

## Errata

**Title & Document Type:** 8657B Synthesized Signal Generator

**Manual Part Number:** 08657-90007

**Revision Date:** September 1989

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### HP References in this Manual

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

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# **HP 8657B SYNTHESIZED SIGNAL GENERATOR**

**(Including Options 001, 002 and 003)**

## **Service Manual**

### **SERIAL NUMBERS**

This manual provides complete information for instruments with serial-number prefixes:

3105U or 3105A and below and all *MAJOR* changes that apply to your instrument/modules.

*rev.20MAR91*

**NOTE**, use this manual only with instruments that have a "U" or "A" in their serial-number prefix.

First Edition

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Service Manual HP Part 08657-90007

Other Documents Available:

Operation and Calibration Manual HP Part 08657-90006

Microfiche Operation and Calibration Manual HP Part 08657-90008

Microfiche Service Manual HP Part 08657-90009

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## SAFETY CONSIDERATIONS

### GENERAL

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

This product 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.*

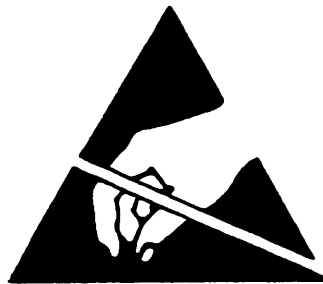
*If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the power source.*

*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.*



**ATTENTION  
Static Sensitive  
Devices**

*This instrument was constructed in an ESD (electro-static discharge) protected environment. This is because most of the semi-conductor devices used in this instrument are susceptible to damage by static discharge.*

*Depending on the magnitude of the charge, device substrates can be punctured or destroyed by contact or mere proximity of a static charge. The results can cause degradation of device performance, early failure, or immediate destruction.*

*These charges are generated in numerous ways such as simple contact, separation of materials, and normal motions of persons working with static sensitive devices.*

*When handling or servicing equipment containing static sensitive devices, adequate precautions must be taken to prevent device damage or destruction.*

*Only those who are thoroughly familiar with industry accepted techniques for handling static sensitive devices should attempt to service circuitry with these devices.*

*In all instances, measures must be taken to prevent static charge build-up on work surfaces and persons handling the devices.*

## Section 6 Replaceable Parts

### INTRODUCTION TO THIS SECTION

This section contains information for ordering parts. Table 6-1 lists reference designations, and Table 6-2 lists abbreviations that are used in the Replaceable Parts List. Table 6-3 lists all replaceable parts in the instrument. Table 6-4 contains the names and addresses that correspond to the manufacturer's code numbers listed in Table 6-3. Also included in this section are photographs and drawings to aid in identifying and ordering chassis mounted parts and mechanical parts.

### REFERENCE DESIGNATIONS AND ABBREVIATIONS USED IN THIS MANUAL

Table 6-1 lists the reference designation letters for electrical parts in the instrument. The letter designations found in Table 6-1 are coupled with numeric designations to provide a unique reference designation for each part in the instrument. For example, A6R101 is the reference designation of a particular resistor R101 on assembly A6.

Table 6-2 lists abbreviations used in the parts list and on schematics.

### REPLACEABLE PARTS LIST

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

- a. Electrical assemblies and their components with reference designations in alphanumeric order.
- b. Chassis-Mounted parts with reference designations in alphanumeric order.
- c. Mechanical parts with reference designations in alphanumeric order.

### Ordering Parts.

#### Instrument Serial Numbers.

Attached to the rear of the instrument is a serial-number plate. The first four digits and the letter are the instrument serial-number prefix. The last five digits (serial-number suffix) are unique to each instrument. When parts in the instrument are changed, the serial-number prefix of the instrument may also change. This means that sometimes a part will be listed more than once in the the replaceable parts list along with a serial-number prefix or range of serial-number prefixes. Find the serial-number prefix on the serial plate of your instrument and order the part listed under the corresponding prefix in the table. If no serial prefix information is listed, the part is compatible in instruments of all serial numbers.

#### NOTE

*It is possible that some assemblies in your instrument have been updated (through service or retrofitting) to reflect changes made to instruments with serial-number prefixes later than that shown on your instrument serial-number tag. Be sure to note the board number of the assembly being repaired or replaced when ordering parts for your instrument.*

### How to Order

To order a part in the Replaceable Parts List, call or write the nearest Hewlett-Packard Sales Office. Have the following information ready to speed the ordering process:

1. The Hewlett-Packard part number with the check digit. (The check digit will ensure accurate and timely processing of your order.)
2. The quantity required.
3. An approved purchase order number. (Sometimes required.)

### NOTE

*Within the USA, it is better to order directly from the HP Support Materials Organization, Roseville, California. Ask your nearest HP office for information and forms for the "Direct Order System".*

### Replaceable Parts List Updating (Manual Updates)

A "MANUAL UPDATES" packet is shipped with the manual, when necessary, to provide the most current information available at the time of shipment. These packets consist of replacement and addition pages which should be incorporated into the manual to bring it up to date.

Hewlett-Packard offers a Documentation Update Service that will provide you with further updates as they become available. If you operate or service instruments of different serial prefixes, we strongly recommend that you join this service immediately to ensure that your manual is kept current. For more information, refer to the Documentation Update Service reply card included in this manual.

### MECHANICAL AND CHASSIS PART LOCATIONS AND REFERENCE DESIGNATIONS

Most mechanical parts are identified in Figures 6-1 to 6-9. These figures are located at the end of this section. Major mechanical parts have reference designations that begin with the letters MP. To find the part number and description of a mechanical part, find the part in one of the photographs or drawings, and then look up the reference designation in Table 6-3. Mechanical hardware, such as screws, are listed under the part which they attach. For example, the screws that attach the fan (B1) to the rear panel are listed under B1.

### 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. You can request a complimentary copy of the "Recommended Spares" list from your nearest Hewlett-Packard office.

When stocking parts to support more than one instrument 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 consolidated "Recommended Spares" lists for any number or combination of instruments. Contact your nearest Hewlett-Packard office for details.

Table 6-1. Reference Designations

REFERENCE DESIGNATIONS			
A	assembly	E	miscellaneous electrical part
AT	attenuator; isolator; termination	F	fuse
B	fan; motor	FL	filter
BT	battery	H	hardware
C	capacitor	HY	circulator
CP	coupler	J	electrical connector (stationary portion); jack
CR	diode; diode thyristor; varactor	K	relay
DC	directional coupler	L	coil; inductor
DL	delay line	M	meter
DS	annunciator; signaling device (audible or visual); lamp; LED	MP	miscellaneous mechanical part
P	electrical connector (movable portion); plug	Q	transistor; SCR; triode thyristor; FET
R	resistor	RT	thermistor
S	switch	T	transformer
TB	terminal board	TC	thermocouple
TP	test point	U	integrated circuit; microcircuit
V	electron tube	VR	voltage regulator; breakdown diode
W	cable; transmission path; wire	X	socket
Y	crystal unit (piezo-electric or quartz)	Z	tuned cavity; tuned circuit

Table 6-2. Abbreviations (1 of 2)

ABBREVIATIONS			
A	ampere	COEF	coefficient
ac	alternating current	COM	common
ACCESS	accessory	COMP	composition
ADJ	adjustment	COMPL	complete
A/D	analog-to-digital	CONN	connector
AF	audio frequency	CP	cadmium plate
AFC	automatic frequency control	CRT	cathode-ray tube
AGC	automatic gain control	CTL	complementary transistor logic
AL	aluminum	CW	continuous wave
ALC	automatic level control	cw	clockwise
AM	amplitude modulation	cm	centimeter
AMPL	amplifier	D/A	digital-to-analog
APC	automatic phase control	dB	decibel
ASSY	assembly	dBm	decibel referred to 1 mW
AUX	auxiliary	dc	direct current
avg	average	deg	degree (temperature interval or difference)
AWG	American wire gauge	°	degree (plane angle)
BAL	balance	°C	degree Celsius (centigrade)
BCD	binary coded decimal	°F	degree Fahrenheit
BD	board	*K	degree Kelvin
BECU	beryllium copper	DEPC	deposited carbon
BFO	beat frequency oscillator	DET	detector
BH	binder head	diam	diameter
BKDN	breakdown	DIA	diameter (used in parts list)
BP	bandpass	DIFF AMPL	differential amplifier
BPF	bandpass filter	div	division
BRS	brass	DPDT	double-pole, double-throw
BWO	backward-wave oscillator	DR	drive
CAL	calibrate	DSB	double sideband
ccw	counter-clockwise	DTL	diode transistor logic
CER	ceramic	DVM	digital voltmeter
CHAN	channel	ECL	emitter coupled logic
cm	centimeter	EMF	electromotive force
CMO	cabinet mount only	EDP	electronic data processing
COAX	coaxial	ELECT	electrolytic
		ENCAP	encapsulated
		EXT	external
		F	farad
		FET	field-effect transistor
		F/F	flip-flop
		FH	flat head
		FIL H	filister head
		FM	frequency modulation
		FP	front panel
		FREQ	frequency
		FXD	fixed
		g	gram
		GE	germanium
		GHZ	gigahertz
		GL	glass
		GRD	ground(ed)
		H	henry
		h	hour
		HET	heterodyne
		HEX	hexagonal
		HD	head
		HDW	hardware
		HF	high frequency
		HG	mercury
		HI	high
		HP	Hewlett-Packard
		HPF	high pass filter
		HR	hour (used in parts list)
		HV	high voltage
		Hz	Hertz
		IC	integrated circuit
		ID	inside diameter
		IF	intermediate frequency
		IMPG	impregnated
		INC	incandescent
		INCL	include(s)
		INP	input
		INS	insulation
		INT	internal
		kg	kilogram
		KHz	kilohertz
		k	kilohm
		kV	kilovolt
		lb	pound
		LC	inductance-capacitance
		LED	light-emitting diode
		LF	low frequency
		LG	long
		LH	left hand
		LIM	limit
		LIN	linear taper (used in parts list)
		LK WASH	lock washer
		LO	low; local oscillator
		LOG	logarithmic taper (used in parts list)
		log	logarithmic
		LPF	low pass filter
		LV	low voltage
		m	meter (distance)
		mA	milliampere
		MAX	maximum
		M	megohm
		MEG	meg (10 <sup>6</sup> ) (used in parts list)
		MET FLM	metal film
		MET OX	metallic oxide
		MF	medium frequency; microfarad (used in parts list)
		MFR	manufacturer
		mg	milligram
		MHz	megahertz
		mH	millihenry
		mho	mho
		min	minute (time)
		min	minute (plane angle)
		MINAT	miniature
		mm	millimeter

NOTE

All abbreviations in the parts list will be in upper-case.



Table 6-2. Abbreviations (2 of 2)

MOM	MOD	modulator	OD	outside diameter	PWV	peak working voltage	TD	time delay
MOS	MOM	momentary	OH	oval head	RC	resistance-capacitance	TERM	terminal
ms	MOS	metal-oxide semiconductor	OP AMPL	operational amplifier	RECT	rectifier	TFT	thin-film transistor
MTG	ms	millisecond	OPT	option	REF	reference	TGL	toggle
MTR	MTG	mounting	OSC	oscillator	REG	regulated	THD	thread
mV	MTR	meter (indicating device)	OX	oxide	REPL	replaceable	THRU	through
mVac	mV	millivolt	oz	ounce	RF	radio frequency	TI	titanium
mVdc	mVac	millivolt, ac	Ω	ohm	RFI	radio frequency interference	TOL	tolerance
mVpk	mVdc	millivolt, dc	P	peak (used in parts list)	RH	round head; right hand	TRIM	trimmer
mVp-p	mVpk	millivolt, peak-to-peak	PAM	pulse-amplitude modulation	RLC	resistance-inductance-capacitance	TSTR	transistor
mVrms	mVp-p	millivolt, rms	PC	printed circuit	RMO	rack mount only	TTL	transistor-transistor logic
mW	mVrms	milliwatt	PCM	pulse-code modulation: pulse-count modulation	rms	root-mean-square	TV	television
MUX	mW	milliwatt	PDM	pulse-duration modulation	RND	round	TVI	television interference
MY	MUX	mylar	pF	picofarad	ROM	read-only memory	TWT	traveling wave tube
μA	MY	microampere	PH BRZ	phosphor bronze	R&P	rack and panel	U	micro (10 <sup>-6</sup> ) (used in parts list)
μF	μA	microfarad	PHL	Phillips	RWV	reverse working voltage	UF	microfarad (used in parts list)
μH	μF	microhenry	PIN	positive-intrinsic-negative	S	scattering parameter	UHF	ultrahigh frequency
μHno	μH	microhenry	PIV	peak inverse voltage	s	second (time)	UNDEF	undefined
μS	μHno	microsecond	pk	peak	...	second (plane angle)	UNREG	unregulated
μV	μS	microvolt	PL	phase lock	S-B	slow-blow (fuse) (used in parts list)	V	volt
μVac	μV	microvolt, ac	PLO	phase lock oscillator	SCR	silicon controlled rectifier; screw	VA	voltampere
μVdc	μVac	microvolt, dc	PM	phase modulation	SE	selenium	Vac	volts, ac
μVpk	μVdc	microvolt, peak-to-peak	PNP	positive-negative-positive	SECT	sections	VAR	variable
μVp-p	μVpk	microvolt, peak-to-peak	P/O	part of	SEMICON	semiconductor	VCO	voltage-controlled oscillator
μVrms	μVp-p	microvolt, rms	POLY	polystyrene	SHF	supernigh frequency	Vdc	volts, dc
μW	μVrms	microwatt	PORC	porcelain	SI	silicon	VDCW	volts, dc, working (used in parts list)
nA	μW	nanowatt	POS	positive: position(s) (used in parts list)	SIL	silver	V(F)	volts, filtered
NC	nA	nanoampere	POSN	position	SL	slide	VFO	variable-frequency oscillator
N/C	NC	no connection	POT	potentiometer	SNR	signal-to-noise ratio	VHF	very-high frequency
NE	N/C	normally closed	P-p	peak-to-peak	SPDT	single-pole, double-throw	Vpk	volts, peak
NEG	NE	neon	PP	peak-to-peak (used in parts list)	SPG	spring	Vp-p	volts, peak-to-peak
NEG	NEG	negative	PPM	pulse-position modulation	SR	split ring	Vrms	volts, rms
nF	NEG	nanofarad	PREAMPL	preamplifier	SPST	single-pole, single-throw	VSWR	voltage standing wave ratio
NI PL	nF	nickel plate	PRF	pulse-repetition frequency	SS	Service Sheet	VTO	voltage-tune oscillator
N/O	NI PL	normally open	PRR	pulse repetition rate	SSB	single sideband	VTVM	vacuum-tube voltmeter
NOM	N/O	nominal	PS	picosecond	SST	stainless steel	V(X)	volts, switched
NORM	NOM	normal	PT	point	STL	steel	W	watt
NPN	NORM	normal	PTM	pulse-time modulation	SQ	square	W/	with
NPN	NPN	negative-positive-negative	PWM	pulse-width modulation	SWR	standing-wave ratio	WIV	working inverse voltage
NPO	NPN	negative-positive zero (zero temperature coefficient)			SYNC	synchronize	WW	wirewound
NRFR	NPO	not recommended for field replacement			T	timed (slow-blow fuse)	W/O	without
NSR	NRFR	not separately replaceable			TA	tantalum	YIG	yttrium-iron-garnet
ns	NSR	nanosecond			TC	temperature compensating	Z <sub>0</sub>	characteristic impedance
nW	ns	nanowatt						
OBD	nW	order by description						
	OBD							

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10 <sup>12</sup>
G	giga	10 <sup>9</sup>
M	mega	10 <sup>6</sup>
k	kilo	10 <sup>3</sup>
da	deka	10
d	deci	10 <sup>-1</sup>
c	centi	10 <sup>-2</sup>
m	milli	10 <sup>-3</sup>
μ	micro	10 <sup>-6</sup>
n	nano	10 <sup>-9</sup>
p	pico	10 <sup>-12</sup>
f	femto	10 <sup>-15</sup>
a	atto	10 <sup>-18</sup>

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A1</b>						
A1	08657-60117	1	1	KEYBOARD	28480	08657-60117
A1DS1	HLMP-1840	4	20	LED GRN	28480	HLMP-1840
A1DS2	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS3	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS4	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS5	HLMP-1800	6	2	LED RED	28480	HLMP-1800
A1DS6	HLMP-1800	6		LED RED	28480	HLMP-1800
A1DS7	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS8	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS9	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS10	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS11	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS12	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS13	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS14	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS15	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS16	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS17	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS18	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS19	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS20	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS21	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1DS22	HLMP-1840	4		LED GRN	28480	HLMP-1840
A1J1	1252-2103	4	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	28480	1252-2103

† Refer to Section 7 for update information.

\* Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A2</b>						
A2	08657-60118	2	1	DISPLAY BOARD	28480	08657-60118
A2C1	0160-4832	4	8	CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C2	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C3	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C4	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C5	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C6	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C7	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C8	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A2C9	0160-4822	2	5	CAP-FXD 1000PF 100 V	09969	RPA20C0G102J100V
A2C10	0160-4822	2		CAP-FXD 1000PF 100 V	09969	RPA20C0G102J100V
A2C11	0160-4822	2		CAP-FXD 1000PF 100 V	09969	RPA20C0G102J100V
A2C12	0160-4822	2		CAP-FXD 1000PF 100 V	09969	RPA20C0G102J100V
A2C13	0160-4822	2		CAP-FXD 1000PF 100 V	09969	RPA20C0G102J100V
A2C14	0180-0100	3	1	CAP-FXD 4.7UF 35 V TA	56289	1500475X9035B2
A2J1	1251-8671	1	1	CONN-POST TYPE .100-PIN-SPCG 10-CONT	28480	1251-8671
A2J2	1252-0223	5	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	28480	1252-0223
A2J3	1251-5618	0	1	CONN-POST TYPE .100-PIN-SPCG 8-CONT	28480	1251-5618
A2J4	1251-4700	9	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4700
A2JU1	1200-0915	3	17	SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU2	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU3	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU4	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU5	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU6	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU7	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU8	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU9	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU10	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU11	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU12	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU13	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU14	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU15	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU16	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2JU17	1200-0915	3		SOCKET-DSPL 14-CONT DIP DIP-SLDR	51167	14-8470-10
A2K1	5041-0944	4	1	KEY CAP POWER	28480	5041-0944
A2L1	9135-0095	9	1	INDUCTOR 143NH +-5.245% 2.6D-MMX6.6LG-MM	24226	10M140X-1
A2R1	1810-0398	9	1	NETWORK-RES 10-SIP 22.0K OHM X 9	C1433	750-101
A2R2	1810-0371	8	1	NETWORK-RES 8-SIP 100.0K OHM X 7	C1433	750-81
A2R3	0698-3438	3	1	RESISTOR 147 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TQ-147R-F
A2R4	0698-7236	7	1	RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TQ-1001-F
A2R5	0757-0442	9	5	RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TQ-1002-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A2R6	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A2R7	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A2R8	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A2R9	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A2R10	0698-3155	1	4	RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A2R11	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A2R12	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A2R13	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A2S1	3101-2692	9	1	SWITCH-PB SPST-NO MOM .125A 115 VAC	12672	ZLL199NB021100
A2U1	1820-3423	8	1	IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A2U2	1820-2634	1	1	IC INV TTL ALS HEX	01295	SN74ALS04BN
A2U3	1820-3181	5	2	IC SHF-RGTR CMOS/74HC SYNC/ASYN	04713	MC74HC165N
A2U4	1820-3181	5		IC SHF-RGTR CMOS/74HC SYNC/ASYN	04713	MC74HC165N
A2U5	1820-4053	2	2	IC INV CMOS/74HC HEX	01295	SN74HC05N
A2U6	1820-4053	2		IC INV CMOS/74HC HEX	01295	SN74HC05N
A2U7	1820-5339	9	5	IC-INTERFACE DRVR CMOS DISPLAY LED	27014	MMS450N
A2U8	1820-5339	9		IC-INTERFACE DRVR CMOS DISPLAY LED	27014	MMS450N
A2U9	1820-5339	9		IC-INTERFACE DRVR CMOS DISPLAY LED	27014	MMS450N
A2U10	1820-5339	9		IC-INTERFACE DRVR CMOS DISPLAY LED	27014	MMS450N
A2U11	1820-5339	9		IC-INTERFACE DRVR CMOS DISPLAY LED	27014	MMS450N
A2XU1	1251-5595	2	1	POLARIZING KEY-POST CONN	76381	3518
	08657-61063	8	1	MTCH LED ASSY	28480	08657-61063

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A3</b>						
A3	08657-60110	4	1	LOW FREQUENCY LOOP ASSEMBLY	28480	08657-60110
<i>3105U AND ABOVE</i>						
A3	08657-60158	4	1	LOW FREQUENCY LOOP ASSEMBLY	28480	08657-60158
A3C1	0160-4835	7	46	CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C2	0160-4834	6	14	CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C3	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C4	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C5	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C6	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C7	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C8	0180-0197	8	3	CAPACITOR-FXD 2.2UF ±10% 20VDC TA	56289	150D225X9020A2
A3C9	0180-2929	8	2	CAPACITOR-FXD 68UF ±10% 10VDC TA	28480	0180-2929
A3C10	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C11	0160-4789	0	1	CAPACITOR-FXD 15PF ±5% 100VDC CER 0-30	28480	0160-4789
A3C12	0160-4786	7	3	CAPACITOR-FXD 27PF ±5% 100VDC CER 0-30	28480	0160-4786
A3C13	0160-4814	2		CAPACITOR-FXD 150PF ±5% 100VDC CER	28480	0160-4814
A3C14	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C15	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C16	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C17	0160-4535	4	2	CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A3C18	0160-4822	2		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4822
A3C19	0180-0094	4	2	CAPACITOR-FXD 100UF ±75-10% 25VDC AL	56289	300107G025DD2
A3C20	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C21	0121-0061	1	1	CAPACITOR-V TRMR CER 5.5-18PF 350V	73899	DV11PS18A
A3C22	0160-4833	5	3	CAPACITOR-FXD .022UF ±10% 100VDC CER	28480	0160-4833
A3C23*	0160-4807	3	3	CAPACITOR-FXD 33PF ±5% 100VDC CER 0-30	28480	0160-4807
A3C24	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C25	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C26	0180-0094	4		CAPACITOR-FXD 100UF ±75-10% 25VDC AL	56289	300107G025DD2
A3C27	0160-4803	9	4	CAPACITOR-FXD 68PF ±5% 100VDC CER 0-30	28480	0160-4803
A3C28	0180-2436	0	2	CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0180-2436
A3C29	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C30	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C31-C99				NOT ASSIGNED		
A3C100	0180-2144	9	3	CAPACITOR-FXD 200UF ±75-10% 25VDC AL	56289	300207G025DH9
A3C101	0180-2821	9	7	CAPACITOR-FXD 22UF ±20% 35VDC TA	28480	0180-2821
A3C102-C199				NOT ASSIGNED		
A3C200	0180-2208	6	5	CAPACITOR-FXD 220UF ±10% 10VDC TA	56289	150D227X9010S2
A3C201	0180-2208	6		CAPACITOR-FXD 220UF ±10% 10VDC TA	56289	150D227X9010S2
A3C202	0180-2144	9		CAPACITOR-FXD 200UF ±75-10% 25VDC AL	56289	300207G025DH9
A3C203	0180-2144	9		CAPACITOR-FXD 200UF ±75-10% 25VDC AL	56289	300207G025DH9
A3C204	0160-4791	4	3	CAPACITOR-FXD 10PF ±5% 100VDC CER 0-30	28480	0160-4791
A3C205	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A3C206	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C207	0160-4801	7	5	CAPACITOR-FXD 100PF ±5% 100VDC CER	28480	0160-4801
A3C208	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C209	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C211	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C212	0180-2929	8		CAPACITOR-FXD 68UF ±10% 10VDC TA	28480	0180-2929
A3C213	0160-5098	6	2	CAPACITOR-FXD .22UF ±10% 50VDC CER	16299	CAC05X7R224J050A
A3C214-C299				NOT ASSIGNED		
A3C300	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C301	0160-4786	7	3	CAPACITOR-FXD 27PF ±5% 100VDC CER 0-30	28480	0160-4786

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3C302	0180-2141	5		CAPACITOR-FXD 3.3UF±10% 35VDC TA	04200	150035X905082-DYS
A3C303	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC TA	28480	0160-4835
A3C304	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C305	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C306	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C307	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C308	0180-1746	5	3	CAPACITOR-FXD 15UF±10% 20VDC TA	56289	1500156X902082
A3C309	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C310	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C311	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C312	0160-4803	9		CAPACITOR-FXD 68PF ±5% 100VDC CER 0-30	28480	0160-4803
A3C313	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C314-C399				NOT ASSIGNED		
A3C400	0180-2821	9		CAPACITOR-FXD 22UF±20% 35VDC TA	28480	0180-2821
A3C401	0180-2208	6		CAPACITOR-FXD 220UF±10% 10VDC TA	56289	1500227X9010S2
A3C402	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C403	0180-2821	9		CAPACITOR-FXD 22UF±20% 35VDC TA	28480	0180-2821
A3C404	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C405	0180-2821	9		CAPACITOR-FXD 22UF±20% 35VDC TA	28480	0180-2821
A3C406	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C407	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C408	0180-2667	1	2	CAPACITOR-FXD 150UF±10% 20VDC TA	56289	1520157X9020S2
A3C409	0160-5469	5	24	CAPACITOR-FXD 1UF 10% 50VDC	28480	0160-5469
A3C410	0160-4535	4		CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A3C411	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C412	0180-0097	7	4	CAPACITOR-FXD 47UF±10% 35VDC TA	56289	1500476X9035S2
A3C413	0180-2667	1		CAPACITOR-FXD 150UF±10% 20VDC TA	56289	1520157X9020S2
A3C414	0160-5098	6	2	CAPACITOR-FXD .22UF ±10% 50VDC CER	16299	CAC05X7R224J050A
A3C415	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C416	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C417-C499				NOT ASSIGNED		
A3C500	0160-4803	9		CAPACITOR-FXD 68PF ±5% 100VDC CER 0-30	28480	0160-4803
A3C501	0160-4803	9		CAPACITOR-FXD 68PF ±5% 100VDC CER 0-30	28480	0160-4803
A3C502	0180-2208	6		CAPACITOR-FXD 220UF±10% 10VDC TA	56289	1500227X9010S2
A3C503	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C504	0160-4801	7		CAPACITOR-FXD 100PF ±5% 100VDC CER	28480	0160-4801
A3C505	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C506	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C507	0160-4801	7		CAPACITOR-FXD 100PF ±5% 100VDC CER	28480	0160-4801
A3C508	0160-4810	8	3	CAPACITOR-FXD 330PF ±5% 100VDC CER	28480	0160-4810
A3C509	0160-4810	8		CAPACITOR-FXD 330PF ±5% 100VDC CER	28480	0160-4810
A3C510	0160-4812	0	3	CAPACITOR-FXD 220PF ±5% 100VDC CER	28480	0160-4812
A3C511	0160-5558	3	1	CAPACITOR-FXD .68UF ±5% 100VDC	28480	0160-5558
A3C512	0160-4801	7		CAPACITOR-FXD 100PF ±5% 100VDC CER	28480	0160-4801
A3C513	0160-4791	4		CAPACITOR-FXD 10PF ±5% 100VDC CER 0-30	28480	0160-4791
A3C514	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C515	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C516	0160-4812	0		CAPACITOR-FXD 220PF ±5% 100VDC CER	28480	0160-4812
A3C517	0160-4799	2	1	CAPACITOR-FXD 2.2PF ±.25PF 100VDC CER	28480	0160-4799
A3C518	0160-4824	4	1	CAPACITOR-FXD 680PF ±5% 100VDC CER	28480	0160-4824
A3C519	0160-4808	4	1	CAPACITOR-FXD 470PF ±5% 100VDC CER	28480	0160-4808
A3C520	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C521	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A3C522-C599				NOT ASSIGNED		
310SU AND ABOVE						
A3C522	0160-4832			CAPACITOR-FXD .1UF ±10% 100VDC CER	28480	0160-4832

† Refer to Section 7 for update information.

\* Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3C600	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C601	0160-4787	8	7	CAPACITOR-FXD 22PF ←5% 100VDC CER 0-30	28480	0160-4787
A3C602	0160-4787	8		CAPACITOR-FXD 22PF ←5% 100VDC CER 0-30	28480	0160-4787
A3C603	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C604	0160-3674	0	1	CAPACITOR-FXD .47UF ←5% 100VDC	28480	0160-3674
<i>3105U AND ABOVE</i>						
A3C604	0160-7013		1	CAPACITOR-FXD .027UF ←5% 100VDC	28480	0160-7013
A3C605	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C606	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C607	0160-3661	5	1	CAPACITOR-FXD .1UF ←5% 50VDC MET-POLYC	28480	0160-3661
A3C608	0160-4787	8		CAPACITOR-FXD 22PF ←5% 100VDC CER 0-30	28480	0160-4787
A3C609	0160-4787	8		CAPACITOR-FXD 22PF ←5% 100VDC CER 0-30	28480	0160-4787
A3C610	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C611	0160-0578	7	2	CAPACITOR-FXD .047UF ←1% 50VDC	28480	0160-0578
A3C612	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C613	0160-2821	9		CAPACITOR-FXD 22UF ←20% 35VDC TA	28480	0160-2821
A3C614	0160-4787	8		CAPACITOR-FXD 22PF ←5% 100VDC CER 0-30	28480	0160-4787
A3C615	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C616	0160-4787	8		CAPACITOR-FXD 22PF ←5% 100VDC CER 0-30	28480	0160-4787
A3C617	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C618	0160-1746	5		CAPACITOR-FXD 15UF ←10% 20VDC TA	56289	150D156X9020B2
A3C619	0160-4787	8		CAPACITOR-FXD 22PF ←5% 100VDC CER 0-30	28480	0160-4787
A3C620	0160-3531	8	1	CAPACITOR-FXD 2UF ←5% 50VDC MET-POLYC	28480	0160-3531
A3C621	0160-0578	7		CAPACITOR-FXD .047UF ←1% 50VDC	28480	0160-0578
A3C622-C699				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
A3C622	0160-5338			CAPACITOR-FXD .33UF ←10% 50VDC CER	28480	0160-5338
A3C623-C659				NOT ASSIGNED		
A3C660	0160-3875			CAPACITOR-FXD 22PF ←10% 200VDC CER	28480	0160-3875
A3C661	0160-4765			CAPACITOR-FXD 38PF ←10% 200VDC CER	28480	0160-4765
A3C662	0160-3875			CAPACITOR-FXD 22PF ←10% 200VDC CER	28480	0160-3875
A3C663-C699				NOT ASSIGNED		
A3C700	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C701	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C702	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C703	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C704	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C705	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C706	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C707	0160-4801	7		CAPACITOR-FXD 100PF ←5% 100VDC CER	28480	0160-4801
A3C708	0160-4565	0	1	CAPACITOR-FXD 1000PF ←1% 100VDC CER	28480	0160-4565
A3C709	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C710	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C711	0160-4835	7		CAPACITOR-FXD .1UF ←10% 50VDC CER	28480	0160-4835
A3C712	0160-4791	4	3	CAPACITOR-FXD 10PF ←5% 100VDC CER 0-30	28480	0160-4791
A3C713	0160-4791	4	3	CAPACITOR-FXD 10PF ←5% 100VDC CER 0-30	28480	0160-4791
A3CR1	1901-0539	3	20	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR2	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR3	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR4	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR5	1901-0050	3	80	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR7	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR8	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR10	1901-0376	6	4	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3CR11	1901-0376	6	4	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A3CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR13-CR14				NOT ASSIGNED		
A3CR15	0122-0173	8	11	DIODE-VVC 13.5PF 7% C3/C25-MIN-5 BVR=30V	25403	BB809 SELECTED
A3CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR19-CR199				NOT ASSIGNED		
A3CR200	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR201	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR202-CR399				NOT ASSIGNED		
A3CR400	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR401	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR402	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR403	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR404	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR405	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR406	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR407-CR499				NOT ASSIGNED		
A3CR500	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR501	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR502	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR503	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR504	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR505	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR506	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR507-CR599				NOT ASSIGNED		
A3CR600	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR601				NOT ASSIGNED		
A3CR602	1901-0376	6	4	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A3CR603-CR699				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
A3CR603	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR700	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR701	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR702	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR703	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3CR704	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR705	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR706	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3CR707	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A3DS1-DS499				NOT ASSIGNED		
A3DS500	1990-0517	4	1	LED-LAMP LUM-INT=3MCD IF=20MA-MAX BVR=5V	28480	5082-4655
A3E1	9170-0847	3	1	CORE-SHIELDING BEAD	02114	56-590-65/38 PARYLENE COATED
A3FL1	9135-0002	8	4	FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A3FL2	9135-0002	8		FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A3FL3	9135-0002	8		FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A3FL4	9135-0002	8		FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A3J1	1251-5647	5	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-5647
	1251-5595	2		POLARIZING KEY-POST CONN	28480	1251-5595
A3J2	1250-0835	1	3	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-0835
<i>3105U AND ABOVE</i>						
A3J2	08656-00133	1	5	CLIP SEMI-RIGID GRND	28480	08656-00133

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3J3	1250-0835	1		CONNECTOR-RF SMC M PC 50-OHM	28480	1250-0835
A3J4	1250-0835	1		CONNECTOR-RF SMC M PC 50-OHM	28480	1250-0835
<i>3105U AND ABOVE</i>						
A3J3	08656-00133	1	5	CLIP SEMI-RIGID GRND	28480	08656-00133
A3J4	08656-00133	1	5	CLIP SEMI-RIGID GRND	28480	08656-00133
A3J5	1250-0828	2	5	CONNECTOR-RF SMC M SGL-HOLE-RR 50-OHM	28480	1250-0828
A3J6	1250-0828	2		CONNECTOR-RF SMC M SGL-HOLE-RR 50-OHM	28480	1250-0828
A3J7	1250-0828	2		CONNECTOR-RF SMC M SGL-HOLE-RR 50-OHM	28480	1250-0828
A3J8	1250-0828	2		CONNECTOR-RF SMC M SGL-HOLE-RR 50-OHM	28480	1250-0828
A3L1	9140-0394	2	3	INDUCTOR RF-CH-MLD 680NH 5%	28480	9140-0394
A3L2	9140-0394	2		INDUCTOR RF-CH-MLD 680NH 5%	28480	9140-0394
A3L3	9140-0394	2		INDUCTOR RF-CH-MLD 680NH 5%	28480	9140-0394
A3L4				NOT ASSIGNED		
A3L5	9140-0144	0	3	INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0144
A3L6*	9100-2255	4	3	INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A3L7				PRINTED CIRCUIT TRACE INDUCTOR		
A3L8	9140-0141	7		INDUCTOR RF-CH-MLD 680NH 10%	28480	9140-0141
A3L9-L199				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
A3L9	9135-0072	7		INDUCTOR 56NH	28480	9135-0072
A3L10	9135-0072	7		INDUCTOR 56NH	28480	9135-0072
A3L200	9100-1788	6	2	CORE-FERRITE CHOKE-WIDEBAND;IMP>680	28480	9100-1788
A3L201	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP>680	28480	9100-1788
A3L202	9100-1618	1	2	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A3L203	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A3L204	9100-3922	4	8	INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3L205-L299				NOT ASSIGNED		
A3L300	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3L301-L399				NOT ASSIGNED		
A3L400	9140-0129	1	3	INDUCTOR RF-CH-MLD 220UH 5%	28480	9140-0129
A3L401	9100-1620	5	3	INDUCTOR RF-CH-MLD 15UH 10%	28480	9100-1620
A3L402	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5%	28480	9140-0129
A3L403	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5%	28480	9140-0129
A3L404	9100-1620	5		INDUCTOR RF-CH-MLD 15UH 10%	28480	9100-1620
A3L405-L499				NOT ASSIGNED		
A3L500	9100-1620	5		INDUCTOR RF-CH-MLD 15UH 10%	28480	9100-1620
A3L501	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3L502	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3L503	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3MP1	08656-00126	5	2	COVER TOP	28480	08656-00126
<i>3105U AND ABOVE</i>						
A3MP1	08656-40016	5	2	COVER TOP	28480	08656-40016
A3MP2	2360-0277	9	16	SCREW-MACH 6-32 .312-IN-LG HEX-RO-SLT	00000	ORDER BY DESCRIPTION
A3MP3	08656-00044	6	1	FENCE LFL SHLD	28480	08656-00044
A3MP4	08656-00128	7	2	COVER-FRAME	28480	08656-00128
A3MP5				NOT ASSIGNED		
A3MP6	2190-0124	4	9	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A3MP7	2190-0008	4	8	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0008
A3MP8	2950-0078	9	5	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A3MP9	08656-00127	6	2	COVER BOTTOM	28480	08656-00127
A3MP10	1400-0966	8	17	CLIP-CMPNT .17-.185-DIA .195-WD STL	91506	6015-13AT

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C	D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3MP11	1205-0660	5		1	HEAT SINK DIP	98978	APIC050CB
A3MP12	0520-0128	7		2	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3MP13	0610-0001	6		2	NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3MP14	2190-0654	5		2	WASHER-LK HILCL 2.0 MM 2.1-MM-ID	28480	2190-0654
<b>3105U AND ABOVE</b>							
A3MP10-MP14					NOT ASSIGNED		
A3MP15	3050-0063	5		5	WASHER-FL MTLCL NO. 8 .172-IN-ID	28480	3050-0063
A3MP16					NOT ASSIGNED		
A3MP17	0570-1189	7		4	STUD-PRS-IN 4-40 UNC-2A .312-IN-LG PH	28480	0570-1189
A3Q1	1853-0405	9		12	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q2	1853-0405	9			TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q3	1854-0810	2		8	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A3Q4	1853-0405	9			TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q5	1854-0809	9		8	TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q6	1853-0405	9			TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q7	1855-0276	6		9	TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q8	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q9	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q10	1853-0281	9		11	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q11	1853-0459	3		8	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A3Q12	1853-0405	9			TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q13	1854-0810	2			TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A3Q14	1854-0810	2			TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A3Q15	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q16	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q17	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q18	1853-0281	9			TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q19	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q20	1853-0459	3			TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A3Q21	1853-0594	7		1	TRANSISTOR-DUAL PNP 2N3808 TO-78	28480	1853-0594
A3Q22	1854-0809	9			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q23	1854-0809	9			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q24	1854-0809	9			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q25	1853-0281	9			TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q26	1855-0277	7		1	TRANSISTOR J-FET 2N5268 P-CHAN D-MODE	04713	2N5268
A3Q27	1853-0281	9			TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q28	1853-0281	9			TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q29	1854-0401	7		1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A3Q30	1853-0430	0		2	TRANSISTOR PNP 2N4959 SI TO-72 PD=200MW	04713	2N4959
A3Q31	1858-0087	3		1	TRANSISTOR ARRAY 14-PIN PLSTC TO-116	04713	MPC3904
A3Q32	1855-0418	8		1	TRANSISTOR J-FET DUAL N-CHAN D-MODE SI	28480	1855-0418
A3Q33	1853-0430	0			TRANSISTOR PNP 2N4959 SI TO-72 PD=200MW	04713	2N4959
A3Q34	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q35	1855-0420	2		7	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A3Q36	1853-0405	9			TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q37	1855-0276	6			TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	04713	2N4416A
A3Q38	1854-0477	7		4	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A3Q39	1854-0809	9			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q40	1854-0809	9			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q41	1854-0809	9			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q42	1854-0809	9			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A3Q43	1853-0281	9			TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q44	1853-0281	9			TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q45					NOT ASSIGNED		

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3Q46	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A3Q47	1854-0345	8	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q48	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q49	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q50	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A3Q51	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q52	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q53	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q54	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3Q55	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q56	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A3R1	0757-0398	4	4	RESISTOR 75 1% .125W F TC=0-100	24546	CT4-1/B-T0-75R0-F
A3R2	0757-0402	1	3	RESISTOR 110 1% .125W F TC=0-100	24546	CT4-1/B-T0-111-F
A3R3	0757-0402	1		RESISTOR 110 1% .125W F TC=0-100	24546	CT4-1/B-T0-111-F
A3R4	0757-1094	9	7	RESISTOR 1.47K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1471-F
A3R5	0757-0402	1		RESISTOR 110 1% .125W F TC=0-100	24546	CT4-1/B-T0-111-F
A3R6	0757-0397	3	2	RESISTOR 68.1 1% .125W F TC=0-100	24546	CT4-1/B-T0-68R1-F
A3R7	0698-3429	2	2	RESISTOR 19.6 1% .125W F TC=0-100	03888	PME55-1/B-T0-19R6-F
A3R8	1810-0203	5	1	NETWORK.RES B-SIP 470.0 OHM X 7	11236	750-81-R470
A3R9	0698-7215	2		RESISTOR 133 1% .05W F TC=0-100	24546	C3-1/B-T0-133R-F
A3R10	0698-3457	6	6	RESISTOR 316K 1% .125W F TC=0-100	28480	0698-3457
A3R11	0698-3457	6		RESISTOR 316K 1% .125W F TC=0-100	28480	0698-3457
A3R12	0698-3444	1	10	RESISTOR 316 1% .125W F TC=0-100	24546	CT4-1/B-T0-316R-F
A3R13	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4641-F
A3R14	0698-3457	6		RESISTOR 316K 1% .125W F TC=0-100	28480	0698-3457
A3R15	0698-3444	1		RESISTOR 316 1% .125W F TC=0-100	24546	CT4-1/B-T0-316R-F
A3R16	0698-3457	6		RESISTOR 316K 1% .125W F TC=0-100	28480	0698-3457
A3R17	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4641-F
A3R18	0757-0438	3	31	RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R19	0698-3444	1		RESISTOR 316 1% .125W F TC=0-100	24546	CT4-1/B-T0-316R-F
A3R20	0757-0280	3	43	RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R21	0757-0465	6	9	RESISTOR 100K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1003-F
A3R22	2100-3659	7	1	RESISTOR-TRMR 20K 10% C TOP.ADJ 17-TRN	28480	2100-3659
A3R23	0698-0084	9	3	RESISTOR 2.15K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2151-F
A3R24	0698-7199	1	4	RESISTOR 28.7 1% .05W F TC=0-100	24546	C3-1/B-T0-28R7-F
A3R25	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0-100	24546	CT4-1/B-T0-348R-F
A3R26	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R27	0757-0405	4	5	RESISTOR 162 1% .125W F TC=0-100	24546	CT4-1/B-T0-162R-F
A3R28	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R29	0698-3432	7	3	RESISTOR 26.1 1% .125W F TC=0-100	03888	PME55-1/B-T0-26R1-F
A3R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R31	0757-0416	7	11	RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-T0-511R-F
A3R32	0698-4037	0	17	RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R33	0698-0082	7	12	RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-T0-4640-F
A3R34-R99				NOT ASSIGNED		
A3R100	0757-0278	9	2	RESISTOR 1.78K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1781-F
A3R101	0757-0382	6	3	RESISTOR 16.2 1% .125W F TC=0-100	19701	5033R-1/B-T0-16R2-F
A3R102				NOT ASSIGNED		
A3R103				NOT ASSIGNED		
A3R104	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0-100	03888	PME55-1/B-T0-19R6-F
A3R105-R199				NOT ASSIGNED		

† Refer to Section 7 for update information.

\* Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3R200	0757-0418	9	4	RESISTOR 619 1% .125W F TC=0-100	24546	CT4-1/B-T0-619R-F
A3R201	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0-100	24546	CT4-1/B-T0-90RS-F
A3R202	0757-0346	2	3	RESISTOR 10 1% .125W F TC=0-100	28480	0757-0346
A3R203	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R204	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R205	0757-0401	0	14	RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R206	0698-3444	1		RESISTOR 316 1% .125W F TC=0-100	24546	CT4-1/B-T0-316R-F
A3R207	0698-3444	1		RESISTOR 316 1% .125W F TC=0-100	24546	CT4-1/B-T0-316R-F
A3R208	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R209	0698-3444	1		RESISTOR 316 1% .125W F TC=0-100	24546	CT4-1/B-T0-316R-F
A3R210	0698-0083	8	28	RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R211	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R212-R299				NOT ASSIGNED		
A3R300	1810-0205	7	1	NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81-RA.7K
A3R301	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R302	1810-0206	8	2	NETWORK-RES 8-SIP 10.0K OHM X 7	11236	750-81-R10K
A3R303	0698-0083	1		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R304	0757-0444	1	7	RESISTOR 12.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1212-F
A3R305	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R306	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R307	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0-100	03888	PME55-1/B-T0-26R1-F
A3R308	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R309-R399				NOT ASSIGNED		
A3R400	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R401	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R402	0757-0441	8	5	RESISTOR 8.25K 1% .125W F TC=0-100	24546	CT4-1/B-T0-8251-F
A3R403	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R404	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R405	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R406	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R407	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R408	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R409	0698-3153	9	4	RESISTOR 3.83K 1% .125W F TC=0-100	24546	CT4-1/B-T0-3831-F
A3R410	0757-0200	7	2	RESISTOR 5.62K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5621-F
A3R411	0757-0419	0	5	RESISTOR 681 1% .125W F TC=0-100	24546	CT4-1/B-T0-681R-F
A3R412	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R413	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1471-F
A3R414	2100-2060	2	2	RESISTOR-TRMR 50 20% C TOP-ADJ 1-TRN	73138	82PR50
A3R415	1810-0284	4	1	NETWORK-RESISTOR 16 PIN DIP; RES	28480	1810-0284
A3R416	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1781-F
A3R417	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1212-F
A3R418	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CT4-1/B-T0-3831-F
A3R419	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R420	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R421	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0-100	24546	CT4-1/B-T0-3481-F
A3R422	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R423	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R424	0757-0440	7	6	RESISTOR 7.5K 1% .125W F TC=0-100	24546	CT4-1/B-T0-7501-F
A3R425	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R426	0757-0418	9		RESISTOR 619 1% .125W F TC=0-100	24546	CT4-1/B-T0-619R-F
A3R427	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R428	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CT4-1/B-T0-3831-F
A3R429	0698-8961	7	1	RESISTOR 909K 1% .125W F TC=0-100	28480	0698-8961
A3R430	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R431	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1212-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3R432	2100-3296	8	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 17-TRN	28480	2100-3296
A3R433	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4222-F
A3R434	0698-4037	0		RESISTOR 48.4 1% .125W F TC=0-100	28480	0698-4037
A3R435	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R436	0698-0073	8	2	RESISTOR 10M 1% .125W F TC=0-150	28480	0698-0073
A3R437	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1211-F
A3R438	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R439	2100-3096	6	1	RESISTOR-TRMR 50K 10% C TOP-ADJ 17-TRN	28480	2100-3096
A3R440	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R441	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R442	0757-0424	7	5	RESISTOR 1.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1101-F
A3R443	0698-8828	5	1	RESISTOR 25.8K 1% .125W F TC=0-10	28480	0698-8828
A3R444	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R445	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R446	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0-100	24546	CT4-1/B-T0-8251-F
A3R447	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2612-F
A3R448	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0-100	24546	CT4-1/B-T0-8251-F
A3R449	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0-100	24546	CT4-1/B-T0-8251-F
A3R450	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R451	0698-8812	7	1	RESISTOR 1 1% .125W F TC=0-100	28480	0698-8812
A3R452	2100-2031	7	2	RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	22PR50K
A3R453-R499				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
A3R453	0698-8913	7		RESISTOR 1.5K 10%	28480	0698-8913
A3R500	0757-0395	1	2	RESISTOR 56.2 1% .125W F TC=0-100	24546	CT4-1/B-T0-56R2-F
A3R501	0757-0395	1		RESISTOR 56.2 1% .125W F TC=0-100	24546	CT4-1/B-T0-56R2-F
A3R502	0757-0419	0		RESISTOR 681 1% .125W F TC=0-100	24546	CT4-1/B-T0-681R-F
A3R503	0757-0419	0		RESISTOR 681 1% .125W F TC=0-100	24546	CT4-1/B-T0-681R-F
A3R504	0757-0317	7	3	RESISTOR 1.33K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1331-F
A3R505	0757-0317	7		RESISTOR 1.33K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1331-F
A3R506	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R507	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R508	0698-0082	7		RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-T0-4640-F
A3R509	0698-0082	7		RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-T0-4640-F
A3R510	0698-0082	7		RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-T0-4640-F
A3R511	0698-0082	7		RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-T0-4640-F
A3R512	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R513	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R514	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R515	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R516	0757-0421	4	8	RESISTOR 825 1% .125W F TC=0-100	24546	CT4-1/B-T0-825R-F
A3R517	0698-3440	7	16	RESISTOR 196 1% .125W F TC=0-100	24546	CT4-1/B-T0-196R-F
A3R518	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R519	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CT4-1/B-T0-825R-F
A3R520	0698-3150	6	3	RESISTOR 2.37K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2371-F
A3R521	0698-3162	0	9	RESISTOR 46.4K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4642-F
A3R522	0698-3430	5	2	RESISTOR 21.5 1% .125W F TC=0-100	03888	PME55-1/B-T0-21R5-F
A3R523	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4642-F
A3R524	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5621-F
A3R525	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0-100	24546	CT4-1/B-T0-3832-F
A3R526	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R527	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0-100	24546	CT4-1/B-T0-909R-F
A3R528	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0-100	24546	CT4-1/B-T0-2610-F
A3R529	0698-3156	2	6	RESISTOR 14.7K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1472-F
<i>3105U AND ABOVE</i>						
A3R529	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1212-F

Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3R530	0757-0382	6		RESISTOR 16.2 1% .125W F TC=0-100	19701	5033R-1/B-T0-16R2-F
A3R531	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R532	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R533	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R534	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1212-F
A3R535	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R536	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R537	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R538	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R539	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-T0-511R-F
A3R540	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1472-F
A3R541	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R542	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CT4-1/B-T0-825R-F
A3R543	0757-0418	9		RESISTOR 619 1% .125W F TC=0-100	24546	CT4-1/B-T0-619R-F
A3R544	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0-100	24546	CT4-1/B-T0-6811-F
A3R545	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0-100	24546	CT4-1/B-T0-51R1-F
A3R546	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1212-F
A3R547	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2151-F
A3R548	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R549	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-T0-511R-F
A3R550	0757-0382	6		RESISTOR 16.2 1% .125W F TC=0-100	19701	5033R-1/B-T0-16R2-F
A3R551	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0-100	24546	CT4-1/B-T0-287R-F
A3R552	0757-0419	0		RESISTOR 681 1% .125W F TC=0-100	24546	CT4-1/B-T0-681R-F
A3R553	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R554	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1782-F
A3R555	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R556	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R557	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0-100	24546	CT4-1/B-T0-51R1-F
A3R558	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R559	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R560	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CT4-1/B-T0-825R-F
A3R561	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R562	2100-2497	9	1	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	73138	82PR2K
A3R563	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R564	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R565	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0-100	24546	CT4-1/B-T0-51R1-F
A3R566	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1472-F
A3R567	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	28480	0698-4037
A3R568	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R569	0698-0082	7		RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-T0-4640-F
A3R570	0757-0199	3	3	RESISTOR 21.5K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2152-F
A3R571-R599				NOT ASSIGNED		
<b>3105U AND ABOVE</b>						
A3R571	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R572	2100-3089		1	RESISTOR-TRMR 5K 10%	24546	2100-3089
A3R600	0757-0462	3	4	RESISTOR 75K 1% .125W F TC=0-100	24546	CT4-1/B-T0-7502-F
A3R601	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4642-F
A3R602	0698-3157	3	5	RESISTOR 19.6K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1962-F
A3R603	0757-0467	8	2	RESISTOR 121K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1213-F
A3R604	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4642-F
A3R605	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0-100	24546	CT4-1/B-T0-3161-F

† Refer to Section 7 for update information.

\* Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3R606	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1212-F
A3R607	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1101-F
A3R608	0698-3444	1		RESISTOR 316 1% .125W F TC=0-100	24548	CT4-1/B-T0-316R-F
A3R609	0698-3154	0	3	RESISTOR 4.22K 1% .125W F TC=0-100	24548	CT4-1/B-T0-4221-F
A3R610	0757-0467	8		RESISTOR 121K 1% .125W F TC=0-100	24548	CT4-1/B-T0-1213-F
A3R611	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R612	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R613	0757-0439	4		RESISTOR 8.81K 1% .125W F TC=0-100	24548	CT4-1/B-T0-8811-F
A3R614	0757-0338	2	1	RESISTOR 1K 1% .25W F TC=0-100	24548	NA5-1/4-T0-1001-F
A3R615	1810-0206	8		NETWORK-RES 8-SIP 10.0K OHM X 7	11236	750-81-R10K
A3R616	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R617	0757-0439	4		RESISTOR 8.81K 1% .125W F TC=0-100	24546	CT4-1/B-T0-8811-F
A3R618	0698-3154	0	3	RESISTOR 4.22K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4221-F
A3R619	0757-0346	2	3	RESISTOR 10 1% .125W F TC=0-100	28480	0757-0346
A3R620	2100-3210	6	2	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	28480	2100-3210
A3R621	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R622	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0-100	24546	CT4-1/B-T0-8251-F
A3R623-R699				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
A3R623	0698-0082	8	1	RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-T0-464R-F
A3R624	0757-0418	9		RESISTOR 619 1% .125W F TC=0-100	24546	CT4-1/B-T0-619R-F
A3R625	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R626	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R700	0698-0085	0	5	RESISTOR 2.61K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2611-F
A3R701	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2611-F
A3R702	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2611-F
A3R703	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2611-F
A3R704	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CT4-1/B-T0-825R-F
A3R705	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R706	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R707	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0-100	28480	CT4-1/B-T0-38R3-F
A3R708	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R709	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R710	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R711	1810-0666	4	1	NETWORK-RES 8-DIP 2.5K OHM X 2	28480	1810-0666
A3R712	2100-3296	8	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 17-TRN	28480	2100-3296
A3R713	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0-100	28480	0757-0465
A3R714	2100-3733	8	1	RESISTOR-TRMR 1M 20% C TOP-ADJ 17-TRN	28480	2100-3733
A3R715	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0-100	24546	CT4-1/B-T0-7501-F
A3R716	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R717	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R718	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0-100	24546	CT4-1/B-T0-7501-F
A3R719	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1101-F
A3R720	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1101-F
A3R721	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A3R722	0757-0465	6		RESISTOR 100K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1003-F
A3R723	2100-2030	6	1	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A3R724	0757-1084	9		RESISTOR 1.47K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1471-F
A3R725	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0-100	24546	CT4-1/B-T0-4642-F
A3R726	0698-3454	3	3	RESISTOR 215K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2153-F
A3R727	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R728	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R729	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A3R730				NOT ASSIGNED		
A3R731	0757-1084	9		RESISTOR 1.47K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1471-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3R732	0757-0200	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R733	0757-0200	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A3R734	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R735	0757-0458	7	6	RESISTOR 51.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5112-F
A3R736	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5112-F
A3R737	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R738	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A3R739				NOT ASSIGNED		
A3R740	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3R741	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-T0-101-F
A3TP1	1251-0600	0	38	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP9	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP10	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP11	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP12	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP13	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP14	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP15	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP16	1251-4926	1	4	CONNECTOR 8-PIN M POST TYPE	28480	1251-4926
A3TP17	1251-4926	1		CONNECTOR 8-PIN M POST TYPE	28480	1251-4926
A3TP18	1251-4926	1		CONNECTOR 8-PIN M POST TYPE	28480	1251-4926
A3TP19	1251-4926	1		CONNECTOR 8-PIN M POST TYPE	28480	1251-4926
A3TP20	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP21	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP22	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP23	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP24	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP25	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP26	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP27	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP28	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP29	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP30	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP31	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP32	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
A3TP33	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SO	28480	1251-0600
3105U AND ABOVE A3TP30-TP33				NOT ASSIGNED		
A3U1	1820-1225	4	2	IC FF ECL D-M/S DUAL	04713	MC10231P
A3U2	1826-0371	1	7	IC OP AMP LOW-BIAS-H/LMPD TO-99 PKG	27014	LF258H
A3U3	1858-0032	8	2	TRANSISTOR ARRAY 14-PIN PLSTC DIP	3L585	CA3146E
A3U4	1826-1012	9	2	ANALOG SWITCH 4 SPST 16 -CERDIP	34371	H11-0201-A
A3U5	1826-0371	1		IC OP AMP LOW-BIAS-H/LMPD TO-99 PKG	27014	LF258H

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3U6	1820-0693	8	4	IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
A3U7	1826-0932	0	2	IC OP AMP PRCN 8-DIP-C PKG	06665	OP-27FZ
A3U8	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3U9	1826-0141	3	1	IC COMPARATOR GP DUAL 14-DIP-C PKG	27014	LM318J
A3U10	1826-0065	0	2	IC COMPARATOR PRCN 8-DIP-P PKG	S0545	UPC311C
A3U11	1826-0065	0	2	IC COMPARATOR PRCN 8-DIP-P PKG	S0545	UPC311C
A3U12	1826-0371	1		IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LF258H
A3U13	1826-1012	9		ANALOG SWITCH 4 SPST 16-CERDIP	34371	H11-0201-4
A3U14	1826-0845	4	1	IC OP AMP PRCN TO-99 PKG	06665	OP-07EJ
A3U15	1820-1144	6	3	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A3U16	1826-0462	1	3	D/A 10-BIT 16-CBRZ/SDR BPLR	04713	MC3410CL
A3U17	1SD6-0046	7	1	IC MISC NMOS	28480	1SD6-0046
A3U18	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A3U19	1820-1112	8	6	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A3U20	1820-1278	7	3	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS191N
A3U21	1826-0021	8	1	IC OP AMP GP TO-99 PKG	27014	LM310H
A3U22	1826-1100	6	1	A/O 8-1/2-BIT 18-DIP-C BPLR	24355	AD570JD
A3U23	1820-1858	9		IC FF TTL LS D-TYPE OCTL	01295	SN74LS377N
A3U24	1820-1279	8	3	IC CNTR TTL LS DECD UP/DOWN SYNCHRO	01295	SN74LS190N
A3U25	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A3U26	1820-1278	7		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS191N
A3U27	1826-0889	6	2	IC OP AMP LOW-NOISE DUAL 14-DIP-C PKG	52063	XR5533AN(PER HP DWG)
A3U28	1820-3618	3	1	IC 8-BIT, 6800 SERIES MCU(MASKED)	04713	MC6805P2CP(MASKED)
<i>3105U AND ABOVE</i>						
A3U27	1826-2190	6		ICS 270 14-DIP	28480	1826-2190
A3U28				NOT ASSIGNED		
A3U29	1820-1196	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A3U30	1820-1279	8		IC CNTR TTL LS DECD UP/DOWN SYNCHRO	01295	SN74LS190N
A3U31	1820-0693	8		IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
A3U32	1820-1278	7		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS191N
A3U33	1826-0889	6		IC OP AMP LOW-NOISE DUAL 14-DIP-C PKG	52063	XR5533AN(PER HP DWG)
A3U34	1826-1202	9	2	D/A 10-BIT 16-CERDIP CMOS	24355	AD7533(SEL)
A3U35	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A3U36	1820-1279	8		IC CNTR TTL LS DECD UP/DOWN SYNCHRO	01295	SN74LS190N
A3U37	1820-0693	8		IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
A3U38	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A3U39	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A3U40	1820-1882	9	1	IC GATE ECL EXCL-OR QUAD	04713	MC10113L
A3U41	1820-1206	1	1	IC GATE TTL LS NOR TPL 3-INP	01295	SN74LS27N
A3U42	1820-1446	1	1	IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN74LS385AN
A3U43	1820-1367	5	1	IC GATE TTL S AND QUAD 2-INP	01295	SN74S08N
A3U44	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A3U45	1826-0785	1	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01295	TL072ACJG
A3U46	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A3U47	1820-0629	0	5	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A3U48	1820-1891	1	1	IC CNTR TTL LS DECD DUAL 4-BIT	07263	74LS390PC
A3U49	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A3U50	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A3U51	1820-1322	2	1	IC GATE TTL S NOR QUAD 2-INP	01295	SN74S02N
A3U52	1820-0693	8		IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
A3U53	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A3U54	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A3U55	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
<i>3105U AND ABOVE</i>						
A3U56	1826-0777			ICS 303 14-PIN	01295	SN74S112N

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3VR1-VR299				NOT ASSIGNED		
A3VR300	1902-0945	7	1	DIODE-ZNR 3V 5% DO-35 PD=4W TC=0.43%	28480	1902-0945
A3VR301-VR399				NOT ASSIGNED		
A3VR400	1902-0680	7	2	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=4W	04713	1N827
A3VR401	1902-0680	7		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=4W	04713	1N827
A3VR402-VR499				NOT ASSIGNED		
A3VR500	1902-0947	9	1	DIODE-ZNR 3.6V 5% DO-35 PD=4W TC=0.36%	28480	1902-0947
A3VR501-VR600				NOT ASSIGNED		
A3VR601	1902-0962	8	1	DIODE-ZNR 15V 5% DO-35 PD=4W TC=0.87%	28480	1902-0962
A3W1	1251-4670	2	6	CONNECTOR 3-PIN M POST TYPE	28480	1251-4670
A3W2	1251-8557	2	13	CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
A3W3	1251-4670	2		CONNECTOR 3-PIN M POST TYPE	28480	1251-4670
A3W4	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
A3W5	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
A3W6	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
A3W7	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
A3W8	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
A3W9	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
A3W10	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
	1258-0209	9	8	JUMPER-REMOVABLE 2 POSITION; .200 IN	28480	1258-0209
A3W11	8159-0005	0		RESISTOR-ZERO OHMS 22AWG LEAD DIA	28480	8159-0005
A3W12	08656-60144	3	1	COAX CABLE F SMC-SMC (5)	28480	08656-60144
A3W13	08656-60145	4	1	COAX F SMC-SMC (6)	28480	08656-60145
<i>3105U AND ABOVE</i>						
A3W12	08656-20141	3	1	FLEX COAX CABLE	28480	08656-20141
A3W13	08656-60167	4	1	FLX CX CAB ASSY	28480	08656-60167
A3W14	8159-0005	4	1	WIRE 22AWG BLACK	28480	8159-0005
A3Y1	0410-1130	0	1	CRYSTAL-QUARTZ 50 MHZ HC-42/U-HLDR	28480	0410-1130
	1200-0758	2	1	SOCKET-KTAL 2-CONT HC-25/U DIP-SLDR	28480	1200-0758
A3Y2-Y299				NOT ASSIGNED		
A3Y300	0410-1180	0	2	CRYSTAL-QUARTZ 4.000 MHZ HC-18/U-HLDR	28480	0410-1180
	2580-0002	4	5	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	28480	2580-0002
	3050-0105	6	4	WASHER-FL MTLG NO. 4 .125-IN-ID	28480	3050-0105

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A3A1</b>						
A3A1	08657-60109	1	1	LOW FREQUENCY OSCILLATOR ASSY	28480	08657-60109
<i>3105U AND ABOVE</i>						
A3A1	08657-60177		1	LOW FREQUENCY OSCILLATOR ASSY	28480	08657-60177
A3A1C1	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A3A1C2	0180-0097	7		CAPACITOR-FXD 47UF ±10% 35VDC TA	56289	1500476X9035S2
A3A1C3	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A3A1C4	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A3A1C5	0160-4588	7	2	CAPACITOR-FXD 270PF ±5% 100VDC CER	28480	0160-4588
A3A1C6	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A3A1C7	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A3A1C8	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A3A1C9	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A3A1C10	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A3A1C11				NOT ASSIGNED		
A3A1C12	0160-4493	3	1	CAPACITOR-FXD 27PF ±5% 200VDC CER 0-30	28480	0160-4493
A3A1C13	0160-4767	4	3	CAPACITOR-FXD 20PF ±5% 200VDC CER 0-30	28480	0160-4767
A3A1C14	0121-0445	5	1	CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0445
A3A1C15	0160-4588	7		CAPACITOR-FXD 270PF ±5% 100VDC CER	28480	0160-4588
A3A1C16	0160-2437	1	2	CAPACITOR-FDTHRU 5000PF ±80 -20% 200V	28480	0160-2437
A3A1C17	0160-2437	1		CAPACITOR-FDTHRU 5000PF ±80 -20% 200V	28480	0160-2437
A3A1C18	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A3A1C19	0160-0576	5	23	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-0576
A3A1C20	0160-4385	2	1	CAPACITOR-FXD 15PF ±5% 200VDC CER 0-30	28480	0160-4385
A3A1C21-C119				NOT ASSIGNED		
A3A1C120	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
A3A1CR1	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR2	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR3	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR4	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR5	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR6	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR7	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR8	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR9	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR10	0122-0173	8		DIODE-VVC 13.5PF 7% C3/C25-MIN=5 BVR=30V	25403	88809 SELECTED
A3A1CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3A1CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3A1J1	1250-0828	2		CONNECTOR-RF SMC M SGL-HOLE-RR 50-OHM	28480	1250-0828
A3A1L1	9140-0452	3	1	INDUCTOR RF-CH-MLD 2.7UH 5% .166DX.38SLG	28480	9140-0452
A3A1L2	9100-2248	5	2	INDUCTOR RF-CH-MLD 120NH 10%	28480	9100-2248
A3A1L3				NOT ASSIGNED		
A3A1L4	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10%	28480	9100-2250
A3A1L5	9135-0073	3	10	INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A3A1L6	9100-2249	6	3	INDUCTOR RF-CH-MLD 150NH 10%	28480	9100-2249
A3A1L7	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH 10%	28480	9100-2252
A3A1L8	9135-0081	3	1	INDUCTOR RF-CH-MLD 68NH 5%	28480	9135-0081

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3A1MP1	08656-00126	5		COVER TOP	28480	08656-00126
<i>3105U AND ABOVE</i>						
A3A1MP1	08656-40016	5		COVER TOP	28480	08656-40016
A3A1MP2	08656-00128	7		COVER-FRAME	28480	08656-00128
A3A1MP3	08656-00127	6		COVER BOTTOM	28480	08656-00127
A3A1MP4	2360-0277	9		SCREW-MACH 8-32 .312-IN-LG HEX-HD-SLT	00000	ORDER BY DESCRIPTION
A3A1MP5	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A3A1MP6	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A3A1MP7	2190-0009	4		WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
A3A1MP8	2580-0002	4		NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	28480	2580-0002
A3A1MP9	2260-0001	5	12	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	28480	2260-0001
A3A1MP10	2190-0004	9	4	WASHER-LK INTL T NO. 4 .115-IN-ID	28480	2190-0004
A3A1MP11	4208-0277	9	1	FOAM-POLYU 9.53-MM-THK 110-MM-WD	28480	4208-0277
A3A1MP12	08657-00025	4	1	PAD-FOAM	28480	08657-00025
A3A1Q1	1854-0632	6	7	TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR91
A3A1Q2	1854-0632	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR91
<i>3105U AND ABOVE</i>						
A3A1Q1	1854-1234	6	2	TRANSISTOR NPN SI PD=180MW FT=4GHZ	28480	1854-1234
A3A1Q2	1854-1234	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	28480	1854-1234
A3A1Q3	1854-0378	7	1	TRANSISTOR NPN ZNS109 SI TO-39 PD=800MW	3L585	ZNS109
A3A1R1	0698-7194	6		RESISTOR 17.8 1% .05W F TC=0-100	24546	C3-1/8-TO-17R8-F
A3A1R2	0698-7212	9		RESISTOR 100 1% .05W F TC=0-100	24546	C3-1/8-TO-100R-F
A3A1R3	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/8-TO-511R-F
A3A1R4	0757-0405	4		RESISTOR 162 1% .125W F TC=0-100	24546	CT4-1/8-TO-162R-F
A3A1R5	0698-7198	8		RESISTOR 10 1% .05W F TC=0-100	24546	C3-1/8-TO-10R-F
A3A1R6	0698-7198	8		RESISTOR 10 1% .05W F TC=0-100	24546	C3-1/8-TO-10R-F
<i>3105U AND ABOVE</i>						
A3A1R5	0698-1902	8		RESISTOR 10 1% .05W F TC=0-100	24546	C3-1/8-TO-10R-F
A3A1R6	0698-1902	8		RESISTOR 10 1% .05W F TC=0-100	24546	C3-1/8-TO-10R-F
A3A1R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/8-TO-1001-F
A3A1R8	0698-3438	3		RESISTOR 147 1% .125W F TC=0-100	24546	CT4-1/8-TO-147R-F
A3A1R9	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/8-TO-5111-F
A3A1R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/8-TO-1001-F
A3A1R11	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/8-TO-511R-F
A3A1R12	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/8-TO-5111-F
A3A1R13	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/8-TO-5111-F
A3A1R14	0698-7212	9		RESISTOR 100 1% .05W F TC=0-100	24546	C3-1/8-TO-100R-F
A3A1R15	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	C3-1/8-TO-51R1-F
A3A1R16	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0-100	24546	C3-1/8-TO-316R-F
A3A1R17	0698-7212	9		RESISTOR 100 1% .05W F TC=0-100	24546	C3-1/8-TO-100R-F
<i>3105U AND ABOVE</i>						
A3A1R17	0698-7209	9		RESISTOR 75 1% .05W F TC=0-100	24546	C3-1/8-TO-100R-F
A3A1R18	0698-7223	2		RESISTOR 287 1% .05W F TC=0-100	24546	C3-1/8-TO-287R-F
A3A1R19	0698-7194	6		RESISTOR 17.8 1% .05W F TC=0-100	24546	C3-1/8-TO-17R8-F
A3A1R20	0698-7223	2		RESISTOR 287 1% .05W F TC=0-100	24546	C3-1/8-TO-287R-F
A3A1R21	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	C3-1/8-TO-51R1-F
A3A1R22	0698-7219	6		RESISTOR 196 1% .05W F TC=0-100	24546	C3-1/8-TO-196R-F
A3A1T1	08657-21022	1	1	CABLE SEMI-RIGID 2.18 NO CONN	28480	08657-21022

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A4</b>						
A4	08657-60102	4	1	HIGH FREQUENCY LOOP ASSY DOES NOT INCLUDE A4MP1 (CS, C44 AND HARDWARE)	28480	08657-60102
A4C1	0180-3770	9	3	CAPACITOR-FXD 2.2UF ±10% 35VDC TA	28480	0180-3770
A4C2	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C3	0180-3770	9		CAPACITOR-FXD 2.2UF ±10% 35VDC TA	28480	0180-3770
A4C4	0160-4389	6	28	CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C5	0160-4082	6	2	CAPACITOR-FDTHRU 1000PF 20% 200V CER	28480	0160-4082
A4C6	0160-4040	6	34	CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C7	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C8	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C9	0160-4619	5	3	CAPACITOR-FXD 2.7PF ±.25PF 200VDC CER	28480	0160-4619
A4C10	0160-4619	5		CAPACITOR-FXD 2.7PF ±.25PF 200VDC CER	28480	0160-4619
A4C11	0160-4619	5		CAPACITOR-FXD 2.7PF ±.25PF 200VDC CER	28480	0160-4619
A4C12	0160-4547	8	1	CAPACITOR-FXD 150PF ±5% 200VDC CER	28480	0160-4547
A4C13	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C14	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C15				NOT ASSIGNED		
A4C16	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C17	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C18	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C19	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C20	0160-4511	6	2	CAPACITOR-FXD 220PF ±5% 200VDC CER	28480	0160-4511
A4C21	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C22				NOT ASSIGNED		
A4C23				NOT ASSIGNED		
A4C24	0160-4518	3	2	CAPACITOR-FXD 3.9PF ±5PF 200VDC CER	28480	0160-4518
A4C25	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C26	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C27				NOT ASSIGNED		
A4C28	0160-3875	3	7	CAPACITOR-FXD 22PF ±5% 200VDC CER 0-30	28480	0160-3875
A4C29	0160-3873	1	2	CAPACITOR-FXD 4.7PF ±5PF 200VDC CER	28480	0160-3873
A4C30	0160-4491	1	7	CAPACITOR-FXD 8.2PF ±5PF 200VDC CER	28480	0160-4491
2921U AND ABOVE						
A4C30				NOT ASSIGNED		
A4C31	0160-4387	4	2	CAPACITOR-FXD 47PF ±5% 200VDC CER 0-30	28480	0160-4387
A4C32	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C33	0160-4519	4	2	CAPACITOR-FXD 9.1PF ±5PF 200VDC CER	28480	0160-4519
A4C34	0180-0197	8		CAPACITOR-FXD 2.2UF ±10% 20VDC TA	56289	150D225X9020A2
A4C35	0160-4498	8	16	CAPACITOR-FXD 5.6PF ±5PF 200VDC CER	28480	0160-4498
A4C36	0160-4519	4		CAPACITOR-FXD 9.1PF ±5PF 200VDC CER	28480	0160-4519
A4C37	0160-4383	0	4	CAPACITOR-FXD 6.8PF ±5PF 200VDC CER	20932	5024E0200RD689D
A4C38	0160-4383	0		CAPACITOR-FXD 6.8PF ±5PF 200VDC CER	20932	5024E0200RD689D
A4C39	0160-3874	2	5	CAPACITOR-FXD 10PF ±5PF 200VDC CER	28480	0160-3874
A4C40				NOT ASSIGNED		
A4C41	0160-4383	0		CAPACITOR-FXD 6.8PF ±5PF 200VDC CER	20932	5024E0200RD689D
A4C42	0160-3875	3		CAPACITOR-FXD 22PF ±5% 200VDC CER 0-30	28480	0160-3875
A4C43	0160-4383	0		CAPACITOR-FXD 6.8PF ±5PF 200VDC CER	20932	5024E0200RD689D
A4C44	0160-3926	5	1	CAPACITOR-FDTHRU 100PF 20% 200V CER	28480	0160-3926
A4C45	0160-3875	3		CAPACITOR-FXD 22PF ±5% 200VDC CER 0-30	28480	0160-3875

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4C46				NOT ASSIGNED		
A4C47	0160-4511	6		CAPACITOR-FXD 220PF $\pm$ 5% 200VDC CER	28480	0160-4511
A4C48				NOT ASSIGNED		
A4C49	0160-3873	1		CAPACITOR-FXD 4.7PF $\pm$ .5PF 200VDC CER	28480	0160-3873
A4C50	0160-4381	8	1	CAPACITOR-FXD 1.5PF $\pm$ .25PF 200VDC CER	28480	0160-4381
A4C51	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C52				NOT ASSIGNED		
A4C53	0121-0449	9	3	CAPACITOR-V TRMR-CER 3.5-10PF 63V PC-MTG	28480	0121-0449
A4C54-CS8				NOT ASSIGNED		
A4C59	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C60	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C61	0160-3875	3		CAPACITOR-FXD 22PF $\pm$ 5% 200VDC CER 0-30	28480	0160-3875
A4C62	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C63	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C64	0160-4767	4		CAPACITOR-FXD 20PF $\pm$ 5% 200VDC CER 0-30	28480	0160-4767
A4C65	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C66	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C67	0160-4389	6		CAPACITOR-FXD 100PF $\pm$ .5PF 200VDC CER	28480	0160-4389
A4C68	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C69	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C70	0160-4926	7	1	CAPACITOR-FXD 110PF $\pm$ 5% 200VDC CER	28480	0160-4926
A4C71	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C72	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C73	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C74	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C75	0121-0449	9		CAPACITOR-V TRMR-CER 3.5-10PF 63V PC-MTG	28480	0121-0449
A4C76	0160-3872	0	1	CAPACITOR-FXD 2.2PF $\pm$ .25PF 200VDC CER	28480	0160-3872
A4C77	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C78	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C79	0160-4387	4		CAPACITOR-FXD 47PF $\pm$ 5% 200VDC CER 0-30	28480	0160-4387
A4C80	0160-4498	8		CAPACITOR-FXD 5.6PF $\pm$ .5PF 200VDC CER	28480	0160-4498
A4C81	0160-4498	8		CAPACITOR-FXD 5.6PF $\pm$ .5PF 200VDC CER	28480	0160-4498
A4C82				NOT ASSIGNED		
A4C83	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C84	0160-4521	8	1	CAPACITOR-FXD 12PF $\pm$ 5% 200VDC CER 0-30	28480	0160-4521
A4C85	0121-0449	9		CAPACITOR-V TRMR-CER 3.5-10PF 63V PC-MTG	28480	0121-0449
A4C86	0160-4382	9	4	CAPACITOR-FXD 3.3PF $\pm$ .25PF 200VDC CER	28480	0160-4382
A4C87	0160-4040	6		CAPACITOR-FXD 1000PF $\pm$ 5% 100VDC CER	28480	0160-4040
A4C88	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C89	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C90	0160-0576	5		CAPACITOR-FXD .1UF $\pm$ 20% 50VDC CER	28480	0160-0576
A4C91	0160-0576	5		CAPACITOR-FXD .1UF $\pm$ 20% 50VDC CER	28480	0160-0576
A4C92	0160-0573	2	1	CAPACITOR-FXD 4700PF $\pm$ 20% 100VDC CER	28480	0160-0573
A4C93	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C94	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C95	0160-0575	4	5	CAPACITOR-FXD .047UF $\pm$ 20% 50VDC CER	28480	0160-0575
A4C96	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879
A4C97	0160-3879	7		CAPACITOR-FXD .01UF $\pm$ 20% 100VDC CER	28480	0160-3879

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4C98	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C99	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C100	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C101	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C102	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C103	0160-4764	1	1	CAPACITOR-FXD 150PF ±5% 100VDC CER	28480	0160-4764
A4C104-C149				NOT ASSIGNED		
A4C150	0160-4527	4	1	CAPACITOR-FXD 56PF ±5% 200VDC CER 0-30	28480	0160-4527
A4C151	0160-4389	6	57	CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C152	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C153	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C154	0160-5469	5		CAPACITOR-FXD 1UF 10% 50VDC	28480	0160-5469
A4C155*	0160-3875	3		CAPACITOR-FXD 22PF ±5% 200VDC CER 0-30	28480	0160-3875
A4C156	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C157	0160-5469	5		CAPACITOR-FXD 1UF 10% 50VDC	28480	0160-5469
A4C158	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C159	0160-4382	9		CAPACITOR-FXD 3.3PF ±.25PF 200VDC CER	28480	0160-4382
A4C160				PRINTED CIRCUIT TRACE CAPACITOR		
A4C161	0160-4766	3	3	CAPACITOR-FXD 30PF ±5% 200VDC CER 0-30	28480	0160-4766
A4C162	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C163	0160-4524	1	1	CAPACITOR-FXD 24PF ±5% 200VDC CER 0-30	51642	200-200-NPG-240J
A4C164	0160-4518	3		CAPACITOR-FXD 3.9PF ±.5PF 200VDC CER	28480	0160-4518
A4C165	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C166	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A4C167	0160-4766	3		CAPACITOR-FXD 30PF ±5% 200VDC CER 0-30	28480	0160-4766
A4C168	0160-4526	3	2	CAPACITOR-FXD 42PF ±5% 200VDC CER 0-30	28480	0160-4526
A4C169	0160-4526	3		CAPACITOR-FXD 42PF ±5% 200VDC CER 0-30	28480	0160-4526
A4C170	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4C171	0160-4386	3	1	CAPACITOR-FXD 33PF ±5% 200VDC CER 0-30	28480	0160-4386
A4C172	0160-4766	3		CAPACITOR-FXD 30PF ±5% 200VDC CER 0-30	28480	0160-4766
A4C173				NOT ASSIGNED		
A4C174	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C175	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C176	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C177	0180-3770	9		CAPACITOR-FXD 2.2UF ±10% 35VDC TA	28480	0180-3770
A4C178	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
A4CR1	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR2	1901-0189	9	1	DIODE-STEP RECOVERY	28480	1901-0189
A4CR3	1906-0098	9	4	DIODE-MATCHED 1V	28480	1906-0098
A4CR4	1906-0098	9		DIODE-MATCHED 1V	28480	1906-0098
A4CR5	1906-0098	9		DIODE-MATCHED 1V	28480	1906-0098
A4CR6	1906-0098	9		DIODE-MATCHED 1V	28480	1906-0098
A4CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

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\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR14	1901-0518	8	2	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A4CR15	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR19	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR20	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR21	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR22-CR100				NOT ASSIGNED		
A4CR101	0122-0161	4	6	DIODE-VVC 2.15PF 7% BVR=30V	25403	884058
A4CR102	0122-0161	4		DIODE-VVC 2.15PF 7% BVR=30V	25403	884058
A4J1	1251-8589	2	3	CONN-POST TYPE .100-PIN-SPCG 10-CONT	28480	1251-8589
A4L1	9100-1627	2	5	INDUCTOR RF-CH-MLD 39UH 5%	28480	9100-1627
A4L2	9100-1627	2		INDUCTOR RF-CH-MLD 39UH 5%	28480	9100-1627
A4L3	9100-1627	2		INDUCTOR RF-CH-MLD 39UH 5%	28480	9100-1627
A4L4	9100-1627	2		INDUCTOR RF-CH-MLD 39UH 5%	28480	9100-1627
A4L5	9100-2247	4	13	INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L6-L9				PRINTED CIRCUIT TRACE INDUCTORS		
A4L10	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L11	9135-0071	1	1	INDUCTOR RF-CH-MLD 62NH 5.806%	28480	9135-0071
A4L12				NOT ASSIGNED		
A4L13	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L14				NOT ASSIGNED		
A4L15	9135-0076	6	1	INDUCTOR RF-CH-MLD 39NH 6%	28480	9135-0076
A4L16	9135-0076	6	1	INDUCTOR RF-CH-MLD 39NH 6%	28480	9135-0076
A4L17				NOT ASSIGNED		
A4L18				NOT ASSIGNED		
A4L19	9135-0068	6	5	INDUCTOR RF-CH-MLD 33NH 6.36%	28480	9135-0068
A4L20	9135-0068	6		INDUCTOR RF-CH-MLD 33NH 6.36%	28480	9135-0068
A4L21	9135-0076	6	1	INDUCTOR RF-CH-MLD 39NH 6%	28480	9135-0076
A4L22	9135-0073	3		INDUCTOR RF-CH-MLD 47NH 6.596%	28480	9135-0073
A4L23	9140-0158	6	37	INDUCTOR RF-CH-MLD 1UH 10%	28480	9140-0158
A4L24	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10%	28480	9140-0158
A4L25	9100-3514	0	4	INDUCTOR 30NH .2850-IND-4LG-IN	28480	9100-3514
A4L26	9135-0072	2	1	INDUCTOR 56NH 5.893% 2.60-MMX6.6LG-MM	28480	9135-0072
A4L27	9135-0068	6		INDUCTOR RF-CH-MLD 33NH 6.36%	28480	9135-0068
A4L28	9100-3514	0		INDUCTOR 30NH .2850-IND-4LG-IN	28480	9100-3514
A4L29				NOT ASSIGNED		
A4L30	9100-2248	5		INDUCTOR RF-CH-MLD 120NH 10%	28480	9100-2248
A4L31	9140-0141	7		INDUCTOR RF-CH-MLD 680NH 10%	28480	9140-0141
A4L32				NOT ASSIGNED		

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4L33	9100-2249	6		INDUCTOR RF-CH-MLD 150NH 10%	28480	9100-2249
A4L34				NOT ASSIGNED		
A4L35	9135-0068	6		INDUCTOR RF-CH-MLD 33NH 6.36%	28480	9135-0068
A4L36	9100-3514	0		INDUCTOR 30NH .285D-INDC4LG-IN	28480	9100-3514
A4L37	9100-3512	8	1	INDUCTOR 50NH .285D-INDC4LG-IN	28480	9100-3512
A4L38	9100-3514	0		INDUCTOR 30NH .285D-INDC4LG-IN	28480	9100-3514
A4L39	9100-3513	9	1	INDUCTOR 75NH .285D-INDC4LG-IN	28480	9100-3513
A4L40				NOT ASSIGNED		
A4L41	9100-2249	6		INDUCTOR RF-CH-MLD 150NH 10%	28480	9100-2249
A4L42	9135-0068	6		INDUCTOR RF-CH-MLD 33NH 6.36%	28480	9135-0068
A4L43	9100-2259	8		INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A4L44-L99				NOT ASSIGNED		
A4L100	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L101	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
<b>2928UU AND ABOVE</b>						
A4L101	9100-2247	4		INDUCTOR RF-CH-MLD 1UH 10%	05524	1M-2
A4L102	08901-00068	2	1	INDUCTOR	28480	08901-00068
A4L103	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L104				PRINTED CIRCUIT TRACE INDUCTOR		
A4L105	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L106	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L107	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L108	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L109	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10%	28480	9100-2247
A4L110	9100-1827	2		INDUCTOR RF-CH-MLD 39UH 5%	28480	9100-1827
A4L111	9135-0074	4		INDUCTOR RF-CH-MLD 47NH 16.17%	28480	9135-0074
A4MP1	08656-80192	1	1	FEEDTHRU ASSEMBLY (INCLUDES CS AND C44)	28480	08656-80192
	2190-0630	7	2	WASHER-LX HLCL NO. 6 .141-IN-ID	28480	2190-0630
	2420-0026	4	2	NUT-HEX-DBL-CHAM 6-32-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
	08656-00089	9	1	FEEDTHRU BRACKET	28480	08656-00089
	08656-00074	2	1	BRACKET PLATE	28480	08656-00074
A4MP2	08657-00041	4	10	TAB-GROUNDING	28480	08657-00041
A4MP3	08656-00133	4	14	CLIP SEMI-R GRND	28480	08656-00133
A4Q1				NOT ASSIGNED		
A4Q2	1854-0632	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR91
A4Q3				NOT ASSIGNED		
A4Q4				NOT ASSIGNED		
A4Q5	1855-0423	5	1	TRANSISTOR MOSFET N-CHAN E-MODE TO-237	17856	VN10KM
A4Q6	1855-0235	7	1	TRANSISTOR J-FET N-CHAN D-MODE TO-S2 SI	04713	U310(SELECTED)
A4Q7	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4Q8	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q9	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q10	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q11-Q100				NOT ASSIGNED		
A4Q101	1854-0632	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR91
A4Q102	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A4Q103	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q104	1854-0632	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR91

† Refer to Section 7 for update information.

\* Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4Q105	1853-0527	6	3	TRANSISTOR PNP SI PD=500MW FT=4GHZ	25403	BFO-32
A4Q106	1854-0632	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR91
A4R1	0698-7227	6	10	RESISTOR 422 1% .05W F TC=0-100	24546	CT3-1/B-T0-422R-F
A4R2	0698-7189	9	2	RESISTOR 11 1% .05W F TC=0-100	24546	CT3-1/B-T0-11R0-F
A4R3	0698-7227	6		RESISTOR 422 1% .05W F TC=0-100	24546	CT3-1/B-T0-422R-F
A4R4				NOT ASSIGNED		
A4R5	0698-7199	1		RESISTOR 28.7 1% .05W F TC=0-100	24546	CT3-1/B-T0-28R7-F
A4R6*	0698-7218	5	4	RESISTOR 178 1% .05W F TC=0-100	24546	CT3-1/B-T0-178R-F
A4R7*	0698-7200	5	2	RESISTOR 31.6 1% .05W F TC=0-100	24546	CT3-1/B-T0-31R6-F
A4R8	0698-3442	9	2	RESISTOR 237 1% .125W F TC=0-100	24546	CT4-1/B-T0-237R-F
A4R9	0698-7252	7	4	RESISTOR 4.64K 1% .05W F TC=0-100	24546	CT3-1/B-T0-4641-F
A4R10*	0698-7218	5		RESISTOR 178 1% .05W F TC=0-100	24546	CT3-1/B-T0-178R-F
A4R11	0698-3440	7		RESISTOR 196 1% .125W F TC=0-100	24546	CT4-1/B-T0-196R-F
A4R12	0698-3440	7		RESISTOR 196 1% .125W F TC=0-100	24546	CT4-1/B-T0-196R-F
A4R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R15	0698-3442	9		RESISTOR 237 1% .125W F TC=0-100	24546	CT4-1/B-T0-237R-F
A4R16	0698-7220	9		RESISTOR 215 1% .05W F TC=0-100	24546	CT3-1/B-T0-215R-F
A4R17				NOT ASSIGNED		
A4R18				NOT ASSIGNED		
A4R19	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	CT3-1/B-T0-51R1-F
A4R20	0698-7253	8	4	RESISTOR 5.11K 1% .05W F TC=0-100	24546	CT3-1/B-T0-5111-F
A4R21	0698-7236	7		RESISTOR 1K 1% .05W F TC=0-100	24546	CT3-1/B-T0-1001-F
A4R22	0698-3438	3		RESISTOR 147 1% .125W F TC=0-100	24546	CT4-1/B-T0-147R-F
A4R23	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	CT3-1/B-T0-51R1-F
A4R24	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	CT3-1/B-T0-51R1-F
A4R25	0757-0346	2		RESISTOR 10 1% .125W F TC=0-100	28480	0757-0346
A4R26	0698-3440	7		RESISTOR 196 1% .125W F TC=0-100	24546	CT4-1/B-T0-196R-F
A4R27	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2151-F
A4R28	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0-100	24546	CT4-1/B-T0-51R1-F
A4R29	0698-3447	4	14	RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R30	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CT4-1/B-T0-825R-F
A4R31				NOT ASSIGNED		
A4R32	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CT4-1/B-T0-825R-F
A4R33	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A4R34	0757-0398	4		RESISTOR 75 1% .125W F TC=0-100	24546	CT4-1/B-T0-75R0-F
A4R35	0757-0398	4		RESISTOR 75 1% .125W F TC=0-100	24546	CT4-1/B-T0-75R0-F
A4R36	0757-0398	4		RESISTOR 75 1% .125W F TC=0-100	24546	CT4-1/B-T0-75R0-F
A4R37	0698-7227	6		RESISTOR 422 1% .05W F TC=0-100	24546	CT3-1/B-T0-422R-F
A4R38	0698-7189	9		RESISTOR 11 1% .05W F TC=0-100	24546	CT3-1/B-T0-11R0-F
A4R39	0698-7227	6		RESISTOR 422 1% .05W F TC=0-100	24546	CT3-1/B-T0-422R-F
A4R40	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R41	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R42	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R43	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R44	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R45	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4R46	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R47	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R48	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R49	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-T0-422R-F
A4R50	1810-0280	8		NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-
A4R51	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2611-F
A4R52	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A4R53	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R54	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A4R55	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A4R56	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R57	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A4R58	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1962-F
A4R59	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-T0-511R-F
A4R60	0757-0465	6		RESISTOR 100K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1003-F
A4R61	0698-3452	1	3	RESISTOR 147K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1473-F
A4R62	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-T0-511R-F
A4R63	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-T0-511R-F
A4R64	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-T0-511R-F
A4R65	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R66	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A4R67	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0-100	24546	CT4-1/B-T0-2152-F
A4R68	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A4R69	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R70	0757-0405	4		RESISTOR 162 1% .125W F TC=0-100	24546	CT4-1/B-T0-162R-F
A4R71	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R72	0698-3441	8		RESISTOR 215 1% .125W F TC=0-100	24546	CT4-1/B-T0-215R-F
A4R73				NOT ASSIGNED		
A4R74	0757-0123	3	1	RESISTOR 34.9K 1% .125W F TC=0-100	28480	0757-0123
A4R75	0757-0463	4		RESISTOR 82.5K 1% .125W F TC=0-100	24546	CT4-1/B-T0-8252-F
A4R76	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0-100	24546	CT4-1/B-T0-5111-F
A4R77				NOT ASSIGNED		
A4R78	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1962-F
A4R79	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1472-F
A4R80	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0-100	28480	0698-3260
A4R81	0757-0462	3		RESISTOR 75K 1% .125W F TC=0-100	24546	CT4-1/B-T0-7502-F
A4R82	0698-0069	2	1	RESISTOR 2.15M 1% .125W F TC=0-100	28480	0698-0069
A4R83	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1961-F
A4R84	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0-100	03808	PME55-1/B-T0-21R5-F
A4R85	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0-100	24546	CT3-1/B-T0-4641-F
A4R86	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	CT3-1/B-T0-51R1-F
A4R87	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1001-F
A4R88	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-T0-1002-F
A4R89	0698-3441	8		RESISTOR 215 1% .125W F TC=0-100	24546	CT4-1/B-T0-215R-F
A4R90-R99				NOT ASSIGNED		

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4R100	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CT4-1/B-TO-101-F
A4R101	0757-0442	9		RESISTOR 10K 1% .125W F TC=0-100	24546	CT4-1/B-TO-1002-F
A4R102	0698-3447	4		RESISTOR 422 1% .125W F TC=0-100	24546	CT4-1/B-TO-422R-F
A4R103	0698-0082	7		RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-TO-4640-F
A4R104	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0-100	24546	CT4-1/B-TO-1961-F
A4R105				NOT ASSIGNED		
A4R106	0757-0416	7		RESISTOR 511 1% .125W F TC=0-100	24546	CT4-1/B-TO-511R-F
A4R107	0698-7236	7		RESISTOR 1K 1% .05W F TC=0-100	24546	CT3-1/B-TO-1001-F
A4R108	0698-7253	8	4	RESISTOR 5.11K 1% .05W F TC=0-100	24546	CT3-1/B-TO-5111-F
A4R109	0698-3438	3		RESISTOR 147 1% .125W F TC=0-100	24546	CT4-1/B-TO-147R-F
A4R110	0698-3438	3		RESISTOR 147 1% .125W F TC=0-100	24546	CT4-1/B-TO-147R-F
A4R111	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	CT3-1/B-TO-51R1-F
A4R112	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	CT3-1/B-TO-51R1-F
A4R113	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0-100	24546	CT3-1/B-TO-51R1-F
A4R114				NOT ASSIGNED		
A4R115	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0-100	24546	CT3-1/B-TO-4641-F
A4R116	0698-7227	6	10	RESISTOR 422 1% .05W F TC=0-100	24546	CT3-1/B-TO-422R-F
A4R117	0698-3438	3		RESISTOR 147 1% .125W F TC=0-100	24546	CT4-1/B-TO-147R-F
A4R118	0698-3438	3		RESISTOR 147 1% .125W F TC=0-100	24546	CT4-1/B-TO-147R-F
A4R119	0698-7218	5		RESISTOR 178 1% .05W F TC=0-100	24546	CT3-1/B-TO-178R-F
A4R120	0698-7200	5		RESISTOR 31.6 1% .05W F TC=0-100	24546	CT3-1/B-TO-31R6-F
A4R121	0698-7218	5		RESISTOR 178 1% .05W F TC=0-100	24546	CT3-1/B-TO-178R-F
A4R122	0698-7199	1		RESISTOR 28.7 1% .05W F TC=0-100	24546	CT3-1/B-TO-28R7-F
A4R123	0698-7236	7		RESISTOR 1K 1% .05W F TC=0-100	24546	CT3-1/B-TO-1001-F
A4R124	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0-100	24546	CT3-1/B-TO-5111-F
A4R125	0757-0280	3		RESISTOR 1K 1% .125W F TC=0-100	24546	CT4-1/B-TO-1001-F
A4R126	0698-7212	9		RESISTOR 100 1% .05W F TC=0-100	24546	CT3-1/B-TO-100R-F
A4T1	11661-60087	7	1	XFMR TORO 6.0TRN	28480	11661-60087
A4TP1	1251-1556	7	18	CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP2	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP3	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP4	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP5	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP6	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP7	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP8	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP9	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP10	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP11	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP12	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP13-TP99				NOT ASSIGNED		
A4TP100	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4TP101	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A4U1	0955-0146	0	1	LL-WAVE MIXER 1 GHZ MAX	28480	0955-0146
A4U2	1826-1612	5	2	IC RF/IF AMPL IF 4-CUSTOM PKG	24539	MSA-0385
A4U3	1826-0982	0	1	IC OP AMP LOW-NOISE 8-DIP-C PKG	28480	1826-0982
A4U4	1826-1049	2	1	IC OP AMP PRON 8-DIP-C PKG	06665	OP-27GZ
A4U5	1820-5490	3	1	IC DRVYR 4810A P8	28480	1820-5490

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4U6	1820-1422	3	2	IC MV TTL LS MONOSTBL RETRIG	01295	SN74LS122N
A4U7	1826-0138	8	3	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A4U8	1820-1212	9	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112AN
A4VR1	1902-0949	1	3	DIODE-ZNR 4.3V 5% DO-35 PD=AW TC=+.017%	28480	1902-0949
A4VR2-VR101				NOT ASSIGNED		
A4VR102	1902-0949	1		DIODE-ZNR 4.3V 5% DO-35 PD=AW TC=+.017%	28480	1902-0949
A4W1	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
	1258-0209	9		JUMPER-REMOVABLE 2 POSITION; .200 IN	28480	1258-0209
A4W2	1251-4670	2		CONNECTOR 3-PIN M POST TYPE	28480	1251-4670
	1258-0209	9		JUMPER-REMOVABLE 2 POSITION; .200 IN	28480	1258-0209
A4W3	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
	1258-0209	9		JUMPER-REMOVABLE 2 POSITION; .200 IN	28480	1258-0209
A4W4	1251-8557	2		CONN-POST TYPE .100-PIN-SPOG 2-CONT	28480	1251-8557
	1258-0209	9		JUMPER-REMOVABLE 2 POSITION; .200 IN	28480	1258-0209
	1251-5595	2		POLARIZING KEY-POST CONN	28480	1251-5595
A4W5	8159-0005	0		RESISTOR-ZERO OHMS 22AWG LEAD DIA	28480	8159-0005
A4W6	8159-0005	0		RESISTOR-ZERO OHMS 22AWG LEAD DIA	28480	8159-0005
A4W7	8159-0005	0		RESISTOR-ZERO OHMS 22AWG LEAD DIA	28480	8159-0005
292&U AND ABOVE						
A4W8	8159-0005	0		RESISTOR -0 OHMS 22AWG LEAD DIA	02499	YZ0

A5

NOT ASSIGNED

<sup>†</sup>Refer to Section 7 for update information.

