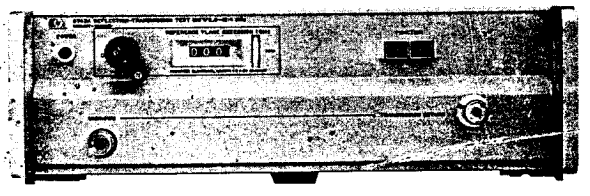
OPERATING AND SERVICE MANUAL

THIS MANUAL CONTAINS A SUPPLEMENT FOR A SPECIAL MODIFICATION TO THE INSTRUMENT. SEE INSIDE COVER.

0-560157

REFLECTION-TRANSMISSION TEST UNIT

8743A



HEWLETT hp PACKARD

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OPERATING AND SERVICE MANUAL

MODIFICATIONS

S-PARAMETER TEST SET
8743A-H23

SERIAL NO. PREFIX
1702A AND ABOVE

MODIFICATION PART NO.
08743-90035
APRIL 1978
REV. I - FEBRUARY 1979

USE THIS MODIFICATION
WITH MANUAL PART NO.
08743-90010
PRINTED: JULY 1972

0-5001495R

HEWLETT-PACKARD COMPANY 3273 AIRWAY DRIVE, SANTA ROSA, CALIFORNIA, U.S.A.

INTRODUCTION:

This Modification describes the differences in the 8743A-H23 S-Parameter Test Set. In addition, it describes the manual changes necessary to document the instrument.

DESCRIPTION:

The Model 8743A-H23 S-Parameter Test Set is a standard 8743A which has been tested to operate to 18 GHz and also provides 10 dB additional dynamic range for transmission measurements and provides an additional 10 dB isolation between the UNKNOWN and TEST ports for reflection measurements. The 8743A-H23 also provides a variable 0 dB to 70 dB attenuation to the UNKNOWN port by means of an internal programmable attenuator. Attenuation is achieved by the external closure of a switch (such as the 59306A HP-IB Relay Actuator).

MANUAL CHANGES NECESSARY TO DOCUMENT THE HP 8743A-H23:

Page 1-1, Paragraph 1-2:

Change Frequency Range to 2.0-18.0 GHz

Page 1-1, Table 1-1:

Change Frequency Range to 2.0-18.0 GHz

Add to Reflection Coefficient, UNKNOWN port:

12.4 to 18.0 GHz $\leq$ 0.20 (VSWR 1.5)

Add to Reflection Coefficient:

Transmission Return Port:

Reflection Measurement: 12.4-18.0 GHz $\leq$ .2 (VSWR 1.5)

Transmission Measurement: 12.4-18.0 GHz $\leq$ .23 (VSWR 1.6)

Add to Coupler Directivity:

2.0-12.4 GHz $\geq$ 30 dB

12.4-18.0 GHz $\geq$ 18 dB typically 20 dB

Page 5-3, Table 5-1:

Change: A5, A6, A7 to HP Part No. 5080-0290, Switch Tree (Matched set of three)

Change: DC1 to HP Part No. 5080-0288, Coupler Assembly, Test

1-560150SR

MANUAL CHANGES (Cont'd):

Page 5-3, Table 5-1 Cont.:

Change: DC2 to HP Part No. 5080-0299, Coupler Assembly, Reference

Add: J101 HP Part No. 1251-0143, Connector, 14 Pin Female

Add: A101 33321H-C03 Attenuator, 70 dB programmable

Change: W3 to HP Part No. 08746-20031, Cable, Patch Line

Change: W6 to HP Part No. 08743-20040, Cable, Coax Line

Delete: W8

Add: W101 HP Part No. 08743-20049, Cable Assembly, CPLR/ATTEN.

Add: W102 HP Part No. 08743-20050, Cable Assembly, ATTEN/CPLR

Add: W103 HP Part No. 08743-60040, Cable Assembly, Attenuator

Change: Rear Panel to HP Part No. 08743-00029

Add: Bracket, Attenuator, HP Part No. 08743-00030

Add: HP P/N 1251-0142, Connector, 14 Pin Male

Page 6-3, Figure 6-4:

Change to Figure 1

Page 6-4, Figure 6-5:

Change to Figure 2

Page 6-5, Figure 6-6:

Change to Figure 3

Add Figure 4.

1-560150SR

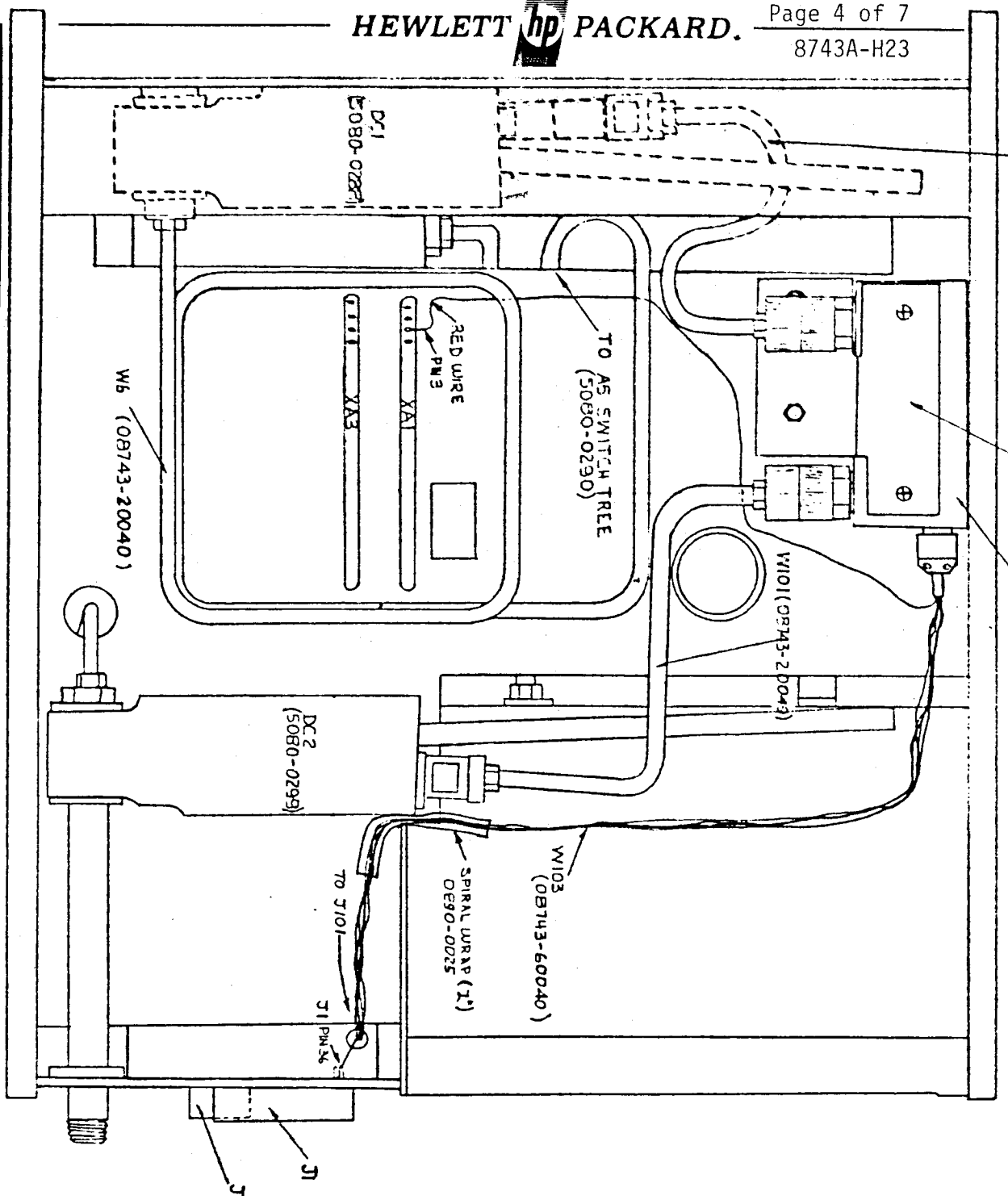

FIGURE 1.

J101 CONNECTION TABLE

CONNECTOR PIN NO.	WIRE COLOR	FROM
1	PURPLE	ATTEN
8	YELLOW	"
3	BLACK	"
10	GREEN	"
5	ORANGE	"
12	BLUE	"
14	BLACK-WHITE	J1-PIN 14

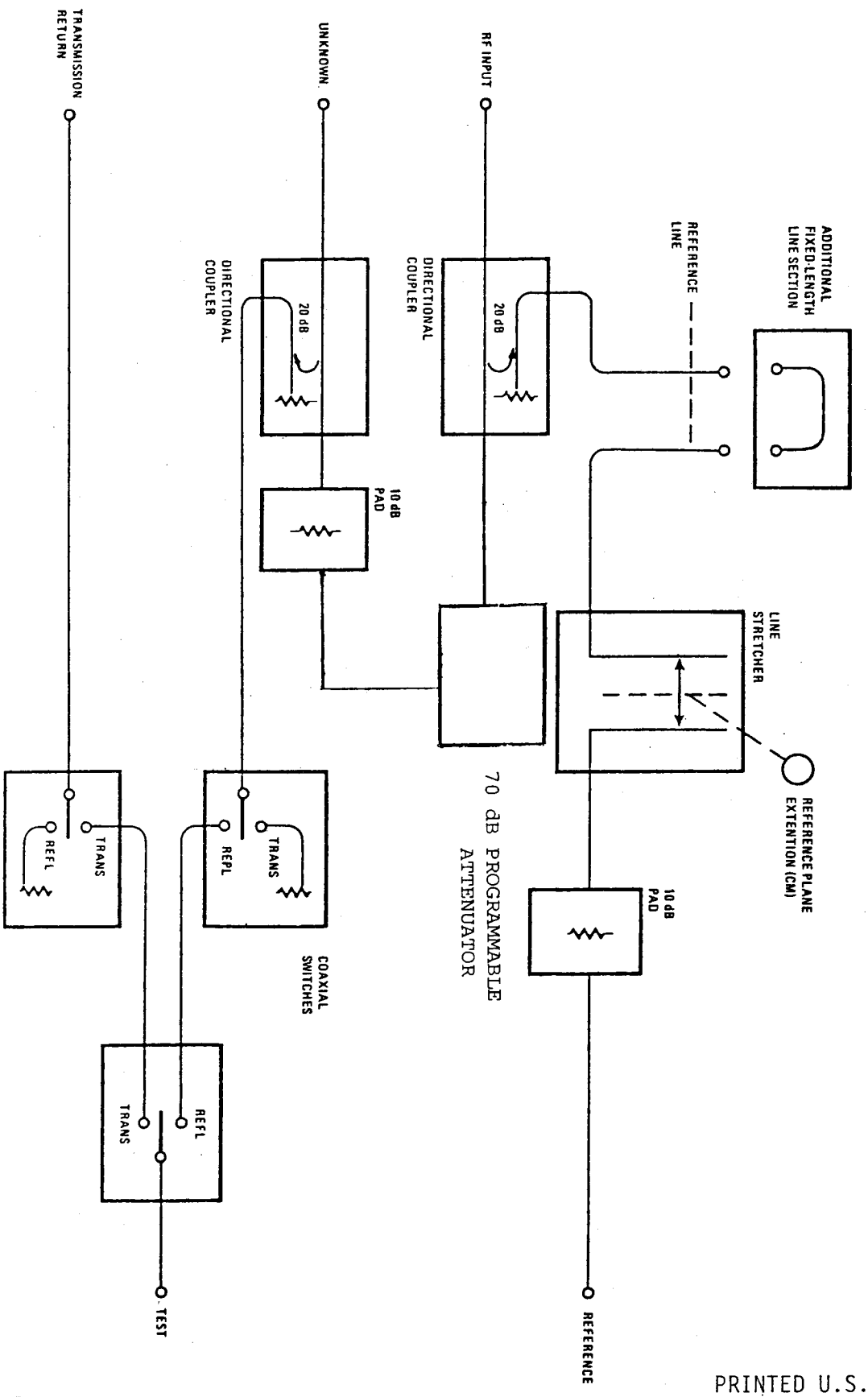

FIGURE 2. SIMPLIFIED RF SCHEMATIC DIAGRAM

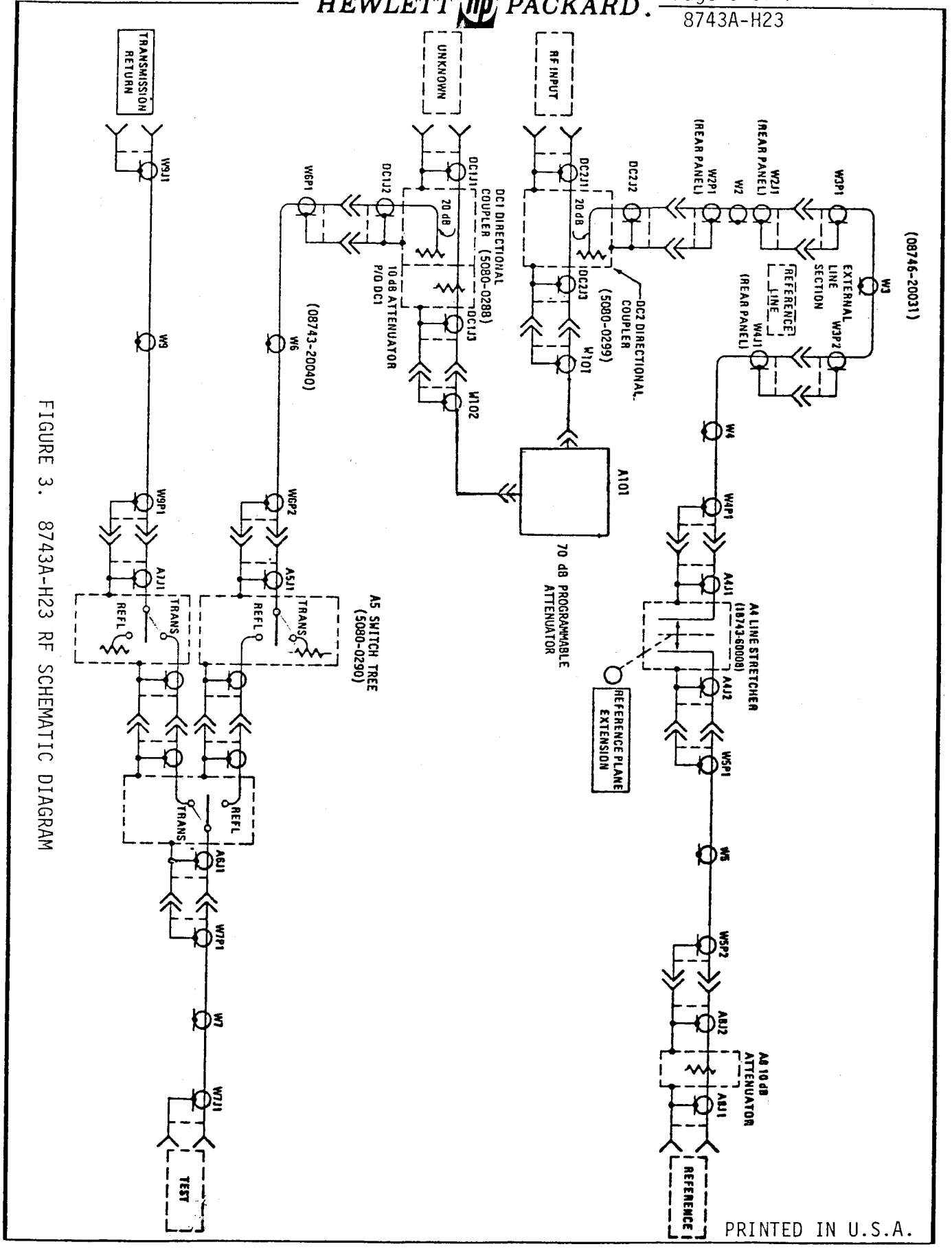

FIGURE 3. 8743A-H23 RF SCHEMATIC DIAGRAM

1-560150SR

PRINTED IN U.S.A.

Button	1	2	3	4	5	6	Atten (dB)
■ = OFF □ = ON							
	—			■	■	■	0
				■	■	□	10
				■	□	■	20
				■	□	□	30
				□	■	■	40
				□	■	□	50
				□	□	■	60
				□	□	□	70

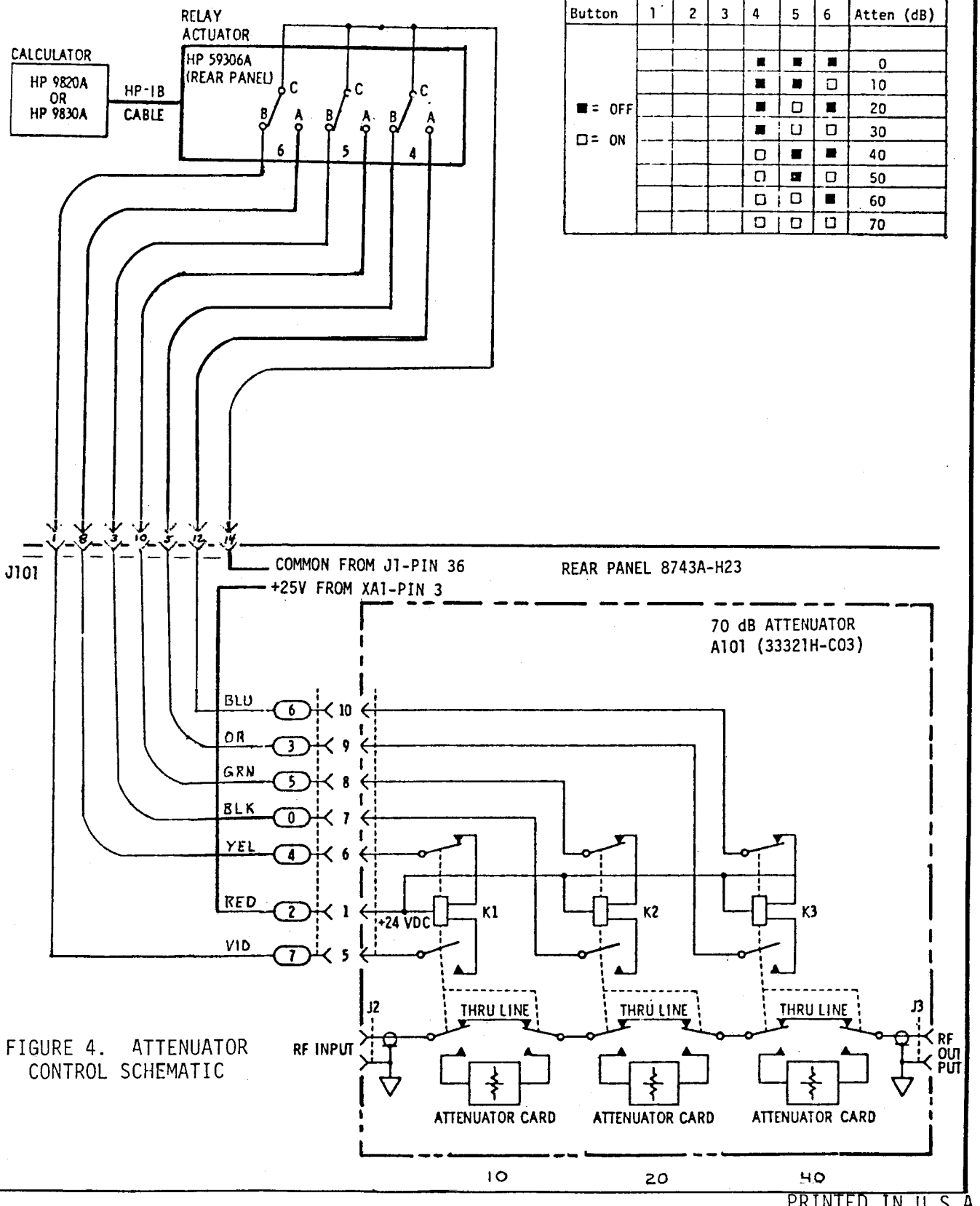

FIGURE 4. ATTENUATOR CONTROL SCHEMATIC

1-560150SR

SAFETY

This product has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the product safe, the information; cautions, and warnings in this manual must be heeded. Refer to Section I for general safety considerations applicable to this product.

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.

WARRANTY

This Hewlett-Packard product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. However, warranty service for products installed by HP and certain other products designated by HP will be performed at Buyer's facility at no charge within the HP service travel area. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses.

For products returned to HP for warranty service, Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

REFLECTION-TRANSMISSION TEST UNIT
8743A

SERIALS PREFIXED: 1226-

This manual applies directly to HP Model 8743A Reflection-Transmission Test Units having serial prefix number 1226-.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 1226, a "Manual Changes" sheet is included with this manual. For serial prefixes below 1226, refer to the Appendix.

1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CALIFORNIA, 95404, U.S.A.

MANUAL PART NO. 08743-90010
MICROFICHE PART NO. 08743-90011

Printed: JULY 1972

HEWLETT hp PACKARD

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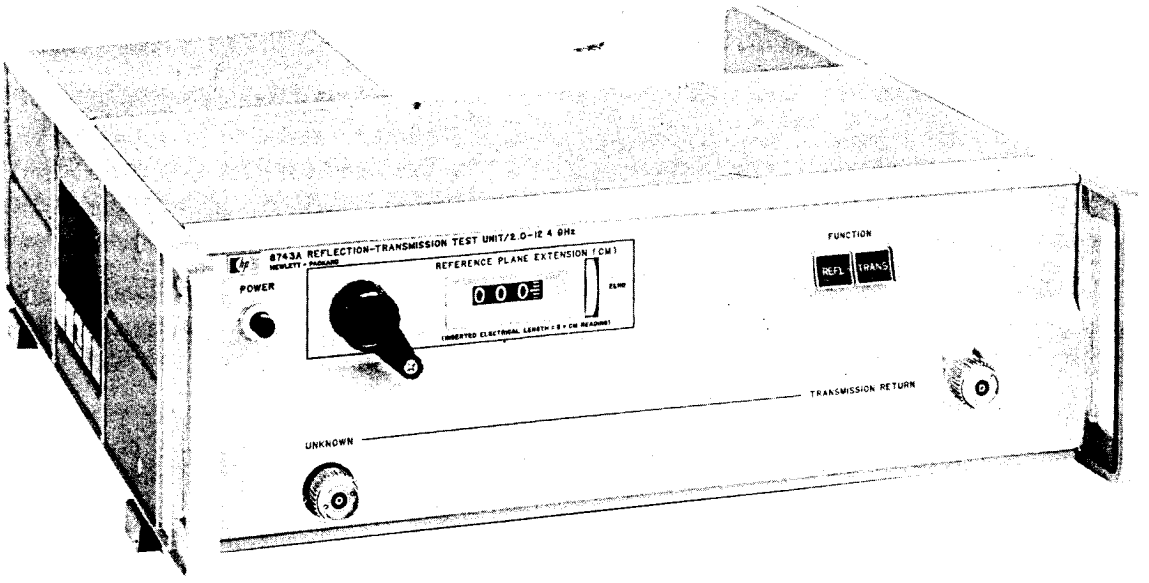
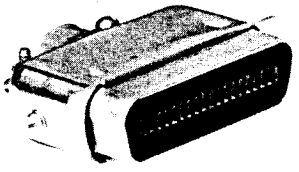
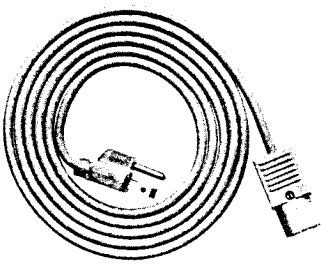


8743A



36 PIN
CONNECTOR

POWER CABLE



RACK MOUNTING KIT

Figure 1-1. MODEL 8743A REFLECTION-TRANSMISSION TEST UNIT.

