



**HEWLETT
PACKARD**

**TROUBLESHOOTING AND REPAIR MANUAL
VOLUME 1**

**8568B SPECTRUM ANALYZER
RF SECTION**

SERIAL NUMBERS

This manual applies directly to RF sections with
serial numbers prefixed 2408A.

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1212 VALLEY HOUSE DRIVE, ROHNERT PARK, CALIFORNIA, 94928, U.S.A.**

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CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of the other International Standards Organization members.

WARRANTY

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

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

LIMITATION OF WARRANTY

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

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

EXCLUSIVE REMEDIES

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

ASSISTANCE

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

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

SAFETY SYMBOLS

The following safety symbols are used throughout this manual and in the instrument. Familiarize yourself with each of the symbols and its meaning before operating this instrument.



Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the instrument against damage. Location of pertinent information within the manual is indicated by use of this symbol in the table of contents.



Indicates dangerous voltages are present. Be extremely careful.



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



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

GENERAL SAFETY CONSIDERATIONS

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

WARNING

There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure its primary power circuitry has been adapted to the voltage of the ac power source. Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

HP 8568B SPECTRUM ANALYZER DOCUMENTATION OUTLINE

Included with the HP Model 8568B Spectrum Analyzer are three manuals: the Operator's Handbook, the Operating and Programming Manual, and the Tests and Adjustments Manual. Not included with the instrument, but available at no charge upon return of the enclosed order card, is the two-volume Troubleshooting and Repair Manual.

OPERATOR'S HANDBOOK (HP Part Number 08568-90045)

Contents:

General Information, Installation, Quick Reference, Specifications, and Operation Verification. Available as separate publications are Specifications (HP Part Number 08568-90046), Operation Verification (HP Part Number 08568-60008), and a pocket-sized version of the Quick Reference Guide.

OPERATING AND PROGRAMMING MANUAL (HP Part Number 08568-90041)

Contents:

Manual and remote operation, including complete syntax and command description. Accompanying this manual is the separate, pocket-sized Quick Reference Guide (HP Part Number 5955-8970).

TESTS AND ADJUSTMENTS MANUAL (HP Part Number 08568-90051)

Contents:

Electrical performance testing and adjustment procedures.

TROUBLESHOOTING AND REPAIR MANUAL (HP Part Number 08568-90043)

Contents:

IF-Display Section and RF Section service information.

CONTENTS

Volume 1

Contents

RF Section	
General Information	General information on the contents of the manual, including storage, shipment, and packaging.
Signature Analysis	
Description	An explanation of the use of Signature Analysis diagrams for digital troubleshooting.
Spectrum Analyzer	
Overall Troubleshooting	Troubleshooting index, special messages, diagnostic functions, error correction routine, sweep system block diagram and troubleshooting, mnemonics listing, and Spectrum Analyzer Overall Block Diagram.
RF Section Analog	
Troubleshooting	Phase lock loop operation, start frequency tuning equations, and phase lock troubleshooting.
RF Section Digital	
Troubleshooting	Instrument preset checks, digital storage verification, and RF Digital Troubleshooting Block Diagram.
A5 Front Panel through	
A26 Motherboard	Service sheets containing circuit descriptions, troubleshooting information (if applicable), replacement procedures (if applicable), replaceable parts lists, parts identification (if applicable), signature analysis troubleshooting diagrams (if applicable), block diagrams, component locations, and schematic diagrams.
General Parts Listing	Replaceable parts information, reference designations and abbreviations, Manufacturer's Code List, RF Miscellaneous Parts List, RF Assemblies Parts List, and instrument parts identification.
Major Assembly and	
Component Locations	RF Section major assembly and component locations.

Volume 2

IF-Display Section	
General Information	General information on manual contents, instrument storage and shipment.
Signature Analysis	
Description	An explanation of the use of Signature Analysis diagrams for digital troubleshooting.
IF Overall Block Diagram	Mnemonic Table, Instrument Bus Pin Connection Table, and Overall IF Block Diagram.
A1 Display Section	
Block Diagram	A1 Display Section Troubleshooting information, Block Diagram, and A1A1 through A1A10 service sheets.

A3 Digital Storage Troubleshooting	A3 Digital Storage Troubleshooting information, Block Diagram, and A3A1 through A3A10 service sheets.
A4 IF Section Troubleshooting	A4 Section Block Diagram, and A4A1 through A4A10 service sheets.
General Parts Listing	Replaceable parts information, and parts identification figures.
Major Assembly and Component Locations	Major assembly identification figure.

RF SECTION SERVICE

INTRODUCTION

This volume of the Troubleshooting and Repair Manual contains information for the troubleshooting and repair of the RF Section of the instrument. This information is combined in service sheets and indexed with tabs for quick reference. Also contained in this volume are overall troubleshooting information and illustrations of the instrument that are useful in isolating failures to the RF or IF-Display Section.

INSTRUMENTS COVERED BY MANUAL

Attached to the rear of each section of your instrument is a serial number plate. The serial number is in two parts. The first four digits and letter are the serial number prefix; the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

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

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

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

SERVICE SHEETS

The service sheets in each volume of this manual are organized in alphanumeric order and are indexed with tabs to make it easy to locate a specific service sheet. Each of the service sheets contain the following information:

- Circuit Description (where practical)
- Troubleshooting Hints (where practical)
- Replaceable Parts List
- Component Location Illustration
- Signature Analysis (for digital boards)
- Block Diagram (where practical)
- Schematic Diagram

Also included, where applicable, are Signature Analysis Diagrams for troubleshooting digital circuits.

REPAIR PROCEDURES

Repair procedures are included for use in removing and replacing assemblies for repair. They are located in the following sections:

- Front-Panel LED Replacement (A5 tab)
- Front Panel Removal and Repair (A5 tab)
- SIGNAL INPUT 1 Fuse Replacement Procedure (A5 tab)
- RF Section Internal Fuse Replacement (A25/A26 tab)

MAJOR ASSEMBLY AND COMPONENT LOCATIONS

Major assembly and component location illustrations for the RF Section are located at the rear of both volumes.

TROUBLESHOOTING

Troubleshooting information for the RF Section is divided into three levels as follows:

Instrument Level

Spectrum Analyzer Overall Troubleshooting
Signature Analysis Description

Section Level

RF Section Analog Troubleshooting
RF Section Digital Troubleshooting
Pilot Third Local Oscillator Block Diagram

Assembly Level

Most assemblies have troubleshooting hints immediately following circuit descriptions. Troubleshooting information is also located on assembly level block diagrams, notes, and schematics.

All assemblies are indexed by tab except for the ones listed below. The index tab they can be found under is also listed.

A13 (not assigned)
A14 (not assigned)
A27 Frequency Standard 10 MHz (A16 tab)
A28 (not assigned)
A29 HP-IB Ground (A15 tab)

PRINTED CIRCUIT BOARD EDGE CONNECTOR CONTACT CLEANING

MATERIALS:

- Lint-free cloth or equivalent (HP Part Number 9310-0039, Check Digit 3).
- Solution of 80% electronics-grade isopropyl alcohol and 20% water.
- Static-free work station.

PROCEDURE:

1. Dampen the cloth with the alcohol and water solution and scrub the edge connector contacts vigorously, using a circular motion. Polish one side of the board at a time until the contacts shine, keeping the cloth damp to dissolve contaminants and reduce static electricity.
2. Using a clean cloth, dry the contacts by wiping from their inside to outside edge. This prevents particles from building up on the contact edges.

CAUTION

Do not use erasers to clean the edge connectors. They cause microscopic damage to the contact surface, removing the thin gold plating and exposing the nickel under-plating, which eventually corrodes. Erasers also leave a film on the contact and generate static electricity.

Do not use paper of any kind to clean the edge connector contacts. Paper or lint particles left on the edge contact surface can cause intermittent electrical connections.

Do not touch contact or trace surfaces with bare hands. Always handle the board by its edges.

SIGNATURE ANALYSIS

This instrument is designed to incorporate signature analysis. Signature analysis diagrams are included in the appropriate sections. For explanation on the use of these diagrams, refer to the Signature Analysis Description Tab.

HP-IB ADDRESS SELECTION

The HP-IB address for the HP 8568B is preset at the factory by means of a five-segment binary switch located on the A15 Controller Assembly. This switch is set to the binary number 11111 which corresponds to a decimal equivalent of 31. The number 31 is a special instruction code that commands the instrument to use the last input address stored in memory. This stored HP-IB address is ASCII 2R (decimal 18) and determines the address to be used on "power-up."

The HP-IB address may be changed to any of the addresses listed in Table 1 by resetting the HP-IB address switch to correspond to the binary equivalent of the desired ASCII character or decimal value as indicated in the table. The five-segment switch is illustrated in Figure 1 and is shown in its preset position (decimal 31).

The HP-IB address may also be changed from the front panel or programmed via a controller using a special shift key function (KSP). This address remains in effect as long as the instrument memory

TABLE 1. CROSS-REFERENCE BETWEEN ASCII, DECIMAL, AND BINARY ADDRESS CODES

ASCII CHARACTER		DECIMAL VALUE	5-BIT BINARY EQUIVALENT
@	SP	00	00000
A	!	01	00001
B	"	02	00010
C	#	03	00011
D	\$	04	00100
E	%	05	00101
F	&	06	00110
G	'	07	00111
H	(	08	01000
I	)	09	01001
J	*	10	01010
K	+	11	01011
L	,	12	01100
M	-	13	01101
N	.	14	01110
O	/	15	01111
P	0	16	10000
Q	1	17	10001
R	2	18	10010
S	3	19	10011
T	4	20	10100
U	5	21	10101
V	6	22	10110
W	7	23	10111
X	8	24	11000
Y	9	25	11001
Z	:	26	11010
[	;	27	11011
\	<	28	11100
]	=	29	11101
(	>	30	11110

SWITCH IN
DOWN POSITION
= LOGIC 1

INDICATES SWITCH
IN DOWN POSITION

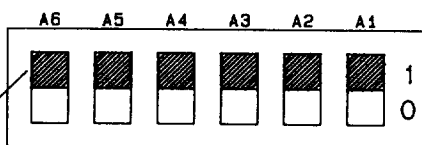


FIGURE 1. HP-IB ADDRESS SWITCH (SHOWN IN FACTORY PRESET POSITION)

has power from either the ac line or the internal battery. However, if this stored address is lost, the default address is the factory preset decimal 18 (ASCII 2R). For additional information on the HP-IB address, refer to the Operating and Programming Manual.

STORAGE AND SHIPMENT

Environment

The instrument may be stored or shipped in environments within the following limits:

Temperature	-40°C to +75°C
Humidity	5% to 90% at 0° to 40°C
Altitude	Up to 15,240 meters (50,000 feet)

The instrument should be protected from temperature extremes which might cause condensation within the instrument.

Original Packaging

It is recommended that the original factory packaging materials be retained for use when shipping the instrument. If original packaging material cannot be retained, packaging materials identical to those used in factory packaging are available through the Hewlett-Packard offices. Part numbers and descriptions of the packaging materials are listed in Figure 3.

The combined weight of the two instrument sections is approximately 50 kg (112 lbs). Because of the weight involved, do not package the instrument sections fastened together as one unit. The instrument sections must be separated and packaged in separate

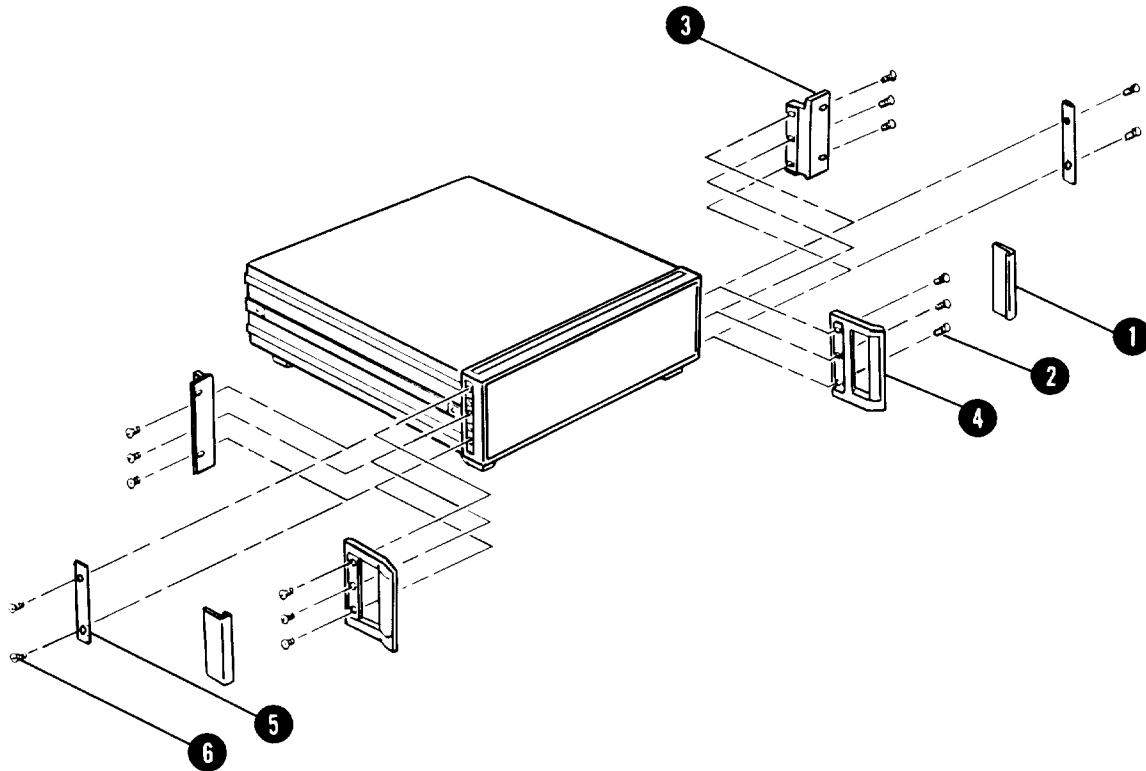
containers. The quantity of packaging materials in Figure 3 is for only one instrument section.

If the instrument is being returned to Hewlett-Packard for servicing, attach a tag to each carton indicating the type of service required, return address, model number, and full serial number. For your convenience, a supply of tags is included at the end of this section. Also, mark each container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

Other Packaging

If it is necessary to use packaging materials other than the type used in original factory packaging, the following general instructions should be followed.

- a. Separate the two instrument sections and wrap each in heavy paper or plastic.
- b. Place the instrument sections in separate containers with 8 to 10 cm (3 to 4 inches) of shock-absorbing material around all sides to provide firm cushioning and prevent movement inside the container. Protect front panels with cardboard. Double-wall corrugated cartons of 125 kg (275 lb) bursting strength are sufficient for shipping containers.
- c. Seal each container securely and, if shipping to a Hewlett-Packard office or service center, attach a tag to each container indicating the type of service required, return address, model number, and full serial number.
- d. Mark each container FRAGILE to assure careful handling.



1. IF FRONT HANDLES ARE INSTALLED, REMOVE TRIM **1**.
2. REMOVE SCREWS **2**, THUS REMOVING RACK MOUNT FLANGES **3** OR FRONT HANDLES **4**.
3. ATTACH SHIPPING BARS* **5** USING SCREWS* **6**.

* Refer to Figure 3 of this tab for part numbers of shipping bars and screws.

FIGURE 2. PREPARING INSTRUMENT SECTION FOR SHIPMENT

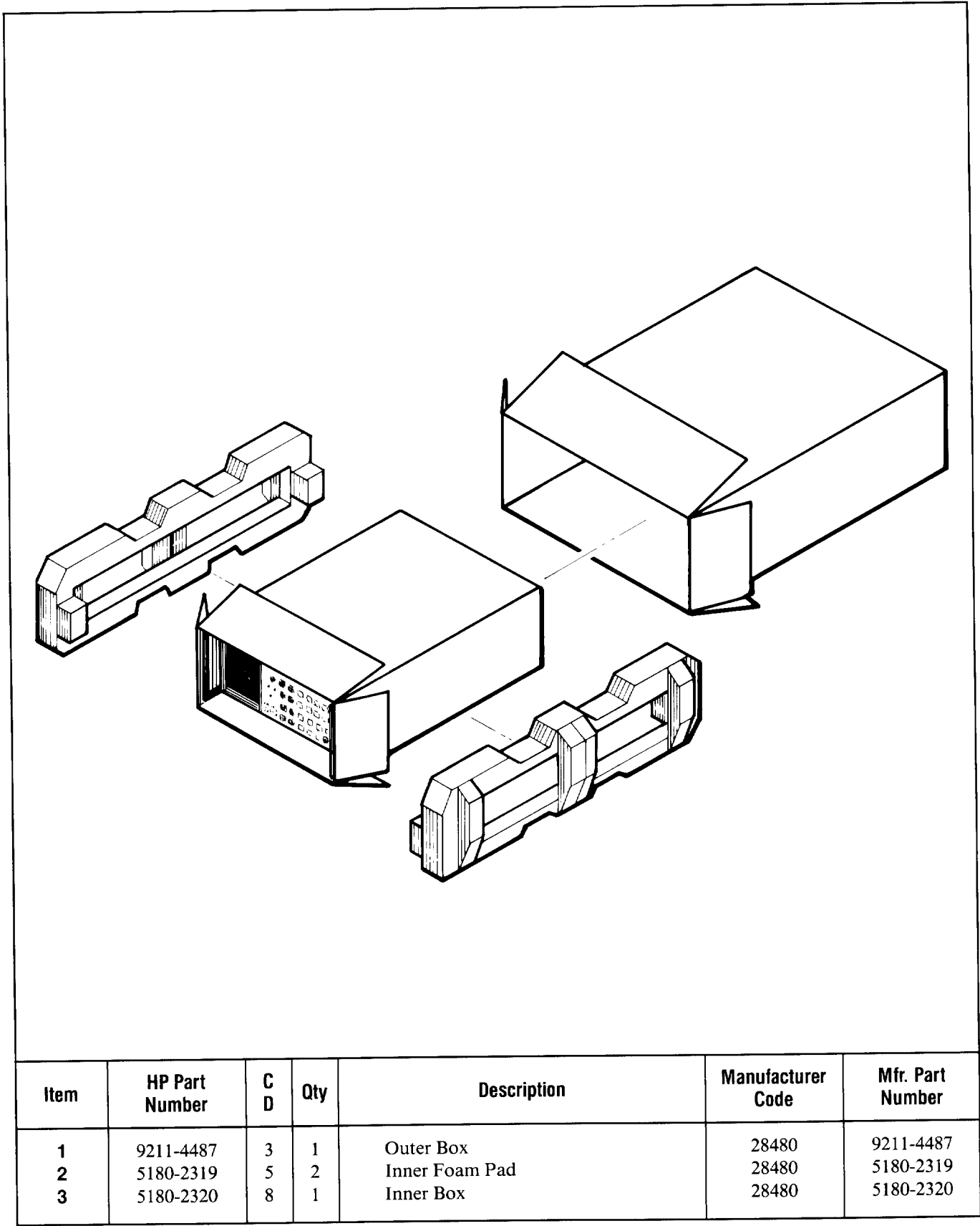


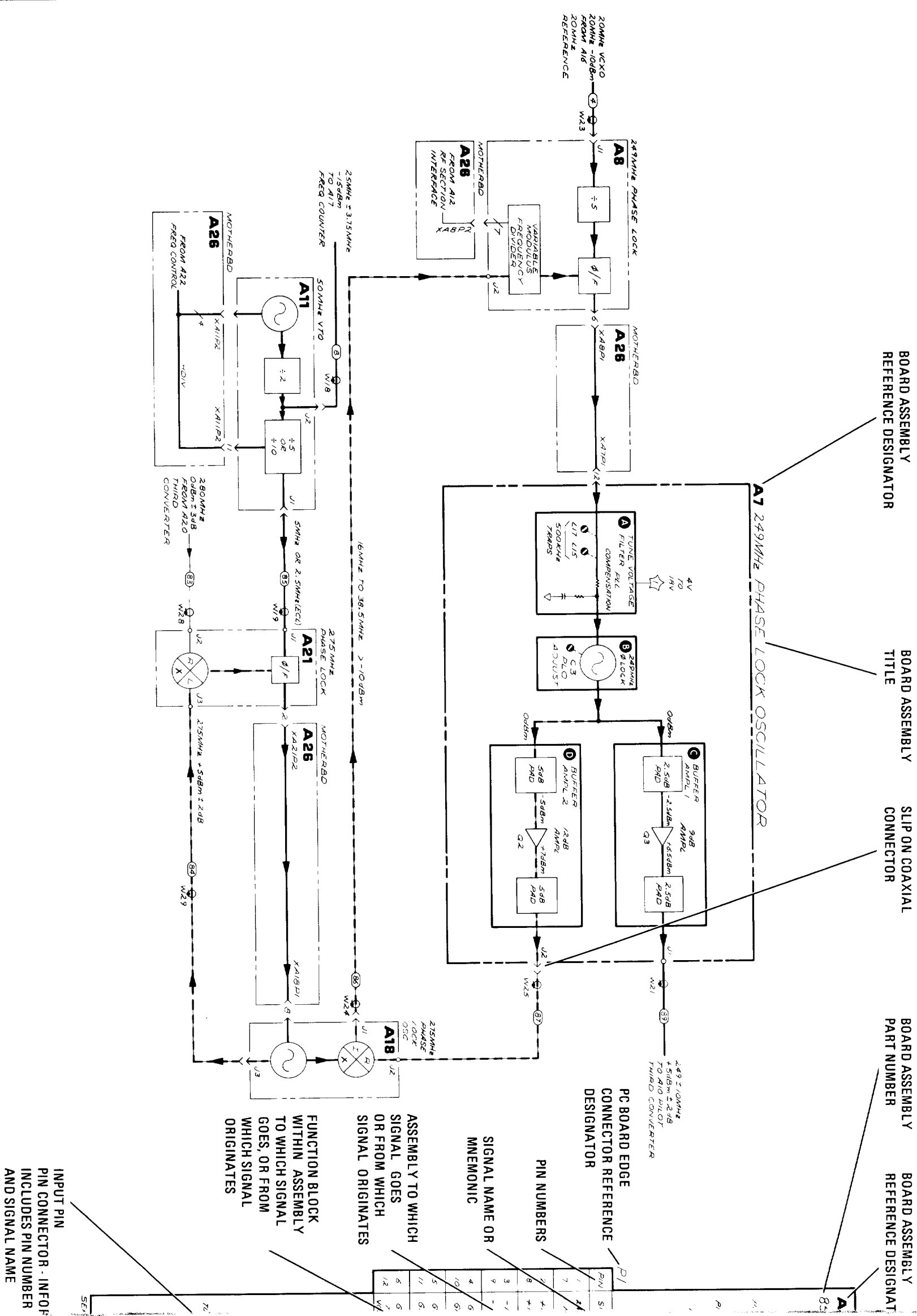
FIGURE 3. PACKAGING FOR SHIPMENT USING FACTORY PACKAGING MATERIALS

TABLE 2. LIST OF TEST EQUIPMENT FOR TROUBLESHOOTING (1 OF 2)