<sup>\*</sup>Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A6</b>						
A6	08657-60121	7	1	OUTPUT BOARD	28480	08657-60121
<i>3025U AND ABOVE</i>						
A6	08657-60140	4	1	OUTPUT BOARD	28480	08657-60140
<i>3105U AND ABOVE</i>						
A6	08657-60159	7	1	OUTPUT BOARD	28480	08657-60159
A6C101	0160-4040	6	10	CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C102	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C103	0160-4389	6	10	CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C104	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C105	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C106	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
<i>3105U AND ABOVE</i>						
A6C107	0160-0575			CAP-FXD 0.047UF 50 V	28480	0160-0575
A6C108	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C109	0160-0575			CAP-FXD 0.047UF 50 V	28480	0160-0575
A6C110	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C111	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C112	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C113	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C114	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C115	0160-4768	5	1	CAP-FXD 470PF 100 V	09969	RPE121-105C0G471J100V
A6C116	0160-3879	7	30	CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C117	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C118	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C119	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C120	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C121	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C123	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C124	0160-0576	5	24	CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C125	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C126	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C127	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C128-C129				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
A6C128				NOT ASSIGNED		
A6C129	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C130	0180-2667	1	1	CAP-FXD 150UF 20 V TA	56289	152D157X9020S2
A6C131	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C132	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C133	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C134	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C135	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C136	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C137	0160-4382	9	3	CAP-FXD 0F 200 V	09969	RPE121-105C0G3R3C200V

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6C138	0160-4382	9		CAP-FXD 0F 200 V	09969	RPE121-105C0G3R3C200V
A6C140	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C141	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C142	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C143	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C144	0160-4040	6		CAP-FXD 1000PF 100 V	09969	RPE121-105C0G102J100V
A6C145	0160-3874	2	2	CAP-FXD 0F 200 V	09969	RPE121-105C0G100D200V
A6C146	0160-3874	2		CAP-FXD 0F 200 V	09969	RPE121-105C0G100D200V
A6C147	0160-3873	1	2	CAP-FXD 0F 200 V	09969	RPE121-105C0G4R7D200V
A6C148	0160-4618	4	1	CAP-FXD 0F 200 V	09969	RPE121-105C0G3R9C200V
<i>2928U AND ABOVE</i>						
A4C148				NOT ASSIGNED		
A6C201	0160-6216	2	9	CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C202	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C204	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C206	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C207	0160-5945	2	4	CAP-FXD 0.01UF 50 V	04222	CC0805X7R103K050LR
A6C208	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C209	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C210	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C211	0160-5945	2		CAP-FXD 0.01UF 50 V	04222	CC0805X7R103K050LR
A6C214	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C215	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C216	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C217	0160-5945	2		CAP-FXD 0.01UF 50 V	04222	CC0805X7R103K050LR
A6C219	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C220	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C221	0160-5961	2	1	CAP-FXD 22PF 50 V	04222	CC0805C0G220J100LR
A6C222	0160-3875	3	1	CAP-FXD 22PF 200 V	09969	RPE121-105C0G220J200V
A6C223	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C224	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C225	0160-4741	4	16	CAP-FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C226	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C227	0160-4741	4		CAP-FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C228	0160-4824	4	1	CAP-FXD 680PF 100 V	09969	RPA10C0G681J100V
A6C230	0160-0116	1	3	CAP-FXD 6.8UF 35 V TA	56289	150D85X9035B2
A6C231	0160-0116	1		CAP-FXD 6.8UF 35 V TA	56289	150D85X9035B2
A6C233	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C234	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C235	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C240	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C241	0160-6216	2		CAP-FXD 1000PF 50 V	04222	CC1210C0G102J100LR
A6C242	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C243	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C244	0160-5945	2		CAP-FXD 0.01UF 50 V	04222	CC0805X7R103K050LR
A6C301	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C302	0160-4494	4	2	CAP-FXD 39PF 200 V	09969	RPE121-105C0G390J200V
A6C303	0160-4741	4		CAP-FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C304	0160-4383	0	1	CAP-FXD 0F 200 V	09969	RPE121-105C0G6R8D200V
A6C305	0160-4767	4	1	CAP-FXD 20PF 200 V	09969	RPE121-105C0G200J200V
A6C306	0160-4494	4		CAP-FXD 39PF 200 V	09969	RPE121-105C0G390J200V
<i>3105U AND ABOVE</i>						
A6C305	0160-4524		2	CAP-FXD 24PF 200 V	28480	0160-4524
A6C306	0160-4524		2	CAP-FXD 24PF 200 V	28480	0160-4524

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6C307	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C308	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C309	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C310	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C311	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C312	0160-3879	7		CAP—FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C314	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C315	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C317	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
<i>310SU AND ABOVE</i>						
A6C318	0160-4491		2	CAP—FXD 8.2PF 200V	28480	0160-4491
A6C319	0160-4491		2	CAP—FXD 8.2PF 200V	28480	0160-4491
A6C320	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C321	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C322	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
<i>2922U AND ABOVE</i>						
A6C322				NOT ASSIGNED		
<i>310SU AND ABOVE</i>						
A6C322	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C323	0160-4382	9		CAP—FXD 0F 200 V	09969	RPE121-105C0G3R3C200V
A6C324	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C325	0160-3873	1		CAP—FXD 0F 200 V	09969	RPE121-105C0G4R7D200V
A6C326	0160-4521	8	1	CAP—FXD 12PF 200 V	09969	RPE121-105C0G120J200V
A6C328	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C329	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C330	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C331	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C332	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C333	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C334	0160-4389	6		CAP—FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C336	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C337	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C338	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C339	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
<i>310SU AND ABOVE</i>						
A6C340	0160-4741	4		CAPACITOR-FXD .22UF ±10% 50VDC CER	28480	0160-4741
A6C341	0160-4741	4		CAPACITOR-FXD .22UF ±10% 50VDC CER	28480	0160-4741
A6C342	0160-0576	5		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-0576
A6C401	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C402	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C403	0160-4031	5	1	CAP—FXD 330PF 100 V	09969	RPE121-105C0G331J100V
A6C404	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C405	0160-3879	7		CAP—FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C406	0160-4741	4		CAP—FXD 0.22UF 50 V	06383	FK22X7R1H224K-T
A6C407	0160-0183	2	1	CAP—FXD 10UF 50 V AL—ELCTLT	56289	300106G050C82
A6C410	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C411	0160-0576	5		CAP—FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6C412	0160-0576	5		CAP-FXD 0.1UF 50 V	09969	RPE121-105X7R104M50V
A6C414	0180-0097	7	1	CAP-FXD 47UF 35 V TA	56289	1500476X9035S2
A6C415	0180-1974	1	2	CAP-FXD 10UF 35 V TA	56289	1500106X9035R2
A6C416	0180-1974	1		CAP-FXD 10UF 35 V TA	56289	1500106X9035R2
A6C417	0180-0116	1		CAP-FXD 6.8UF 35 V TA	56289	1500685X9035B2
A6C418	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C419	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C421	0160-4389	6		CAP-FXD 100PF 200 V	09969	RPE121-105C0G101J200V
A6C422	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C423	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C424	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C425	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A6C426	0160-3879	7		CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
<b>3105U AND ABOVE</b>						
A6C427	0180-0291	1		CAPACITOR-FXD 1UF-10% 35VDC TA	56289	0180-0291
A6C428-C479				NOT ASSIGNED		
A6C480	0160-4389	6		CAPACITOR-FXD 100PF -5PF 200VDC CER	28480	0160-4389
A6CR101	1901-1096	9	13	DIODE-PIN	28480	1901-1096
A6CR102	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR103	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR104	0122-0161	4	4	DIODE-VVC 2.15PF 7% BVR=30V	25403	BB805B
A6CR105	0122-0161	4		DIODE-VVC 2.15PF 7% BVR=30V	25403	BB805B
A6CR106	1901-0050	3	30	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR107	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR108	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR109	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR110	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR111	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR112	0122-0162	5	10	DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR113	0122-0162	5		DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR114	0122-0162	5		DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR115	0122-0162	5		DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR116	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR117	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR118	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR119	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR120	0122-0162	5		DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR121	0122-0162	5		DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR122	0122-0162	5		DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR123	0122-0162	5		DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A6CR124	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR125	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR126	1901-1096	9		DIODE-PIN	28480	1901-1096
A6CR127	1902-0627	2	1	DIODE-CUR RGLTR 1N5312 100V DO-7	04713	1N5312
A6CR128	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR129	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR130	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR131	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR132	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR133	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR134	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A6CR135	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6CR136	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR137	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR138	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR139	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR140	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR141	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR142	1901-1134	6	1	DIODE—PIN	06132	BA284
A6CR143	0122-0161	4		DIODE—VVC 2.15PF 7% BVR=30V	25403	BB405B
A6CR144	0122-0161	4		DIODE—VVC 2.15PF 7% BVR=30V	25403	BB405B
A6CR145	0122-0162	5		DIODE—VVC 29PF 10% BVR=30V	25403	BB809
A6CR146	0122-0162	5		DIODE—VVC 29PF 10% BVR=30V	25403	BB809
A6CR201	1906-0245	8	4	DIODE—MATCHED VF DIFF-SMV	29480	1906-0245
A6CR202	1906-0245	8		DIODE—MATCHED VF DIFF-SMV	29480	1906-0245
A6CR203	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR204	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR205	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR206	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR207	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR208	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR209	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR210	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR211	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR301	1906-0245	8		DIODE—MATCHED VF DIFF-SMV	29480	1906-0245
A6CR302	1901-1096	9		DIODE—PIN	29480	1901-1096
A6CR303	1906-0245	8		DIODE—MATCHED VF DIFF-SMV	29480	1906-0245
<i>3105U AND ABOVE</i>						
A6CR304	1902-0943			DIODE ZENER 2.40V 5%	29480	1902-0943
A6CR305	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
<i>2922U AND ABOVE</i>						
A6CR306	1901-0518	8		DIODE SCHOTTKY SM SIG	02002	5082-5509
A6CR401	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR402	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR411	1901-0050	3		DIODE—SWITCHING 80V 200MA 2NS DO—35	9N171	1N4150
A6CR412	1990-0671	1	1	LED—LAMP LUM—INT=200UCD IF—SMA—MAX	29480	HLMP-6620
<i>3035U AND ABOVE</i>						
A6CR412	1990-0468			LED-RED HLMP-1301	29480	1990-0468
A6E301	9170-0847	3	2	CORE—SHIELDING BEAD	02114	56-590-65/38 PARTLENE COATED
A6E302	9170-0847	3		CORE—SHIELDING BEAD	02114	56-590-65/38 PARTLENE COATED
A6I1	0340-0669	9	12	INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I2	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I3	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I4	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I5	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I6	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I7	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I8	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I9	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I10	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I11	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75
A6I12	0340-0669	9		INSULATOR—XSTR SLBL—ORG—POLYM	06773	CD-515-.070 THK-AWP-75

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6J203	1251-2194	1	4	CONNECTOR—SGL CONT SKT .021—IN—BSC—SZ	00779	3-331272-0
A6J301	1251-2194	1		CONNECTOR—SGL CONT SKT .021—IN—BSC—SZ	00779	3-331272-0
A6J302	1251-2194	1		CONNECTOR—SGL CONT SKT .021—IN—BSC—SZ	00779	3-331272-0
A6J303	1251-2194	1		CONNECTOR—SGL CONT SKT .021—IN—BSC—SZ	00779	3-331272-0
A6J401	1251-8599	2	2	CONN—POST TYPE .100—PIN—SPCG 10—CONT	28480	1251-8599
A6J402	1251-8599	2		CONN—POST TYPE .100—PIN—SPCG 10—CONT	28480	1251-8599
A6JU203	5021-2826	3	3	RF FITTING	28480	5021-2826
A6JU302	5021-2826	3		RF FITTING	28480	5021-2826
A6JU303	5021-2826	3		RF FITTING	28480	5021-2826
AGL101	9140-0158	6	30	INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL102	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL103	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL104	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL105	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL106	9100-2247	4	3	INDUCTOR RF—CH—MLD 100NH ←—10%	91637	IM-2 1UH 10%
AGL107	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL108	9135-0073	3	6	INDUCTOR RF—CH—MLD 51NH ←—6.596%	24226	10M051X-1
AGL109	9135-0073	3		INDUCTOR RF—CH—MLD 51NH ←—6.596%	24226	10M051X-1
AGL110	9135-0073	3		INDUCTOR RF—CH—MLD 51NH ←—6.596%	24226	10M051X-1
AGL111	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL112	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL113	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL118	9100-1630	7	1	INDUCTOR RF—CH—MLD 51UH ←—5%	91637	IM-4 51UH 5%
AGL119	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL120	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL121	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL122	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL123	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
<i>3105U AND ABOVE</i>						
AGL124	9140-0158	6		INDUCTOR RF—CH—MLD 1UH 10%	28480	9140-0158
AGL125-L126				NOT ASSIGNED		
AGL127	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL128	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL201	9100-2247	4		INDUCTOR RF—CH—MLD 100NH ←—10%	91637	IM-2 1UH 10%
AGL202	9100-2247	4		INDUCTOR RF—CH—MLD 100NH ←—10%	91637	IM-2 1UH 10%
AGL203	9100-3922	4	4	INDUCTOR—FIXED 120—1300 HZ	28480	9100-3922
AGL204	9100-3922	4		INDUCTOR—FIXED 120—1300 HZ	28480	9100-3922
AGL205	9100-3922	4		INDUCTOR—FIXED 120—1300 HZ	28480	9100-3922
AGL207	9100-3560	6	6	INDUCTOR RF—CH—MLD 5.6UH ←—5%	91637	IM-4 5.6UH 5%
AGL208	9100-3560	6		INDUCTOR RF—CH—MLD 5.6UH ←—5%	91637	IM-4 5.6UH 5%
AGL209	9140-0158	6		INDUCTOR RF—CH—MLD 1UH ←—10%	91637	IM-2 1UH 10%
AGL210	9100-3922	4		INDUCTOR—FIXED 120—1300 HZ	28480	9100-3922
AGL300	9100-3560	6		INDUCTOR RF—CH—MLD 5.6UH ←—5%	91637	IM-4 5.6UH 5%
AGL301	9135-0073	3		INDUCTOR RF—CH—MLD 51NH ←—6.596%	24226	10M051X-1
AGL302	9135-0078	8	1	INDUCTOR RF—CH—MLD 82NH ←—5.61%	24226	10M082X-1
AGL303	9135-0073	3		INDUCTOR RF—CH—MLD 51NH ←—6.596%	24226	10M051X-1
<i>3105U AND ABOVE</i>						
AGL301	9135-0071			INDUCTOR RF—CH—MLD 62NH 5.806%	28480	9135-0071
AGL302	9100-2817			INDUCTOR RF—CH—MLD 100NH 5.61%	28480	9135-0078
AGL303	9135-0071			INDUCTOR RF—CH—MLD 62NH 5.806%	28480	9135-0071
AGL304	9135-0073	3		INDUCTOR RF—CH—MLD 51NH ←—6.596%	24226	10M051X-1
AGL305				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
AGL305	9100-2247			INDUCTOR RF—CH—MLD 100NH 10%	28480	9100-2247
AGL306	8159-0005	0	1	RESISTOR—ZERO OHMS 22 AWG LEAD DIA	11502	YZO 1/4

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<i>3105U AND ABOVE</i> ASL307 ASL308-L400	9100-2247			INDUCTOR RF-CH-MLD 100NH 10% NOT ASSIGNED	28480	9100-2247
ASL401	9100-1665	8	2	INDUCTOR RF-CH-MLD 3.3MH +-5%	91637	IM-8 3300UH 5%
ASL402	9100-1665	8		INDUCTOR RF-CH-MLD 3.3MH +-5%	91637	IM-8 3300UH 5%
ASL410	9100-3551	5	1	INDUCTOR RF-CH-MLD 1UH +-5%	91637	IM-4 1UH 5%
ASL411	9100-3560	8		INDUCTOR RF-CH-MLD 5.6UH +-5%	91637	IM-4 5.6UH 5%
ASL412	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH +-5%	91637	IM-4 5.6UH 5%
ASL413	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH +-5%	91637	IM-4 5.6UH 5%
ASL414	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL415	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL416	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL417	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL418	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL419	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL420	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL421	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL422	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL423	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL424	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL425	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
ASL426	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
AGMP1	08656-00090	2	6	GROUNDING TAB	28480	08656-00090
AGMP2	08656-00090	2		GROUNDING TAB	28480	08656-00090
AGMP3	08656-00090	2		GROUNDING TAB	28480	08656-00090
AGMP4	08656-00090	2		GROUNDING TAB	28480	08656-00090
AGMP5	08656-00090	2		GROUNDING TAB	28480	08656-00090
AGMP6	08656-00133	4	1	CLIP SEMI-R GRND	28480	08656-00133
<i>3105U AND ABOVE</i> AGMP7-MP8 AGMP9	08656-00090	2		NOT ASSIGNED TAB-GROUNDING	28480	08656-00090
AGN1	0535-0109	5	3	NUT-HEX DBL-CHAM M5 X 0.8 2.5MM-THK	28480	0535-0109
AGN2	0535-0109	5		NUT-HEX DBL-CHAM M5 X 0.8 2.5MM-THK	28480	0535-0109
AGN3	0535-0109	5		NUT-HEX DBL-CHAM M5 X 0.8 2.5MM-THK	28480	0535-0109
<i>3105U AND ABOVE</i> AGN1 AGN2 AGN3	0535-0034	3		NUT-HEX DBL-CHAM M5	28480	0535-0034
	0535-0034	3		NUT-HEX DBL-CHAM M5	28480	0535-0034
	0535-0034	3		NUT-HEX DBL-CHAM M5	28480	0535-0034
AGQ101	1854-0477	7	4	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
AGQ102	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
AGQ103	1854-0632	6	1	TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR91
AGQ104	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
AGQ201	1854-1032	2	4	TRANSISTOR NPN SI PD=2.5W	04713	MRF581
AGQ202	1853-0459	3	6	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
AGQ203	1854-1032	2		TRANSISTOR NPN SI PD=2.5W	04713	MRF581
AGQ204	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
AGQ205	1854-1032	2		TRANSISTOR NPN SI PD=2.5W	04713	MRF581
AGQ206	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6Q207	1858-0032	8	1	TRANSISTOR ARRAY 14--PIN PLSTC DIP	27014	LM3146
A6Q208	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A6Q209	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A6Q210	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A6Q211	1854-1032	2		TRANSISTOR NPN SI PD=2.5W	04713	MRF581
A6Q212	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
<i>3105U AND ABOVE</i>						
A6Q213	1855-0216			J-FET P-CHAN	28480	1855-0216
A6Q214	1855-0216			J-FET P-CHAN	28480	1855-0216
A6Q301	1853-0527	6	2	TRANSISTOR PNP SI PD=500MW FT=4GHZ	25403	BFO-32
A6Q302	1853-0527	6		TRANSISTOR PNP SI PD=500MW FT=4GHZ	25403	BFO-32
A6Q303	1854-0720	3	2	TRANSISTOR NPN SI PD=500MW FT=4GHZ	28480	1854-0720
A6Q304	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	28480	1854-0720
<i>3105U AND ABOVE</i>						
A6Q305	1855-0216			J-FET P-CHAN	28480	1855-0216
A6Q306	1855-0216			J-FET P-CHAN	28480	1855-0216
A6Q410	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6Q411	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
<i>3105U AND ABOVE</i>						
A6Q412	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6R101	0698-3150	6	1	RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-2371-F
A6R102	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-511R-F
A6R103	0698-3440	7	11	RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-196R-F
A6R104	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-196R-F
A6R105	0698-7227	6	6	RESISTOR 422 +-1% .05W TF TC=0+-100	12498	C3-1/8-TC-422R-F
A6R106	0698-1902	4	3	RESISTOR 10 +-1% .05W TF TC=0+-100	91637	CMF-50-21
A6R107	0698-7227	6		RESISTOR 422 +-1% .05W TF TC=0+-100	12498	C3-1/8-TC-422R-F
A6R108	0757-0438	3	10	RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-5111-F
A6R109	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-5111-F
A6R110	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-5111-F
A6R111	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-5111-F
A6R112	0698-0082	7	5	RESISTOR 464 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-4640-F
A6R113	0698-0082	7		RESISTOR 464 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-4640-F
<i>3105U AND ABOVE</i>						
A6R112	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-TC-196R-F
A6R113	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-TC-196R-F
A6R114	0698-0082	7		RESISTOR 464 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-4640-F
A6R115	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-196R-F
A6R116	0698-3438	3	1	RESISTOR 147 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-147R-F
A6R117	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-196R-F
A6R118	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TC-196R-F
A6R119	0698-7227	6		RESISTOR 422 +-1% .05W TF TC=0+-100	12498	C3-1/8-TC-422R-F
A6R120	0698-1902	4		RESISTOR 10 +-1% .05W TF TC=0+-100	91637	CMF-50-21

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
AGR121	0698-7227	6		RESISTOR 422 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-422R-F
AGR122	0757-0438	3		RESISTOR 5.11K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-5111-F
AGR123	0698-0083	8	6	RESISTOR 1.96K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1961-F
AGR124	0698-0082	7		RESISTOR 464 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-4640-F
AGR125-R127				NOT ASSIGNED		
<i>3105U AND ABOVE</i>						
AGR125	0698-0082	7		RESISTOR 464 1% .125W F TC=0-100	24546	CT4-1/B-TO-4640-F
AGR126	0698-7219	6		RESISTOR 196 1% .125W F TC=0-100	24546	CT4-1/B-TO-196R-F
AGR127				NOT ASSIGNED		
AGR128	0698-3440	7		RESISTOR 196 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-196R-F
AGR129	0698-3440	7		RESISTOR 196 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-196R-F
AGR130	0698-7227	6		RESISTOR 422 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-422R-F
AGR131	0698-1902	4		RESISTOR 10 $\pm$ 1% .05W TF TC=0-100	91637	CMF-50-21
AGR132	0698-7227	6		RESISTOR 422 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-422R-F
AGR133	0698-0083	8		RESISTOR 1.96K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1961-F
AGR134	0757-0288	1	2	RESISTOR 9.09K $\pm$ 1% .125W TF TC=0-100	19701	5033R-1/B-TC-9091-F
AGR135	0698-3157	3	2	RESISTOR 19.6K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1962-F
AGR136	0698-3161	9	1	RESISTOR 38.3K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-3832-F
AGR137	0757-0463	4	1	RESISTOR 82.5K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-8252-F
AGR138	0757-0470	3	1	RESISTOR 162K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1623-F
AGR139	0698-3457	6	1	RESISTOR 316K $\pm$ 1% .125W TF TC=0-100	12498	CT4
AGR140	0757-0442	9	19	RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1002-F
AGR141	0757-0288	1		RESISTOR 9.09K $\pm$ 1% .125W TF TC=0-100	19701	5033R-1/B-TO-9091-F
AGR142	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1002-F
AGR143	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1002-F
AGR144	0757-0280	3	9	RESISTOR 1K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1001-F
AGR145	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1002-F
AGR146	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1002-F
AGR147	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1001-F
AGR148	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1002-F
AGR149	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1002-F
AGR150	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-1001-F
AGR151	0698-3160	8	3	RESISTOR 31.6K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-3162-F
AGR152	0698-3160	8		RESISTOR 31.6K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-3162-F
AGR153	0698-3160	8		RESISTOR 31.6K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-3162-F
AGR154	0698-3440	7		RESISTOR 196 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-196R-F
AGR155	0698-3440	7		RESISTOR 196 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-196R-F
AGR156	0698-3440	7		RESISTOR 196 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-196R-F
AGR157	0698-3440	7		RESISTOR 196 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-TO-196R-F
AGR158	0698-7219	6	1	RESISTOR 196 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-196R-F
<i>3105U AND ABOVE</i>						
AGR158	0698-0583			RESISTOR 34.8 1% .05W F TC=0-100	24546	CT4-1/B-TO-348R-F
AGR159	0698-7205	0	6	RESISTOR 51.1 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-51R1-F
AGR160	0698-7223	2	3	RESISTOR 287 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-287R-F
AGR161	0698-7223	2		RESISTOR 287 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-287R-F
<i>2928U AND ABOVE</i>						
AGR161	0698-7194	6		RESISTOR 17.8 $\pm$ 1% .05W TF TC=0-100	05524	CMF-50-2
AGR162	0698-7223	2		RESISTOR 287 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-287R-F
AGR163	0698-7204	9	1	RESISTOR 46.4 $\pm$ 1% .05W TF TC=0-100	12498	C3-1/B-TO-46R4-F

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6R164	0698-7212	9	1	RESISTOR 100 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/8-TQ-100R-F
A6R201	0698-3334	8	2	RESISTOR 178 $\pm$ 1% .5W TF TC=0--100	K8479	H2
A6R202	0698-3334	8		RESISTOR 178 $\pm$ 1% .5W TF TC=0--100	K8479	H2
A6R203	0698-7243	6	4	RESISTOR 1.96K $\pm$ 1% .05W TF TC=0--100	12498	C3-1/8-TQ-1961-F
A6R204	0698-1421	2	4	RESISTOR 178 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R205	0698-3618	1	4	RESISTOR 82 $\pm$ 5% 2W MO TC=0--200	12498	FP-88
A6R206	0698-1360	8	16	RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R207	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R208	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R209	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R210	0698-3618	1		RESISTOR 82 $\pm$ 5% 2W MO TC=0--200	12498	FP-89
A6R211	0698-7243	6		RESISTOR 1.96K $\pm$ 1% .05W TF TC=0--100	12498	C3-1/8-TQ-1961-F
A6R212	0698-1356	2	2	RESISTOR 31.6 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R213	0698-1421	2		RESISTOR 178 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R214	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R215	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R216	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R217	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R218	0757-0440	7	1	RESISTOR 7.5K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/8-TQ-7501-F
A6R219	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/8-TQ-1002-F
A6R220	0698-7243	6		RESISTOR 1.96K $\pm$ 1% .05W TF TC=0--100	12498	C3-1/8-TQ-1961-F
A6R221	0698-1356	2		RESISTOR 31.6 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R222	0698-3618	1		RESISTOR 82 $\pm$ 5% 2W MO TC=0--200	12498	FP-88
A6R223	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R224	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R225	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R226	0698-1360	8		RESISTOR 46.4 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R227	0698-1364	2	1	RESISTOR 68.1 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R228	0698-1415	4	1	RESISTOR 100 $\pm$ 1% .125W TKF TC=0--100	19701	9C12063AFKR
A6R229	0698-7236	7	4	RESISTOR 1K $\pm$ 1% .05W TF TC=0--100	12498	C3-1/8-TQ-1001-F
A6R230	0698-3452	1	2	RESISTOR 147K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/8-TQ-1473-F
A6R231	0698-3452	1		RESISTOR 147K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/8-TQ-1473-F
A6R232	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/8-TQ-1002-F
A6R233	0698-0083	8		RESISTOR 1.96K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/8-TQ-1961-F
A6R234	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/8-TQ-1002-F
A6R235	0698-7244	7	2	RESISTOR 2.15K $\pm$ 1% .05W TF TC=0--100	12498	C3-1/8-TQ-2151-F
A6R236	2100-1986	9	1	RESISTOR-TRMR 1K 10% TKF TOP-ADJ 1-TRN	73138	82PR1K
<i>3105U AND ABOVE</i>						
A6R237	0698-7284	5	2	RESISTOR 100K 1% .05W F TC=0--100	24546	CT3-1/8-TQ-1003-F
A6R238	0698-7284	5	2	RESISTOR 100K 1% .05W F TC=0--100	24546	CT3-1/8-TQ-1003-F
A6R239	0698-7219	6	1	RESISTOR 196 1% .05W F TC=0--100	24546	CT4-1/8-TQ-196R-F

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6R306	0698-7260	7	1	RESISTOR 10K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-1002-F
<i>3025U AND ABOVE</i>						
A6R306	0698-0084	7	1	RESISTOR 2.15K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12482	CC
A6R307	0698-7205	0		RESISTOR 51.1 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-51R1-F
A6R308	0698-7236	7		RESISTOR 1K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-1001-F
A6R309	0698-7244	7		RESISTOR 2.15K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-2151-F
A6R310	0698-7253	8	1	RESISTOR 5.11K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-5111-F
A6R311	0698-3439	4	2	RESISTOR 178 $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-178R-F
A6R312	0698-3439	4		RESISTOR 178 $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-178R-F
A6R313	0698-7192	4	3	RESISTOR 14.7 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-14R7-F
A6R314	0698-7192	4		RESISTOR 14.7 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-14R7-F
A6R315	0698-7192	4		RESISTOR 14.7 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-14R7-F
<i>3105U AND ABOVE</i>						
A6R313-R315 NOT ASSIGNED						
A6R316	0698-7284	5	2	RESISTOR 100K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-1003-F
<i>2922U AND ABOVE</i>						
A6R316	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-1002-F
A6R317	0698-7199	1	1	RESISTOR 28.7 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-28R7-F
A6R318	0698-7205	0		RESISTOR 51.1 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-51R1-F
A6R319	0698-7220	9	1	RESISTOR 215 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-215R-F
A6R320	0698-2079	8		RESISTOR 82.5 $\pm$ 1% .05W TF TC=0 $\pm$ 100	91637	CMF-50-21
A6R321	0698-7284	5		RESISTOR 100K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-1003-F
<i>2922U AND ABOVE</i>						
A6R321	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-1002-F
A6R322	0698-3437	2	2	RESISTOR 133 $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-133R-F
A6R323	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-1001-F
A6R323	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-1001-F
A6R324	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-1001-F
A6R325	0698-7203	8	6	RESISTOR 42.2 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-42R2-F
A6R326	0698-7203	8		RESISTOR 42.2 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-42R2-F
A6R327	0757-0394	0	2	RESISTOR 51.1 $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-51R1-F
A6R328	0698-7236	7		RESISTOR 1K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-1001-F
A6R329	0698-7229	8	1	RESISTOR 511 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-511R-F
A6R330	0698-7236	7		RESISTOR 1K $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-1001-F
A6R331	0698-7203	8		RESISTOR 42.2 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-42R2-F
A6R332	0698-7203	8		RESISTOR 42.2 $\pm$ 1% .05W TF TC=0 $\pm$ 100	12498	C3-1/B-T0-42R2-F
A6R333	0757-0394	0		RESISTOR 51.1 $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-51R1-F
A6R336	0698-3437	2		RESISTOR 133 $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-133R-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6R339	0757-0399	5	2	RESISTOR 82.5 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-82RS-F
A6R340	0757-0399	5		RESISTOR 82.5 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-82RS-F
A6R341	0698-7216	3	2	RESISTOR 147 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/B-T0-147R-F
A6R342	0698-7202	7	1	RESISTOR 38.3 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/B-T0-38R3-F
A6R343	0698-7216	3		RESISTOR 147 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/B-T0-147R-F
<b>3105U AND ABOVE</b>						
A6R339				NOT ASSIGNED		
A6R340	0757-0401	0		RESISTOR 100 1% .125W F TC=0--100	24546	CT4-1/B-T0-101-F
A6R341	0698-7212	9		RESISTOR 100 1% .05W F TC=0--100	24546	CT3-1/B-T0-100R-F
A6R342	0698-7201	6		RESISTOR 75 1% .05W F TC=0--100	24546	CT3-1/B-T0-75R0-F
A6R343	0698-7212	9		RESISTOR 100 1% .05W F TC=0--100	24546	CT3-1/B-T0-100R-F
A6R346	0698-3456	5	2	RESISTOR 287K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-2873-F
A6R347	0698-3456	5		RESISTOR 287K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-2873-F
A6R349	0698-7205	0		RESISTOR 51.1 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/B-T0-51R1-F
A6R351	0698-7205	0		RESISTOR 51.1 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/B-T0-51R1-F
A6R352	0757-0401	0		RESISTOR 100 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-101-F
A6R353	0698-7203	8		RESISTOR 42.2 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/B-T0-42R2-F
A6R354	0698-7203	8		RESISTOR 42.2 $\pm$ 1% .05W TF TC=0--100	12498	C3-1/B-T0-42R2-F
<b>3025U AND ABOVE</b>						
A6R355	2100-2031	7	1	RESISTOR-TRMR 50K 10% TKF TOP-ADJ 1-TRN	73138	B2PR50K
<b>3105U AND ABOVE</b>						
A6R356	0698-7284	5		RESISTOR 100K 1% .05W F TC=0--100	24546	CT3-1/B-T0-1003-F
A6R357	0698-7284	5		RESISTOR 100K 1% .05W F TC=0--100	24546	CT3-1/B-T0-1003-F
A6R358-R361				NOT ASSIGNED		
A6R362	0698-7223			RESISTOR 287 1% .05W F TC=0--100	24546	CT3-1/B-T0-287R-F
A6R363-R369				NOT ASSIGNED		
A6R370	0757-0401	0		RESISTOR 100 1% .125W F TC=0--100	24546	CT4-1/B-T0-101-F
A6R371-R400				NOT ASSIGNED		
A6R401	0757-0438	3		RESISTOR 5.11K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-5111-F
A6R402	0757-0447	4	1	RESISTOR 16.2K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-1622-F
A6R410	1810-0206	8	1	NETWORK-RES 8-SIP 10.0K OHM X 7	C1433	750-81
A6R412	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-1001-F
A6R414	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-1002-F
A6R415	0698-0083	8		RESISTOR 1.96K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-1961-F
A6R416	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-1002-F
A6R417	0698-0083	8		RESISTOR 1.96K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-T0-1961-F
<b>2928U AND ABOVE</b>						
A6R418	0698-7228	7	1	RESISTOR 464 $\pm$ 1% .05W TF TC=0--100	05524	CMF-50-2
A6R419	0698-7239	0	1	RESISTOR 1.33K $\pm$ 1% .05W TF TC=0--100	05524	CMF-50-2
<b>3105U AND ABOVE</b>						
A6R420	0757-0442	9		RESISTOR 10K 1% .125W F TC=0--100	24546	CT4-1/B-T0-1002-F
A6R421	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0--100	24546	CT4-1/B-T0-3162-F
A6R422	0757-0464			RESISTOR 90.9K 1% .125W F TC=0--100	24546	CT4-1/B-T0-9092-F
A6R423	0757-0442	9		RESISTOR 10K 1% .125W F TC=0--100	24546	CT4-1/B-T0-1002-F
A6TP206	1251-0600	0	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A6TP401	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6J1-U100 A6J101	1820-2933	3	1	NOT ASSIGNED IC PRESCR ECL	52648	SP86068
<i>3105U AND ABOVE</i> A6J101	1820-7278			IC DIGITAL	28480	1820-7278
A6J102	1820-3485	2	1	IC PRESCR ECL	04713	MC12090L
A6J103	1826-0557	5	1	IC OP AMP GP QUAD 14-DIP-C PKG	27014	LM348J
A6J201	1826-1613	6	2	IC RF/IF AMPL IF 4-CUSTOM PKG	24539	MSA-0485
A6J202	1826-1613	6		IC RF/IF AMPL IF 4-CUSTOM PKG	24539	MSA-0485
A6J207	1826-0753	3	1	IC OP AMP LOW-BIAS-H-IMPQ QUAD 14-DIP-C	04713	MC34004BL
A6J301	0955-0145	9	1	U-WAVE MIXER 1 GHZ MAX	15542	TFM2-10
A6J302	1826-0371	1	1	IC OP AMP LOW-BIAS-H-IMPQ 8-TO-99 PKG	27014	LF256H
A6J303	1826-1612	5	1	IC RF/IF AMPL IF 4-CUSTOM PKG	24539	MAS-0385
A6J401	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	18324	NE555N
A6J410	1820-5490	3	1	IC-INTERFACE DRVR BIMOS DISPLAY	56289	UCN-5810A
A6J411	1820-1422	3	1	IC MV TTL LS MONOSTBL RETRIG	01295	SN74LS122N
A6W202	1251-4670	2	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4670
	1258-0209	9	1	JUMPER-REMOVABLE 2 POSITION; .250 IN	18873	68786-202
A6XE101	1251-1556	7	9	CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE201	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE202	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE203	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE204	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE205	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE301	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE302	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XE303	1251-1556	7		CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990
A6XU401	1251-5595	2	2	POLARIZING KEY-POST CONN	76381	3518
A6XU402	1251-5595	2		POLARIZING KEY-POST CONN	76381	3518

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A7</b>						
A7	08657-60111	5	1	200MHZ LOW-PASS FILTER ASSEMBLY	28480	08657-60111
<i>3105U AND ABOVE</i>						
A7				NOT ASSIGNED		
A7C1	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C2	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C3	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C4	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C5	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C6	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C7	0160-4491	1		CAPACITOR-FXD 8.2PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4491
A7C8	0160-4491	1		CAPACITOR-FXD 8.2PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4491
A7C9	0160-4491	1		CAPACITOR-FXD 8.2PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4491
A7C10	0160-4491	1		CAPACITOR-FXD 8.2PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4491
A7C11	0160-4491	1		CAPACITOR-FXD 8.2PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4491
A7C12	0160-4491	1		CAPACITOR-FXD 8.2PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4491
A7C13	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C14	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C15	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C16	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C17	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7C18	0160-4498	8		CAPACITOR-FXD 5.6PF $\leftarrow$ .5PF 200VDC CER	28480	0160-4498
A7MP1	08656-00133	4		CLIP SEMI-R GRND	28480	08656-00133
A7MP2	08656-00133	4		CLIP SEMI-R GRND	28480	08656-00133
A7MP3	0380-1680	0	12	SPACER-PRESS-IN 0.188 IN LG; 0.143 IN ID	00000	ORDER BY DESCRIPTION
A7MP4	0380-1680	0		SPACER-PRESS-IN 0.188 IN LG; 0.143 IN ID	00000	ORDER BY DESCRIPTION
A7MP5	0380-1680	0		SPACER-PRESS-IN 0.188 IN LG; 0.143 IN ID	00000	ORDER BY DESCRIPTION

† Refer to Section 7 for update information.

\* Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A8</b>						
A8	08657-60132	0	1	FREQUENCY MULTIPLIER ASSEMBLY	28480	08657-60132
ABC1	0180-2207	5		CAPACITOR-FXD 100UF ±10% 10VDC TA	56289	150D107X9010R2
ABC2	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC3	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC4	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC5*	0160-4527	4	4	CAPACITOR-FXD 56PF ±5% 200VDC CER 0-30	28480	0160-4527
ABC6	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC7	0160-2249	3	1	CAPACITOR-FXD 4.7PF ±25PF 500VDC CER	28480	0160-2249
ABC8	0160-4527	4		CAPACITOR-FXD 56PF ±5% 200VDC CER 0-30	28480	0160-4527
ABC9	0160-4527	4		CAPACITOR-FXD 56PF ±5% 200VDC CER 0-30	28480	0160-4527
ABC10	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC11	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC12	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC13	0160-4383	0		CAPACITOR-FXD 6.8PF ±.5PF 200VDC CER	20932	5Q24E0200RD689D
<i>2949U AND ABOVE</i>						
ABC13	0160-4358	2		CAP-FXD 0.03UF 100VDC POL	05176	X1263UW
ABC14	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC15	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC16	0160-6705	4		CAPACITOR-FXD 27PF ±5% 200VDC CER 0-30	28480	0160-6705
ABC17	0160-2055	9		CAPACITOR-FXD .01UF ±80-20% 100VDC CER	28480	0160-2055
ABC18	0160-2243	7	1	CAPACITOR-FXD 2.7PF ±.25PF 500VDC CER	28480	0160-2243
ABC19*	0160-6705	4	5	CAPACITOR-FXD 27PF ±5% 200VDC CER 0-30	28480	0160-6705
ABC20	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC21	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC22	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC23	0160-6705	4		CAPACITOR-FXD 27PF ±5% 200VDC CER 0-30	28480	0160-6705
ABC24	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC25	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC26	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC27	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC28	0160-3873	1		CAPACITOR-FXD 4.7PF ±.5PF 200VDC CER	28480	0160-3873
ABC29	0160-3873	1		CAPACITOR-FXD 4.7PF ±.5PF 200VDC CER	28480	0160-3873
ABC30	0160-2237	9	1	CAPACITOR-FXD 1.2PF ±.25PF 500VDC CER	28480	0160-2237
ABC31	0121-0448	8		CAPACITOR-V TRMR-CER 2.5-5PF 63V PC-MTG	28480	0121-0448
ABC32	0160-3029	9		CAPACITOR-FXD 7.5PF ±.5PF 100VDC CER	28480	0160-3029
ABC33	0160-4518	3		CAPACITOR-FXD 3.9PF ±.5PF 200VDC CER	28480	0160-4518
ABC34	0160-4527	4		CAPACITOR-FXD 56PF ±5% 200VDC CER 0-30	28480	0160-4527
ABC35	0160-4382	9		CAPACITOR-FXD 3.3PF ±.25PF 200VDC CER	28480	0160-4382
<i>2949U AND ABOVE</i>						
ABC35	0160-3873	1		CAP-FXD 4.7PF 200VDC	06352	FD12COG2D4R7D
ABC36	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC37	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC38	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC39	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC40*	0160-3878	6	27	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC41	0160-4383	0		CAPACITOR-FXD 6.8PF ±.5PF 200VDC CER	20932	5Q24E0200RD689D
ABC42	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040
ABC43	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC44	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
ABC45	0160-4040	6		CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4040

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
ABC46	0160-2234	8	1	CAPACITOR-FXD .51PF ←.25PF 500VDC CER	29480	0160-2234
ABC47	0121-0452	4	1	CAPACITOR-V TRMR-AIR 1.3-5.4PF 175V	74970	187-0103-028
ABC48	0160-4040	8		CAPACITOR-FXD 1000PF ←5% 100VDC CER	29480	0160-4040
ABC49				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABC50	0180-4518	3		CAPACITOR-FXD 3.8PF ←.5PF 200VDC CER	29480	0160-4518
ABC51				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABC52	0160-4040	6		CAPACITOR-FXD 1000PF ←5% 100VDC CER	29480	0160-4040
ABC53				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABC54	0160-3878	6		CAPACITOR-FXD 1000PF ←20% 100VDC CER	29480	0160-3878
ABC55	0160-4040	6		CAPACITOR-FXD 1000PF ←5% 100VDC CER	29480	0160-4040
ABC56	0160-4382	9		CAPACITOR-FXD 3.3PF ←.25PF 200VDC CER	29480	0160-4382
ABC57	0160-4490	0	1	CAPACITOR-FXD 1.8PF ←.25PF 200VDC CER	29480	0160-4490
ABC58	0160-3878	6		CAPACITOR-FXD 1000PF ←20% 100VDC CER	29480	0160-3878
ABJ1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	29480	1200-0507
ABJ2	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	29480	1200-0507
ABJ3	1250-1626	0	2	CONNECTOR-RF SMC M PC 50-OHM	29480	1250-1626
	2190-0124	4	7	WASHER-LK INTL T NO. 10 .195-IN-ID	29480	2190-0124
	2950-0078	9	7	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	29480	2950-0078
ABJ4	1250-1626	0		CONNECTOR-RF SMC M FJ 50-OHM	29480	1250-1626
	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	29480	2190-0124
	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	29480	2950-0078
ABL1	9140-0210	1	1	INDUCTOR RF-CH-LMLD 100UH 5%	29480	9140-0210
ABL2	9140-0141	7		INDUCTOR RF-CH-LMLD 880NH 10% .105DX.26LG	29480	9140-0141
ABL3				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL4				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL5				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL6				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL7	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	29480	9100-3922
ABL8				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL9				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL10				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL11	9100-2251	0	3	INDUCTOR RF-CH-LMLD 220NH 10% .105DX.26LG	29480	9100-2251
ABL12				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL13				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL14				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL15				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL16	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	29480	9100-3922
ABL17				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL18				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL19				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL20				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL21				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL22				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL23				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL24	9100-2251	0		INDUCTOR RF-CH-LMLD 220NH 10% .105DX.26LG	29480	9100-2251
ABL25				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL26				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL27	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	29480	9100-3922
ABL28				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL29				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL30				PART IS ETCHED TRACE ON CIRCUIT BOARD		

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
ABL31				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL32				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL33				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL34				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL35				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL36				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL37				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL38				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL39				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL40	9100-2251	0		INDUCTOR RF-CH-MLD 220NH 10% .10SDX.26LG	28480	9100-2251
ABL41				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL42				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL43				PART IS ETCHED TRACE ON CIRCUIT BOARD		
ABL44-ABL56				NOT ASSIGNED		
ABL57	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
ABMP1	08656-00099	1	1	MULTI GROUND TAB	28480	08656-00099
ABMP2	08656-00133	4		CLIP SEMLR GRND	28480	08656-00133
ABMP3	1251-2194	1	1	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	28480	1251-2194
ABC1	1854-1050	4		TRANSISTOR NPN SI PD=180MW FT=5GHZ	25403	BFR91A
ABC2	1854-1050	4		TRANSISTOR NPN SI PD=180MW FT=5GHZ	25403	BFR91A
ABC3	1854-1234	6	2	TRANSISTOR NPN SI PD=300MW	03334	BFG-65
ABC4	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
ABC5	1854-1234	6		TRANSISTOR NPN SI PD=300MW	03334	BFG-65
ABC6	1854-0696	2		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0696
ABC7	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
ABC8	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
ABR1	0757-0294	9		RESISTOR 17.8 1% .125W F TC=0-100	19701	MF4C1/B-T0-17R8-F
ABR2	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0-100	24546	CA-1/B-T0-121R-F
ABR3	0698-3439	4		RESISTOR 178 1% .125W F TC=0-100	24546	CA-1/B-T0-178R-F
ABR4	0698-3443	0		RESISTOR 287 1% .125W F TC=0-100	24546	CA-1/B-T0-287R-F
ABR5	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CA-1/B-T0-1101-F
ABR6*	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CA-1/B-T0-3831-F
ABR7*	0757-0398	4		RESISTOR 75 1% .125W F TC=0-100	24546	CA-1/B-T0-75R0-F
ABR8	0757-0346	2		RESISTOR 10 1% .125W F TC=0-100	24546	CA-1/B-T0-10R0-F
ABR9	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CA-1/B-T0-1101-F
ABR10*	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CA-1/B-T0-3831-F
ABR11	0698-3442	9		RESISTOR 237 1% .125W F TC=0-100	24546	CA-1/B-T0-237R-F
ABR12	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0-100	24546	CA-1/B-T0-1781-F
ABR13	0757-0398	4		RESISTOR 75 1% .125W F TC=0-100	24546	CA-1/B-T0-75R0-F
ABR14	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0-100	24546	CA-1/B-T0-1781-F
ABR15	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CA-1/B-T0-3831-F
ABR16	0757-0346	2		RESISTOR 10 1% .125W F TC=0-100	24546	CA-1/B-T0-10R0-F
2949U AND ABOVE						
ABR16	0698-1902	4	2	RESISTOR 10 1% .05W TF TC=0-100	05524	CMF-50-21
ABR17	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CA-1/B-T0-1101-F
ABR18	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0-100	24546	CA-1/B-T0-46R4-F
ABR19	0757-0346	2		RESISTOR 10 1% .125W F TC=0-100	24546	CA-1/B-T0-10R0-F
2949U AND ABOVE						
ABR19	0698-1902	4	2	RESISTOR 10 1% .05W TF TC=0-100	05524	CMF-50-21
ABR20	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CA-1/B-T0-1101-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
ABR21	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CA-1/B-T0-3831-F
ABR22	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CA-1/B-T0-3831-F
ABR23	0757-0398	4		RESISTOR 75 1% .125W F TC=0-100	24546	CA-1/B-T0-75R0-F
ABR24	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CA-1/B-T0-101-F
ABR25	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CA-1/B-T0-825R-F
ABR26	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CA-1/B-T0-1101-F
ABR27	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CA-1/B-T0-101-F
ABR28	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CA-1/B-T0-1101-F
ABR29	0757-0346	2		RESISTOR 10 1% .125W F TC=0-100	24546	CA-1/B-T0-10R0-F
ABR29	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0-100	24546	CA-1/B-T0-1101-F
ABR30	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0-100	24546	CA-1/B-T0-3831-F
ABR31	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CA-1/B-T0-101-F
ABR32	0757-0398	4		RESISTOR 75 1% .125W F TC=0-100	24546	CA-1/B-T0-75R0-F
ABR33	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0-100	28480	0757-0180
ABR34	0757-0401	0		RESISTOR 100 1% .125W F TC=0-100	24546	CA-1/B-T0-101-F
ABR35	0757-0421	4		RESISTOR 825 1% .125W F TC=0-100	24546	CA-1/B-T0-825R-F

*Table 6-3. Replaceable Parts*

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A9</b>						
A9	08657-69002	1	1	RESTORED ATTENUATOR MODULE	28480	08657-69002

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Descriptions	Mfr. Code	Mfr. Part Number
<b>A10</b>						
A10	08657-60113	7	1	ATTENUATOR DRIVE BOARD	28480	08657-60113
A10C1	0160-4833	5	2	CAP-FXD 0.022UF 100 V	09969	RPA20X7R223K100V
A10C2	0160-4833	5		CAP-FXD 0.022UF 100 V	09969	RPA20X7R223K100V
A10C3	0160-4835	7	6	CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A10C4	0180-0291	3	6	CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A10C5	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A10C6	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A10C7	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A10C8	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A10C9	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A10C10	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A10C11	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A10C12	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A10C13	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A10C14	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A10C15	0180-3467	1	1	CAP-FXD 22UF 63 V AL-ELCTLT	10392	CELSM1J220
A10C16	0160-5469	5	2	CAP-FXD 1UF 50 V POLYE-MET	50088	BF064D0105KDB
A10C17	0160-5469	5		CAP-FXD 1UF 50 V POLYE-MET	50088	BF064D0105KDB
A10C18	0160-4832	4		CAP-FXD 0.01UF 100 V	28480	0160-4832
A10CR1	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A10CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A10CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A10CR4	1901-0731	7	1	DIODE-PWR RECT 400V 1A	28480	1901-0731
A10CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A10J1	1251-8106	7	1	CONN-POST TYPE .100-PIN-SPOG 20-CONT	28480	1251-8106
A10J2	1251-4927	2	1	CONN-POST TYPE .100-PIN-SPOG 16-CONT	28480	1251-4927
A10J3	1251-4670	2	2	CONN-POST TYPE .100-PIN-SPOG 3-CONT	28480	1251-4670
A10J4	5021-2826	3	1	RF FITTING	28480	5021-2826
A10J5	1251-4670	2		CONN-POST TYPE .100-PIN-SPOG 3-CONT	28480	1251-4670
A10N4	0535-0109	5	1	NUT-HEX DBL-CHAM M5 X 0.8 2.5MM-THK	28480	0535-0109
A10Q1	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A10Q2	1853-0406	0	1	TRANSISTOR PNP 2N6476 SI TO-220AB PD=40W	34371	2N6476
A10R1	0757-0442	9	4	RESISTOR 10K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1002-F
A10R2	0757-0442	9		RESISTOR 10K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1002-F
A10R3	0698-3152	8	1	RESISTOR 3.48K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-3481-F
A10R4	0757-1084	9	1	RESISTOR 1.47K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1471-F
A10R5	0698-0083	8	3	RESISTOR 1.98K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1961-F
A10R6	0698-0083	8		RESISTOR 1.98K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1961-F
A10R7	0757-0442	9		RESISTOR 10K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1002-F
A10R8	0698-0083	8		RESISTOR 1.98K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1961-F
A10R9	0757-0442	9		RESISTOR 10K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1002-F
A10R10	0757-0428	1	1	RESISTOR 1.62K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1621-F
A10R11	0757-0394	0	1	RESISTOR 51.1 ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-51R1-F
A10R12	0757-0465	6	1	RESISTOR 100K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-1003-F
A10R13	0698-3396	2	2	RESISTOR 38.3 ←-1% .5W TF TC=0-100	K8479	H2
A10R14	0698-3396	2		RESISTOR 38.3 ←-1% .5W TF TC=0-100	K8479	H2
A10R15	0757-0460	1	1	RESISTOR 61.9K ←-1% .125W TF TC=0-100	12498	CT4-1/8-T0-6192-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A10R16	0757-0417	8	1	RESISTOR 562 $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-562R-F
A10R17	0757-0439	4	2	RESISTOR 6.81K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-6811-F
A10R18	0811-1854	5	1	RESISTOR 50 $\pm$ 5% 5W PWI TC=0 $\pm$ 20	01686	TS
A10R19	0757-0443	0	1	RESISTOR 11K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-1102-F
A10R20	0757-0814	9	1	RESISTOR 511 $\pm$ 1% .5W TF TC=0 $\pm$ 100	K8479	H2
A10R21	0698-3155	1	1	RESISTOR 4.64K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-4641-F
A10R22	0757-0439	4	1	RESISTOR 6.81K $\pm$ 1% .125W TF TC=0 $\pm$ 100	12498	CT4-1/B-T0-6811-F
A10R23	0698-8905	8	1	RESISTOR 10.35K $\pm$ 0.1% .125W TF TC=0 $\pm$ 25	12498	NE55
A10TP1	0360-2359	0	2	TERMINAL-TEST POINT .230IN ABOVE	4G810	230.100
A10TP2	0360-2359	0	2	TERMINAL-TEST POINT .230IN ABOVE	4G810	230.100
A10U1	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A10U3	1820-1422	3	1	IC MV TTL LS MONOSTBL RETRIG	01295	SN74LS122N
A10U4	1820-2634	1	1	IC INV TTL ALS HEX	01295	SN74ALS04BN
A10U6	1820-3480	7	3	IC DRVR TTL ALS AND QUAD 2-INP	01295	SN74ALS1008AN
A10U7	1820-3480	7	3	IC DRVR TTL ALS AND QUAD 2-INP	01295	SN74ALS1008AN
A10U9	1820-3480	7	3	IC DRVR TTL ALS AND QUAD 2-INP	01295	SN74ALS1008AN
A10U10	1826-0139	9	1	IC OP AMP GP DUAL 8-DIP-P PKG	04713	MC1458P1
A10U11	1826-0785	1	1	IC OP AMP LOW-BIAS-H-IMP DUAL 8-DIP-C	04713	MC34002BU
A10U12	1858-0086	2	1	TRANSISTOR ARRAY 14-PIN PLSTC TO-116	04713	MPQ6700
A10U13	1820-2111	9	2	IC-INTERFACE DRVR INV	01295	SN75468N
A10U14	1820-2111	9	2	IC-INTERFACE DRVR INV	01295	SN75468N
A10U15	1826-0393	7	1	IC V RGLTR-ADJ-POS 1.2/37V TO-220 PKG	27014	LM317T
A10U16	1820-2498	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A10U17	1820-2924	2	1	IC GATE CMOS/74HC NOR QUAD 2-INP	04713	MC74HC02N
A10VR1	1902-0244	9	1	DIODE-ZNR 30V 5% PD=1W IR=5UA	28480	1902-0244
A10W1	1258-0209	9	1	JUMPER-REMOVABLE 2 POSITION; .250 IN	18873	68786-202
A10XE4	1251-1556	7	1	CONNECTOR-SGL CONT SKT .02-IN-BSC-SZ RND	98291	006-4844-00-0-990

<sup>†</sup>Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A11</b>						
A11	08657-60114	8	1	AUDIO BOARD	28480	08657-60114
A11C1	0180-0291	3	3	CAP--FXD 1UF 35 V TA	56289	150D105X9035A2
A11C2	0180-0291	3		CAP--FXD 1UF 35 V TA	56289	150D105X9035A2
A11C3	0180-0291	3		CAP--FXD 1UF 35 V TA	56289	150D105X9035A2
A11C4	0160-4835	7	6	CAP--FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A11C5	0160-4835	7		CAP--FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A11C6	0160-4835	7		CAP--FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A11C7	0160-4791	4	1	CAP--FXD 10PF 100 V	09969	RPA10C0G100D100
A11C8	0180-2815	1	2	CAP--FXD 100UF 10 V TA	12344	T354J107M010AS
A11C9	0180-2815	1		CAP--FXD 100UF 10 V TA	12344	T354J107M010AS
A11C10	0160-4795	8	1	CAP--FXD 0F 100 V	09969	RPA10C0G4R7D100
A11C11	0160-4807	3	2	CAP--FXD 33PF 100 V	09969	RPA10C0G330J100
A11C12	0160-4835	7		CAP--FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A11C13	0160-4835	7		CAP--FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A11C14	0160-4807	3		CAP--FXD 33PF 100 V	09969	RPA10C0G330J100
A11C15	0180-2821	9	2	CAP--FXD 22UF 35 V TA	12344	T354K226M035AS
A11C16	0180-2821	9		CAP--FXD 22UF 35 V TA	12344	T354K226M035AS
A11C17	0160-2225	5	1	CAP--FXD 2000PF 300 V MICA	28480	0160-2225
A11C18	0160-0336	5	1	CAP--FXD 100PF 300 V MICA	28480	0160-0336
A11C19	0180-0375	4	1	CAP--FXD 68UF 20 V TA	56289	150D686X9020B2
A11C20	0160-5035	1	1	CAP--FXD 0.051UF 100 V POLYP--MET	84411	051-100-2-X363UW
A11C21	0160-5036	2	1	CAP--FXD 0.27UF 100 V POLYP--MET	84411	27-100-2-X363UW
A11C22	0160-5469	5	1	CAP--FXD 1UF 50 V POLYE--MET	50088	BF064D0105KDB
A11C23	0180-0100	3	2	CAP--FXD 4.7UF 35 V TA	56289	150D475X9035B2
A11C24	0180-0100	3		CAP--FXD 4.7UF 35 V TA	56289	150D475X9035B2
A11C25	0160-4835	7		CAP--FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A11C26	0160-4812	0	1	CAP--FXD 220PF 100 V	09969	RPA10C0G221J100V
A11C27	0180-2698	8	1	CAP--FXD 4.7UF 35 V TA	04222	MD6-035-475-10/9038
A11C28	0160-4835	7		CAP--FXD 0.1UF 50 V	28480	0160-4835
A11C29	0160-4835	7		CAP--FXD 0.1UF 50 V	28480	0160-4835
A11CR1	1901-0376	6	2	DIODE--GEN PRP 35V 50MA DO--35	9N171	1N3595
A11CR2	1901-0376	6		DIODE--GEN PRP 35V 50MA DO--35	9N171	1N3595
A11CR3	1901-0050	3	3	DIODE--SWITCHING 80V 200MA 2NS DO--35	9N171	1N4150
A11CR4	1901-0050	3		DIODE--SWITCHING 80V 200MA 2NS DO--35	9N171	1N4150
A11CR5	1901-0050	3		DIODE--SWITCHING 80V 200MA 2NS DO--35	9N171	1N4150
A11CR6	1901-0880	7	1	DIODE--GEN PRP 125MA DO--35	28480	1901-0880
A11CR7	1901-0040	1	3	DIODE--SWITCHING 30V 50MA 2NS DO--35	9N171	1N4148
A11CR8	1901-0040	1		DIODE--SWITCHING 30V 50MA 2NS DO--35	9N171	1N4148
A11CR9	1901-0040	1		DIODE--SWITCHING 30V 50MA 2NS DO--35	9N171	1N4148
A11J1	1251-8248	8	1	CONN--POST TYPE .100--PIN--SPCG 26--CONT	28480	1251-8248
A11J2	1251-4700	9	1	CONN--POST TYPE .100--PIN--SPCG 3--CONT	28480	1251-4700
A11J3	1251-4670	2	2	CONN--POST TYPE .100--PIN--SPCG 3--CONT	28480	1251-4670
A11J4	1251-4670	2		CONN--POST TYPE .100--PIN--SPCG 3--CONT	28480	1251-4670
A11J5	1258-0209	9	2	JUMPER--REMOVABLE 2 POSITION; .250 IN	18873	68786-202
A11J6	1258-0209	9		JUMPER--REMOVABLE 2 POSITION; .250 IN	18873	68786-202

<sup>1</sup>Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11L1	9140-0144	0	2	INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A11L2	9140-0142	8	1	INDUCTOR RF-CH-MLD 2.2UH +-10%	91637	IM-2 2.2UH 10%
A11L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A11Q1	1855-0420	2	8	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11Q2	1855-0253	9	1	TRANSISTOR J-FET N-CHAN D-MODE TO-92 SI	28480	1855-0253
A11Q3	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11Q4	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11Q5	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11Q6	1855-0292	6	2	TRANSISTOR J-FET 2N5432 N-CHAN D-MODE	27014	2N5432
A11Q7	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11Q8	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11Q9	1855-0292	6	1	TRANSISTOR J-FET 2N5432 N-CHAN D-MODE	27014	2N5432
A11Q10	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11Q11	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A11R1	0757-0814	9	1	RESISTOR 511 +-1% .5W TF TC=0+-100	K8479	H2
A11R2	0698-3447	4	1	RESISTOR 422 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-422R-F
A11R3	2100-3534	7	2	RESISTOR-TRMR 100 10% TKF TOP-ADJ 17-TRN	09969	3105W101
A11R4	0698-3440	7	1	RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-196R-F
A11R5	0698-6295	6	2	RESISTOR 300 +-0.1% .125W TF TC=0+-50	12498	NC55
A11R6	0698-6295	6		RESISTOR 300 +-0.1% .125W TF TC=0+-50	12498	NC55
A11R7	0698-6983	9	7	RESISTOR 20.4K +-0.1% .125W TF TC=0+-25	19701	5033R-1/8-TS-2042-B
A11R8	0698-4015	4	2	RESISTOR 600 +-0.5% .125W TF TC=0+-100	12498	NA4
A11R9	0757-0438	3	1	RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-5111-F
A11R10	0757-0465	6	8	RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A11R11	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A11R12	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A11R13	0698-6983	9		RESISTOR 20.4K +-0.1% .125W TF TC=0+-25	19701	5033R-1/8-TS-2042-B
A11R14	0698-6983	9		RESISTOR 20.4K +-0.1% .125W TF TC=0+-25	19701	5033R-1/8-TS-2042-B
A11R15	0757-0463	4	1	RESISTOR 82.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-8252-F
A11R15	0757-0464	5	1	RESISTOR 90.9K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-9092-F
A11R16	2100-3659	7	3	RESISTOR-TRMR 20K 10% TKF TOP-ADJ 17-TRN	09969	3105W203
A11R17	2100-3659	7		RESISTOR-TRMR 20K 10% TKF TOP-ADJ 17-TRN	09969	3105W203
A11R18	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A11R19	0698-3266	5	2	RESISTOR 237K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2373-F
A11R20	2100-3296	6	1	RESISTOR-TRMR 10K 10% TKF TOP-ADJ 17-TRN	09969	3105W103
A11R21	0698-3266	5		RESISTOR 237K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2373-F
A11R25	0698-4475	0	1	RESISTOR 9.76K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-9761-F
A11R26	0757-0280	3	5	RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F
A11R27	0757-0442	9	6	RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A11R28	0757-0394	0	3	RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-51R1-F
A11R29	0698-3154	0	1	RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4221-F
A11R30	0698-6320	8	2	RESISTOR 5K +-0.1% .125W TF TC=0+-25	12498	NESS
A11R31	0698-8863	8	2	RESISTOR 5.2K +-0.1% .125W TF TC=0+-25	12498	NESS
A11R32	0698-8863	8		RESISTOR 5.2K +-0.1% .125W TF TC=0+-25	12498	NESS
A11R33	0698-6320	8		RESISTOR 5K +-0.1% .125W TF TC=0+-25	12498	NESS
A11R34	0698-3151	7	2	RESISTOR 2.87K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2871-F
A11R35	0698-3151	7		RESISTOR 2.87K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2871-F
A11R36	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F
A11R37	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11R38	0698-3454	3	2	RESISTOR 215K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-2153-F
A11R39	0698-3454	3		RESISTOR 215K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-2153-F
A11R40	0698-3160	8	1	RESISTOR 31.6K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-3162-F
A11R41	0698-0073	8	1	RESISTOR 10M $\pm$ 1% .125W TF TC=0--150	19701	S053YL10M00F
A11R42	0757-0465	6		RESISTOR 100K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1003-F
A11R43	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1002-F
A11R44	0757-0465	6		RESISTOR 100K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1003-F
A11R45	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1002-F
A11R46	0698-3441	8	1	RESISTOR 215 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-215R-F
A11R47	0757-0461	2	1	RESISTOR 68.1K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-6812-F
A11R48	0757-0288	1	1	RESISTOR 9.09K $\pm$ 1% .125W TF TC=0--100	19701	5033R-1/B-TQ-9091-F
A11R49	0757-0420	3	1	RESISTOR 750 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-751-F
A11R50	2100-3534	7		RESISTOR-TRMR 100 10% TKF TOP-ADJ 17-TRN	09969	3105W101
A11R51	0757-0394	0	1	RESISTOR 51.1 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-51R1-F
A11R53	0757-0462	3	1	RESISTOR 75K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-7502-F
A11R54	0698-3457	6	1	RESISTOR 316K $\pm$ 1% .125W TF TC=0--100	12498	CT4
A11R55	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1001-F
A11R56	0698-6983	9		RESISTOR 20.4K $\pm$ 0.1% .125W TF TC=0--25	19701	5033R-1/B-T9-2042-B
A11R57	0698-6983	9		RESISTOR 20.4K $\pm$ 0.1% .125W TF TC=0--25	19701	5033R-1/B-T9-2042-B
A11R58	0757-0465	6		RESISTOR 100K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1003-F
A11R59	0757-0465	6		RESISTOR 100K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1003-F
A11R60	0698-3157	3	1	RESISTOR 19.6K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1962-F
A11R61	0757-0440	7	1	RESISTOR 7.5K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-7501-F
A11R61	0757-0444	1	1	RESISTOR 12.1K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1212-F
A11R62	2100-3091	1	1	RESISTOR-TRMR 2K 10% TKF TOP-ADJ 17-TRN	09969	3105W202
A11R63	0757-0401	0	1	RESISTOR 100 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-101-F
A11R64	0757-0422	5	1	RESISTOR 909 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-909R-F
A11R65	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1001-F
A11R66	2100-3502	9	1	RESISTOR-TRMR 200 10% TKF TOP-ADJ 17-TRN	09969	3105W201
A11R67	0757-0278	9	1	RESISTOR 1.78K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1781-F
A11R68	0757-1094	9	1	RESISTOR 1.47K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1471-F
A11R69	0698-8827	4	3	RESISTOR 1M $\pm$ 1% .125W TF TC=0--100	12498	CT4
A11R70	0698-3459	8	1	RESISTOR 383K $\pm$ 1% .125W TF TC=0--100	12498	CT4
A11R71	0757-0421	4	1	RESISTOR 825 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-825R-F
A11R72	2100-3659	7		RESISTOR-TRMR 20K 10% TKF TOP-ADJ 17-TRN	09969	3105W203
A11R73	0698-3444	1	1	RESISTOR 316 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-316R-F
A11R74	0698-7394	8	1	RESISTOR 698 $\pm$ 0.1% .125W TF TC=0--25	19701	5033R-1/B-T9-698R-LR
A11R75	0698-6347	9	1	RESISTOR 1.5K $\pm$ 0.1% .125W TF TC=0--25	12498	NE55
A11R76	0757-0384	0		RESISTOR 51.1 $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-51R1-F
A11R77	0698-6983	9		RESISTOR 20.4K $\pm$ 0.1% .125W TF TC=0--25	19701	5033R-1/B-T9-2042-B
A11R78	0698-6983	9		RESISTOR 20.4K $\pm$ 0.1% .125W TF TC=0--25	19701	5033R-1/B-T9-2042-B
A11R79	0698-8827	4		RESISTOR 1M $\pm$ 1% .125W TF TC=0--100	12498	CT4
A11R80	0698-8827	4		RESISTOR 1M $\pm$ 1% .125W TF TC=0--100	12498	CT4
A11R81	0698-3136	8	2	RESISTOR 17.8K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1782-F
A11R82	0698-3136	8		RESISTOR 17.8K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1782-F
A11R83	2100-3089	7	1	RESISTOR-TRMR 5K 10% TKF TOP-ADJ 17-TRN	09969	3105W502
A11R84	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1002-F
A11R85	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1002-F
A11R86	0757-0442	9		RESISTOR 10K $\pm$ 1% .125W TF TC=0--100	12498	CT4-1/B-TQ-1002-F
A11R87	0698-4015	4		RESISTOR 600 $\pm$ 0.5% .125W TF TC=0--100	12498	NA4

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11TP1	0360-2359	0	7	TERMINAL—TEST POINT .230IN ABOVE	4G810	230.100
A11TP2	0360-2359	0		TERMINAL—TEST POINT .230IN ABOVE	4G810	230.100
A11TP3	0360-2359	0		TERMINAL—TEST POINT .230IN ABOVE	4G810	230.100
A11TP4	0360-2359	0		TERMINAL—TEST POINT .230IN ABOVE	4G810	230.100
A11TP5	0360-2359	0		TERMINAL—TEST POINT .230IN ABOVE	4G810	230.100
A11TP6	0360-2359	0		TERMINAL—TEST POINT .230IN ABOVE	4G810	230.100
A11TP7	0360-2359	0		TERMINAL—TEST POINT .230IN ABOVE	4G810	230.100
A11U1	1820-1730	6	5	IC FF TTL LS D—TYPE POS—EDGE—TRIG COM	01295	SN74LS273N
A11U2	1820-1730	6		IC FF TTL LS D—TYPE POS—EDGE—TRIG COM	01295	SN74LS273N
A11U3	1820-1730	6		IC FF TTL LS D—TYPE POS—EDGE—TRIG COM	01295	SN74LS273N
A11U4	1820-1730	6		IC FF TTL LS D—TYPE POS—EDGE—TRIG COM	01295	SN74LS273N
A11U5	1820-1730	6		IC FF TTL LS D—TYPE POS—EDGE—TRIG COM	01295	SN74LS273N
A11U6	1820-0471	0	1	IC INV TTL HEX 1—INP	01295	SN7406N
A11U7	1820-2739	7	1	IC GATE TTL ALS NOR QUAD 2—INP	01295	SN74ALS02N
A11U8	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2—INP	01295	SN74ALS08N
A11U9	1826-0932	0	1	IC OP AMP PRCN 8—DIP—C PKG	06665	OP-27FZ
A11U10	1826-0138	8	2	IC COMPARATOR GP QUAD 14—DIP—P PKG	27014	LM339N
A11U11	1826-1652	3	1	IC OP AMP WB QUAD 14—DIP—P PKG	04713	MC34084AP
A11U12	1826-0371	1	2	IC OP AMP LOW—BIAS—H—IMPD 8—TO—99 PKG	27014	LF256H
A11U13	1826-1202	9	1	D/A 10—BIT 16—CERDIP CMOS	24355	AD7533(SEL)
A11U14	1826-0138	8		IC COMPARATOR GP QUAD 14—DIP—P PKG	27014	LM339N
A11U15	1826-0785	1	1	IC OP AMP LOW—BIAS—H—IMPD DUAL 8—DIP—C	04713	MC34002BU
A11U16	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A11U17	1826-0753	3	2	IC OP AMP LOW—BIAS—H—IMPD QUAD 14—DIP—C	04713	MC34004BL
A11U18	1826-0371	1		IC OP AMP LOW—BIAS—H—IMPD 8—TO—99 PKG	27014	LF256H
A11U19	1826-0462	1	2	D/A 10—BIT 16—CERDIP BPLR	18324	MC3410CF
A11U20	1826-0462	1		D/A 10—BIT 16—CERDIP BPLR	18324	MC3410CF
A11U21	1826-0753	3		IC OP AMP LOW—BIAS—H—IMPD QUAD 14—DIP—C	04713	MC34004BL
A11VR1	1902-0777	3	1	DIODE—ZNR 1N825 6.2V 5% DO—7 PD=4W	04713	1N825
A11VR2	1902-0957	1	2	DIODE—ZNR 9.1V 5% DO—35 PD=4W TC=0.69%	28480	1902-0957
A11VR3	1902-0957	1		DIODE—ZNR 9.1V 5% DO—35 PD=4W TC=0.69%	28480	1902-0957
A11VR4	1902-0064	1	1	DIODE—ZNR 7.5V 5% DO—35 PD=4W TC=0.05%	28480	1902-0064

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

*Table 6-3. Replaceable Parts*

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A12</b>						
A12	08657-69003	2	1	RESTORED DOUBLER MODULE	28480	08657-69003

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A13</b>						
A13	08657-60116	8	1	PROCESSOR BOARD	28480	08657-60114
A13B1	1420-0281	2	1	BATTERY 2.8V .35A-HR LI/1 PIN	08800	2736WT
A13C1	0160-5189	6	1	CAP-FXD 4700PF 100 V POLYP-FL	07282	472K01PP460
A13C2	0160-4832	4	14	CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C3	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C4	0160-5098	6	1	CAP-FXD 0.22UF 50 V	09969	RP440X7R224K50V
A13C5	0180-1746	5	1	CAP-FXD 15UF 20 V TA	56289	150D156X9020B2
A13C6	0160-4835	7	1	CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A13C7	0160-4786	7	2	CAP-FXD 27PF 100 V	09969	RPA10COG270J100
A13C8	0160-4786	7		CAP-FXD 27PF 100 V	09969	RPA10COG270J100
A13C9	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C10	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C11	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C12	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C13	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C14	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C15	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C16	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C17	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C18	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C19	0180-0197	8	1	CAP-FXD 2.2UF 20 V TA	56289	150D225X9020A2
A13C20	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13C21	0180-2207	5	1	CAP-FXD 100UF 10 V TA	56289	150D107X9010R2
A13C22	0160-4833	5	2	CAP-FXD 0.022UF 100 V	09969	RPA20X7R223K100V
A13C23	0160-4833	5		CAP-FXD 0.022UF 100 V	09969	RPA20X7R223K100V
A13C24	0180-0229	7	3	CAP-FXD 33UF 10 V TA	56289	150D336X9010B2
A13C25	0180-0229	7		CAP-FXD 33UF 10 V TA	56289	150D336X9010B2
A13C26	0180-0229	7		CAP-FXD 33UF 10 V TA	56289	150D336X9010B2
A13C27	0160-4832	4		CAP-FXD 0.01UF 100 V	09969	RPA10X7R103K100V
A13CR1	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A13CR2	1901-0518	8	1	DIODE-SCHOTTKY 5M SIG	12403	5082-2800
A13DS1	1990-0835	9	5	LED-LAMP LUM-INT-6MCD F=30MA-MAX BVR=5V	28480	HLMP-1523
A13DS2	1990-0835	9		LED-LAMP LUM-INT-6MCD F=30MA-MAX BVR=5V	28480	HLMP-1523
A13DS3	1990-0835	9		LED-LAMP LUM-INT-6MCD F=30MA-MAX BVR=5V	28480	HLMP-1523
A13DS4	1990-0835	9		LED-LAMP LUM-INT-6MCD F=30MA-MAX BVR=5V	28480	HLMP-1523
A13DS5	1990-0835	9		LED-LAMP LUM-INT-6MCD F=30MA-MAX BVR=5V	28480	HLMP-1523
A13J1	1251-8105	6	1	CONN-POST TYPE .100-PIN-SPCG 16-CONT	28480	1251-8105
A13J2	1251-5618	0	1	CONN-POST TYPE .100-PIN-SPCG 8-CONT	28480	1251-5618
A13J3	1251-4927	2	2	CONN-POST TYPE .100-PIN-SPCG 16-CONT	28480	1251-4927
A13J4	1251-4927	2		CONN-POST TYPE .100-PIN-SPCG 16-CONT	28480	1251-4927
A13J5	1252-2637	9	2	CONN-POST TYPE .156-PIN-SPCG 8-CONT	28480	1252-2637
A13J6	1252-2637	9		CONN-POST TYPE .156-PIN-SPCG 8-CONT	28480	1252-2637
A13J7	1252-1325	0	3	CONN-POST TYPE .100-PIN-SPCG 10-CONT	28480	1252-1325
A13J8	1251-8248	8	2	CONN-POST TYPE .100-PIN-SPCG 26-CONT	28480	1251-8248
A13J9	1251-8106	7	1	CONN-POST TYPE .100-PIN-SPCG 20-CONT	28480	1251-8106
A13J10	1252-1325	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	28480	1252-1325

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A13J11	1251-4926	1	1	CONN-POST TYPE .100-PIN-SPOG 8-CONT	28480	1251-4926
A13J12	1252-1325	0	0	CONN-POST TYPE .100-PIN-SPOG 10-CONT	28480	1252-1325
A13J13	1251-8248	8	8	CONN-POST TYPE .100-PIN-SPOG 26-CONT	28480	1251-8248
A13MP2	0570-0639	0	2	STD-PRS-IN M3 X 0.5 12.000 PH-BRZ	46384	KFLM3-12-ET
A13MP3	0590-1837	4	4	THREADED INSERT-SPCR-PRESS IN 20-MM-LG	46384	KSSC-4M-20
A13MP4	0590-1838	5	3	THREADED INSERT-STDF M3.5 X 0.6 18-MM-LG	11783	SCBS-M3.5-18
A13MP5	1200-0567	1	3	SOCKET-IC-DIP 28-CONT DIP DIP-SLDR	01295	C8728-01
A13Q1	1854-0810	2	1	TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A13Q2	1858-0008	8	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	SPOS26X
A13R1	0757-0279	0	2	RESISTOR 3.16K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-3161-F
A13R2	0757-0442	9	8	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R3	0757-0279	0	8	RESISTOR 3.16K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-3161-F
A13R4	0757-0419	0	2	RESISTOR 681 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-681R-F
A13R5	0757-0290	5	1	RESISTOR 6.19K ←-1% .125W TF TC=0→-100	19701	5033R-1/B-T0-6191-F
A13R6	0757-0442	9	1	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R7	0757-0417	8	1	RESISTOR 562 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-562R-F
A13R8	0698-3154	0	1	RESISTOR 4.22K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-4221-F
A13R9	0757-0442	9	1	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R10	0757-0317	7	1	RESISTOR 1.33K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1331-F
A13R11	0757-0401	0	1	RESISTOR 100 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-101-F
A13R12	0698-3437	2	3	RESISTOR 133 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-133R-F
A13R13	1810-0286	4	1	NETWORK-RES 16-DIP 10.0K OHM X 15	11236	761-1-R10K
A13R14	0757-0442	9	1	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R15	0757-0442	9	1	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R16	0757-0442	9	1	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R17	0757-0442	9	1	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R18	0757-0442	9	1	RESISTOR 10K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1002-F
A13R19	0698-3437	2	1	RESISTOR 133 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-133R-F
A13R20	0698-3437	2	1	RESISTOR 133 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-133R-F
A13R21	0698-3444	1	4	RESISTOR 316 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-316R-F
A13R22	0698-3444	1	1	RESISTOR 316 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-316R-F
A13R23	0757-0419	0	1	RESISTOR 681 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-681R-F
A13R24	0698-3444	1	1	RESISTOR 316 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-316R-F
A13R25	0698-3444	1	1	RESISTOR 316 ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-316R-F
A13R26	0757-1094	9	1	RESISTOR 1.47K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1471-F
A13R27	0698-3162	0	3	RESISTOR 46.4K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-4642-F
A13R28	0698-3162	0	3	RESISTOR 46.4K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-4642-F
A13R29	0757-0280	3	2	RESISTOR 1K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1001-F
A13R30	0698-3162	0	3	RESISTOR 46.4K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-4642-F
A13R31	0757-0280	3	1	RESISTOR 1K ←-1% .125W TF TC=0→-100	12498	CT4-1/B-T0-1001-F
A13S1	3101-2243	6	1	SWITCH-DIP PKR 8-1A 0.05A 30VDC	81073	76Y22318S
A13U1	1826-0065	0	1	IC COMPARATOR PRON 8-DIP-P PKG	27014	LM311N
A13U2	1826-0791	9	1	SAMPLE AND HOLD 8-DIP-P	27014	LF398N
A13U3	1820-3372	6	1	IC GATE TTL ALS NAND 13-INP	01295	SN74ALS133N
A13U4	1820-1568	8	2	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A13U5	1820-2861	6	2	IC DDDR TTL F 3-TO-8-LINE	18324	74F138N

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A13U6	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A13U7	1820-2056	1	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS378N
A13U8	1820-4165	7	1	IC DCDR TTL ALS 2-TO-4-LINE DUAL	01295	SN74ALS139N
A13U9	1820-1568	8		IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A13U10	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN74ALS00AN
A13U11	1820-3707	1	6	IC DRVR TTL ALS LINE OCTL	01295	SN74ALSS41N
A13U12	1820-1338	2	1	IC MSC 8-DIP-P PKG	01295	TL7705A
A13U13	1820-3707	1		IC DRVR TTL ALS LINE OCTL	01295	SN74ALSS41N
A13U14	1820-2099	2	1	IC-MPU; CLK FREQ=1 MHZ, WITH CLOCK AND	04713	MC6802P
A13U15	1820-3145	1	1	IC DRVR TTL ALS BUS OCTL	01295	SN74ALS244AN
A13U16	1820-2056	1		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS378N
A13U17	1820-2861	6		IC DCDR TTL F 3-TO-8-LINE	18324	74F138N
A13U18	1820-3707	1		IC DRVR TTL ALS LINE OCTL	01295	SN74ALSS41N
A13U19	1820-2219	8	1	IC-GENERAL PURPOSE INTERFACE ADAPTOR	04713	MC68488P
A13U20	1820-3121	3	2	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN74ALS245AN
A13U21	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A13U22	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A13U23	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2-INP	01295	SN74ALS08N
A13U24	1818-3185	4		IC CMOS 65536 (64K) STAT RAM 130NS 3-S	06916	HME264LP-12
A13U26				IF U26 FAILS, CONTACT HEWLETT-PACKARD SERVICE CENTER		
A13U27	06657-80008	1	1	ROM	28480	06657-80008
A13U28	1820-3707	1		IC DRVR TTL ALS LINE OCTL	01295	SN74ALSS41N
A13U29	1820-3121	3		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN74ALS245AN
A13U30	1820-3707	1		IC DRVR TTL ALS LINE OCTL	01295	SN74ALSS41N
A13U31	1820-3707	1		IC DRVR TTL ALS LINE OCTL	01295	SN74ALSS41N
A13U32	1820-1689	4	4	IC-INTERFACE XCVR INSTRUMENT BUS IEEE	01295	MC3446N
A13U33	1820-1689	4		IC-INTERFACE XCVR INSTRUMENT BUS IEEE	01295	MC3446N
A13U34	1820-1689	4		IC-INTERFACE XCVR INSTRUMENT BUS IEEE	01295	MC3446N
A13U35	1820-1689	4		IC-INTERFACE XCVR INSTRUMENT BUS IEEE	01295	MC3446N
A13VR1	1902-0946	8	1	DIODE-ZNR 3.3V 5% DO-35 PD=4W TC=-.039%	28480	1902-0946
A13VR2	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=4W TC=-.037%	28480	1902-0943
A13VR3	1902-0943	5		DIODE-ZNR 2.4V 5% DO-35 PD=4W TC=-.037%	28480	1902-0943
A13VR4	1902-0959	3	2	DIODE-ZNR 11V 5% DO-35 PD=4W TC=-.076%	28480	1902-0959
A13VR5	1902-0959	3		DIODE-ZNR 11V 5% DO-35 PD=4W TC=-.076%	28480	1902-0959
A13VR6	1902-0970	8	1	DIODE-ZNR 33V 5% DO-35 PD=4W TC=-.097%	28480	1902-0970
A13W1	1258-0233	9	1	JUMPER 8 POSITION PACKAGE; FOUR OPEN	08014	69145-208-M
A13Y1	0410-1180	0	1	CRYSTAL-QUARTZ 4.000 MHZ HC-18/U-HLDR	28480	0410-1180

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
<b>A14</b>						
A14	08657-60112	6	1	POWER SUPPLY (STD)	28480	08657-60112
A14	08657-60123	9	1	POWER SUPPLY (OPT 002)	28480	08657-60123
A14	08657-60124	0	1	POWER SUPPLY (OPT 002/003)	28480	08657-60124
A14C1	0180-3589	8	1	CAP-FXD 470UF 100 V AL-ELCTLT	00494	KM100VB470M
A14C2	0180-3797	0	2	CAP-FXD 8200UF 50 V AL-ELCTLT	28480	0180-3797
A14C3	0180-3797	0		CAP-FXD 8200UF 50 V AL-ELCTLT	28480	0180-3797
A14C4	0180-3458	0	1	CAP-FXD 4700UF 50 V AL-ELCTLT	08810	50TWP4700
A14C5	0180-3793	6	2	CAP-FXD 25 V AL-ELCTLT	28480	0180-3793
A14C6	0180-3793	6		CAP-FXD 25 V AL-ELCTLT	28480	0180-3793
A14C7	0180-0291	3	8	CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14C8	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14C9	0160-4574	1	1	CAP-FXD 1000PF 100 V	09969	RPA10X7R102K100V
A14C10	0180-3466	0	9	CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C11	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14C12	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14C13	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C14	0160-4835	7	5	CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A14C15	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C16	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A14C17	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A14C18	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A14C19	0160-4835	7		CAP-FXD 0.1UF 50 V	09969	RPA20X7R104K50VPT
A14C20	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C21	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C22	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C23	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C24	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14C25	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14C27	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14C28	0180-3466	9	1	CAP-FXD 4.7UF 100 V AL-ELCTLT	10392	CEUSM2A4R7
A14C29	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C30	0180-3466	0		CAP-FXD 10UF 63 V AL-ELCTLT	10392	CEUSM1J100
A14C31	0180-0291	3		CAP-FXD 1UF 35 V TA	56289	150D105X9035A2
A14CR1	1906-0096	7	1	DIODE-FW BRDG 200V 2A	28480	1906-0096
A14CR2	1906-0261	8	2	DIODE-CT-RECT 150V 16A	28480	1906-0261
A14CR3	1901-0662	3	7	DIODE-PWR RECT 100V 6A	04713	MR751
A14CR4	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A14CR5	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A14CR6	1906-0261	8		DIODE-CT-RECT 150V 16A	28480	1906-0261
A14CR7	1901-0731	7	4	DIODE-PWR RECT 400V 1A	28480	1901-0731
A14CR8	1901-0731	7		DIODE-PWR RECT 400V 1A	28480	1901-0731
A14CR9	1901-0731	7		DIODE-PWR RECT 400V 1A	28480	1901-0731
A14CR10	1901-0050	3	6	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A14CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A14CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A14CR13	1901-0731	7		DIODE-PWR RECT 400V 1A	28480	1901-0731
A14CR14	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A14CR15	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A14CR16	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A14CR17	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A14CR18	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A14CR19	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A14CR20	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A14F1	2110-0003	0	1	FUSE (INCH) 3A 250V NTD FE UL	75915	312 003
A14F2	2110-0010	9	1	FUSE (INCH) 5A 250V NTD FE UL	75915	312 006
A14J1	1252-2641	5	1	CONN-POST TYPE .156-PIN-SPCG 2-CONT	28480	1252-2641
A14J2	1252-2640	4	1	CONN-POST TYPE .156-PIN-SPCG 4-CONT	28480	1252-2640
A14J3	1252-2637	9	1	CONN-POST TYPE .156-PIN-SPCG 8-CONT	28480	1252-2637
A14J4	1252-2479	7	1	CONN-RECT D-SUBMIN 15-OKT 15-CONT	28480	1252-2479
A14J5	1250-1884	2	2	CONNECTOR-RF BNC FEM PC-W-STDFS 50-OHM Options 002/003 only	00779	227161-6
A14J6	1250-1884	2		CONNECTOR-RF BNC FEM PC-W-STDFS 50-OHM Options 002, 002/003 only	00779	227161-6
A14J8	1251-4700	9	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4700
A14J9	1251-5041	3	1	CONN-POST TYPE .100-PIN-SPCG 5-CONT	28480	1251-5041
A14K1	0490-1407	2	1	RELAY 4C 24VDC-COIL 7.5A 115VAC	77342	R10-R2-W4-V700
A14L1	9135-0095	9	1	INDUCTOR 143NH $\pm$ 5.245% 2.60-MMX6.6LG-MM	24226	10M140X-1
A14Q1	1855-0618	0	1	TRANSISTOR MOSFET N-CHAN E-MODE TO-3 SI	04713	IRF140
A14Q2	1855-0461	1	1	TRANSISTOR MOSFET N-CHAN TO-220	9M011	IRF520
A14Q3	1864-0281	4	1	THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A14Q4	1854-0474	4	1	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A14R1	0698-3159	5	1	RESISTOR 26.1K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-2612-F
A14R2	0698-3407	6	2	RESISTOR 1.96K $\pm$ 1% .5W TF TC=0-100	K8479	H2
A14R5	0698-3407	6		RESISTOR 1.96K $\pm$ 1% .5W TF TC=0-100	K8479	H2
A14R6	0757-0816	1	1	RESISTOR 681 $\pm$ 1% .5W TF TC=0-100	K8479	H2
A14R7	0698-3136	8	1	RESISTOR 17.8K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-1782-F
A14R8	0698-3162	0	2	RESISTOR 46.4K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-4642-F
A14R9	0698-3447	4	3	RESISTOR 422 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-422R-F
A14R10	2100-0552	3	3	RESISTOR-TRMR 50 10% TKF SIDE-ADJ 1-TRN	28480	2100-0552
A14R11	0698-3935	5	3	RESISTOR 4.946K $\pm$ 0.1% .125W TF TC=0-25	12498	NESS
A14R12	0698-3447	4		RESISTOR 422 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-422R-F
A14R13	2100-0552	3		RESISTOR-TRMR 50 10% TKF SIDE-ADJ 1-TRN	28480	2100-0552
A14R14	0757-0317	7	1	RESISTOR 1.33K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-1331-F
A14R15	0698-3447	4		RESISTOR 422 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-422R-F
A14R16	2100-0552	3		RESISTOR-TRMR 50 10% TKF SIDE-ADJ 1-TRN	28480	2100-0552
A14R17	0698-3935	5		RESISTOR 4.946K $\pm$ 0.1% .125W TF TC=0-25	12498	NESS
A14R18	0757-0442	9	4	RESISTOR 10K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-1002-F
A14R19	0757-0420	3	1	RESISTOR 750 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-751-F
A14R20	0757-0280	3	3	RESISTOR 1K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-1001-F
A14R21	0757-0317	7		RESISTOR 1.33K $\pm$ 1% .125W TF TC=0-100	05524	CMF-55-1
A14R22	0757-0280	3		RESISTOR 1K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-1001-F
A14R23	0757-0416	7	2	RESISTOR 511 $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-511R-F
A14R24	0698-0084	9	2	RESISTOR 2.15K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-2151-F
A14R25	2100-3273	1	2	RESISTOR-TRMR 2K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3273
A14R26	0698-1074	1	1	RESISTOR .05 $\pm$ 3% 3W MFS TC=0-337	01686	LO-3-0.05-3-8P
A14R27	0757-0440	7	2	RESISTOR 7.5K $\pm$ 1% .125W TF TC=0-100	12498	CT4-1/B-T0-7501-F

<sup>†</sup>Refer to Section 7 for update information.

<sup>\*</sup>Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A14R28	0698-3460	1	1	RESISTOR 422K ±1% .125W TF TC=0±100	12498	CT4
A14R29	0698-3445	2	1	RESISTOR 348 ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-348R-F
A14R30	0698-3835	5		RESISTOR 4.948K ±0.1% .125W TF TC=0±25	12498	NE55
A14R31	0698-3180	8	1	RESISTOR 31.8K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-3162-F
A14R32	0698-8822	9	1	RESISTOR 8.81 ±1% .125W TF TC=0±100	12498	L040
A14R33	0698-3182	0		RESISTOR 46.4K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-4642-F
A14R34	0698-0082	7	1	RESISTOR 464 ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-4640-F
A14R35	2100-3273	1		RESISTOR-TRMR 2K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3273
A14R36	0698-3439	4	1	RESISTOR 178 ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-178R-F
A14R37	0757-0440	7		RESISTOR 7.5K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-7501-F
A14R38	0698-0084	9		RESISTOR 2.15K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-2151-F
A14R39	0757-0416	7		RESISTOR 511 ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-511R-F
A14R40	0757-0442	9		RESISTOR 10K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-1002-F
A14R41	0757-0442	9		RESISTOR 10K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-1002-F
A14R42	0757-0442	9		RESISTOR 10K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-1002-F
A14R43	0757-0280	3		RESISTOR 1K ±1% .125W TF TC=0±100	12498	CT4-1/8-T0-1001-F
A14U1	1826-0631	6	1	IC V RGLTR-ADJ-POS 1.2/33V TO-3 PKG	27014	LM350K
A14U2	1826-0527	9	1	IC V RGLTR-ADJ-NEG 1.2/37V TO-220 PKG	27014	LM337T
A14U3	1826-0523	5	1	IC V RGLTR-ADJ-NEG 1.2/37V TO-3 PKG	27014	LM337K
A14U4	1826-0785	1	2	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	04713	MC34002BU
A14U5	1826-0785	1		IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	04713	MC34002BU
A14VR1	1902-0777	3	2	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	1N825
A14VR2	1902-0777	3		DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	1N825
A14MP1	2190-0584	0	15	WASHER-LK HLCL 3.0 MM 3.1-MM-ID	28480	2190-0584
A14MP2	2110-0269	0	4	FUHLR-CLP-TYP	91506	6008-32CN
A14MP3	08657-00021	0	1	HEATSINK	28480	08657-00021
A14MP4	0340-0620	2	4	INSULATOR-XSTR THRM-CNDCT	55285	7403-09FR-54
A14MP5	0340-0875	9	3	INSULATOR-XSTR THRM-CNDCT	55285	7403-09FR-05
A14MP6	0535-0025	4	15	NUT-HEX DBL-CHAM M3 X 0.5 2.4MM-THK	00000	ORDER BY DESCRIPTION
<b>A15</b>						
A15	0960-0411	2	1	LINE MODULE-FILTERED	28480	0960-0679
<b>A16</b>						
A16	0950-0411	2	1	10MHz REFERENCE OSCILLATOR ASSEMBLY	28480	0950-0411
A16W1	08656-60166	9	1	CABLE ASSEMBLY COAXIAL	28480	08656-60166

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
B1	08657-61049	0	1	FAN ASSY	28480	08657-61049
<i>3010U AND ABOVE</i>						
B1	08657-61107	1	1	FAN ASSY	28480	08657-61107
C10	0160-4082	6	1	CAP-FXD 1000PF 0 V	33095	54-779-003-X5F-102M
F1	2110-0303	3	1	FUSE (INCH) 2A 250V TD FE UL For 100/120V Operation	11870	60.020
F1	2110-0304	4	1	FUSE (INCH) 1.5A 250V TD FE UL For 220/240V Operation	75915	31301.5
FL1	08656-60005	5	1	PCA BP ASSY	28480	08656-60005
J2	1250-1811	5	1	ADAPTER-COAX STR F-N F-SMA	16179	3080-3201-02
J2	5061-5386	0	1	CONN TP N (UTIL)	28480	5061-5386
<i>2935U AND ABOVE</i>						
L1	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +/-10% .105D-INX.2	05524	1M-2
MP1	08657-21012	3	1	CASTING, MACH	28480	08657-21012
MP2	5041-8802	9	1	TOP TRIM FR FR	28480	5041-8802
MP3	5001-0539	9	2	SIDE TRIM	28480	5001-0539
MP4	08657-00032	3	1	COVER, TOP	28480	08657-00032
MP6	08656-00034	4	1	HINGE TOP	28480	08656-00034
MP7	1460-1761	9	2	SPRING-CPRSN .36-IN-OD 1.5-IN-OA-LG MUW	84830	LC-042E-14-MW
MP8	2740-0003	5	10	NUT-HEX-W/LKWR 10-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
MP9	3050-0002	2	10	WASHER-FL MTLCL NO. 10 .203-IN-ID	28480	3050-0002
MP11	2360-0113	2	4	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP12	08657-61014	9	1	CVR TOP RF	28480	08657-61014
MP13	08657-00034	5	1	BNC-BRKT F/P	28480	08657-00034
MP14	5062-3703	3	2	STRAP HANDLE	28480	5062-3703
MP15	5041-8834	7	4	STRP HOLE & CAP	28480	5041-8834
MP17	0515-1239	2	6	SCREW-MACH M5 X 0.8 12MM-LG	00000	ORDER BY DESCRIPTION
MP18	8160-0351	2	4	RFI GASKET MNL/NPRN 3.2-MM-OD 44-MM-LG	28480	8160-0351
MP19	08656-20112	1	2	RTNR RF GASKET	28480	08656-20112
MP20	08656-00100	5	2	RETAINER HINGE	28480	08656-00100
MP21	8160-0350	1	1	RFI GASKET MNL/NPRN 3.2-MM-OD 25-MM-LG	09686	03-0101-8826
MP22	08657-61045	6	1	BTM RFI COVER	28480	08657-61045
MP24	08657-00033	4	1	COVER, BTM	28480	08657-00033
MP25	08657-21016	7	2	FRONT FOOT	28480	08657-21016
MP26	1460-1345	5	2	TILT STAND SST	28480	1460-1345
MP27	5041-8801	8	2	FOOT	28480	5041-8801
MP31	08656-00079	7	4	CVR INTRNL RF #1	28480	08656-00079
MP32	08656-00080	0	2	CVR INTRNL RF #2	28480	08656-00080
MP33	08657-00027	6	2	CVR INT RF #3	28480	08657-00027
MP34	08656-00082	2	2	CVR INTRNL RF #4	28480	08656-00082
MP35	08656-00083	3	2	CVR INTRNL RF #5	28480	08656-00083
MP36	08657-00013	0	2	CVR INTRNL RF #6	28480	08657-00013
MP37	08656-00086	6	4	CVR INTRNL RF #8	28480	08656-00086
MP38	08656-00087	7	2	CVR INTRNL RF #9	28480	08656-00087
MP41	0520-0131	2	1	SCREW-MACH 2-56 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP42	0515-1091	4	3	SCREW-MACHINE ASSEMBLY M3.5 X 0.6	00000	ORDER BY DESCRIPTION
<i>2935U AND ABOVE</i>						
MP42	3050-0003	3		WASHER-FL NM NO.6 .144-IN-ID .375-IN-OD		1471
MP44	3050-0890	6	1	WASHER-FL MTLCL 2.5 MM 2.78-MM-ID	28480	3050-0890
MP46	08657-00006	1	1	RFI CLIP-OUTPUT	28480	08657-00006

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
MP47	08657-00005	0	1	RFI CLIP-OUTPUT	28480	08657-00005
MP48	08656-00037	7	2	WALL CLIP SEMI-R	28480	08656-00037
MP49	08656-00039	9	1	CLIP F0THRU MLPR	28480	08656-00039
MP50	2360-0121	2	13	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP51	8150-4815	0	3	WIRE 22AWG 1X22 105C	01634	J0.200X0.125B22
MP52	08657-00020	9	1	XFMR BRACKET	28480	08657-00020
MP54	08657-61025	2	1	REAR PNL	28480	08657-61025
MP55	2200-0155	4	8	SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP57	0535-0007	2	2	NUT-HEX DBL-CHAM M3.5 X 0.6 3.3MM-THK	00000	ORDER BY DESCRIPTION
MP58	08657-00022	1	1	AUDIO BOARD SERVICE MOUNT	28480	08657-00022
MP60	6960-0024	0	1	PLUG-HOLE TR-HD FOR .688-D-HOLE NYL	28520	2673 (BLACK)
MP61	0380-2061	2		STANDOFF-HEX .327-IN-LG .281-IN- A/F STL		
MP62	0624-0206	2	1	SCREW-TPG 6-32 .25-IN-LG PAN-HD-POZI STL	00000	ORDER BY DESCRIPTION
MP63	1400-0054	5	1	CLAMP-CABLE .078-DIA .375-WD STL	79963	139
MP64	08657-00031	2	1	HP-IB SHIELD	28480	08657-00031
MP66	08657-40001	0	1	KEY PAD #1	28480	08657-40001
MP67	08657-40002	1	1	KEY PAD #2	28480	08657-40002
MP68	08657-21014	5	14	FRNT PNL STDOFF	28480	08657-21014
MP69	08657-00018	5	1	FRONT SUPPORT PN	28480	08657-00018
MP70	2950-0132	6	1	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP71	2190-0104	0	1	WASHER-LX INTL T 7/16 IN .439-IN-ID	78189	1922-04
MP73	0535-0004	9	2	NUT-HEX DBL-CHAM M3 X 0.5 2.9MM-THK	00000	ORDER BY DESCRIPTION
MP74	0515-2052	9	8	SCREW-THD-RLG M5 X 0.8 12MM-LG PAN-HD	00000	ORDER BY DESCRIPTION
<i>2935U AND ABOVE</i>						
MP74A	0535-0006	2		NUT-HEX DBL-CHAM M5X0.8 4MM THK 8MM-A1		M5
MP74B	2190-0586	6		WASHER-LX HLCL 4.0 4.1-MM-ID 7.6-MM-OD		M5
MP75	8151-0013	4	1	WIRE 22AWG 1X22	28480	8151-0013
MP76	1400-0249	0	14	CABLE TIE .062-.625-DIA .091-WD NYL	16956	08-465/GRAY
MP77	0535-0109	5	4	NUT-HEX DBL-CHAM M5 X 0.8 4MM-THK 8MM-A1		M5
MP78	0380-0920	9	5	STANDOFF-HEX .875-IN-LG 6-32-THD	28480	0380-0920
MP79	0380-1617	3	5	STANDOFF-HEX .5-IN-LG 6-32-THD	00000	ORDER BY DESCRIPTION
MP80	2190-0918	3	15	WASHER-LX HLCL NO. 6 .141-IN-ID		
MP92	3050-0172	7	14	WASHER-FL NIM NO. 10 .203-IN-ID	28480	3050-0172
MP100	08657-61032	1	1	FRNT PNL	28480	08657-61032
MP101	0510-0741	9	2	BRACKET-RTANG .344-LG X .407-LG .312-WD	73734	36-510 MOD
MP102	2420-0003	7	1	NUT-HEX-DBL-CHAM 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP103	2190-0918	4	1	WASHER-LX HLCL NO. 6 .141-IN-ID	28480	2190-0918
MP107	2360-0184	7	4	SCREW-MACH 6-32 .438-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP109	08656-00147	0	1	BRKT OUTPUT CONN	28480	08656-00147
MP110	0515-0824	0	4	SCREW-MACH M3 X 0.5 8MM-LG PAN-HD	00000	ORDER BY DESCRIPTION
MP111	2200-0111	2	8	SCREW-MACH 4-40 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP112	1400-0510	8	9	CLAMP-CABLE .15-DIA .62-WD NYL	02788	8511-28-00-9909
MP127	0515-0896	5	11	SCREW-MACH M4 X 0.7 10MM-LG	00000	ORDER BY DESCRIPTION
MP131	2200-0103	2	4	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP133	0515-1126	6	4	SCREW-MACH M3 X 0.5 18MM-LG	00000	ORDER BY DESCRIPTION
MP134	2360-0201	9	3	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP135	2190-0068	5	2	WASHER-LX INTL T 1/2 IN .505-IN-ID	78189	1924-02
MP136	2190-0034	5	2	WASHER-LX HLCL NO. 10 .194-IN-ID	28480	2190-0034
MP137	08657-40003	2	1	FAN SHIELD	28480	08657-40003
MP140	3160-0309	5	1	FINGER GUARD	06680	9480-2-4038-1
MP141	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP141	2200-0165	6	2	SCREW-MACH 4-40 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP142	2950-0054	1	2	NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	00000	ORDER BY DESCRIPTION

\*Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
MP143	0515-1079	8	18	SCREW—MACHINE ASSEMBLY M3 X 0.5 8MM—LG	00000	ORDER BY DESCRIPTION
MP144	6960-0041	1	5	PLUG HOLE .500	28520	2643 (BLACK)
MP145	08657-00026	5	1	CLIP RFI	28480	08657-00026
MP146	2510-0045	8	57	SCREW—MACH 8—32 .375—IN—LG PAN—HD—POZI	00000	ORDER BY DESCRIPTION
MP147	3050-0176	1	3	WASHER—FL MTLN NO. 8 .188—IN—ID	78553	AA-0107-2SS
MP149	0515-1241	6	3	SCREW—MACH M5 X 0.8 12MM—LG PAN—HD	00000	ORDER BY DESCRIPTION
MP151	2360-0115	4	21	SCREW—MACH 8—32 .312—IN—LG PAN—HD—POZI	00000	ORDER BY DESCRIPTION
MP152	08657-00030	1	1	ATTN—BRACKET	28480	08657-00030
<i>3001U AND ABOVE</i>						
MP153	0515-0168	4		SCR-MACHINE	28480	0515-0168
MP154	1400-0054	5		CLAMP CABLE .78-DIA	28480	1400-0054
MP155	0340-0620	2		INSULATOR-XSTR THRM-CONDUCT	28480	0340-0620
R1	0757-0346	2	1	RESISTOR 10 $\pm$ 1% .125W TF TC=0—100	D8439	MK2
R2	0837-0366	6	1	THERMISTOR—SURGE PTCTR 5 OHM AT 25 DEG C	6E259	SG200
<i>2949U AND ABOVE</i>						
R2	0699-1902	4		R10 1% .05W	28480	0699-1902
T1	028267	8	1	TRANSFORMER	28480	028267
U2	5061-4831	8	1	RESTORED HET ASSY	28480	5061-4831
U5	08645-67004	5	1	RPP MODULE	28480	08645-67004
U8	08657-69004	3	1	RESTORED PULSE MODULATOR	28480	08657-69004
W1	08657-61012	7	1	A2J1—W2P1	28480	08657-61012
W2	08657-60119	3	3	W1P1—A13J12	28480	08657-60119
W3	08657-61039	8	3	A3A1J1—W11P2	28480	08657-61039
W4	08656-60169	2	1	A3J1—W11P2	28480	08656-60169
W5	08656-60019	1	1	A3J8—A8J3	28480	08656-60019
W6	08657-61053	6	1	A6J402—A4J1	28480	08657-61053
W7	08656-60171	6	1	W15P2—A6J401	28480	08656-60171
W8	08656-20022	2	2	FL1—A4	28480	08656-20022
W9	08656-20019	7	1	A8—A4	28480	08656-20019
W10	08656-20023	3	1	A8—A6J301	28480	08656-20023
W11	08657-60119	3		A13J7—W4P2	28480	08657-60119
W12	08657-21019	0	1	A6J303—U2	28480	08657-21019
W13	08657-21021	4	1	U2—A6J302	28480	08657-21021
W14	08657-21020	3	1	A6J203—U2J3	28480	08657-21020
W15	08657-60119	3		A13J10—W7P2	28480	08657-60119
W16	08657-61029	6	1	A13J13—A11J1	28480	08657-61029
W17	08657-61024	1	1	U5—J2(RF OUT)	28480	08657-61024
W18	08656-60173	8	1	A13J8—J7(MP10)	28480	08656-60173
W19	08657-61030	9	1	A13J9—A10J1	28480	08657-61030
W20	08657-61056	9	1	A13J1—A12J1	28480	08657-61056
W21	08657-61043	4	1	A13J5—A14J4	28480	08657-61043
W22	08656-60183	0	1	J3—A3J6	28480	08656-60183
<i>3001U AND ABOVE</i>						
W22	08657-61092	3		J3-A3J6	28480	08657-61092
W23	08657-61093	4		A10J4—U8J11	28480	08657-61093
W23	08657-21010	1	1	A10J4—U8J11	28480	08657-21010
W24	08656-60184	1	1	A3J7—TB O/P	28480	08656-60184
W25	08657-61039	8		A7—A8J4	28480	08657-61039
W26	08657-61027	4	1	U5—A9AT2J2	28480	08657-61027
W27	08657-61023	0	1	A12J5—A9AT1J1	28480	08657-61023
W28	08657-61028	5	1	U8J10—A12J6	28480	08657-61028
W29	08657-61057	0	1	U5—W30P1	28480	08657-61057
W30	08657-61058	1	1	W29P1—RF OUT	28480	08657-61058
W31	08657-61040	1	1	A11J2—A12J3	28480	08657-61040
W32	08657-61031	0	1	PULSE INPUT—A10J3	28480	08657-61031
W33	08657-61022	9	1	A9AT1J2—A9AT2J1	28480	08657-61022
W34	08657-21017	8	1	U2J6—U8J9	28480	08657-21017
W35	08657-61062	7	1	U2—A12J6	28480	08657-61062

†Refer to Section 7 for update information.