LIST OF TABLES

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Model 8743A Reflection - Transmission Test Unit is a complementary instrument for the HP 8410A Network Analyzer. It contains microwave circuits for making reflection and transmission measurements from 2.0 to 12.4 GHz. 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.

1-4. As shown in Figure 6-5 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. A rack-mounting kit, a male 36-pin connector (HP part number 1251-0084) and a detachable power cable are furnished with the Model 8743A.

1-7. RACK-MOUNTING KIT.

1-8. The rack-mounting kit contains all the hardware needed to adapt the Model 8743A cabinet for installation in equipment racks with standard 19-inch spacing. Instructions for conversion to rack mounting are included with the kit.

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 8743A. (See Table 3-1 for wiring information.)

Table 1-1. Specifications.

Frequency Range: 2.0 to 12.4 GHz.

Impedance: 50 ohms nominal.

Reflection Coefficient
UNKNOWN port:* 2-8 GHz, ≤ 0.091 (VSWR 1.2)
8-12.4 GHz, ≤ 0.13 (VSWR 1.3)
TRANSMISSION RETURN port:
REFL Measurement: ≤ 0.13 (VSWR 1.3)
TRANS Measurement: ≤ 0.20 (VSWR 1.5)

Coupler Directivity: 30 dB

Insertion Loss:

RF Input to REFERENCE output: 30 dB nominal

RF Input to UNKNOWN port: 20 dB nominal

UNKNOWN port to TEST output in Reflection mode: 10 dB nominal

TRANSMISSION RETURN port to TEST output in transmission mode: <1.5 dB.

Maximum RF input: 8743A damage level, 2 W

Connectors:

RF INPUT port: Type N[1] female, stainless steel.

REFERENCE and TEST channel output ports mate with APC-7[2] connectors.

TRANSMISSION and UNKNOWN ports: APC-7[2] sexless connectors

REMOTE INPUT: 36 pin female.

Microwave Switches: Typical switching time, 40 msec. Estimated switch lifetime 1 million cycles.

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

Transmission-Reflection Selection: Manual by front-panel, lighted pushbuttons. Remote by contact closures or saturated transistors through 36-pin connector at rear panel. Pin 17 to pins 18 or 36 (ground) selects remote operation. Opening or closing pin 24 to pins 18 or 36 selects Reflection or Transmission. Pins 17 and 24 are at 12V and short to ground will draw 12 mA.

Accessories Furnished:

Rack-mounting kit
36-pin male connector
Power cable

[1] Compatible with connectors whose dimensions conform to MIL-C-39012 or MIL-C-71.

[2] Amphenol RF Division, Danbury, Connecticut.

*Equivalent source reflection coefficient when used with 8410A Network Analyzer.

1-11. ACCESSORIES AVAILABLE.

1-12. FLEXIBLE ARM.

1-13. The Model 11605A Flexible Arm is a combination of three rotary air lines and three swivel joints. It combines the phase stability of rigid line with the flexibility of cable so that devices with any port geometry can be connected to the 8743A.

1-14. ATTENUATOR.

1-15. A 50-ohm coaxial attenuator is recommended for transmission measurements. An attenuator connected between the output of the device under test and the HP 11605A Flexible Arm reduces the ambiquity due to mismatch between the 11605A, 8743A,and 8411A. A 10-dB low reflection attenuator, such as a 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 11605A 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.

1-16. APC-7 SHORT.

1-17. The Model 11565A APC-7 Short is useful for establishing reflection measurement, phase and magnitude, reference.

1-18. COMPLEMENTARY EQUIPMENT.

1-19. MODEL 8410A NETWORK ANALYZER.

1-20. The 8410A 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. Two plug-in display units are available. The 8413A plug-in unit displays relative amplitude and phase data on a meter. Phase and amplitude output signals allow display of swept signals on an oscilloscope or X-Y recorder. The 8414A plug-in unit displays relative amplitude and phase data in polar coordinates on a 5-inch CRT for either swept or CW mode of measurement.

1-21. SIGNAL SOURCE.

1-22. HP 8690 Sweep Oscillator main frames with 8692B, 8693B and 8694B RF plug-in units provide swept frequency coverage of the entire 8743A frequency range. These oscillators have features which make them especially compatible with the 8410A Network Analyzer system. For example, the sweep reference voltage output permits the 8410A phase lock system to track the fastest sweeps for flicker-free oscilloscope displays. Also, the between-sweep pause at the start frequency enables the Network Analyzer to phase lock solidly before a sweep begins.

1-23. INSTRUMENTS COVERED BY MANUAL.

1-24. Each Model 8743A carries a two-section, eight-digit serial number (000-00000). The first three digits of the number are a prefix. The contents of this manual apply directly to the Model 8743A which has the same serial number prefix(es) as those listed after SERIALS PREFIXED on the title page.

1-25. 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 1-7 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 8743A 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 8743A 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 350 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 8743A requires a power source of 115 or 230 volts ±10%, 50 to 1000 Hz, single phase that can supply approximately 20 watts.

2-13. 115/230 VOLT OPERATION.

2-14. A two-position slide switch on the rear panel of the Model 8743A 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 8743A 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 8743A 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. To preserve the protection feature when operating the Model 8743A from a two-contact outlet, use a three-prong to two-prong adapter (HP part number 1251-0048), and connect the green wire on the adapter to ground.

2-19. BENCH OPERATION.

2-20. The Model 8743A 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 8743A self-aligning when stacked on other Hewlett-Packard full rack-width modular instruments.

2-21. RACK MOUNTING.

2-22. All necessary hardware and instructions are contained in the supplied rack-mounting kit (HP part number 5060-0775). Care must be taken to insure that the ambient operating temperature does not exceed 55° C (140° F).

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. The combination of the Model 8743A Reflection-Transmission Test Unit with the Model 11605A Flexible Arm, a signal source, and a compatible phase-amplitude ratio indicator, such as the HP Model 8410A Network Analyzer, makes up a system for measuring reflection and transmission, phase and magnitude, from 2.0 to 12.4 GHz.

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 8410A Network Analyzer's harmonic frequency converter permits direct connection to the 8743A 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.

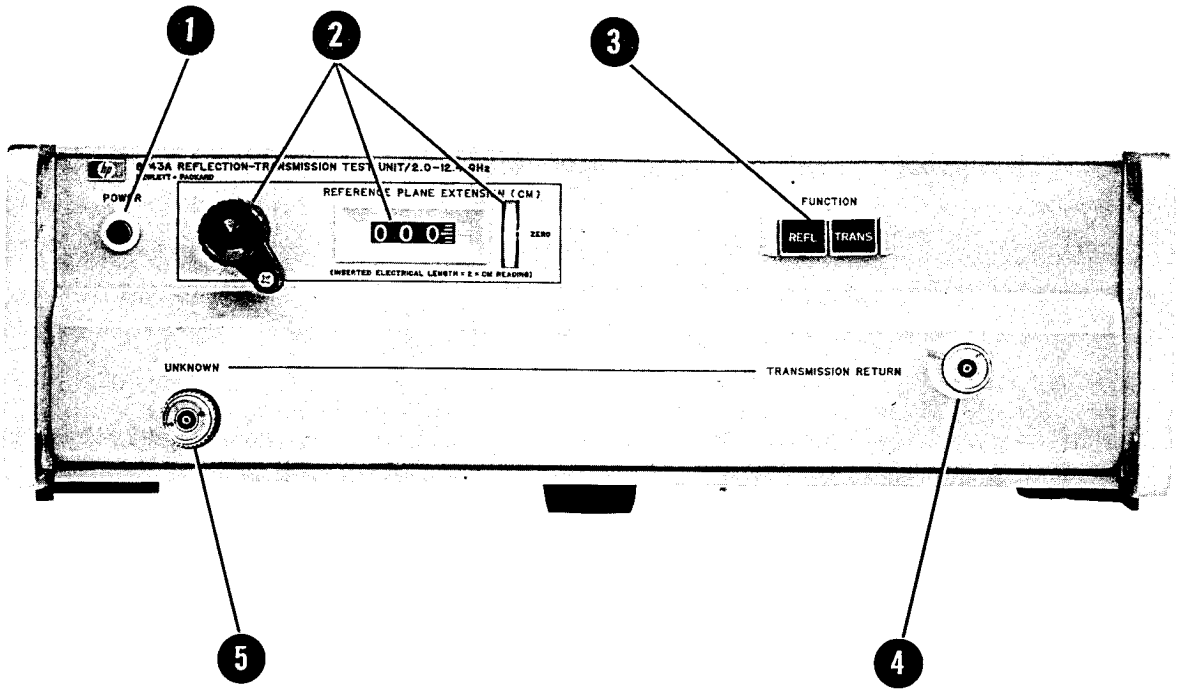
3-9. MAXIMUM RF POWER.

3-10. Do not apply more than 2 watts of RF power to the rear-panel RF INPUT. Power in excess of 2 watts may damage the internal directional couplers. When making transmission measurements using the 8410A Network Analyzer, do not apply more than 50 mW to the 8743A TRANSMISSION RETURN port. More than 50 mW may damage the 8411A Harmonic Frequency Converter.

3-11. MEASUREMENT PROCEDURES.

3-12. Procedures for making transmission and reflection measurements using the HP 8743A with the HP 8410A 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.

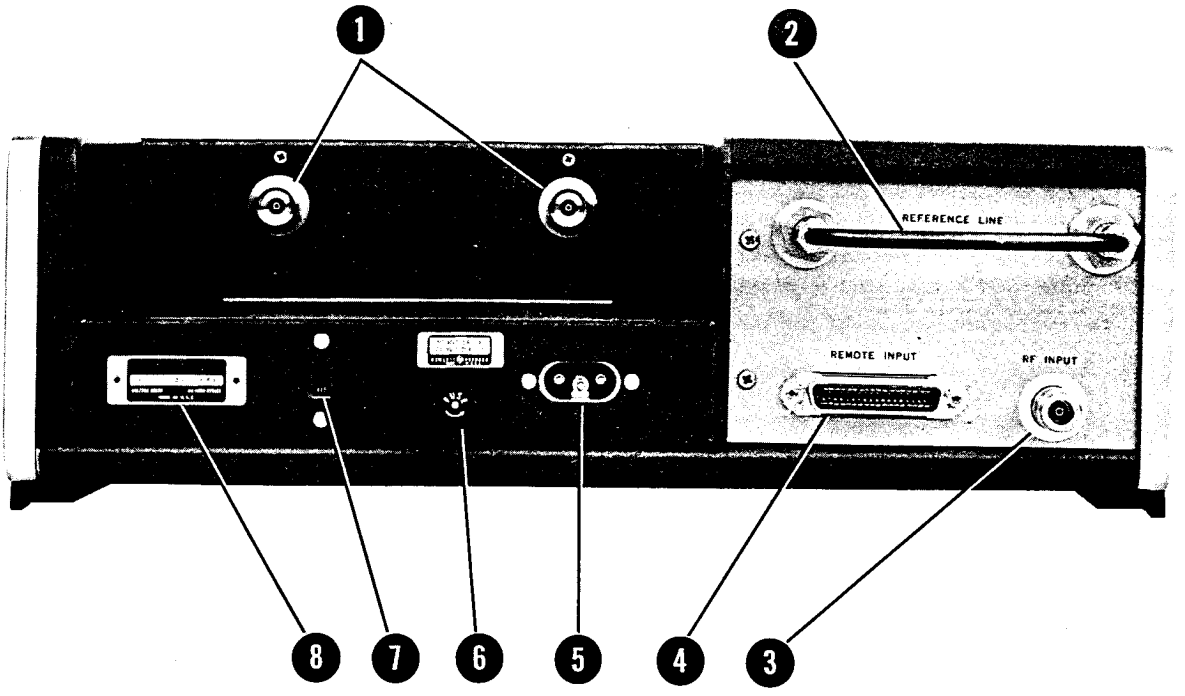
4. TRANSMISSION RETURN port. Makes RF connection from the device under test for transmission measurements. APC-7 type* 50-ohm precision 7mm sexless connector.

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.

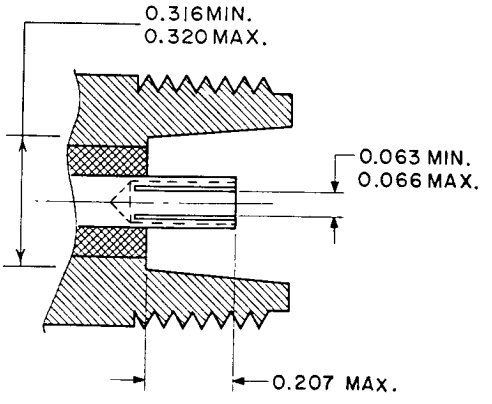
* Amphenol RF Division, Danbury, Connecticut. See Figure 3-11 for important information about use, care of APC-7 connectors.

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 8410A 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. 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 8743A when the contact is open is 12 Vdc. Maximum current from the 8743A when the contact is short circuited is 12 mA.
5. Power Cable Connector. NEMA type with offset pin connected to 8743A cabinet. Power requirements: 115 or 230 V ac ±10%, 50 to 1000 Hz, approximately 20 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 or 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. Eight-digit serial number should be included in any correspondence concerning the 8743A

* Amphenol RF Division, Danbury, Connecticut.

Figure 3-2. Rear Panel Features

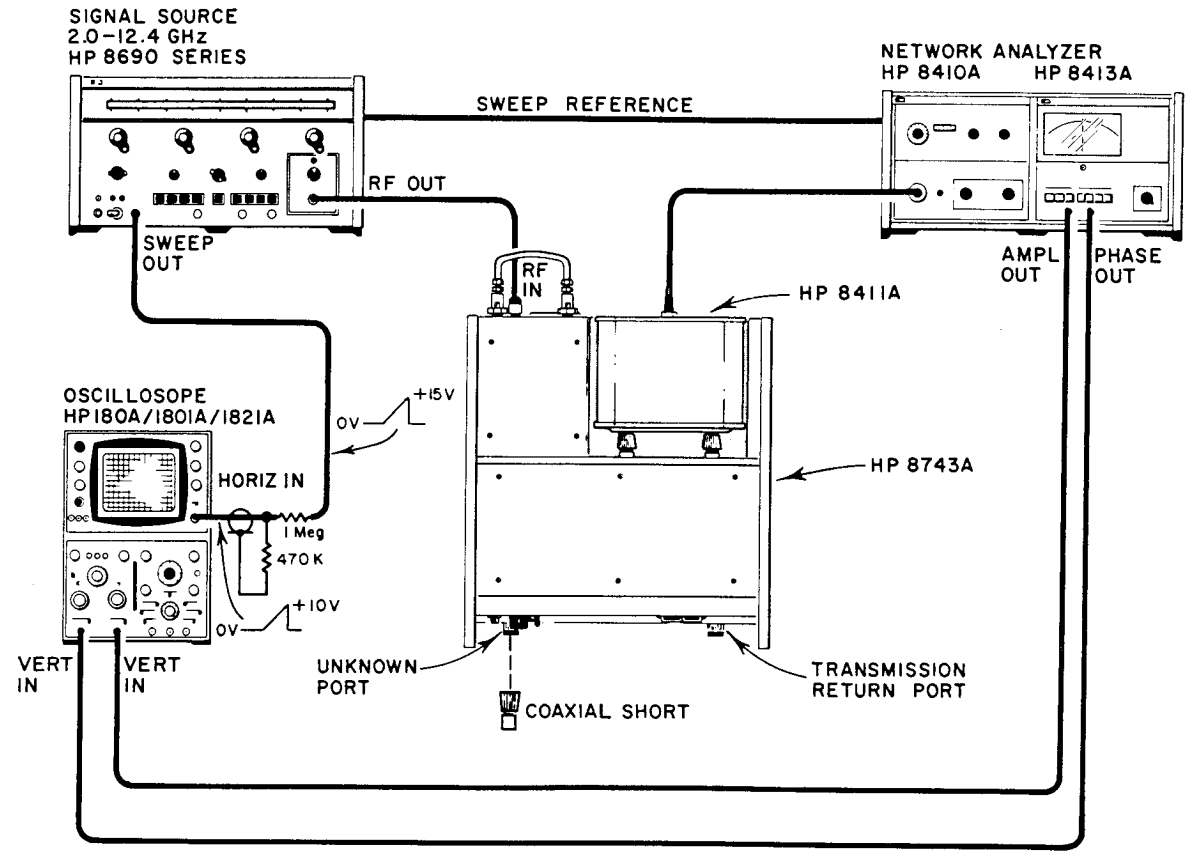


Figure 3-3. Reflection Measurement, Using Network Analyzer with 8413A Display Unit. (Sheet 1 of 2)

CALIBRATION

DESCRIPTION. Calibration consists of adjusting the 8743A REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference, magnitude and phase, indications using a termination of known magnitude and phase angle.

PROCEDURE.

1. Connect equipment as shown in setup.
2. Connect a coaxial short such as the HP 11565A to the 8743A UNKNOWN port and depress the REFL pushbutton.
3. Adjust 8413A phase offset control for 180° 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.
5. Adjust the oscilloscope to display the swept phase output from the 8413A.
6. Obtain equal reference and test channel electrical lengths by adjusting the REFERENCE PLANE EXTENSION for a horizontal phase display on the oscilloscope. If the plane of measurement is to be extended beyond the plane of the short, the digital counter should be set to zero so that it can be used to set the 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 display on the oscilloscope.
7. For swept-frequency measurements, adjust the oscilloscope display as follows:
   a. Disconnect oscilloscope vertical input from 8413A AMPLITUDE channel, to simulate zero volts dc from 8413A. Note trace position.
   b. Reconnect vertical input and adjust 8410A test channel gain and amplitude vernier controls so that the average of the trace falls on the zero trace position noted in step (a) above.
   c. Adjust oscilloscope vertical position for a convenient amplitude reference.
   d. Disconnect oscilloscope vertical input from 8413A PHASE channel, to simulate zero volts dc from 8413A. Note trace position.
   e. Reconnect vertical input and adjust 8410A phase vernier control so that the average of the trace falls on the zero trace position noted in step (d) above.
   f. Adjust oscilloscope vertical position for a convenient phase reference.
8. To calibrate for single-frequency measurements, perform the following:
   a. Set the Sweep Oscillator for single-frequency operation.
   b. Adjust the 8410A PHASE VERNIER for a zero degree indication on the 8413A.
   c. Adjust 8410A test channel gain and amplitude vernier controls for a 0 dB indication on the 8413A.

NOTE

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

MEASUREMENT.

1. Remove the coaxial short and connect the device to be tested to the 8743A UNKNOWN port.
2. Return the 8413A phase offset to zero.
3. For swept-frequency measurements, read magnitude and phase as follows:
   a. For magnitude, note 8410A test channel gain settings. Increase test channel gain to return oscilloscope display to reference obtained during calibration. The difference in test channel gain settings is the reflection magnitude in return loss[1].
   b. For phase, adjust oscilloscope vertical sensitivity and position controls to view the swept-phase display of the device under test. Use the calibrated 8413A output (10 mV/degree) and the oscilloscope vertical calibration to determine phase angle.
4. For single-frequency measurements, read magnitude and phase as follows:
   a. For magnitude, note 8410A test channel gain settings. Increase test channel gain to return the 8413A meter indication to zero. The difference in test channel gain settings is the reflection magnitude in return loss.[1]
   b. For phase, adjust the 8413A phase offset for an on scale meter indication on the most sensitive scale. The phase angle is the algebraic sum of phase offset and meter indication.

[1] $|\rho| = \frac{1}{\text{Log}^{-1}(0.05 \times \text{Return Loss})}$

Figure 3-3. Reflection Measurement, Using Network Analyzer with 8413A Display Unit. (Sheet 2 of 2)

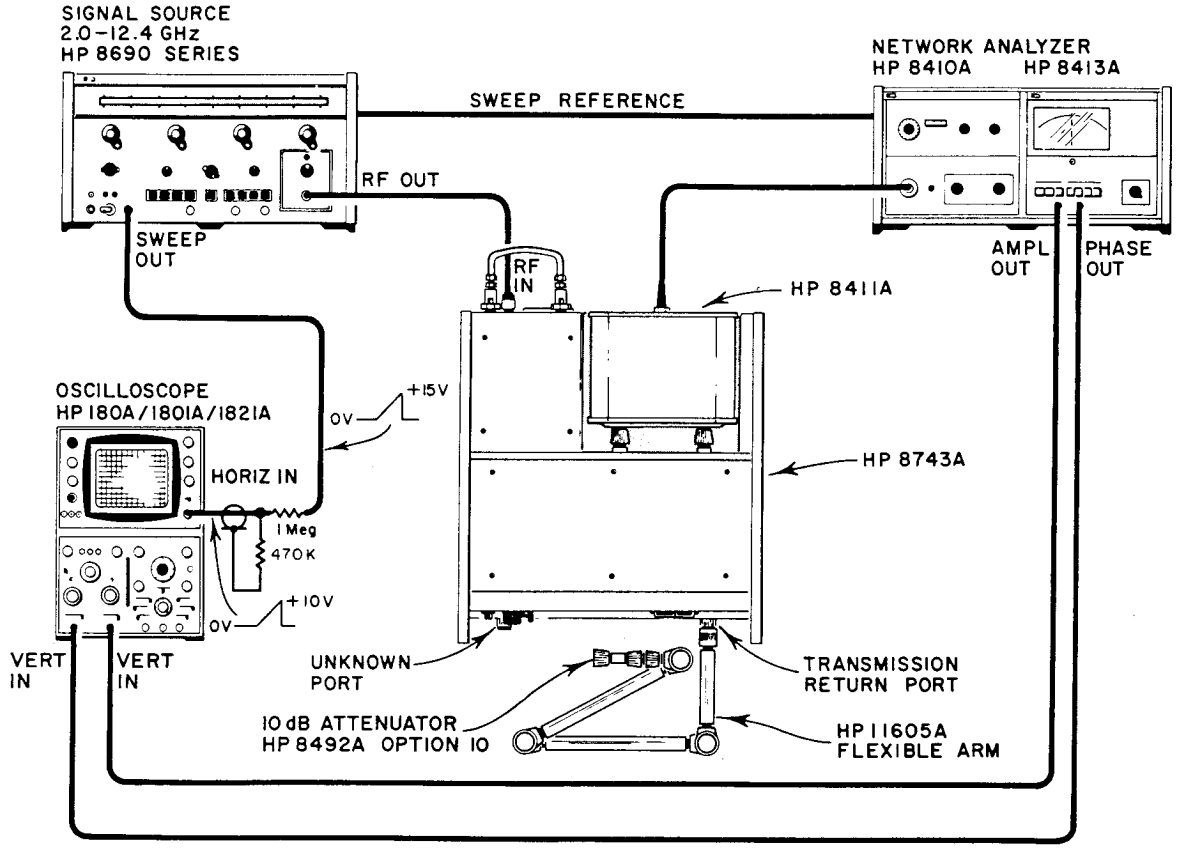


Figure 3-4. Transmission Measurement, Using Network Analyzer with 8413A Display Unit (Sheet 1 of 2)

CALIBRATION

DESCRIPTION. Calibration consists of adjusting the 8743A REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference, magnitude and phase, indications.

PROCEDURE.

1. Connect equipment as shown in setup. Connect a 10-dB attenuator, such as the HP 8492A Option 10, to the HP 11605A Flexible Arm (see Paragraph 3-17), and connect the attenuator to the 8743A UNKNOWN port.

2. Dc couple and dc balance the oscilloscope vertical amplifiers. Adjust the oscilloscope to display the swept-phase output from the 8413A.

