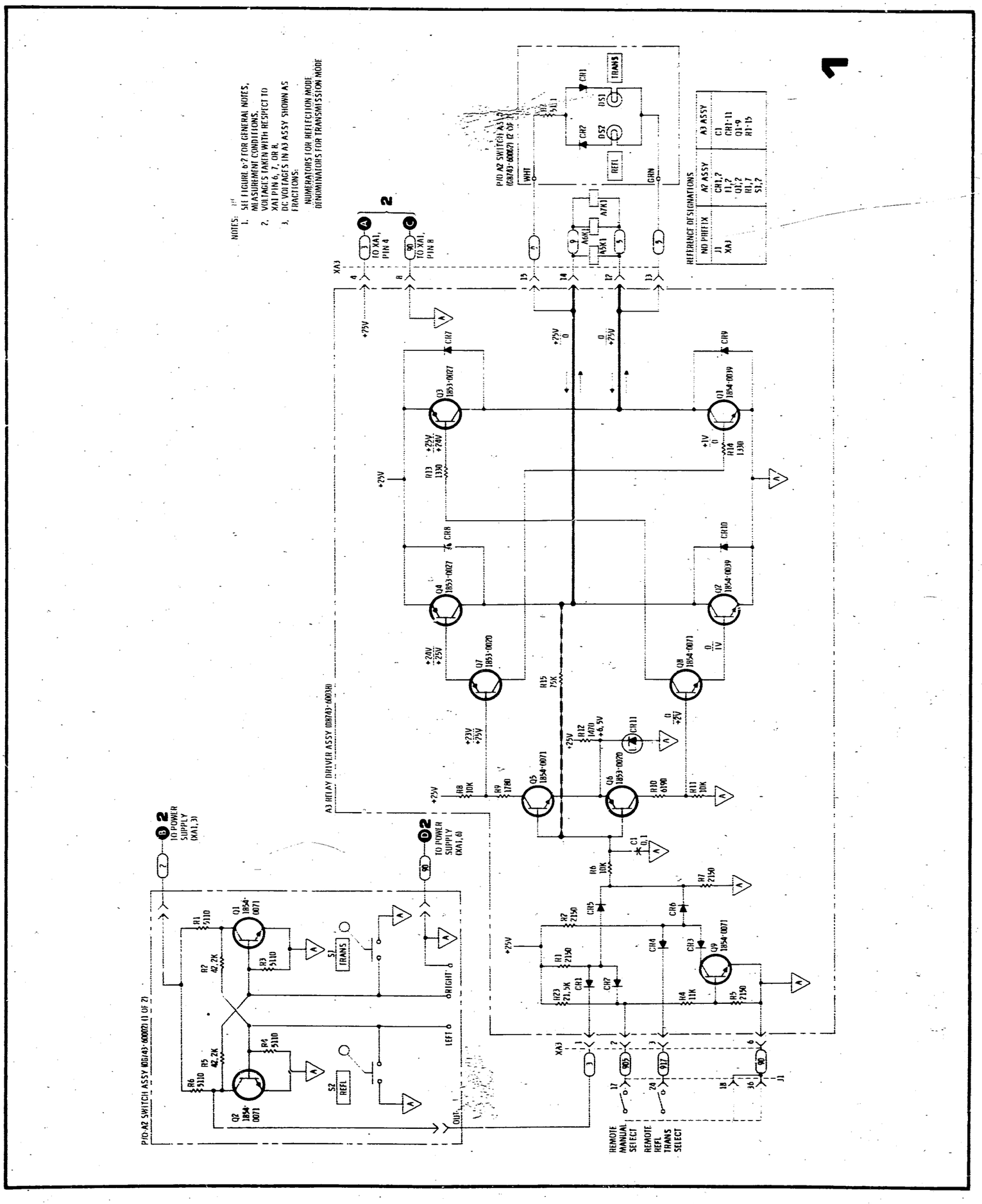


Figure 6-11. Relay Drive Assembly Schematic Dia

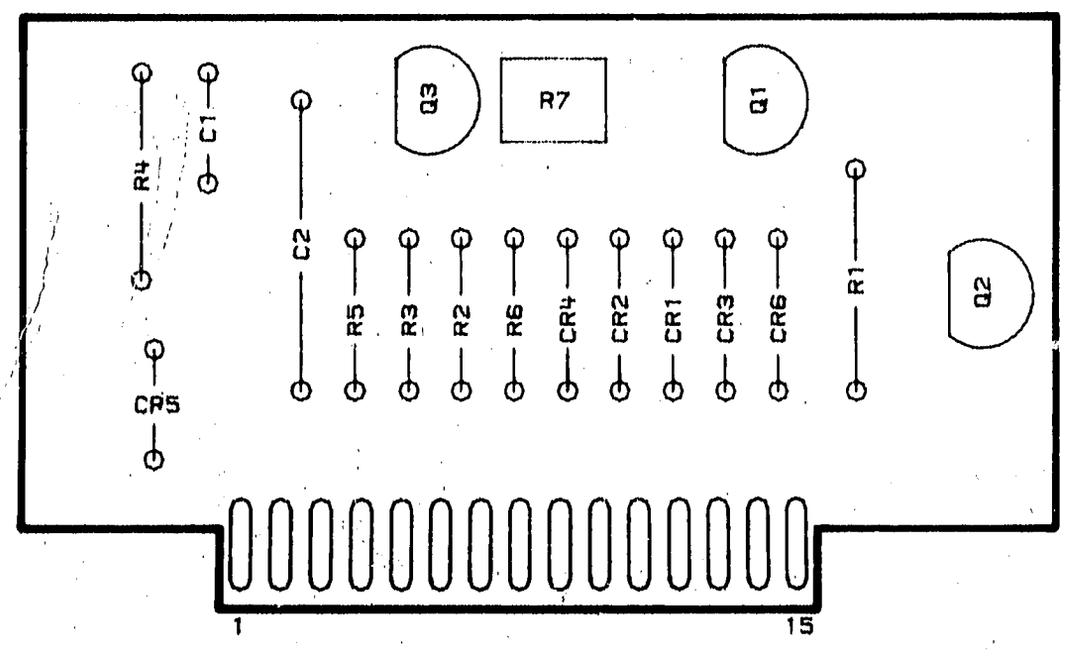


Figure 6-12. Power Supply Assy Component Identification

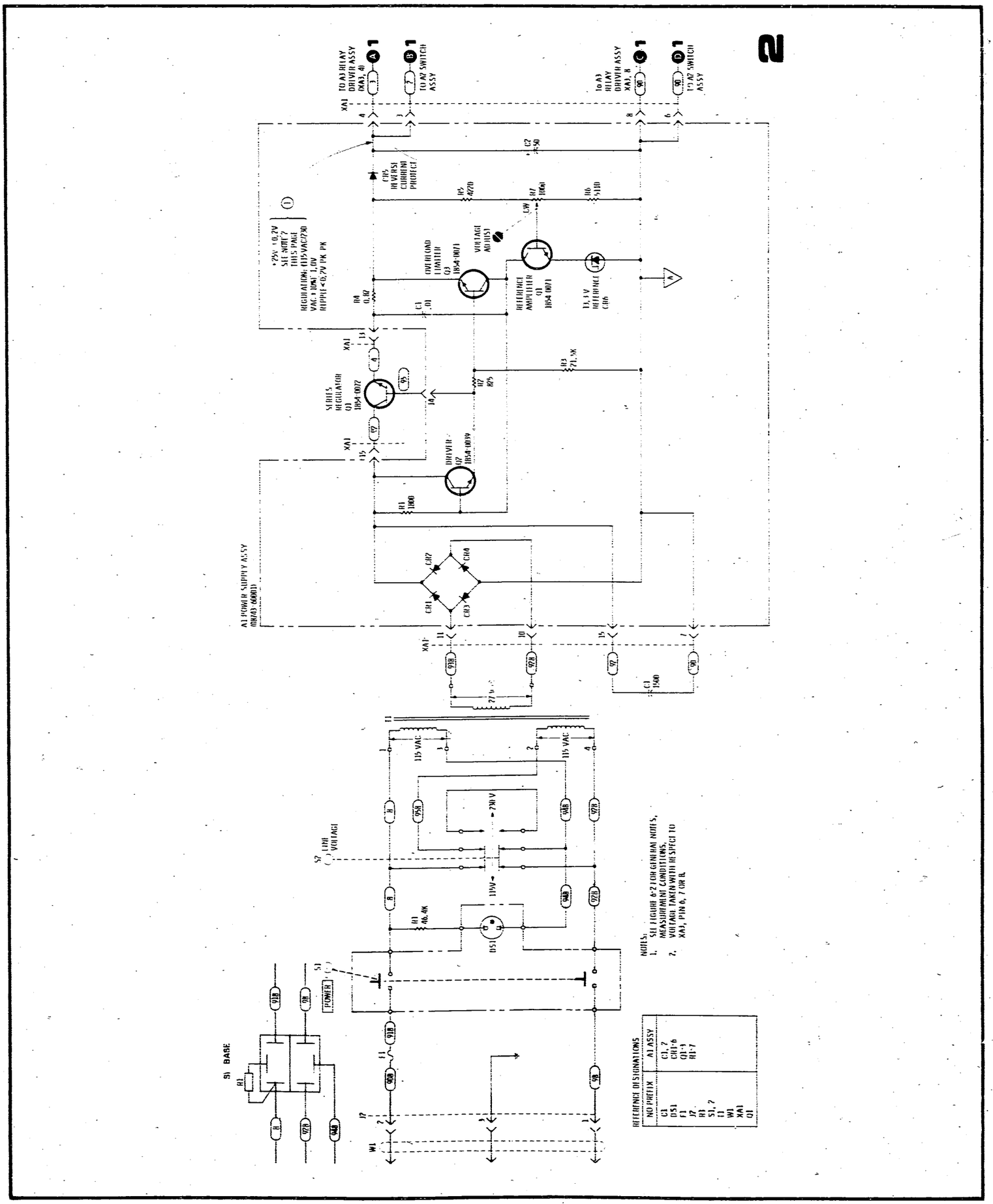


Figure 6-13. Power Supply Schematic

MANUAL CHANGES

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 8743B
Date Printed: August 1981
Part Number: 08743-90040

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement, make all ERRATA corrections and all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

► NEW ITEM

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