\*Factory Selected Component (Refer to Section 5).



*Table 6-3. Replaceable Parts*

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
W36	08657-61064	9	1	J1-A2J4	29480	08657-61064
W37	08657-61048	9	1	TIMEBASE OUT-A16	29480	08657-61048
W38	8120-2682	2	1	CABLE ASSY-COAX 50-OHM 8.5-IN-LG 30PF/FT	29480	8120-2682
W39	08657-61065	0	1	PULSE INPUT-A10J3	29480	08657-61065

†Refer to Section 7 for update information.

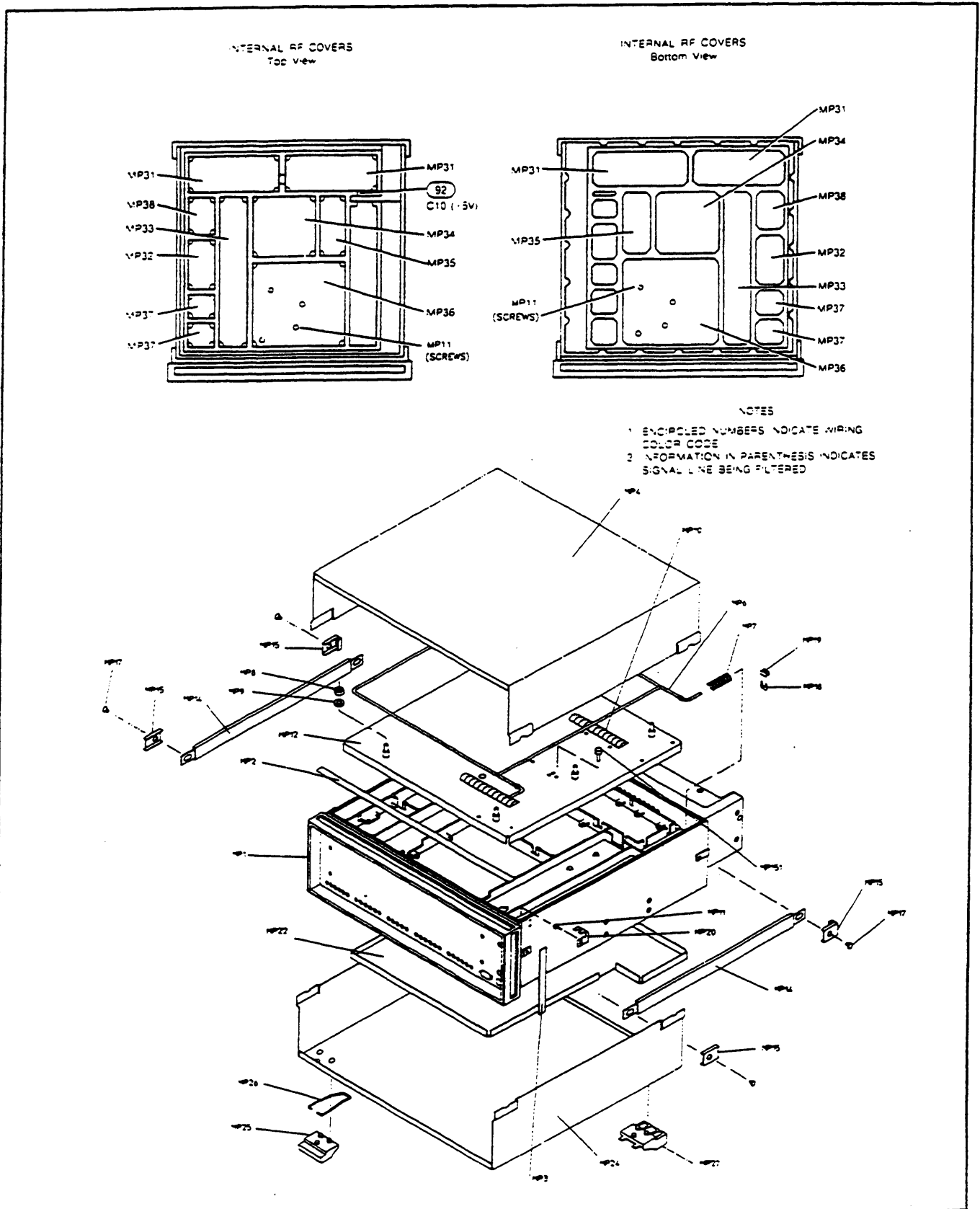
\*Factory Selected Component (Refer to Section 5).

Table 6-4. Code List of Manufacturers

Mfr. Code	Manufacturer Name	Location	Zip Code
C1433	AB ELEKTRONIK GMBH	SALZBURG, AU	A-501
D8439	ROEDERSTEIN/RESISTA GMBH	LANDSHUT, GM	8300
K8479	HOLSWORTHY ELECTRONICS LTD	HOLSWORTHY, EG	
S4013	HITACHI AMERICA LTD	SUNNYVALE, CA	94086
00000	ANY SATISFACTORY SUPPLIER		
00494	ADDRESSOGRAPH FARRINGTON	TREVOSE, PA	44117
00779	AMP INC	HARRISBURG, PA	17111
01295	TEXAS INSTRUMENTS INC	DALLAS, TX	75265
01634	ALUMINUM CO OF AMERICA	PITTSBURGH, PA	15219
01686	RCL ELECTRONICS INC	NORTHBROOK, IL	60062
02114	FERROXCUBE CORP	SAUGERTIES, NY	12477
02768	ITW FASTEX	DES PLAINES, IL	60016
04222	AVX CORP	GREAT NECK, NY	11021
04713	MOTOROLA INC	ROSELLE, IL	60195
06132	COMPUTER TERMINAL CORP	SAN ANTONIO, TX	78784
06383	PANDUIT CORP	TINLEY PARK, IL	60477
06660	JOHNSON A L CO	MONROVIA, CA	91016
06665	PRECISION MONOLITHICS INC	SANTA CLARA, CA	95054
06773	TIMBER TOP INC	FREEPORT, NY	11520
07282	FAIRCHILD IND INC IND PROD DIV	WINSTON-SALEM, NC	27105
08014	UNIVERSAL SHELLAC & SUPPLY CO INC	HICKSVILLE, NY	11801
08800	GE CO INSULATING MATERIALS PROD	SCHENECTADY, NY	12306
08810	ANGELL MFG CO	DAYTON, OH	45404
09686	SCHRADERS A & SON DIV SCOVILL MFG	TORONTO, CN	
09969	DALE ELECTRONICS INC	YANKTON, SD	57078
10392	GENERAL STAPLE CO INC	NEW YORK, NY	10010
11236	CTS CORP	ELKHART, IN	46514
11502	IRC INC	BOONE, NC	28607
11783	NY-GLASS PLASTICS	PARAMOUNT, CA	90723
11870	MELABS INC	PALO ALTO, CA	94304
12344	TALLY CORP	KENT, WA	98031
12360	ALBANY PROD CO DIV OF PHEUMO DYN	NORWALK, CT	06850
12403	CANFIELD H O CO OF INDIANA INC THE	SEYMOUR, IN	47274
12498	CRYSTALONICS, DIV TELEDYNE	CAMBRIDGE, MA	02140
12672	RCA CORP RECEIVING TUBE DIV	AVENEL, NJ	07001
15542	MINI-CIRCUITS LAB	BROOKLYN, NY	11235
16179	M/A-COM INC	BURLINGTON, MA	01803
16956	DENNISON MFG CO	FRAMINGHAM, MA	01701
17856	SILICONIX INC	SANTA CLARA, CA	95054
18324	SIGNETICS CORP	SUNNYVALE, CA	94086
18873	DUPONT E I DE NEMOURS & CO	WILMINGTON, DE	19801
19701	MEPCO/CENTRALAB INC	RIVIERA, FL	33404
24226	GOWANDA ELECTRONICS CORP	GOWANDA, NY	14070
24355	ANALOG DEVICES INC	NORWOOD, MA	02062
24539	AVANTEK INC	SANTA CLARA, CA	95054
25403	NV PHILIPS ELCOMA	EINDHOVEN, NE	02876
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA, CA	95052

Table 6-4. Code List of Manufacturers

Mfr. Code	Manufacturer Name	Location	Zip Code
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO, CA	94304
28520	HEYCO MOLDED PRODUCTS	KENTWORTH, NJ	07033
33095	SPECTRUM CONTROL INC	ERIE, PA	16505
34371	HARRIS CORP	MELBOURNE, FL	32901
4G810	NATIONWIDE PAPERS INC	ST LOUIS, MO	63110
46384	PENN ENGINEERING & MFG CORP	DOYLESTOWN, PA	18901
50088	SGS-THOMSON MICROELECTRONICS INC	PHOENIX, AZ	85022
51167	ARIES ELECTRONICS INC	FRENCHTOWN, NJ	08825
52648	PLESSEY SEMICONDUCTORS	SANTA ANA, CA	92705
55285	BERGQUIST CO	MINNEAPOLIS, MN	55420
56289	SPRAGUE ELECTRIC CO	LEXINGTON, MA	02173
6E259	AMETEK INC	PAOLI, PA	19301
73138	BECKMAN INDUSTRIAL CORP	FULLERTON, CA	92635
73734	FEDERAL SCREW PRODUCTS CO	CHICAGO, IL	60618
75915	LITTELFUSE INC	DES PLAINES, IL	60016
76381	3M CO	ST PAUL, MN	55144
77342	POTTER & BRUMFIELD INC	PRINCETON, IN	47671
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN, IL	60126
78553	TINNERMAN PRODUCTS INC	CLEVELAND, OH	44101
79963	ZIERICK MFG CO	MT KISCO, NY	10549
81073	GRAYHILL INC	LA GRANGE, IL	60525
84411	AMERICAN SHIZUKI CORP	CANOGA PARK, CA	91304
84830	LEE SPRING CO	BROOKLYN, NY	11219
9M011	INTL RECTIFIER CORP	LOS ANGELES, CA	90069
9N171	UNITRODE CORP	LEXINGTON, MA	02173
91506	AUGAT INC	MANSFIELD, MA	02048
91637	DALE ELECTRONICS INC	COLUMBUS, NE	68601
98291	ITT SEAELECTRO CORP	TRUMBULL, CT	06611



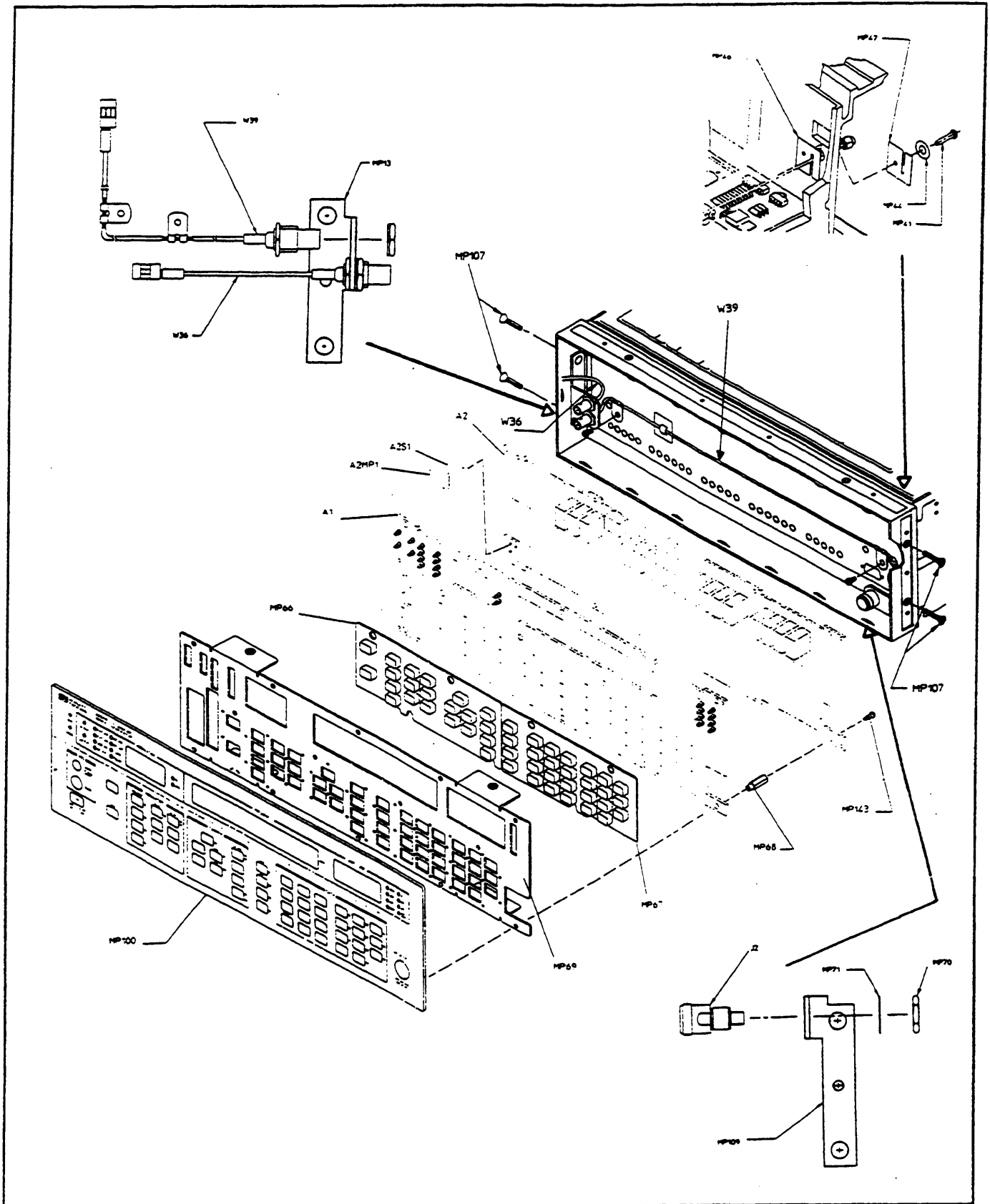


Figure 6-2. Exploded view of the Front Panel

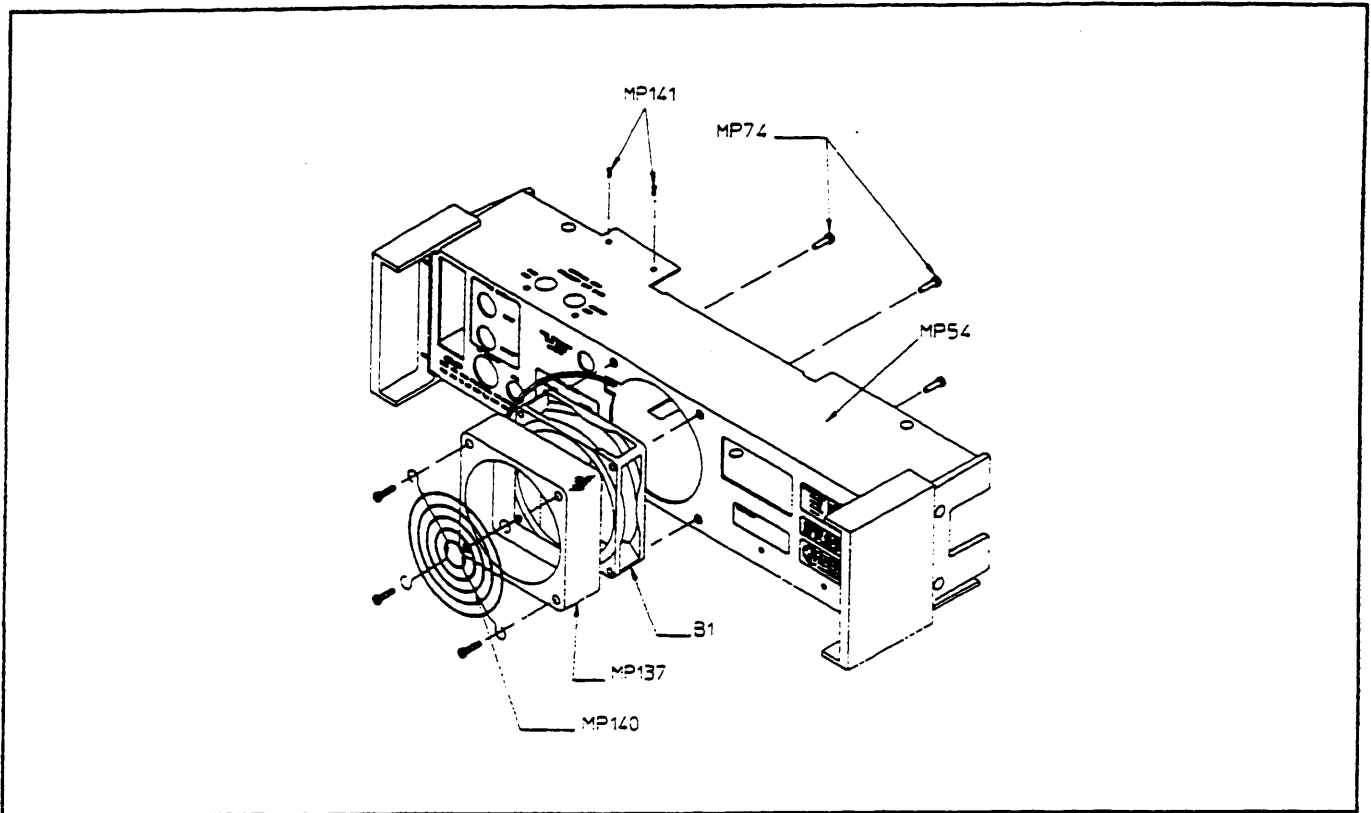


Figure 6-3. Exploded view of the Rear Panel

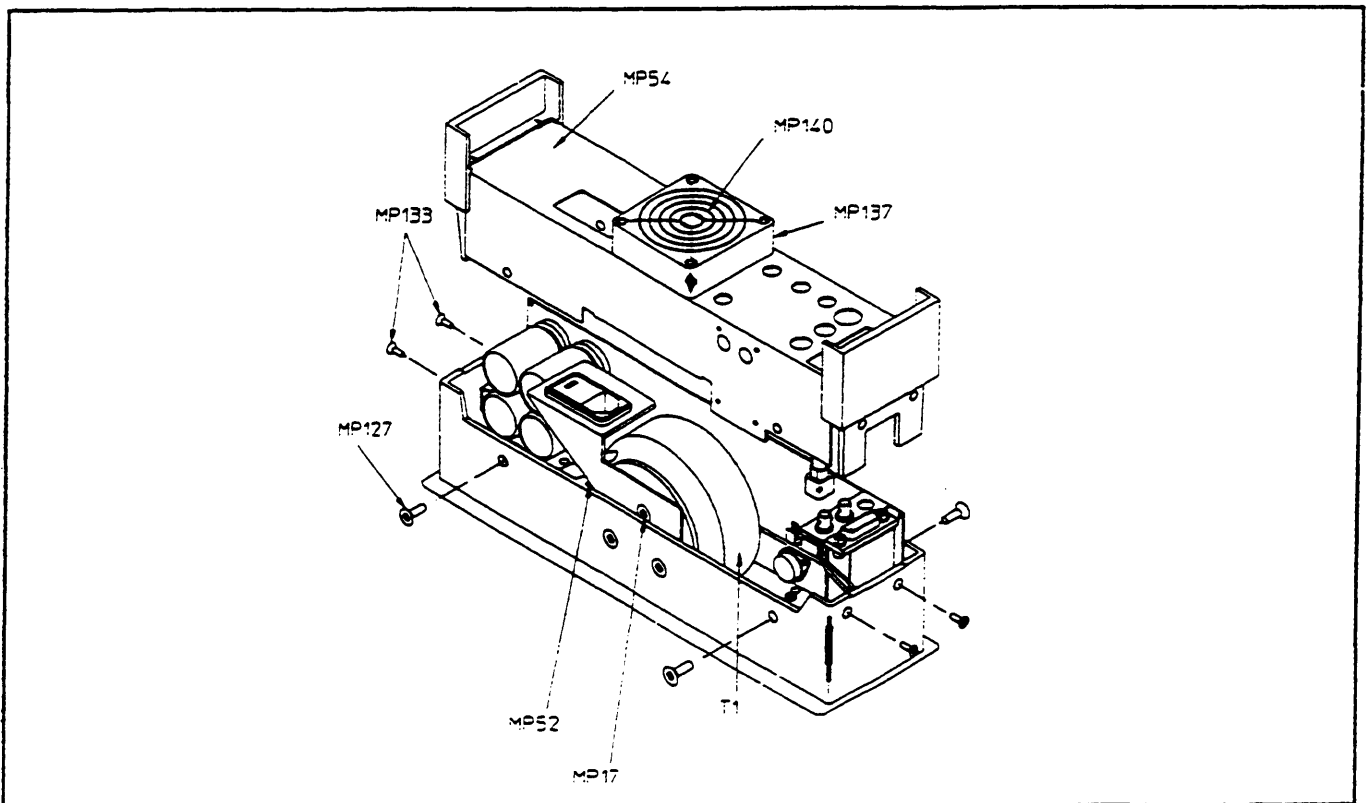


Figure 6-4. Exploded view of the Rear Panel

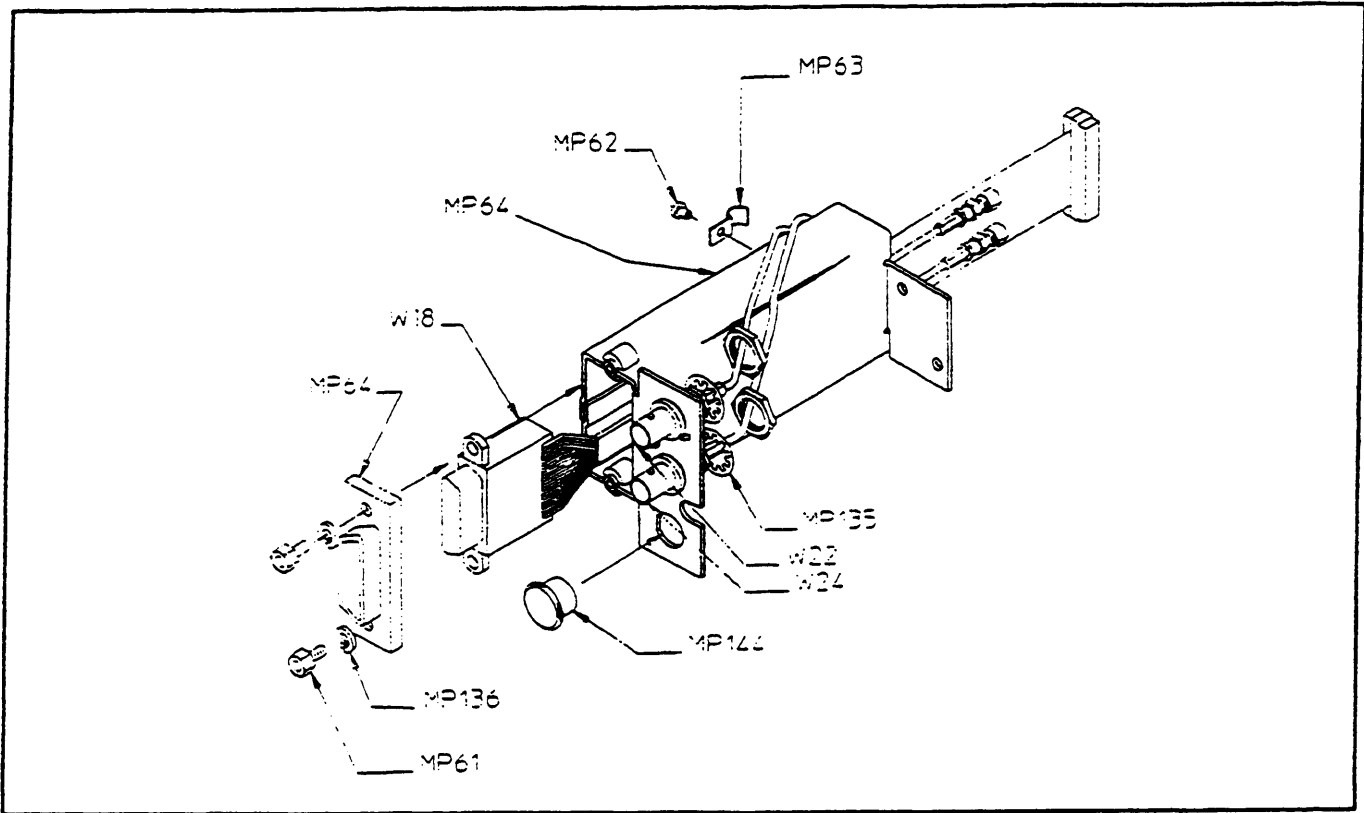


Figure 6-5. HP-IB and Modulation bracket (STD)

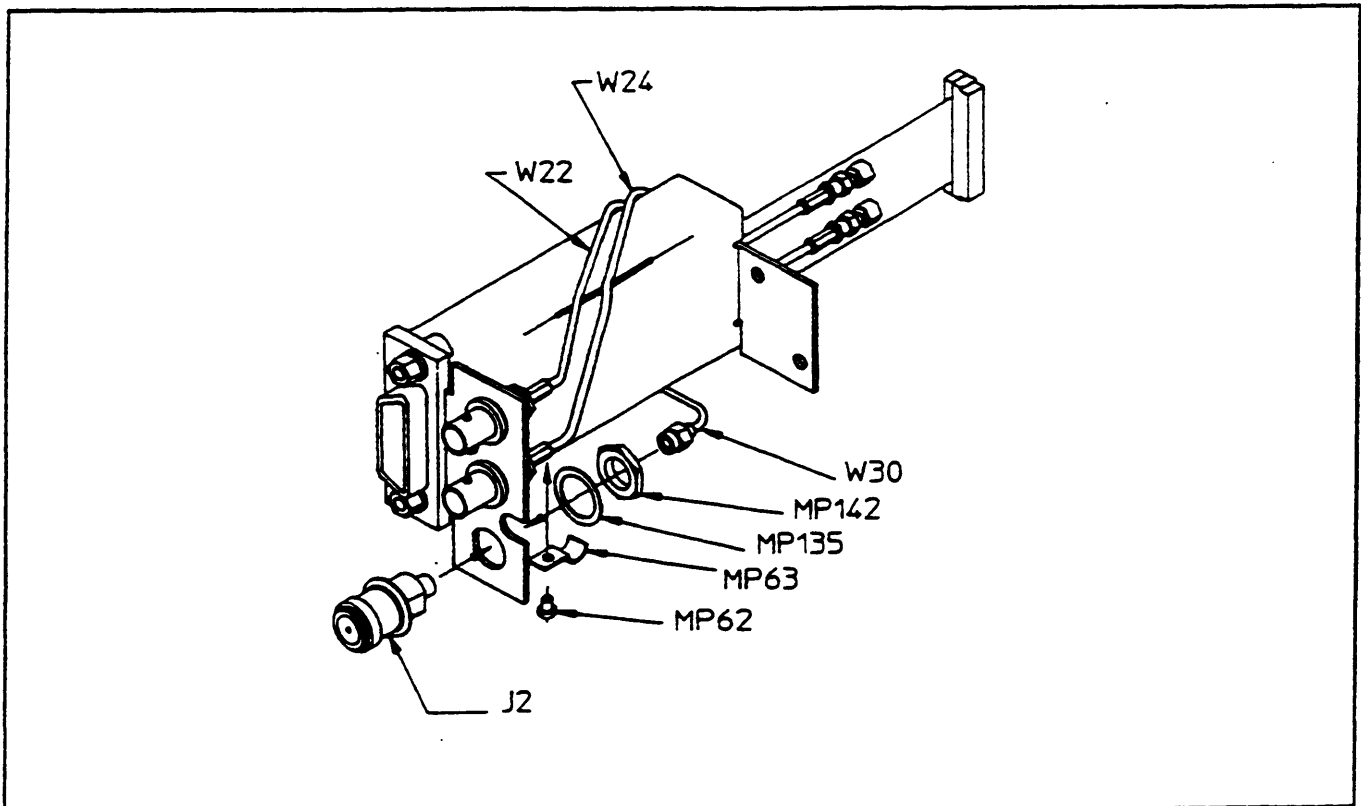


Figure 6-6. HP-IB and Modulation bracket (Opt 002)

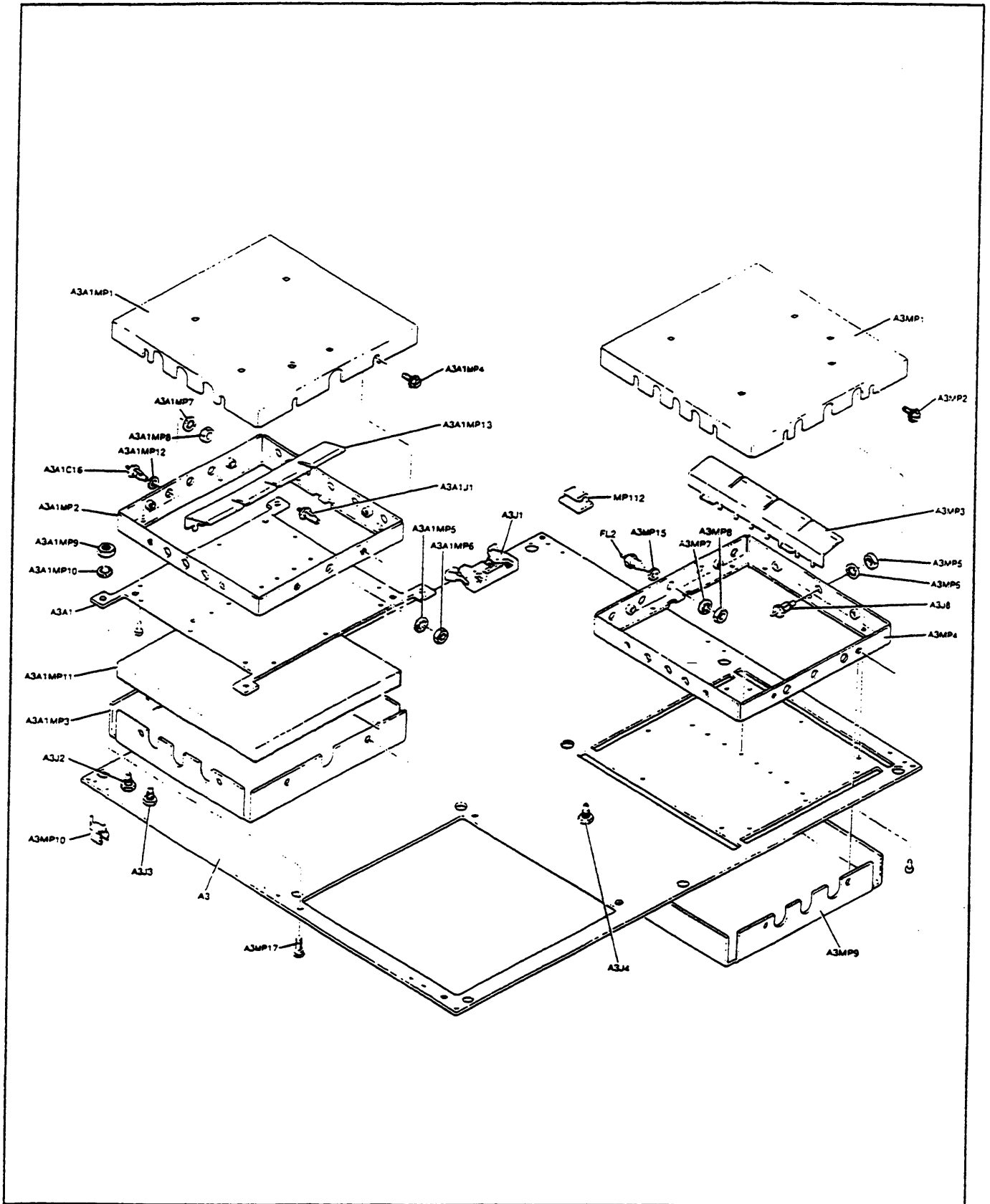


Figure 6-7. Exploded view of the A3A1 Assembly



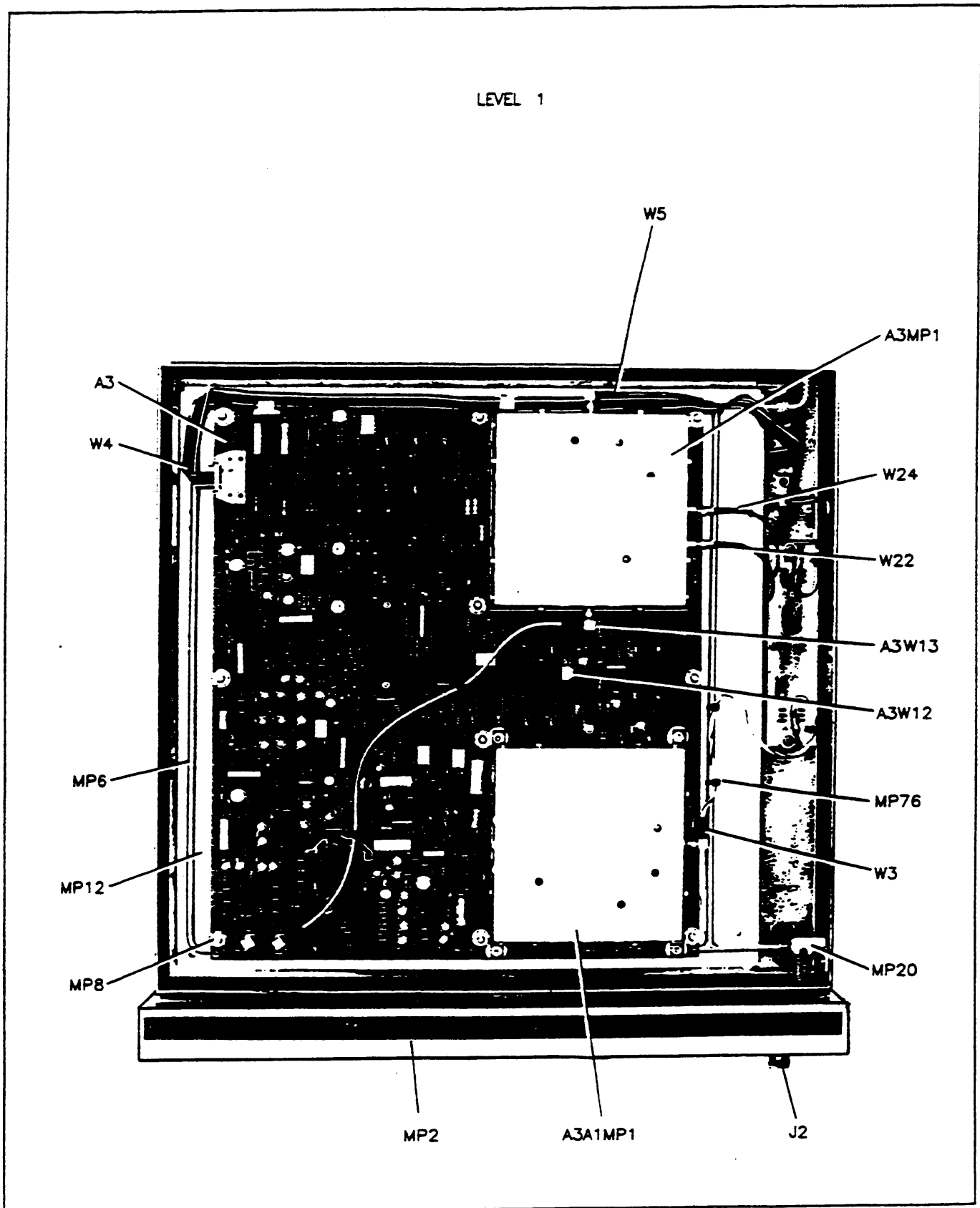


Figure 6-8. Top Internal view Level 1

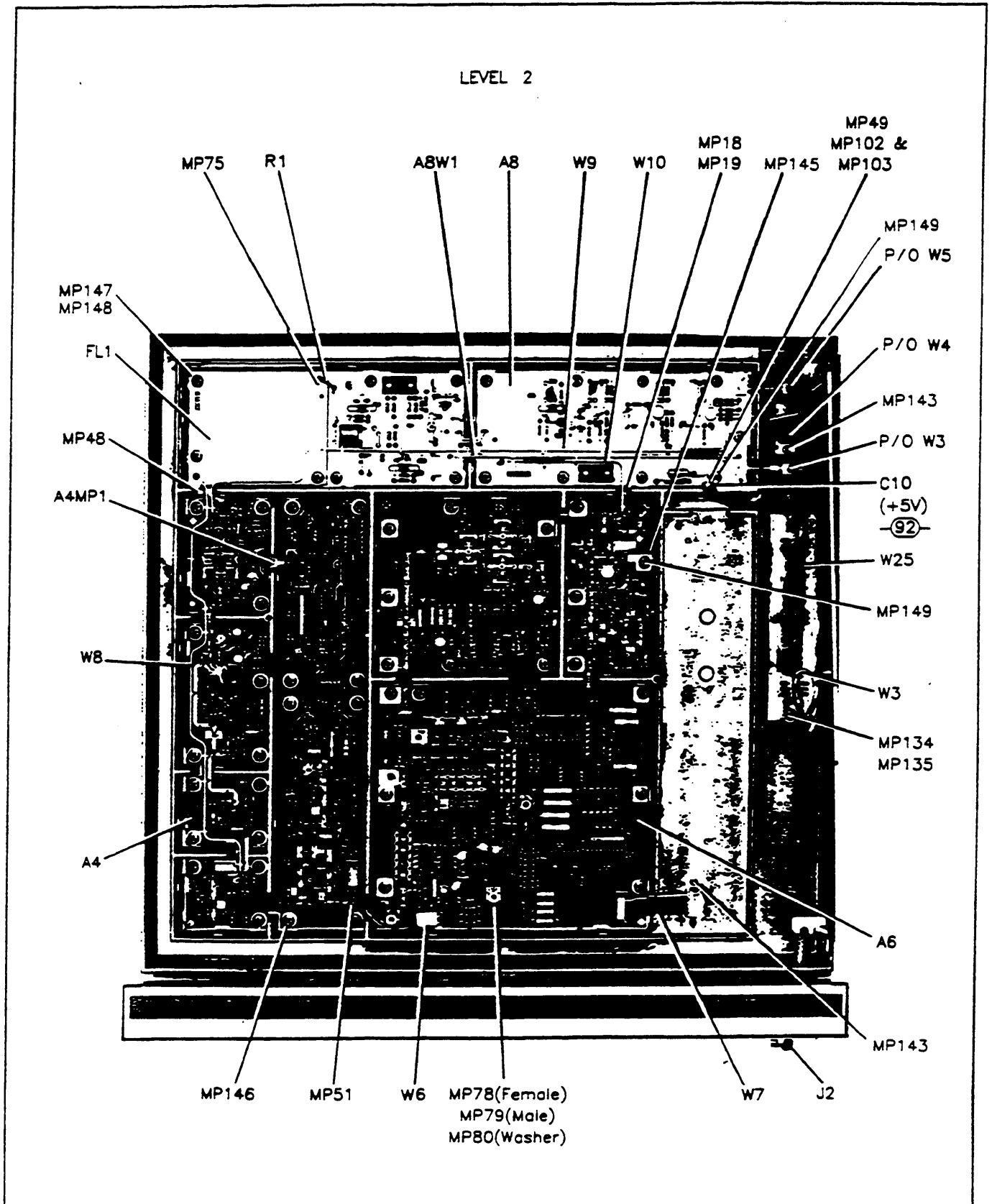


Figure 6-9. Top Internal view Level 2

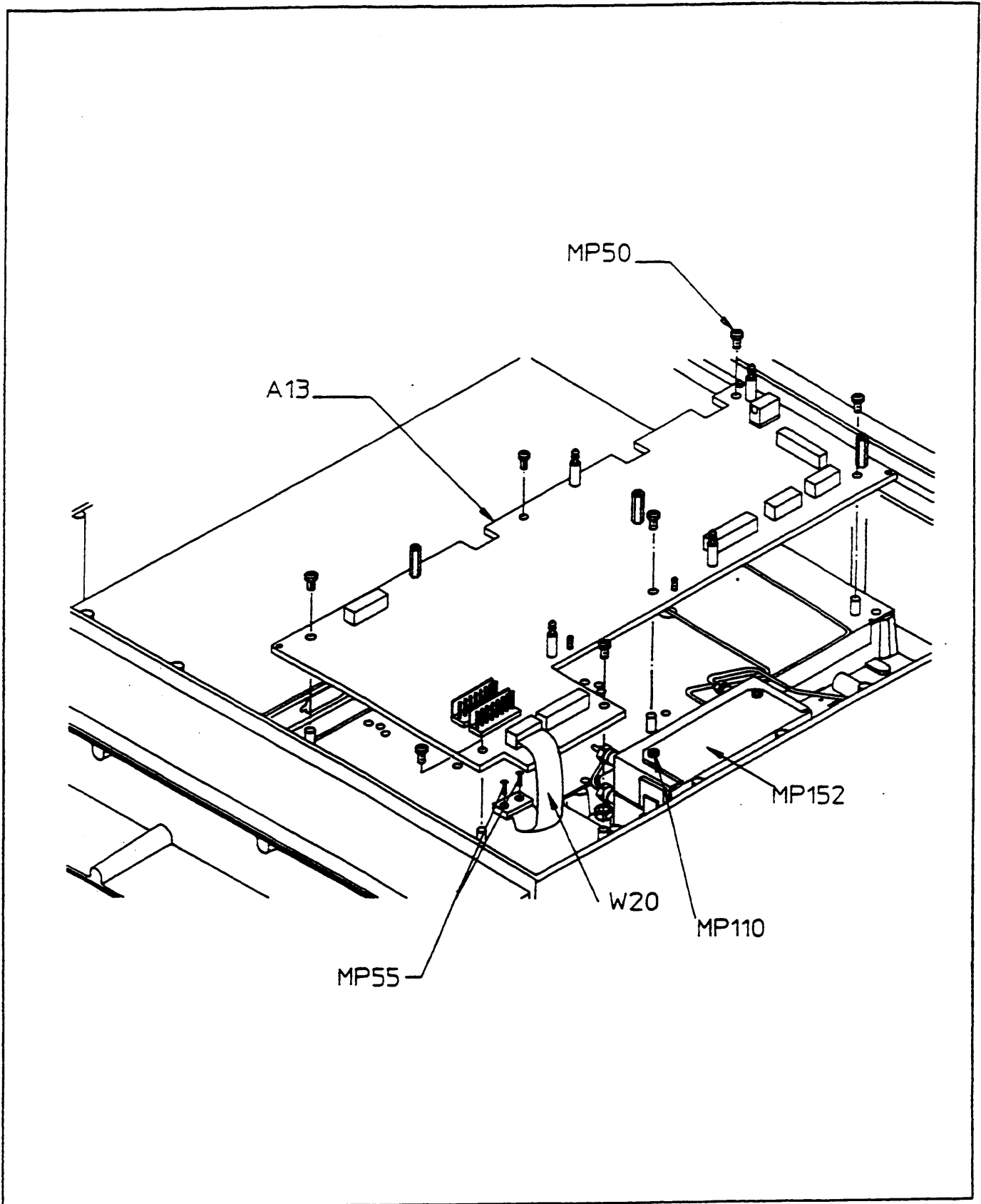


Figure 6-10. A13 Parts

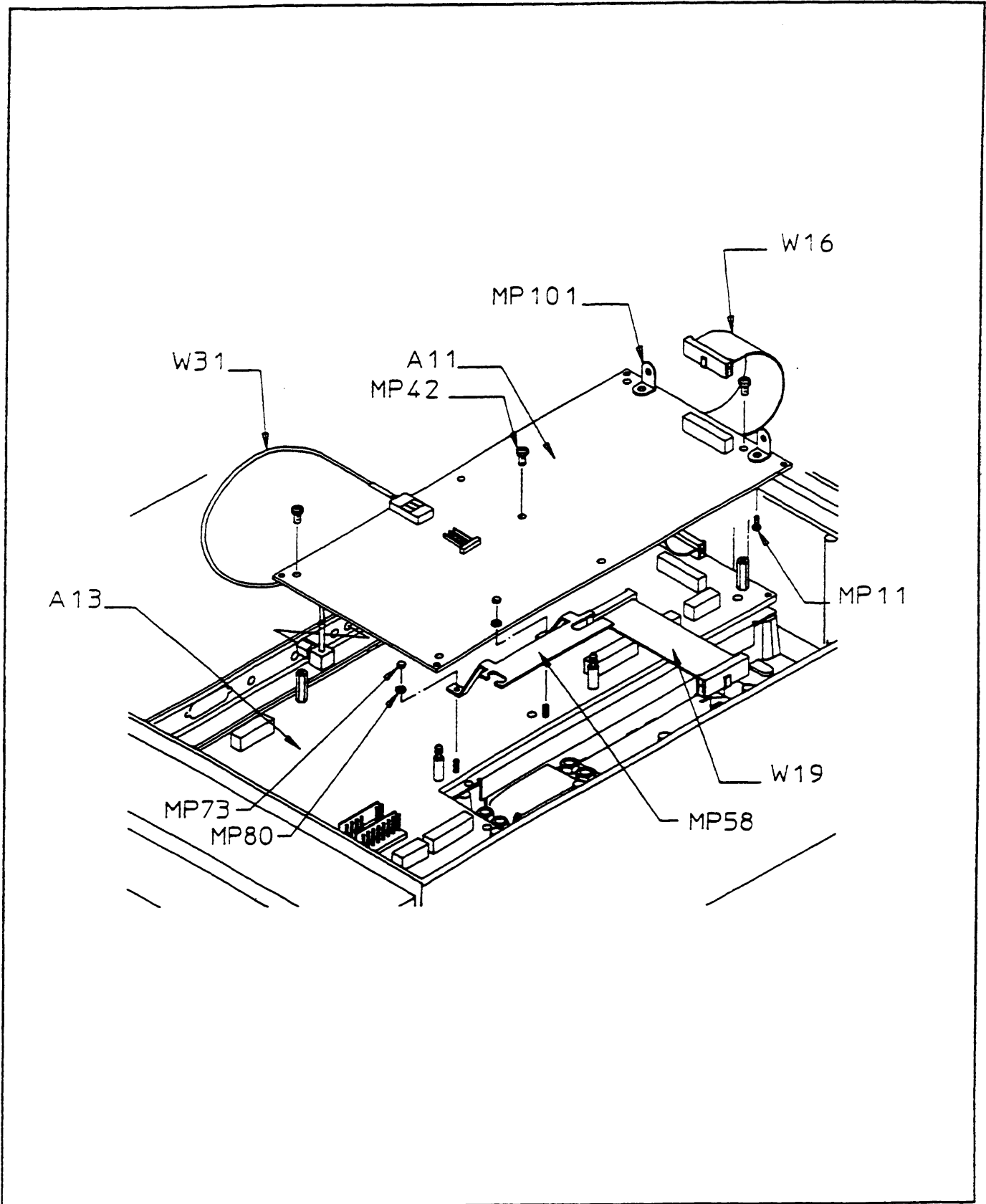


Figure 6-11. All Parts

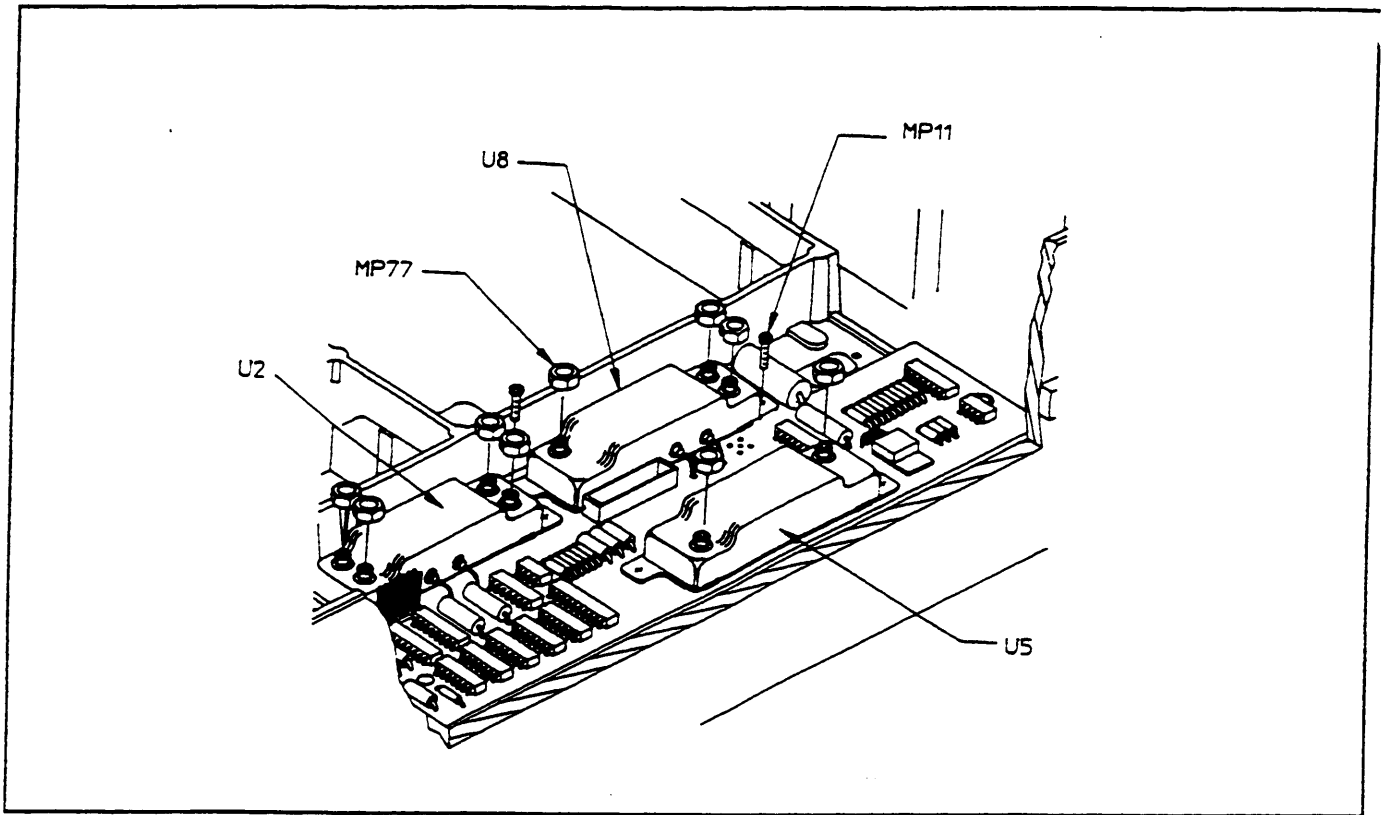


Figure 6-12. A10 parts

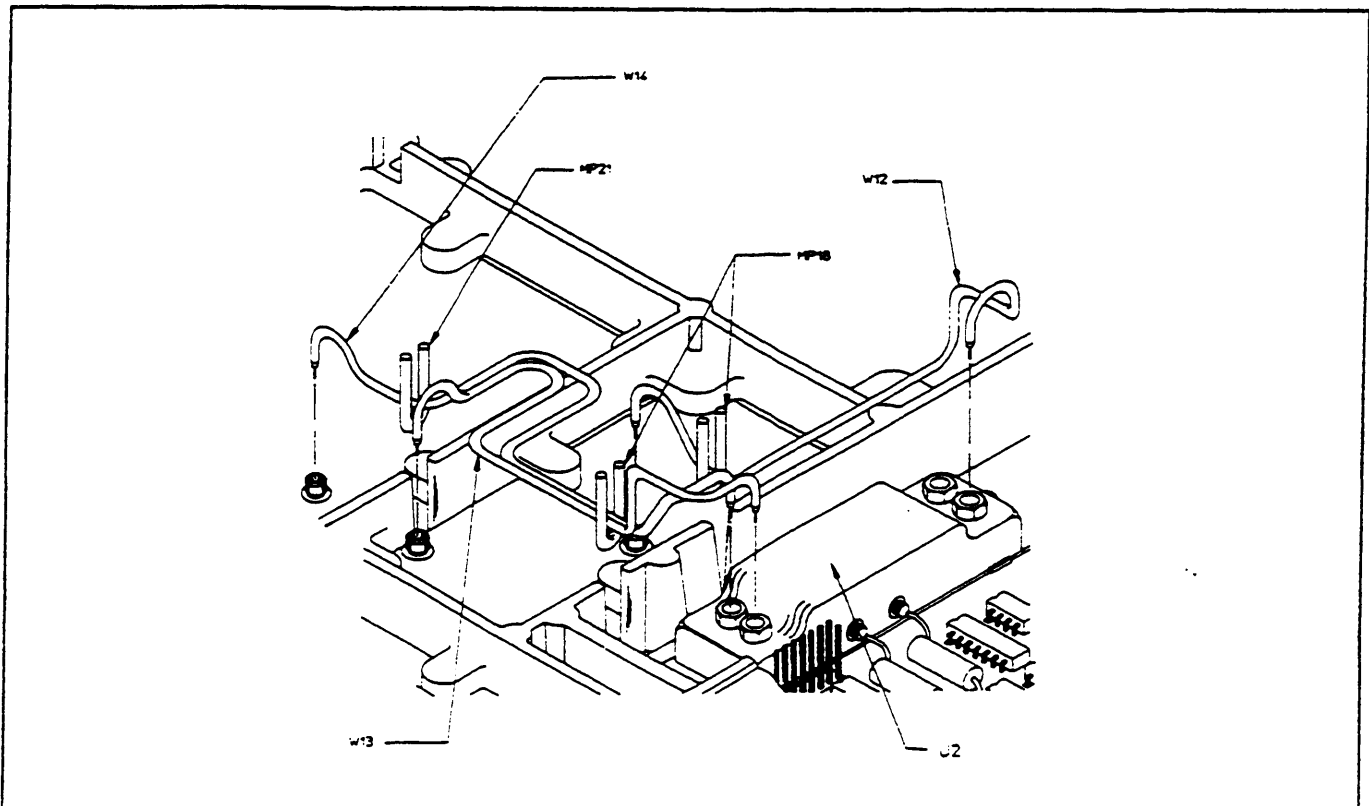


Figure 6-13. A10 Semi-Rigids

## Section 7 Instrument Changes

### INTRODUCTION TO THIS SECTION

This section contains instrument modification recommendations and procedures that could improve the performance and reliability of your instrument. Refer to *Instruments Covered by This Manual* in Section 1 of the HP 8657B *Operation and Calibration Manual* for important information about serial number coverage.

### INSTRUMENT MODIFICATIONS

**2922U AND ABOVE.** Modification to the A6 Output assembly (heterodyne circuitry) to improve switching speed. Additional components are CR304, CR305 and CR306. R316 and R321 change to 10k $\Omega$ .

**2928U AND ABOVE.** Improvement of A4 High Frequency Loop assembly stability and A6 Output assembly divider power sensitivity.

**2935U AND ABOVE.** Reduce the effects of electro-magnetic fields on frequency stability. The fan finger guard is grounded and an RF choke is in series with the fan's positive supply lead.

**2949U AND ABOVE.** Improved filter tuning stability and output power of the A8 Frequency Multiplier. Low inductance resistors are used and the capacitance coupling characteristic is changed.

**3001U AND ABOVE.** W22 and W24 are changed to new parts to improve the radiated RF performance. The new cables are grounded to the casting wall in addition to the HP-IB shield.

**3010U AND ABOVE.** A flying lead is added to the transformer assembly.

**3025U AND ABOVE.** The A6 Output Assembly is changed to part number 08657-60140. The previous A6 assembly had several modifications which have been incorporated into the new board layout.

**3035U AND ABOVE.** A diode, A6CR412, is changed to a new part.

**3105U AND ABOVE.** The A3 Low Frequency Loop Assembly and A6 Output Assembly are changed to part numbers 08657-60158 and 08657-60159 respectively. The changes allow the switching speed of the HP 8657B to be greatly improved. The instrument is also now equipped with flexible sequencing.



## Block Diagram 3

### LOW FREQUENCY LOOP AND FM SECTION

#### PRINCIPLES OF OPERATION

##### Fractional-N Phase Lock Loop Overview.

The Low Frequency Loop is a Fractional-N phase lock loop. The Low Frequency Loop VCO can be locked at fractional frequencies of the 100 kHz Reference. A VCO fractional frequency is any frequency that is not a whole number, integer, multiple of the reference. The VCO's frequency range is 60 to 110 MHz. When the VCO frequency is 100 MHz, its frequency is an integer multiple of the 100 kHz reference ( $100 \text{ kHz} \times 1000$ ) = 100 MHz. When the VCO frequency is 100.01 MHz, its frequency is not an integer multiple of the 100 kHz reference ( $100 \text{ kHz} \times 1000.1$ ) = 100.01 MHz, a fractional frequency.

The method used to divide by a fractional number is to have a integer divider that can be switched between two divide numbers (N and N-1) so the average divide number has a fractional part. From the example,  $N = 1000.1$ , the divider would divide-by-1000 for 9 times and 1001 for 1 time.

Figure 1 illustrates the basic Phase Lock Loop. The Phase Detector compares the Voltage Controlled Oscillator (VCO) output signal to the Reference signal. A Tune Voltage proportional to the phase difference between the two signals is produced. The Tune Voltage is filtered by the Low Pass Filter to suppress noise and high frequency components. The Tune Voltage corrects the VCO's frequency so it phase-tracks the Reference. For this loop to lock the VCO and the Reference must be at the same frequency. For the loop to lock at multiple integer frequencies of the VCO a Divide-By-N circuit must be added as shown in Figure 2. The VCO can now produce a discrete range of frequencies all phase locked to the Reference.

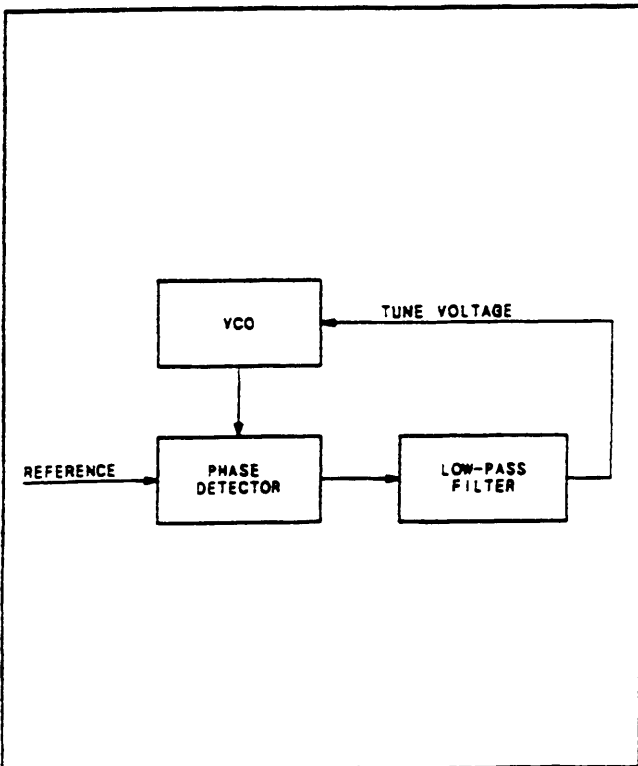


Figure 1. Basic Single Frequency Phase Lock Loop.

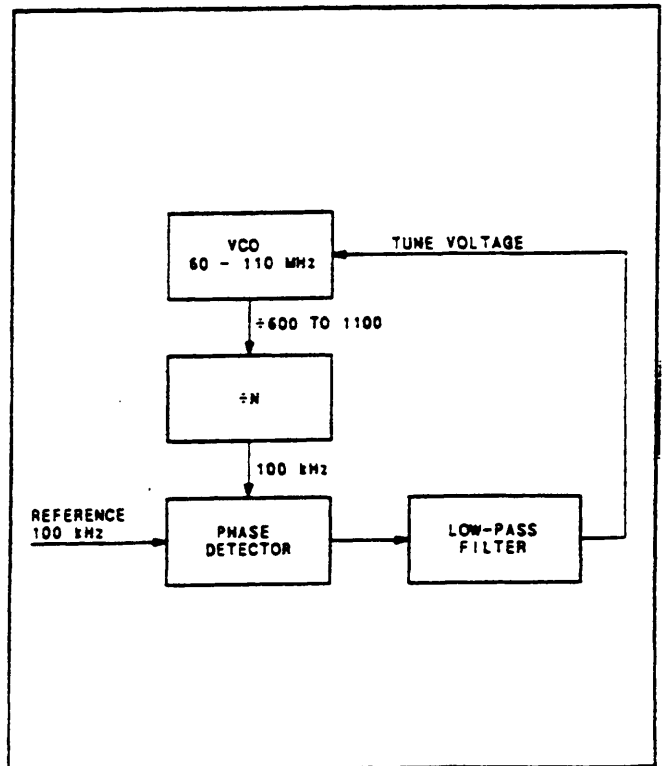


Figure 2. Basic 100 kHz Step Phase Lock Loop.



A Fractional-N loop is a modified Divide-By-N loop and can lock at frequencies that are not integers of the Reference. It can lock at fractional multiples of the Reference. For Fractional-N loops the N in N.F. represents the integral multiple, the Divide-By-N number. The F represents the fractional part of the VCO's offset frequency with respect to the integral frequency. With our fixed Reference frequency of 100 kHz, the VCO's frequency can be changed in 100 kHz steps,  $(100 \text{ kHz} \times N) = \text{VCO frequency}$ , the VCO's integral part. When the VCO's frequency is a fractional frequency, the VCO is continually advancing in phase with respect to the Divide-By-N number N times the Reference. When the phase of the VCO has advanced one cycle the loop divides by N-1 to remove a VCO cycle. In the following example, a VCO cycle is removed every 10 reference cycles.

The Reference frequency is 100 kHz, the divide number is 1000.1, and the VCO frequency is 100.01 MHz, a fractional multiple (1000.1) of the reference. Without the removal of a VCO cycle every 10 reference cycles the VCO will advance one cycle (refer to Table 1), and the output voltage of the Phase Detector would continue to increase. The loop would not lock. The continual removal of a VCO cycle means that the output of the Phase Detector is a sawtooth waveform. The waveform increases linearly because of the advancing phase of the VCO. When a cycle is removed it drops to a fixed voltage, canceling the phase advancement of one cycle. With one cycle ( $360^\circ$ ) removed, the Phase Detector returns to  $0^\circ$  phase output (refer to Figure 3).

Since one cycle must be removed from the VCO each time its phase advances one cycle on the VCO's integral part ( $100 \text{ kHz} \times N$ ), a Remove Cycle circuit is added in Figure 4. If a VCO cycle is removed each time its output advances one cycle of phase, the average frequency applied to the Divide-By-N block is  $100 \text{ kHz} \times N$ , and the average frequency applied to the Phase Detector is 100 kHz.

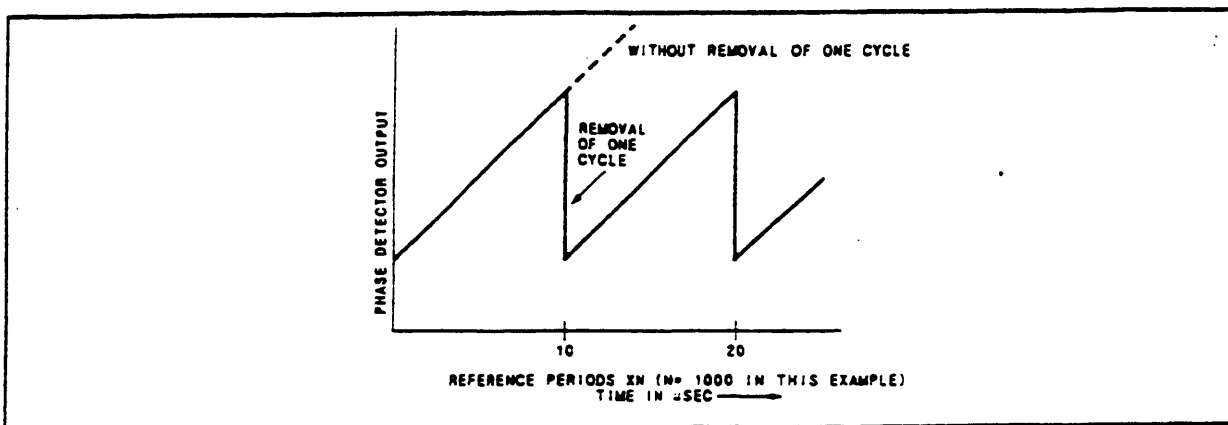


Figure 3. The Output of the Phase Detector Shown Here is a Sawtooth Riding on a dc Voltage.

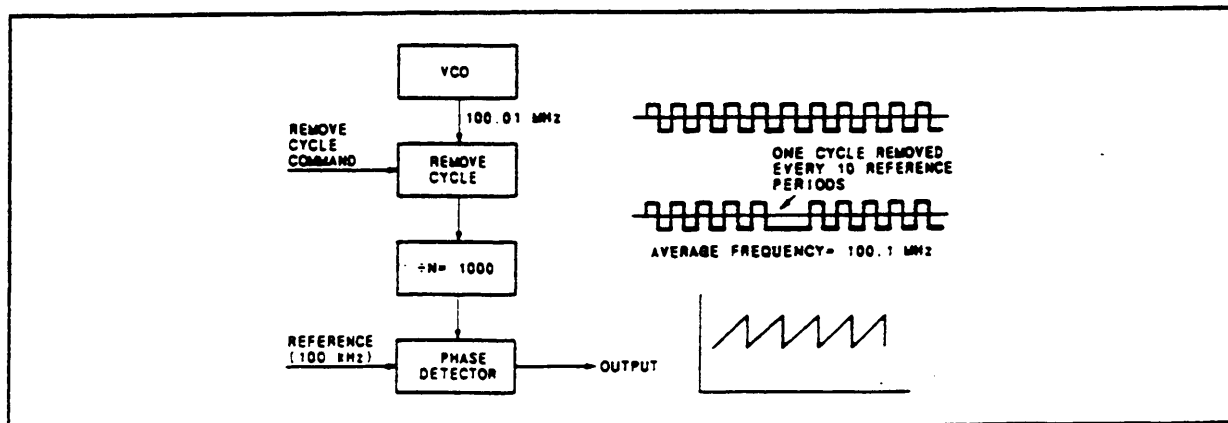


Figure 4. The Basic Block Diagram of a Modified Divide-by-N Loop with a Pulse Remover Added to Allow the VCO to Operate at a Fractional Frequency.

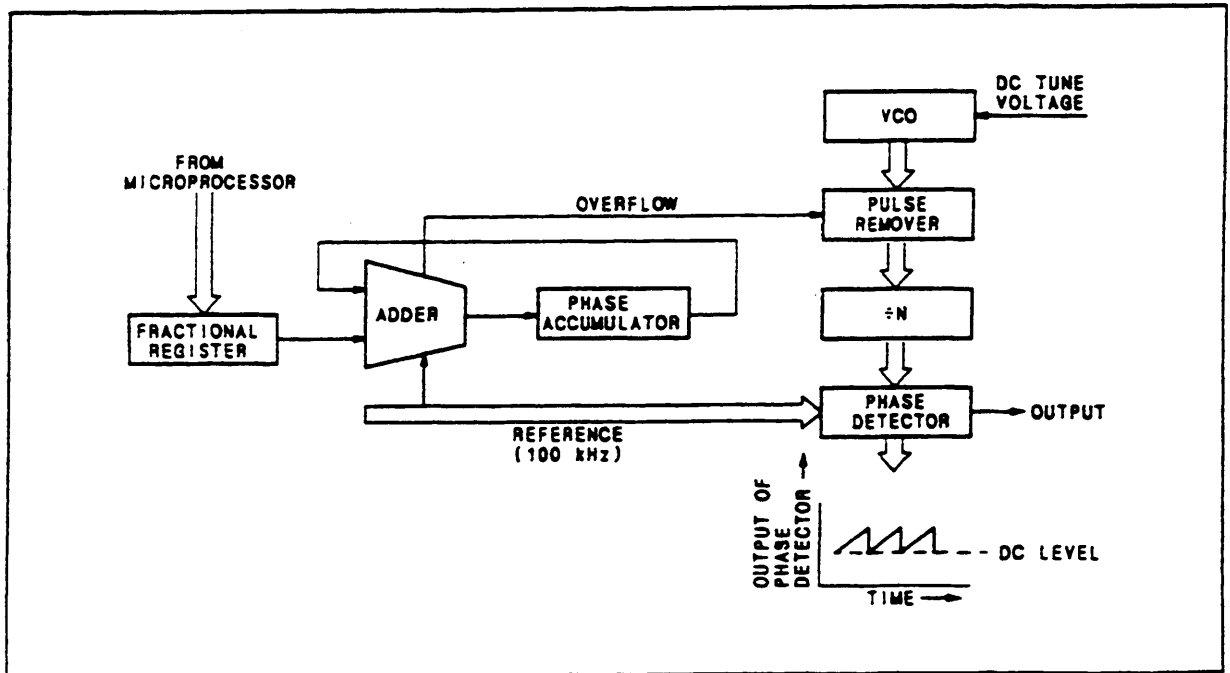
A method of determining when the VCO has advanced one cycle of phase is needed. The Remove Cycle circuit can then be triggered to remove a cycle. The fractional part of the VCO frequency determines the time required for the oscillator's frequency to advance one cycle of phase in reference to  $100 \text{ kHz} \times N$ . The time required is the period of  $F$  and corresponds to a number of reference periods. In the example, the Signal Generator's frequency is  $100.01 \text{ MHz}$ . The divide number is  $1000.1$ ,  $N = 1000$  and  $F = 0.1$ .

**Table 1. Phase Relationship of the Integral Part of the VCO Frequency Times  $N$  Relative to its Fractional Part as Expressed in Phase Advancement.**

No. of Ref. Periods ( $F_{ref} = 100 \text{ kHz} = 0.1 \text{ MHz}$ )	No. of Completed Cycles of		Phase Advancement on $N.F$ on $N \times F_{ref}$
	$N \times F_{ref}^* = 100 \text{ MHz}$ ( $N = 1000$ )	$N.F^{**} = 100.01 \text{ MHz}$	
1	1000	1000.1	0.1 cycle of phase
2	2000	2000.2	0.2 cycle of phase
3	3000	3000.3	0.3 cycle of phase
4	4000	4000.4	0.4 cycle of phase
⋮	⋮	⋮	⋮
9	9000	9000.9	0.9 cycle of phase
10	10000	10001.0	1 full cycle of phase ( $360^\circ$ )
11	1000	1000.1	0.1 cycle of phase

\* $N \times F_{ref}$  = Integer part of the VCO frequency.  
 \*\* $N.F$  = Integer and fractional part of the VCO frequency.

The fractional part of the frequency is stored in the Fractional Register, and then added to a second register each reference cycle. The second register, the Phase Accumulator, contains the total number of degrees the phase of the VCO has advanced at any point in time. The Fractional Register, Phase Accumulator, and Add Circuit are added as shown in Figure 5.



**Figure 5. Fractional-N Loop Showing a Phase Register Used to Trigger the Removal of One VCO Cycle (or Pulse).**

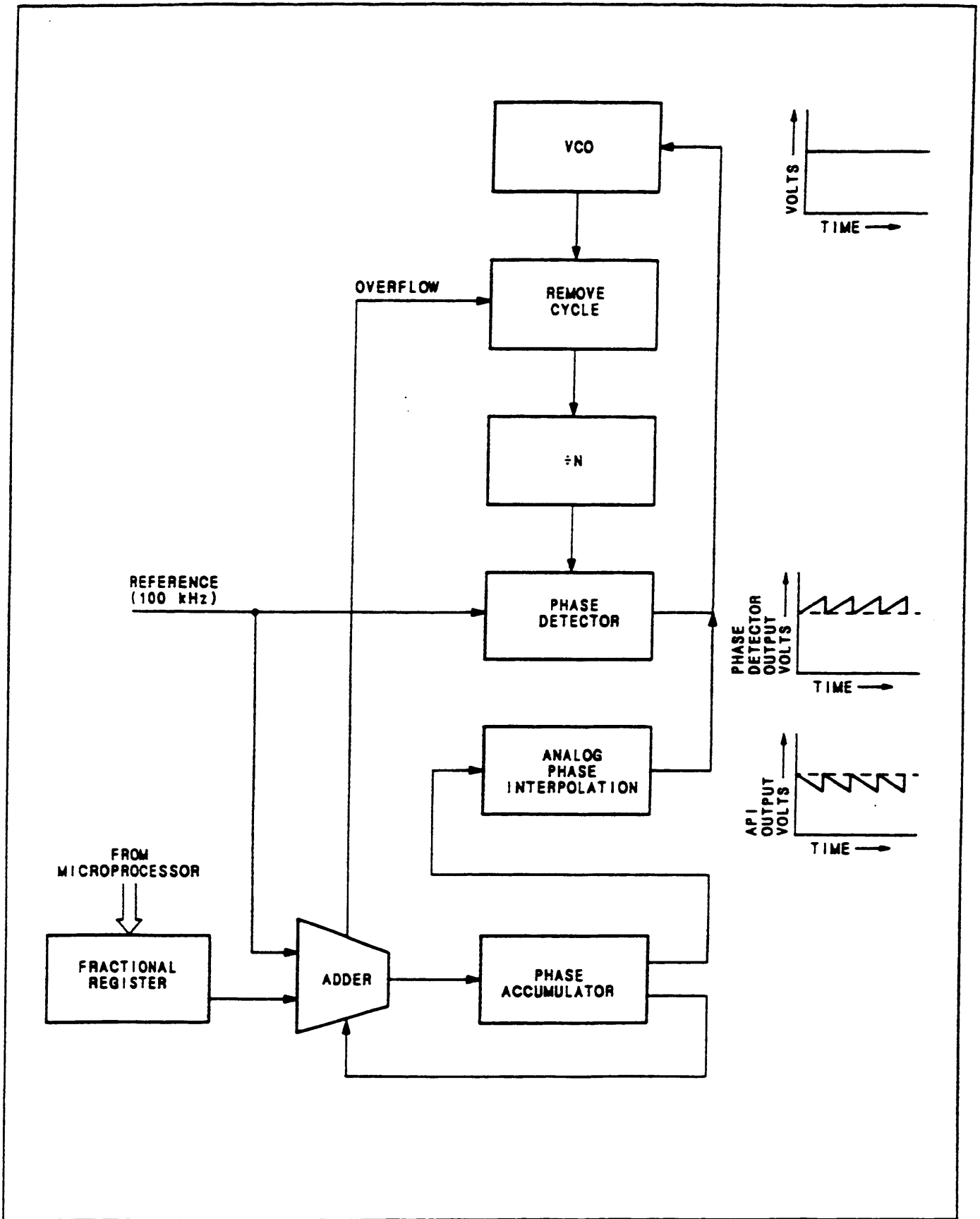
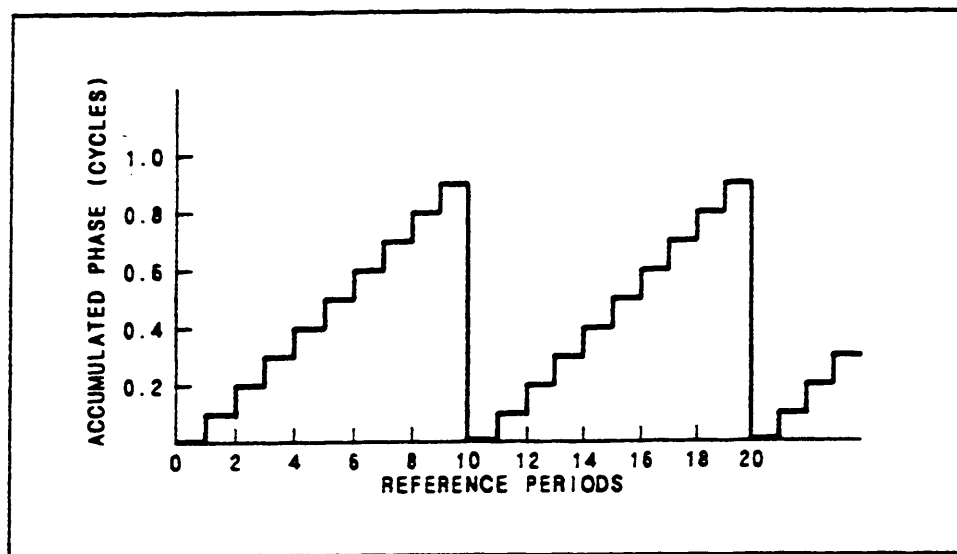


Figure 6. Simplified Diagram of A Fractional-N Phase Lock Loop.

During the reference cycle that the VCO advances one full cycle of phase, the Phase Accumulator reaches unity. For example, the oscillator has gone 1000.1 cycles in one reference cycle, 10  $\mu$ s, 2000.2 cycles in two reference cycles, and so on. The Phase Accumulator contains 0.1 after one reference cycle, 0.2 after the second, and so on. When unity is reached, the register overflows. The VCO has advanced one cycle of phase and the overflow bit instructs the Remove Cycle circuits to remove a cycle from the VCO.

The open-loop Phase Detector output is sawtooth on some dc voltage level as tuning voltage for a stable output signal. A sawtooth signal on the dc tuning voltage will cause frequency modulation of the VCO's output. The sawtooth signal must be removed from the tuning voltage. The output of the Phase Detector is a voltage that at some value, rises to an increased value, and returns to the value started with when the cycle repeats. Figure 7 shows the waveform generated by the Phase Detector.



*Figure 7. Phase Detector Waveform.*

The technique used to eliminate this unwanted sawtooth waveform is to generate a waveform with the same shape but opposite in polarity, and sum it with the Phase Detector output. This cancels the unwanted waveform leaving only the dc voltage to tune the VCO. It is possible to generate a waveform of the opposite polarity because the shape of the unwanted waveform can be predicted exactly. The Analog Phase Interpolation (API) circuit in Figure 6 is added to determine the voltage on each reference cycle to sum with the output of the Phase Detector.

### A3 Low Frequency Loop Assembly.

The 50 MHz Reference Oscillator (Service Sheet 16) is a crystal oscillator that is used to phase lock the Voltage Controlled Oscillators. Its output is divided down to provide the 100 kHz Reference to the Phase Detector. The rear-panel TIME BASE OUTPUT signal is a jumper-selectable frequency of 1, 5, or 10 MHz divided from the 50 MHz Reference Oscillator and coupled through the Crystal Phase Lock Circuit. For Option 001, a 10 MHz temperature-stabilized crystal oscillator is installed in the Signal Generator. The Option 001 oscillator output is available at the rear-panel TIME BASE HIGH STABILITY OPTION connector (not shown). When connected to the TIME BASE INPUT connector, a phase lock is established between the high stability oscillator and the 50 MHz Reference Oscillator. The switched 5 MHz is the clock that generates the 400 ns pulses required for DCFM and ACFM (in-band) Reset Timing.

Digital data is written from the main Microprocessor to the Low Frequency Loop Microprocessor (Service Sheet 11) when its frequency is changed, when frequency modulation (AC or DC) is selected, turned off, changed or calibrated. The digital data consists of instructions and data. Instructions select frequency modulation and controls when a frequency modulation calibration is performed. Instructions and data are sent from the Low Frequency Loop Microprocessor to the Fractional-N Controller which handles all instructions and data to lock the Low Frequency Loop at fractional frequencies (refer to the Low Frequency Loop Timing Diagram Figure 8). The Fractional-N Controller converts the data to its nine's compliment and transfers the data to the Divide-By-N Latches. The nine's compliment data is used by the Divide-By-N Counters, clocked by the Chip Clock output of the Prescaler, to generate the VCO Divide-By-N.F. 100 kHz pulse input to the Phase Detector. The output pulse of the Phase Detector (Service Sheet 13) determines the length of time Phase Detector current is active and the voltage output of the Loop Integrator is changed. The output of the Loop Integrator is stored on the Sample and Hold Capacitor and corrects the output frequency of the VCO.

After the correction voltage is stored on the Sample and Hold Capacitor, the Fractional-N Controller sets the Bias Control active to reset the Loop Integrator. The Loop Integrator is reset by the Bias Current that supplies current to the Loop Integrator. If the frequency of the VCO is a fractional frequency (not an integer multiple of 100 kHz), the Analog Phase Interpolation (API) (Service Sheet 12) outputs from the Fractional-N Controller are active for a varying amount of time when Bias is active. The API Currents are summed with the Bias Current to determine the voltage reset point of the Loop Integrator (Figure 9 shows how the API currents are shared). The voltage is dependent on the phase difference between the 100 kHz reference and the VCO Divided-By-N.F. that is the result of the VCO's frequency being a fractional frequency.

A cycle is added or removed at the Prescaler (Service Sheet 10) to change its modulus from 10 to 9 or 11. A remove cycle is latched into the Cycle Add/Remove Latches and gated to the Prescaler by the Fractional-N Controller to generate fractional frequencies, and by the FM Digital circuits to control Frequency Modulation. An add cycle is latched into the Cycle Add/Remove Latches by the FM Calibration circuits, and by the FM Digital Control circuits to control Frequency Modulation. FM calibration is necessary to ensure that the FM deviation does not vary with oscillator frequency. Calibration is performed by offsetting the frequency of the VCO by 200 kHz, and then removing the offset. Any difference in voltage is detected by the Tune Voltage Sampler, and then converted by the A/D to set the bits of the FM Cal DAC.

To have continuous Frequency Modulation both in the bandwidth and out of the bandwidth of the Low Frequency Loop, the Low Frequency Loop VCO is Phase Modulated in the loop bandwidth. The modulation signal is converted to phase by the FM to  $\Phi$ M Integrator and summed with the current to the Loop Integrator. When the output of the FM to  $\Phi$ M Integrator crosses the high threshold, the High Threshold Comparator is set and a Remove Cycle control pulse is generated. When the output of the Integrator crosses the low threshold, the Low Threshold comparator is set and an Add Cycle control pulse is generated. The Remove or Add Cycle pulse is gated to the Prescaler and a cycle is removed or added to the VCO Divide-By-N.F. signal. When a cycle is removed or added, a precise API 2 or API 3 current is directed to the FM to  $\Phi$ M Integrator. Just enough charge is removed from or added to the Integrator to offset the  $360^\circ$  of phase caused by removing or adding a cycle by the Prescaler. (Figure 9 shows how the API currents are shared.)

The FM Reset Timing and currents reset the Integrator (Service Sheet 15). The Up/Down Counters and Phase Deviation DAC keep track of the number of times, and the direction the Integrator is reset. The Up/Down Counters and Phase Deviation DAC reconstruct a staircase voltage approximation of the total VCO phase offset caused by the modulation Remove or Add Cycle control inputs to the Prescaler.

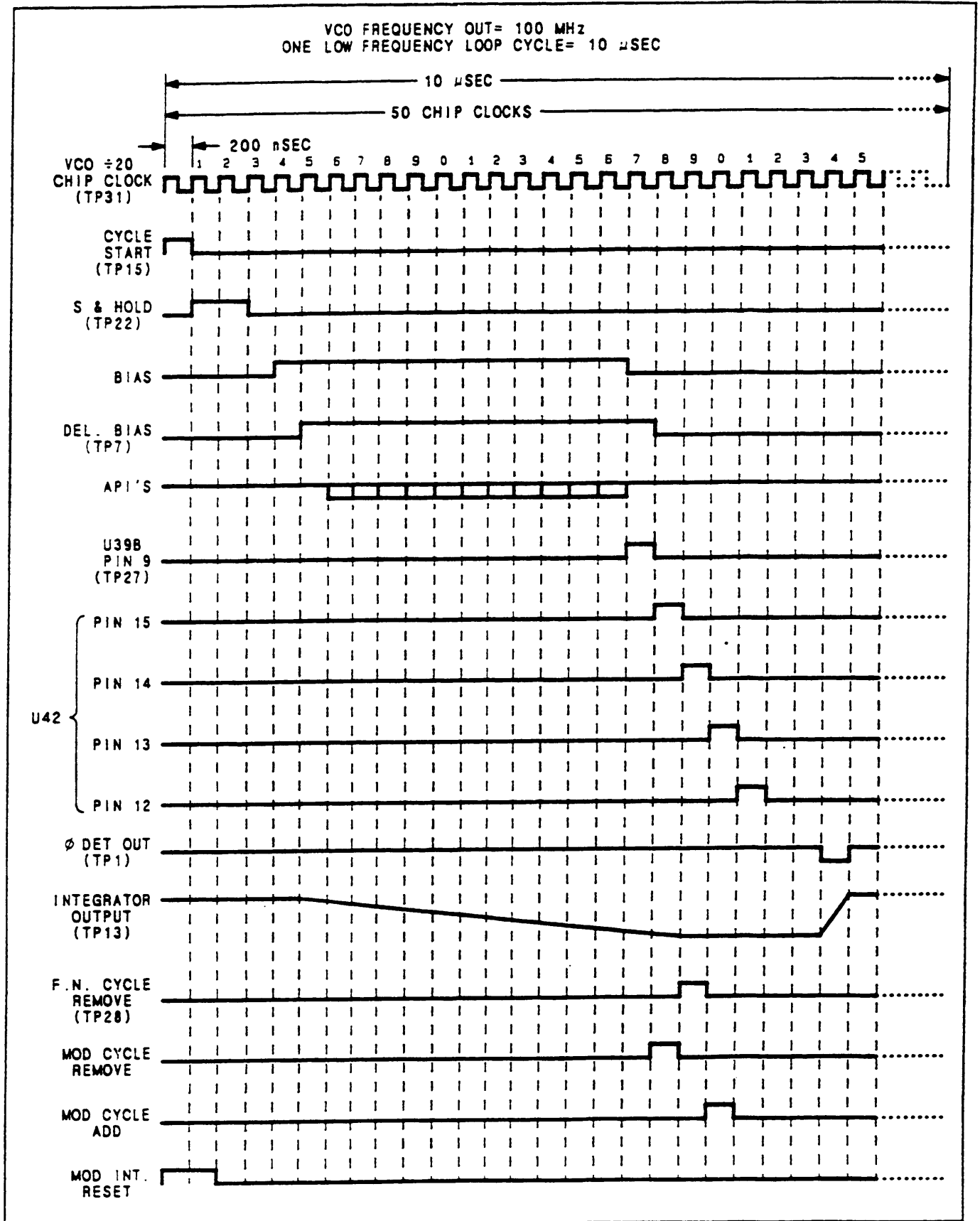


Figure 8. Low Frequency Loop Timing Diagram.

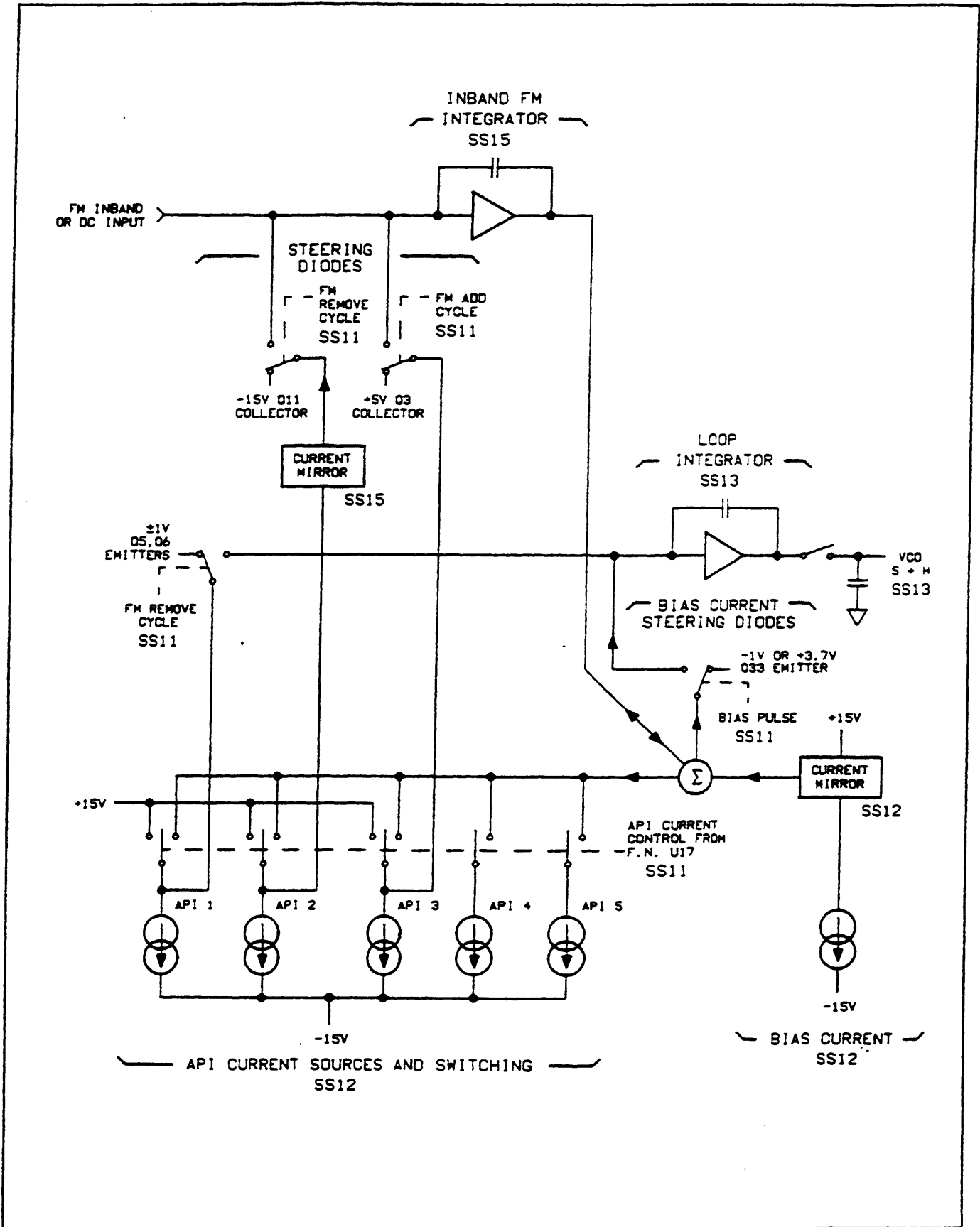



Figure 9. Low Frequency Loop API and Bias Currents.

## TROUBLESHOOTING

Procedures for checking the Low Frequency Loop and FM Sections of the instrument are given below. The blocks or points to check are marked on the block diagram by a hexagon with a check mark and a number inside, for example, 

### Troubleshooting Help

- Block Diagram 1
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustments

### Test Equipment

Digital Multimeter .....	HP 3466A
Measuring Receiver .....	HP 8902A
Sensor Module .....	HP 11722A
Oscilloscope.....	HP 54100A
Oscilloscope Active Probe .....	HP 54001A
Function Generator.....	HP 3312A

### Low Frequency Loop Lock Check

The Low Frequency Loop can be checked from the front panel to determine if the loop is locked or unlocked. Enter the Keyboard-Invoked Tests and run Test 6 to determine the loop's condition. When the loop is locked a "1" is shown in the FREQUENCY Display window, and when it's unlocked a "0" is shown.

- Enter the Keyboard-Invoked Tests by first pressing the "SHIFT" key, and then pressing the "INCR SET" key. A "1" should be shown in the MODULATION Display window.
- Press the "AMPTD" up-arrow key until a "6" is shown in the MODULATION Display window. Test 6, the Low Frequency Loop Lock Test, is ready to run.
- Press the "INCR SET" key to start the test. A "1" is shown in the FREQUENCY Display when the loop is locked. A "0" is shown in the FREQUENCY Display when the loop is unlocked.
- To exit Test 6, press the "AMPTD" up-arrow key once. A "00" should be shown in the AMPLITUDE Display window.
- To exit the Keyboard-Invoked Tests, press the "AMPTD" up-arrow key until a "7" is shown in the MODULATION Display window. Then press the "INCR SET" key.

The red LED, A3DS500 on the Low Frequency Loop Assembly (refer to Service Sheet 13), is lit when the loop is unlocked.

### 50 MHz Reference Oscillator Checks

1. Set the Signal Generator as follows:
 

Frequency.....	500 MHz
Amplitude.....	0.0dBm
Modulation.....	Off
2. Connect the Signal Generator's TIME BASE OUTPUT (J4) on the rear panel to the measuring receiver's INPUT. With the Signal Generator's Time Base jumper in the 10 MHz position check that the frequency at J4 is 10 MHz. If the frequency is not correct, go to step 3.
3. Connect the measuring receiver to the 50 MHz Reference output by removing W5 from A3J8. The frequency at A3J8 should be 50 MHz and the power level +16 to +19 dBm. If the frequency or level is not correct, go to Service Sheet 16.



4. Select Frequency Modulation at the front panel, press the FM key. Check the switched 5 MHz at feedthrough capacitor A3C28 with an oscilloscope. If the 5 MHz square wave is not correct go to Service Sheet 16.
5. Check the 100 kHz Reference pulse to the Phase Detector at connector A3J5 with the oscilloscope. The pulse is approximately +2V, 0.1  $\mu$ s pulse (including ringing) and occurs every 10  $\mu$ s. Adjust the Timebase Sec/Div to view more than one pulse. If the pulses are not present go to Service Sheet 16.

**√2 VCO Tune Voltage and FM Checks**

1. Remove jumper A3W6 (refer to Service Sheet 14). The VCO Tune Voltage goes to approximately 0.0V.
2. Connect the measuring receiver to A3A1J1 (VCO output). The frequency should be 96 MHz  $\pm$ 7 MHz and the power level -9 to -7 dBm. If it is not correct go to Service Sheet 9.
3. Connect the digital multimeter to feedthrough capacitor A3A1C101 (the +11 Vdc power supply for the Low Frequency Loop VCO). The voltage should be +11  $\pm$ 2 Vdc with the noise less than 0.05 Vpp. (Measure the + 11V noise with an Analog Oscilloscope, such as the HP 1740A). If the voltage or noise is not correct, go to Service Sheet 9 or Service Sheet 25 (+15 Vdc power supply).