3. Obtain equal reference and test channel electrical lengths by adjusting the REFERENCE PLANE EXTENSION for a horizontal phase display on the oscilloscope. If the digital counter is to be used to determine the electrical length of the device under test, it 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 for a horizontal display on the oscilloscope.

4. For swept-frequency measurements, adjust the oscilloscope display as follows:

   a. Disconnect oscilloscope vertical input from 8413A AMPLITUDE channel to simulate zero volts dc from 8413A. Note trace position.

   b. Reconnect vertical input and adjust 8410A test channel gain and amplitude vernier controls so that the average of the trace falls on the zero trace position noted in step (a) above.

   c. Adjust oscilloscope vertical position for convenient amplitude reference.

   d. Disconnect oscilloscope vertical input from 8413A PHASE channel to simulate zero volts dc from 8413A. Note trace position.

   e. Reconnect vertical input and adjust the 8410A PHASE vernier control so that the average of the trace falls on the zero trace position noted in step (d) above.

   f. Adjust oscilloscope vertical position for a convenient phase reference.

5. To calibrate for single-frequency measurements perform the following:

   a. Set the Sweep Oscillator for single-frequency operation.

   b. Adjust 8410A PHASE VERNIER for zero degree indication on the 8413A.

   c. Adjust 8410A test channel gain and amplitude vernier controls for a 0 dB indication on the 8413A.

MEASUREMENT

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

2. For swept-frequency measurements, read magnitude and phase as follows:

   a. For magnitude, note 8410A test channel gain settings. Adjust test channel gain to return oscilloscope display to reference obtained during calibration. The difference in test channel gain settings is the transmission gain or loss in dB of the device under test.

   b. For phase, adjust oscilloscope vertical sensitivity and position controls to view the swept-phase display of the device under test. Use the calibrated 8413A output (10 mv/degree) and the oscilloscope vertical calibration to determine phase angle.

NOTE

The phase display is the combination of linear phase (due to electrical length) and non-linear phase shift. Group delay can be determined from this display (see HP Application Note 92).

3. For single-frequency measurements, read magnitude and phase as follows:

   a. For magnitude, note 8410A test channel gain settings. Adjust test channel gain to return the 8413A meter indication to zero. The difference in test channel gain settings is the transmission gain or loss in dB of the device under test.

   b. For phase, adjust the 8413A phase offset for an on-scale meter indication on the most sensitive scale. The phase angle is the algebraic sum of phase offset and meter indication.

Figure 3-4. Transmission Measurement, Using Network Analyzer with 8413A Display Unit (Sheet 2 of 2)

REFLECTION MEASUREMENT

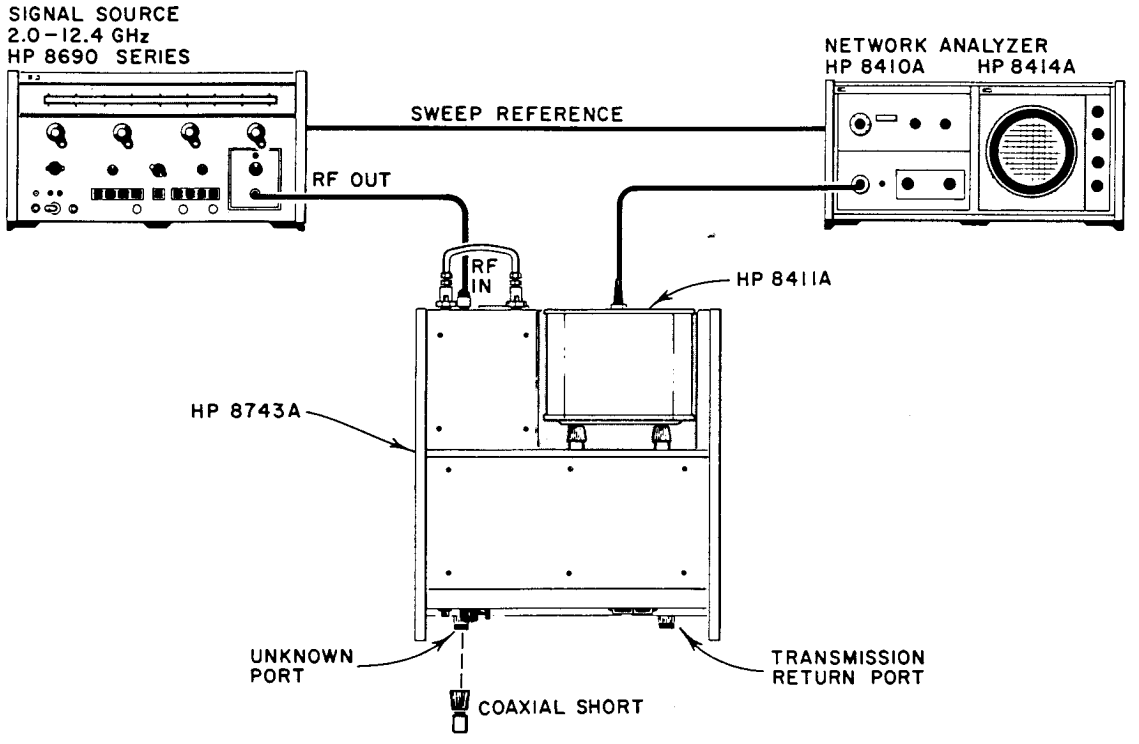


Figure 3-5. Reflection Measurement, Using Network Analyzer with 8414A Polar Display Unit (Sheet 1 of 2)

CALIBRATION

DESCRIPTION. Calibration consists of adjusting the 8743A REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference, magnitude and phase, indications.

PROCEDURE.

1. Connect equipment as shown in setup.
2. Connect a coaxial short such as the HP 11565A to the 8743A 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.
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. Obtain equal reference and test channel electrical lengths by adjusting the REFERENCE PLANE EXTENSION to collapse the trace to a dot or smallest cluster. If the plane of measurement is to be extended beyond the plane of the short, the digital counter should be set to zero so that it can be used to set the 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 8410A PHASE VERNIER, TEST CHANNEL GAIN and AMPL VERNIER controls to place the dot or cluster for a reference indication of $\Gamma = 1 \angle 180°$.

NOTE

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

MEASUREMENT

1. Remove the coaxial short and connect the device to be tested to the 8743A 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 8410A 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.

3. The effective load plane of the device under test may be determined by adjusting the REFERENCE PLANE EXTENSION to again collapse the trace to a dot or smallest cluster. The distance from reference plane to load plane may be read directly from 8743A digital counter (counter set to zero during calibration).

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

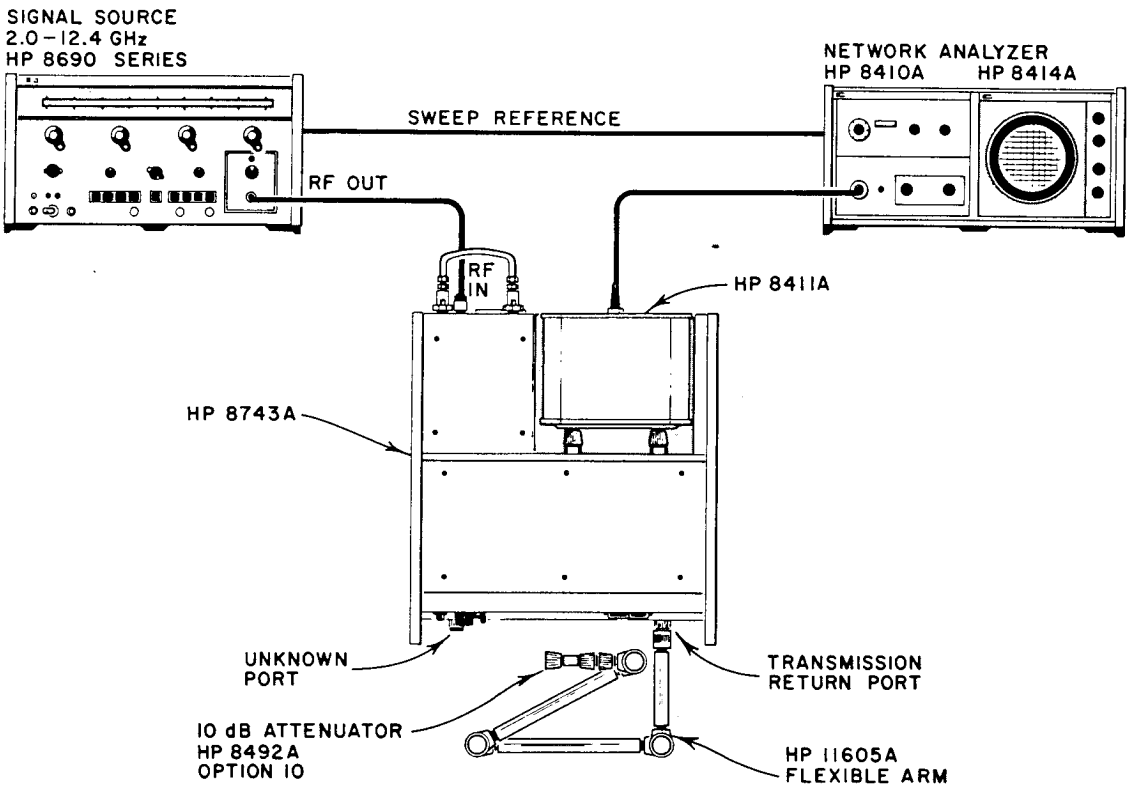


Figure 3-6. Transmission Measurements, Using Network Analyzer with 8414A Polar Display Unit (Sheet 1 of 2)

CALIBRATION

DESCRIPTION. Calibration consists of adjusting the 8743A REFERENCE PLANE EXTENSION to obtain equal reference and test channel electrical lengths and obtaining reference, magnitude and phase, indications.

PROCEDURE.

1. Connect equipment as shown in setup. Connect a 10-dB attenuator, such as the HP 8492A Option 10, to the Flexible Arm (see Paragraph 3-17) and connect the attenuator to the 8743A UNKNOWN port.

2. Depress the 8743A 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.

4. 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. If the digital counter is to be used to determine the electrical length of the device under test, it 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 8410A phase and amplitude controls to place the dot or cluster for a reference indication of $\Gamma=1 \angle 0°$

MEASUREMENT

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

2. Note the 8410A test channel gain setting. This is the calibrated gain setting. Adjust the test channel gain controls 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.

3. To determine the electrical length of the device under test perform the following:

   a. Adjust the REFERENCE PLANE EXTENSION to again collapse the trace to a dot or smallest cluster.

   b. The electrical length of the device under test is two times the digital counter reading.

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

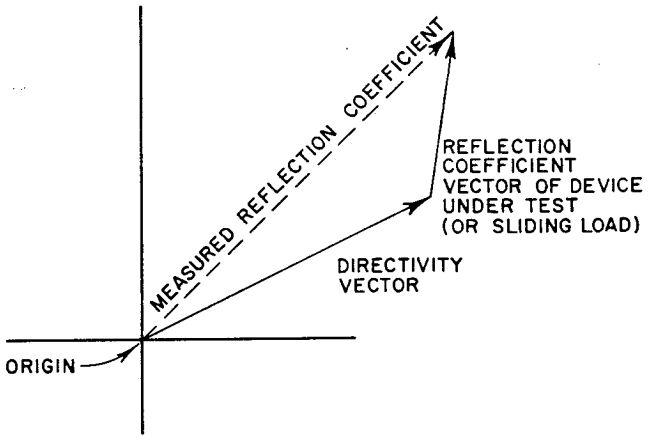


Figure 3-7. Measured Reflection Coefficient.

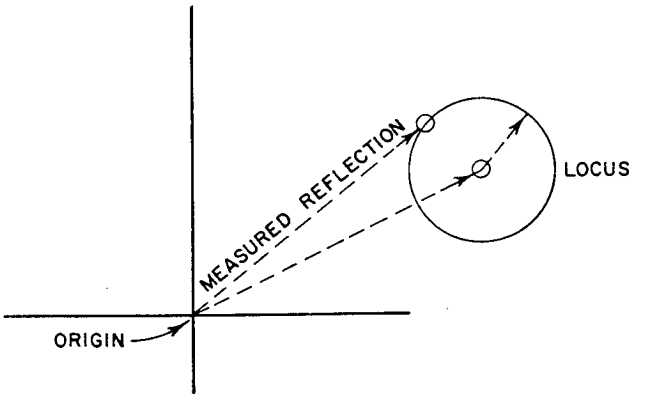


Figure 3-8. Locus of Measured Reflection when Load is Moved.

3-13. INCREASED ACCURACY FOR REFLECTION MEASUREMENTS BY MINIMIZING DIRECTIVITY ERRORS.

3-14. The 8743A 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.

3-15. The vector subtraction can be performed directly with the horizontal and vertical controls on the 8414A polar display. Increase the 8410A 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 8743A 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 8743A 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 orgin of the graph to this center must be vectorically subtracted from any reflection measurement at this frequency.

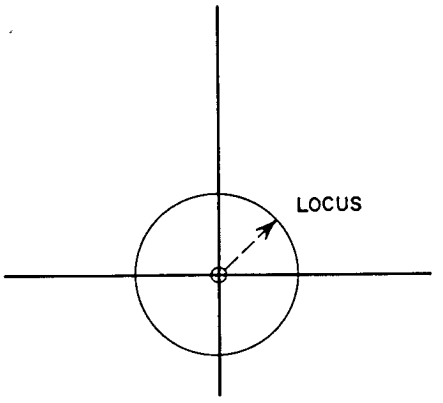


Figure 3-9. Locus of Measured Reflection with Directivity Cancelled

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 11605A Flexible Arm reduces the ambiguity due to mismatch between the 11605A, 8743A and 8411A. A 10-dB low-reflection attenuator, such as a HP 8492A Option 10 reduces this 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 11605A, 8743A 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 11605A 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.

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

3-18. REMOTE OPERATION.

3-19. A thirty-six pin connector on the rear panel of the 8743A 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 8743A 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 8743A 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.

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 partiular 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.

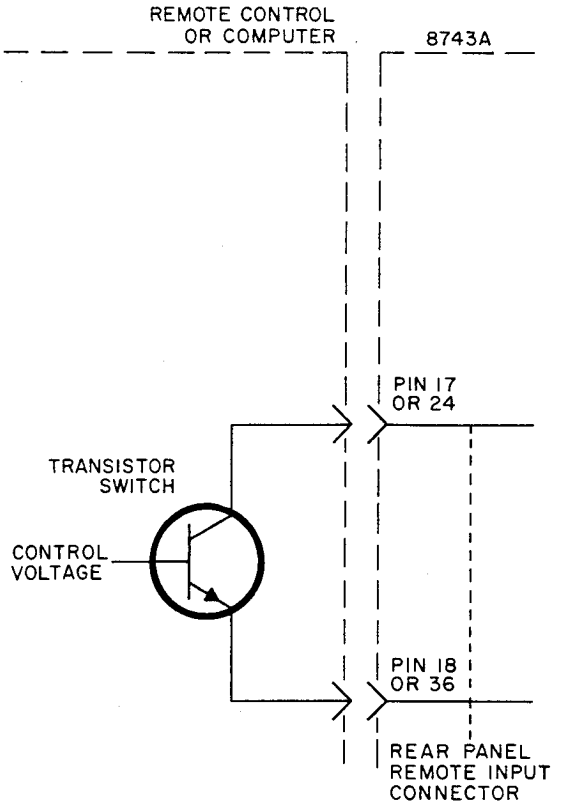


Figure 3-10. Typical Transistor Remote Control Circuit.

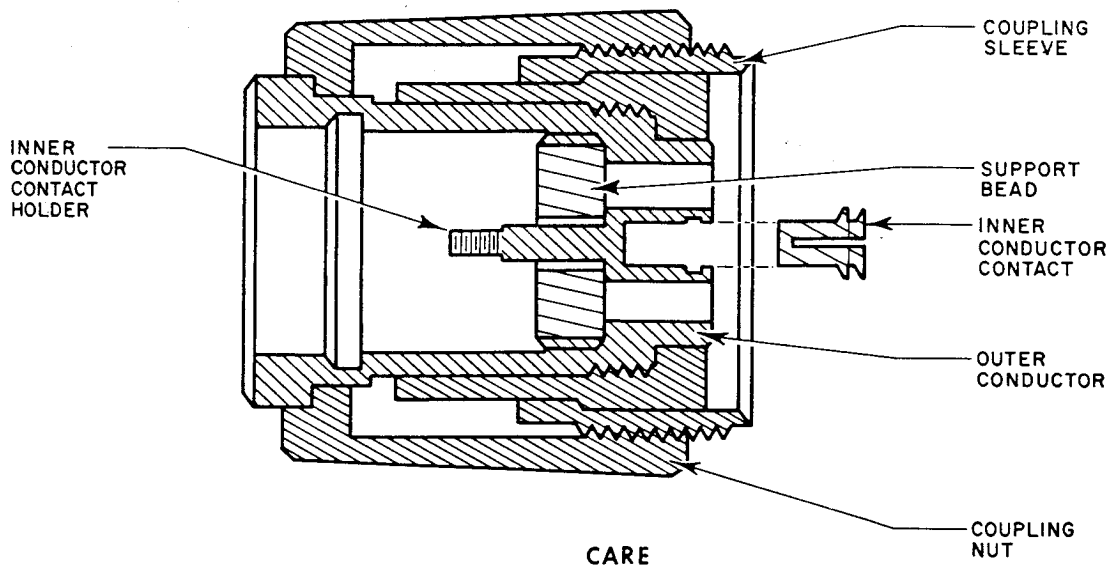
Table 3-2. Signal Requirements for Remote Operation.

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

3-22. 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).



USE

To Connect:

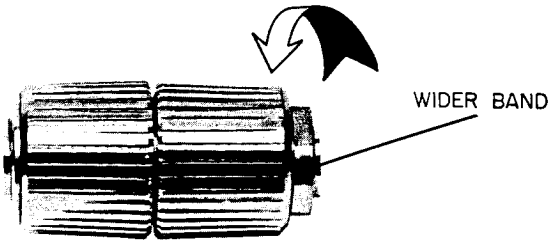
1. On one connector, retract the coupling sleeve by turning the coupling nut counterclockwise until the sleeve and nut disengage.

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:

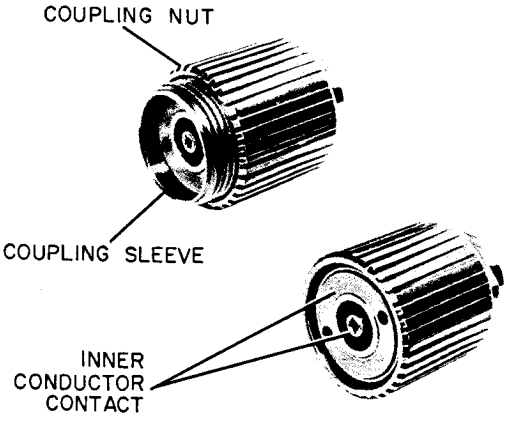
1. Loosen the coupling nut of the connector showing the wider gold band.



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.

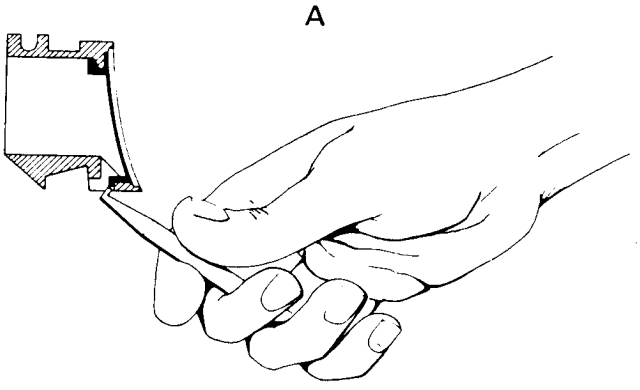
3. Use lintless material and/or firm-bristled brush such as tooth brush for cleaning. If a cleaning fluid is needed use isopropyl alcohol. IMPORTANT: Do not use aromatic or chlorinated hydrocarbons, esters, ethers, terpenes, higher alcohols, ketones, or ether-alcohols such as benzene, toluene, turpentine,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

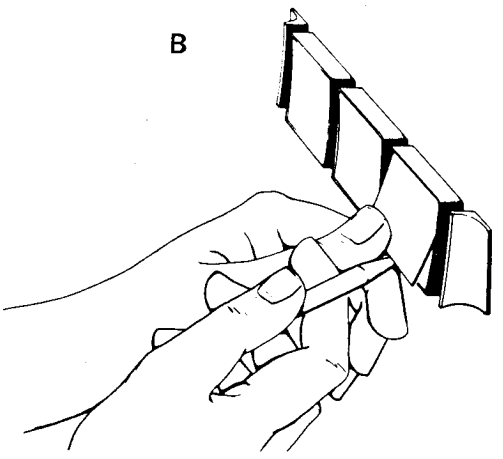
Figure 3-11. APC-7 Connectors

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.

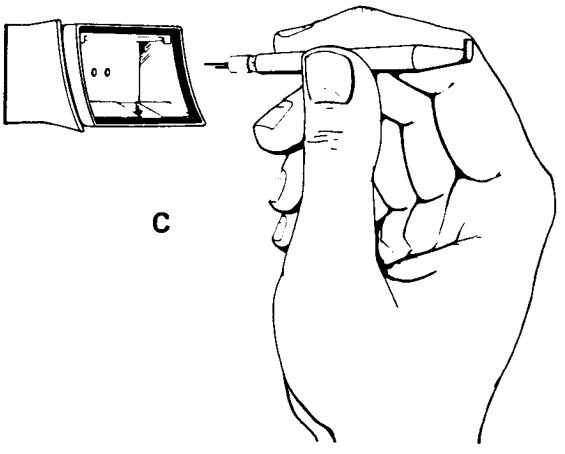
BULB REPLACEMENT PROCEDURE

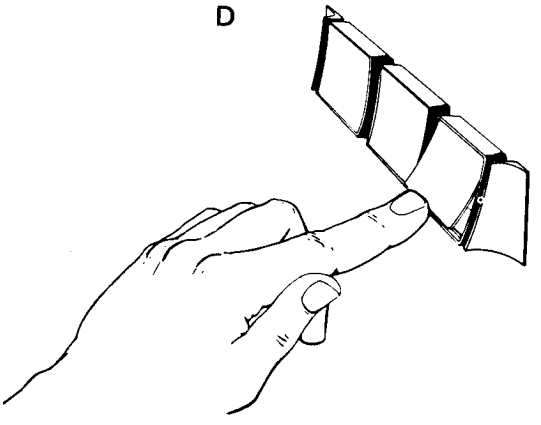
1. Place the end of the thumb of one hand over the corner of the pushbutton switch. With the bulb extractor tool in the other hand, place the hooked end of the tool into the front of the slot on the bottom of the pushbutton (A) and gently push up until the lower end of the pushbutton lens pops out as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

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 8743A 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)[1] 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.

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

3-28. COUPLING MECHANISMS.

3-29. The coupling mechanism includes the coupling nut and the two-piece coupling sleeve assembly shown in Figure 3-11. Both of these parts can be replaced without access to the inside of the Model 8743A, and without disturbing either of the conductors. A special spanner wrench, HP Stock Number 5060-0237[1], is required.

3-30. To remove a coupling mechanism:

a. Fully extend the coupling sleeve to provide a guide for the spanner wrench.

b. Align the wrench so both pegs engage the holes in the end of the coupling sleeve assembly.

c. Unscrew the sleeve assembly by turning the wrench counterclockwise.

3-31. When installing a coupling mechanism, set the coupling nut in place on the connector first, then thread on the coupling sleeve assembly, and tighten it firmly with the spanner wrench. Extending the coupling sleeve helps to keep the spanner in position during the final tightening.