Printed in U.S.A.

13 JUNE 1984

2 pages

HEWLETT PACKARD

ERRATA

Page 5-3, Table 5-2:

Change the first reference of DC1 to HP Part Number 5080-0330.

Change the HP Part Number of DC2 to 5080-0316.

Change the entry for W9 as follows:

Ref. Desig.	HP P/N	CD	Description
W9	08743-20035	3	Cable Assembly (Includes only W9J1 and cable. Does not include W9J2 and associated hardware and W9MP1 thru W9MP3 listed below.)
W9J2	08743-20031	9	APC-7 CONNECTOR AT TRANS RETURN PORT
W9J2MP1	1250-0909	0	APC-7 NUT
W9J2MP2	1250-0816	8	CONTACT PIN
W9J2MP3	5040-0306	0	BEAD
W9J2MP4	08740-2087	5	CENTER CONDUCTOR
W9J2MP5 thru MP7	2200-0169	0	SCREW-MACH 4-40 .5-IN-LG 82 DEG
W9MP1	08743-20032	0	CONNECTOR SUPPORT
W9MP2	0590-0035	2	BUSHING-LKG NUT .218-LG 3/8-32-THD BRS
W9MP3	5000-8976	2	CABLE WASHER

Change XF1 to HP Part Number 2110-0564, CD 8.

Page 5-4, Table 5-2:

Add HP Part Number 0370-1113, Knob, Gray.

► Add HP Part Number 08743-00015, CD 7, Brace, Coupler.

► Add HP Part Number 08743-00003, CD 3, Deck, Mounting (Includes Transister Socket, HP Part Number 1200-0168, CD 8).

Page 6-9 and 6-11, Figure 6-8 and 6-11:

Reverse the direction of diodes A2CR1 and A2CR2.