Instrument	Critical Specifications for Equipment Substitution	Recommended Model Model
SIGNAL SOURCES		
Signal Generator	Frequency: 20 MHz to 450 MHz SSB Phase Noise: >130 dB below carrier at 20 kHz away Stability: <10 ppm/10 min. (HP 8340A may be substituted)	HP 8640B
ANALYZERS		
Spectrum Analyzer	Frequency: .04 to 325 MHz	HP 8557A/853A
Spectrum Analyzer	Frequency: 100 MHz to 1500 MHz	HP 8558B/853A
Signature Analyzer	No known substitute. Provides preferred method for troubleshooting digital circuitry	HP 5005A/B
AC Probe	Active probe compatible with probe power connector on Spectrum Analyzer Accessory: 10:1 Divider (Optional)	HP 1121A
OSCILLOSCOPE		
Oscilloscope	Frequency: 100 MHz Sensitivity: .005V/Division Dual Channel: Third Channel Trigger View	HP 1741A
Probe	10:1 Divider, compatible with oscilloscope	HP 1004D
METERS		
Digital Voltmeter	Resolution: ± 0.1 mV Range: 0 Vdc to 100 Vdc Input Impedance 100V Range: 10 M Ω HP-IB Compatible	HP 3456A or HP 3455A
High Voltage Probe	1000:1 Divider Impedance: 10 M Ω	HP 34111A
Power Meter	Range: -20 dBm to +10 dBm Accuracy: ± 0.02 dB	HP 432A
Thermistor Mount	Frequency: 100 Hz to 1500 MHz Compatible with HP 432A Power Meter	HP 478A
ATTENUATORS		
10 dB Step Attenuator	Steps: 10 dB from 0 to 120 dB Frequency: 20 MHz to 1500 MHz Calibrated to uncertainty error of $\pm (0.02 \text{ dB} + 0.01 \text{ dB}/10 \text{ dB step})$ at 20 MHz from 0 dB to 120 dB	HP 355D-H89

TABLE 2. LIST OF TEST EQUIPMENT FOR TROUBLESHOOTING (2 OF 2)

Instrument	Critical Specifications for Equipment Substitution	Recommended Model
ATTENUATORS (Cont'd)		
1 dB Step Attenuator	Steps: 1 dB from 0 to 12 dB Frequency: 20 MHz to 1500 MHz Calibrated to uncertainty error of $\pm (0.02 \text{ dB} + 0.01 \text{ dB}/10 \text{ dB step})$ at 20 MHz from 0 dB to 12 dB	HP 355C-H25
TERMINATIONS		
Termination	Impedance: 50 Ω ; BNC	HP 11593A
SPECIAL DEVICES		
Display Adjustment PC Board	Required for preliminary display adjustments	HP 85662-60088
CABLES		
Test Cable	SMB Snap-On (f) to SMB Snap-On (f)	HP 85662-60042
ADAPTERS		
Adapter	SMB Snap-On (m) to SMB Snap-On (m)	HP 1250-0669
BOARD EXTENDERS		
Extender*	A12 RF Section Interface Extender	HP 85860-60035
Extender* (2 required)	PC Board: 50 contacts; 2 rows of 25	HP 85680-60034
Extender* (2 required)	PC Board: 36 contacts; 2 rows of 18	HP 08505-60042
Extender*	PC Board: 30 contacts; 2 rows of 15	HP 08505-60041
Extender*	PC Board: 20 contacts; 2 rows of 10	HP 85680-60028
Extender*	PC Board: 12 contacts; 2 rows of 6	HP 08505-60109
PC Board Extractor	PC Board Extracting Tool	HP 03950-4001
* Part of Service Accessories		



GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS

BASIC COMPONENT SYMBOLS

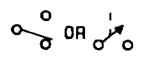
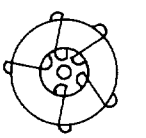
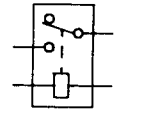
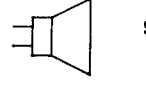
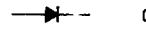
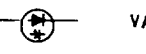
	VARIABLE RESISTOR: CW INDICATES CLOCKWISE ROTATION OF SHAFT MOVES WIPER TOWARDS LOCATION OF CW.		LIGHT-EMITTING DIODE
	THERMISTOR		PIN DIODE
	ELECTROLYTIC CAPACITOR		TRIAC
	VARIABLE CAPACITOR		STEP RECOVERY DIODE
	SLIDE, TOGGLE, OR ROCKER SWITCH		TEMPERATURE-COMPENSATED VOLTAGE-REFERENCE DIODE
	FEEDTHROUGH CAPACITOR		SCR (SILICON CONTROLLED RECTIFIER)
	TOROIDAL TRANSFORMER		TRANSISTOR, PNP
	RELAY		TRANSISTOR, NPN
	SURFACE ACOUSTIC WAVE (SAW) RESONATOR		JUNCTION-FET, N-CHANNEL
	FERRITE BEAD		JUNCTION-FET, P-CHANNEL
	PUSHBUTTON SWITCH		MOS-FET, N-CHANNEL
	CRYSTAL		MOS-FET, P-CHANNEL
	SPEAKER		INDICATES A FACTORY SELECTED COMPONENT
	GENERAL PURPOSE DIODE		INDICATES SHIELDING CONDUCTOR FOR CABLES
	BREAKDOWN DIODE: ZENER		INDICATES A PLUG-IN CONNECTION
	SCHOTTKY DIODE		INDICATES A SOLDERED OR MECHANICAL CONNECTION
	VARACTOR DIODE (VARICAP)		INDICATES A SINGLE PIN OF A PC BOARD EDGE CONNECTOR
			CONNECTION SYMBOL INDICATING A JACK (EXCEPT FOR PC BOARD EDGE CONNECTORS)
			CONNECTION SYMBOL INDICATING A PLUG (EXCEPT FOR PC BOARD EDGE CONNECTORS)

FIGURE 5. GRAPHIC SYMBOLS (1 OF 2)

GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS

BASIC COMPONENT SYMBOLS (CONT'D)



OR

TEST POINT: TERMINAL PROVIDED FOR TEST PROBE CONNECTION



EARTH GROUND SYMBOL



OR

MEASUREMENT POINT: USED TO INDICATE A CONVENIENT POINT FOR MEASUREMENT. NO TERMINAL PROVIDED FOR TEST PROBE.



INSTRUMENT CHASSIS GROUND. MAY BE ACCOMPANIED BY A NUMBER OR LETTER TO SPECIFY A PARTICULAR GROUND.



INDICATES WIRE OR CABLE COLOR CODE. COLOR CODE SAME AS RESISTOR COLOR CODE. FIRST NUMBER INDICATES BASE COLOR, SECOND AND THIRD NUMBERS INDICATE COLORED STRIPES.



SCREWDRIIVER ADJUSTMENT



JUMPER WIRE



PANEL CONTROL

COMMONLY USED ASSEMBLY AND CIRCUIT SYMBOLS



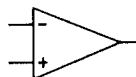
OSCILLATOR, RPG (ROTARY PULSE GENERATOR)



TRANSMISSION LINE



FAN MOTOR



OP AMP



MIXER



INVERTER, BUFFER

FIGURE 5. GRAPHIC SYMBOLS (2 OF 2)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS

The following is a guide to the symbols used for digital or logic ICs in this manual. The symbology is based on American National Standard ANSI Y32.14, *Graphic Symbols for Logic Diagrams (Two-State Devices)*, but does not strictly follow the standard.

DEFINITIONS

Logic Element: The part or parts of a logic device symbol having a well-defined logic function (OR, AND, FLIP-FLOP, etc.) and one or more outputs. The inputs of a logic element may be data or control inputs; the outputs are data outputs.

Control Block: The part of a logic device symbol to which all the logic lines common to a group of logic elements are connected. Lines connected to a control block are control lines.

Function Label: The notation within a logic device symbol that denotes its overall logic function (counter, shift register, multiplexer, etc.).

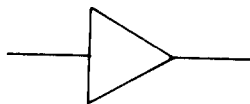
Line Label: The symbol or abbreviation associated with an output or input line that defines the action of the line.

Indicator Symbol: A symbol associated with an input or output line which defines the active state or special characteristics of the line.

BASIC LOGIC SYMBOLS

Distinctive-Shape Symbols

Amplifier/Buffer



AND Gate

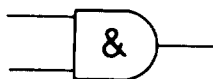


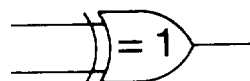
FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (1 OF 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

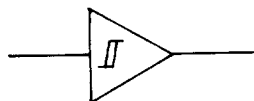
OR Gate



EXCLUSIVE OR Gate

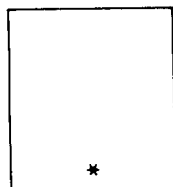
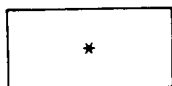


Schmitt Trigger



Rectangular Symbols

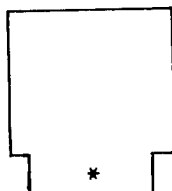
General Logic Element



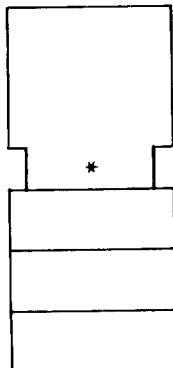
NOTE

The asterisk indicates where the function label is placed.

Control Block



Logic Elements with Common Control Block



NOTE

If elements sharing control lines are widely separated, each element will have a control block.

FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (2 OF 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

INDICATOR SYMBOLS (positive logic assumed)

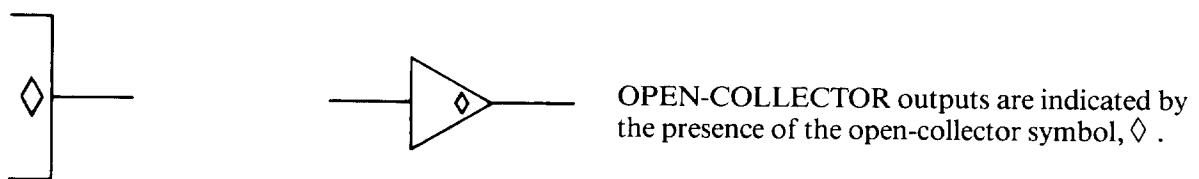
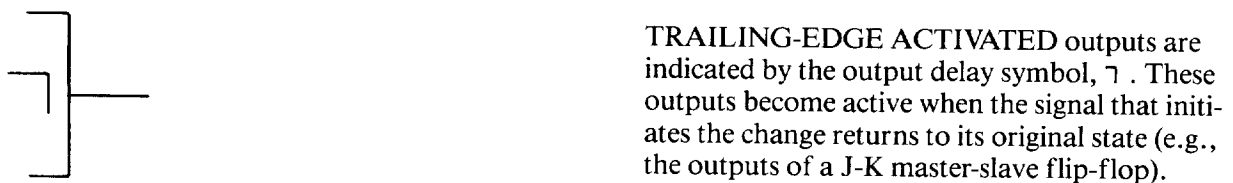
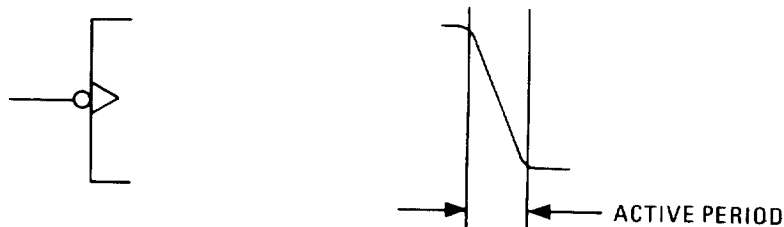
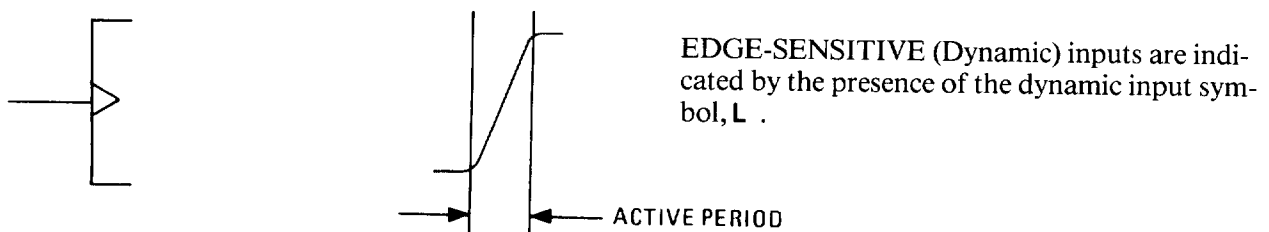
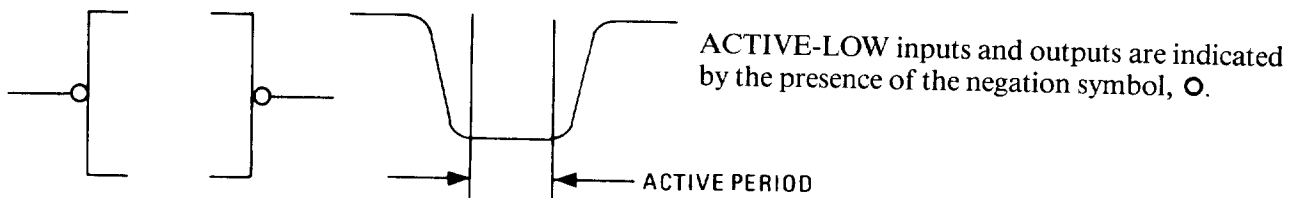
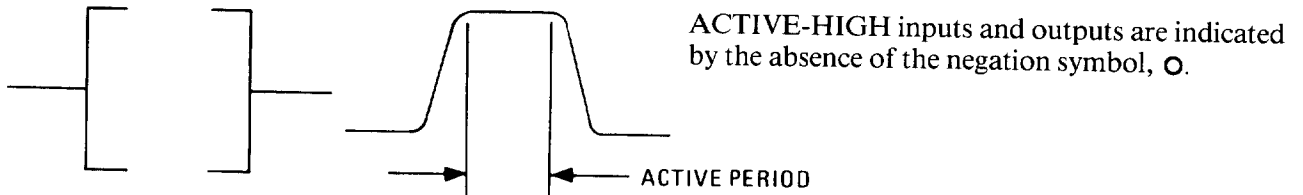


FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (3 OF 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

NOTE

The logic negation symbol (O) alone gives no information about the actual voltage levels used in a digital circuit. For this reason, the type of logic system (positive or negative) must be specified. In this manual, unless otherwise noted on the schematic, the logic system is positive; that is, the more positive voltage level is the HIGH or 1-state and the less positive level is the LOW or 0-state.

FUNCTION LABELS

Σ	ADDER
$\triangleright$	AMPLIFIER/BUFFER
1 	MONOSTABLE MULTIVIBRATOR (ONE-SHOT)
&	AND GATE
≥ 1	OR GATE
$= 1$	EXCLUSIVE OR GATE
$X \rightarrow Y$	ENCODER, DECODER
$X_{MAX} \rightarrow Y$	PRIORITY ENCODER
	SCHMITT TRIGGER
ALU	ARITHMETIC AND LOGIC UNIT
CTR	COUNTER
DEMUX	DEMULTIPLEXER
FF	FLIP-FLOP
MUX	MULTIPLEXER
RAM	RANDOM-ACCESS MEMORY
REG	REGISTER
ROM	READ-ONLY MEMORY
SAR	SUCCESSIVE APPROXIMATION REGISTER
SR	SHIFT REGISTER

FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (4 OF 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

LINE LABELS

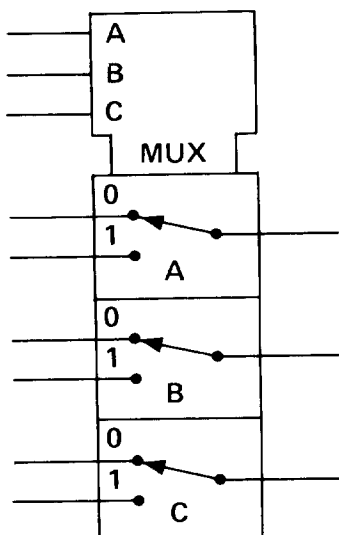
	SHIFT LEFT (OR UP)
	SHIFT RIGHT (OR DOWN)
+1	COUNT UP
-1	COUNT DOWN
=0, -1	BORROW OUTPUT
=9, +1	CARRY OUTPUT (DECIMAL COUNTER)
=15, +1	CARRY OUTPUT (BINARY COUNTER)
A _n	n TH ADDRESS BIT (ROM, RAM)
C	CLOCK INPUT
D	DATA OR DELAY INPUT (FLIP-FLOP)
D _n	n TH DATA BIT INPUT
EN	ENABLE
F	3-STATE ENABLE INPUT (SEE "DEPENDENCY")
G	GATING INPUT (SEE "DEPENDENCY")
J	J-K FLIP-FLOP J INPUT
K	J-K FLIP-FLOP K INPUT
LD	LOAD ENABLE INPUT (SYNCHRONOUS)
PS	PRESET INPUT (ASYNCHRONOUS)
R	RESET OR CLEAR INPUT
RD	READ ENABLE INPUT (RAM, ROM)
S	SET INPUT
SEL	LINE OR FUNCTION SELECT INPUT
SER	SERIAL DATA INPUT (SHIFT REGISTER)
T	TRIGGER INPUT (MONOSTABLE)
WR	WRITE ENABLE INPUT (RAM)
Y _n	n TH DATA BIT OUTPUT OR I/O
3-ST (placed by function label)	3-STATE

FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (5 OF 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

NOTES

1. The suffix or subscript 0 denotes the least significant bit (LSB) or a data or address word.
2. Letters may be used to identify a line or logic element without indicating a specific logic function. For example:

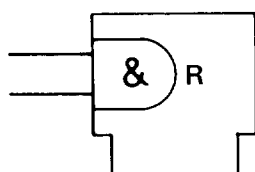


Triple 2-Channel Multiplexer

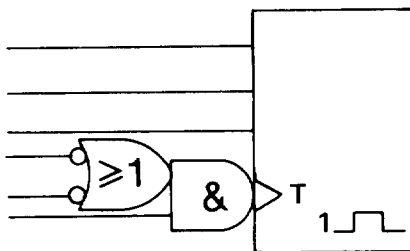
Letters are used to relate control inputs to logic elements. The numerals 0 and 1 indicate 0-state and 1-state, respectively, and relate the position of a "switch" to the logic state of the corresponding control line.

DEPENDENCY (G and F)

The dependency of inputs or outputs on an input is indicated with gate symbols or the G line label. Gate symbols are often used when the dependency exists between inputs. Two examples are:



Two inputs
ANDed to
produce a reset



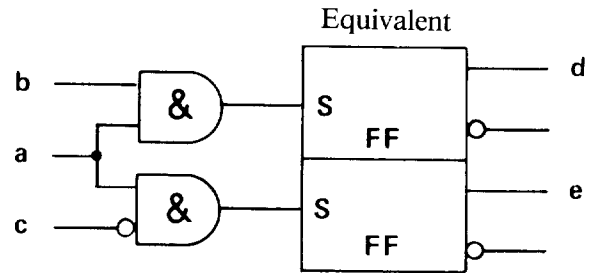
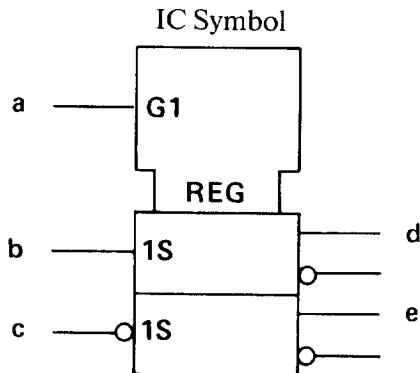
Three inputs
gated to
produce a
trigger

FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (6 OF 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

When the G label is used, the gating input is labelled with a G followed by a numeral or letter. The line labels of the gated inputs or outputs are prefixed with the same numeral or letter. Two examples are:

2-Bit Register



2-to-4-Line Decoder

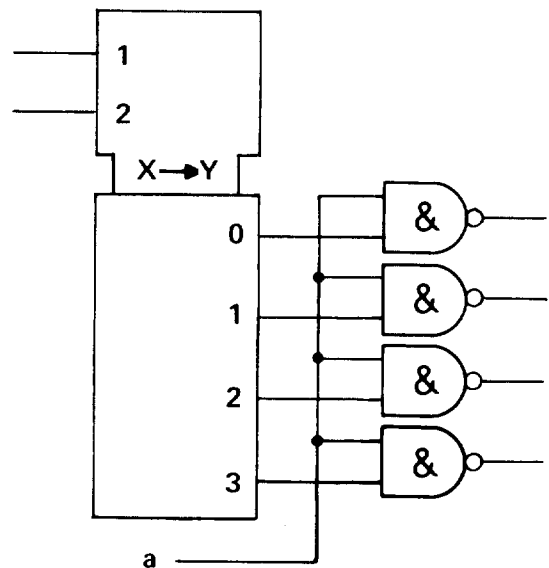
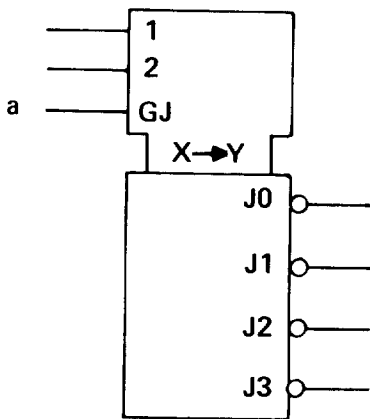
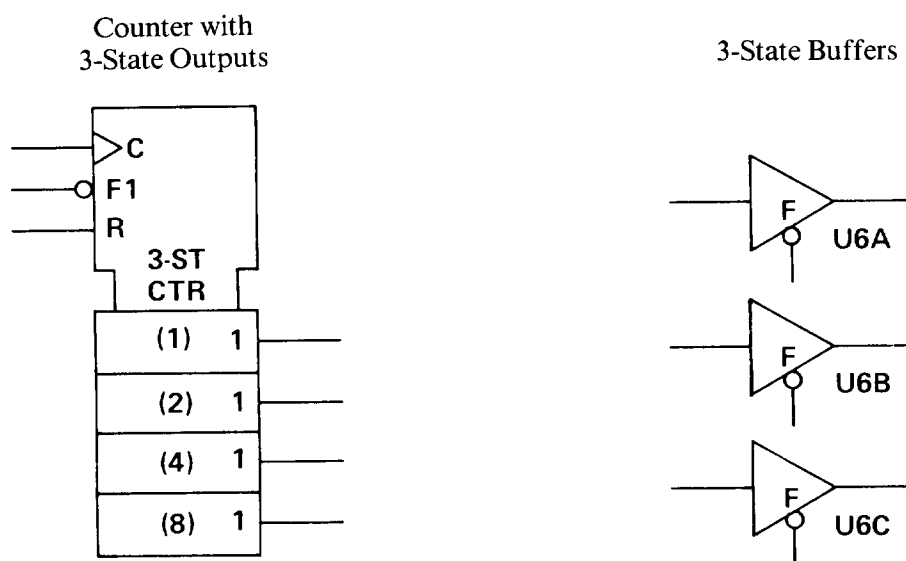


FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (7 OF 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

The F line label is used to indicate 3-state logic. The 3-state enable input is labelled with an F and numerals or letters are used as with the G label:



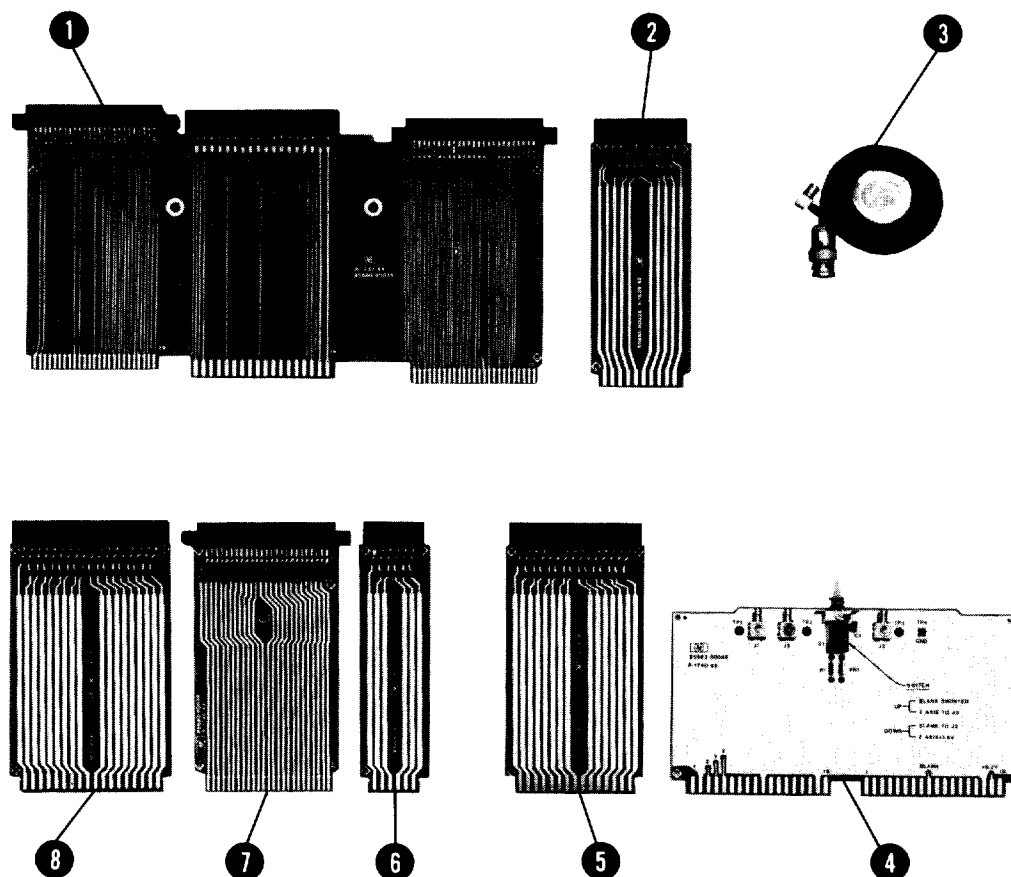
WEIGHTING OF INPUT AND OUTPUT LINES

The coding of multiplexers, demultiplexers, encoders, and decoders is shown by decimal weighting. An example is the 2-to-4 line decoder shown on the previous page.