CAUTION

The UNKNOWN port connector is part of a directional coupler. When tightening a coupling sleeve assembly on this connector, do not apply excessive torque. Excessive torque may be transmitted to the center conductor and may damage the coupler.

3-32. POWER SWITCH LAMP REPLACEMENT.

3-33. The lamp that indicates line power is applied to the Model 8743A 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 2140-0052, LAMP: GLOW.

SECTION IV
MAINTENANCE

4-1. INTRODUCTION.

4-2. This Preliminary Operating and Service Manual provides instructions for testing the performance of the 8743A. The complete Operating and Service Manual will include more detailed maintenance information. If repair of the Model 8743A is necessary before the complete manual is received, contact the nearest Hewlett-Packard office for instructions. HP office locations are listed in the back pages of this manual.

4-3. COMPLETE OPERATING AND SERVICE MANUAL.

4-4. To obtain a copy of the complete Operating and Service Manual, when it is available, fill out and return the mailing card inside the front cover of this manual. If this mailing card is not filled out and r turned, the complete Operating and Service Manu will not be sent.

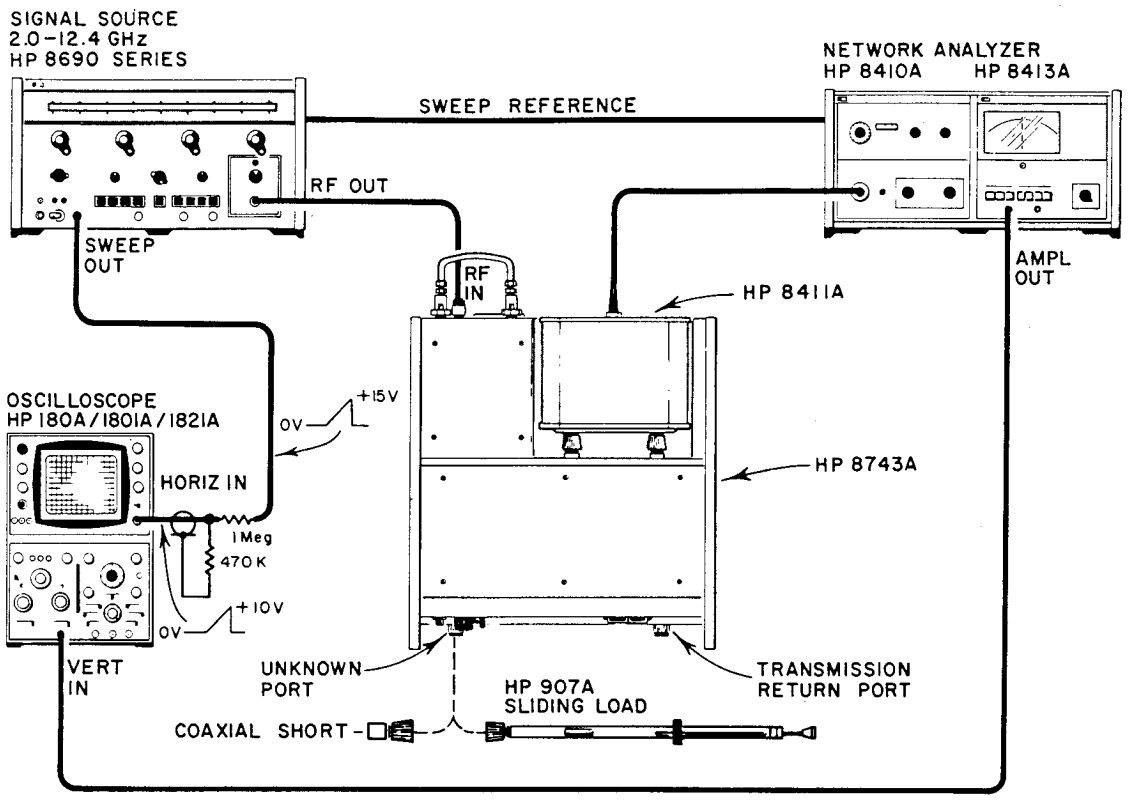
4-5. PERFORMANCE TEST PROCEDURES.

4-6. The performance test procedures presented Figure 4-1 are useful for incoming inspection and pe iodic evaluation, and after repair. The specificatio of Table 1-1 are the performance standards. Te equipment required for the procedures is listed Table 4-1. Instruments other than those recommend may be used, provided their performance equals c exceeds the critical specifications listed in the tabl

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 Output Power: 1 mW minimum into 50 ohm Power Variation: ±7 dB VSWR: < 3:1	8690A, B/8692A, B (2 to 4 GHz) 8690A, B/8693A, B (4 to 8 GHz) 8690A, B/8694A, B (8 to 12.4 GHz)
Network Analyzer	No substitute may be used	8410A/8411A/8413A and 8414A
Oscilloscope	Bandwidth: 5 MHz minimum Sensitivity: 50 mV/cm Horizontal Sweep Rate: 25 ms/cm	140A/1405A/1422A or 180A/1801A/1821A and 141A/1416A
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	907A
Swept Slotted Line	Frequency Range: 2.0 to 12.4 GHz Impedance: 50 ohm Output Connector: APC-7 Residual VSWR: < 1.02	817A

DIRECTIVITY TEST



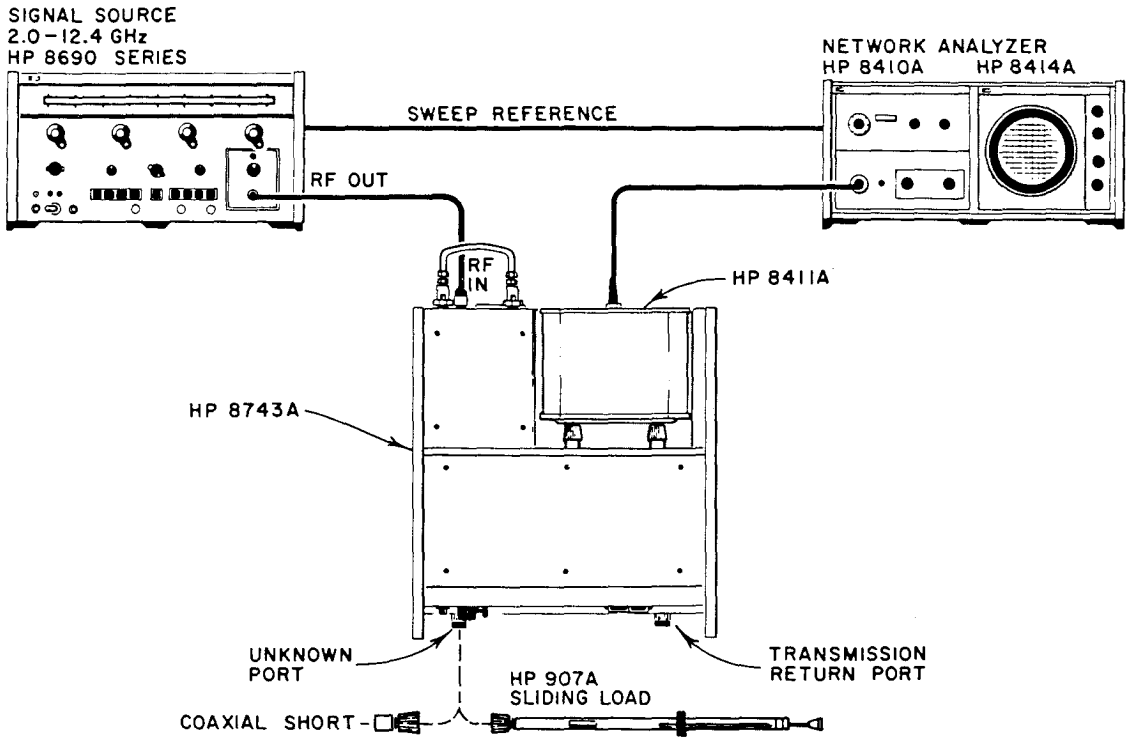
DESCRIPTION: The accuracy of a reflection measurement is affected primarily by the directivity of the coupler monitoring reflected signal. This test measures the directivity of the directional coupler associated with the UNKNOWN port. The test consists of measuring the combination of coupler directivity and load reflection. The load reflection is canceled, and the resultant is directivity. Two procedures are given for making the test. One using the 8413A display unit and the other using the 8414A display unit.

PROCEDURE, Using 8413A Display Unit

1. Connect equipment as shown in setup above.
2. Connect the coaxial short to the 8743A 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 8743A frequency range covered by the sweep oscillator.
4. Set the 8410A test channel gain to 20 dB. Adjust the 8410A amplitude vernier and oscilloscope vertical position controls for a convenient amplitude reference on the oscilloscope. 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 8410A test channel gain by 30 dB. Phase the sliding load, noting oscilloscope display. The average of this display 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.

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

DIRECTIVITY TEST (Cont.)

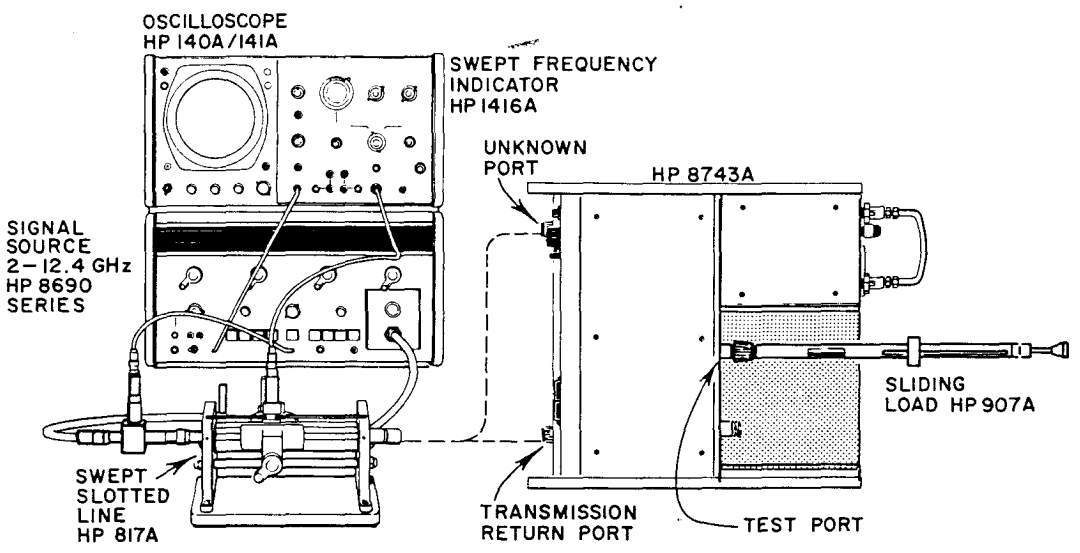


PROCEDURE, Using the 8414A Display Unit

1. Connect equipment as shown in setup above.
2. Connect the coaxial short to the 8743A 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 8743A frequency range covered by the sweep oscillator.
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. Adjust the REFERENCE PLANE EXTENSION to collapse the trace to a dot or smallest cluster.
6. Adjust the 8410A test channel gain and amplitude vernier controls to place the dot or the center of the cluster at the outer graticule.
7. Remove the coaxial short and replace with the sliding load.
8. Increase the 8410A test channel gain by 30 dB. Phase the sliding load, noting the CRT display. The average of this display 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.
10. Repeat steps 2 through 9 for other frequency segments as necessary to cover the range of 2.0 to 12.4 GHz.

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

REFLECTION COEFFICIENT TEST



1. Use a Swept Slotted Line in the setup shown above (with 8743A TEST port terminated in a low-reflection 50-ohm termination) to measure the reflection coefficient of the 8743A TRANSMISSION RETURN port from 2.0 to 12.4 GHz in both the transmission and reflection mode. The maximum peak-to-peak oscilloscope display for each mode must not exceed 2.93 dB (VSWR 1.4).

2. Measure the UNKNOWN port equivalent source reflection coefficient as follows:

   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

a. Connect equipment to make a reflection measurement as shown in Figure 3-3.

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

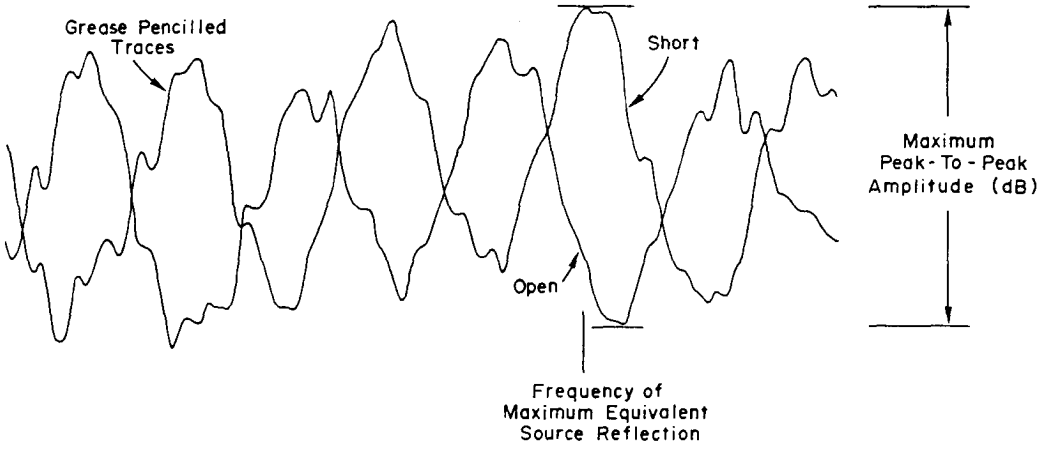
c. Set the Sweep Oscillator to automatic sweep. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over a full octave band in the 2.0 to 12.4 GHz range.

d. Disconnect oscilloscope vertical input from 8413A amplitude channel, to simulate zero volts dc from 8413A. Adjust trace position to the center of the CRT.

e. Reconnect vertical input and adjust 8410A test channel gain and amplitude vernier controls so that the average of the trace falls on the zero trace position noted in step (d).

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

REFLECTION COFFICIENT TEST



f. Increase oscilloscope vertical sensitivity to obtain a maximum amplitude CRT presentation. Draw the trace on the face of the CRT with a grease pencil.

g. Remove the coaxial short from the UNKNOWN port and grease pencil the trace of the open circuit on the CRT.

h. Determine the maximum peak-to-peak amplitude as shown above.

(1) Set the Sweep Oscillator to manual operation and adjust Sweep Oscillator manual frequency control and Network Analyzer amplitude vernier control to place the oscilloscope dot at one peak of the grease pencil trace. Note the 8413A meter indication. Place the dot at the other peak and again note the 8413A meter indication. The dB difference between the two meter indications is the peak-to-peak amplitude of

i. The maximum peak-to-peak amplitude must not exceed 1.59 dB (VSWR $\leq$ 1.2) from 2 to 8 GHz or 2.29 dB (VSWR $\leq$ 1.3) from 8 to 12.4 GHz.

VSWR = antilog 0.05 (peak-to-peak amplitude in dB)

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 b through i for other relative phase relations of the load, directivity, and source reflection vectors (i.e., offset the coaxial short using various lengths of air lines).

j. Repeat steps b through i for other frequency bands to cover the range of 2.0 to 12.4 GHz.

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

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 8743A 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.

RF TROUBLESHOOTING

Introduction.

8743A 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 service note discusses each category separately.

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 8743A 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 8743A, Network Analyzer, and Display Unit to calibrate for a transmission measurement (connect a through section between the 8743A 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 8743A, Network Analyzer, and Display Unit to calibrate for a reflection measurement (connect a coaxial short to the 8743A 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. 08743-60009.

2. If a repeatability problem occured in the RELFECTION check only, replace A5 Unknown Port Relay Assembly (HP Part No. 08743-60011).

3. If a repeatability problem occurred in the TRANSMISSION check only, replace A7 Transmission Return Port Relay Assembly (HP Part No. 08743-60010).

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.

COAXIAL SWITCH REPLACEMENT PROCEDURE.

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

1. Remove the 8743A 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 3/4 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 3/4 inch open-end wrench.

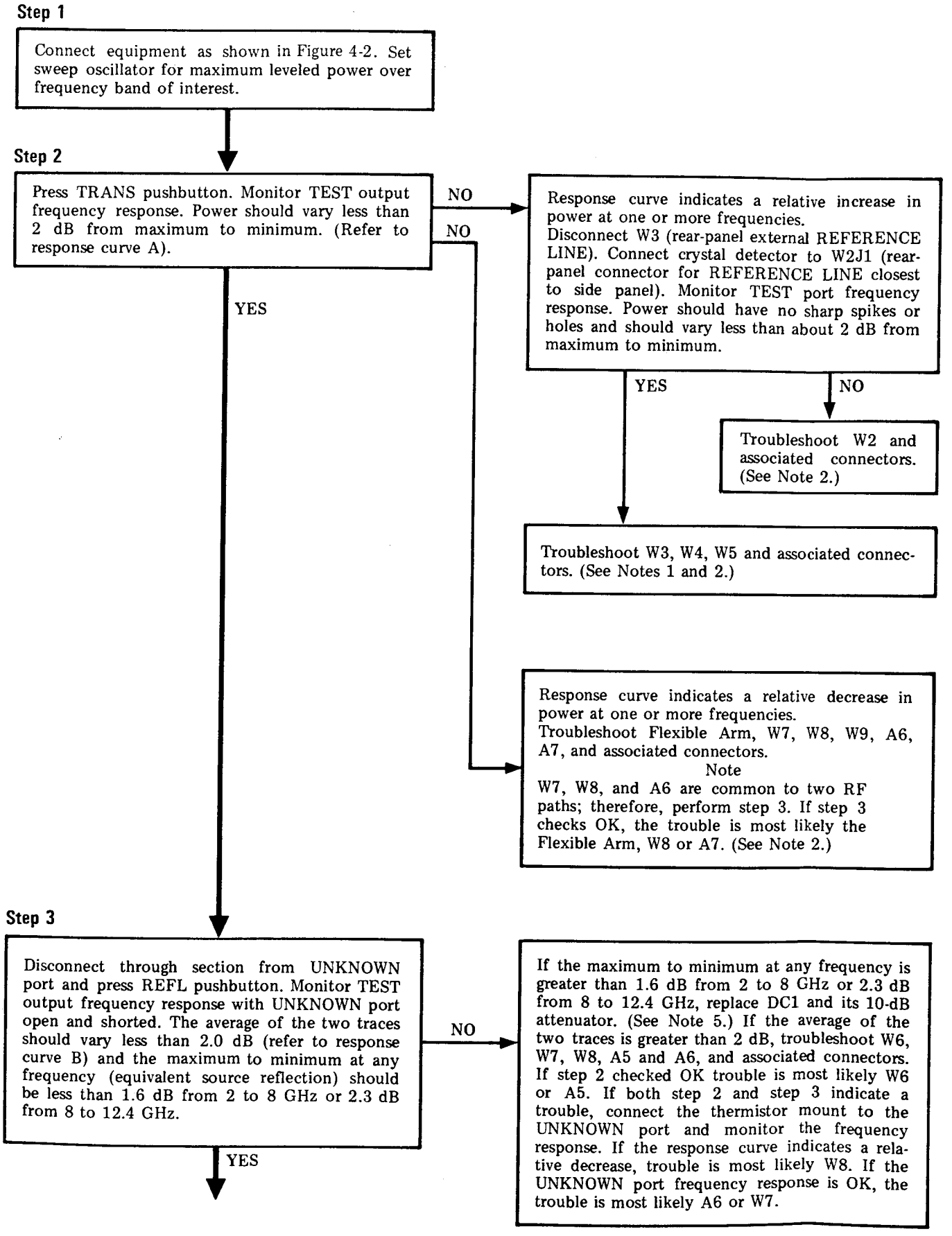
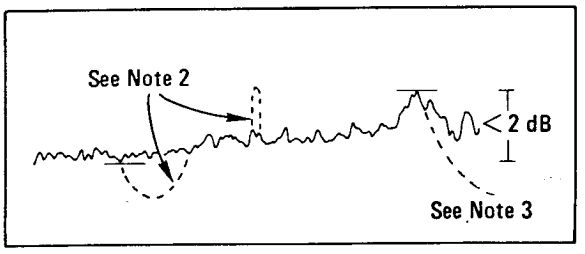
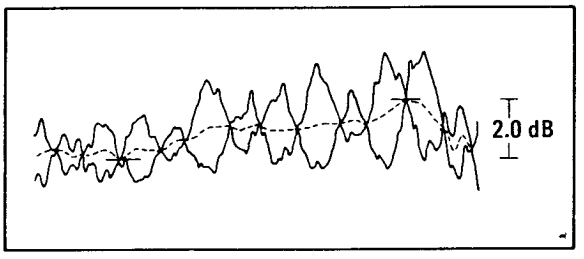


Figure 4-2. Insertion Loss Troubleshooting (Sheet 2 of 4)

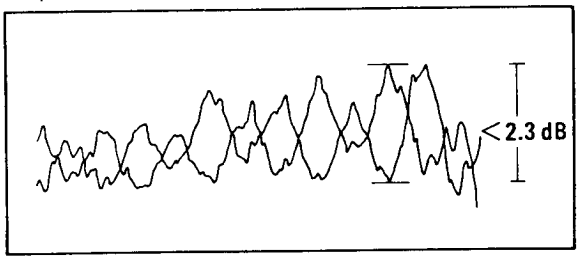
Response Curve A



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 2.

Figure 4-2. Insertion Loss Troubleshooting (Sheet 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. 08743-60005) 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 (Sheet 3 of 4)

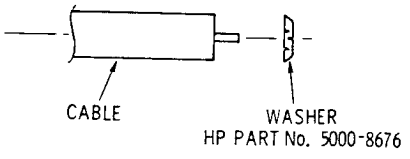


Figure 4-3. Position of Outer Conductor Washer

SECTION V

REPLACEABLE PARTS

5-1. INTRODUCTION.

5-2. This section contains information for ordering replaceable parts. Parts are listed in alpha-numerical 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 5-1:

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.

