Errata

Title & Document Type: **8954A Transceiver Interface Operating and Service Manual**

Manual Part Number: **08954-90010**

Revision Date: **February 1983**

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

HP References in this Manual

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

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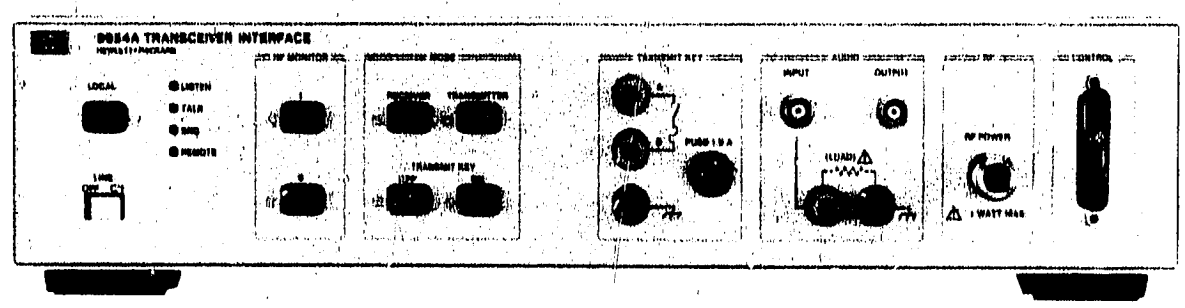
Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

OPERATING AND SERVICE MANUAL

8954A TRANSCEIVER INTERFACE



HEWLETT PACKARD

8954A
TRANSCEIVER
INTERFACE

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2243A.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY THIS MANUAL in Section I.

EAST 24001 MISSION AVENUE, TAF C-34, SPOKANE, WASHINGTON, U.S.A., 99220

Manual Part No. 08954-90010
Microfiche Part No. 08954-90011

Printed: FEBRUARY 1983

HEWLETT PACKARD

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal).

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed.

SAFETY EARTH GROUND

An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

SAFETY SYMBOLS

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

Indicates hazardous voltages

Indicates earth (ground) terminal

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

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

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection).

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the power source.

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

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

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.

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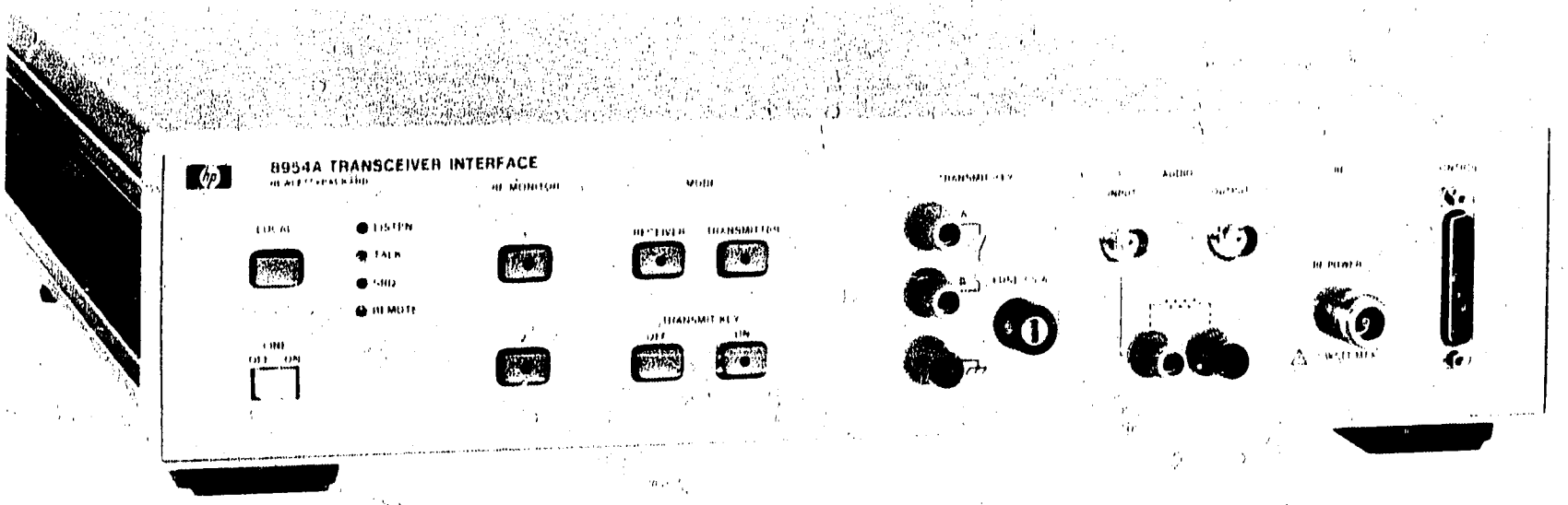
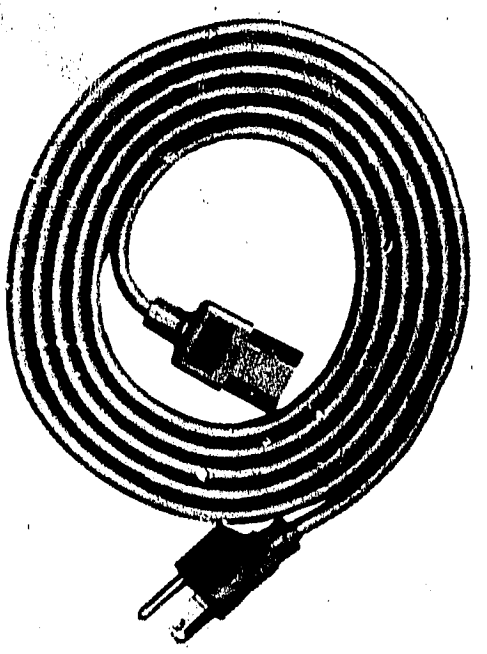


Model 8954A



Line Power Cord

Figure 1-1. HP Model 8954A Transceiver Interface with Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This Operating and Service Manual contains information required to install, operate, test, and service the Hewlett-Packard Model 8954A Transceiver Interface. Figure 1-1 shows the instrument and accessories supplied.

The information structure of this manual is as described below:

Section I, General Information: provides instrument description and specifications, explains accessories and options, and lists recommended test equipment.

Section II, Installation: provides information concerning initial inspection, preparation for use (including HP-IB address selection for remote operation), and storage and shipment.

Section III, Operation: provides information about panel features, including operators checks and operators maintenance information.

Section IV, Performance Tests: provides tests to check that the electrical performance of the instrument agrees with the published specifications.

Section V, Adjustments: normally provides the information required to properly adjust the instrument. This instrument, however, has no adjustments.

Section VI, Replaceable Parts: provides ordering information for all replaceable parts and assemblies.

Section VII, Manual Changes: provides manual change information necessary to document all serial prefixes listed on the Operating and Service Manual title page. In addition, this section also contains recommended modifications for earlier instrument configurations.

Section VIII, Service: provides the information required to repair the instrument.

Additional copies of the Operating and Service Manual can be ordered separately through your nearest Hewlett-Packard office. The part number is listed on the title page of this manual. Refer to paragraph 1-7, "Options and Accessories", for additional ordering information.

Also on the title page of this manual, below the manual part number, is a microfiche part number. This number may be used to order 100 × 150 mm (4 × 6) microfilm transparencies of the Operating and Service Manual. Each microfiche contains up to 96 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement.

1-2. SPECIFICATIONS

Instrument specifications are listed in Table 1-1. These are the performance standards, or limits, against which the instrument may be tested. Information listed under Supplemental Characteristics, Table 1-2, are not warranted specifications but are typical characteristics included as additional information for the user.

1-3. SAFETY CONSIDERATIONS

This product is a Safety Class I instrument; that is, one provided with a protective earth terminal. The Transceiver Interface and all related documentation must be reviewed for familiarization with safety markings and instructions before operation. Refer to the Safety Considerations page found at the beginning of this manual for a summary of the safety information. Safety information pertinent to the task at hand; that is, installation, operation, performance testing, or service, is found throughout this manual.

1-4. INSTRUMENTS COVERED BY THIS MANUAL

This instrument has a two-part serial number in the form 0000A00000 which is stamped on the serial number plate attached to the rear of the instrument. The first four digits and the letter constitute the serial number prefix and the last five digits form the suffix. The prefix is the same for all identical instruments. It changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply directly to any instrument that has the same serial number prefix as listed under SERIAL NUMBERS on the title page.

An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates that the instrument is different from those documented in this manual. The manual for this newer instrument is accompanied by a yellow MANUAL CHANGES supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and as accurate as possible, Hewlett-Packard recommends that you periodically request the latest MANUAL CHANGES supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

For information concerning a serial number prefix that is not listed on the title page or in the MANUAL CHANGES supplement, contact your nearest Hewlett-Packard office.

1-5. GENERAL DESCRIPTION

The HP Model 8954A Transceiver Interface is a switching interface specifically designed for transceiver testing. The utility of the Transceiver Interface is optimized when incorporated in a test-set environment. A test set provides the Transceiver Interface with the capability of directing signals between the transceiver under test and the appropriate test equipment; thus allowing for comprehensive, transceiver characterization.

1-6. TRANSCEIVER TESTING

The Transceiver Interface has two, independent, signal-path configurations for transceiver testing; one is the RECEIVER MODE (RCVR) and the other is the TRANSMITTER MODE (XMTR). Figure 1-2 shows the signal paths for these modes; selected by either the front-panel keyboard or the Hewlett-Packard Interface Bus (HP-IB).

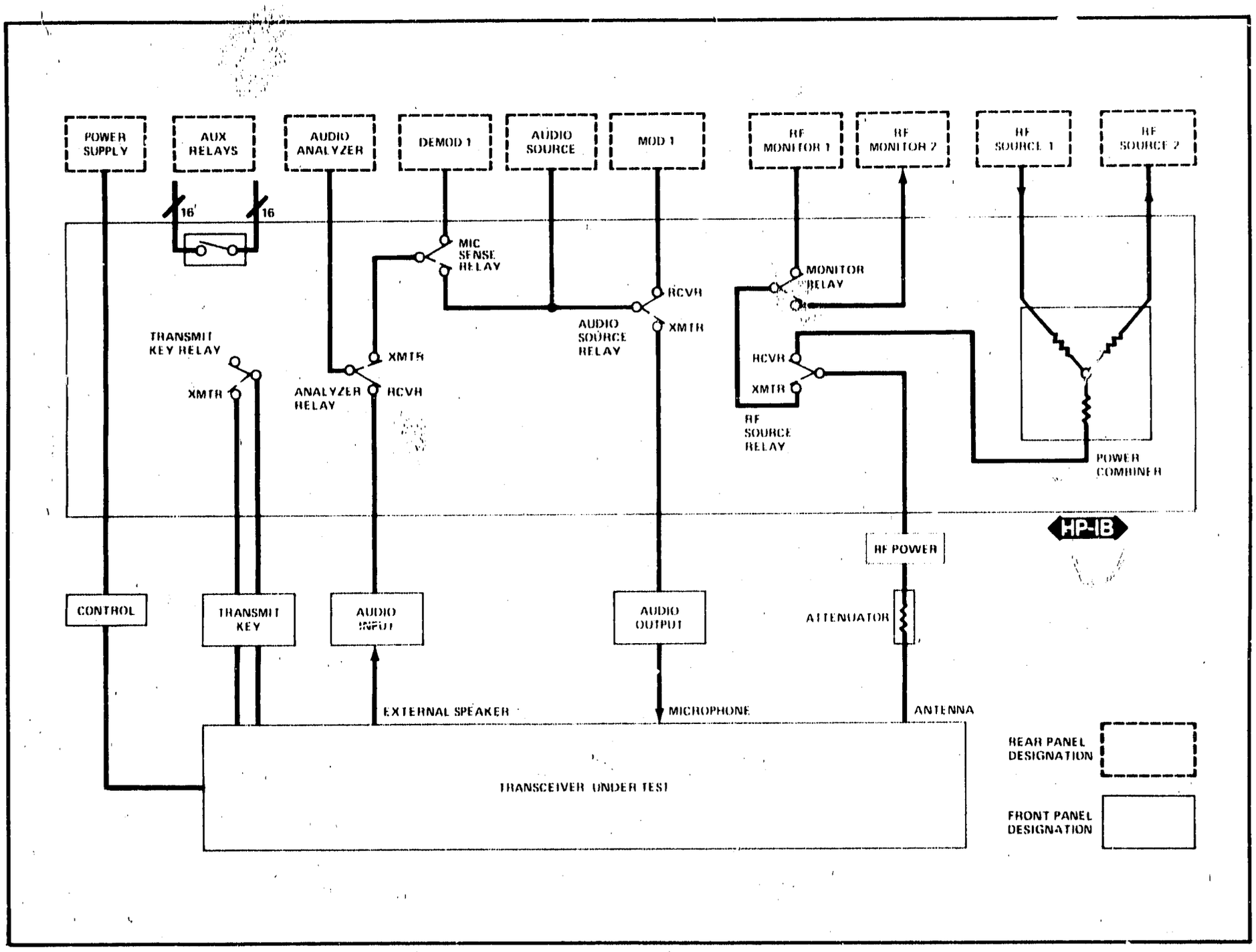


Figure 1-2. HP 8954A Transceiver Interface Test Configuration

1-7. OPTIONS AND ACCESSORIES

The following options and accessories are available and may have been ordered and received with the Transceiver Interface. If they were not received with the original shipment and are now desired, they may be ordered from your nearest Hewlett-Packard office using the part number included in the following paragraphs.

1-8. Operating and Service Manual (Option 910)

This option adds one extra Operating and Service manual with the HP 8954A Transceiver Interface.

1-9. Mechanical Options

Front-Handle Kit Option 907. Ease of handling is increased with front-panel handles. Order HP part number 5061-0088.

Rack-Flange Kit Option 908. This kit contains all necessary hardware and installation instructions for mounting the Transceiver Interface in a rack with 482.5mm (standard 19") spacing. Order HP part number 5061-0074 which has standard 1.75" (4.45 cm) hole spacing.

Rack-Flange and Front-Handle Combination Kit Option 909. This kit is not simply a front-handle kit and rack flange kit packaged together. The combination is made up of unique parts which include both functions. Order HP part number 5061-0075 which has 1.75" (4.45 cm) hole spacing and is a standard flange.

1-10. Accessories Available

50-Ohm Termination. Type-N, 50-ohm, coaxial termination; DC-4 GHz. Order HP part number 908A.

Control Connector and Cable. Control connector with 10 feet (3.05 m) of cable (sheathed, 9-conductor cable: 2, coaxial conductors; 2, DC power supply conductors; and 5, single-conductor wires). Order HP part number 08956-60108. Connector mates with the instrument's front panel connector J9.

Auxiliary Relay Connector. Auxiliary Relay connector hardware (unassembled; cable not included). Order HP part number 08956-60111. Connector mates with rear panel Aux. Relay connector J19.

DC Power Supply Connector. DC Power Supply connector hardware (unassembled; cable not included). Order HP part number 08956-60112. Connector mates with rear panel DC Power Supply connector J18.

NOTE

The limit to the length of cable attached to the DC Power Supply connector is determined by the amount of insertion loss developed in that cable. Refer to the dc power supply's operating manual for information which discusses power-cable parameters as a function of insertion loss. The Transceiver Interface has 2 feet (61 cm) of #12 AWG wire between the rear panel DC Power Supply connector and the front panel Control Connector.

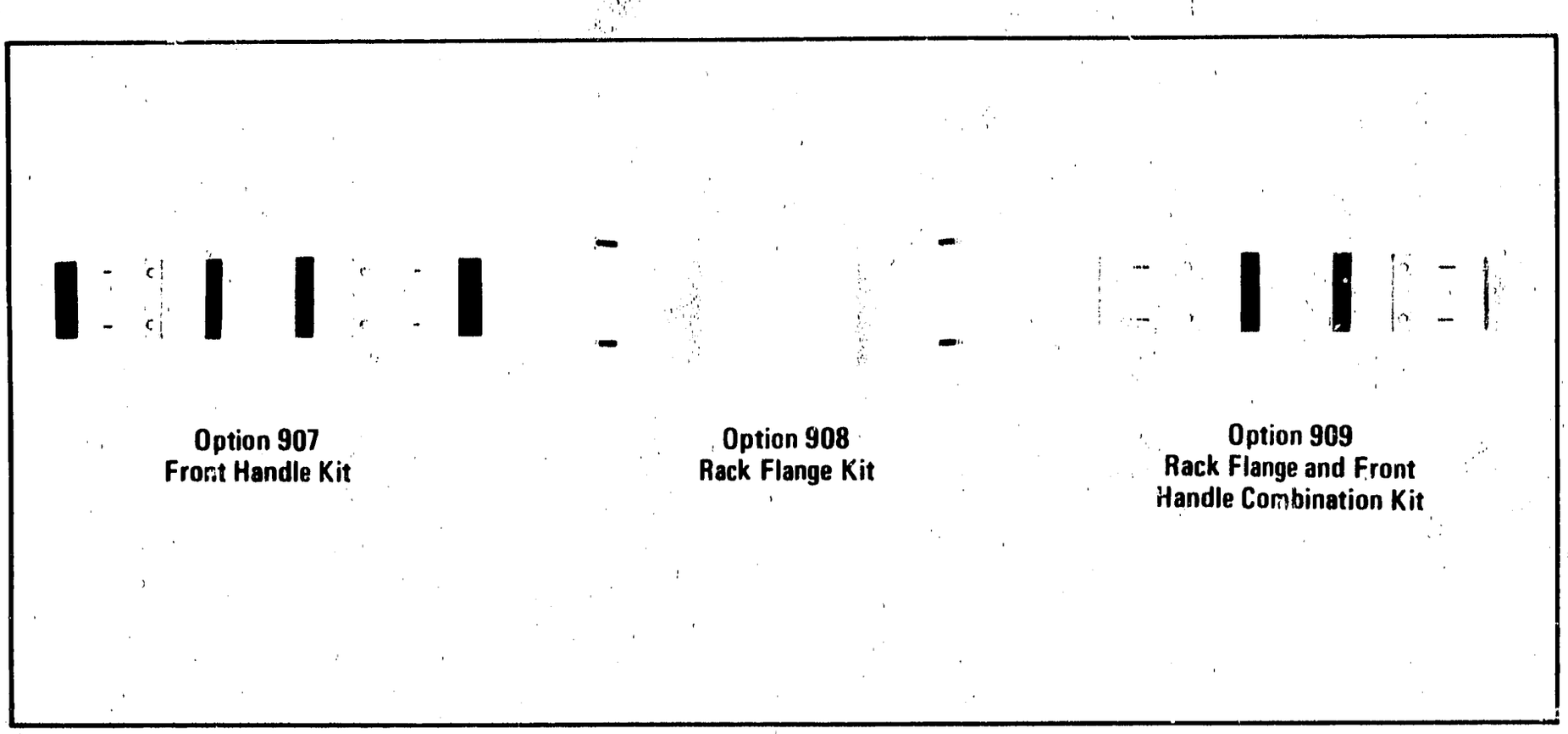


Figure 1-3. Rack Mounting Options

1-11. Service Accessories

HP-IB Test Jumpers. These service accessories are designed for use in the HP-IB signature analysis test. Test Jumper 1 is a dual-in-line test fixture which adapts the HP-IB GPIA socket for the HP-IB test (Test B), HP part number; 85650-60052. Test Jumper 2 is a dual-in-line test fixture which adapts the HP-IB socket for the HP-IB test (Test C), HP part number; 08954-60005. Both test jumpers may be ordered as a kit under HP part number (08954-60115).

1-12. HEWLETT-PACKARD INTERFACE BUS

HP-IB *

1-13. Compatibility

The Transceiver Interface has an HP-IB interface and can be used with any HP-IB controller or computer for automatic-system applications. The Transceiver Interface is fully programmable via the HP-Interface Bus. The Transceiver Interface's complete compatibility with HP-IB is defined by the following list of interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, and E1 (refer to Table 3-2). The Transceiver Interface interfaces with the bus via open-collector TTL circuitry. An explanation of the compatibility codes can be found in the IEEE Standard 488 and the identical ANSI Standard MC1.1.

For more detailed information relating to programmable control of the Transceiver Interface, refer to Remote Operation in Section III of this manual.

1-14. Selecting the HP-IB Address

Five miniature HP-IB address switches are located on the rear panel of the Transceiver Interface. These switches represent a five-bit binary number (00 through 31 in decimal). HP-IB addresses greater than 30 (decimal) are invalid. When the instrument is shipped from the factory, the HP-IB address is preset to 03 (decimal). To determine the Transceiver Interfaces HP-IB address, refer to paragraph 2-7, HP-IB Address Selection.

*Not just IEEE-488, but the hardware, documentation, and support that delivers the shortest path to a measurement system.

1-15. RECOMMENDED TEST EQUIPMENT

Table 1-4 lists the test equipment required for testing and servicing the Transceiver Interface. The Critical Specifications column describes the essential requirements for each piece of test equipment. Other equipment can be substituted if it meets or exceeds these critical specifications.

Table 1-1. Specifications

Electrical Specifications	Performance Limit	Conditions
RF INPUT		
Range	20 Hz to 1300 MHz	
Maximum Power	1 Watt	
RF INSERTION LOSS		
Loss	≤0.5 dB	RF port to RF MONITOR port 1 or 2.
Loss	−6.15 dB ±0.35 dB	RF SOURCE port 1 or 2 to RF port. (Unused RF SOURCE port terminated with 50 ohms.)
SWR		
Ratio	≤1.15	Between RF port and RF MONITOR port 1 or 2.
Ratio	≤1.15	Between RF SOURCE 1 or 2 and RF port. (RF port and unused RF SOURCE port terminated with 50 ohms.)
AUDIO FREQUENCY		
Range	20 Hz to 100 kHz	DC-Coupled.
AUDIO INSERTION LOSS		
Loss	<0.03	20 to 20 kHz.
	<0.03 dB	20 kHz to 100 kHz.

Table 1-2. Supplemental Characteristics

Electrical Characteristics	Performance Limit	Conditions
EXTERNAL DC POWER SUPPLY		
Current	30A	Voltage <28 Vdc
Voltage	50 Vdc	Current <15A
KEY RELAY		
Current	1.5A	Voltage <28 Vdc
Voltage	50 Vdc	Current <0.5A
AUXILIARY RELAYS		
Current	0.5A	Voltage <20 Vdc
Voltage	50 Vdc	Current <0.2A

Table 1-3. General Specifications

Operating Characteristics	Performance Limit	Conditions
POWER REQUIREMENTS		
Line Voltage		
100, 120 Vac	+5%, −10%	48—440 Hz
220, 240 Vac	+5%, −10%	48—66 Hz
POWER DISSIPATION	22 VA max.	
NET WEIGHT	6.12 kg (13.5 lb)	
DIMENSIONS (Full Envelope)		
Height	89 mm (3.5 in.)	
Width	411 mm (16.2 in.)	
Depth	406 mm (16.0 in.)	

Table 1-4. Recommended Test Equipment

Instrument	Critical Specifications	Model	Use*
Signal Generator	Frequency Range: 5—1000 MHz. Output Level: +13 dBm. Output Level Flatness: +1.5 dB.	HP 8640B Opt. 002	P, T
Audio Source Audio Analyzer	Frequency Range: 20—100 kHz. Output Level: 1—6V. AC Level Accuracy: ±4% (20 kHz—100 kHz, 1 mV—6V.	HP 8903A	P, T
Digital Multimeter	Accuracy: 4½ digits, +0.02% of reading plus one digit. Range: 20 mV to 6V, 2 Vac. Sensitivity: 100 μV	HP 3455A	P, T
Signature Multimeter	Provides preferred method for troubleshooting digital circuitry.	HP 5005A	T
Power Meter	Frequency Range: 5—1000 MHz. Input Level: +13 dBm max. Dynamic Range: 40 dB.	HP 436A with HP 8482A	P, T
SWR Bridge	Frequency Range: 5—1300 MHz. Impedance: 50 Ohms. Directivity: >40 dB. Connectors: Type-N.	Wiltron 60N50 Opt. 01	P
Controller HP-IB	HP-IB compatibility as defined by IEEE Standard 488 and the identical ANSI standard MC1.1: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, and E1.	HP 9825A/98034B/92213A or HP9826A Opt. 001 or HP 85F/00085-15003/82937A	T
50 Ohm Load		HP 908A	P
600 Ohm Load		HP 11095A	P
*P = Performance Tests; T = Troubleshooting.			

SECTION II
INSTALLATION

2-1. INTRODUCTION

This section provides the information needed to install the Transceiver Interface. Included is information pertinent to initial inspection, power requirements, line voltage and fuse selection, power cables, HP-IB address selection, interconnection, mating connectors, operating environment, instrument mounting, storage, and shipment.

2-2. INITIAL INSPECTION

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers and panels).

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, the shipping materials should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are given in Section IV of this manual. Notify the nearest Hewlett-Packard office if the Transceiver Interface is received in any of the following conditions: incomplete contents, mechanical damage or defect, or failure of any of the instrument's electrical performance tests. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

2-3. PREPARATION FOR USE

2-4. Power Requirements

The Transceiver Interface requires a power source of 100 to 120 (+5%, −10%) Vac 48—440 Hz, 220 to 440 (+5%, −10%) Vac 48—66 Hz, single-phase. Power consumption is 22 volt-amperes maximum.

WARNING

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

If this instrument is to be energized via an external autotransformer for voltage reduction, make sure that the common terminal is connected to the earth pole of the power source.

2-5. Line Voltage and Fuse Selection

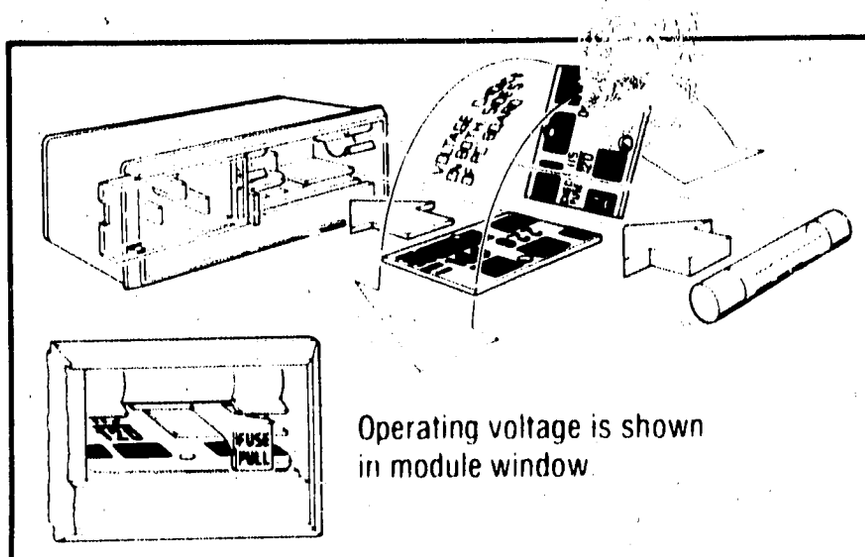
CAUTION

BEFORE PLUGGING THIS INSTRUMENT into the Mains (line) voltage, be sure the correct voltage and fuse have been selected.

The rear-panel, Line-Filter Module permits operation from 100, 120, 220, or 240 Vac. The number visible in the window (located on the module) indicates the nominal line voltage to which the instrument must be connected. Verify that the line voltage selection card and the fuse are matched to the power source. See Figure 2-1, "Line Voltage and Fuse Selection". Table 2-1, lists the voltage and current ratings, and the HP part numbers for the replaceable fuses.

WARNING

For protection against fire hazard, the line fuse should only be a 250V fuse with the correct current rating.



Operating voltage is shown in module window.

SELECTION OF OPERATING VOLTAGE

1 Open cover door, pull the FUSE PULL lever and rotate to left. Remove the fuse.

2 Remove the Line Voltage Selection Card. Position the card so the line voltage appears at top-left cover. Push the card firmly into the slot.

3 Rotate the Fuse Pull lever to its normal position. Insert a fuse of the correct value in the holder. Close the cover door.

WARNING

To avoid the possibility of hazardous electrical shock, do not operate this instrument at line voltages greater than 126.5 Vac with line frequencies greater than 66 Hz (leakage currents at these line settings may exceed 3.5 mA).

Figure 2-1. Line Voltage and Fuse Selection

Table 2-1. Line Fuse Ratings and Part Numbers

Line Voltage	Rating	Part Numbers
100/120V	250 mA, 250V	HP 2110-0004
220/240V	125 mA, 250V	HP 2110-0027

2-6. Power Cables

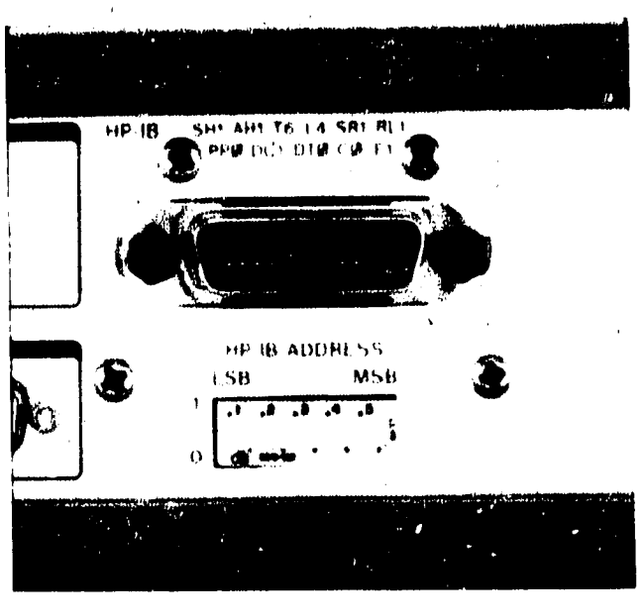
WARNING

BEFORE CONNECTING THIS INSTRUMENT, the protective earth terminal of the instrument must be connected to the protective conductor of the (Mains) power cord. The Mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.

This instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet. The type of power-cable plug shipped with the instrument depends on the country of destination. See Figure 2-3 for part numbers of the power cables and Mains plugs available.

2-7. HP-IB Address Selection HP-IB

The HP-IB address for the HP 8954A is preset at the factory for address 03. (This decimal value corresponds to a talk address of "C" and a listen address of "#".) Figure 2-2 shows the HP-IB address switch in its preset position.



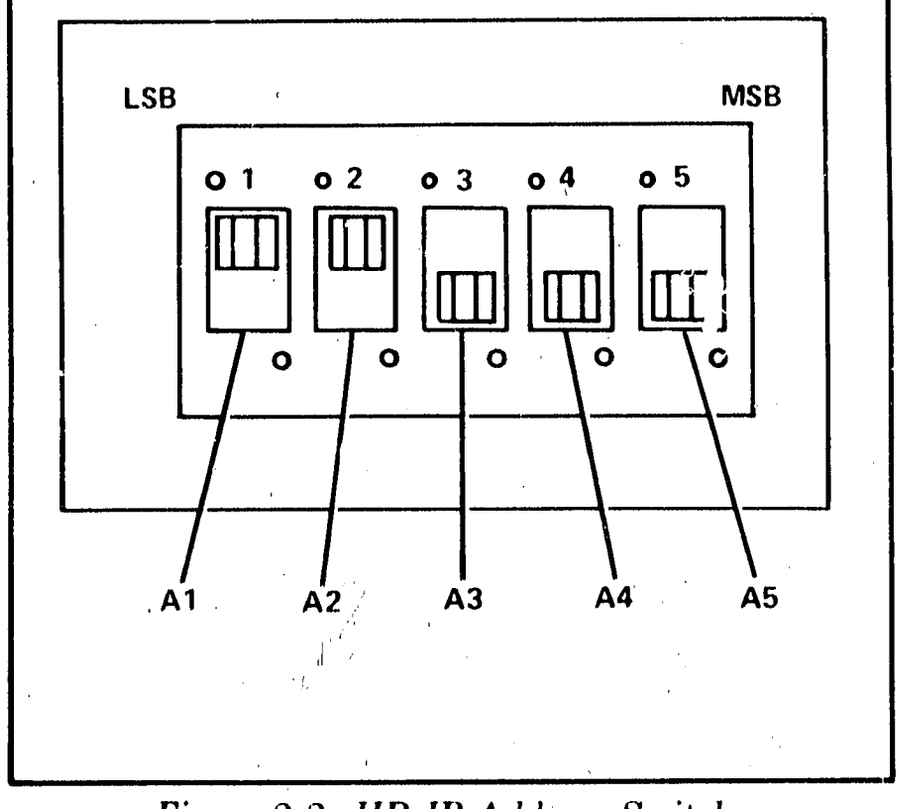
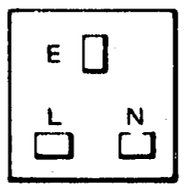
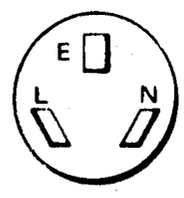
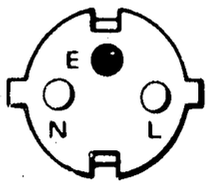
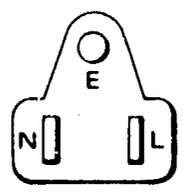
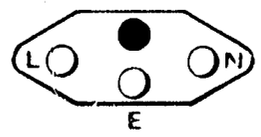
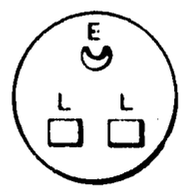
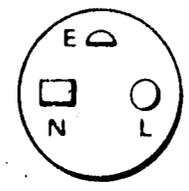
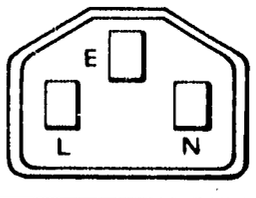


Figure 2-2. HP-IB Address Switch Location and Settings

Plug Type	Cable HP Part Number	C D	Plug Description	Cable Length (inches)	Cable Color	For Use In Country
250V 	8120-1351 8120-1703	0 6	Straight*BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore
250V 	8120-1369 8120-0696	0 4	Straight*NZSS198/ASC112 90°	79 87	Gray Gray	Austrailia, New Zealand
250V 	8120-1689 8120-1692	7 2	Straight*CEE7-Y11 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt So. Africa, India (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	5 5 7 1 6 2	Straight*NEMA5-15P 90° Straight*NEMA5-15P Straight*NEMA5-15P 90° Straight*NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan (100V or 200V), Mexico, Philippines, Taiwan
250V 	8120-2104	3	Straight*SEV1011 1959-24507 Type 12	79	Gray	Switzerland
250V 	8120-0698	6	Straight*NEMA6-15P			United States, Canada
220V 	8120-1957 8120-2956	2 3	Straight*DHCK 107 90°	79 79	Gray Gray	Denmark
250 V 	8120-1860	6	Straight*CEE22-VI (Systems Cabinet use)			

*Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.
E = Earth Ground; L = Line; N = Neutral

Figure 2-3. Power Cable HP Part Numbers

The addresses listed in Table 2-2 can be selected by setting the five segments of the HP-IB address switch (located on the rear panel) to correspond with the five-bit binary equivalent of the desired device address.

NOTE

Binary weighting of Address switch, least significant to most significant as read from left to right.

If the HP-IB settings are changed while the instrument is on, the LINE ON/OFF switch must be cycled off and then ...hich activates the instrument at the new address

2-8. Interconnection

Interconnection data for the Hewlett-Packard Interface Bus is provided in Figure 2-4.

2-9. Mating Connectors

Coaxial Connectors. Coaxial mating connectors used with the Transceiver Interface should be either BNC male connectors or 50-ohm, Type-N male connectors that are compatible with those specified in US MIL-C-39012.

Interface Connectors. HP-IB mating connector is shown in Figure 2-4. Note that the two securing screws are metric.

For more information regarding Transceiver Interface connectors refer to paragraph 1-10, entitled "Accessories Available".

2-10. Operating Environment

The operating environment should be within the following limitations:

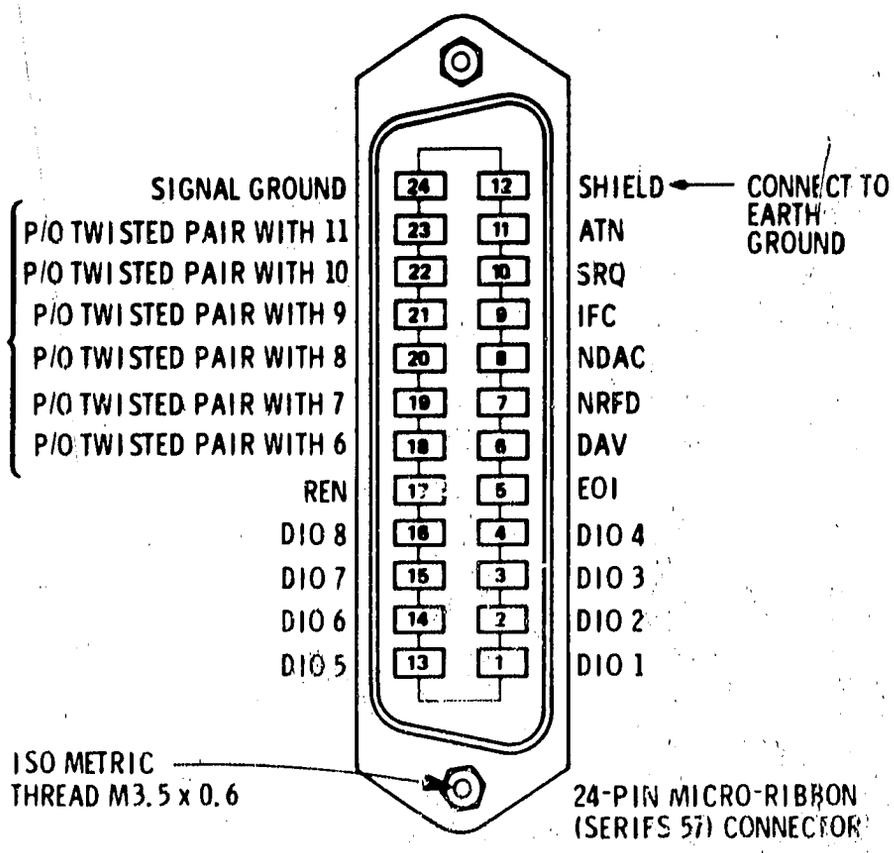
Temperature ..... 0°C to +55°C
Humidity ..... <95% relative at 40°C
Altitude ..... <4570 metres (15,000 feet)

2-11. Bench Operation

The instrument cabinet has plastic feet and foldaway tilt stands for convenience in bench operation. (The plastic feet are shaped to ensure self-alignment of instruments when they are stacked.) The tilt stands raise the front of the Transceiver Interface for easier viewing of the front panel.

Table 2-2. Allowable HP-IB Address Codes

Address Switch					Equivalent Decimal Value	Equivalent ASCII Character (LISTEN)	Equivalent ASCII Character (TALK)
A1 LSB	A2	A3	A4	A5 MSB			
0	0	0	0	0	00	SP	@
1	0	0	0	0	01	!	A
0	1	0	0	0	02	"	B
1	1	0	0	0	03	#	C
0	0	1	0	0	04	$	D
1	0	1	0	0	05	%	E
0	1	1	0	0	06	&	F
1	1	1	0	0	07	'	G
0	0	0	1	0	08	(	H
1	0	0	1	0	09	)	I
0	1	0	1	0	10	*	J
1	1	0	1	0	11	+	K
0	0	1	1	0	12	,	L
1	0	1	1	0	13	-	M
0	1	1	1	0	14	.	N
1	1	1	1	0	15	/	O
0	0	0	0	1	16	0	P
1	0	0	0	1	17	1	Q
0	1	0	0	1	18	2	R
1	1	0	0	1	19	3	S
0	0	1	0	1	20	4	T
1	0	1	0	1	21	5	U
0	1	1	0	1	22	6	V
1	1	1	0	1	23	7	W
0	0	0	1	1	24	8	X
1	0	0	1	1	25	9	Y
0	1	0	1	1	26	:	Z
1	1	0	1	1	27	;	[
0	0	1	1	1	28	<	\
1	0	1	1	1	29	=	]
0	1	1	1	1	30	>	^
1	1	1	1	1	31	INVALID	INVALID
Factory Selected Address							



Logic Levels

The Hewlett-Packard Interface Bus Logic Levels are TTL compatible, i.e., the true (1) state is 0.0 Vdc to +0.4 Vdc and the false (0) state is +2.5 Vdc to +5.0 Vdc.

Programming and Output Data Format

Refer to Section III, Operation.

Mating Connector

HP 1251-0293; Amphenol 57-30240.

Mating Cables Available

HP 10631A, 1 metre (3.3 ft), HP 10631B, 2 metres (6.6 ft)
HP 10631C 4 metres (13.2 ft), HP 10631D, 0.5 metres (1.6 ft)

Cabling Restrictions

1. A Hewlett-Packard Interface Bus system may contain no more than 2 metres (6 ft) of connecting cable per instrument.

2. The maximum accumulative length of connecting cable for any Hewlett-Packard Interface Bus system is 20.0 metres (65.6 ft).

Figure 2-4. Hewlett-Packard Interface Bus Connections

2-12. Rack Mounting

Rack mounting information is provided with the rack mounting kits. If the kits were not ordered with the instrument as options, they may be ordered through the nearest Hewlett-Packard office. Refer to paragraph 1-9, "Mechanical Options", in Section I.

2-13. STORAGE AND SHIPMENT

2-14. Environment

The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment.

Temperature	−55°C to +75°C
Humidity	<95% relative
Altitude	15,300 metres (50,000 feet)

2-15. Packaging

Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument 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 ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

Other Packaging. The following general instructions should be used for repackaging the instrument with commercially available materials.

1. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number).

2. Use a strong shipping container. A double-wall carton made of 2.4 MPa (350 psi) test material is adequate.

3. Use enough shock-absorbing material (75 to 100 millimeter layer; 3 to 4 inches) around all sides of the instrument to provide a firm cushion and to prevent movement in the container. Protect the front panel with cardboard.

4. Seal the shipping container securely.

5. Mark the shipping container FRAGILE to ensure careful handling.

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

This section provides operating information for the Transceiver Interface. Included are operating instructions, operator's maintenance procedures, operational descriptions of all front- and rear-panel features, operator's checks, and information on Remote (HP-IB) operation.

3-2. Operating Characteristics

For detailed information on the Transceiver Interface's characteristics, refer to Table 1-1, "Specifications", and Table 1-2, "Supplemental Characteristics". For information on the instrument's HP-IB capabilities, refer to the summary contained in Table 3-2, "HP-IB Message Reference List".

3-3. Local Operation

The front-panel operation of the Transceiver Interface is presented in this section under "Front-Panel Features", "General Operating Instructions", and "Detailed Panel Features".

Front-Panel Features. Figure 3-1 illustrates the front panel of the Transceiver Interface and provides descriptions of each key, connector, and switch.

3-4. Remote Operation

The Transceiver Interface is capable of remote operation via the Hewlett-Packard Interface Bus (HP-IB). Knowledge of the instrument's LOCAL mode of operation is beneficial in understanding HP-IB programming. HP-IB information is presented in the following areas of this section:

1. Beginning with paragraph 3-12, general HP-IB information.

2. Table 3-2, a summary of HP-IB capabilities.

3. Table 3-3, a summary of HP-IB program codes.

3-5. Instrument Checks

Operator's checks are simple procedures designed to verify that the Transceiver Interface is operating properly. Two procedures are provided: one for basic (front-panel) functional checks, and the other for HP-IB functional checks.

Basic Functional Checks. This procedure assures that the front-panel-controlled functions are being properly executed by the Transceiver Interface. The only equipment needed to perform this test is a signal generator and a spectrum analyzer. (Interconnecting cables and adapters must also be provided.)

HP-IB Functional Checks. HP-IB

These procedures assume that the instrument's front-panel operation has been previously verified; that is, that the Basic Functional Checks have been performed. These procedures check all of the applicable bus messages summarized in Table 3-2. This series of procedures requires a computing controller (HP-IB compatible) and an HP-IB interconnecting cable.

3-6. GENERAL OPERATING INSTRUCTIONS

WARNING

Before the Transceiver Interface is switched on, all protective earth terminals, extension cords, autotransformers, and devices attached to the instrument should be connected to a protective earth grounding socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in personal injury.

For continued protection against fire hazard, replace the line fuse with only a 250V fuse of the same rating. Do not use repaired fuses or short-circuited fuseholders.

CAUTION

Before the Transceiver Interface is switched on, it must be set to the same line voltage as the power source or damage to the instrument may result.

3-7. Power-On Procedure

The Transceiver Interface has an "off" state and an "on" state. If the Transceiver Interface is already plugged in, set the LINE OFF/ON switch to ON. If the power cable is not plugged in, follow these instructions:

1. Ensure that the LINE OFF/ON switch is OFF.

2. Check that the instrument's line voltage setting corresponds to the voltage of the power source. Refer to paragraph 2-5.

3. Check that the line fuse rating is appropriate for the line voltage being used. Refer to paragraph 2-5.

4. Plug in the power cable.

5. Set the LINE OFF/ON switch to ON.

3-8. OPERATOR'S MAINTENANCE

WARNING

For continued protection against fire hazards, replace the line fuse with only a 250V fuse of the same rating. Do not use repaired fuses or short-circuited fuseholders.

The only maintenance the operator may need to perform is the replacement of the primary power fuse (in A4 Line Filter Module), the TRANSMIT KEY FUSE (accessible from the front panel) or the Power Supply fuses A2F1, and A2F2 (located inside the instrument). Instructions on how to change the primary power fuse are found in Figure 2-1, steps 1 and 3, and paragraph 2-5.