WEIGHTING OF FLIP-FLOPS

When the position of a flip-flop in an array is significant (as in counters and shift registers), the flip-flop is labelled with its decimal weight. An example is the "Counter with 3-State Outputs" shown above.

FIGURE 6. SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (8 OF 8)



Item	Qty	Description	HP Part Number
1	1	Extender Board: A12 RF Section Interface	85680-60035
2	1	Extender Board: 20 contacts; 2 rows of 10	85680-60028
3	2	Cable: 4-foot long; BNC to SMB snap-on	85680-60093
4	1	PC Board: Display Adjustment Test	85662-60088
5	1	Extender Board: 30 contacts; 2 rows of 15	08505-60041
6	2	Extender Board: 12 contacts; 2 rows of 6	08505-60109
7	2	Extender Board: 50 contacts; 2 rows of 25	85680-60034
8	2	Extender Board: 36 contacts; 2 rows of 18	08505-60042

FIGURE 7. SERVICE ACCESSORIES

SIGNATURE ANALYSIS GENERAL DESCRIPTION

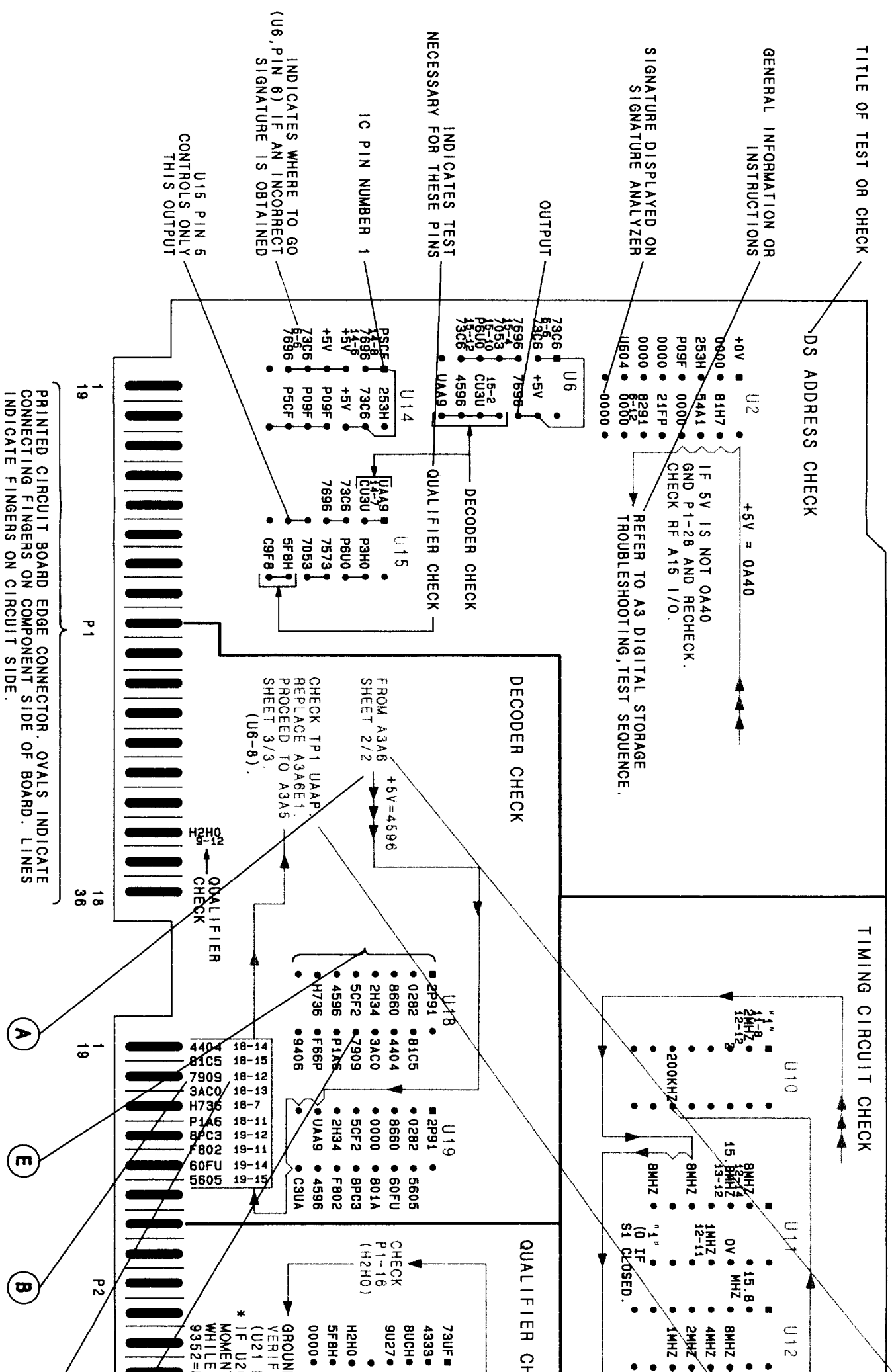
This instrument is designed to incorporate signature analysis. Troubleshooting the instrument using signature analysis requires the use of an HP Model 5005A, 5005B, or 5006B Signature Analyzer. The signature analyzer is a service tool that receives signals via a probe from the circuit under test, compresses them, and displays the result in the form of a digital signature that corresponds to specific data nodes in the circuit under test. For a complete description of signature analyzer operation, refer to the HP 5005A, 5005B, or 5006B Signature Analyzer Operating and Service Manual.

Signature Analysis Troubleshooting Diagrams are included with the service sheets for the A12 Front-Panel Interface, the A15 Controller, the A17 Frequency Counter, and the A22 Frequency Control assemblies. Refer to the following Signature Analysis Troubleshooting instructions as a guide for the use of the Signature Analysis Troubleshooting Diagram.

SIGNATURE ANALYSIS TROUBLESHOOTING DIAGRAMS FORMAT

1. Connect signature analyzer and set controls according to diagram instructions.
2. Set up test configuration as indicated in the diagram, such as jumpering test points or removing test jumpers.
3. Verify the +5Vdc signature for the test being performed as indicated in green lettering on the main verification path (GREEN LINE). This signature can be verified by probing the +5Vdc. If +5Vdc signature is incorrect, first check equipment settings and connections. Then check for activity at CLOCK, START, and STOP connections using signature analyzer probe. If there is no activity, refer to assembly schematic for troubleshooting.
4. Begin probing the printed circuit board at the beginning of the green line on the diagram. (Point A in the sample.)
5. Probe every point indicated by the green line.
6. If a signature at a node is incorrect (Point B in sample), the node is suspect. Information printed in red on the troubleshooting diagram is helpful for tracing the problem to its source. Location instruction (Point C) indicates the source of the signal to that node. For example, "18-12" indicates that the signature originates at U18 pin 12.
7. Check signature at new location (D). If signature is still bad, use schematic to locate input pin(s) related to that output (E). A red line connecting the input to the output indicates that the output is affected by only that input. A black line represents an electrical connection between IC pins.
8. Verify signatures to all IC pins connected to a suspect node. If all signatures for a circuit node are not identical, the printed circuit board, connectors, and solder joints should be checked for faults. After locating the faulty source node, proceed with conventional troubleshooting.
9. Before replacing any suspected defective component, follow instructions printed in red on the troubleshooting diagram. These troubleshooting instructions are usually referenced by an asterisk (*).

**A3A7
INTERFACE
85662-60127**



SPECTRUM ANALYZER OVERALL TROUBLESHOOTING

The information in the Spectrum Analyzer Overall Troubleshooting Section is organized as follows:

- Troubleshooting Index

 - Troubleshooting information locations

- Special Messages

 - CRT Messages description

- Diagnostic Function

 - Front Panel Diagnostic Functions descriptions

- Error Correction Routine

 - Error Correction Routine description

- Sweep System

 - Sweep System circuit description and troubleshooting information

- Overall Block Diagram (including mnemonics listing)

TABLE 1. TROUBLESHOOTING INDEX (1 OF 2)

Troubleshooting Information	Tab Title	Vol.
Center Frequency Tuning Equations and Phase Lock	RF Section Analog Troubleshooting Block Diagram	1
Diagnostic Functions	Spectrum Analyzer Overall Troubleshooting	1
Digital Storage	A3 Digital Storage	2
Display System	Spectrum Analyzer Overall Troubleshooting A1 Display Section Block Diagram	1 2
Error Correction Routine	Spectrum Analyzer Overall Troubleshooting	1
RF Section Digital (includes INSTR CHECK LEDs)	A3 Digital Storage RF Section Digital Troubleshooting A15 Controller	2 1 1
Special Messages	Spectrum Analyzer Overall Troubleshooting	1
Sweep System	Spectrum Analyzer Overall Troubleshooting	1
A1A1 Keyboard	A12 RF Section Interface	1
A3 Digital Storage	Spectrum Analyzer Overall Troubleshooting A3 Digital Storage	1 2
A3A1 Trigger*	Spectrum Analyzer Overall Troubleshooting (Sweep System) A3 Digital Storage	1 2
A3A2 Intensity Control*	A1 Display Section A3 Digital Storage	2 2
A3A3 Line Generator*	A1 Display Section A3 Digital Storage	2 2
A3A4 Memory*	A1 Display Section A3 Digital Storage	2 2
A3A5 Data Manipulator* A3A6 Main Control* A3A7 Interface*	A3 Digital Storage	2
A3A8 Analog-Digital Converter*	Spectrum Analyzer Overall Troubleshooting (Sweep System) A1 Display Section A3 Digital Storage	1 2 2
A3A9 Track and Hold*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions) A1 Display Section A3 Digital Storage	1 2 2

TABLE 1. TROUBLESHOOTING INDEX (2 OF 2)

Troubleshooting Information	Tab Title and/or Location	Vol.
A4A1 Video Processor* A4A2 Log Amplifier-Detector* A4A3 Log Amplifier-Filter* A4A4 Bandwidth Filter A4A5 Step Gain* A4A6 Down/Up Converter* A4A7 3 MHz Bandwidth Filter A4A8 Attenuator-Bandwidth Filter* A4A9 IF Control*	Spectrum Analyzer Overall Troubleshooting (Error Correction Routine)	1
A5 Front Panel	A12 RF Section Interface A15 Controller	1 1
A6 YTO Phase Lock* A8 249 MHz Phase Lock* A11 50 MHz Voltage-Tuned Oscillator	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions)	1
A12 RF Section Interface*	Spectrum Analyzer Overall Troubleshooting (Sweep System) A15 Controller	1 1
A15 Controller*	Spectrum Analyzer Overall Troubleshooting (Sweep System)	1
A17 Frequency Counter*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions) RF Section Digital Troubleshooting	1 1
A22 Frequency Control*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions, Sweep System)	1
A23 RF Converter	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions, Error Correction Routine)	1
*Troubleshooting information is also located behind the tab having the same title as that listed in this table.		

SPECIAL MESSAGES

As a convenience to the operator and an aid in servicing, ten messages can appear in the upper right corner of the CRT display. (Seven of these messages are shown in Figure 1.) Five of the messages inform the operator of possible erroneous data from improper instrument operation. The other five provide warnings of instrument malfunctions that must be repaired for proper instrument operation.

A brief description of each message follows. The troubleshooting information listed is not meant to be exhaustive. Refer to the appropriate Troubleshooting tab and Troubleshooting Hints for more detailed information.

EXT REF

Indication to operator that the external frequency reference is selected. (When the external reference is selected on the rear panel, the external 10 MHz signal must be present before any front panel, display, or HP-IB functions will operate.)

MEAS UNCAL

A warning to the operator that the amplitude/frequency data on the CRT is invalid because the analyzer's sweep speed is too fast for the selected bandwidth.

*

A warning to the operator that the analyzer settings displayed on the CRT have been changed but the trace data has not been updated. This would occur, for example, when Trace A view is selected and then Center Frequency is changed.

OVEN COLD

Indication that the frequency reference oven temperature is too low. There will be an oven cold indication normally for about 10 minutes after the line power is initially applied to the instrument. (The oven is powered and should stay warm as long as the instrument is in standby.) The time base Oven Mtr output is detected on A24 and the HOVC (High Oven Cold) signal is routed to the A12 RF Section Interface.

BATTERY

A warning to the operator that the CMOS memory on A15 Controller has probably lost its stored instrument states. The warning can only appear at instrument turn-on. If it appears, the instrument will automatically reinitialize all the instrument states to the instrument preset condition. Removing the A15 Controller assembly or performing the "long POP" instrument check (see RF Section Digital Troubleshooting) will erase the stored instrument states and cause a battery warning to appear at instrument turn-on. If the HP-IB address has been changed from the front panel, the HP-IB address is also lost.

275 UNLOCK

The 275 MHz phase lock loop is unlocked. Items to check are:

- 275 MHz mixer, phase detector, amplifier, and lock detector on A21 275 MHz Phase Lock (275 MHz TUNE voltage on A18TP1)
- A18 275 MHz Phase Lock Oscillator output at A18J3
- 5 MHz input (A11J1) from A11 50 MHz Voltage-Tuned Oscillator (VTO)
(VTO operation can be verified from the front panel by using   (KSN) which directly counts and displays the VTO frequency.)
- 280 MHz input (A20J3) from A20 Third Converter

249 UNLOCK

The 249 MHz phase lock loop is unlocked. Items to check are:

- Frequency divider, phase detector, amplifier, and lock detector on A8 249 MHz Phase Lock (249 MHz TUNE voltage on A7TP1)
- A7 249 MHz Phase Lock Oscillator output at A7J2
- A18 275 MHz Phase Lock Oscillator output at A18J1 Oscillator

VTO UNCAL

The analyzer was unable to tune the A11 50 MHz VTO to the required frequency. Items to check are:

- VTO tune DACs on A22 Frequency Control (50 MHz TUNE voltage on A22TP9)
- A11 50 MHz VTO output at A11J2
- VTO amplifier/multiplexer on A17 Frequency Counter (See front-panel Diagnostic Function keys to directly set the VTO DACs and to monitor the VTO frequency.)

YTO ERROR

The YIG-Tuned Oscillator (YTO) did not tune close enough to the required center frequency. The A15 Controller had to offset the YTO DAC on A22 by more than 9 MHz from its proper setting. Items to check are:

- YTO tune DAC and drivers on A22 Frequency Control (YTO Tune voltage at A22TP6)
- A23A1 YTO output. (Output can be monitored at rear-panel connector J2, 1st LO OUT. Tune DAC can be set using   (KSJ).)
- Pilot RF to IF converter A23
- A9 Pilot Second IF Amplifier and A10 Pilot Third Converter
- A6 YTO Phase Lock, Pilot IF output to A17 Frequency Counter   (KSK)
- A7 249 MHz Phase Lock Oscillator

YTO UNLOCK

The YTO Phase lock loop did not phase lock. Items to check are:

- A6 YTO Phase Lock (YTO LOCK voltage at A6TP4)
- Pilot converter chain and comb generator (A23, A9, and A10)
- A7 249 MHz Phase Lock Oscillator output at A7J2

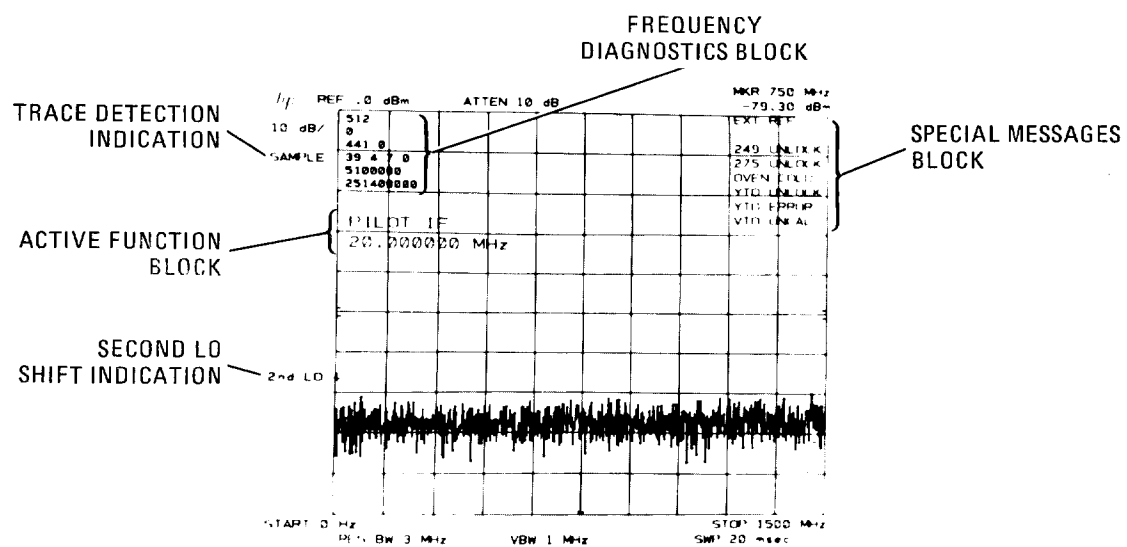


FIGURE 1. CRT LOCATIONS OF SPECIAL MESSAGES AND DIAGNOSTIC FUNCTION INDICATORS

DIAGNOSTIC FUNCTIONS

The Diagnostic Functions are accessible through the blue  key on the front panel. Through their use it is possible to trace many instrument malfunctions back to the functional block without removing any assemblies. A summary of the Diagnostic Functions follows. More information on their use can be found in the troubleshooting procedures

Frequency Diagnostics (KSR)

This function displays many of the internal frequency control parameters in the upper left corner of the CRT display. (See Figure 1.) These parameters are the programmed values determined by the A15 Controller. For example, following an , a   (KSR) might display the following values:

- (1) 387
- (2) 438
- (3) 439 – 2
- (4) 39 4 7 0
- (5) 5100000
- (6) 251400000

Line 1 is the setting of the least significant 50 MHz VTO Tune DAC A22U6. The setting varies from 0 to 1023.

Line 2 is the setting of the most significant 50 MHz VTO Tune DAC A22U9. The setting varies from 0 to 1023.

Line 3 contains two different numbers. The first is the programmed setting of the YTO Tune DAC A22U4. The setting varies from 0 for 0 Hz Center Frequency to 1023 for a 1739 MHz Center Frequency. The second number is the difference between the calculated YTO Tune DAC setting and the actual one needed to program the Center Frequency. A number larger than ± 4 would indicate that the A22 Frequency Control circuitry may need adjustment.

Line 4 contains four different numbers. The first number represents N, the harmonic of 20 MHz to which the analyzer's center frequency is locked. This number varies from 2 at a center frequency of 0 Hz to 89 at a center frequency of 1739 MHz. The next two numbers are the M and P numbers of the Variable Modulus Frequency Divider on the A8 249 MHz Phase Lock assembly. M varies from 0 to 5 and corresponds to 4-MHz steps in center frequency. P varies from 0 to 7 and corresponds to 500-kHz steps in center frequency. The last number is either a 0 or a 1; 1 indicates that the 2nd LO is shifted up 5 MHz in frequency (1753.6 MHz), and 0 indicates no 2nd LO shift (1748.6 MHz).

Line 5 indicates the frequency to which the A11 50 MHz VTO output has been programmed to be at center frequency. This is not a counted frequency. This frequency varies from 4.75 MHz to 5.25 MHz for frequency spans greater than 100 kHz and from 2.25 to 2.75 MHz for frequency spans less than 100 kHz.

Line 6 shows the frequency to which the processor has programmed the Pilot 3rd LO, the output of the A7 249 MHz Phase Lock Oscillator. This is not a counted frequency; the processor assumes that the 3rd LO frequency is exactly 280 MHz, so the actual Pilot 3rd LO frequency may vary at center frequency by up to 70 kHz – the accuracy of the 280 MHz oscillator. The displayed frequency for the Pilot 3rd LO varies from 238.75 MHz to 259.25 MHz.

Inhibit Phase Lock Flags (KSv) or A15TP8 (STS) jumpered to A14TP11 (T1)

This function permits the analyzer to sweep at normal sweep rates, ignoring any phase lock flag indications. For example, if a YTO UNLOCK problem exists, the analyzer might only sweep once every 30 seconds, since it spends most of its time trying to lock up the YTO at center frequency during retrace. By performing the phase lock inhibit function, the analyzer does not waste time trying to lock the YTO, so that the front-panel keys and

display can be used as in normal operation. Note, of course, that the displayed frequencies will probably not be accurate. In addition, when the phase lock inhibit function is implemented, a list of the special messages are displayed in the upper right corner of the display. (See Figure 1.)

Sometimes a YTO lock problem at turn-on will prevent the operator from performing a   (KSv) for about the first three minutes. In this case, a jumper can be placed from A15TP4 (STS) to A15TP1-4 (T1). When  is then pushed, the inhibit phase lock flags function is automatically implemented, and in addition the A17 Frequency Counter output is ignored. As long as the jumper is in place, the processor will substitute 20 MHz for all frequency counts instead of reading the actual counter output. To enable the Frequency Counter readings, the jumper is removed after  is pushed. If the analyzer then stops sweeping, troubleshoot A17 Frequency Counter.

Manual DAC Control (KSJ)

This function permits direct control of the frequency control DACs on A22 Frequency Control in the analyzer. This permits verification of these DACs that is easier and faster than trying to set them indirectly by varying the center frequency and span. When   (KSJ) is first pushed, all the DAC settings (YTO Tune DAC, 2 VTO Tune DACs, and Sweep Attenuator DAC) are set to 0. They can then be changed by turning the RPG to vary them continuously, using the step up and step down keys to vary them in a binary 1, 2, 3, 4, 8, 16, 32, ... sequence, or by keying in numbers directly on the keyboard. When using the numeric keyboard, the GHz units key updates only the Sweep Attenuator DAC, MHz units updates only the YTO Tune DAC, kHz updates the most significant VTO Tune DAC, Hz updates the least significant VTO Tune DAC. Note that after a units key is pressed, the DAC function reads out the most significant VTO Tune DAC. These DAC settings can be monitored by simultaneously displaying the Frequency Diagnostics using KSR.