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	
CONN = connector	LK WASH = lock washer		TA = tantalum
CP = cadmium plate	LOG = logarithmic taper	PH BRZ = phosphor bronze	TD = time delay
CRT = cathode-ray tube	LPF = low pass filter	PHL = Phillips	TGL = toggle
CW = clockwise		PIV = peak inverse voltage	THD = thread
	M = milli = 10^{-3}	PNP = positive-negative-positive	TI = titanium
DEPC = deposited carbon	MEG = meg = 10^{6}		TOL = tolerance
DR = drive	MET FLM = metal film	P/O = part of	TRIM = trimmer
	MET OX = metallic oxide	POLY = polystyrene	TWT = traveling wave tube
ELECT = electrolytic	MFR = manufacturer	PORC = porcelain	
ENCAP = encapsulated	MHZ = mega hertz	POS = position(s)	U = micro = 10^{-6}
EXT = external	MINAT = miniature	POT = potentiometer	
	MOM = momentary	PP = peak-to-peak	VAR = variable
F = farads	MTG = mounting	PT = point	VDCW = dc working volts
FH = flat head	MY = "mylar"	PWV = peak working voltage	
FIL H = fillister head			W/ = with
FXD = fixed	N = nano (10^{-9})	RECT = rectifier	W = watts
	N/C = normally closed	RF = radio frequency	WIV = working inverse voltage
G = giga (10^{9})	NE = neon	RH = round head or right hand	
GE = germanium	NI PL = nickel plate		WW = wirewound
GL = glass			W/O = without
GRD = ground(ed)			

Table 5-1. Reference Designation Index

Reference Designation	Part No.	Description #	Note
A1	08743-60001	POWER SUPPLY ASSY	
A1C1	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C2	0180-0141	C:FXD ELECT 50 UF +75-10% 50VDCW	
A1CR1	1901-0026	DIODE:SILICON 0.75A 200PIV	
A1CR2	1901-0026	DIODE:SILICON 0.75A 200PIV	
A1CR3	1901-0026	DIODE:SILICON 0.75A 200PIV	
A1CR4	1901-0026	DIODE:SILICON 0.75A 200PIV	
A1CR5	1901-0200	DIODE:SILICON 3A 100PIV	
A1CR6	1902-3193	DIODE BREAKDOWN:13.3V 5%	
A1Q1	1854-0071	TRANSISTOR:SILICON NPN	
A1Q2	1854-0039	TRANSISTOR:SILICON 2N3053	
A1Q3	1854-0071	TRANSISTOR:SILICON NPN	
A1R1	0698-3640	R:FXD MET OX 1.8K OHM 5% 2W	
A1R2	0757-0421	R:FXD MET FLM 825 OHM 1% 1/8W	
A1R3	0757-0199	R:FXD MET FLM 21.5K OHM 1% 1/8W	
A1R4	0811-1672	R:FXD WW 3.3 OHM 5% 2W	
A1R5	0698-3154	R:FXD MET FLM 4.22K OHM 1% 1/8W	
A1R6	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A1R7	2100-1758	R:VAR WW 1K OHM 10% LIN 1/2W	
A2	08743-60002	SWITCH ASSY	
A2CR1	1901-0025	DIODE:SILICON 100WV 100MA	
A2CR2	1901-0025	DIODE:SILICON 100WV 100MA	
A2DS1	2140-0213	LAMP:INCANDESCENT 28V 0.04A	
A2DS2	2140-0213	LAMP:INCANDESCENT 28V 0.04A	
A2Q1	1854-0071	TRANSISTOR:SILICON NPN	
A2Q2	1854-0071	TRANSISTOR:SILICON NPN	
A2R1	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A2R2	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W	
A2R3	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A2R4	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A2R5	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W	
A2R6	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A2R7	0757-1000	R:FXD MET FLM 51.1 OHM 1% 1/2W	
A2S1		NOT SEPARATELY REPLACEABLE	
A2S2		NOT SEPARATELY REPLACEABLE	
A3	08743-60038	RELAY DRIVER ASSY	
A3C1	0150-0121	C:FXD CER 0.1 UF +80-20% 50VDCW	
A3CR1	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR2	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR3	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR5	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR6	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR7	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR8	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR9	1901-0025	DIODE:SILICON 100WV 100MA	
A3CR10	1901-0025	DIODE:SILICON 100WV 100MA	

 # · See introduction to this section for ordering information

Table 5-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A3CR11	1902-0551	DIODE BREAKDOWN:6.19V 5%	
A3Q1	1854-0039	TRANSISTOR:SILICON 2N3053	
A3Q2	1854-0039	TRANSISTOR:SILICON 2N3053	
A3Q3	1853-0012	TRANSISTOR:SILICON PNP	
A3Q4	1853-0012	TRANSISTOR:SILICON PNP	
A3Q5	1854-0071	TRANSISTOR:SILICON NPN	
A3Q6	1853-0020	TRANSISTOR:SILICON PNP	
A3Q7	1853-0020	TRANSISTOR:SILICON PNP	
A3Q8	1854-0071	TRANSISTOR:SILICON NPN	
A3Q9	1854-0071	TRANSISTOR:SILICON NPN	
A3R1	0698-3408	R:FXD MET FLM 2.15K OHM 1% 1/2W	
A3R2	0698-3408	R:FXD MET FLM 2.15K OHM 1% 1/2W	
A3R3	0757-0199	R:FXD MET FLM 21.5K OHM 1% 1/8W	
A3R4	0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	
A3R5	0698-0084	R:FXD MET FLM 2.15K OHM 1% 1/8W	
A3R6	0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	
A3R7	0698-0084	R:FXD MET FLM 2.15K OHM 1% 1/8W	
A3R8	0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	
A3R9	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A3R10	0757-0290	R:FXD MET FLM 6.19K OHM 1% 1/8W	
A3R11	0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	
A3R12	0757-1078	R:FXD MET FLM 1.47K OHM 1% 1/2W	
A3R13	0698-3406	R:FXD MET FLM 1.33K OHM 1% 1/2W	
A3R14	0698-3406	R:FXD MET FLM 1.33K OHM 1% 1/2W	
A3R15	0757-0462	R:FXD MET FLM 75K OHM 1% 1/8W	
A4	08741-60004	LINE STRETCHER ASSY	
A5	08743-60011	RELAY ASSY,UNKNOWN PORT	
A6	08743-60009	RELAY ASSY,TEST PORT	
A7	08743-60010	RELAY ASSY,TRANSMISSION RETURN PORT	
C1	0180-0198	C:FXD ELECT 1500 UF 50/60VDCW	
DC1	08743-60005	DIRECTIONAL COUPLER(TEST)	
DC2	08743-60004	DIRECTIONAL COUPLER(INPUT)	
DS1	2140-0244	LAMP:GLOW	
F1	2110-0336	FUSE:CARTRIDGE 1/2A 250V SLOW-BLOW(115VAC)	
	2110-0340	FUSE:CARTRIDGE 0.25A SLOW-BLOW(230VAC)	
J1	1251-0085	CONNECTOR:FEMALE 36-PIN MINIATURE	
J2	1251-2357	SOCKET:3-PIN(AC POWER)	
Q1	1854-0072	TRANSISTOR:SILICON NPN 2N3054	
R1	0698-3162	R:FXD MET FLM 46.4K OHM 1% 1/8W	
S1	3101-1244	SWITCH:PUSHBUTTON SPDT(AC AND PILOT LIGHT)	
S2	3101-1235	SWITCH:SLIDE DPDT(115/230V AC)	
T1	9100-2728	TRANSFORMER:24.4V	
W1	8120-1348	CABLE ASSY:POWER CORD	
W2	08743-20021	CABLE ASSY:DC2 TO W3	
W3	08745-20064	CABLE ASSY:EXTERNAL REFERENCE LINE	

 # See introduction to this section for ordering information

Table 5-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
W4	08743-20023	CABLE ASSY:W3 TO A4	
W5	08743-20024	CABLE ASSY:A4 TO A8	
W6	08743-20033	CABLE ASSY:A5 TO DC1	
W7	08743-20026	CABLE ASSY:A6 TO TEST OUTPUT	
W8	08743-20027	CABLE ASSY:DC2 TO UNKNOWN PORT	
W9	08743-20035	CABLE ASSY:A7 TO TRANSMISSION RETURN PORT	
XF1	1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	
		MISCELLANEOUS	
	0370-0770	LENS	
	5000-6469	LABEL:PUSHBUTTON "TRANS"	
	5000-6470	LABEL:PUSHBUTTON "REFL"	
	08743-60014	10 DB ATTENUATOR CARTRIDGE	
		THIS MANUAL IMPLEMENTS A DIFFERENT COLOR SCHEME FOR THE STANDARD INSTRUMENT. COLORS PRIOR TO THIS CHANGE ARE NOW AVAILABLE AS OPTIONS. REFER TO THE LIST BELOW.	
		8743A STANDARD - INDICATES COLOR SCHEME FOR THE 8740A BEGINNING WITH INSTRUMENTS SERIAL PREFIXED 1226. (INCLUDES MINT GRAY FRONT PANEL AND OLIVE GRAY CABINET).	
		8743A OPTION A85 - INDICATES LIGHT GRAY FRONT PANEL.	
		8743A OPTION X95 - INDICATES COLOR SCHEME FOR 8743A PRIOR TO SERIAL PREFIX 1226. (INCLUDES LIGHT GRAY FRONT PANEL AND BLUE-GRAY CABINET).	
	0370-0974	PUSHBUTTON, JADE GRAY(STANDARD)	
	0370-0767	PUSHBUTTON, GRAY(OPT A85, X95)	
	0370-0975	BEZEL:END CAP(LEFT)JADE GRAY(STANDARD)	
	0370-0765	BEZEL:END CAP(LEFT)GRAY(OPT A85, X95)	
	0370-0976	BEZEL:END CAP(RIGHT)JADE GRAY(STANDARD)	
	0370-0766	BEZEL:END CAP(RIGHT)GRAY(OPT A85, X95)	
	5000-8705	SIDE COVER:REAR,OLIVE GRAY(STANDARD)	
	5000-0736	SIDE COVER:REAR,BLUE-GRAY(OPT X95)	
	5000-8707	SIDE COVER:FRONT,OLIVE GRAY(STANDARD)	
	5000-0737	SIDE COVER:FRONT,BLUE-GRAY(OPT X95)	
	5040-0351	BEZEL:COUNTER,MINT GRAY(STANDARD)	
	5040-0204	BEZEL:COUNTER,GRAY(OPT A85, X95)	
	5060-0268	COVER ASSY:BOTTOM,OLIVE GRAY(STANDARD)	
	5060-0228	COVER ASSY:BOTTOM,BLUE-GRAY(OPT X95)	
	5060-8737	RETAINER:HANDLE ASSY,OLIVE GRAY(STANDARD)	
	5060-0766	RETAINER:HANDLE ASSY,BLUE-GRAY(OPT X95)	
	08743-00018	PANEL:REAR,MINT GRAY(STANDARD)	
	08743-00002	PANEL:REAR,LIGHT GRAY(OPT X95)	
	08743-00019	COVER ASSY:TOP,OLIVE GRAY(STANDARD)	
	08743-00004	COVER ASSY:TOP,BLUE-GRAY(OPT X95)	
	08743-00020	TOP COVER:REAR CORNER,OLIVE GRAY(STANDARD)	
	08743-00005	TOP COVER:REAR CORNER,BLUE-GRAY(OPT X95)	
	08743-00021	FILLER PLATE:CENTER,OLIVE GRAY(STANDARD)	
	08743-00006	FILLER PLATE:CENTER,BLUE-GRAY(OPT X95)	
	08743-00022	FILLER PLATE:SIDE,OLIVE GRAY(STANDARD)	
	08743-00007	FILLER PLATE:SIDE,BLUE-GRAY(OPT X95)	

 # See introduction to this section for ordering information

Reference Designation	Part No.	Description #	Note
	08743-00024	PANEL:FRONT,MINT GRAY(STANDARD)	
	08743-00013	PANEL:FRONT,LIGHT GRAY(OPT A85, X95)	
	08743-00023	SUB-DECK,OLIVE GRAY(STANDARD)	
	08743-00014	SUB-DECK,BLUE-GRAY(OPT X95)	
	08745-20068	TRIM:LOWER FRAME,MINT GRAY(STANDARD)	
	08745-2019	TRIM:LOWER FRAME,LIGHT GRAY(OPT A85, X95)	
	08745-20069	TRIM:UPPER FRAME,MINT GRAY(STANDARD)	
	08745-2020	TRIM:UPPER FRAME,LIGHT GRAY(OPT A85, X95)	

 # See introduction to this section for ordering information

SECTION VI
SCHEMATIC DIAGRAMS

6-1. INTRODUCTION.

6-2. The schematic diagrams in this section represent the circuits electrically. They are not wiring diagrams, though wire colors are given where practical.

6-3. 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.

6-4. 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.

6-5. As an aid to finding components and assemblies in the set of diagrams, each diagram has a box labelled Reference Designations that contains all the reference designations appearing on the diagram.