- Primary power fuses may be ordered under HP Part Numbers 2110-0004 (0.250A, 250V) for 100/120 Vac operation and 2110-0027 (0.125A, 250V) for 220/240 Vac operation.

CAUTION

Before replacing the TRANSMIT KEY fuse, ensure that the Transceiver Interface LINE OFF/ON switch is in the OFF position.

- The TRANSMIT KEY FUSE is contained in the front-panel fuse holder. It can be easily removed with a flat-blade screwdriver. The TRANSMIT KEY FUSE may be ordered under HP part number 2100-0043 (1.5A, 250V).

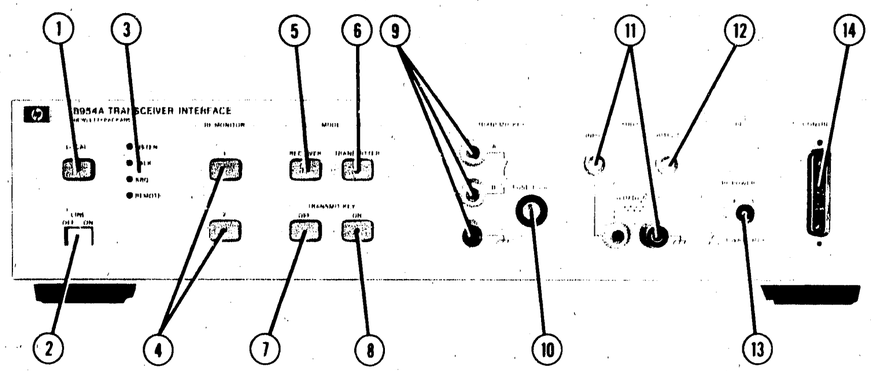
CAUTION

Before replacing the Power Supply fuses, ensure that the Transceiver Interface LINE OFF/ON switch is in the OFF position.

- The Power Supply fuses A2F1 and A2F2 are located on the A2 assembly (see Service Sheet 4). The fuses may be ordered under HP part numbers HP 2110-0269 (A2F1; 0.75A, 250V) and HP 2110-0027 (A2F2; 0.125A, 250V).

3-9. DETAILED PANEL FEATURES

The Transceiver Interface may be controlled by either the front panel or the Hewlett-Packard Interface Bus. The front- and rear-panel features are described in detail in Figures 3-1 and 3-2.



1. **LOCAL Key.** The LOCAL key returns the instrument to the local operating mode (full, front-panel control) from the remote mode of operation. The LOCAL key is disabled if a Local Lockout command has been given by the HP-IB controller.

2. **LINE OFF/ON.** The LINE OFF/ON switch applies line power to the Transceiver Interface when the switch is set to the ON position.

3. **REMOTE Annunciators.** Four LED annunciators are used to display the instrument's operational status in the remote mode. The LISTEN and TALK annunciators indicate that the instrument is addressed to LISTEN or TALK. The SRQ annunciator indicates that the Transceiver Interface has initiated a service request. The REMOTE annunciator indicates that the instrument has entered the remote operating mode.

4. **RF MONITOR Keys (1 and 2).** The RF MONITOR keys (1 and 2) allow the input signal to the RF, Type-N connector (front panel), to be output at either RF MONITOR 1 or RF MONITOR 2, Type-N connectors (rear panel).

The utilization of either monitor may be done only when the instrument is in its TRANSMITTER MODE. (Refer to TRANSMITTER MODE Key explanation).

5. **RECEIVER MODE Key.** The RECEIVER MODE key causes the instrument to make the following internal relay connections to accomodate receiver testing:

   - Input signals to the RF SOURCE 1 and/or 2, Type-N connectors (rear panel), are switched to the RF, Type-N connector (front panel). (Simultaneous input signals to the RF SOURCE connectors 1 and 2 are combined through a 6-dB power combiner before being output at the RF Power connector.)

   - Input signals to the AUDIO SOURCE, BNC connector (rear panel) are switched to the RF SOURCE MOD 1, BNC connector (rear panel).

   - Input signals to the AUDIO INPUT, BNC connector (front panel) are switched to the AUDIO ANALYZER, BNC connector (rear panel).

   - Opens the Transmit Key relay if the instrument is in the Transmit mode with the Transmit Key on.

6. **TRANSMITTER MODE Key.** The TRANSMITTER MODE key causes the instrument to make the following internal relay connections to accomodate transmitter testing:

   - Input signals to the RF Power, Type-N connector (front panel) are switched to either RF MONITOR 1 or 2, Type-N connector (rear panel).

   - Input signals to the AUDIO SOURCE, BNC connector (rear panel) are switched to the AUDIO OUTPUT, BNC connector (front panel).

   - Input signals to the RF MONITOR DEMOD 1, BNC connector (rear panel) are switched to the AUDIO ANALYZER, BNC connector (rear panel). See Figure 1-2 for an illustration of relay activity for both the receiver and transmitter modes.

7. **TRANSMIT KEY OFF MODE.** The TRANSMIT KEY OFF key opens the relay (TRANSMIT KEY Relay) that keys the transmitter.

8. **TRANSMIT KEY ON MODE.** The TRANSMIT KEY ON key closes the relay contacts (TRANSMIT KEY Relay) which keys the transmitter when the instrument is in the TRANSMITTER MODE. In the RECEIVER MODE, when the TRANSMIT KEY ON key is selected, the Transceiver Interface switches to the TRANSMITTER MODE.

9. **TRANSMIT KEY.** The TRANSMIT KEY consists of connectors A, B, and ground ⏚, which are provided for keying the transmitter. A and B are connected via relay contacts that are controlled by the TRANSMIT KEY ON and TRANSMIT KEY OFF. The TRANSMIT KEY connectors A and B may be allowed to float or be referenced to ground ⏚.

CAUTION

Damage to the test setup may occur if the transmitter is keyed during testing without an attenuator connected between the device under test and the Transceiver Interface. The attenuator should be selected to prevent the RF input power from exceeding 1 watt.

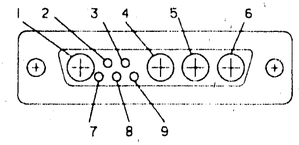
10. **TRANSMIT KEY FUSE.** The TRANSMIT KEY FUSE will open if current in excess of 1.5A is drawn through the instrument's transmitter-key circuit.

11. **AUDIO INPUT.** When the Transceiver Interface is in the RECEIVER MODE, an audio input signal to the AUDIO INPUT, BNC connector is output at the AUDIO ANALYZER connector (rear panel). The AUDIO INPUT is in parallel with two terminal posts (LOAD) for attaching a simulated speaker impedance.

12. **AUDIO OUTPUT.** In the TRANSMITTER MODE, the AUDIO OUTPUT, BNC connector outputs a signal received from the AUDIO SOURCE input (rear panel). The AUDIO OUTPUT signal is used as the microphone input to the transceiver under test.

13. **RF POWER.** The RF Power, Type-N connector, is used for both RF input and output signals. When the instrument is in the RECEIVER MODE, the RF Power connector is switched to RF SOURCE 1 and 2. In the TRANSMITTER MODE, the RF Power connector is switched to either RF MONITOR 1 or 2. The maximum allowable RF input power is +30 dBm (1 Watt). The input impedance is 50 ohms nominal.

14. **CONTROL.** The CONTROL connector consists of the following Transceiver Interface inputs and outputs (see following illustration):



CONTROL CONNECTOR
FRONT VIEW

   - Pin 1 is in parallel with the AUDIO INPUT (front panel); both BNC connector and terminal posts.

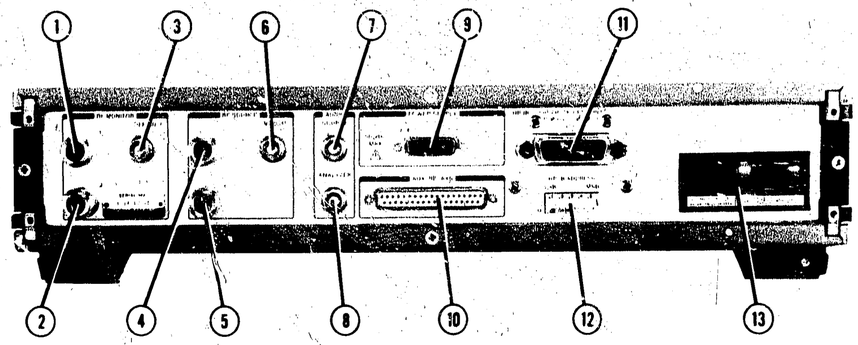
   - Pins 2 and 3 are in parallel with the TRANSMIT KEY terminals B and A, (front panel) respectively.

   - Pin 4 is wired to the negative (−) dc voltage-input pin and the negative (−) dc voltage-sense pin (pin 4 and 5 respectively) of the rear-panel POWER SUPPLY connector. Pin 5 is wired to the positive (+) dc voltage-input and the positive (+) dc voltage sense pin (pin 4 and 7 respectively) of the rear-panel POWER SUPPLY connector.

   - Pin 6 is in parallel with front-panel AUDIO OUTPUT, BNC connector.

Refer to paragraph 1-10 and Service Sheet 2 for more information regarding this connector.

Figure 3-1. Front-Panel Features



1. **RF MONITOR 1.** In the TRANSMITTER MODE, RF MONITOR 1, Type-N connector outputs an RF signal that is received from the RF connector (front panel). See Figure 3-1, Front-Panel Features for RF MONITOR 1 selection procedure (via front-panel keys).

2. **RF MONITOR 2.** In the TRANSMITTER MODE, RF MONITOR 2, Type-N connector outputs an RF signal that is received from the RF connector (front panel). See Figure 3-1, Front-Panel Features for RF MONITOR 2 selection procedure (via front-panel keys).

3. **RF MONITOR DEMOD 1.** In the TRANSMITTER MODE, the transmitter's demodulated RF signal is switched from the RF MONITOR DEMOD 1, BNC connector to the AUDIO ANALYZER connector (rear panel).

4. **RF SOURCE 1.** In the RECEIVER MODE, an RF signal path is connected from the RF SOURCE 1, Type-N connector to the RF connector (front panel). Refer to following NOTE.

5. **RF SOURCE 2.** In the RECEIVER MODE, an RF signal path is connected from the RF SOURCE 2, Type-N connector to the RF connector (front panel). Refer to following NOTE.

NOTE

Independent input signals to RF SOURCE 1 and RF SOURCE 2 are combined through a 6-dB power combiner before they are output at the RF POWER connector (front panel). If only one RF SOURCE is used, the other RF SOURCE connector must be terminated with 50 ohms.

6. **RF SOURCE MOD 1.** In the RECEIVER MODE, an audio signal path is connected from the RF SOURCE MOD 1, BNC connector to the AUDIO SOURCE input connector (rear panel). The RF SOURCE MOD 1 output signal is used as an external-modulation input to the RF signal source.

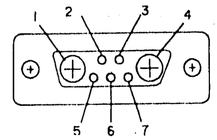
7. **AUDIO SOURCE.** In the TRANSMITTER MODE, an input signal from an audio source to the AUDIO SOURCE BNC connector is output at the AUDIO OUTPUT connector (front panel). In the RECEIVER MODE, an input signal from an audio source to the AUDIO SOURCE connector is output at the RF SOURCE MOD 1 connector (rear panel).

8. **AUDIO ANALYZER.** In the TRANSMITTER MODE, the AUDIO ANALYZER, BNC connector outputs an audio signal that is received from the RF MONITOR DEMOD, BNC connector (rear panel).

If the MIC. SENSE relay is activated (HP-IB control only), the AUDIO ANALYZER connector will output a signal received from the AUDIO SOURCE connector.

In the RECEIVER MODE, the AUDIO ANALYZER, BNC connector outputs an audio signal that is received from the AUDIO INPUT connector (front panel)

9. **POWER SUPPLY.** The POWER SUPPLY, seven-pin connector is wired to the CONTROL connector (front panel). This connector is used as the input for an external dc power supply. The external supply provides a programmable voltage source for the transceiver under test. ⚠



POWER SUPPLY CONNECTOR
FRONT VIEW

Pin 1 is the positive (+) input pin and Pin 4 is a negative (−) input pin. Additional POWER SUPPLY connections are the remote sensing input pins, which includes: Pin 5; which is the positive (+) voltage sense input pin, and Pin 7; which is the negative (−) voltage sense input pin.

Maximum input voltage is 50 Vdc (current <15A).

10. **AUX. RELAYS.** The AUX. RELAYS, 36-pin connector is the external connection to 16 sets of relay contacts (single-pole, single-throw); relays are internal to the Transceiver Interface. Service Sheet 2 contains more detailed information regarding these relays.

11. **HP-IB Connector.** The HP-IB, 24-pin connector is used to connect the Transceiver Interface to the Hewlett Packard-Interface Bus. This will allow the instrument to be controlled with any HP-IB controller. Connection information is presented in paragraph 2-9.

12. **HP-IB Address Switch.** The HP-IB address switch is a five-segment switch used to select the Transceiver Interface's HP-IB address. Address selection information is presented in paragraph 2-7.

13. **Line Filter Module.** The Line Filter Module permits operation from 100, 120, 220, or 240 Vac. The number visible in the module window indicates the nominal line voltage to which the instrument must be connected. The center conductor is connected to safety earth ground. Line-voltage selection information is presented in paragraph 2-5.

Figure 3-2. Rear-Panel Features

OPERATORS CHECKS

3-10. OPERATOR'S CHECKS

Operator's checks are simple procedures designed to verify that the main functions of the Transceiver Interface operate properly. Two procedures are provided: one for front-panel functional checks, and the other for HP-IB functional checks.

3-11. Basic Functional Checks

DESCRIPTION:

This procedure assures that the front-panel-controlled functions are being properly executed by the Transceiver Interface. The only equipment needed to perform this test is a signal generator and a spectrum analyzer. (Interconnecting cables and adapters must also be provided.)

EQUIPMENT:

Signal Generator	HP 8640B
Spectrum Analyzer	HP 8558B/182T

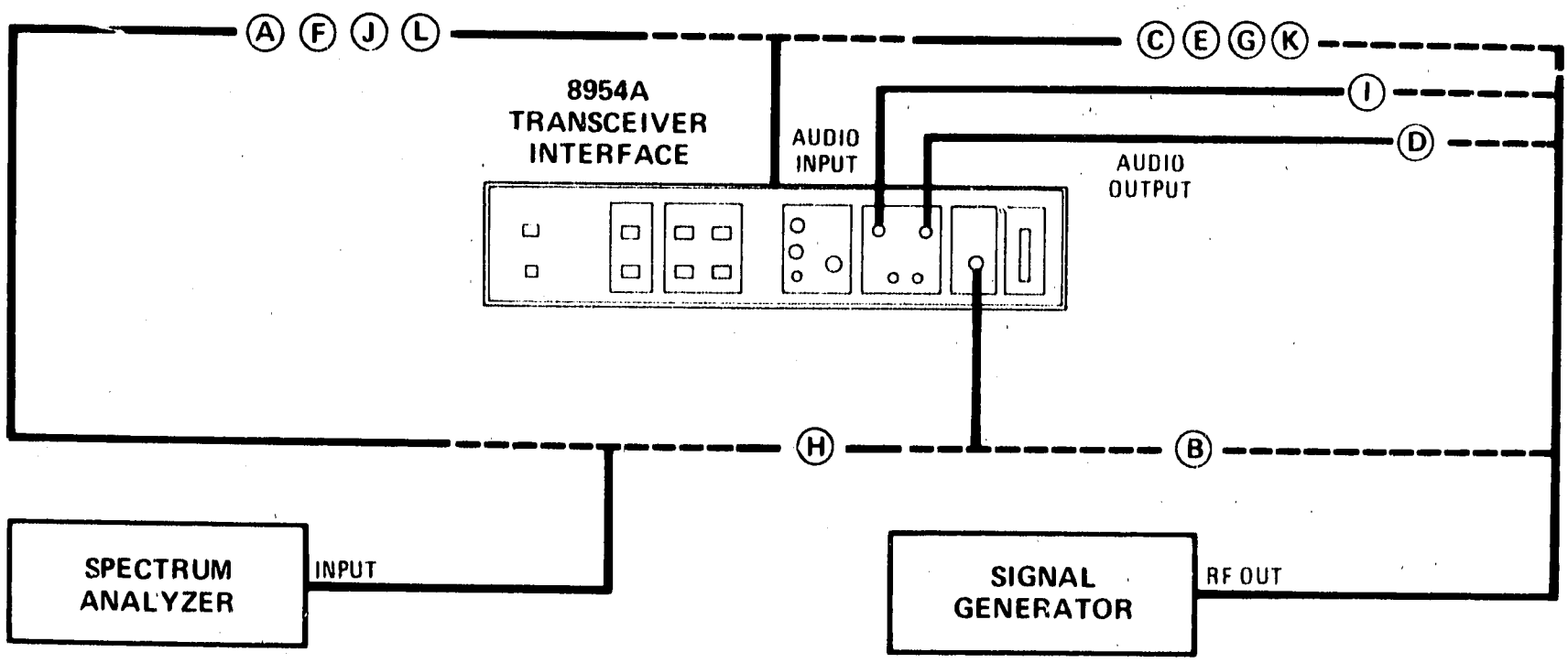


Figure 3-3. Test Configuration for Basic Function Checks

OPERATORS CHECKS

3-11. Basic Functional Checks (Cont'd)

Table 3-1. Connections for Basic Functional Checks

BASIC FUNCTIONAL CHECKS (PROCEDURE STEPS)	CONNECTIONS
3—8	Ⓐ RF MON 1 or 2 to Spectrum Analyzer Input. Ⓑ Signal Generator output to RF POWER input.
9—12	Ⓒ AUDIO SOURCE to Spectrum Analyzer Input. Ⓓ Signal Generator output to AUDIO OUTPUT.
13—15	Ⓔ Signal Generator output to RF MONITOR DEMOD. 1 Ⓕ AUDIO ANALYZER to Spectrum Analyzer.
18—22	Ⓖ Signal Generator output to RF SOURCE 1. Ⓗ RF POWER to Spectrum Analyzer input.
24—25	Ⓘ Signal Generator output to AUDIO INPUT. Ⓙ AUDIO ANALYZER to Spectrum Analyzer.
26—27	Ⓚ Signal Generator output to AUDIO SOURCE. Ⓛ RF SOURCE MOD 1 to Spectrum Analyzer.

PROCEDURE:

1. Ensure that the power cable is plugged into a suitable source of Mains Power. (Refer to paragraph 2-4, 2-5, and 2-6.)

2. Set the LINE OFF/ON switch to ON. The Transceiver Interface powers up in the RECEIVER MODE (key-cap LED, on) with RF MONITOR 1 selected (key-cap LED, on).

3. Connect the Transceiver Interface RF connector to the signal generator's RF output and the Transceiver Interface RF MONITOR 1 connector (on the rear panel) to the spectrum analyzer input.

Transmitter Mode Checks

4. Set the output amplitude of the signal generator to 0 dBm, and set the carrier frequency to 10 MHz.

5. Set the center frequency of the spectrum analyzer to 10 MHz, and set the reference level to 0 dBm.

6. Select the TRANSMITTER MODE. Verify that the level displayed on the spectrum analyzer is 0 dBm +5 dB.

7. Connect the spectrum analyzer to the RF MONITOR 2 connector (on the rear panel). The signal level on the spectrum analyzer should be less than−60 dBm.

8. Select RF MONITOR 2. Verify that the level displayed on the spectrum analyzer is 0 dBm +5 dB.

OPERATORS CHECKS

3-11. Basic Functional Checks (Cont'd)

Transmitter Mode Checks (Cont'd)

9. Set the signal generator's carrier frequency to 100 kHz and the spectrum analyzer's center frequency to 100 kHz.

10. Connect the signal generator to the AUDIO SOURCE connector (rear panel).

11. Connect the spectrum analyzer to the AUDIO OUTPUT connector (front panel). Verify that the level displayed on the spectrum analyzer is 0 dBm +5 dB.

12. Select the RECEIVER MODE. The signal level on the spectrum analyzer should be less than −60 dBm.

13. Connect the signal generator to the RF MONITOR DEMOD 1 connector (on the rear panel).

14. Connect the spectrum analyzer to the AUDIO ANALYZER connector (on the rear panel).

15. Select the TRANSMITTER MODE. Verify that the level displayed on the spectrum analyzer is 0 dBm +5 dB.

16. Select the TRANSMIT KEY ON MODE. Verify that there is continuity between TRANSMIT KEY terminals A and B.

Receiver Mode Checks

17. Set the signal generator's frequency to 10 MHz and the spectrum analyzer's center frequency to 10 MHz.

18. Connect the signal generator to the RF SOURCE 1 connector (on the rear panel).

19. Connect the spectrum analyzer to the RF connector (on the front panel).

20. Terminate RF SOURCE 2 connector with a 50-ohm load (RF SOURCE 1 and RF SOURCE 2 are connected through a 6-dB power combiner).

21. Select the RECEIVER MODE. Verify that the signal level displayed on the spectrum analyzer is −6 dBm +5 dB.

22. Connect the signal generator to the RF SOURCE 2 connector. Connect the 50-ohm load to the RF SOURCE 1 connector. Verify that the level displayed on the spectrum analyzer is −6 dBm +5 dB.

23. Set the signal generator's carrier frequency to 100 kHz and the spectrum analyzer's center frequency to 100 kHz.

24. Connect the signal generator to the AUDIO INPUT connector (on the front panel).

3-11. Basic Functional Checks (Cont'd)

Receiver Mode Checks (Cont'd)

25. Connect the spectrum analyzer to the AUDIO ANALYZER connector (on the rear panel). Verify that the level displayed on the spectrum analyzer is 0 dBm +5 dB.

26. Connect the signal generator to the AUDIO SOURCE connector on the rear panel.

27. Connect the spectrum analyzer to the RF SOURCE MOD 1 connector on the rear panel. Verify that the level displayed on the spectrum analyzer is 0 dBm ±5 dB.

3-12. HP-IB Functional Checks HP-IB

DESCRIPTION:

The following procedures check the Transceiver Interface's ability to: recognize its own HP-IB talk and listen address, properly make remote-to-local transitions and process all of the applicable HP-IB messages described in Table 3-2. During these tests, all data input/output bus lines, control lines, and handshake lines of the Tranceiver Interface's HP-IB are exercised. A Transceiver Interface, a bus controller, and an HP-IB interface with appropriate cabling are required to perform these procedures. Since these checks are intended to be independent from one another, each begins with the instrument reset to its initialized condition.

The validity of these checks is based on the following assumptions:

- The Transceiver Interface performs properly when operated via the front-panel keys (that is, in the Local operating mode). This can be verified by performing the Basic Functional Checks outlined in paragraph 3-11.

- The bus controller properly executes HP-IB operations.

- The bus controller properly interfaces with theHP-IB (able to transfer control instructions).

- The select code of the bus controller's interface is set to 7.

- The HP-IB address of the Transceiver Interface is set to 03 (the factory-set address).

The select-code address, combination 703, is used. (This select-code address is not necessary for these checks to be valid; however, the program lines presented in the following procedures would need modification for any other combination.)

If the Transceiver Interface appears to fail any of the Remote functional checks, the validity of the preceding assumptions should be reconfirmed before attempting to service the instrument.

NOTE

The Transceiver Interface's proper operation is verified by successfully performing the HP-IB functional checks. These procedures do not check all Transceiver Interface program-code responses. However, if the front-panel operation and HP-IB functional checks are confirmed to be correct, the instrument will most likely respond properly to all of its program codes.

HP-IB

OPERATORS CHECKS

3-12. HP-IB Functional Checks (Cont'd)

INITIAL SETUP:

The test setup is the same for all of the checks; that is, the Transceiver Interface is connected to the bus controller's HP-IB interface via the appropriate cabling.

EQUIPMENT:

HP-IB Controller ..... HP 85F/00085-15003 (I/O ROM)
—or— ..... HP 9825/98213A (General and Extended I/O ROMs)
—or— ..... HP 9826A Opt. 001
—or— ..... HP 9845A (I/O ROM)

HP-IB Interface ..... HP 82937A (HP 85)
—or— ..... HP 98034B (HP 9825)
—or— ..... HP 98034B (HP 9845)

Address Recognition

This check determines whether the Transceiver Interface is capable of recognizing an HP-IB address.

NOTE

It is assumed that the Instrument is in the Local operating mode and that it properly handshakes on the bus.

Before beginning this check, set the LINE OFF/ON switch to OFF, then ON, for instrument initialization.

Description	HP 9825A (HPL)	HP 85F, HP 9845A & HP 9826A (BASIC)
Set the Remote Enable, bus-control line (REN) false.	lcl 7	LOCAL 7
Send the listen address to the Transceiver Interface.	wrt 703	OUTPUT 703

OPERATOR'S RESPONSE: Verify that the Transceiver Interface REMOTE annunciator remains off and that its LISTEN annunciator lights.

Unaddress the Transceiver Interface by sending a different address.	wrt 719	OUTPUT 719

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE and LISTEN annunciators are both off.

3-12. HP-IB Functional Checks (Cont'd)

Remote and Local Messages, and LOCAL Key

This check determines whether the Transceiver Interface properly switches from Local to Remote operation, and from Remote to Local operation.

NOTE

It is assumed that the Transceiver Interface is able to properly handshake on the bus and recognize its own HP-IB address.

Before beginning this check, set the LINE OFF/ON switch to OFF, then ON for instrument initialization.

Description	HP 9825A (HPL)	HP 85F, HP 9845A & HP 9826A (BASIC)
Send the Remote message which sets the Remote Enable, bus-control line (REN) true and addresses the Transceiver Interface to listen.	rem 703	REMOTE 703

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE and LISTEN annunciators both light.

Send the Local message to the Transceiver Interface.	lcl 703	LOCAL 703

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE annunciator turns off and that its LISTEN annunciator remains on.

Send the Remote message to the Transceiver Interface.	rem 703	REMOTE 703

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE and LISTEN annunciators are both on. Press the LOCAL key on the front panel of the Transceiver Interface. Verify that the REMOTE annunciator turns off and that the LISTEN annunciator remains on.

3-12. HP-IB Functional Checks (Cont'd)

Data Message

This check determines that the Transceiver Interface properly receives data messages.

NOTE

It is assumed that the Transceiver Interface is able to handshake, recognize its own address, and properly make Remote/Local transitions. The data message sent will cause the HP-IB data lines to be placed in both the true and false states.

Before beginning this check, set the LINE OFF/ON switch to OFF, then to ON, for instrument initialization.

Description	HP 9825A (HPL)	HP 85F, HP 9845A & HP 9826A (BASIC)
Send the first part of the Remote message (which enables the Transceiver Interface to Remote).	rem 703	REMOTE 703
Address the Transceiver Interface to listen (which completes the Remote message), and send the data message (which selects the TRANSMITTER MODE).	wrt 703, "XM"	OUTPUT 703; "XM"

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE and LISTEN annunciators both light and that the TRANSMITTER MODE annunciator (key-cap LED) lights.

3-12. HP-IB Functional Checks (Cont'd)

Local Lockout and Clear Lockout/Set Local Message

This check determines whether the Transceiver Interface properly receives the Local Lockout message that disables all front-panel keys. In addition, this check determines whether the Clear Lockout/Set Local message is properly received and executed by the instrument.

NOTE

It is assumed that the Transceiver Interface is able to handshake, recognize its own address, and properly make Remote/Local transitions.

Before beginning this check, set the LINE OFF/ON switch to OFF, then to ON, for instrument initialization.

Description	HP 9825A (HPL)	HP 85F, HP 9845A & HP 9826A (BASIC)
Send the first part of the Remote message (which enables the Transceiver Interface to remote).	rem 7	REMOTE 7
Send the Local Lockout message.	llo 7	LOCAL LOCKOUT 7
Address the Transceiver Interface to listen (which completes the Remote message).	wrt 703	OUTPUT 703

OPERATOR'S RESPONSE: Verify that the Transceiver interface's REMOTE and LISTEN annunciators both light. Press the LOCAL key on the front panel of the Transceiver Interface and verify that the REMOTE and LISTEN annunciators both remain on.

Send the Clear Lockout/Set Local message.	lcl 7	LOCAL 7

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE annunciator is turned off and that its LISTEN annunciator remains on.

HP-IB **OPERATORS CHECKS**

3-12. HP-IB Functional Checks (Cont'd)

Clear Message

This check determines whether the Transceiver Interface properly responds to the Clear message.

NOTE

It is assumed that the Transceiver Interface is able to handshake, recognize its own address, and properly make Remote/Local transitions.

Before beginning this check, set the LINE OFF/ON switch to OFF, then to ON, for instrument initialization.

Description	HP 9825A (HPL)	HP 85F, HP 9845A & HP 9826A (BASIC)
Send the first part of the Remote message (which enables the Transceiver Interface to Remote).	rem 7	REMOTE 7
Address the Transceiver Interface to listen (which completes the Remote message), and send the Data message.	wrt 703, "XYZ"	OUTPUT 703; "XYZ"

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE and LISTEN annunciators remain on and that the SRQ annunciator lights.

Send the Clear message.	clr 703	RESET 703 CLEAR 703 (HP 85 & 9826A)

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE and LISTEN annunciators remain on and that the SRQ annunciator is not on.

3-12. HP-IB Functional Checks (Cont'd)

Abort Message

This check determines whether the Transceiver Interface becomes unaddressed when it receives the Abort message.

NOTE

It is assumed that the Transceiver Interface is able to handshake, recognize its own address, and properly make Remote/Local transitions.

Before beginning this check, set the LINE OFF/ON switch to OFF, then to ON, for instrument initialization.

Description	HP 9825A (HPL)	HP 85F, HP 9845A & HP 9826A (BASIC)
Send the complete Remote message.	rem 703	REMOTE 703

OPERATOR'S RESPONSE: Verify that the Transceiver Interface's REMOTE and LISTEN annunciators both light.

Send the Abort message (which unaddresses the Transceiver Interface to listen).	cli 7	ABORTIO 7 ABORT 7 (HP 9826A)

OPERATOR'S RESPONSE: Verify that the LISTEN annunciator turns off.

3-13. REMOTE OPERATION, HEWLETT-PACKARD INTERFACE BUS

The Transceiver Interface can be operated through the Hewlett-Packard Interface Bus (HP-IB). Bus compatability, programming, and data formats are described in the following paragraphs.

All front-panel functions and auxiliary relays are programmable via the HP-IB. A quick check of the Transceiver Interface's HP-IB input/output capability is described in paragraph 3-12, "HP-IB Functional Checks". These checks are used to verify that the Transceiver Interface responds to each of the applicable HP-IB messages described in Table 3-2.

3-14. HP-IB Compatibility

The Transceiver Interface has an open collector, TTL, HP-IB interface capability. This capability enables the instrument to be controlled by any computer or computing controller that is HP-IB programmable. The Transceiver Interface is fully programmable via the Hewlett-Packard Interface Bus. The instrument's programming capability is described by the twelve HP-IB messages listed in Table 3-2. Foremost among these messages is the Data message. Data messages contain the program codes that control the Transceiver Interface's signal paths. The Transceiver Interface's complete compatability with HP-IB is further defined by the following list of interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, and C0. A more detailed explanation of these compatibility codes can be found in the IEEE Standard 488 (and the identical ANSI Standard MC1.1).

3-15. Remote Mode

Remote Capability. In Remote operation, the front-panel keys are disabled (except for the LINE OFF/ON switch and the LOCAL key). The Transceiver Interface can be addressed to listen and to talk. When addressed to listen, the Transceiver Interface will respond to the following messages: Data, Clear, Remote, Local, Local Lockout, Clear Lockout/Set Local, and Abort. Each message is discussed in detail in the following paragraphs of this section. When addresed to talk, the Transceiver Interface outputs the following messages: Service Request and Instrument Identification (after receiving the ID Output Command).

Local-to-Remote Change. The Transceiver Interface transfers to the Remote operating mode upon receipt of the Remote message. The Remote message is comprised of two parts. They are:

- Remote Enable bus-control line (REN) set true.
- Device listen address received once (while REN is true).

The Transceiver Interface's REMOTE and LISTEN annunciators will both light and the instrument's relay switch positions will remain unchanged when the local to remote transition occurs.

3-16. Local Mode

Local Capability. In Local operation, the Transceiver Interface's front panel is fully operational and the instrument will respond to the Remote message. Whether addressed or not, the Transceiver Interface will also respond to the Clear, Local Lockout, Clear Lockout/Set Local, and Abort messages. It will not, however, respond to the Data messages (unless it has been previously addressed).

Remote-to-Local Change. The Transceiver Interface returns to Local operation upon receipt of the Local message (GTL) or Clear Lockout/ Set Local message. The Clear Lockout/Set Local message sets the Remote Enable bus-control line (REN) false. The instrument can always be set to Local operation by pressing the front-panel LOCAL key provided that a Local Lockout is not in effect. The signal paths will remain unchanged when the remote-to-local transition occurs.

Local Lockout. When a data transmission is interrupted (which can happen by returning the Transceiver Interface to Local operation with the LOCAL key) the data can be lost. This would leave the Transceiver Interface in an unknown state. To prevent this, a Local Lockout is recommended. Local Lockout disables the LOCAL key and allows a return-to-local only under program control.

NOTE

A return-to-local can also be accomplished by setting the LINE OFF/ON switch first to off, then back to ON. This technique, however, has some potential disadvantages:

- *It defeats the purpose of Local Lockout; that is, the system controller will lose its control over the Transceiver Interface.*
- *Some HP-IB conditions are reset to their default state during turn on.*

3-17. Addressing

When the Transceiver Interface is in the command-entry mode, it interprets the byte of information on its eight-data, input/output lines as either an address or a bus command. The command-entry mode is entered when the Attention bus-control line (ATN) is true and the Interface Clear bus control line (IFC) is false. Whenever the Transceiver Interface is being addressed (whether in Local or Remote operation), the front-panel LISTEN annunciator lights if addressed to listen and the TALK annunicator lights if addressed to talk.

The Transceiver Interface's address is established by five switches located on the rear panel of the instrument. The address selection procedure is described in section II (Installation). Refer to Table 2-2 for a list of the valid decimal addresses and their equivalent ASCII characters.

3-18. Data Messages

The Transceiver Interface communicates on the interface bus with Data messages. Each Data message consists of one or more bytes of information sent over the Transceiver Interface's eight, input/output bus lines (DIO1 through DIO8) during the data-entry mode. The data-entry mode is established when Attention bus-control line (ATN) is false. Data messages include the program codes listed in Table 3-3. These program codes contain the necessary information to: program all of the instrument functions available in LOCAL operation, program the 16 auxiliary relays, and program the Output Commands.

3-19. Receiving the Data Message

The Transceiver Interface must be in Remote operation and addressed to listen before it can respond to Data messages. The instrument will remain addressed to listen until it receives an Abort message, a universal unlisten command from the controller, or an address to talk.

Data Message Input Format. Data messages contain the controller's talk address, the Transceiver Interface's listen address, a string of program codes, and an End Of String message (EOS). The auxiliary relay code can be entered at any place in the string. The EOS message can be a Line Feed (LF), a bus END message (EOI and ATN bus-control lines both set true), or an internally produced EOS. Figure 3-4 provides some examples of Data messages.

A complete list of ASCII characters with conversion to binary, octal, decimal, and hexadecimal is provided in Table 2-2.

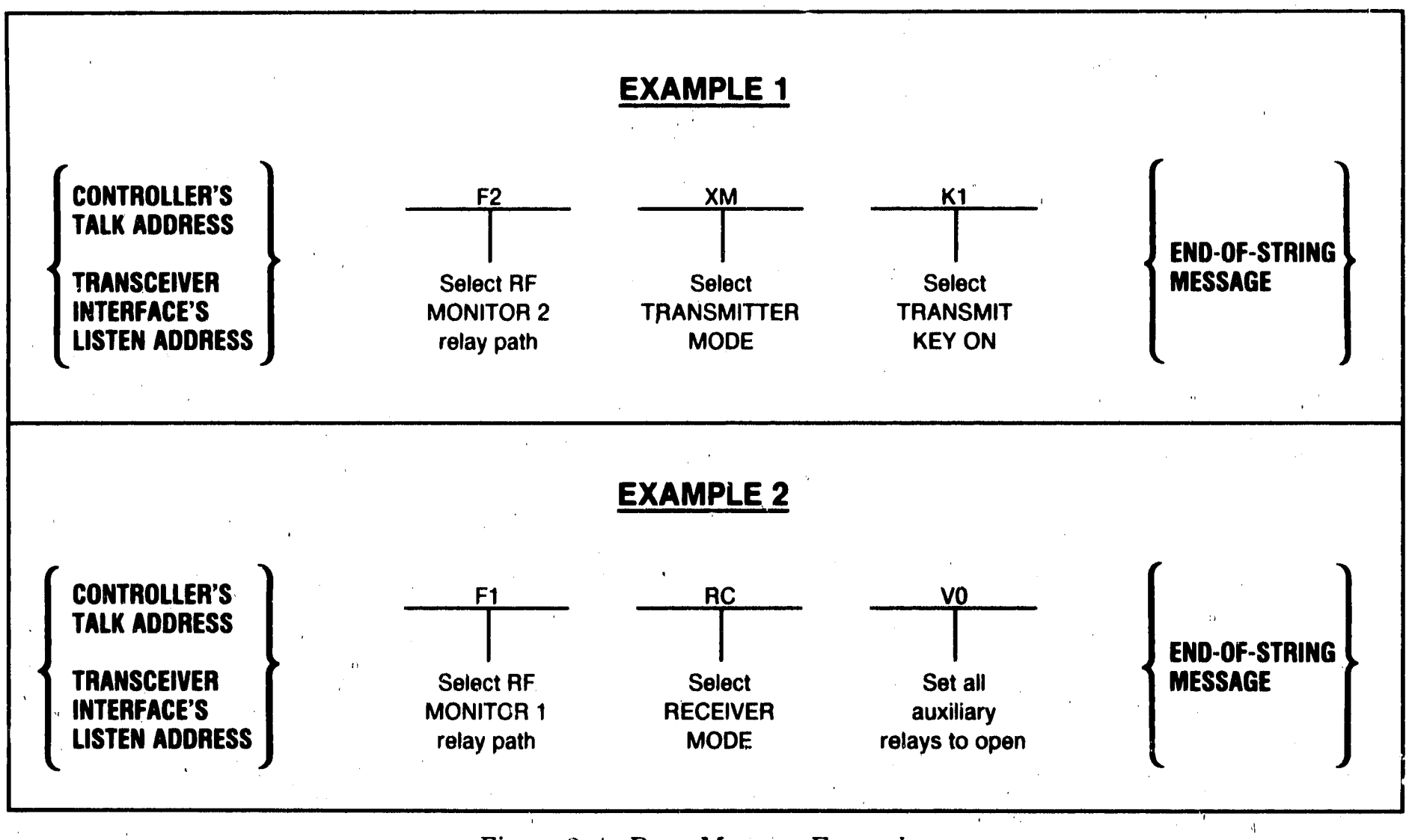


Figure 3-4. Data Message Examples

3-20. Receiving the Trigger Message

The Transceiver Interface does not have the capability to respond to the trigger message.

3-21. Receiving the Clear Message

The Transceiver Interface will respond to a Clear message by setting the listen or talk function off. The Transceiver Interface will respond equally to the Selected Device Clear (SDC) bus command when addressed to listen, and to the Device Clear (DCL) bus command whether addressed or not.

3-22. Receiving the Remote Message

The Remote message is comprised of two parts. First, the Remote Enable, bus-control line (REN) is held true, then the device listen address is sent by the controller. These two actions occur synchronously to configure the Transceiver Interface in the Remote operating mode. Therefore, the instrument is enabled to go in Remote operation when the controller begins the Remote message. The Transceiver Interface does not actually make the transition to Remote operation until it is addressed to listen for the first time. All instrument settings remain unchanged when the transition from local-to-remote operation occurs. The front-panel REMOTE and LISTEN annunciators will both light and remain on when the Transceiver Interface has received the Remote message and is addressed to listen.

3-23. Receiving the Local Message

The controller will configure the Transceiver Interface in the Local mode by sending the Go-to-Local (GTL) bus command. If addressed to listen, the Transceiver Interface will return to Local operation (full, front-panel control) when it receives the Local message. If the instrument is in Local Lockout when the Local message is received, full, front-panel control will be returned, but Local Lockout will remain in effect. Unless the Tranceiver Interface receives the Clear Lockout/-Set Local message, it will return to Local Lockout the next time it receives a Remote message. All instrument settings remain unchanged when the transition from Remote to Local is made.

The front-panel REMOTE annunciator will be turned off when the Transceiver Interface switches to Local operation. However, the front-panel LISTEN annunciator will remain lit if the Transceiver Interface is still being addressed to listen (whether in Remote or Local operation), and the front-panel TALK annunicator will remain lit if the instrument is addressed to talk.

The front-panel LOCAL key can also be used to return the Transceiver Interface to Local operation. However, pressing the LOCAL key (when the instrument is not in Local Lockout) might interrupt a Data message being sent to the Transceiver Interface. This would leave the Transceiver Interface in a state unknown to the controller. This situation is undesirable and can be avoided by sending the Local Lockout message to disable the LOCAL key.

3-24. Receiving the Local Lockout Message

The controller sends the Local Lockout command preventing access to the Local mode via the Transceiver Interface's front panel. If the Transceiver Interface is in Remote operation, it will respond to the Local Lockout message by disabling the front-panel LOCAL key. Local Lockout prevents the loss of data or system control due to someone accidentally pressing the front-panel LOCAL key. If the Transceiver Interface is in Local operation when it is enabled to Remote operation (that is, REN is set true) and it receives the Local Lockout message, it will switch to Remote with Local Lockout operation the first time it is addressed to listen. Once in Local Lockout, the Transceiver Interface can only be returned to Local operation by the controller, by unplugging or resetting the instrument, or by placing the LINE OFF/ON to OFF and then back to ON.

3-25. Receiving the Clear Lockout/Set Local Message

The Clear Lockout/Set Local message is the way the controller sets the Remote Enable, bus-control line (REN) false. The Transceiver Interface will return to Local operation (front-panel control) when it receives the Clear Lockout/Set Local message. All instrument settings remain unchanged after the transition from Remote operation (with lockout) to Local operation occurs. The front-panel REMOTE annunciator will be turned off when the Transceiver Interface switches to Local operation.

3-26. Receiving the Pass Control Message

The Transceiver Interface does not respond to the Pass Control message because it does not have a control capability.

3-27. Sending the Request Service Message

The Require Service Message is the way the Transceiver Interface sets the Service Request, bus-control line (SRQ) true. When the Service Request message is received, the controller can be instructed to serial poll the instruments on the bus.

3-28. Sending the Status Byte Message

The Status Byte message is the way the Transceiver Interface responds to a Serial Poll Enable (SPE) bus command and sends the Status Byte message to the controller. The Transceiver Interface sends the eight-bit, data word which has the following meaning to the controller:

bit

0 Not used.

1 Not used.

2 Illegal Transceiver Interface bus command.

3 Not used, "always a one except when controller is reset".

4 HP-IB error, "hardware broken".

5 Not used.

6 Universal HP-IB Request Service Bit.

7 Bus command complete (HP-IB or front panel not busy).

3-29. Sending the Status Bit Message

The Transceiver Interface does not have the capability to respond to a Parallel Poll Enable (PPE) bus command; therefore, it cannot send the Status Bit message.

3-30. Receiving the Abort Message

The Abort message is the way the controller sets the Interface Clear, bus-control line (IFC) true. When the Abort message is received, the Transceiver Interface becomes unaddressed and stops listening.

3-31. OUTPUT COMMANDS

The Output Commands in the following paragraphs are available for use with a remote controller.

3-32. Identification (ID)

The Identification command is used to identify the Transceiver Interface. When the command is sent by the controller and the Transceiver Interface is addressed to talk, it answers "8954A TRANSCEIVER INTERFACE" (Month, Day Year).

3-33. Output Memory (OM)

The Output Memory command is used to provide information for a service routine. (Refer to Section VIII, Service Sheet 1, for details.)

3-34. Request Service (RS)

The Request Service command allows the Transceiver Interface to Request Service when an incorrect command is received from the instrument controller. (Refer to paragraph 3-27.)