Frequency Count at Marker

The A17 Frequency Counter can count the frequency of three different inputs: the Pilot IF, the Signal IF, and the 50 MHz VTO. Normally these counts at the Marker are used to calculate the RF input signal frequency, but by using the following shift functions the actual frequencies can also be displayed.

Count Pilot IF (KSK)

Counts and displays the Pilot IF frequency. In non-phase-locked modes (spans greater than 1 MHz), it will vary from approximately 8 MHz to 32 MHz. In phase-locked modes (spans less than or equal to 1 MHz), it should always be 20 MHz. This signal comes to A17 from A6 YTO Phase Lock assembly.

Count Signal IF (KSQ)

Counts and displays the Signal IF frequency. This signal is from the output of the log amplifiers in the IF-Display Section. At the peak of a signal, this frequency should be 21.4 MHz, and will vary as the marker is moved away from the peak.

Count VTO (KSN)

Counts and displays the A11 50 MHz VTO output. This frequency should be 25 MHz $\pm$ 3.8 MHz. At center frequency, it will be either 5 or 10 times higher than the final VTO output frequency as displayed on line 5 of the Frequency Diagnostics. For spans greater than 1 MHz, its frequency remains constant across the sweep; for spans less than 1 MHz, its frequency varies with the marker position.

RF SECTION

As an example, this can be used to check the tuning range of the VTO oscillator as follows:

- Use   (KSJ) to set the VTO Tune DACs to 0 kHz
- Use   (KSN) to verify the high-end frequency of the VTO
- Use   (KSJ) and set VTO Tune DACs to 1012 kHz
- Use   (KSN) to verify the low-end frequency of the VTO

Sweep Time Measure (KSF)

This function is used to measure the sweep times (less than 75 sec) of the analyzer. By using KSF to display the sweep generator time, it can be determined if the A22 Sweep Generator is properly responding to its control settings. A small amount of start-up time (1 to 5%) is included in this measurement, and it must be subtracted to determine the exact sweep times. This function is also useful in troubleshooting the A17 Frequency Counter. By setting a 1500-sec sweep time and pushing   (KSF), the counter will count a fixed 1 MHz clock for 25 minutes. This enables a straightforward checking of the multiplexer, counters, and bus drivers on A17.

Second LO Shift Control (KSU)(KST)

Three functions can be used to control the 5 MHz Second LO shift, which normally is automatically switched by the controller depending on center frequency and span. The state is indicated on the left side of the CRT display. (See Figure 1.) The 2nd LO output can be monitored at A23A3J3.

-   (KSU) forces the 2nd LO to shift up (1753.6 MHz)
-   (KST) forces the 2nd LO to shift down (1748.6 MHz)
-   (KSS) forces the control back to auto and removes the CRT indication

Note that spurious responses may appear on the display when the LO shift is being controlled by   (KSU) or   (KST).

Trace Detection

Three different sampling modes are used by the analyzer in converting the video signal; these are positive peak, negative peak, and sample. Normally the analyzer selects the proper mode for each measurement, but these can be manually selected to verify proper operation. The mode selected is indicated on the upper left side of the CRT display when under manual control. (See Figure 1.) For example, a signal could be expanded to 2 dB/div to eliminate the noise floor, and then, by comparing a positive peak trace measurement, it can be determined if the gains and offsets of the three modes are properly aligned. All three should appear the same on a stable, noise-free signal. When in the noise, the positive peak should display the highest noise peaks, negative peak mode should display the lowest noise levels, and sample mode should display values between the positive and negative peaks.

-  Trace A  (KSb) displays positive peaks
-  Trace A  (KSd) displays negative peaks
-  Trace A  (KSe) displays sampled data
-  Trace A  (KSa) returns to the normal automatic detection modes and removes the CRT indication.

ERROR CORRECTION ROUTINE

The internal Error Correction Routine available by pressing **SHIFT** **FREQUENCY SPAN** (KSW) is also useful as a diagnostic aid. If a malfunction causes it to stop, restart it and note the control settings (RES BW, ATTN, REF LEVEL, LOG/LIN, etc.) when the failure occurred. If the routine runs, the correction factors can be displayed by pressing **SHIFT** **LINE** (KSw). Figure 2 displays the data for a typical instrument. Table 2 gives the parametric information, specifications, and a place to start the troubleshooting procedure.

Caution must be exercised in interpreting the correction factor data. Wrong conclusions can be reached by not understanding how the internal program runs. The program assumes that the input signal level is -10 dBm. Any error in this level will translate to the correction factors. Thus the Amplitude Accuracy test **RECALL** **8** should be performed first. The internal program runs in the LIN mode while **RECALL** **8** is in 1 dB/LOG mode. Thus large offsets in LOG/LIN offset (lines 1 and 14) will cause errors in the data.

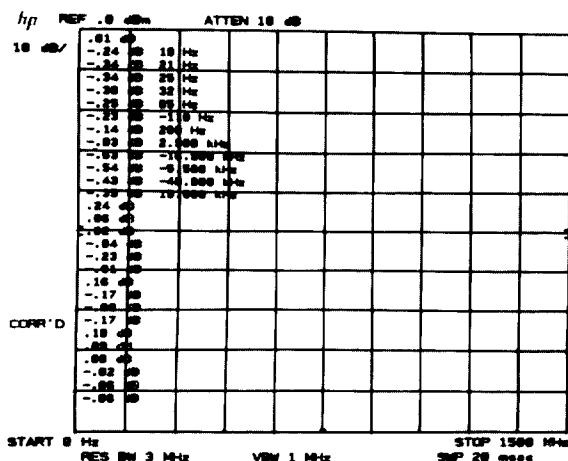


FIGURE 2. ERROR CORRECTION ROUTINE DATA

TABLE 2. ERROR CORRECTION ROUTINE PARAMETERS

Line	Parameter	Specification	Troubleshooting Information
1	LOG and LIN scale, BW <100 kHz	± 1 dB typical	A4A3/A4A2
2	RES BW = 10 Hz	± 1 dB*	}
3	30 Hz	}	
4	100 Hz		
5	300 Hz		
6	1 kHz		
7	3 kHz		
8	10 kHz		
9	30 kHz		}
10	100 kHz		
11	300 kHz		
12	1 MHz	*	}
13	3 MHz		
14	LOG and LIN scale, BW ≥ 100 kHz	± 1 dB*	A4A3/A4A2
15	2nd local oscillator frequency shift	± 1 dB typical	A23
16	30 dB gain	}	A4A3/A4A2
17	20 dB gain		}
18	10 dB gain		
19	50 dB step gain errors 40 dB step gain errors 30 dB step gain errors 20 dB step gain errors 10 dB step gain errors 0 dB step gain errors – 10 dB step gain errors – 20 dB step gain errors	}	A4A5
20			
21			
22			
23			
24			
25			
26			
27	offset error 2 dB/LOG offset error 5 dB/LOG offset error 10 dB/LOG	}	A4A1
28			
29			
30	RF attenuator correction factor		A5AT1

* Specifications for all Resolution Bandwidths are referenced to the 1 MHz Resolution Bandwidth. The frequency error terms are for error correction only.

SWEEP SYSTEM CIRCUIT DESCRIPTION

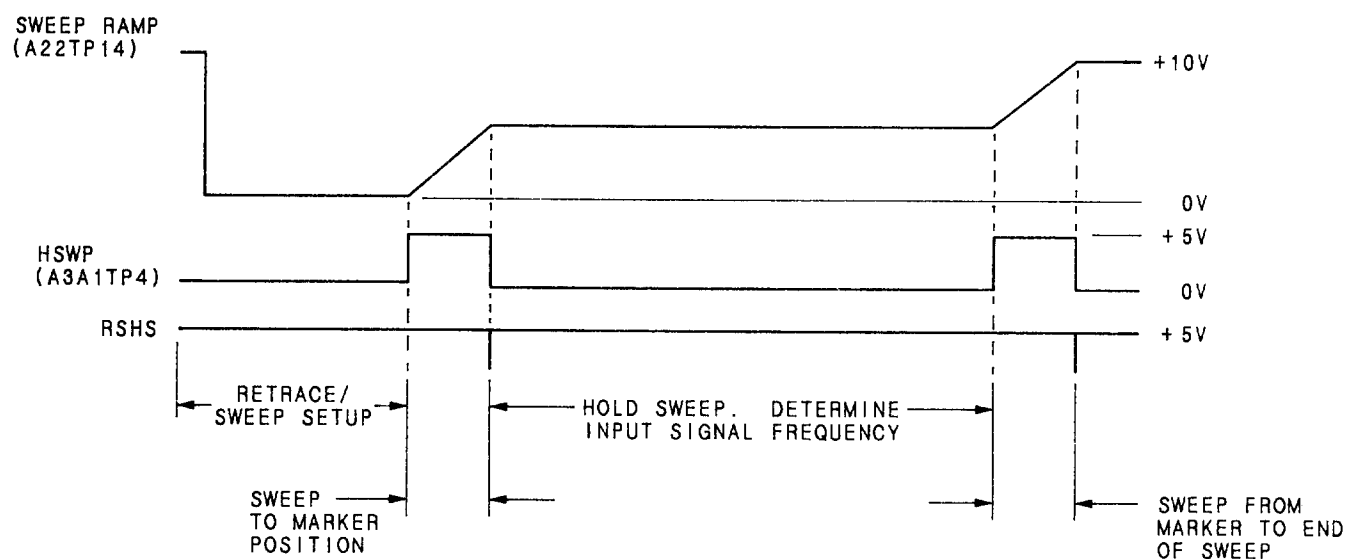
The HP 8568B Spectrum Analyzer sweep system consists of the following modes:

Continuous Sweep; Free Run Trigger

Several different assemblies are involved in the HP 8568B sweep system. A sweep generator portion of the A22 Frequency Control generates the 0V to 10V sweep ramp. The ramp converter on the A3A8 Digital Analog Converter and the Digital Storage Processor digitize this ramp into a 10-bit sweep address. When the sweep address reaches the marker address, the Digital Storage Processor outputs a RSHS (Low = Reset High Sweep) pulse. This signal resets the High Sweep flip-flop on the A3A1 Trigger assembly. HSWP (High Sweep) goes low and the current source charging the sweep capacitor on A22 is shunted to ground, stopping the sweep ramp at its present value. The negative transition on the HSWP line generates a service request on A12 RF Section Interface, forcing LSRQ low which sets LSTP (Low Stop) high. This "wakes up" the A15 Controller. The Controller then reads the sweep address from the Digital Storage Processor. If it corresponds to the end of the sweep, the A15 Controller outputs a sweep reset command to the sweep generator on A22, resetting the sweep ramp to 0V. After all service requests have been handled (LSRQ is high), the A15 Controller starts the sweep by issuing a set HSWP command to the A3A1 Trigger. The A15 Controller then issues a stop command to the A12 RF Section Interface assembly that forces LSTP low, stopping the Controller. After a 500 μ sec delay on A3A1, HSWP goes high, the sweep ramp starts, the Digital Storage assembly starts digitizing the ramp, and the front-panel SWEEP LED turns on, indicating that a sweep is in progress.

Frequency Count at Marker

If the HP 8568B Frequency Counter is on, the Digital Storage Processor will stop the sweep, as described above, when the sweep address reaches the marker address. When the A15 Controller wakes up and reads the sweep address, it recognizes that it is not at the end of the sweep (Address < 1000), so it does not reset the sweep generator. Instead, it determines the input signal frequency, resets the Digital Storage marker address to the end of sweep, and then restarts the sweep by issuing the same set HSWP command and stopping itself as before. See Figure 3 for an example of the sweep system timing.



INSTRUMENT CONTROL SETTINGS: INSTRUMENT PRESET, MARKER NORMAL AND FREQUENCY COUNT

FIGURE 3. SWEEP SYSTEM TIMING EXAMPLE

Triggered Sweep

The triggered sweep modes are very similar to free run operation except that instead of the A15 Controller outputting a set HSWP command to the A3A1 Trigger Board, it outputs a trigger enable command. The output of the trigger-select circuit (line, external, or video) then clocks the HSWP line high.

Single Sweep

The single sweep mode is useful in troubleshooting the sweep system because it does not rely on feedback from Digital Storage before resetting the sweep generator. Whenever the  key is pressed, the A15 Controller resets the sweep generator and then sets HSWP high through A3A1. Digital Storage then stops the sweep when it has reached the end and the ramp stays at 10V until the  key is again pressed.

Fast Sweep

Fast sweep is enabled only for 0 Hz frequency spans and sweep times less than 20 msec. HSWP is forced low, and the A22 sweep generator is not used. See A3A1 for a description of the fast sweep operation.

Service Requests

Any of the service requests on A12 will force LSRQ low, which forces HSWP low. For example, when a front-panel key is depressed a keyboard service request is generated, LSRQ goes low, LSTP goes high, and HSWP goes low, stopping the sweep. Depending on which key was pressed, the A15 Controller will either continue the sweep or reset it and start a new sweep. Note that the analyzer cannot sweep if any service requests are present.

SWEEP SYSTEM TROUBLESHOOTING

The following procedure is an aid to rapidly isolate sweep system malfunctions. When the malfunction has been traced to a single assembly, check the service sheets for that assembly for a more thorough troubleshooting procedure.

Isolate the Sweep Generator

Disconnect the ramp from A3A8J1 and jumper A3A8TP1 to A3A8TP2. This forces the ramp comparator output high. The Digital Storage should continue to process data and increment the sweep address. The HSWP light should be flashing and HSWP should have an approximately 16-msec pulse width. (Note that the instrument preset state may appear to be functioning properly but will become distorted as the sweep time is slowed down.) If this works, the Digital Storage and A15 Controller, A12 RF Section Interface, and A3A1 Trigger assemblies are operating properly. Suspect the sweep generator on A22 Frequency Control or ramp converter on the A3A8 Analog Digital Converter. To further isolate the sweep generator, reconnect the sweep ramp to A3A8J1 and remove the jumper. Set the sweep time to 1 sec and press the single sweep key. The ramp waveform will start at greater than 10V, go to 0V when single sweep key is pressed, and ramp back up to greater than 10V. If the ramp waveform is correct, check the A3A8 ramp converter. Otherwise, check the sweep generator on A22.

Isolate the Phase Lock Service Requests and Frequency Counter

Jumper A15TP4 (STS) to A15TP1-4 (T1) and push . This causes the A15 Controller to gate out all phase lock errors and to ignore the A17 Frequency Counter output. (20 MHz is substituted for all frequency counts.) The system should now sweep repetitively, although the frequency will not be accurate. If the system stops sweeping when the jumper is removed, troubleshoot A17. See Diagnostic Functions for a more detailed description of this function.

Isolate Digital Storage Processor if HSWP Stays High (SWEEP LED ON)

With the sweep ramp disconnected from A3A8J1 and A3A8TP1 jumpered to A3A8TP2, check RSHS output for the presence of 60-nsec low pulses. (The logic probe of the Signature analyzer can be used to detect them.) If present, check A3A1. If not, check the Digital Storage Processor.

Isolate A12 RF Section Interface if HSWP Stays Low (SWEEP LED OFF)

With the A15TP4 to A15TP1-4 jumper in place, check the LSRQ output. It should be high. If it is not, find out which input is requesting service. Troubleshoot A12 using the Signature Analyzer diagrams.

See A3A1 Trigger Troubleshooting Procedure

Note that the A3A1 assembly also generates and controls the fast sweep timing (sweeps less than 10 msec).

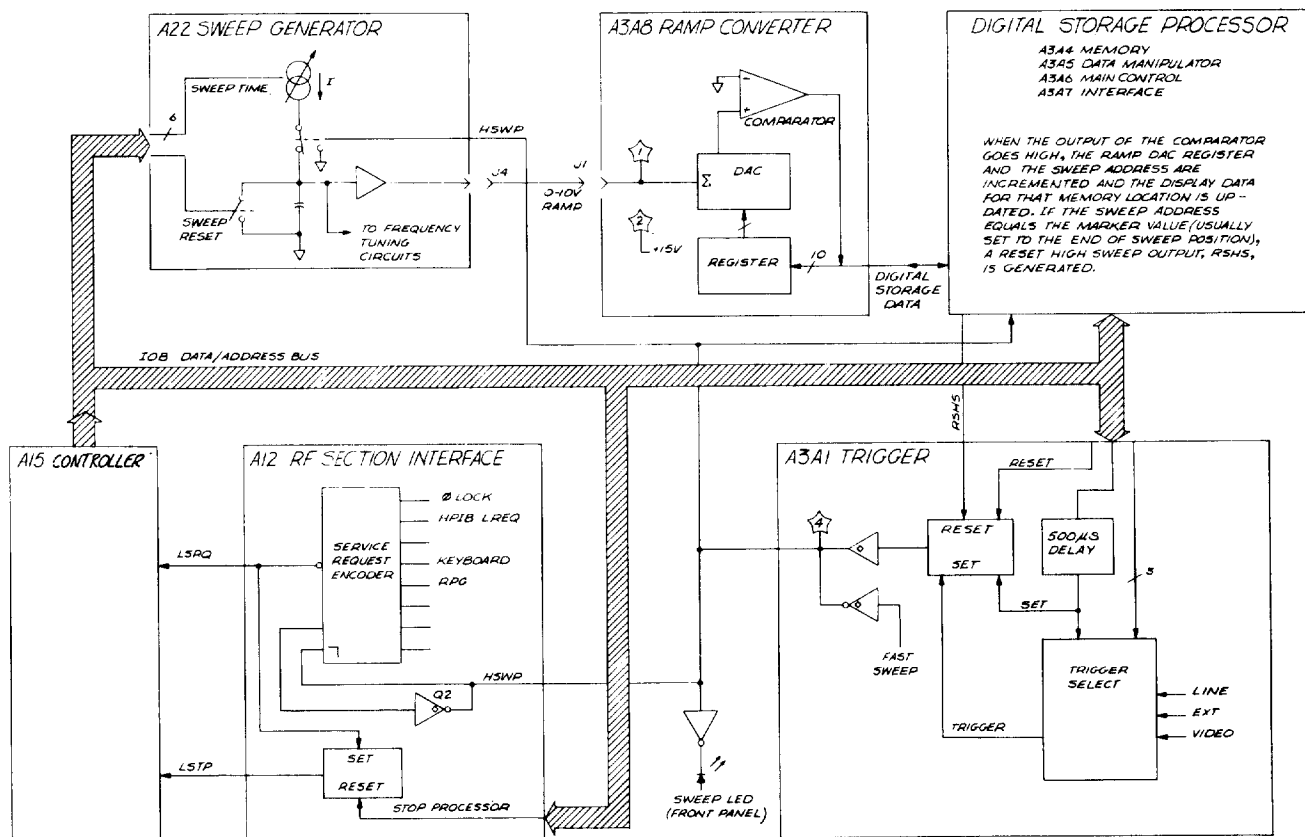
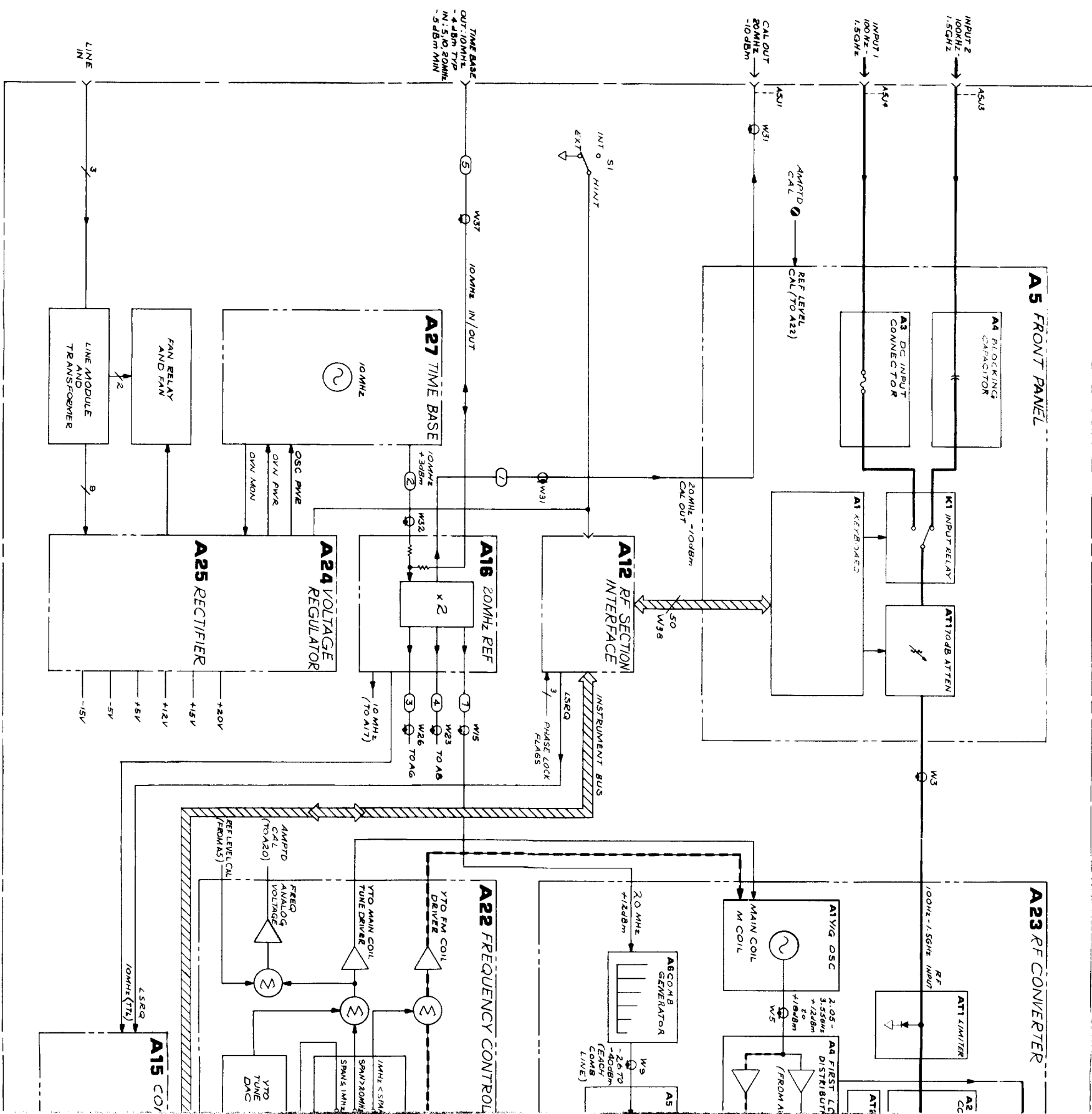