**√3 Divider and Prescaler Checks**

1. Check the Low Frequency Loop VCO's frequency at A3TP29. The frequency should be 100 MHz (Signal Generator's frequency 500 MHz). If the frequency is not correct go to Service Sheet 10.
2. Check the Low Frequency Loop VCO's frequency Divided-By-2 at A3TP30 and divided-by-20 at A3TP31. If either frequency is not correct go to Service Sheet 10. If loop is still unlocked go to **√4** below.
3. Set the Signal Generator's frequency to 500.0011 MHz. Check the Remove Cycle pulse input at A3W8. If the pulse is not present go to Service Sheet 11.

4. Set the Signal Generator as follows:

Frequency..... 500 MHz  
 Amplitude..... Any  
 Modulation..... ACFM, 99 kHz  
 Source..... EXT

5. Connect a function generator to the MOD INPUT connector on the Signal Generator.

6. Set the function generator as follows:

Function..... Square Wave  
 Frequency..... 100 Hz  
 Output Level..... 1 V/P (HI and LO LED's out)

7. Check the Add Cycle pulse at A3W7. If the pulse is not present go to Service Sheet 11.

**√4 Digital Control, Remove and Add Cycle, and Divide-By-N Counters Checks**

1. Check the Cycle Start pulse at A3TP15. Refer to Figure 8 Low Frequency Loop Timing Diagram. If the pulse is not present go to Service Sheet 11.
2. Check the VCO Divided-By-N.F., 100 kHz pulses, at A3J4. It should be a narrow approximately +2V pulse every 10  $\mu$ s. Adjust the Timebase Sec/Div to view more than one pulse. If the pulse is not present go to Service Sheet 11.

**√5 Integrator Set and Reset Checks**

1. Check the +1 to -1V waveform at A3TP1 every 10  $\mu$ s. If it is not correct go to Service Sheet 13.
2. Check the voltage waveform output of the Integrator at A3TP13. Refer to Figure 8. If the waveform is not correct go to Service Sheet 12.
3. Check the Bias Control pulse at A3TP10. Refer to Figure 8 (Bias Pulse). If the pulse is not correct go to Service Sheet 11.
4. Check the API Control Delayed Bias at A3TP7. TP7 should be approximately -7 to +1 volt pulse, one Chip Clock less than the Bias Pulse. Refer to Figure 8. If the pulse is not correct go to Service Sheet 11.

**√6 Frequency Modulation (In-Band) Checks**

1. In-band frequency modulation is checked with the Low Frequency Loop locked.
2. Set the Signal Generator as follows:

Frequency .....	950 MHz
Amplitude .....	Any
Modulation .....	ACFM, 5 kHz
Source .....	EXT

3. Set the oscilloscope as follows:

**Chan 1**

Chan 1 Display .....	On
VOLTS/DIV .....	500 mV
OFFSET .....	850 mV

**Timebase**

SEC/DIV .....	2 ms
---------------	------

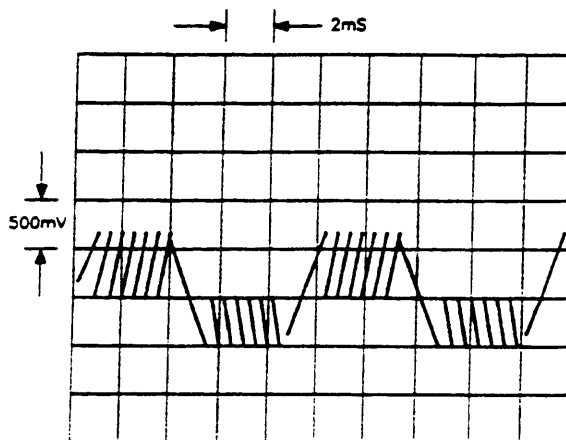
**Trigger**

Trigger Mode .....	Edge
Trig Src .....	Chan 1
TRIG LEVEL .....	1.5V
Slope .....	Positive

4. Set the function generator as follows:

Function .....	Square Wave
Frequency .....	100 Hz
Output Level .....	1 V/P (HI and LO LED's out)

5. Connect the oscilloscope to A3TP3. If the waveform at TP3 is not the same as shown in Figure 10 go to Service Sheet 15.



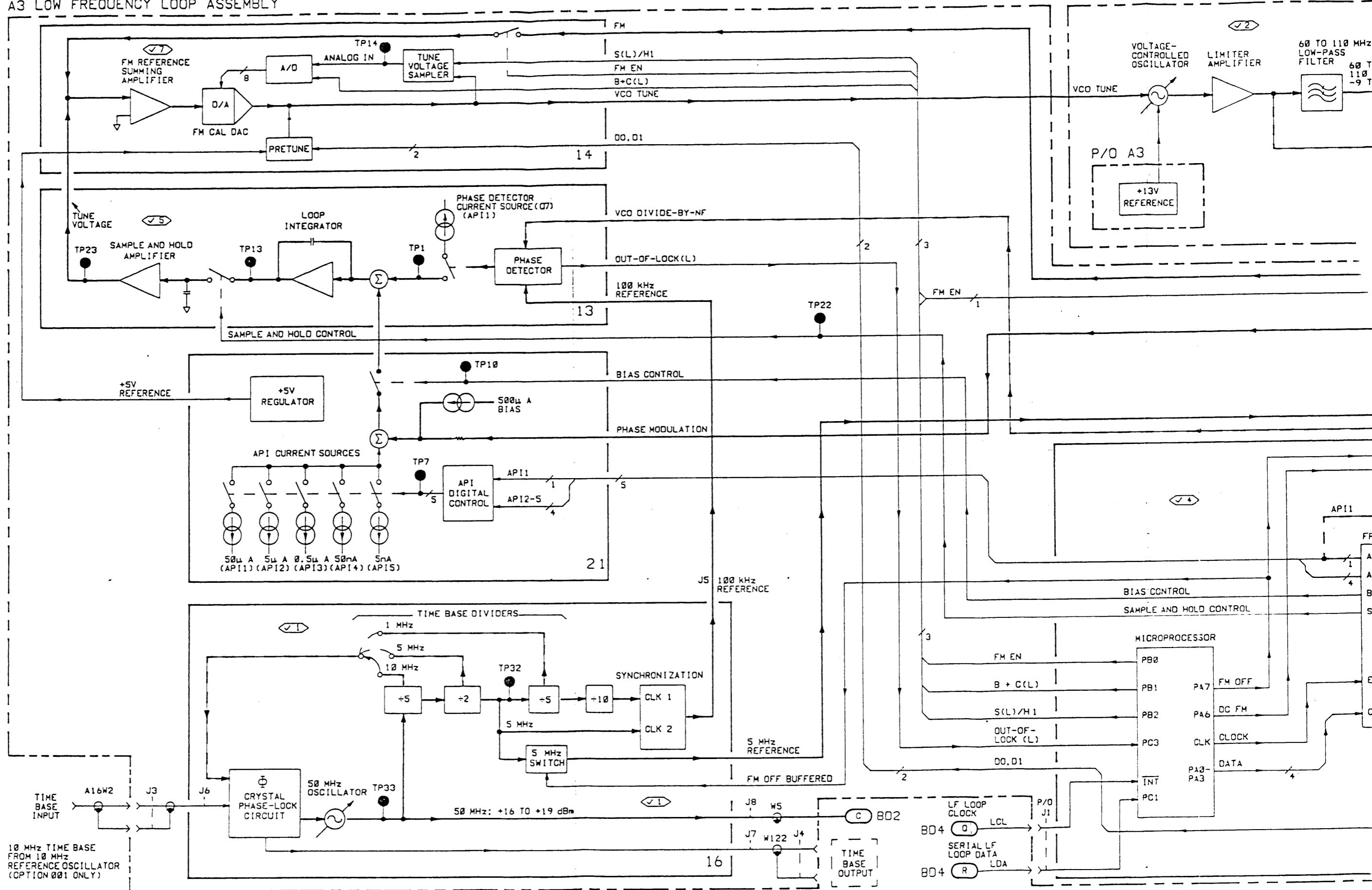
**Figure 10.** Oscilloscope Display of TP3 (dc Coupled), Signal Generator's Frequency 950 MHz, Modulation EXT FM, 5 kHz Deviation (100 Hz Square Wave).

### **J7** Frequency Modulation Calibration Checks

1. Connect the oscilloscope to feedthrough Capacitor A3A1C100 or A3W6 and set the Signal Generator's modulation to 1 kHz INT, FM, 99 kHz deviation. The modulation signal should be approximately 0.1 Vpp. If it is not correct, go to Service Sheet 14 and perform the FM checks.
2. Connect the oscilloscope to A3TP14. Verify that the voltage changes when the Signal Generator's frequency is incremented 10 MHz. If the voltage does not change, go to Service Sheet 14.

A3 LOW FREQUENCY LOOP ASSEMBLY

A3A1 LOW FREQUENCY OSCILLATOR



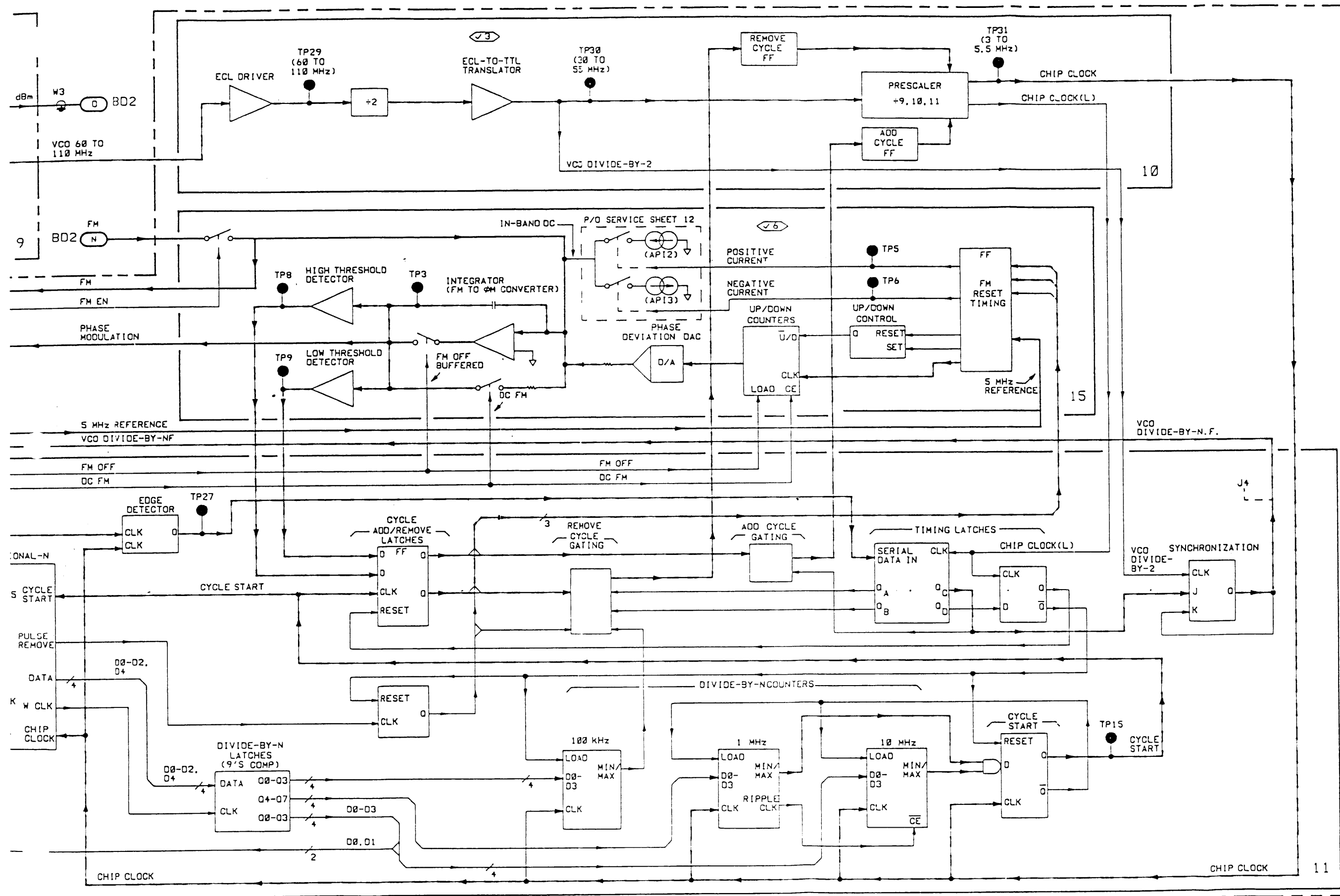


Figure 11  
Block Diagram 3 13

## Block Diagram 4

### MICROPROCESSOR, KEYBOARD, AND DISPLAY SECTION

#### PRINCIPLES OF OPERATION

##### A1 Keyboard Assembly

The Keyboard Assembly consists of 48 pushbuttons or keys hardwired in an 8-row by 6-column matrix. Whenever a key is pressed, a row line is connected to a column line. This causes a keyboard interrupt to be issued to the Microprocessor. When the Microprocessor is interrupted, the row and column data is strobed into the Keyboard Data Latch/Shift Register and then serially shifted over the data bus to the Microprocessor.

##### A13 Microprocessor, Memory, and HP-IB Assembly.

The data bus (D0 through D7) consists of eight bidirectional lines which are used to transfer 8-bit, positive-true data to and from the Microprocessor. The Microprocessor reads data from memory, the keyboard, and the HP-IB interface. Information on the data bus is buffered as it enters or leaves the Microprocessor. The Read/Write signal (R/W) from the Microprocessor is used to control the direction of data transfer on the data bus. This signal is buffered by one of the Microprocessor Control Line Buffers.

The address bus (A0 through A15) consists of sixteen unidirectional lines which are used to transfer the 16-bit, positive-true address from the Microprocessor. These address bits are buffered and then used to enable the Interface Bus Select Decoder and to address the ROM and RAM locations. In addition, the buffered address bits are decoded to produce control strobes for modulation, attenuation, and serial I/O. The Serial I/O Control changes six bits of parallel data into serial data and clocks this data to the high frequency loop and output section (see BD2), the low frequency loop (see BD3), and the display. It also clocks serial input data from the keyboard to the Microprocessor.

The Reset input starts the Microprocessor from a power-down condition and is used during initial power-up of the instrument, after a power failure has occurred, or after TP12 RESET is momentarily touched to ground (see Service Sheet 17). When the Microprocessor is reset, it enters its power-up subroutine to initialize the instrument.

The Maskable Interrupt Request (IRQ) input to the Microprocessor is used to interrupt program execution. Maskable interrupts occur whenever a key on the keyboard is pressed, a reverse power condition is detected, or an active low is on the rear-panel connector J5 (SEQ). The three maskable interrupts plus the four status conditions (i.e., Over Modulation, Under Modulation, HP-IB Interrupt, and LF Loop Ready) all provide status inputs to the Interrupt Processing circuit which puts the instrument status information on the data bus. The Signal Generator memory consists of 2k bytes of RAM and 32k bytes of ROM. The program used to control the operation of the Signal Generator is stored in the ROM.

All HP-IB data input/output, control, and handshake signals are buffered before being applied to the HP-IB General Purpose Interface Adapter.

##### A2 Display Assembly

Sixteen bits of serial display data (DDA) are sent from the Microprocessor to the Display Address and Data Shift Registers. Six of the bits are decoded to produce the twelve display strobes and two keyboard strobes. The keyboard strobes are used to strobe column and row data from the keyboard while the display strobes are used to strobe modulation, frequency, and amplitude display data into their respective control drivers and latches. The display data is decoded and latched to drive the applicable 7-segment display or LED annunciator.

## TROUBLESHOOTING

### General

Procedures for checking the Microprocessor, Keyboard, and Display sections of the instrument are given below. The blocks or points to check are marked on the block diagram by a hexagon with a check mark and a number inside, for example,  $\sqrt{3}$

### Troubleshooting Help

- Block Diagram 1
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustments

### Test Equipment

HP-IB Controller .....	Any
HB-IB Interface .....	Any
Measuring Receiver .....	HP 8902A

### $\sqrt{1}$ Power-On Sequence

1. Press the POWER switch from STBY to ON to initiate an internal memory check. This check tests for a failure in ROM (Read Only Memory) and in RAM (Random Access Memory). During this check, all front-panel indicators light for approximately 1.5 seconds to provide a quick visual inspection of each front-panel annunciator and display segment. All the display segments will display the number eight except the most significant AMPLITUDE digit which will be a number one. If a memory failure is detected, a RAM or ROM error code will be displayed in the FREQUENCY Display window. The error code remains displayed until any front-panel key is pressed. Refer to Table 1 for a listing of the Power-On Error Codes. If the memory check was successful, the front-panel indicators will display the frequency, amplitude and modulation settings as when the instrument was last ON.

Table 1. Power-On Error Codes.

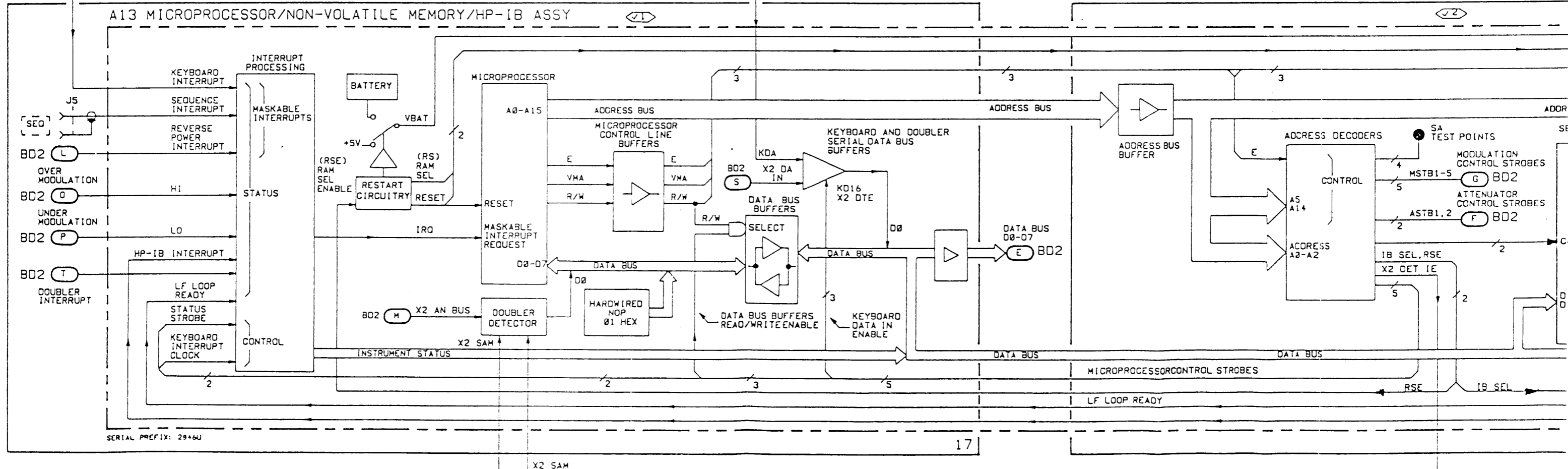
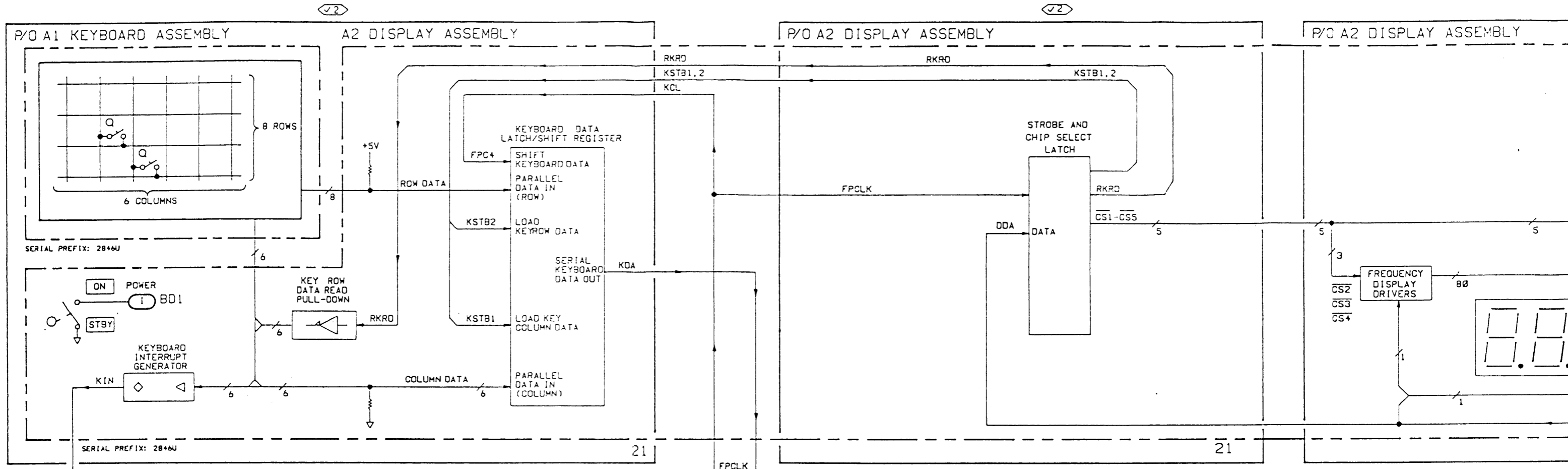
Error Code	Faulty Device	Location
1000	RAM Error	A13-U24
0100	ROM1 Error	A13-U25
0010	ROM2 Error	A13-U26
0001	ROM3 Error	A13-U27

If the power-on sequence was not completed successfully, see Troubleshooting for Service Sheets 17 and 19.

**√2 Keyboard and HP-IB Checks**

1. Connect the measuring receiver to the Signal Generator's RF OUTPUT connector.
2. Connect the HP-IB controller to the Signal Generator's HP-IB connector.
3. Enter modulation, frequency and amplitude data from the Signal Generator's keyboard and from the controller.
  - a. If the RF output modes follow the data entered, but one or more of the displays do not, go to Service Sheets 21 and 22 or 23. Troubleshoot the appropriate strobes, latches, drivers and displays.
  - b. If the displays follow the data entered but one or more of the RF output modes do not, go to the Troubleshooting sections for Block Diagram 2, Block Diagram 3, or Service Sheet 18.
  - c. If the output modes and displays follow data entered from the keyboard but not the HP-IB controller, go to Service Sheet 20 Troubleshooting .
  - d. If the output and displays follow data entered from the HP-IB controller but not the keyboard, go to Service Sheet 21 Troubleshooting.





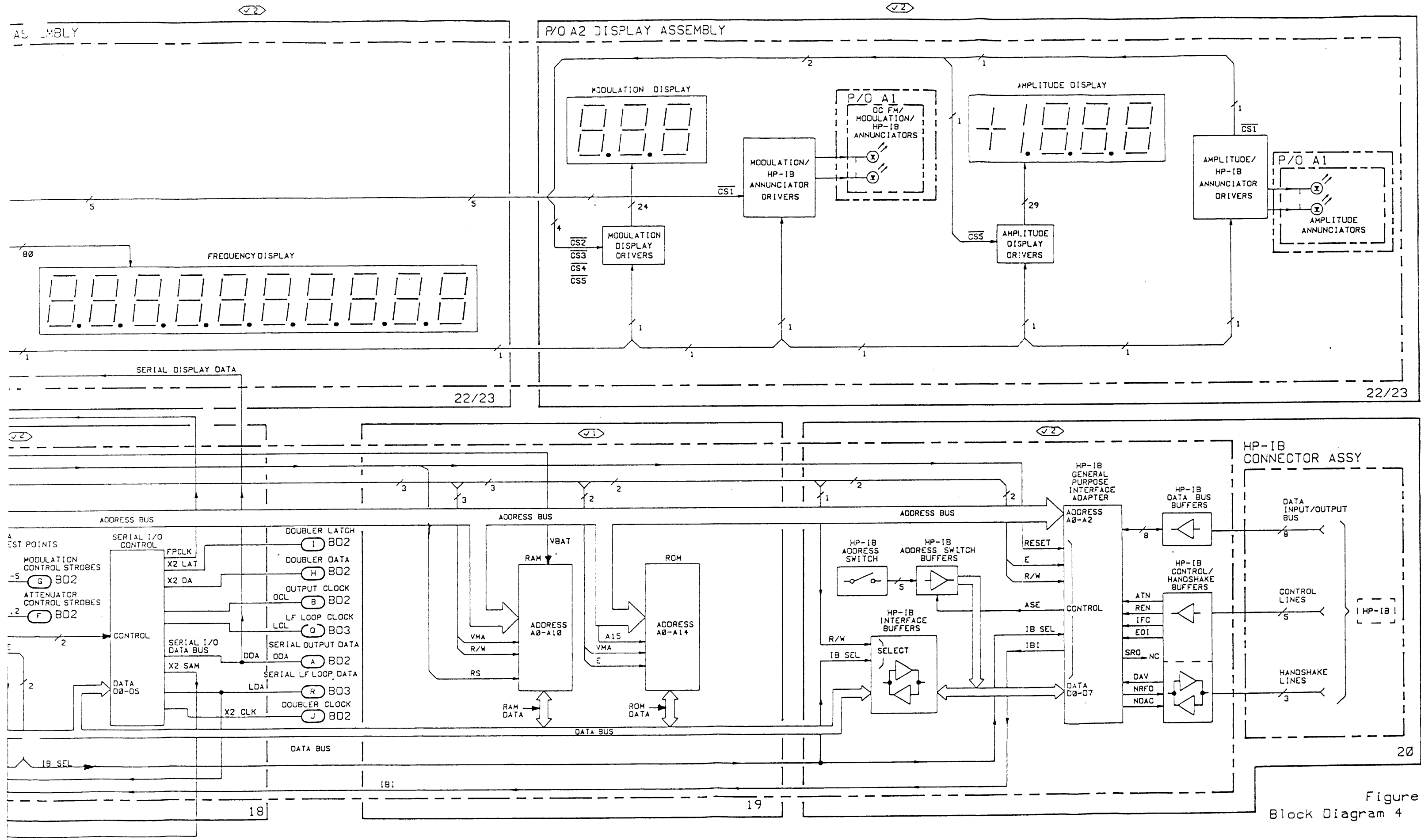


Figure 1  
Block Diagram 4

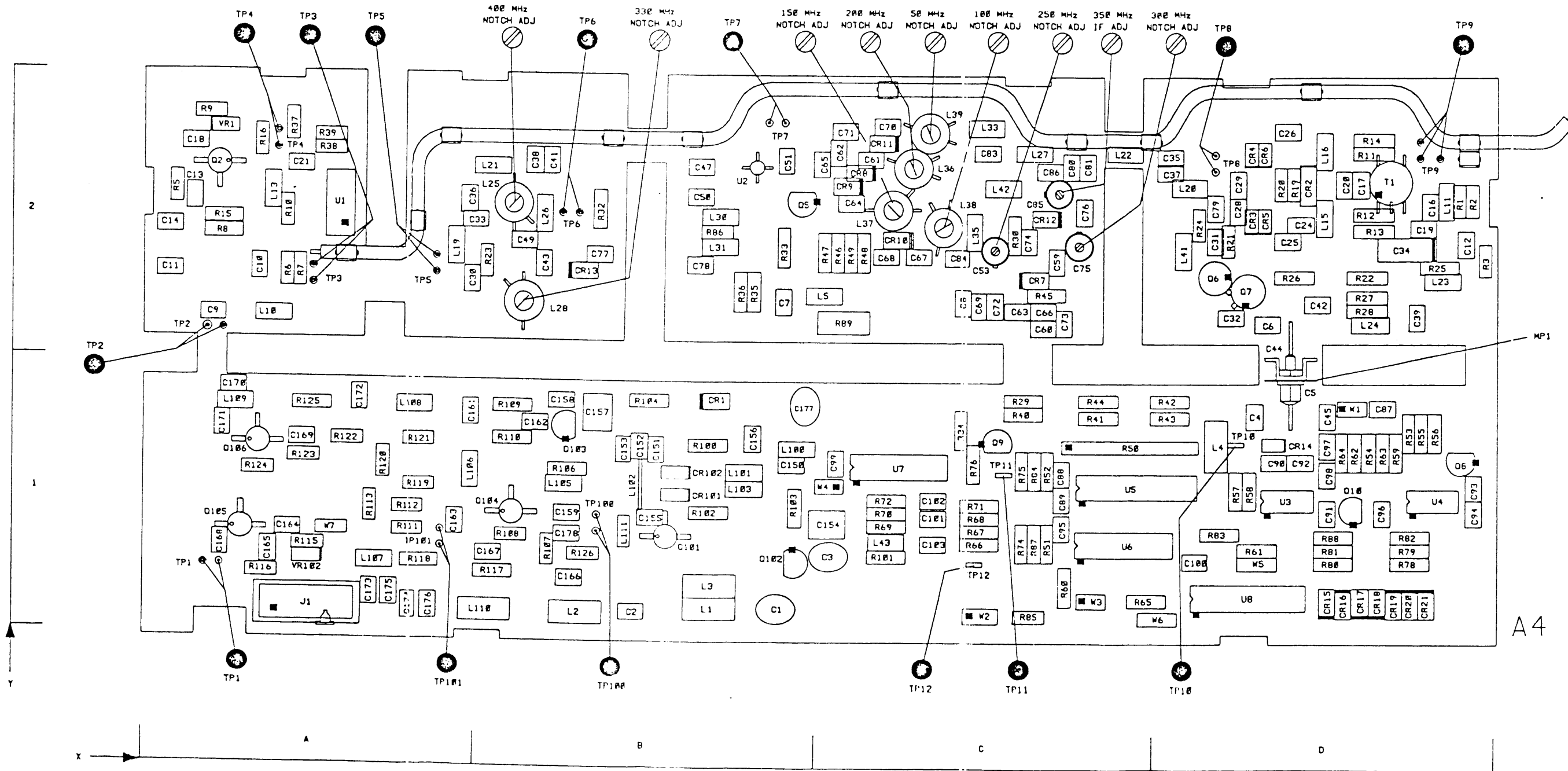
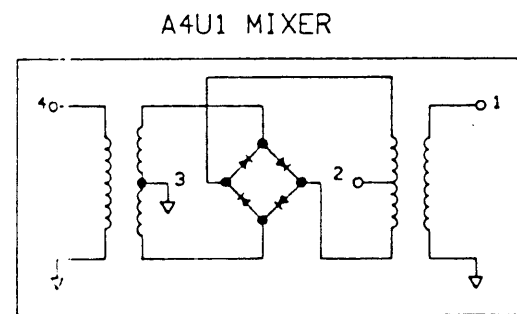
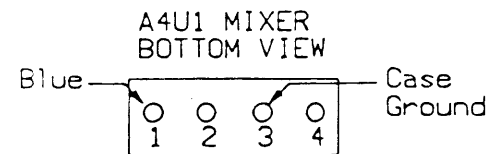


Figure 0. Service Sheet 1 Information.

Component Locator

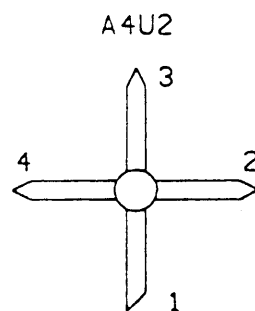
NOTES

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. Chassis ground is achieved by mechanical contact through nuts holding PC board to frame.
3. Chassis ground is represented as  $\text{---}\nabla$ .
4. Printed circuit trace inductor.
5. Bottom view and schematic diagram of A4U1 are as follows:

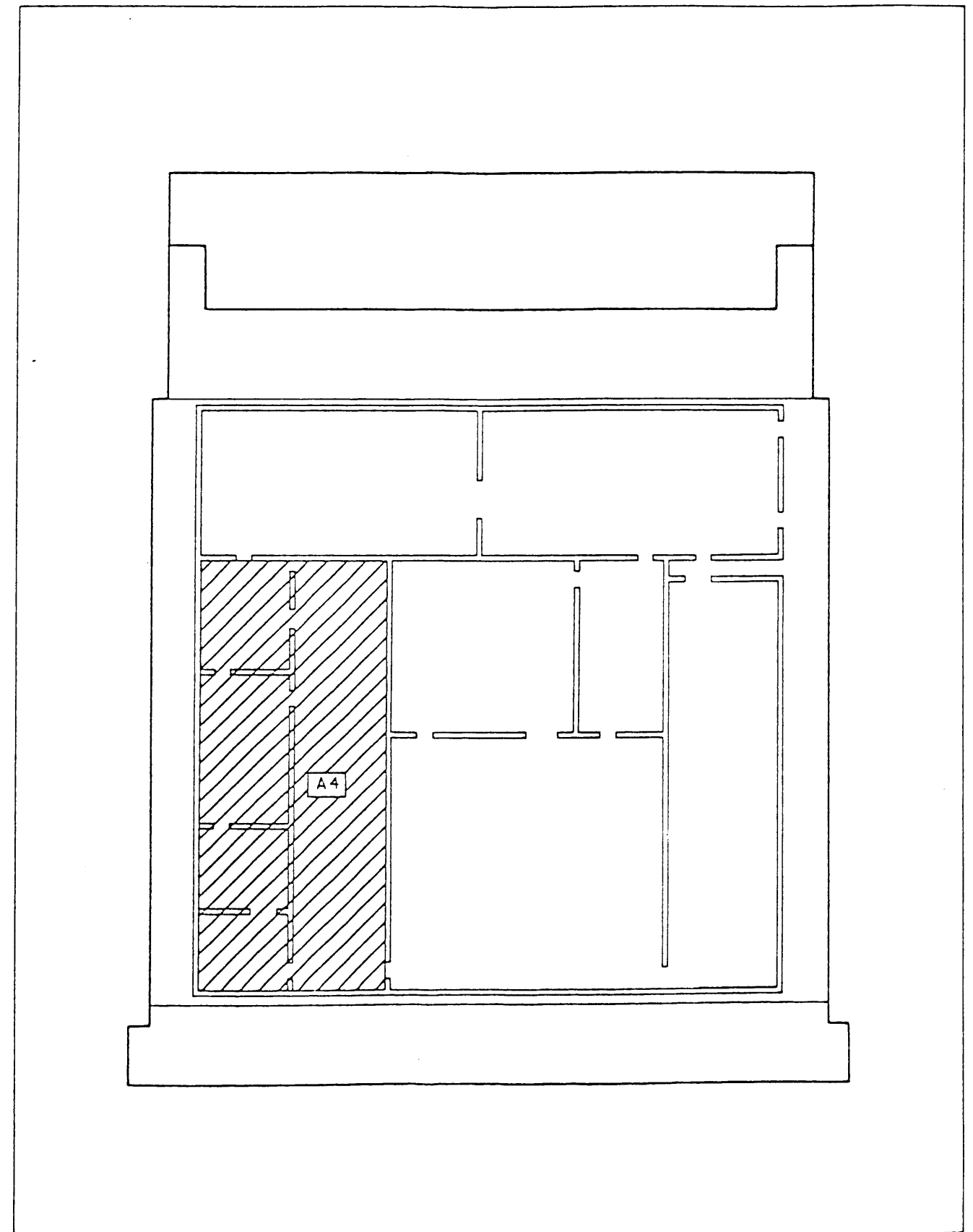


6. The mismatch caused by inserting a 50 ohm impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is more than 3 dB, at others less than 3 dB

\* Indicates factory selected part. Typical value shown. Refer to Section 5 for selection procedure.



MICROPROCESSOR, KEYBOARD  
AND DISPLAY SECTION  
SEE REVERSE SIDE **BD4**



## Service Sheet 1

### HIGH FREQUENCY OSCILLATOR AND IF

#### PRINCIPLES OF OPERATION

##### General

The Voltage Controlled Oscillator (VCO) oscillates over a range of 520 to 1040 MHz. It is tuned over this range by a  $-7.5V$  to  $+12V$  signal. The output signal passes through a resistor power splitter and is coupled to Buffer Amplifier No. 3 to lock the High Frequency Loop and Buffer Amplifier No. 2 to the Output Assembly's RF Dividers. When the RF is turned OFF at the front panel or over HP-IB,  $+15V$  to the oscillator is switched OFF. The HF Loop VCO Buffer Amplifiers No. 1, No. 2 and No. 3 are disabled.

Within the High Frequency Loop, the VCO signal is mixed with the phase locked signal (690 to 740 MHz). As the VCO is searching for its lock point, the mixer generated sidebands pass through a bank of selectable notch filters. The appropriate filter is turned off thus allowing the selected Intermediate Frequency (IF) to pass. The sampling bridge phase-compares the IF Frequency (a multiple of 50 MHz) with a 50 MHz reference signal. When the correct IF Frequency appears at the sampling bridge, the output from the Loop Amplifier (which up to now has been a continuously changing voltage) becomes a fixed voltage. This voltage sets the High Frequency Loop phase lock point. For more information, refer to Service Sheet 2.

##### Voltage Controlled Oscillator

The tune voltage ramp and the phase lock voltage are supplied to varicaps CR101 and CR102 by the Loop Amplifier in conjunction with the Sideband Select and Loop Amplifier Ramp controls. This voltage is coupled into the VCO by the low-pass filter composed of L100, L101 and C150. The low-pass filter also isolates the VCO. Varicaps CR101 and CR102 tune the tank circuit which includes inductor L102. Capacitors C151, C152 and C153 provide RF ground for the tank circuit. Varicap bias voltage of approximately  $-7.5$  Vdc is obtained from voltage divider R102, R103 and the  $-15V$  (F5) supply. The output of the tank circuit is coupled into the VCO transistor Q101 by capacitor C155. Transistor Q101 is dc biased by R102, R103, and L103. Power Supply variations are filtered by Q102 and capacitor C154 for the  $-15V$  supply and Q103 and capacitor C157 for the  $+15V$  supply. Series inductor L104, Inductor L111, capacitor C178, and resistor R126, provide the necessary load for the oscillator over its frequency range 520 MHz to 1040 MHz to prevent spurious oscillations. Capacitors C156 and C158 bypass RF frequencies and power supply noise to ground. Power supply noise or other noise will frequency modulate the oscillator output.

##### Buffer Amplifier No. 1

Output of the VCO is coupled to the base of Buffer Amplifier No. 1, Q104, by capacitor C159. High frequency transistor Q104 is dc biased by resistor R107 and R108. The base of Q104 is biased at 0.7V. The output of Q104 is voltage limited. Inductor L106 is an RF choke and capacitors C161 and C162 are RF bypass capacitors.

##### Power Splitter

Output of Q104 is coupled to the resistive Power Splitter R111, R112 and R113 by capacitor C163. There is a 6 dB loss through the Power splitter. One output of the Power Splitter is coupled to Buffer Amplifier No. 2 by C164 and R114. The other output goes through the 4 dB pad R119, R120, R121, and is then coupled to Buffer Amplifier No. 3 by C169 and R122. This output is used to phase lock the VCO.

### Buffer Amplifier No. 2 and Buffer Amplifier No. 3

Output of the Power Splitter is coupled to the base of Buffer Amplifier No. 1, Q105, by capacitor C164 and resistor R114. High frequency transistor Q105 is dc biased by zener diode VR102 and resistor R115. Capacitor C165 provides collector to base feedback. The base of Q105 is biased at 0.7V and the zener diode sets the collector voltage at +5V. The output of Q105 is voltage limited. Inductor L107 is an RF choke and capacitors C160 and C167 RF by-pass capacitors. Output of the Power Splitter is ac coupled to the base of Buffer Amplifier No. 3, Q106, by capacitor C169 and resistor R122. Q106 is dc biased by resistors R123 and R124. Output is current limited.

### Buffer Amplifier No. 4 / Mixer

Output from Buffer Amplifier No. 3 is ac coupled to the base of Q2, Buffer Amplifier No. 4, through the 1100 MHz Low-Pass Filter composed of L6 through L9, C9 through C11, and C14. Buffer Amplifier No. 4 operates the same as Buffer Amplifier No. 2 but is not a limiter.

The signal, 520 MHz to 1040 MHz, is then ac coupled by C21 to the 2 dB pad and the pad's output is one input of the Mixer U1. The other input of Mixer U1 is a 690 to 740 MHz signal from the Frequency Multiplier Assembly A8. The factory selected pad of resistors R6\*, R7\*, and R10\* is selected to adjust this input to -10 dBm controlling the gain of the loop. The difference frequencies from the Mixer are passed through a 320 MHz Low-Pass Filter which consists of inductors L19, L21, L26 and capacitors C33, C36, C38 and C41. The output of mixer, U1, is terminated by C30 and R23. C43 and L28 form a notch filter tuned to 300 MHz, and C49 and L25 form a notch filter tuned to 400 MHz. The 400 MHz notch filter is adjusted to remove spurious signals. The 300 MHz notch filter adjustment L28 is adjusted with 300 MHz notch filter adjustment C75 to remove 300 MHz signals.

### IF Buffer Amplifier / Notch Filters

Mixer U1 mixes the 520 to 1040 MHz input from the VCO with the 690 to 740 MHz input from the Multiplier Assembly. The 690 to 740 MHz input is tuned so the Mixer's output is a multiple of 50 MHz from 0 MHz (dc voltage) to 300 MHz when the VCO is locked. The Mixer's output functions as a phase detector when both of the inputs are in the 690 to 740 MHz frequency range. The Mixer's output is filtered by the 320 MHz Low Pass Filter and applied to the IF Buffer Amplifier. The Notch Filters select the IF from the Mixer to lock the High Frequency Loop VCO at the correct frequency. Refer to Table 1 for a listing of frequencies. Table 1 can be used to find the IF frequency for any VCO frequency.

For all High Frequency Loop frequencies other than 690 to 740 MHz, the Mixer outputs an IF Frequency that is the frequency difference of the two inputs. The IF Amplifier is biased on to amplify the IF Frequency, frequency difference, by approximately 12 dB. The DC Notch Filter is on to remove dc offset voltages from the Mixer. One of the Notch Filters, 50, 100, 150, 200, 250 or 300 MHz is not selected (turned off). The IF Frequency is selected to lock the VCO at the correct frequency. The DC Notch Select bit, pin 10 of U5 (refer to Service Sheet 2) is a positive voltage (+15V) and biases on Q9. Q9 switches +15V to the gate of Q5 and to U2 to turn them on. When a notch filter control line is set high by the output of Shift Register, U5, (refer Service Sheet 2), the Notch Filter is turned off by biasing on one of the diodes CR7, CR8, CR9, CR10, CR11 or CR15 which shorts out the series capacitor of the Notch Filter C53, C61, C64, C67, C70 or C76. The Notch Filter that is turned off and the Notch Filters that are turned on form a bandpass filter to pass the selected IF frequency. The amplified and filtered IF signal is then compared to the 50 MHz reference by the Sampler to lock the VCO or to correct the VCO's frequency.

At High Frequency Loop VCO frequencies of 690 to 740 MHz, the Mixer acts as a phase detector. The Mixers output voltage is proportional to the phase difference between the two input signals. The IF Buffer Amplifier, U2, is biased off. The dc Notch Select bit biases off Q9 and the +15V is removed from Q5 and U2 turning them off. The gate of Q5 is grounded through resistors in U2. The dc Notch Filter, Q5, is biased off, and the Notch Filters are not selected (turned off). The dc voltage from the mixer passes through L30 and L33 and is then compared to the 50 MHz reference by the Sampler to lock the VCO or to correct the VCO's frequency.

Table 1. HF Loop and IF Sideband Frequencies.

High Frequency VCO Output (MHz)	Difference Frequencies from Mixing LF Loop Output and 800 MHz (MHz)	'Not Selected' IF Sideband (MHz)
520 to 540	720 to 740	-200
540 to 590	690 to 740	-150
590 to 640	690 to 740	-100
640 to 690	690 to 740	-50
690 to 740	690 to 740	dc
740 to 790	690 to 740	+50
790 to 840	690 to 740	+100
840 to 890	690 to 740	+150
890 to 940	690 to 740	+200
940 to 990	690 to 740	+250
990 to 1040	690 to 740	+300

The 350 MHz Notch Filter C85, C86 and C40 filter any 350 MHz spurious signals. The bias supply voltage to U2 and Q5 is filtered by low pass filter C8, L5 and C7 to remove any high frequency signals on the supply. Diplexer C50 and R86 is a high frequency match for U2's input. Inductors L 30 and L 33 are RF chokes and block high frequency signals from passing through the DC path.

### Sampling Bridge and Pulse Generator

The output of the IF Buffer Amplifier and Notch Filters or the DC Notch Filter is the input to be sampled by the Sampling Bridge. The 50, 100, 150, 200, 250 or 300 MHz IF frequency is filtered by the IF Output Filter (L20, L22, L27, C35, C37, C80, and C81). Resistor R24 and capacitors C79 and C31 provide a 50 ohm impedance looking into the Sampling Bridge. Capacitor C29 and inductor L41 decreases the input level to the sampling bridge when the IF frequency is 50 MHz.

The 50 MHz Reference Oscillator drives the Sampling Bridge. The 50 MHz, +7.8 to +11.8 dBm reference signal is applied to transformer T1. Resistors R1, R2 and R3 form a 2 dB pad and inductor L11 and capacitor C12 are used for impedance matching. T1 is the input to the Pulse Generator where 50 MHz pulses are generated by biasing the step recovery diode CR2 on and off. When CR2 is biased off, inductors L15 and L16 turn the Sampling Bridge on for 1.5 ns. The IF input to the Sampling Bridge is sampled every 20 ns for 1.5 ns.

The sampled output is stored in capacitors C28 and C29, and the dc voltage is applied to the 13 MHz Low-Pass Filter through R27. When the level of the voltage from the sampler is changing at a rate greater than 80 Hz, the voltage is coupled through C29 and C34 to the 13 MHz Low-Pass Filter. FET Q6 provides a high impedance for the sampling bridge to drive, and transistor Q7 provides a low impedance output to drive the 13 MHz Low-Pass Filter. The Sampler Amplifier, which consists of Q6 and Q7, is a voltage follower feedback amplifier which functions to increase the bandwidth of the sampler. Transistor Q7 and FET Q6 are always turned on. Approximately 5 mA flows through R22 and Q6 providing 0.6 Vdc between the base and emitter to bias Q7 on. The sampled voltage is stored in capacitor C29 and C28 which is connected to the gate of Q6. For a small voltage change on the gate of Q6 more current must go through R26 to produce the voltage change at the collector-source junction of Q6 and Q7. A portion of the current is supplied by Q6 and the remainder is collector current from Q7. This voltage change is also coupled through C16 to increase the sampler bandwidth.

## TROUBLESHOOTING

Procedures for checking circuits of the A5 High Frequency Oscillator Assembly and P/O A4 High Frequency Loop Assembly are given below. The areas or points to check are marked on the schematic by a hexagon with a checkmark and a number inside, for example,  $\checkmark 1$ . Fixed voltages are shown on the schematic inside a hexagon, for example,  $2V \pm 0.2V$ . Transistor bias voltages are shown without tolerances.

### Troubleshooting Help

Block Diagram 2

Table 4-1. Abbreviated Performance Tests

Table 5-2. Post-Repair Adjustments

### Test Equipment

Measuring Receiver .....	HP 8902A
Sensor Module .....	HP 11722A
Digital Multimeter .....	HP 3466A
Frequency Counter .....	HP 5328A
Adapter Probe .....	HP 1250-1598
Adapter N(f) to BNC(m) .....	HP 1250-0077
Adapter BNC(f) to BNC(f) .....	HP 1250-0080
Cable BNC(m) to SMC (f) .....	HP 08662-60075

### $\checkmark 1$ Voltage Tuned Oscillator Check

1. Check the bias voltages on A4Q101.
2. Connect the frequency counter to A4TP100 using the appropriate cables and adapters.
3. Connect the frequency counter's time base to the Signal Generator's TIME BASE INPUT.
4. Set the Signal Generator as follows:

Frequency .....	520 MHz
Amplitude .....	-10 dBm
Modulation .....	Off

5. Verify that the oscillator frequency is within  $\pm 1000$  Hz, and that the VCO tune voltage is within tolerance for each frequency shown in Table 2.

#### NOTE

*If the signal generator does not lock up, or locks to the wrong frequency, a variable dc power supply (HP 6200B or equivalent) can be used to tune the VCO. This allow you to continue with the troubleshooting checks.*

*Disconnect A4W4 (VCO Tune) and connect the power supply to A4L100. VCO frequency versus tune voltage must be within the range specified in Table 2. In addition, to check the A4 IF section, the front panel setting must correspond to the tuned VCO frequency  $\pm 1$  MHz (for example, if the front panel setting is 520 MHz, VCO frequency must be 520 MHz  $\pm 1$  MHz).*



Table 2. VCO Frequency versus Tune Voltage.

Oscillator Frequency (MHz)	Typical Tune* Voltage (Vdc)	Tune Voltage* Tolerance (Vdc)
520.0000	-6.127	-6.5 to -5.6
530.0000	-5.912	-6.3 to -5.4
540.0000	-5.688	-6.1 to -5.6
550.0000	-5.450	-5.9 to -5.0
715.0000	-0.905	-3.0 to +2.5
990.0000	+6.945	+2.5 to +12
1040.000	+9.580	+5.5 to +14

\* Voltage measured at TUNE signal location (A4W4).

**√2 Buffer Amplifier No. 1, No. 2, and No. 3**

1. Check the bias voltages on transistors A4Q104, A4Q105, and A4Q106.
2. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... Off

3. Set the measuring receiver with the sensor module precalibrated as follows:

Measurement..... RF POWER  
 Display..... LOG

4. Zero the measuring receiver and wait for the zero LED to go out.

**NOTE**

*The mismatch caused by insertion of the 50 ohm input impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is 3 dB, and at others it can be less or greater than 3 dB.*

5. Connect the sensor module to the test points indicated in Table 3 by using the appropriate cables and adapters. Verify that the power levels are correct.

Table 3. Buffer Amplifier No. 1, No. 2, and No. 3 Power Levels.

Test Point	Power Level (dBm)		Circuit Opened By*
	Closed Circuit	Open Circuit	
A4TP101	+9.2 to +1.5	+13.0 to +5.0	Remove A4R111 and A4R112
A4TP1	+9.0 to +2.0	+14.5 to +8.5	Remove jumper to A6
A4TP2	+5.0 to -3.0	+6.0 to -1.0	Remove A4C9, C10, C11 and C14

\* The circuit is opened by unsoldering one end of the component(s) or jumpers and lifting the unsoldered end from the printed circuit board.

**√3 Buffer Amplifier No. 4 and IF Mixer Input**

1. Check the bias voltages on A4Q2
2. Set the Signal Generator as follows:
  - Frequency..... 520 MHz
  - Amplitude..... -10 dBm
  - Modulation..... Off
3. Set the measuring receiver with the sensor module precalibrated as follows:
  - Measurement..... RF POWER
  - Display..... LOG
4. Zero the measuring receiver and wait for the zero LED to go out.
5. Connect the sensor module to the test points indicated in Table 4 by using the appropriate cables and adapters. Verify that the power levels are correct.

*Table 4. Buffer Amplifier No. 4 and IF Mixer Input Power Levels.*

Test Point	Power Level (dBm)		Circuit Opened By*
	Closed Circuit	Open Circuit	
A4TP3	-2.0 to -10.0	+1.0 to -7.5	Remove A4R6 and R7
A4TP4	+9.5 to +2.5	+14.0 to +8.2	Remove A4R37 and R38

\* The circuit is opened by unsoldering one end of the component(s) or jumpers and lifting the unsoldered end from the printed circuit board.

**√4 320 MHz Low-Pass IF Input Filter**

1. Set the Signal Generator as follows:
  - Frequency..... 520 MHz
  - Amplitude..... -10 dBm
  - Modulation..... Off
2. Set the measuring receiver with the sensor module precalibrated as follows:
  - Measurement..... RF POWER
  - Display..... LOG
3. Zero the measuring receiver and wait for the zero LED to go out.
4. Connect the sensor module to the test points indicated in Table 5 by using the appropriate cables and adapters. Verify that the power levels are correct.

**NOTE**

*When power levels at TP5 and TP6 are measured using a spectrum analyzer, the levels will be approximately 7 dB below the power level shown in Table 5. The HP 11722A Sensor Module is a wideband detector and measures all the outputs from the mixer U1.*

Table 5. IF Input Filter Power Levels.

Test Point	Power Level (dBm)		Circuit Opened By*
	Closed Circuit	Open Circuit	
A4TP5	-14.0 to -20.0	-12.0 to -17.5	Disconnect A4C30, L19
A4TP6	-20.0 to -24.0	-17.5 to -22.5	Disconnect A4C47, C50, L30

\* The circuit is opened by unsoldering one end of the component(s) or jumpers and lifting the unsoldered end from the printed circuit board.

**√5 IF Buffer Amplifier**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... Off

2. Measure and verify the voltages shown at A4U2 for the frequencies indicated in Table 6.

Table 6. IF Buffer Amplifiers Bias Voltages.

Signal Generator Frequency	Bias Voltages A4U2 (Vdc)	
	Pin 1	Pin 3
520 MHz	+1.6V	+4.7V
700 MHz	0.0V	0.0V

3. Set the measuring receiver with the sensor module precalibrated as follows:

Measurement..... RF Power  
 Display..... Log

4. Connect the sensor module to the test point indicated in Table 7 by using the appropriate cables and adapters. Verify that the power levels are correct for the frequencies indicated.
5. Disconnect the TUNE voltage to the VCO at A4W4. Verify the the voltage at TP8 is 0.000 ±0.005 Vdc.

Table 7. IF Buffer Amplifier Output Power Levels.

Signal Generator Frequency	Power Levels at TP7 (dBm)
520 MHz	-10.0 to -16.0

**√6 Notch Filters**

1. Set the Signal Generator as follows:

Frequency..... 700 MHz  
 Amplitude..... -10 dBm  
 Modulation..... Off

2. Connect the frequency counter to A4TP8 by using the appropriate cables and adapters.
3. Measure and verify the Notch Filter select voltages and IF frequencies as indicated in Table 8.

*Table 8. Notch Filter Select Voltages.*

Signal Generator Frequency (MHz)	Voltage (Vdc) At IF SEL Input							Frequency at A4TP8 (MHz)
	300	250	200	150	100	50	AC	
700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	DC
750	0.0	0.0	0.0	0.0	0.0	12.5	12.5	50
800	0.0	0.0	0.0	0.0	12.5	0.0	12.5	100
850	0.0	0.0	0.0	12.5	0.0	0.0	12.5	150
900	0.0	0.0	12.5	0.0	0.0	0.0	12.5	200
950	0.0	12.5	0.0	0.0	0.0	0.0	12.5	250
1000	12.5	0.0	0.0	0.0	0.0	0.0	12.5	300

**√7 Pulse Generator, Sampling Bridge**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... Off

2. Set the measuring receiver with the sensor module precalibrated as follows:

Measurement..... RF POWER  
 Display..... LOG

3. Zero the measuring receiver and wait for the zero LED to go out.
4. Connect the sensor module to the test points indicated in Table 9 by using the appropriate cables and adapters. Verify that the power levels are correct.
5. Disconnect the VCO Tune voltage at A4W4. Disconnect W1 from the A4 Assembly (refer to Service Sheet 2). Verify that the voltage at the feedthrough A4C44 is 0.000 ±0.010 Vdc.

*Table 9. Pulse Generator and Sampling Bridge Power Levels.*

Test Point	Power Level (dBm)		Circuit Opened By*
	Closed Circuit	Open Circuit	
A4TP8	-9.0 to -15.0	-	-
A4TP9	+10.0 to +5.0	+15.0 to +11.0	Disconnect A4R1, R2

\* The circuit is opened by unsoldering one end of the component(s) and lifting the unsoldered end from the printed circuit board.

A4 Component Coordinates (1 of 2)

COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
C1	B,1	C59	C,2	C151	B,1	CR18	D,1	L106	A,1	R26	D,2
C2	B,1	C60	C,2	C152	B,1	CR19	D,1	L107	A,1	R27	D,2
C3	C,1	C61	C,2	C153	B,1	CR20	D,1	L108	A,1	R28	D,2
C4	D,1	C62	C,2	C154	C,1	CR21	D,1	L109	A,1	R29	C,1
C5	D,1	C63	C,2	C155	B,1	CR101	B,1	L110	B,1	R30	C,2
C6	D,2	C64	C,2	C156	B,1	CR102	B,1	L111	B,1	R32	B,2
C7	B,2	C65	C,2	C157	B,1					R33	B,2
C8	C,2	C66	C,2	C158	B,1	J1	A,1	MP1	D,1	R34	C,1
C9	A,2	C67	C,2	C159	B,1					R35	B,2
C10	A,2	C68	C,2	C161	A,1	L1	B,1	Q2	A,2	R36	B,2
C11	A,2	C69	C,2	C162	B,1	L2	B,1	Q5	B,2	R37	A,2
C12	D,2	C70	C,2	C163	A,1	L3	B,1	Q6	D,2	R38	A,2
C13	A,2	C71	C,2	C164	A,1	L4	D,1	Q7	D,2	R39	A,2
C14	A,2	C72	C,2	C165	A,1	L5	C,2	Q8	D,1	R40	C,1
C16	D,2	C73	C,2	C166	B,1	L10	A,2	Q9	C,1	R41	C,1
C17	D,2	C74	C,2	C167	B,1	L11	D,2	Q10	D,1	R42	D,1
C18	A,2	C75	C,2	C168	A,1	L13	A,2	Q101	B,1	R43	D,1
C19	D,2	C76	C,2	C169	A,1	L15	D,2	Q102	B,1	R44	C,1
C20	D,2	C77	B,2	C170	A,1	L16	D,2	Q103	B,1	R45	C,2
C21	A,2	C78	B,2	C171	A,1	L19	A,2	Q104	B,1	R46	C,2
C24	D,2	C79	D,2	C172	A,1	L20	D,2	Q105	A,1	R47	C,2
C25	D,2	C80	C,2	C173	A,1	L21	B,2	Q106	A,1	R48	C,2
C26	D,2	C81	C,2	C174	A,1	L22	C,2			R49	C,2
C28	D,2	C83	C,2	C175	A,1	L23	D,2	R1	D,2	R50	C,1
C29	D,2	C84	C,2	C176	A,1	L24	D,2	R2	D,2	R51	C,1
C30	A,2	C85	C,2	C177	B,1	L25	B,2	R3	D,2	R52	C,1
C31	D,2	C86	C,2	C178	B,1	L26	B,2	R5	A,2	R53	D,1
C32	D,2	C87	D,1			L27	C,2	R6	A,2	R54	D,1
C33	A,2	C88	C,1	CR1	B,1	L28	B,2	R7	A,2	R55	D,1
C34	D,2	C89	C,1	CR2	D,2	L30	B,2	R8	A,2	R56	D,1
C35	D,2	C90	D,1	CR3	D,2	L31	B,2	R9	A,2	R57	D,1
C36	A,2	C91	D,1	CR4	D,2	L33	C,2	R10	A,2	R58	D,1
C37	D,2	C92	D,1	CR5	D,2	L35	C,2	R11	D,2	R59	D,1
C38	B,2	C93	D,1	CR6	D,2	L36	C,2	R12	D,2	R60	C,1
C39	D,2	C94	D,1	CR7	C,2	L37	C,2	R13	D,2	R61	D,1
C41	B,2	C95	C,1	CR8	C,2	L38	C,2	R14	D,2	R62	D,1
C42	D,2	C96	D,1	CR9	C,2	L39	C,2	R15	A,2	R63	D,1
C43	B,2	C97	D,1	CR10	C,2	L41	D,2	R16	A,2	R64	D,1
C44	D,2	C98	D,1	CR11	C,2	L42	C,2	R19	D,2	R65	C,1
C45	D,1	C99	C,1	CR12	C,2	L43	C,1	R20	D,2	R66	C,1
C47	B,2	C100	D,1	CR13	B,2	L100	B,1	R21	D,2	R67	C,1
C49	B,2	C101	C,1	CR14	D,1	L101	B,1	R22	D,2	R68	C,1
C50	B,2	C102	C,1	CR15	D,1	L102	B,1	R23	B,2	R69	C,1
C51	B,2	C103	C,1	CR16	D,1	L103	B,1	R24	D,2	R70	C,1
C53	C,2	C150	B,1	CR17	D,1	L105	B,1	R25	D,2	R71	C,1

A4 Component Coordinates (2 of 2)

COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
R72	C,1	TP1	A,1						
R74	C,1	TP2	A,2						
R75	C,1	TP3	A,2						
R76	C,1	TP4	A,2						
R78	D,1	TP5	A,2						
R79	D,1	TP6	B,2						
R80	D,1	TP7	B,2						
R81	D,1	TP8	D,2						
R82	D,1	TP9	D,2						
R83	D,1	TP10	D,1						
R84	C,1	TP11	C,1						
R85	C,1	TP12	C,1						
R86	B,2	TP100	B,1						
R87	C,1	TP101	A,1						
R88	D,1								
R89	C,2	U1	A,2						
R100	B,1	U2	B,2						
R101	C,1	U3	D,1						
R102	B,1	U4	D,1						
R103	B,1	U5	C,1						
R104	B,1	U6	C,1						
R106	B,1	U7	C,1						
R107	B,1	U8	D,1						
R108	B,1								
R109	B,1	VR1	A,2						
R110	B,1	VR102	A,1						
R111	A,1								
R112	A,1	W1	D,1						
R113	A,1	W2	C,1						
R115	A,1	W3	C,1						
R116	A,1	W4	C,1						
R117	A,1	W5	D,1						
R118	A,1	W6	D,1						
R119	A,1	W7	A,1						
R120	A,1								
R121	A,1								
R122	A,1								
R123	A,1								
R124	A,1								
R125	A,1								
R126	B,1								
T1	D,2								

### CHANGES

**All serial prefixes**

On the A4 Schematic Diagram:

- L15/16 - Add an asterix to these parts to indicate that they are select on test parts.

**2928U and above**

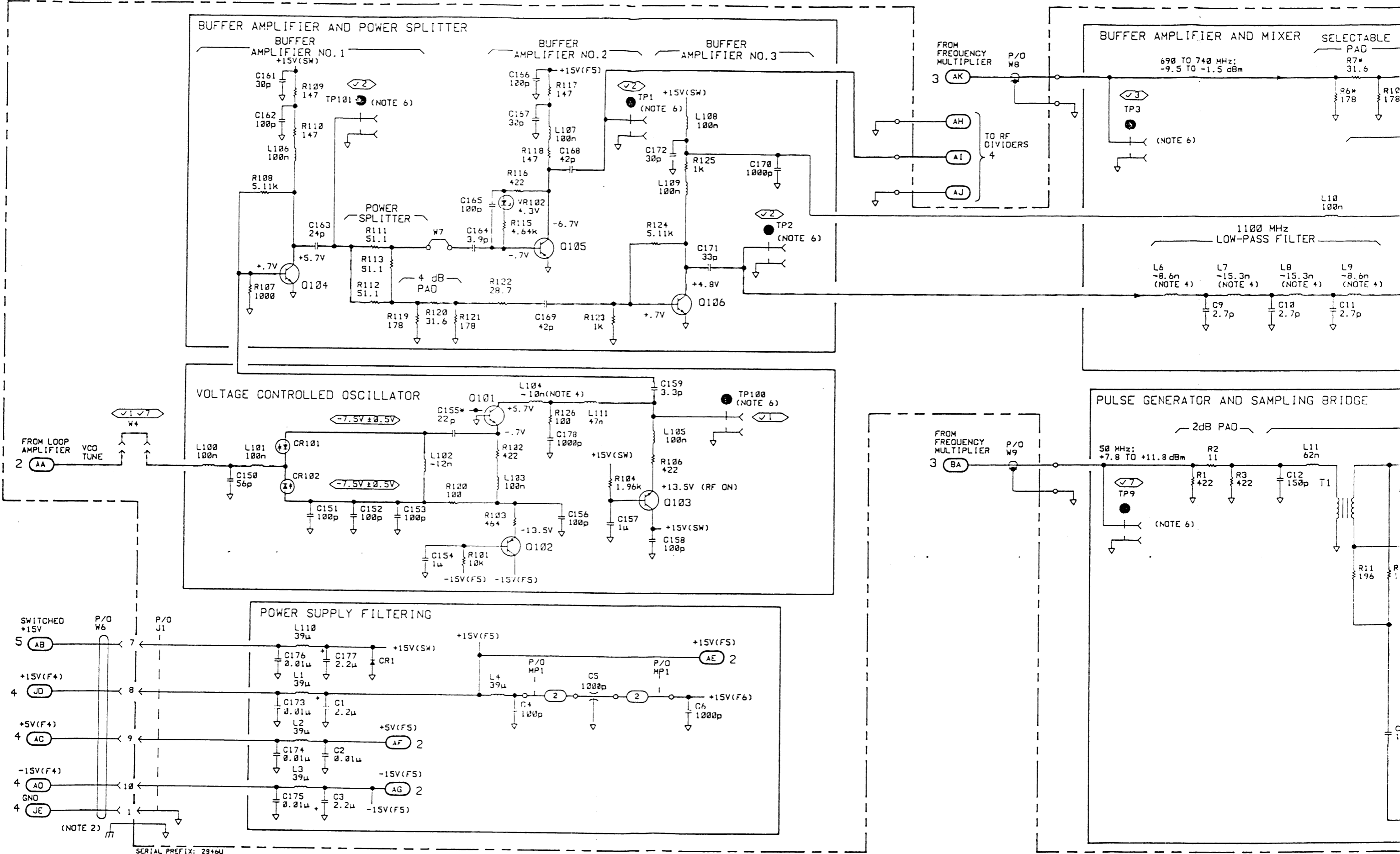
On the A4 Schematic

- R118 - Change the value to  $0\Omega$
- L101 - Change the value to  $1\mu\text{H}$
- C30 - Change the value to  $68\text{P}$





P/O A4 HIGH FREQUENCY LOOP ASSEMBLY (08657-60102)



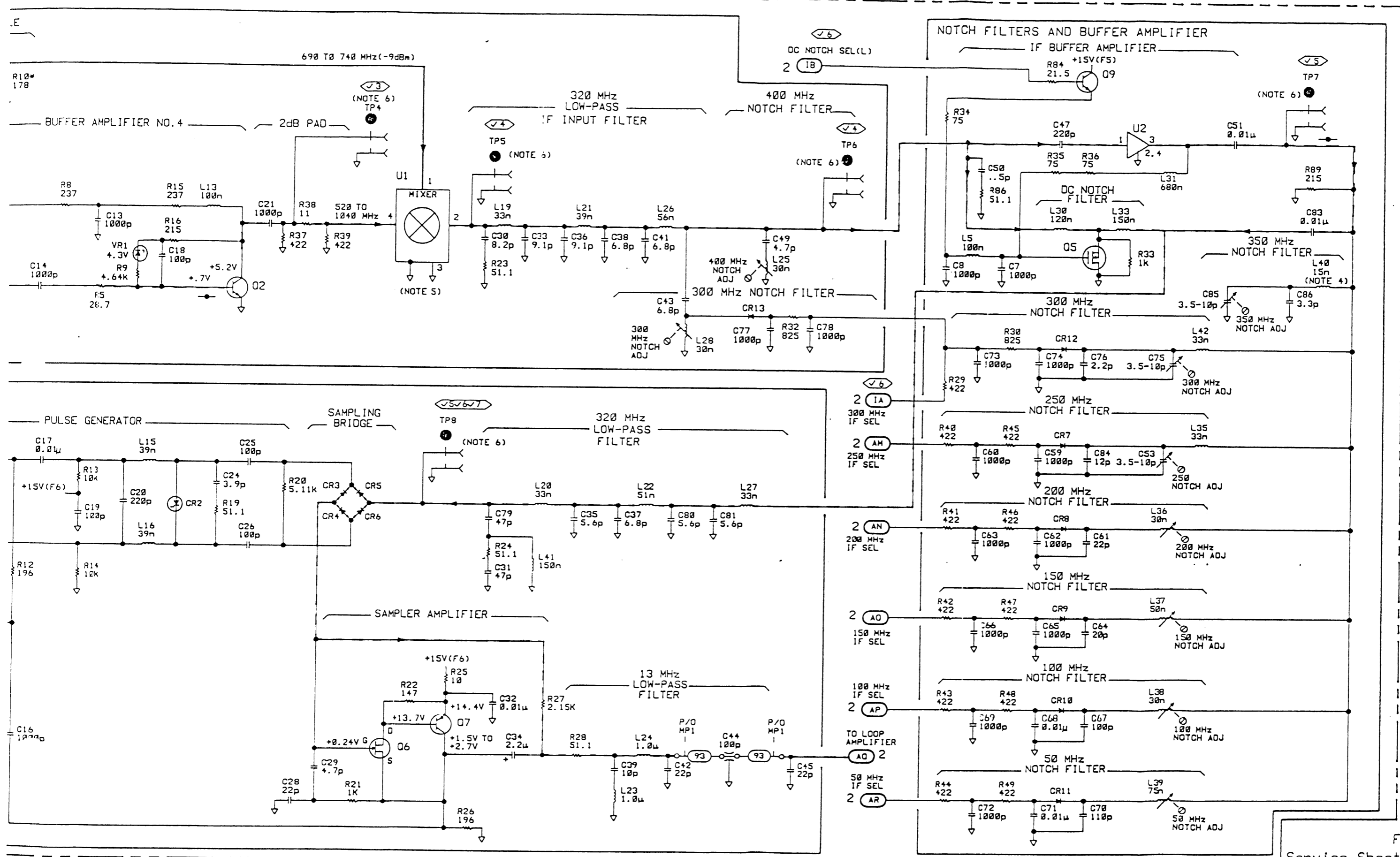


Figure-1  
Service Sheet 1 11

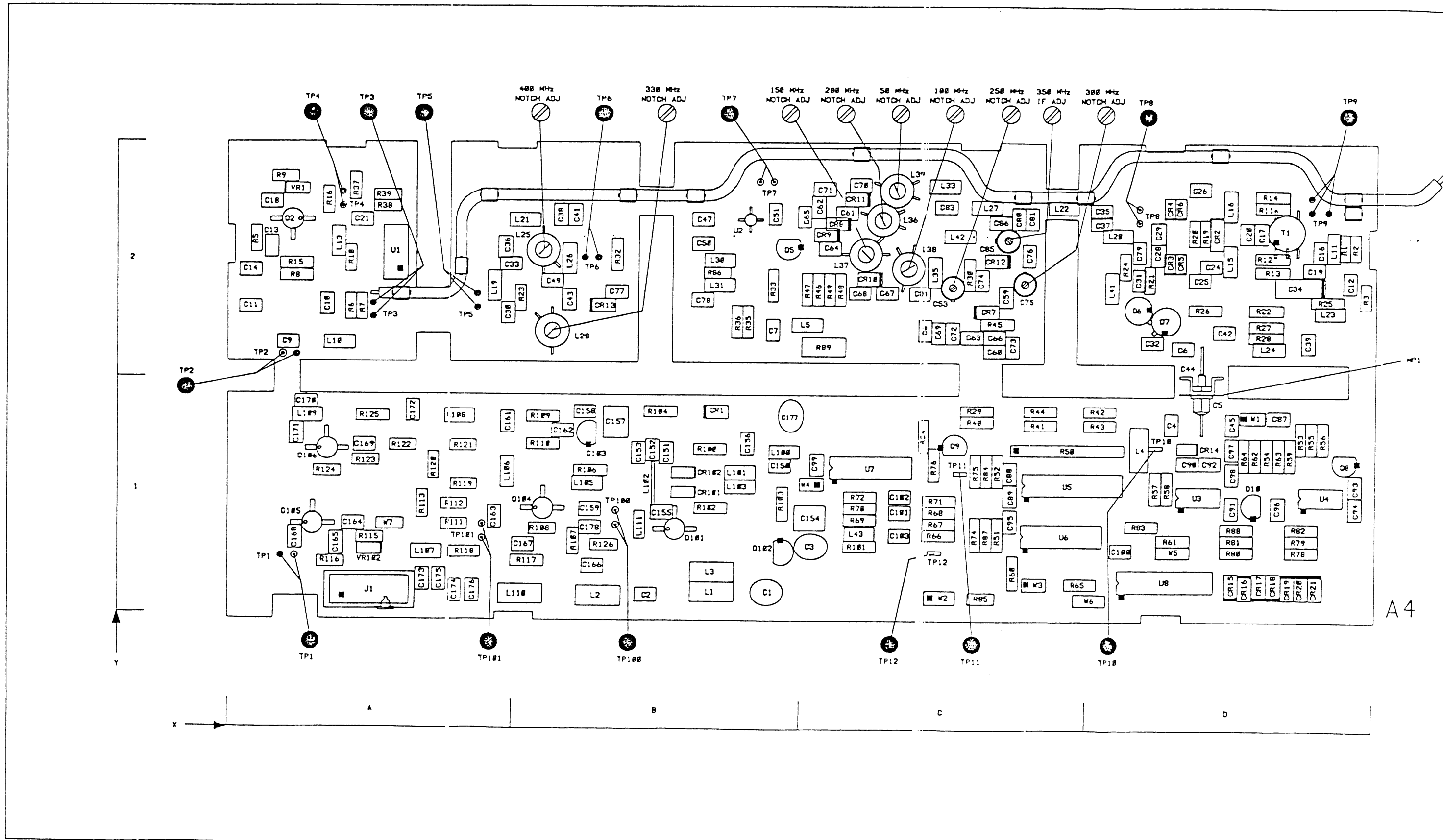


Figure 0. Service Sheet 2 Information

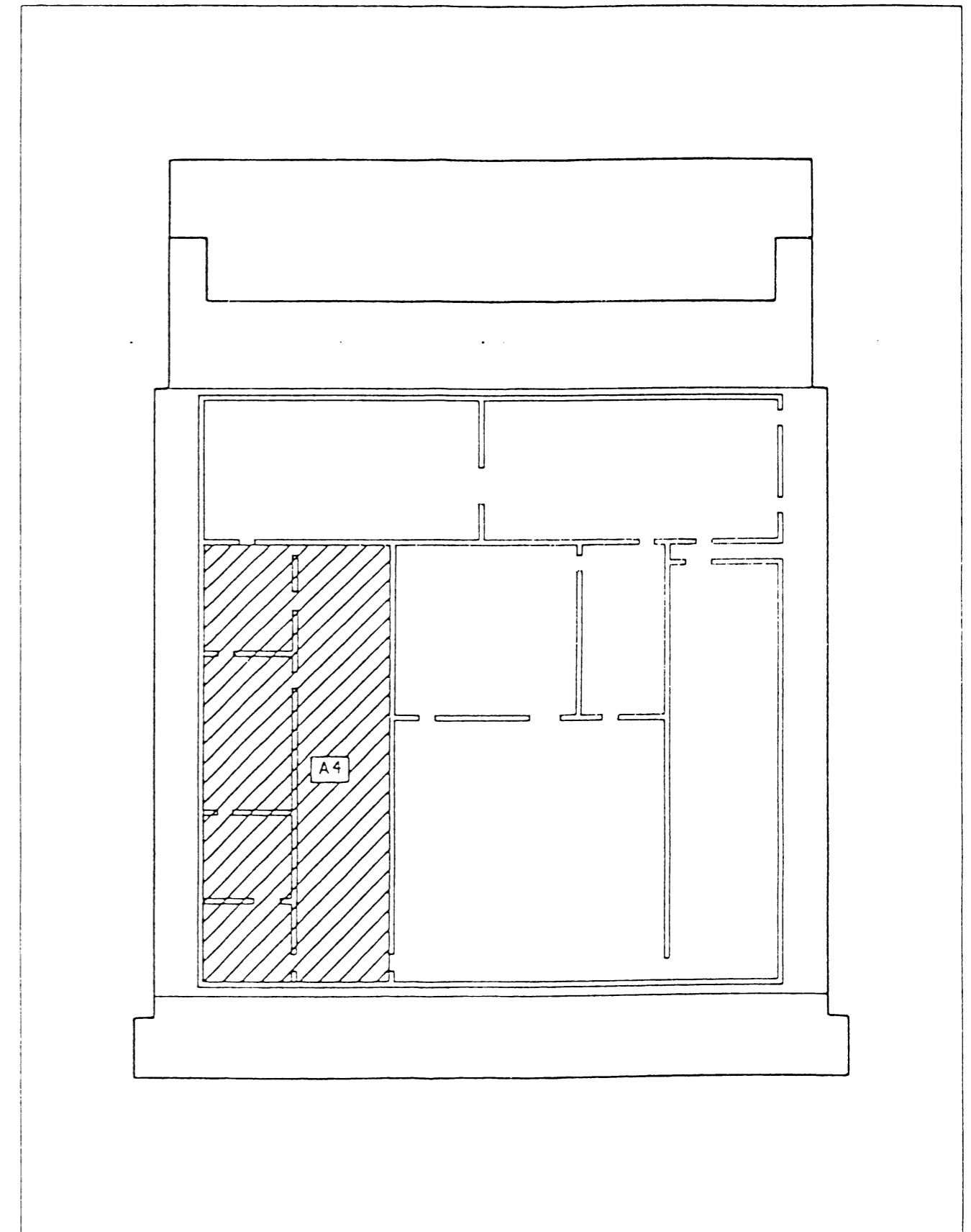
Component Locator

NOTES

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. Chassis ground is achieved by mechanical contact through nuts holding PC board to frame.

LOGIC LEVELS

	TTL	CMOS
HIGH	2V	3.5V
LOW	0.8V	1.5V
IS MORE NEG. THAN IS MORE POS. THAN		
OPEN	HIGH	UNDEF.
GROUND	LOW	LOW



P/O A4 HIGH FREQUENCY LOOP SS1  
SEE REVERSE SIDE

## Service Sheet 2

### HIGH FREQUENCY LOOP AMPLIFIER AND CONTROL

#### PRINCIPLES OF OPERATION

##### General

Latched data in the High Frequency Loop Data Shift Register will select the Notch Filters (refer to Service Sheet 1), the Gain Compensation, and the Sideband that the High Frequency Loop will lock on.

A High Frequency Loop Lock cycle is started by the SDA input from the Microprocessor Assembly or the Out-Of-Lock Detector by triggering the High Frequency Loop One-Shot. The High Frequency Loop One-Shot output pulse causes the Side Band Select Control and Loop Amplifier Ramp Control to ramp the Loop Amplifier to its Maximum voltage. When the High Frequency Loop One-Shot times out, the Loop Amplifier voltage will ramp down. As the voltage ramps down, the High Frequency Loop VCO's frequency will sweep from high, 1040 MHz, to low, 520 MHz. During this sweep, the VCO's frequency will pass through a valid High Frequency Loop lock point. At the lock point, the Sampler will output a beatnote. The beatnote is amplified and detected by the Beatnote Detector. The Beatnote Detector outputs a clock pulse to the Side Band Select Control to terminate the Loop Amplifier's voltage ramp at the lock point. See Figure 1.

##### Beatnote Amplifier

When the VCO frequency is swept over its frequency range and a lock point is encountered, a beatnote will be generated by the Sampler. The beatnote starts out as a high frequency sine wave that decreases in frequency and increases in amplitude. See Figure 1, High Frequency Loop Control Timing Diagram. The beatnote from the sampler is amplified by the Beatnote Amplifier, U3, and is applied to the Beatnote Detector, U7C.

Capacitor C87 and resistor R53 are a high pass filter to couple the beatnote into the amplifier. The amplifier voltage gain is set by R57 and R58. C90 and C91 are power supply bypass capacitors.

##### Beatnote Detector

The Beatnote Detector senses the presence of a valid beatnote and generates a negative going pulse to clock the sideband select control flip-flops U8A and U8B.

Diode CR14 and capacitor C92 detect the positive peak of the beatnote sine wave from the amplifier and converts it to a positive voltage. The voltage is applied through resistor R66 to the negative input of comparator U7C. When the voltage at the negative input becomes greater than the threshold level set at the positive input, the comparator output goes low (0V). The comparator's threshold voltage is set by R67, R68, R87, and the comparator's output. When the comparator output is high (no beatnote), the threshold level at U7C pin 9 is set to approximately 0.2V by resistors R67, R68, and R87. When the comparator output is low (beatnote detected), the threshold level is set to approximately 0V because no current flows through R67 and R87. This hysteresis in the threshold level prevents the comparator from going back high until the voltage level from the detector has returned to 0V. (The low-going output pulse from the comparator is referred to as the birdie pulse.) This birdie pulse clocks the Side Band Select Logic Control, U8A pin 1 and U8B pin 13.

## Ramp Timing Control

When the instrument's frequency is changed, a 1 ms SDA strobe pulse from the microprocessor, is applied to the High Frequency Loop One-Shot U6 pin 2. This strobe pulse starts the lock-up procedure for the loop.

The strobe pulse triggers the High Frequency Loop One-Shot, a high to low 1.5 ms pulse is generated. The pulse is applied to the Loop Amplifier Ramp Control ramp-up circuitry and the Reset inputs of the Sideband Select Control flip-flops U8A and U8B. R60 and C95 set the one-shot pulse width. R65 is a pull-up for the one-shot not Q output.

The negative pulse turns off diodes CR15, CR16, and CR17. When these diodes are turned off, CR18 turns on and applies a negative voltage  $-15V$  through R78 to the negative input of Loop Amplifier U4. This negative voltage causes the output voltage of the Loop Amplifier (integrator) to ramp up. The negative pulse from the one-shot applied to the Reset inputs of flip-flops U8A and U8B causes the Sideband Select Control's Q outputs goes Low and not Q outputs goes high.

The high not Q output at U8B pin 7 does three things. It turns on transistor Q8 sideband switch which grounds the positive input to the Loop Amplifier U4. This removes the Sampler signal from the loop amplifier. Transistor Q10 is also turned on and provides a path to ground for capacitors C98 and C34 (refer to Service Sheet 1) to prevent any charge from being developed on the capacitors when the tune voltage is changing. Also, the output not Q high turns on CR19 forming a voltage divider between R79 and R81 which turns off CR20. When CR20 is off, CR21 turns on and applies  $+15V$  through R80 to the negative input of the Loop Amplifier U4. Normally a positive voltage would cause the amplifier to ramp downward. However, when CR21 first turns on, CR18 is also turned on. Since the resistance of R78 is less than that of R80, the net effect is that the Loop Amplifier's output continues to ramp up. The amplifier will continue to ramp up until the positive rail of the op-amp is reached,  $+14V$ . The amplifier will remain railed to the high side until the one-shot U6 times-out and its output goes high. At this time CR15, CR16, and CR17 turn on and CR18 turns off. CR21 is still on which causes the loop amplifier's output voltage to ramp down. At this time, the Side Band Select Control is active and determines the proper sideband to lock the High Frequency Loop.

## Sideband Select Control/Loop Amplifier Ramp Control

The Side Band Select Control determines if the High Frequency VCO locks at a frequency above or below 715 MHz. When the VCO's frequency is greater than 940 MHz, the 250 MHz or 300 MHz IFs are used to lock the loop. The loop can only lock on the upper sideband in these two IFs. When the VCO's frequency is 940 MHz or less, the 50, 100, 150 or 200 MHz IFs are used to lock the loop, and the loop can lock on the upper or lower sideband. Therefore, in the lower four IFs there are two lock points, one above the VCO frequency of 715 MHz and one below the VCO frequency of 715 MHz. When an IF frequency is passed by the Notch Filters, the correct sideband is selected by the data bit at pin 1 of Shift Register U5. If the data bit is low, the loop is to lock on the upper sideband. If data bit is high, the loop is to lock on the lower sideband. R51 and R52 convert the voltage at U5 pin 1 to TTL levels which drives the set input of U8A at pin 4.

When the Ramp Timing Control High Frequency One-Shot U6 times-out (pulse goes from low to high), the Side Band Control logic flip-flops, U8A and U8B, have been Reset by the Low pulse and the Loop Amplifier, U4, output voltage is approximately  $+14V$ . When the Reset inputs at U8A pin 15 and at U8B pin 14 are high, the Side Band Select Control becomes active to select the correct sideband for the loop to lock. The high not Q output of U6 also turns diodes CR15, CR16 and CR17 on which turns CR18 off. U8B's not Q output at pin 7 is high. Diode CR19 is on, CR20 is off, and CR21 is on. With CR21 turned on, the Loop Amplifier's output voltage (VCO's tune voltage) starts ramping down. The VCO's frequency is tuned from high, 1040 MHz, to low, 520 MHz. As the VCO frequency goes through a valid lock point, a birdie is generated by the Beatnote Detector U7C from the sampler input and applied to the CLK inputs of the flip-flops U8A and U8B.

When the Sideband Control bit at U8A's set input (pin 4) is low, Sideband Select Control's U8A is not clocked. U8A's Q output is set high. U8B's Q output is low and not Q output is high. The J input of U8B is High and the K input remains Low. The set input of U8B is tied High and U8B will clock on each clock received. With U8B's J input High and K input Low the first birdie clock received clocks its Q output High and not Q output Low. The High Frequency Loop's VCO locks on the upper sideband. The first beatnote received from the Sampler.

A high Sideband Control input to the set input of U8A allows it to clock on each clock received. U8A's Q output is set low, and U8B's Q output is low and not Q output is high. The first birdie clock received clocks both U8A and U8B. The first birdie clocks U8A's Q output High and not Q output Low, since its J input is High and K input is Low. The outputs of U8B will not change on the first clock with its J input Low and K input Low. The first Sampler beatnote is skipped and the VCO's tune voltage and frequency continues to ramp down. The next Sampler beatnote and Beatnote Detector birdie clock clocks the not Q output of U8B low. The High Frequency Loop VCO locks on the lower sideband.

When the not Q output of U8B goes Low, diode CR19 turns off and no current flows through R79 thus the cathode of CR20 is pulled low through R81 and CR20 is turned on. CR21 now turns off and the Loop Amplifier output voltage stops ramping downward. At this point, transistor Q8 and Q10 turns off, the Sampler output is applied to the Loop Amplifier, and the High Frequency Loop locks-up.

### Example

Let's take an example.

1. Enter Keyboard Invoked Test No. 3 by pressing the **SHIFT** key, and then the **INCR SET** key.
2. Press the **AMPT**  $\uparrow$  key three times until the number "3" appears in the **MODULATION** Display.
3. Press **INCR SET** key and "00" should appear in the **AMPLITUDE** Display.

Keyboard Invoked Test No. 3 allows you to enter data to the Signal Generator while the test is running.

1. Press the **AMPT**  $\uparrow$  key four times until a "7" is displayed in the **AMPLITUDE** Display.
2. Press **INCR SET**. The Signal Generator will go through its power-up routine and will be ready to accept data. The test will continue until the Signal Generator is reset.
3. Set the Signal Generator's Frequency to 550 MHz. See Figure 1, High Frequency Loop Control Timing Diagram.

### NOTE

*With the Signal Generator tuned to 550 MHz, and Service Function 3 initiated, the High Frequency Loop is unlocked by the SDA signal from the Microprocessor. The VCO tune Voltage is reset to +14V and then ramps downward to -5V while the HF Loop VCO locks at 550 MHz. At time T5, the SDA signal unlocks the loop again. The cycle repeats itself again.*

The High Frequency Loop VCO is to lock at a frequency of 550 MHz. The sideband select data bit at pin 1 of Shift Register U5 is high. The loop is to lock on the lower sideband. The 150 MHz Notch Filter is not selected, and the 150 MHz IF is passed to the Sampler. The other IFs are filtered out by the Notch Filters selected. The input frequency to Mixer A4U1 is 700 MHz. See Figure 1. At time T1, the SDA data bit triggers the High Frequency One-Shot U6. The Loop Amplifier's output voltage at W4 is ramped high and remains high until U6 times out at time T2. The VCO's frequency has been swept high, 1040 MHz. At time T2, the VCO tune voltage and frequency starts to ramp down. At time T3, the VCO's frequency is 850 MHz. The IF is 150 MHz,  $850 - 700 = 150$ , and a beatnote is received from the Sampler. The beatnote is amplified and detected by the Beatnote Detector. The Beatnote Detector sends a birdie pulse to clock the Side Band Select Control. The loop would lock

but the high sideband select data at U5 pin 1 will cause the Side Band Select Control to skip the first birdie pulse, the upper beatnote at time T3. The loop is prevented from locking at 850 MHz.

The VCO tune voltage and frequency continue to sweep down. At time T4 the VCO's frequency has swept down to 550 MHz and the IF is 150 MHz,  $550 - 700 = -150$ . A beatnote is received from the Sampler. The beatnote is amplified and detected by the Beatnote Detector. A birdie pulse is output to the Side Band Select Control. The Side Band Select Control stops the Loop A Amplifier from ramping down and the High Frequency Loop VCO locks on the lower sideband, at time T4. The loop is locked at 550 MHz. The High Frequency Loop VCO remains locked until time T5 when a SDA is received and the High frequency Loop One-Shot is triggered. The process is repeated.

### Out-of-Lock Detector

When the frequency of the instrument is changed, the loop will go through its lock-up procedure to change to the new frequency. During the lock-up procedure, the Loop Amplifier's output voltage is ramped to its highest value and then ramped downward. During normal operation the loop will lock during this downward voltage ramp. However, if for some reason the loop has not properly settled, it may not lock during the downward ramp. If this is the case, once the ramp voltage gets below  $-7V$  (VCO frequency  $< 520$  MHz), then the voltage at the positive input of the comparator U7D drops lower than the negative input and the Out-Of-Lock Detector's, U7D, output goes low. The low transition from the comparator triggers the Ramp Timing Control's High Frequency Loop One-Shot which restarts the loop lock-up procedure.

R75 and R74 set the  $-7V$  threshold on the Loop Amplifier output voltage. R76 is a pull-up resistor for the U7D comparator.

### Gain Compensation

The VCO gain is not constant over its frequency range; therefore, the gain of the loop changes with frequency. To compensate for this non-linear condition, lead-lag network C101 and R70 and lead-lag network C102 and R72 are switched in. U7A and U7B are open collector comparators which act as switches to turn on and off the switchable lead-lag networks. R69 and R71 are protection resistors for the comparator inputs. A logic High from the High Frequency Loop Data Shift Register U5 pin 2 will make the voltage at the negative input of U7A higher than the positive input. This causes the output transistor in the comparator to turn on thus switching in the lead-lag network C101 and R70. A logic High from U5 pin 12 switches the output of comparator U7B Low and lead-lag network C102 and R72 is switched in.

### Loop Amplifier

The loop amplifier U4 serves as an integrator for frequencies less than 15 kHz and a non-inverting unity gain amplifier for frequencies greater than 15 kHz. Resistor R59 and capacitor C96 serve as the ac feedback network for the integrator portion of the amplifier. The lowpass filter created by R63 and C97 rolls off the integrator portion of the amplifier as the non-inverting portion of the amplifier starts occurring. The non-inverting unity gain portion of the amplifier is achieved through the feed-forward network R62, C98, and R64.

Resistor R82 creates a constant positive offset voltage on the negative input to the amplifier. This forces the amplifier output voltage to slew down if the loop is unlocked. Capacitors C93 and C94 are power supply bypass capacitors for the amplifier.



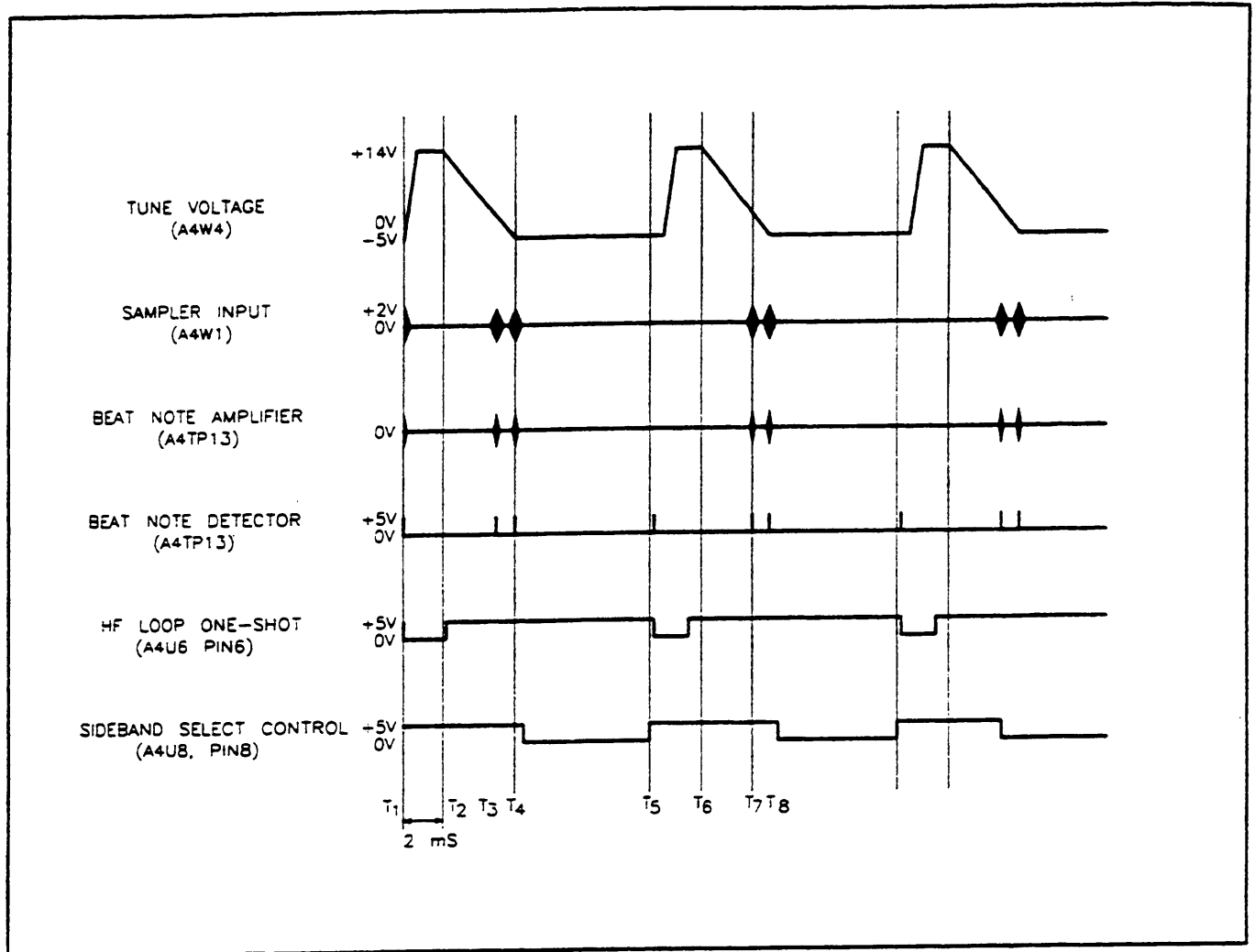


Figure 1. High Frequency Loop Control Timing Diagram.

## TROUBLESHOOTING

Procedures for checking part of the A4 High Frequency Loop Assembly circuits are given below. The area or points to check are marked on the schematic by a hexagon with a check mark and a number inside, for example,  $\checkmark 1$ . Fixed voltages are shown on the schematic inside a hexagon, for example,  $2V \pm 0.2V$ . Transistor bias voltages are shown without tolerances.

### Troubleshooting Help

- Block Diagram 2
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustments

### Test Equipment

Digital Multimeter .....	HP 3466A
Oscilloscope .....	HP 54100A
Oscilloscope, Analog .....	HP 1740A
Oscilloscope 1 Megohm Probe Pod, Chan 2 .....	HP 54003A
Oscilloscope Active Probe, Chan 1 .....	HP 54001A
Oscilloscope Probe .....	HP 54003-61617

### $\checkmark 1$ HF Loop Data Shift Register

4. Set the Signal Generator as follows:

Frequency .....	650 MHz
Amplitude .....	-10 dBm
Modulation .....	Off

5. Verify A4U5 output levels for the frequencies indicated in Table 1.

Table 1. High Frequency Loop Control Logic.

Signal Generator Frequency (MHz)	A4U5 Digital Logic Levels*									
	IF SEL (L) Notch Filters**							Side-Band Select	Gain Compensation	
	300 Pin 18	250 Pin 11	200 Pin 10	150 Pin 9	100 Pin 8	50 Pin 3	DC Pin 17	Pin 1	Pin 12	Pin 2
650	L	L	L	L	L	H	H	H	H	H
700	L	L	L	L	L	L	L	L	H	L
750	L	L	L	L	L	H	H	L	H	L
800	L	L	L	L	H	L	H	L	H	L
850	L	L	L	H	L	L	H	L	H	L
900	L	L	H	L	L	L	H	L	H	L
950	L	H	L	L	L	L	H	L	H	L
1000	H	L	L	L	L	L	H	L	L	L

\* Digital Levels: H  $\geq$  12 Vdc, L < 0.5 Vdc.  
 \*\* A notch filter that is selected filters out that IF sideband. Therefore, the required IF sideband filter is not selected in order to pass the required frequency.

**√2 Loop Amplifier, Out of Lock Detector, Beatnote Detector**

The High Frequency Loop is unlocked and placed in a continuous sweep mode by placing A4W2 into the W2A position and then clocking the High Frequency Loop one-shot. Sideband Select Control is disabled and will not detect the lock point and the Loop Amplifier will continue to sweep through the tune voltage range of -7V to +14V as seen at A4W4. The Out of Lock Detector and High Frequency Loop One-Shot will continue to reset the Loop Amplifier as seen at U6 pin 6.

1. Set the Signal Generator as follows:

FREQUENCY ..... 800 MHz  
 AMPLITUDE ..... -10 dBm

2. Switch the Signal Generator to STBY.

3. Place A4W2 in the W2A position.

4. Set the oscilloscope as follows:

**Chan 1**

Ch 1 Mode ..... Normal  
 Ch 1 Display ..... On  
 VOLTS/DIV ..... 10.0V  
 OFFSET ..... 0.0V

**Chan 2**

Ch 2 Mode ..... Normal  
 Ch 2 Display ..... On  
 VOLTS/DIV ..... 4.0V  
 OFFSET ..... 360 mV

**Timebase**

SEC/DIV ..... 2 ms  
 DELAY ..... 0.0s  
 Delay Ref at ..... Left  
 Sweep ..... Trg'd

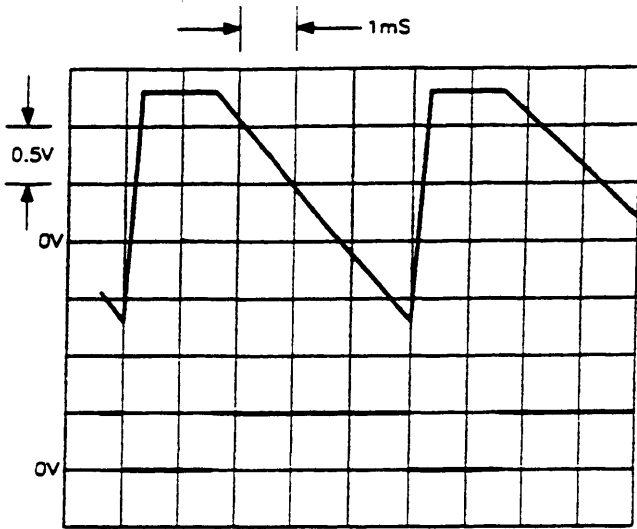
**Trigger**

Trigger Mode ..... Edge  
 Trig Src ..... Chan 1  
 TRIG LEVEL ..... 0.0 mV  
 Slope ..... Pos  
 Holdoff ..... Time

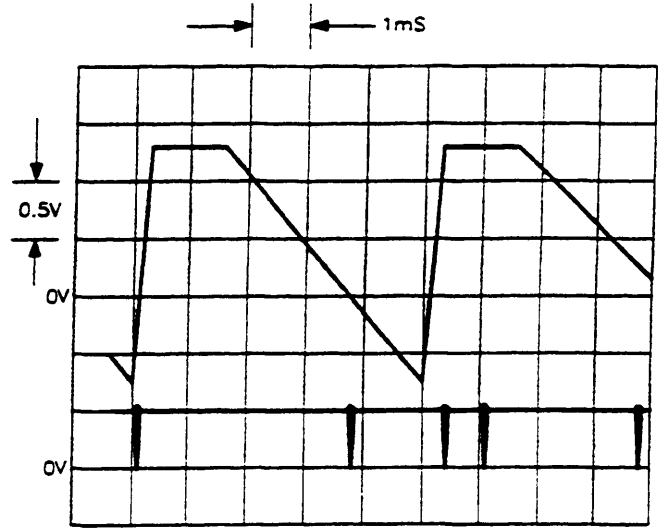
**Display**

Display Mode ..... Normal  
 DISPLAY TIME ..... 200 ms  
 Split Screen ..... ON  
 Graticle ..... Grid

5. Connect Channel 1 to VCO Tune at A4W4.
6. Connect Channel 2 to A4U6 pin 6.
7. Switch the Signal Generator back ON. Verify that the oscilloscope display shown in Figure 2 is correct.
8. Connect Chan 2 to A4W2, open pin. Verify that the oscilloscope display shown in Figure 3 is correct.