EXAMPLE OUTPUT COMMAND

CONTROLLER'S TALK ADDRESS TRANSCEIVER INTERFACE'S LISTEN ADDRESS	ID Sets the Transceiver Interface to output its instrument number, name, and software date when addressed to talk.	END-OF-STRING MESSAGE
CONTROLLER'S LISTEN ADDRESS TRANSCEIVER INTERFACE'S TALK ADDRESS	Read output data from Transceiver Interface (output must be read into string variable).	END-OF-STRING MESSAGE

Figure 3-5. Output Command Example

Table 3-2. HP-IB Message Reference List

HP-IB Message	Applicable	Response	Related Command	Interface Functions
Data	Yes	All front-panel functions are programmable. Front-panel LISTEN annunciator lights when instrument is addressed to listen. TALK annunciator lights when addressed to talk.		T6, L4, AH1, SH1
Trigger	No	Transceiver Interface does not have Device Trigger (DT0) capability.	GET	DT0
Clear	Yes	Clears the status byte. Responds equally to Device Clear (DCL) and Selected Device Clear (SDC) bus commands.	DCL, SDC	DC1
Remote	Yes	Remote operation is entered when Remote Enable (REN), bus-control line is true and instrument is first addressed to listen. Front-panel REMOTE and LISTEN annunciators light when remote operation is entered; all front-panel keys are disabled (except for the (LOCAL key).	REN	RL1
Local	Yes	Transceiver Interface returns to local operation (front-panel control) when either Go To Local bus command is received or front-panel LOCAL key is pressed.	GTL	RL1
Local Lockout	Yes	Disables front-panel LOCAL key so only controller can return instrument to local operation.	LL0	
	No	Electrical interface designation. Open collector bus drivers.		E1
Clear	Yes	Transceiver Interface returns to local operation and clears local lockout when REN bus-control line goes false.	REN	RL1
Pass Control Take Control	No	Transceiver Interface has no control capability.		CO0
Require Service	Yes	Transceiver Interface sets Service Request, bus-control line (SRQ) true if an invalid program code is received.	SRQ	SR1
Status Byte	Yes	Transceiver Interface responds to a Serial Poll Enable bus command (SPE) by sending one byte of information, when addressed to talk. If instrument is holding SRQ control line true (issuing the Require Service message), RQS bit 7 in Status Byte, and bit representing condition that caused Require Service message to be issued, will both be true. Bits in the Status Byte are latched but can be cleared by: 1. Removing causing condition. 2. Reading Status Byte	SPE, SPD	T6
Status Bit	No	Transceiver Interface does not have capability to respond to parallel poll.		PP0
Abort	Yes	Instrument stops listening or talking.	IFC	T6, L4

Table 3-3. HP-IB Programming Codes

Program Codes *	Parameter	Comments
C1	MIC SENSE Relay ON	Activates relay A2K20
C4	MIC SENSE Relay OFF	Deactivates relay A2K20. (Receiver or Transmitter keys will also accomplish the same function.)
F1	RF MONITOR 1	Activates relay K2.
F2	RF MONITOR 2	Activates relay K2.
RC	RECEIVER MODE	Activates relay K1.
XM	TRANSMITTER MODE	Activates relay K1.
J1		Turns on A2TP14
J2		Turns off A2TP14
J3		Turns on A2TP15
J4		Turns off A2TP15
K0	TRANSMIT Key OFF	Opens relay A2K17.
K1	TRANSMIT Key ON	Closes relay A2K17 (forces XMT).
GF	TRANSMIT Key ON	Closes relay A2K17 without forcing XMT mode.
V1—V9	Auxiliary Relays	Opens relays A2K1—A2K9. (V1 opens A2K1.)
VA—VG	Auxiliary Relays	Opens relays A2K10—A2K16. (VA opens A2K10.)
U1—U9	Auxiliary Relays	Closes relays A2K1—A2K9. (U1 closes A2K1.)
UA—UG	Auxiliary Relays	Closes relays K10—K16. (UA closes A2K10.)
V0	Auxiliary Relays	Opens relays A2K1—A2K16 all with one command.
U0	Auxiliary Relays	Closes relays A2K1—A2K16 all with one command.
ID	Output Command	Instrument identification; when addressed to talk, outputs instrument name, number, and Software Date.
OM	Output Command	Output Memory; information for service routine, refer to Section VIII, Service Sheet 1.
RS	Output Command	Request Service; allows Transceiver Interface to request service, refer to paragraph 3-27.

*Program codes must be in upper case.

PERFORMANCE CHECK AND ADJUSTMENTS

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

The procedures, in this section, test the instrument's electrical performance using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in paragraph 3-11, under "Basic Functional Checks".

NOTE

No warm-up time period is required for these tests.

4-2. EQUIPMENT REQUIRED

Equipment required for the performance tests is listed in Table 1-4, "Recommended Test Equipment", in Section I (General Information). Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

4-3. PERFORMANCE TEST RECORD

Results of the performance tests may be tabulated on the Performance Test Record, Table 4-2 at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. The results, recorded at incoming inspection, can be used for comparison in periodic maintenance and troubleshooting.

4-4. ABBREVIATED PERFORMANCE TESTS

No abbreviation of performance testing is recommended.

PERFORMANCE TESTS

4-5. SWR PERFORMANCE TEST

SPECIFICATION

Electrical Characteristics	Performance Limits	Conditions
SWR RF to RF MONITOR 1 or RF MONITOR 2	≤1.15 dB	RF MONITOR port under test, terminated with 50 ohms
RF SOURCE 1 or RF SOURCE 2 to RF	≤1.15 dB	RF and unused RF SOURCE port terminated with 50 ohms

DESCRIPTION

SWR is measured by comparing the reflected power (of frequencies from 5 MHz to 1300 MHz) to a reference that exhibits 100% return loss. The reference level is determined by disconnecting the Transceiver Interface from the SWR bridge to create an open circuit (100% reflected power) to the power meter. The dB [REF] Mode, on the power meter, is then used to record the reference. The reflected power at any frequency can be compared to the reference level. The return loss of the RF, RF SOURCE 1 and 2, RF MONITOR 1 and 2 ports should be less than or equal to 22.0 dB.

PERFORMANCE TESTS

4-5. SWR PERFORMANCE TEST (Cont'd)

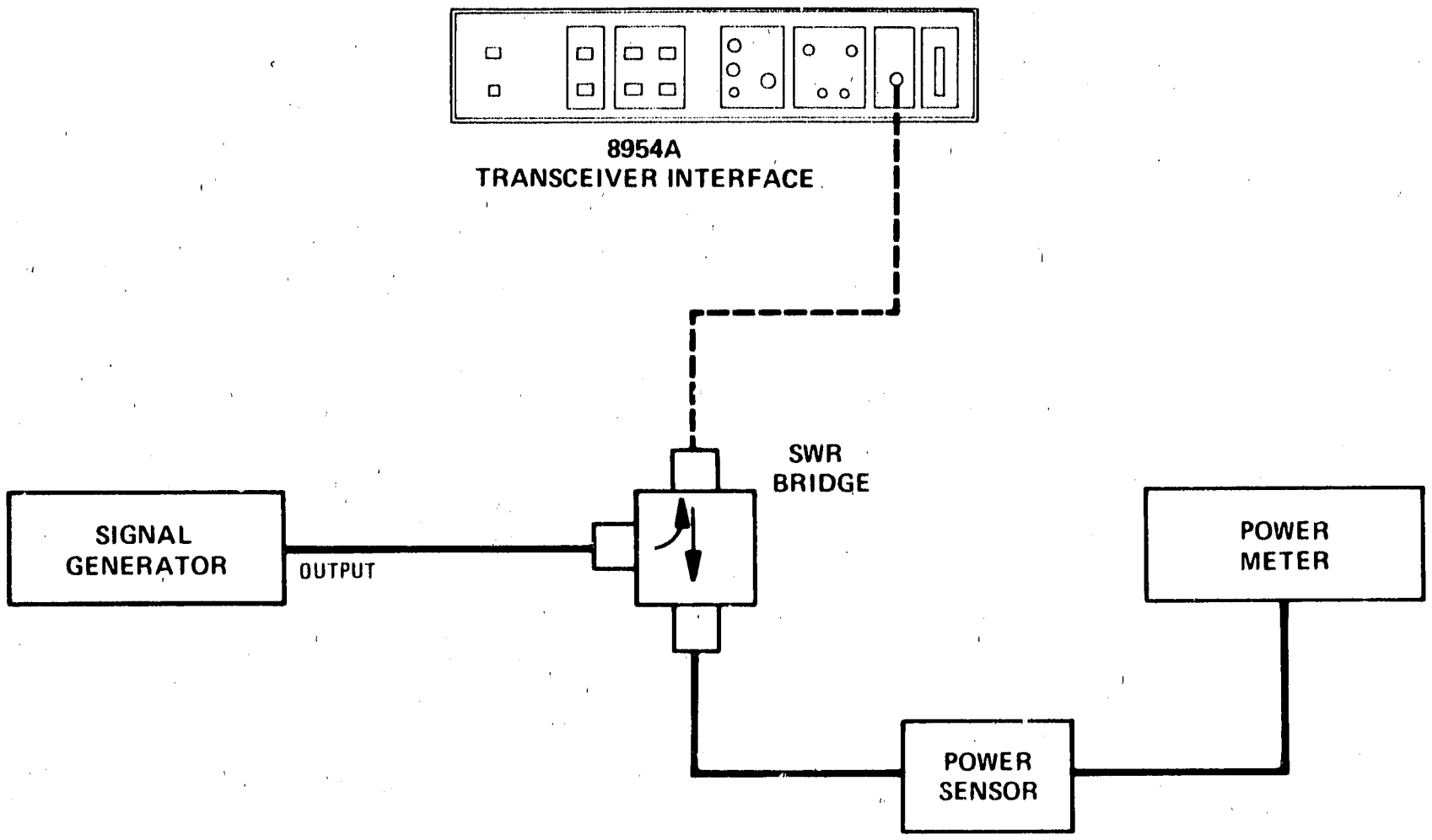


Figure 4-1. SWR Performance Test Setup

EQUIPMENT

Signal Generator	HP 8640B Opt.002
Power Meter	HP 436A
Power Sensor	HP 8482A
SWR Bridge	Wiltron 60N50 Opt. 01
Cables (UG-210/U Type-N)	HP 11500B (2 Required)
50-ohm terminations	HP 908A (2 Required)

PROCEDURE

1. Zero and calibrate the power meter.

2. Set the equipment as follows:

Signal Generator:	
Output Level	+13 dBm
AM Modulation	Off
FM Modulation	Off
Transceiver Interface:	
MODE	TRANSMITTER

PERFORMANCE TESTS

4-5. SWR PERFORMANCE TEST (Cont'd)

3. Before connecting the Transceiver Interface to the SWR bridge, press dB [REF] on the power meter to set the open circuit (which exhibits maximum return loss) as a reference.

4. Connect the equipment as shown in Figure 4-1. Connect the SWR bridge to the RF port on the Transceiver Interface and select RF MONITOR 1. Terminate the RF MONITOR 1 port with 50 ohms.

5. Tune the signal generator to each frequency to be recorded in step 9. Use the Fine Tune control on the signal generator to peak the reflected power.

6. Set the cal factor of the power sensor for each frequency to be measured. (See the Cal Factor % table on the power sensor body.)

7. For each frequency measured, when the peak selected power is found, disconnect the SWR bridge from the Transceiver Interface and select the power meter's dB [REF] mode to establish the 0-dB reference.

8. Reconnect the SWR bridge to the Transceiver Interface. The reflected power displayed on the power meter is in respect to the established 0-dB reference.

9. Manually tune the signal generator from 5 MHz to 1000 MHz. Record, in the following table, those frequencies that have reflected-power readings greater than −22.0 dB on the power meter. (If the reading on the 436A is 0 and the underrange LED is lit, the reflected power measured is <−30 dB. Proceed to step 11.)

   The maximum value of return loss is −22.0 dB for the SWR to be less than 1.15.

Frequency	Return Loss dB	Maximum Return Loss dB
5 MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
1000 MHz	_____	−22.0

11. Connect the equipment as shown in Figure 4-1. Connect the SWR bridge to the RF port on the Transceiver Interface, select RF MONITOR 2 and then terminate RF MONITOR 2 with 50 ohms. Repeat steps 5 through 9.

Frequency	Return Loss dB	Maximum Return Loss dB
5 MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
1000 MHz	_____	−22.0

PERFORMANCE TESTS

4-5. SWR PERFORMANCE TEST (Cont'd)

12. Connect the SWR Bridge to the RF SOURCE 2 connector and select the Transceiver Interface's RECEIVER MODE. Terminate both the RF and the RF SOURCE 1 ports with 50-ohm loads. Repeat steps 5 through 9.

Frequency	Return Loss dB	Maximum Return Loss dB
5 MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
1000 MHz	_____	−22.0

13. Connect the SWR Bridge to the RF SOURCE 1 connector and terminate the RF and RF SOURCE 2 port with 50 ohms. Repeat steps 5 through 9.

Frequency	Return Loss dB	Maximum Return Loss dB
5 MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
____ MHz	_____	−22.0
1000 MHz	_____	−22.0

4-6. RF INSERTION LOSS

SPECIFICATION

Electrical Characteristics	Performance Limits	Conditions
RF INSERTION LOSS		
RF to RF MONITOR 1 or RF MONITOR 2	≤0.5 dB	
RF to RF SOURCE 1 or RF SOURCE 2	−6.15 dB ±0.35 dB	Unused RF SOURCE port terminated with 50 ohms

DESCRIPTION

To measure RF insertion loss, a signal generator is connected to the power meter through the Transceiver Interface. The insertion loss of each RF signal path is measured and compared to a reference power level obtained when the signal generator's output power is measured directly by the power meter.

PERFORMANCE TESTS

4-6. RF INSERTION LOSS (Cont'd)

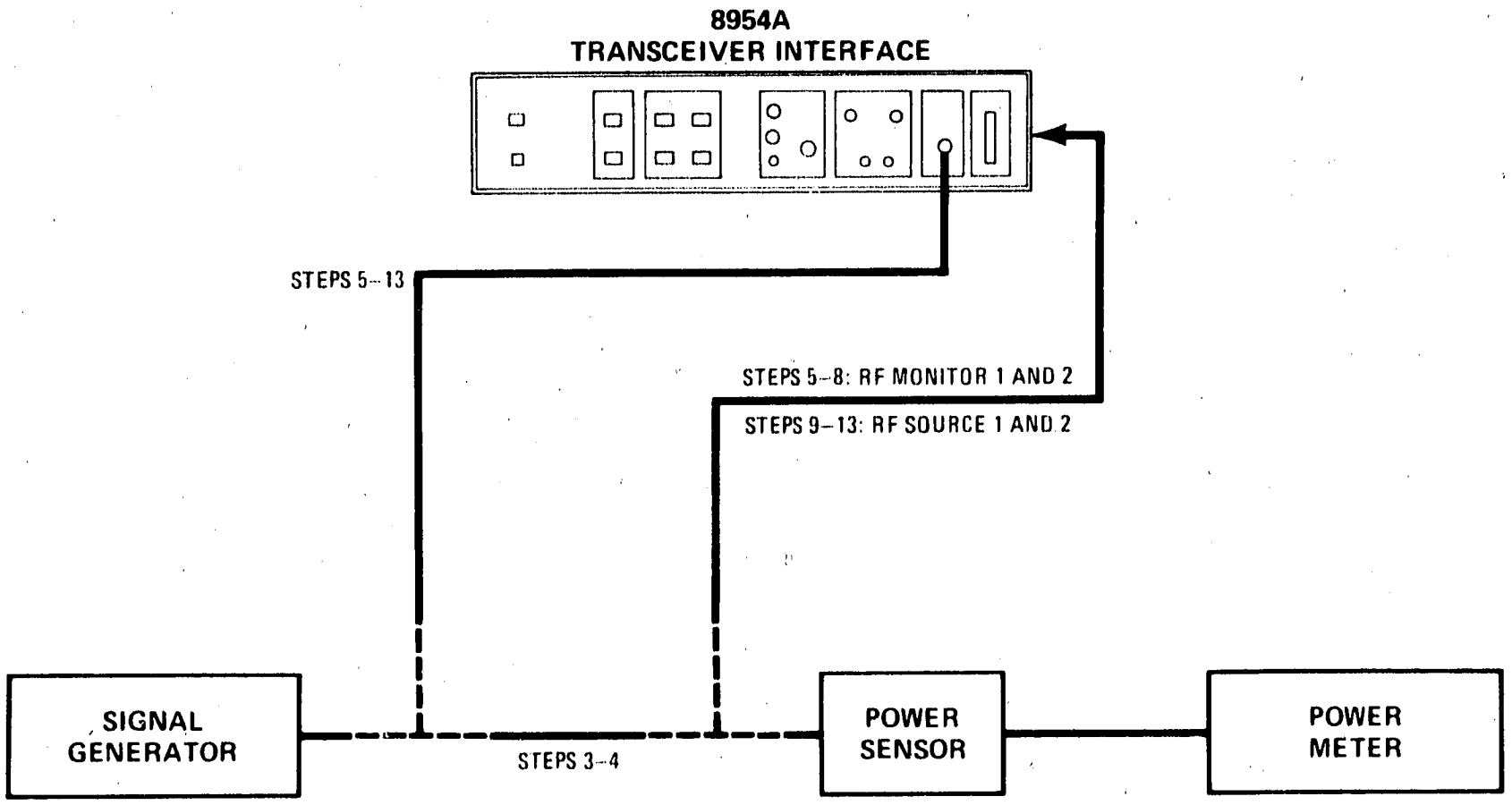


Figure 4-2. RF Insertion Loss Test

EQUIPMENT

Signal Generator	HP 8640A Opt. 002
Power Meter	HP 436A
Power Sensor	HP 8482A
50-ohm Termination	HP 908A
Cable (UG-210/U type-N connectors)	HP 11500B
Adapter, N (f) to N (f)	HP 1250-0777

PROCEDURE

1. Zero and calibrate the power meter.

2. Set the instrument controls as follows:

Signal Generator:	
Frequency MHz	1000
Output Level	0.0 dBm
Amplitude Modulation	Off
Frequency Modulation	Off
Power Meter:	
Mode	dBm
Transceiver Interface:	
MODE	TRANSMITTER
RF MONITOR	1

PERFORMANCE TESTS

4-6. RF INSERTION LOSS (Cont'd)

3. Connect the equipment as shown in Figure 4-2. Using the listed adapter HP 1250-0777, connect the power sensor to the output end of cable 11500B. (Calibrating at the end of the cable compensates for any loss that might be incurred within the cable.)

4. When the reading on the power meter stabilizes, select the power meter's dB [REF] Mode.

5. Connect the power sensor to RF MONITOR 1 on the rear panel. Remove the adapter and connect the signal generator to the RF input.

6. The power meter should read less than or equal to 0.5 dB. Record this reading in the space provided.

_____ <0.5 dB

7. Connect the power sensor to RF MONITOR 2 on the rear panel. Press RF MONITOR 2 on the front panel of the Transceiver Interface.

8. The power meter should read less than or equal to 0.5 dB. Record this reading in the space provided.

_____ <0.5 dB

9. Connect the power sensor to RF SOURCE 1, and terminate RF SOURCE 2 with 50 ohms.

10. Select the Transceiver Interface's RECEIVER MODE.

11. The power meter should read −6.15 dB ± 0.35 dB. Record this reading in the space provided.

_____ −6.15 dB ±0.35 dB

12. Connect the power sensor to the RF SOURCE 2 and terminate RF SOURCE 1 with 50 ohms.

13. The power meter should read −6.15 dB ±0.35 dB. Record this reading in the space provided.

_____ −6.15 dB ±0.35 dB

14. Repeat steps 3 through 13 for any frequency between 100 kHz and 1.0 GHz.

4-7. AUDIO INSERTION LOSS

SPECIFICATIONS

Electrical Characteristics	Performance Limits	Conditions
AUDIO INSERTION LOSS 20 Hz to 20 kHz 20 Hz to 100 kHz	 <0.03 dB <0.3 dB	 Audio Input and Output Terminated in 600 ohms

PERFORMANCE TESTS

4-7. AUDIO INSERTION LOSS (Cont'd)

DESCRIPTION

An audio source is connected directly to a digital volt meter with a 600-ohm load. A reference voltage is noted. The Transceiver Interface is connected between the audio source and the digital voltmeter. The voltage level is recorded as each of the audio paths is checked. Audio insertion loss is calculated by dividing the reference voltage by the recorded voltage levels and converting the resultant quotient to dB.

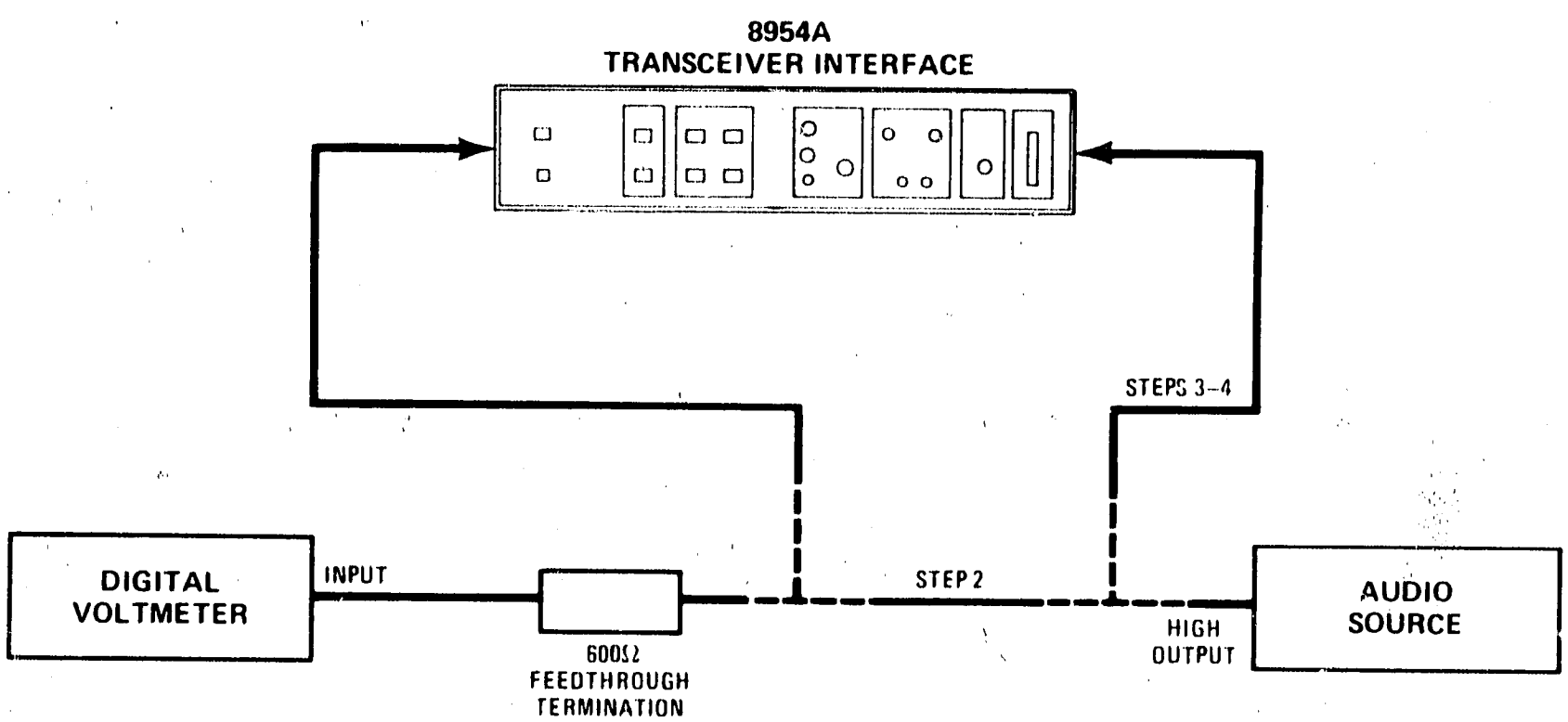


Figure 4-3. Audio Insertion Loss Test Setup

EQUIPMENT

Digital Voltmeter	HP 3455A
Audio Source	HP 8903A
600-ohm feedthrough	HP11095A
Cables (2 required)	HP 10503A

PROCEDURE

1. Set the equipment controls as follows:

Audio Source:	
Frequency	20 kHz
Amplitude	2V
Output Ground	Ground
Digital Voltmeter:	
Function	~V(ac)
Trigger	Internal
Range	Auto

PERFORMANCE TESTS

4-7. AUDIO INSERTION LOSS (Cont'd)

2. Connect the audio source output to the digital voltmeter input through the 600-ohm feedthrough. Record the reading (V_o). Voltage V_o is the reference voltage for the insertion loss measurements.

V_o = _____

3. Connect the equipment as shown in Figure 4-3.

4. Configure the Transceiver Interface according to Table 4-1. Record the ac voltage (V_n) for each path selected and determine the audio insertion loss in dB by the following formula:

Insertion Loss dB = $20 \cdot \log (V_o/V_n)$ = _____

5. Change the frequency of the audio source to 100 kHz, and repeat steps 2 through 4.

Insertion Loss = $20 \cdot \log (V_o/V_n)$

Table 4-1. Audio Insertion Loss

Transceiver Interface Configuration	Audio Source Connection	Digital Voltmeter Connection	Voltmeter Reading V_n (ac Volts)		Insertion Loss V_o/V_n	
			20 kHz	100 kHz	20 kHz <0.03 dB	100 kHz <0.3 dB
TRANSMITTER MODE	AUDIO SOURCE	AUDIO OUTPUT	_____	_____	_____	_____
TRANSMITTER MODE	RF MONITOR DEMOD 1	AUDIO ANALYZER	_____	_____	_____	_____
RECEIVER MODE	AUDIO SOURCE	RF SOURCE MOD 1	_____	_____	_____	_____
RECEIVER MODE	AUDIO INPUT	ANALYZER	_____	_____	_____	_____

Table 4-2. Performance Test Record (1 of 3)

Hewlett-Packard Company
Model 8954A
Transceiver Interface

Tested By _____

Serial Number _____ Date _____

Para. No.	Test Description	Results		
		Min	Actual	Max
4-5.	**SWR:**			
	RF to RF MONITOR 1			
	5 MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	1000 MHz		_____	−22.0 dB
	RF to RF MONITOR 2			
	5 MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	1000 MHz		_____	−22.0 dB
	RF SOURCE 1 to RF			
	5 MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	1000 MHz		_____	−22.0 dB
	RF SOURCE 2 to RF			
	5 MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	___ MHz		_____	−22.0 dB
	1000 MHz		_____	−22.0 dB

Table 4-2. Performance Test Record (2 of 3)

Hewlett-Packard Company
Model 8954A
Transceiver Interface

Tested By _____

Serial Number _____ _____

Date _____

Para. No.	Test Description	Results		
		Min	Actual	Max
4-6	**RF INSERTION LOSS:**			
	RF to RF MONITOR 1			
	100 kHz, 0 dBm		_____	0.5 dB
	____ _Hz, 0 dBm		_____	0.5 dB
	____ _Hz, 0 dBm		_____	0.5 dB
	____ _Hz, 0 dBm		_____	0.5 dB
	1000 MHz, 0 dBm		_____	0.5 dB
	RF to RF MONITOR 2			
	100 kHz, 0 dBm		_____	0.5 dB
	____ _Hz, 0 dBm		_____	0.5 dB
	____ _Hz, 0 dBm		_____	0.5 dB
	____ _Hz, 0 dBm		_____	0.5 dB
	1000 MHz, 0 dBm		_____	0.5 dB
	RF to RF SOURCE 1			
	100 kHz, 0 dBm	−5.80 dB	_____	−6.50 dB
	____ _Hz, 0 dBm	−5.80 dB	_____	−6.50 dB
	____ _Hz, 0 dBm	−5.80 dB	_____	−6.50 dB
	____ _Hz, 0 dBm	−5.80 dB	_____	−6.50 dB
	1000 MHz, 0 dBm	−5.80 dB	_____	−6.50 dB
	RF TO RF SOURCE 2			
	100 kHz, 0 dBm	−5.80 dB	_____	−6.50 dB
	____ _Hz, 0 dBm	−5.80 dB	_____	−6.50 dB
	____ _Hz, 0 dBm	−5.80 dB	_____	−6.50 dB
	____ _Hz, 0 dBm	−5.80 dB	_____	−6.50 dB
	1000 MHz, 0 dBm	−5.80 dB	_____	−6.50 dB

Table 4-2. Performance Test Record (3 of 3)

Hewlett-Packard Company
Model 8954A
Transceiver Interface

Tested By _____

Serial Number _____

Date _____

Para. No.	Test Description	Results		
		Min	Actual	Max
4-7	**AUDIO INSERTION LOSS:**			
	AUDIO SOURCE to AUDIO OUTPUT (TRANSMITTER MODE)			
	20 Hz to 20 kHz		_____	0.03 dB
	20 Hz to 100 kHz		_____	0.3 dB
	RF MONITOR DEMOD 1 to AUDIO ANALYZER (TRANSMITTER MODE)			
	20 Hz to 20 kHz		_____	0.03 dB
	20 Hz to 100 kHz		_____	0.3 dB
	AUDIO SOURCE to RF SOURCE MOD 1 (RECEIVER MODE)			
	20 Hz to 20 kHz		_____	0.03 dB
	20 Hz to 100 kHz		_____	0.3 dB
	AUDIO INPUT to AUDIO ANALYZER (RECEIVER MODE)			
	20 Hz to 20 kHz		_____	0.03 dB
	20 Hz to 100 kHz		_____	0.3 dB

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

This section normally contains information necessary to adjust the instrument into compliance with it's performance specifications. However, since this instrument does not have any adjustments, no information is given here.

PARTS LIST

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-3 lists all replaceable parts in reference designator order. Table 6-1 contains the names and addresses that correspond to the manufacturer's code numbers.

6-2. ABBREVIATIONS

Table 6-2 lists abbreviations used in the parts list, schematics, and throughout the manual. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-3. REPLACEABLE PARTS LIST

Table 6-3 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alphanumeric order by reference designation.

b. Chassis-mounted parts and mechanical parts in alphanumeric order by reference designation.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. Part number check digit (CD).

c. The total quantity (Qty) for the entire instrument except for the option assemblies.

d. The description of the part.

e. A typical manufacturer of the part in a five-digit code.

f. The manufacturer's number for the part.

NOTE

The total quantity for each part is given only once, that is, at the first occurrence of the part number in the list. The total quantities for the optional assemblies are totaled by assembly and not integrated into the standard list.

6-4. FACTORY SELECTED PARTS (*)

Parts marked with an esterisk (*) are factory selected parts. The value listed in the parts list is the nominal value. Refer to Sections V and VIII of this manual for information on determining what value to use for replacement.

6-5. PARTS LIST BACKDATING (†)

Parts marked with a dagger (†) are different in Transceiver Interfaces with serial number prefixes lower than the one that this manual applies to directly. Table 7-1 lists the backdating changes by serial number prefix. Table 7-2 lists components affected by each change.

6-6. PARTS LIST UPDATING (Change Sheet)

Production changes to Transceiver Interfaces made after the publication date of this manual are accompanied by a change in the serial prefix. Changes to the parts list are recorded by serial number prefix on a MANUAL CHANGES supplement. Also, parts list errors are noted in the ERRATA portion of the MANUAL CHANGES supplement.

6-7. ILLUSTRATED PARTS BREAKDOWNS

Most mechanical parts are identified in figures 6-1 through 6-5. These figures are located at the end of the replaceable parts table.

6-8. ORDERING INFORMATION

To order a part listed in the replaceable parts table, include the Hewlett-Packard part number (with the check digit) and the quantity required. Address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, description and function of the part, and the quantity of parts required. Address the order to the nearest Hewlett-Packard office.

NOTE

Within the USA, it is better to order directly from the HP Parts Center in Mountain View, California. Ask your nearest HP office for information and forms for the "Direct Mail Order System".

6-9. RECOMMENDED SPARES LIST

Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has prepared a "Recommended Spares" list for this instrument. The contents of the list are based on failure reports and repair data. Quantities given are for one year of parts support. A complimentary copy of the "Recommended Spares" list may be requested from your nearest Hewlett-Packard office.

When stocking parts to support more than one Transceiver Interface or to support a variety of Hewlett-Packard instruments, it may be more economical to work from one consolidated list rather than simply adding together stocking quantities from the individual instrument lists. Hewlett-Packard will prepare a consolidated "Recommended Spares" lists for any number or combination of instruments. Contact your nearest Hewlett-Packard office for details.

Table 6-1. Manufacturers Code List

MFR. NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
H9027	SCHURTER A G H	LUZERN	SW	
00000	ANY SATISFACTORY SUPPLIER			
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85008
06915	RICHCO PLASTIC CO	CHICAGO	IL	60646
17856	SILICONIX INC	SANTA CLARA	CA	95054
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
24931	SPECIALTY CONNECTOR CO INC	GREENWOOD	IN	46227
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247

Table 6-2. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A ..... Assembly
AT ..... Attenuator, Isolator, Limiter, Termination
B ..... Fan, Motor
BT ..... Battery
C ..... Capacitor
CP ..... Coupler
CR ... Diode, Diode Thyristor, Step Recovery Diode (SCR), Varactor
DC ..... Directional Coupler
DL ..... Delay Line
DS .... Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Audible or Visible)
E ..... Miscellaneous Electrical Part
F ..... Fuse
FL ..... Filter
H ..... Hardware
HY ..... Circulator
J ..... Electrical Connector (Stationary Portion), Jack
K ..... Relay
L ..... Coil, Inductor
M ..... Meter
MP ..... Miscellaneous Mechanical Part
P ..... Electrical Connector (Movable Portion), Plug
Q .... Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R ..... Resistor
RT ..... Thermistor
S ..... Switch
T ..... Transformer
TB ..... Terminal Board
TC ..... Thermocouple
TP ..... Test Point
U ..... Integrated Circuit, Microcircuit
V ..... Electron Tube
VR ... Breakdown Diode (Zener), Voltage Regulator
W ..... Cable, Transmission Path, Wire
X ..... Socket
Y ..... Crystal Unit (Piezoelectric, Quartz)
Z ... Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

A ..... Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ ..... Adjust, Adjustment
ALC ..... Alcohol, Automatic Level Control
AM ..... Amplitude Modulation
AMP ..... Amperage
AMPL ..... Amplifier
ANLG ..... Analog
ASSY ..... Assembly
ASTBL ..... Astable
ATTEN ... Attenuation, Attenuator

B

BCD ..... Binary Coded Decimal
BFR ..... Before, Buffer
BNC ..... Type of Connector
BSC ..... Basic

C

C ..... Capacitance, Capacitor, Center Tapped, Centistoke, Ceramic, Cermet, Circular Mil Foot, Closed Cup, Cold, Compression
CER ..... Ceramic
CH ..... Center Hole
CHAM ..... Chamfer
CNTR ..... Container, Counter
COAX ..... Coaxial
COM .... Commercial, Common
CONN .... Connect, Connection, Connector
CONT ..... Contact, Continuous, Control, Controller
CONV ..... Converter
CP ..... Cadmium Plate, Candle Power, Centipoise, Conductive Plastic, Cone Point
CRP ..... Crepe, Crimp
CS .... Case, Centistoke, Cesium, Cross Section

D

D ..... Deep, Depletion, Depth, Diameter, Direct Current
DB ..... Decibel, Double Break
DBL ..... Double
DCDR ..... Decoder
DEG ..... Degree
DIFF ..... Differential
DO ... Package Type Designation
DRVR ..... Driver
DX ..... Duplex

E

E-MODE ... Enhancement Mode
ECL ..... Emitter-Coupled Logic
EPROM ..... Eraseable Programmable Read Only Memory
EXCL ..... Excluding, Exclusive
EXT ..... Extended, Extension, External, Extinguish

F

F ..... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency
FEM ..... Female
FF ... Flange, Female Connection; Flip Flop
FL ..... Flash, Flat, Fluid
FM ... Flange, Male Connection; Foam, Frequency Modulation
FR ..... Folder
FT ..... Current Gain Bandwidth Product (Transition Frequency); Feet, Foot
FXD ..... Fixed

G

GE ..... Germanium
GEN ..... General, Generator
GHZ ..... Gigahertz
GL ..... Glass
GP ..... General Purpose, Group

H

HD ..... Hand, Hard, Head, Heavy Duty
HEX ..... Hexadecimal, Hexagon, Hexagonal

Table 6-2. Reference Designations and Abbreviations (2 of 2)

HI ..... High
HS .... Heat Sealed, Heat Shrink, High Speed

I

IC ..... Collector Current, Integrated Circuit
ID ..... Identification, Inside Diameter
IF ..... Forward Current, Intermediate Frequency
IN ..... Inch, Indium
IN ..... Inch, Indium
INP ..... Input
INT ..... Integral, Intensity, Internal
INTL ..... Internal, International
INV ..... Invert, Inverter

J

J-FET ..... Junction Field Effect Transistor
JFET ..... Junction Field Effect Transistor
JGK ..... Jade Gray Knob (HP 6009-0021)

K

KB ..... Knob

L

LED ..... Light Emitting Diode
LG ..... Length, Long
LKG ..... Leakage, Locking
LKWR ..... Lockwasher
LO ..... Local Oscillator, Low
LS ..... Loudspeaker, Low Power Schottky, Series Inductance
LT ..... Left, Light, Liter

M

MA ..... Milliampere
MACH ..... Machined
MCD ..... Millicandela
MISC ..... Miscellaneous
MLD ..... Mold, Molded
MOD ..... Model, Modified, Modular, Modulated, Modulator
MONO/ASTBL ..... Monostable/ Astable
MONOSTBL ..... Monostable
MOSFET ..... Metal Oxide Semiconductor Field Effect Transistor
MTG ..... Mounting
MV ..... Millivolt, Multivibrator
MW ..... Milliwatt

N

N-CHAN ..... N-Channel
NAND ..... Logic Not-AND
NM .... Nanometer, Nonmetallic
NMOS ..... N-Channel Metal Oxide Semiconductor
NO .... Normally Open, Number
NPN ... Negative Positive Negative (Transistor)
NS ..... Nanosecond, Non-Shorting, Nose

O

OCTL ..... Octal
OD ..... Olive Drab, Outside Diameter
OP ..... Operational
OPT ... Optical, Option, Optional

P

PAN-HD ..... Pan Head
PC ..... Picocoulomb, Piece, Printed Circuit
PCB ..... Printed Circuit Board
PD ..... Pad, Palladium, Pitch Diameter, Power Dissipation
PF ..... Picofarad; Pipe, Female Connection; Power Factor
PL ..... Phase Lock, Plain, Plate, Plug
PLSTC ..... Plastic
POS ..... Position, Positive
POZI ..... Pozidriv Recess
PRCN ..... Precision
PRP ..... Purple, Purpose
PVC ..... Polyvinyl Chloride

Q

QUAD ..... Set of Four

R

RCVR ..... Receiver
RCVY ..... Recovery
REF ..... Reference
RES ..... Research, Resistance, Resistor, Resolution
RETRIG ..... Retriggerable
RGLTR ..... Regulator
RKR ..... Rocker
RND ..... Round
RPG .... Rotary Pulse Generator
RT ..... Real Time, Right

S

SCR ..... Screw, Scrub, Silicon Controlled Rectifier
SEC ..... Second, Secondary
SGL ..... Single
SHFT ..... Shaft
SI ..... Silicon, Square Inch
SLDR ..... Solder
SM ..... Samarium, Seam, Small, Square Meter, Sub Modular, Subminiature
SMB ..... Subminiature, B Type (Snap-On Connector)
SNP ..... Snap
STAT ..... Status
STL ..... Steel
SW ..... Single Wall, Switch
SZ ..... Size

T

TA ..... Ambient Temperature, Tantalum
TC ..... Thermoplastic
THD ..... Thread, Threaded
THK ..... Thick
TPG ..... Tapping
TPL ..... Triple
TRIG ..... Trigger, Triggerable, Triggering, Trigonometry
TRMR ..... Trimmer
TRN ..... Turn, Turns
TTL ..... Tan Translucent, Transistor Transistor Logic

U

U/W ..... Used With
UF ..... Microfarad

V

V ..... Vanadium, Variable, Violet, Volt, Voltage
VAR ..... Variable
VDC ..... Volts, Direct Current
VID ..... Video

Table 6-3. Replaceable Parts (1 of 7)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	08954-60001	2	1	KEYBOARD/ANNUNCIATORS ASSEMBLY	28480	08954-60001
A1DS1	1990-0487	7	2	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1DS2	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1DS3	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A1DS4	1990-0485	5	1	LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A1DS5	1990-0670	0	4	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS6	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS7	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS8	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS9	1990-0665	3	1	LED-LAMP LUM-INT=.1MCD IF=20MA-MAX BVR=5V	28480	1990-0665
A1J1	1251-5719	2	4	CONNECTOR 26-PIN M POST TYPE	28480	1251-5719
A1R1	1810-0272	8	1	NETWORK-RES 10-SIP330.0 OHM X 9	01121	210A201
A1S1	5060-9436	7	7	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0310	8	2	KEY CAP-LOCAL	28480	5041-0310
A1S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0319	7	5	KEY CAP-HALF GRAY-LIT	28480	5041-0319
A1S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0319	7		KEY CAP-HALF GRAY-LIT	28480	5041-0319
A1S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0319	7		KEY CAP-HALF GRAY-LIT	28480	5041-0319
A1S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0310	8		KEY CAP-LOCAL	28480	5041-0310
A1S6	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0319	7		KEY CAP-HALF GRAY-LIT	28480	5041-0319
A1S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0319	7		KEY CAP-HALF GRAY-LIT	28480	5041-0319
				(SEE SECTION B SERVICE TOOLS FOR S1-S7)		
A2	08954-60002	3	1	INTERFACE/MICROPROCESSOR/RELAY CONTROL	28480	08954-60002
A2C1	0160-2055	9	17	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C5	0160-2257	3	1	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A2C6	0160-2263	1	1	CAPACITOR-FXD 18PF +-5% 500VDC CER 0+-30	28480	0160-2263
A2C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C8	0180-0291	3	2	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C18	0180-2154	1	2	CAPACITOR-FXD 1900UF+75-10% 15VDC AL	28480	0180-2154
A2C19	0180-2154	1		CAPACITOR-FXD 1900UF+75-10% 15VDC AL	28480	0180-2154
A2C20	0180-2217	7	4	CAPACITOR-FXD 350UF+75-10% 50VDC AL	56289	39D357G050FLL DSB
A2C21	0180-2217	7		CAPACITOR-FXD 350UF+75-10% 50VDC AL	56289	39D357G050FLL DSB
A2C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C24	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C25	0180-2217	7		CAPACITOR-FXD 350UF+75-10% 50VDC AL	56289	39D357G050FLL DSB
A2C26	0180-2217	7		CAPACITOR-FXD 350UF+75-10% 50VDC AL	56289	39D357G050FLL DSB
A2C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2CR1	1901-0159	3	4	DIODE-PWR RECT 400V 750MA DO-41	28480	1901-0159
A2CR2	1901-0159	3		DIODE-PWR RECT 400V 750MA DO-41	28480	1901-0159
A2CR3	1901-0159	3		DIODE-PWR RECT 400V 750MA DO-41	28480	1901-0159
A2CR4	1901-0159	3		DIODE-PWR RECT 400V 750MA DO-41	28480	1901-0159
A2CR5	1901-0040	1	28	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

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

Table 6-3. Replaceable Parts (2 of 7)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR18	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR19	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR20	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR21	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR22	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR23	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR24	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR25	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR26	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR27	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR28	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR29	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR30	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR31	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR33	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2F1	2110-0063	2	1	FUSE .75A 250V NTD 1.25X.25 UL	28480	2110-0063
	2110-0269	0	4	FUSEHOLDER-CLIP TYPE.25D-FUSE	28480	2110-0269
A2F2	2110-0027	8	2	FUSE .125A 250V NTD 1.25X.25 UL	28480	2110-0027
	2110-0269	0		FUSEHOLDER-CLIP TYPE.25D-FUSE	28480	2110-0269
A2J1	1251-3412	8	3	CONNECTOR 6-PIN M POST TYPE	28480	1251-3412
A2J2	1251-4969	2	1	CONNECTOR 4-PIN M POST TYPE	28480	1251-4969
A2J3	1251-5719	2		CONNECTOR 26-PIN M POST TYPE	28480	1251-5719
A2J4	1251-5720	5	1	CONNECTOR 34-PIN M POST TYPE	28480	1251-5720
A2J5	1251-3412	8		CONNECTOR 6-PIN M POST TYPE	28480	1251-3412
A2J6	1251-5719	2		CONNECTOR 26-PIN M POST TYPE	28480	1251-5719
A2J7	1250-0257	1	6	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J8	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J9	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J10	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J11	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J12	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2K1	0490-0916	6	16	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7	16	SOCKET-IC 14 CONT DIP DIP-SLDR	28480	1200-0638
A2K2	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K3	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K4	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K5	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K6	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K7	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K8	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K9	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K10	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K11	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K12	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K13	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K14	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K15	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K16	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
A2K17	0490-0766	4	1	RELAY 2C 12VDC-COIL 5A 24VDC	28480	0490-0766
	0490-0769	7	1	SOCKET-RLY PC	28480	0490-0769
	0490-0771	1	1	RELAY RETAINER .924-IN-W 1.355-IN-OA-LG	28480	0490-0771
A2K18	0490-1013	6	3	RELAY-REED 1C 250MA 28VDC 5VDC-COIL 3VA	28480	0490-1013
A2K19	0490-1013	6		RELAY-REED 1C 250MA 28VDC 5VDC-COIL 3VA	28480	0490-1013
A2K20	0490-1013	6		RELAY-REED 1C 250MA 28VDC 5VDC-COIL 3VA	28480	0490-1013
A2L1	9100-1637	4	1	INDUCTOR RF-CH-MLD 120UH 5% .166DX.385LG	28480	9100-1637
A2L2	9100-1624	9	2	INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A2L3	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624

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

Table 6-3. Replaceable Parts (3 of 7)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2Q1	1855-0423	5	24	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q2	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q3	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q4	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q5	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17056	VN10KM
A2Q6	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q7	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17056	VN10KM
A2Q8	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q9	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17056	VN10KM
A2Q10	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q11	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17056	VN10KM
A2Q12	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q13	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q14	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q15	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17056	VN10KM
A2Q16	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q17	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q18	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q19	1853-0314	9	2	TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
A2Q20	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q21	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q22	1853-0314	9		TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
A2Q23	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q24	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q25	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q26	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2R1	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R2	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R5	0757-0422	2	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R6	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A2R7	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A2R8	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A2R9	0698-8821	8	2	RESISTOR 5.62 1% .125W F TC=0+-100	28480	0698-8821
A2R10	0698-8821	8		RESISTOR 5.62 1% .125W F TC=0+-100	28480	0698-8821
A2R11	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2R12	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R13	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A2R14	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R15	0757-0466	7	1	RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1103-F
A2TP1	0360-0535	0	16	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP13	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP14	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP15	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2U1	1820-2485	0	1	IC RCVR TTL LS BUS OCTL	01295	SN75160N
A2U2	1820-2483	8	1	IC RCVR TTL LS BUS OCTL	01295	SN75161N
A2U3	1820-1544	0	7	IC FF CMOS D-TYPE COM CLOCK QUAD	3L585	CD4076BF
A2U4	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	3L585	CD4076BF
A2U5	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	3L585	CD4076BF
A2U6	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	3L585	CD4076BF
A2U7	1820-2551	1	1	IC-IM6914 GBIB	28480	1820-2551
	1200-0654	7	2	SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654
A2U8	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	3L585	CD4076BF
A2U9	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	3L585	CD4076BF
A2U10	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	3L585	CD4076BF
A2U11	08954-80002	5	1	PROGRAMMED-MICROPROCESSOR	28480	08954-80002
	1200-0654	7		PROGRAMMED-MICROPROCESSOR	28480	1200-0654
A2U12	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A2U13	1820-0683	6	1	IC INV TTL S HEX 1-INP	01295	SN74S04N
A2U14	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2U15	08954-80001	4	1	PROGRAMMED-ROM	28480	08954-80001
	1200-0541	1	1	SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A2U16	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L