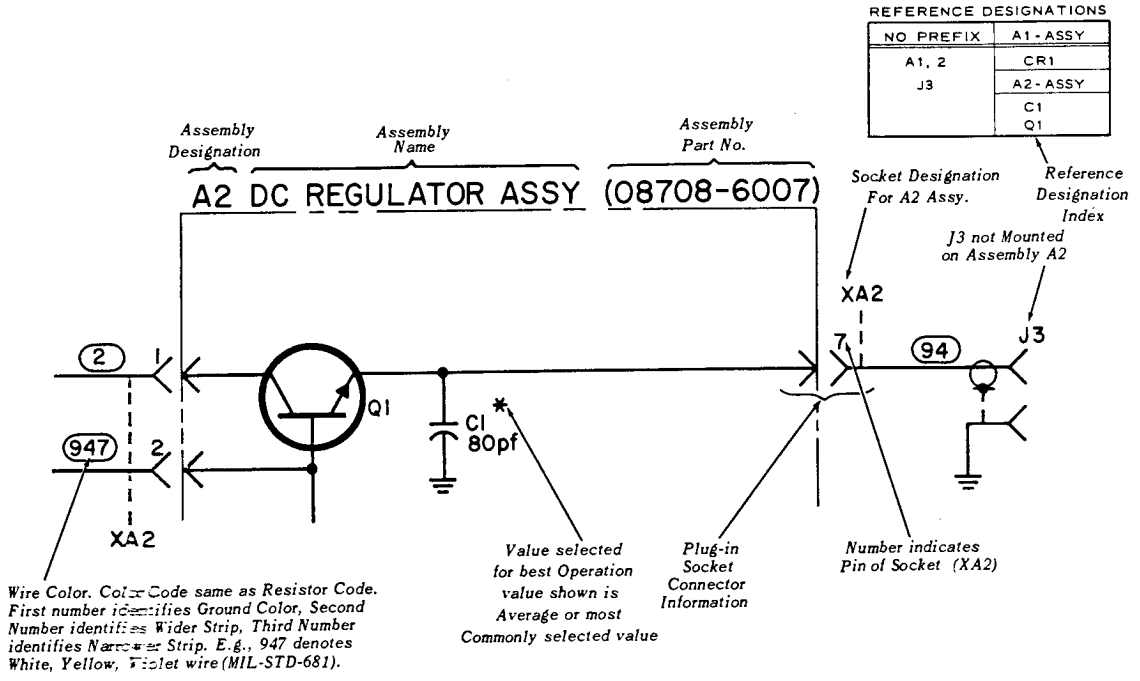


Figure 6-1. General Information on Schematic Diagrams

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

Figure 6-2. Schematic Diagram Notes

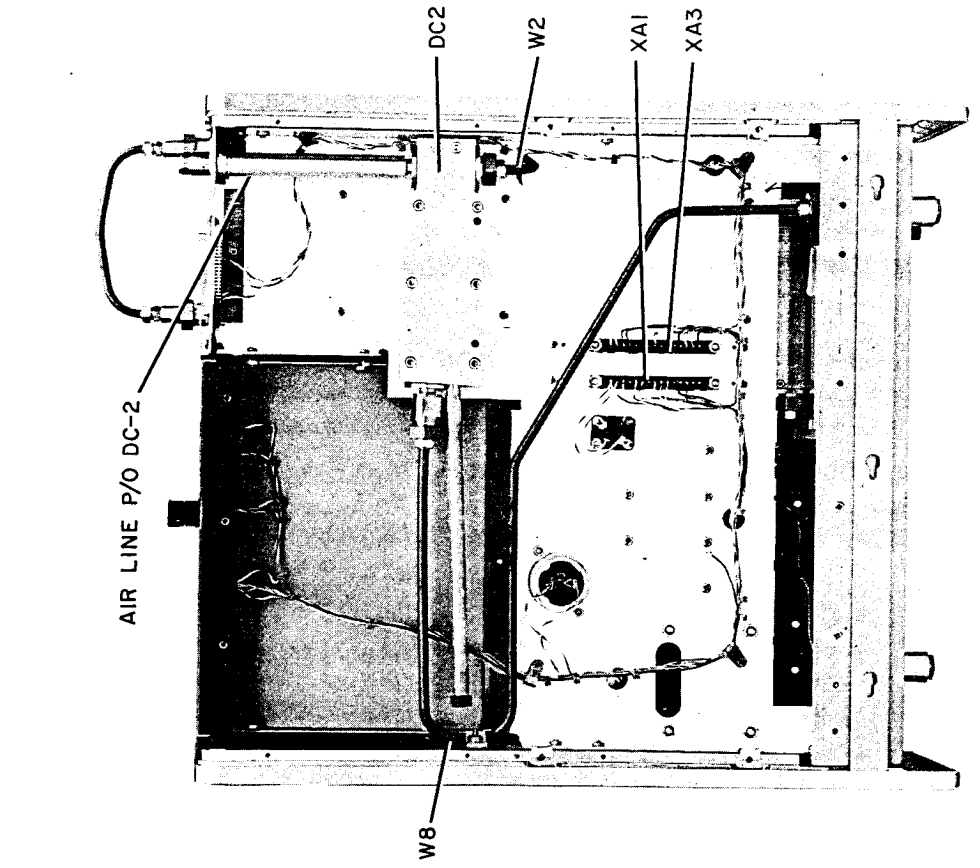


Figure 6-4. 8743A Component Identification, Bottom View

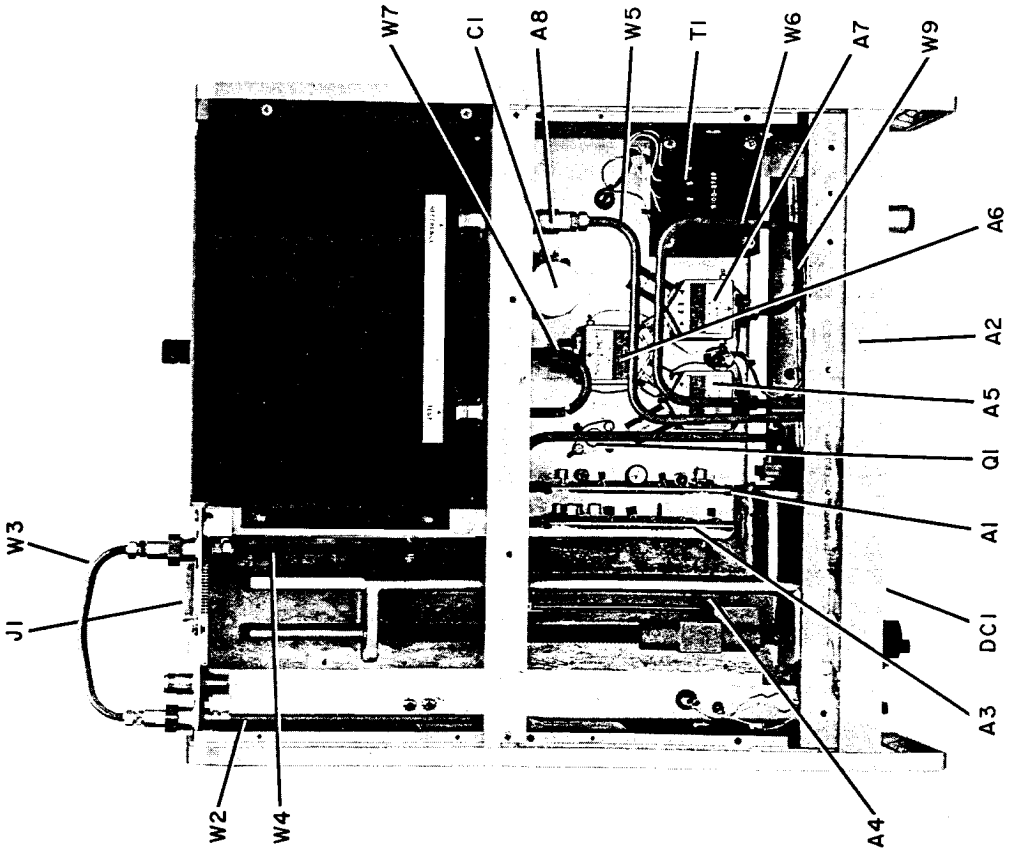


Figure 6-3. 8743A Component Identification, Top View

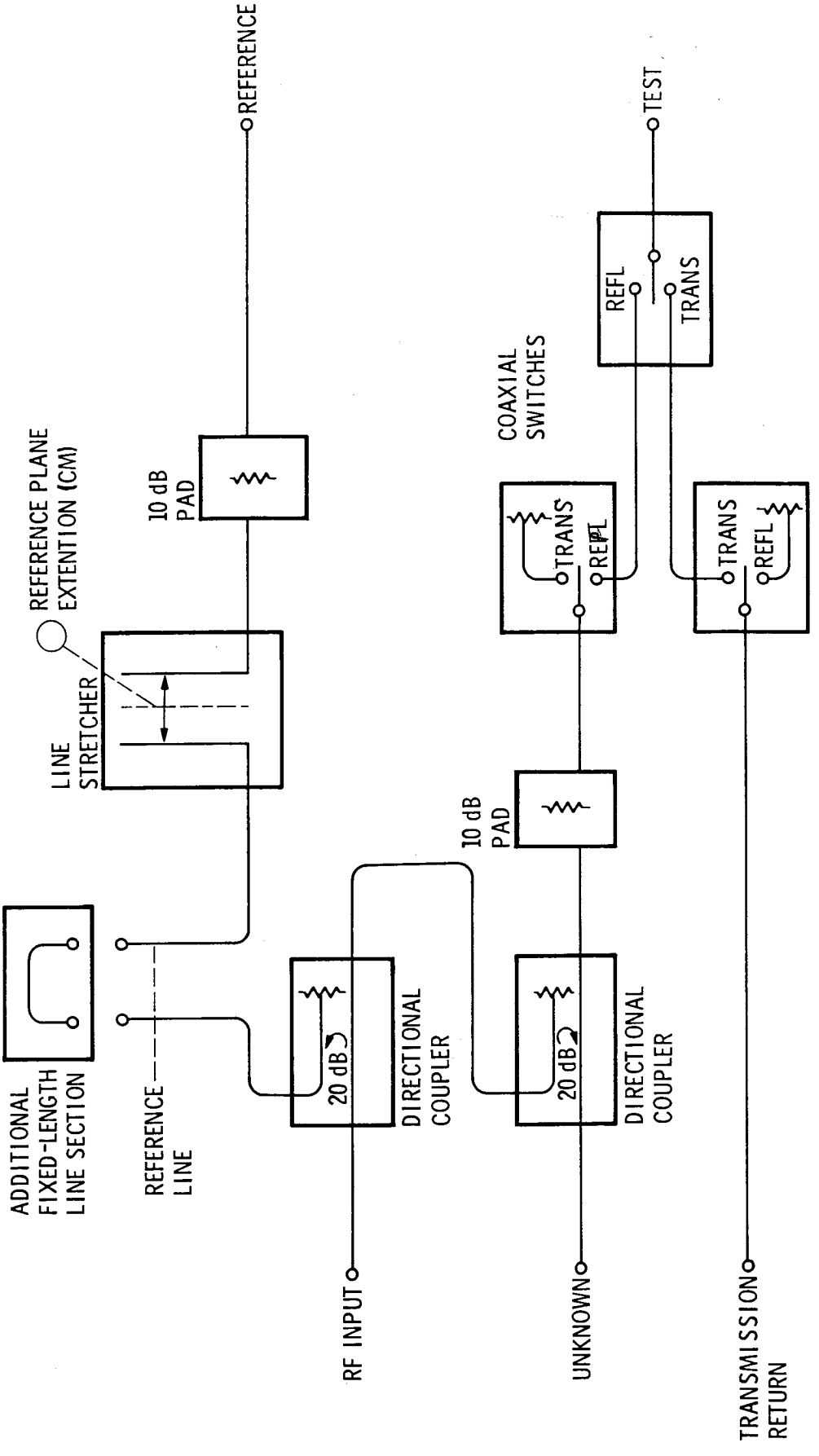


Figure 6-5. Simplified RF Schematic Diagram

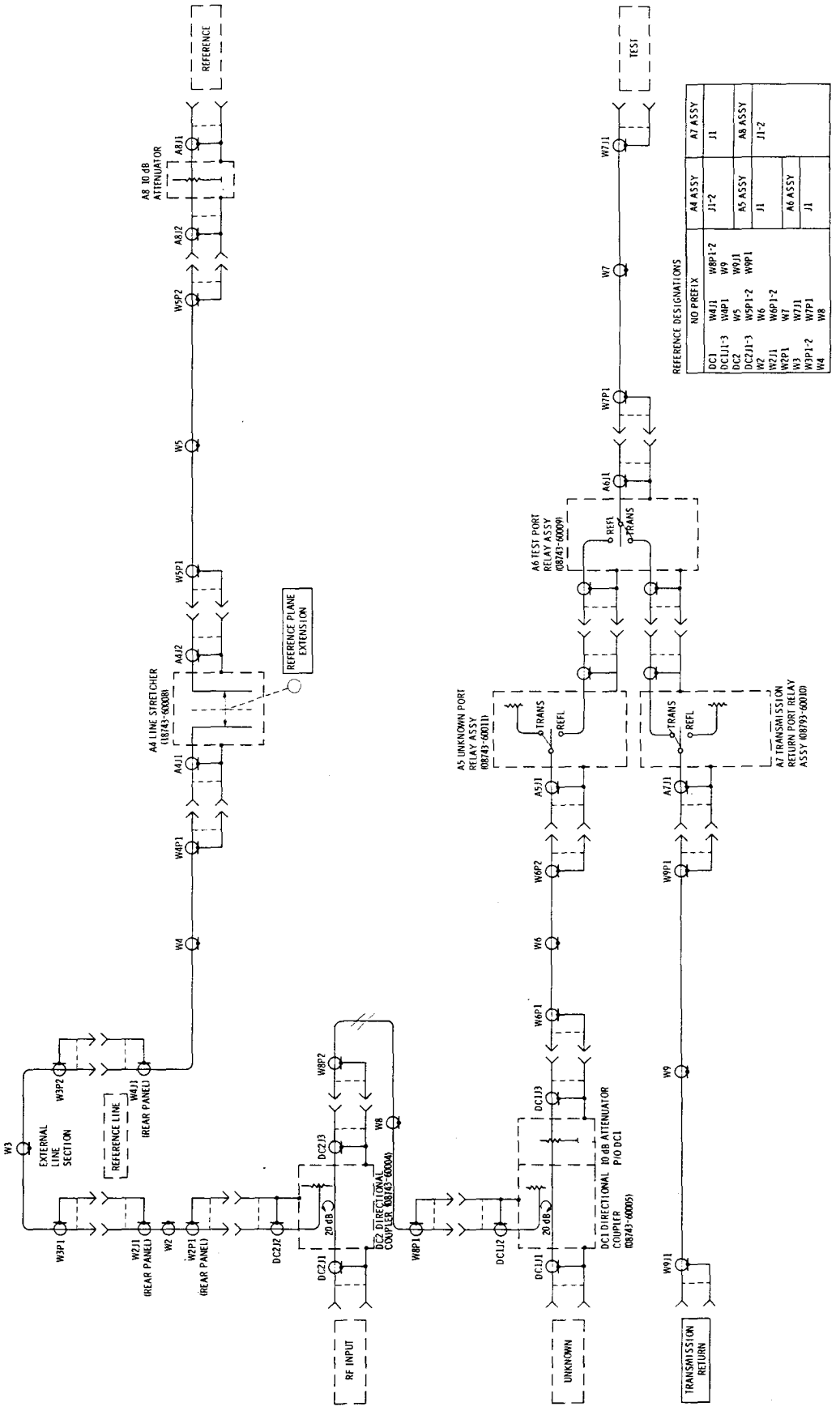


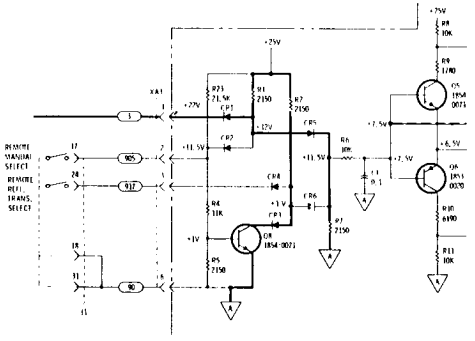
Figure 6-6. RF Schematic Diagram

MANUAL CONTROL

REFLECTION

REFLECTION

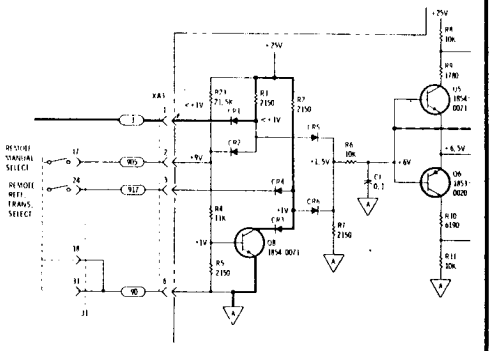
A high output from the flip-flop reverse biases CR1. With CR1 open the majority of current through R1 flows through CR5 and R7. The voltage across R7 is > 6V which turns Q5 on and Q6 off.



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

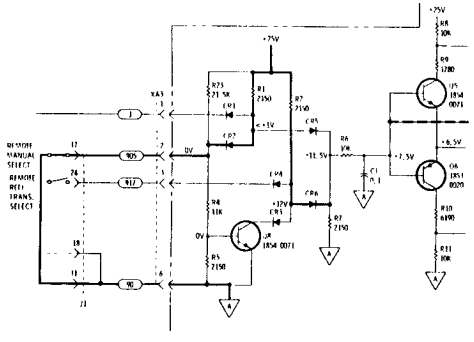
REFLECTION

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.

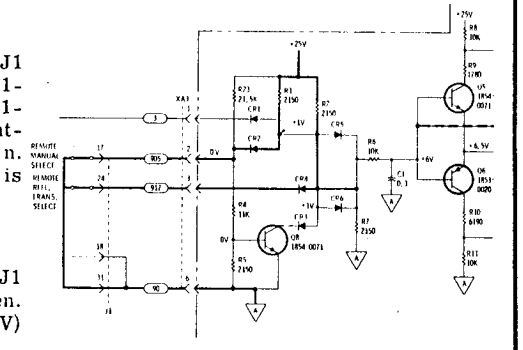


Figure 6-7. Relay Driver Input Circuit Talking Schematic Diagram

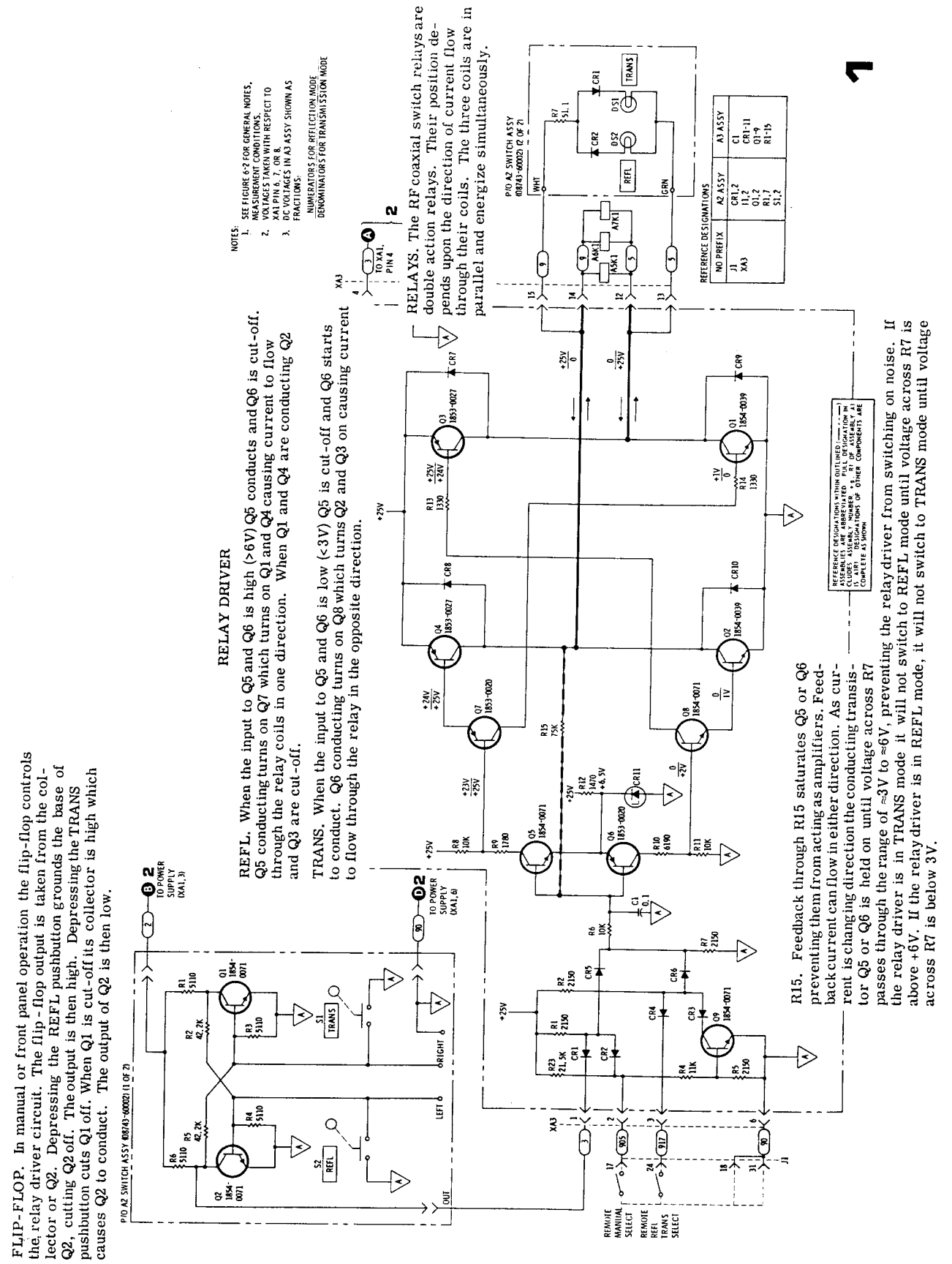


Figure 6-8. Relay Driver Talking Schematic Diagram

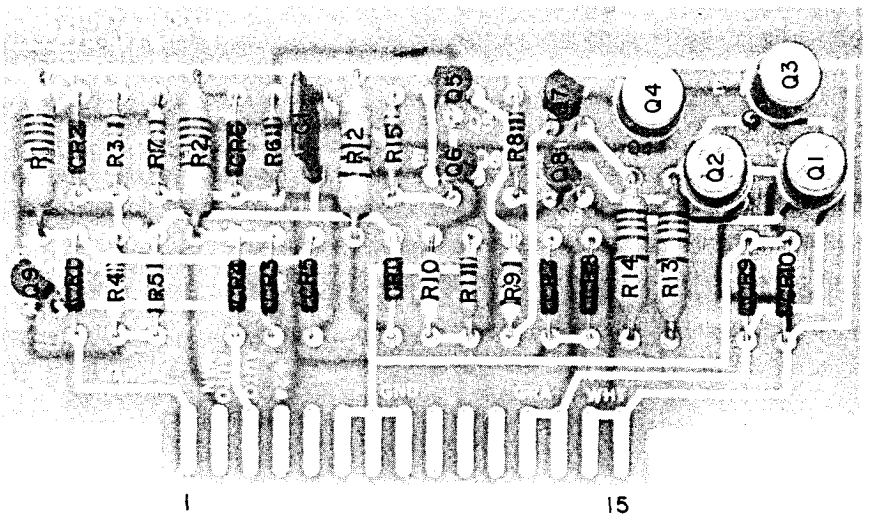


Figure 6-9. Relay Driver Assy Component Identification

(Applies to A3 Assembly, HP Part No. 08743-60038 except for Q1 through Q4, which are identified on the PC Board.)

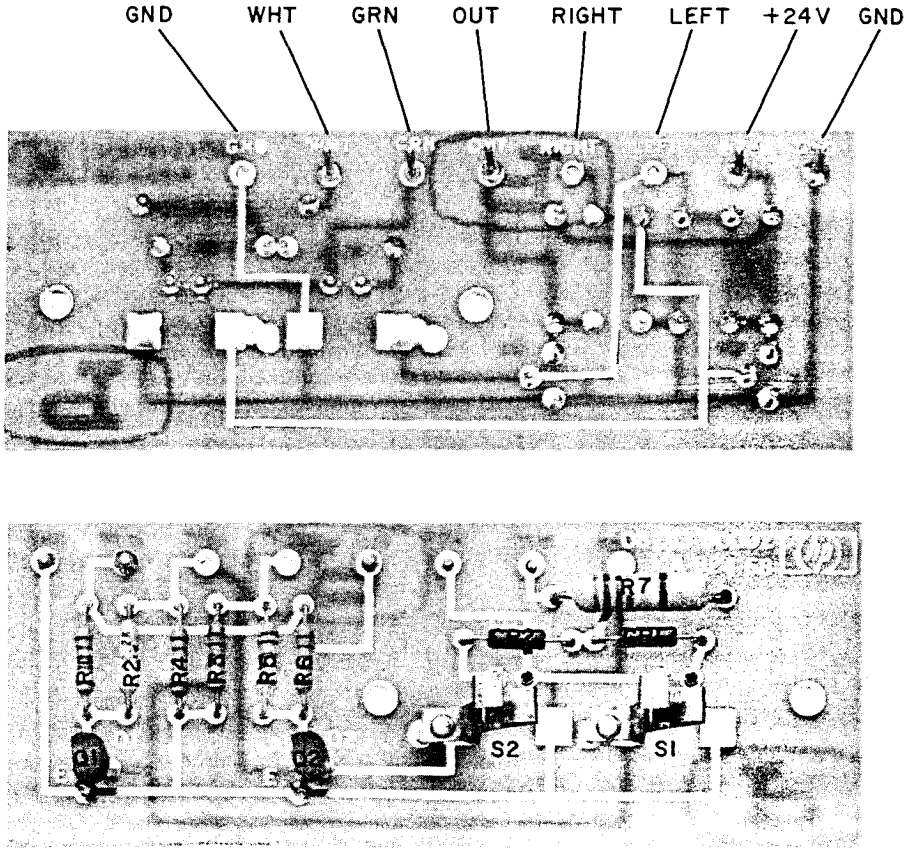


Figure 6-10. Switch Assy Component Identification

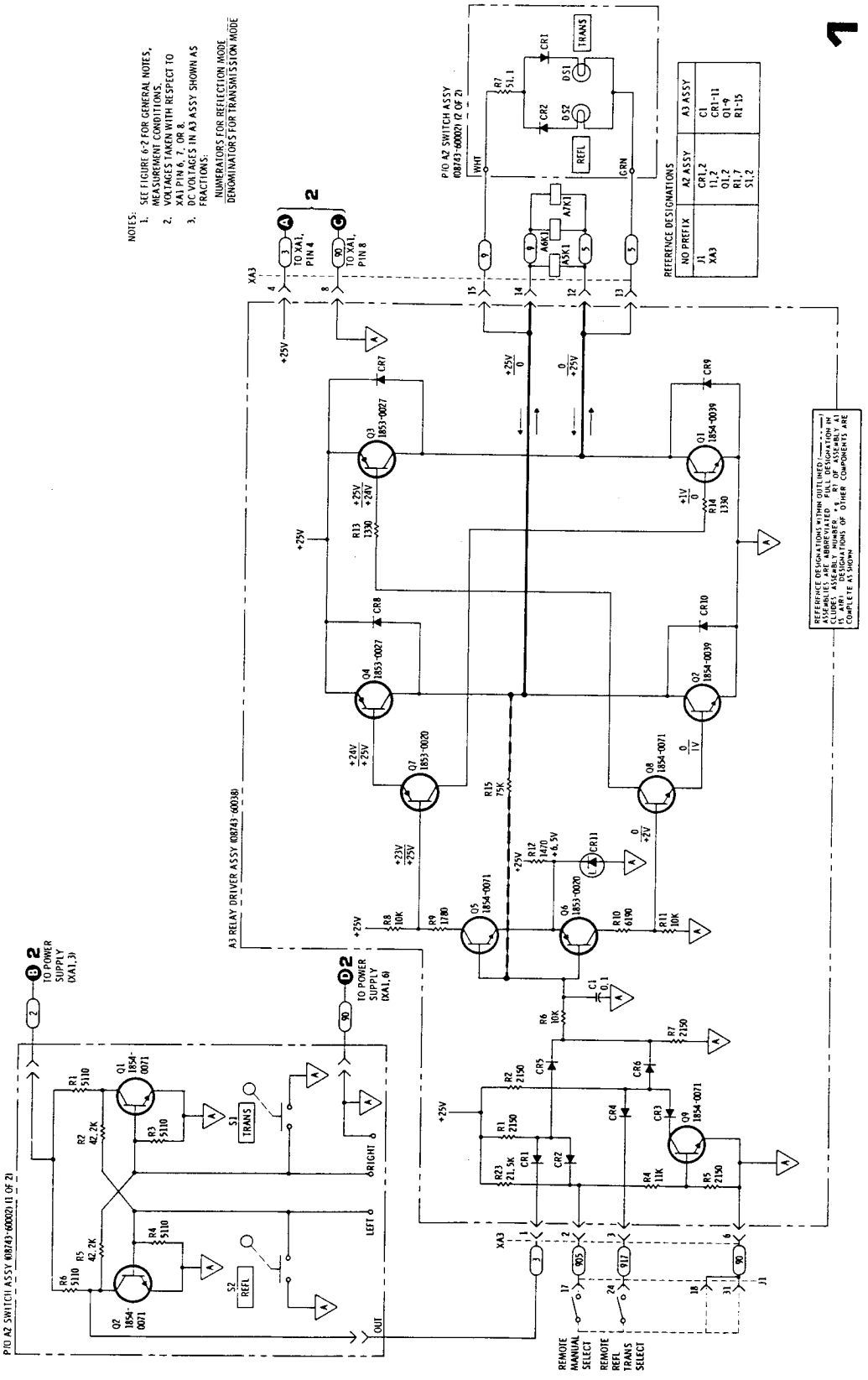


Figure 6-11. Relay Driver Assy Schematic Diagram

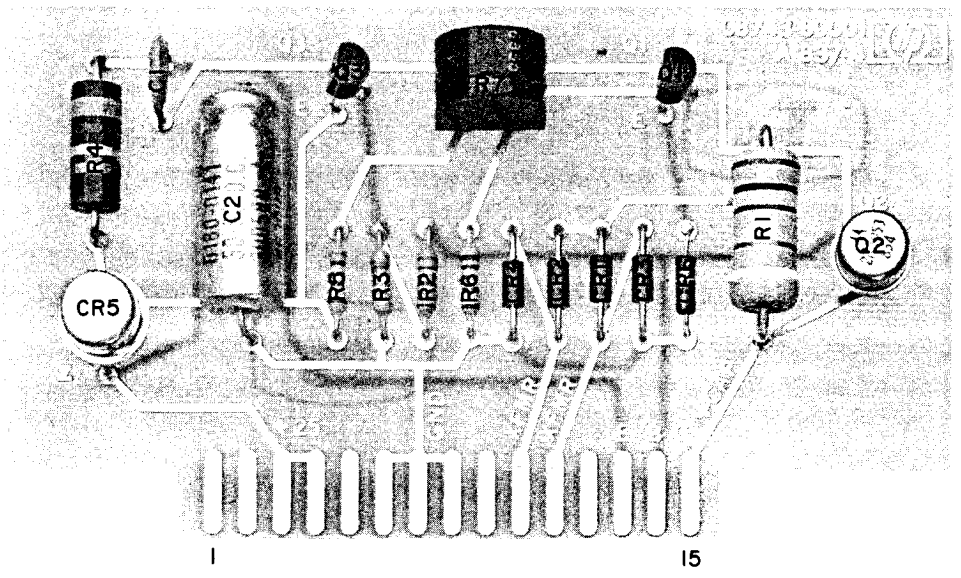
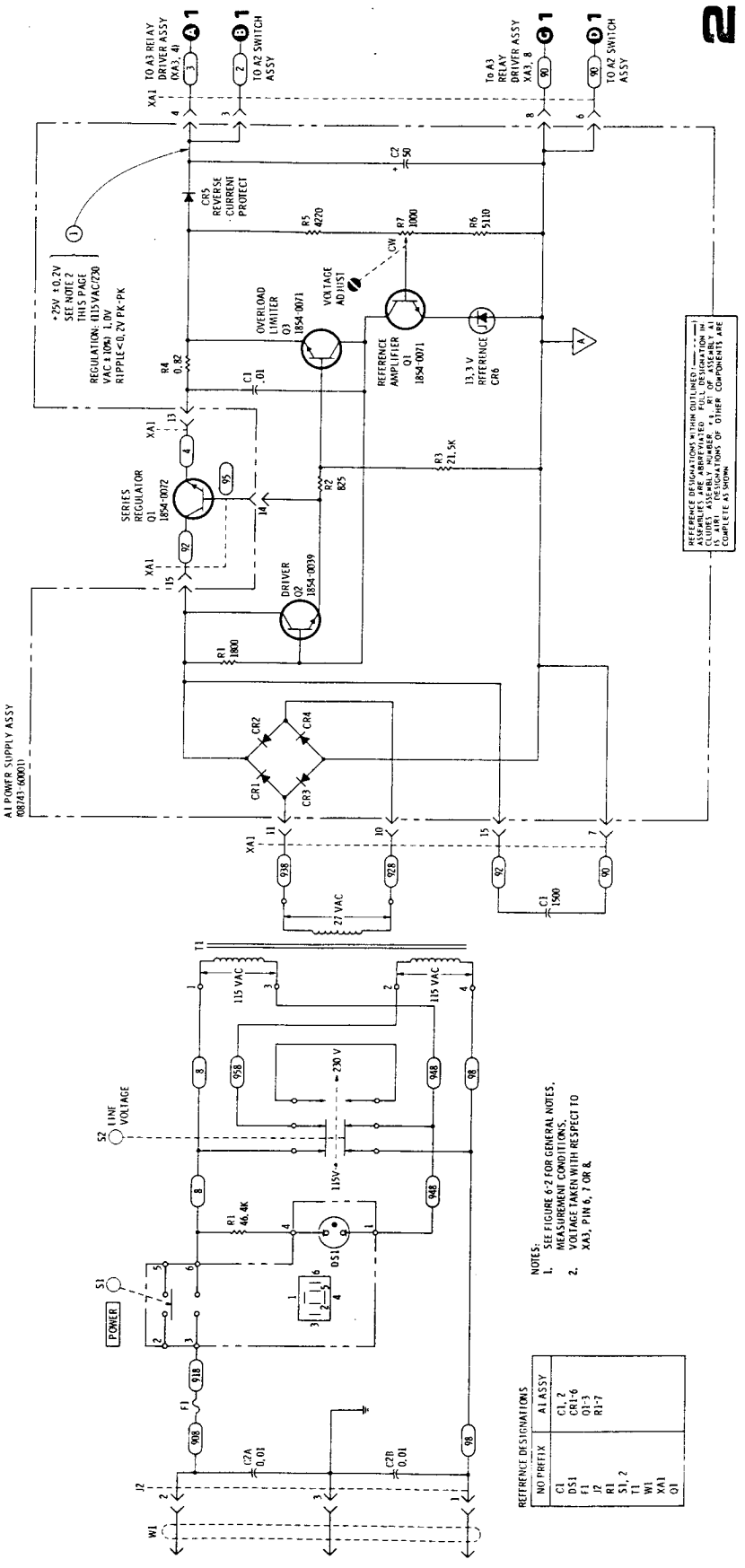


Figure 6-12. Power Supply Assy Component Identification



NO PREFIX	A1 ASSY
C1	C1, 2
DS1	CR1-6
F1	Q1-3
J2	R1-7
R1	
S1, 2	
T1	
W1	
XA1	
Q1	

Figure 6-13. Power Supply Schematic

APPENDIX

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MANUAL CHANGES

To adapt this manual to instruments with Serial Numbers listed in the table below, make the indicated manual changes.