**Figure 2.** VCO Tune and High Frequency Loop One-Shoot.



**Figure 3.** VCO Tune and Beatnote Detector.

**3 Beatnote Detector**

Beatnotes from the 13 MHz Low Pass Filter at W1 (refer to Service Sheet 1) are compared to the amplified beatnotes at A4TP10 and the detected beatnotes at A4W2 (open pin). If no beatnotes are present out of the 13 MHz Low Pass Filter, check the circuits associated with Service Sheet 1.

1. Set the Signal Generator as follows:

Frequency..... 750 MHz  
 Amplitude..... -10 dBm

2. Switch the Signal Generator to STBY.
3. Place A4W2 in the W2A position.

**NOTE**

*The beatnotes in Figures 4 and 5 can not be checked with the digital oscilloscope. The HP 1740A analog oscilloscope (obsolete) or equivalent can be used.*

4. Set the oscilloscope as follows:

TRIGGER ..... Channel A  
 TIME/DIV ..... 2 ms  
 Channel A VOLTS/DIV ..... 0.005V  
 Channel B VOLTS/DIV ..... 0.1V

5. Connect Channel A to A4W1.
6. Connect Channel B to A4TP10.
7. Switch the Signal Generator back ON and verify that the oscilloscope display shown in Figure 4 is correct.
8. Connect Channel B to A4W2, open pin, and verify that the oscilloscope display shown in Figure 5 is correct. Place A4W2 back to the W2 position.

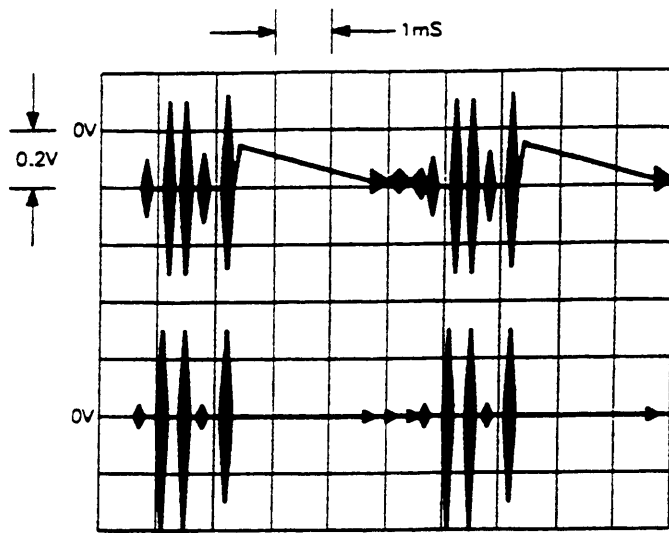


Figure 4. Beatnote Amplifier.

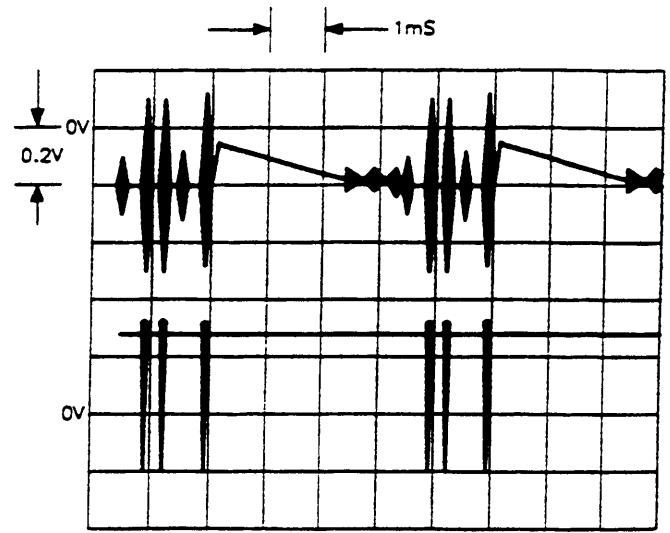


Figure 5. Beatnote Detector.

**J4 High Frequency Loop Keyboard Invoked Test.**

The Signal Generator has a special Keyboard Invoked Test for troubleshooting the A4 High Frequency Loop. During the test, data from the Microprocessor starts a new lock-up cycle every 10 ms. During every lock-up cycle, the Loop Amplifier's output voltage ramps up to approximately +14 Vdc and then ramps downward until the proper beatnote is detected, at which point the loop should lock. The loop stays locked until the Microprocessor begins the next lock-up cycle. Full front panel control is maintained while the test is running. This allows loop lock-up to be checked at any frequency setting.

1. Set the Signal Generator as follows:

Frequency..... 550 MHz  
 Amplitude..... -10 dBm

2. Set the oscilloscope as follows:

**Channel 1**

Ch 1 Mode..... Normal  
 Ch 1 Display..... On  
 VOLTS/DIV..... 10.0V  
 OFFSET..... 0.0V

**Channel 2**

Ch 2 Mode..... Normal  
 Ch 2 Display..... On  
 VOLTS/DIV..... 2.0V  
 OFFSET..... 2.0V

**Timebase**

SEC/DIV..... 2 ms  
 DELAY..... 0.0s  
 Delay Ref at..... Left  
 Sweep..... Trg'd

**Trigger**

Trigger Mode .....	Edge
Trig Src .....	Chan 1
TRIG LEVEL .....	7.0V
Slope .....	Pos
Holdoff .....	Time

**Display**

Display Mode .....	Normal
DISPLAY TIME .....	200 ms
Split Screen .....	ON
Graticle .....	Grid

3. Connect Chan 1 to the VCO Tune at A4W4.
4. Connect Chan 2 to A4W2.
5. The test routine is "entered" to start the test and then "exited" to regain control of the front panel. The test continues to run until the instrument is reset.
  - Enter the Keyboard-Invoked Tests by first pressing the SHIFT key and then pressing the INCR SET key. A "1" should be shown in the MODULATION display window.
  - Enter the High Frequency Loop Test by pressing the AMPTD  $\uparrow$  until a "3" is shown in the MODULATION display window.
  - Start the test routine by pressing the INCR SET key. "00" should be shown in the AMPLITUDE Display window.
  - Exit the Keyboard-Invoked Tests by pressing the AMPTD  $\uparrow$  until a "7" is shown in the MODULATION display window, then press the INCR SET key. The Signal Generator should go through it's power-up routine and then display a front panel setting of 550 MHz and -10 dBm.
6. Verify that the oscilloscope display shown in Figure 6 is correct. Note the lock-up point of approximately -5.0 Vdc on the Channel A display and that lock-up occurs on the second beatnote detected during ramp down of the Loop Amplifier.
7. Change the frequency of the Signal Generator to 850 MHz. Verify that the oscilloscope display shown in Figure 7 is correct. Note the lock-up point of approximately +0.4 Vdc on the Channel A display and that lock-up occurs on the first beatnote detected during ramp down of the Loop Amplifier.
8. Reset the Signal Generator by pressing the SHIFT key and then pressing the 0 key, PRESET.

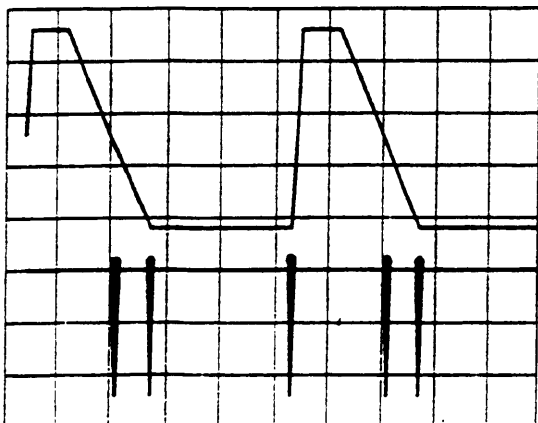


Figure 6. Loop Amplifier -5.0 Vdc Lock-Up.

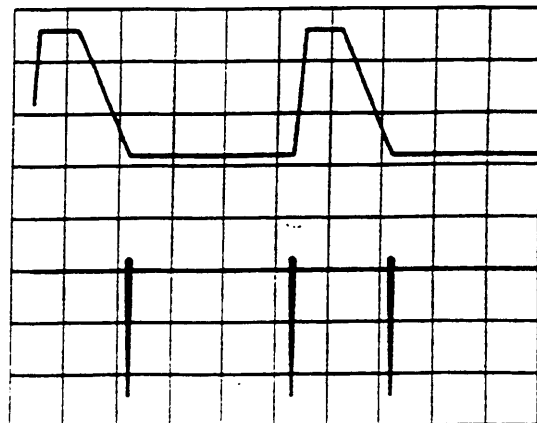


Figure 7. Loop Amplifier +0.4 Vdc Lock-Up.

A4 Component Coordinates (1 of 2)

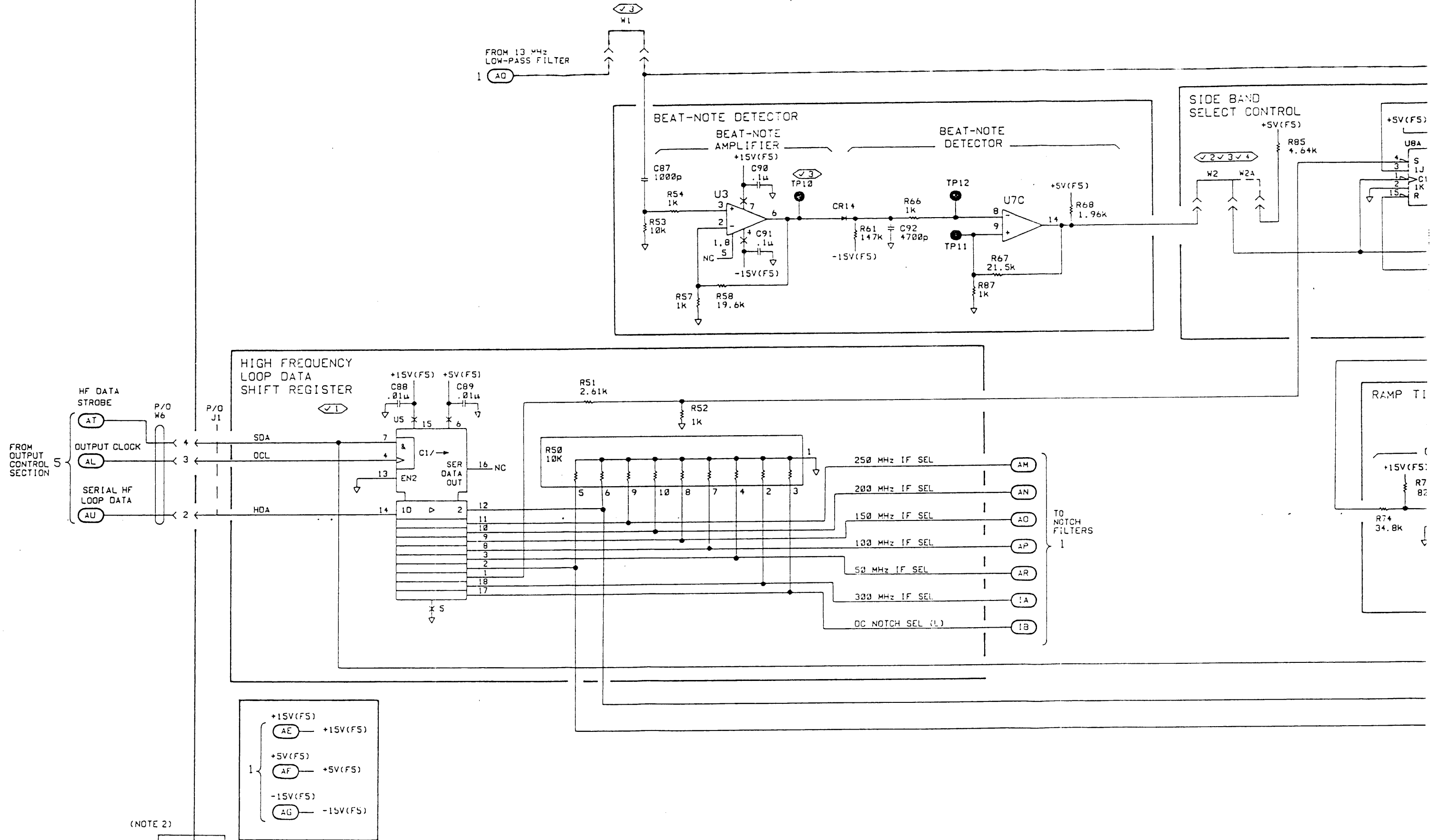
COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
C1	B,1	C59	C,2	C151	B,1	CR18	D,1	L106	A,1	R26	D,2
C2	B,1	C60	C,2	C152	B,1	CR19	D,1	L107	A,1	R27	D,2
C3	C,1	C61	C,2	C153	B,1	CR20	D,1	L108	A,1	R28	D,2
C4	D,1	C62	C,2	C154	C,1	CR21	D,1	L109	A,1	R29	C,1
C5	D,1	C63	C,2	C155	B,1	CR101	B,1	L110	B,1	R30	C,2
C6	D,2	C64	C,2	C156	B,1	CR102	B,1	L111	B,1	R32	B,2
C7	B,2	C65	C,2	C157	B,1					R33	B,2
C8	C,2	C66	C,2	C158	B,1	J1	A,1	MP1	D,1	R34	C,1
C9	A,2	C67	C,2	C159	B,1					R35	B,2
C10	A,2	C68	C,2	C161	A,1	L1	B,1	Q2	A,2	R36	B,2
C11	A,2	C69	C,2	C162	B,1	L2	B,1	Q5	B,2	R37	A,2
C12	D,2	C70	C,2	C163	A,1	L3	B,1	Q6	D,2	R38	A,2
C13	A,2	C71	C,2	C164	A,1	L4	D,1	Q7	D,2	R39	A,2
C14	A,2	C72	C,2	C165	A,1	L5	C,2	Q8	D,1	R40	C,1
C16	D,2	C73	C,2	C166	B,1	L10	A,2	Q9	C,1	R41	C,1
C17	D,2	C74	C,2	C167	B,1	L11	D,2	Q10	D,1	R42	D,1
C18	A,2	C75	C,2	C168	A,1	L13	A,2	Q101	B,1	R43	D,1
C19	D,2	C76	C,2	C169	A,1	L15	D,2	Q102	B,1	R44	C,1
C20	D,2	C77	B,2	C170	A,1	L16	D,2	Q103	B,1	R45	C,2
C21	A,2	C78	B,2	C171	A,1	L19	A,2	Q104	B,1	R46	C,2
C24	D,2	C79	D,2	C172	A,1	L20	D,2	Q105	A,1	R47	C,2
C25	D,2	C80	C,2	C173	A,1	L21	B,2	Q106	A,1	R48	C,2
C26	D,2	C81	C,2	C174	A,1	L22	C,2			R49	C,2
C28	D,2	C83	C,2	C175	A,1	L23	D,2	R1	D,2	R50	C,1
C29	D,2	C84	C,2	C176	A,1	L24	D,2	R2	D,2	R51	C,1
C30	A,2	C85	C,2	C177	B,1	L25	B,2	R3	D,2	R52	C,1
C31	D,2	C86	C,2	C178	B,1	L26	B,2	R5	A,2	R53	D,1
C32	D,2	C87	D,1			L27	C,2	R6	A,2	R54	D,1
C33	A,2	C88	C,1	CR1	B,1	L28	B,2	R7	A,2	R55	D,1
C34	D,2	C89	C,1	CR2	D,2	L30	B,2	R8	A,2	R56	D,1
C35	D,2	C90	D,1	CR3	D,2	L31	B,2	R9	A,2	R57	D,1
C36	A,2	C91	D,1	CR4	D,2	L33	C,2	R10	A,2	R58	D,1
C37	D,2	C92	D,1	CR5	D,2	L35	C,2	R11	D,2	R59	D,1
C38	B,2	C93	D,1	CR6	D,2	L36	C,2	R12	D,2	R60	C,1
C39	D,2	C94	D,1	CR7	C,2	L37	C,2	R13	D,2	R61	D,1
C41	B,2	C95	C,1	CR8	C,2	L38	C,2	R14	D,2	R62	D,1
C42	D,2	C96	D,1	CR9	C,2	L39	C,2	R15	A,2	R63	D,1
C43	B,2	C97	D,1	CR10	C,2	L41	D,2	R16	A,2	R64	D,1
C44	D,2	C98	D,1	CR11	C,2	L42	C,2	R19	D,2	R65	C,1
C45	D,1	C99	C,1	CR12	C,2	L43	C,1	R20	D,2	R66	C,1
C47	B,2	C100	D,1	CR13	B,2	L100	B,1	R21	D,2	R67	C,1
C49	B,2	C101	C,1	CR14	D,1	L101	B,1	R22	D,2	R68	C,1
C50	B,2	C102	C,1	CR15	D,1	L102	B,1	R23	B,2	R69	C,1
C51	B,2	C103	C,1	CR16	D,1	L103	B,1	R24	D,2	R70	C,1
C53	C,2	C150	B,1	CR17	D,1	L105	B,1	R25	D,2	R71	C,1

A4 Component Coordinates (2 of 2)

COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
R72	C,1	TP1	A,1						
R74	C,1	TP2	A,2						
R75	C,1	TP3	A,2						
R76	C,1	TP4	A,2						
R78	D,1	TP5	A,2						
R79	D,1	TP6	B,2						
R80	D,1	TP7	B,2						
R81	D,1	TP8	D,2						
R82	D,1	TP9	D,2						
R83	D,1	TP10	D,1						
R84	C,1	TP11	C,1						
R85	C,1	TP12	C,1						
R86	B,2	TP100	B,1						
R87	C,1	TP101	A,1						
R88	D,1								
R89	C,2	U1	A,2						
R100	B,1	U2	B,2						
R101	C,1	U3	D,1						
R102	B,1	U4	D,1						
R103	B,1	U5	C,1						
R104	B,1	U6	C,1						
R106	B,1	U7	C,1						
R107	B,1	U8	D,1						
R108	B,1								
R109	B,1	VR1	A,2						
R110	B,1	VR102	A,1						
R111	A,1								
R112	A,1	W1	D,1						
R113	A,1	W2	C,1						
R115	A,1	W3	C,1						
R116	A,1	W4	C,1						
R117	A,1	W5	D,1						
R118	A,1	W6	D,1						
R119	A,1	W7	A,1						
R120	A,1								
R121	A,1								
R122	A,1								
R123	A,1								
R124	A,1								
R125	A,1								
R126	B,1								
T1	D,2								



P/O A4 HIGH FREQUENCY LOOP ASSEMBLY (08657-60102)



(NOTE 2)

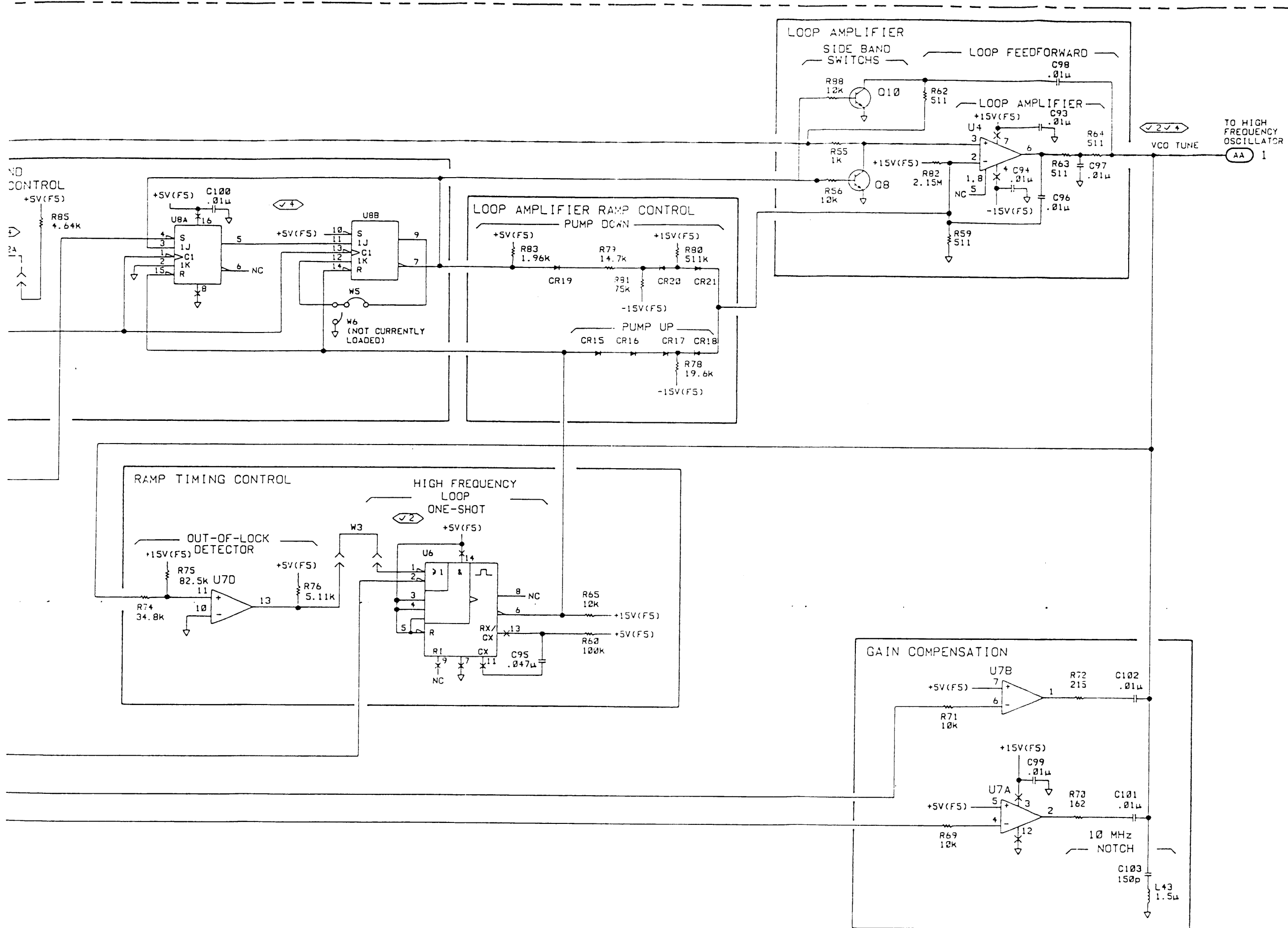


Figure-8  
Service Sheet 2 13

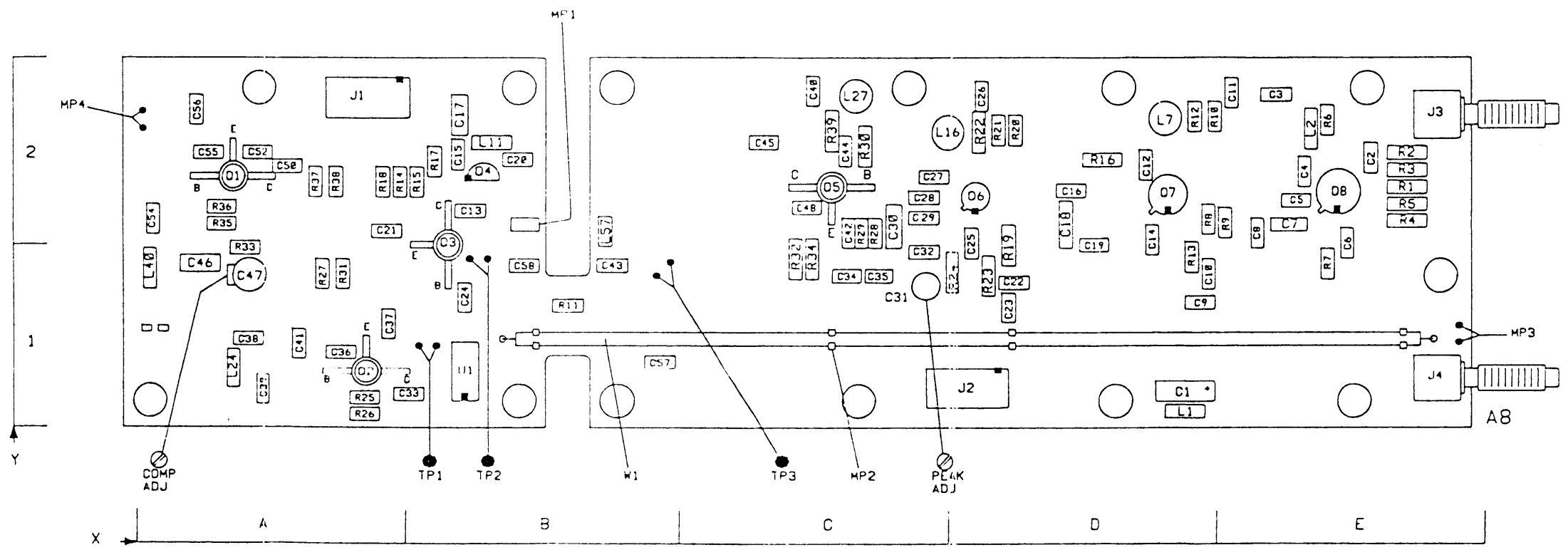
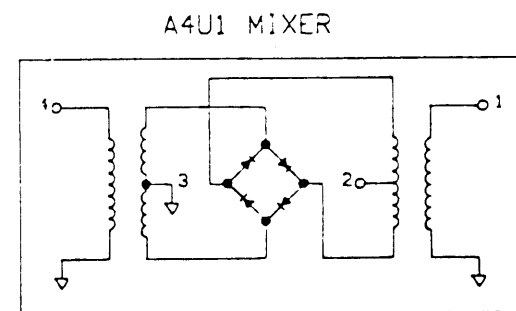
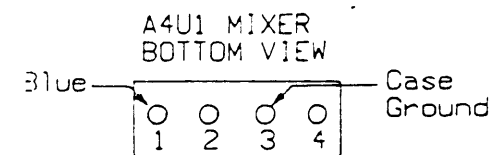


Figure 0. Service Sheet 3 Information

Component Locator

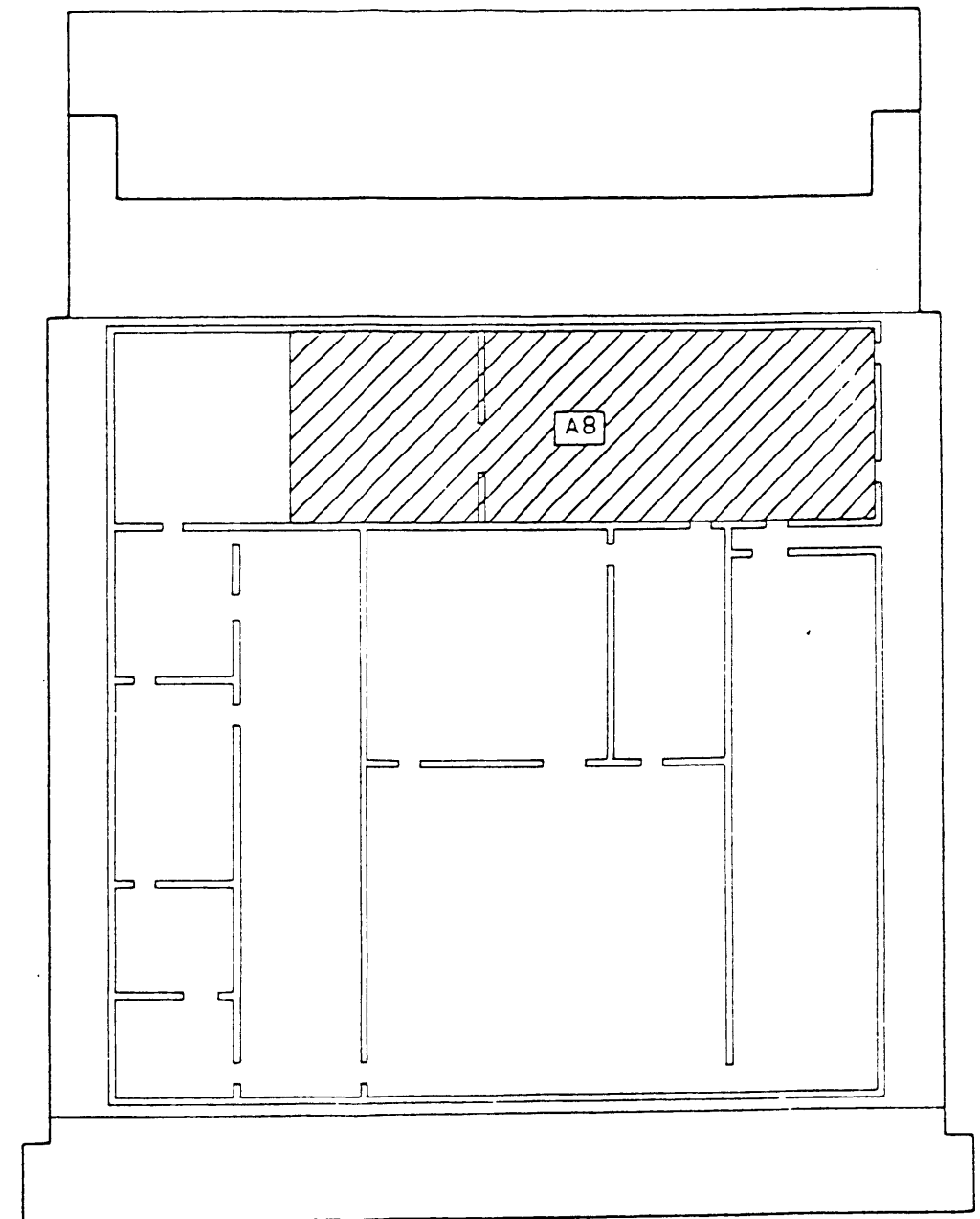
## NOTES

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. Printed circuit trace inductor.
3. Printed circuit trace capacitor.
4. Service test point. Pin of dual-in-line test socket J1 or J2.
5. Chassis ground is achieved by mechanical contact through nuts holding PC board to frame.
6. PC board shipped with jumper installed. In for normal operation. Out for service.
7. L7, 16, 27 and 57 present an impedance 1200 ohms at 120 MHz to 650 MHz and 900 ohms at 650 MHz to 1300 MHz.
8. Bottom view and schematic diagram of A4U1 are as follows:



9. The mismatch caused by inserting a 50 ohm impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is more than 3 dB, at others less than 3 dB.

\* Indicates factory selected part. Typical value shown. Refer to Section 5 for selection procedure.



P/O A4 HIGH FREQUENCY LOOP  
AMPLIFIER AND CONTROL SS2  
SEE REVERSE SIDE

## Service Sheet 3

### FREQUENCY MULTIPLIER

#### PRINCIPLES OF OPERATION

##### General

The 50 MHz reference is multiplied by 16 to 800 MHz. It is mixed with the phase locked 60 to 110 MHz signal from the Low Frequency Loop Assembly. The Mixer's output is amplified and applied to a Bandpass Filter that passes the difference frequency 690 to 740 MHz. The input frequencies to the Mixer are phase locked to the 50 MHz reference. Therefore, the Mixer's output serves as a reference to lock the High Frequency Loop. The 800 MHz output is also applied to the Output Assembly (refer to Service Sheet 5).

##### Frequency Multiplier

The 50 MHz +16 to +19 dBm input from the Reference Oscillator is applied to the Power Splitter consisting of R1, R2, R3, and R4. One output of the Power Splitter goes to the Sampling Bridge of the High Frequency Loop (shown on Service Sheet 1). The other output is ac coupled by C2 to Q8, the first multiplier stage. Subsequently, the 50 MHz is doubled four times to a frequency of 800 MHz.

Each of the four multiplier stages (Q8, 7, 6, and 5) is dc biased so the transistor operates in its non-linear region thus generating harmonics. The output of each stage is filtered by a bandpass filter at 100, 200, 400, or 800 MHz. This passes the doubled frequency and filters out the input frequency and other harmonics. Since the stages are electrically equivalent, only the first stage will be discussed in detail. Note, however, that the 800 MHz filter utilizes printed circuit trace capacitors and inductors instead of discrete capacitors and inductors.

Resistors R5 and R6 divide the +5 Vdc supply voltage to dc bias the base of Q8 at approximately +1.0 Vdc without the 50 MHz signal connected. Resistor R7 is the emitter bias resistor. Capacitor C6 bypasses the ac emitter signal to ground. Inductor L2 is an RF choke. Capacitor C3 is an RF bypass. Capacitor C4 ac couples the output to the 100 MHz Bandpass Filter. The 800 MHz output of the last multiplier stage Q5 is applied to the 800 MHz Bandpass Filter on the output Assembly A6 (shown on Service Sheet 5) and to Buffer Amplifier No. 1.

##### Buffer Amplifier No. 1/Mixer U1

The 800 MHz signal is coupled to the base of Q3 through resistor R11, the circuit board transmission line, and capacitor C13. The transmission line serves to isolate Q3 from the input. DC current flows through resistors R14 and R15 to dc bias the base of Q4. Since the emitter of Q4 is also connected to the +5V(F) supply by resistor R18, the emitter voltage will be approximately 0.6 Vdc more positive than the base. The current through resistor R18 is determined by the voltage difference between the +5 Vdc supply and the voltage at the emitter of Q4. The current through R18 takes two paths. One path is into the emitter of Q4 and out at its collector. This current minus the base current of Q4 is the base current of Q3. The other path for the current from R18 flows through L12 and into the collector of Q3. The base to collector current ratio depends on the dc current gain of Q3. Therefore, the total current from R18 is equal to the emitter current of Q3. Inductor L11 is an RF choke while L12 serves as a matching element. Capacitors C15, C20, C21, and C58 are RF bypass capacitors. Capacitor C24 ac couples the output of Buffer Amplifier No.1 to Mixer U1. The other input to Mixer U1 is the 60 to 110 MHz from the Voltage Controlled Oscillator (refer to Service Sheet 9). The difference output of 690 to 740 MHz is ac coupled to Buffer Amplifier No. 2.

### Buffer Amplifiers No. 2 and 3

The dc current flowing through resistors R25 and R26 dc biases the base of Q2 at approximately 2.0 Vdc. Resistor R27 is the emitter bias resistor and capacitors C36 and C37 are the emitter resistor bypass to ground. Inductor L24 is an RF choke while capacitors C38 and C39 are RF bypass capacitors. L23, L25 and C41 all serve as matching elements. The output of Buffer Amplifier No. 2 is ac coupled to the Compensation Network by capacitor C41. The Compensation Network is adjusted to keep the 690 to 740 MHz flatness within  $\pm 1.5$  dB. The signal is ac coupled to Buffer Amplifier No. 3 which functions the same as Buffer Amplifier No. 2. The output of the buffer amplifier passes through Bandpass Filter FL1 which passes the difference frequencies (between 690 and 740 MHz) from the Mixer, and filters and eliminates all the other frequencies. A frequency between 690 and 740 MHz goes to the Mixer in the High Frequency Loop (refer to Service Sheet 1) to serve as a phase locked reference for the A5 Voltage Controlled Oscillator.

## TROUBLESHOOTING

Procedures for checking circuits of the A8 Frequency Multiplier Assembly are given below. The areas or points to check are marked on the schematic by a hexagon with a check mark and a number inside, for example,  $\checkmark 3$ . Fixed voltages are shown on the schematic inside a hexagon, for example,  $2V \pm 0.2V$ . Transistor bias voltages are shown without tolerances.

### Troubleshooting Help

Block Diagram 2

Table 4-1. Abbreviated Performance Tests

Table 5-2. Post-Repair Adjustments

### Test Equipment

Measuring Receiver .....	HP 8902A
Sensor Module .....	HP 11722A
Digital Multimeter .....	HP 3466A
Adapter Probe .....	HP 1250-1598
Adapter N(f) to BNC(m) .....	HP 1250-0077
Adapter BNC(f) to BNC(f) .....	HP 1250-0080
Cable BNC(m) to SMC(f) .....	HP 08662-60075

### $\checkmark 1$ Multiplier Stages Bias Voltages

1. Set the Signal Generator to any frequency.
2. Measure and verify the bias voltages as indicated in Table 1 with and without the 50 MHz Reference Oscillator input signal connected at A8J3.

*Table 1. Multiplier Stages Bias Voltages.*

Transistor	50 MHz Input Signal (Vdc)	
	Connected	Not Connected
Q8-E (J2-Pin 2)	+0.8	+0.23 to 0.47
Q8-B	+1.0	+1.0
Q8-C	+5.0	+5.0
Q7-E (J2-Pin 4)	+0.8	+0.23 to 0.47
Q7-B	+1.0	+1.0
Q7-C	+5.0	+5.0
Q6-E (J2-Pin 6)	+0.8	+0.23 to 0.47
Q6B	+1.0	+1.0
Q5-E (J2-Pin 8)	+0.8	+0.23 to 0.47
Q5-B	+1.0	+1.0
Q5-C	+5.0	+5.0

**√2 RF Levels**

1. Set the Signal Generator as follows:  
 Frequency.....Any  
 Amplitude.....Any  
 Modulation.....Off
2. Set the measuring receiver with the sensor module precalibrated as follows:  
 Measurement..... RF POWER  
 Display ..... Log
3. Zero the measuring receiver and wait for the zero LED to go out.
4. Check the 50 MHz Reference Oscillator input to the Frequency Multiplier Assembly.
5. Disconnect coax cable W5 from A8J3, and connect the sensor module to W5 using the appropriate cables and adapters. The level should be +16 to +19 dBm and the frequency should be 50 MHz ±100 Hz.
6. Reconnect W5 to the A8 Assembly.
7. Check the 60 to 110 MHz Low Frequency Loop input to the Frequency Multiplier Assembly.
8. Disconnect coax cable W3 from A8J4, and connect the sensor module to W3 using the appropriate cables and adapters. The level should be -9 to -7 dBm.
9. Reconnect W3 to the A8 assembly.
10. Table 2 shows power levels at various points and the conditions for measurement. Verify that each level is within the required range by connecting the sensor module to each point using the appropriate cables and adapters.

**NOTE**

*The mismatch caused by insertion of the 50 ohm input impedance adapter probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is 3 dB, and at others it is less than 3 dB.*

*Table 2. RF Power Levels.*

Conditions	RF Power Levels (dBm) at Measurement Locations				
	W10	TP3	TP2	TP1	A8 Output to FL1
All Cables Connected	+1 to +7	+2 to +8	+2 to +8	-20 to -14	0 to +6
W10 Not Connected	+5 to +9	+5 to +9	+5 to +9	-	-
Jumper Removed	-	-	-	-14 to -10	-
FL1 Not Connected	-	-	-	-	+2 to +7



A8 Component Coordinates

COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
C1	D,1	C45	C,2	R5	E,2				
C2	E,2	C46	A,1	R6	E,2				
C3	E,2	C47	A,1	R7	E,1				
C4	E,2	C48	C,2	R8	D,2				
C5	E,2	C50	A,2	R9	E,2				
C6	E,1	C52	A,2	R10	E,2				
C7	E,2	C54	A,2	R11	B,1				
C8	E,2	C55	A,2	R12	D,2				
C9	D,1	C56	A,2	R13	D,1				
C10	D,1	C57	B,1	R14	A,2				
C11	E,2	C58	B,1	R15	B,2				
C12	D,2			R16	D,2				
C13	B,2	J1	A,2	R17	B,2				
C14	D,2	J2	D,1	R18	A,2				
C15	B,2	J3	E,2	R19	D,1				
C16	D,2	J4	E,1	R20	D,2				
C17	B,2			R21	D,2				
C18	D,2	L1	D,1	R22	D,2				
C19	D,1	L2	E,2	R23	D,1				
C19	D,2	L7	D,2	R24	D,1				
C20	B,2	L11	B,2	R25	A,1				
C21	A,2	L16	C,2	R26	A,1				
C22	D,1	L24	A,1	R27	A,1				
C23	D,1	L27	C,2	R28	C,2				
C24	B,1	L40	A,1	R29	C,2				
C25	D,1	L57	B,2	R30	C,2				
C26	D,2			R31	A,1				
C27	C,2	MP1	B,2	R32	C,1				
C28	C,2	MP2	C,1	R33	A,1				
C29	C,2	MP3	E,1	R34	C,1				
C30	C,2	MP4	A,2	R35	A,2				
C31	C,1			R36	A,2				
C32	C,1	Q1	A,2	R37	A,2				
C33	B,1	Q2	A,1	R38	A,2				
C34	C,1	Q3	B,1	R39	C,2				
C35	C,1	Q4	B,2						
C36	A,1	Q5	C,2	TP1	B,1				
C37	A,1	Q6	D,2	TP2	B,1				
C38	A,1	Q7	D,2	TP3	B,1				
C39	A,1	Q8	E,2						
C40	C,2			U1	B,1				
C41	A,1	R1	E,2						
C42	C,2	R2	E,2	W1	B,1				
C43	B,1	R3	E,2						
C44	C,2	R4	E,2						

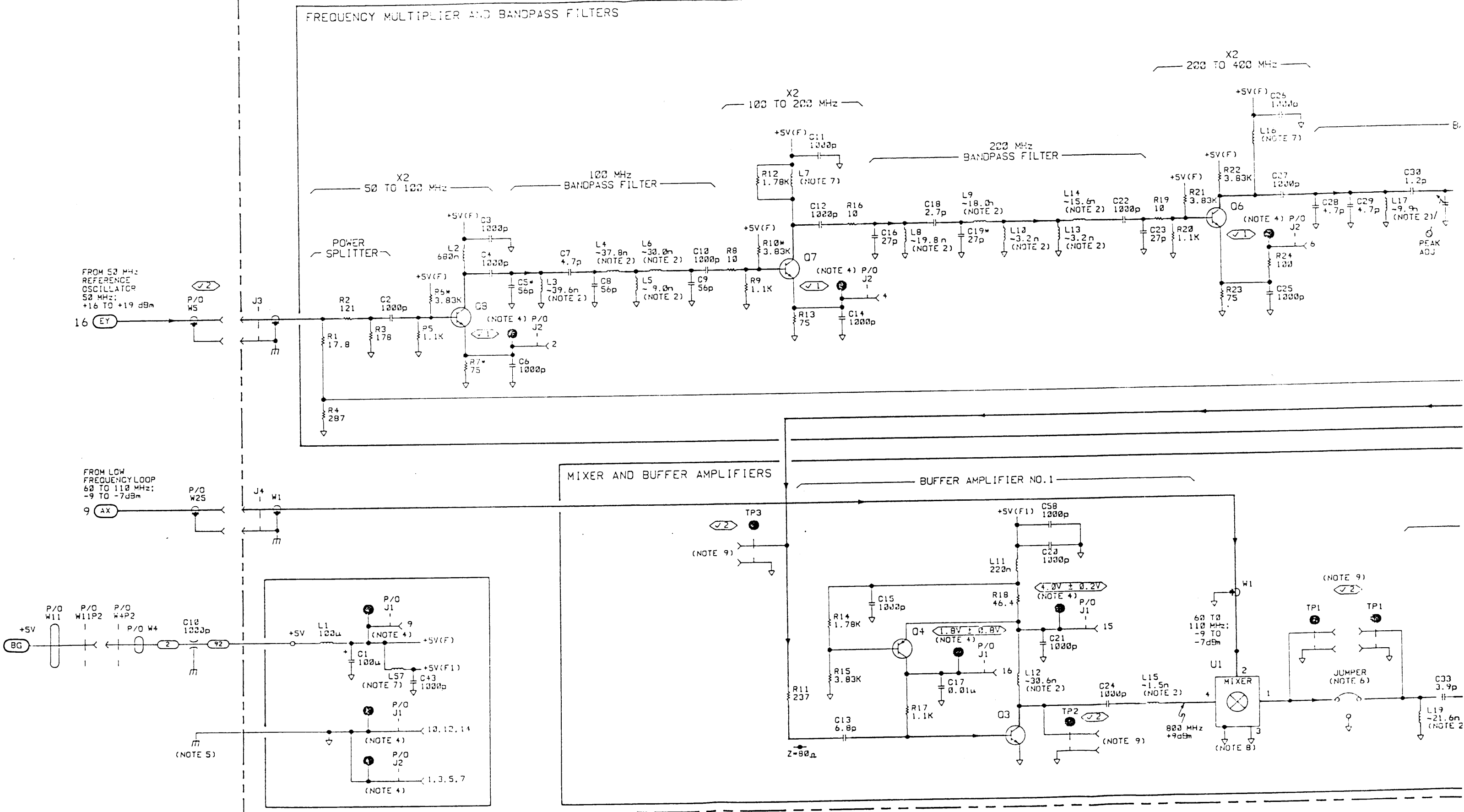
### CHANGES

2849U and above

On the A8 Schematic Diagram:

- C13 - Change the value to 15p.
- C35 - Change the value to 47p.

A8 FREQUENCY MULTIPLIER ASSEMBLY (08657-60132)



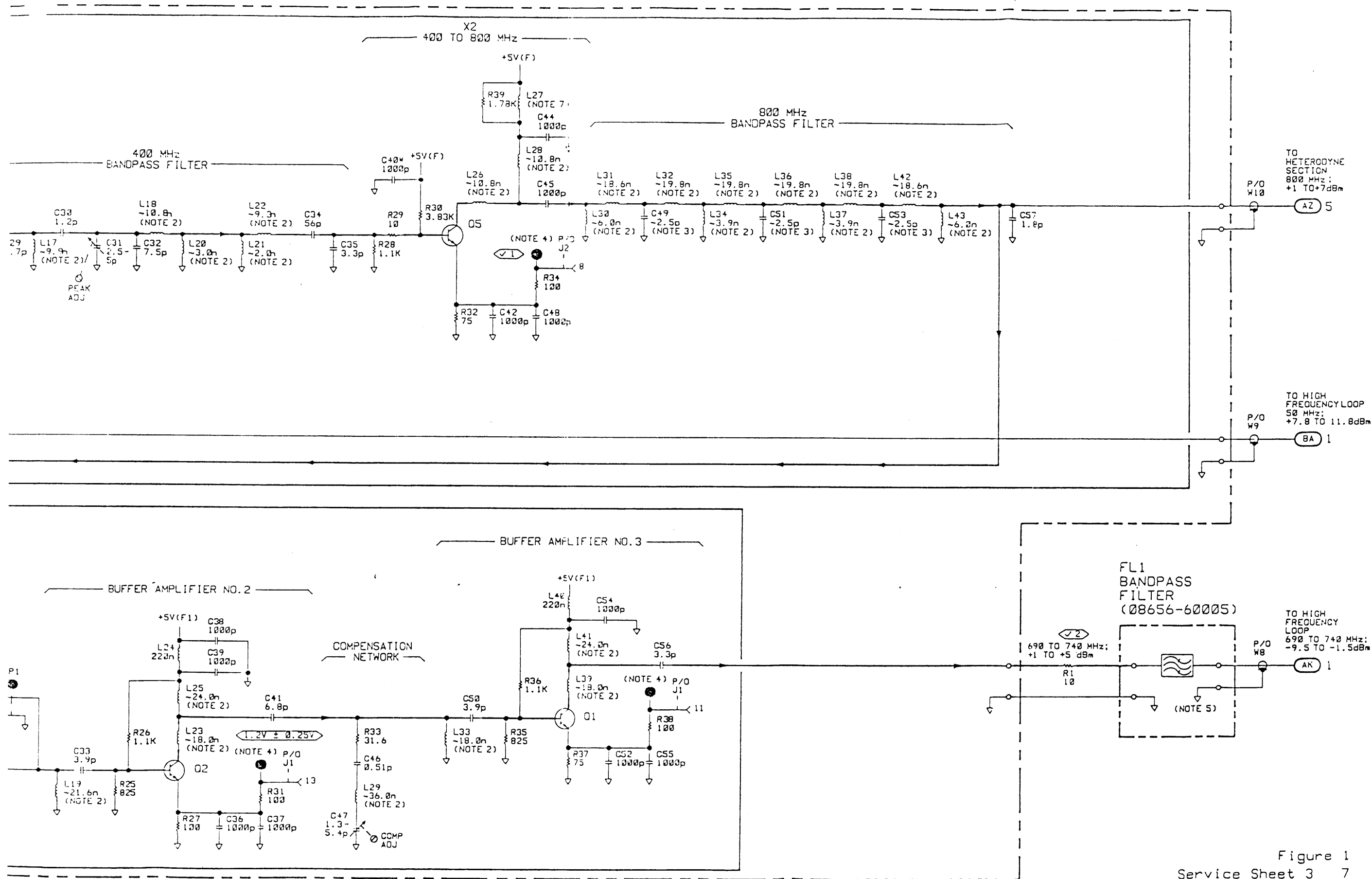


Figure 1  
Service Sheet 3 7

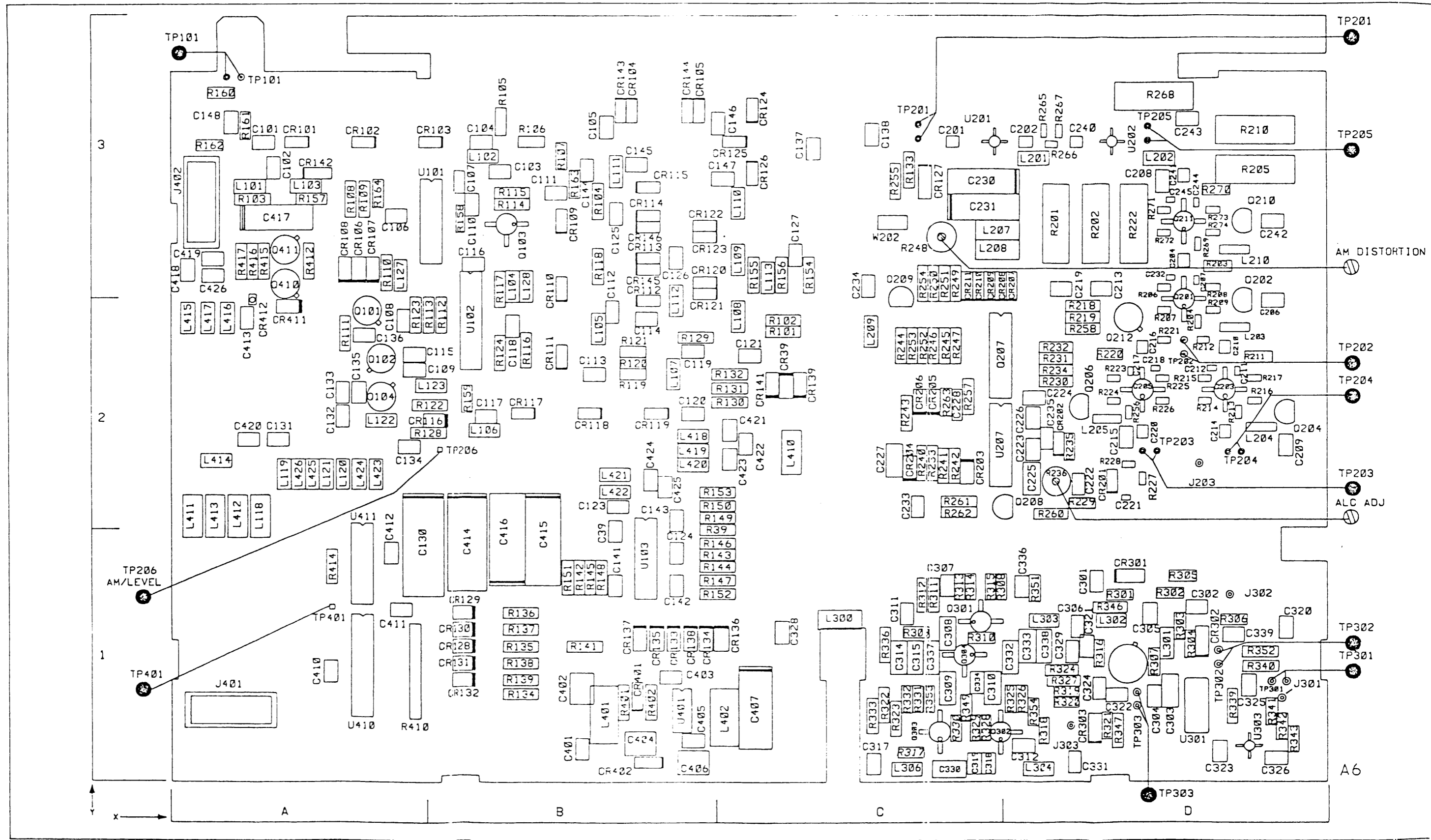
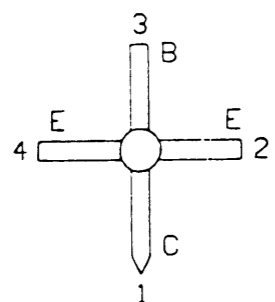


Figure 0. Service Sheet 4 Information

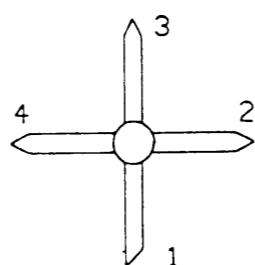
Component Locator

NOTES

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
  2. Chassis ground is achieved by mechanical contact through nuts holding PC board to frame.
  3. Matched for temperature characteristics.
  4. Printed circuit trace inductor.
  5. The mismatch caused by inserting a 50 ohm impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is more than 3 dB, at others less than 3 dB.
- \* Indicates factory-selected part. Typical value is shown. Refer to Section 5 for selection procedure.



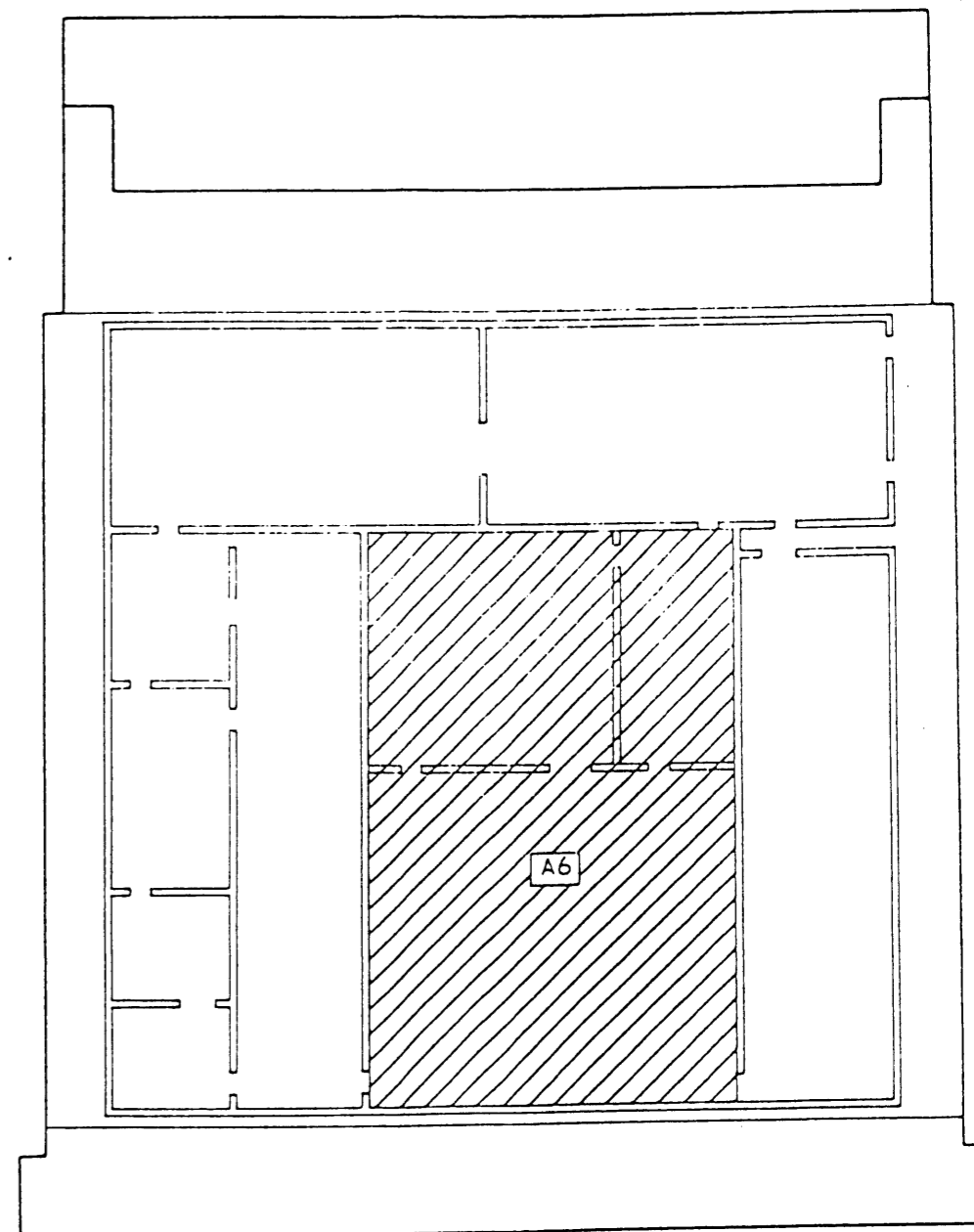
A6Q201, 203, 205



A6U201, 202, 303

LOGIC LEVELS

	TTL	ECL	EECL
HIGH	2V	+4.2V	+5.1V
LOW	0.8V	+3.3V	+4.7V
	IS MORE NEG. THAN	IS MORE POS. THAN	
OPEN	HIGH	LOW	LOW
GROUND	LOW	HIGH	HIGH



A8 FREQUENCY MULTIPLIER SS3

SEE REVERSE SIDE

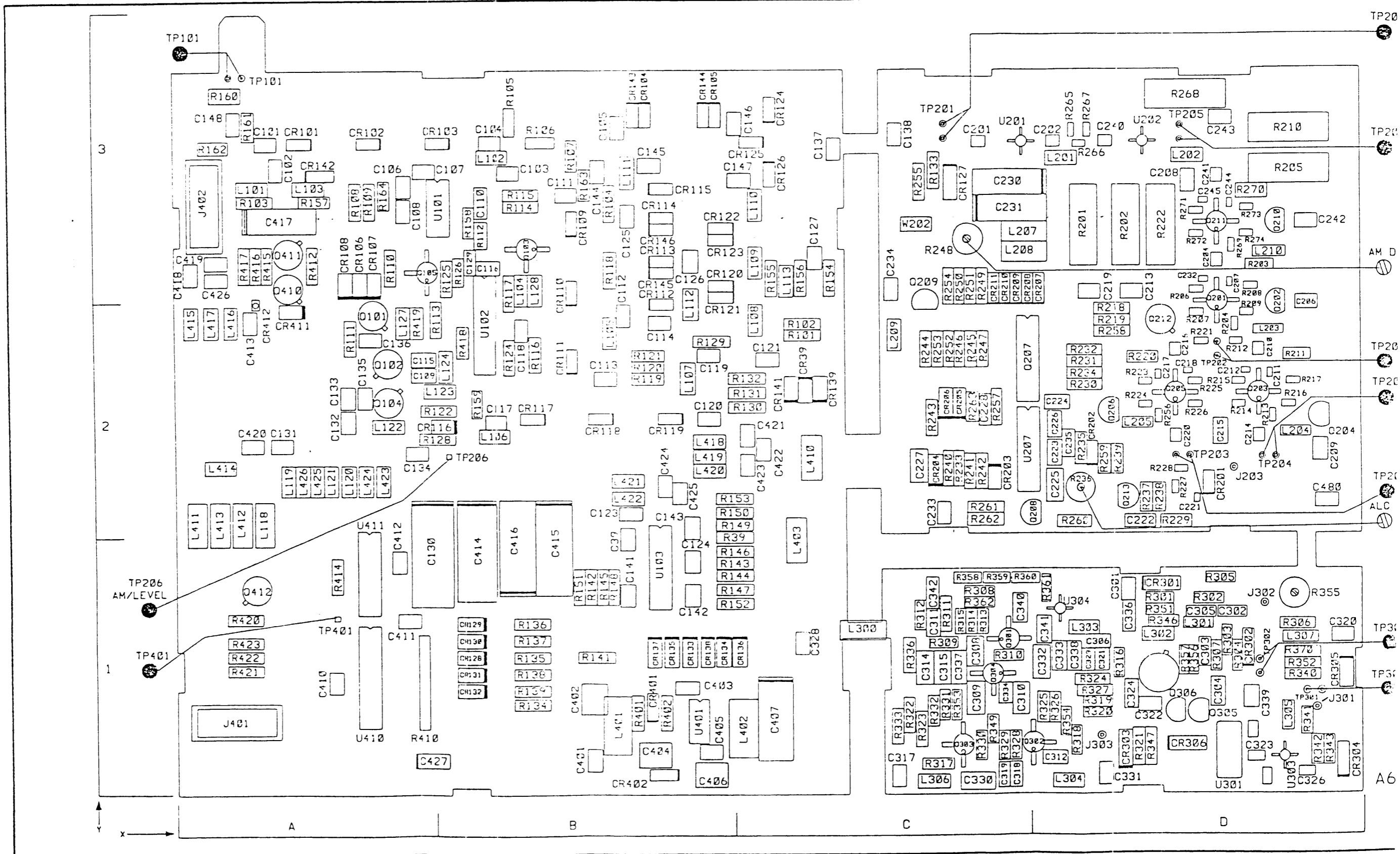
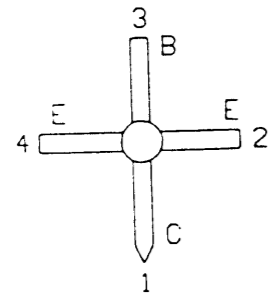


Figure 0. Service Sheet 4 Information  
Serial Prefix 3105U

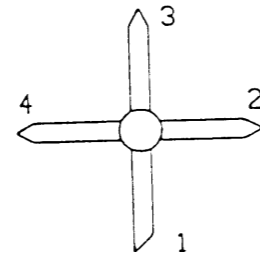
Component Locator

NOTES

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. Chassis ground is achieved by mechanical contact through nuts holding PC board to frame. Matched for temperature characteristics.
3. Printed circuit trace inductor.
4. The mismatch caused by inserting a 50 ohm impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is more than 3 dB, at others less than 3 dB.
- \* Indicates factory-selected part. Typical value is shown. Refer to Section 5 for selection procedure.



A60201, 203, 205

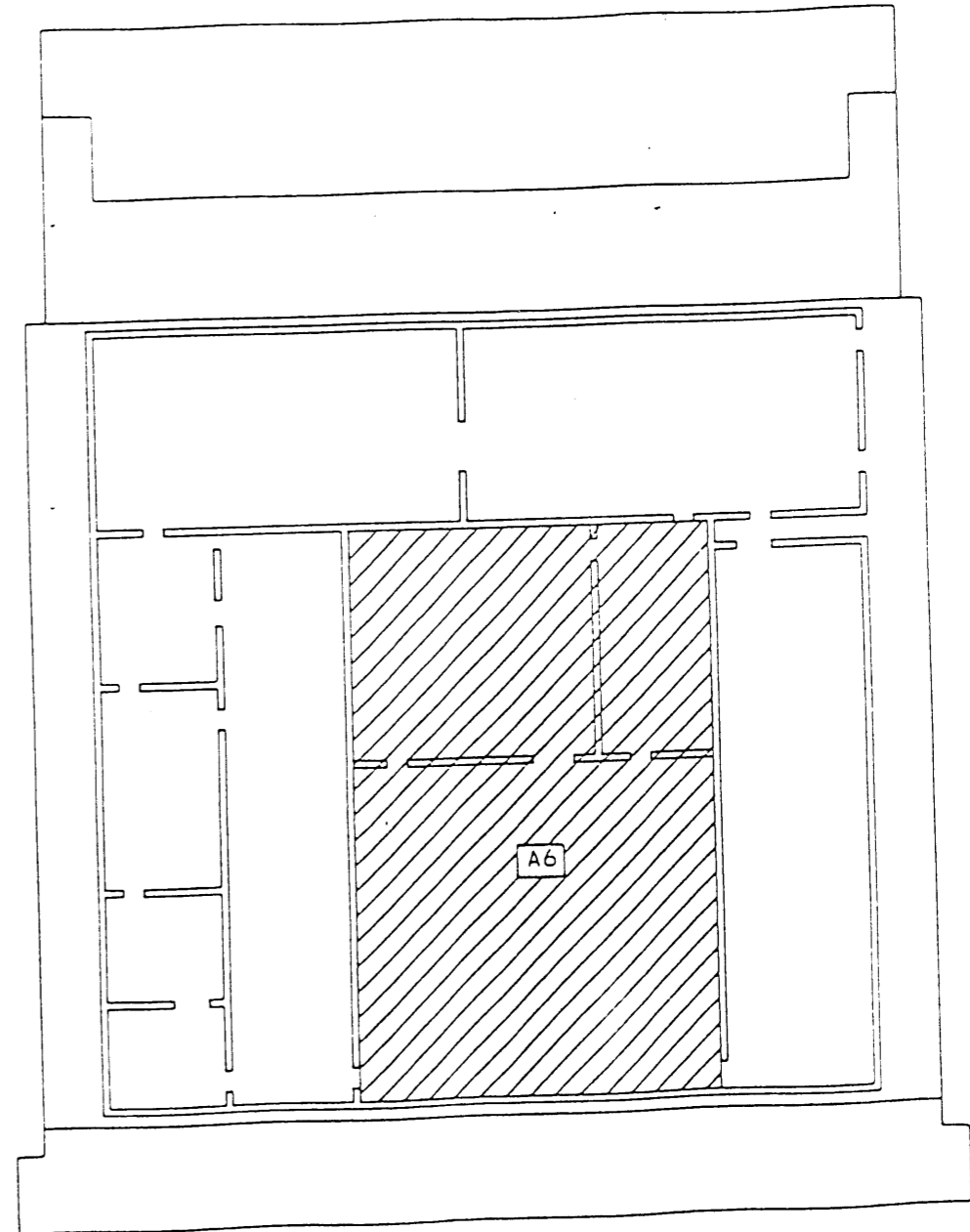


A6U201, 202, 303

LOGIC LEVELS

	TTL	ECL	EECL
HIGH	2V	+4.2V	+5.1V
LOW	0.8V	+3.3V	+4.7V
IS MORE NEG. THAN IS MORE POS. THAN			
OPEN	HIGH	LOW	LOW
GROUND	LOW	HIGH	HIGH

TOP INTERNAL VIEW - LEVEL 2





## Service Sheet 4

### OUTPUT

#### PRINCIPLES OF OPERATION

##### General

The 520 to 1040 MHz signal from the High Frequency Oscillator is input to the Output Assembly. The signal takes one of three paths determined by the frequency selected at the front panel. The signal is divided-by-1, 2 or 4. The signal is then passed through the Pin Diode Modulators and the Voltage Tuned Filter for the divider path selected. The harmonic filtered output is then amplified by the Output Amplifiers.

The Output Amplifier's output is applied to the Peak Detector and to the output Attenuator. The Peak Detector measures the signal's level and with the Automatic Level Control (ALC) Loop keeps the output level constant. In the ALC loop, the Peak Detector's voltage is compared to the AM/Reference input voltage. The difference is amplified and coupled back to the PIN Modulator which acts as a current controlled attenuator. The Attenuator provides amplitude control beyond the range of the ALC Loop.

##### Divider, PIN Modulator, And Voltage Tuned Filter Path Selection

The Divide-by-1, Divide-by-2, or Divide-by-4 data control inputs from the VTF/Band Select Shift Register And Driver, U410 (refer to Service Sheet 5), select the divide-by-1, divide-by-2, or divide-by-4 path. The active divider's control input is at a logic High (+12V), and the other two dividers control inputs are at a logic Low (0V). The active divider control input turns on the divider's power supply, activates the PIN modulator, and selects the voltage tuned filter for that path. PIN Modulator selection is accomplished by allowing current to flow through the diodes. The Voltage Tuned Filters are controlled by the voltage output of U103B, C, or D (refer to Service Sheet 5). The 520 to 1040 MHz oscillator output signal from the High Frequency Loop Buffer Amplifier (+2 to +8 dBm) is applied to the Output Assembly. The signal is ac coupled by C101 into the RF Dividers where it is divided by one, two, or four depending on the output frequency selected at the front-panel. The divider selected determines the signal path. The divide-by-1 path is selected when an output frequency from 520 to 1029.999999 MHz, or less than 130 MHz is selected. The divide-by-2 path is selected when an output frequency from 260 to 519.999999 MHz is selected. The divide-by-4 path is selected when an output frequency from 130 to 259.999999 MHz is selected.

##### Divide-By-1 Path

When the divide-by-1 path is selected, the divide-by-1 control output of the VTF/Band Select Shift Register And Drivers is set high (+12V), (refer to Service Sheet 5). With the divide-by-1 control line high, diode CR142 is turned off and PIN Modulator diodes CR101, CR102, and CR103 are selected. The signal is ac coupled from the PIN Modulator through a 2 db impedance matching pad to the divide-by-1 band Voltage-Tuned Filter. Diode CR124 is turned on and the signal is routed to the High Band Output Amplifier.

### Divide-By-2 Path

In the divide-by-2 configuration, the divide-by-2 control input is set high (+12V) and diodes CR107, CR108, and CR142 are turned on. With diode CR142 turned on, C106 couples the input signal to U101 where it is divided-by-two. Divider U101 and Buffer Amplifier Q103 are turned on by the positive voltage at the base of Q101 and Q102. Q101 switches the +5V to the divider's Vcc input at pin 14 turning the divider on. Q102 switches the +5V to Q103 biasing Q103 on. The output at pin 10 of U1 is dc coupled to Q103. The output of Q103 is coupled to the PIN Modulator by C111. The positive divide-by-2 voltage also selects the divide-by-2 Pin Modulator diodes CR109, CR110, and CR111. The signal is ac coupled from the PIN Modulator through a 2 db impedance matching pad to the divide-by-2 band Voltage-Tuned Filter. Diode CR125 is turned on and the signal is routed to the High Band Output Amplifier.

### Divide-By-4 Path

In the divide-by-4 configuration, the divide-by-4 control input is set high (+12V) and diodes CR106, CR116, and CR142 are turned on. With diode CR142 turned on, C106 couples the input signal to U101 where it is divided by two. Divider U101 is turned on by the positive voltage at the base of Q101. Q101 switches the +5V to the divider's Vcc input at pin 14 turning the divider on, the same as in the Divide-By-2 mode.

The output at pin 7 of U101 is applied to the input at pin 7 of the second divider, U102. Divider U102 is activated when CR116 is turned on and Q104 switches +5V to pins 1 and 16. The positive divide-by-4 voltage also selects the divide-by-4 Pin Modulator diodes CR117, CR118, and CR119. The signal is ac coupled from the PIN Modulator through a 2 db impedance matching pad to the divide-by-4 band Voltage-Tuned Filter. Diode CR126 is turned on and the signal is routed to the High Band Output Amplifier.

### PIN Modulator

The divide-by-1, 2, 4 PIN Modulators are identical. The PIN Modulators consist of three series PIN diodes. The RF resistance of the PIN diodes decreases as the current through the diodes increase. The diodes function as current controlled RF resistors where the RF resistance is inversely proportional to the current through the diodes. Output level and amplitude modulation are controlled by varying the current through the PIN diodes.

### Voltage-Tuned Filters

Three voltage-tuned low-pass filters pass the 130 to 1029.999999 MHz output of the PIN Modulators and remove the harmonics generated by the dividers and oscillator. Each filter covers one octave of the frequency range; therefore, the harmonics are not passed to the Output Amplifier. Each Voltage Tuned Filter's (VTF) tune voltage is derived from data bits 6 through 10 of RF Word 2, (refer to Service Sheet 5). The 5 VTF data bits to the binary weighted resistor network R135 through R139 (discrete DAC) are summed for the correct current input to U103A. The divide-by-1, 2, 4 control data bits also select the correct VTF.

The power supply voltages of U103 are 0 and +27V which allows the tune voltage to vary from +2V to +25V. U103B, C, or D amplifies the output of U103A. The amplifier that is not turned off by the divide-by-1, 2, or 4 controls the inputs.

When the divide-by-1 band is selected diodes CR135 and CR137 are turned on and amplifiers U103C and D are turned off. The output voltage of U103B tunes the divide-by-1 VTF to pass the correct frequency and turns on diode CR124 to pass the output to the first Output Amplifier U201. Divide-by-2 and 4 function the same.

The VTF TUNE voltage of +2 to +25V will vary the capacitance of the varactors approximately 8 to 32 pF in the 260 To 520 MHz Voltage-Tuned Filter and the 130 to 260 MHz Voltage-Tuned Filter, and approximately 2 to 8 pF in the 520 to 1030 MHz Voltage-Tuned Filter.

## Output Amplifier

The output of the Voltage-Tuned Filters is ac coupled to the Output Amplifier by capacitor C201. The High-Band Output Amplifier functions as a five stage amplifier with 32 dB of gain from 130 MHz to 1040 MHz. U201 and U202 are monolithic amplifiers with 12 dB and 8 dB of gain respectively. The third and fourth stages consist of transistor pairs Q210/Q211 and Q201/Q202. Each pair provides about 6 dB of gain and a maximum output power level of approximately +20 dBm. The output of Q201 is applied to broadband resistor power splitter R212 and R221. The power splitter couples the output to the final output amplifier Q203 and to the ALC Loop Amplifier Q205. Both amplifiers are identical and have 6 dB of gain. The total gain of the Output section is approximately 32 dB. Amplifiers Q211, Q201, Q203 and Q205 are identical, each with 6 dB of gain minimum.

The bases of Q210, Q202, Q204, and Q206 are dc biased by the +7.5V reference voltage divided from the +15V (F3) power supply voltage by resistors R218 and R219. The transistor emitters are connected to the +15V supply by 82 ohm resistors, the emitter voltage is approximately 0.6V more positive than the base. The current in the 82 ohm resistor is determined by the voltage difference of the emitter voltage and the +15V supply. The current takes two paths. One path for the current is into the emitter of and out the collector. This current is multiplied by the common-base current gain which is approximately one. This is the base current for each following amplifier. The other current path is the collector current. The total current across the the 82 ohm resistors is the sum of the base current and collector current. The result is that the bias current for amplifiers is stable. Each transistor has a resistor and capacitor for collector-to-base feedback. Each amplifier has two emitters with series resistor pair feedback to ground.

The output of Q203 is ac coupled by capacitor C214 to the Heterodyne section of the Attenuator and is the main output. The output of Q205 is applied to the load and Peak Detector formed by R227, R228, CR301 and C221. The gain of Q203 and Q205 is matched in every respect so their outputs track over temperature and aging. The level measured by the peak detector at the output of Q205 should be the same as the main output at J203.

## ALC Loop

The Automatic Level Control Loop (ALC Loop) Peak Detector detects the output of amplifier Q205. The Peak Detector's output is compared to the AM/ Reference input (refer to Service Sheet 7) in the loop to keep the level constant and to provide Amplitude Modulation.

## Peak Detector

Transistors Q207B and Q207C are two tracking temperature compensated 50  $\mu$ A current sources that bias diodes CR201 and CR302. The correct sources are temperature compensated by transistors Q207A and Q207D. The Detector Adjustment (DET ADJ) R236 is adjusted to compensate offsets in the detector circuits. The transistors are biased-on by the resistor divider network of R232, R234. Diodes CR201 and CR202 are matched diodes. CR202 provides temperature compensation for the detector CR201.

### ALC Amplifier

The ALC Amplifier has two modes of operation, narrow and wide bandwidth. Narrow bandwidth is used when the Signal Generator's output is CW, no modulation, and wide bandwidth is used when its output is modulated, AM, FM, or both.

The voltage at the positive input of U207B and U207C is the peak voltage of the RF output. The voltage at their negative inputs is the AM/Reference voltage from the Audio Power Supply Assembly, A10. This input voltage at U207B pin 6 and U207C pin 9 is shaped by resistors R207, R248, R249, R250, R251 and diodes CR207, CR208, CR209, and CR210 and CR211. For very low levels, the input voltage characteristic should approximate the square law region of the detector. (The square law region is the non-linear portion of the detector's current-versus-voltage curve. In this region the change in current is proportional to the square of the change in voltage.) If the voltages to the inputs are the same, there is very little distortion.

When CW is selected, (AM and FM Modulation off) Continuous Wave Select (refer to Service Sheet 5) to Bandwidth Select comparator U207A selects summing amplifier U207C and narrow bandwidth. The High CW Select +15V input to voltage divider R246, R245 sets the positive input to approximately +10V and switches the output of U207A to +15V. The +15V output turns on Diode CR203, and the high input voltage sets the output of U207B high. Diode CR205 is turned off and U207B is disconnected from the circuit. Amplifier U207C is active (the narrow bandwidth amplifier).

When Amplitude Modulation, Frequency Modulation, or both are selected, the CW Select input to the Bandwidth Select Comparator, U207A, is low. U207A's output is switched to approximately -15V. Diode CR204 is turned on and the low input voltage to U207C sets its output low. Diode CR206 is turned off and narrow bandwidth amplifier U207C is disconnected from the circuit. Wide bandwidth amplifier U207B is active. The output of the ALC Amplifier controls the current of the selected PIN Modulator and therefore controls its resistance (jumper W201 in position W201A). The Modulation Shaper circuit (R101, R102, and diodes CR139, CR140, and CR141) compensates for the non-linearity of the PIN Modulator diodes. When jumper W201 is in the W201B position, the PIN Modulator current is fixed and the ALC Loop is open for service.

In Fast Mode, FET's Q213 and Q214 are switched on. Each FET's "on" resistance reduces the values of R243 and R241 respectively. This, therefore changes the time constant of the circuit thereby improving the switching time of the loop.

## TROUBLESHOOTING

Procedures for checking part of the A6 Output Assembly circuits are given below. The area or points to check are marked on the schematic by a hexagon with a checkmark and a number inside, for example,  $\checkmark 3$ . Fixed voltages are shown on the schematic inside a hexagon, for example,  $2V \pm 0.2V$ . Transistor bias voltages are shown without tolerances.

### Troubleshooting Help

- Block Diagram 2
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustment Procedures

### Test Equipment

Digital Multimeter .....	HP 3466A
Measuring Receiver .....	HP 8902A
Sensor Module .....	HP 11722A
Adapter Probe .....	HP 1250-1598
Adapter N(f) to BNC(m).....	HP 1250-0077
Adapter BNC(f) to BNC(f) .....	HP 1250-0080
Cable BNC(m) to SMC(f).....	HP 08662-60075

### $\checkmark 1$ RF Dividers

1. Set the Signal Generator as follows:

Frequency.....	520 MHz
Amplitude.....	-20 dBm
Modulation.....	Off

2. Set the measuring receiver with the sensor module precalibrated as follows:

Measurement.....	RF POWER
Display .....	LOG

#### NOTE

*The mismatch caused by insertion of the 50 ohm input impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is 3 dB, and at others it is less than 3 dB.*

3. Zero the measuring receiver and wait for the zero LED to go out.
4. Measure the voltages, power levels, and signals as shown in Tables 1, 2, and 3 for each front-panel frequency setting.

Table 1. RF Divider Voltages.

Signal Generator Frequency (MHz)	Divider Voltages (Vdc), U410			Signal at TP101	
	÷1 SEL Pin 10	÷2 SEL Pin 11	÷4 SEL Pin 12	Level (dBm)	Frequency (MHz)
520	+12.5	+0.04	+0.04	+8.0 to +2.0	520
260	+0.04	+12.5	+3.5	+8.0 to +2.0	520
130	+0.04	+3.5	+12.5	+8.0 to +2.0	520

Table 2. RF Divider Vcc Voltage.

Signal Generator Frequency (MHz)	Voltages (Vdc) on	
	U101 Pin 14	U102 Pin 1,16
520	+0.4	+0.4
260	+5.0	+2.1
130	+5.0	+5.0

Table 3. Bias Voltages.

Signal Generator Frequency (MHz)	Bias Voltages (Vdc)											
	Q101			Q102			Q103			Q104		
	E	B	C	E	B	C	E	B	C	E	B	C
520	0.0	0.0	+5.2	0.0	0.0	+5.2	0.0	0.0	0.0	0.0	0.0	+5.2
260	+5.0	+5.7	+5.2	+5.0	+5.7	+5.2	0.0	+0.7	+2.3	+2.2	+2.8	+5.2
130	+5.0	+5.7	+5.2	+2.6	+3.2	+5.2	0.0	+0.6	+1.7	+5.0	+5.7	+5.2

√2 Voltage Tuned Filters.

The tune voltage for each Voltage Tuned Filters is checked at its highest tuned frequency in each of the three RF divider bands. The input power to the Dividers and the output power of the Voltage Tuned filters are checked.

1. Set the Signal Generator as follows:

Frequency..... 1040 MHz  
 Amplitude..... -10 dBm

2. Measure the voltages shown in Table 4 for each Signal Generator frequency.

*Table 4. Voltage Tuned Filter (VTF) Control Voltages.*

Signal Generator Frequency (MHz)	VTF Tune Voltages (Vdc) (Maximum Tune Frequency)		
	130 to 259.99999 MHz VTF	260 to 519.99999 MHz VTF	520 to 1040 MHz VTF
1040	+2.1	+2.1	+22.0
519	+2.1	+22.0	+2.1
259	+22.0	+2.1	+2.1

- Set the Signal Generator as follows:  
 Frequency ..... 520 MHz  
 Amplitude ..... -20 dBm
- Set the Measuring Receiver with the sensor precalibrated as follows:  
 Measurement ..... RF POWER  
 Display ..... LOG
- Zero the Measuring Receiver and wait for the zero LED to go out.
- Measure the power levels and frequencies shown in Table 5 and change the front-panel frequency as indicated.

*Table 5. RF Divider Signal Measurements.*

Signal Generator Frequency (MHz)	Signal at TP101		Signal at TP201	
	Level (dBm)	Frequency (MHz)	Level (dBm)	Frequency (MHz)
520	+8.0 to +1.0	520	-23.0 to -30.0	520
260	+8.0 to +1.0	520	-23.0 to -30.0	260
130	+8.0 to +1.0	520	-23.0 to -30.0	130

**√3 High-Band Output Amplifier.**

- Check the bias voltages on A6U201, U202, Q211, Q201, Q203, and Q205.
- Set the Signal Generator as follows:  
 Frequency ..... 520 MHz  
 Amplitude ..... -20 dBm  
 Modulation ..... Off
- Set the Measuring Receiver with the sensor module precalibrated as follows:  
 Measurement ..... RF Power  
 Display ..... Log
- Zero the measuring receiver and wait for the zero LED to go out.
- Measure the power levels at the test points indicated in Table 6.

*Table 6. High-Band Output Amplifier Levels (ALC Loop Closed).*

Test Point	Power Levels (dBm)
TP201	-23.0 to -30.0
TP205	-10.0 to -16.0
TP202	+1.0 to -5.0
TP203	+4.0 to -2.0
TP204	+4.0 to -2.0

6. Open the ALC loop by placing jumper W202 in the W202B position.
7. Measure the power levels at the test points indicated in Table 7.

*Table 7. High-Band Output Amplifier Levels (ALC Loop Open).*

Test Point	Power Levels (dBm)
TP201	-2.0 to -9.0
TP205	+8.0 to +1.0
TP202	+16.0 to +9.0
TP203	+19.0 to +12.0
TP204	+19.0 to +12.0

8. Place W202 back in the W202A position.

**J4** ALC Amplifier

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -20 dBm  
 Modulation..... Off

2. Check the ALC Bandwidth Control voltage as indicated in Table 8 for both modulation off and 1% AM (Internal 1 kHz source).

*Table 8. ALC Bandwidth Control Voltages.*

Signal Generator AM	U207					
	Pin 3	Pin 1	Pin 5	Pin 7	Pin 9	Pin 8
Off	+8.5V	+13.0V	+4.5V	+13.3V	+0.5V	+10.1V
AM 1% (1k Int)	0.0V	-13.0V	+0.5V	+10.2V	-10.6V	+13.4V

3. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... +13 dBm  
 Modulation..... Off



4. Check the ALC amplifier voltages as indicated in Table 9. Change the front-panel amplitude as indicated.

**NOTE**

*Voltages may differ from the voltages shown in Table 9 because of level correction. The voltage change for each step from +13 dBm to -3 dBm is consistent.*

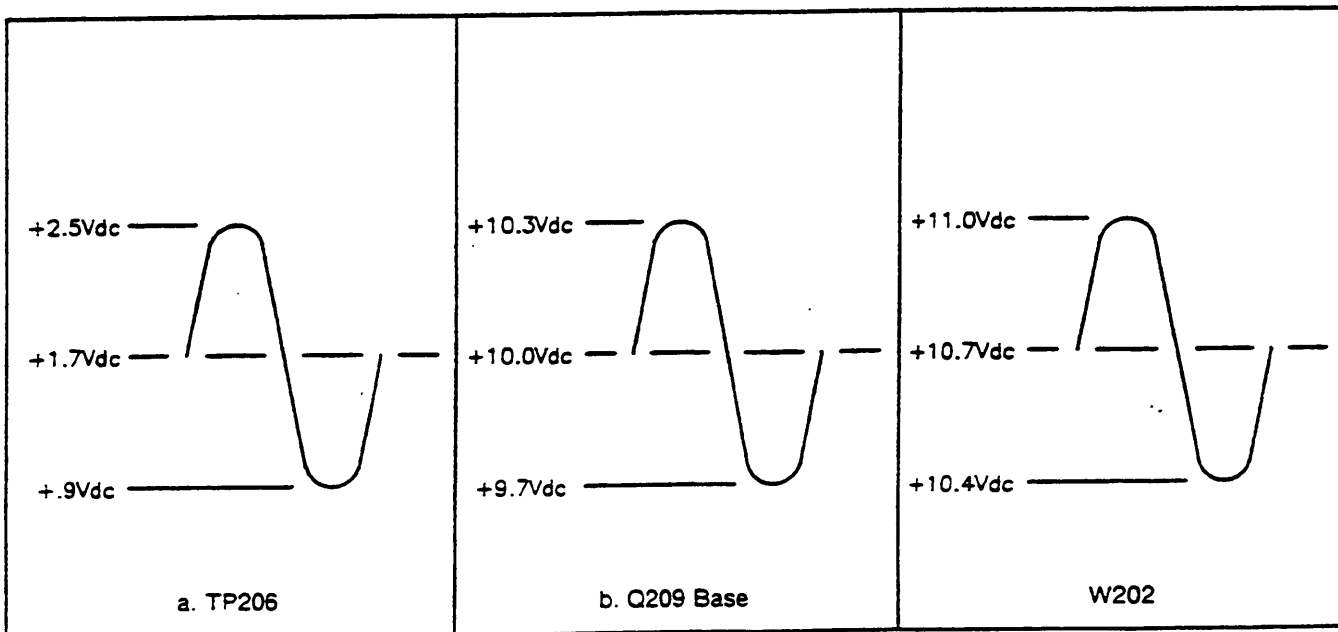
*Table 9. ALC Amplifier Voltages (Vdc).*

Signal Generator Amplitude	A6TP206	A6U207				A6Q209	
		Pin 12	Pin 13	Pin 14	Pin 8	B	E
+13 dBm	+2.24	+1.85	+1.85	+2.25	+9.64	+10.17	+10.77
+7 dBm	+1.15	+0.76	+0.76	+1.16	+9.96	+10.48	+11.09
+5 dBm	+0.89	+0.5	+0.5	+0.89	+10.03	+10.55	+11.15
+2 dBm	+0.64	+0.25	+0.25	+0.64	+10.08	+10.60	+11.23
0 dBm	+0.51	+0.12	+0.12	+0.52	+10.14	+10.66	+11.27
-3 dBm	+0.37	+0.02	+0.02	+0.37	+10.19	+10.71	+11.32

5. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... AM 50%  
 Source..... 1 kHz (Int.)