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

Table 6-3. Replaceable Parts (4 of 7)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2VR1	1902-0943	5	1	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A3	08954-60003	4	1	HP-IB CONNECTOR ASSEMBLY	28480	08954-60003
A3J1	1251-4040	0	1	CONNECTOR 24-PIN F MICRO RIBBON	28480	1251-4040
	0380-0643	3	2	STANDOFF-HEX .255-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
	2190-0017	4	4	WASHER-LK HLCL NO. 8 .160-IN-ID	28480	2190-0017
	2360-0113	2	16	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2420-0003	7	2	NUT-HEX-DBL-CHAM 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A3J2	1251-5719	2		CONNECTOR 26-PIN M POST TYPE	28480	1251-5719
A3MP1	08954-00002	7	1	CONNECTOR PANEL	28480	08954-00002
A3S1	3101-2126	4	1	SWITCH-SL 5-SPDT DIP-SLIDE-ASSY .1A	28480	3101-2126
A4	0960-0443	1	1	LINE MODULE-FILTERED	28480	0960-0443
	0360-0007	1	1	TERMINAL-SLDR LUG PL-MTG FOR-#10-SCR	28480	0360-0007
	2190-0008	3	1	WASHER-LK EXT T NO. 6 .141-IN-ID	28480	2190-0008
	2360-0117	6	1	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2420-0002	6	3	NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002

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

Table 6-3. Replaceable Parts (5 of 7)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				CHASSIS PARTS		
C1	0160-4065	5	1	CAPACITOR-FXD .1UF +-20% 250VAC(RMS) (ATTACHES TO LINE FILTER MODULE)	28480	0160-4065
F1	2110-0043	8	1	FUSE 1.5A 250V NTD 1.25X.25 UL	28480	2110-0043
F2	2110-0004	1	1	FUSE .25A 250V NTD 1.25X.25 UL (FOR 100/120V OPERATION)	28480	2110-0004
F2	2110-0027	8	1	FUSE .125A 250V NTD 1.25X.25 UL (FOR 220/240V OPERATION)	28480	2110-0027
J1	1510-0090	2	3	BINDING POST SGL SGL-TUR JGK	28480	1510-0090
	2190-0016	3	7	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8	7	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J2	1510-0090	2		BINDING POST SGL SGL-TUR JGK	28480	1510-0090
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J3	1510-0107	2	2	BINDING POST SGL SGL-TUR JGK CBK	28480	1510-0107
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	0360-1190	5	3	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
J4	1250-0118	3	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
	0360-1190	5		TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J5	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
	0360-1190	5		TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
	2190-0016	3		WASHER-L, INTL T 3/8 IN .377-IN-ID	28480	2190-0016
J6	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	1510-0090	2		BINDING POST SGL SGL-TUR JGK	28480	1510-0090
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J7	1510-0107	2		BINDING POST SGL SGL-TUR JGK CBK	28480	1510-0107
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J8	08954-60004	5	5	TYPE-N CONNECTOR ASSEMBLY	28480	08954-60004
	2190-0104	0	5	WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
	2950-0132	6	5	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J9	1251-1239	3	1	CONNECTOR 9-PIN F D SERIES	28480	1251-1239
	1251-0536	1	4	CONTACT-CONN U/W-SUBMIN-D FEM SLDR-POT	28480	1251-0536
	1251-2942	7	2	LOCK-SUBMIN D CONN	28480	1251-2942
J10	08954-60004	5		TYPE-N CONNECTOR ASSEMBLY	28480	08954-60004
	2190-0104	0		WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
	2950-0132	6		NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J11	08954-60004	5		TYPE-N CONNECTOR ASSEMBLY	28480	08954-60004
	2190-0104	0		WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
	2950-0132	6		NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J12				CONNECTOR-BNC (P/O W7)		
	1250-0870	4	4	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
	1250-0872	6	4	CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0872
	1250-0958	9	4	BUSHING RF CONN BNC/TNC: FOR INTL	24931	CS 105-3
	1250-0964	7	4	NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	5	5	WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	2950-0035	8	5	NUT-HEX-DBL-CHAM 15/32-32-THD	00000	ORDER BY DESCRIPTION
J13	08954-60004	5		TYPE-N CONNECTOR ASSEMBLY	28480	08954-60004
	2190-0104	0		WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
	2950-0132	6		NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J14	08954-60004	5		TYPE-N CONNECTOR ASSEMBLY	28480	08954-60004
	2190-0104	0		WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
	2950-0132	6		NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J15				CONNECTOR-BNC (P/O W10)		
	1250-0870	4		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
	1250-0872	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0872
	1250-0958	9		BUSHING RF CONN BNC/TNC: FOR INTL	24931	CS 105-3
	1250-0964	7		NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	1		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	2950-0035	8		NUT-HEX-DBL-CHAM 15/32-32-THD	00000	ORDER BY DESCRIPTION
J16				CONNECTOR-BNC (P/O W11)		
	1250-0870	4		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
	1250-0872	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0872
	1250-0958	9		BUSHING RF CONN BNC/TNC: FOR INTL	24931	CS 105-3
	1250-0964	7		NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	2950-0035	8		NUT-HEX-DBL-CHAM 15/32-32-THD	00000	ORDER BY DESCRIPTION
J17				CONNECTOR-BNC (P/O W12)		
	1250-0870	4		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
	1250-0872	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0872
	1250-0958	9		BUSHING RF CONN BNC/TNC: FOR INTL	24931	CS 105-3
	1250-0964	7		NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	2950-0035	8		NUT-HEX-DBL-CHAM 15/32-32-THD	00000	ORDER BY DESCRIPTION

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

Table 6-3. Replaceable Parts (6 of 7)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
J18	1251-0181	2	1	CONNECTOR 7-PIN F D SERIES	28480	1251-0181
	1251-0218	6	6	LOCK-SUBMIN D CONN	28480	1251-0218
	1251-0536	1		CONTACT-CONN U/W-SUBMIN-D FEM SLDR-POT	28480	1251-0536
				(SEE SECTION B - SERVICE TOOLS)		
J19	1251-7455	7	1	CONN-D-SMIN 37F (P/O W13)	28480	1251-7455
	1251-0218	6		LOCK-SUBMIN D CONN	28480	1251-0218
	8761A-0555	1	2	COAX SWITCH-18 GHZ 3MM JACK	28480	8761A-0555
K1	2360-0199	4	2	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2190-0006	1		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
K2	8761A-0555	1		COAX SWITCH-18GHZ 3MM JACK	28480	8761A-0555
	2360-0199	4		SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2190-0006	1		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
MP1	0510-1148	2	6	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
MP2	1400-0017	0	1	CLAMP-CABLE .312-DIA .375-WD NYL	28480	1400-0017
	2190-0006	1		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
	2360-0121	2	2	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2420-0002	6	2	NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002
	3050-0227	3	3	WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
MP3	1480-0611	0	4	CLAMP-FL-CA 1-WD	06915	CFCC-8
MP4	1460-1345	5	2	TILT STAND SST	28480	1460-1345
MP5	2200-0105	4	16	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
				(SECURE A2 TO DECK)		
MP6	2360-0113	2		SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
				(ATTACH REAR PANEL TO A3 & REAR FRAME)		
MP7	2360-0114	3	6	SCREW-MACH 6-32 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
				(FRONT PANEL TO FRONT FRAME)		
MP8	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
				(A1 TO FRONT & DECK TO SIDE STRUTS)		
MP9	2510-0192	6	8	SCREW-MACH 8-32 .25-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
				(FRONT & REAR FRAMES TO SIDE STRUTS)		
MP10	7120-1254	1	1	NAMEPLATE .312-IN-WD .54-IN-LG AL	28480	7120-1254
MP11	7120-3328	4	1	LABEL	28480	7120-3328
MP12	7120-4296	7	1	LABEL	28480	7120-4296
MP13	7120-4627	8	1	LABEL	28480	7120-4627
MP14	7120-5911	5	1	LABEL	28480	7120-5911
MP15	7122-0097	2	1	LABEL	28480	7122-0097
MP16	7124-2372	4	1	LABEL	28480	7124-2372
MP17	5001-0438	7	2	TRIM;SIDE	28480	5001-0438
MP18	5020-8801	4	1	FRAME, FRONT, FULL	28480	5020-8801
MP19	5020-8802	5	1	FRAME, REAR	28480	5020-8802
MP20	5020-8831	0	2	SIDE STRUTS	28480	5020-8831
MP21	5040-7201	8	4	FOOT(STANDARD)	28480	5040-7201
MP22	5040-7202	9	1	TRIM, TOP	28480	5040-7202
MP23	5060-9834	9	1	TOP COVER	28480	5060-9834
MP24	5060-9846	3	1	BOTTOM COVER	28480	5060-9846
MP25	5060-9906	6	2	SIDE COVER	28480	5060-9906
MP26	08954-00001	6	1	REAR PANEL	28480	08954-00001
MP27	08954-00003	8	1	DECK	28480	08954-00003
MP28	08954-00004	9	1	FRONT SUB PANEL	28480	08954-00004
MP29	08954-00005	0	1	FRONT DRESS PANEL	28480	08954-00005
S1				LINE SWITCH (P/O W20)		
	3101-2080	9	1	SWITCH-RKR BASIC DPDT 3A 250VAC SLDR-LUG	28480	3101-2080
	5041-1418	9	1	ROCKER	28480	5041-1418
	2200-0165	6	2	SCREW-MACH 4-40 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
T1	9100-3962	2	1	TRANSFORMER-POWER 100/120/220/240V	28480	9100-3962
	0362-0265	7	5	CONNECTOR-SGL CONT SKT 1.14-MM-BSC-SZ	28480	0362-0265
	1251-3275	1	2	CONNECTOR 6-PIN F POST TYPE	28480	1251-3275
	1251-3897	3	6	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-3897
	2190-0019	6	2	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
	2200-0125	8	2	SCREW-MACH 4-40 1.5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0001	9	2	SCREW-MACH 4-40 .125-IN-LG RD-HD-SLT	00000	ORDER BY DESCRIPTION
	3050-0004	4	2	WASHER-SHLDR NO. 4 .12-IN-ID .312-IN-OD	28480	3050-0004
U1	1826-0181	1	1	IC V RGLTR TO-3	27014	LM323K
	0360-0001	5	1	TERMINAL-SLDR LUG LK-MTG FOR-#6-SCR	28480	0360-0001
	2190-0006	1	2	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
	2360-0115	4	16	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0121	2		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2420-0002	6		NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002
	3050-0227	3		WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
W1	08954-60100	2	1	CABLE "AUDIO INPUT"	28480	08954-60100
W2	08954-60101	3	1	CABLE "AUDIO OUTPUT"	28480	08954-60101
W3	08954-20101	9	1	SEMI-RIGID CABLE "RF POWER"	28480	08954-20101
W4	08954-60102	4	1	CABLE ASSY "POWER SUPPLY/CONTROL"	28480	08954-60102
				(INCLUDES J9, J18 AND HARDWARE)		
	08954-60113	7	1	CABLE ASSEMBLY-COAX (RED)	28480	08954-60113
	08954-60114	8	1	CABLE ASSEMBLY-COAX (ORANGE)	28480	08954-60114
				WIRE-24 AWG (BLK)		
				WIRE-24 AWG (RED)		
				WIRE-24 AWG (BLK)		

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

Table 6-3. Replaceable Parts (7 of 7)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				WIRE-24 AWG (RED)		
				WIRE-24 AWG (GRAY/WHITE)		
				WIRE-24 AWG (GRAY)		
W5	08954-20102	0	1	CABLE,SEMI-RIGID "MONITOR 1"	28480	08954-20102
W6	08954-20103	1	1	CABLE,SEMI-RIGID "MONITOR 2"	28480	08954-20103
W7	08954-60103	5	1	CABLE,COAX "DEMOD" (INCLUDES J12 HDW)	28480	08954-60103
W8	08954-20104	2	1	CABLE,SEMI-RIGID "RF SOURCE 1"	28480	08954-20104
W9	08954-20105	3	1	CABLE,SEMI-RIGID "RF SOURCE 2"	28480	08954-20105
W10	08954-60104	6	1	CABLE ASSEMBLY-COAX "RF SOURCE-MOD 1" (INCLUDES J15 HARDWARE)	28480	08954-60104
W11	08954-60105	7	1	CABLE ASSY-COAX "AUDIO SOURCE" (INCLUDES J16 HARDWARE) (INCLUDES J17 HARDWARE)	28480	08954-60105
W12	08954-60106	8	1	CABLE ASSY-COAX "AUDIO ANALYZER" (INCLUDES J19 AND HARDWARE)	28480	08954-60106
W13	08954-60107	9	1	RIBBON CABLE "AUX RELAY"	28480	08954-60107
W14				NOT ASSIGNED		
W15	08954-60109	1	1	CABLE-RIBBON "HP-IB ADDRESS"	28480	08954-60109
W16	08954-60110	4	1	CABLE ASSEMBLY "TRANSMIT KEY"	28480	08954-60110
	1251-3275	1		CONNECTOR 6-PIN F POST TYPE	28480	1251-3275
	1251-4283	3	9	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4283
W17	08954-20106	4	1	CABLE,SEMI-RIGID "RELAY TO RELAY"	28480	08954-20106
W18	08954-60111	5	1	CABLE,RIBBON "A2J6 TO A1J1"	28480	08954-60111
W19	08954-60112	6	1	CABLE ASSY "A2J2 TO Q1" (INCLUDES CONNECTOR AND CONTACTS)	28480	08954-60112
	1251-3277	3	1	CONNECTOR 4-PIN F POST TYPE	28480	1251-3277
	1251-4283	3		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4283
W20	08954-60108	0	1	CABLE ASSY "POWER SOURCE" (INCLUDES S1)	28480	08954-60108
XF1	2110-0564	8	1	FUSEHOLDER BODY 12A MAX FOR UL	H9027	031.1657
	2110-0565	9	1	FUSEHOLDER CAP 12A MAX FOR UL	28480	2110-0565
	2110-0569	3	1	FUSEHOLDER COMPONENT NUT; THREAD M12.7	28480	2110-0569
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
Z1	0960-0459	9	1	POWER COMBINER	28480	0960-0459

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

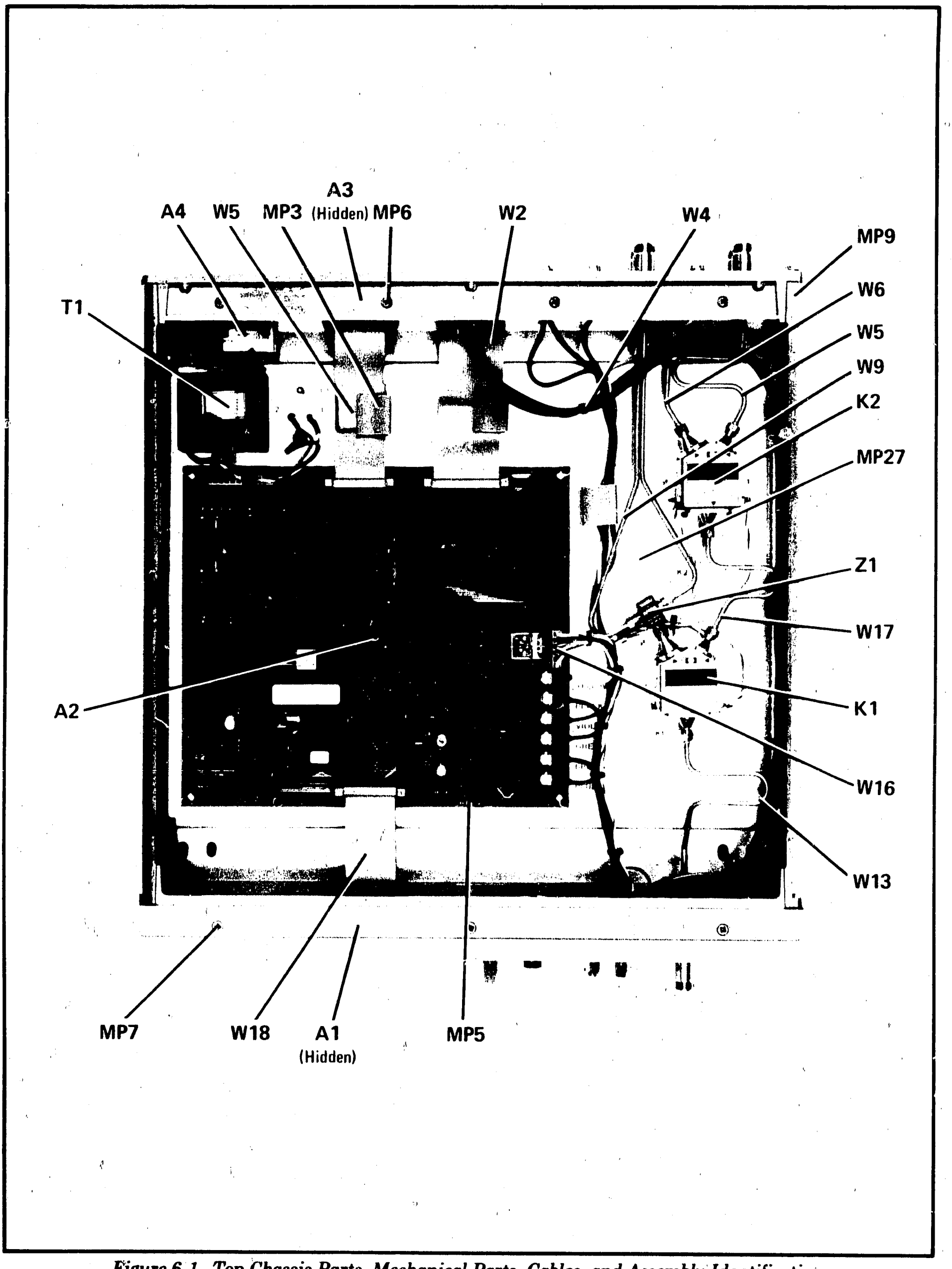


Figure 6-1. Top Chassis Parts, Mechanical Parts, Cables, and Assembly Identification

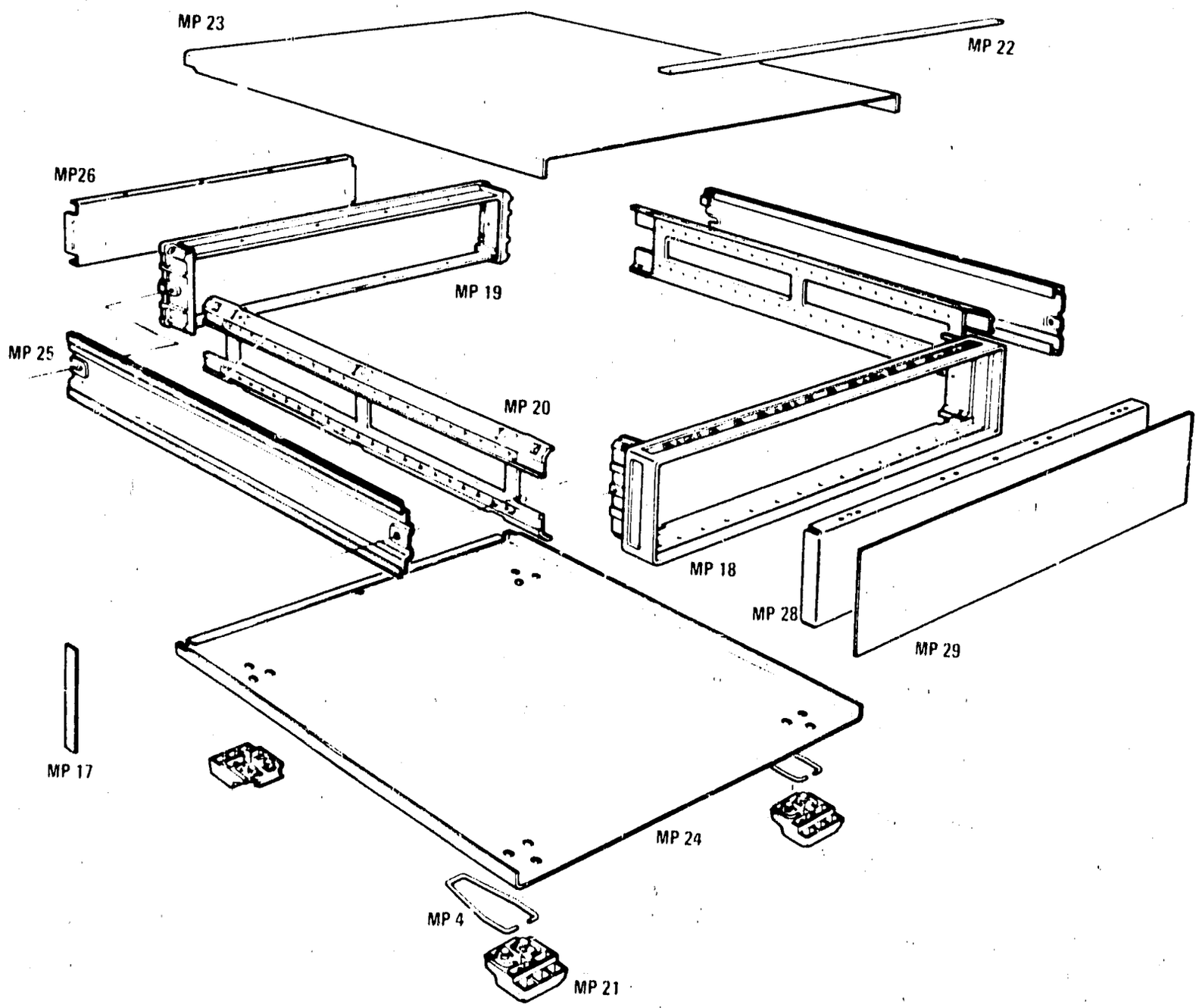


Figure 6-2. Cabinet Parts

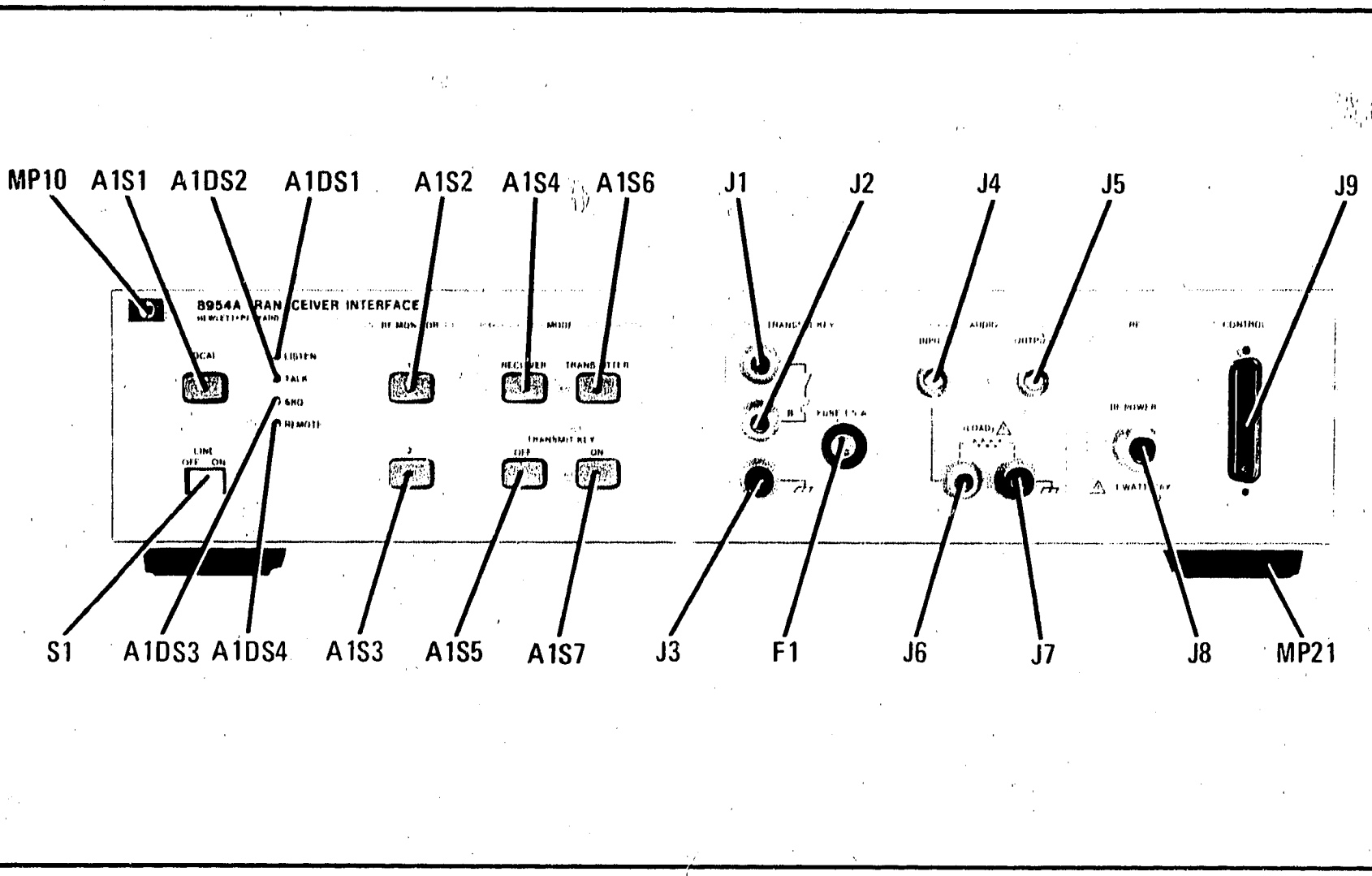


Figure 6-3. Chassis and Mechanical Parts Identification—Front Panel

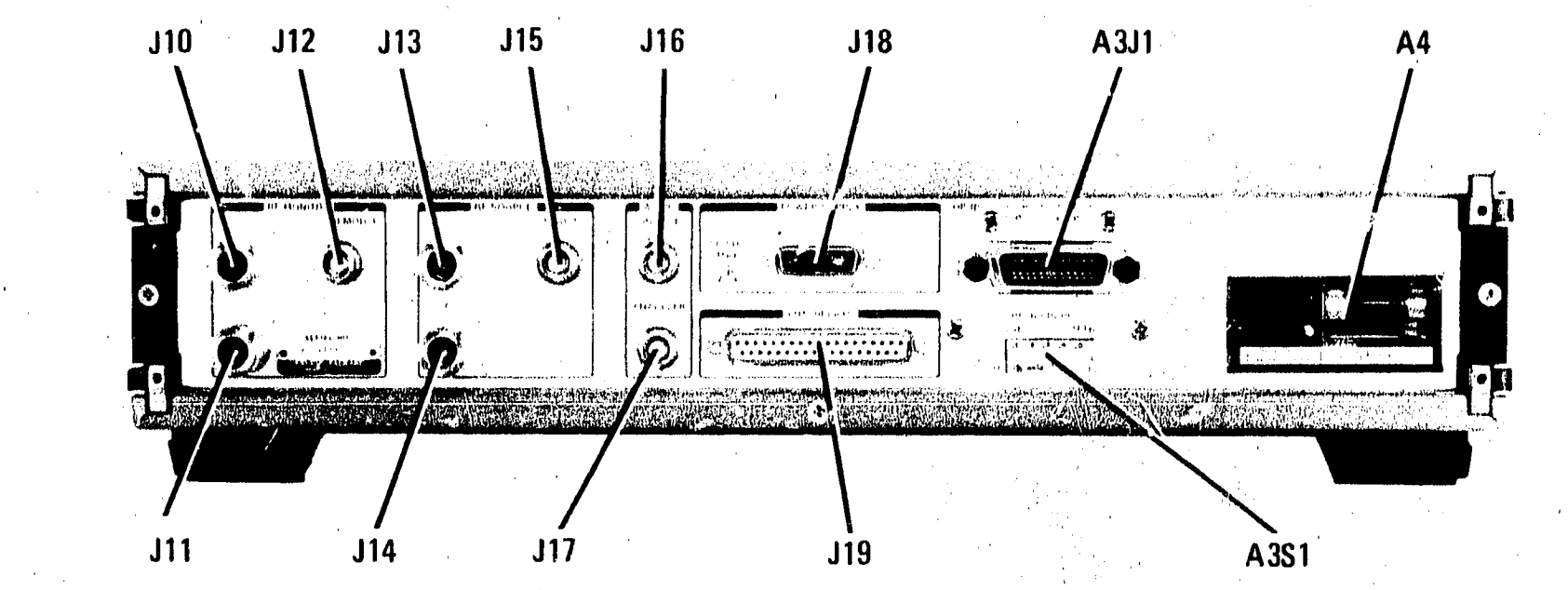


Figure 6-4. Chassis and Mechanical Parts Identification—Rear Panel

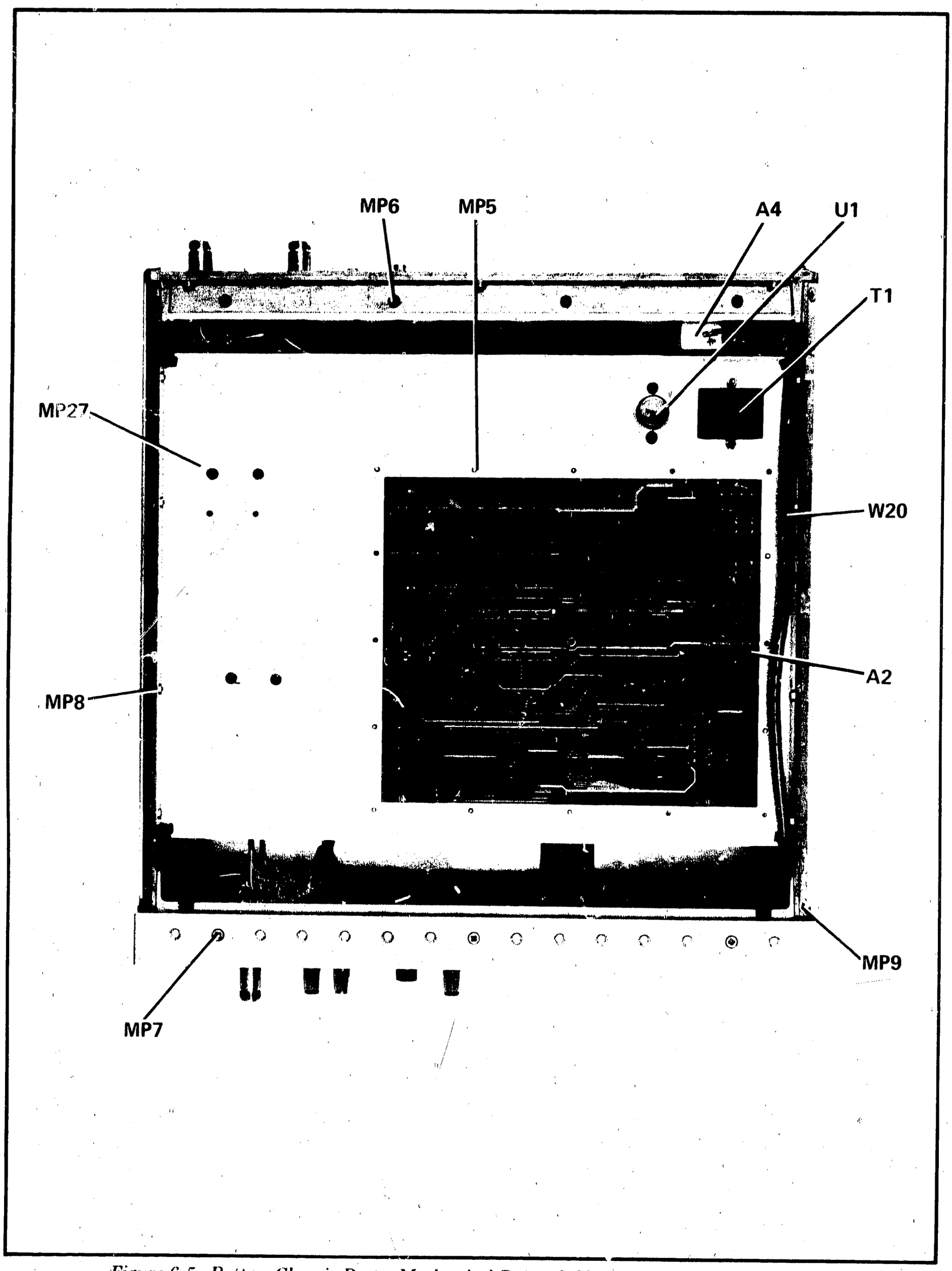


Figure 6-5. Bottom Chassis Parts, Mechanical Parts, Cable and Assembly Identification

BACK DATING MANUAL CHANGES

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

This section contains manual change instructions for adapting this manual to cover HP Model 8954A Transceiver Interfaces that have serial number prefixes which are lower than the first prefix listed on the title page.

7-2. MANUAL CHANGES

To adapt this manual to your instrument, refer to Table 7-1 and make all of the manual changes listed opposite your instrument's serial number or serial number sequence. The changes to your manual should be made in the sequence listed; for example, Change AA should be made after Change AB, Change AB should be made after Change AC, etc. Table 7-2 is a summary of changes by component.

If your instrument's serial number or prefix is not listed on the title page of this manual or in Table 7-1, it may be documented in a **MANUAL CHANGES** supplement. For additional information about serial number coverage, refer to **INSTRUMENTS COVERED BY MANUAL** in Section I.

Table 7-1. Manual Changes by Serial Number for "A" Prefix Instruments

Serial Prefix or Number	Changes to Manual
2146	AA

Table 7-2. Summary of Changes by Component

Changes	Assemblies Affected			
	A1	A2	A3	A4
AA		CR33, K20, Q26		

CHANGE AA

Page 1-3, Figure 1-2:

Replace *Figure 1-2. HP 8945A Transceiver Interface Test Configuration* with the attached Figure 1-2.

Page 3-7, Figure 3-2:

Under **(8) AUDIO ANALYZER**, delete the second paragraph.

Page 3-29, Table 3-3:

Under HP-IB Programming Codes, delete the following:

Delete	C1	MIC. SENSE Relay ON.	Activates relay A2K20.
Delete	C4	MIC. SENSE Relay OFF.	De-activate relay A2K20. (RECEIVER or TRANSMITTER keys will also accomplish the same function.)
Delete	GF	TRANSMIT KEY ON	Closes Relay A2K17 without forcing Transmitter mode.
Delete	J1	Turns On A2TP14.	
Delete	J2	Turns Off A2TP14.	
Delete	J3	Turns On A2TP15.	
Delete	J4	Turns Off A2TP15.	

Page 6-6, Table 6-2:

In the list of **Replaceable Parts** delete the following:

Delete A2CR33 1901-0040 CD1 DIODE SWITCHING 30V 50 MA
Delete A2K20 0490-1013 CD6 RELAY REED .25A1C 5VDC

Page 6-7, Table 6-2:

In the list of **Replaceable Parts** delete A2Q26.

Page 8-49, Service Sheet 2; **Principles of Operation**:

Under **Relay Buffers**, in the second to the last sentence, replace Q1–Q26 with Q1–Q25.

Under **MOSFETS**, in the first sentence replace Q23–Q26 with Q23–Q25.

Under **MOSFETS**, in the second sentence replace A2K1–A2K20 with A2K1–A2K19.

Under **MOSFETS**, in the second paragraph delete Q26 and replace CR20,CR33 with CR30.

Page 8-27, Figure 8-18, BD1 Service Sheet:

Replace the appropriate portion of the block diagram with the attached partial block diagram (*P/O Figure 8-18, BD1 Service Sheet*).

CHANGE AA (Cont'd)

Page 8-52, Figure 8-23, Component Locations:

Replace the **Interface Control Board** Component Locator (A2 Assembly) with the attached figure. (*Figure 8-23. Interface Control Board Component Locations*).

Page 8-53, Figure 8-24, Schematic:

Replace the appropriate portion of the schematic diagram with the attached partial schematic diagram (*P/O Figure 8-24. Relay Control Driver and Relays*).

In the table of **Reference Designations**, under A2 Assembly, change the following:

Delete CR33.
Replace K1–20 with K1–19.
Replace Q1–26 with Q1–25.
Replace TP14–15 with TP14–16.

In the table of **Transistor and Integrated Circuit Part Numbers**, under **Reference Designators**, replace Q23–26 with Q23–25.

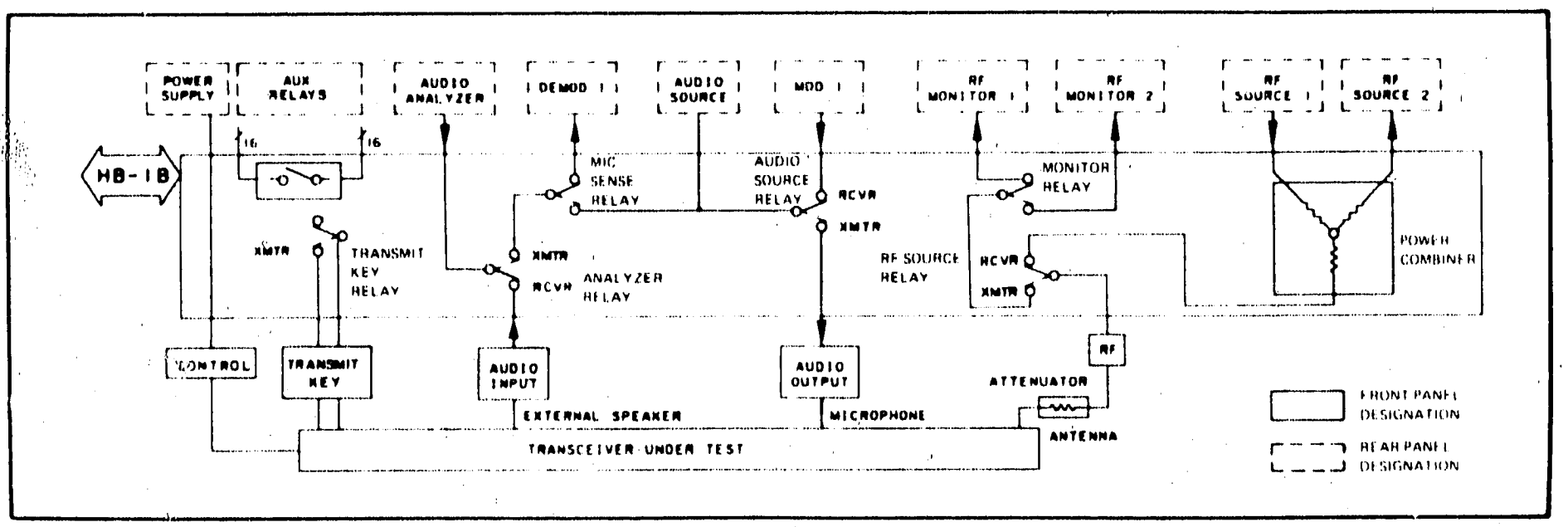
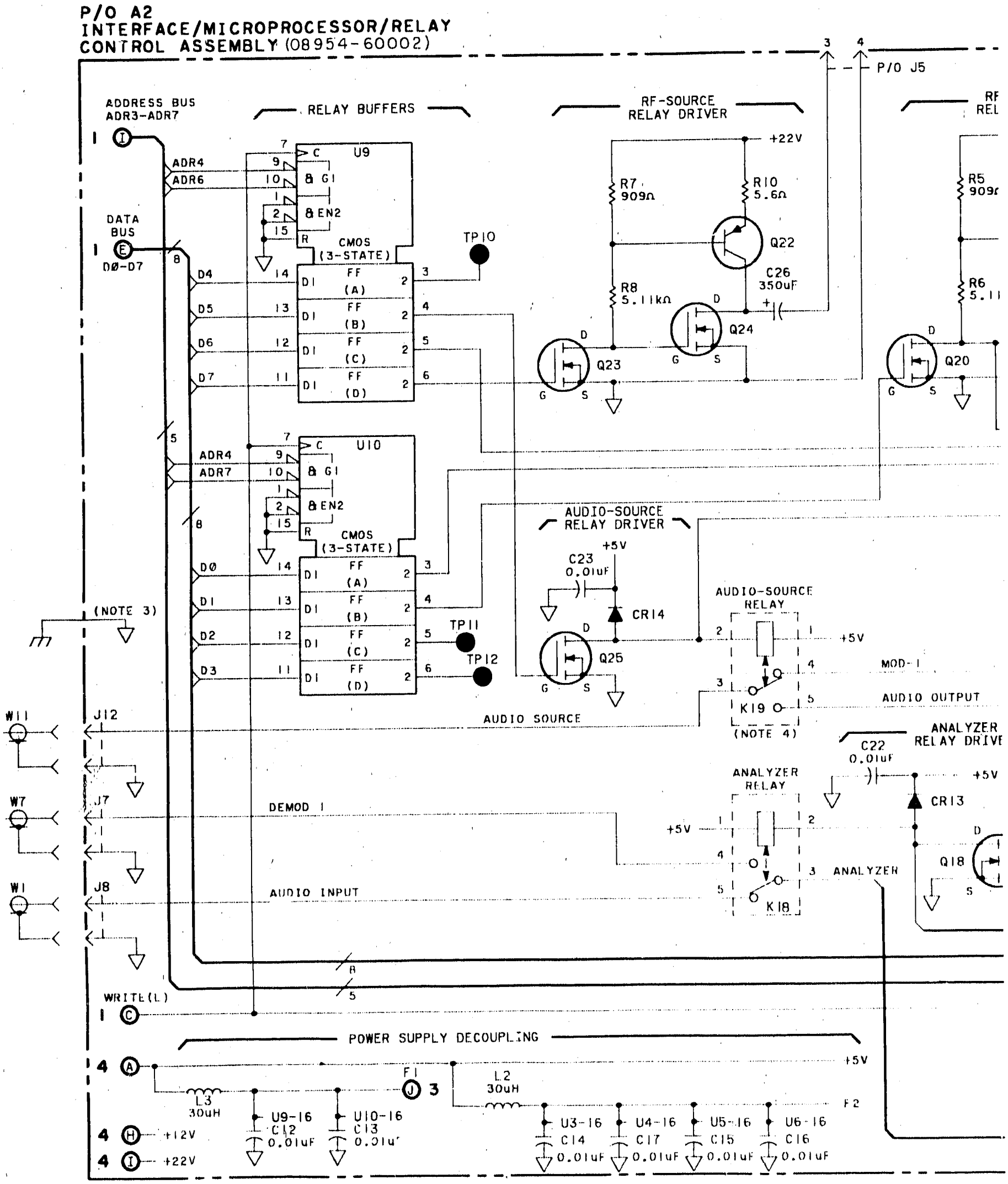
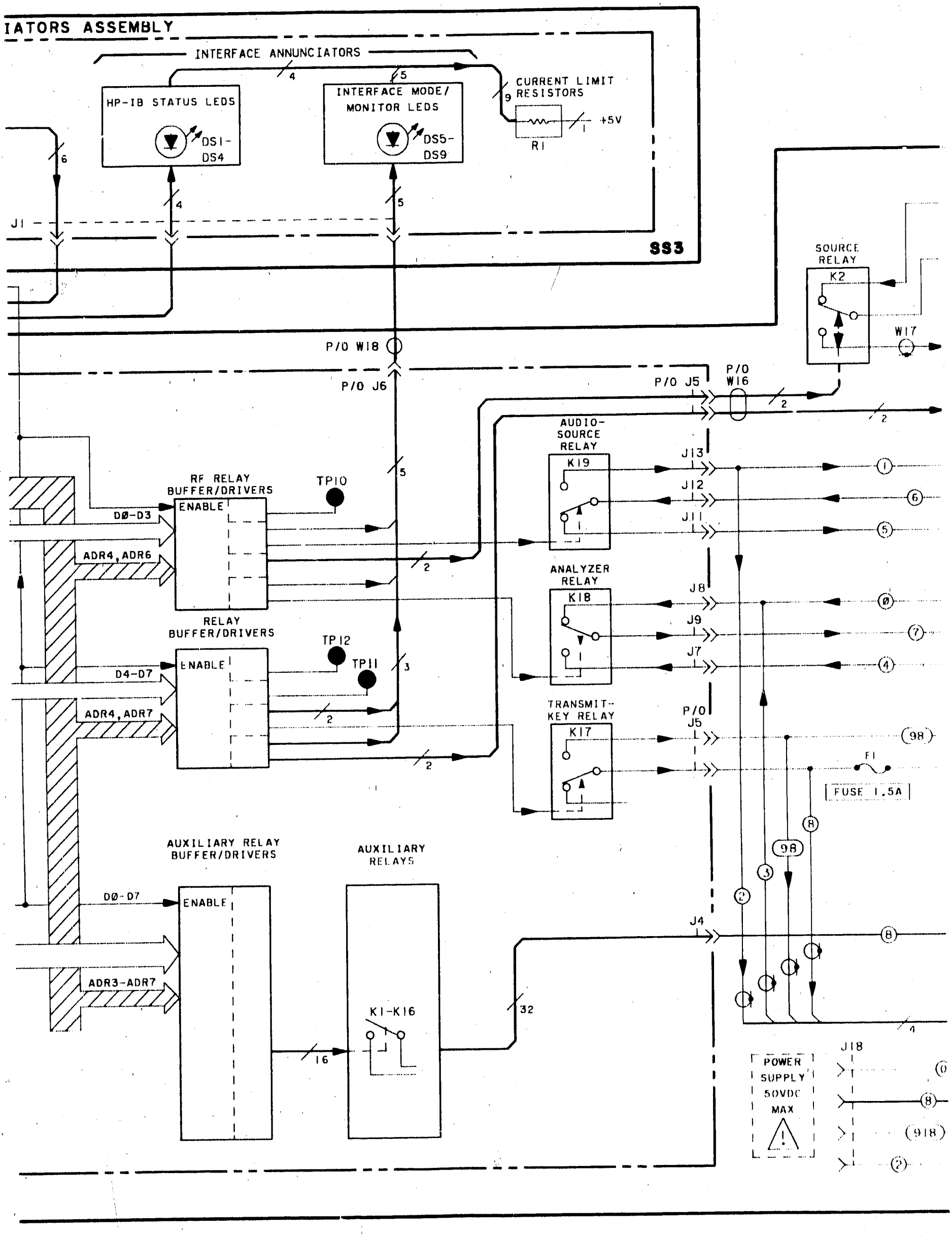


Figure 1-2. HP 8954A Transceiver Interface Test Configuration



P/O Figure 8-18 BD1 Service Sheet



P/O Figure 8-24. Service Sheet 2, Relay Control Driver and Relays

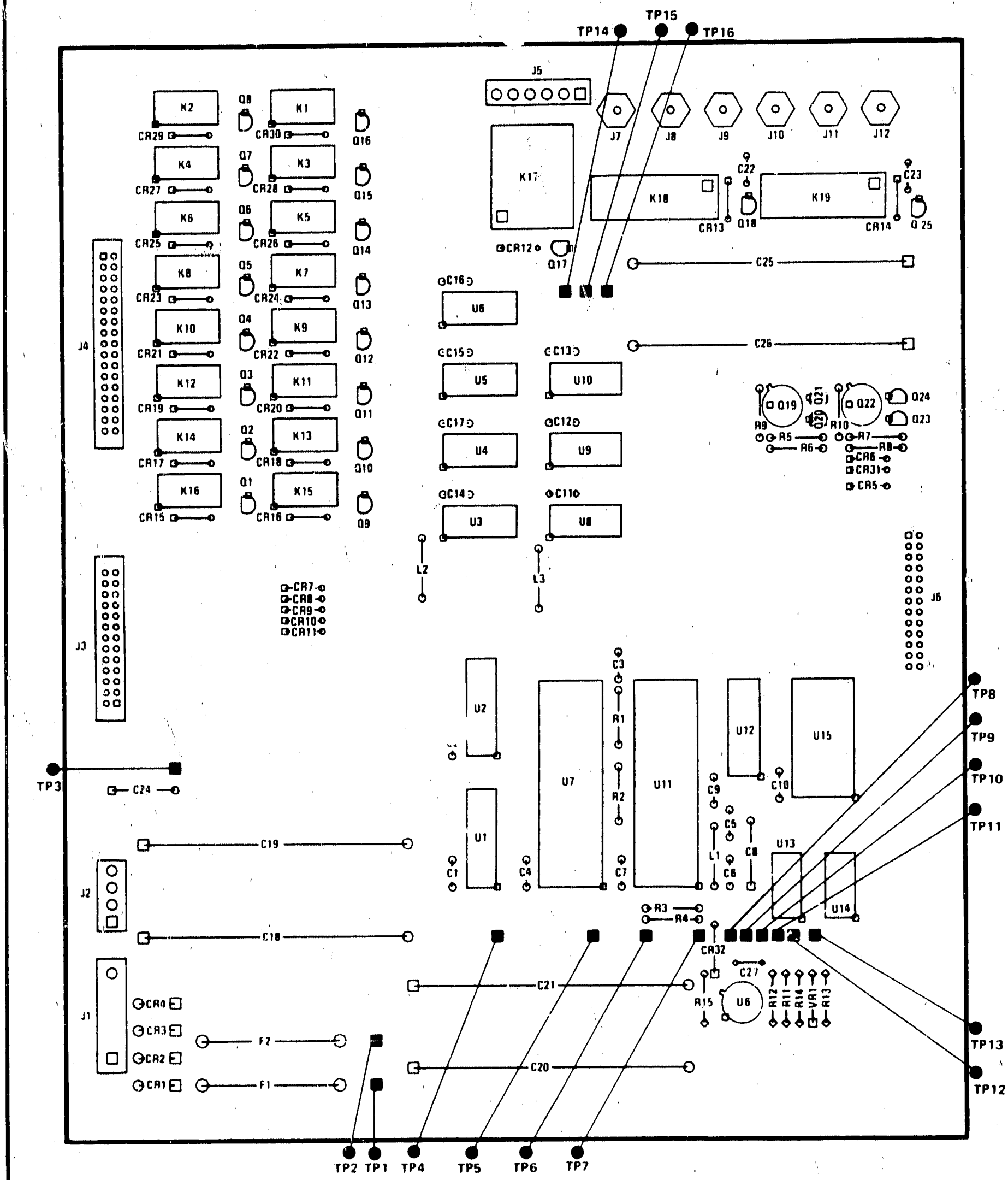


Figure 8-23. Interface Control Board (A2 Assembly) Component Locations

SERVICE INFORMATION

SECTION VIII
SERVICE

8-1. INTRODUCTION

This section contains information for troubleshooting and repairing the Transceiver Interface. Included are block and circuit diagrams, principles of operation, troubleshooting tests, and repair procedures.