Information for adapting this manual to instruments with Serial Numbers not listed below may be included in a yellow MANUAL CHANGES insert supplied with this manual. Information about Serial Numbers not covered in any of these ways can be obtained from the nearest Hewlett-Packard office.

► NEW ITEM.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
834-	A, B, C, D
917, 928	B, C, D
968-, 990-	C, D
1141	D

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

CHANGE A

Page 5-3, Table 5-1:

Change A3R12 to HP Part No. 0757-0816 R: FXD MET FLM 681 OHM 1% 1/2W.

Change A3R15 to HP Part No. 0757-0458 R: FXD MET FLM 51.1K OHM 1% 1/8W.

CHANGE B

Page 5-3, Table 5-1:

Change F1 (115V) to HP Part No. 2110-0008 FUSE: 1/2A SLOW-BLOW.

Change F1 (230V) to HP Part No. 2110-0340 FUSE: 0.25A SLOW-BLOW.

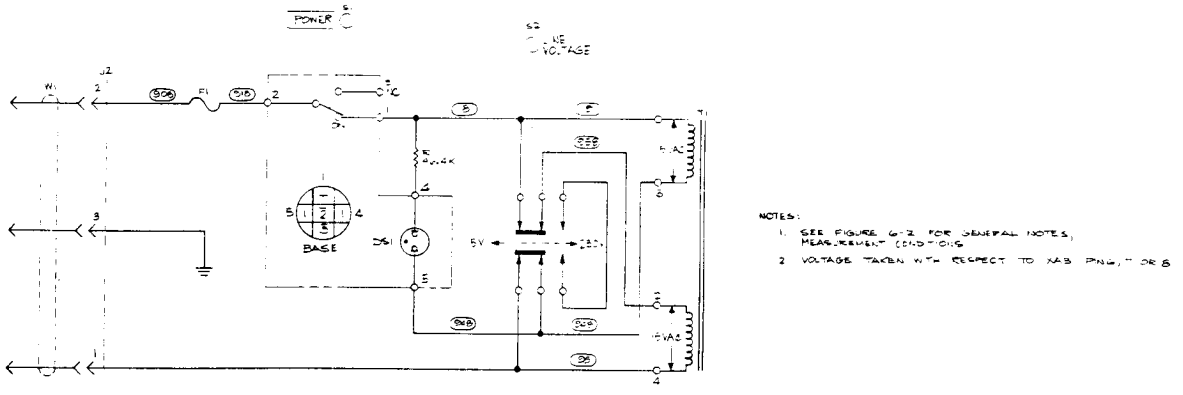
Change S1 to HP Part No. 3101-0100 (Same description).

Change S2 to HP Part No. 3101-1235 (Same description).

Change W1 to HP Part No. 8120-0078 (Same description).

Page 6-11, Figure 6-13:

Replace power supply primary circuit with partial schematic shown below.



CHANGE C

Page 5-2, Table 5-1:

Change A1R4 to HP Part No. 0811-1672 R: FXD WW 0.82 OHM 5% 2W.

Change A3 to HP Part No. 08743-60003 (Same description).

CHANGE D

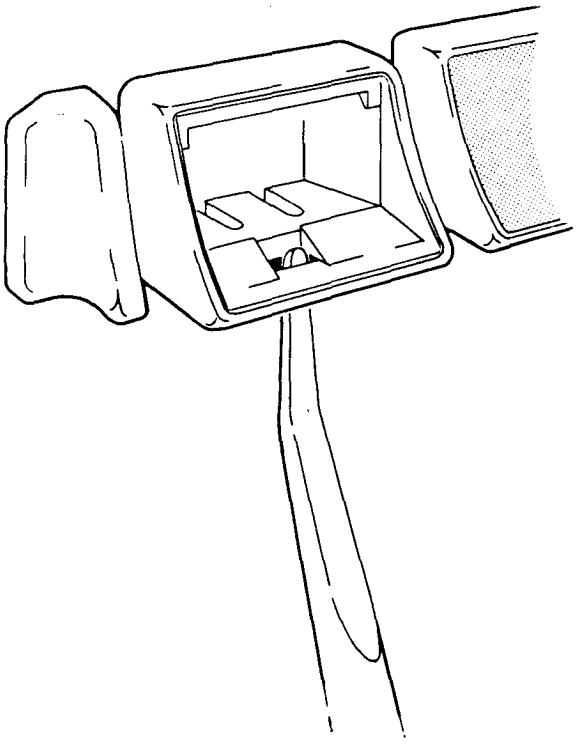
Page 3-15, Figure 3-12:

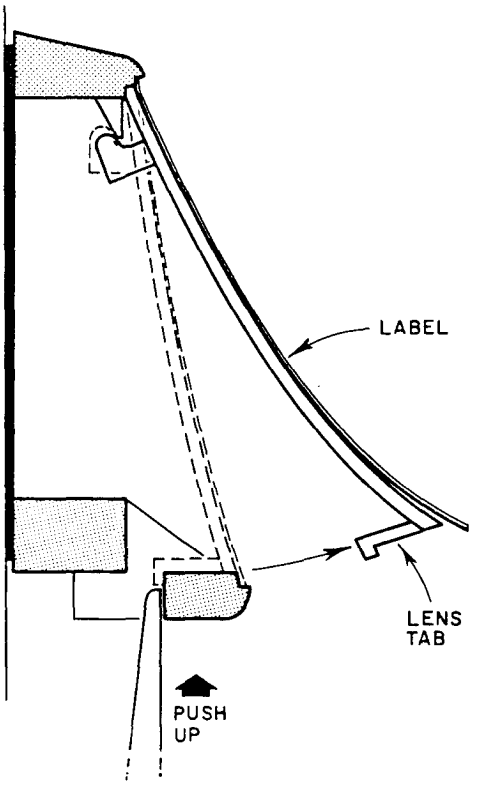
Use the following Figure 3-12 in place of the Figure 3-12 shown in the manual.

Page 5-4, Table 5-1:

Delete 08743-00024 listing.

PUSHBUTTON LAMP REPLACEMENT





1. DO NOT REMOVE PUSHBUTTON. Remove pushbutton lens and label by inserting a soldering aid or other small, blunt tool in the slot in the bottom of the pushbutton. Press tool forward against lens tab to release lens and label. If pushbutton comes out see NOTE in Step 3.

2. Remove defective lamp. A needle-nose pliers or tweezers can be used as an extracting tool. Install new lamp (HP part number 2140-0213).

3. Press lens and label into place in pushbutton opening.

NOTE:
If the pushbutton has been removed:
a. Reinstall pushbutton, lens and label removed.
b. Insert the metal contactor in slot of pushbutton as shown. If contactor is not inserted in slot properly, switch may stay on at all times.

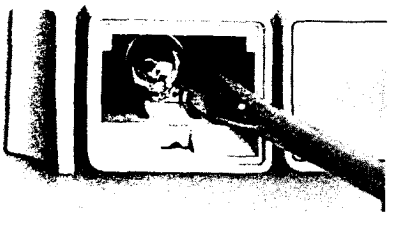


Figure A-1. Pushbutton Lamp Replacement

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AUSTRALIA
Hewlett-Packard Australia Pty. Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
P.O. Box 36
Doncaster East, Victoria 3109
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Telex: 31-024
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Tel: 804244
Telex: 62650
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5th Floor
Teachers Union Building
495-499 Boundary Street
Spring Hill, Queensland 4000
Tel: 2291544
Cable: HEWPARD Brisbane

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Magnet House 72
Dilkusha Commercial Area
Motijheel, Dacca 2
Tel: 252415, 252419
Telex: 734
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ETHIOPIA
Abdella Abdulmalik
P.O. Box 2635
Addis Ababa
Tel: 11 93 40

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Tel: 646-4513
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Schmidt & Co. (Hong Kong) Ltd.
Wing On Centre, 28th Floor
Connaught Road, C.
Hong Kong
Tel: 5-455644
Telex: 74766 SCHMC HX

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Kasturi Buildings
Jamshedji Tata Rd.
Bombay 400 020
Tel: 29 50 21
Telex: 011-2156
Cable: BLUEFROST

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
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Blue Star Ltd.
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Prabhadevi
Bombay 400 025
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Blue Star Ltd.
Bhavdeep
Stadium Road
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Tel: 42880
Telex: 234
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Telex: 021-7655
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7th & 8th Floor
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New Delhi 110 024
Tel: 634770 & 635166
Telex: 031-2463
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House
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Tel: 55668
Telex: 043-430
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Meeakshi Mandiram
xxx 1678 Mahatma Gandhi Rd.
Cochin 682 016
Tel: 32069, 32161, 32282
Telex: 0885-514
Cable: BLUESTAR

Blue Star Ltd.
1-1-117/1
Sarojini Devi Road
Secunderabad 500 003
Tel: 70126, 70127
Telex: 015-459
Cable: BLUEFROST

Blue Star Ltd.
2/34 Kodambakkam High Road
Madras 600 034
Tel: 82056
Telex: 041-379
Cable: BLUESTAR

INDONESIA
BERCA Indonesia P.T.
P.O. Box 496 Jkt.
Jln Abdu. Muis 62
Jakarta
Tel: 349255, 349886
Telex: 46748 BERSIL IA
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BERCA Indonesia P.T.
P.O. Box 174 Sby.
23 Jln. Jimerto
Surabaya
Tel: 42027
Cable: BErcacon

ISRAEL
Electronics Engineering Div. of Motorola Israel Ltd.
16, Kremenetski Street
P.O. Box 25016
Tel-Aviv
Tel: 38973
Telex: 33569, 34164
Cable: BASTEL Tel-Aviv

JAPAN
Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg., 4th Floor
4-20, Nishinakajima 5-chome
Yodogawa-ku, Osaka-shi
Osaka 532
Tel: 06-304-6021
Telex: 523-3624

Yokogawa-Hewlett-Packard Ltd.
29-21, Takaido-Higashi 3-chome
Suginami-ku, **Tokyo** 168
Tel: 03-331-6111
Telex: 232-2024 YHP-Tokyo
Cable: YHPMARKET TOK 23 724

Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
24 Kami Sasajima-cho
Nakamura-ku, **Nagoya**, 450
Tel: 052 571-5171

Yokogawa-Hewlett-Packard Ltd.
Tangawa Building
2-24-1 Tsuruya-cho
Kanagawa-ku
Yokohama 221
Tel: 045-312-1252
Telex: 382-3204 YHP YOK

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Building
105, 1-chome, Sanno-maru
Mito, Ibaragi 310
Tel: 0292-25-7470

Yokogawa-Hewlett-Packard Ltd.
Inoue Building
1348-3, Asahi-cho, 1-chome
Atsugi, Kanagawa 243
Tel: 0462-24-0452

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi
Hachijuni Building
4th Floor
3-4, Tsukuba
Kumagaya, Saitama 360
Tel: 0485-24-6563

KENYA
Advanced Communications Ltd.
P.O. Box 30070
Nairobi
Tel: 331955
Telex: 22639

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P.O. Box 19012
Nairobi Airport
Nairobi
Tel: 336055,56
Telex: 22201 22301
Cable: INTAERIO Nairobi

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P.O. Box 95221
Mombasa

KOREA
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15th Floor, Daeyongak Bldg.,
25-5, 1-KA
Choong Moo-Ro, Chung-Ku,
Seoul
Tel: (23) 6811, 778-3401 2 3 4
Telex: 22575

MALAYSIA
Hewlett-Packard Sales SDN. BHD.
Suite 2.21.2.22
Bangunan Angkasa Raya
Jalan Ampang
Kuala Lumpar
Tel: 23320 27491

Protel Engineering
P.O. Box 1917
Lot 259, Satok Road
Kuching, **Sarawak**
Tel: 53544
Cable: PROTELENG

MOZAMBIQUE
A.N. Goncalves, Ltd.
162, 1. Apt. 14 Av. D. Luis
Caixa Postal 107
Maputo
Tel: 27091, 27114
Telex: 6-203 NEGON Mo
Cable: NEGON

NEW GUINEA
Hewlett-Packard Australia Pty. Ltd.
Development Bank Building
Ground Floor
Ward Strip
Port Moresby, Papua
Tel: 258933

NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
4-12 Cruickshank Street
Kilbirnie, Wellington 3
P.O. Box 9443
Courtney Place
Wellington
Tel: 877-199
Cable: HEWPACK Wellington

Hewlett-Packard (N.Z.) Ltd.
Pakuranga Professional Centre
267 Pakuranga Highway
Box 51092
Pakuranga
Tel: 569-651
Cable: HEWPACK Auckland

Analytical Medical Only
Medical Supplies N.Z. Ltd.
Scientific Division
79 Carlton Gore Road, Newmarket
P.O. Box 1234
Auckland
Tel: 75-289
Cable: DENTAL Auckland

Analytical Medical Only
Medical Supplies N.Z. Ltd.
Norrie and Parumoana Streets
Porirua
Tel: 75-098
Telex: 3858

Analytical Medical Only
Medical Supplies N.Z. Ltd.
P.O. Box 309
239 Stanmore Road
Christchurch
Tel: 892-019
Cable: DENTAL Christchurch

Analytical Medical Only
Medical Supplies N.Z. Ltd.
303 Great King Street
P.O. Box 233
Dunedin
Tel: 88-817
Cable: DENTAL Dunedin

NIGERIA
The Electronics Instrumentations Ltd.
N6B 770 Oyo Road
Oluseun House
P.M.B. 5402
Ibadan
Tel: 461577
Telex: 31231 TEIL NG
Cable: THETIEL Ibadan

The Electronics Instrumentations Ltd.
144 Agege Motor Road, Mushin
P.O. Box 6645
Lagos
Cable: THETEIL Lagos

PAKISTAN
Mushko & Company Ltd.
Dosman Chambers
Abdullah Haroon Road
Karachi-3
Tel: 511027, 512927
Telex: 2894
Cable: COOPERATOR Karachi

Mushko & Company Ltd.
38B, Satellite Town
Rawalpindi
Tel: 41924
Cable: FEMUS Rawalpindi

PHILIPPINES
The Online Advanced Systems Corporation
Rico House
Amorsolo cor. Herrera Str.
Legaspi Village, Makati
P.O. Box 1510
Metro **Manila**
Tel: 85-35-81, 85-34-91, 85-32-21
Telex: 3274 ONLINE

RHODESIA
Field Technical Sales
45 Kelvin Road North
P.O. Box 3458
Salisbury
Tel: 705231 (5 lines)
Telex: RH 4122

SINGAPORE
Hewlett-Packard Singapore (Pte.) Ltd.
1150 Depot Road
Alexandra P.O. Box 58
Singapore 4
Tel: 270-2355
Telex: HPSG RS 21486
Cable: HEWPACK, Singapore

SOUTH AFRICA
Hewlett-Packard South Africa (Pty.) Ltd.
Private Bag Wendywood
Sandton, Transvaal, 2144
Hewlett-Packard Centre
Daphne Street, Wendywood,
Sandton, 2144
Tel: 802-1040/8
Telex: 8-4782
Cable: HEWPACK Johannesburg

Hewlett-Packard South Africa (Pty.) Ltd.
P.O. Box 120
Howard Place, Cape Province, 7450
Pine Park Centre, Forest Drive,
Pinelands, Cape Province, 7405
Tel: 53-7955 thru 9
Telex: 57-0006

SRI LANKA
Metropolitan Agencies Ltd.
256/9 Union Place
Colombo 2
Tel: 33947
Telex: 1377 METROLTD CE
Cable: METROLTD

SUDAN
Ragson Trade
P.O. Box 921
Khartoum
Tel: 74048
Telex: 375

TAIWAN
Hewlett-Packard Far East Ltd.
Taiwan Branch
39 Chung Hsiao West Road
Section 1, 7th Floor
Taipei
Tel: 3819160-9, 3141010
Cable: HEWPACK TAIPEI

Hewlett-Packard Far East Ltd.
Taiwan Branch
68-2 Chung Cheng 3rd. Road
Kaohsiung
tel: (07) 242318-Kaohsiung

Analytical Only
San Kwang Instruments Co., Ltd.
20 Yung Sui Road
Taipei
Tel: 3615446-9 (4 lines)
Telex: 22894 SANKWANG
Cable: SANKWANG Taipei

TANZANIA
Medical Only
International Aeradio (E.A.) Ltd.
P.O. Box 861
Dar es Salaam
Tel: 21251 Ext. 265
Telex: 41030

THAILAND
UNIMESA Co., Ltd.
Elcom Research Building
2538 Sukumvit Ave.
Bangchak, Bangkok
Tel: 3932387, 3930338
Cable: UNIMESA Bangkok

UGANDA
Medical Only
International Aeradio (E.A.) Ltd.
P.O. Box 2577
Kampala
Tel: 54388
Cable: INTAERIO Kampala

ZAMBIA
R.J. Tilbury (Zambia) Ltd.
P.O. Box 2792
Lusaka
Tel: 73793
Cable: ARJAYTEE Lusaka

OTHER AREAS NOT LISTED, CONTACT:
Hewlett-Packard Intercontinental
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 856-1501
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd.
11620A - 168th Street
Edmonton T5M 3T9
Tel: (403) 452-3670
TWX: 610-831-2431

Hewlett-Packard (Canada) Ltd.
210, 7220 Fisher St. S.E.
Calgary T2H 2H8
Tel: (403) 253-2713
Twx: 610-821-6141

BRITISH COLUMBIA
Hewlett-Packard (Canada) Ltd.
10691 Shellbridge Way
Richmond V6X 2W7
Tel: (604) 270-2277
TWX: 610-925-5059

MANITOBA
Hewlett-Packard (Canada) Ltd.
380-550 Century St.
Winnipeg R3H 0Y1
Tel: (204) 786-6701
TWX: 610-671-3531

NOVA SCOTIA
Hewlett-Packard (Canada) Ltd.
800 Windmill Road
Dartmouth B3B 1L1
Tel: (902) 469-7820
TWX: 610-271-4482

ONTARIO
Hewlett-Packard (Canada) Ltd.
1020 Morrison Dr.
Ottawa K2H 8K7
Tel: (613) 820-6483
TWX: 610-563-1636

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
Mississauga L4V 1M8
Tel: (416) 678-9430
TWX: 610-492-4246

Hewlett-Packard (Canada) Ltd.
552 Newbold Street
London N6E 2S5
Tel: (519) 686-9181

QUEBEC
Hewlett-Packard (Canada) Ltd.
275 Hymus Blvd.
Pointe Claire H9R 1G7
Tel: (514) 697-4232
TWX: 610-422-3022
TLX: 05-821-521 HPCL

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett-Packard (Canada) Ltd. in Mississauga.

CENTRAL AND SOUTH AMERICA

ARGENTINA
Hewlett-Packard Argentina S.A.
Av. Leandro N. Alem 822 - 12°
1001 **Buenos Aires**
Tel: 31-6063/4/5/6
Telex: 122443 AR CIGY
Cable: HEWPACKARG

Biotron S.A.C.I. y M.
Bolivar 177
1066 **Buenos Aires**
Tel: 30-4846, 34-9356, 34-0460, 33-2863
Telex: 011-7595
Cable: Biotron Baires

BOLIVIA
Casa Kavlin S.A.
Calle Potosi 1130
P.O. Box 500
La Paz
Tel: 47530, 53221
Telex: CWC BX 5298, ITT 3560082
Cable: KAVLIN

BRAZIL
Hewlett-Packard do Brasil I.e.C. Ltda.
Alameda Rio Negro, 750
Alphaville
06400 **Barueri** SP
Tel: 429-3222
Cable: HEWPACK Sao Paulo

Hewlett-Packard do Brasil I.e.C. Ltda.
Rua Padre Chagas, 32
90000-**Porto Alegre**-RS
Tel: (0512) 22-2998, 22-5621
Cable: HEWPACK Porto Alegre

Hewlett-Packard do Brasil I.e.C. Ltda.
Av. Epitacio Pessoa, 4664
Lagoa
20000-**Rio de Janeiro**-RJ
Tel:
Telex: 021-21905 HPBR-BR
Cable: HEWPACK
Rio de Janeiro

CHILE
Jorge Calcagni y Cia. Ltda.
Vicuna MacKenna 3, Ofic. 1204
Casilla 16475
Correo 9, **Santiago**
Tel: 34152
Telex: JCALCAGNI

COLOMBIA
Instrumentacion
Henrik A. Langebaek & Kier S.A.
Carrera 7 No. 48-75
Apartado Aereo 6287
Bogota, D.E.
Tel: 269-8877
Telex: 44400
Cable: AARIS Bogota

Instrumentacion
H.A. Langebaek & Kier S.A.
Carrera 63 No. 49-A-31
Apartado 54098
Medellin
Tel: 304475

COSTA RICA
Cientifica Costarricense S.A.
Avenida 2, Calle 5
San Pedro de Montes de Oca
Apartado 10159
San Jose
Tel: 24-38-20, 24-08-19
Telex: 2367 GALGUR CR
Cable: GALGUR

ECUADOR
Computadoras y Equipos Electronicos del Ecuador
P.O. Box 6423 CCI
Eloy Alfaro No. 1824, 3 Piso
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Casilla 3590
Robles 625
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IPESA
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San Salvador
Tel: 252787

GUATEMALA
IPESA
Avenida Reforma 3-48,
Zona 9
Guatemala City
Tel: 316627, 314786, 66471-5 ext. 9
Telex: 4192 Teletro Gu

MEXICO
Hewlett-Packard Mexicana, S.A. de C.V.
Av. Periférico Sur No. 6501
Tepepan, Xochimilco
Mexico 23, D.F.
Tel: 905-676-4600
Telex: 017-74-507

Hewlett-Packard Mexicana, S.A. de C.V.
Ave. Constitucion No. 2184
Monterrey, N.L.
Tel: 48-71-32, 48-71-84
Telex: 038-410

NICARAGUA
Roberto Terán G.
Apartado Postal 689
Edificio Terán
Managua
Tel: 25114, 23412, 23454, 22400
Cable: ROTERAN, Managua

PANAMA
Electronico Balboa, S.A.
Aparatado 4929
Panama 5
Calle Samuel Lewis
Edificio "Alfa", No. 2
Cuidad de Panama
Tel: 64-2700
Telex: 3483103 Curundu, Canal Zone
Cable: ELECTRON Panama

PERU
Compañia Electro Medica S.A.
Los Flamencos 145
San Isidro Casilla 1030
Lima 1
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Telex: Pub. Booth 25424 SISIDRO
Cable: ELMED Lima

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Surtel Radio Holland N.V.
Grote Hofstr. 3-5
P.O. Box 155
Paramaribo
Tel: 72118, 77880
Cable: Surtel

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P.O. Box 732
69 Frederick Street
Port-of-Spain
Tel: 62-53068

URUGUAY
Pablo Ferrando S.A.C.e.I.
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel: 40-3102
Telex: 702 Public Booth Para Pablo Ferrando
Cable: RADIUM Montevideo

VENEZUELA
Hewlett-Packard de Venezuela C.A.
P.O. Box 50933
Caracas 105
Los Ruices Norte
3a Transversal
Edificio Segre
Caracas 107
Tel: 239-4133 (20 lines)
Telex: 25146 HEWPACK
Cable: HEWPACK Caracas

FOR AREAS NOT LISTED, CONTACT:
Hewlett-Packard Inter-Americas
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 856-1501
TWX: 910-373-1260
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

EUROPE, NORTH AFRICA AND MIDDLE EAST

AUSTRIA
Hewlett-Packard Ges.m.b.H.
Handelskai 52
P.O. Box 7
A-1205 **Vienna**
Tel: 351621-27
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