6. Using the oscilloscope, check the waveforms as indicated in Figure 1.



*Figure 1. ALC Amplifier Waveforms and Logic Level.*

A6 Component Coordinates (1 of 2)

COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
C101	A,3	C206	D,2	C320	D,1	CR105	B,3	CR204	C,2	L202	D,3
C102	A,3	C207	D,2	C321	D,1	CR106	A,3	CR205	C,2	L203	D,2
C103	B,3	C208	D,3	C322	D,1	CR107	A,3	CR206	C,2	L204	D,2
C104	B,3	C209	D,2	C324	D,1	CR108	A,3	CR207	D,2	L205	D,2
C105	B,3	C210	D,2	C325	D,1	CR109	B,3	CR208	C,2	L207	C,3
C106	A,3	C211	D,2	C326	D,1	CR110	B,2	CR209	C,2	L208	C,3
C107	A,3	C212	D,2	C328	C,1	CR111	B,2	CR210	C,2	L209	C,2
C108	A,2	C214	D,2	C329	D,1	CR112	B,2	CR211	C,2	L300	C,1
C109	A,2	C215	D,2	C330	C,1	CR113	B,3	CR301	D,1	L301	D,1
C110	B,3	C216	D,2	C331	D,1	CR114	B,3	CR302	D,1	L302	D,1
C111	B,3	C217	D,2	C332	C,1	CR115	B,3	CR303	D,1	L303	D,1
C112	B,2	C218	D,2	C333	C,1	CR116	A,2	CR401	B,1	L304	D,1
C113	B,2	C219	D,3	C334	C,1	CR117	B,2	CR402	B,1	L306	C,1
C114	B,2	C220	D,2	C336	C,1	CR118	B,2	CR411	A,2	L401	B,1
C115	A,2	C221	D,2	C337	C,1	CR119	B,2	CR412	A,2	L402	B,1
C116	B,3	C222	D,2	C338	D,1	CR120	B,2	J203	D,2	L410	C,2
C117	B,2	C223	C,2	C339	D,1	CR121	B,2	J301	D,1	L411	A,2
C119	B,2	C224	C,2	C401	B,1	CR122	B,3	J302	D,1	L412	A,2
C120	B,2	C225	C,2	C402	B,1	CR123	B,3	J303	D,1	L413	A,2
C121	B,2	C226	C,2	C403	B,1	CR124	C,3	J401	A,1	L414	A,2
C123	B,2	C227	C,2	C404	B,1	CR125	B,3	J402	A,3	L415	A,2
C124	B,1	C228	C,2	C405	B,1	CR126	C,3	L101	A,3	L416	A,2
C125	B,3	C230	C,3	C406	B,1	CR127	C,3	L102	B,3	L417	A,2
C126	B,3	C231	C,3	C407	C,1	CR128	A,1	L103	A,3	L418	B,2
C127	C,2	C232	D,2	C410	A,1	CR129	A,1	L104	B,2	L419	B,2
C130	A,1	C233	C,2	C411	A,1	CR130	A,1	L105	B,2	L420	B,2
C131	A,2	C234	C,2	C412	A,1	CR131	A,1	L106	B,2	L421	B,2
C132	A,2	C235	C,2	C414	B,1	CR132	A,1	L107	B,2	L422	B,2
C133	A,2	C301	D,1	C415	B,1	CR133	B,1	L108	B,2	L423	A,2
C134	A,2	C302	D,1	C416	B,1	CR134	B,1	L109	B,3	L424	A,2
C135	A,2	C303	D,1	C417	A,3	CR135	B,1	L110	B,3	L425	A,2
C136	A,2	C304	D,1	C417	A,3	CR136	B,1	L111	B,3	L426	A,2
C137	C,3	C305	D,1	C418	A,3	CR137	B,1	L112	B,2	Q101	A,2
C138	C,3	C306	D,1	C419	A,3	CR138	B,1	L113	C,2	Q102	A,2
C140	B,1	C307	C,1	C421	B,2	CR139	C,2	L118	A,2	Q103	B,3
C141	B,1	C308	C,1	C422	B,2	CR140	C,2	L119	A,2	Q104	A,2
C142	B,1	C309	C,1	C423	B,2	CR141	C,2	L120	A,2	Q201	D,2
C143	B,2	C310	C,1	C424	B,2	CR142	A,3	L121	A,2	Q202	D,2
C144	B,3	C311	C,1	C425	B,2	CR143	B,3	L122	A,2	Q203	D,2
C145	B,3	C312	C,1	C426	A,3	CR144	B,3	L123	A,2	Q204	D,2
C146	B,3	C314	C,1			CR145	B,3	L127	A,3	Q205	D,2
C147	B,3	C315	C,1	CR101	A,3	CR146	B,3	L128	B,2	Q206	D,2
C201	C,3	C317	C,1	CR102	A,3	CR201	D,2	L201	D,3	Q207	C,2
C202	D,3	C318	C,1	CR103	A,3	CR202	D,2			Q208	C,2
C204	D,3	C319	C,1	CR104	B,3	CR203	C,2				

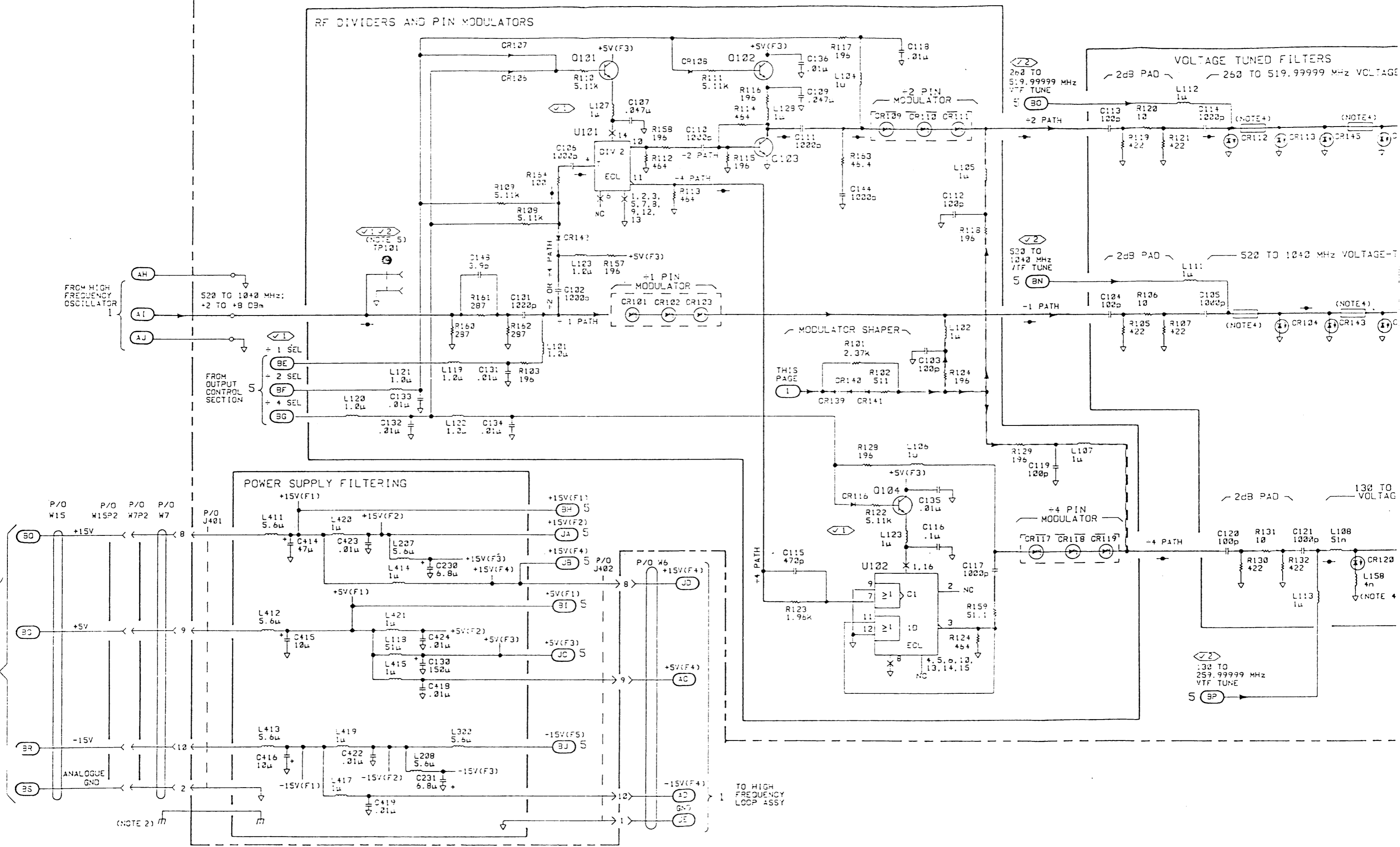
A6 Component Coordinates (2 of 2)

COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
Q209	C,2	R141	B,1	R222	D,2	R309	C,1	R417	A,3		
Q301	C,1	R142	B,1	R223	D,2	R310	C,1				
Q302	C,1	R143	B,1	R224	D,2	R311	C,1	TP101	A,3		
Q303	C,1	R144	B,1	R225	D,2	R312	C,1	TP201	C,3		
Q304	C,1	R145	B,1	R226	D,2	R313	C,1	TP202	D,2		
Q410	A,2	R146	B,1	R227	D,2	R314	C,1	TP207	D,2		
Q411	A,3	R147	B,1	R228	D,2	R315	C,1	TP204	D,2		
		R148	B,1	R229	D,2	R316	D,1	TP205	D,3		
R101	C,2	R149	B,2	R230	D,2	R317	C,1	TP206	A,2		
R102	C,2	R150	B,2	R231	D,2	R318	D,1	TP301	D,1		
R103	A,3	R151	B,1	R232	D,2	R319	D,1	TP302	D,1		
R104	B,3	R152	B,1	R233	C,2	R320	D,1	TP303	D,1		
R105	B,3	R153	B,2	R234	D,2	R321	D,1	TP401	A,1		
R106	B,3	R154	C,2	R235	D,2	R322	C,1				
R107	B,3	R155	C,2	R236	D,2	R323	C,1	U101	A,3		
R108	A,3	R156	C,2	R240	C,2	R324	D,1	U102	B,2		
R109	A,3	R157	A,3	R241	C,2	R325	C,1	U103	B,1		
R110	A,3	R158	A,3	R242	C,2	R326	C,1	U201	C,3		
R111	A,2	R159	B,2	R243	C,2	R327	D,1	U202	D,3		
R112	A,2	R160	A,3	R244	C,2	R328	C,1	U203	C,2		
R113	A,2	R161	A,3	R245	C,2	R329	C,1	U301	D,1		
R114	B,3	R162	A,3	R246	C,2	R330	C,1	U302	D,1		
R115	B,3	R163	B,3	R247	C,2	R331	C,1	U303	D,1		
R116	B,2	R164	A,3	R248	C,3	R332	C,1	U401	B,1		
R117	B,2	R201	D,3	R249	C,3	R333	C,1	U410	A,1		
R118	B,3	R202	D,2	R250	C,2	R336	C,1	U411	A,1		
R119	B,2	R203	D,3	R251	C,2	R339	D,1				
R120	B,2	R204	D,2	R252	C,2	R340	D,1	W202	C,3		
R121	B,2	R205	D,3	R253	C,2	R341	D,1				
R122	A,2	R206	D,2	R254	C,2	R342	D,1				
R123	A,2	R207	D,2	R255	C,3	R343	D,1				
R124	B,2	R208	D,2	R256	D,2	R346	D,1				
R128	A,2	R209	D,2	R257	C,2	R347	D,1				
R129	B,2	R210	D,3	R260	D,2	R349	C,1				
R130	B,2	R211	D,2	R261	C,2	R351	D,1				
R131	B,2	R212	D,2	R262	C,2	R352	D,1				
R132	B,2	R213	D,2	R263	C,2	R353	C,1				
R133	C,3	R214	D,2	R301	D,1	R354	D,1				
R134	B,1	R215	D,2	R302	D,1	R401	B,1				
R135	B,1	R216	D,2	R303	D,1	R402	B,1				
R136	B,1	R217	D,2	R304	D,1	R410	A,1				
R137	B,1	R218	D,2	R305	D,1	R412	A,3				
R138	B,1	R219	D,2	R306	D,1	R414	A,1				
R139	B,1	R220	D,2	R307	D,1	R415	A,3				
R140	B,1	R221	D,2	R308	C,1	R416	A,3				

## CHANGES

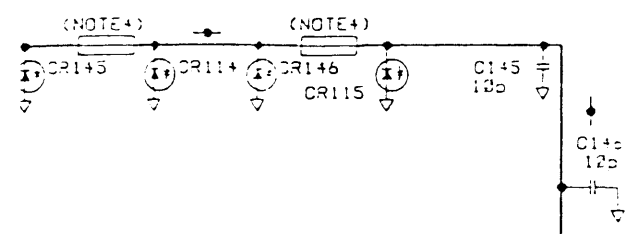
<b>2928U and above</b>	<p>On the A6 Schematic Diagram:</p> <ul style="list-style-type: none"><li>• <u>C148</u> - Remove C148.</li><li>• <u>R161</u> - Change the value to 17.8<math>\Omega</math>.</li><li>• <u>R149</u> - Add R149, 1.33K. R149 is connected between U102 pin 7 and ground.</li><li>• <u>R123</u> - Delete R123.</li><li>• <u>R418</u> - Add R148, 464<math>\Omega</math>. R148 is connected between U102 pin 1 and pin 7.</li></ul>
<b>3025U and above</b>	<p>On the A6 Schematic Diagram:</p> <ul style="list-style-type: none"><li>• <u>Part Number</u> - Change the board part number to 08657-60140.</li></ul>
<b>3105U and above</b>	<p>The A6 assembly changes to part number 08657-90159.</p> <ul style="list-style-type: none"><li>• <u>Schematic Diagram and Component Locator</u> - Use the Schematic diagram and Component Locator marked Serial Prefix 3105U.</li></ul>

P/O A6 OUTPUT ASSEMBLY (08657-60121)

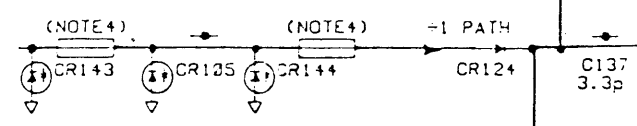


SERIAL PREFIX: 29+50

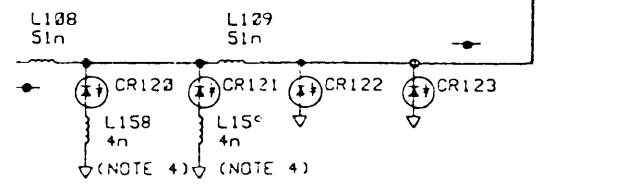
15  
7.5 MHz VOLTAGE-TUNE FILTER



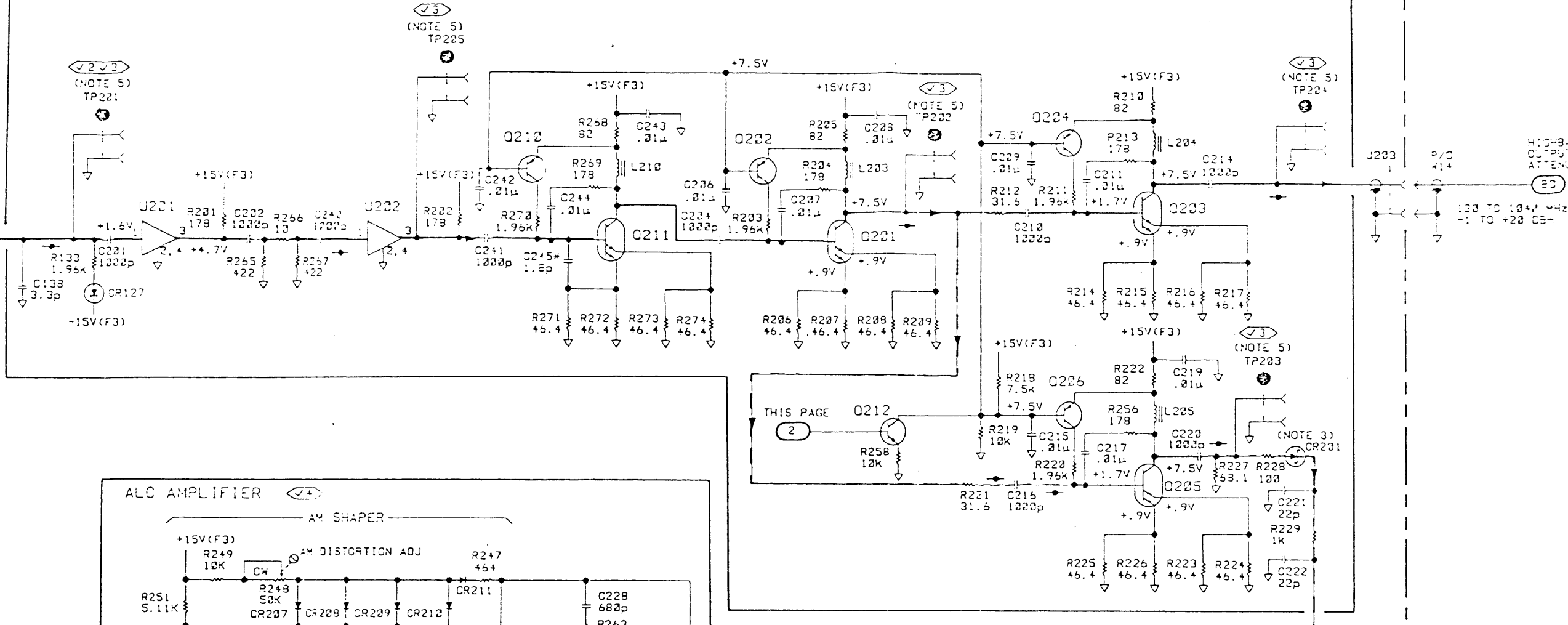
130 Hz VOLTAGE-TUNED FILTER



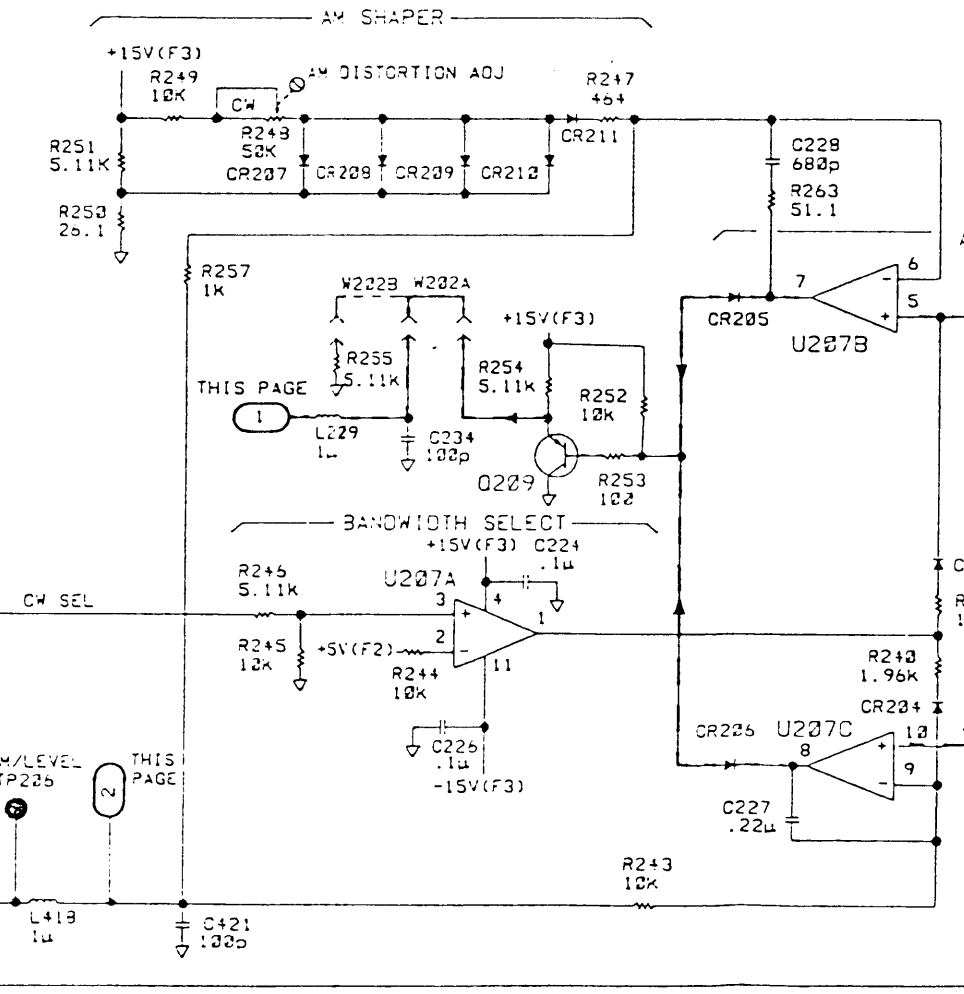
130 TO 259.99999 MHz VOLTAGE-TUNED FILTER



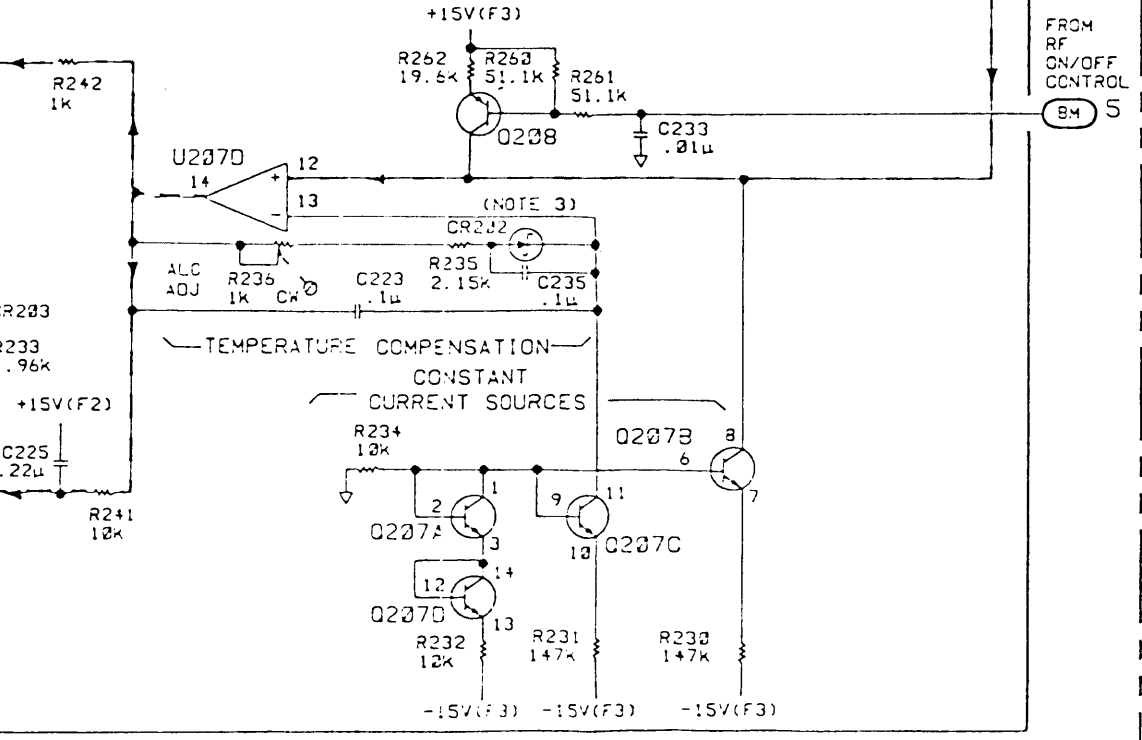
### HIGH-BAND OUTPUT AMPLIFIER



### ALC AMPLIFIER



### ALC AMPLIFIER



CONTINUOUS WAVE SEL

5 (BL)

AM/LEVEL TP225

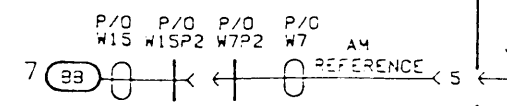
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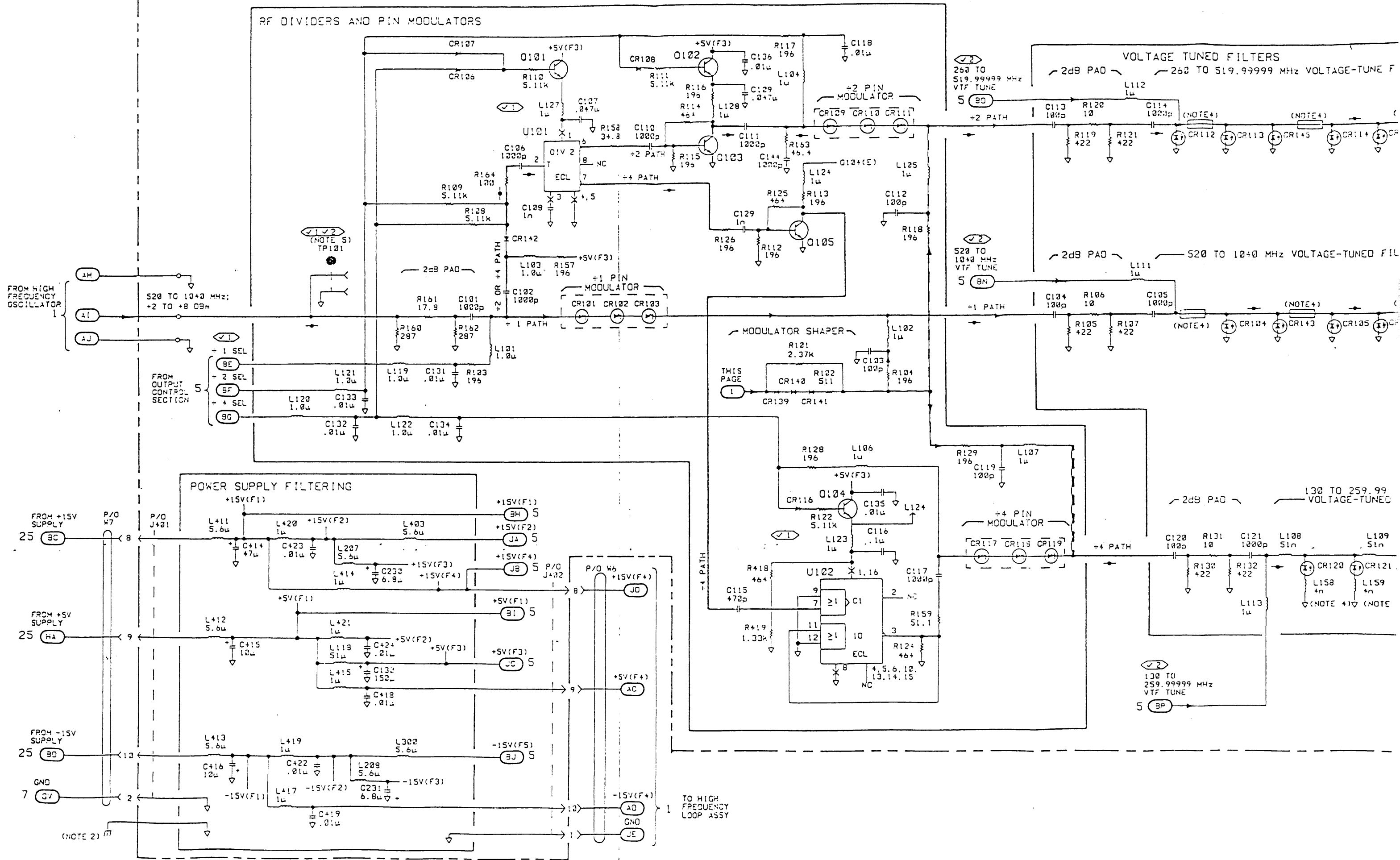
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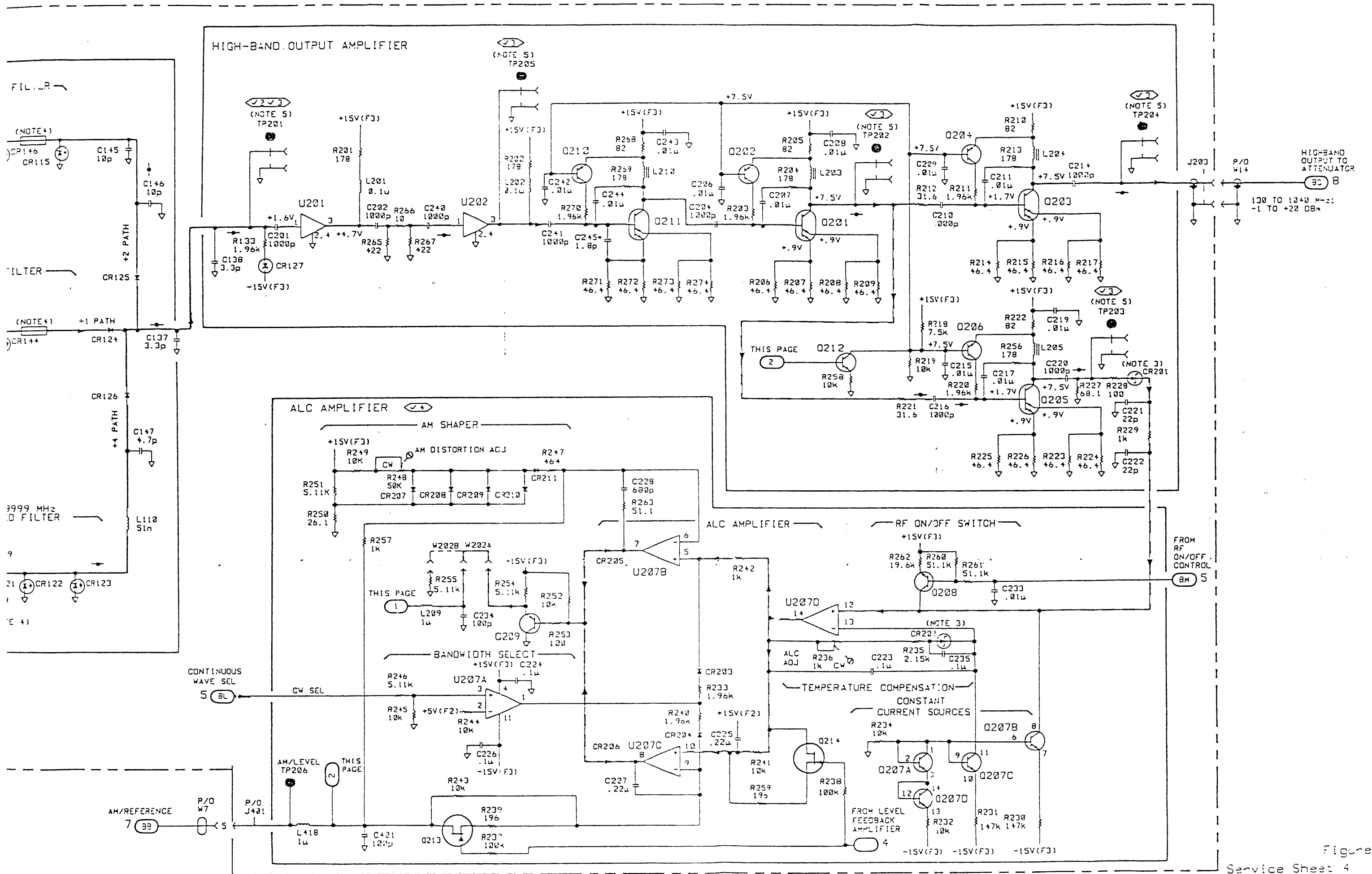


Figure 2  
Service Sheet 4 15



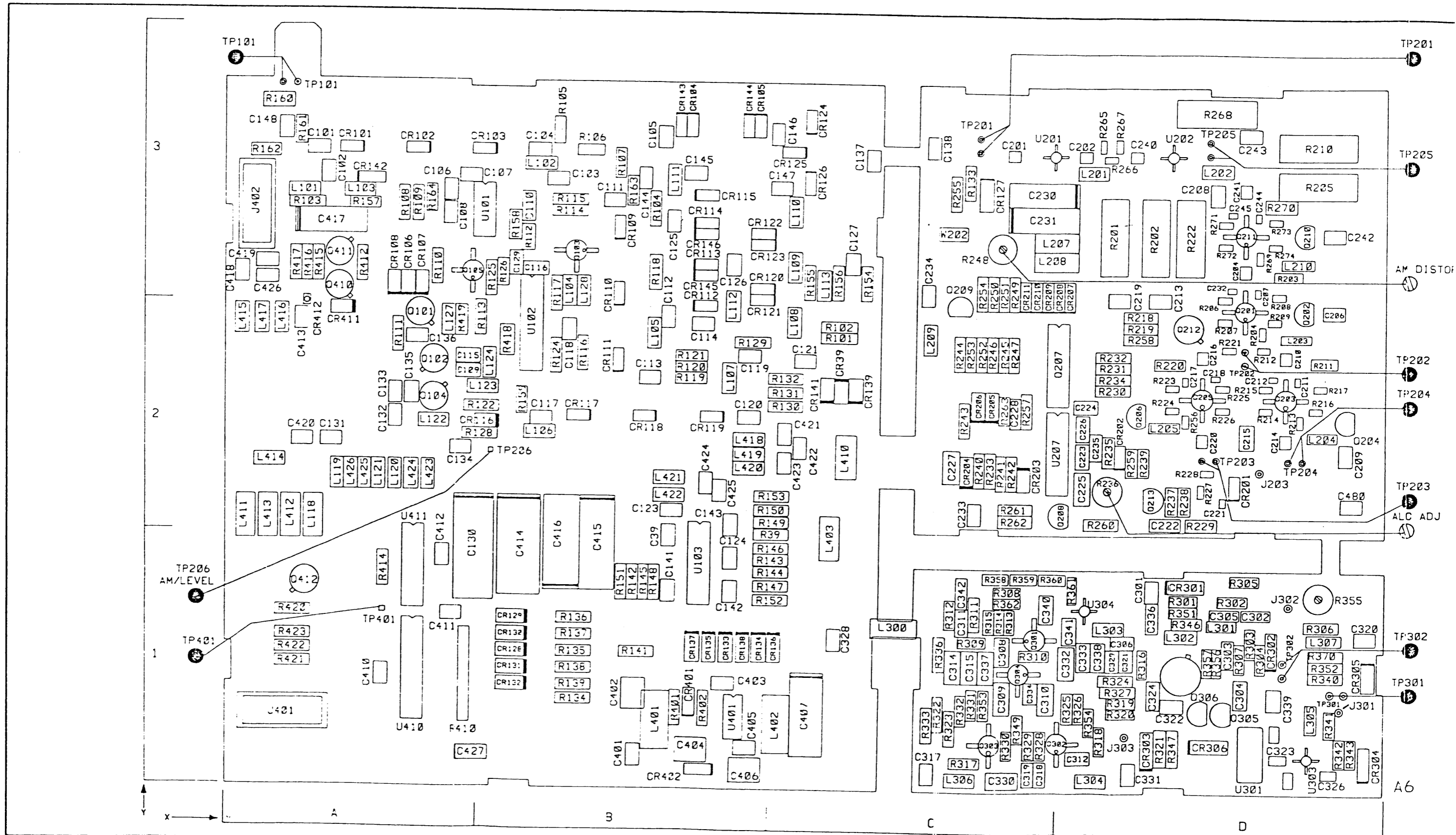
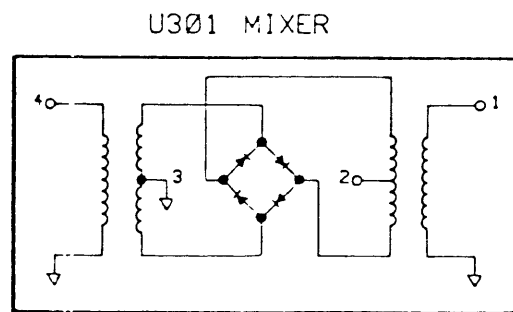
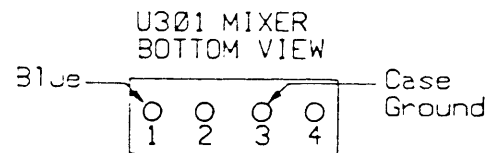


Figure 0. Service Sheet 5 Information  
Serial Prefix 3105U

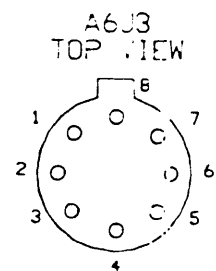
Component Locator

NOTES

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. Chassis ground is achieved by mechanical contact through nuts holding PC board to frame.
3. Bottom view and schematic diagram of U301 are as follows:



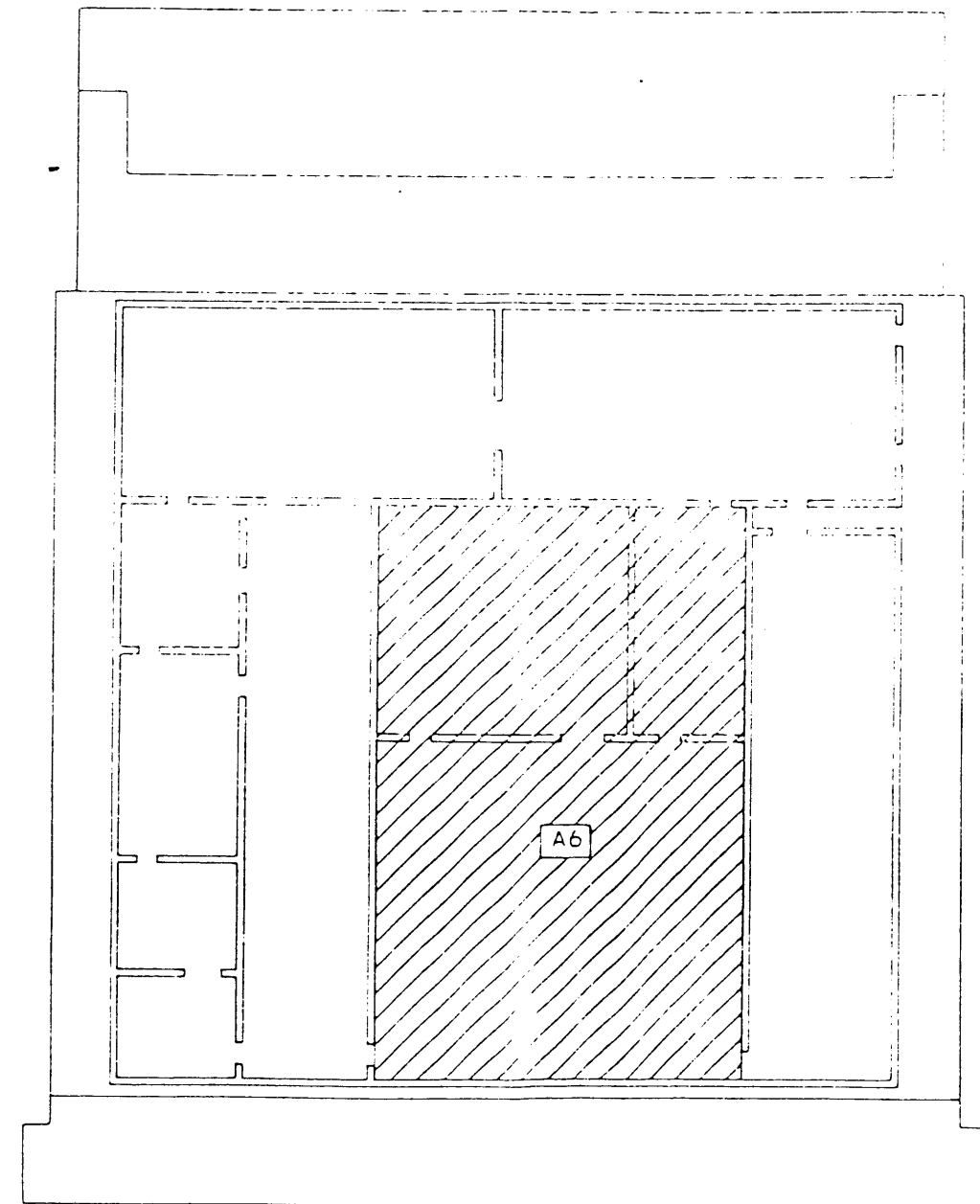
4. Printed circuit trace inductor.
5. The mismatch caused by inserting a 50 ohm impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is more than 3 dB, at others less than 3 dB.



LOGIC LEVELS

	TTL	CMOS
HIGH	2V	3.5V
LOW	0.8V	1.5V
IS MORE NEG. THAN IS MORE POS. THAN		
OPEN	HIGH	UNDEF.
GROUND	LOW	LOW

TOP INTERNAL VIEW - LEVEL 2



P/O A6    OUTPUT    SS4

SEE REVERSE SIDE

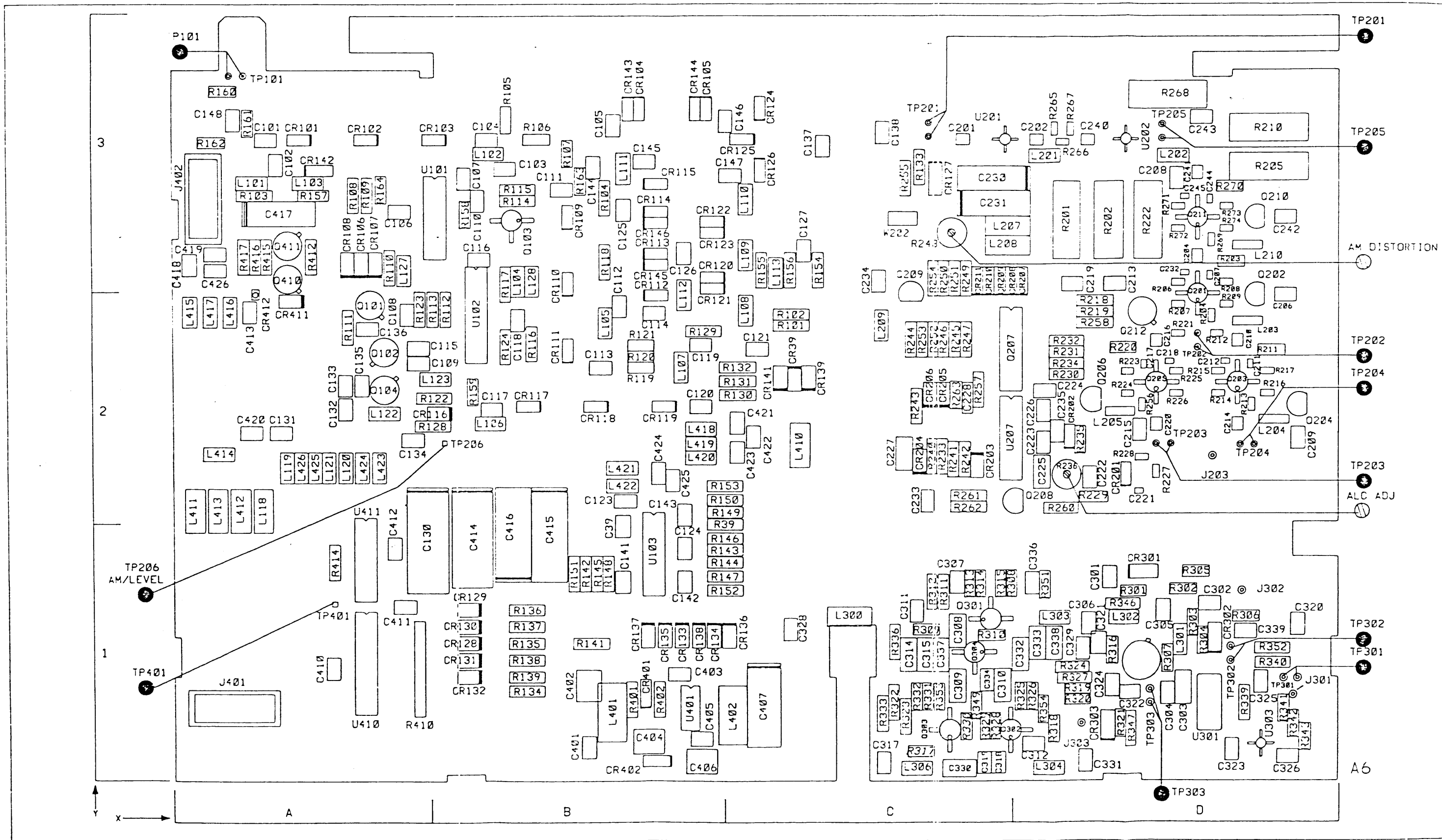
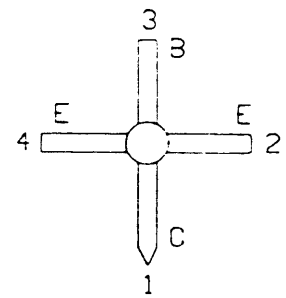


Figure 0. Figure 2. Service Sheet 5 information

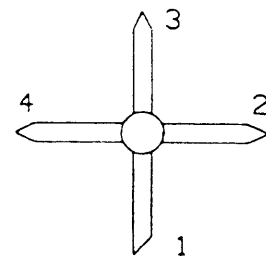
Component Locator

NOTES

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
  2. Chassis ground is achieved by mechanical contact through nuts holding PC board to frame.
  3. Matched for temperature characteristics.
  4. Printed circuit trace inductor.
  5. The mismatch caused by inserting a 50 ohm impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is more than 3 dB, at others less than 3 dB.
- \* Indicates factory-selected part. Typical value is shown. Refer to Section 5 for selection procedure.



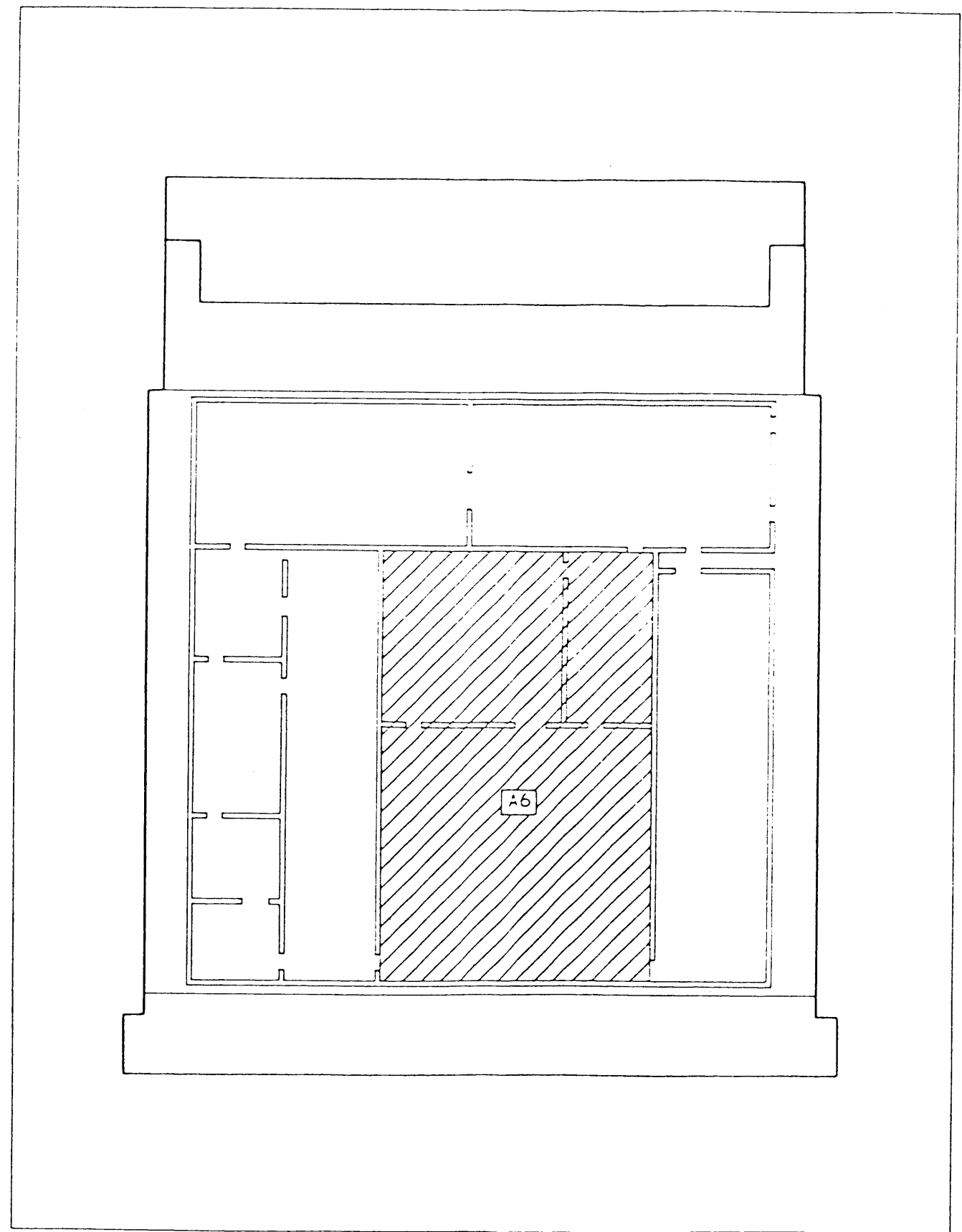
A60201, 202, 205



A6U201, 202, 303

LOGIC LEVELS

	TTL	ECL	EECL
HIGH	2V	+4.2V	+5.1V
LOW	0.8V	+3.3V	+4.7V
IS MORE NEG. THAN IS MORE POS. THAN			
OPEN	HIGH	LOW	LOW
GROUND	LOW	HIGH	HIGH



P/O A6    OUTPUT    SS4  
SEE REVERSE SIDE

## Service Sheet 5

### HETERODYNE AND OUTPUT CONTROL

#### PRINCIPLES OF OPERATION

##### General

When the RF Output frequency is between 0.1 and 129.99999 MHz, the Divide-By-1/Heterodyne mode is selected. The High Frequency Loop VCO's frequency is between 800.1 and 929.99999 MHz. These frequencies are mixed with 800 MHz and the difference frequencies, 0.1 to 129.99999 MHz, are the heterodyne band frequencies.

The Output Clock (OCL) clocks twenty Serial Output Data (ODA) bits into the VTF/Band Select Shift Register And Driver, U410, and by way of the HDA line, into the High Frequency Loop Data Shift Register, U5, (refer to Service Sheet 2).

The ten bits of Serial Output Data latched into U410 are the RF Divider Control Data, VTF Voltage Control Data, and CW Select Data. The RF Divider Control data selects the RF Divider, PIN Modulator, and the VTF Driver.

##### Heterodyne Section

When an RF Output frequency between 0.1 and 129.99999 MHz is selected, the Heterodyne mode is entered. An RF signal (between 800.1 and 929.99999 MHz) from the High Band Output Amplifier Q203 (refer to Service Sheet 4) goes to the Attenuator Assembly, A9. The Attenuator Assembly's Heterodyne Switch switches the RF signal into the Heterodyne Section.

A frequency from 800.1 MHz to 929.99999 MHz at a level from -1 to +20 dBm, vernier level dependent, is switched to the Heterodyne Section and applied to the Mixer, U301, through J302, 16 dB pad (R301, 302 and 303), and PIN diode CR302. The 16 dB pad and PIN diode control the signal level into the Mixer, U301. The PIN diode's attenuation is controlled by Integrator U302. The Integrator's output is controlled by the Input Peak Detector (CR301) and the Output Peak Detector (CR303). The Peak Detector outputs are the inputs to the Integrator, controlling the output. The output level of the Heterodyne Section is controlled by the input level.

In Fast Mode, FET's Q305 and Q306 are switched on. The "on" resistance of the FET's reduces the value of resistors R316 and R321 respectively and hence changes the time constant of the circuit. This improves the switching time of the loop.

The other input to the Mixer is the 800 MHz from the Multiplier Assembly (refer to Service Sheet 3). The 800 MHz at +1 to +7 dBm enters the Output Assembly, A6, through J301, 10 dB pad (R341, 342, and 343), and Buffer Amplifier U303. The Buffer Amplifier is tuned for maximum gain at 800 MHz. The difference output frequencies (0.1 to 129.99999 MHz) are passed by the 200 MHz Low-Pass Filter (LPF) to Low-Band Amplifier Q301. The input of the filter is diplexed by C304 and R307 to give a good match at all frequencies and to reduce spurious signals, primarily from the other mixing products. The output of the Mixer is coupled to the Low-Pass Filter and Amplifier, Q301.

Resistors R308, R310, R311 and R312 form a voltage divider to dc bias Q301. Resistors R313, R314, and R315 in the emitter provide series feedback, and collector to base resistor R310 provides shunt feedback. By using three emitter resistors, the inductance in the emitter current path is reduced. The Amplifier's gain is approximately 15 dB.

The output of Q301 is ac coupled to the base of emitter follower Q304. The emitter follower functions as an impedance matching transformer and drives the push-pull Low-Band Output Amplifier stage of Q302 and Q303.

Resistors R323, R324, R328 and R330 form a voltage divider to dc bias Q302 and Q303. Their collector voltage is set to approximately  $-7.5V$  by the voltage divider. The  $-7.5V$  is divided by resistors R309 and R329 to bias the emitter-follower Q304. Resistors R325, R326, and R354 in the emitter of Q302 provide series feedback. By using three resistors and three by-pass capacitors, the inductance in the emitter path is reduced. The resistors and capacitors in the emitter of Q303 have the same function. The Low-Band Output Push-Pull Amplifier drives the Output Peak Detector and the load. The output is filtered by the Low-Pass Filter.

The Low-Band Amplifier is coupled back to the Attenuator Assembly's Heterodyne Section. Resistor R317 approximates a 50 ohm output impedance. The Low-Band Output Amplifier's gain is approximately 15 dB for a total Heterodyne Section gain of 30 dB to restore the RF Signal to the same level as the input but at the lower frequency.

## Output Control Section

The 10 bit High Frequency Word 2 is received by the VTF/Band Select Shift Register and Driver from the Microprocessor by way of the Serial Output Data line (ODA). The five most significant data bits (VTF1, 2, 4, 16) set the five bit discrete resistor DAC of R134, 135, 136, 137, 138, and 139. The output voltage of the DAC tunes the selected VTF. The VTF and RF Dividers are selected by the three least significant bits, divide-by-1, divide-by-2, or divide-by-4. The VTF and RF Divider are selected when output frequencies in their frequency band are selected. Divide-by-1 band is 520-1040 MHz, Divide-by-2 band is 260-520 MHz and Divide-by-4 band is 130-260 MHz.

High Frequency Word 2 data bit 4 is the CW Select Control for the ALC Loop (refer to Service Sheet 4), and data bit 5 controls the switched +15V supply. Transistor Q410 is turned off when the RF Output is turned off by the RF ON/OFF front-panel key or over the HP-IB.

When the RF Output is turned OFF, the Microprocessor sets data bit 5 at pin 8 of U410 Low (0V). Diode CR411 is turned on and resistors R415 and R416 form a voltage divider to dc bias Q411 on. Q411 is turned on and Q410 is dc biased off. The switched +15V to the RF ON/OFF switch (refer to Service Sheet 4) and to the A4 Assembly (refer to Service Sheets 1 and 2) is switched off. LED CR412 is turned on indicating the +15V is off. With the RF Output ON, the data bit is +15V. CR411 is turned OFF, Q411 is biased OFF and Q410 is turned ON.

Q410 and Q411 also function as a circuit breaker if the switched +15V is shorted to ground. The circuit functions the same when the switched +15V is shorted as when the Microprocessor sets data bit 5 low. LED CR412 is turned on, when the RF OUTPUT is off or when the switched +15V is shorted.

## VTF Drivers

The DC To DC Converter U401 translates the +15V (F1) power supply voltage to +27V. U401 is a timer configured to operate as an astable multivibrator. Its output at pin 3 is a square wave 0 to approximately +15V at a frequency of approximately 100 kHz. The output frequency of the square wave is determined by R401, R402 and C403. CR401, CR402, C404 and C406 form a voltage doubler circuit. The output voltage is filtered by capacitor C406 and inductor L402. The output of the filter is approximately +27V and is the power supply voltage for U103. With its power supply voltages of 0 and +27V, U103 can produce a VTF tune voltage from +2V to +25V. The output of U103A is amplified by U103B, U103C or U103D. The amplifier that is not turned off by the divide-by-1, 2, or 4 controls input.

The VTF tune voltage is derived from VTF1, VTF2, VTF4, VTF8, and VTF16 (data bits 6 through 10 latched into U410). The five VTF input voltages to binary weighted resistors R135 through R139 (discrete DAC) are summed to provide the input to U103A.

### TROUBLESHOOTING

Procedures for checking part of the A6 Output Assembly circuits are given below. The area or points to check are marked on the schematic by a hexagon with a checkmark and a number inside, for example,  $\checkmark 3$ . Fixed voltages are shown on the schematic inside a hexagon, for example,  $\langle 2V \pm 0.2V \rangle$ . Transistor bias voltages are shown without tolerances.

### TROUBLESHOOTING HELP

- Block Diagram 2
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustment Procedures

### Test Equipment

Digital Multimeter .....	HP 3466A
Measuring Receiver .....	HP 8902A
Sensor Module .....	HP 11722A
Adapter Probe .....	HP 1250-1598
Adapter N(f) to BNC(m) .....	HP 1250-0077
Adapter BNC(f) to BNC(f) .....	HP 1250-0080
Cable, BNC(m) to SMC(f) .....	HP 08662-60075
Test Cable .....	HP 5061-4827

### $\checkmark 1$ Heterodyne Section

1. Check biasing on transistors Q305, Q301, Q309, and Q310.
2. Set the Signal Generator as follows:

Frequency .....	100 MHz
Amplitude .....	-20 dBm
Modulation .....	Off

3. Set the measuring receiver with the sensor module precalibrated as follows:

Measurement .....	RF POWER
Display .....	LOG

#### NOTE

*The mismatch caused by insertion of the 50 ohm input impedance Adapter Probe into the 50 ohm transmission line (at the RF Test Points), decreases power level readings. At some frequencies the decrease is 3 dB, and at others it is less than 3 dB.*

4. Zero the measuring receiver and wait for the zero LED to go out.
5. Connect the sensor module to the test points indicated in Table 1 by using the appropriate cables and adapters. Verify that the power levels and frequencies are correct.

**NOTE**

Measure power levels for J302, input from Attenuator Assembly, at A9AT1J3 using the Test Cable.

*Table 1. Heterodyne Section Power Levels.*

Test Point	Power Level (dBm)	Frequency (MHz)
TP301	+7.0 to +3.5	800.00
TP302	-3.5 to -6.5	900.00
J303	-3.5 to -6.5	100.00

**√2 Divider Control, CW SEL, and SW +15V**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -20 dBm  
 Modulation..... Off

2. Measure the voltage at U410 pin 9 (CW SEL). It should be +13.0 Vdc.

3. Set the Signal Generator as follows:

Modulation..... AM 50%  
 Source..... Internal 1 kHz

4. Measure the voltage at U410 pin 9 (CW SEL). It should measure 0.0 Vdc.

5. Set the Signal Generator as follows:

Modulation..... Off  
 RF ON/OFF Control..... RF ON

6. Measure the voltages and verify LED function as indicated in Table 2 for both RF ON and RF OFF.

*Table 2. Switched +15V, Switched +15V Protection.*

RF ON/OFF Control	U410 Pin 8	Q411 Base	Q410 Base	Q410 Collector	CR412 (LED)
RF ON	+13.0 Vdc	+14.0 Vdc	+13.4 Vdc	+14.0 Vdc	Off
RF OFF	+2.1 Vdc	+13.0 Vdc	+14.2 Vdc	+0.3 Vdc	On

7. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -20 dBm  
 Modulation..... Off



8. Measure the voltages for U410 Divider Selects as shown in Table 3 and change the front panel frequencies as indicated.

Table 3. RF Divider Selects.

Signal Generator Frequency	Divider Select Voltages (Vdc)		
	÷1 Select U410 Pin 10	÷2 Select U410 Pin 11	÷4 Select U410 Pin 12
520	12.5	+0.04	+0.04
260	+0.04	+12.5	+3.5
130	+0.04	+3.5	+12.5

**√3 Voltage Tuned Filter (VTF) Drivers.**

The Voltage Tuned Filter's tune voltage is tuned manually to set different tune voltage. The data entered manually by a series of front Panel key strokes overrides data sent to the Voltage Tuned Filters from the Microprocessor in normal operation. The data and tune voltages are checked in the 520 MHz to 1040 MHz frequency band. The VTF's data and tune voltage are checked at the maximum voltage level for the divide-by-2 and divide-by-4 bands.

1. Set the Signal Generator as follows:

Frequency..... 1040 MHz  
 Amplitude..... -10 dBm

2. Measure the supply voltage at U103 pin 4. It should be between +23 Vdc and +27 Vdc.
3. Set the Voltage Tuned Filters to their maximum frequency setting by pressing the **FREQ** key, the **0** key, the **SHIFT** key, and then the **←** key. The **0** key entry determines the data sent to U410 which determines the tune voltage.

**NOTE**

*The key sequence described in step 3 must be repeated for each number key or keys entered to change tune data from the Microprocessor.*

4. Measure the data bits at U410 and the VTF tune voltages as indicated in Table 4 for each front-panel entry as indicated. The VTF tune voltage may vary depending on the +27 Vdc supply voltage. Repeat step 3 after each number key change.

Table 4. Voltage Tuned Filter (VTF) Data and Tune Voltage.

Number Key	VTF Data U410 (Vdc)					VTF Tune Voltage (Vdc)
	Pin 3	Pin 2	Pin 1	Pin 18	Pin 17	U103, Pin 7
0	+0.3	+0.3	+0.3	+0.3	+0.3	+23.8
5	+13.5	+0.3	+13.5	+0.3	+0.3	+23.2
10	+0.3	+13.5	+0.3	+13.5	+0.3	+18.5
15	+13.5	+13.5	+13.5	+13.5	+0.3	+14.0
20	+0.3	+0.3	+13.5	+0.3	+13.5	+9.5
25	+13.5	+0.3	+0.3	+13.5	+13.5	+4.7
31	+13.5	+13.5	+13.5	+13.5	+13.5	+2.0

5. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm

6. Tune the Voltage Tuned Filters to their maximum frequency setting by pressing the **FREQ** key, the **0** key, the **SHIFT**, and then the **←**.

**NOTE**

*The key sequence described in step 6 must be repeated after each frequency change in order to override tune data from the Microprocessor.*

7. Measure the voltages for U410 and VTF tune voltages as indicated in Table 5. The VTF tune voltages may vary slightly depending on the +27 Vdc supply voltage. Change the front-panel frequency as indicated. Repeat step 6 after each frequency change.

*Table 5. Voltage Tuned Filter (VTF) Drivers (Maximum Frequency Setting).*

Signal Generator Frequency (MHz)	VTF Data U410 (Vdc)					VTF Tune Voltage (Vdc), U103		
	Pin 3	Pin 2	Pin 1	Pin 18	Pin 17	Divide-By-4 Band Pin 14	Divide-By-2 Band Pin 8	Divide-By-1 Band Pin 7
520	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+2.0	+23.8
260	+0.3	+0.3	+0.3	+0.3	+0.3	+2.0	+23.8	+2.0
130	+0.3	+0.3	+0.3	+0.3	+0.3	+23.8	+2.0	+2.0

A6 Component Coordinates (1 of 2)

COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
C101	A,3	C206	D,2	C320	D,1	CR105	B,3	CR204	C,2	L202	D,3
C102	A,3	C207	D,2	C321	D,1	CR106	A,3	CR205	C,2	L203	D,2
C103	B,3	C208	D,3	C322	D,1	CR107	A,3	CR206	C,2	L204	D,2
C104	B,3	C209	D,2	C324	D,1	CR108	A,3	CR207	D,2	L205	D,2
C105	B,3	C210	D,2	C325	D,1	CR109	B,3	CR208	C,2	L207	C,3
C106	A,3	C211	D,2	C326	D,1	CR110	B,2	CR209	C,2	L208	C,3
C107	A,3	C212	D,2	C328	C,1	CR111	B,2	CR210	C,2	L209	C,2
C108	A,2	C214	D,2	C329	D,1	CR112	B,2	CR211	C,2	L300	C,1
C109	A,2	C215	D,2	C330	C,1	CR113	B,3	CR301	D,1	L301	D,1
C110	B,3	C216	D,2	C331	D,1	CR114	B,3	CR302	D,1	L302	D,1
C111	B,3	C217	D,2	C332	C,1	CR115	B,3	CR303	D,1	L303	D,1
C112	B,2	C218	D,2	C333	C,1	CR116	A,2	CR401	B,1	L304	D,1
C113	B,2	C219	D,3	C334	C,1	CR117	B,2	CR402	B,1	L306	C,1
C114	B,2	C220	D,2	C336	C,1	CR118	B,2	CR411	A,2	L401	B,1
C115	A,2	C221	D,2	C337	C,1	CR119	B,2	CR412	A,2	L402	B,1
C116	B,3	C222	D,2	C338	D,1	CR120	B,2			L410	C,2
C117	B,2	C223	C,2	C339	D,1	CR121	B,2	J203	D,2	L411	A,2
C119	B,2	C224	C,2	C401	B,1	CR122	B,3	J301	D,1	L412	A,2
C120	B,2	C225	C,2	C402	B,1	CR123	B,3	J302	D,1	L413	A,2
C121	B,2	C226	C,2	C403	B,1	CR124	C,3	J303	D,1	L414	A,2
C123	B,2	C227	C,2	C404	B,1	CR125	B,3	J401	A,1	L415	A,2
C124	B,1	C228	C,2	C405	B,1	CR126	C,3	J402	A,3	L416	A,2
C125	B,3	C230	C,3	C406	B,1	CR127	C,3			L417	A,2
C126	B,3	C231	C,3	C407	C,1	CR128	A,1	L101	A,3	L418	B,2
C127	C,2	C232	D,2	C410	A,1	CR129	A,1	L102	B,3	L419	B,2
C130	A,1	C233	C,2	C411	A,1	CR130	A,1	L103	A,3	L420	B,2
C131	A,2	C234	C,2	C412	A,1	CR131	A,1	L104	B,2	L421	B,2
C132	A,2	C235	C,2	C414	B,1	CR132	A,1	L105	B,2	L422	B,2
C133	A,2	C301	D,1	C415	B,1	CR133	B,1	L106	B,2	L423	A,2
C134	A,2	C302	D,1	C416	B,1	CR134	B,1	L107	B,2	L424	A,2
C135	A,2	C303	D,1	C417	A,3	CR135	B,1	L108	B,2	L425	A,2
C136	A,2	C304	D,1	C417	A,3	CR136	B,1	L109	B,3	L426	A,2
C137	C,3	C305	D,1	C418	A,3	CR137	B,1	L110	B,3		
C138	C,3	C306	D,1	C419	A,3	CR138	B,1	L111	B,3	Q101	A,2
C140	B,1	C307	C,1	C421	B,2	CR139	C,2	L112	B,2	Q102	A,2
C141	B,1	C308	C,1	C422	B,2	CR140	C,2	L113	C,2	Q103	B,3
C142	B,1	C309	C,1	C423	B,2	CR141	C,2	L118	A,2	Q104	A,2
C143	B,2	C310	C,1	C424	B,2	CR142	A,3	L119	A,2	Q201	D,2
C144	B,3	C311	C,1	C425	B,2	CR143	B,3	L120	A,2	Q202	D,2
C145	B,3	C312	C,1	C426	A,3	CR144	B,3	L121	A,2	Q203	D,2
C146	B,3	C314	C,1			CR145	B,3	L122	A,2	Q204	D,2
C147	B,3	C315	C,1	CR101	A,3	CR146	B,3	L123	A,2	Q205	D,2
C201	C,3	C317	C,1	CR102	A,3	CR201	D,2	L127	A,3	Q206	D,2
C202	D,3	C318	C,1	CR103	A,3	CR202	D,2	L128	B,2	Q207	C,2
C204	D,3	C319	C,1	CR104	B,3	CR203	C,2	L201	D,3	Q208	C,2

A6 Component Coordinates (2 of 2)

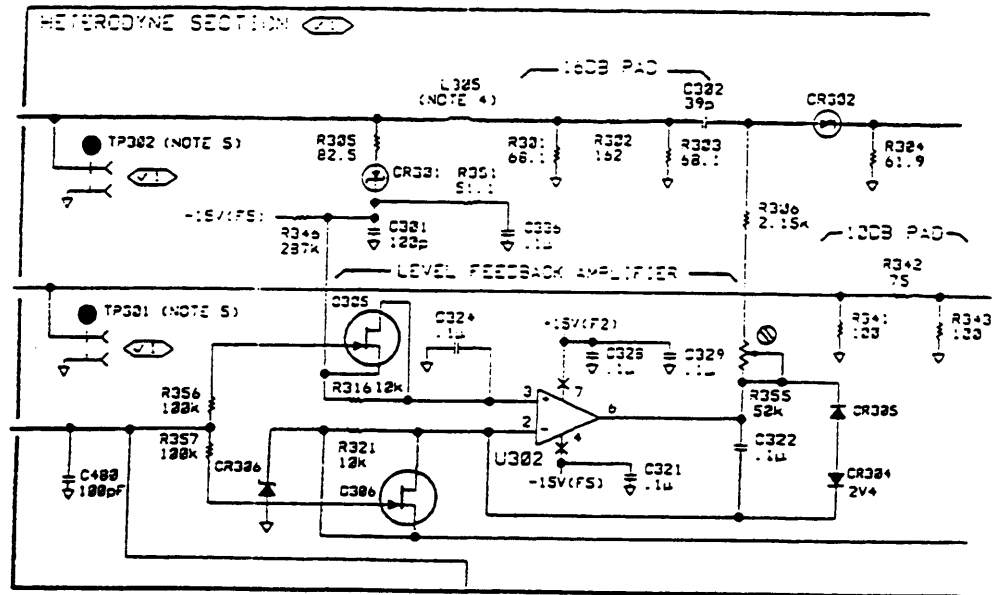
COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y	COMP	X,Y
Q209	C,2	R141	B,1	R222	D,2	R309	C,1	R417	A,3		
Q301	C,1	R142	B,1	R223	D,2	R310	C,1				
Q302	C,1	R143	B,1	R224	D,2	R311	C,1	TP101	A,3		
Q303	C,1	R144	B,1	R225	D,2	R312	C,1	TP201	C,3		
Q304	C,1	R145	B,1	R226	D,2	R313	C,1	TP202	D,2		
Q410	A,2	R146	B,1	R227	D,2	R314	C,1	TP207	D,2		
Q411	A,3	R147	B,1	R228	D,2	R315	C,1	TP204	D,2		
		R148	B,1	R229	D,2	R316	D,1	TP205	D,3		
R101	C,2	R149	B,2	R230	D,2	R317	C,1	TP206	A,2		
R102	C,2	R150	B,2	R231	D,2	R318	D,1	TP301	D,1		
R103	A,3	R151	B,1	R232	D,2	R319	D,1	TP302	D,1		
R104	B,3	R152	B,1	R233	C,2	R320	D,1	TP303	D,1		
R105	B,3	R153	B,2	R234	D,2	R321	D,1	TP401	A,1		
R106	B,3	R154	C,2	R235	D,2	R322	C,1				
R107	B,3	R155	C,2	R236	D,2	R323	C,1	U101	A,3		
R108	A,3	R156	C,2	R240	C,2	R324	D,1	U102	B,2		
R109	A,3	R157	A,3	R241	C,2	R325	C,1	U103	B,1		
R110	A,3	R158	A,3	R242	C,2	R326	C,1	U201	C,3		
R111	A,2	R159	B,2	R243	C,2	R327	D,1	U202	D,3		
R112	A,2	R160	A,3	R244	C,2	R328	C,1	U203	C,2		
R113	A,2	R161	A,3	R245	C,2	R329	C,1	U301	D,1		
R114	B,3	R162	A,3	R246	C,2	R330	C,1	U302	D,1		
R115	B,3	R163	B,3	R247	C,2	R331	C,1	U303	D,1		
R116	B,2	R164	A,3	R248	C,3	R332	C,1	U401	B,1		
R117	B,2	R201	D,3	R249	C,3	R333	C,1	U410	A,1		
R118	B,3	R202	D,2	R250	C,2	R336	C,1	U411	A,1		
R119	B,2	R203	D,3	R251	C,2	R339	D,1				
R120	B,2	R204	D,2	R252	C,2	R340	D,1	W202	C,3		
R121	B,2	R205	D,3	R253	C,2	R341	D,1				
R122	A,2	R206	D,2	R254	C,2	R342	D,1				
R123	A,2	R207	D,2	R255	C,3	R343	D,1				
R124	B,2	R208	D,2	R256	D,2	R346	D,1				
R128	A,2	R209	D,2	R257	C,2	R347	D,1				
R129	B,2	R210	D,3	R260	D,2	R349	C,1				
R130	B,2	R211	D,2	R261	C,2	R351	D,1				
R131	B,2	R212	D,2	R262	C,2	R352	D,1				
R132	B,2	R213	D,2	R263	C,2	R353	C,1				
R133	C,3	R214	D,2	R301	D,1	R354	D,1				
R134	B,1	R215	D,2	R302	D,1	R401	B,1				
R135	B,1	R216	D,2	R303	D,1	R402	B,1				
R136	B,1	R217	D,2	R304	D,1	R410	A,1				
R137	B,1	R218	D,2	R305	D,1	R412	A,3				
R138	B,1	R219	D,2	R306	D,1	R414	A,1				
R139	B,1	R220	D,2	R307	D,1	R415	A,3				
R140	B,1	R221	D,2	R308	C,1	R416	A,3				

**CHANGES**

**All serial prefixes**

On the A6 Schematic Diagram:

- R341,342,343 - Add an asterisk to these parts to indicate they are select on test parts.
- U412 - Add U412 to the Hetrodyne Section as shown in the following diagram.



**2922U and above**

On the A6 Schematic Diagram

- CR306 - Add CR306 as shown in the above diagram.
- R316,321 - Change the value to 10k.

**3025U and above**

On the A6 Schematic Diagram:

- R306 - Change the value to 2k.
- R355 - Add R355 as shown in the above diagram.
- Part Number - Change the board part number to 08657-60140.

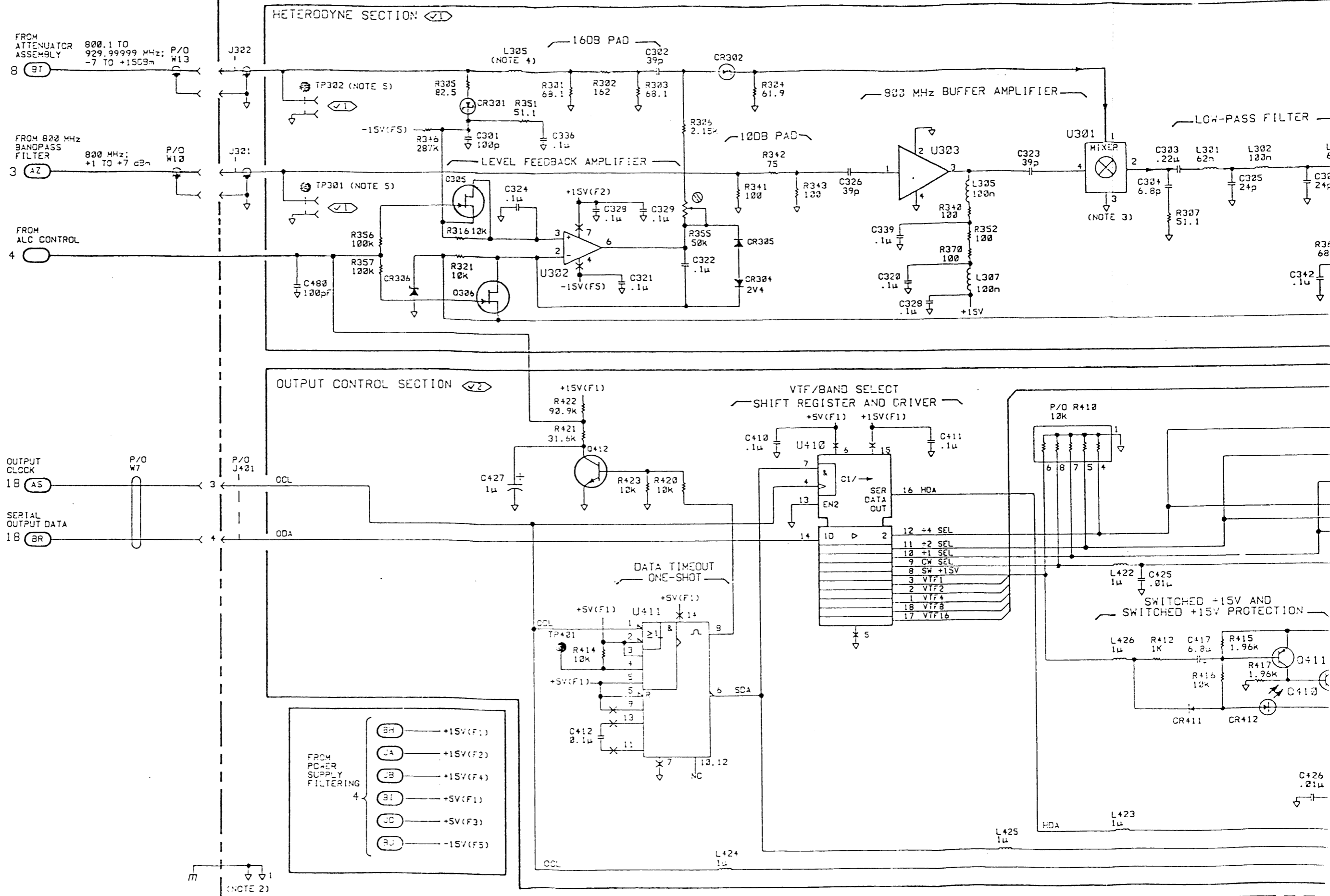
**3105U and above**

The A6 assembly changes to part number 08657-90159.

- Schematic Diagram and Component Locator - Use the Schematic diagram and Component Locator marked Serial Prefix 3105U.



P/O A6 OUTPUT ASSEMBLY (08657-60159)



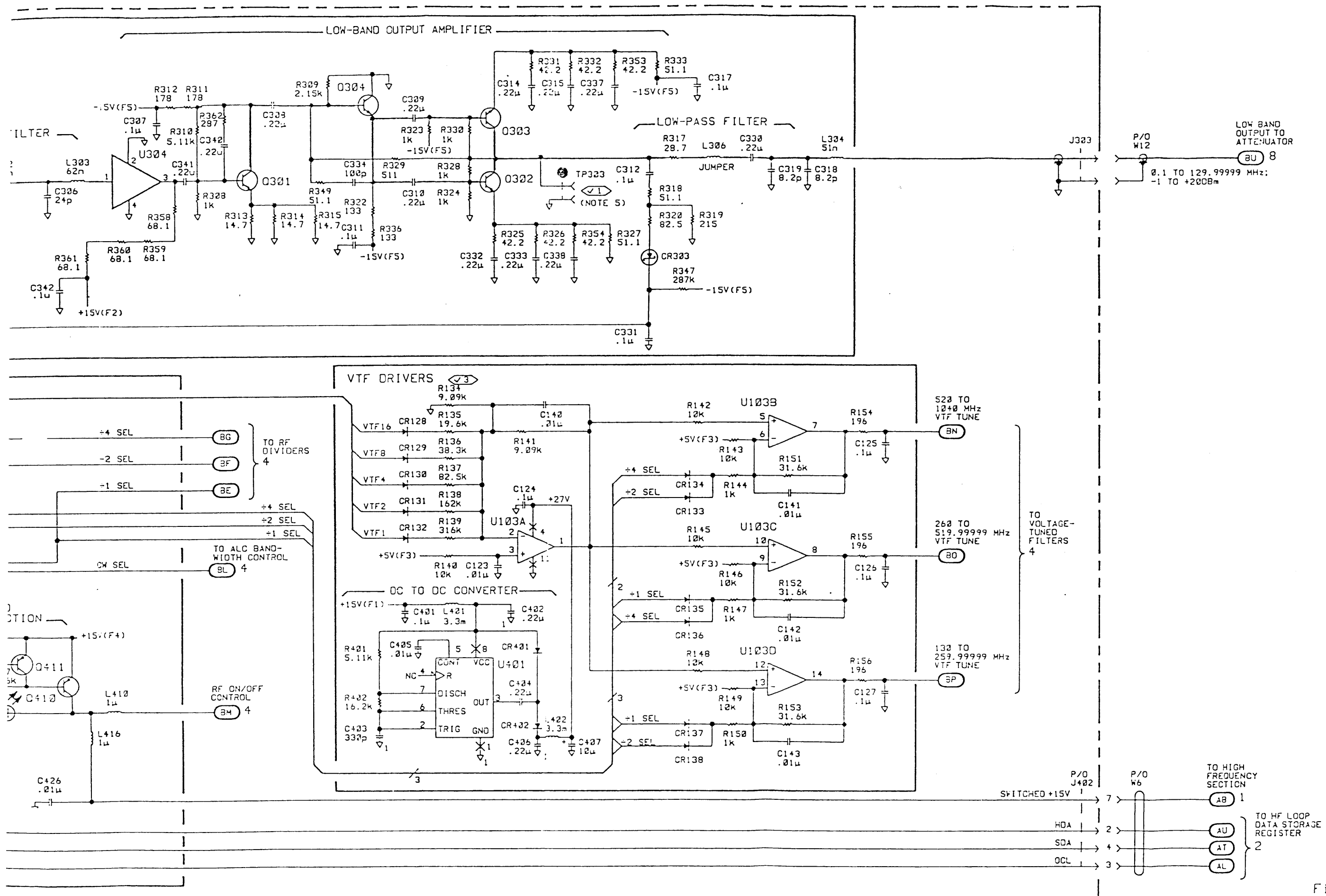


Figure 1  
Service Sheet 5 9



P/O A6 OUTPUT ASSEMBLY (08657-60121)

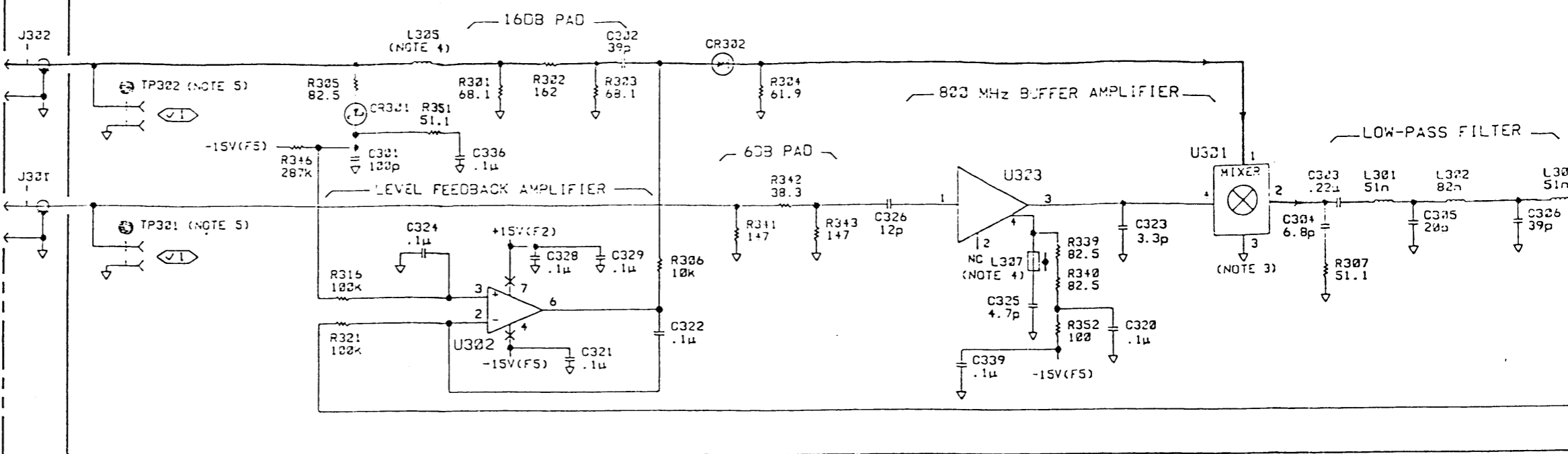
FROM ATTENUATOR ASSEMBLY  
820.1 TO 929.99999 MHz;  
-7 TO +150dBm  
P/O W:3

FROM 800 MHz BANDPASS FILTER  
800 MHz;  
+1 TO +7 dBm  
P/O W:2

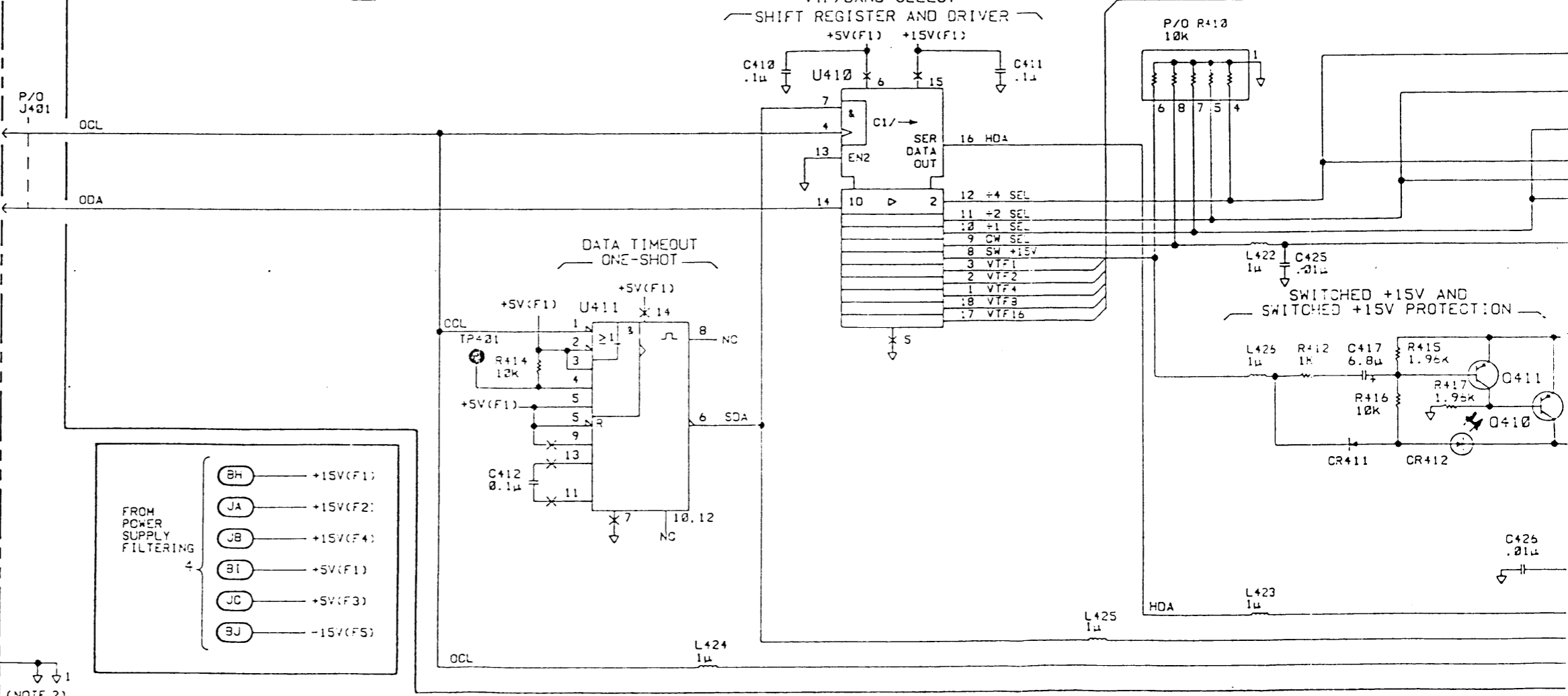
OUTPUT CLOCK  
18 AS  
P/O W:7

SERIAL OUTPUT DATA  
18 9R

HETERODYNE SECTION (V1)



OUTPUT CONTROL SECTION (V2)



- FROM POWER SUPPLY FILTERING
- BH — +15V(F1)
  - JA — +15V(F2)
  - JB — +15V(F4)
  - BI — +5V(F1)
  - JC — +5V(F3)
  - BJ — -15V(F5)

(NOTE 2)  
SERIAL PREFIX: 2846U

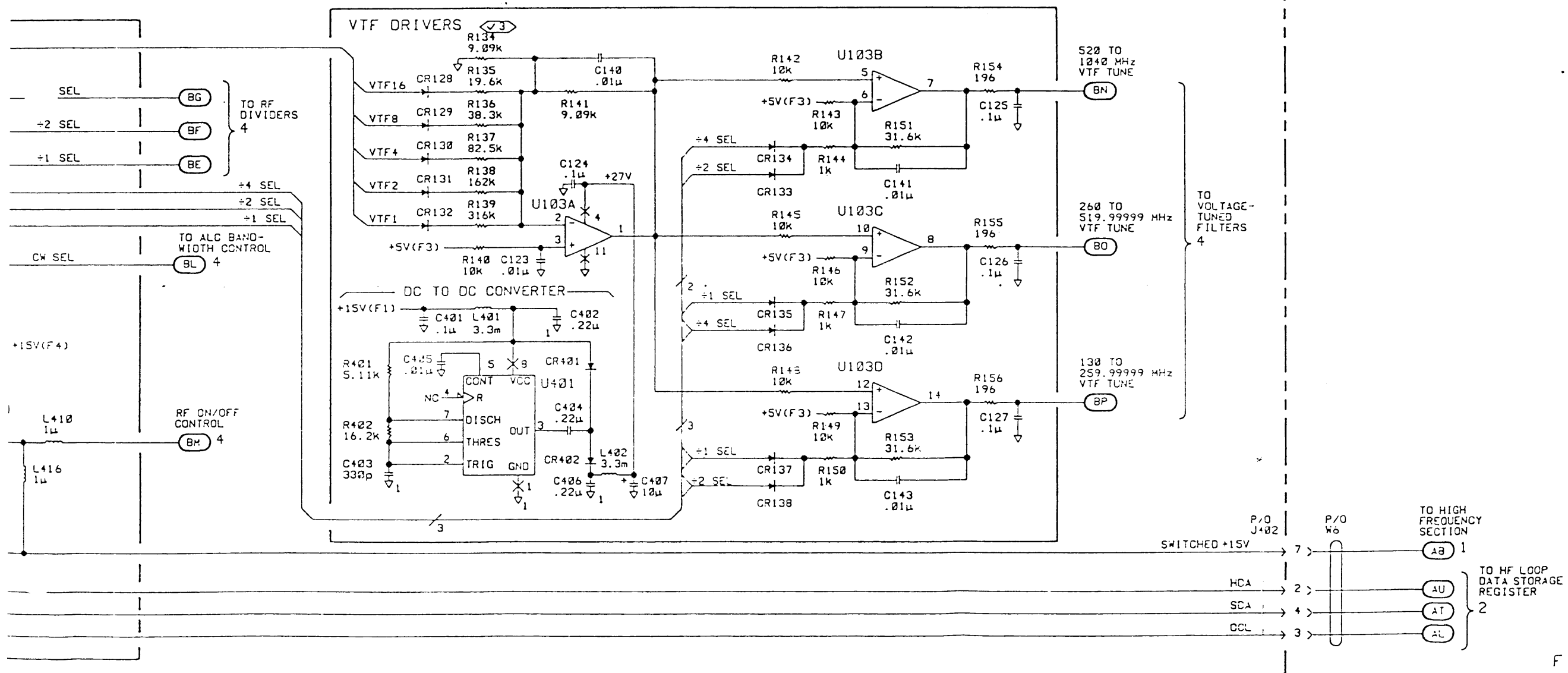
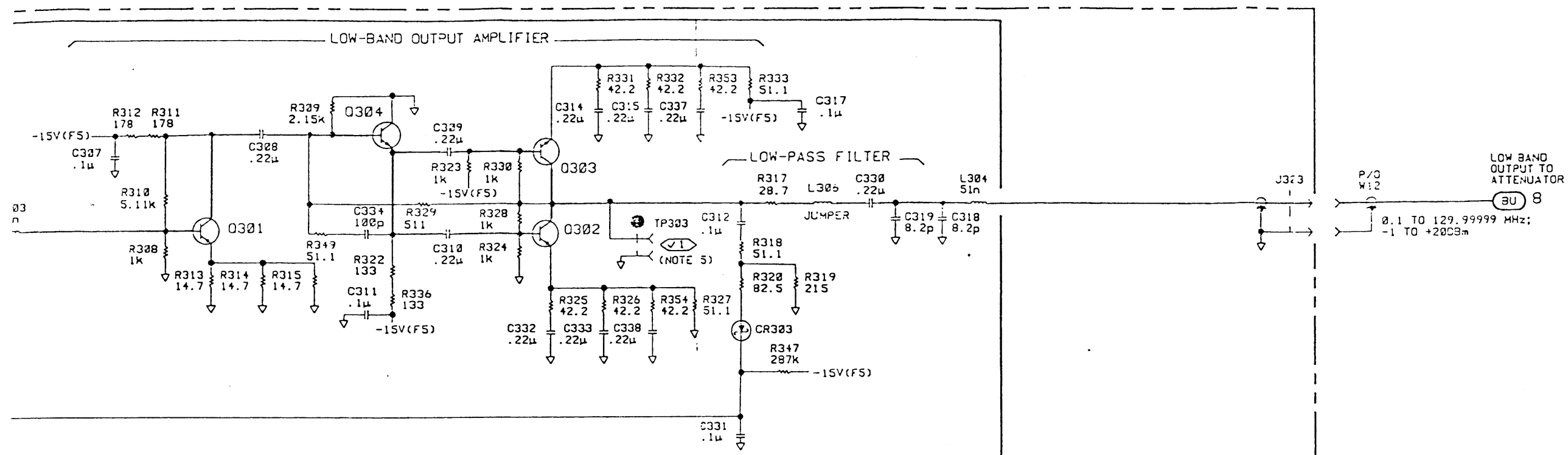


Figure 1  
Service Sheet 5 9

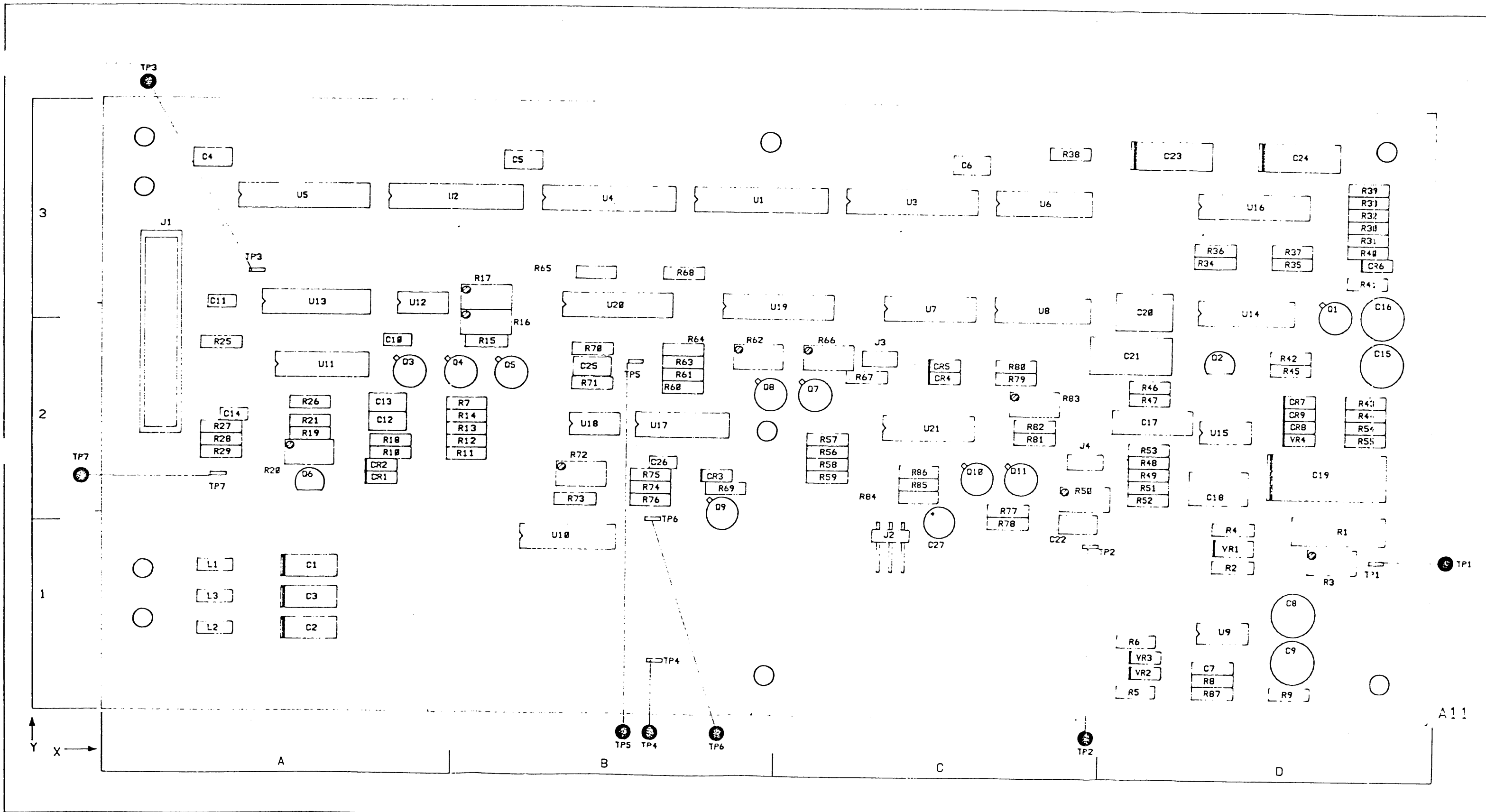


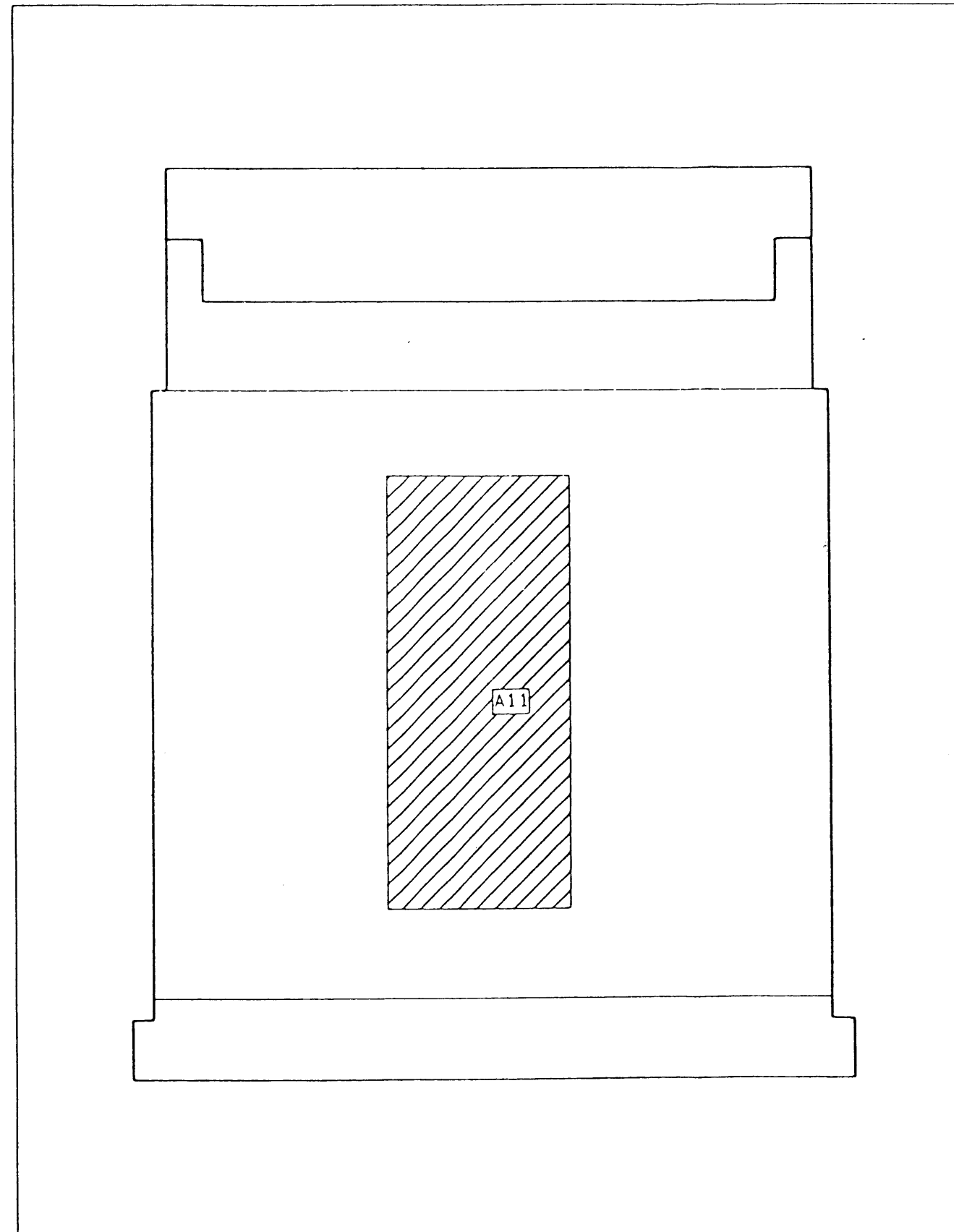
Figure 0. Service Sheet 6 Information.

Component Locator

NOTES  
 1. For an explanation of schematic symbols,  
 see "SCHEMATIC DIAGRAM NOTES" in Section 8.

LOGIC LEVELS

	TTL	CMOS
HIGH	2V	3.5V
LOW	0.8V	1.5V
IS MORE NEG. THAN IS MORE POS. THAN		
OPEN	HIGH	UNDEF.
GROUND	LOW	LOW



P/O A6 HETERODYNE AND OUTPUT CONTROL SS5  
 SEE REVERSE SIDE

## Service Sheet 6

### MODULATION CONTROL AND LEVEL LATCHES AND MODE SELECT

#### PRINCIPLES OF OPERATION

##### General

Encoded data output from the Microprocessor is input to the Level and Modulation Control Latches. This data is used to control the RF output amplitude level versus the output frequency. The data also controls the amplitude and frequency modulation signals.

##### Amplitude Control/Level Latches

Data from the Microprocessor is used to control output level vernier adjustments, and to perform output level correction. The level vernier adjusts the output level in increments as small as 0.1 dB. Typical vernier range is from  $-1.5$  dB to  $+3.5$  dB used for attenuator settings and output levels less than  $-1.5$  dBm. Vernier is used exclusively for output levels greater than  $-1.5$  dBm and extends to  $\approx +17$  dB. The level vernier's dB adjustment varies from one instrument to another because of different level correction data stored in ROM. A vernier overrange is selected by the Microprocessor to add 13.5 dB to the vernier range for output levels above  $+3.5$  dBm or whenever a vernier setting greater than  $+3.5$  dB is necessary for level correction. Using the vernier overrange permits level correction without changing attenuator settings. For example, if a front panel setting of 100 MHz and an output level of  $-63.6$  dBm is selected, with no level correction, the Microprocessor would switch in 65 dB of attenuation and set the vernier to  $+1.4$  dB ( $-65+1.4 = -63.6$ ). If  $+1.0$  dB of level correction (stored in ROM) is necessary to achieve the proper output level at that frequency and attenuator setting, the Microprocessor would select the vernier overrange and then increase the vernier setting to  $+2.4$  dBm ( $1.4+1.0$ ).

When a new output amplitude level is selected, the Microprocessor controls the change so that the final level is always approached from a lower level. For example, if the vernier level is at its minimum and the output level is decreased by 2 dB, the Attenuator will increase attenuation by 5 dB. The vernier level then increases the level input to the attenuator by 3 dB to complete the change. The 3 dB increase will never occur first. For the same reason, a 2 dB increase with the vernier set to maximum causes a 3 dB decrease in level followed by a 5 dB decrease in attenuation in the Attenuator. After the output amplitude is changed, the level correction for frequency is made. The vernier's level is also turned off every time a frequency change is made.

Ten bits of Microprocessor data are strobed into Modulation Control Level Latches U1 and U4 by strobes MSTB1 and MSTB2 from Address Decoder U? (refer to Service Sheet 18). The data bits, X0-X9, are then applied to the Level Digital-To-Analog Converter (DAC) U19 (refer to Service Sheet 7).

##### Modulation Control

Data from the Microprocessor selects AM, FM or both AM and FM, internal modulation sources of 400 or 1000 Hz, and/or external modulation. External AC FM and external DC FM can not be selected at the same time. Data from the Microprocessor also controls AM depth and FM deviation levels.

##### AM % Latches

Ten bits of Microprocessor data are clocked into Modulation Control Latches U4 and U2 by strobes MSTB2 and MSTB3 from the Address Decoder U17 (refer to Service Sheet 18). The data bits, Y0-Y9, are then applied to the AM% DAC U20 (refer to Service Sheet 7).

## FM Latches

Ten bits of Microprocessor data are clocked into Modulation Control Latches U2 and U5 by strobes MSTB3 and MSTB4 from the Address Decoder U17 (refer to Service Sheet 18). The data bits, Z0-Z9, are then applied to the FM Deviation DAC U13 (refer to Service Sheet 7).

Level range select bit is latched into U5. It controls the gain of the AM-Reference Summing Amplifier U17A (refer to Service Sheet 7). The Level range bit is set high when the vernier output level is greater than  $\approx +5.5$  dBm (may vary according to calibration data).

## Modulation Function Latch

Eight bits of Microprocessor data are clocked into the Modulation Function Latch U3 by strobe MSTB5 from the Address Decoder U17 (refer to Service Sheet 18). The data bits are then applied to the appropriate comparator for the modulation function selected (refer to Service Sheet 7).

## Audio Oscillator Control Buffer

The Audio Oscillator is enabled by a high from either the INT AM or INT FM data bits. Both bits are applied to U6. The output of U6 enables the Audio Oscillator U15A (refer to Service Sheet 7).

## Ext FM Mode Select

Data bits AC FM and EXT FM are gated through NOR gates U7A, B, C and D. The two bits are gated together so that external AC FM is turned off when external DC FM is selected. The EXT FM data bit is high when external FM is selected. The AC FM data bit is high when external AC FM is selected and low when external DC FM is selected. Both data bits are low when external FM is off. The output at pin 13 of U7D is high when external DC FM is selected, and the output at pin 4 of U7B is high when external AC FM is selected.

## AM X1, X2 Mode Select

The X2(L) input to U8A and U8B determines if the X2 or X1 mode is selected. Data bits, INT AM, EXT AM, and X2(L) are gated through U8A and U8B to select X1 INT AM or X1 EXT AM. The INT AM and X2(L) are gated at U8A to select X1 INT AM. In the X1 mode, output frequencies are  $\leq$  to 1030 MHz, INT AM and X2(L) are both high and U8A's output is high. EXT AM and X2(L) select X1 EXT AM. Data bit X2(L) is active low to select the INT AM and EXT AM X1 mode. With both inputs high, the X1 EXT AM mode is selected. When the X2(L) input to and gates U8A and U8B is low, the output of the two gates is low. The X2 mode is selected. When the INT AM or EXT AM is selected, the modulation signals are directed to the doubler. See Service Sheet 7. The output frequency is  $>1030$  MHz in doubled band.

## TROUBLESHOOTING

Procedures for checking part of the All Audio Assembly circuits are given below. The areas or points to check are marked on the schematic by a hexagon with a checkmark and a number inside, for example,  $\checkmark 1$ . Fixed voltages are shown on the schematic inside a hexagon, for example,  $2V \pm 0.2V$ . Transistor bias voltages are shown without tolerances.

### Troubleshooting Help

Block Diagram 2

Table 4-1. Abbreviated Performance Tests

Table 5-2. Post-Repair Adjustments

### Test Equipment

Digital Multimeter ..... HP 3466A

### $\checkmark 1$ P/O Modulation Control Latches, Level

1. Data bits latched into the Level Latches A11U1 and U4, can vary for each instrument. This is because the level correction data can be different for each instrument. The Level Latches are checked using Keyboard-Invoked Test 2. Data bits latched into U1 and U4 are all Low.
2. The test routine is "entered" to start the test and the "exited" to regain control of the front panel.
  - Enter the Keyboard-Invoked Tests by first pressing the SHIFT key and then pressing the INCR SET key. A "1" should be shown in the MODULATION display window.
  - Enter the High Frequency Loop Test by pressing the AMPTD  $\uparrow$  until a "2" is shown in the AMPLITUDE Display window.
  - Start the test routine by pressing the INCR SET key. "00" should be shown in the AMPLITUDE Display window.
  - Exit the Keyboard-Invoked Tests by pressing the AMPTD  $\uparrow$  until a "7" is shown in the MODULATION display window, then press the INCR SET key. The Signal Generator should go through it's power-up routine.
3. Check that data bits X0 through X9, U1 and U4, are all Low.
4. Exit Keyboard-Invoked Tests.
5. Set Signal Generator as follows:
 

Amplitude.....	-10 dBm
Amplitude Increment Set .....	1 dB
Frequency.....	100 MHz
Modulation.....	OFF
6. Increment the amplitude up and down in 1.0 dB steps.
7. Check that all data bits X0 through X9 change from Low to High.

√2 P/O Modulation Control Latches, AM%

1. Data bits latched in the AM% Latches, A11U4 and U2, will vary for each instrument. The data bits are different because the level correction data which is used to determine the data sent to the AM% DAC is different for each instrument. The AM% Latches are checked using Keyboard-Invoked Test 2. Data bits latched into U4 and U2 are all Low.
2. The test routine is "entered" to start the test and the "exited" to regain control of the front panel.
  - Enter the Keyboard-Invoked Tests by first pressing the SHIFT key and then pressing the INCR SET key. A "1" should be shown in the MODULATION display window.
  - Enter the High Frequency Loop Test by pressing the AMPTD ↑ until a "2" is shown in the MODULATION Display window.
  - Start the test routine by pressing the INCR SET key. "00" should be shown in the AMPLITUDE Display window.
3. Check that data bits Y0 through Y9 are all Low.
4. Exit Keyboard-Invoked Tests.
  - Exit the Keyboard-Invoked Tests by pressing the AMPTD ↑ until a "7" is shown in the MODULATION display window, then press the INCR SET key. The Signal Generator should go through it's power-up routine.
5. Set Signal Generator as follows:
 

Amplitude.....	-7 dBm
Frequency.....	Any
Modulation.....	AM, 80%
Source .....	1 kHz (Int.)
AM Increment Set .....	1%
6. Increment the modulation up and down in 1% steps.
7. Check that all data bits Y0 through Y9 change from Low to High.



**√3 P/O Modulation Control Latches, FM Deviation**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... FM 1 kHz  
 Source ..... 1 kHz (Int.)

2. Measure the voltage levels as indicated in Table 1 for each of the front-panel FM settings.

*Table 1. FM Deviation Control Voltage Levels.*

Front-Panel FM kHz	Measure the Voltage* as Indicated at									
	A11U2				A11U5					
	12	15	16	19	2	5	6	9	12	15
1	L	L	L	L	H	H	L	L	H	H
5	L	H	L	L	L	L	L	L	L	L
10	H	L	L	L	L	L	L	L	L	L
20	H	H	H	H	H	H	H	H	H	H
50	L	H	L	L	L	L	L	L	L	L
80	L	H	H	L	L	H	H	L	L	H
99	L	H	H	H	H	H	H	L	H	L

\* Low is  $\leq 0.8$  Vdc; High is  $\geq 2.0$  Vdc.