FIGURE 4. SWEEP SYSTEM BLOCK DIAGRAM

RF SECTION



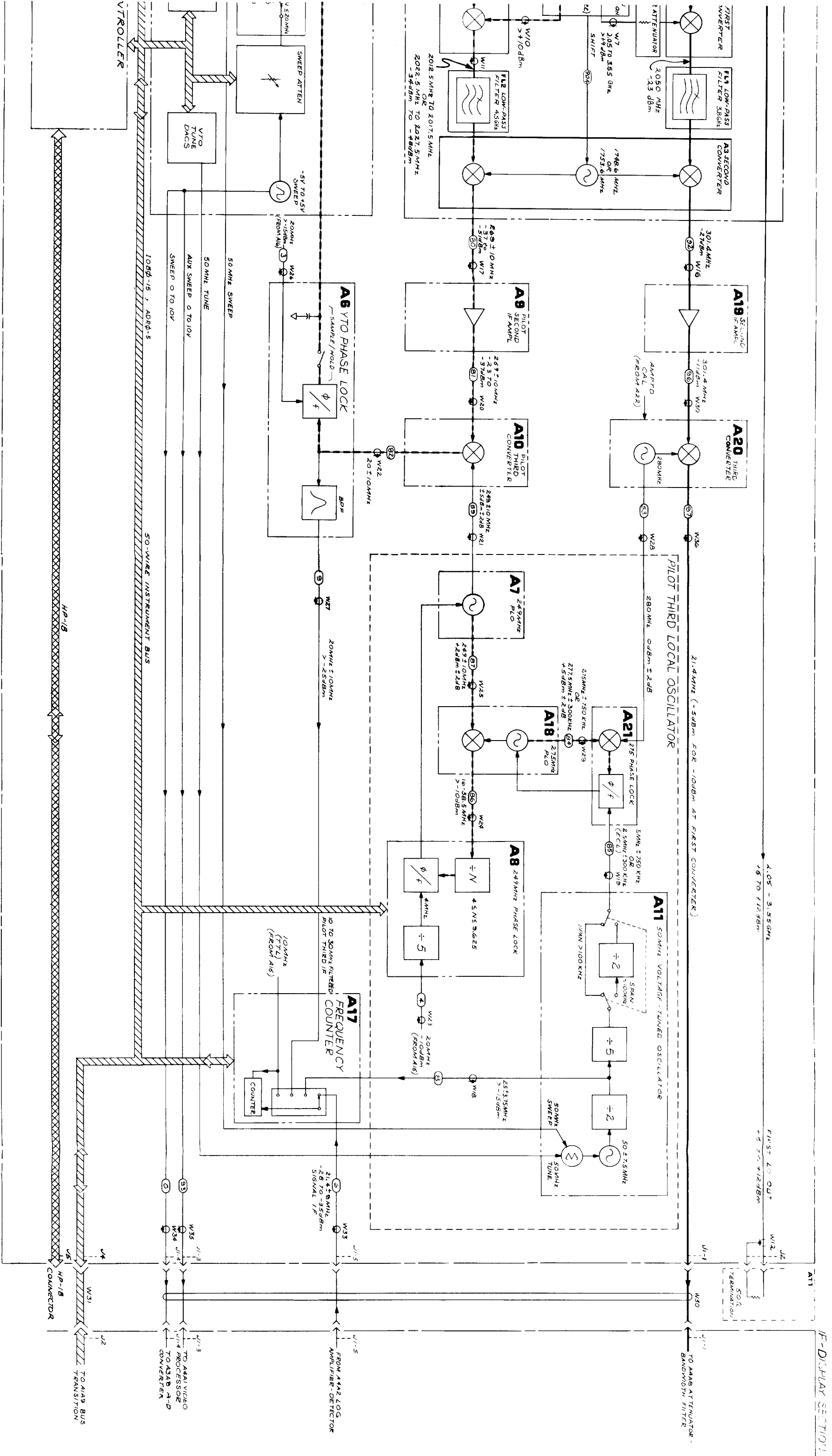


FIGURE 5. SPECTRUM

NOTE
1. UN
L₁
L₂
F₁
F₂
AC
4N

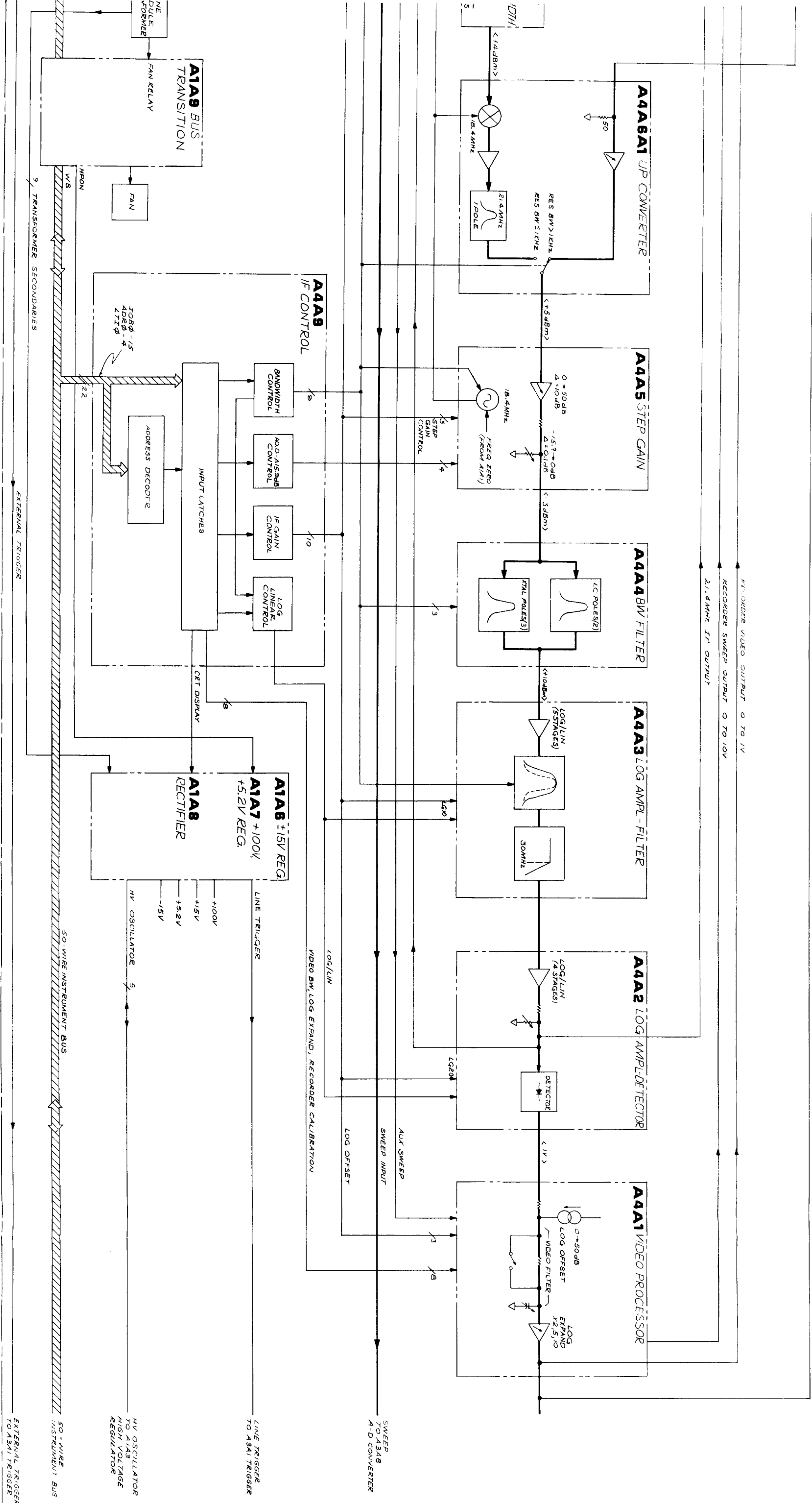
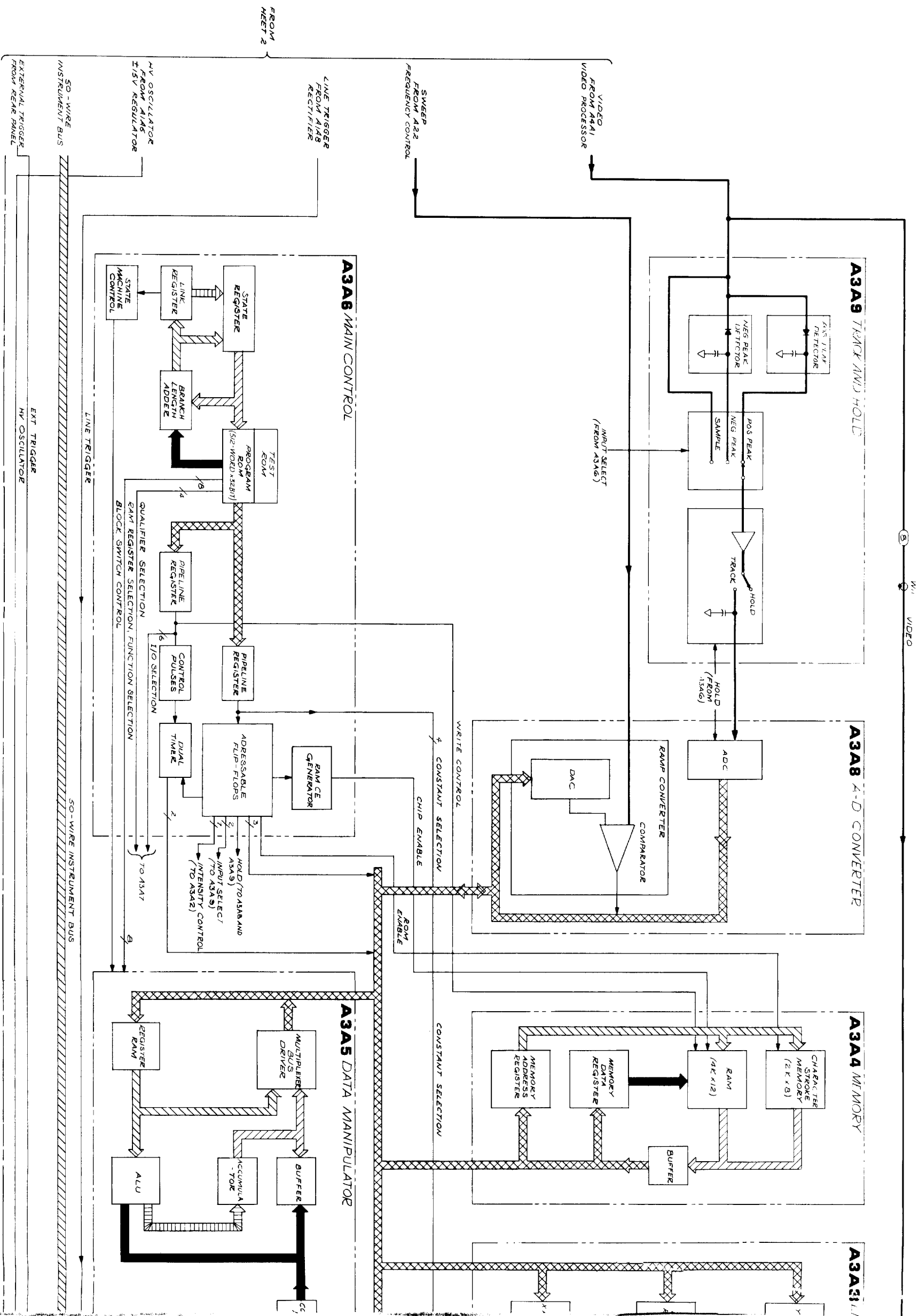
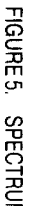


FIGURE 5. SPECTRUM

IF DISPLAY SECTION





RF SECTION ANALOG TROUBLESHOOTING

CENTER FREQUENCY TUNING EQUATIONS AND PHASE LOCK TROUBLESHOOTING

With an understanding of how the center frequency and the counts at marker are derived, troubleshooting of the phase lock loops is much easier. Phase lock troubleshooting is also simplified by the use of the Diagnostic Functions.

Figure 1 shows a simplified block diagram of the assemblies involved in setting the center frequency. The HP 8568B has two tuning modes. For frequency spans greater than 1 MHz, a method called lock and roll is used. Basically, this involves phase locking the analyzer at the center frequency only during the retrace period of a sweep. A more thorough description of this technique is included in the A6 YTO Phase Lock Troubleshooting. For frequency spans of 1 MHz and less, the analyzer is phase locked during all of a sweep.

The equation for center frequency is

$$f_{CF} = 20 \text{ MHz} \cdot N + f_{PILOT} - f_{VTO} - (9 - M + .125P) \cdot f_{REF} - f_{IF}$$

where

f_{CF} = Center Frequency

f_{PILOT} = Pilot IF-frequency. Use KSK to count. Range is approximately 8 MHz to 32 MHz.

f_{VTO} = 50 MHz VTO frequency divided by either 20 (for frequency spans of 100 kHz or less), or 10 (for spans greater than 100 kHz). KSN counts the 50 MHz VTO frequency divided by 2. The range is 25 MHz $\pm$ 3.75 MHz.

f_{REF} = 4 MHz

f_{IF} = Signal IF frequency. Use KSQ to count.

N = Harmonic for 20 MHz comb to which analyzer is locked. KSR displays value of N which varies from 2 to 89.

M, P = Divide number used by A8 Phase Lock assembly. KSR displays values. M varies from 0 to 5 while P varies from 0 to 7.

As an example, these values are used following an INST
PRESET.

$$f_{PILOT} = 20 \text{ MHz}$$

$$f_{VTO} = 5.1 \text{ MHz}$$

$$N = 39, M = 4, P = 7$$

Substituting these values into the equation:

$$f_{CF} = 20 \text{ MHz} \cdot 39 + 20 \text{ MHz} - 5.1 \text{ MHz} - (9 - 4 + .125 \cdot 7) \cdot 4 \text{ MHz} - 21.4 \text{ MHz} = 750 \text{ MHz}$$

The same equation is used in the FREQ
COUNT mode except that the frequencies are counted at the marker. The Marker mode readout method will be described later. Note that the YTO, Second LO and 280 MHz oscillators do not affect the center frequency equation, as all are in both the signal path and pilot path.

Lock and Roll Tuning

In the lock and roll mode, the sweep is applied to either the YTO Main Coil or the FM Coil as indicated in Figure 1. The Second LO is set at 1748.6 MHz. The 275 MHz PLO is not swept and thus the 249 MHz loop frequency is constant. (The programmed frequency for this loop can be read with KSR.) The Pilot IF frequency is approximately 20 MHz at the center frequency of the analyzer. The Pilot IF is counted by A17 when the Controller is determining if the YTO is actually tuned to the correct frequency.

Phase Locked Tuning

In the phase locked mode, the sweep is derived from the 50 MHz VTO. This causes the 249 MHz loop to sweep. Because the Pilot IF is exactly 20 MHz, the 269 MHz (loop) and the 249 MHz loop are always 20 MHz apart. The Second LO is switched between 1748.6 MHz and 1753.6 MHz to eliminate crossing spurs. For center frequency of 0 to 2.49 MHz, it is 1753.6 MHz. It goes to 1748.6 MHz for center frequency from 2.50 MHz to 7.49 MHz. This pattern of switching every 5 MHz is repeated to the highest center frequency of 1500 MHz. The state of the Second LO is indicated by the last digit in row 4 of KSR.

Marker Modes

NORMAL

When the Marker **NORMAL** mode is selected, the analyzer does the following: first, the center frequency is determined. In the **NORMAL** mode the Signal IF is not counted but 21.4 MHz is assumed by the Controller. Because the **NORMAL** Marker is a display marker, the position of the marker on the display is determined after the center frequency is calculated. By knowing that the display consists of 1000 points and the programmed frequency span, the Controller calculates the offset between the center frequency and the marker. The frequency span accuracy is the major cause of error in the readout accuracy of the Marker **NORMAL** mode.

FREQ COUNT

When the **FREQ COUNT** Marker mode is selected, the analyzer counts the 50 MHz VTO, Signal IF and the Pilot IF frequencies at the marker. If the analyzer is phase locked, the Pilot IF is not counted but is assumed to be 20 MHz. This implies that the accuracy is determined by the time base.

Frequency Readout Errors

A malfunction in one or more of the RF assemblies often leads to an offset in the center frequency. The most common offsets are:

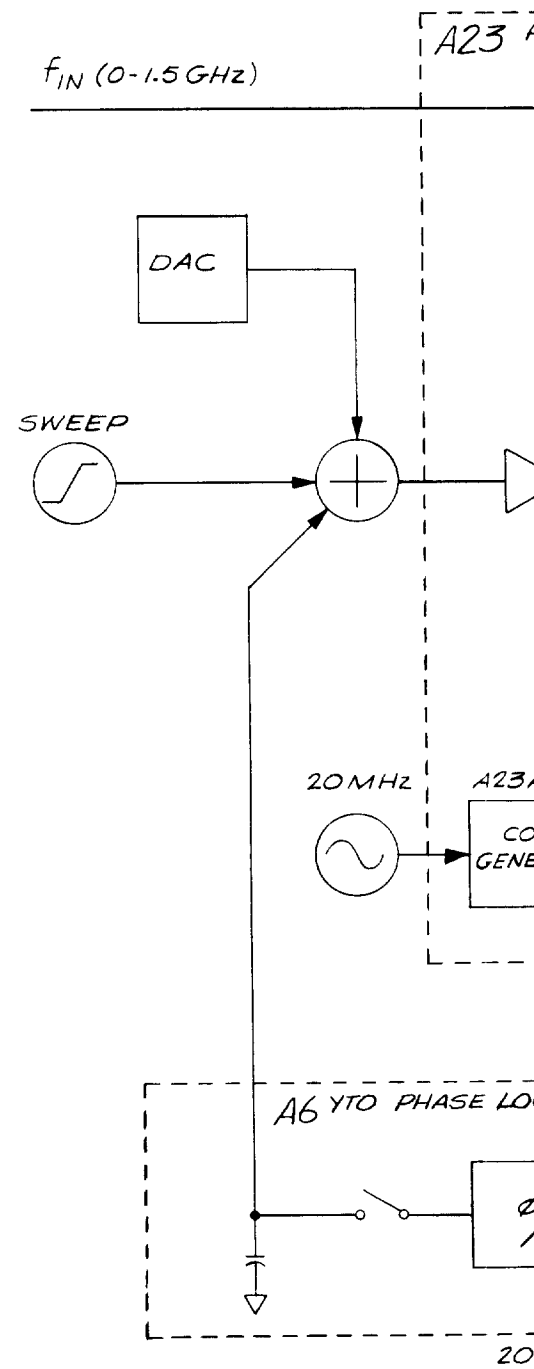
- a. 20 MHz
This may be caused by a maladjusted Comb Generator, A23A6; or on the A22 Frequency Control, a maladjustment of the START/STOP circuitry, or a Sweep Attenuator that is not sweeping over the correct range.
- b. 4 MHz, 500 kHz, or their multiples
Check the A8 Phase Lock assembly for proper operation.
- c. 21.4 MHz
This occurs in **FREQ COUNT** mode if the Signal IF frequency is not read by A17. Check coaxial interconnect cable, A4A2 Log Amplifier-Detector in the IF-Display Section, and A17.

Phase Lock Loop Troubleshooting

If one of the phase lock error messages appears, a loop has failed. Start the troubleshooting procedure by determining if the malfunction is dependent on center frequency, frequency span, etc. Next, break the suspected loop and measure the power levels as indicated on the RF Section Analog Block Diagram. Even with the oscillators at the extremes of their ranges, the power levels must be within the limits indicated. The loop frequencies can be counted and compared with the programmed frequencies listed by KSR by inserting a Tee connector into the loop.

The Phase Lock Inhibit jumper (see RF Section Digital Troubleshooting) may be necessary if the keyboard is locked out. Use the information from the Diagnostic Function and the Center Frequency Tuning Equations to narrow the fault to a single assembly.

RF SECTION



FREQUENCY
SPAN
1 MHz < SPAN
100 KHz < SPAN
SPAN

$f_{CF} = 20 \text{ MHz}$

COUNTER M
KSK
KSQ
KSN

RF SECTION DIGITAL TROUBLESHOOTING

PRELIMINARY CHECKS

Instrument Preset Check

The two red INSTR CHECK LEDs are forced on whenever the instrument is turned on or  is pushed. The A15 Controller then performs a self check of itself, a checksum verification of all the ROMs on the A15 Controller assembly, a partial check of the Instrument Bus, and a read-write check of the RAMs in the A3 Digital Storage. If all the checks pass, both INSTR CHECK LEDs go out.

If the checks fail, one or more of the INSTR CHECK LEDs remain on.

- Both LEDs on indicates an A15 Controller problem. First check to see that A15 is pushed completely into its edge connectors.
- Left LED on indicates a failure occurred when checking Digital Storage memory. First check to see that the Analyzer Bus Interconnect Cable, W31, is connected properly.
- Right LED on indicates a failure during the partial interface check.

The partial interface check reads the key column lines from the A5 front panel. If any key, except , is pressed when the  is pressed, the right INSTR CHECK LED should stay on. This can be used to verify that the check routine is working and that a particular key is working.

Use the A15 Controller Self Test Fail Indicators Table (in the A15 tab) to further isolate the source of the failure.

“LONG POP” Instrument Preset Check (Jumper A15TP8 [STS] to A15TP1-7 [T3])

This check is very similar to the normal INSTR PRESET check; an additional A15 Controller check is performed, all of the RAM locations in Digital Storage are checked, and the memory (RAM) on A15 is verified.

HP-IB Verification

When the instrument is turned on, keep the  key pressed. The ADRS'D LED should flash until the  key is released and the A15 Controller acknowledges the HP-IB request. If it doesn't flash, the A15 Controller is malfunctioning. All cables must be removed from the HP-IB connector, J5.

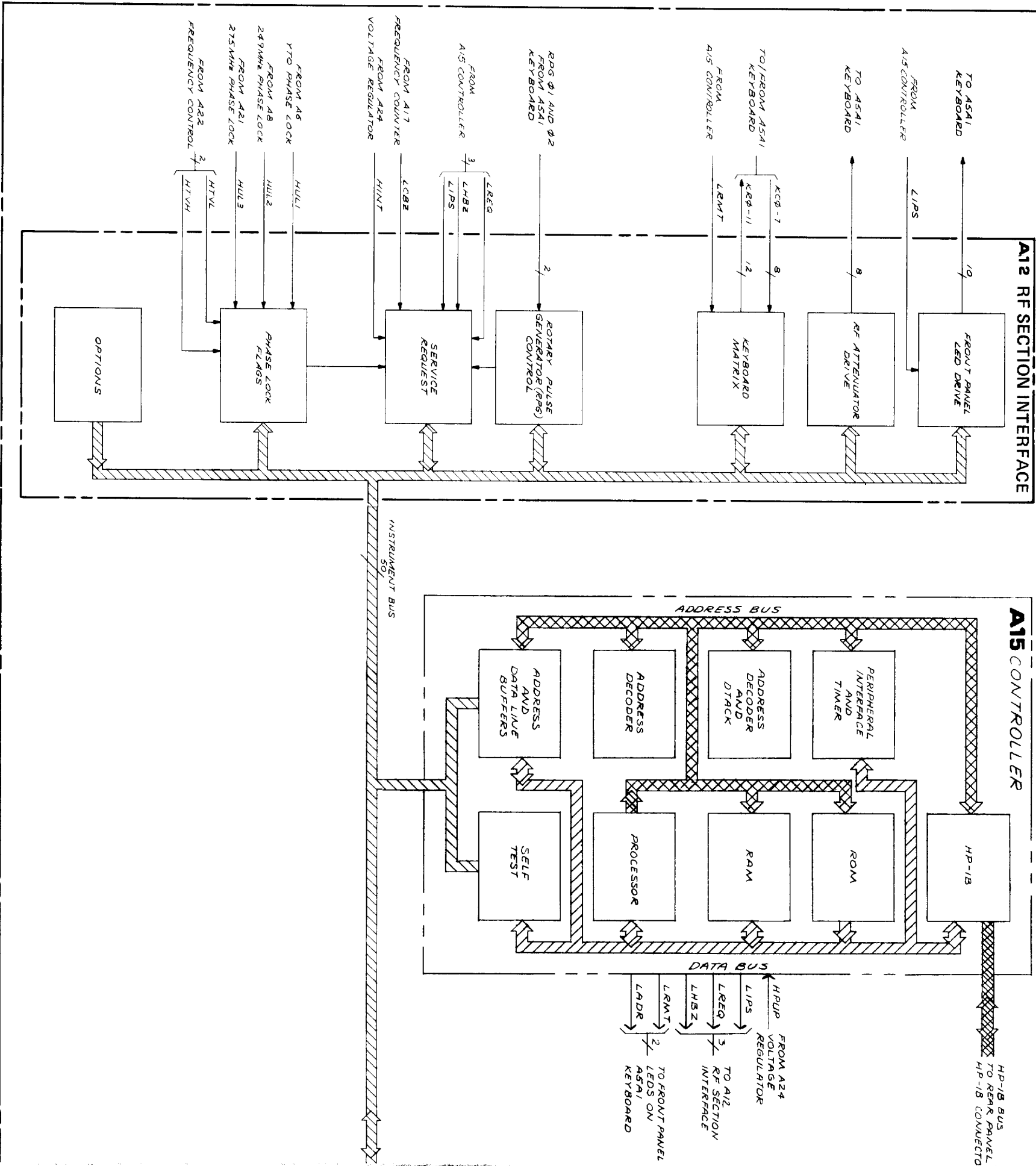
Phase Lock and Counter Inhibit (Jumper A15TP4 [STS] to A15TP1-4 [T1])

Following INSTR PRESET, the processor performs the phase lock inhibit function and ignores the A17 Frequency Counter. (20 MHz is substituted for all frequency counts.) Removing the jumper re-enables the counter. If the analyzer stops sweeping immediately after the jumper is removed, the A17 Frequency counter is malfunctioning.