8-2. SERVICE SHEETS

The foldout pages in the last part of this section are the service sheets. They consist of a block diagram, some circuit schematic diagrams, supplemental diagrams, and associated information. For more information refer to the paragraphs under the general heading of "TROUBLESHOOTING" in this section.

8-3. Block Diagrams

Block Diagram BD1 shows all of the major circuits and their functional groupings. This block serves as an index to the circuit schematic diagrams.

8-4. Schematic Diagrams

The circuit schematic diagrams and their associated information are found on Service Sheets 1 through 4. These diagrams, in functional groupings, are aids for understanding the operation and for troubleshooting the Transceiver Interface. Refer to the paragraphs entitled "TROUBLESHOOTING..." for more information.

8-5. SAFETY CONSIDERATIONS

8-6. Before Applying Power

The instrument must be set to match the available line voltage and have the correct fuse installed. An uninterrupted safety earth ground must be provided from the main power source to the instrument input wiring terminals, power cord, or supplied power cord set. Refer to paragraph 2-3 entitled "PREPARATION FOR USE".

8-7. Warnings and Cautions

WARNINGS and CAUTIONS must be followed for operator protection and to avoid damage to the equipment.

WARNING

Maintenance described herein is performed with power supplied to the instrument and with the protective covers removed. Such maintenance should be performed only by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock).

WARNING

Where maintenance can be performed without power supplied, the power should be removed. When any repair is completed, be sure that all safety features are intact and functioning and that all necessary parts are connected to their protective grounds.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnection of the protective earth terminal will create a potential shock hazard that could result in personal injury. Grounding one conductor of a two conductor outlet is not sufficient. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative; i.e., secured against unintended operation.

If this instrument is to be energized via an autotransformer, make sure that the autotransformer's common terminal is connected to the earth terminal of the power source.

Capacitors inside the instrument can still be charged even if the instrument is disconnected from its source of supply.

Make sure that only 250 volt fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. Do not use repaired fuses or shortcircuited fuseholders. To do so could create a shock or fire hazard.

CAUTION

Do not disconnect or remove any boards in the Transceiver Interface unless the instrument is unplugged. A board may contain devices which can be damaged if the board is removed when the power is on. Use conductive foam when removing MOS devices from circuit boards. Use care when unplugging ICs from high-grip sockets.

8-8. RECOMMENDED TEST EQUIPMENT AND ACCESSORIES

Test equipment and test accessories required to maintain the Transceiver Interface are listed in the table of "Recommended Test Equipment" in Section I. Equipment other than that listed may be used if it meets the listed critical specifications.

8-9. SERVICE TOOLS, AIDS, AND INFORMATION

8-10. Service Tools

The following paragraphs list some unique tools that make servicing of this instrument easier. Service aids (such as test points and reference designators) are provided in the instrument, and service information is provided in this manual.

Pozidriv Screwdrivers. Many screws in the Transceiver Interface appear to be Phillips type, but are not. To avoid damage to the screw slots, Pozidriv screwdrivers should be used. HP 8710-0899 is the No. 1 Pozidriv. HP 8710-0900 is the No. 2 Pozidriv.

Heat Staking Tool. The front panel pushbutton switches have small plastic pins protruding from the back. These tabs fit through holes in the printed circuit board and are melted down to hold the switch in place. This process is known as heat staking. The heat staking tool is a standard soldering iron with a special tip attached. (See Figure 8-2 and paragraphs entitled "Replacement of Key Cap and Pushbutton Switches".)

Refer to the paragraphs entitled "Replacement of Key Cap and Pushbutton Switches" under REPAIR in this section for the heat staking procedure.

Connector Insert Extraction Tool. The front-panel Control connector and the rear-panel Power Supply connector contain removable contacts. Easy removal of these contact inserts may be achieved with the following extraction tool. Cannon Electric, CET-6B Extraction Tool.

8-11. Assembly Locations

Assemblies in the Transceiver Interface are numbered sequentially from front to back; for example, A1 is on the front panel and A3 is on the back panel.

8-12. Replaceable Parts

The component location diagram is adjacent to the schematic diagram on the appropriate service sheet. The reference designator of the part is the assembly designator plus the part designator; for example, A6R9 is R9 on the A6 assembly. For specific component descriptions and ordering information, refer to Table 6-2, Replaceable Parts, in Section VI.

Major mechanical parts have reference designations that begin with the letters MP. Other mechanical parts, such as screws, are listed in the replaceable parts list below the part to which they fasten.

8-13. Test Points

All test points are indicated on individual circuit board assemblies. Test points and can also be found on the component locator diagram adjacent to the assembly's schematic diagram.

8-14. Service Aids on Printed Circuit Boards

Service aids on printed circuit boards include test points, transistor, integrated circuit, and relay designations, and assembly part numbers.

8-15. Other Service Documents

Service Notes, Manual Change Supplements, and other service literature are available through Hewlett-Packard. For further information, contact your nearest Hewlett-Packard office.

8-16. TROUBLESHOOTING

8-17. General

Instrument problems will usually appear either as a result of an operator error or a catastrophic failure. The troubleshooting strategy is described in the following paragraphs. For more information as to the intended operation of this instrument, refer to Sections I through III of this manual.

When a catastrophic failure occurs, begin the troubleshooting procedure described in Block Diagram BD1. The troubleshooting information found on BD 1 will help isolate the problem to one of the four major sections of this instrument.

8-18. Strategy

Troubleshooting for the Transceiver Interface is organized into two levels. The overall troubleshooting level allows malfunctions to be identified to the circuit level, and then isolated to the component level with the aid of the circuit schematic. It is expected that effective troubleshooting, to the component level, is dependent on the skill and experience of the troubleshooter.

8-19. Overall Troubleshooting (Service Sheet BD1)

Overall troubleshooting begins with verifying that the power-on sequence occurs properly. At this point, power supply problems may become evident. The effect of inputs from the keyboard and an external computer are compared to indicate either a defective keyboard, a problem with the HP-IB interface, or to signify improper data processing by the instrument's control logic.

8-20. Circuit Troubleshooting (Service Sheets 1 through 4)

The goal of troubleshooting at the previous service sheet level is to isolate a problem to one of the four block diagrams shown in BD1. The number at the bottom right corner of each of these blocks references the user to the service sheet schematic.

8-21. SIGNATURE ANALYSIS

Signature analysis is a simple method of verifying the operation of digital circuitry. When properly used, signature analysis can detect extremely subtle hardware faults.

Refer to the HP 5005A Signature Multimeter Operating and Service Manual for a complete description of the instrument.

8-22. Signature Multimeter Features

Front Panel. Six LED seven-segment displays are on the front panel. There are two LEDs to the right of the displays. One indicates gate (measurement window) activity and the other signifies the presence of an unstable signature.

After the signature multimeter power-up sequence, all pushbutton controls automatically default into predetermined settings. The THRESHOLD and FUNCTION controls are set in the positions necessary for the measurements done in this instrument's troubleshooting procedures. However, the POLARITY control settings must be modified to match the ones given under the multimeter POLARITY settings given in the troubleshooting section of each service sheet.

Data Probe. The Data Probe (more commonly referred to as a probe) is a handheld probe. Its main function is to accept signature information; however, it can also function as a logic probe. The lamp at the tip reacts the same as the lamp of the HP 545A Logic Probe. The lamp glows brightly for a logic high, turns off for a logic low, and glows dimly for a bad logic level, open circuit, or open state of a three-state device.

Timing Pod. The Timing Pod (more commonly referred to as a pod) houses three channels for START, STOP, and CLOCK control inputs. The input wires can be plugged directly to a 0.03-inch round pin or connected to a "grabber", which can be connected to a test point, component lead, or IC pin. It might be necessary to extend the length of the input wires of the pod. This can be accomplished by connecting wires of the desired length (with grabbers at each end) to the grabbers already present at the pod. HP part numbers for the grabbers are: red, 1400-0833; black, 1400-0832.

8-23. Signature Multimeter Operation

Signature Display. The signature multimeter uses a compression technique that reduces any long, complex data stream on a logic node into a four-digit signature. The digits used for this signature display are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, C, F, H, P, and U. The last six digits (letters) were chosen (rather than the hexadecimal A, B, C, D, E, F) to avoid confusion between letters and numbers on the seven-segment displays. For example, an 8 and a B would appear exactly the same on a seven-segment display.

Logic data is input to the signature multimeter through the probe for each and every circuit clock cycle that occurs within a circuit-controlled time window (see Figure 8-1). The signature multimeter has a 16-bit serial shift register that allows approximately 65 thousand possible signatures to be generated from a logic node.

The signature is a unique number representing time-dependent logic activity during a specified measurement interval for the node being monitored. This signature will always be the same for that node, provided the circuit is functioning properly. Any change in the behavior of the node will produce a signature different from the one that appears in the signature table; thus indicating a circuit malfunction.

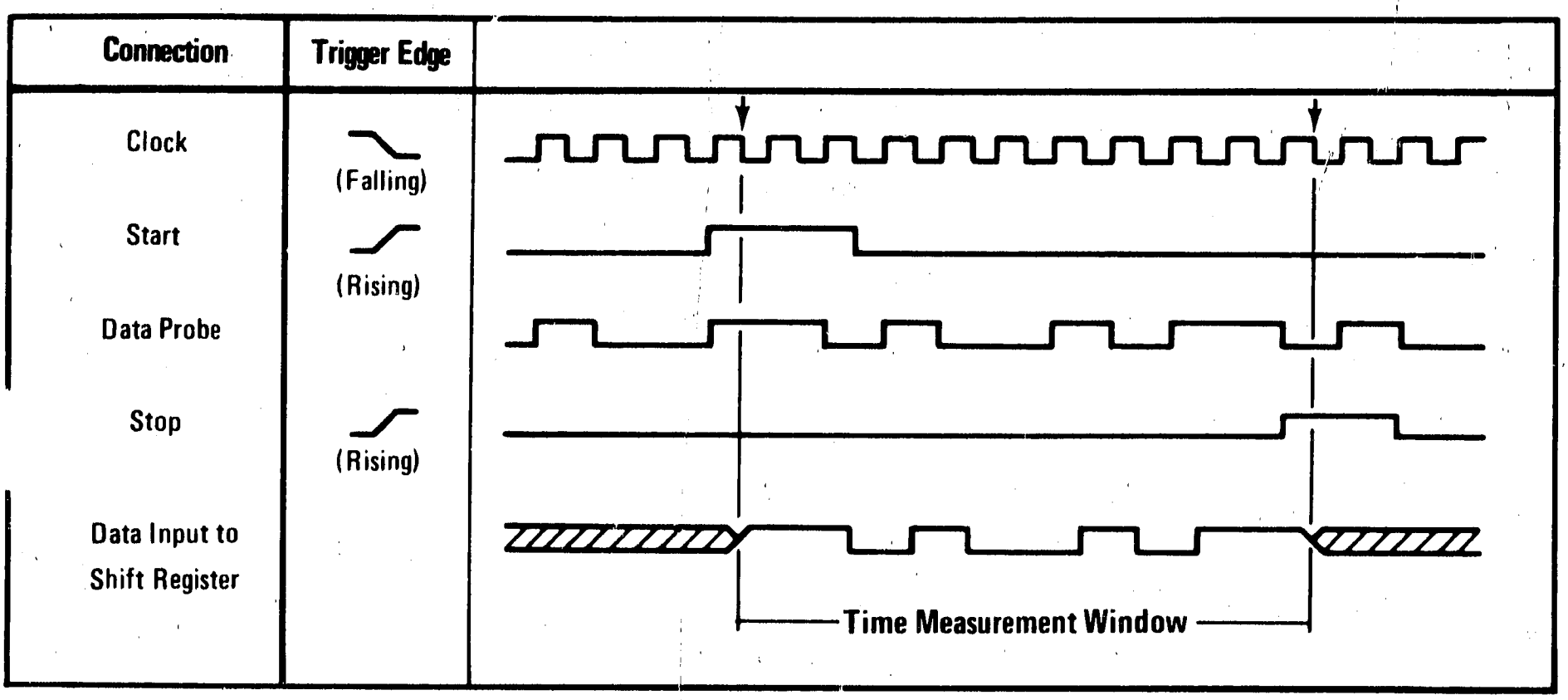


Figure 8-1. Signature Multimeter Timing Diagram

8-24. Unstable Signature

If there is an inconsistency in the data received during consecutive time-measurement windows, the UNSTABLE signature indicator lamp will blink. This indicates that an intermittent fault is occuring within the time-measurement window. However, the signature multimeter might not indicate an unstable signature if the measurement-window cycle time is too short.

8-25. Signature Analysis Considerations

To expedite signature analysis, the following steps must be observed:

1. Every step must be performed as described in the setup procedure. The CLOCK, START, and STOP connections, and the front-panel triggering must all be correct.

2. The node where the signatures are taken should be double-checked to be sure it is the correct node.

3. The signature multimeter probe must make good contact with the pin being checked. Oxidation on pins can cause invalid signatures due to poor contacts.

4. Each signature should be double-checked if it does not agree with the signature in the troubleshooting check.

5. When checking a node, the UNSTABLE signature indicator must not blink.

8-26. Additional Information

Additional troubleshooting information is found throughout the manual. References are made to this information in each troubleshooting procedure. Examples of this information are the "Power-On Procedure," the "Basic Functional Checks," and the "HP-IB Functional Checks," which are all found in Section III.

8-27. REPAIR

8-28. Replacement of Key Cap and Pushbutton Switches

Key Cap Replacement. Removing a front-panel key cap may be easily done in one of two ways. If the front panel has been removed, use a small flat-blade screwdriver to press on the switch side of the key cap while working it from side-to-side with your fingers. Removing the key cap without opening the instrument is done as follows: Grasp the key cap firmly with pliers. Work it from side-to-side while pulling away from the panel.

NOTE

The pliers may damage the key cap unless the jaws are covered with a protective material.

Be sure the key cap is aligned properly before snapping into place. Note that the key cap has eight possible positions (See Figure 8-2).

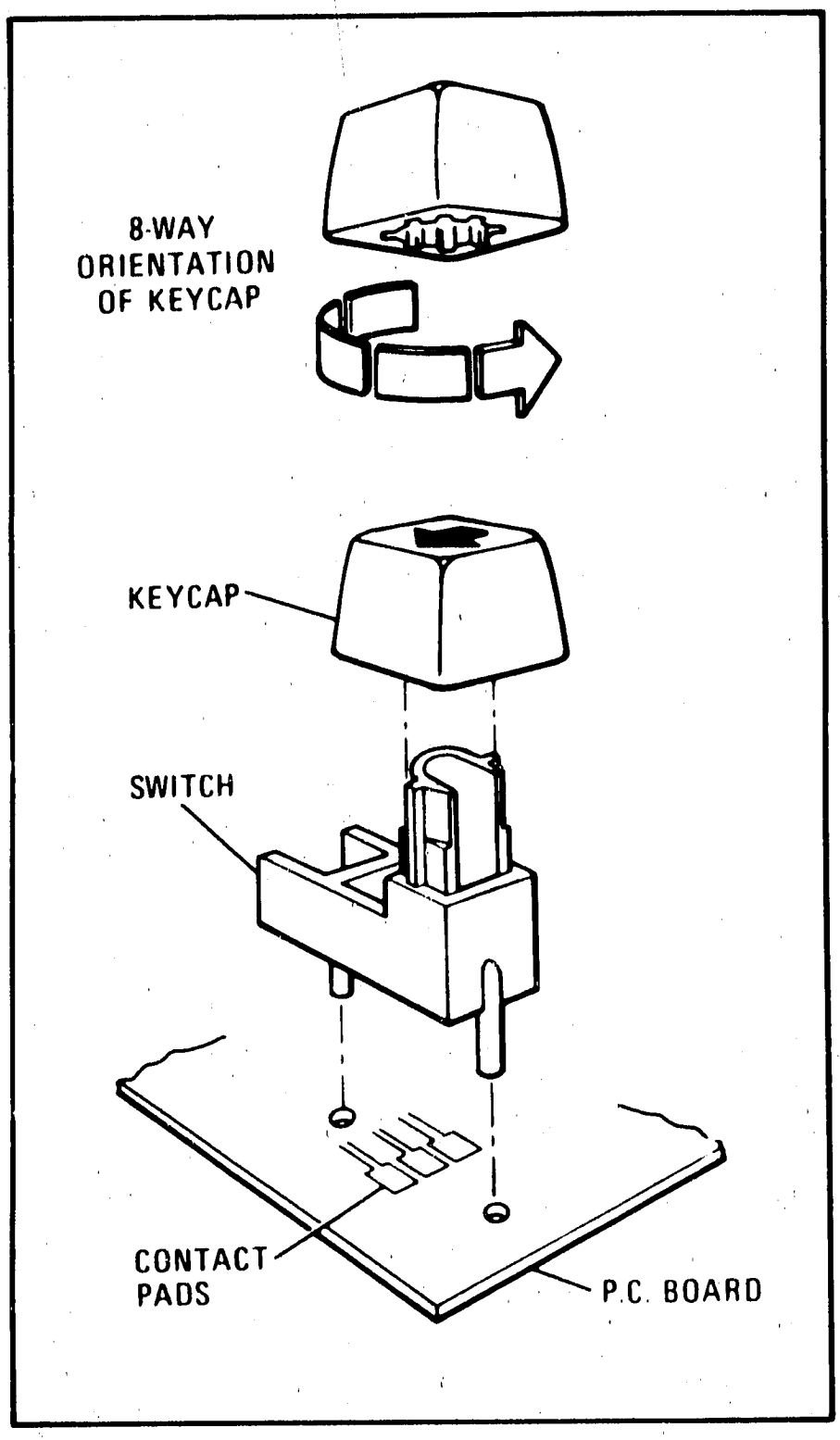


Figure 8-2. Front-Panel Pushbutton Switch Assembly

Switch Replacement. The front-panel switches have a very high cycle life. However, if one becomes faulty and needs replacement, follow the procedure outlined below:

1. Remove the front panel.

2. Remove the key cap as indicated in the Key Cap Replacement paragraph.

3. Remove the switch by chipping away the melted plastic tabs at the circuit-side of the keyboard which holds the switch in place.

4. To assure long life and reliable electrical performance, the circuit board contact traces (found underneath the switch) should be clean and free of surface imperfections. Clean the switch contact pads before installing a new switch.

5. For reliable operation, any method of assembly must assure that the switch is mounted tightly against the pc board. To facilitate the heat staking operation, specially molded support anvils (HP 5040-6881) can be ordered. (See Figure 8-3)

6. To assure proper switch assembly, verify that the switch is pushed firmly against the circuit board and with the hot (440C or 825F) staking tip (see Figure 8-3), push down on both posts of the switch. With the proper cycle, the post initially turns a darker color and in about ten seconds, returns to its original bright red color. The correctly staked post should have a smooth, round, "rivet-like" top (see Figure 8-3).

CAUTION

Do not disturb the assembly for at least 10 seconds after heat staking.

If not enough heat is applied, the plastic will tend to stick to the tip of the iron.

If too much heat is applied, the plastic will fume profusely, the "rivet" will be irregularly shaped, and the plastic will be permanently discolored.

If the staking tool is worn or flaked, it will cause a misshaped rivet and/or a contamination deposit on the surface.

NOTE

The heat staking operation should be done in a well ventilated area. If the heat staking tip is too hot, the plastic will vaporize and emit fumes. These fumes, however, are non-toxic.

8-29. Manual Updating (Manual Changes Supplement)

Production changes to Transceiver Interfaces made after the publication date of this manual are indicated by a change in the serial number prefix. Changes to this manual's information are recorded by a serial prefix on the Manual Changes supplement. Errors are also noted in the ERRATA portion of the Manual Changes supplement.

Keep this manual up to date by periodically requesting the latest, complimentary supplement from your Hewlett-Packard office.

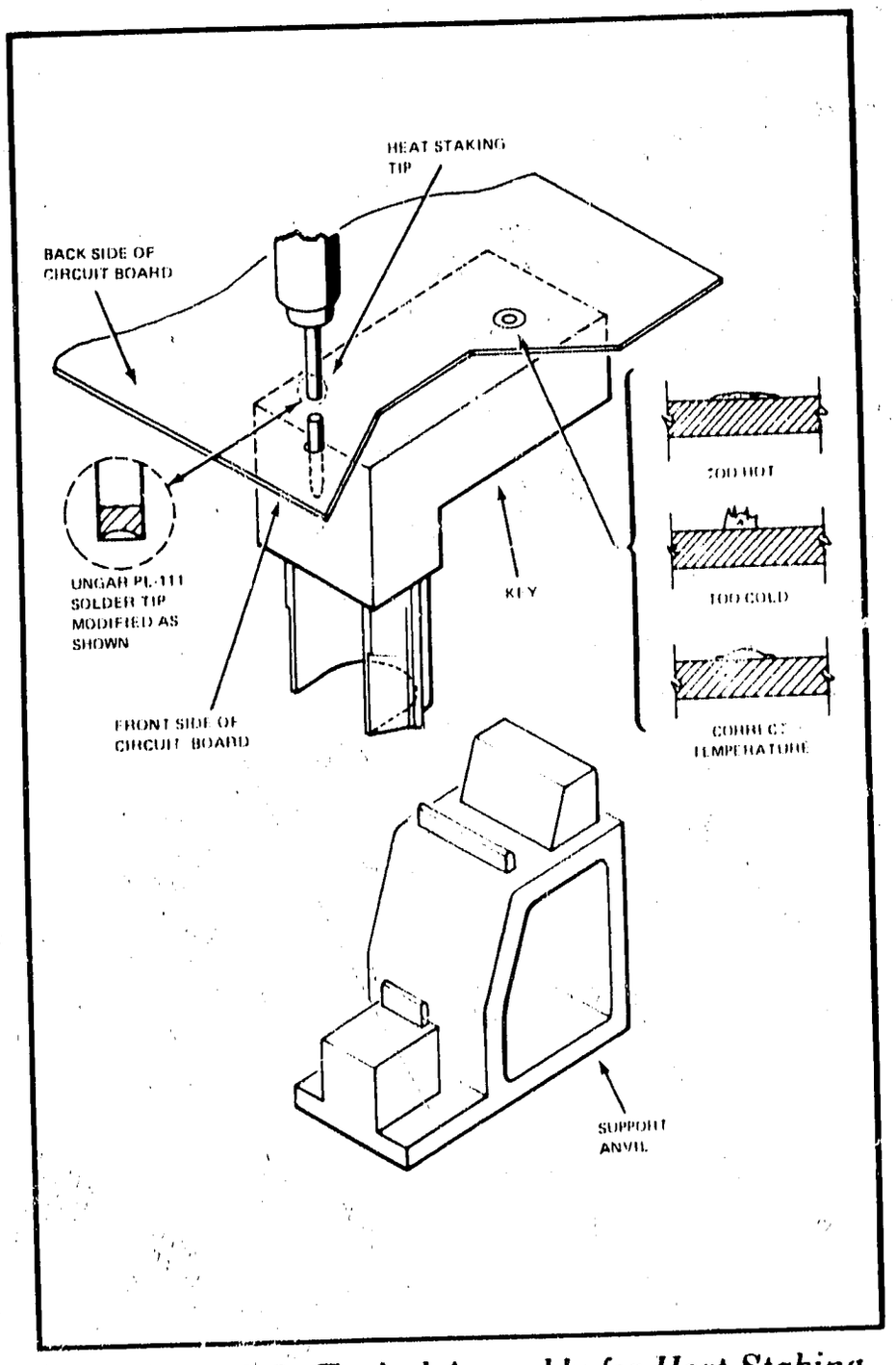


Figure 8-3. Typical Assembly for Heat Staking Operation

8-30. Etched Circuits (Printed Circuit Boards)

The etched circuit boards in the Transceiver Interface have plated-through holes which make a solderable path through to both sides of the insulating material. Soldering can be done from either side of the board with equally good results. When soldering to any circuit board, keep in mind the following recommendations:

1. Avoid unnecessary component substitution. Substitution can result in damage to the circuit board and/or the adjacent components.

2. Do not use a high-power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

3. Use a suction device or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

8-31. MOS and CMOS Integrated Circuit Replacement

MOS and CMOS integrated circuits are used in this instrument. They are prone to damage from both static and transient voltages and require careful handling. When working on the Transciever Interface the following steps must be observed:

1. Do not remove any board unless the Transceiver Interface has been unplugged.

2. When removing a MOS or CMOS device from an assembly, precautions must be taken to avoid damage to its internal circuitry. Avoid removing devices from sockets with pullers. Instead, use a small screwdriver to pry the device up at one end, slowly pulling it up, one pair of pins at a time.

3. Once a MOS or CMOS device has been removed from an assembly, immediately place it in a pad of conductive foam or any other suitable holding medium.

4. When replacing a MOS or CMOS device, ground the foam on which it resides to the instrument before removing it. If a device requires soldering, the assembly must be lying on a sheet of conductive foam. The foam and soldering iron tip must be grounded to the assembly under repair. Apply as little heat as possible.

5. Before turning the instrument off, remove any large ac sources which may be driving MOS switches.

Table 8-1. Etched Circuit Soldering Equipment

ITEM	USE	SPECIFICATIONS	ITEM RECOMMENDED	HP PART NO.
Soldering Tool	Soldering Heat Staking	Wattage: 35W Tip Temp.: 390C–440C (735F–825F)	Ungar No. 135 Ungar Division Eldon Ind. Corp. Compton, CA 90220	8690-0167
Soldering Tip	Soldering, Unsoldering	*Shape: Chisel	*Ungar PL113	8690-0007
Soldering Tip	Heat Staking	Shape: Cupped	HP 5020-8160 or modified Ungar PL111 (see Fig. 8-2)	5020-8160
Support Anvil	Heat Staking	Support key during heat staking	HP 5020-8160	5020-8160
De-Soldering Aid	To remove molten solder from connection	Suction Device	Soldapullt by Edsyn Co., Van Nuys, CA 91406	8690-0060
Rosin (flux) Solvent	To remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board	Freon	8500-0232
Solder	Component replacement Circuit board repair wiring	Rosin (flux) core, high tin content. (63/37, tin/lead) 18 gauge (SWG) 0.048 in. diam. preferred.		8090-0607

*For working on circuit boards; for general purpose work, use No. 555 Handle (8690-0261) and No. 4037 Heating Unit 47½–56½ W (8690-0006); tip temperature of 850-900F, and Ungar No. PL113 ⅛" chisel tip.

8-32. SCHEMATIC SYMBOLOGY AND OPERATING PRINCIPLES

8-33. Schematic Diagram Notes

Table 8-2, which just precedes BD1, summarizes the symbology used in the schematics of the Transceiver Interface.

8-34. Basic Logic Symbology

The logic symbols used in this manual are based on the American National Standards Institute (ANSI) Y32.14-1973, "Graphic Symbols for Logic Diagrams (Two State Devices)". These logic symbols are summarized in the following paragraphs, which include a brief description of the basic logic symbols, a summary of indicator symbols, a discussion of contiguous blocks, control blocks, and dependency notation, and a summary of symbology for some of the more complex devices.

Gates and Qualifiers. Qualifiers are that portion of a device symbol that denote the logic function; for example, "&" denotes the AND function. (See Figure 8-4 for a summary of the basic logic symbols and their qualifiers.) Power supply and ground connections are not shown on the symbols. This information is tabulated under "NOTES" in the right margins of the service sheets.

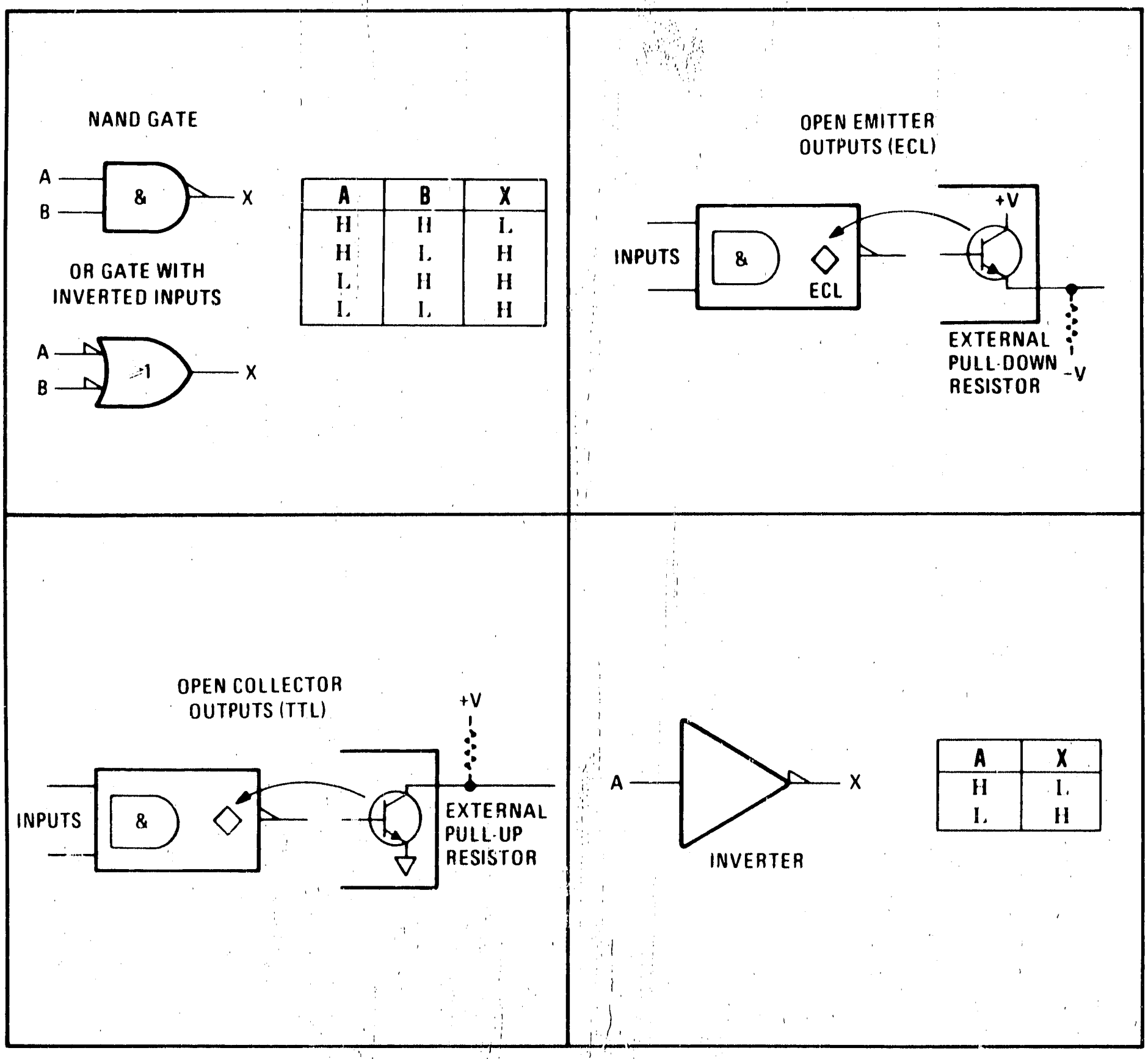


Figure 8-4. Basic Logic Symbols and Qualifiers

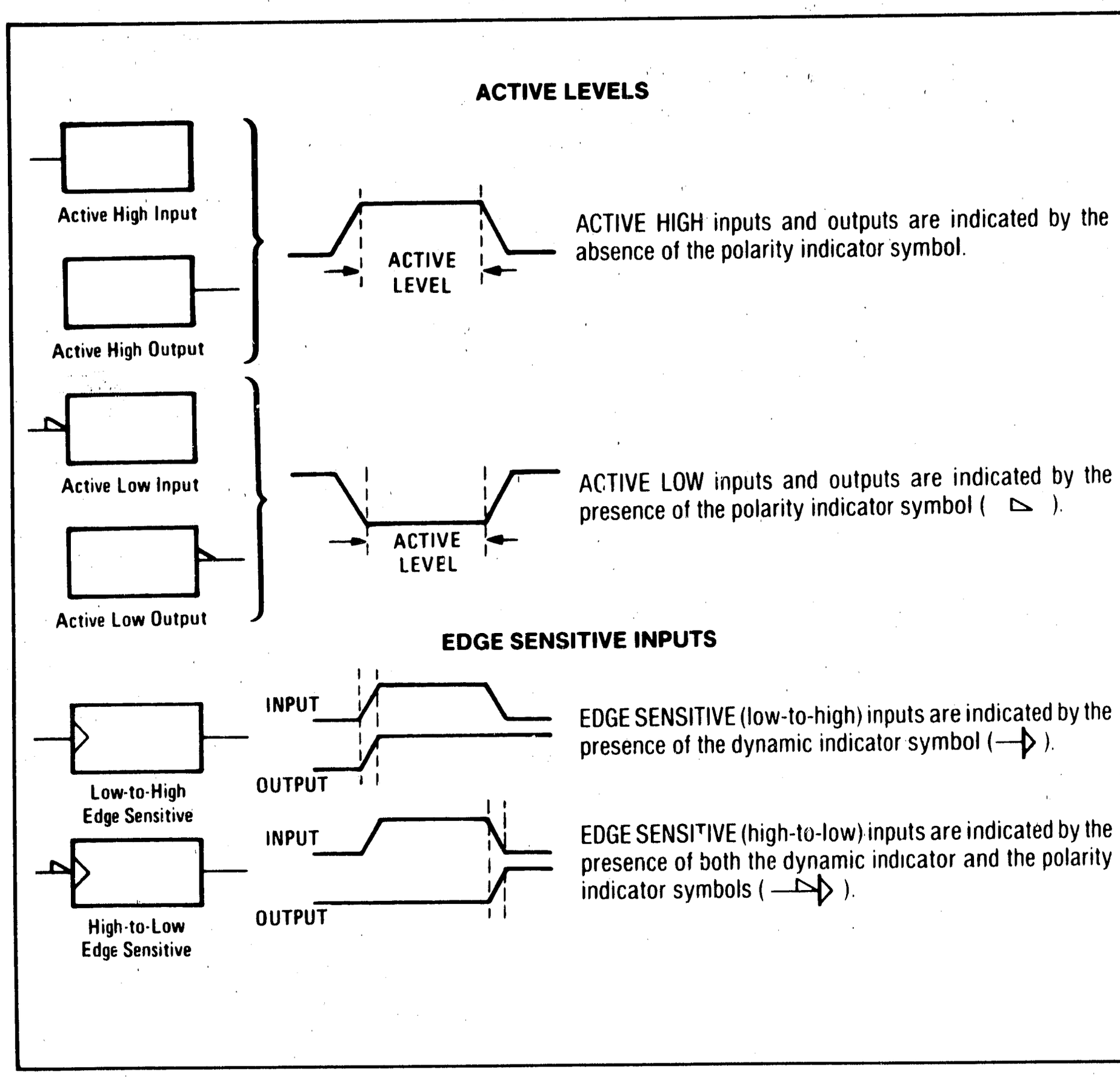


Figure 8-5. Indicator Symbols

Indicator Symbols. Indicator symbols identify the active state of a device's input or output as shown in Figure 8-5.

Common Control Block. The control block is used in conjunction with an array of related symbols to group common logic lines. Figure 8-6 shows how the control block is usually represented. Figure 8-10 shows a quad, D-type flip-flop with reset (redrawn in Figure 8-11). The more complex representation shown in Figure 8-10 is used when the flip-flops are functionally scattered around the schematic; that is when they are not used as a quad unit.

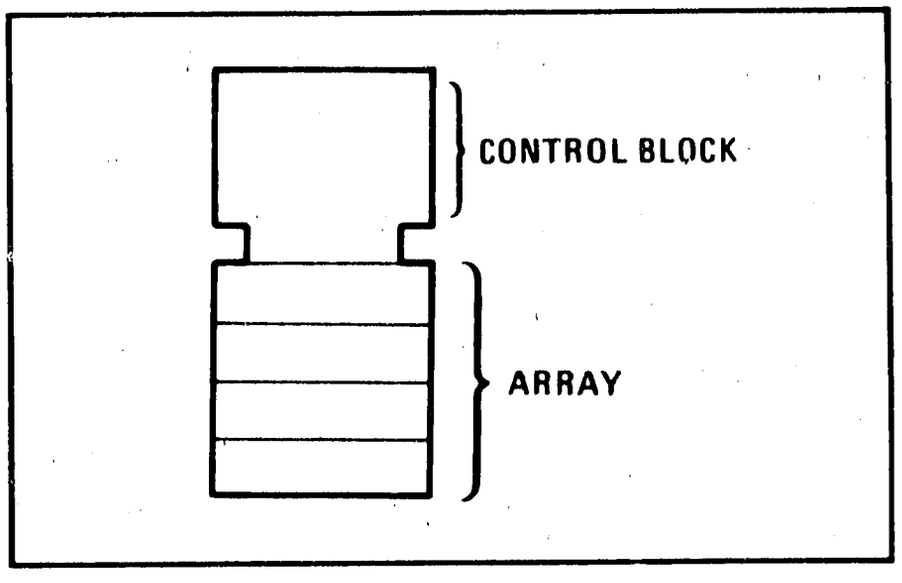
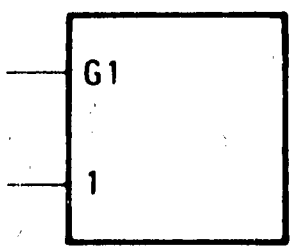


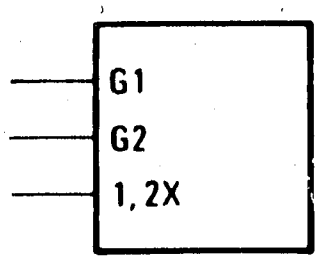
Figure 8-6. Control Block

Dependency Notation. Dependency notation simplifies symbols for complex integrated circuit elements by defining the interdependencies of inputs or outputs without actually showing all the elements and interconnections involved. Letters or symbols are used as abbreviations for these interdependencies: Figures 8-7 through 8-13 use A for address, C for control, G for AND, > for OR, and EN for output enable. A number prefix on an input or output denotes its dependency on the letter or symbol with the same number as a suffix (see Figure 8-7 and 8-8).

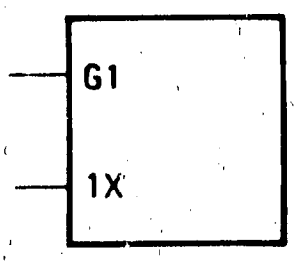
Contiguous Blocks. Two symbols may share a common boundary parallel or perpendicular to the direction of the signal flow. Note that in the examples shown in Figure 8-9, portions of the symbol that are separated by a horizontal line have no logic connection, but there is always an implied logic connection between portions of the symbol that are separated by a vertical line. Exceptions to this rule are the horizontal lines beneath control blocks and between sections of shift registers and counters (dividers).



The input that controls or gates other inputs is labeled with a C or a G, followed by an identifying number.
The controlled or gated input or output is labeled with the same number. In this example, 1 is controlled by G1.

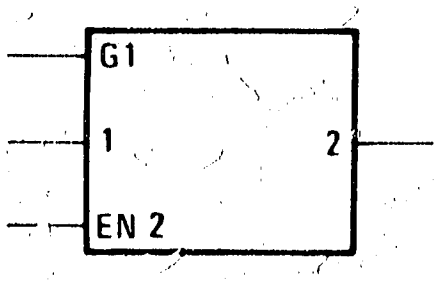


If the input or output is affected by more than one gate or control input, then the identifying numbers of each gate or control input will appear in the prefix separated by commas. In this example, X is controlled by G1 and G2.



When the controlled or gated input or output already has a functional label (X is used here), that label will be prefixed or subscripted by the identifying number.

Figure 8-7. AND Dependency Notation



When the EN input is active, the output is allowed to function normally. When EN is inactive, the output enters 3-STATE (high impedance), effectively removing that device output from the circuit.