**√4 P/O Modulation Control Latches, Function**

1. Set the Signal Generator as follows:

Frequency ..... 520 MHz  
 Amplitude ..... -10 dBm

2. Measure the voltage levels as indicated in Table 2 for each of the front-panel Modulation Source settings. The AM depth or FM deviation for each front-panel Modulation Source setting can be between 0-99% or 0-99 kHz respectively.

*Table 2. Function Control Voltage Levels.*

Front-Panel	Measure the Voltage* as Indicated at											
	A11U3								A11U7		A11U5	
	2	5	6	9	12***	15	16	19	4	13	19	16
Int 1 kHz AM	H	H	L	L	L	L	L	H	L	L	L	H
Freq 1300MHz	H	H	L	L	L	L	L	H	L	L	H	L
Freq 520MHz (Int AM Off)	H	H	L	L	L	L	L	H	L	L	L	H
Int 400 Hz FM (Int FM Off)	H	L	H	H**	L	L	L	H	L	L	L	
Ext AM (Ext AM Off)	L	L	L	H	L	H	L	H	L	L	L	
Ext AC FM	L	L	L	H	L	L	H	H	H	L	L	
Ext DC FM	L	L	L	H	L	L	H	L	L	H	L	
Amp + 10 dBm	L	L	L	H	L	L	L	H	L	L	H	

\* Low is  $\leq 0.8$  Vdc; High is  $\geq 2.0$  Vdc.

\*\* Internal 400 Hz bit. Frequency Pin 9 remains high until 1 kHz source is selected with Modulation Function.

\*\*\* Low for FM Deviation 20 kHz and below.

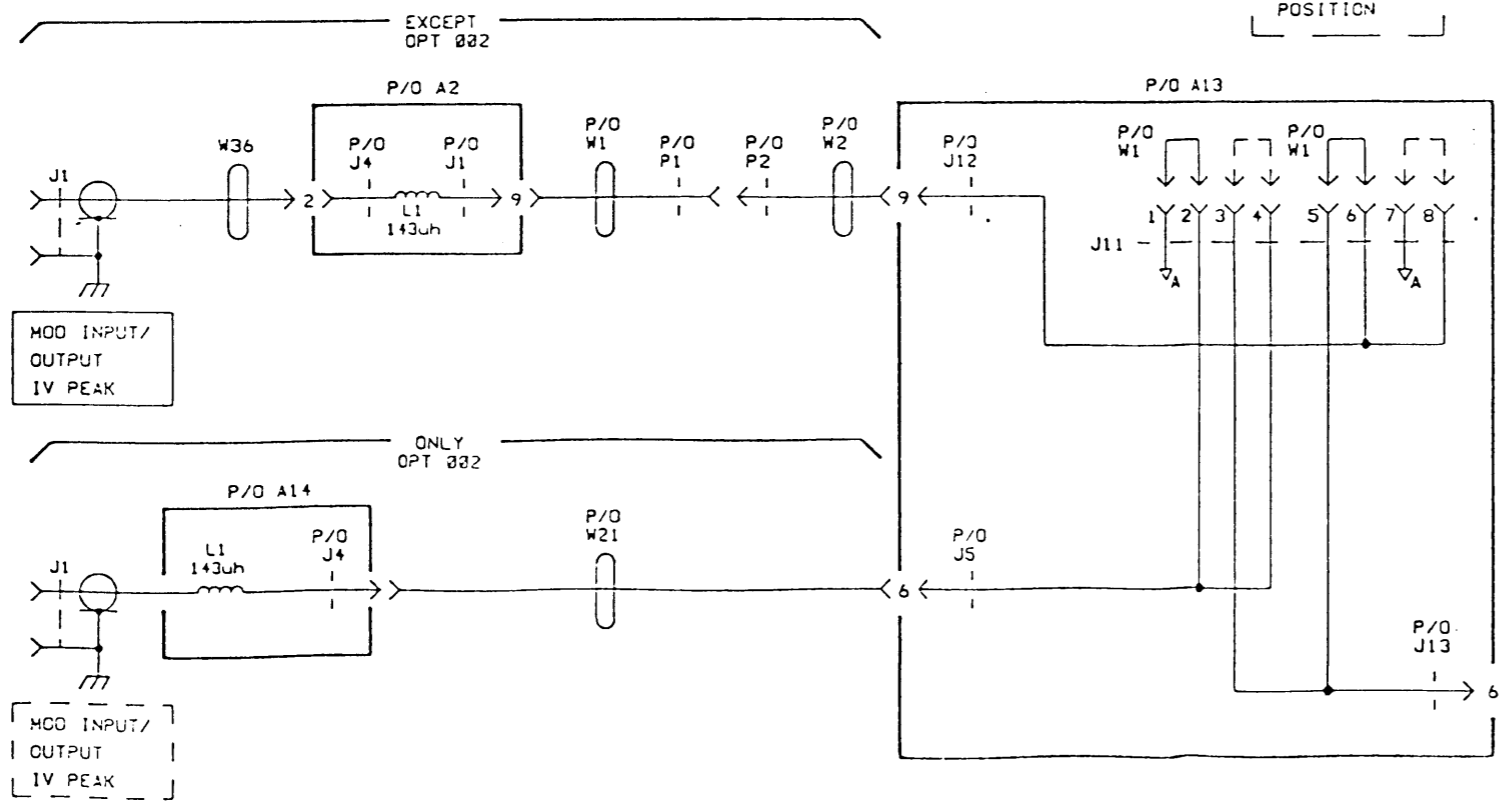
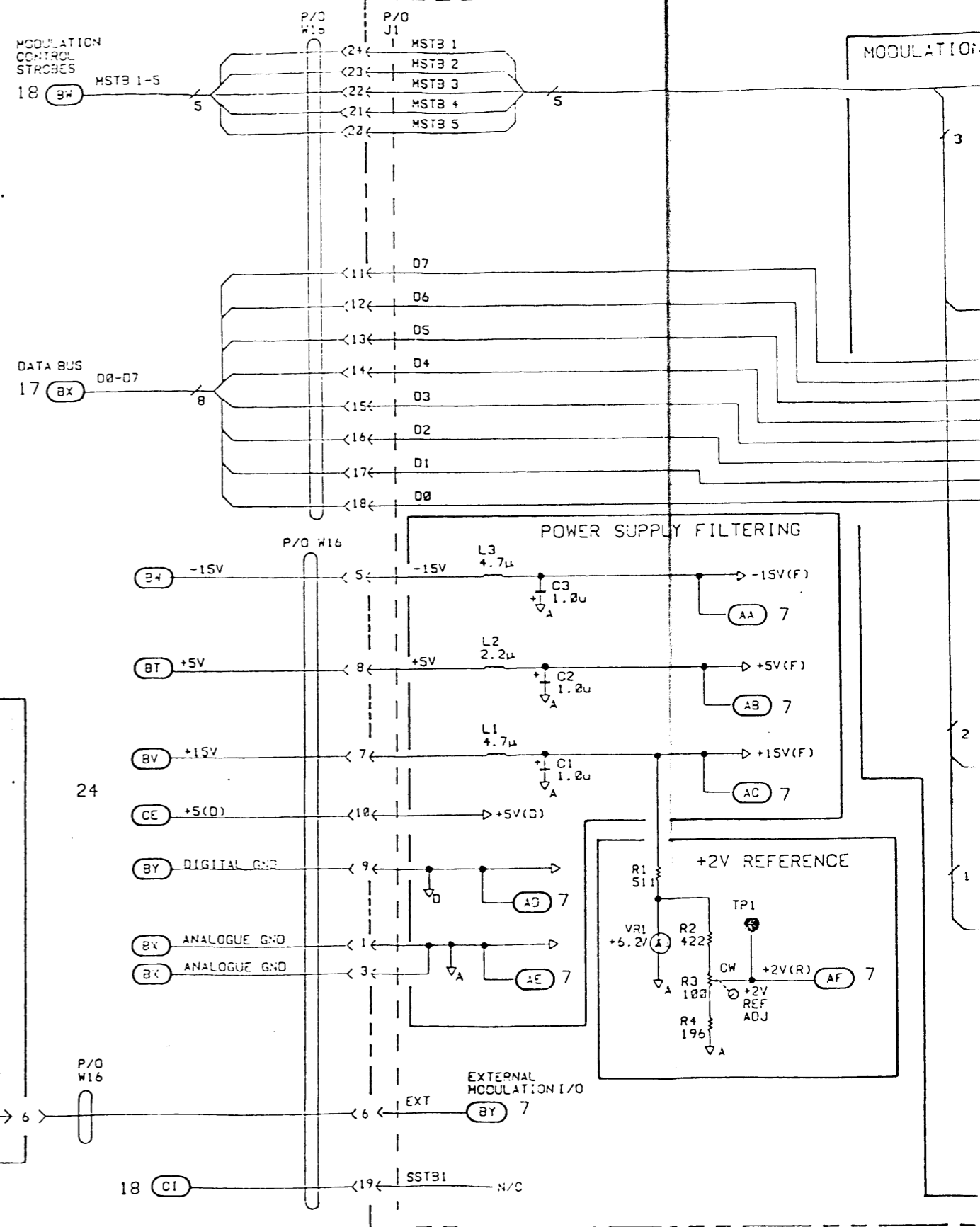
A11 Component Coordinates

COMP	X	Y	COMP	X	Y	COMP	X	Y
C1	A	1	Q4	B	2	R45	D	2
C2	A	1	Q5	B	2	R46	D	2
C3	A	1	Q6	A	2	R47	D	2
C4	A	3	Q7	C	2	R48	D	2
C5	B	3	Q8	C	2	R49	D	2
C6	C	3	Q9	B	2	R50	C	2
C7	D	1	Q10	C	2	R51	D	2
C8	D	1	Q11	C	2	R52	D	2
C9	D	1				R53	D	2
C10	A	2	R1	D	1	R54	D	2
C11	A	3	R2	D	1	R55	D	2
C12	A	2	R3	D	1	R56	C	2
C13	A	2	R4	D	1	R57	C	2
C14	A	2	R5	D	1	R58	C	2
C15	D	2	R6	D	1	R59	C	2
C16	D	3	R7	B	2	R60	B	2
C17	D	2	R8	D	1	R61	B	2
C18	D	2	R9	D	1	R62	B	2
C19	D	2	R10	A	2	R63	B	2
C20	D	3	R11	B	2	R64	B	2
C21	D	2	R12	B	2	R65	B	3
C22	C	1	R13	B	2	R66	C	2
C23	D	3	R14	B	2	R67	C	2
C24	D	3	R15	B	2	R68	B	3
C25	B	2	R16	B	2	R69	B	2
C26	B	2	R17	B	3	R70	B	2
C27	C	1	R18	A	2	R71	B	2
			R19	A	2	R72	B	2
CR1	A	2	R20	A	2	R73	B	2
CR2	A	2	R21	A	2	R74	B	2
CR3	B	2	R25	A	2	R75	B	2
CR4	C	2	R26	A	2	R76	B	2
CR5	C	2	R27	A	2	R77	C	2
CR6	D	3	R28	A	2	R78	C	1
CR7	D	2	R29	A	2	R79	C	2
CR8	D	2	R30	D	3	R80	C	2
CR9	D	2	R31	D	3	R81	C	2
			R32	D	3	R82	C	2
J1	A	1	R33	D	3	R83	C	2
J2	C	1	R34	D	3	R84	C	2
J3	C	2	R35	D	3	R85	C	2
J4	C	2	R36	D	3	R86	C	2
			R37	D	3	R87	D	1
L1	A	1	R38	C	3			
L2	A	1	R39	D	3	TP1	D	1
L3	A	1	R40	D	3	TP2	D	1
			R41	D	3	TP3	A	3
Q1	D	3	R42	D	2	TP4	B	1
Q2	D	2	R43	D	2	TP5	B	2
Q3	A	2	R44	D	2	TP6	B	1

A11 Component Coordinates

COMP	X	Y	COMP	X	Y	COMP	X	Y
TP7	A	2						
U1	B	3						
U2	B	3						
U3	C	3						
U4	B	3						
U5	A	3						
U6	C	3						
U7	C	3						
U8	C	3						
U9	D	1						
U10	B	1						
U11	A	2						
U12	A	3						
U13	A	3						
U14	D	3						
U15	D	2						
U16	D	3						
U17	B	2						
U18	B	2						
U19	C	3						
U20	B	3						
U21	C	2						
VR1	D	1						
VR2	D	1						
VR3	D	1						
VR4	D	2						

P/O A11 AUDIO ASSEMBLY (28657-62114)



MODULATION CONTROL AND LEVEL LATCHES/MODE SELECTS

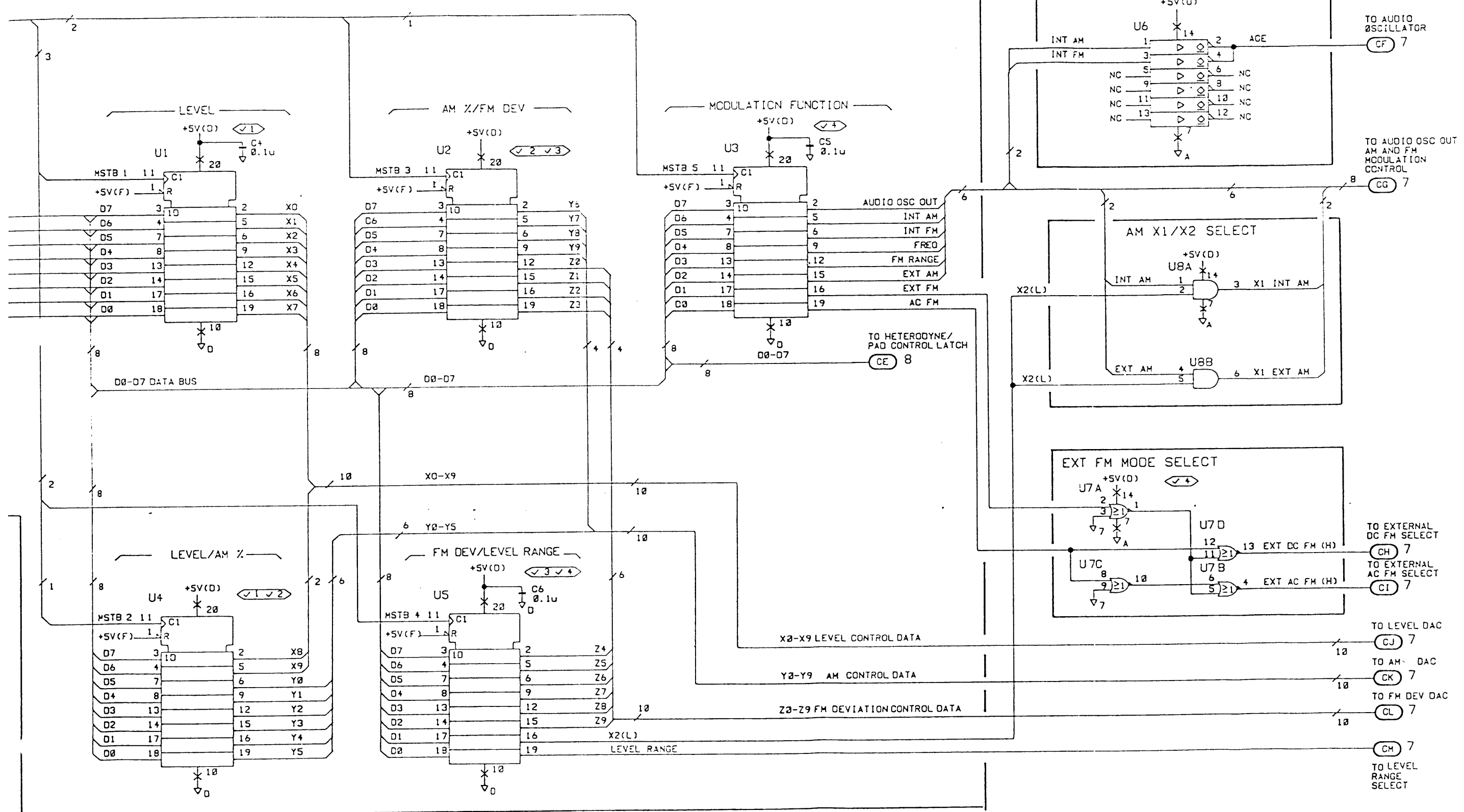


Figure Service Sheet 6

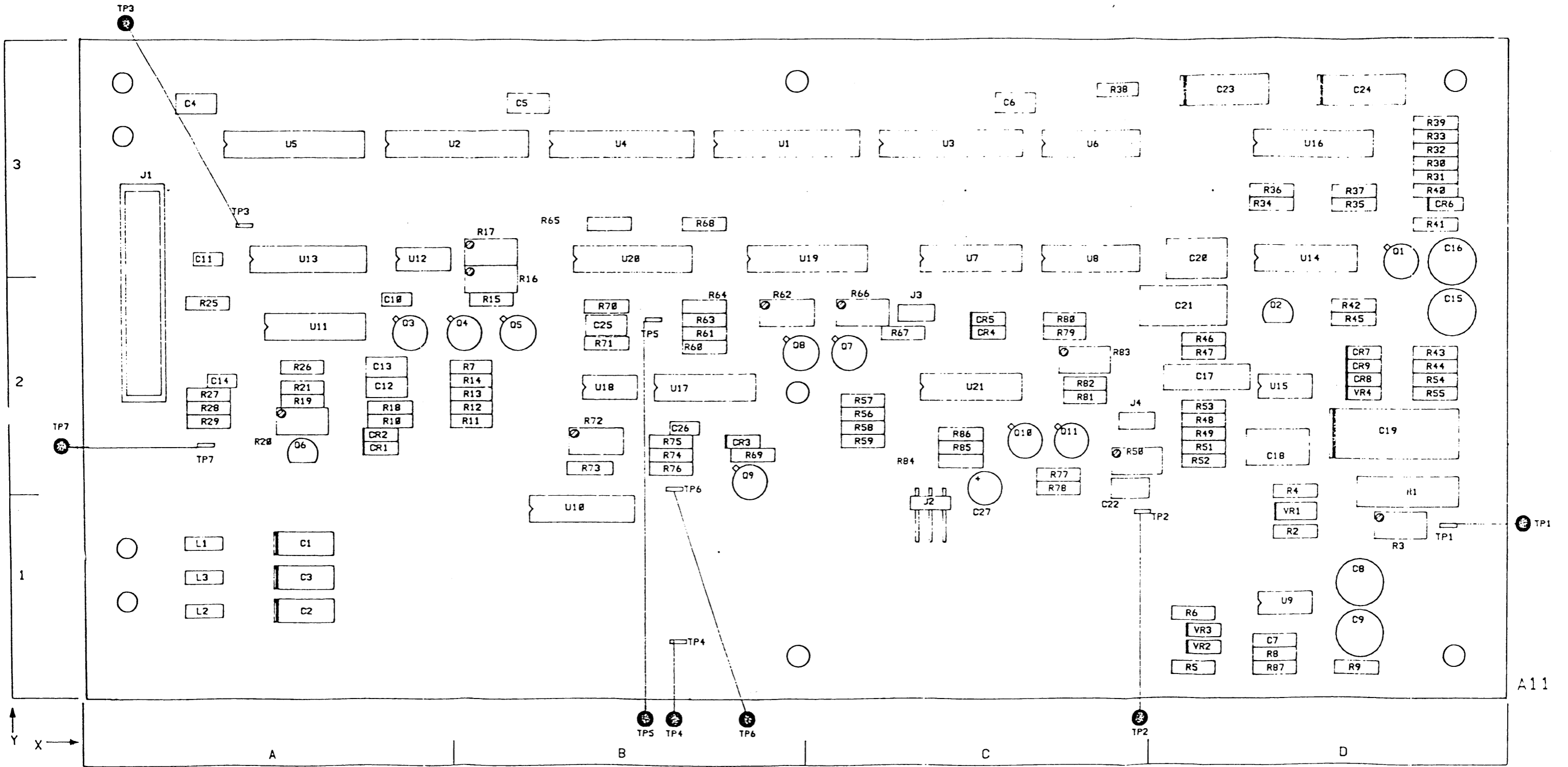


Figure 0. Service Sheet 7 Information.

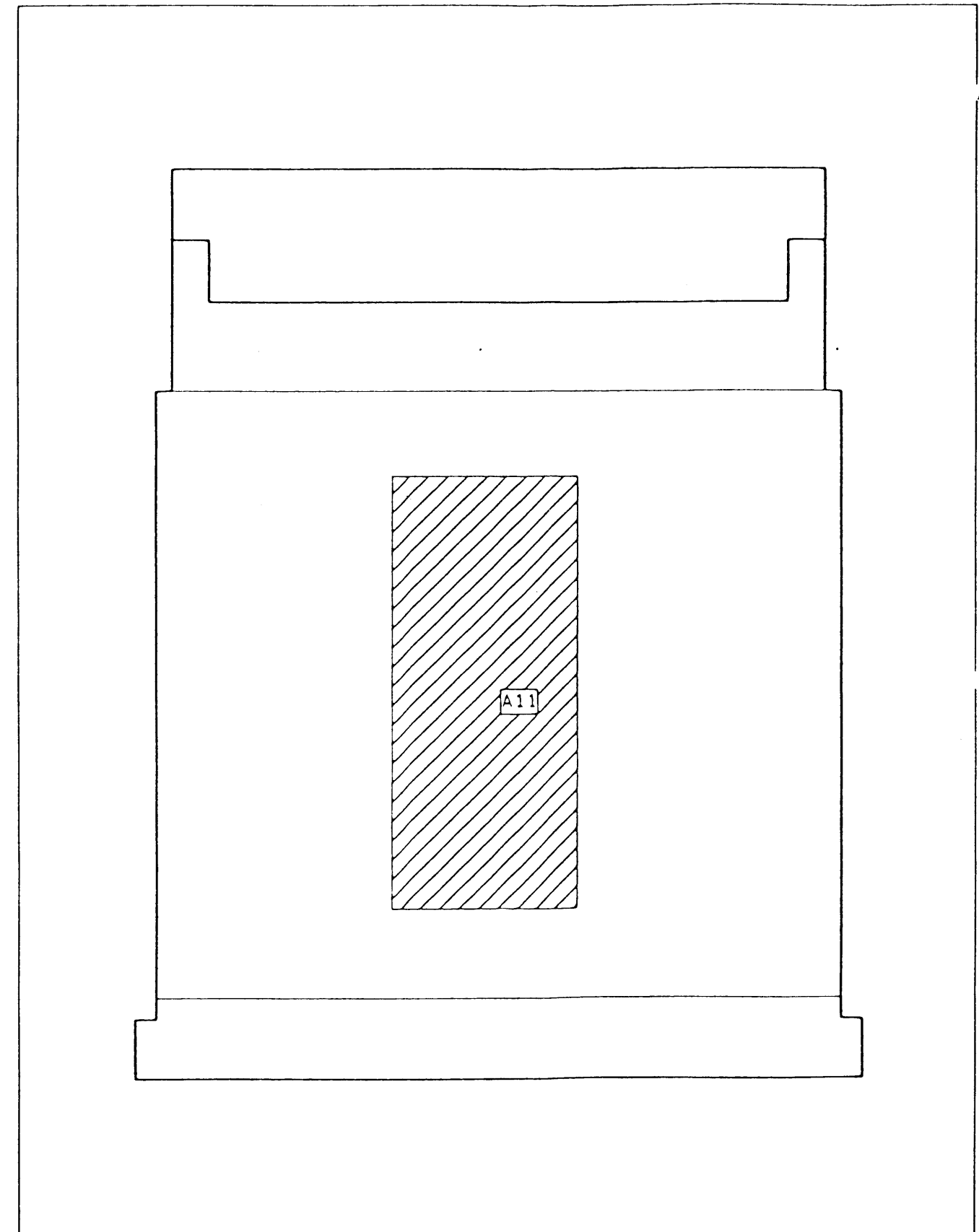
Component Locator

NOTES

- For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

LOGIC LEVELS

	TTL	CMOS
HIGH	2V	3.5V
LOW	0.8V	1.5V
IS MORE NEG. THAN IS MORE POS. THAN		
OPEN	HIGH	UNDEF.
GROUND	LOW	LOW



MODULATION CONTROL  
P/O A10 LATCHES AND MODE SELECT SS6  
SEE REVERSE SIDE



## Service Sheet 7

### FM AND AM MODULATION CONTROL, AND RF AMPLITUDE CONTROL

#### PRINCIPLES OF OPERATION

##### General

Data from the Level Control Latches is used to control the RF output amplitude level in fine steps, and the RF output amplitude level versus frequency correction. The Modulation Control Latches also control the amplitude and frequency modulation signals.

##### RF Output Amplitude Control

Ten data bits latched into Modulation Control Latches U1 and U4 (refer to Service Sheet 6) are applied to the Level Digital-to-Analog Converter (DAC) U19. The digitally controlled output of the Level DAC adjusts the reference voltage input from the unity-gain Level Buffer U17C. This dc voltage controls the vernier output level. The output voltage is applied to the AM Reference Summing Amplifier U17A.

When amplitude modulation is selected, the Level DAC voltage is summed with the AM% DAC voltage, and applied to A6U6 of the Automatic Level Control (ALC) Amplifier (refer to Service Sheet 4).

The Microprocessor determines when the vernier output level is greater than +7.0 dBm. At this time the Level Range select bit is set high, and the output of U17B goes to approximately -15 V. FET switch Q9 opens increasing the gain of AM-Reference Summing Amplifier U17A. This allows for the higher output levels and for level correction.

##### AM Modulation Control

Ten data bits latched into Modulation Control Latches U4 and U2 (refer to Service Sheet 6) are applied to the AM% DAC U20. The digitally controlled output level of the AM% DAC adjusts the input modulation signal from the AM% Summing Amplifier U17D to the level that modulates the RF signal to the depth selected. The output signal is ac coupled by C25 to the unity-gain AM Offset Buffer U18. The AM Offset Adjustment at R72 nulls any dc offset of the modulation signal. The amplitude modulation signal is then summed with the level voltage at U17A as discussed above.

##### Internal AM (X1) Select

Internal AM is selected when the data bit latched into pin 5 of U3 is high and X2(L) bit latched into pin 16 of U5 is high. The output of U8A is high (refer to Service Sheet 6). The high output (X1 INT AM) to the positive input of the Internal AM Select comparator U10B, being more positive than +2 V(R) at the negative input, switches its output to approximately 0.0 V. FET switch Q8 is turned on. When Q8 is on, the output of the Audio Oscillator U15A is then ac coupled by C22 through resistor R57 to the AM% Summing Amplifier U17D.

##### External AM (X1) Select

External AM is selected when the data bit latched into pin 15 of U3 is high and the X2(L) bit latched into pin 16 of U5 is high. The output of U8B is high (refer to Service Sheet 6). The high output (X1 EXT AM) switches the output of the External AM Select comparator U10A to approximately 0.0 V. FET switch Q7 is turned on. When Q7 is on, the external modulation signal from the External Modulation Buffer U9 is then applied to the X1 AM% Summing Amplifier U17D through resistor R56.

**Internal AM (X2) Select (Doubler Mode)**

Internal AM doubler (X2) is selected when the data bit latched into pin 5 of U3 is high (refer to Service Sheet 6). The high output (INT AM) to the positive input of the Internal AM Select X2 comparator U21B, being more positive than the +2 V(R) at the negative input, switches its output to approximately 0.0 V. FET switch Q11 is turned on. When Q11 is on, the output of the Audio Oscillator U15A is then ac coupled by C22 through resistor R78 to the Doubler (X2) AM% Summing Amplifiers U21C and U21D.

The internal modulation signal is sent to the Doubler whenever the INT AM bit at U3 pin 5 is high (refer to Service Sheet 6). The Doubler is not active when Internal AM (X1) is selected so the modulation signal being sent to the Doubler Assembly does not effect instrument operation. When the Doubler is selected, X2(L) bit latched into pin 16 of U5 is low. The Doubler signal is amplitude modulated and the X1 AM is disabled.

**External AM (X2) Select (Doubler Mode)**

External AM doubler (X2) is selected when the data bit latched into pin 15 of U3 is high (refer to Service Sheet 6). The high output (EXT AM) to the positive input of the External AM Select X2 comparator U21A, being more positive than the +2 V(R) at the negative input, switches its output to approximately 0.0 V. FET switch Q10 is turned on. When Q10 is on, the external modulation signal is then coupled through resistor R77 to the Doubler (X2) AM% Summing Amplifiers U21C and U21D.

The Internal AM(X2) is selected when INT AM U3 pin 5 is high (refer to Service Sheet 6). The Doubler is not active when Internal AM (X1) is selected so the modulation signal being sent to the Doubler Assembly does not effect instrument operation. When the Doubler is selected, X2(L) bit latched into pin 16 of U5 is low. The Doubler signal is amplitude modulated and the X1 AM is disabled.

**FM Modulation Control**

Ten data bits latched into the Modulation Control Latches U2 and U5 (refer to Service Sheet 6), and applied to the FM Deviation DAC U13. The digitally controlled output level of the FM deviation DAC adjusts the modulation signal from the FM Deviation Summing Amplifier U12 to the FM Deviation Amplifier U11A. The DAC and FM Deviation Amplifier output the signal level required to frequency modulate the RF output at the selected FM deviation.

**Internal FM Select**

Internal FM is selected when the data bit latched into pin 6 of U3 is high (refer to Service Sheet 6). The high output (INT FM) switches the output of the Internal FM Select comparator U10D to approximately 0.0 V. FET switch Q5 is turned on. When Q5 is on, the output of the Audio Oscillator U15A is ac coupled by C22 through resistor R13 to the FM Deviation Summing Amplifier U12.

**External FM Select**

External AC FM or DC FM is selected by the data bits latched into pin 19 (AC FM) and pin 16 (EXT FM) of U3, and gated through NOR gates U7 (refer to Service Sheet 6). The high output at pin 4 of U7B switches the output of the External AC FM Select comparator U10C to approximately 0.0 V. FET switch Q4 is turned on. When Q4 is on, the external ac modulation signal from the External Modulation Buffer U9 is ac coupled by C8 and C9 through resistor R14 to the FM Deviation Summing Amplifier U12. The high output at pin 13 of U7D switches the output of the External DC FM Select comparator U11C to approximately 0.0 V. FET switch Q3 is turned on. When Q3 is on, the external dc modulation signal from the External Modulation Buffer U9 is dc coupled by resistor R7 to the FM Deviation Summing Amplifier U12. External AC FM and external DC FM can not be selected at the same time.

## Audio Oscillator Section

When only internal modulation is selected, the data bit latched into pin 2 of U3 is high (refer to Service Sheet 6). The high output (AUDIO OSC OUT) switches the output of Audio Oscillator Out comparator U14B to approximately 0.0 V. FET switch Q1 is turned on. When Q1 is on, the 400 Hz or 1 kHz internal Audio Oscillator output through buffer amplifier U15B and C15 and C16 is applied to the MOD INPUT/OUTPUT connector on the front-panel.

The internal Audio Oscillator's frequency is enabled by a high latched into pins 5 or 6 of U3. These two bits (INT AM and INT FM) are each applied to Audio Oscillator Buffer U6 (refer to Service Sheet 6). The low output (AOE) of U6 enables the internal Audio Oscillator U15A.

The internal Audio Oscillator's frequency of 400 Hz or 1 kHz is selected by the data bit latched into pin 9 of U3. For 1 kHz the FREQ line is low; for 400 Hz it is high. The high output switches the output of Audio Frequency Select comparator U14A to approximately 0.0 V. FET switch Q2 is turned on and capacitor C20 is bypassed. This increased capacitance switches the Audio Oscillator's frequency to 400 hz. If 1 kHz is selected, Q2 is turned off by a low on the FREQ line to U14A, and C20 is left in the oscillator's circuit. The peak output of the Audio Oscillator is approximately +7.5 V as determined by VR4, CR8, and CR9. These components form the feedback path for the positive input of U15A.

### Modulation Calibration

Internal and external modulation is calibrated only if the modulation signal from the internal Audio Oscillator or the external MOD INPUT/OUTPUT connector is equal to  $+1.00 \text{ Vpk} \pm 0.05 \text{ Vpk}$ . The amplitude from the internal Audio oscillator is adjusted by R50 (OSC ADJ).

## Over/Under Modulation Comparators


The input amplitude level at the MOD INPUT/OUTPUT connector must be set by the external source. The input amplitude level is monitored by the Over/Under Modulation comparators U14C and U14D. When the modulation input signal is high, comparator U14C switches its output from  $-15 \text{ V}$  to  $0.0 \text{ V}$ . The monostable multivibrator U16A is enabled. The output at pin 13 goes high for approximately 0.45 seconds. As long as the input is enabled by the high modulation signal, the multivibrator continues to output the pulse.

The HI(H) pulse from the multivibrator is applied to the Service Request Register A11U (refer to Service Sheet 17). The Microprocessor receives this status bit over the data bus when the inputs to the Service Request Register are clocked in by the status strobe. The HI EXT LED is turned on.

When the modulation input signal is low, the output of comparator U14C and U14D are both approximately  $-15 \text{ V}$ . The monostable multivibrators are not enabled. The active high output of U16A is low and the active low output of U16B is high. The high output of U16B is applied to the Service Request Register, and the LO EXT LED is turned on.

When the modulation input signal is  $1 \text{ Vpk}$ , the output of comparator U14D is switched high which enables the monostable multivibrator U16B. The high output at pin 12 is set low, and the LO EXT LED is turned off.

**TROUBLESHOOTING**

Procedures for checking part of the A11 Audio Assembly circuits are given below. The areas or points to check are marked on the schematic by a hexagon with a checkmark and a number inside, for example, 

**Troubleshooting Help**

- Block Diagram 4
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustments

**Test Equipment**

Digital Multimeter ..... HP 3466A

 **Level DAC, AM Reference Summing Amplifier**

1. Set the Signal Generator as follows:

Frequency ..... 520 MHz  
 Amplitude ..... -3 dBm  
 Modulation ..... Off

2. Measure and verify the voltages shown in Table 1 at test point A11TP6 (AM). Change the RF output amplitude level from the front-panel as indicated.

**NOTE**

*Voltages measured may differ from the voltages shown in Table 1 because of level correction. The voltage change for each step from -1 to +13.0 dBm is consistent.*

*Table 1. Level Control Voltages versus Front-Panel Amplitude.*

Front-Panel Amplitude (dBm)	A11TP6 (Vdc)
-1.0	+0.5
+2.0	+0.7
+5.0	+1.0
+10.0	+1.8
+13.0	+2.5

**√2 AM% DAC, AM Offset Buffer**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... AM 1%  
 Source ..... 1 kHz (Int.)

2. Measure and verify the voltages shown in Table 2 at test point A11TP6 (AM). Change the AM% depth from the front panel as indicated.

**NOTE**

*Absolute voltage levels measured may differ from the voltages shown in Table 2 depending on the adjustment of A11R62 (AM%). The relative change for each AM% change should be consistent, however.*

*Table 2. AM% Control Voltage Levels.*

Front-Panel AM%	A11TP6 (Vrms)
1	0.004
5	0.020
10	0.040
20	0.080
50	0.200
70	0.280
99	0.390

**√3 FM Deviation DAC, FM Deviation Amplifier**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... FM 1 kHz  
 Source ..... 1 kHz (Int.)

2. Measure and verify the voltages shown in Table 3 at test point A11TP7 (FM). Change the FM deviation from the front panel as indicated.

**NOTE**

*Absolute voltage levels measured may differ from the voltages shown in Table 3 depending on the adjustment of A11R16 (FM GAIN). The relative change for each FM kHz change should be consistent, however.*

**Table 3. FM Deviation Control Voltage Levels.**

Front-Panel FM (kHz)	A11TP7 (Vrms)
1	0.02
5	0.10
10	0.20
20	0.40
50	1.00
70	1.40
100	2.00
200	4.00

**4 Comparators, FET Switches**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... Off

2. Select the front-panel Modulation Source functions as indicated in Table 4. Measure and verify the voltages shown for the associated comparator.

**Table 4. Voltage Checks.**

Function Selected	Comparator	Comparator Output (Vdc)	FET Switch	Open/Closed
Int 1 kHz, AM	U10B-1	0.0	Q8	closed
Int 400 Hz	U14A-2	0.0	Q2	closed
Audio Osc Out	U14B-1	+5.0	Q1	closed
Int FM	U10D-13	0.0	Q5	closed
Ext AC FM	U10C-14	0.0	Q4	closed
Ext DC FM	U11C-8	+14.0	Q3	closed
Ext AM	U10A-2	0.0	Q7	closed
Amplitude +10 dBm	U17B-7	-13.0	Q9	open
FM Range (< 21 kHz)	U11B-7	+14.0	Q6	open
Ext AM No Input	U14D-13	-13.0	J1 pin 5 J1 pin 4	L H
Ext AM 1 Vpk Input	U14D-13	-13.0	J1 pin 5 J1 pin 4	H L

A11 Component Coordinates

COMP	X	Y	COMP	X	Y	COMP	X	Y
C1	A	1	Q4	B	2	R45	D	2
C2	A	1	Q5	B	2	R46	D	2
C3	A	1	Q6	A	2	R47	D	2
C4	A	3	Q7	C	2	R48	D	2
C5	B	3	Q8	C	2	R49	D	2
C6	C	3	Q9	B	2	R50	C	2
C7	D	1	Q10	C	2	R51	D	2
C8	D	1	Q11	C	2	R52	D	2
C9	D	1				R53	D	2
C10	A	2	R1	D	1	R54	D	2
C11	A	3	R2	D	1	R55	D	2
C12	A	2	R3	D	1	R56	C	2
C13	A	2	R4	D	1	R57	C	2
C14	A	2	R5	D	1	R58	C	2
C15	D	2	R6	D	1	R59	C	2
C16	D	3	R7	B	2	R60	B	2
C17	D	2	R8	D	1	R61	B	2
C18	D	2	R9	D	1	R62	B	2
C19	D	2	R10	A	2	R63	B	2
C20	D	3	R11	B	2	R64	B	2
C21	D	2	R12	B	2	R65	B	3
C22	C	1	R13	B	2	R66	C	2
C23	D	3	R14	B	2	R67	C	2
C24	D	3	R15	B	2	R68	B	3
C25	B	2	R16	B	2	R69	B	2
C26	B	2	R17	B	3	R70	B	2
C27	C	1	R18	A	2	R71	B	2
			R19	A	2	R72	B	2
CR1	A	2	R20	A	2	R73	B	2
CR2	A	2	R21	A	2	R74	B	2
CR3	B	2	R25	A	2	R75	B	2
CR4	C	2	R26	A	2	R76	B	2
CR5	C	2	R27	A	2	R77	C	2
CR6	D	3	R28	A	2	R78	C	1
CR7	D	2	R29	A	2	R79	C	2
CR8	D	2	R30	D	3	R80	C	2
CR9	D	2	R31	D	3	R81	C	2
			R32	D	3	R82	C	2
J1	A	1	R33	D	3	R83	C	2
J2	C	1	R34	D	3	R84	C	2
J3	C	2	R35	D	3	R85	C	2
J4	C	2	R36	D	3	R86	C	2
			R37	D	3	R87	D	1
L1	A	1	R38	C	3			
L2	A	1	R39	D	3	TP1	D	1
L3	A	1	R40	D	3	TP2	D	1
			R41	D	3	TP3	A	3
Q1	D	3	R42	D	2	TP4	B	1
Q2	D	2	R43	D	2	TP5	B	2
Q3	A	2	R44	D	2	TP6	B	1

A11 Component Coordinates

COMP	X	Y	COMP	X	Y	COMP	X	Y
TP7	A	2						
U1	B	3						
U2	B	3						
U3	C	3						
U4	B	3						
U5	A	3						
U6	C	3						
U7	C	3						
U8	C	3						
U9	D	1						
U10	B	1						
U11	A	2						
U12	A	3						
U13	A	3						
U14	D	3						
U15	D	2						
U16	D	3						
U17	B	2						
U18	B	2						
U19	C	3						
U20	B	3						
U21	C	2						
VR1	D	1						
VR2	D	1						
VR3	D	1						
VR4	D	2						



**CHANGES****All Serial Prefixes**

On the A11 Schematic Diagram:

- C28,29 - Add C28 and C29, values  $0.1\mu$ . C28 is connected in parallel with R31. C29 is connected in parallel with R33 (Over /Under Modulation Comparators).
- R48 - Change the value to  $8.66k\Omega$ .



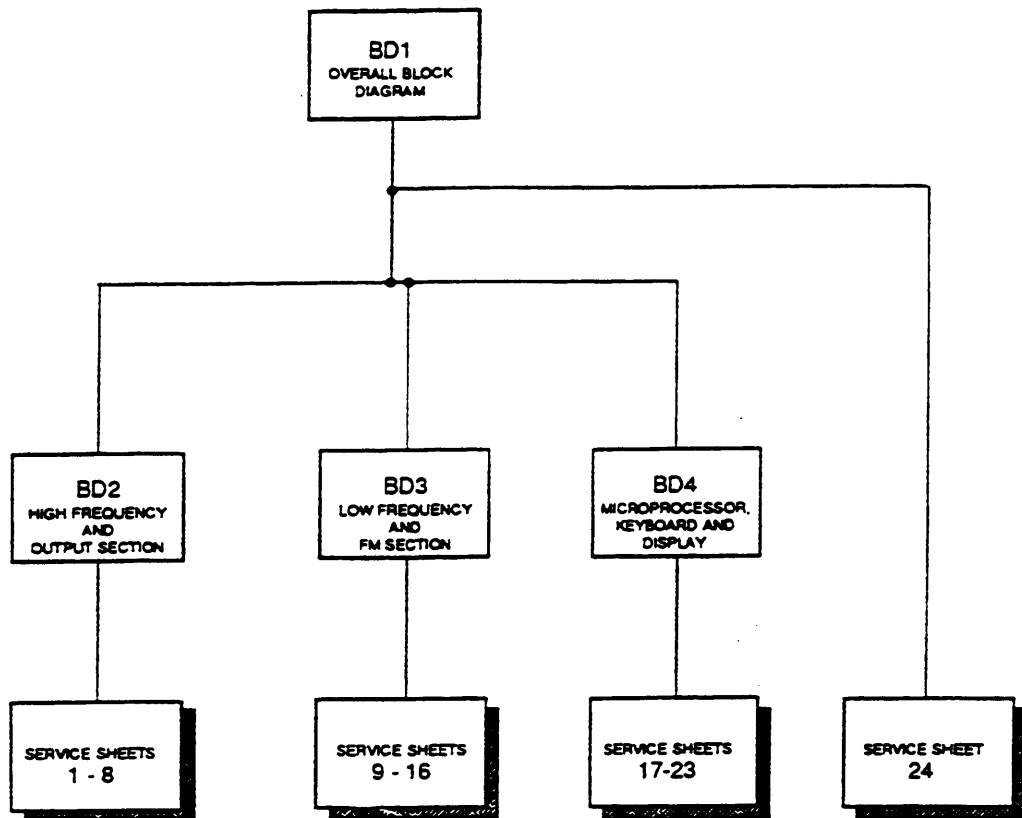
## Section 8 General Information

### INTRODUCTION

This section contains information for troubleshooting and repairing the HP 8657B. Troubleshooting and repair is to component level except for the A9 Attenuator assembly and the A12 Frequency Doubler which are replaced as complete units. The troubleshooting information is organized as shown in Figure 8-1.

#### NOTE

*It is recommended that the start point for all troubleshooting is BD1.*



*Figure 8—1. Troubleshooting Information Organization.*

### BOARD ASSEMBLY TO SERVICE SHEET(S) CROSS REFERENCE

Table 8-1 provides a cross reference between a board assembly and the Service Sheet(s) associated with it.

Table 8—1. Assembly to Service Sheet Cross Reference.

Assembly	Associated Service Sheet(s)
A1 Keyboard	SS21
A2 Display	SS21,22,23
A3 Low Frequency Loop	SS9,10,11,12,13,14,15,16
A3A1 Low Frequency Osc	SS9
A4 High Frequency Loop	SS1,2
A6 Output	SS4,5
A7 200 MHz Low Pass Filter	SS9
A8 Frequency Multiplier	SS3
A9 Attenuator	SS8
A10 Attenuator Drive	SS8
U5 Reverse Power Protection	SS8
U2 Hetrodyne Switch	SS8
U8 Pulse Modulator	SS8
A11 Audio	SS6,7
A12 Frequency Doubler	SS8
A13 Processor	SS17,18,19,20
A14 Power Supply	SS24
A15 Line Module	SS24
A16 10 MHz Reference Osc	SS24

## SAFETY CONSIDERATIONS

### Before Applying Power

Verify that the HP 8657B is set to match the available AC line voltage and that the correct fuse is installed (refer to paragraph 2-6 in Section 2 of the Operation and Calibration manual). An uninterrupted safety earth ground must be provided from the main power source to the HP 8657B input wiring terminals, power cord, or supplied power cord set.

### Warnings and Cautions

Pay attention to WARNINGS and CAUTIONS. They must be followed for your protection and to avoid damage to the HP 8657B.

#### WARNING

*Maintenance described herein is performed with power supplied to the HP 8657B 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). Where maintenance can be performed without power supplied, the power should be removed.*

*Any interruption of the protective (grounding) conductor (inside or outside the HP 8657B) 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 HP 8657B must be made inoperative (that is, secured against unintended operation).*

*If the HP 8657B 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 HP 8657B can still be charged even if the HP 8657B 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 short-circuited fuseholders. To do so could create a shock or fire hazard.*

**CAUTION**

*Do not disconnect or remove any boards in the HP 8657B unless the HP 8657B is unplugged from the AC line. Some boards contain devices which can be damaged if the board is removed when the power is on. Use conductive foam when removing MOS devices from sockets. Use care when unplugging ICs from high-grip sockets.*

## SPECIAL HANDLING CONSIDERATIONS FOR STATIC SENSITIVE DEVICES

### General

This information is provided to familiarize users of Hewlett-Packard instruments with special handling precautions for static sensitive devices. These precautions should be observed when servicing printed circuit boards or components that are static sensitive.

All schematics with circuit assemblies containing static sensitive components are designated with the international awareness symbol. This symbol indicates that special precautions apply when servicing these circuits. Following the precautions described in the following paragraphs could prevent damage to the circuit and its components.



**ATTENTION  
Static Sensitive  
Devices**

### Description

Static Sensitive Devices are electronic components that are susceptible to damage or complete destruction in the presence of a static discharge. While all electronic components are static sensitive to some degree, the possibility of damage due to electro-static discharge (ESD) becomes greater as the insulating materials in the components become thinner and as component densities increase. Depending on the magnitude of the charge, device substrates can be punctured or destroyed by contact or mere proximity of a static charge.

Static charges accumulate harmlessly in a person's body, therefore the charges can be passed on in numerous ways such as simple contact with the device, during separation of materials, or during normal motions of persons with static sensitive devices. In many cases, destructive static discharges (< 4000V) cannot be seen or felt. The results of this damage can cause degradation of device performance, early failure, or complete destruction of the device.

### Component Handling Precautions

- a. If you are servicing or repairing an instrument, you should wear a metal or conductive plastic wriststraps with a 1 Megohm series resistor connected to ground.
- b. Packages should not be removed from their conductive or antistatic carriers until required and should only be removed by an operator that is grounded through a 1 Megohm series resistor. Devices that are removed should be placed in a conductive tray.
- c. Metal parts of fixtures, tools, soldering irons, and table tops should be grounded to a common point.
- d. Handling equipment, trays, table tops, and transport carts should be electrically conductive.
- f. The circuit board should have a conductive strip placed on the board edge-connectors to short all the connections together.

### Device Classes

The following is a classification of the ESD sensitivity of components used in most Hewlett-Packard instruments:

**CLASS I devices have a sensitivity range from 0 to 1,000V.** Devices in this range include microwave diodes (especially Schottky), BIFET and precision OP AMP ( $I_{os} < 50 \text{ nA}$ ,  $V_{os} < 1 \text{ mV}$ ), unprotected MOS (especially VLSI), MOS capacitors, advanced Schottky logic, junction FETs and low current SCRs (< 0.15A), microwave and VHF transistors and ICs, precision IC voltage regulators and resistors, low power resistors (< 0.05W), VLSICs with dual-level metallization, and Surface Acoustic Wave (SAW) devices.

**CLASS II devices have a sensitivity range from 1,000 to 4,000V.** Devices in this range include MOS ICs with internal protection (CMOS, NMOS, PMOS) and LSI ICs, Schottky rectifier diodes, linear ICs (bipolar), precision resistor networks, high speed bipolar logic (ECL, LS-TTL, S-TTL), varactor diodes, monolithic ceramic capacitors, RF Mixers and other RF devices utilizing diodes.

**CLASS III devices have a sensitivity range from 4,000 to 15,000V.** Devices in this range include small signal diodes, and transistors, low-speed bipolar logic (TTL, DTL), quartz and piezoelectric crystals, and thin and thick film resistors (< 1/8W,  $\geq 500\text{k ohms}$ ).

### RECOMMENDED TEST EQUIPMENT AND ACCESSORIES

Test equipment and test accessories required to maintain the HP 8657B are listed in the table of Recommended Test Equipment in Section 1. Equipment other than that listed may be used if it meets the listed critical specifications.

### SERVICE TOOLS, AIDS AND INFORMATION

#### Service Tools

There are unique tools available that will make servicing of the HP 8657B easier. Service aids are provided in the HP 8657B. Service information is provided in this manual. Information provided

in the paragraph entitled Repair (found in this section) shows how the HP 8657B is accessed for repair purposes.

**Pozidriv Screwdrivers.** Many screws in the HP 8657B 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.

**Tuning Tools.** For adjustments requiring non-metallic tuning tools, use the HP 8710-0033 blade tuning tool or the HP 8710-1010 (JFD Model No. 5284) hex tuning tool. For other adjustments an ordinary small screwdriver or suitable tool is sufficient. No matter which tool is used, never force any adjustment control. This is especially critical when adjusting variable inductors or capacitors.

**Torque Wrench.** A torque wrench is needed whenever semi-rigid cables are installed. Use an 8 mm open end torque wrench capable of 4.5 in/lbs ( $\pm 0.5$  in/lbs) of torque. Overtightening the connectors that hold these cables will change the cables dielectric constant. Undertightening can cause RF leakage.

## Parts and Cable Locations

The locations of individual components mounted on printed circuit boards or other assemblies are shown adjacent to the schematic diagram on the back of the preceding Service Sheet. The part reference designator 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 6-3, Replaceable Parts, in Section 6. Illustrated parts breakdowns of chassis and frame parts, as well as assemblies and mechanical parts and cables, are shown in Section 6.

Mechanical parts have reference designations that begin with the letters MP. Some mechanical parts, such as screws, are listed in the replaceable parts list below the part to which they fasten. To find the part number and description of mechanical part, find the part in one of the figures in Section 6 or Section 8. The part in the figure is labeled with its reference designator. Look up that reference designator in the table of Replaceable Parts. If the part is a fastener, such as a screw, nut, or washer and does not have an assigned reference designator, look to the figure for the part to which it fastens. Then, look up the fastened part in the parts list. Just below the fastened part, you will see the part numbers and descriptions of the desired fastener.

## Test Points and Adjustment Locations

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

## Service Aids on Printed Circuit Boards

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

## Service Kit

To assist in servicing the HP 8657B, a service kit is available from Hewlett-Packard. For more information about this kit, contact your nearest Hewlett-Packard Sales Office.

## Other Service Documents

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

**REPAIR****Disassembly Procedures**

The following procedures provide information to enable you to disassemble the HP 8657B. Table 8-2 indicates which procedures you need to perform to give access to a particular assembly. Reference to the appropriate exploded view in Section 6 or 8 is included. If a circuit board within the main casting is to be removed from the HP 8657B, seek access to its component (top) side. To reassemble the HP 8657B, follow the procedures in the reverse order.

**WARNING**

*Before beginning any disassembly procedure be sure that the AC line voltage is disconnected.*

*Table 8-2. Assembly Access Information.*

Operation	Perform Procedure(s)	For Part Locations Refer to Figure(s)
A1 and A2 removal	1	6-1, 6-2
Remove external RF covers	2	6-1
A3 Service Position	2, 3	6-1, 6-8, 8-2
A4, A6, A8 (component side)	2, 3, 4	6-1, 6-8, 8-2
A11 Removal/Service Position	2, 5	6-1, 6-11, 8-5
A13 Removal/Service Position	2, 5, 6	6-1, 6-10, 6-11
Doubler Removal	2, 5, 6, 7	6-1, 6-10, 6-11
Bottom Internal RF covers	2, 5, 6, 7, 8	6-1, 6-10, 6-11
A6 to A10 Semi-Rigid Removal	2, 5, 6, 7, 8, 9	6-1, 6-11, 6-13
A10 removal	2, 5, 6, 7, 8, 9, 14	6-1, 6-10, 6-11, 6-12, 6-13
A4 Removal	2, 3, 4, 5, 6, 7, 10	6-1, 6-9, 6-11, 8-2, 8-4
A6 Removal	2, 3, 4, 5, 6, 7, 8, 9, 11	6-1, 6-9, 6-11, 8-2, 8-4
A8/FL1 Removal	2, 3, 4, 12	6-1, 6-8, 6-9, 8-4
Attenuator Removal	2, 13	6-1, 6-10
A14 Removal	15	6-4, 8-3



**Procedure 1.** Remove the top trim MP2. Remove the four No. 2 Pozidriv screws MP107 from the top and bottom edge of the front-panel casting. If the unit is **NOT** an option 002, it may be necessary to remove the two side trims MP3 and loosen the two RF Output Bracket mounting screws MP107 and the MOD input/output bracket mounting screws MP107. Pull the front-panel forward until it is free of the casting.

**Procedure 2.** Remove the four screws MP17 and then remove the four handle caps MP15 and the two handles MP14. Place a thin piece of card between the external cover (top or bottom) and the rear casting. This will prevent the rear casting from damage. Use a flat headed screwdriver to lever up each corner in turn. Repeat this procedure in the middle of the cover. Remove covers MP4 and 24.

**Procedure 3.** Remove the ten 10/32 inch nuts and washers (MP8 and MP9) from the top of the A3 circuit board. Rotate the circuit board on the hinged carrier MP6 up and to the right (Refer to Figure 8-2). To lock the carrier in place, press the spring loaded hinge towards the rear of the HP 8657B until it slides around the hingelock MP20.

**Procedure 4.** Remove the two screws MP151 and remove the top internal cover MP12. To gain access to the component sides of the A4, A8 or A8, use a flat-headed screwdriver to lever up the appropriate internal RF covers. Covers MP33 and MP36 will also require removal of their retaining screws.

**Procedure 5.** Disconnect W16 and W31 and then remove the three (or seven) screws MP42 from the A11. To troubleshoot the A13 when still requiring operation of the A11, reconnect W16 and mount the A11 in the Service position shown in Figure 8-5.

**Procedure 6.** Remove the seven screws from the A13 Assembly. Disconnect W20 from the A12 and A13. To place the A13 in its service position, slide the A13 service bracket onto the two uppermost attenuator standoffs (i.e. between the casting wall and the attenuator mounting bracket) and ensure that it locks in place. To remove the A13, disconnect W2, W11, W15, W18, W19 and W21 from the A13 Assembly and lift free.

**Procedure 7.** Disconnect W37 from A12J3, W27 from A12J5 and W37 (or W28 if the unit is an option 003) from A12J8. Disconnect W20 and the six screws which secure the doubler to the bottom RF internal cover MP22. The A12 can now be removed.

**Procedure 8.** Remove the ten screws MP151 from the bottom internal RF cover. Remove W27 and W35 (or W28 if the unit is an option 003). Remove the bottom internal RF cover MP22. To gain access to the underside of the A4, A6 or A8, use a flat-headed screwdriver to lever up the appropriate covers. Covers MP33 and MP36 will also require removal of their retaining screws.

**Procedure 9.** Remove MP34 and MP35. Remove semi-rigid cables W12, W13 and W14.

**Procedure 10.** Unsolder the three wire links between the A4 and A6 (MP151). Unsolder the semi-rigid cables W8 and W9 at points 1, 2, 3, and 4 (Refer to Figure 8-4). Remove cable W6. Remove the twenty-two A4 mounting screws MP146. Carefully bend back W9 to allow the A4 to be removed.

**Procedure 11.** Remove the cables W6 and W7. Unsolder the three wire links MP151. Unsolder semi-rigid cable W10 at the point shown in Figure 8-4. Remove the eighteen A6 mounting screws MP146. Carefully bend back W10 to allow the A6 to be removed.

**Procedure 12.** Disconnect W5 from A8J3 and W25 from A8J1. Unsolder the white/red +5 V supply wire from the A8. Unsolder W8, W9 and W10 at points 1, 2, 3 and 4 (Refer to Figure 8-4). Remove the sixteen A8/FL1 mounting screws MP146. Carefully bend back W10 to allow the A6 to be removed.

**Procedure 13.** Disconnect W26 and W27 from the attenuator. Disconnect the ribbon cables from A10J2. Remove the four black screws which hold the attenuator mounting bracket to the side of the casting. The attenuator assembly can now be removed.

**Procedure 14.**

- a. If the instrument is a standard option, remove W17 from the Reverse Power Module U5.
- b. If the instrument is an option 002, remove W26 from the Reverse Power Module U5.
- c. If the instrument is an option 003, remove W39 from A10J3.
- d. If the instrument is an option 002/003, remove W32 from A10J3.
- e. For **ALL OPTIONS**, remove the eight A10 mounting screws. The A10 assembly can now be removed.

**Procedure 15.** Remove the five screws MP127 which fasten the power supply cover to the casting. **DO NOT** remove the two screws marked "TRANSFORMER MOUNTING ONLY." Remove the four screws MP133 from each side of the rear casting. Remove the BNC retaining nuts from the "SEQ," "MOD I/O," and "PULSE INPUT" connectors if fitted. Remove the power supply cover. Disconnect the cables from A14J1 and A14J2 if fitted. Remove the three (or two) screws fastening the A14 heatsink to the power supply. Withdraw the A14.

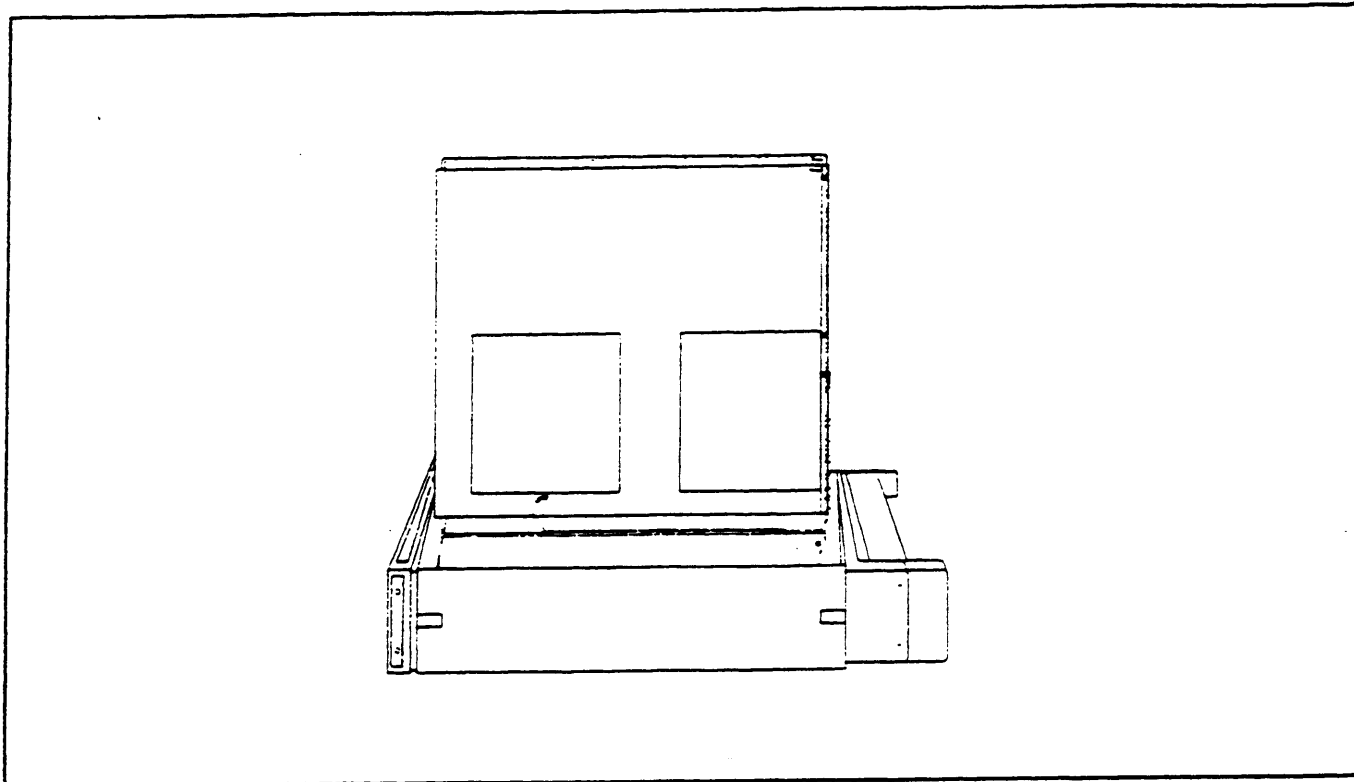


Figure 8-2. A3 Service Position.

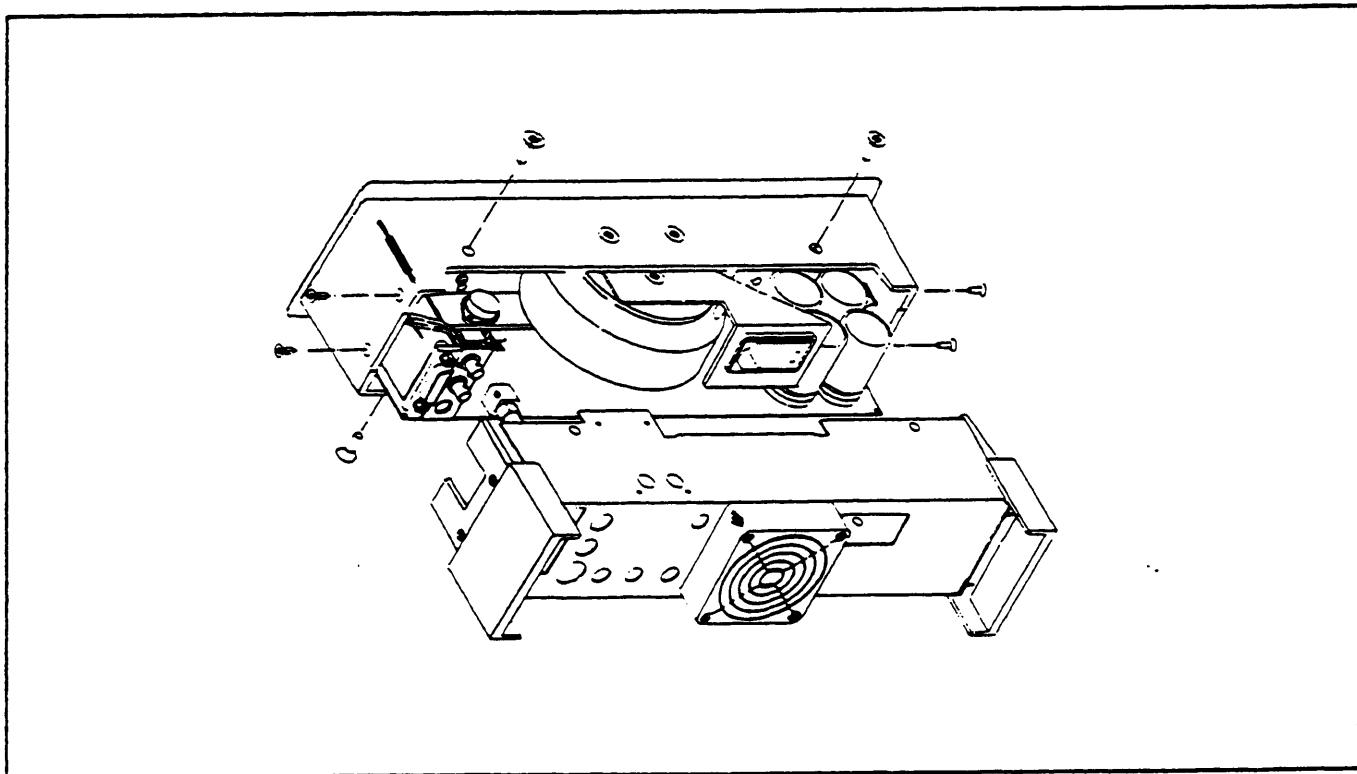


Figure 8-3. Rear Panel Removal.



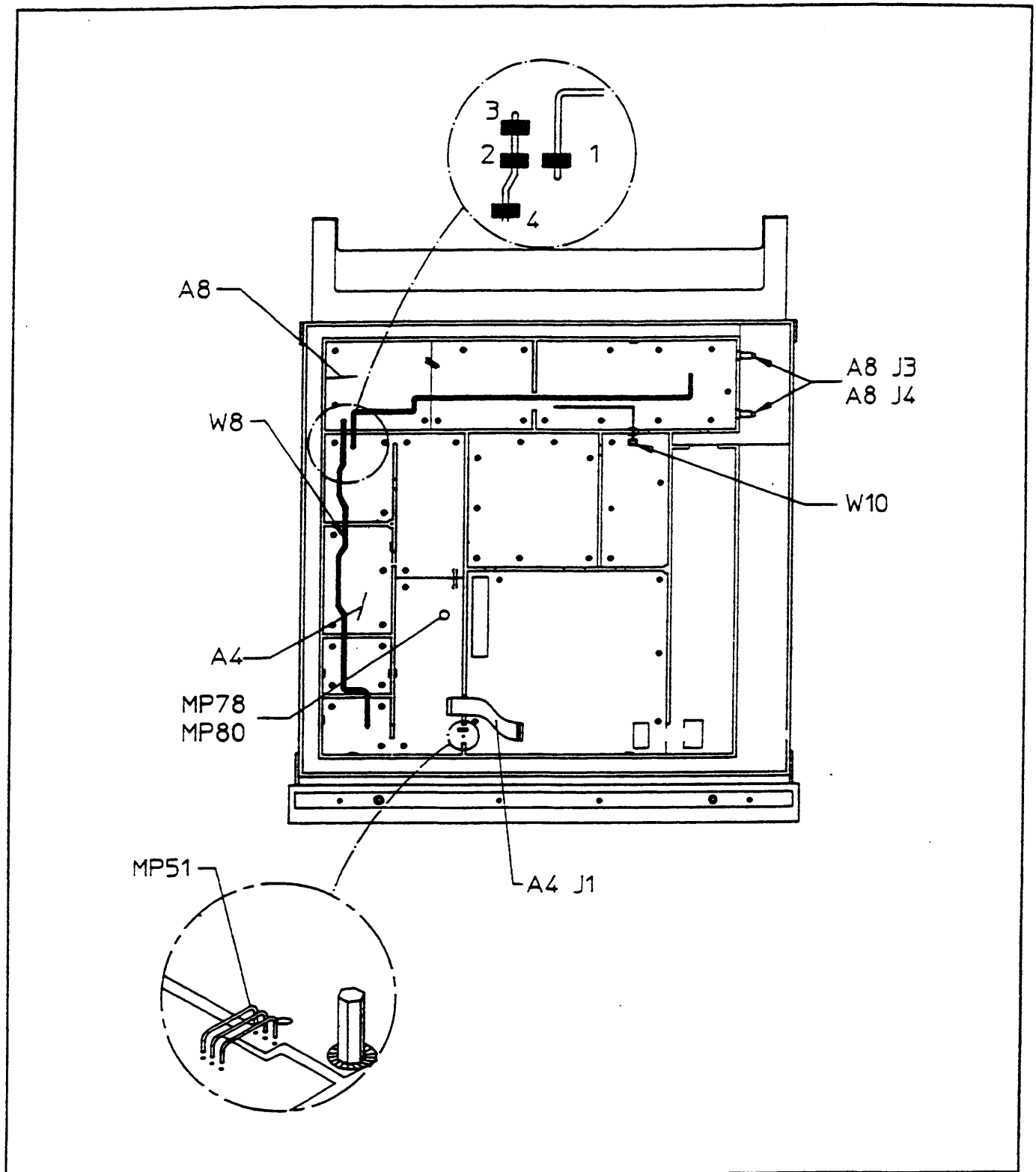
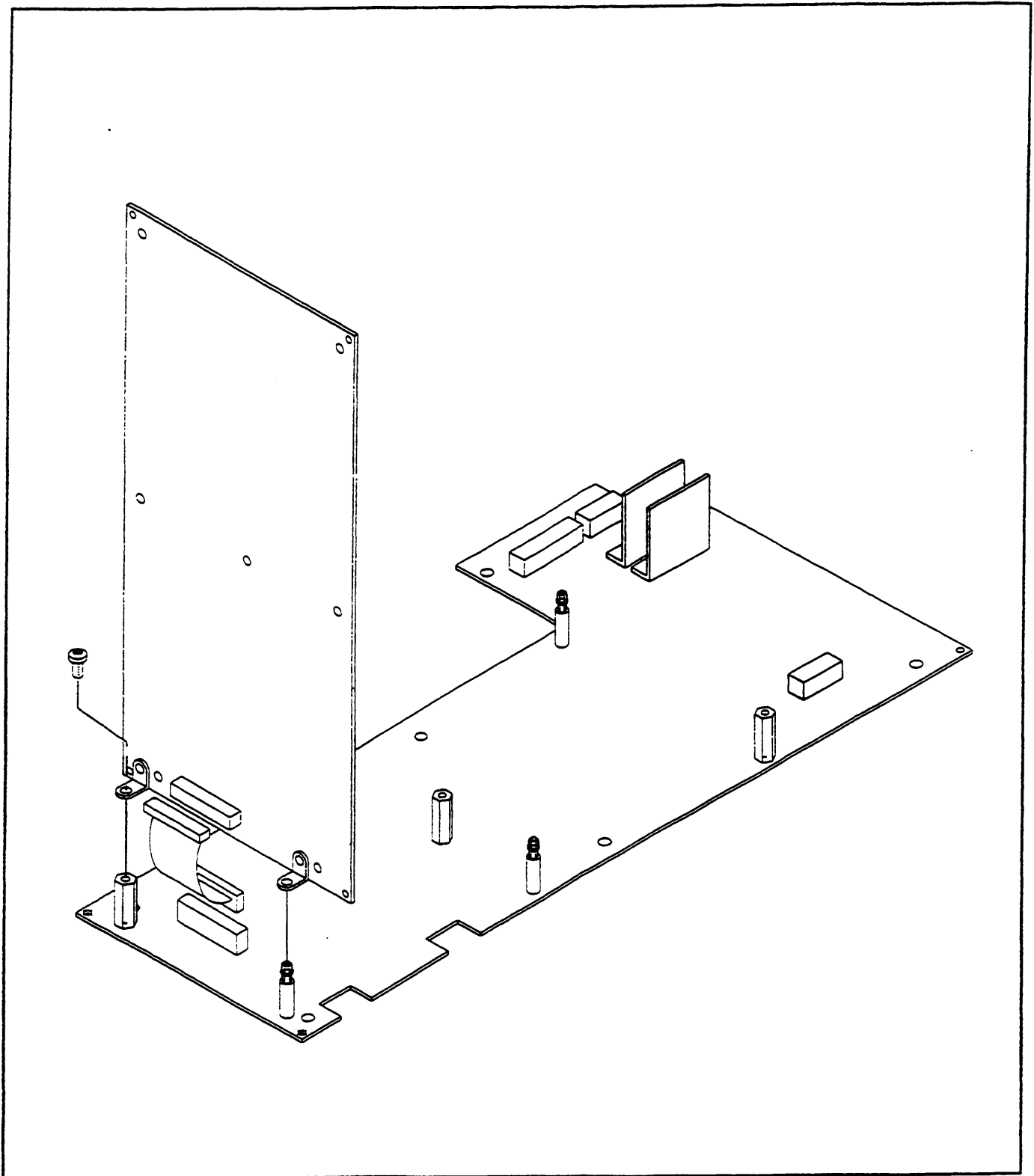


Figure 8-4. A4 and A8 disassembly.



*Figure 8-5. All Service Position.*

## Reassembly Information

### NOTE

*When reassembling the HP 8657B, insert all shield braid removed during disassembly into the appropriate space(s) in the casting wall before the internal RF covers are reinstalled.*

*DO NOT PRESS the internal RF covers all the way into the casting during reassembly. Make sure the top of the cover is the same level as the top of the casting.*

### CAUTION

*Do not overtighten the nuts which secure the semi-rigid cables to the RF connectors, as this may change the dielectric constant of the cable. Under tightening may cause RF leakage. Use an 8 mm open end torque wrench capable of 4.5 in/lbs ( $\pm 0.5$  in/lbs) of torque.*

## Component Replacement Procedures for SMOBC PCB's

All PCB assemblies in the HP 8657B, except the A1 Keyboard, are Solder Mask Over Bare Copper (SMOBC) The printed circuit board traces, pads and plated-through holes (PTH) are copper. The printed circuit boards are more susceptible to broken traces, lifted pads, and damage to the plated-through holes. Therefore, additional care must be taken when replacing components on SMOBC printed circuit boards. The following steps should be taken to reduce the risk of damage.

1. Use a temperature controlled soldering iron set at a temperature of 600° F (315° C).  
Extensive tests were made by Hewlett-Packard using commercial brands of soldering irons. As a result of these tests, the recommended soldering iron was the HEXACON THERM-O-TRAC STATION #1000 with the FINGER GRIP SLEEVE 21 A-5 and solder tip #J 301X. During soldering, the tip temperature of the HEXACON THERM-O-TRAC STATION remained very stable.
2. Cut out the body of the component to be removed. (Leave leads as long as possible for easier removal.)
3. Apply heat to the lead only, add solder as required, slide tip down to the pad and remove solder with solder sucker.

### CAUTION

*Tip pressure on the pad is most critical and is totally operator dependent. Excessive tip pressure will damage or destroy the board. Do not use tin desoldering braid or solder wicking techniques on Hot Air Levelled boards.*

The melting point of solder in the plated through hole (PTH) is reached in 2.5 seconds at tip temperature of 600° to 750° F (315° to 400° C). The recommended time for heat to be applied is 3 seconds.

Keep the solder sucker clean and do not let the tip of the solder sucker hit the pad when removing solder. Breaking the lead loose can damage the PTH. If the lead is attached to the PTH after the solder has been removed, reheat the lead to remove it.

4. When soldering or desoldering multilead components, do not consecutively apply heat to adjacent leads. Distribute heat by skipping leads or crossing to opposite side of device.

## MOS and CMOS Integrated Circuit Replacement

MOS and CMOS integrated circuits are used in the HP 8657B. They are prone to damage from both static and transients and must be handled carefully. Refer to paragraph 8-4 Special Handling Considerations for Static Sensitive Devices for further information. When working on the Signal Generator, keep in mind the following recommendations to avoid damaging these sensitive components.

1. Do not remove any board unless the Signal Generator has been unplugged.
2. When removing a socketed MOS and CMOS device from an assembly, be careful not to damage it. Avoid removing devices from these sockets with pullers. Instead, use a small screwdriver to pry the device up from 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 stick it into a pad of conductive foam or other suitable holding medium.
4. When replacing a MOS or CMOS device, ground the foam on which it resides to the HP 8657B before removing it. If a device requires soldering, make sure that the assembly is lying on a sheet of conductive foam, and that the foam and soldering iron tip are grounded to the assembly. Apply as little heat as possible.
5. Before turning the HP 8657B off, remove any large ac sources which may be driving MOS switches.

## Factory-Selected Components (\*)

Some component values are selected at the time of final checkout at the factory (see Table 5-1). These values are selected to provide optimum compatibility with associated components. These components are identified on individual schematics and the parts list by an asterisk (\*).

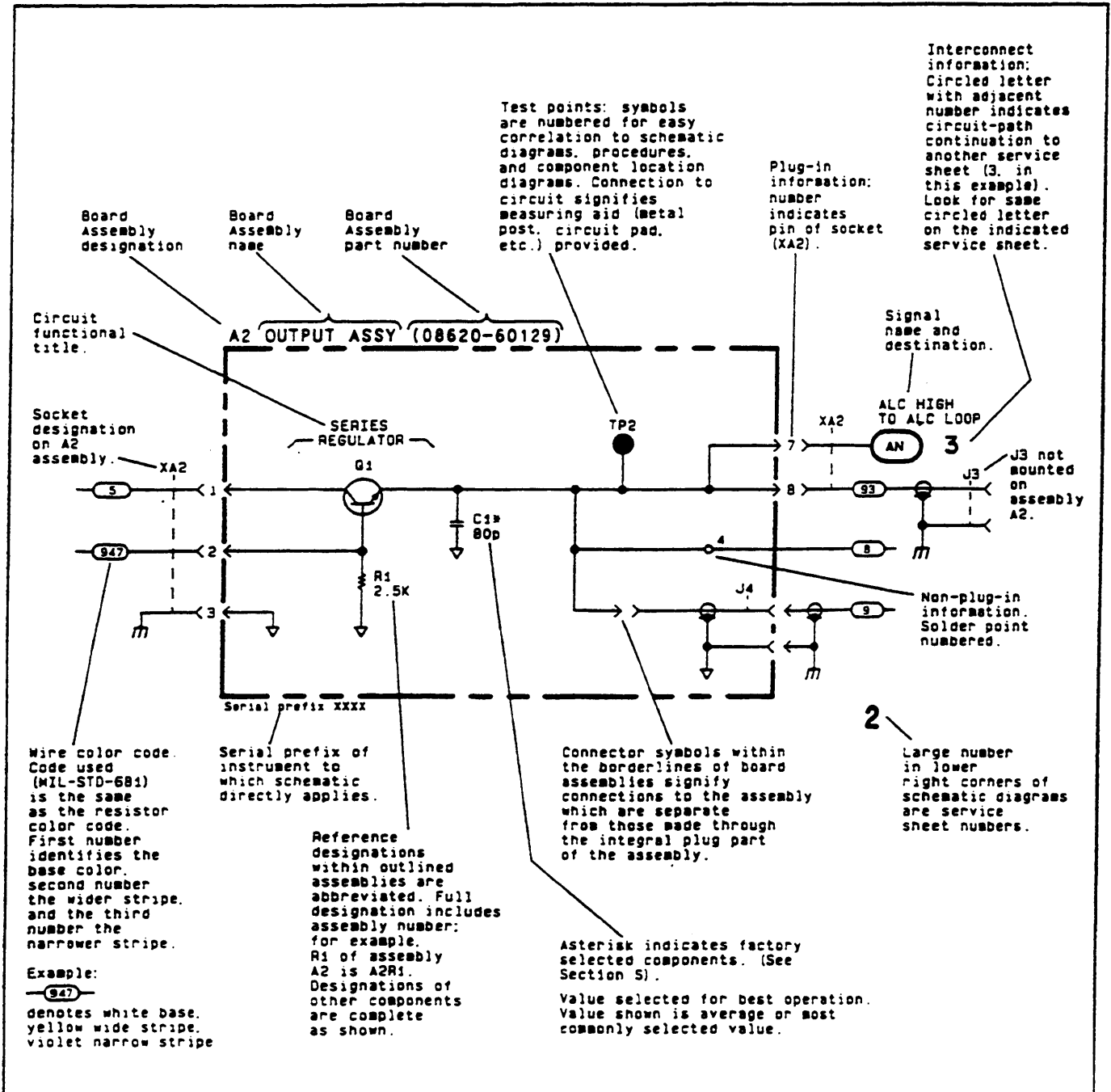


### SCHEMATIC SYMBOLOGY AND SCHEMATIC DIAGRAM NOTES

Table 8-3 summarizes the symbology used in presenting many devices found in the HP 8657B. The logic symbols used in this manual are based on the Institute of Electrical and Electronic Engineers (IEEE) in IEEE-STD 91-1984, *Graphic Symbols for Logic Functions*. This publication may be purchased from:



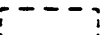














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Table 8-3. Schematic Diagram Notes (1 of 11)



**Table 8-3. Schematic Diagram Notes (2 of 11)**

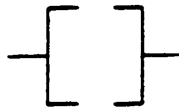
*Values for all components are marked in units of farads, henries, and ohms unless otherwise specified.*

*	Asterisk denotes a factory-selected value. Value shown is typical. See Section V.
	Tool-aided 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.
	Heavy dashed line with arrows indicates path and direction of main feedback.
	Indicates stripline (i.e., RF transmission line above ground).
	Wiper moves toward cw with clockwise rotation of control (as viewed from shaft or knob).
	Numbered Test Point measurement aid provided.
	Encloses wire or cable color code. Code used is the same as the resistor color code. First number identifies the base color, second number identifies the wider stripe, and the third number identifies the narrower stripe, e.g.,  denotes white base, yellow wide stripe, violet narrow stripe.
	A direct conducting connection to earth, or a conducting connection to a structure that has a similar function (e.g., the frame of an air, sea, or land vehicle).
	A conducting connection to a chassis or frame.
	Common connections. All like-designation points are connected.
	Letter = off-page connection. Number = Service Sheet number for off-page connection. In the example, signal flow is continued on Service Sheet 12, at the point marked.
	Number (only) = on-page connection.

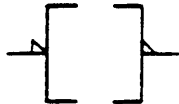
**Table 8-3. Schematic Diagram Notes (3 of 11)**

**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.



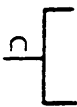
**Polarity Indicator**—The active state is a relatively low voltage level.



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



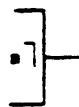
**Inhibit Input**—Input that, when active, inhibits (blocks) the active state outputs of a digital device.



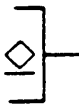
**Analog Input**—Input that is a continuous signal function (e.g., a sine wave).



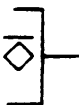
**Polarity Indicator used with Inhibit Indicator**—Indicates that the relatively low level signal inhibits (blocks) the active state outputs of a digital device.



**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 Output.**



**Open Emitter Output.**



**Three-state Output**—Indicates outputs can have a high impedance (disconnect) state in addition to the normal binary logic states.

**Table 8-3. Schematic Diagram Notes (4 of 11)**

	<p>Indicates multiple paths represented by only one line. Letters or names identify individual paths. Numbers indicate number of paths represented by the line.</p>
	<p>Coaxial or shielded cable.</p>
	<p>Ferrite bead. (Increases the self-inductance of the conductor passing through the bead.)</p>
	<p>Relay. Contact moves in direction of arrow when energized.</p>
	<p>Indicates a pushbutton switch with a momentary (ON) position.</p>
	<p>Feedthrough capacitor. (Acts as a feedthrough terminal when mounted on a chassis or a frame.)</p>
	<p>Indicates a PIN diode.</p>
	<p>Indicates a current regulation diode.</p>
	<p>Indicates a voltage regulation diode.</p>
	<p>Indicates a capacitive (varactor) diode.</p>
	<p>Indicates a Schottky (hot-carrier) diode.</p>
	<p>Light-emitting diode.</p>
	<p>Multiple transistors in a single package—physical location of the pins is shown in package outline on schematic.</p>
	<p>Identification of logic families as shown (in this case, ECL).</p>

**Table 8-3. Schematic Diagram Notes (5 of 11)****DIGITAL SYMBOLOGY REFERENCE INFORMATION****Combinational Logic Symbols and Functions**



$\Sigma$	Summing Junction—Outputs added together at a common point.
&	AND—All inputs must be active for the output to be active.
$\geq 1$	OR—One or more inputs being active will cause the output to be active.
$\geq m$	Logic Threshold—m or more inputs being active will cause the output to be active (replace m with a number).
=1	EXCLUSIVE OR—Output will be active when one (and only one) input is active.
=m	m and only m—Output will be active when m (and only m) inputs are active (replace m with a number).
=	Logic Identity—Output will be active only when all or none of the inputs are active (i.e., when all inputs are identical, output will be active).
	Amplifier—The output will be active only when the input is active (can be used with polarity or logic indicator at input or output to signify inversion).
X/Y	Signal Level Converter—Input level(s) are different than output level(s).
	Bilateral Switch—Binary controlled switch which acts as an on/off switch to analog or binary signals flowing in both directions. Dependency notation should be used to indicate affecting/affected inputs and outputs. Note: amplifier symbol (with dependency notation) should be read to indicate unilateral switching.
X→Y	Coder—Input code (X) is converted to output code (Y) per weighted values or a table.
(Functional Labels)	The following labels are to be used as necessary to ensure rapid identification of device function.
MUX	Multiplexer—The output is dependent only on the selected input.
DEMUX	Demultiplexer—Only the selected output is a function of the input.
CPU	Central Processing Unit

Table 8-3. Schematic Diagram Notes (6 of 11)

## DIGITAL SYMBOLOGY REFERENCE INFORMATION

## Sequential Logic Functions



**Monostable**—Single shot multivibrator. Output becomes active when the input becomes active. Output remains active (even if the input becomes inactive) for a period of time that is characteristic of the device and/or circuit.



**Oscillator**—The output is a uniform repetitive signal which alternates between the high and low state values. If an input is shown, then the output will be active if and only if the input is in the active state.

FF

**Flip-Flop**—Binary element with two stable states, set and reset. When the flip-flop is set, its outputs will be in their active states. When the flip-flop is reset, its outputs will be in their inactive states.

T

**Toggle Input**—When active, causes the flip-flop to change states.

S

**Set Input**—When active, causes the flip-flop to set.

R

**Reset Input**—When active, causes the flip-flop to reset.

J

**J Input**—Analogous to set input.

K

**K Input**—Analogous to reset input.

D

**Data Input**—Always enabled by another input (generally a C input—see Dependency Notation). When the D input is dependency-enabled, a high level at D will set the flip-flop; a low level will reset the flip-flop. Note: strictly speaking, D inputs have no active or inactive states—they are just enabled or disabled.

-m

**Count-Up Input**—When active, increments the contents (count) of a counter by "m" counts (m is replaced with a number).

-m

**Count-Down Input**—When active, decrements the contents (count) of a counter by "m" counts (m is replaced with a number).

-m

**Shift Right (Down) Input**—When active, causes the contents of a shift register to shift to the right or down "m" places (m is replaced with a number).

-m

**Shift Left (Up) Input**—When active, causes the contents of a shift register to shift to the left or up "m" places (m is replaced with a number).

## NOTE

*For the four functions shown above, if m is one, it is omitted.*

(Functional Labels)

The following functional labels are to be used as necessary in symbol build-ups to ensure rapid identification of device function.

mCNTR

**Counter**—Array of flip-flops connected to form a counter with modules m (m is replaced with a number that indicates the number of states: 5 CNTR, 10 CNTR, etc.).

**Table 8-3. Schematic Diagram Notes (7 of 11)**

<b>DIGITAL SYMBOLOGY REFERENCE INFORMATION</b>	
<b>Sequential Logic Functions (Cont'd)</b>	
REG	Register—Array of unconnected flip-flops that form a simple register or latch.
SREG	Shift Register—Array of flip-flops that form a register with internal connections that permit shifting the contents from flip-flop to flip-flop.
ROM	Read Only Memory—Addressable memory with read-out capability only.
RAM	Random Access Memory—Addressable memory with read-in and read-out capability.
<b>Dependency Notation</b>	
Cm	Control Dependency—Binary affecting input used where more than a simple AND relationship exists between the C input and the affected inputs and outputs (used only with D-type flip-flops).
Gm	Gate (AND) Dependency—Binary affecting input with an AND relationship to those inputs or outputs labeled with the same identifier. The m is replaced with a number or letter (the identifier).
Vm	OR Dependency—Binary affecting input with an OR relationship to those inputs or outputs labeled with the same identifier. The m is replaced with a number or the letter (the identifier).
mAm	Address Dependency—Binary affecting inputs of affected outputs. The m prefix is replaced with a number that differentiates between several address inputs, indicates dependency, or indicates demultiplexing of address inputs and outputs. The m suffix indicates the number of cells that can be addressed.
ENm	Enable Dependency—Binary affecting input which, when active enables all outputs. When inactive open-collector and open-emitter outputs are off, and three-state outputs are at an external high impedance state. When the enable input affects only certain inputs and outputs, they will be numbered to indicate the logic connection.
Xm	Transmission Dependency—Binary affecting input which bidirectionally connects dependent inputs and outputs.
Mm	Mode Dependency—Binary affecting input used to indicate that the effects of particular inputs and outputs of an element depend on the mode in which the element is operating. The m is replaced with a number or letter (the identifier).
Zm	Interconnection Dependency—Indicates the existence of internal logic connections between inputs, outputs, internal inputs, and/or internal outputs. The m is replaced with a number (the identifier).
.	Comma—AND Function.
/	Slant—OR Function.
<b>NOTE</b>	
<i>The identifier (m) is omitted if it is one—that is, when there is only one dependency relationship of that kind in a particular device. When this is done, the dependency indicator itself (G, C, EN, or V) is used to prefix or suffix the affected (dependent) input or output.</i>	

*Table 8-3. Schematic Diagram Notes (8 of 11)***DIGITAL SYMBOLOGY REFERENCE INFORMATION****Miscellaneous**

Schmitt Trigger—Input characterized by hysteresis; one threshold for positive going signals and a second threshold for negative going signals.

Active

Active State—A binary physical or logical state that corresponds to the true state of an input, an output, or a function. The opposite of the inactive state.



Table 8-3. Schematic Diagram Notes (9 of 11)

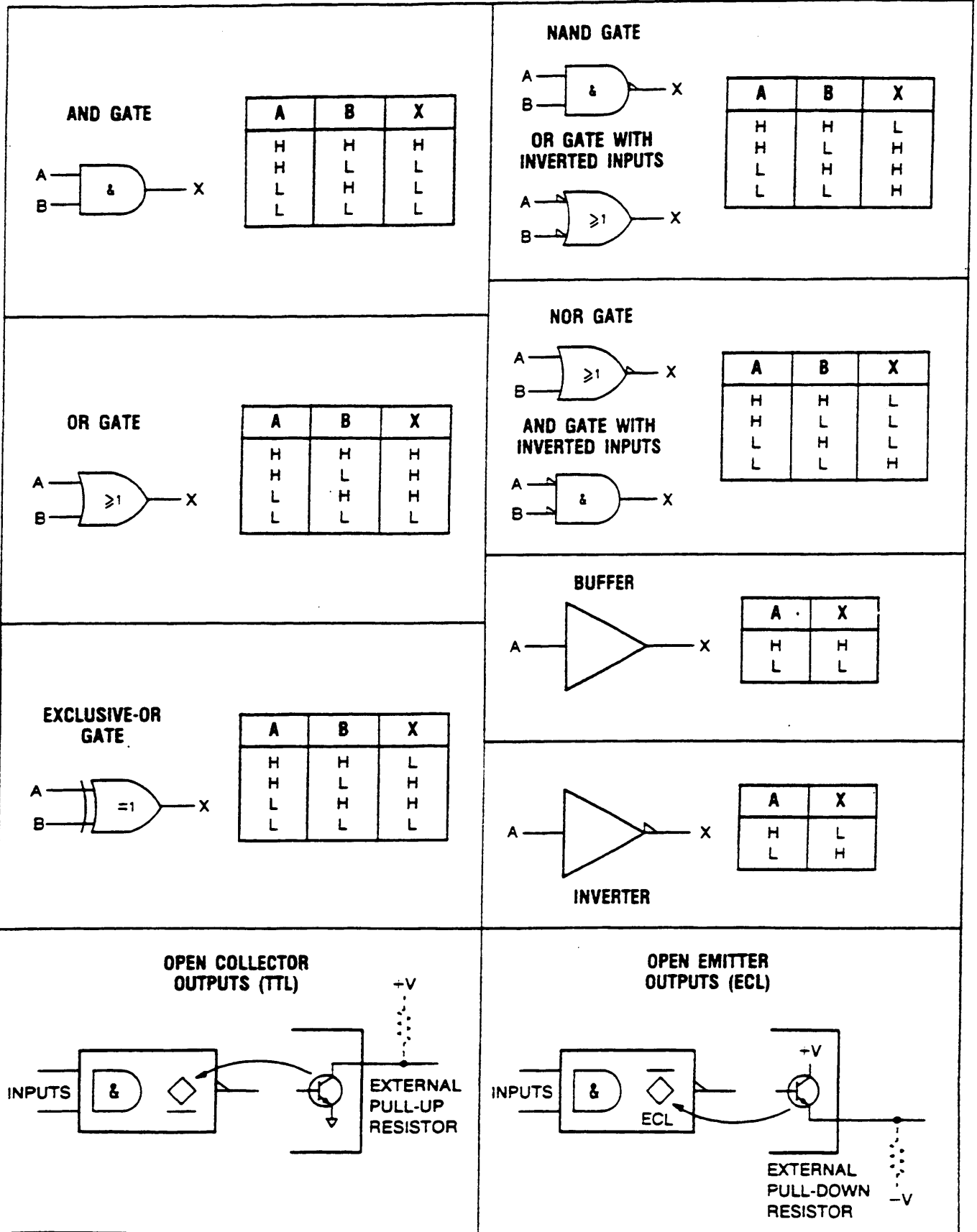


Table 8-3. Schematic Diagram Notes (10 of 11)

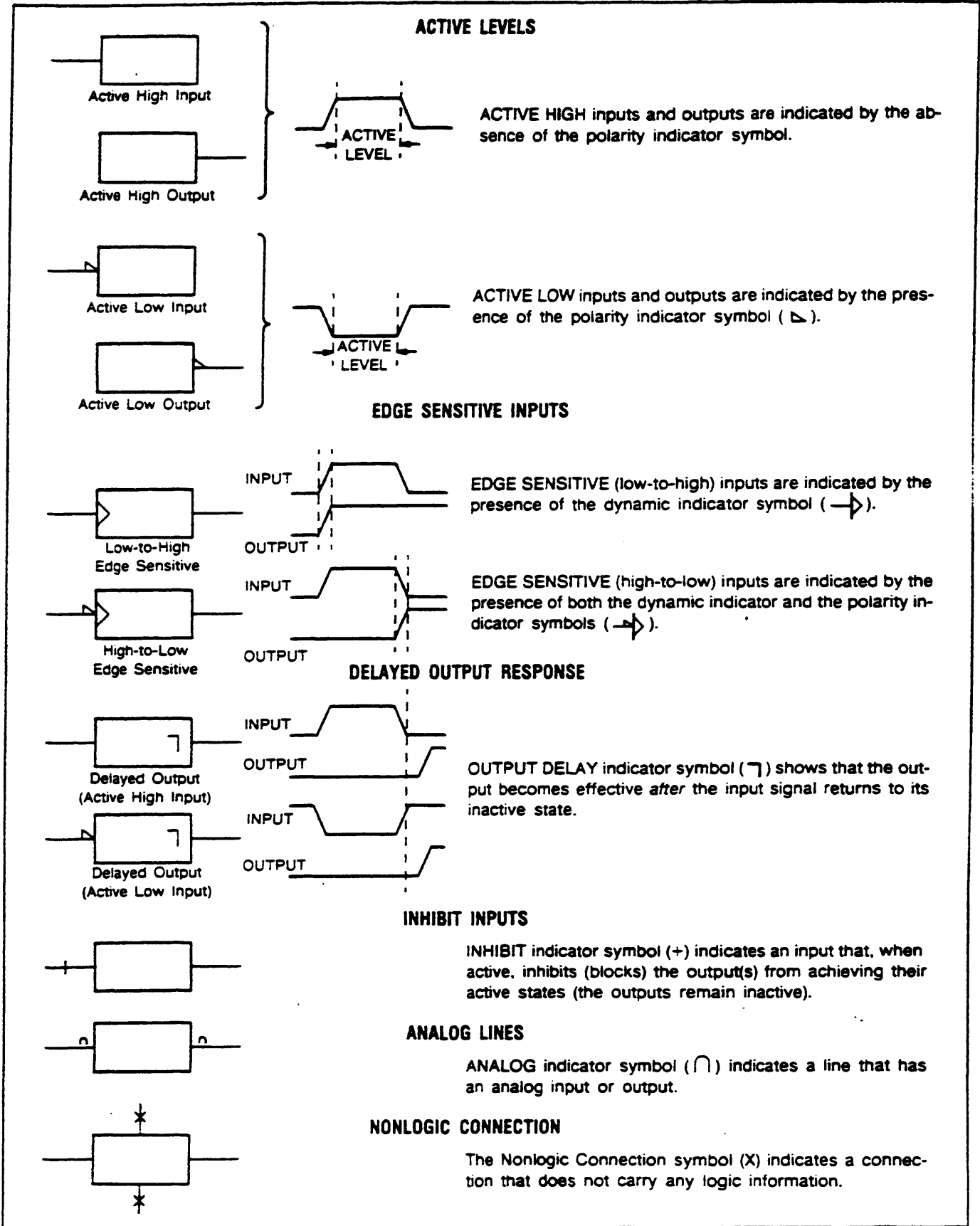
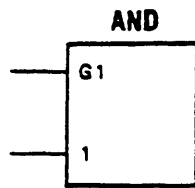
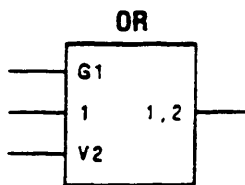


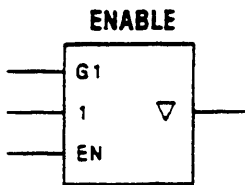
Table 8-3. Schematic Diagram Notes (11 of 11)



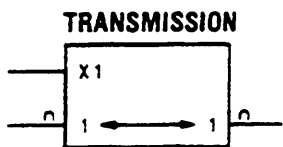
The input that controls or gates other inputs is labeled with a C or a G, followed by an identifying number. The controlled or gated input or output is labeled with the same number. In this example, 1 is controlled by G1.



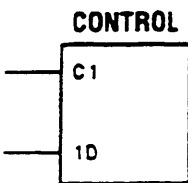
When a V input is active, the output will be in its active state. With the V input inactive, the device functions as if the V input doesn't exist.



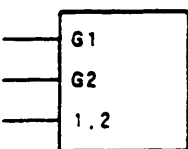
When the EN input is active, the output is enabled to function normally. When the EN input is inactive, the three-state output (▽), in this case, becomes a high impedance, effectively removing that device from the circuit.



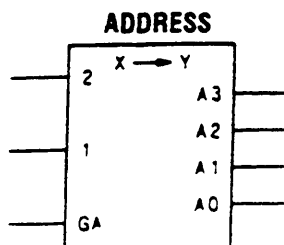
When the X1 input is active, the associated input-output pair are bi-directionally connected together. When X1 is inactive, the connection is broken.



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



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 separated by commas.



When GA is active, the active address line (0 through 3) is the decoded value of the 1 and 2 binary inputs. When the controlled address lines have a functional value, that value will be prefixed by the identifying letter.

## TROUBLESHOOTING

### General

Instrument problems usually fall into three general categories: operator errors, instrument out of specification, and catastrophic failures. The troubleshooting strategy is different for each category. For more information refer to the table of Specifications in Section 1 and the detailed operating instructions found in Section 3.

**Operator Error.** Apparent failures sometimes result from operator errors. These may take one of several forms. The operator may allow external influences which affect instrument operation. At times he may attempt to operate the instrument in an "out of specification" mode. Under certain circumstances the HP 8657B allows for out of specification operation. Under other conditions it does not.

A reverse power level greater than 1.0 watt (7.07V) coupled to the front-panel RF OUTPUT connector switches the output signal off and causes the Amplitude display to flash. This, however, is normal operation under the circumstances. The HP 8657B has temporarily disconnected itself from the high power level that could do damage to internal circuits. To bring the Signal Generator back to its normal operating mode, remove the high reverse power at the RF OUTPUT connector and enter a new output power level at the front-panel.

#### NOTE

*The Reverse Power Protection provided by this circuit is adequate up to 50 watts (25V dc).*

The HP 8657B does allow out of specification operation at frequencies below 0.1 MHz. The frequency is accurate but other specifications, such as RF output power level may be incorrect.