Digital Storage Verification

The above INSTR PRESET check does a fairly complete verification of the Digital Storage controller and Memory. An additional check can be done, independent from the RF section, by jumpering A3A6TP3 to A3A6TP6 and pushing A3A7S1 momentarily. A test pattern should appear on the display. See the Digital Storage Troubleshooting notes for more detail. Note that when the jumper is connected, the left check LED always stays on following an INSTR PRESET, since in the test pattern mode, Digital Storage ignores all instructions from A15 Controller.

RF SECTION INSTRUMENT BUS STRUCTURE



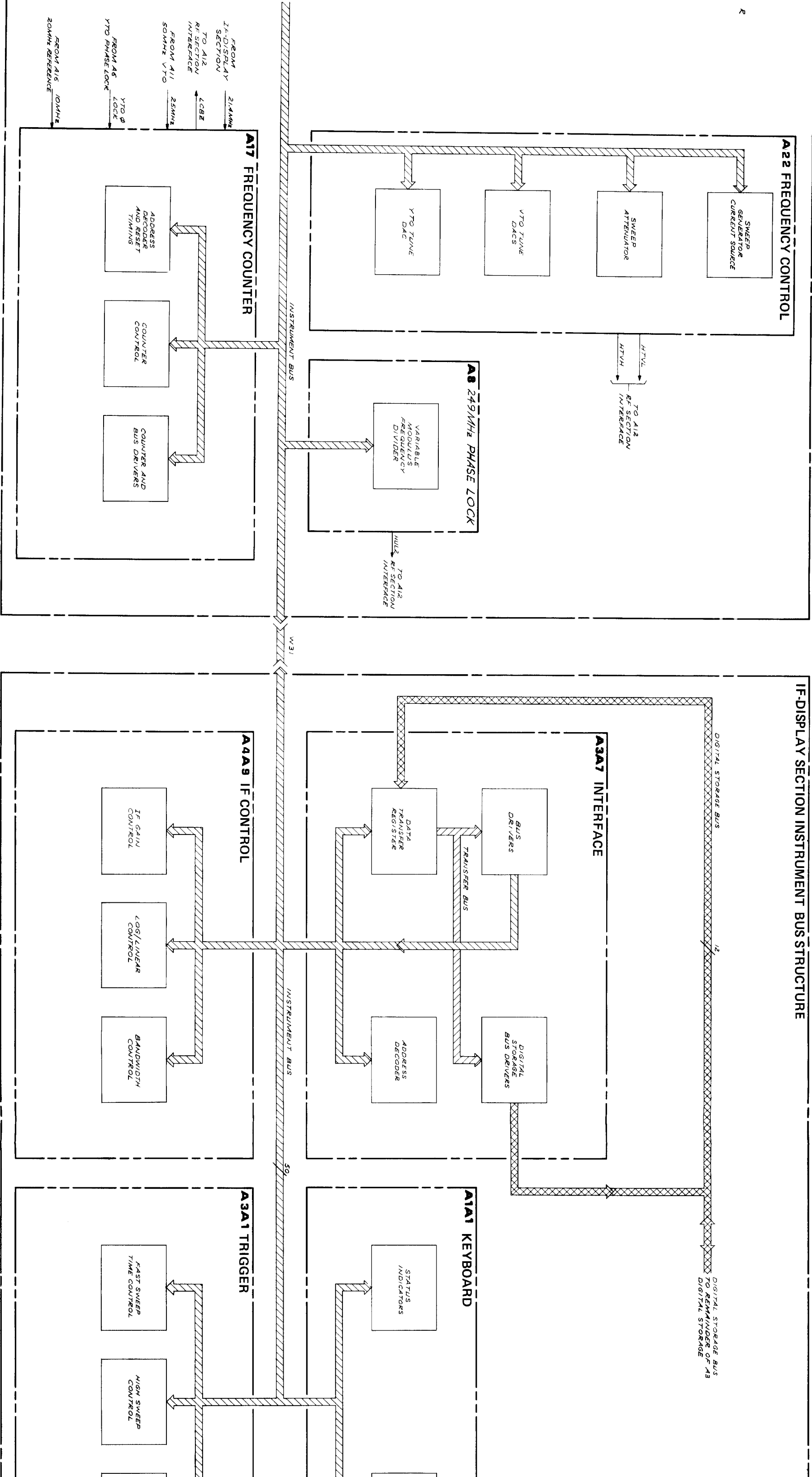


FIGURE 1. RF SECTION

PILOT THIRD LOCAL OSCILLATOR, CIRCUIT DESCRIPTION

The purpose of the Pilot Third Local Oscillator is to produce the precise frequency in the range of 238.5 MHz to 259.5 MHz that will allow the analyzer to be tuned to frequencies between the 20-MHz reference combs.

The Pilot Third Local Oscillator is comprised of the following assemblies:

- A7 249 MHz Phase Lock Oscillator
- A8 249 MHz Phase Lock
- A18 275 MHz Phase Lock Oscillator
- A21 275 MHz Phase Lock
- A11 50 MHz Voltage-Tune Oscillator

A7 249 MHz Phase Lock Oscillator

The control voltage from A8 249 MHz Phase Lock allows A7 249 MHz Phase Lock Oscillator to generate two signals:

- A Signal to A10 Pilot Third Converter which can be continuously tuned over a range of 239 MHz to 259 MHz and can be swept up to ± 500 kHz about any point in that range.
- Another signal to A18 275 MHz Oscillator. (Refer to the description of that assembly.)

A8 249 MHz Phase Lock

The frequency from A18 (16 MHz to 38.5 MHz) is divided in A8 249 MHz Phase Lock to produce one of the two frequency inputs to a Phase/Frequency Detector. The other input is a 4 MHz reference signal (20 MHz divided by 5) from A16 20 MHz Reference. If the two inputs to the Phase/Frequency Detector are out of phase, a control voltage is generated to force a change in the frequency of A7 249 MHz Phase Lock Oscillator until the inputs are in phase.

A18 275 MHz Phase Lock Oscillator

A 249 (± 10) MHz signal from A7 249 MHz Phase Lock Oscillator is mixed with the output of the 275 MHz Phase Lock Oscillator to produce a signal to A8 249 MHz Phase Lock that is in the range of 16 MHz to 38.5 MHz. A18 also sends 275 MHz to A21, where it is mixed with 280 MHz from A20 Third Converter.

A21 275 MHz Phase Lock

In A21 275 MHz Phase Lock, the signal from the 275 MHz oscillator in A18 is mixed with 280 MHz from A20 Third Converter, and the difference frequency is sent to the Phase/Frequency Detector for comparison with the reference frequency from A11. If the two input frequencies are out of phase, a correction voltage from the Phase/Frequency Detector will force a change in the 275 MHz oscillator frequency until the inputs are in phase.

A11 50 MHz Voltage-Tuned Oscillator (VTO)

The 50 MHz VTO is used to tune the Pilot Third Local Oscillator ± 250 kHz corresponding to the spacing between the lock points in A7 249 MHz Phase Lock Oscillator. This is accomplished by providing a reference frequency to the Phase/Frequency Detector of A21 275 MHz Phase Lock. The reference frequency is either 5 (± 0.75) MHz or 2.5 (± 0.300) MHz, depending on the selected frequency span. For spans >100 kHz but ≤ 1 MHz, the 50 (± 7.5) MHz oscillator frequency is divided by 10; for spans of 100 kHz or less, the frequency is divided by 20. For spans greater than 1 MHz, the VTO is not swept; the sweep is applied to A23A1 YIG-Tuned Oscillator (the first LO).

The frequency to which the 50 MHz oscillator is tuned is determined by the output of the Summing Amplifier, whose inputs are the 50 MHz SWEEP and the 50 MHz TUNE signals from A22 Frequency Control. For sweep times of 10 sec or longer, the Slow Sweep Filter is switched into the circuit to filter off low-frequency components (on the 50 MHz SWEEP and 50 MHz TUNE lines) which in the most narrow bandwidths (30 Hz and 10 Hz) might cause spurious responses.

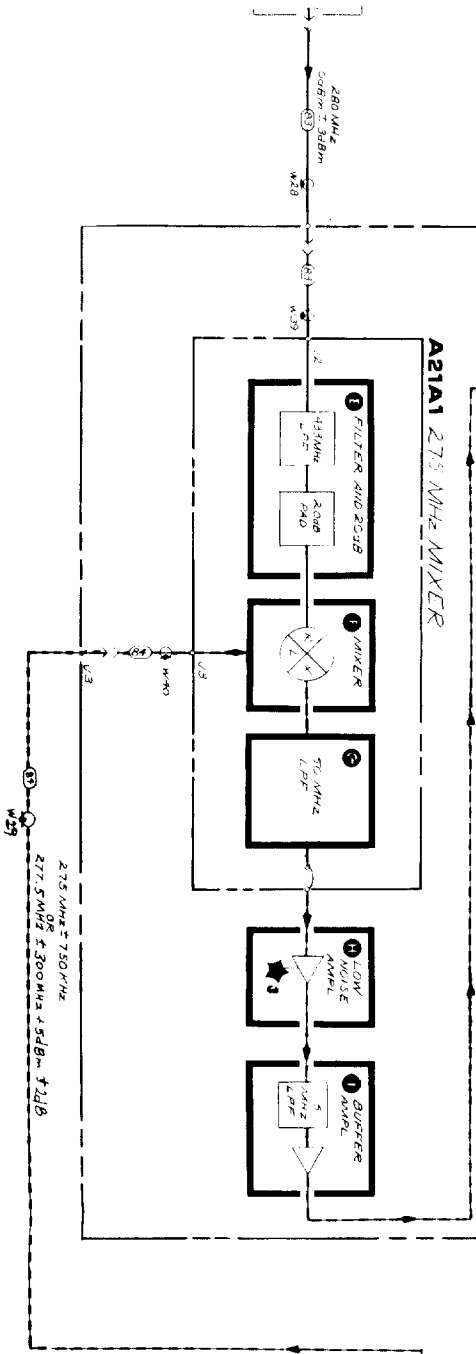
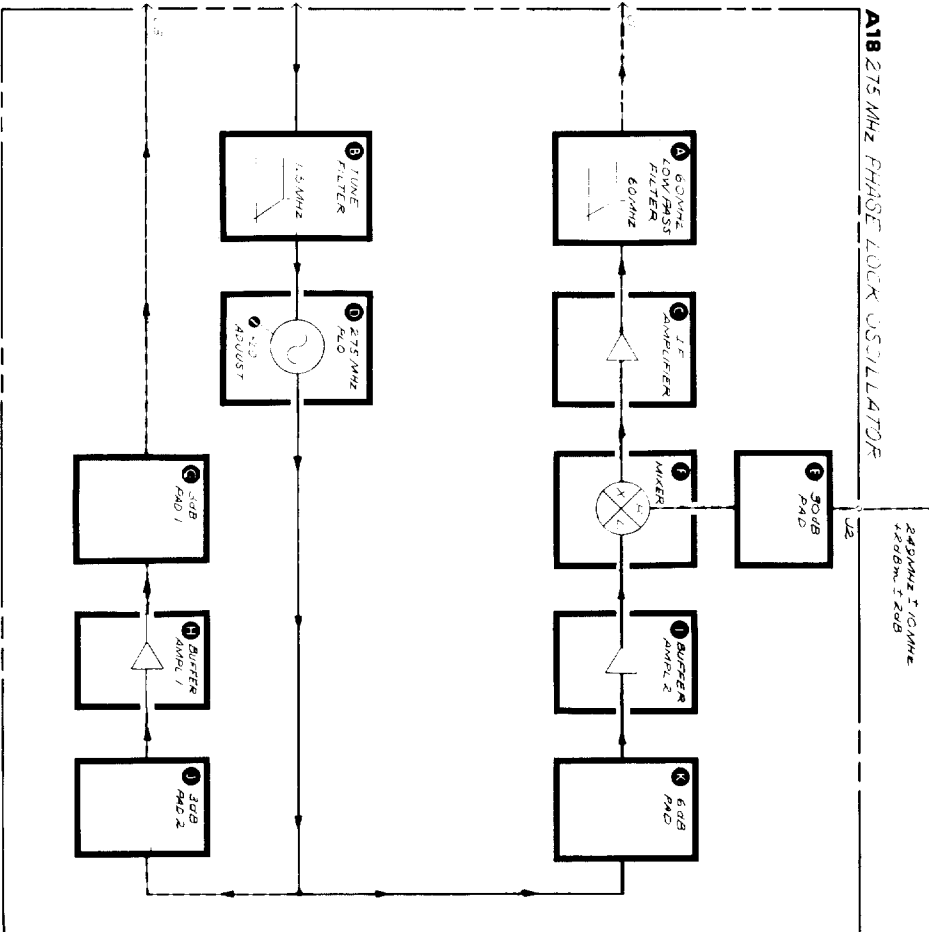
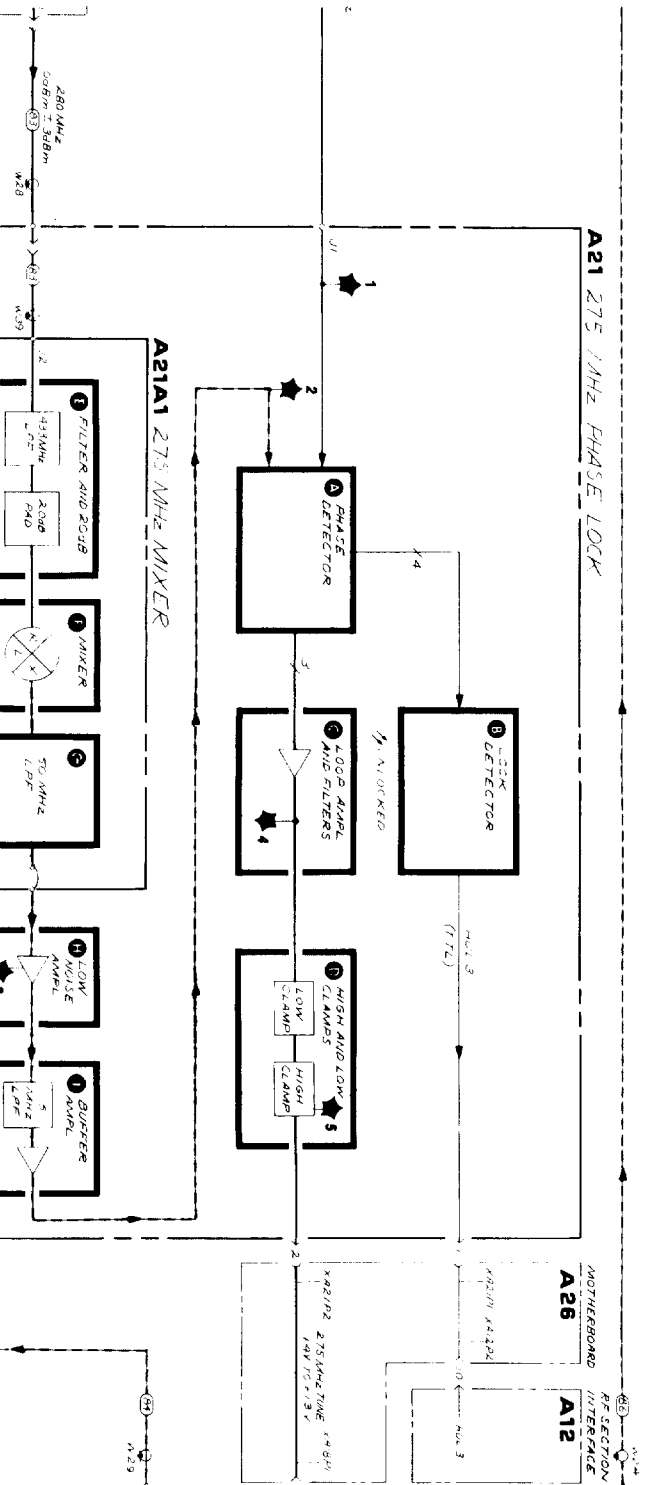
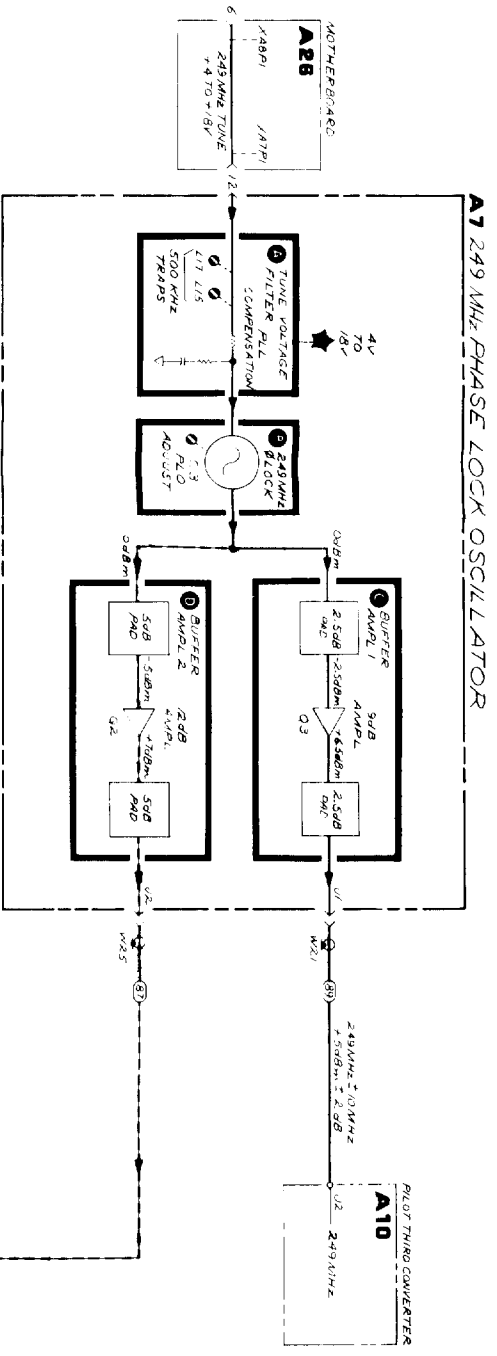
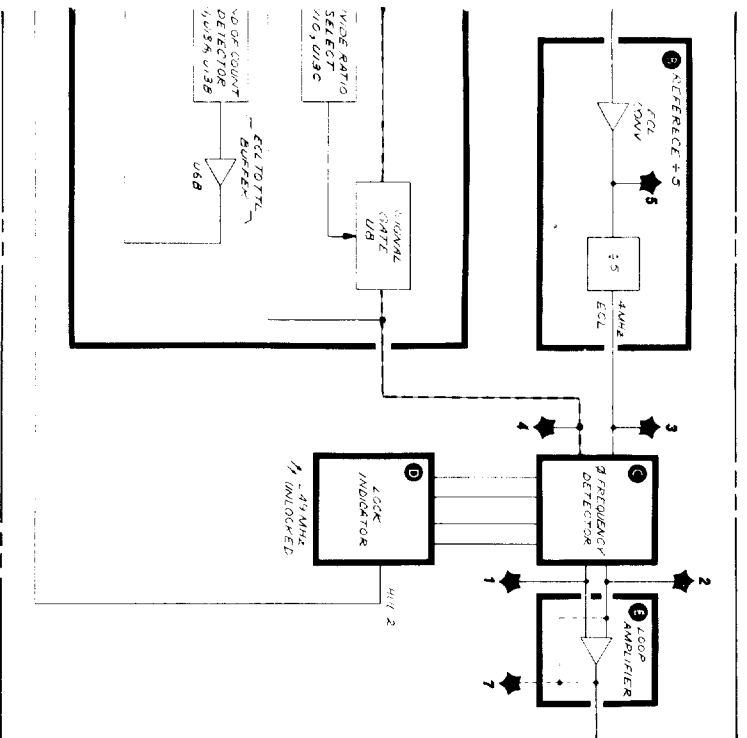


FIGURE 1. PILOT THIRD LOCAL OSCILLATOR BLOCK DIAGRAM

A5 FRONT PANEL, CIRCUIT DESCRIPTION

A5 Front Panel includes the following subassemblies:

- A5A1 Keyboard
- A5A2 Rotary Pulse Generator
- A5A3 DC Input Connector
- A5A4 Blocking Capacitor
- A5A5 Input Select

Also included are K1 Input Relay and AT1 Step Attenuator (0 to 70 dB in 10-dB steps).

A5A1 Keyboard

A5A1 Keyboard includes all the front-panel pushbutton key-switches and indicator LEDs. (Refer to A12 RF Section Interface for a description of the key-switch circuitry.) The LEDs, which are driven by A12, indicate the status of pushbuttons, except for INSTR CHECK indicators I (DS2) and II (DS3).

The INSTR CHECK indicators are used with a self-test routine that is run whenever the LINE switch is placed ON or the  key is pressed. The self-test routine checks the digital circuitry in the A15 Controller, portions of A12 RF Section Interface, and A3 Digital Storage in the IF-Display Section. Both LEDs are lit until the self-test routine is completed. If both LEDs remain on, the trouble is probably in A15, INSTR CHECK II indicates a probable trouble in A12 or the Instrument Bus, and INSTR CHECK I indicates a probable trouble in the A3 Digital Storage section of the IF-Display Section.

A5A2 Rotary Pulse Generator

A5A2 Rotary Pulse Generator (RPG) is operated by the DATA knob on the front panel. The rate and direction of rotation of the knob are transmitted to A12 RF Section Interface on the Ø1 and the Ø2 lines.

A5A3 DC Input Connector

A5A3 DC Input Connector is normally used for signals which have no DC component. It is selected when the SIGNAL INPUT 1 pushbutton is pressed, energizing K1 Input Relay. This circuit is protected by fuse A5A3F1.

A5A4 Blocking Capacitor

A5A4 Blocking Capacitor prevents any dc component (up to ± 50 VDC) of the input signal from getting into the Step Attenuator or Input Mixer. It has a frequency response of 100 kHz to 1.5 GHz.

A5A5 Input Select

The Input Select circuit includes two pushbutton switches, each with an indicator LED in its center. SIGNAL INPUT 1 selects the input through the DC Input Connector (Input Relay energized) for frequencies from 100 Hz to 1.5 GHz. SIGNAL INPUT 2 selects the input through the Blocking Capacitor for frequencies from 100 kHz to 1.5 GHz (Input Relay de-energized). The signal, in either case, is sent through AT1, the 0–70 dB Attenuator, to A23A2 First Converter.

When SIGNAL INPUT 1 is selected, the Input Relay is energized (refer to A12 RF Section Interface) and LED indicator DS11 is lit by +15V through R1, since a Darlington Pair in A12 conducts, grounding its cathode.

(DS12 is off because its anode is grounded.) When SIGNAL INPUT 2 is selected, the Input Relay is de-energized, turning off DS11 and applying +15V to DS12 through the relay coil to light the SIGNAL INPUT 2 indicator LED.