Figure 8-8. Free Dependency Notation

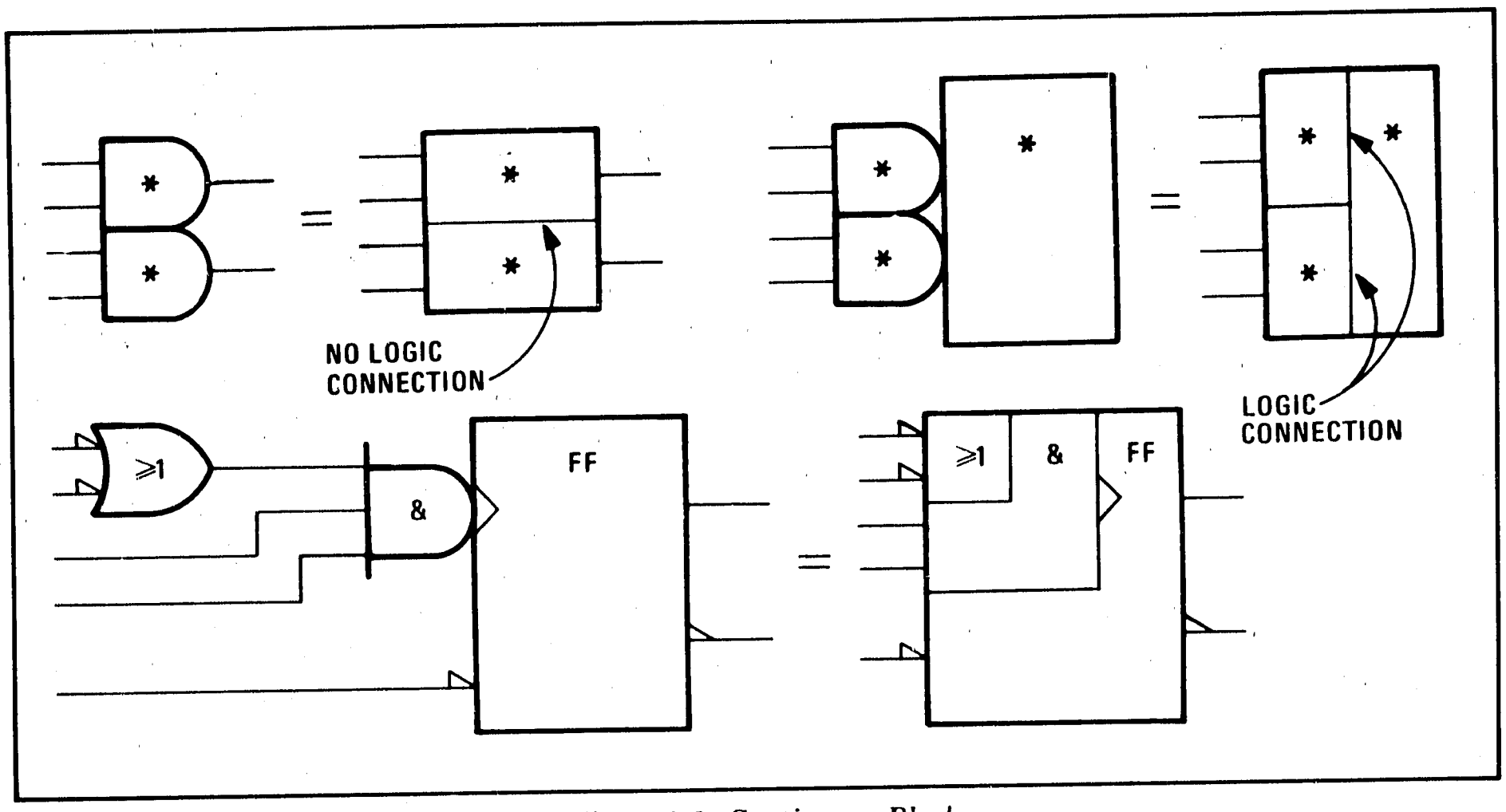


Figure 8-9. Contiguous Blocks

Quad, D-Type Latch. The Register control block is used to illustrate a quad, D-type latch. A common, active-low reset (R), and a common, edge-triggered control input (C) are used to control the latch. Since there is only one dependency relationship, the controlling input is not numbered.

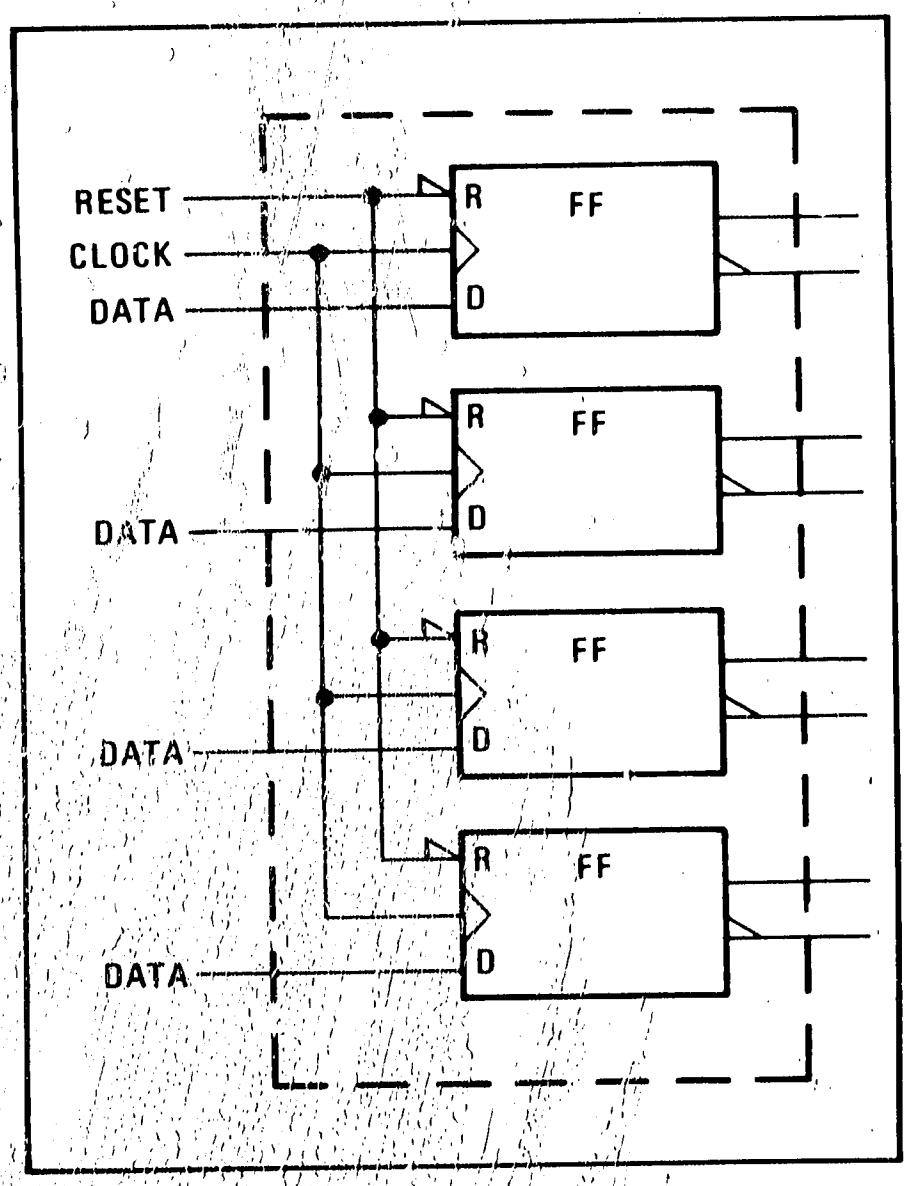


Figure 8-10. Quad D-Type Latch (Individual)

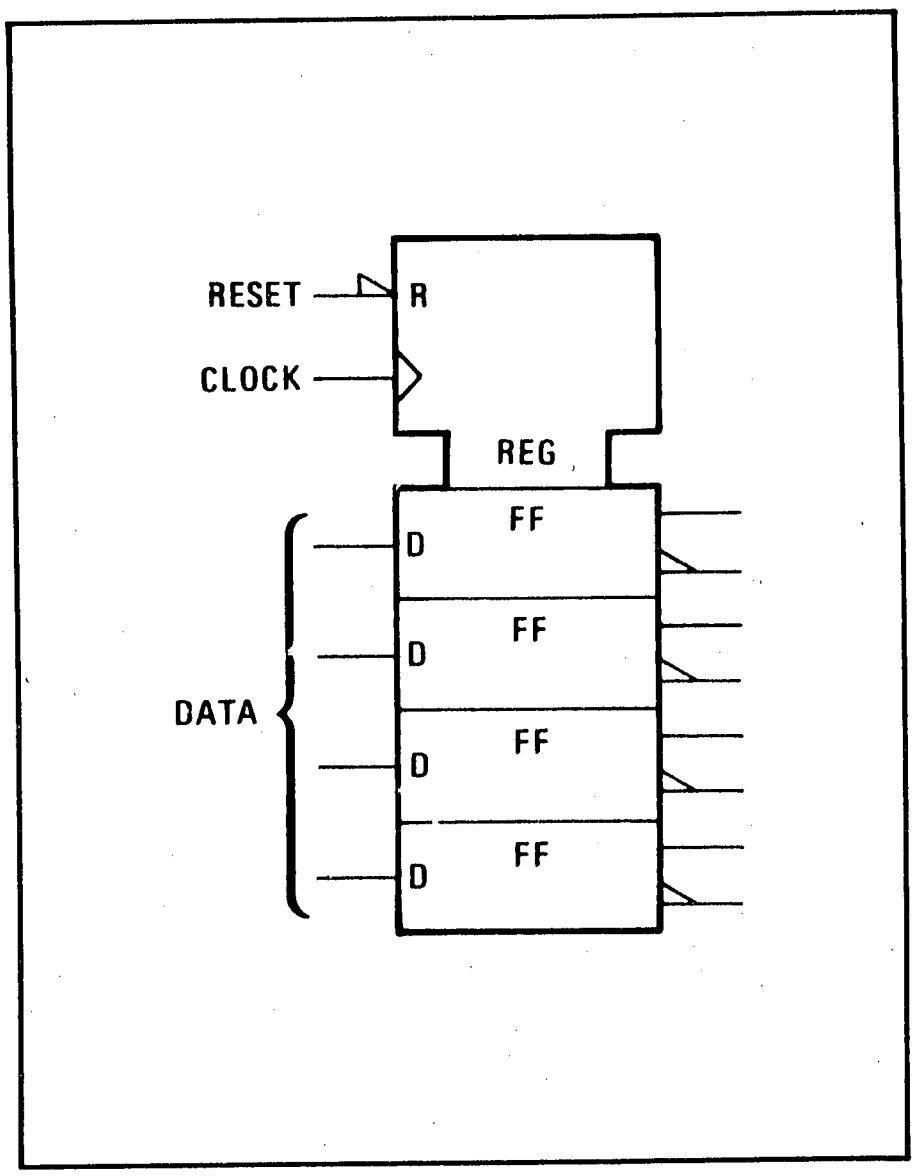


Figure 8-11. Quad D-Type Latch (Combined)

8-35. Complex Logic Symbology and Operating Principles

Microprocessor. For information regarding this device, refer to the principles of operation on Service Sheet 1.

Read Only Memory (ROM). The ROM in Figure 8-12 provides permanent storage for up to 2048 eight-bit words. Memory words are addressed by the address bus. When all control inputs are active, the output of the ROM is enabled. When any one of the EN inputs are inactive, the output is forced into an inactive (high impedance) state.

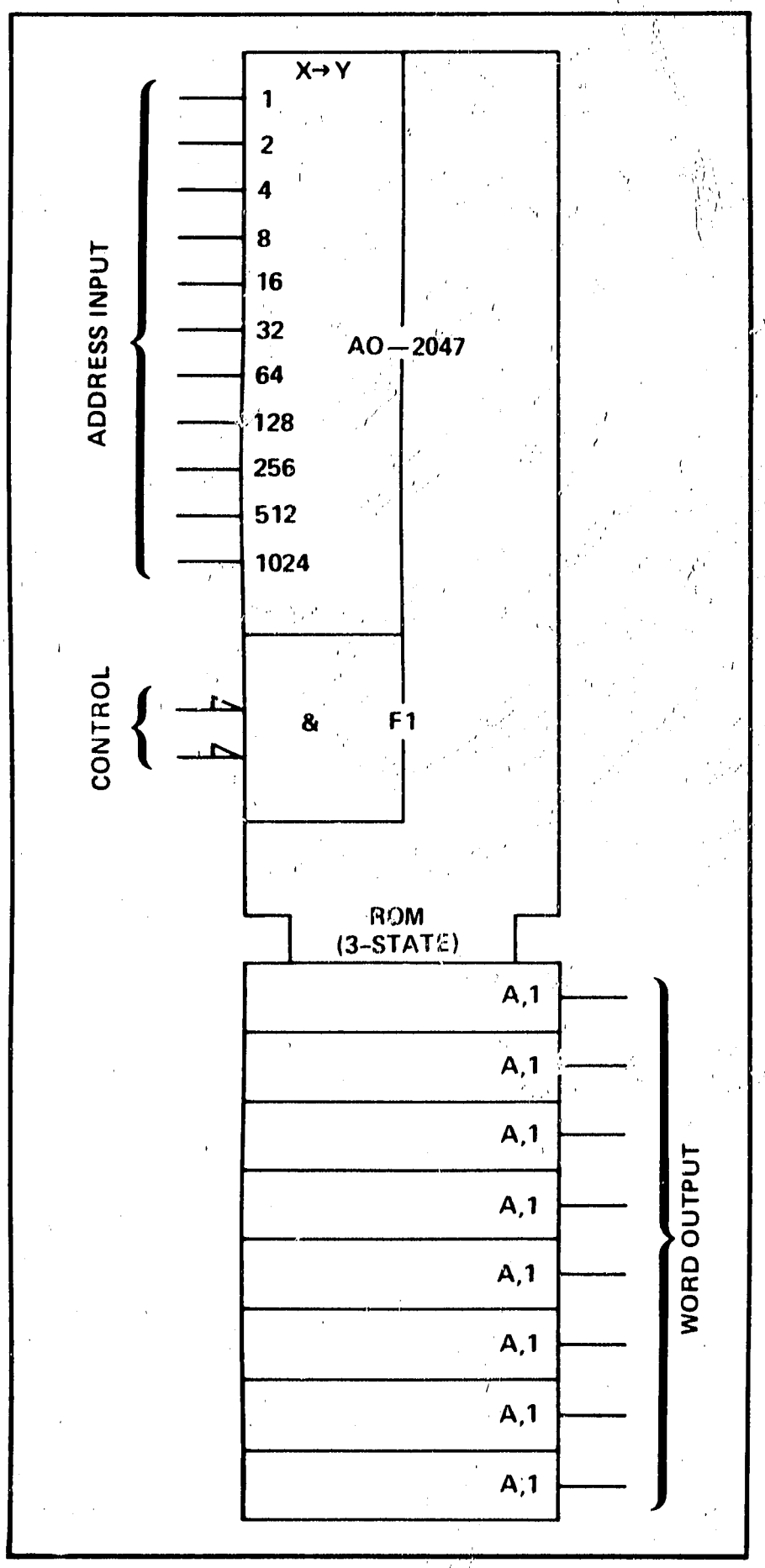


Figure 8-12. Read Only Memory (ROM)

Multiple Bus Transceivers. The data bus buffer in Figure 8-13 is used as a buffer between the Transceiver Interface's interface adapter (GPIA) and the external HP-IB data bus. This buffer allows bidirectional data transfer controlled by the talk enable (TE) and pull-up enable (PE) inputs.

The handshake and control buffer in Figure 8-14 is used as a buffer between the Transceiver Interface's interface adapter (GPIA) and the external HP-IB handshake and control lines.

The management of bidirectional Figure 8-12. Read Only Memory data flow is provided by the (ROM) Talk Enable (TE) and Attention (ATN) inputs.

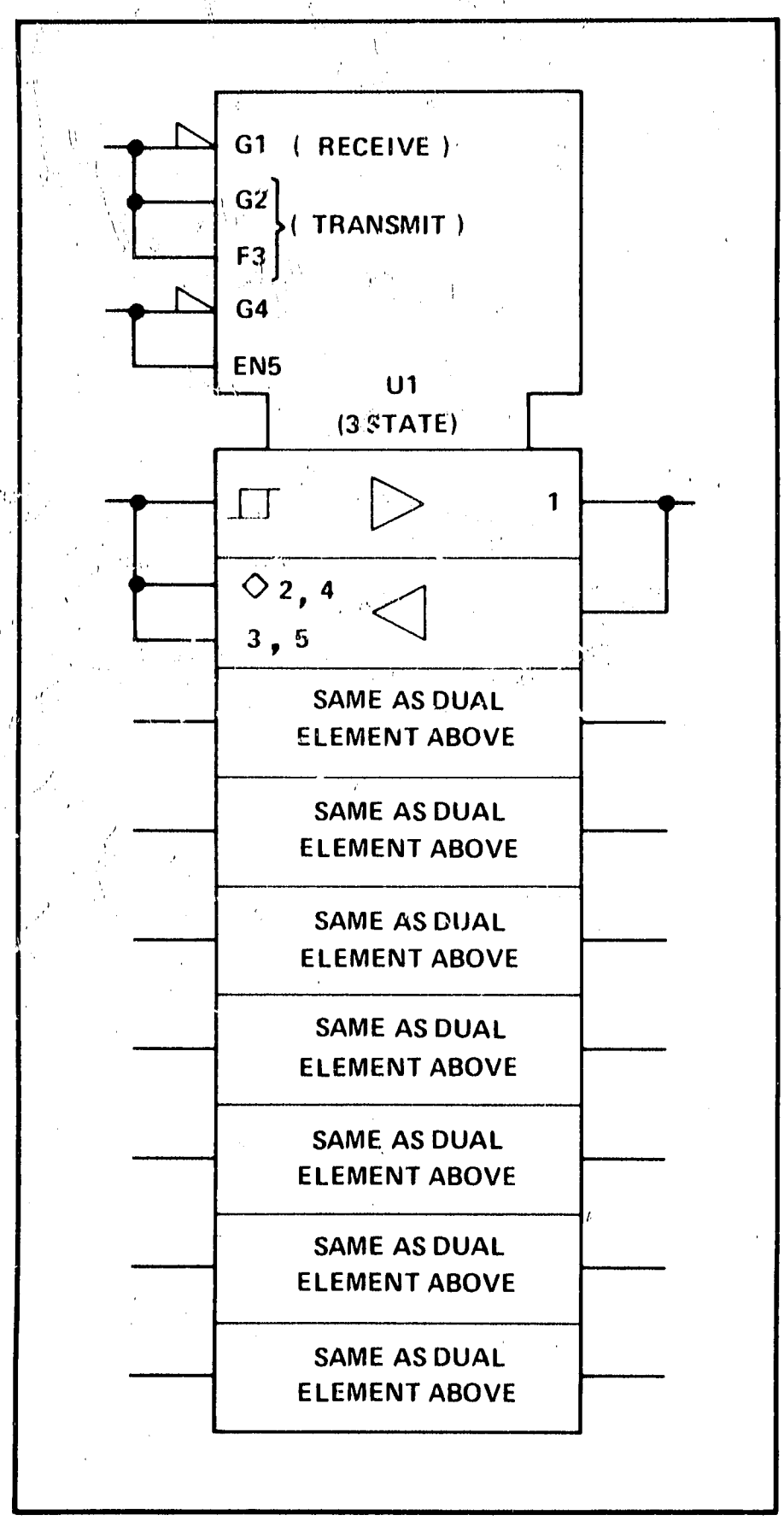


Figure 8-13. HP-IB Data Bus Buffer

Service Sheet 1 contains more detailed information regarding these bus transceivers.

NOTE

The illustrated configuration in Figure 8-14 represents the device operation as determined by pin 11 tied high.

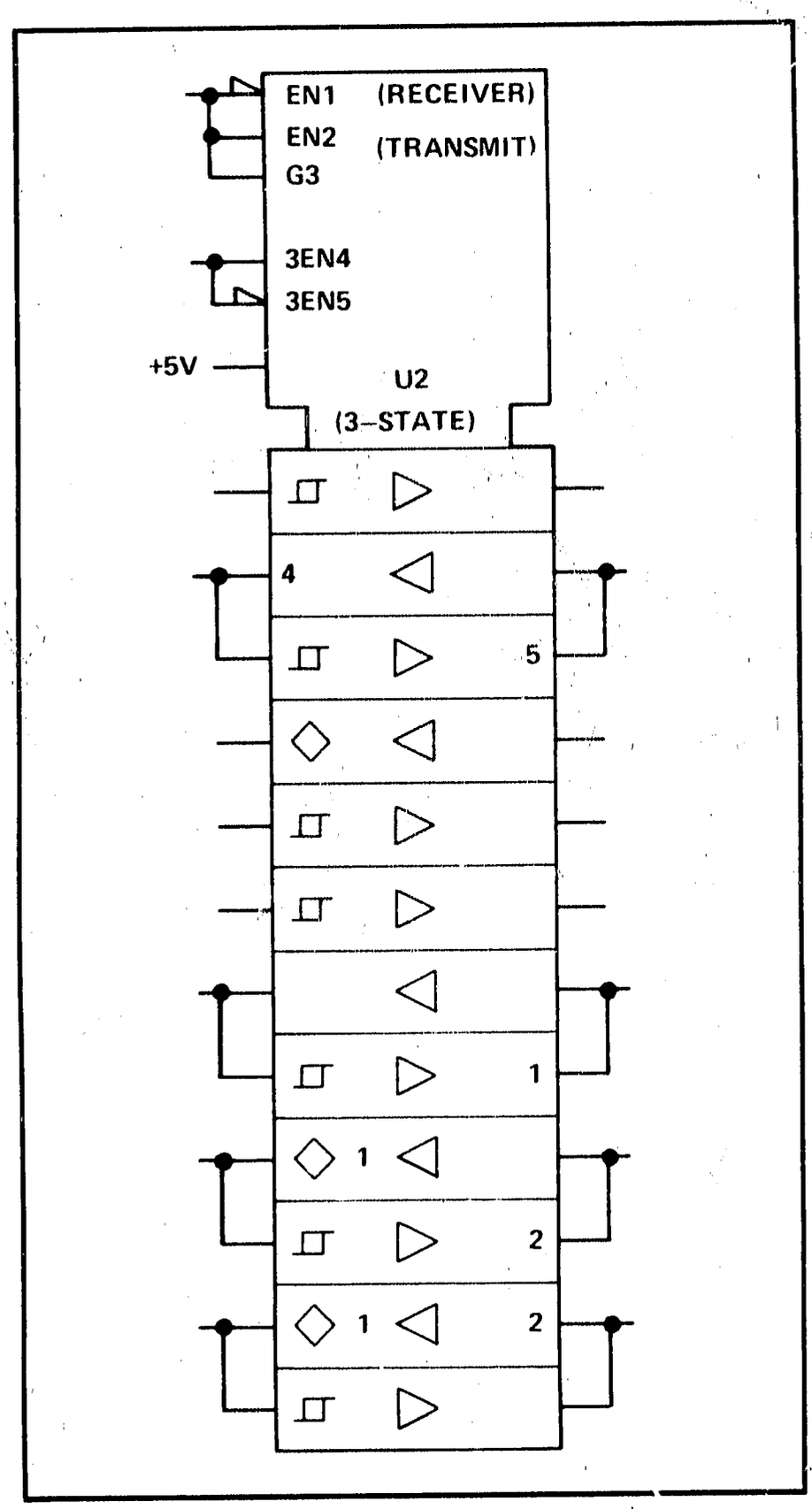


Figure 8-14. HP-IB Handshake and Control Buffer

General Purpose Interface Adapter (GPIA). The GPIA in Figure 8-15 interfaces the microprocessor in the instrument to the Hewlett-Packard Interface Bus (HP-IB). The GPIA is assigned to automatically handle HP-IB protocol. More detailed information regarding the operation and description of the General Purpose Interface Adapter can be found on Service Sheet 1.

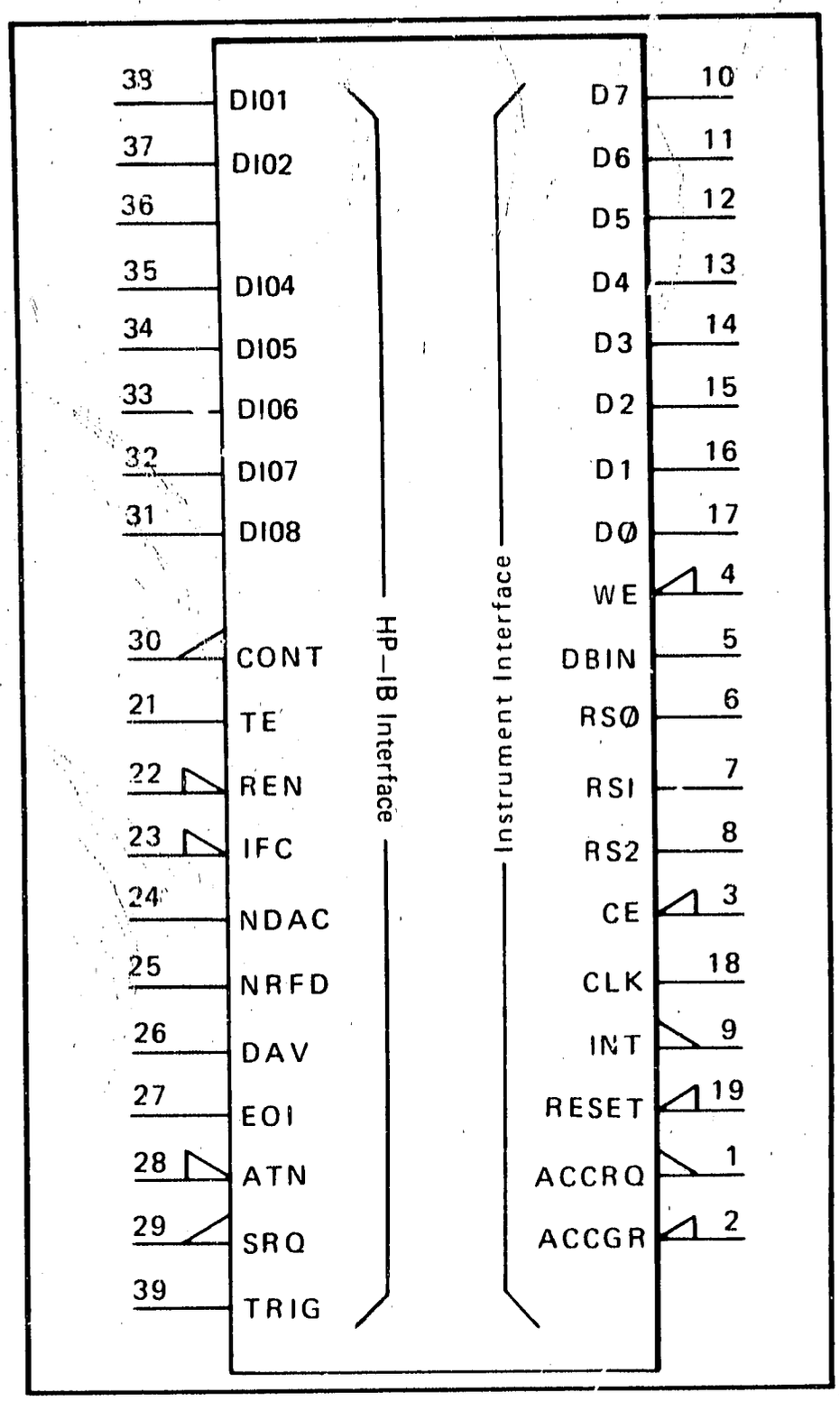


Figure 8-15. General Purpose Interface Adapter (GPIA)

Non-inverting Comparator. The non-inverting comparator is used as a level-sense amplifier. A voltage reference is connected to the inverting input as shown in Figure 8-16. When the voltage level on the non-inverting input crosses the reference, the output voltage is switched to the opposite polarity until the input signal recrosses the reference voltage level.

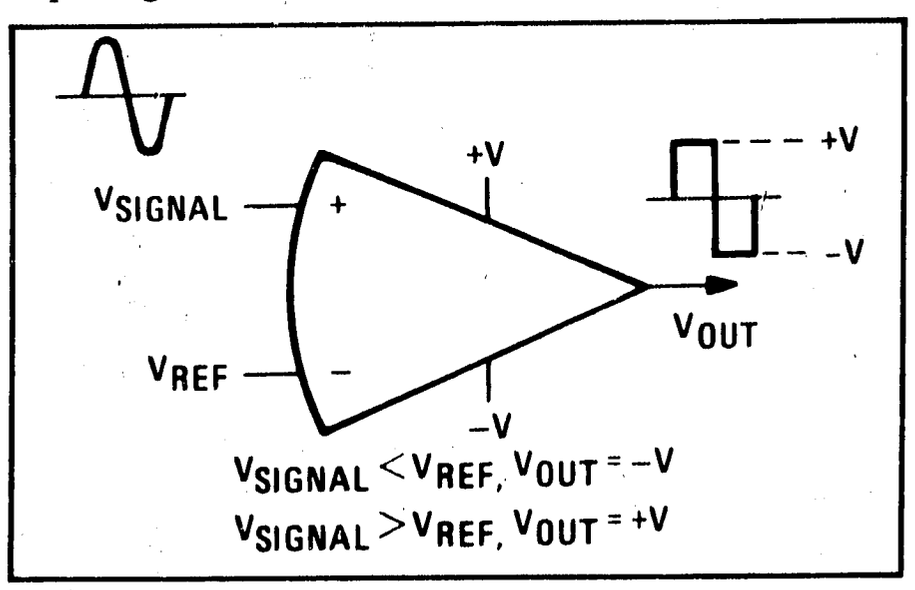


Figure 8-16. Non-inverting Comparator

Table 8-2. Schematic Diagram Notes (1 of 3)

BASIC COMPONENT SYMBOLOGY

R, L, C — Resistance is in ohms, inductance is in microhenries, capacitance is in microfarads, unless otherwise noted.

P/O — Part of.

✳ — Indicates a factory selected component.

Panel Control.

Screwdriver adjustment.

Encloses front panel designation.

Encloses rear panel designation.

Circuit assembly borderline.

Other assembly borderline.

Heavy line with arrows indicates path and direction of main signal.

Indicates path and direction of main feedback.

Earth ground symbol.

Assembly ground. May be accompanied by a number or letter to specify a particular ground.

Chassis ground.

n — Represents n number of transmission paths.

Test Point: Terminal provided for test probe.

918 — Indicates wire or cable color code. Color code same as resistor color code. First number indicates base color, second and third numbers indicate colored stripes.

Indicates shielding conductor for cables.

Indicates a plug-in connection.

Indicates a soldered or mechanical connection.

Connection symbol indicating a male connection.

Connection symbol indicating a female connection.

Resistor.

Variable Resistor.

General purpose diode.

Breakdown Diode: Zener

Light-Emitting Diode.

SCR (Silicon Controlled Rectifier).

FET: Field Effect Transistor (N-channel).

MOSET: Metal Oxide Semiconductor Field Effect Transistor. Enhancement mode, N channel

Dual Transistor.

Transistor NPN

Transistor PNP

Electrolytic Capacitor.

Toroid: Magnetic core inductor.

Operational Amplifier.

Fuse

Pushbutton Switch.

Toggle Switch.

LOGIC SYMBOLOGY

&— AND Gate

≥1 — OR Gate

&○ — NAND Gate

≥1○ — NOR Gate

=1 — Exclusive OR Gate

Buffer/Amplifier

Inverter

Table 8-2. Schematic Diagram Notes (2 of 3)

FUNCTION LABEL ABBREVIATIONS

Σ	Adder
	Amplifier/Buffer
	Schmitt Trigger
&	AND
≥1	OR
=1	Exclusive OR
X→Y	Encoder, Decoder
◇	Open Collector
	Monostable Multivibrator
BCD	Binary Coded Decimal
CTR	Counter
DAC	Digital-to-Analog Converter
FF	Flip-Flop
I/O	Input/Output
LED	Light-Emitting Diode
MUX	Multiplexer
RAM	Random-Access Memory
REG	Register
ROM	Read Only Memory
RPG	Rotary Pulse Generator

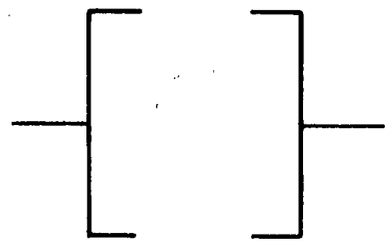
LINE LABEL ABBREVIATIONS

CK, C	Clock Input
D	Data or Delay Input (Flip-Flop)
EN	Enable
G	Gating Input
LSB	Least Significant Bit
MSB	Most Significant Bit
Q	Output
$\overline{Q}$	Not Q (Complement of Q)
R	Reset or Clear Input
RD	Read
S	Set Input
T	Trigger Input (Monostable)
WR	Write
+1	Count Up
−1	Count Down
3-ST	3-State (placed by function)

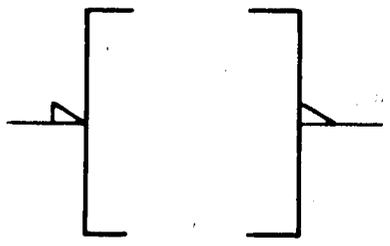
Table 8-2. Schematic Diagram Notes (3 of 3)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

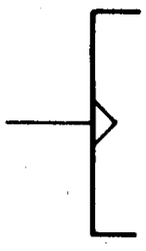
Input and Output Indicators



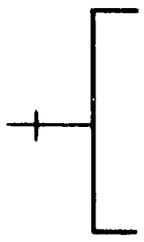
Implied Indicator—Absence of polarity indicator (see below) implies that the active state is a relative high voltage level. Absence of negation indicator (see below) implies that the active state is a relative high voltage level at the input or output.



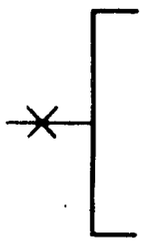
Polarity Indicator—The active state is a relatively low voltage level.



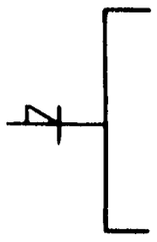
Dynamic Indicator—The active state is a transition from a relative low to a relative high voltage level.



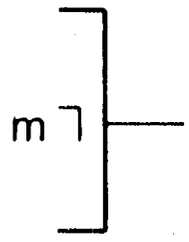
Inhibit Input—Input that, when active, inhibits (blocks) the active state outputs of a digital device.



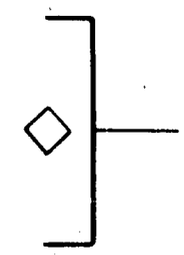
Analog Input—Input that is a continuous signal function (e.g., a sine wave).



Polarity Indicator used with Inhibit Indicator—Indicates that the relatively low level signal inhibits (blocks) the active state outputs of a digital device.



Output Delay—Binary output changes state only after the referenced input (m) returns to its inactive state (m should be replaced by appropriate dependency or function symbols).



Open Collector or Open Emitter Output—Output that must form part of a distributed connection.

SERVICE SHEET BD1
MODEL 8954A TRANSCEIVER INTERFACE
TROUBLESHOOTING HELP

PRINCIPLES OF OPERATION

The Transceiver Interface is divided into four subsections; each represented by the following service sheets:

Service Sheet 1	HP-IB Interface/Microprocessor/Relay Control
Service Sheet 2	Relays and Relay Drivers
Service Sheet 3	Interface Keyboard and Annunciators
Service Sheet 4	Power Supply

The Transceiver Interface uses relays to establish the instrument's signal through-paths. These relays are switched into user defined configurations via the instrument's microprocessor and associated control circuitry. The microprocessor performs relay switching functions after it receives and interprets data from either a local or remote source.

In the Local mode, the microprocessor accepts data from the Transceiver Interface keyboard; located on the instrument's front panel. In the Remote mode, the microprocessor receives data from the HP-IB controller via the HP-IB Interface.

Figure 8-17 is a simplified, functional illustration of the Transceiver Interface circuitry. This diagram may be helpful in gaining an overview of the instrument's Block Diagram BD1.

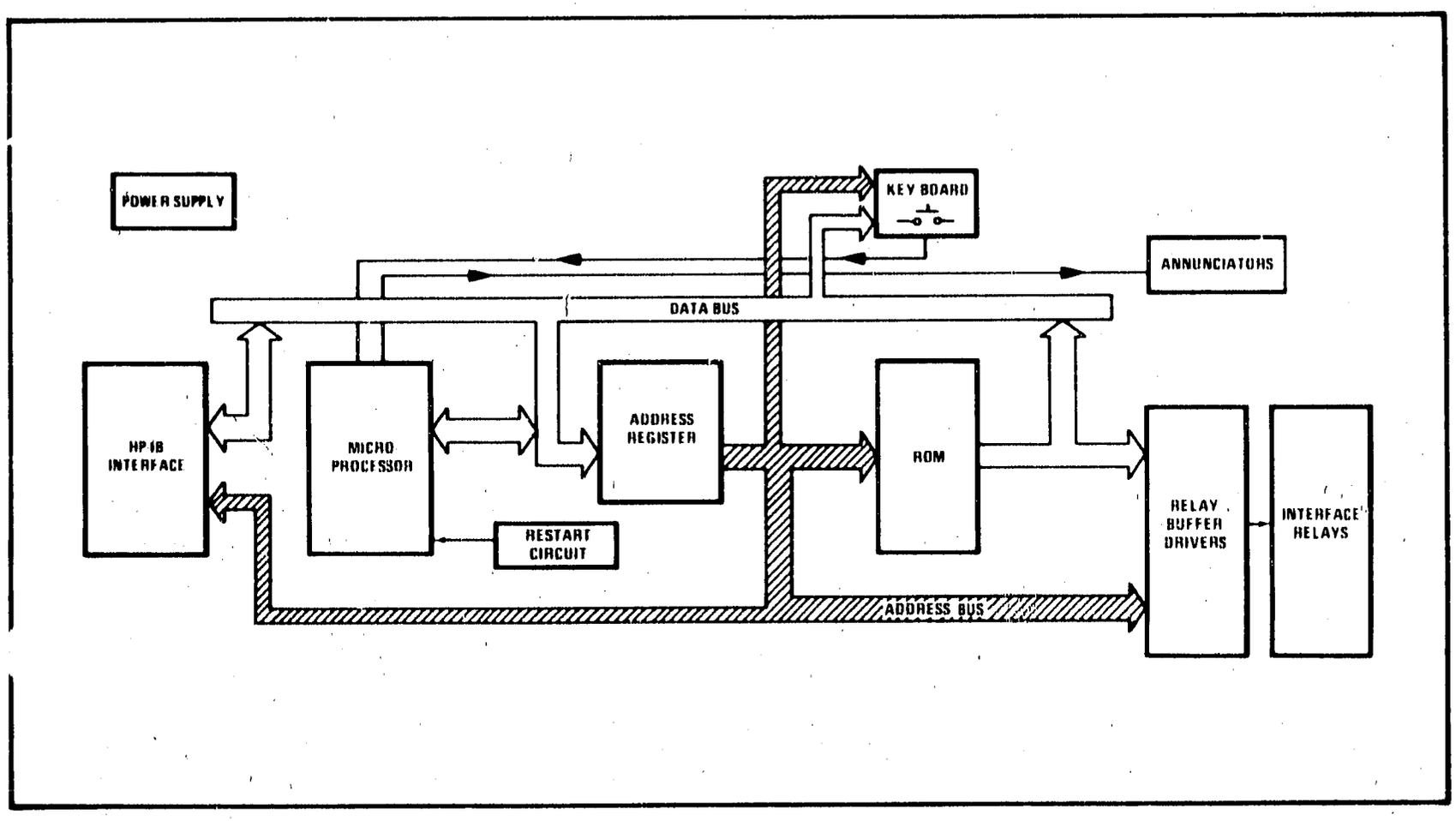
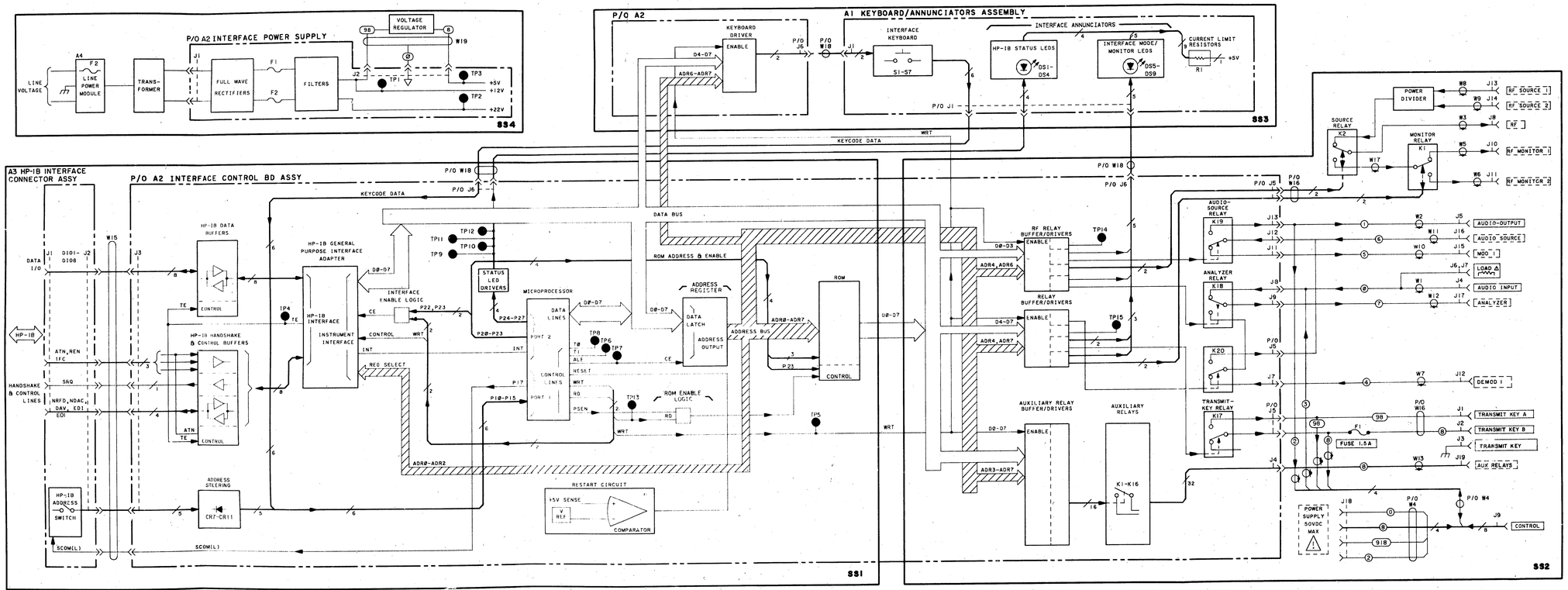


Figure 8-17. Simplified Block Diagram



SERVICE SHEET BD1

Figure 8-18. Interface Control Board

SERVICE SHEET 1
INTERFACE/MICROPROCESSOR/RELAY CONTROL (P/O A2)
TROUBLESHOOTING HELP

PRINCIPLES OF OPERATION

Microprocessor

Microprocessor U11 serves as the internal controller for the Transceiver Interface. U11 implements its control over the instrument via the Address Register U12 and the Read Only Memory (ROM) U15.

The microprocessor, upon power-up, executes a monitor program (stored in its on-chip memory) for instrument-function initialization.

Local Mode. The monitor program configures the Transciever Interface in the Local operating mode by enabling the keyboard; this mode allows full, front-panel control of the instrument. Following the keyboard enable, the microprocessor scans Port 1 (P10-P15) for any data output on the Keycode Data lines. When a key is pressed, the microprocessor receives and internally interprets the keyed command and forms an address that is input to ROM U15. This address dictates the switch position of a specific relay within the Transceiver Interface. (The instrument will remain functioning in the Local mode unless it is interruped by a remote source; that is, an HP-IB instrument controller.)

Remote Mode. The HP-IB instrument controller sends a remote-mode command that is received by the instrument's HP-IB General Purpose Interface Adapter (GPIA) U7. The GPIA, upon receipt of this remote mode command, interrupts the microprocessor, causing it to disable the keyboard and only receive ASCII (American Standard for Information Interchange) encoded data from the GPIA. This ASCII encoded data from the GPIA is interpreted by the microprocessor to perform either HP-IB protocol functions or activation of the instrument's relay switches.

NOTE

The Transceiver Interface's LOCAL key is the only key not disabled in Remote operation, unless a "Local Lockout" command has been sent by the instrument controller.

The Transceiver Interface's Remote-mode status is indicated by the HP-IB status LEDs on the front panel.

Microprocessor Reset. The microprocessor is initialized, upon power-up, by a momentary low at its Reset input, U11 pin 4. This momentary low is caused by the charging of C8 through a resistor (internal to the microprocessor at pin 4). The Reset input is disabled when C8 is sufficiently charged.

Microprocessor Restart Circuit

The Restart Circuit re-initializes the microprocessor in the event of a power supply glitch. VR1 serves as a voltage reference for the comparator U16. When the comparator senses a power supply interruption at the node of its non-inverting input, its output grounds the U11 Reset pin, Pin 4. The Reset input is held low preventing C8 from charging until the supply voltage reaches the level necessary for correct instrument operation.

Address Register

The Address Register U12 is a D-type flip-flop which functions as a data latch. The address data written to the Register is latched at the address inputs of the ROM U15. This address data represents the eight, least-significant bits of the ROM's 11-bit address.

Read Only Memory (ROM)

The ROM U15 is the device that contains the data necessary for relay switch positioning. The ROM receives address information through 11 address inputs (ADR0-ADR10): The eight, least-significant, address bits (ADR0-ADR7) are received from the Address Register. The three, most-significant, address bits are received from the microprocessor's Port 2 (P20-P23). The ROM, upon receipt of an address and enable pulse, outputs data on the data bus for relay-switch control.