Not-allowed operation is generally indicated by displays that flash or default to the last valid entry. An example of the former is a flashing FM display that occurs when a frequency is changed to a range that will not allow wide deviation. To stop the flashing display, press the FM mode select button. This changes the FM deviation to a level that is acceptable.

Examples of not-allowed operation where the HP 8657B defaults to the last valid entry are: selecting an RF output level that is too high or selecting an AM depth that causes the maximum total RF output power level to be too high.

**Instrument Out of Specification.** If it is suspected that the instrument's operating parameters are out of tolerance, the abbreviated Performance Tests table in Section 4 tells which test may be performed to verify proper operation. This table may also be used to determine which assembly requires adjusting and on what service sheet the adjustable components are located. The Post-Repair Adjustments table in Section 5 tells which adjustments are related and may also require adjustment. After adjustments are complete, perform the performance test(s) in Section 4. If the performance is still out of tolerance, refer to troubleshooting information. Although the problem may be solved very quickly by going to the service sheet where the adjustment is located, it is good practice to begin with the overall troubleshooting information found on Block Diagram 1.

**Catastrophic Failures.** When a catastrophic failure occurs, begin troubleshooting on Block Diagram 1. The information there is used to quickly isolate the problem to one of three major sections in instrument.

## Strategy

Troubleshooting for the HP 8657B is organized into three levels. The overall troubleshooting level is where problems are isolated to the power supply or one of the functional sections. The functional section level of troubleshooting isolates the malfunction to the circuit level. At the circuit level, the problem is isolated to a stage within the circuits shown on the schematic. It is expected that further troubleshooting, to the component level, depends on the skill and experience of the troubleshooter.

### Overall Troubleshooting (Block Diagram 1)

Overall troubleshooting begins with verifying that the power-on sequence occurs properly. At this point, power supply problems become evident. The effect of inputs from the keyboard and an external computer are compared. It is possible to separate a digital or analog problem at this level. Digital problems are usually referred to Block Diagram 4. Further troubleshooting determines which analog (phase lock) loop is defective. Problems here are referred to Block Diagrams 2 or 3. If none of the sections or circuits above are defective, further troubleshooting isolates a malfunction in the special circuits.

### Functional Section Troubleshooting (Block Diagrams 2-4)

Troubleshooting of the loop sections (Block Diagrams 2 and 3) is done primarily from an analog viewpoint with the intent of isolating a malfunction to the circuit level. The digital section (Block Diagram 4) continues with troubleshooting from Block Diagram 1 but with the intent of isolating the problem to the circuit level.

### Circuit Troubleshooting (Service Sheets 1-24)

The goal of troubleshooting at the previous service sheet level is to be confident that the problem is within the circuits shown by the schematic. Because of the interaction of the circuits in the HP 8657B, it may be necessary to refer to other service sheets to completely isolate a problem. Some of the circuits that are mostly analog have digital control circuits. In these cases, troubleshooting the digital circuits first is offered as an alternative.

### Additional Information

Additional troubleshooting information may be found in various locations in the manual. Reference is made to the information in the appropriate troubleshooting procedure. Examples of this information are the Power-On Sequence, the Basic Functional Checks, and the HP-IB Functional Checks which are all found in Section 3.



# Block Diagram 1

## OVERALL BLOCK DIAGRAM

## PRINCIPLES OF OPERATION

### General

The Signal Generator can be conceptually broken down into three subsections. The individual subsections are illustrated on the following Block Diagrams.

Block Diagram 2 - High Frequency and Output Section

Block Diagram 3 - Low Frequency and FM Section

Block Diagram 4 - Microprocessor, Keyboard, and Display Section

The Signal Generator uses frequency synthesis to generate a carrier frequency range of 100 kHz to 2060 MHz. Its output amplitude is leveled and calibrated from +13 to -143.5 dBm. AM and/or FM functions can be individually selected. The carrier frequency, output amplitude, and modulation functions can be remotely programmed via the HP-IB.

Frequency synthesis translates a stable, accurate reference into an output signal of a different frequency. The output frequency can have a finite number of values within a frequency range. The resolution of the synthesizer determines the spacing between the discrete values that the output frequency can assume. All output frequencies retain the same accuracy and stability as the reference signal.

When using the indirect synthesis method of generating output frequencies, phase lock loops are locked to a signal from a crystal controlled reference oscillator. The two phase lock loops used in the Signal Generator generate signals which are combined to produce the instrument's frequency range (100 kHz to 2060 MHz). Every output frequency starts as a signal in the basic oscillator frequency band (520 to 1040 MHz) and is divided or heterodyned in the output section if required. The broad frequency range is generated in the following four bands:

1. 100 kHz to 129.999999 MHz (Heterodyned)
2. 130 to 259.999999 MHz (Divide by 4)
3. 260 to 519.999999 MHz (Divide by 2)
4. 520 to 1029.999999 MHz (Divide by 1 or Basic Band)
5. 1030 to 2060 MHz (Double Band)

### High Frequency and Output Section

The Frequency Multiplier multiplies the 50 MHz reference signal by 16 to obtain an 800 MHz signal. It also mixes the 800 MHz with the 60 to 110 MHz output of the low frequency loop to provide a frequency between 690 and 740 MHz in steps of 1 Hz and to phase lock the high frequency loop. The 800 MHz is also sent to the Output Section and mixed with specific frequencies in the basic band (800.1 to 929.999999 MHz) to obtain the heterodyne band of frequencies (100 kHz to 129.999999 MHz).

The high frequency feedback loop phase locks the 520 to 1040 MHz High Frequency VCO. A signal from the oscillator is mixed with a 690 to 740 MHz signal from the Frequency Multiplier. Both the upper and lower sidebands from the Mixer are used to obtain one of six possible Intermediate Frequencies (IF) every 50 MHz from 0 to 300 MHz. Any frequency in the 520 to 1029.999999 MHz range can be selected by adding or subtracting the appropriate IF frequency (for example, 690 to 740 + 300 = 990 to 1040 MHz, 690 to 740 - 150 = 540 to 590 MHz). The IF

frequency is sampled by the output of the Pulse Generator that is driven by the 50 MHz Reference Oscillator signal. Correction voltage from the sampler tunes the high frequency VCO to correct for frequency error. The VCO is phase locked to an oscillator in the low frequency loop with only a 50 MHz tuning range (60 to 110 MHz) which in turn is phase locked to the 50 MHz reference through a programmable divider. Noise from the high frequency VCO is corrected for in the wideband phase lock loop. Therefore, the main contributor of noise and residual FM is the 60 to 110 MHz low frequency VCO.

The Output Section translates the 520 to 1040 MHz High Frequency VCO frequencies to all other frequencies by multiplying (1030 MHz to 2060 MHz), dividing (130 MHz to 1029.999999 MHz) or heterodyning (100 kHz to 129.999999 MHz). It controls the RF output amplitude, and provides harmonic filtering and AM.

Each of the divide-by-1, 2, and 4 bands is one octave (for example, 520 to 1029.999999 MHz for the divide-by-1 band, 260 to 519.999999 MHz for the divide-by-2 band, and 130 to 259.999999 MHz for the divide-by-4 band). Each Voltage Tuned Filter's bandwidth is also one octave and tuned by the microprocessor. The filters therefore track the oscillator's frequency and are biased on only when that band is selected. This selection of filters provides filtering of the out-of-band spurious and harmonic frequencies.

Output level is stepped in 5 dB steps by an electronic step attenuator. Output level changes less than 5 dB are controlled by the ALC Amplifier from the Level DAC. The ALC Amplifier has two inputs. One is the detected output voltage. The other is the sum of the amplitude modulation voltage and the level voltage (for level changes less than 5 dB and level correction for frequency response). The output of the ALC Amplifier controls the current through the PIN Modulator which controls the fine level attenuation and amplitude modulation of the output.

When triggered, the reverse power protection circuit opens a relay in series with the output. Limiting diodes protect the attenuator and level circuits during high power transients. A detector senses reverse power and provides the voltage to open the relay and protect the output circuits until the reverse power circuit is reset.

Internal modulation signals of 400 Hz or 1 kHz for amplitude and frequency modulation from the Audio Oscillator can be used, or external amplitude and frequency modulation can be selected at the front-panel. The internal and external modulation signals are converted by the AM% DAC and the FM Dev DAC. The Signal Generator's output can be simultaneously amplitude and frequency modulated by either one of the 400 Hz or 1 kHz internal signals and an external signal or any combination thereof. The carrier frequency modulation is generated in the low frequency loop which allows the following RF output FM deviations.

Frequency Range	Max FM Deviation
100 kHz to 129.999999 MHz	200 kHz
130 MHz to 259.999999 MHz	50 kHz
260 MHz to 519.999999 MHz	100 kHz
520 MHz to 1029.999999 MHz	200 kHz
1030 MHz to 2060 MHz	400 kHz

## Low Frequency and FM Section

The 50 MHz Reference Oscillator is a crystal oscillator. Its output phase locks the VCOs, and is also divided down to provide the 1 MHz time base. The rear-panel TIME BASE OUTPUT is a jumper-selectable frequency of 1, 5, or 10 MHz that is divided from the 50 MHz Reference Oscillator and can be used as a stable reference for other instruments.



For Option 001, a 10 MHz temperature-stabilized crystal oscillator is used. A phase lock loop is established between the crystal oscillator and the internal reference for greater accuracy and stability. An external reference of 1, 5, or 10 MHz may also be used to phase lock the 50 MHz Reference Oscillator. However, the jumper-selected frequency of 1, 5, or 10 MHz must be the same as the external frequency. The 50 MHz reference signal is distributed and translated by frequency doublers and mixers to provide reference signals at other frequencies.

The 60 to 110 MHz low frequency VCO is tracked by the high frequency basic band oscillator's frequency. The low frequency VCO is tuned to the correct frequency by the Microprocessor and is locked to the 50 MHz Reference Oscillator. Depending upon the frequency, the Reference Oscillator and the low frequency VCO signals are both divided down to 100 kHz. This output is used to phase lock the VCO. Any phase difference between the two signals is converted to a voltage, sampled, and applied to the VCO to correct its frequency. The low frequency loop's VCO is frequency modulated outside the loop bandwidth and phase modulated inside the loop bandwidth. The VCO is tuned over its 50 MHz range in 1 Hz steps. It therefore steps the 690 to 740 MHz signal, generated by mixing the 60 to 110 MHz with the 800 MHz in the Frequency Multiplier Mixer, in 1 Hz steps.

### Microprocessor, Keyboard, and Display Section.

The Microprocessor controls the information on the address and data bus, thereby controlling all digital data throughout the instrument. The Microprocessor with its associated read only memory (ROM), random access memory (RAM), input/output (I/O), and decoder circuits processes the front-panel keyboard inputs, the HP-IB inputs, and all displayed information.

Digital data sent to the High Frequency and Output Section performs the following functions:

- a. Controls the Voltage-Controlled Oscillator (VCO) lock point.
- b. Turns off the correct IF notch filter to pass the specified IF frequency and lock the VCO at the correct frequency.
- c. Corrects the output level for frequency response.
- d. Changes output amplitude in less than 5 dB increments.
- e. Controls the amplitude modulation of the carrier.
- f. Selects the heterodyne frequencies, and the divide-by-one, two, or four band as required.
- g. Sets attenuation in 5 dB steps.
- h. Resets the Reverse Power Relay.
- i. Tunes the Voltage Tuned Filters.
- j. Turns switched +15V and RF on or off.
- k. Sets the bandwidth of the ALC amplifier.
- l. Activates Frequency Doubler in the Double Band.

Digital data sent to the Low Frequency and FM Section determines the frequency modulation of the carrier and the frequency resolution of the output (1 Hz).

Two high and low frequency data words are serially sent to the High Frequency and Output Sections, and the Low Frequency and FM Section. The serial data is strobed into the correct registers by decoding the address bus bits. Parallel data is also sent to the High Frequency and Output Section to select AM, FM, and level control, to select the frequency bands, and to select the amount of attenuation in the step attenuator.

## TROUBLESHOOTING

The troubleshooting checks on this service sheet are used to isolate a malfunction to one of the three major functional assemblies. The checks are easy to perform and provide much key information. In most instances the checks isolate a failure to either a hardware or a software (controller) problem. The comments associated with each procedure summarize the information known as a result of passing or failing the check. The checks should be done in order.

### Troubleshooting Help

Section 2, Line Voltage and Fuse Selection

Section 3, Operator's Checks, and Power-On Sequence

#### √1 Line Check

##### Procedure.

Remove the Signal Generator's bottom cover. Refer to Disassembly Procedures under Repair in Section 8. After the bottom cover is removed, connect the line voltage.

##### Normal Indications.

1. Set the POWER switch to the ON position. The three light emitting diodes (LEDs) on the A10 Audio Power Supply Assembly are lighted indicating that the regulated supplies are operating. This does not mean that the supply voltages are within the required tolerance.

##### Abnormal Indications. If an abnormal indication occurs:

1. Check rear-panel line fuse and line voltage selector.
2. Measure individual regulated supplies and the unregulated supply. If necessary, go to Service Sheet 25 Troubleshooting.

#### √2 Power-Up Check

##### Procedure.

Switch the POWER switch to STBY and back to ON. Check the front-panel annunciators (LEDs) and display segments.

##### Normal Indications.

All front-panel indicators are lighted for approximately 1.5 seconds to provide a visual inspection of each front-panel annunciator and display segment.

1. All the display segments will display the number eight, and the most significant AMPLITUDE digit will be a one.
2. When the power-on subroutine is completed, the signal generator will display the same modulation, frequency, and amplitude settings as when it was last ON.

**Abnormal Indications.**

If an abnormal indication occurs, that is:

1. The LEDs stay lighted and display segments remain eights, and one, go to Block Diagram 4.
2. The LEDs stay lighted and the numerical displays are all zeros.
  - a. Check for a noisy +5 Vdc power supply. If necessary, go to Service Sheet 25 Troubleshooting.
  - b. Check the Microprocessor clock. Go to Service Sheet 17 Troubleshooting.
3. An LED or display segment does not show the correct output. Check the display's associated components and drive circuits. Go to Service Sheets 22 or 23 Troubleshooting (FREQUENCY Display problem) or Service Sheet 22 or 24 Troubleshooting (MODULATION or AMPLITUDE Display problem).
4. A RAM or ROM error code is displayed in the FREQUENCY Display. Refer to Table 3-1 Power-On Error Codes to identify where the problem is.

**√3 Frequency and Amplitude**

**Procedure.**

1. Set the Signal Generator as follows:

Frequency.....	100 MHz
Amplitude.....	0 dBm
Modulation.....	Off

2. Check the RF Output frequency and output amplitude.

**Normal Indications.**

1. The RF output frequency is phase locked at 100 MHz; the output amplitude is 0 dBm ±1.0 dB.
2. The FREQUENCY Display is 100 MHz; the AMPLITUDE Display is 0 dBm.

**Abnormal Indications.**

If an abnormal indication occurs, that is:

1. The RF output frequency is not phase locked, go to Block Diagram 2 or Block Diagram 3 Troubleshooting.
2. The RF output frequency is incorrect, go to Block Diagram 2 Troubleshooting.
3. The output amplitude is incorrect, go to Block Diagram 2 Troubleshooting.

**√4 Modulation**

**Procedure.**

1. Set the Signal Generator as follows:

Frequency.....	100 MHz
Amplitude.....	0 dBm
Modulation.....	AM 50%, and FM 50 kHz
Source .....	1 kHz (Int.)

2. Check AM and FM at the RF OUTPUT connector J2.

**Normal Indications.**

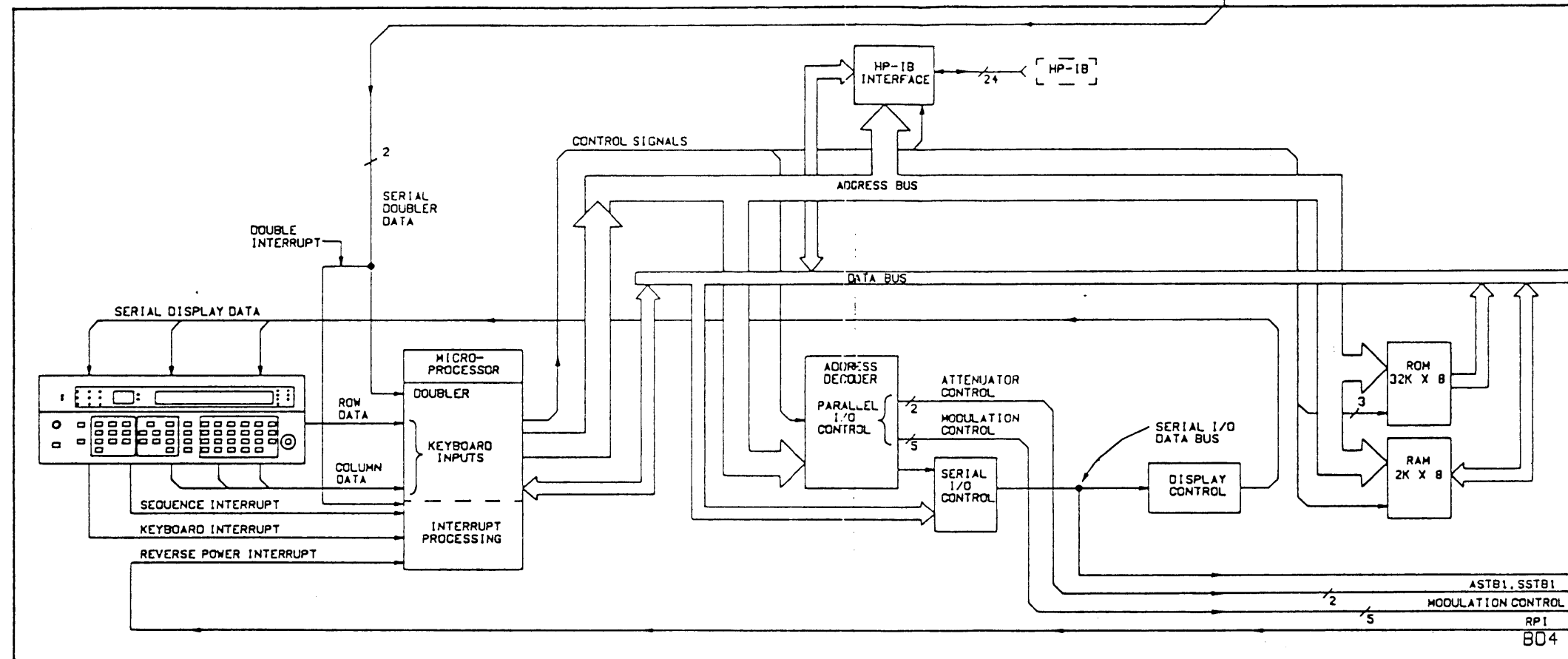
1. The MODULATION Display shows 50% or 50 kHz, and the MODULATION LEDs 1 kHz, INT AM, INT FM will be lighted (depending on last input).
2. Modulation at the RF OUTPUT connector, J2, should be 50% AM and 50 kHz FM deviation at a 1 kHz rate.

**Abnormal Indications.**

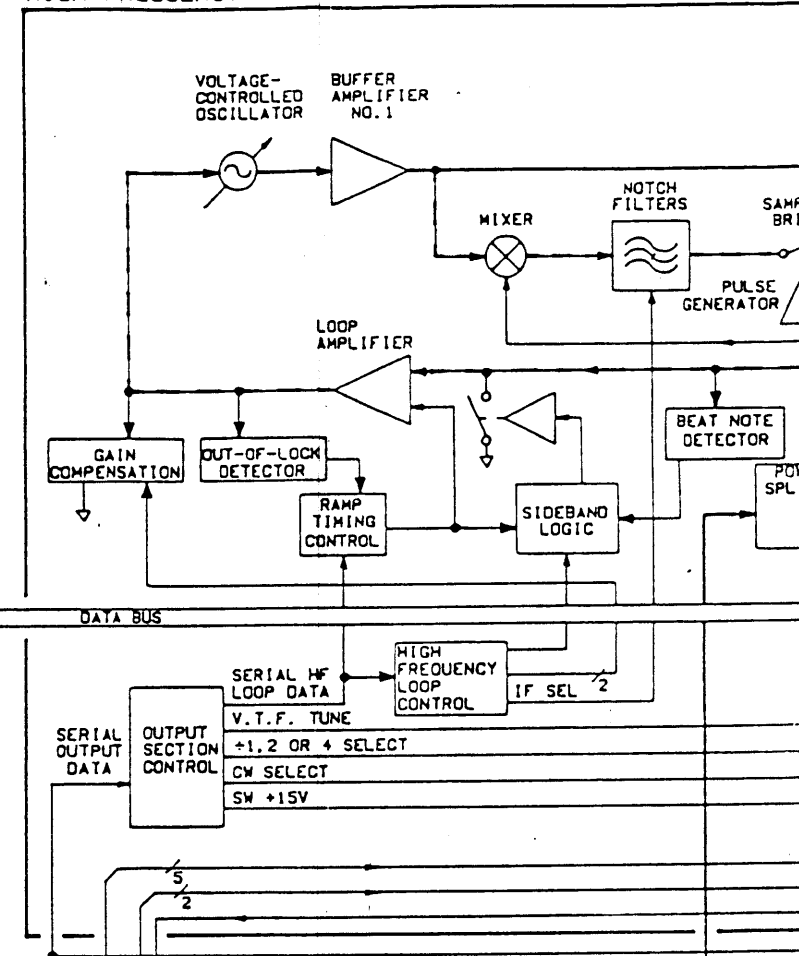
If abnormal indications occur, that is:

1. The MODULATION Display is incorrect, go to Block Diagram 4 Troubleshooting.
2. The AM level is incorrect, go to Block Diagram 2 Troubleshooting.
3. The FM level is incorrect, go to Block Diagram 2 or Block Diagram 3 Troubleshooting.
4. The 1 kHz modulation rate is incorrect, go to Service Sheets 6 and 7 Troubleshooting.

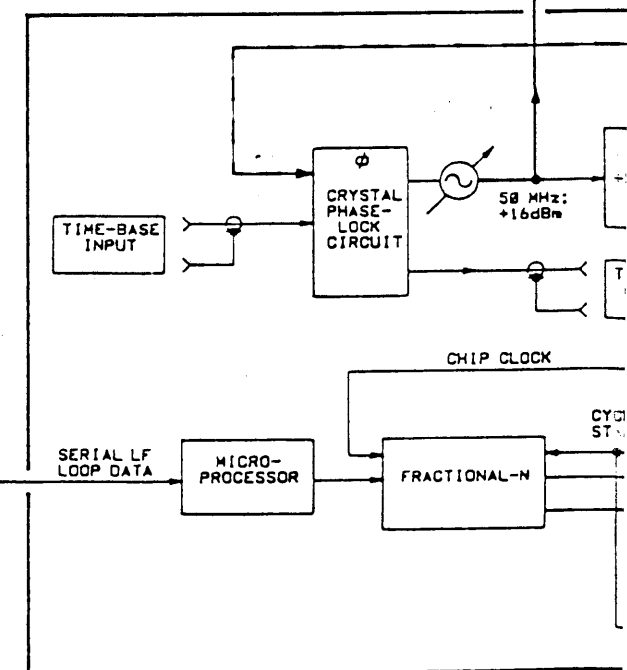
MICROPROCESSOR, KEYBOARD, AND DISPLAY SECTION



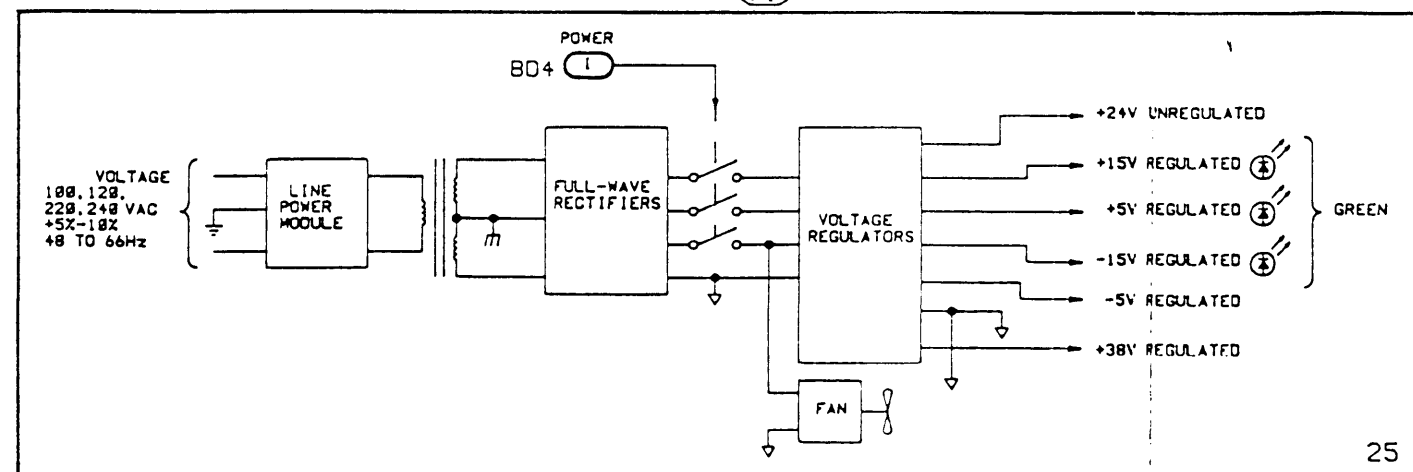
HIGH FREQUENCY AND OUTPUT SECTION



LOW FREQUENCY AND FM SECTION



POWER SUPPLY SECTION



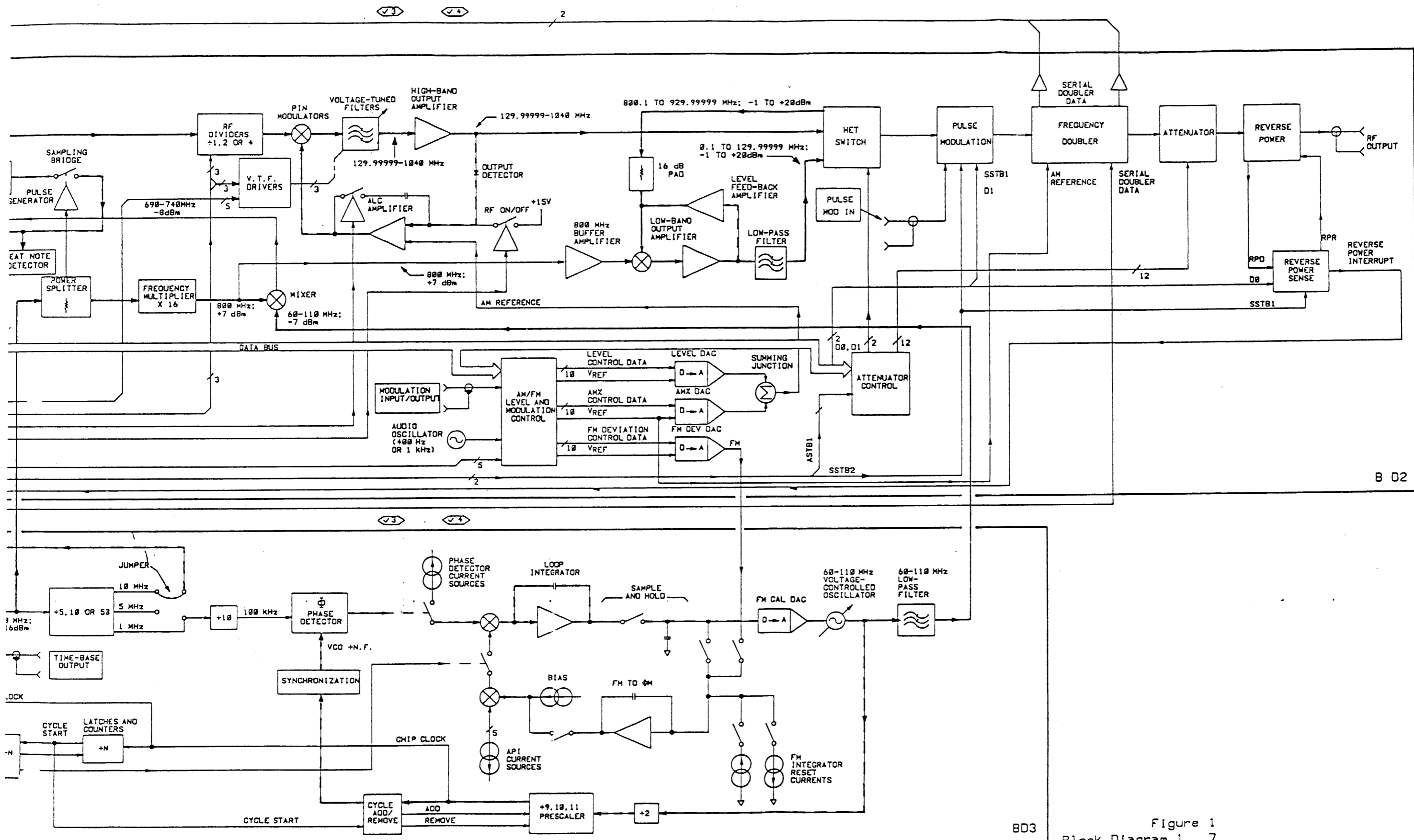


Figure 1  
Block Diagram 1 7

## Block Diagram 2

### HIGH FREQUENCY AND OUTPUT SECTION

#### PRINCIPLES OF OPERATION

##### A8 Frequency Multiplier Assembly

The Frequency Multiplier Assembly multiplies the 50 MHz reference signal by 16 to obtain an 800 MHz signal. The reference signal is doubled four times for frequencies of 100, 200, 400, and 800 MHz. The output of each multiplier is passed through a bandpass filter for the output frequency of that stage to filter out the harmonics and subharmonics generated by the multiplier.

The 800 MHz signal is applied to the A6 Output Assembly and mixed with specific basic band frequencies (800.1 to 929.999999 MHz) when output frequencies in the heterodyne band (100 kHz to 129.999999 MHz) are selected. It is also applied to the Frequency Multiplier Buffer Amplifier No. 1. The signal is amplified and then mixed with the 60 to 110 MHz output from the A3 Low Frequency Loop Assembly (see BD3). The output from the mixer is a frequency between 690 and 740 MHz that is used to phase lock the high frequency loop. Before a frequency between 690 and 740 MHz is sent to the A4 High Frequency Loop Assembly, it is amplified by two buffer amplifiers and filtered by a bandpass filter. The 690 to 740 MHz Bandpass Filter filters out the 800 MHz and the mixer products of 860 to 910 MHz. The Compensation Network is adjusted for a flat frequency response of  $\pm 1.5$  dB at the input of the A4 High Frequency Loop Assembly.

##### A4 High Frequency Loop Assembly

The High Frequency Loop Assembly phase locks the High Frequency VCO to the A3 50 MHz Reference Oscillator. The High Frequency VCO generates the instrument's 520 to 1040 MHz basic band frequencies. The output from the VCO is amplified by Buffer Amplifier No. 1 and then split by the Power Splitter. One output of the Power Splitter is amplified by Buffer Amplifier No. 2 and sent to the A6 Output Assembly. The other output of the Power Splitter is amplified by Buffer Amplifier No. 3, filtered by the 1100 MHz Low-Pass Filter, amplified by Buffer Amplifier No. 4, and attenuated 2 dB before being applied to the mixer and mixed with a frequency between 690 and 740 MHz from the A8 Frequency Multiplier Assembly. Both upper and lower sidebands from the Mixer are used to obtain Intermediate Frequencies (IF) phase lock signals in 50 MHz steps from DC to 300 MHz. The IF phase lock signal is filtered by the 320 MHz Low-Pass IF Input Filter, and then the 300 and 400 MHz Notch Filters. The IF signal is then amplified by the IF Buffer Amplifier and is applied to the Notch Filters. The notch filter for the specific IF is not selected and allows that IF signal to pass through the Notch Filters. The IF signal is filtered by the 320 MHz Low-Pass IF Output Filter, and then sampled at a 50 MHz rate by a pulse from the Pulse Generator that is driven by the A3 50 MHz Reference Oscillator signal. The output of the Sampling Bridge is a correction voltage proportional to the phase difference of the IF frequency and the 50 MHz reference. The correction voltage is amplified by the Sampler Amplifier, filtered by the 13 MHz Low-Pass Filter and applied to the Loop Amplifier. It is then fed back to correct the frequency of the VCO.

The dc notch is not selected, and the IF Buffer Amplifier is not biased on when the high frequency VCO output is 690 to 740 MHz. The Mixer then functions as a phase detector with both inputs at the same frequency. The Mixer's output is now a voltage proportional to the phase difference of the two inputs. All other circuits function as previously described in the high frequency loop.

The ten bit data word used to control the high frequency loop is clocked serially into the HF Loop Data Shift Register and then latched to the shift register's parallel output by the data strobe. Seven bits are used to select either the DC, 50, 100, 150, 200, 250, or 300 MHz IF. Two bits control the Gain Compensation to compensate for the nonlinearity of the VCO frequency change with respect to voltage. One bit controls whether the loop will lock on the upper IF frequency or on the lower IF frequency.

This is necessary because both the upper and lower sidebands from the Mixer are used for IF frequencies of 50, 100, 150, and 200 MHz to phase lock VCO frequencies between 520 and 940 MHz. Also, only the upper sidebands are used and the lower sidebands must be rejected for IF frequencies of 250 and 300 MHz in order to phase lock VCO frequencies between 940 and 1040 MHz. The data strobe is also applied to the Ramp Timing Control circuits, and starts the Loop Amplifier ramping downwards in voltage from its positive rail. This sweeps the VCO from its highest frequency towards its lowest frequency. When the proper IF beatnote is detected by the Beatnote Detector, the Sideband Switch will open and the loop will lock.

## A6 Output Assembly

The Output Assembly translates the 520 to 1040 MHz High Frequency VCO frequencies by passing (520 to 1029.999999 MHz), dividing (130 to 520 MHz), or heterodyning (100 kHz to 129.999999 MHz) the basic band frequencies. Each of the divide-by-1, 2, and 4 bands is one octave. The output of the dividers passes through the PIN diode Modulators to the Voltage-Tuned Filters. Each filter's bandwidth is also one octave and tuned by the Microprocessor. The filters track the VCO frequency and are biased on only when that band is selected. This selection of filters provides better isolation and filtering of the out-of-band spurious and harmonic frequencies.

A ten-bit data word is clocked serially into the Output Section Data Storage/Drivers circuit. Three bits control the dividers and five bits control the Voltage-Tuned Filters. One bit selects CW, and one bit turns the switched +15V on and off, which turns RF on and off.

The output from the Voltage-Tuned Filters is amplified by the High-Band Output Amplifier and applied to the Output Detector, then routed to the A9 Attenuator Assembly via the hetswitch, pulse modulator (if fitted) and the A12 Doubler Assembly. Output level changes (when the accumulated change is less than 5 dB referenced from +1.5 dBm for non-pulse options or -1.5 dBm for pulse options) are controlled by the input to the ALC Amplifier from the digital-to-analog converter (DAC) on the A11 Audio Assembly. The ALC amplifier has two inputs. One is the detected output voltage to level the output. The other is the sum of the amplitude modulation voltage and the level voltage (for level changes less than 5 dB and level correction for frequency response). The output of the ALC amplifier controls the current through the PIN diodes of the PIN Modulator which controls amplitude modulation and level into the output attenuator (-8 to +20 dBm).

## A12 Frequency Doubler Assembly

When output frequencies from 1030 MHz to 2060 MHz are selected the A12 Frequency Doubler switches from the pass through mode to the doubling mode. The base band signal (520 to 1030 MHz) is multiplied times 2 for the appropriate double frequency. Serial data from the A13 Microprocessor controls the doubler, see Block Diagram 4. The A12 Frequency Doubler is not repairable to the component level and must be replaced as either a new or exchange module when found defective.

## A10 Attenuator/Het Switch/Pulse Mod/Reverse Power Assembly

The Attenuator is a electronically controlled step attenuator providing attenuation settings from 0 dB to 145 dB in 5 dB steps. The output circuits are reverse power protected for inputs up to 50 watts and 25 Vdc. A power level of 1 watt will trigger the circuit and open the reverse power relay within the attenuator assembly. When a reverse power condition is detected by the Reverse Power Sense circuit, the RPI bit is generated to interrupt the Microprocessor. The AMPLITUDE Display will flash to indicate that a reverse power condition has been detected. The reverse power relay remains open until the source of reverse power is removed and the AMPTD key is pressed. At that time, ASTB1 from the Microprocessor will reset the relay.

Two 8-bit data words are clocked into the Attenuator Control Latches by ASTB1 and ASTB2. The output of the latches are applied to the Attenuator Drivers circuit to turn on or off the appropriate switching networks within the attenuator.

When output frequencies from 100 kHz to 129.999999 MHz are selected, the A10 Attenuator Assembly switches to the A6 Output Assembly where the output frequencies of 800.1 to 929.999999 MHz



are mixed (heterodyned) with the 800 MHz from the A8 Frequency Multiplier Assembly. The difference frequency of 100 kHz to 129.999999 MHz is filtered by a low-pass Diplex Filter, amplified by the Low-Band Output Amplifier, and returned to the A10 Attenuator Assembly.

If Option 003 is installed in the instrument there will be an additional Pulse Modulator on the A10 Assembly. The Pulse Modulator is essentially a high speed switch composed of two GAs FET transistor circuits. Data line D1 controls the switch On/Off function. The Pulse Modulator is not individually repairable to the component level and must be replaced as a complete unit if found defective.

### **A11 Audio Assembly**

The amplitude modulation, frequency modulation and level circuits of the Audio Assembly are shown on Block Diagram 2. The external modulation signal level must be set at the source and, the output of the External Modulation Buffer is monitored by the Over and Under Modulation Comparators which control the HI EXT and LOW EXT LEDs (not shown) on the front-panel to indicate when the input is too high or low.

The modulation signals are applied to the FM Deviation Summing Amplifier, the AM% Summing Amplifier and the X2 (times 2) AM Summing Amplifier. On the A11 Audio Assembly, the internal and external frequency modulation signals are applied to the FM Deviation Summing Amplifier, converted by the FM Deviation DAC (programmed by the FM Deviation Control Data from the Microprocessor), and amplified by the FM Deviation Amplifier. Below frequencies of 1030 MHz, the output of the AM% Summing Amplifier is used as a reference voltage by the AM% DAC. The digitally controlled output of the AM% DAC is summed with the dc level voltage from the Level DAC and applied to the input of the AM Reference Summing Amplifier. The AM reference is applied to the ALC Amplifier on A6. At output frequencies of 1030 MHz and above, the output of the X2 AM Summing Amplifier is used as a reference by the A12 Doubler's internal AM circuitry.

Five 8-bit data words are strobed into the Modulation Control Latches each time a front-panel or HP-IB modulation entry is made. These data words are used to control all modulation functions, the level of the modulation signals, and the reference level voltage applied to the ALC loop.

## TROUBLESHOOTING

### General

Procedures for checking the High Frequency and Output Section of the instrument are given below. The blocks or points to check are marked on the block diagram by a hexagon with a check mark and a number inside, for example,  $\sqrt{2}$

### Troubleshooting Help

- Block Diagram 1
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustments

### Test Equipment

Measuring Receiver .....	HP 8902A
Sensor Module .....	HP 11722A
Adapter Probe .....	HP 1250-1598
Adapter N(f) to BNC(m) .....	HP 1250-0077
Adapter BNC(f) to BNC(f) .....	HP 1250-0080
Cable BNC(m) to SMC(f) .....	HP 08662-60075

### $\sqrt{1}$ RF Output and Attenuator Check (A4, A10 and A12)

1. Set the Signal Generator as follows:
 

Frequency .....	520 MHz
Amplitude .....	0 dBm
Modulation .....	Off
2. Set the measuring receiver with the sensor module precalibrated as follows:
 

Measurement .....	RF POWER
Display .....	LOG
3. Zero the measuring receiver and wait for the zero LED to go out.
4. Connect the sensor module to the Signal Generator's RF OUTPUT connector.
5. Verify that the RF output frequency is locked at 520 MHz with an output amplitude of 0 dBm.
  - a. If the signal is unlocked perform  $\sqrt{3}$
  - b. If there is no output, perform  $\sqrt{2}$
  - c. If the output amplitude is not 0 dBm  $\pm 3.0$  dB, continue with  $\sqrt{1}$  step 6.
6. Reduce the Signal Generator's output amplitude in 10 dB steps to -50 dBm. The output amplitude should change 10 dB for each step.
  - a. If the output amplitude does not change in 10 dB steps, go to Service Sheet 8 Troubleshooting.
  - b. If the output amplitude changes in 10 dB steps, perform  $\sqrt{2}$
7. Set the Signal Generator's frequency to 100 MHz. If there is no RF output frequency or if it's low, go to Service Sheet 5 Troubleshooting.
8. Set the Signal Generator as follows:
 

Frequency .....	1040 MHz
Amplitude .....	0 dBm
Modulation .....	Off

- 9. Verify that the RF output frequency (Double Band) is locked at 1040 MHz with an output amplitude of 0 dBm.
  - a. If there is no output, go to Service Sheet 8 for Frequency Doubler controls and input/output conditions. There is no internal service for A12 Frequency Doubler.

**√2 Output Assembly Check (A6)**

- 1. Set the Signal Generator as follows:
 

Frequency.....	520 MHz
Amplitude.....	0 dBm
Modulation.....	Off
- 2. Set the measuring receiver with the sensor module precalibrated as follows:
  - a. For amplitude measurements...
 

Measurement .....	RF POWER
Display .....	LOG
  - b. For frequency measurements...
 

Measurement .....	FREQ
-------------------	------
- 3. When making amplitude measurements, zero the measuring receiver and wait for the zero LED to go out.
- 4. Measure amplitude and frequency at the assembly input A6TP1 and output A6J5 with the measuring receiver (see Service Sheet 4).
  - a. If the input is correct (520 MHz and -3 to +4 dBm), but the output level is low (less than -1.5 dBm measured by disconnecting coax cable W14 from A6J5), or if the frequency is incorrect, go to Service Sheet 4 Troubleshooting.
  - b. If the input amplitude or frequency is wrong, go to Service Sheet 1 Troubleshooting.
- 5. Set the Signal Generator's frequency to 300 MHz and then 150 MHz. Measure the output of the assembly with the measuring receiver. If the output level is low or the frequency is not 300 or 150 MHz, check the Output Control Section (see Service Sheet 5 Troubleshooting).

**√3 Frequency Multiplier (A8)**

- 1. Set the Signal Generator as follows:
 

Frequency.....	500 MHz
Amplitude.....	0 dBm
Modulation.....	Off
- 2. Set the measuring receiver with the sensor module precalibrated as follows:
 

Measurement .....	RF POWER
Display .....	LOG
- 3. Zero the measuring receiver and wait for the zero LED to go out.
- 4. Measure the 50 MHz input directly from W5 with the measuring receiver (see Service Sheet 3). If either the level (+16 to +19 dBm) or the frequency (50 MHz) is incorrect, go to Service Sheet 16 Troubleshooting.
- 5. Measure the 60 to 110 MHz input (100 MHz) directly from W3 with the measuring receiver. If either the level (-9 to -7 dBm) or the frequency (100 MHz) is incorrect or unlocked, go to Block Diagram 3 Troubleshooting.
- 6. Measure the output (690 to 740 MHz) of the FL1 Bandpass Filter. If either the level (<-5.0 dBm) or the frequency (700 MHz) is incorrect, go to Service Sheet 3 Troubleshooting. If both level and frequency are correct, go to Service Sheet 1 or Service Sheet 2 Troubleshooting.

**J4 Audio Assembly (A11)**

1. Set the Signal Generator as follows:

Frequency ..... 500 MHz  
 Amplitude ..... 0 dBm  
 Modulation ..... AM 50%  
 Source ..... 1 kHz (Int.)

2. Set the measuring receiver as follows:

Measurement ..... AM

3. Connect the measuring receiver to the Signal Generator's RF OUTPUT connector.

4. Measure the amplitude modulation. It should be 50%  $\pm$ 5%. If the modulation level is incorrect, go to Service Sheet 7 Troubleshooting (control circuits) or Service Sheet 4 Troubleshooting (ALC PIN modulator).

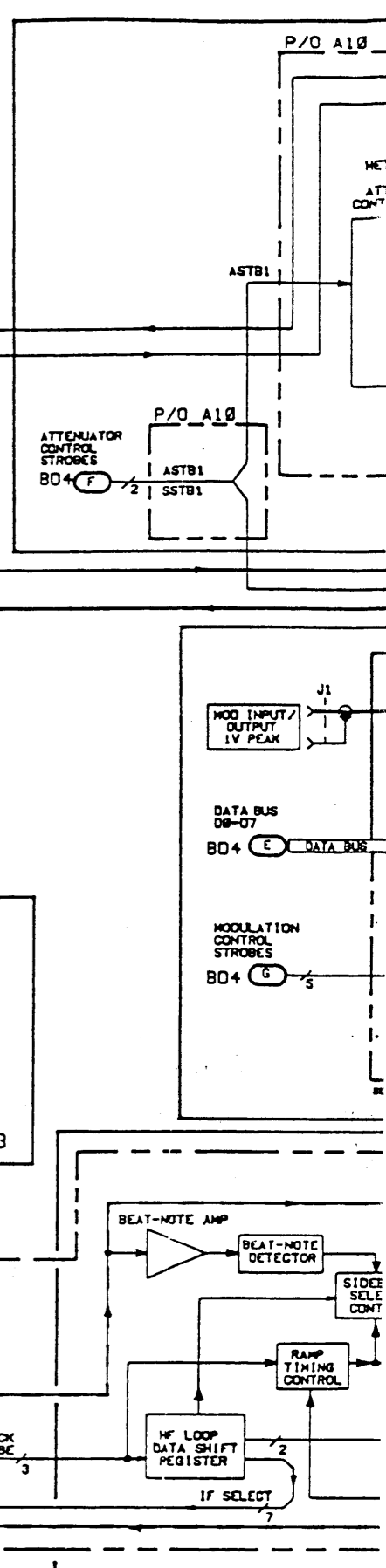
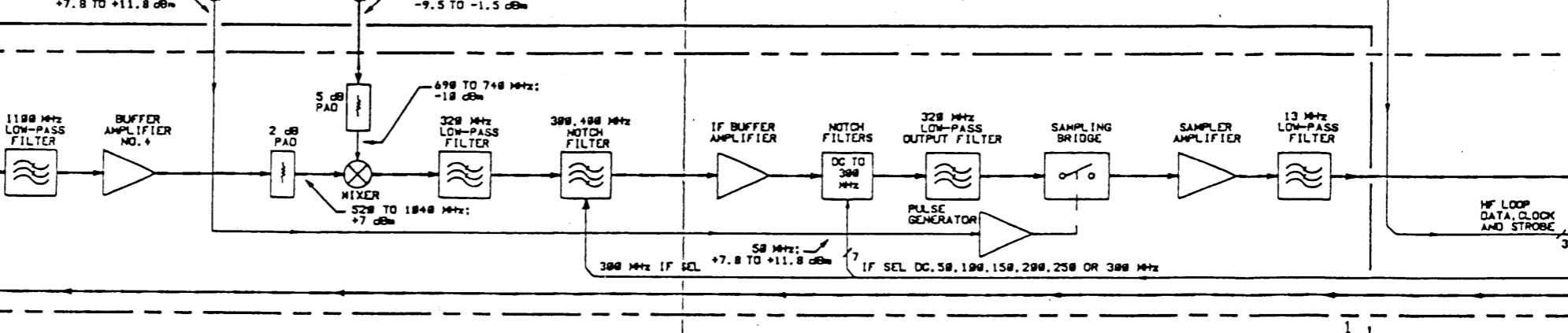
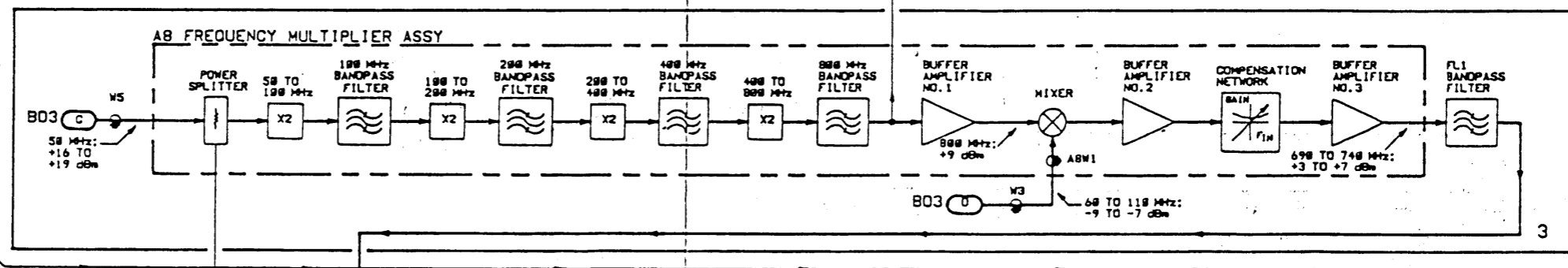
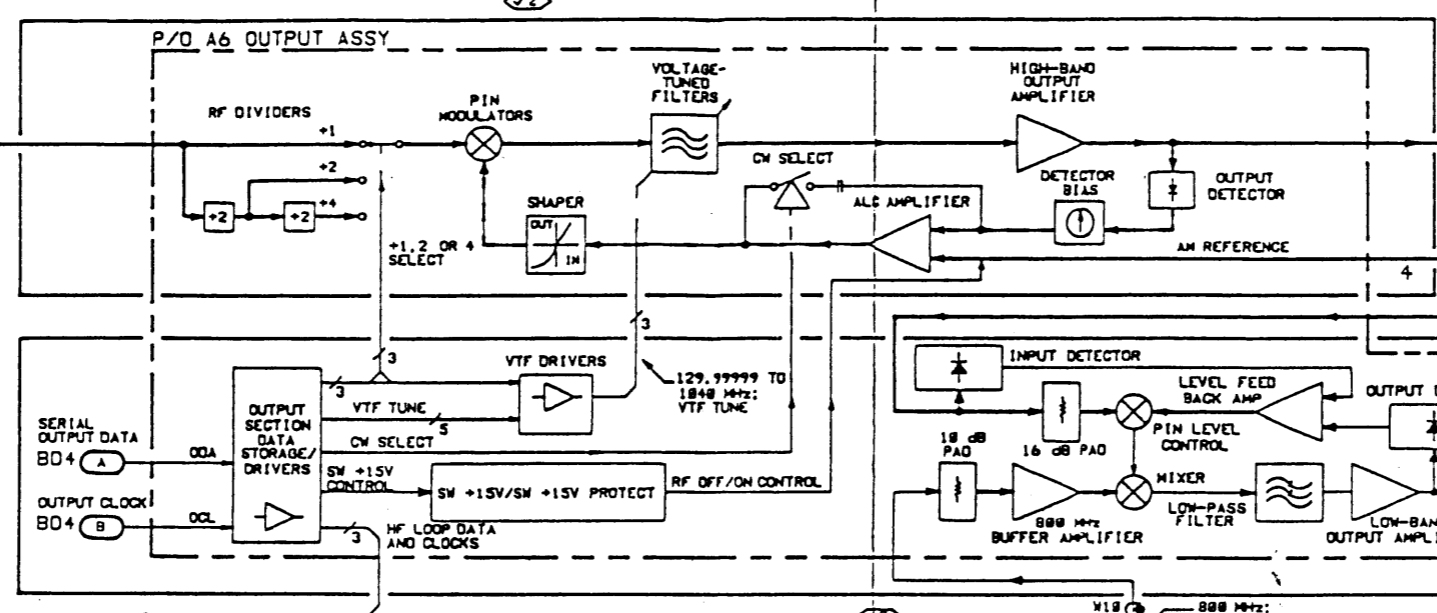
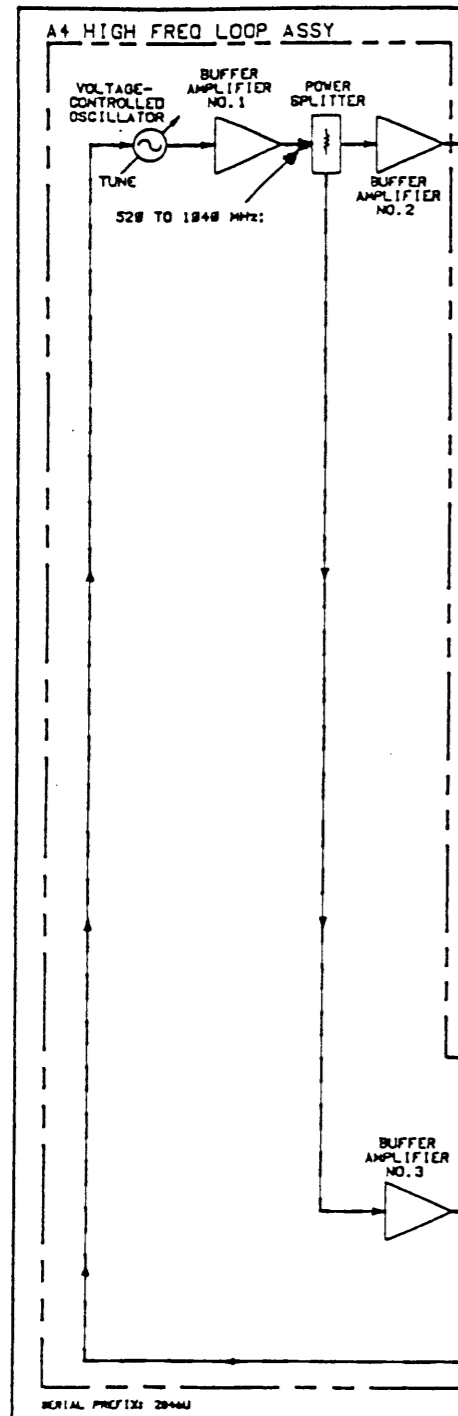
5. Set the Signal Generator as follows:

Frequency ..... 500 MHz  
 Amplitude ..... 0 dBm  
 Modulation ..... FM 50 kHz  
 Source ..... 1 kHz (Int.)

6. Set the measuring receiver as follows:

Measurement ..... FM

7. Measure the frequency modulation. It should be 50 kHz  $\pm$ 2.5 kHz. If the modulation level is incorrect, go to Service Sheet 7 Troubleshooting (control circuits) or Block Diagram 3 Troubleshooting.



SERIAL PREFIX: 2844U

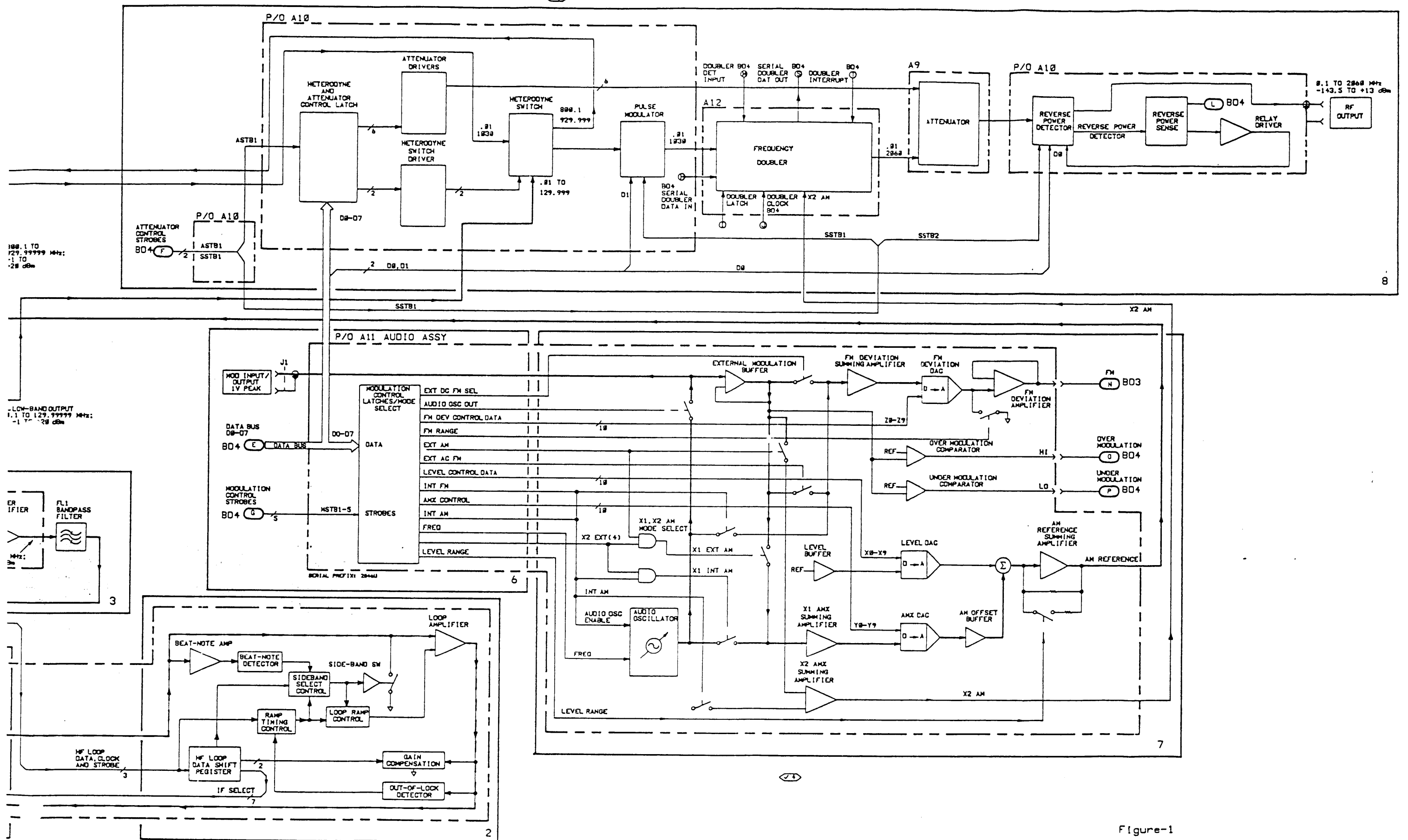
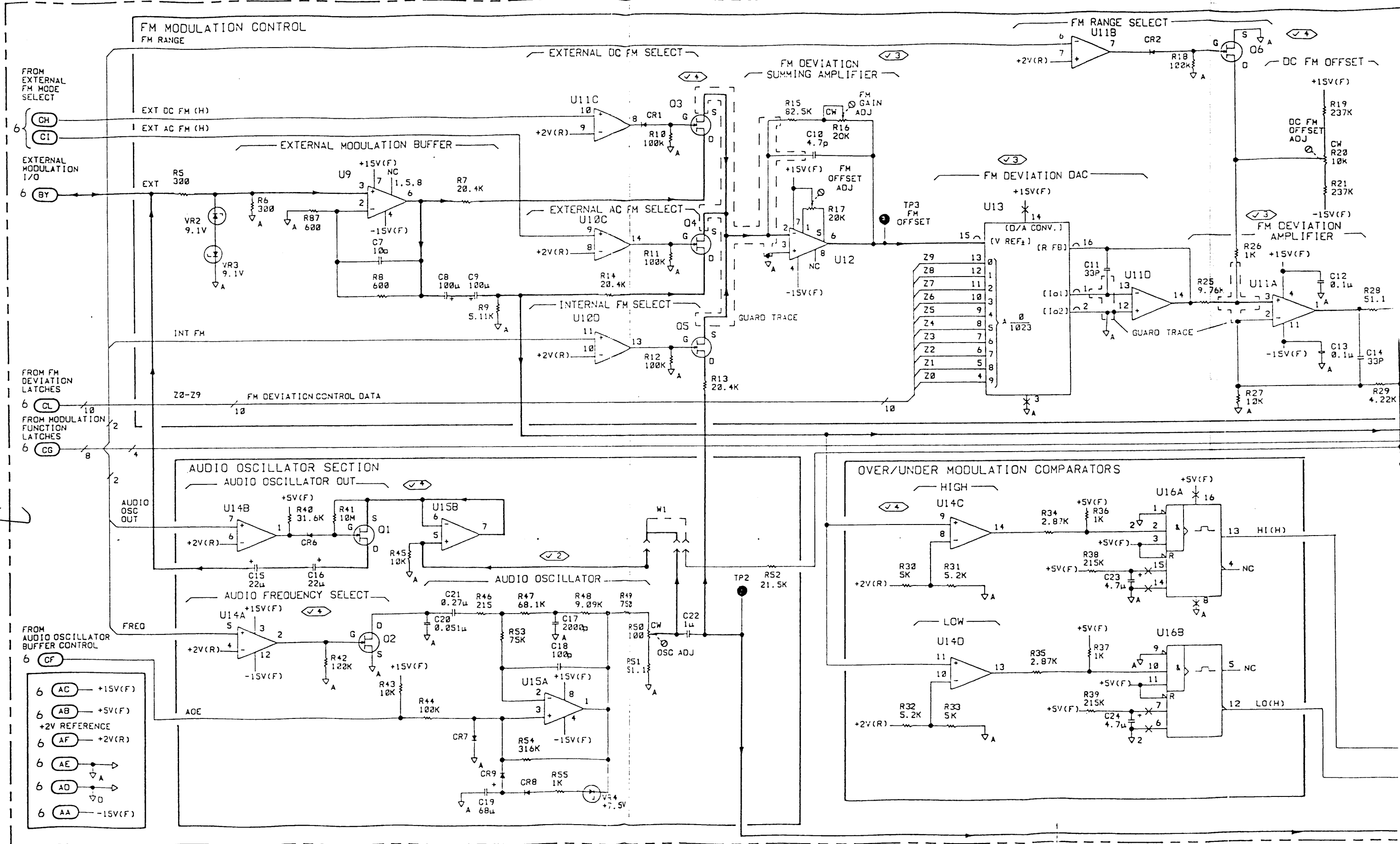


Figure-1  
Block Diagram 2 7



RF OUTPUT AMPLITUDE AND AM MODULATION CONTROL

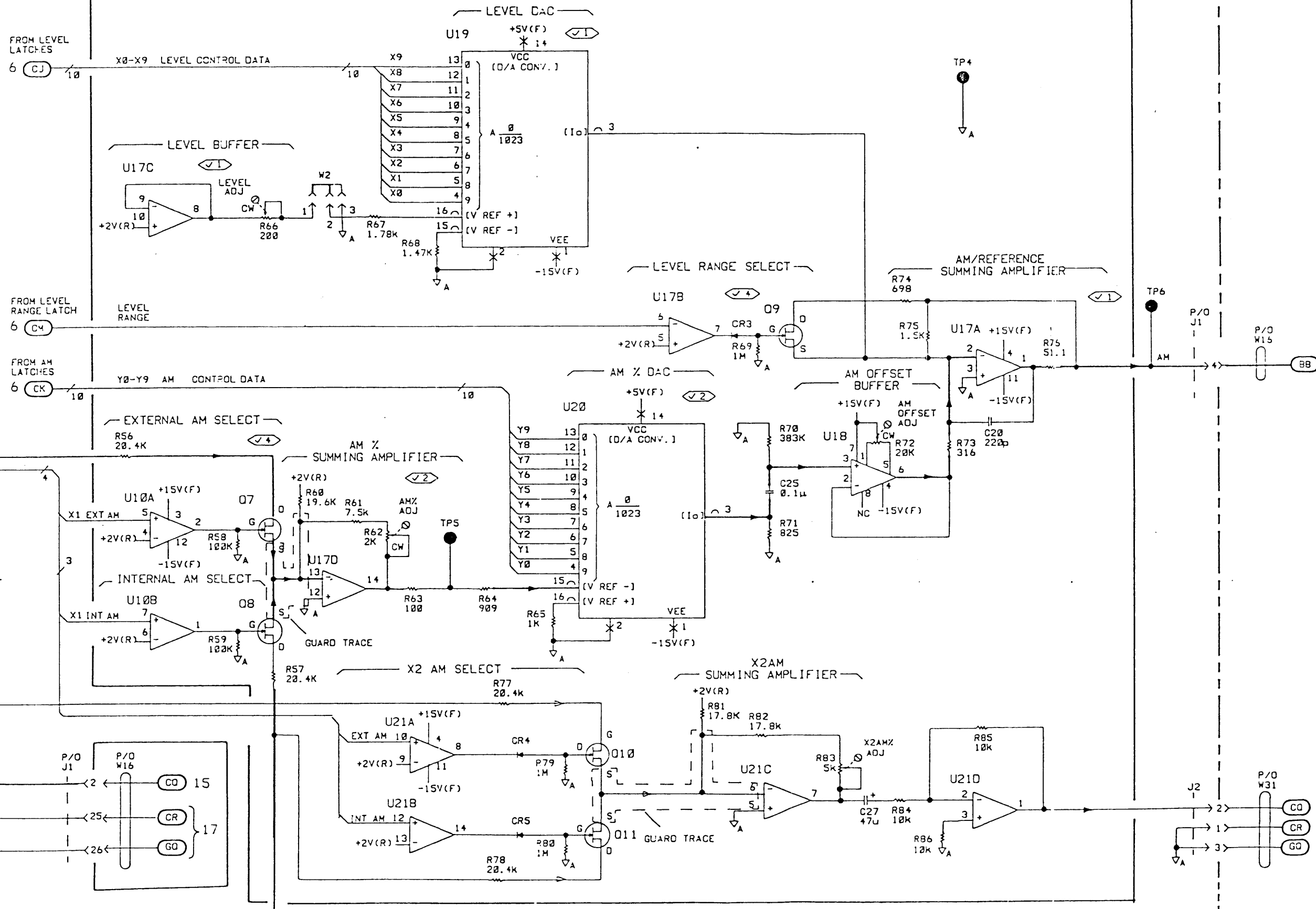


Figure 1  
Service Sheet 7 9



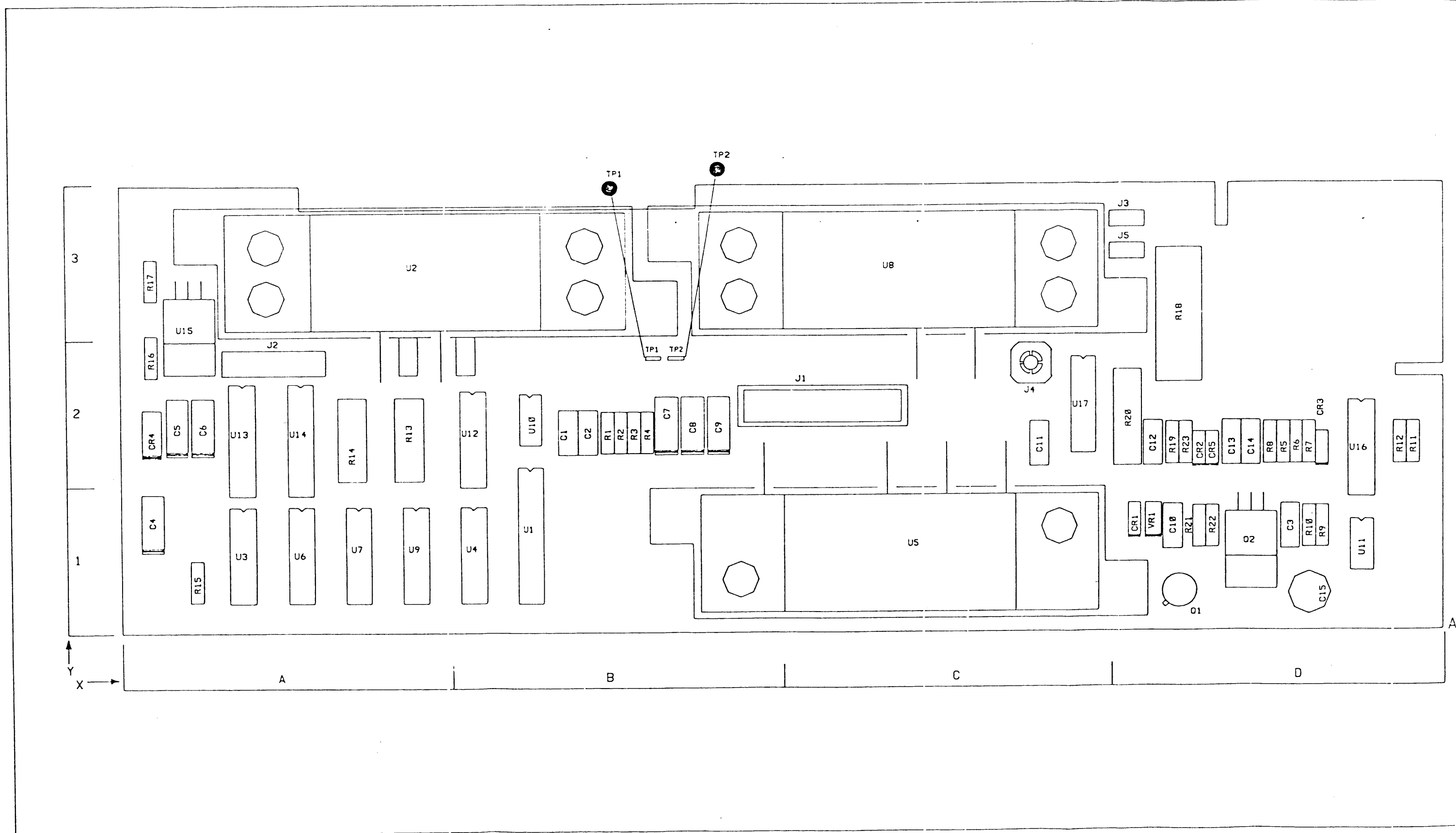
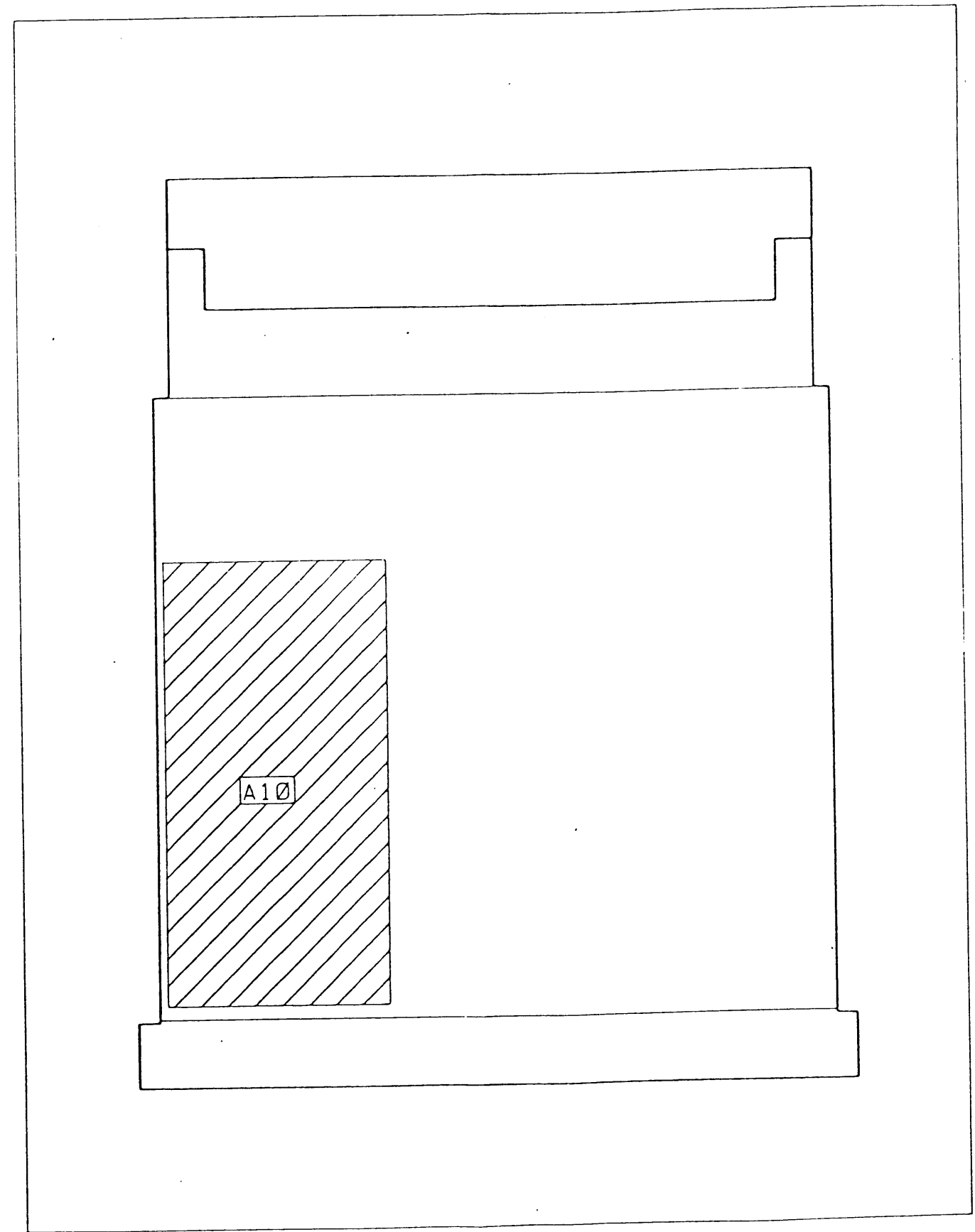


Figure 0. Service Sheet 8 Information.

Component Locator

NOTES

- 1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.



P/O A10      FM AND AM MODULATION  
 SEE REVERSE SIDE      CONTROL AND RF  
    AMPLITUDE CONTROL      SS7

## Service Sheet 8

### HETERODYNE SWITCH, ATTENUATOR CONTROL, AND REVERSE POWER PROTECTION PRINCIPLES OF OPERATION

#### General

Encoded data from the Microprocessor is clocked into the Attenuator Control Latches, and is applied to the Attenuator Drivers. Control signals select the heterodyne mode for frequencies below 130 MHz. Turn on pulse modulation when it is selected, and add or remove attenuation from the RF output signal path depending upon the output amplitude selected.

If excessive power from an external source is connected to the RF OUTPUT connector. The Reverse Power Protection circuits cause a relay in series with the output to open.

#### Heterodyne Switch

The RF OUTPUT path is from the Heterodyne Switch, through the Pulse Modulator, Doubler, Attenuator, and Reverse Power Protection to the Front Panel RF OUTPUT connector. Data from the Microprocessor is clocked into the Attenuator Control Latch U1 by Attenuator Strobes ASTB1. Data bits D7 and D8 are applied to the negative inputs of comparators U10A and U10B and is compared to the +1.5 V reference at the comparator's positive input. With a logic high applied to the comparator's negative input, its output is +14 V. A 0.022  $\mu$ F feedback capacitor is used to decrease the slew rate of the comparator. This prevents high frequency switching transients which could couple into the attenuator. If the comparator output is +14 V, the voltage is applied through a diode to the base of the positive source transistor, turning it on, and to the base of the negative source transistor, turning it off. The source transistors provide the necessary current to drive the diode switching networks within the assembly. The collector of the positive source transistor is tied to +15 V. When the transistor is turned on, +15 V is applied to the switching circuits and the function is turned on. Resistors are used to limit current from the positive source transistors for HET (HET), HET (MAIN).

A logic low from the Attenuator Control Latch applied to the comparator's negative input will cause the output to go to -14 V. A -14 V output from the comparator turns off the positive source transistor and turns on the negative source transistor. The collector of the negative source transistor is tied to -15 V. When the transistor is turned on, -15 V is applied through a current limiting resistor to the switching circuits within the attenuator, and the attenuator function is turned off. The diode in the base circuit of the positive source transistor prevents emitter/base junction reverse bias limits from being exceeded when the comparator output switches from +14 V to -14 V.

#### Attenuator Control, Attenuator

The A9 Attenuator Assembly consists of two separate sub-assemblies AT1 and AT2. The Doubler Assembly inputs the signal to A9AT1J1. Frequencies of 100 kHz to 2060 MHz are sent from the Doubler to the Attenuator Assembly. Together AT1 and AT2 provide from 0 to -145 dB of attenuation in 5 dB steps. Data from the microprocessor selects the proper attenuator combination for the output amplitude selected.

The ASTB1 strobe also clocks monostable U3. The output of U3 is a 20 msec pulse to the attenuator drive and gates U6, U7, and U9 to switch attenuator pads in or out for the output amplitude selected.

Data bits D0 through D5 determine if an attenuator pad is switched in or out. A high data bit switches an attenuator pad in and a low data bit switches an attenuator pad out. One data word is latched into the Attenuator Control Latch U1 by Attenuator Strobe ASTB1. The outputs D0 through D5 of the latch are applied to the Attenuator Driver circuit and Gates U6, 7 and 9 to switch a pad in or inverter U4 to switch a pad out. The output of inverters U13 and U14 switch the selected pad in or out. The current path is removed after approximately 20 msec (U3 times out).

## Pulse Modulation

All RF is sent through the Pulse Modulator to the Doubler when the Pulse Modulation option 003 is installed. When Pulse Modulation is selected and a modulation signal is connected to the Pulse Modulation Input connector, the RF OUTPUT is pulse modulated. The SSTB1 strobe input clocks a D1 input to U16B to the  $\bar{Q}$  output at pin 8. U17A is enabled to gate the Pulse Modulator Input signal to the Pulse Modulator. The output of U17A turns the Pulse Modulator on and off sending pulsed RF to the Doubler. The pulses of RF are switched to the attenuator or doubled in frequency and switched to the attenuator. The pulse modulator is not internally repairable and must be replaced as a unit.

## Reverse Power Protection

The U5 reverse power limiter/detector circuits prevent reverse power levels from damaging the Attenuator or Output Amplifiers. The limiter limits the maximum voltage on the transmission line to  $\pm 5$  Vpk. The power in the attenuator is detected and a proportional dc voltage is applied to the negative input of A10U11A. U11A functions as a voltage comparator where the positive input reference voltage is approximately +0.5 Vdc by resistors A10R9 and R10 divided from the +5 V supply voltage. When the negative input to comparator A10U11A becomes more positive than the +0.5 V reference, the output of A10U11A switches to approximately -15 Vdc.

The current through A10R7 fixes the voltage at D Flip-Flop A10U16A at approximately 0.0 V which resets the flip-flop. The active low output at pin 6 of A10U16A is high and biases transistor A10Q1 off and removes the current through the reverse power relay within the reverse Power Module. This opens the relay in the transmission line removing the external input. The active high output at pin 5 of A10U16A is low and provides a reverse power interrupt, RPI, to the Microprocessor. The Microprocessor services the interrupt causing the AMPLITUDE Display to flash. The keyboard is locked up except for the Amplitude controls alerting the operator of a reverse power condition. The relay remains open until a new output level is entered. Strobe 1 (SSTB1) clocks A10U16A and the high D0 input sets the Q output at pin 6 high  $\bar{Q}$  output at pin 5 low. The active low not Q output turns on A10Q1 energizing the relay. If the reverse power condition was not removed, the detector detects the condition as before, re-opening the relay.

## TROUBLESHOOTING

Procedures for checking the A9 Attenuator, and part of the A10 Audio/Power Supply Assembly circuits are given below. The areas or points to check are marked on the schematic by a hexagon with a checkmark and a number inside, for example,  $\checkmark 1$ . Fixed voltages are shown on the schematic inside a hexagon, for example,  $2\text{ V} \pm 0.2\text{ V}$ . Transistor bias voltages are shown without tolerances.

### Troubleshooting Help

- Block Diagram 2
- Table 4-1. Abbreviated Performance Tests
- Table 5-2. Post-Repair Adjustments

### Test Equipment

Digital Multimeter .....	HP 3466A
DC Power Supply .....	HP 6215A
Measuring Receiver .....	HP 8902A
Sensor Module .....	HP 11722A
Test Cable .....	HP 5061-4827

#### CAUTION

*The hex nuts on the RF connectors on A10U8 (Pulse Modulator), A10U5 (Reverse Power), and A10U2 (HET Switch) should not be torqued to greater than 5 in/lbs. Under-tightening the nuts may cause RF leakage.*

#### NOTE

*The Attenuator Assembly, A9, is repaired by replacing the complete failed section composed of AT1 and AT2.*

✓1 Attenuator and HET Control

One data word is latched into the Attenuator Control Latch U1 by Attenuator Strobe ASTB1. The outputs D0 through D5 of the latch are applied to the Attenuator Driver circuit and Gates U6, 7 and 9 to switch a pad in or inverter U4 to switch a pad out. The output of inverters U13 and U14 when low switch the selected pad in or out. The current path is removed after approximately 20 msec (U3 times out).

1. Set the Signal Generator as follows:

Frequency..... 100 MHz  
 Amplitude..... 0 dBm

2. Verify the HET Control Latch output logic and drive voltages shown in Table 3 and change the front-panel frequency as indicated.

Table 1. Main Band/HET Band Drivers.

Signal Generator Frequency	A10U1 Logic*		A10U12 (Vdc)	
	Pin 16	Pin 19	Pin 3	Pin 12
100	H	L	-12.0	+13.1
520	L	H	+13.1	-12.0

\* Low is  $\leq 0.8$  Vdc; High is  $\geq 2.0$  Vdc.

3. Set the Signal Generator as follows:

Frequency ..... Any  
 Amplitude ..... 10 dBm

4. Verify the Attenuator Control Latch logic levels shown in Table 4. The exact levels at which the pads will switch will vary with frequency due to calibration data in ROM. To find the starting point at which the attenuator pads begin switching start at +10 dBm and step down in 1 dBm increments until A10U1-2 is set to high (>2.0 Vdc), this will be 5 dB of attenuation. From that point the increment size can be changed to 5 dBm and then follow the steps in Table 4.

Table 2. Attenuator Control Output Logic.\*

AT1 AT2 Attenuation (dB)	A10U1					
	Pin 2 5 dB Pad	Pin 5 30 dB Pad	Pin 6 40 dB Pad	Pin 9 10 dB Pad	Pin 12 40 dB Pad	Pin 15 20 dB Pad
**0	L	L	L	L	L	L
***5	H	L	L	L	L	L
10	L	L	L	H	L	L
15	H	L	L	H	L	L
20	L	L	L	L	L	H
25	H	L	L	L	L	H
30	L	L	L	H	L	H
35	H	L	L	H	L	H
40	L	L	L	L	H	L
45	H	L	L	L	H	L
50	L	L	L	H	H	L
55	H	L	L	H	H	L
60	L	L	L	L	H	H
65	H	L	L	L	H	H
70	L	L	L	H	H	H
75	H	H	H	L	L	L
80	L	H	H	H	L	L
85	H	H	H	H	L	L
90	L	H	H	L	L	H
95	H	H	H	L	L	H
100	L	H	H	H	L	H
105	H	H	H	H	L	H
110	L	H	H	L	H	L
115	H	H	H	L	H	L
120	L	H	H	H	H	L
125	H	H	H	H	H	L
130	L	H	H	L	H	H
135	H	H	H	L	H	H
140	L	H	H	H	H	H

\* Low is  $\leq 0.8$  Vdc; High is  $\geq 2.0$  Vdc.  
 \*\* Start at +10 dBm, 1 dB increment.  
 \*\*\* Set point for 5 dB increments.

**√2 Reverse Power Protection**

1. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... Off

2. Set the dc power supply to +20 Vdc, turn the power supply OFF, and connect it to the RF OUTPUT connector. Then turn the power supply ON. This will open the Reverse Power Relay.

The Reverse Power Protection circuitry should be activated and the front-panels AMPLITUDE Display should be flashing. (Dependent upon the rise time of the power supply output voltage.)

3. Measure and verify the voltages shown in Table 6. Probing A10U16-1 may cause the Reverse power Relay to activate, to test the closed relay voltage press the AMPTD key while leaving the probe on A10U11-1.

*Table 3. Reverse Power Protection Operating Voltages (Vdc).*

Reverse Power Relay	A10U11	A10U16		A10Q1		
	Pin 1	Pin 1	Pin 6	E	B	C
Closed	+4.5	+4.5	+0.2	+5.0	+4.3	+5.0
Open	+4.5*	+4.5	+5.0	+5.0	+5.0	0.0

\* The output of the comparator (A10U11 pin 1) will be low only for the time required to open the reverse power relay.

4. Disconnect the dc power supply from the Signal Generator and press the front-panel AMPTD key. Check for a high TTL SSTBI pulse at A10U16A pin 3. The SSTBI pulse clocks the D Flip-Flop, biasing A10Q1 on, and closes the reverse power relay in the attenuator.



**√3 Pulse Modulation**

5. Set the Signal Generator as follows:

Frequency..... 520 MHz  
 Amplitude..... -10 dBm  
 Modulation..... Pulse

6. Set the dc power supply to +5 Vdc, turn the power supply OFF, and connect it to the PULSE INPUT connector. Check for the logic levels in Table 6.

*Table 4. Pulse Modulation Drivers.*

Pulse Input Voltage	Pulse Modulation	A10U16-8	A10U17-1
0 Vdc	Off	H	L
0 Vdc	On	L	L
+5 Vdc	On	L	H

\* Low is  $\leq 0.8$  Vdc; High is  $\geq 2.0$  Vdc.

A10 Component Coordinates

COMP	X	Y	COMP	X	Y	COMP	X	Y
C1	B	2	R18	D	1			
C2	B	2	R19	D	2			
C3	D	1	R20	D	2			
C4	A	1	R21	D	1			
C5	A	2	R22	D	1			
C6	A	2	R23	D	2			
C7	B	2						
C8	B	2	TP1	B	2			
C9	B	2	TP2	B	2			
C10	D	1						
C11	C	2	U1	B	2			
C12	D	2	U2	A	3			
C13	D	2	U3	A	1			
C14	D	2	U4	B	1			
C15	D	1	U5	C	1			
C16	A	2	U6	A	1			
C17	B	2	U7	A	1			
			U8	C	3			
CR1	D	1	U9	A	1			
CR2	D	2	U10	B	2			
CR3	D	2	U11	D	1			
CR4	A	2	U12	B	2			
CR5	D	2	U13	A	2			
			U14	A	2			
J1	B	2	U15	A	3			
J2	A	2	U16	D	2			
J3	D	3	U17	C	2			
J4	C	2						
J5	D	3	VR1	D	1			
Q1	D	1						
Q2	D	1						
R1	B	2						
R2	B	2						
R3	B	2						
R4	B	2						
R5	D	2						
R6	D	2						
R7	D	2						
R8	D	2						
R9	D	1						
R10	D	1						
R11	D	2						
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R14	A	2						
R15	A	1						
R16	A	2						
R17	A	3						

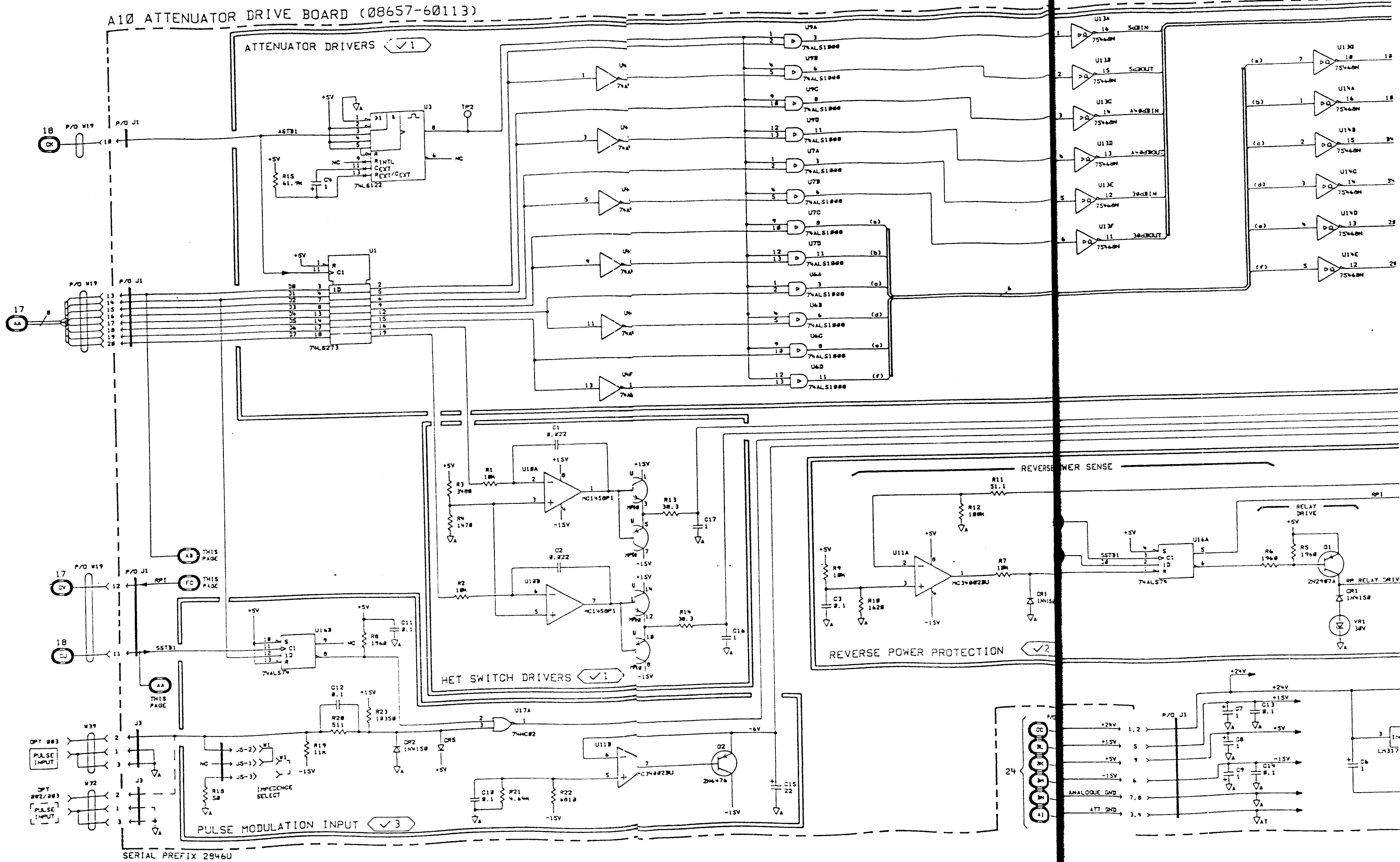
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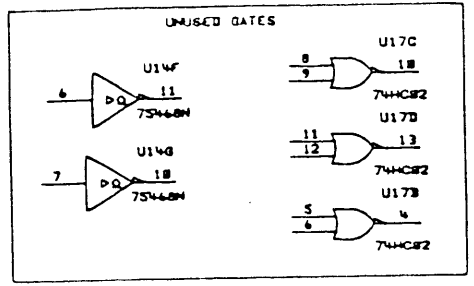
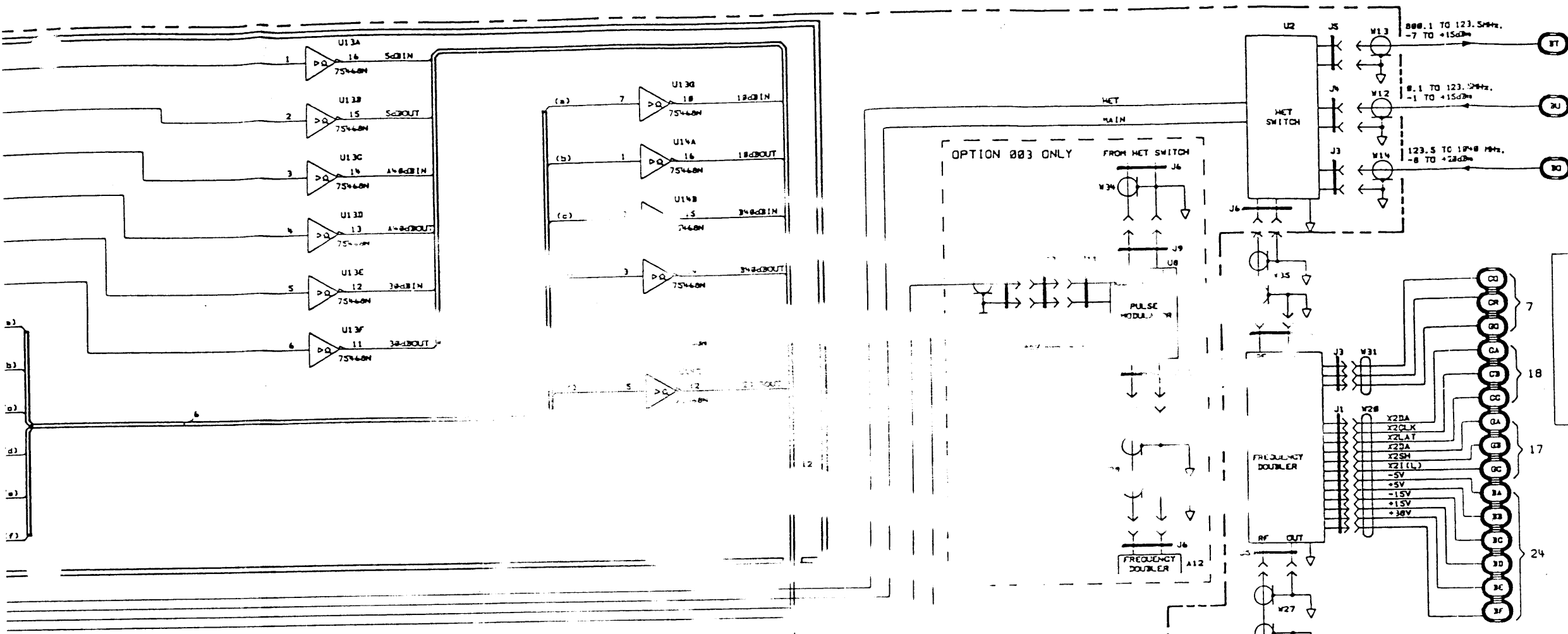
On the A10 Schematic Diagram:

- C18 - Add C18, 0.01  $\mu$  C18 is connected from U3 pin 5 to ground.



# A10 ATTENUATOR DRIVE BOARD (08657-60113)





REF DES	SUPPLY	PIN NUMBER
U1P	+5V	28
U1P	AGND	18
U3P	+5V	14
U3P	AGND	7
U4P	+5V	14
U4P	AGND	7
U7P	+5V	14
U7P	AGND	7
U9P	+5V	14
U9P	AGND	7
U13P	+15VAT	9
U14P	+15VAT	9
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U17P	+5V	14
U17P	AGND	7
U18P	+5V	14
U18P	AGND	7

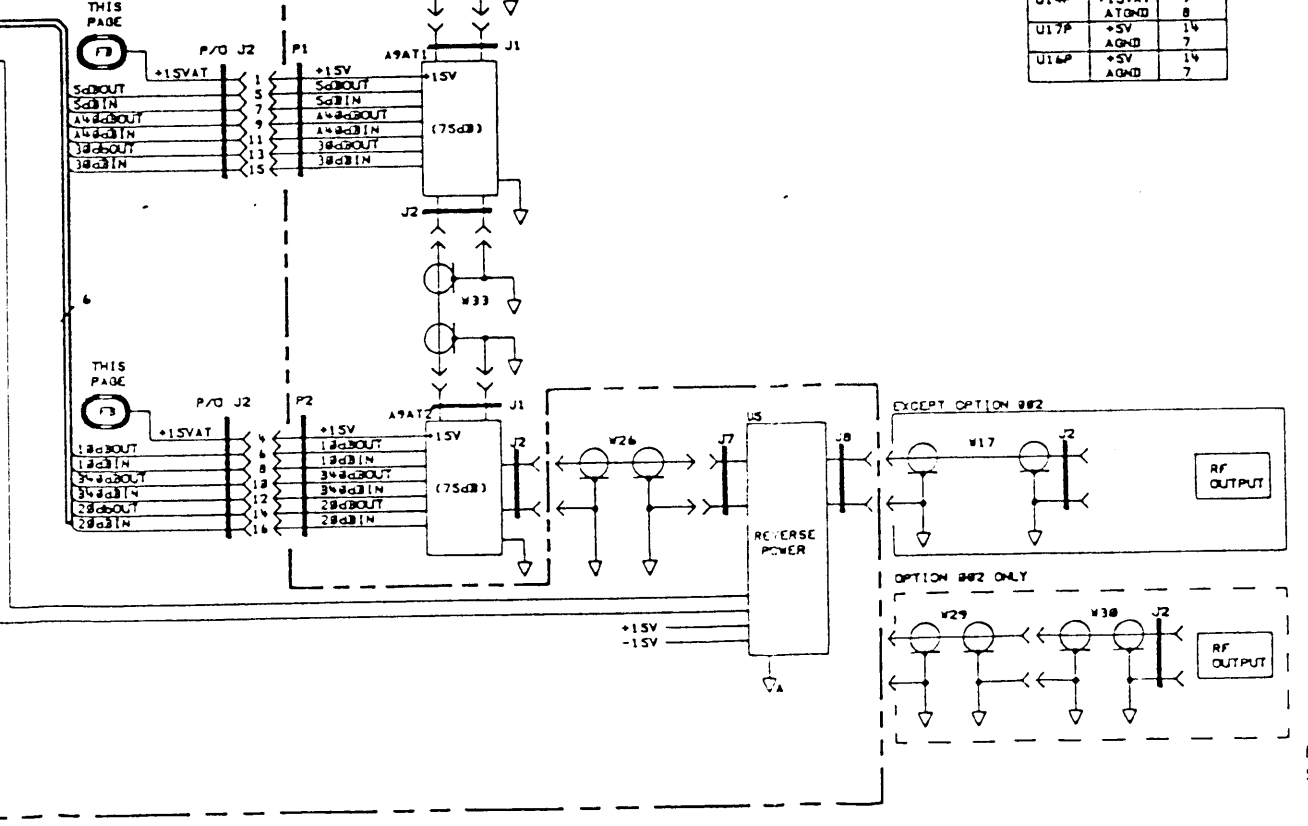
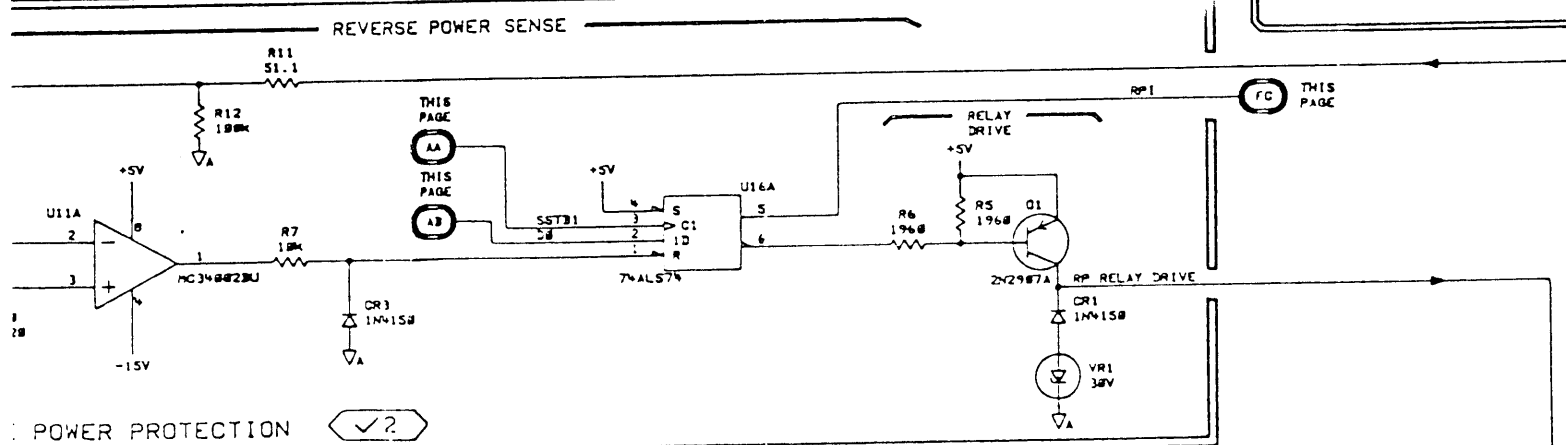


FIGURE 1 SERVICE SHEET 8 9