ON/STANDBY Control

When the LINE switch is in STANDBY, a circuit is completed to A26 Motherboard to light STANDBY indicator LED DS1. The LED is lit when the instrument is in STANDBY or when regulated power to the instrument is removed during thermal shutdown.

PROBE POWER

The PROBE POWER connector provides power for active RF probes such as HP 1121A or HP 1120A Active probes. Three diodes on A26 Motherboard are in the –15V line from A24 Regulator, resulting in about –13.4V to the connector.

Reference Level Amplitude Calibration

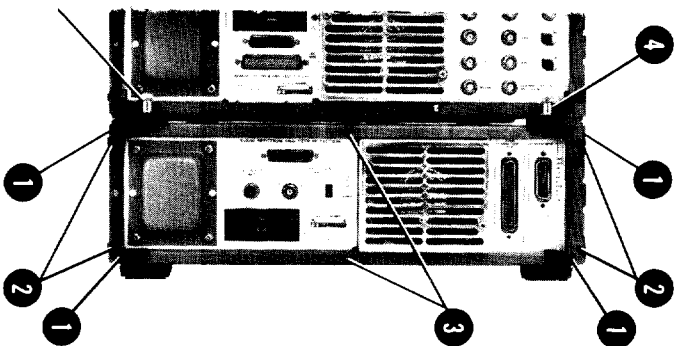
AMPTD CAL screwdriver adjustment R3 provides a REF LEVEL CAL voltage to A22 Frequency Control.

CAL OUTPUT

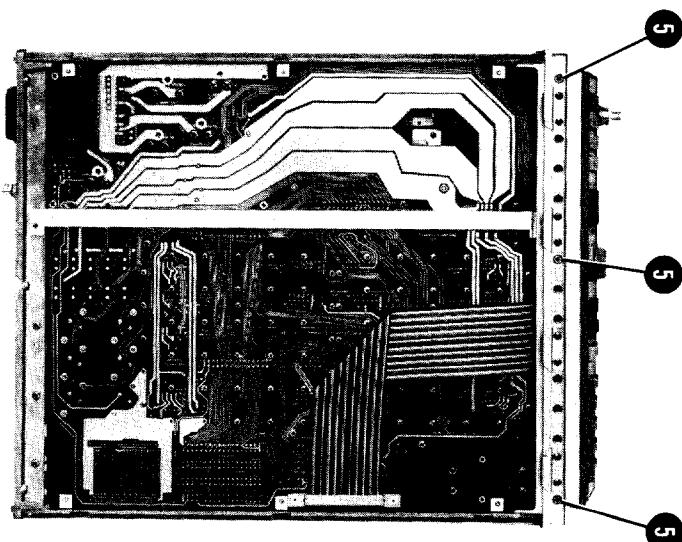
The CAL OUTPUT connector provides a 20 MHz, –10 dBm signal from A16 20 MHz Reference.

FRONT PANEL REMOVAL AND REPAIR

1. Remove AC Line cords from both instruments and remove interconnecting cables between instruments.
2. Position instrument on right side as shown in View A.
3. Loosen thumbscrews 4.
4. Remove feet 1 by removing screws 2.
5. Remove covers from top and bottom of RF Section by loosening screws 3.
6. Separate instruments by holding IF-Display Section in place while pushing the RF Section at the front panel.
7. After separating the instruments, slide RF Section away from IF-Display Section far enough to remove screws 5 holding front panel to frame. (Refer to View B.)
8. Remove screws 6 from other side of instrument. (Refer to View C.)
9. Pull front panel out of frame, as shown in View D.
10. Disconnect cable 7 at connector 8. Disconnect cable 9 at connector 10. Disconnect cable 11 at connector 12. Disconnect cable 13 at connector A16J6 14. It will be necessary to remove screw from cable clamp 15 to remove cable 13 from instrument. (Refer to View D.)
11. To replace INSTR CHECK and STANDBY LEDs, proceed as follows (refer to View E):
 - a. Disconnect cable at connector 16.
 - b. Remove nut 17 and remove SIGNAL INPUT 2 connector from front panel.
 - c. Remove three screws 18.
 - d. Disconnect connector 19, remove nut 20, and remove SIGNAL INPUT 1 connector from front panel.
 - e. Remove nut and washer from PROBE POWER connector 21.
 - f. Remove knurl-nut (located on front panel) from CAL OUTPUT connector 22 and remove connector from front panel.



View A



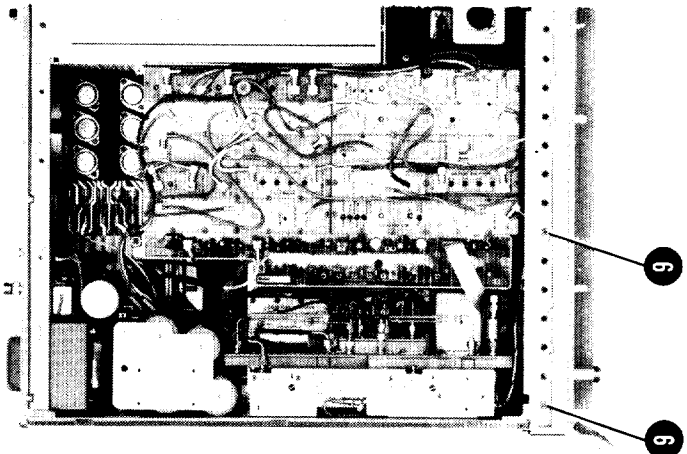
View B

FRONT PANEL REMOVAL AND REPAIR (Cont'd)

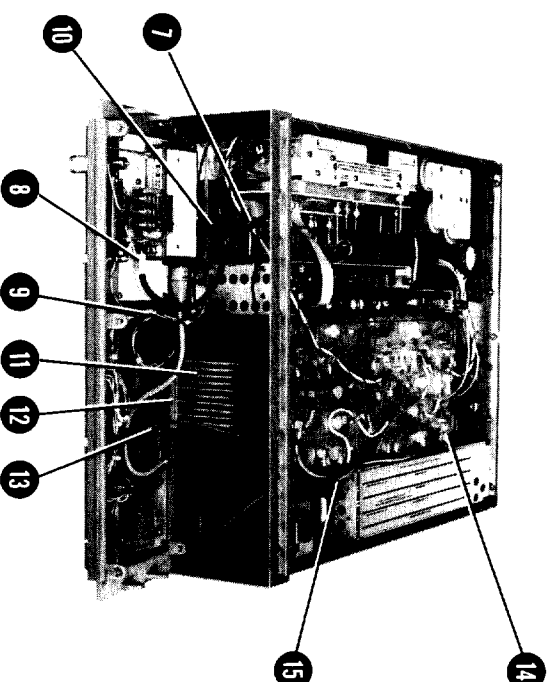
- g. Lower front panel should now separate from front panel assembly. It may be necessary to cut the cable wraps on the cable near the **PROBE POWER** connector to allow the connector to be removed from the panel far enough to replace the defective LEDs.
- h. To replace the defective LEDs, unsolder the wires from the LED leads and push on the leads with a soldering aid to force the LED out of the socket through the front panel. Insert a new LED and resolder the wires to the LED leads as follows (refer to View F): **STANDBY LED-905** wire to anode, 0 wire to cathode; **INST CHECK I LED-94** wire to anode, 95 wire to cathode; **INST CHECK II LED-93** wire to anode, 96 wire to cathode. Trim excess lead length.
- i. Reassemble lower front panel.

12. To replace **SIGNAL INPUT** LEDs, switches, or keys, proceed as follows (refer to View E):

- a. Disconnect connectors **16** , **23** , and **24** and move cables from over printed circuit board where LEDs, switches, and keys are located.
- b. Remove three screws **18** and lift printed circuit board away from front panel.
- c. To remove defective LED, remove key from front of switch, unsolder LED leads from printed circuit board, free leads with a soldering aid, and push leads through printed circuit board so that LED is forced out of switch.
- d. To replace defective LED, insert a new LED through switch so that leads extend through printed circuit board. Negative (cathode) lead goes to square pad on PC Board. (Refer to View F.) Pull leads with fingers or needlenose pliers to ensure that LED is far enough into switch to allow room for reinstalling key. Solder leads to rear of printed circuit board and reinstall key on switch.
- e. To remove defective switch, remove key from switch, melt plastic pins holding switch to printed circuit board using a soldering iron, and remove switch from printed circuit board.
- f. To replace switch, insert plastic pins of new switch through printed circuit board and melt the pins with a soldering iron on the rear of the printed circuit board enough to secure switch. Replace key.
- g. Reassemble printed circuit board to front panel and reconnect cables.

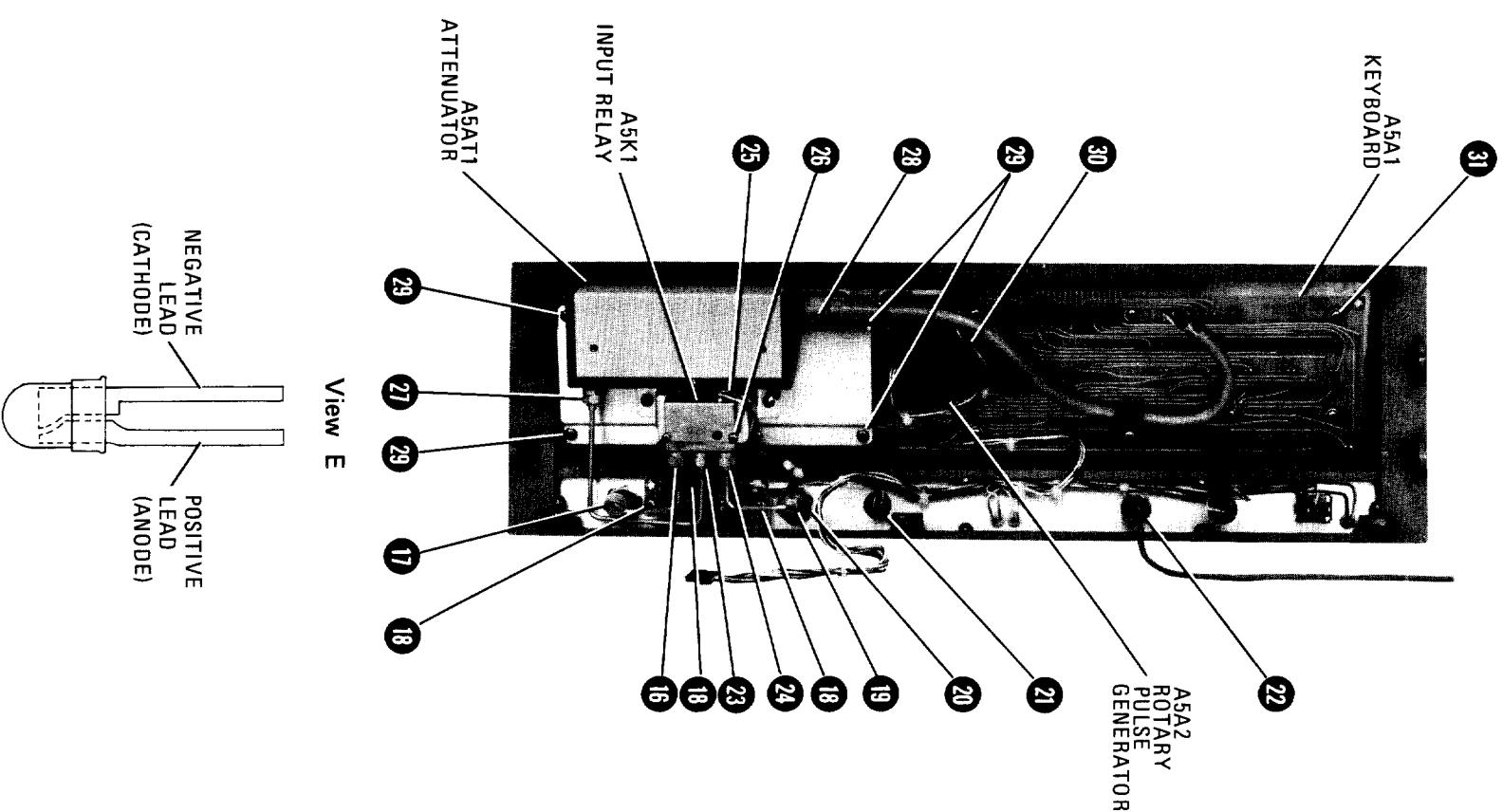


View C



View D

FRONT PANEL REMOVAL AND REPAIR (Cont'd)



13. To replace input relay, proceed as follows (refer to View E):
 - a. Disconnect connectors **16** , **23** , and **24** , unsolder wires **25** , and remove screws **26** .
 - b. Secure a new input relay to the mounting bracket with screws **26** , solder wires to new relay , and connect cables **16** , **23** , and **24** .
14. To replace input attenuator, proceed as follows (refer to View E):
 - a. Disconnect connectors **16** , **23** , and **24** from input relay. Disconnect connectors **27** and **28** from input attenuator. Remove five screws **29** from mounting bracket, turn mounting bracket over and remove two screws from rear of bracket used to secure input attenuator.
 - b. Position new input attenuator on mounting bracket and install two screws. Position mounting bracket on A5A1 Keyboard and reinstall four screws **29** . Reconnect cables **27** and **28** to attenuator. Reconnect cables **16** , **23** , and **24** .
 - c. Remove A12 RF Section Interface Board and replace A12U17 with new error correction ROM. Refer to A12 tab in this volume for location of A12U17.
15. To replace Rotary Pulse Generator (RPG), proceed as follows (refer to View E):
 - a. Disconnect DATA control (RPG) knob and nut from front panel. Refer to Figure 2 for procedure to remove knob and nut.
 - b. Disconnect wires **30** from A5A1 Keyboard and remove RPG.
 - c. Insert a new RPG through the A5A1 Keyboard so that shaft protrudes through front panel.
 - d. Reinstall nut and knob on RPG shaft. Refer to Figure 2.
 - e. Reconnect wires **30** to A5A1 Keyboard.
16. To replace switches on A5A1 Keyboard, refer to Figure 2 for front panel removal and see procedure in steps 12e and 12f of this figure for switch replacement.
17. The A5A1 Keyboard may be removed by first removing the input attenuator and mounting bracket as described in step 14 of this procedure, and then removing screws securing Keyboard to front panel frame (**31** shows typical location of screws).

FIGURE 1. FRONT PANEL REMOVAL AND REPAIR

FRONT-PANEL LED REPLACEMENT

NOTE

This procedure does not cover replacement of SIGNAL INPUT ②, INSTR CHECK ③, or STANDBY ④ LEDs. Refer to Figure 9-7 for replacement of these LEDs.

1. Remove front panel from RF Section as instructed in Figure 9-7, Steps 1 through 8.
2. Loosen set screws in DATA control knob (RPG) ① using a No. 4 allen wrench (HP Part Number 8710-0857) and remove knob.
3. Remove nut from DATA control using a 7/16-inch wrench.
4. For instrument sections with serial numbers prefixed 1803A and above, the front panel is fastened to the sub-panel by four (4) studs with snap fasteners. These fasteners may be removed using needle-nose pliers to allow removal of front dress panel. After front dress panel is removed, front-panel LEDs may be replaced as specified in Step 6.
5. For instrument sections with serial numbers prefixed lower than 1803A, the front panel may be glued to the sub-panel. Some instruments below 1803A serial prefix are equipped with stud fasteners as described in Step 4. If the front panel is not equipped with these stud fasteners, it is necessary to remove the Keyboard from the front panel assembly. Refer to Figure 9-7, Step 16 for removal instructions. After Keyboard is removed, front-panel LEDs may be replaced as specified in Step 6.
6. Pull defective LED out of socket with fingers (it may be necessary to pry slightly with a pointed instrument such as a soldering aid), trim both leads on new LED to 3/8-inch (1 cm), and insert new LED in socket with negative (cathode) lead to square pad on printed circuit board. Refer to LED lead identification illustration below.
7. Reassemble front panel and reinstall in instrument.

LED LEAD IDENTIFICATION

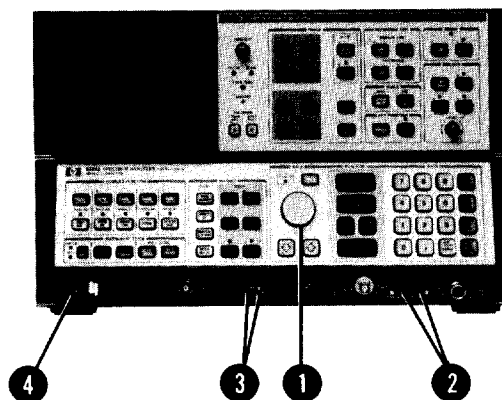
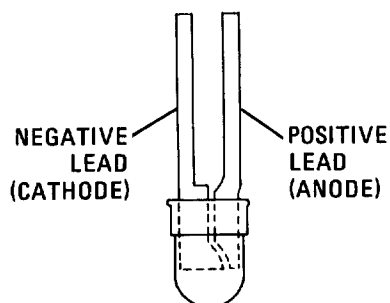
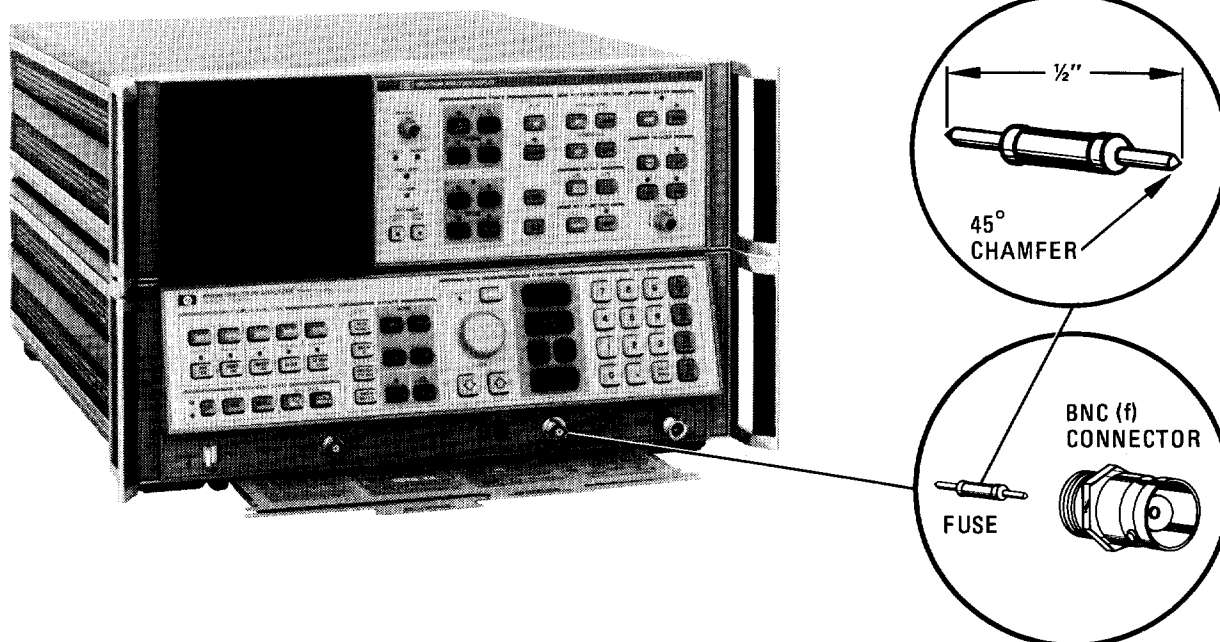


FIGURE 2. FRONT PANEL LED REPLACEMENT



SIGNAL INPUT 1 FUSE REPLACEMENT

1. Remove SIGNAL INPUT 1 BNC Connector using a 7/16-inch open end wrench. (See Figure 3.)
2. Remove blown fuse, using long nose pliers if necessary.

NOTE

Avoid confusion as to which is the good fuse after the new fuse has been properly clipped. One method is to mark the blown fuse using a felt-tip marker or the like before cutting the leads of the new fuse.

3. Clip leads of new fuse (HP Part Number 2110-0301 or 1535-3716) to the same length as the blown fuse which was removed. Overall length should be approximately 1/2 inch.
4. Using a small file, chamfer the ends of both leads at about a 45 degree angle.
5. Carefully insert one end of fuse into the small hole in threaded end of BNC connector. When fuse is properly seated into the center conductor, about half of the fuse should extend beyond the BNC connector body.
6. Carefully replace BNC connector (with new fuse) on SIGNAL INPUT 1.

CAUTION

Do not overtighten BNC connector on SIGNAL INPUT 1.