Hewlett-Packard Interface Bus (HP-IB) Address

The HP-IB address is established by the HP-IB Address Switch S1 on the rear panel. S1 places its set address on the I/O lines (Port 1) of the microprocessor by momentarily enabling the switch-common line SCOM (P17, low enable). The microprocessor reads these I/O lines and stores the address in the address register of the HP-IB General Purpose Interface Adapter U7 at power-up. The Transceiver Interface can then respond to its address when the controller places it on the HP-IB Data I/O lines.

To change the address, the switch must be changed to the new address and then the LINE OFF/ON switch must be cycled OFF, then ON.

HP-IB Handshake and Control Buffer

The Handshake and Control Buffer U2 transfers control and handshake information between the HP-IB controller and the Transceiver Interface's GPIA U7. The Talk Enable (TE) line determines the direction of data transfer. The Talk Enable line allows the instrument to be a receiver (listener) when TE is low. When TE is high, the instrument may serve as a transmitter (talker). The Attention (ATN) line, when true, allows the GPIA to be polled by the controller. When false, the Transceiver Interface is allowed to signify to the controller the end of a multi-byte information string.

HP-IB Data Bus Buffer

The Data Bus Buffer U1, allows bidirectional data transfer via the data lines DIO1-DIO8 between the HP-IB controller and the Transceiver Interface's GPIA U7. The Talk Enable (TE) line determines the direction of data flow. When the instrument is a listener (receiver), TE is low. With TE low, the receive buffer's outputs are enabled out of three-state. The receive buffers, with the exception of their Schmitt Trigger inputs, do not change the incoming data.

HP-IB General Purpose Interface Adapter

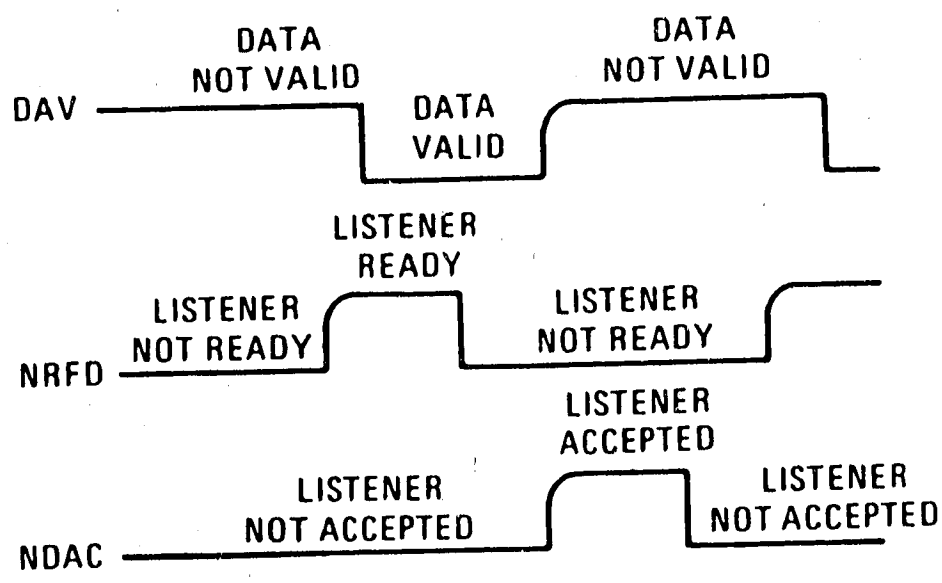
The General Purpose Interface Adapter (GPIA) U7, interfaces the microprocessor in the Transceiver Interface with the controller via the Hewlett-Packard Interface Bus.

The Transceiver Interface GPIA U7, becomes active when the instrument is turned on. At power-up, the GPIA's initialization is insured by the RC network at its Reset pin, pin 19. The GPIA also receives its clock, derived from the microprocessor system clock at this time.

The Transceiver Interface Remote operation is initiated by the HP-IB controller. When the controller addresses the instrument, the GPIA sends an interrupt to the microprocessor. The microprocessor interrupt-service routine enables the GPIA Register Select lines ADR0-ADR2 by way of the Interface Enable Logic (U14 A, B, and D and U13 B). The ability to select the GPIA registers allows the microprocessor to talk and listen to the HP-IB controller via the Data Bus.

The GPIA has five "control" lines: REN (L), IFC (L), ATN (L), EOI (L), and SRQ (L). These lines provide the Transceiver Interface with the ability to properly handle HP-IB protocol.

The GPIA has three "handshake" lines: NDAC (L), NRFD (L), and DAV (L). The handshake lines allow the Transceiver Interface to transfer data in an asynchronous, bidirectional mode with the HP-IB controller. The handshake occurs when the listener first indicates when it is ready to listen (receive data). The talker responds by indicating when the data that appears on the data lines (DIO1-DIO8) is valid. The listener then informs the talker when the data has been accepted, thus completing a data transfer. See Figure 8-19 for the handshake-timing diagram.



Start with the talker waiting for the listener to release NRFD (not ready for data) indicating it is ready.

When the listener is ready, NRFD goes high (false). The talker then places valid data on DIO1 through DIO8 and sets DAV (data valid) low (true).

NRFD then goes low (true) and the talker waits for the listener to indicate it has accepted the data (or ignored it) by releasing the NDAC (not data accepted) to a high (false, i.e., data is accepted).

The talker sets DAV high (false) and again waits for the listener to release NRFD.

(NOTE that if ATN is true, all instruments on the bus must handshake regardless of whether they are talkers, listeners, or bystanders. Being in remote or local has noting to do with handshaking. if ATN is false, they only handshake if addressed.)

Figure 8-19. Simplified HP-IB Handshake Between a Talker (Computer Controller) and One Listener (Transceiver Interface)

TROUBLESHOOTING

Diagnostic Program (Using an HP-IB Controller)

OM (Output Memory) Command. This command is a useful service diagnostic which verifies the integrity of the HP-IB Interface and Control Circuitry; namely the Microprocessor (U11), Address Register (U12), and ROM (U15) as well as associated circuitry. This is accomplished by summing each byte contained in ROM U15, then adding 255 to this sum. The resultant value, which indicates correct circuit operation, is equal to zero. Since this command is executed by an HP-IB controller, internal access to the Transceiver Interface for the performance of this test is unnecesary.

The following programs depict typical usage of the "OM" command using the HP 9825, HP 85F, and HP 9845 Desktop Computers.

HP 9825 (hpl)

```
0: wrt 703,"OM"
1: 255→J
2: for I=1 to
 2048;J+rdb(703)
 →J;dsp I,J;next
  I
3: dsp Jmod256,
 I-1
*4237
```

HP 85F/ 9845 (BASIC)

```
10      OUTPUT 703;
"OM"
20      J=255
30      FOR I=1 TO
2048
40      J=J+READBIN
(703)
50      PRINT I;J
60      NEXT I
70      PRINT LIN(2
0);J MOD 256;I-1
80      END
```

The correct display output is:

```
0 . 0 0                                    2048 . 0 0
```

The first number is the check sum, while the second is the last memory location read.

Should this confidence test fail, it will be necessary to troubleshoot the instrument using signature analysis.

Signature Analysis

Digital troubleshooting of the Transceiver Interface circuitry is accomplished by the use of signature analysis. The instrument's signature analysis test program is stored in the on-chip ROM of the microprocesor U11.

The HP 5005A Signature Multimeter is a node-level troubleshooting tool. The Transceiver Interface has specified logic nodes with unique signatures; specific nodes and signatures listed in Tables 8-3 through 8-14. Refer to paragraph 8-21 for more information regarding digital signature analysis.

The Transceiver Interface has single nodes with multiple integrated circuits (IC's) connected to them. This configuration is a characteristic of bus structured instruments and can complicate troubleshooting since any one of the IC's that are connected to that node can cause a bad signature. The signature multimeter will not locate defective components or circuit traces; however, it will isolate the problem to a specific node.

The HP 546A Logic Pulser and the HP 547A Current Tracer can then be used to isolate the problem to an IC or to a specific point on a circuit trace. (References to block diagram BD1 and schematics SS1-SS4 are necessary to follow bus lines throughout the instrument.) Information on the use of the 546A and the 547A is in Application Note 163-2, which is available from any Hewlett-Packard sales or service office.

Grounding of A2TP6 turns on the test program. For each test program, a characteristic +5 VDC signature is given. With the exception of the Control Circuit Test, a correct +5 VDC signature does not indicate that a test has completely passed. It merely indicates that the test program is cycling properly and that the signature analyzer pod has been connected correctly. Many IC failures cause a node to be stuck either high (+5 VDC signature) or low (0 VDC signature).

Refer to Section I, "Service Accessories" for accessories listed as troubleshooting aids for the HP-IB Interface.

TROUBLESHOOTING USING SIGNATURE ANALYSIS

NOTE

The HP 5005A Signature Multimeter is recommended for troubleshooting the Transceiver Interface. If the HP 5004A Signature Multimeter is used, note the following signature changes.

Table 8-3. Signature Changes for the HP 5004A Signature Multimeter

TEST	NODE		SIGNATURE
Test 3. Address Test Table 8-6	U11#12	D0	4AF6
	U11#13	D1	INVALID
	U11#14	D2	PPCU
	U11#15	D3	85F6
	U11#16	D4	C06F
	U11#17	D5	INVALID
	U11#18	D6	C24P
	U11#19	D7	OP7C
Test 4. Interface Test Table 8-9	U14#13	Write (I)	HH9A
Table 8-10	U2#9	SRQ(L)	INVALID (A2TP4 (TE) Grounded)

Test 1. Control-Circuit Test.

Purpose. Verify the correct operation of the Control Circuit; namely the Microprocessor, Address Register, and ROM circuitry.

NOTE

This test should be performed when any repairs to the Control Circuit have been made; insuring that the suspected malfunction has been corrected.

Setup. Connect the signature multimeter TIMING POD as follows:

1)	START	to	A2TP12 – LISTEN.
2)	STOP	to	A2TP12 – LISTEN.
3)	CLOCK	to	A2TP7 – SA CLOCK.
4)	GROUND	to	A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1)	START	–	Leading Edge.
2)	STOP	–	Trailing Edge.
3)	CLOCK	–	Trailing Edge.

NOTE

The ground connection on the pod of the signature analyzer should be as close as possible to the circuitry being checked. (Poor grounding can cause unstable signatures.)

Set up the Transceiver Interface as follows:

1) Jumper A2TP6 to A2 Ground.

2) Cycle the LINE OFF/ON switch OFF and then ON.

Table 8-4. Control Circuit Signatures

NODE		SIGNATURES
U15#21	+5VDC	2C15
U15#24	+5VDC	2C15

If the Control Circuit signatures are incorrect, continue with the following steps (1-6):

1. Check power supply voltages and re-check signature multimeter connections.

2. Check the microprocessor system clock, (U11 pins 2 and 3) for a 3 MHz signal (distorted sine wave) with an oscilloscope.

3. Use the signature multimeter Data Probe as a logic probe to test TP7 and TP12 for logic activity. No activity on these test points may indicate a defective microprocessor.

4. Check that the microprocessor's Reset line RESET (L), pin 4 is high.

5. Check that the microprocessor's Interrupt line INT (L), pin 6 is high.

6. If the Transceiver Interface still does not pass the Control Circuit Test, perform the following tests in order to isolate the defective node(s) within the Control Circuit:

   - Test 2. Data Bus Test (SS1).

   - Test 3. Address Bus Test (SS1).

7. If the Control Circuit Test passes (correct signatures) and the instrument is still inoperable, perform the following tests to help isolate the defective node(s) not within the Control Circuit:

- Test 4. Interface Test (SS1).
- Test 5. Relay Driver Test (SS2).
- Test 6. Keyboard Test (SS3).

Test 2. Data Bus Test

Purpose. Isolate and identify defective Data Bus line(s) as well as any devices which may be associated with the malfunction of the Data Bus.

The Data Bus signatures used in this test are generated solely by the microprocessor. Any Address Register and ROM logic activity on the Data Bus is transparent to the signature multimeter because of the strategic placement and length of the gate (measurement window) used to produce the signatures in this test.

Setup. Connect the signature multimeter TIMING POD as follows:

1)	START	to	A2TP11 – TALK.
2)	STOP	to	A2TP11 – TALK.
3)	CLOCK	to	A2TP5 – WRITE (L).
4)	GROUND	to	A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1)	START	– Leading Edge.
2)	STOP	– Trailing Edge.
3)	CLOCK	– Leading Edge.

Set up the Transceiver Interface as follows:

1) Jumper A2TP6 to A2 Ground.
2) Cycle the LINE OFF/ON switch OFF and then ON.

Table 8-5. Data Bus Signatures

NODE		SIGNATURES
U15#21	+5VDC	HH9A
U15#24	+5VDC	HH9A
U15#9	D7	96PF
U15#10	D6	725C
U15#11	D5	P5PH
U15#13	D4	5CP0
U15#14	D3	7P25
U15#15	D2	85PA
U15#16	D1	77F7
U15#17	D0	6PCP

If any of the Data Bus signatures are incorrect (e.g., HH9A or 0000), use the logic pulser and current tracer to determine which component is "hung up" on the Data Bus. However, if by using the pulser/tracer combination, the Data Bus does not appear defective, then replace the Microprocessor A2U11.

Test 3. Address Test

Purpose. Isolate and identify defective Address Bus line(s) as well as components that may be associated with the malfunction of the Address Bus.

Set up the signature multimeter TIMING POD connections as follows:

1) START to A2TP12 – LISTEN.
2) STOP to A2TP12 – LISTEN.
3) CLOCK to A2TP13 – READ (L).
4) GROUND to A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1) START – Leading Edge.
2) STOP – Trailing Edge.
3) CLOCK – Trailing Edge.

Set up the Transceiver Interface as follows:

1) Jumper A2TP6 to A2 Ground.

2) Cycle the LINE OFF/ON switch OFF and then ON.

Table 8-6. Address Signatures

NODE		SIGNATURE
U15#21	+5VDC	0P7C
U15#24	+5VDC	0P7C
U15#1	A7	PPC2
U15#2	A6	C24P
U15#3	A5	22HF
U15#4	A4	C06F
U15#5	A3	85F6
U15#6	A2	PPCU
U15#7	A1	4176
U15#8	A0	4AF6
U11#12–19	D0–D7	0P7C

If any of the Address Signatures are incorrect (assuming the instrument passed the Data Bus Test, Test 2) troubleshoot the Address Bus in order to locate the failure. If the Address Signatures were correct, continue with the following signatures which test the most significant address bits and the enable lines for ROM U15.

Table 8-7. MSB Signatures

NODE		SIGNATURE
U15#19	P22	5484
U15#22	P21	UU77
U15#23	P20	787U
U15#18	P23	0001
U15#20	PSEN*RD(L)	0P7C

The signatures P20-P22 test the ROM's most-significant address bits. If any of the signatures (P20-P22) are incorrect, use the logic pulser and current tracer to troubleshoot these lines. However, if the pulser/tracer combination fails to locate a defective line or component and the signatures are still incorrect, then replace Microprocessor A2U11.

P23 and PSEN*RD(L) are the ROM enable lines. If the PSEN*RD(L) signature is incorrect, continue with the following signatures which test the ROM Enable logic.

Table 8-8. ROM Enable Signatures

NODE		SIGNATURE
U14#8	PSEN*RD	0000
U14#9	READ	0P7C
U14#10	PSEN	0P7C

Test 4. Interface Test

Interface Tests A, B, C, and D test the Transceiver Interfaces HP-IB capabilities only. The devices under test are: the General Purpose Interface Adapter and its associated enable logic, Data Bus Buffer, Handshake & Control Buffer, and the HP-IB Address Switch.

Before performing the Interface Test, verify the following:

1. That the Transceiver Interface passes the Control Circuit Test (Test 1).

2. That the GPIA Interrupt line, INT (L) is high.

3. That the GPIA Reset line, RESET (L) is high.

A. GPIA Enable Logic.

Purpose. Verify the correct operation of the GPIA Enable Logic.

Setup. Connect the signature multimeter TIMING POD as follows:

1)	START	to	A2TP11 – TALK.
2)	STOP	to	A2TP11 – TALK.
3)	CLOCK	to	A2TP5 – WRITE (L).
4)	GROUND	to	A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1)	START	–	Leading Edge.
2)	STOP	–	Trailing Edge.
3)	CLOCK	–	Leading Edge.

Set up the Transceiver Interface as follows:

1) Jumper A2TP6 to A2 Ground.

2) Cycle the LINE OFF/ON switch OFF and then ON.

Table 8-9. Control Circuit Signatures

NODE		SIGNATURES
U14#14	+5VDC	HH9A
U14#6	CE(L)	13A6
U14#5		FP3F
U14#4		HH9A
U14#3		13A6
U14#2		2HU0
U14#1		U2U6
U14#12	READ(L)	HH9A
U14#13	WRITE(L)	0000

B. HP-IB Transmit Test

Purpose. Verify the correct operation of the HP-IB General Purpose Interface Adapter, HP-IB Handshake & Control buffers, Data Bus transmit buffers as well as associated circuit traces.

Setup. Connect the signature multimeter TIMING POD as follows:

1)	START	to	A2TP11 – TALK.
2)	STOP	to	A2TP11 – TALK.
3)	CLOCK	to	A2TP5 – WRITE (L).
4)	GROUND	to	A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1) START – Leading Edge.
2) STOP – Trailing Edge.
3) CLOCK – Leading Edge.

Set up the Transceiver Interface as follows:

1) Remove U7 from its socket (ensure that the Transceiver Interface line switch is in the OFF position).

2) Insert Test 1 jumper (HP part number 85650-60052) into U7 socket.

3) Jumper A2TP6 to A2 Ground.

4) Disconnect the HP-IB ribbon cable W15 from the A3J2 connector on the rear panel.

5) Turn the Transceiver Interface LINE OFF/ON switch to the ON position.

Test 1 jumper is used to connect the Data Bus lines D0-D7 to the DIO8-DIO1 lines (respectively). The jumper also connects five of the D0-D7 lines to the Handshake/Control transmit buffers: SRQ (L), EOI (L), DAV (L), NRFD (L), and NDAC (L).

A jumper cable for A2TP4 is necessary for the performance of this signature test.

Table 8-10. HP-IB Signatures

NODE		SIGNATURE A2TP4 (TE) TIED HIGH	SIGNATURE A2TP4 (TE) GROUNDED
U1#20	+5VDC	HH9A	HH9A
U1#2	DIO1	96PF	HH9A
U1#3	DIO2	725C	HH9A
U1#4	DIO3	P5PH	HH9A
U1#5	DIO4	5CP0	HH9A
U1#6	DIO5	7P25	HH9A
U1#7	DIO6	85PA	HH9A
U1#8	DIO7	77F7	HH9A
U1#9	DIO8	6PCP	HH9A
U2#20	+5VDC	HH9A	HH9A
U2#4	NDAC(L)	HH9A	85PA
U2#5	NRFD(L)	HH9A	7P25
U2#6	DAV(L)	5CPO	HH9A
U2#7	EOI(L)	P5PH	HH9A
U2#9	SRQ(L)	96PF	96PF

Troubleshoot any lines that have incorrect signatures. If the devices and circuit traces under test do not appear defective, perform the HP-IB Receive Test.

C. HP-IB Receive Test

Purpose. Verify the correct operation of the HP-IB Data Bus and Handshake & Control receive buffers (U1 and U2), as well as associated circuit traces.

Setup. Connect the signature multimeter TIMING POD as follows:

1)	START	to	A2TP11 – TALK.
2)	STOP	to	A2TP11 – TALK.
3)	CLOCK	to	A2TP5 – WRITE (L).
4)	GROUND	to	A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1)	START	–	Leading Edge.
2)	STOP	–	Trailing Edge.
3)	CLOCK	–	Leading Edge.

Set up Transceiver Interface as follows:

1) Remove U7 from its socket (ensure that the Transceiver Interface line switch is in the OFF position).

2) Insert Test 2 jumper (HP part number 08954-60005) into U7 socket.

3) Jumper A2TP6 to A2 GROUND.

4) Disconnect the HP-IB ribbon cable W15 from the A3J2 connector and attach it to the connector on the Test 2 jumper.

5) Turn the Transceiver Interface LINE OFF/ON switch to the ON position.

Test 2 jumper is used to connect the Data Bus lines D0-D7 (via ribbon cable W15) to the receiver side of the Data Bus Buffer U1, DIO1-DIO8 (respectively). The jumper also connects D0-D6 to the receive side of the U2 Handshake & Control Buffer lines: REN (L), IFC (L), NDAC (L), NRFD (L), DAV (L), EOI (L), and ATN (L) respectively.

A jumper cable for A2TP4 is necessary for the performance of this signature test.

If any of the HP-IB Receive Signatures are incorrect, verify that continuity exists (in ribbon cable W15) from each pin on the A3J2 side of the cable to the corresponding pin on the A2J3 connector. If continuity is verified and the signatures are still incorrect, replace the Handshake & Control Buffer U2.

Table 8-11. HP-IB Receive Signatures

NODE		SIGNATURE A2TP4 (TE) TIED HIGH +5 VDC A2TP4 (TE) TIED HIGH	SIGNATURE A2TP4 (TE) GROUNDED A2TP4 (TE) GROUNDED
U1#20	+5VDC	HH9A	HH9A
U1#12	DIO8	INVALID*	96PF
U1#13	DIO7	INVALID	725C
U1#14	DIO6	INVALID	P5PH
U1#15	DIO5	INVALID	5CPO
U1#16	DIO4	INVALID	7P25
U1#17	DIO3	INVALID	85PA
U1#18	DIO2	INVALID	77F7
U1#19	DIO1	INVALID	6PCP
U2#20	+5VDC	HH9A	HH9A
U2#13	ATN (L)	725C	725C
U2#14	EOI (L)	P5PH	P5PH
U2#15	DAV (L)	INVALID*	5CP0
U2#16	NRFD (L)	7P25	INVALID*
U2#17	NDAC (L)	85PA	INVALID*
U2#18	IFC (L)	77F7	77F7
U2#19	REN (L)	6PCP	6PCP

*This invalid state is a result of U2 register's three-state output. Grounding the signature multimeter Data Probe will give a 0000 signature; this signature will not change when an invalid voltage level is measured. Also, the probe lamp will glow dimly, indicating an invalid logic level.

D. HP-IB Address Switch Test.

Purpose. Verify the correct operation of the HP-IB Address Switch and its associated circuitry.

Setup. Connect the signature multimeter TIMING POD as follows:

1) START to A2TP11 – TALK.
2) STOP to A2TP11 – TALK.
3) CLOCK to A2TP5 – WRITE (L).
4) GROUND to A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1) START – Leading Edge.
2) STOP – Trailing Edge.
3) CLOCK – Leading Edge.

Set up the Transceiver Interface as follows:

1) Jumper A2TP6 to A2 Ground.

2) Disconnect ribbon cable W18 from the A1 Keyboard Annunciator Assembly which removes the instrument's keyboard from the lines shared with the Address Switch.

3) Ensure that the HP-IB ribbon cable, W15 is connected from the A2 assembly to the A3 assembly.

4) Cycle the Transceiver Interface LINE OFF/ON switch OFF, then ON.

Table 8-12. Address Switch Signatures

NODE		SIGNATURE Address = 31*	SIGNATURE Address = 00*
U11#40	+5VDC	HH9A	HH9A
CR7 Anode	P14	3U12	48P5
CR7 Cathode	S1-A5	HH9A	C75U
CR8 Anode	P13	2HU0	AH1A
CR8 Cathode	S1-A4	HH9A	C75U
CR9 Anode	P12	U2U6	7FCP
CR9 Cathode	S1-A3	HH9A	C75U
CR10 Anode	P11	392H	8P46
CR10 Cathode	S1-A2	HH9A	C75U
CR11 Anode	P10	4C76	92FA
CR11 Cathode	S1-A1	HH9A	C75U

*Refer to paragraph 2-7 for information entitled "HP-IB Address Selection".

The column with Address = 31, lists signatures as they appear when the Address Switch contacts are open. The column with Address = 00, lists signatures as they appear when the Address Switch contacts are closed.

If the Transceiver Interface passes the Interface Test (A, B, C, and D) but fails to perform the "HP-IB Functional Checks" found in paragraph 3-12, replace the HP-IB General Purpose Interface Adapter U7.

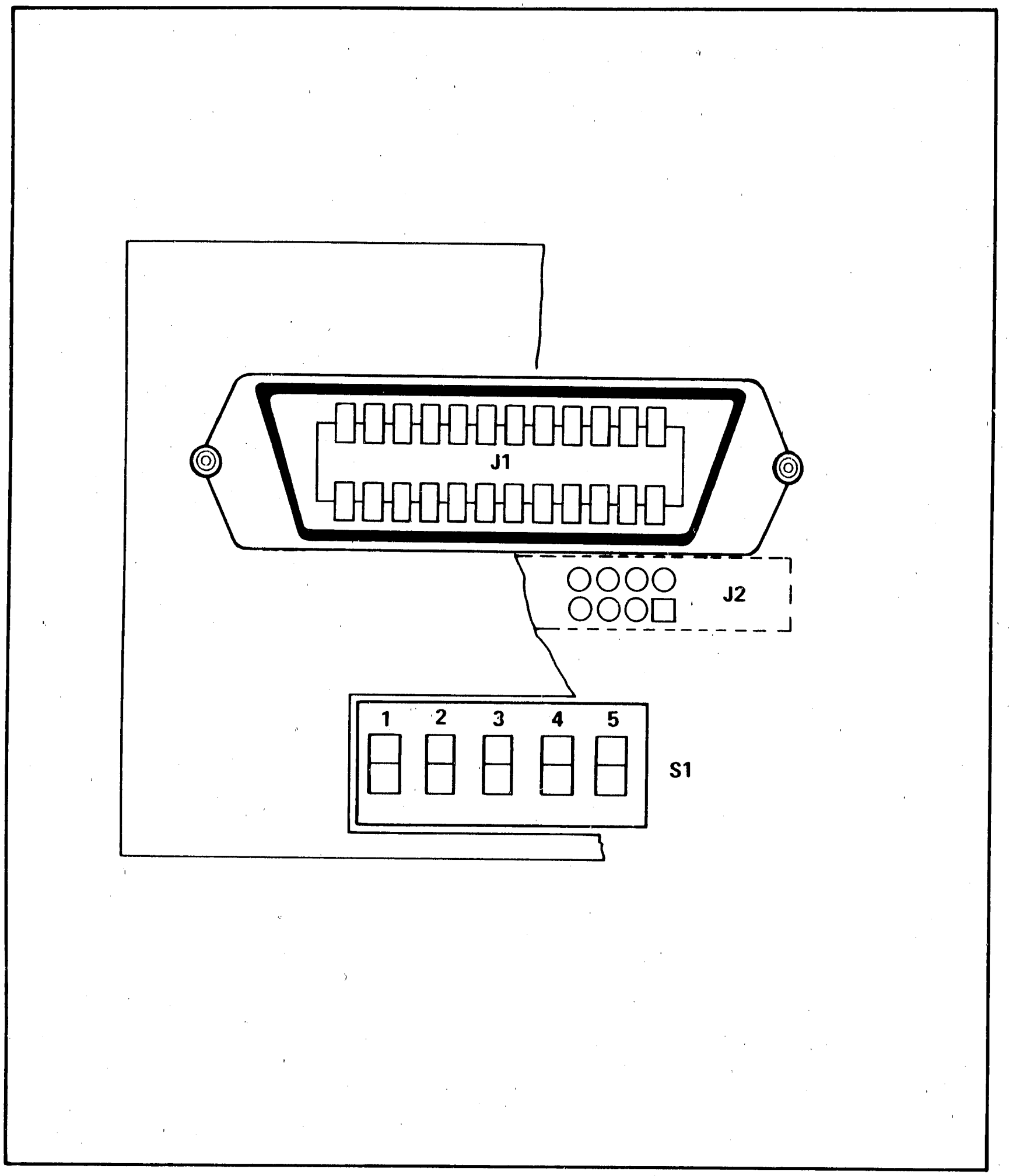


Figure 8-20. HP-IB (A3 Assembly) Connector Component Locations

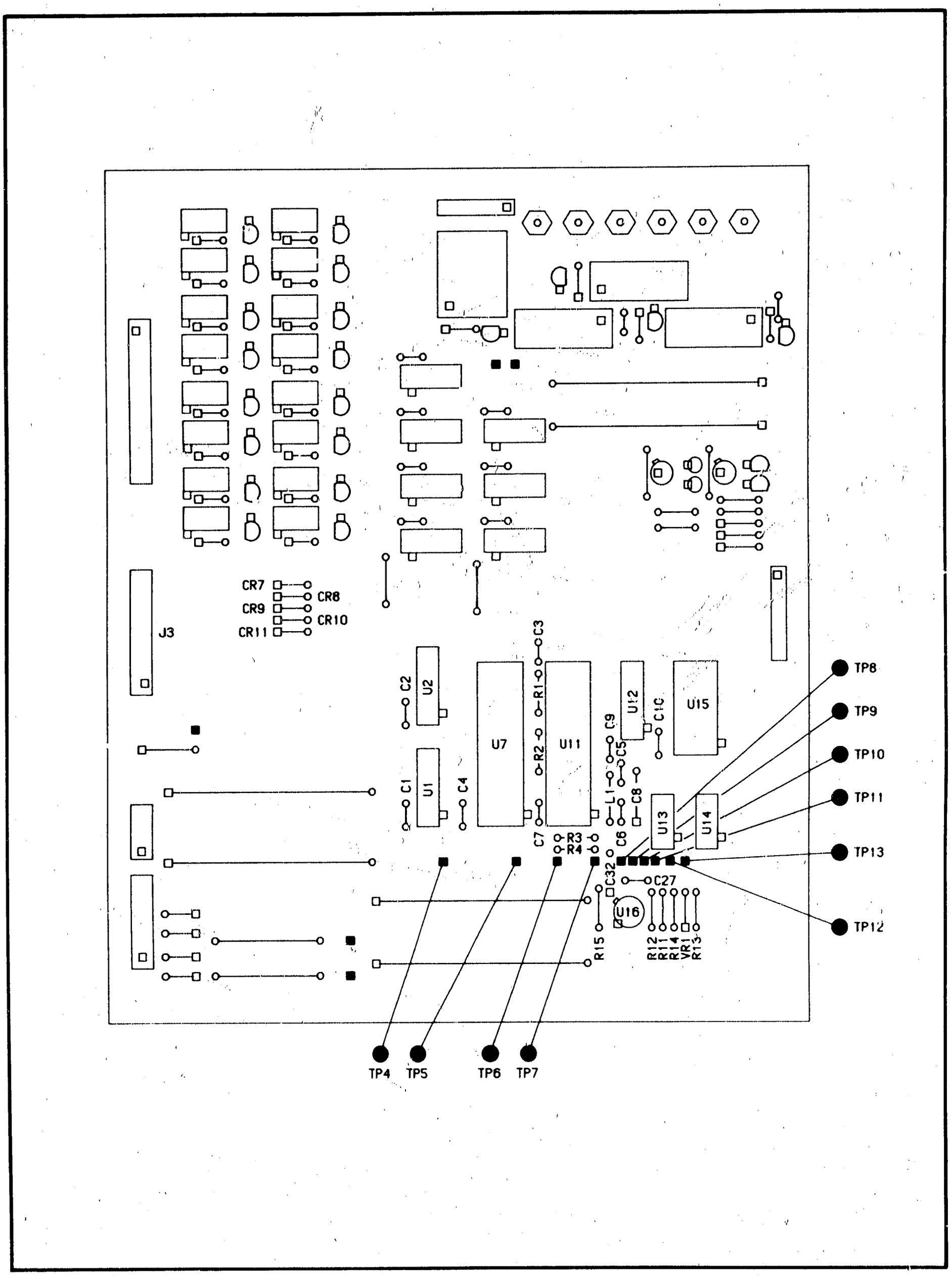
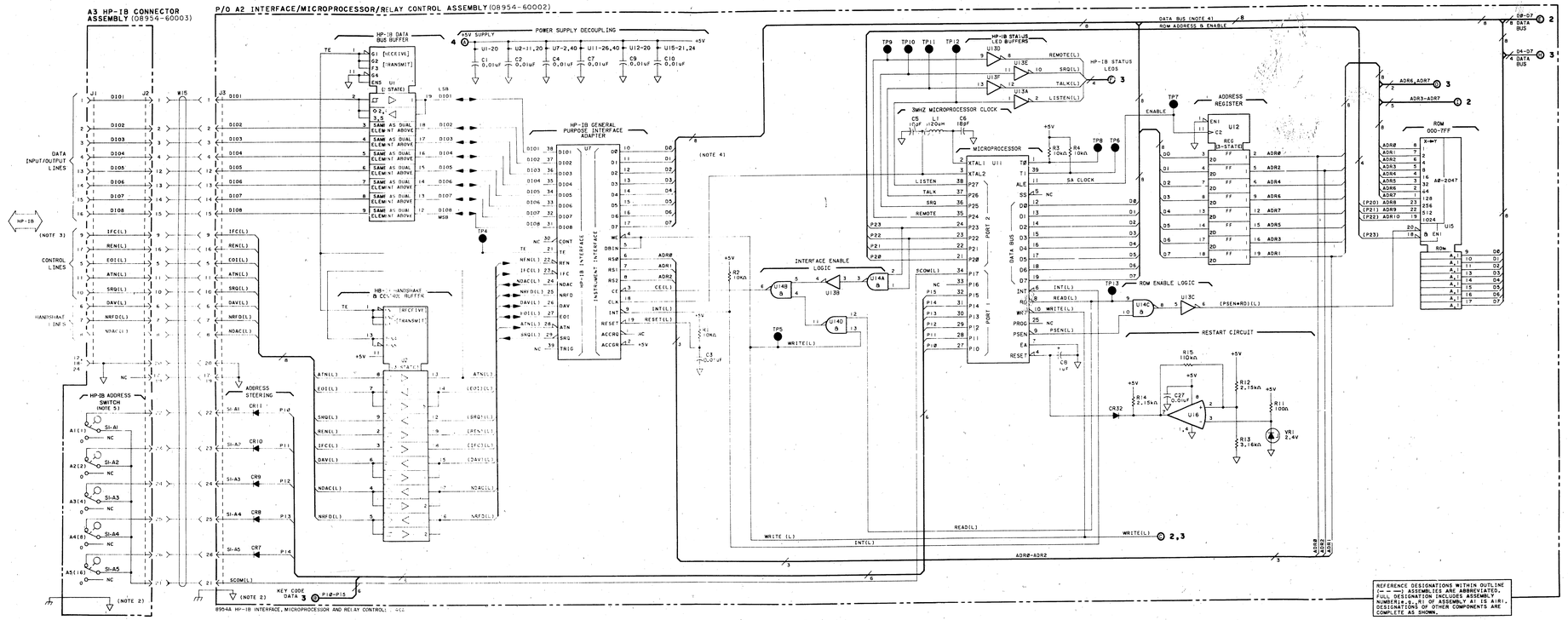


Figure 8-21. Interface Control Board (A2 Assembly) Component Locations



8954A HP-IB INTERFACE, MICROPROCESSOR AND RELAY CONTROL 4/82

SERVICE SHEET 1

P/O A2, A3

Figure 8-22. Interface Control Board

SERVICE SHEET 2
P/O A2 INTERFACE/MICROPROCESSOR/RELAY CONTROL ASSEMBLY

PRINCIPLES OF OPERATION

Relay Buffers. Relay Buffers U3-U6, U9 and U10 are CMOS, D-type, FF-registers. The registers (A through D), receive their input data from the microprocessor A2U11, via the Data Bus. The register inputs are enabled by the appropriate data sent on the Address Bus. The FF-register outputs respond to the data at the register inputs when the clock input receives the Write(L) clock pulse. The FF-register outputs are used to energize or de-energize the relay-driver transistors Q1-Q26. Refer to following NOTE.

MOSFETS. The transistors Q1-Q18, Q20-Q21, and Q23-Q26 are N-channel, enhancement mode MOSFETS. These transistors are used for the Transceiver Interface relay drivers for relays K1, K2, and A2K1-A2K20. A positive gate voltage (+5V) causes the transistor to turn on, permitting drain current to flow; grounding the gate, causes the transistor to turn off.

MOSFETs Q1-Q18 and Q25-26 are protected from reverse-voltage transients by diodes CR12–CR30 and CR33. Refer to following NOTE.

NOTE

MOS and CMOS devices used in the Transceiver Interface are prone to damage when improperly handled. Further information regarding the treatment of these devices is found in paragragh 8-31 of this section, entitled "MOS and CMOS Integrated Circuit Replacement".

RF Source and RF Monitor Relays and Drivers

Relays. The RF Source and RF Monitor relays (K1 and K2 respectively) are single-pole, double-throw, latching-type relays. The latching function of the relay is accomplished with permanent magnets. These magnets will hold the relay switch in the set position after current flow through the relay inductor has stopped. The direction of current flow necessary to switch the relay, from position 1 to position 2, is opposite the direction required to switch the relay from position 2 to position 1.

Drivers. A positive gate voltage (+5V), from the relay buffer, turns on FET Q23; FET Q24 turns off. This causes Q22 to turn on, charging C26. The K1 relay coil is in series with the C26 charge path, which causes the relay to switch from position 1 to position 2.

C26 will remain charged and K1 will remain latched in position 2, until FET Q23 is turned off by the relay buffer. With FET Q23 turned off, PNP transistor Q22 is off and FET Q24 is on; discharging C26 through the K1 relay coil. The direction of current flow, caused by the discharging of capacitor C26, switches the relay from position 2 to position 1.

TROUBLESHOOTING USING SIGNATURE ANALYSIS

Test 5. Relay Driver Test

Purpose. Verify the correct operation of the Transceiver Interface Relay Buffers, as well as associated circuit traces.

Setup. Connect the signature multimeter TIMING POD as follows:

1)	START	to	A2TP11 – TALK.
2)	STOP	to	A2TP11 – TALK.
3)	CLOCK	to	A2TP7 – SA CLOCK.
4)	GROUND	to	A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1)	START	–	Leading Edge.
2)	STOP	–	Trailing Edge.
3)	CLOCK	–	Trailing Edge.

Set up the Transceiver Interface as follows:

1) Jumper A2TP6 to A2 Ground.

2) Cycle the LINE OFF/ON switch OFF, then ON.

The validity of this test is dependent upon the correct operation of the Control circuitry; more specifically, the Address Bus and Data Bus. (Refer to Test 1. Control Circuit Test.)

Table 8-13. Relay Driver Signatures

NODE		SIGNATURE
U3#16	+5 VDC	P882
A2TP5	WRITE (L)	P882
U3, U4, U9#3	FF (A)	76U8
U3, U4, U9#4	FF (B)	HU14
U3, U4, U9#5	FF (C)	C38U
U3, U4, U9#6	FF (D)	10HP
U5, U6, U10#3	FF (A)	058C
U5, U6, U10#4	FF (B)	U801
U5, U6, U10#5	FF (C)	P985
U5, U6, U10#6	FF (D)	2533

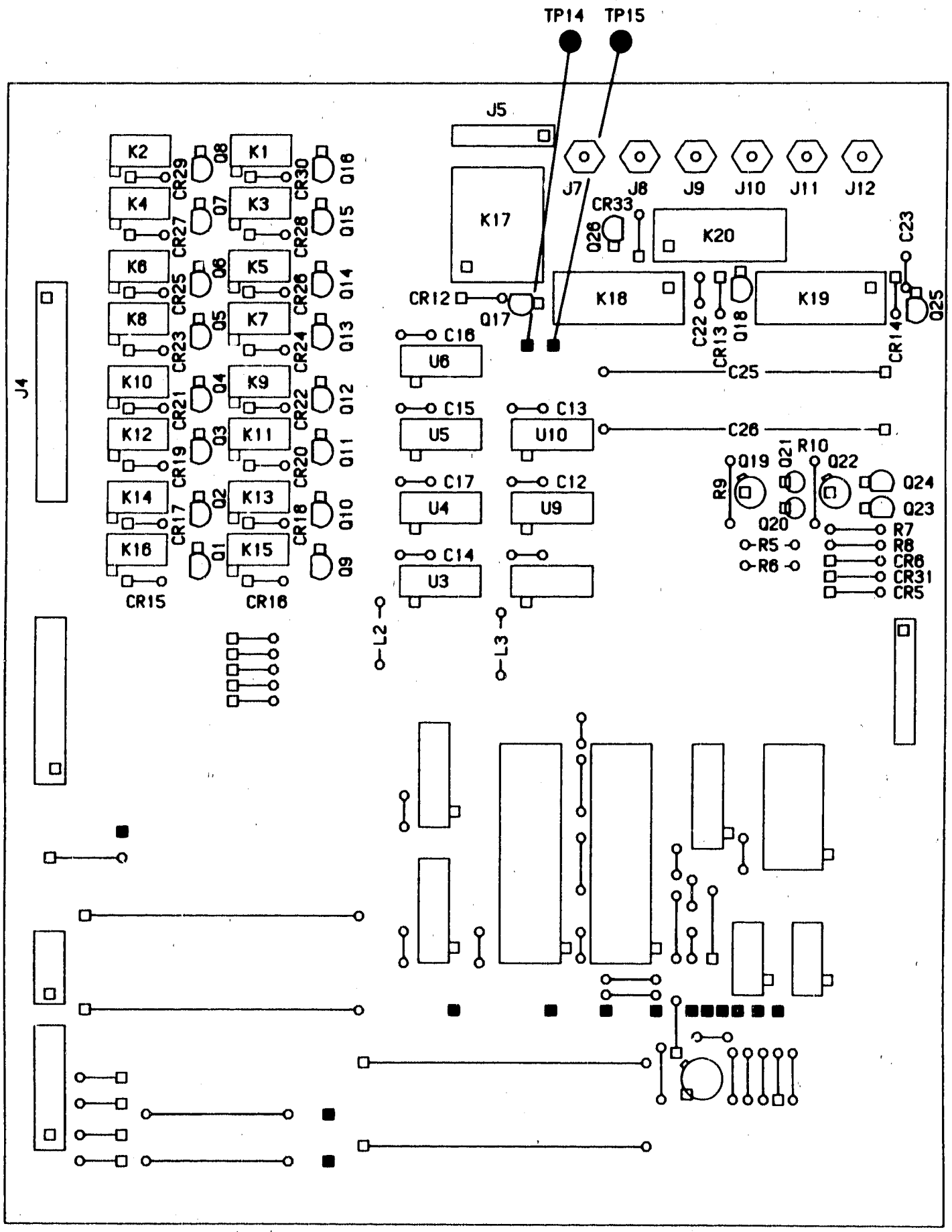
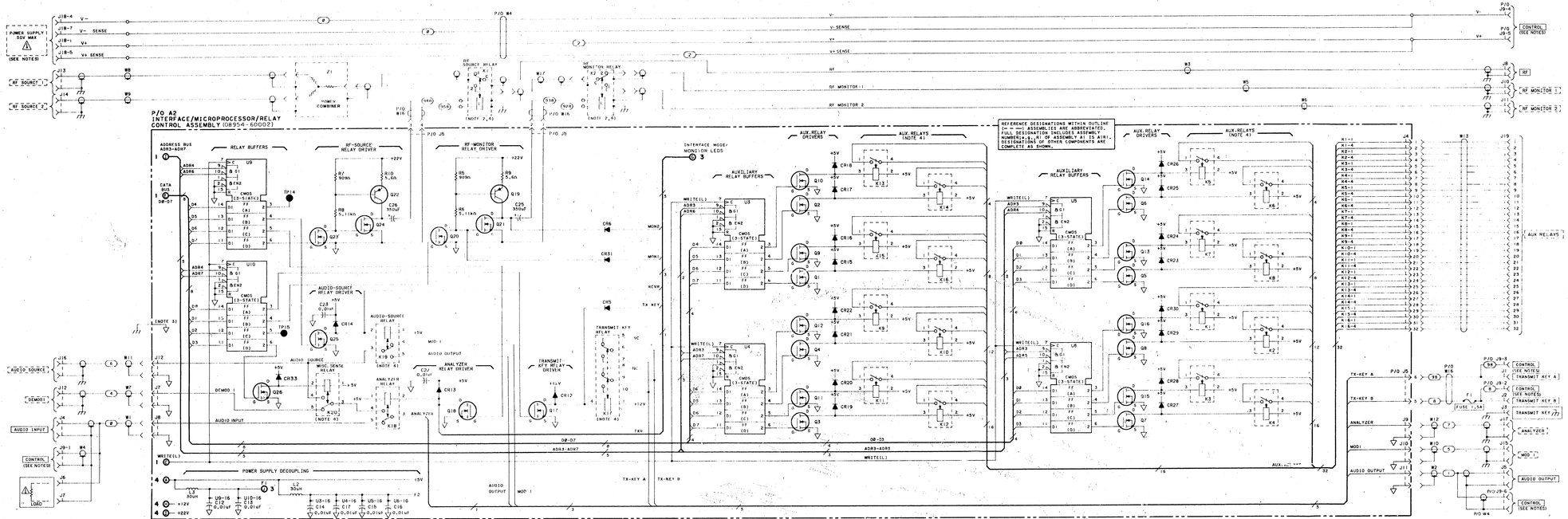


Figure 8-23. Interface Control Board (A2 Assembly) Component Locations



NOTES

1. SEE TABLE 8-7 FOR SCHEMATIC DIAGRAM NOTES
2. RF RELAY CONTACTS ARE HELD IN EITHER LATCHED POSITION BY THE USE OF INTERNAL PERMANENT MAGNETS
3. CHASSIS GROUND IS ACHIEVED BY MECHANICAL CONTACT THROUGH SCREWS HOLDING PC BOARD TO FRAME
4. ALL RELAY CONTACTS ARE SHOWN IN THEIR POWER-UP POSITION

REFERENCE DESIGNATIONS	
NO PREFIX	A2
F1	C12-17,22,23 C25,26,29,33 J4,5,7-12 K 1-20 L1,2 Q1-26 R5-10 TP14-16 U3-6,9,10
J1-19 K1,2 W1-3,16,17 Z1	

TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS	
REFERENCE DESIGNATIONS	PART NUMBERS
Q1-Q18, Q20-Q21, Q23-Q26	1855-0423
Q19,Q22	1853-0314
U3-U6 U9,U10	1820-1544

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U3-U6	F2 - 16 F1 - 8
U9-U10	F1 - 16 F2 - 8

LOGIC LEVELS

	CMOS
HIGH	>3.5V
LOW	<1.5V
* IS MORE NEG. THAN IS MORE POS. THAN	
OPEN	UNDEF.
GROUND	LOW

BOTTOM VIEW Q1-18,20-21, 23-26
SOURCE G GATE D DRAIN
CIRCUIT BOARD BOTTOM VIEW
BOTTOM VIEW Q19,22
CIRCUIT BOARD BOTTOM VIEW
A2/K17 BOTTOM VIEW
CIRCUIT BOARD BOTTOM VIEW
A2/K1-K16 TOP VIEW
CIRCUIT BOARD TOP VIEW
RELAY IS SOCKETED
A2/K18,K19 BOTTOM VIEW
CIRCUIT BOARD BOTTOM VIEW
A2/J18-J9, J9,U10 TOP VIEW
CIRCUIT BOARD TOP VIEW
J18 POWER SUPPLY CONNECTOR FRONT VIEW
J9 CONTROL CONNECTOR FRONT VIEW
J19 AUX RELAY CONNECTOR FRONT VIEW

SERVICE SHEET 2
P/O A2

Figure 8-24. Relay Control Driver and Relays

SERVICE SHEET 3
A1 KEYBOARD AND INTERFACE ANNUNCIATOR ASSEMBLY

PRINCIPLES OF OPERATION

Keyboard. The Transceiver Interface keyboard is comprised of seven momentary-pushbutton switches, S1-S7. The switches are driven by a D-type, FF register A2U8. The microprocessor A2U11, Port 1 (P10-P15) receives its inputs from the keyboard via the A2 Keycode Data lines.