BAHRAIN
Medical Only
Wael Pharmacy
P.O. Box 648
Bahrain
Tel: 54886, 56123
Telex: 8550 WAEL GJ
Cable: WAELPHARM

Analytical Only
Al Hamidiya Trading and Contracting
P.O. Box 20074
Manama
Tel: 259978, 259958
Telex: 8895 KALDIA GJ

BELGIUM
Hewlett-Packard Benelux S.A./N.V.
Avenue du Col-Vert, 1, (Groenkraaglaan)
B-1170 **Brussels**
Tel: (02) 660 50 50
Cable: PALOBEN Brussels
Telex: 23-494 paloben bru

CYPRUS
Kypronics
19 Gregorios Xenopoulos Street
P.O. Box 1152
Nicosia
Tel: 45628/29
Cable: Kypronics Pandehis
Telex: 3018

CZECHOSLOVAKIA
Vyvojova a Provozni Zakladna
Vyzkumnych Ustavu v Bechovicich
CSSR-25097 **Bechovice u Prahy**
Tel: 89 93 41
Telex: 12133

Institute of Medical Bionics
Vyskumny Ustav Lekarskej Bioniky
Jedlova 6
CS-88346
Bratislava-Kramare
Tel: 4251
Telex: 93229

DDR
Entwicklungslabor der TU Dresden
Forschungsinstitut Meinsberg
DDR-7305
Waldheim/Meinsberg
Tel: 37 667
Telex: 518741

Export Contact AG Zuerich
Guenther Forgber
Schiegelstrasse 15
1040 **Berlin**
Tel: 42-74-12
Telex: 111889

DENMARK
Hewlett-Packard A/S
Datavej 52
DK-3460 **Birkerod**
Tel: (02) 81 66 40
Cable: HEWPACK AS
Telex: 37409 hpas dk

Hewlett-Packard A/S
Navervej 1
DK-8600 **Silkeborg**
Tel: (06) 82 71 66
Telex: 37409 hpas dk
Cable: HEWPACK AS

EGYPT
I.E.A.
International Engineering Associates
24 Hussein Hegazi Street
Kasr-el-Aini
Cairo
Tel: 23 829
Telex: 93830
Cable: INTENGASSO

SAMITRO
Sami Amin Trading Office
18 Abdel Aziz Gawish
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Tel: 24932
Cable: SAMITRO CAIRO

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Hewlett-Packard OY
Nahkahousunti 5
P.O. Box 6
SF-00211 **Helsinki** 21
Tel: (90) 6923031

FRANCE
Hewlett-Packard France
Avenue des Tropiques
Les Ulis
Boite Postale No. 6
91401 **Orsay**-Cedex
Tel: (1) 907 78 25
TWX: 600048F

Hewlett-Packard France
Chemin des Mouilles
B.P. 162
69130 **Ecully**
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TWX: 310617F

Hewlett-Packard France
Péricentre de la Cépière
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TWX: 740912F

Hewlett-Packard France
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67300 **Schiltigheim**
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TWX: 890141F

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Immeuble péricentre
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59650 **Villeneuve D'Ascq**
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TWX: 160124F

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Bureau de Vente
Centre d'affaires Paris-Nord
Bâtiment Ampère
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B.P. 300
93153 **Le Blanc Mesnil Cédex**
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Hewlett-Packard France
Av. du Pdt. Kennedy
33700 **Merignac**
Tel: (56) 97 22 69

Hewlett-Packard France
"France-Evry" immeuble Lorraine
Boulevard de France
91035 **Evry-Cedex**
Tel: 077 96 60

Hewlett-Packard France
60, Rue de Metz
57130 **Jouy aux Arches**
Tel: (87) 69 45 32

GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 **Frankfurt** 56
Tel: (0611) 50-04-1
Cable: HEWPACKSA Frankfurt
Telex: 04 13249 hpftm d

Hewlett-Packard GmbH
Technisches Büro Böblingen
Herrenberger Strasse 110
D-7030 **Böblingen**, Württemberg
Tel: (0703) 667-1
Cable: HEWPACK Böblingen
Telex: 07265739 bbn

Hewlett-Packard GmbH
Technisches Büro Düsseldorf
Emanuel-Leutze-Str. 1 (Seestern)
D-4000 **Düsseldorf**
Tel: (0211) 59711
Telex: 085/86 533 hpdd d

Hewlett-Packard GmbH
Technisches Büro Hamburg
Wendenstrasse 23
D-2000 **Hamburg** 1
Tel: (040) 24 13 93

Cable: HEWPACKSA Hamburg
Telex: 21 63 032 hphh d

Hewlett-Packard GmbH
Technisches Büro Hannover
Am Grossmarkt 6
D-3000 **Hannover 91**
Tel: (0511) 46 60 01
Telex: 092 3259

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyerstrasse 90
D-8500**Nurnberg**
Tel: (0911) 56 30 83
Telex: 0623 860

Hewlett-Packard GmbH
Technisches Büro München
Eschenstrasse 5
D-8021 **Taufkirchen**
Tel: (089) 6117-1

Hewlett-Packard GmbH
Technisches Büro Berlin
Kaithstrasse 2-4
D-1000 **Berlin** 30
Tel: (030) 24 90 86
Telex: 018 3405 hpbln d

GREECE
Kostas Karayannis
8 Omirou Street
Athens 133
Tel: 32 30 303/32 37 731

Analytical Only
INTECO
G. Papathanassiou & Co
17 Marni Street
Athens 103
Tel: 5522 915/5221 989
Telex: 21 5329 INTE GR
Cable: INTEKNIKA

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52 Skoufa Street
Athens 135
Tel: 3626 972

HUNGARY
MTA
Müszerugy és Méréstechnikai Szolgalata
Hewlett-Packard Service
Lenin Krt. 67. P.O. Box 241
1391 Budapest VI
Tel: 42 03 38
Telex: 22 51 14

ICELAND
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Hafnarnvoli - Tryggvagötu
P.O. Box 895
IS-**Reykjavik**
Tel: 1 58 20/1 63 03
Cable: ELDING Reykjavik

IRAN
Hewlett-Packard Iran Ltd.
No. 13, Fourteenth St.
Mir Emad Avenue
P.O. Box 41 2419
Tehran
Tel: 851082-5
Telex: 213405 hewp ir

IRELAND
Hewlett-Packard Ltd
King Street Lane
Winnersh, Wokingham
Berks. RG11 5AR
GB-England
Tel: (0734) 78 47 74
Telex: 847178
Cable: Hewpie London

Hewlett-Packard Ltd.
2C Avonbeg Industrial Estate
Long Mile Road
Dublin 12 Eire
Tel: (01) 514322
Telex: 30439

Medical Only
Cardiac Services (Ireland) Ltd.
Kilmore Road
Artane
Dublin 5, Eire
Tel: (01) 315820

Medical Only
Cardiac Services Co.
95A Finaghy Rd. South
Belfast BT10 0BY
GB-Northern Ireland

ITALY
Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio, 9
20063 Cernusco
Sul Naviglio (MI)
Tel: (2) 903691
Telex: 311046 HEWPACKIT

Hewlett-Packard Italiana S.p.A.
Via Turazza, 14
35100 **Padova**
Tel: (49) 664888
Telex: 41612 HEWPACKI

Hewlett-Packard Italiana S.p.A.
Via G. Armellini, 10
I-00143 **Roma**
Tel: (06) 54 69 61
Telex: 61514
Cable: HEWPACKIT Roma

Hewlett-Packard Italiana S.p.A.
Corso Giovanni Lanza 94
I-10133 **Torino**
Tel: (011) 682245/659308

Medical Calculators Only
Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43 G/C
I-95126 **Catania**
Tel: (095) 37 05 04

Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco A. Capodimonte, 62A
I-80131 **Napoli**
Tel.: (081) 7913544

Hewlett-Packard Italiana S.p.A.
Via E. Masi, 9/8
I-40137 **Bologna**
Tel: (051) 307887/300040

JORDAN
Mouasher Cousins Co.
P.O. Box 1387
Amman
Tel: 24907/39907
Telex: SABCO JO 1456
Cable: MOUASHERCO

KUWAIT
Al-Khaldiya Trading & Contracting
P.O. Box 830-Safat
Kuwait
Tel: 42 4910/41 1726

LUXEMBURG
Hewlett-Packard Benelux S.A./N.V.
Avenue du Col-Vert, 1
(Groenkraaglaan)
B-1170 **Brussels**
Tel: (02) 672 22 40
Cable: PALOBEN Brussels
Telex: 23 494

MOROCCO
Dolbeau
81 rue Karatchi
Casablanca
Tel: 3041 82
Telex: 23051-22822
Cable: MATERIO

Gerep
3, rue d'Agadir
Casablanca
Tel: 272093-5
Telex: 23739
Cable: GEREP-CASA

Cogedir
31 rue Omar Slaoui
Casablanca
Tel: 27 65 40
Telex: 21737-23003
Cable: COGEDIR

NETHERLANDS
Hewlett-Packard Benelux N.V.
Van Heuven Goedhartlaan 121
P.O. Box 667
NL-**Amstelveen** 1134
Tel: (020) 47 20 21

NORWAY
Hewlett-Packard Norge A.S.
Osterdalen 18
P.O. Box 34
1345 **Osteraas**
Tel: (02) 1711 80
Telex: 16621 hpnas n

Hewlett-Packard Norge A.S.
Nygaardsgaten 114
5000 **Bergen**

POLAND
Biuro Informacji Technicznej
Hewlett-Packard
Ul. Stawki 2, 6P
00-950 **Warszawa**
Tel: 33 25 88,39 67 43
Telex: 81 24 53 hepa pl

UNIPAN
Biuro Obslugi Technicznej
01-447 Warszawa
ul. **Newelska** 6
Polanc

Zakłady Naprawcze Sprzetu Medycznego
Plac Komuny Paryskiej 6
90-007 **Lodz**
Tel: 334-41, 337-83
Telex: 886981

PORTUGAL
Telectra-Empresa Técnica de Equipamentos Electricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-**Lisbon** 1
Tel: (19) 68 60 72
Cable: TELECTRA Lisbon
Telex: 12598

Medical only
Mundinter
Intercambio Mundial de Comércio S.a.r.l.
P.O. Box 2761
Avenida Antonio Augusto de Aguiar 138
P - **Lisbon**
Tel: (19) 53 21 31 7
Telex: 16691 munter p
Cable: INTERCAMBIO Lisbon

QATAR
Nasser Trading & Contracting
P.O. Box 1563
Doha
Tel: 22170
Telex: 4439 NASSER
Cable: NASSER

RUMANIA
Hewlett-Packard Reprezentanta
Bd. n. Balcescu 16
Bucuresti
Tel: 15 80 23.13 88 85
Telex: 10440

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Intreprinderea Pentru Intretinerea
Si Repararea Utilajelor de Calcul
Bd-dul Prof. Dimitrie Pompei 6
Bucuresti-Sectorul 2
Tel: 88-20-70; 88-24-40; 88-67-95
Telex: 118

SAUDI ARABIA
Modern Electronic Establishment (Head Office)
P.O. Box 1228, Baghdadiah Street
Jeddah 1
Tel: 27 798
Telex: 40035
Cable: ELECTA JEDDAH

Modern Electronic Establishment (Branch)
P.O. Box 2728
Riyadh
Tel: 62596 66232
Cable: RAOUFCO

Modern Electronic Establishment (Branch)
P.O. Box 193
Al-Khobar
Tel: 44678-44813

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Hewlett-Packard Española, S.A.
Calle Jerez 3
E-**Madrid** 16
Tel: (1) 458 26 00 (10 lines)
Telex: 23515 hpe

Hewlett-Packard Española S.A.
Colonia Mirasierra
Edificio Juban
9, Costa Brava 13
Madrid 34

Hewlett-Packard Española, S.A.
Milanesado 21-23
E-**Barcelona** 17
Tel: (3) 203 6200 (5 lines)

Hewlett-Packard Española, S.A.
Av. Ramón y Cajal, 1
Edificio Sevilla, planta 9°
Seville 5
Tel: 64 44 54 58

Hewlett-Packard Española S.A.
Edificio Albia II, 7°, B
E-**Bilbao** 1
Tel: 23 83 06 23 82 06

Hewlett-Packard Española S.A.
C/Ramon Gordillo, 1 (Entlo.)
E-**Valencia**-10
Tel: 96-361 13 54 361 13 58

SWEDEN
Hewlett-Packard Sverige AB
Enighetsvägen 3, Fack
S-161 **Bromma** 20
Tel: (08) 730 05 50
Telex: 10721
Cable: MEASUREMENTS Stockholm

Hewlett-Packard Sverige AB
Frötallsgatan 30
S-421 32 **Vastra Frolunda**
Tel: (031) 49 09 50
Telex: 10721 via Bromma office

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Zurcherstrasse 20
P.O. Box 307
CH-8952 **Schlieren-Zurich**
Tel: (01) 7305240
Telex: 53933 hpag ch
Cable: HPAG CH

Hewlett-Packard (Schweiz) AG
Château Bloc 19
CH-1219 **Le Lignon-Geneva**
Tel: (022) 96 03 22
Telex: 27333 hpag ch
Cable: HEWPACKAG Geneva

SYRIA
General Electronic Inc.
Nur. Basha-Ahnar Ebn Kays Street
P.O. Box 5781
Damascus
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Telex: 11215 ITIKAL
Cable: ELECTROBOR DAMASCUS

Medical-Personal Calculator only
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Place Azmé
B.P. 2308
Damascus
Tel: 16 367-19 697-14 268

Suleiman Hilal El-Mlawi
P.O. Box 2528
Mamoun Bitar Street, 56-58
DamascusTel: 11 46 63

TUNISIA
Tunisie Electronique
31 Avenue de la Liberte
Tunis
Tel: 280 144

Corema
1 ter, Av. de Carthage
Tunis
Tel: 253 821
Telex: 12319 CABAM TN

TURKEY
TEKNIM Company Ltd.
Riza Sah Pehlevi
Caddesi No. 7
Kavaklidere, **Ankara**
Tel: 275800
Telex: 42155

Teknim Com. Ltd.
Barbaros Bulvari 55/12
Besiktas, **Istanbul**
Tel: 613 546
Telex: 23540

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Muhendslik Kollektif Sirketi
Medina Eidemi Sokak 41/6
Yuksel Caddesi
Ankara
Tel: 17 56 22
Cable: EMATRADE Ankara

Analytical only
Yilmaz Özyürek
Milli Mudafaa Cad. 16/6
Kizilay
Ankara
Tel: 25 03 09 - 17 80 26
Telex: 42576 OZEK TR
Cable: OZYUREK ANKARA

UNITED ARAB EMIRATES
Emitac Ltd. (Head Office)
P.O. Box 1641
Sharjah
Tel: 354121 3
Telex: 68136

Emitac Ltd. (Branch Office)
P.O. Box 2711
Abu Dhabi
Tel: 331376 1

UNITED KINGDOM
Hewlett Packard Ltd
King Street Lane
Winnersh, Wokingham
Berks. RG11 5AR
Tel: (0734) 784774
Telex: 847178 9

Hewlett Packard Ltd
Trafalgar House
Navigation Road
Altrincham
Cheshire WA14 1NU
Tel: (061) 928 6422
Telex: 668068

Hewlett Packard Ltd
Lygnn Court
Hereward Rise
Dudley Road
Halesowen
West Midlands B62 8SD
Tel: (021) 550 9911
Telex: 339105

Hewlett Packard Ltd
Wedge House
799 London Road
Thornton Heath
Surrey CR4 6XL
Tel: (01) 6840103
Telex: 946825

Hewlett Packard Ltd
10 Wesley St
Castleford
Yorks. WF10 1AE
Tel: (0977) 550016
Telex: 557355

Hewlett Packard Ltd
1 Wallace Way
Hitchin
Hertfordshire, SG4 0SE
Tel: (0462) 31111
Telex: 82 59 81

USSR
Hewlett Packard
Representative Office USSR
Pokrovsky Boulevard 4-17-kw
Moscow 101000
Tel: 294 20 24
Telex: 7825 hewpak su

YUGOSLAVIA
Iskra Standard-Hewlett-Packard
Miklosiceva 38 VII
61000 **Ljubljana**
Tel: 31 56 79 32 16 74

SOCIALIST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett Packard Ges.m.b.H.
Handelskai 52
P.O. Box 7
A-1205 **Vienna**, Austria
Tel: (0222) 35 16 21 to 27

MEDITERRANEAN AND MIDDLE EAST COUNTRIES NOT SHOWN PLEASE CO
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Mediterranean and Middle East Operations
35 Kolokotroni Street
Platia Kefallariou
GR-Kifissia-**Athens**, Greece
Tel: 8080337 259 429

FOR OTHER AREAS NOT LISTED CONTACT
Hewlett Packard S.A.
7 rue du Bois-du-Lan
P.O. Box
CH-1217 Meyrin 2 - **Geneva**
Switzerland
Tel: (022) 82 70 00

UNITED STATES

ALABAMA
P.O. Box 4207
8290 Whitesburg Dr.
Huntsville 35802
Tel: (205) 881-4591

8933 E. Roebuck Blvd
Birmingham 35206
Tel: (205) 836-2203 2

ARIZONA
2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 244-1361

2424 East Aragon Rd.
Tucson 85706
Tel: (602) 889-4661

***ARKANSAS**
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Brady Station
Little Rock 72215
Tel: (501) 376-1844

CALIFORNIA
1579 W. Shaw Ave.
Fresno 93771
Tel: (209) 224-0582

1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2671

5400 West Rosecrans Blvd.
P.O. Box 92105
World Way Postal Center
Los Angeles 90009
Tel: (213) 776-7500
TWX: 910-325-6608

***Los Angeles**
Tel: (213) 776-7500
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Santa Clara 95050
Tel: (408) 988-7000
***Ridgecrest**
Tel: (714) 446-6165

646 W. North Market Blvd.
Sacramento 95834
Tel: (916) 929-7222

9606 Aero Drive
P.O. Box 23333
San Diego 92123
Tel: (714) 279-3200

***Tarzana**
Tel: (213) 705-3344

COLORADO
5600 DTC Parkway
Englewood 80110
Tel: (303) 771-3455

CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel: (203) 389-6551
TWX: 710-465-2029

FLORIDA
P.O. Box 24210
2727 N.W. 62nd Street
Ft. Lauderdale 33309
Tel: (305) 973-2600

4428 Emerson Street
Unit 103
Jacksonville 32207
Tel: (904) 725-6333

P.O. Box 13910
6177 Lake Ellenor Dr.
Orlando 32809
Tel: (305) 859-2900

P.O. Box 12826
Suite 5, Bldg. 1
Office Park North
Pensacola 32575
Tel: (904) 476-8422

GEORGIA
P.O. Box 105005
450 Interstate North Parkway
Atlanta 30348
Tel: (404) 955-1500

Medical Service Only
***Augusta** 30903
Tel: (404) 736-0592

P.O. Box 2103
1172 N. Davis Drive
Warner Robins 31098
Tel: (912) 922-0449

HAWAII
2875 So. King Street
Honolulu 96826
Tel: (808) 955-4455

ILLINOIS
5201 Tollview Dr.
Rolling Meadows 60008
Tel: (312) 255-9800
TWX: 910-687-2260

INDIANA
7301 North Shadeland Ave.
Indianapolis46250
Tel: (317) 842-1000
TWX: 810-260-1797

IOWA
2415 Heinz Road
Iowa City 52240
Tel: (319) 338-9466

KENTUCKY
Medical Only
3901 Atkinson Dr.
Suite 407 Atkinson Square
Louisville 40218
Tel: (502) 456-1573

LOUISIANA
P.O. Box 1449
3229-39 Williams Boulevard
Kenner 70063
Tel: (504) 443-6201

MARYLAND
7121 Standard Drive
Parkway Industrial Center
Hanover 21076
Tel: (301) 796-7700
TWX: 710-862-1943

2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS
32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN
23855 Research Drive
Farmington Hills 48024
Tel: (313) 476-6400

724 West Centre Ave.
Kalamazoo 49002
Tel: (606) 323-8362

MINNESOTA
2400 N. Prior Ave.
St. Paul 55113
Tel: (612) 636-0700

MISSISSIPPI
322 N. Mart Plaza
Jackson 39206
Tel: (601) 982-9363

MISSOURI
11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

1024 Executive Parkway
St. Louis 63141
Tel: (314) 878-0200

NEBRASKA
Medical Only
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Omaha 68106
Tel: (402) 392-0948

NEVADA
***Las Vegas**
Tel: (702) 736-6610

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W. 120 Century Rd.
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

Crystal Brook Professional Building, Route 35
Eatontown 07724
Tel: (201) 542-1384

NEW MEXICO
P.O. Box 11634
Station E
11300 Lomas Blvd., N.E.
Albuquerque 87123
Tel: (505) 292-1330
TWX: 910-989-1185

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 526-2484
TWX: 910-9983-0550

NEW YORK
6 Automation Lane
Computer Park
Albany 12205
Tel: (518) 458-1550
TWX: 710-444-4961

650 Pennton Hill Office Park
Fairport 14450
Tel: (716) 223-9950
TWX: 510-253-0092

No. 1 Pennsylvania Plaza
55th floor
34th street & 8th Avenue
New York 10001
Tel: (212) 971-0800

5858 East Molloy Road
Syracuse 13211
Tel: (315) 455-2486

1 Crossways Park West
Woodbury 11797
Tel: (516) 921-0300

NORTH CAROLINA
5605 Roanne Way
Greensboro 27405
Tel: (919) 852-1800

OHIO
Medical/Computer Only
Bldg. 300
7313 E. Kemper Rd.
Cincinnati 45249
Tel: (513) 891-7400

16500 Sprague Road
Cleveland 44130
Tel: (216) 243-7300
TWX: 810-423-9430

330 Progress Rd.
Dayton 45449
Tel: (513) 859-6202

1041 Kingsmill Parkway
Columbus 43229
Tel: (614) 436-1041

OKLAHOMA
P.O. Box 32008
6301 N. Meridan Avenue
Oklahoma City 73112
Tel: (405) 721-0200

9920 E. 42nd Street
Suite 121
Tulsa 74145

OREGON
17890 SW Lower Boones Ferry road
Tualatin 97062
Tel: (503) 620-3350

PENNSYLVANIA
111 Zeta Drive
Pittsburgh 15238
Tel: (412) 782-0400

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel: (215) 265-7000
TWX: 510-660-2670

PUERTO RICO
Hewlett-Packard Inter-Americas
Puerto Rico Branch Office
Calle 272
Edif. 203 Urb. Country Club
Carolina 00924
Tel: (809) 762-7255
Telex: 345 0514

SOUTH CAROLINA
P.O. Box 6442
6941-0 N. Trenholm Road
Columbia 29260
Tel: (803) 782-6493

TENNESSEE
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Knoxville 37922
Tel: (615) 693-0562

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Director's Plaza
Memphis 38131
Tel: (901) 346-8370

***Nashville**
Medical Service only
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TEXAS
4171 North Mesa
Suite C110
El Paso 79902
Tel: (915) 533-3555

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201 E. Arapaho Rd.
Richardson 75080
Tel: (214) 231-6101

P.O. Box 42816
10535 Harwin Dr.
Houston 77036
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***Lubbock**
Medical Service only
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208 Billy Mitchell Road
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Tel: (512) 434-8241

UTAH
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Salt Lake City 84119
Tel: (801) 972-4711

VIRGINIA
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Norfolk 23502
Tel: (804) 460-2471

P.O. Box 9669
2914 Hungary Springs Road
Richmond 23228
Tel: (804) 285-3431

WASHINGTON
Bellevue Office Park
1203-114th Ave. S.E.
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2446

P.O. Box 4010
Spokane 99202
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