The A2 microprocessor (after power-up initialization), enables the keyboard by placing a low on the outputs of U8, FF registers C and D. A key closure prompts the microprocessor to read the Keycode Data lines; once, after enabling register C (disabling D) and a second time, after enabling register D (disabling C). This routine allows the microprocessor to differentiate between a closure of either the TRANSMIT KEY ON or TRANSMIT KEY OFF key. This process is necessary because of the hard-wired OR configuration of those two transmit keys.

Interface Annunciators

HP-IB Status LEDS. The HP-IB Status LEDs (DS1-DS4) are driven by buffers U13 (A, D, E, and F) on the A2 assembly. The buffers receive their status information from the microprocessor A2U11.

Interface Mode/Monitor LEDs. The Interface Mode/Monitor LEDs (DS5–DS9) are driven by the A2 audio- and RF-relay driver transistors (Q17, Q20, Q21, and Q25).

TROUBLESHOOTING USING SIGNATURE ANALYSIS

Test 6. Keyboard Test

Purpose. Verify the correct operation of the keyboard switches and keyboard circuitry.

Setup. Connect the signature multimeter TIMING POD as follows:

1)	START	to	A2TP11 – TALK.
2)	STOP	to	A2TP11 – TALK.
3)	CLOCK	to	A2TP7 – SA CLOCK.
4)	GROUND	to	A2 Ground.

Set the signature multimeter POLARITY controls as follows:

1)	START	–	Leading Edge.
2)	STOP	–	Trailing Edge.
3)	CLOCK	–	Trailing Edge.

Set up the Transceiver Interface as follows:

1) Jumper A2TP6 to A2 GROUND.

2) Disconnect all HP-IB cables from A3J1 on the rear panel; this removes the Address Switch from the Keycode Data lines.

3) Cycle the LINE OFF/ON switch OFF, then ON.

Table 8-14. Keycode Signatures

NODE		PORT SIGNATURE	KEY SIGNATURE (Specified key held in "on" position)
U11#40	+5 VDC	P882	**********
U11#27	P10	4162	CAPA TRANSMIT KEY OFF key
U11#27	P10	4162	0FP9 TRANSMIT KEY ON key
U11#28	P11	7P00	A9PA TRANSMITTER key
U11#29	P12	UA61	F470 RECEIVER key
U11#30	P13	894F	71UF RF MONITOR 2 key
U11#31	P14	9HCP	P104 RF MONITOR 1 key
U11#32	P15	U7F5	396F LOCAL key

The PORT SIGNATURE column, lists the signatures that relate to the microprocessor port (P10–P15) which verify the integrity of the Keycode Data lines. The KEY SIGNATURE column lists signatures which are a result of a depression of the specified key. Valid signatures on these lines indicate the correct operation of the A2U8 Keyboard Driver and Interface Keyboard keys.

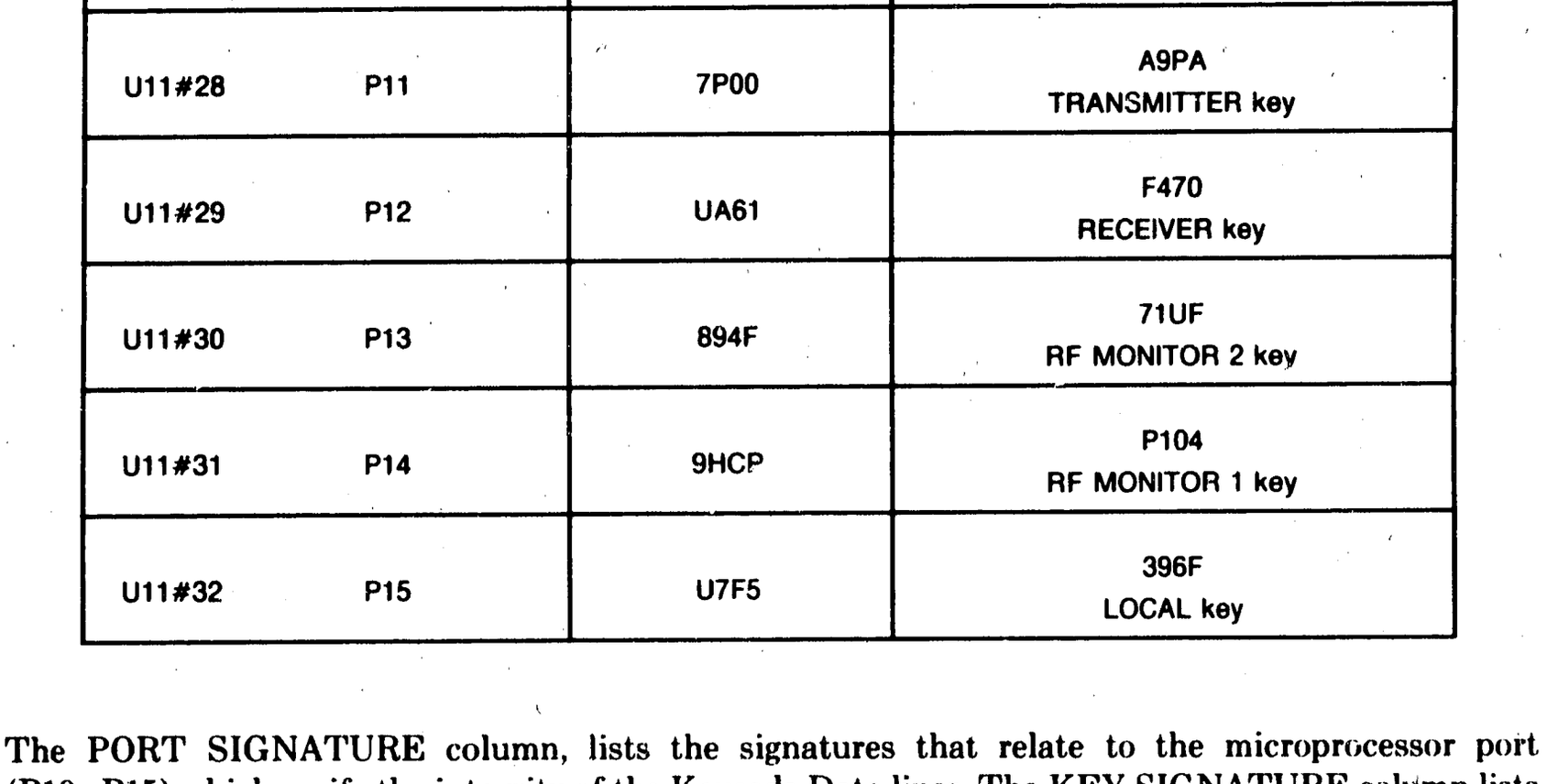


Figure 8-25. Keyboard and Annunciators (A1 Assembly) Component Locations

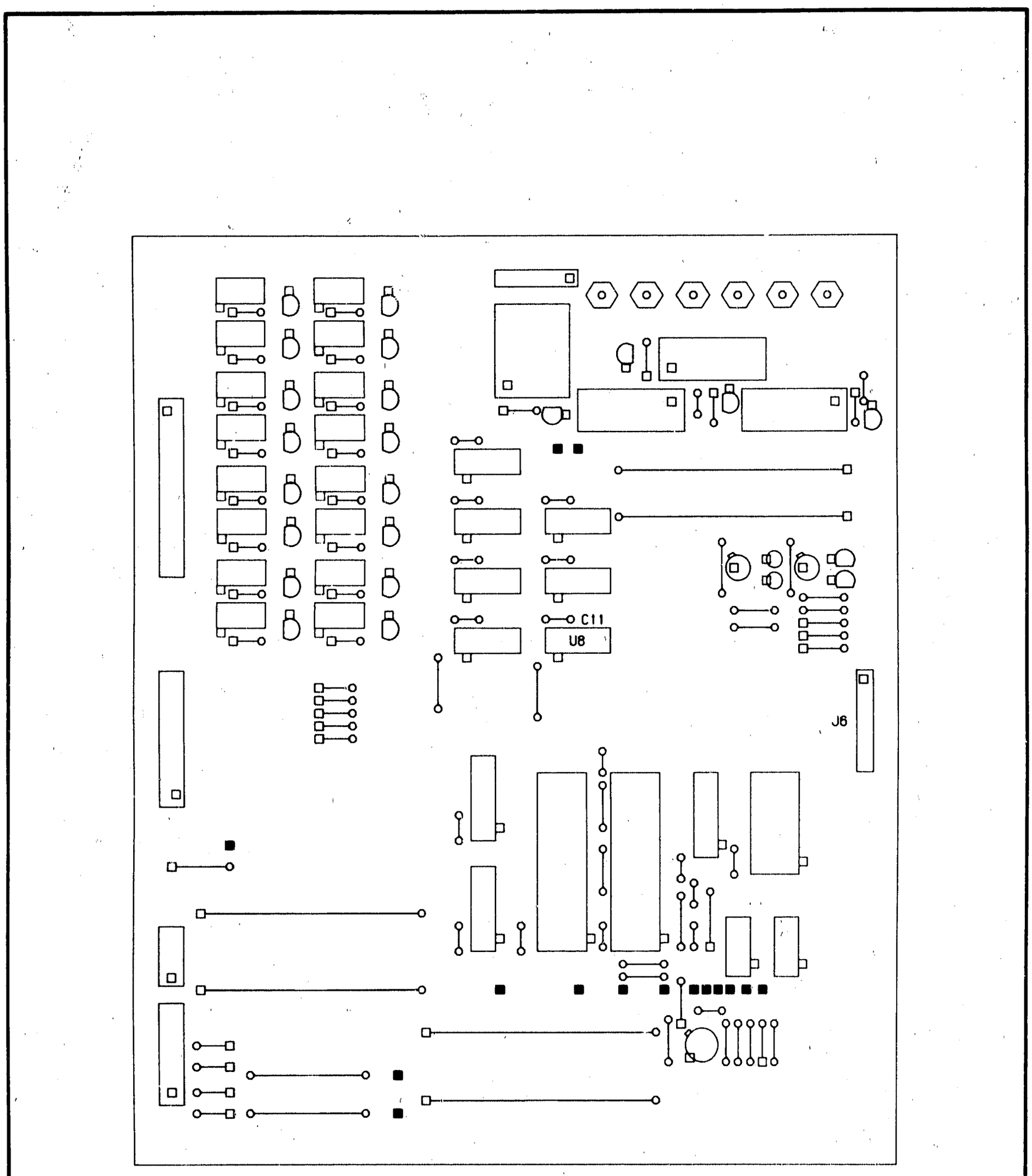
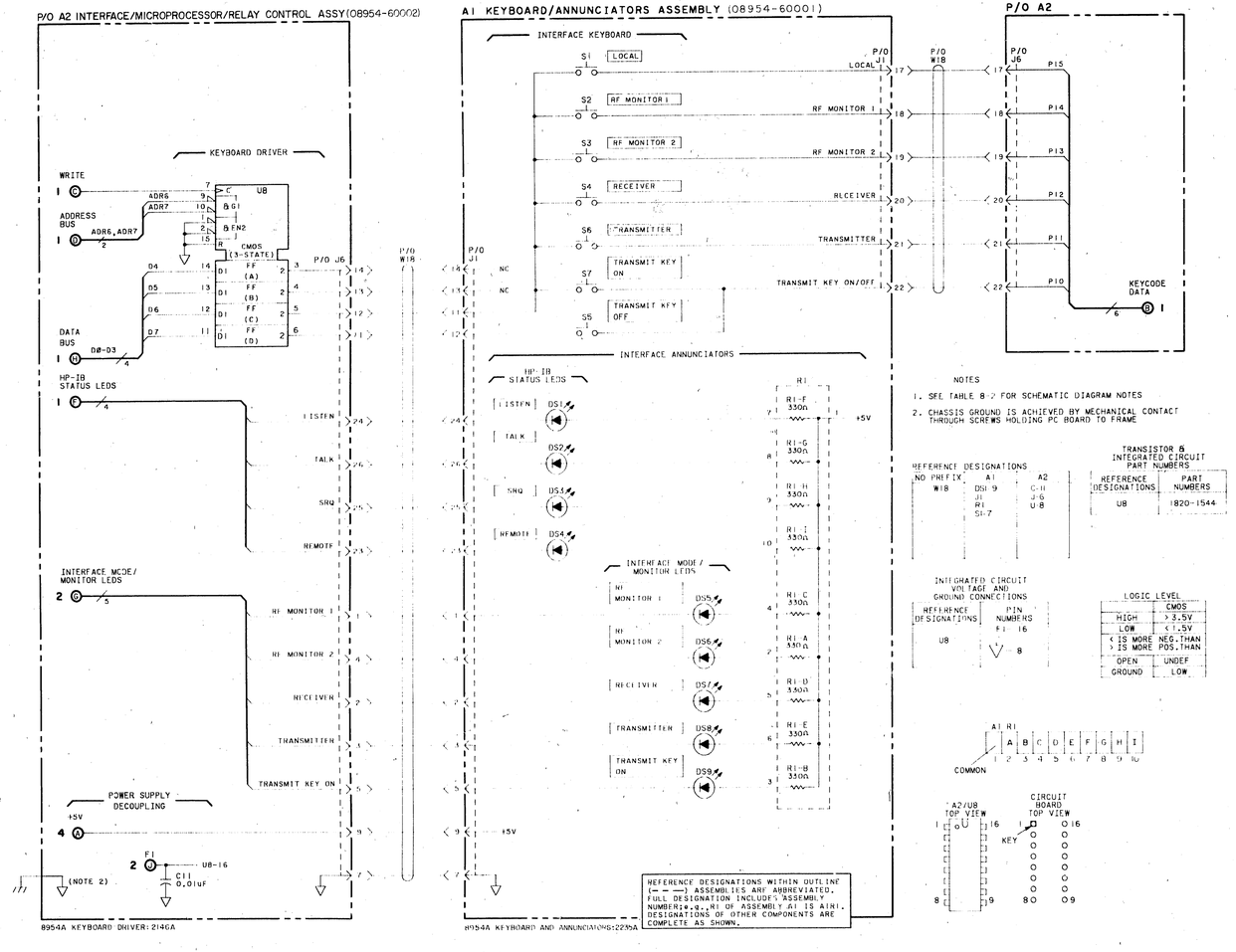


Figure 8-26. Interface Control Board (A2 Assembly) Component Locations



SERVICE SHEET 3

P/O A2, A1

Figure 8-27. Keyboard and Annunciator Assembly

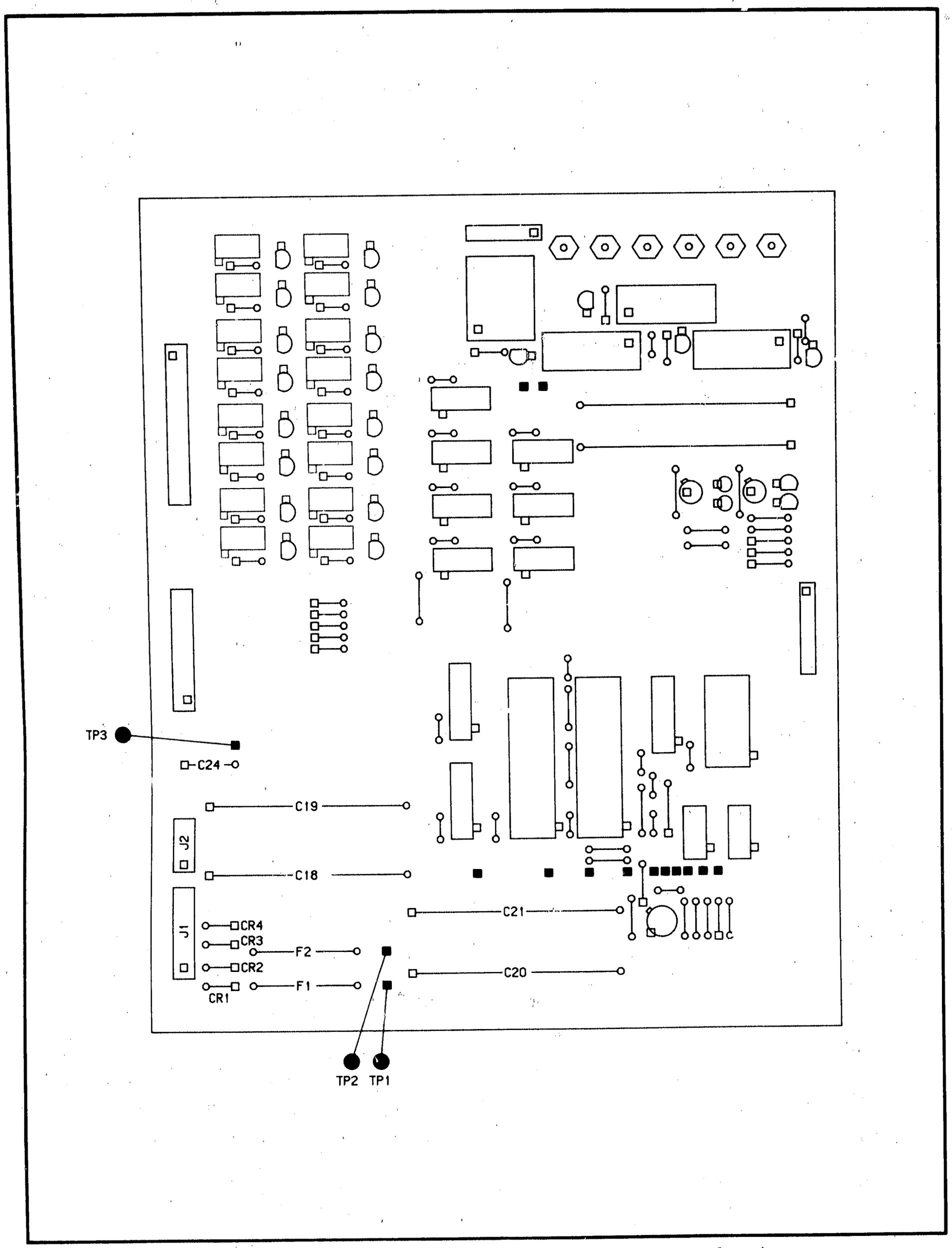
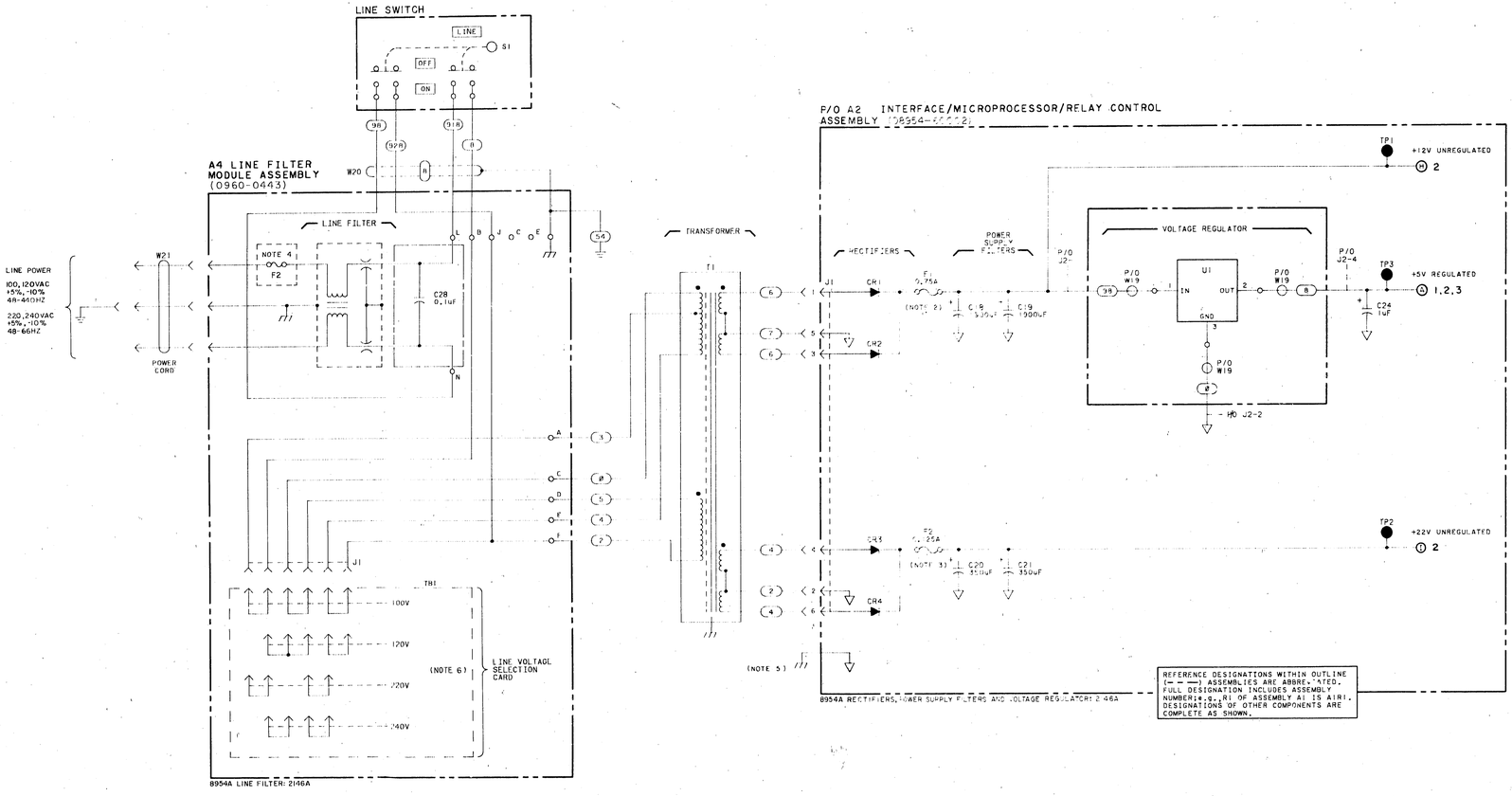


Figure 8-28. Interface Control Board (A2 Assembly) Component Locations



NOTES

1. SEE TABLE 8-2 FOR SCHEMATIC DIAGRAM NOTES
2. VALUE OF A2F1 IS 0.75A (250V).
3. VALUE OF A2F2 IS 0.125A (250V).
4. VALUE OF A4 F1 IS 0.125A FOR 250V OPERATION & 0.250A FOR 120V.
5. CHASSIS GROUND IS ACHIEVED BY MECHANICAL CONTACT THROUGH SCREWS HOLDING PC BOARD TO FRAME
6. SEE FIG 2-1 FOR LINE VOLTAGE SELECTION PROCEDURE.

REFERENCE DESIGNATIONS

NO PREFIX	A2	A4
S1	C18-21,	F1
T1	Z4	J1
U1	CR1-4	P1
W19-21	F1,2	
	J1,2	
	TP1-3	

TRANSISTOR & INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATION	PART NUMBER
U1	1826-0181

U1 BOTTOM VIEW

SERVICE SHEET 4

P/O A2, A4

Figure 8-29. Interface Power Supply

MANUAL

CHANGES

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 8954A
Date Printed: Feb. 1983
Part Number: 08954-90010

TRANSCEIVER INTERFACE
OPERATING AND SERVICE MANUAL

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

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

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
2429A	1
2516A	1-2
2525A	1-3
>> 2612A	1-4

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

>> NEW ITEM

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

Printed in U.S.A.

HEWLETT PACKARD

23 May 1986
4 Pages Text
4 Pages Illustrations
1 Foldout

ERRATA

Page 2-1, paragraph 2-5:
After the "CAUTION" information insert the following text:

Two fuses are supplied with each instrument. One fuse has the proper rating for 110/120 Vac line operation; the other fuse is rated for 200/220 Vac operation.

One fuse is installed in the instrument at the time of shipment. The rating of the installed fuse is selected according to the line voltage specified by the customer. If the voltage is not specified, the rating of the installed fuse will be selected according to the country of destination.

>> Page 2-3, Figure 2-3:
Replace Figure 2-3 with the attached "Figure 2-3. Power Cable HP Part Numbers (P/O ERRATA)."

Page 3-7 and 3-8, Transmitter Mode Checks:
In steps 6, 8, and 11, replace "+5 dB" with "+/-5 dB."

Page 6-1, paragraph 6-1:
In paragraph 6-1 Introduction, second sentence, change "Table 6-1" to "Table 6-2."

Page 6-9, Table 6-3:
Under A4C1, add HP Part Number 0890-0052 CD9 TUBING-HS 1-D/.5-RCVD .035-WALL POLYO.

Page 8-24, TROUBLESHOOTING:
Under "Diagnostic Program (using an HP-IB Controller)" delete the "**HP 85F/**" from the title of the program listing on the right side of page and add the third listing, "**HP 85B (BASIC) (P/O ERRATA)**", attached in this supplement.

>> Page 8-41, Service Sheet 2 (NOTES):
On the pin configuration diagram labeled "A2/K18, K19 BOTTOM VIEW", change pin number 2 to 3 and pin number 3 to 2.

Page 8-47, Service Sheet 4 (schematic):
In the A4 LINE FILTER MODULE ASSEMBLY SCHEMATIC, change C28 to C1.
In the table of REFERENCE DESIGNATIONS, under A4, add C1.

CHANGE 1 - Serial Prefix 2429A

Page 6-6, Table 6-3:
Change A2F1 to 2110-0360 CD2 FUSE .75A 250V TD 1.25X.25 UL.
Change A2F2 to 2110-0318 CD0 FUSE .125A 250V TD 1.25X.25 UL.

CHANGE 2 - Serial Prefix 2516A

Page 6-6, Table 6-3:
Change A2K18-K20 to 0490-1423 CD6 RELAY-REED IC 250MA 28VDC 5VDC-COIL 3VA.

CHANGE 3 - Serial Prefix 2525A

NOTE

The following change information documents the conversion to metric cabinet hardware in the HP 8954A.

Page 1-3, paragraph 1-9:
Change the part numbers shown for the following options to:

Option 907	5061-9688
Option 908	5061-9674
Option 909	5061-9675

Page 6-10, Table 6-3:
Change the following cabinet part numbers:

MP9	0515-1331	CD5	SCREW-MACH M4X0.7 6MM-LG
MP18	5021-5801	CD0	FRAME, FRONT, FULL
MP19	5021-5802	CD1	FRAME, REAR
MP20	5021-5831	CD6	SIDE STRUTS
MP23	5061-9434	CD7	TOP COVER
MP24	5061-9446	CD1	BOTTOM COVER
MP25	5061-9506	CD4	SIDE COVER

>> CHANGE 4

Page 6-5, Table 6-3:
Change A2 to 08954-60007 CD8 INTERFACE/MICROPROCESSOR/RELAY CONTROL.
Page 6-6, Table 6-3:
Add A2K21 0490-1423 CD2 RELAY-REED IC 250MA 28VDC 5VDC-COIL 3VA.
Page 6-7, Table 6-3:
Add A2R16 0757-0438 CD3 RESISTOR 5.11K 1% .125W F TC=0+-100.
Change A2U16 to 1826-0412 CD1 IC COMPARATOR PRCN DUAL 8-DIP-P PKG 27014 LM393N.
Page 6-9, Table 6-3:
Under J4 and J5 add, 5040-0345 CD7 INSULATOR:CONNECTOR.
Under J12, 15, 16, and 17 add 00310-48801 CD0 INSULATOR:CONNECTOR.
Page 6-10, Table 6-3:
Change MP26 to 08954-00007 CD2.
Change MP28 to 08954-00008 CD3.
Change MP29 to 08954-00009 CD4.

Page 6-11, Table 6-3:
Change W7 to 08954-60116 CD0.
Change W10 to 08954-60117 CD1.
Change W11 to 08954-60118 CD2.
Change W12 to 08954-60119 CD3.

Page 8-36, Figure 8-21 (component locator):
Change reference designator R14 to R15, and change R15 to R14. Add R16 between U13 and C8.

Page 8-37, Service Sheet 1 (schematic):
Replace the appropriate portion of Figure 8-22 with the attached, "P/O Figure 8-22. Interface Control Board (P/O CHANGE 4)."

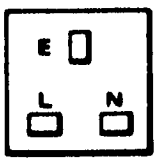
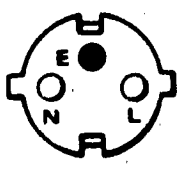
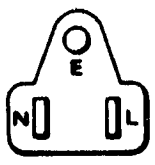
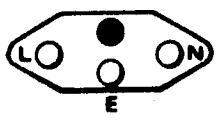
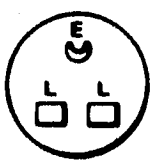
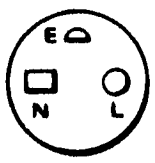
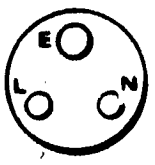
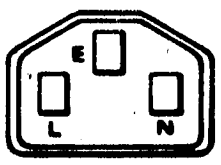
Page 8-40, Figure 8-23 (component locator):
Replace the appropriate portion of Figure 8-23 with the attached "P/O Figure 8-23. Interface Control Board (A2 Assembly) Component Locations (P/O CHANGE 4)."

Page 8-41, Service Sheet 2:
Replace Figure 8-24 with the attached "Figure 8-24. Relay Control Driver and Relays (P/O CHANGE 4)."

Page 8-45, Service Sheet 3:
Replace the appropriate portion of Figure 8-27 with the attached "P/O Figure 8-27. Keyboard and Annunciator Assembly (P/O CHANGE 4)."

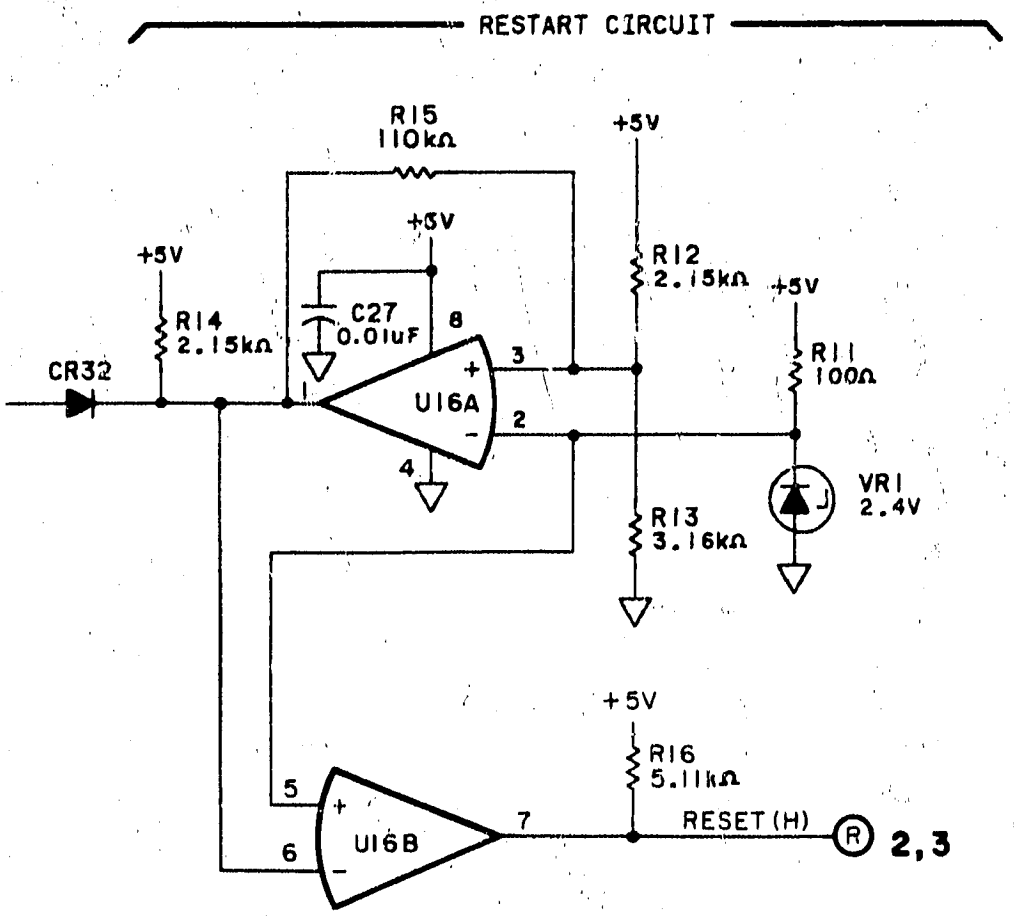
```
 10 OUTPUT 703 USING "2A" ; "ID"
 20 ENTER 703 ; A$
 30 OUTPUT 703 USING "2A" ; "OM"
 40 DIM X$[2048]
 50 ENTER 703 USING "# ,2048A" ;
     X$
 60 J=255
 70 FOR I=1 TO 2048
 80 X=NUM(X$[I,1])
 90 J=J+X
100 DISP I;J
110 NEXT I
120 DISP USING "20/"
130 DISP J MOD 256;I-1
140 END
```

HP 85B (BASIC) (P/O ERRATA)

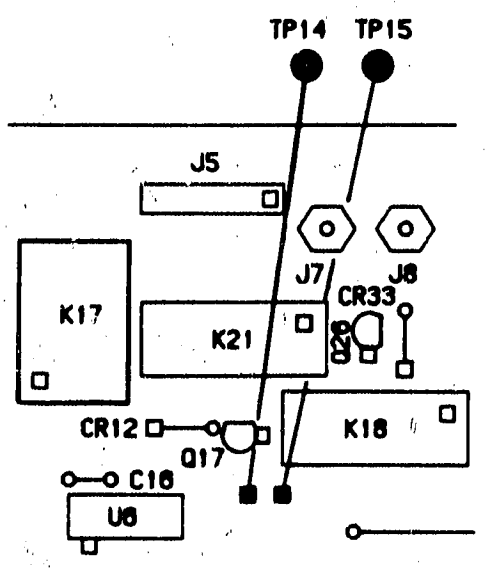
Plug Type	Cable HP Part Number	C D	Plug Description	Cable Length (inches)	Cable Color	For Use In Country
250V 	8120-1351 8120-1703	0 4	Straight*BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore
250V 	8120-1369 8120-0696	0 4	Straight*NZSS198/ASC112 90°	79 87	Gray Gray	Austrailia, New Zealand
250V 	8120-1689 8120-1692	7 2	Straight*CEE7-Y11 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, (unpolarized in many nations)
125V 	8120-1378 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	5 5 7 1 6 2	Straight*NEMA5-15P 90° Straight*NEMA5-15P Straight*NEMA5-15P 90° Straight*NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Mexico, Japan (100V or 200V), Philippines, Taiwan
250 V 	8120-2104	3	Straight*SEV1011 1959-24507 Type 12	79	Gray	Switzerland
250V 	8120-0698	6	Straight*NEMA6-15P			United States, Canada
220V 	8120-1957 8120-2956	2 3	Straight*DHCK107 90°	79 79	Gray Gray	Denmark
250V 	8120-4211	7	Straight*IEC83-B1	79	Black	South Africa, India
250V 	8120-1860	6	Straight*CEE22-VI (Systems Cabinet Use)			

*Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.
E = Earth Ground; L = Line; N = Neutral

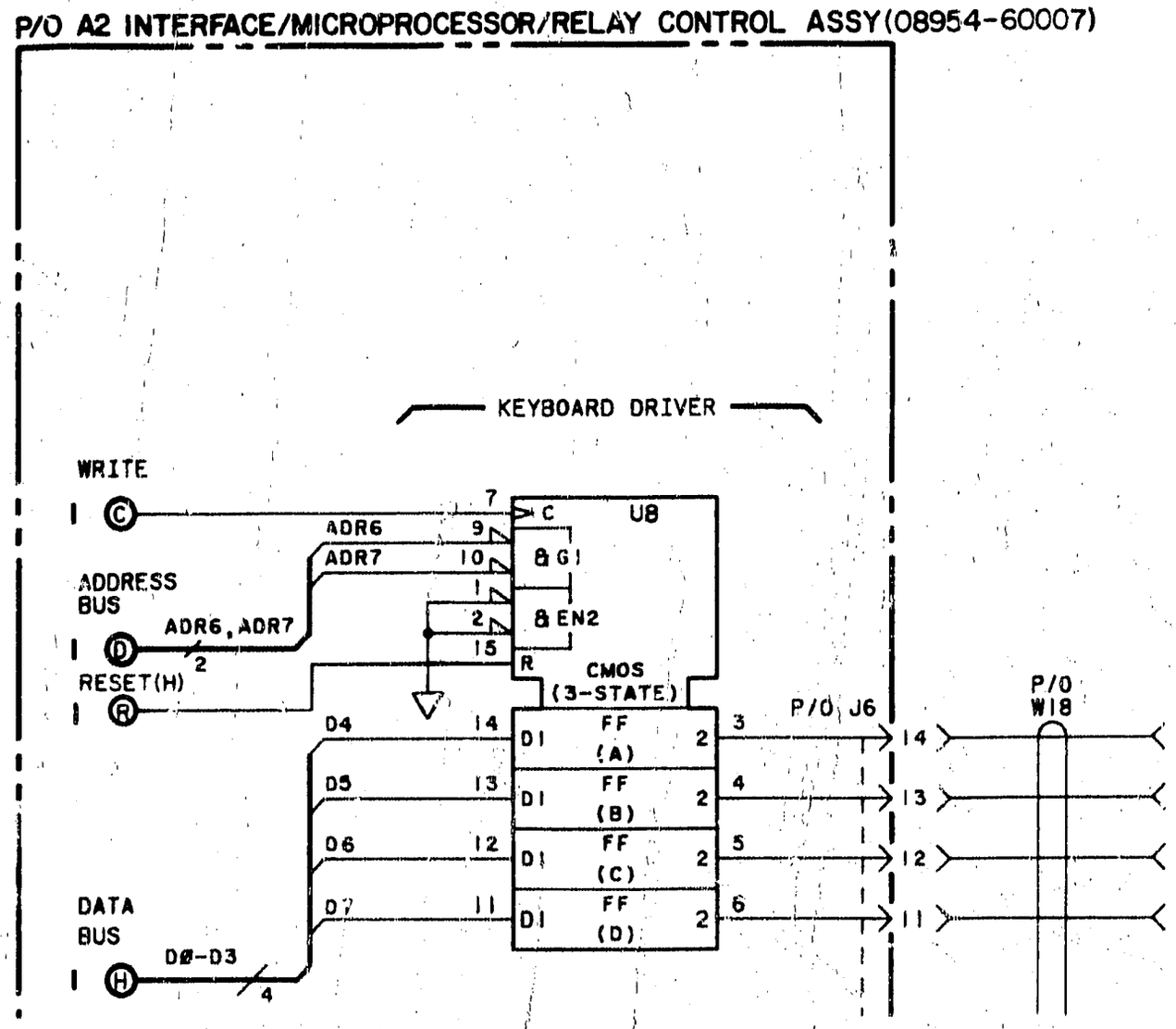
Figure 2-3. Power Cable HP Part Numbers (P/O ERRATA).



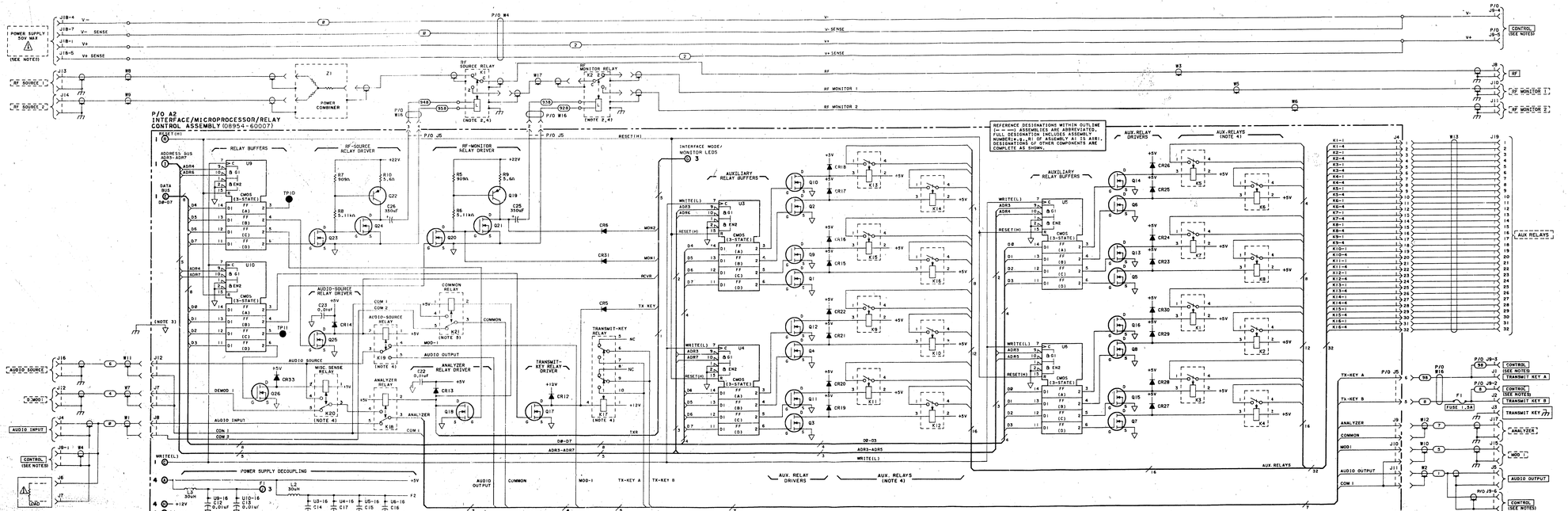
P/O Figure 8-22. Interface Control Board (P/O CHANGE 4).



P/O Figure 8-23. Interface Control Board (A2 Assembly) Component Locations (P/O CHANGE 4).



P/O Figure 8-27. Keyboard and Annunciator Assembly (P/C CHANGE 4).



NOTES

1. SEE TABLE 8-7 FOR SCHEMATIC DIAGRAM NOTES
2. RF RELAY CONTACTS ARE HELD IN EITHER LATCHED POSITION BY THE USE OF INTERNAL PERMANENT MAGNETS
3. CHASSIS GROUND IS ACHIEVED BY MECHANICAL CONTACT THROUGH SCREWS HOLDING PC BOARD TO FRAME
4. ALL RELAY CONTACTS ARE SHOWN IN THEIR POWER-UP POSITION
5. K01 SHOWN IN DEACTIVATED POSITION.

REFERENCE DESIGNATIONS

NO PREFIX	A2
F1	C12-17,22,23, 25,26
J1-19	CR5,6,12-31
K1,2	J4,5,7-12
W1-13,16,17	K1-19
Z1	L1,2
	P1-12
	R5-10
	TP10-12
	U3-6,9,10

TRANSISTOR AND I.C. PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
Q1-Q18, Q20-Q23, Q23-Q25	1855-0423
Q19,Q26,Q32	1853-0314
U5-U8, U9,U10	1820-1544

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U3-U6	P2 - 16 P1 - 8
U9-U10	P1 - 16 P2 - 8

LOGIC LEVELS

	CMOS
HIGH	>3.5V
LOW	<1.5V
= IS MORE NEG. THAN	
= IS MORE POS. THAN	
OPEN	UNDEF.
GROUND	LOW

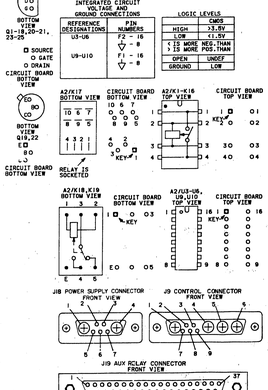


Figure 8-24. Relay Control Driver and Relays (P/O CHANGE 4).

SERVICE SHEET 2
P/O A2