7. Tighten snugly with 7/16-inch open end wrench (should not exceed 45 inch-pounds of torque).

FIGURE 3. SIGNAL INPUT 1 FUSE REPLACEMENT

TABLE 1. A5 FRONT PANEL, REPLACEABLE PARTS (1 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	85680-60051	3	1	FRONT PANEL (INCLUDES A5A1 KEYBOARD, A5A3 CONNECTOR: DC INPUT, A5A4 BLOCKING CAPACITOR, W1-W3 AND W31)	28480	85680-60051
A5	85680-60050	2	1	75-OHM VERSION OF 85680-60051	28480	85680-60050
A5	08568-60117	3	1	INPUT ATTENUATOR/ERROR CORRECTION ROM REPLACEMENT ASSEMBLY (INCLUDES A5A1 AND A12U17)	28480	08568-60117
A5DS1	1990-0487	7	11	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5DS2	1990-0486	6	2	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A5DS3	1990-0486	6		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A5J1	5060-0467	6	1	P/O W31-NOT SEPARATELY REPLACEABLE	28480	5060-0467
A5J2				CONN MALE PROBE		
A5J3				P/O A5A3-NOT SEPARATELY REPLACEABLE		
A5J4				P/O A5A4-NOT SEPARATELY REPLACEABLE		
A5J5				P/O A5A1-NOT SEPARATELY REPLACEABLE		
A5J6				P/O A5A1-NOT SEPARATELY REPLACEABLE		
A5J7				P/O A5A1-NOT SEPARATELY REPLACEABLE		
A5J8				P/O A5K1-NOT SEPARATELY REPLACEABLE		
A5J9				P/O A5K1-NOT SEPARATELY REPLACEABLE		
A5J10				P/O A5K1-NOT SEPARATELY REPLACEABLE		
A5K1	3106-0024	7	1	SWITCH-COAXIAL SPDT FAIL-SAFE OPN; 50	28480	3106-0024
A5R1	2100-2488	8	1	RESISTOR-VAR CONTROL CCP 10K 10% LIN	28480	2100-2488
A5S1	3101-2193	5	1	SWITCH-TGL SUBMIN SPDT 2A 250VAC	28480	3101-2193
A5A1	85680-60019	3	1	KEYBOARD BOARD ASSEMBLY	28480	85680-60019
A5A1DS1	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS2	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS3	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS4	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS5	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS6	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS7	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS8	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS9	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS10	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A5A1DS11	1990-0670	0	4	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A5A1DS12	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A5A1J1	1251-5549	6	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5549
A5A1R1	0757-1094	9	4	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A5A1R2	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A5A1S1-	5060-9436	7	53	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5A1S51						
A5A1U1	1810-0203	5	2	NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A5A1U2	1810-0203	5		NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A5A1XDS1	0380-1233	9	10	SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS2	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS3	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS4	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS5	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS6	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS7	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS8	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS9	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A1XDS10	0380-1233	9		SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
A5A2	5060-0329	9	1	ROTARY PULSE GENERATOR (RPG)	28480	5060-0329
A5A2DS1	2140-0016	8	1	LAMP-INCAND 683 5VDC 60MA T-1-BULB	00115	683
A5A3	85680-60059	1		CONNECTOR ASSEMBLY, DC INPUT	28480	85680-60059
A5A3	85680-60116	1	1	CONNECTOR ASSEMBLY, DC INPUT 750HM (OPTION 001)	28480	85680-60116
A5A3F1	1535-3716	7	1	DEM FUSE; 1/8 AMP PICO FUSE; USE W/	28480	1535-3716
A5A3J1	1250-1557	6	1	ADAPTER-COAX STR F-BNC M-SMC	28480	1250-1557
A5A4	85680-60053	5	1	BLOCKING CAPACITOR ASSEMBLY	28480	85680-60053
A5A5	85680-60117	2	1	BOARD ASSEMBLY, INPUT SELECT	28480	85680-60117
A5A5DS1-	1990-0670	0		NOT ASSIGNED	28480	1990-0670
A5A5DS10				LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V		
A5A5DS11				LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V		
A5A5DS12	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670

*Indicates factory selected value

TABLE 1. A5 FRONT PANEL, REPLACEABLE PARTS (2 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5A5R1	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A5A5R2	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A5A5S1	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5A5S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436

*Indicates factory selected value

A5 FRONT PANEL

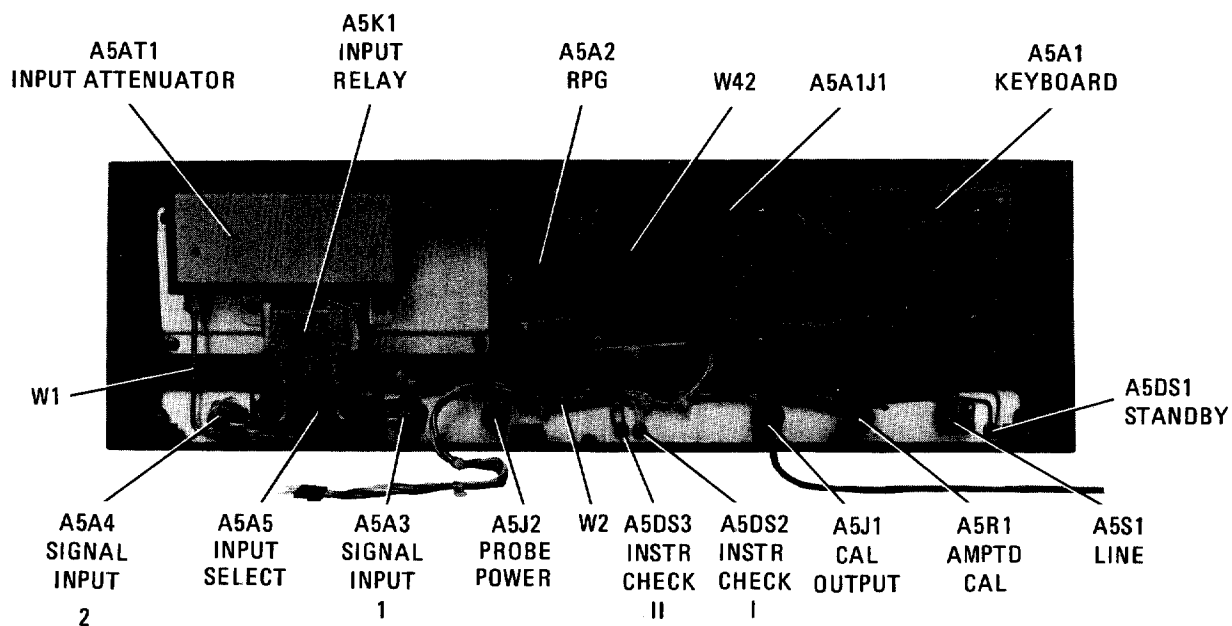


FIGURE 4. A5 FRONT PANEL, ASSEMBLY AND COMPONENT LOCATIONS

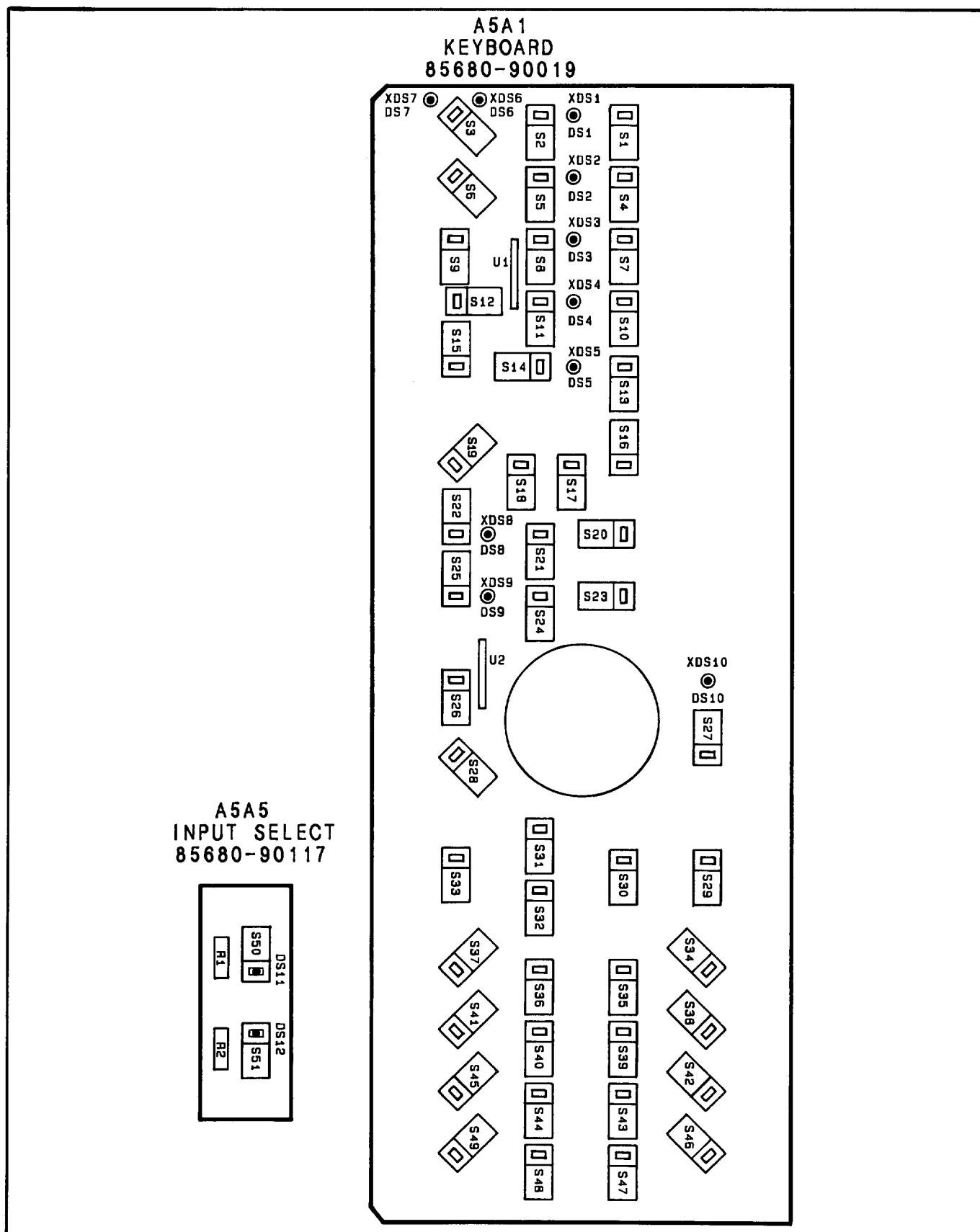
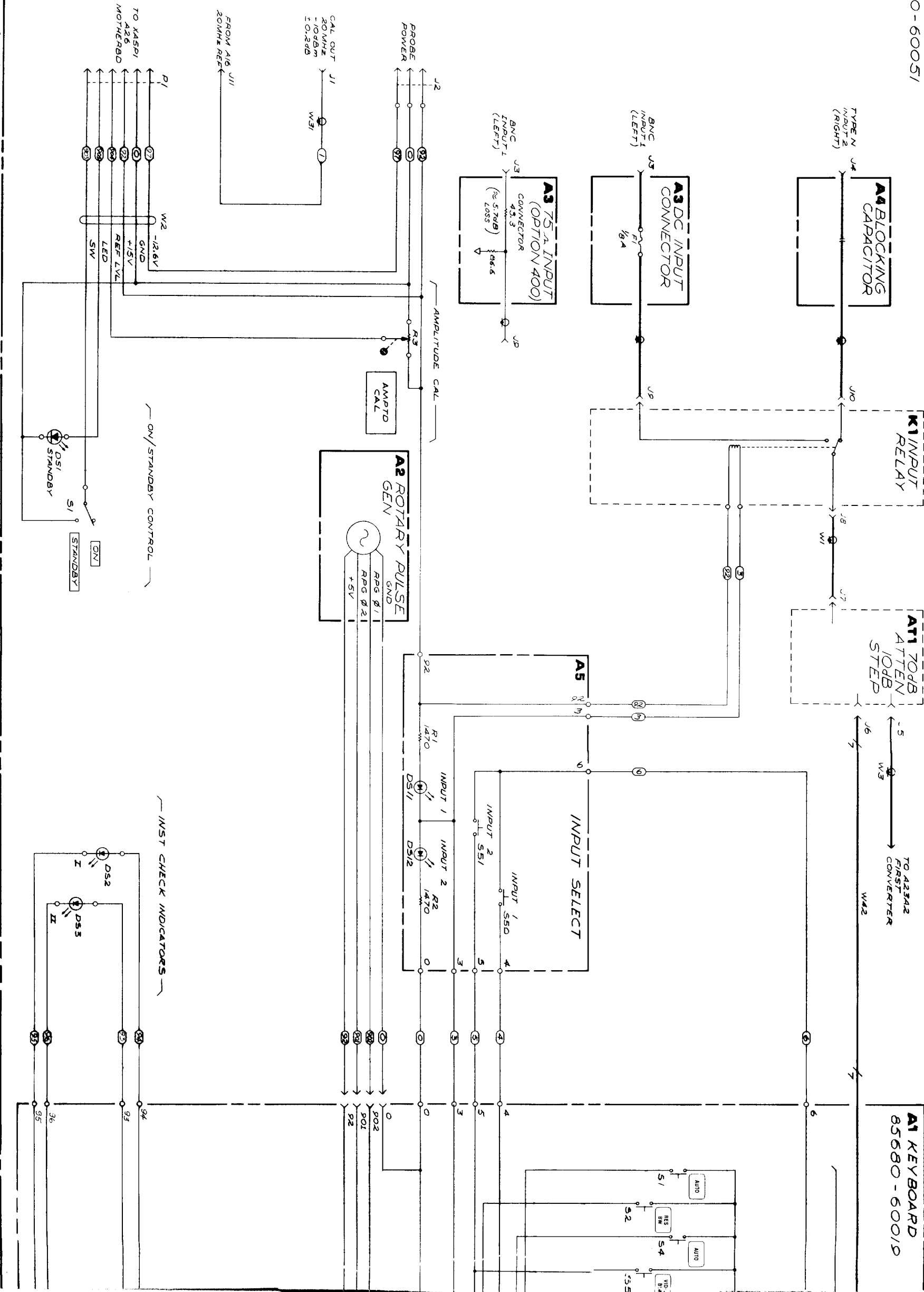
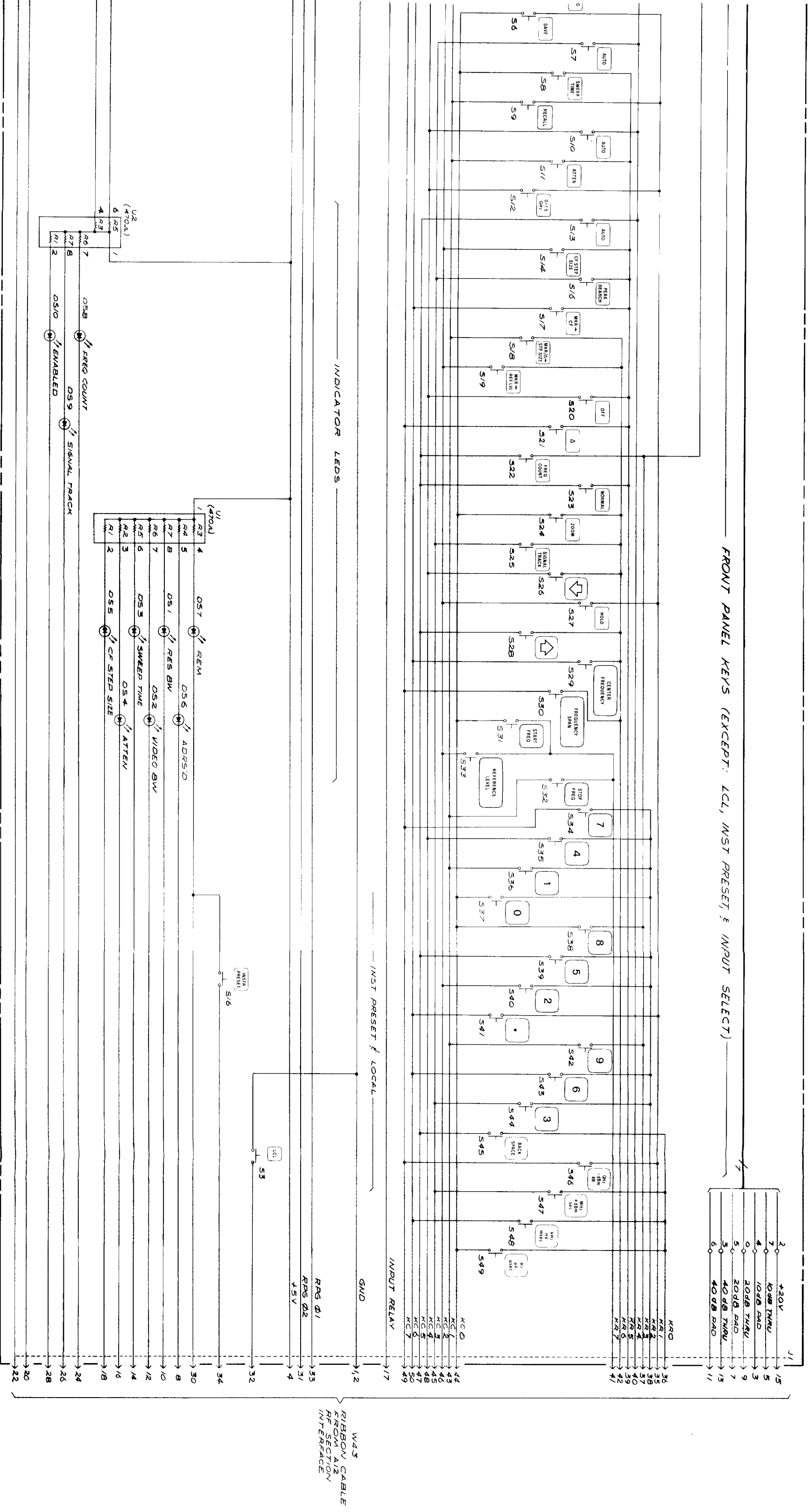


FIGURE 5. A5A1 KEYBOARD AND A5A5 INPUT SELECT, COMPONENT LOCATIONS

A5 FRONT PANEL
85680-60051

A1 KEYBOARD
85680-60019





A6 YIG-TUNED OSCILLATOR PHASE LOCK, CIRCUIT DESCRIPTION

A6 YIG-Tuned Oscillator (YTO) Phase Lock consists of circuitry to phase lock the YTO to a reference voltage from A16 20 MHz Reference. A lock indication is provided, and a filtered output of the Pilot Third IF Amplifier circuit is routed to A17 Frequency Counter. For wide sweeps, a Sample/Hold circuit retains the output voltage.

20 MHz Reference Amplifier (A)

The 20 MHz Reference Amplifier uses C2, C3, and L2 to match the 20 MHz, 50-ohm input from A16 20 MHz Reference to the ECL-driving differential amplifier (Q5, Q6). R1 and R3 set current levels, and R2 sets the voltage swing to drive an ECL input.

Pilot Third IF Amplifier (F)

The Pilot Third IF Amplifier uses a voltage feedback pair (Q1, Q2), which provides about 20 dB gain and two outputs. VR2, C6, and R7 provide bias and feedback. R8 serves to match the amplifier input to 50 ohms and (with R9) to set gain. R12 and R13 set current in Q2. C8 is a dc block to the 15 – 25 MHz Bandpass Filter (BPF), C11, L3, C12, L4, C13, and L5. R7 stabilizes the impedance at the filter output. Q3 and Q4 are an ECL-driving differential amplifier.

Phase Frequency Detector (B)

The Phase Frequency Detector is a dual D flip-flop, 4-pi-radian type detector consisting of U1A and U1B. If signal at pins 6 and 11 are in phase, outputs at 2 and 14 will cancel when summed. If the signals are out of phase, outputs 2 and 14 will sum to an offset. When both flip-flops become set with active high (Q outputs at logic high), U2C pin 14 resets both U1A and U1B. R21, R22, and C15 provide a dc level to the Loop Amplifier that is midway between logic high and logic low, while R19, R20, R23, R24, and R25 pull down outputs. R4 sets the D input of U1B high while U3A, R55, and C43 allow the D input of U1A to be high or low. A logic low at U3 pin 1 disables the Phase Frequency Detector.

Loop Amplifier (C)

The Loop Amplifier uses a high-speed, high-gain, monolithic op amp, U4. It is configured as an integrator with a zero at 1 kHz because of C22 and R35. R31 through R34, C17, and C18 set gain at 6 dB and sum and filter the outputs of the Phase Frequency Detector. U3C shorts the integrator to disable it.

Loop Filter Sample/Hold (D)

The Loop Filter Sample/Hold circuit can be switched to several configurations:

- 10 kHz break point, 9 dB attenuation using R36, U3D, Q12, C24, and R44
- Loop grounded using U3B and Q12
- Sample and hold using Q12, R44, and C24

Q7 and Q8 switch the sample and hold, and C47 balances the charge on Q12. VR1 is a level-shift zener diode. Other resistors provide bias and voltage levels as needed.

Buffer Amplifier (E)

The Buffer Amplifier consists of high input impedance dual FETS (Q13A and Q13B) in a differential stage whose unity gain is due to feedback. Q11 improves loop gain and gives a level shift. R48 sets source current, and R49 biases Q11. R51 and C46 protect the YTO lock voltage from external loading.

Phase Lock Indicator (H)

The Phase Lock Indicator circuit (using U2A, U2B, and R27) senses when either pins 2 and 15 (noninverting outputs) or pins 3 and 14 (inverting outputs) from U1A and U1B are high. This condition signifies UNLOCK. Because of the 20-MHz pulse train at U2A pins 4 and 5 and U2B pins 6 and 7, the signal must be filtered (CR26, C16) to provide a signal of less than -953 mV to turn on U6A. U6A lights LED indicator DS2 and produces a TTL logic high when the loop is unlocked.

Switched Filter and Amplifier (G) (J)

A 10-30 MHz signal at J1 from A10 Pilot Third Converter is fed through the Switched Filter and the Amplifier, where it goes through J3 to A17 Frequency Counter. The Switched Filter consists of two bandpass filters (one at 10-20 MHz and one at 20-30 MHz) and diodes to provide switching of the signal through the bandpass filters. L12, L13, C26, C23, R62, and R63 provide isolation for the switching voltage.

The Amplifier is a voltage-feedback pair (Q9 and Q10) with a 3-dB pad on the output.

Filter Control (I)

The Filter Control detects the signal at the collector of Q10 in the Amplifier using CR2 and its associated bias resistors (R70 and R71) and C42 and R72 as a filter. U6C senses when the signal is too low and toggles JK flip-flop U7A, which switches filter driver U6B in search of a larger signal in the other passband of the Switched Filter circuit.

A6 YIG-TUNED OSCILLATOR PHASE LOCK, TROUBLESHOOTING

Lock and Roll Theory

To aid in troubleshooting this assembly, an understanding of a phase locking technique called “lock and roll” is needed. For frequency spans greater than 1 MHz, the center frequency is phase locked only during the retrace period. The waveforms in Figure 1 and in the schematic for this assembly should be consulted.

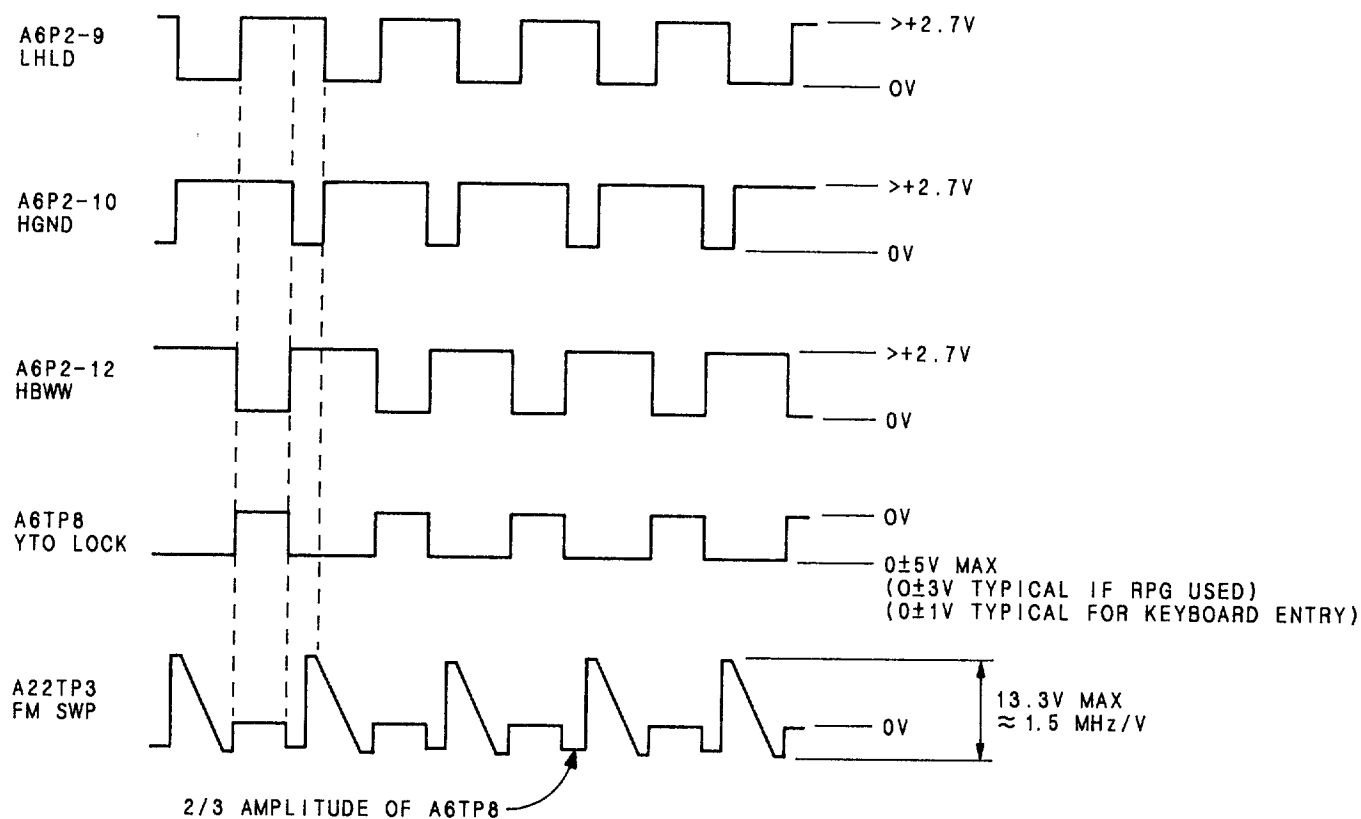


FIGURE 1. A6 YTO PHASE LOCK TIMING WAVEFORMS

Please note the following information about the waveforms. No timing information or voltage levels are given. The timing is controlled by the Sweep Time and the time needed for the A15 Controller to do certain tasks. The transitions are important and must occur as shown. The voltages of the first three waveforms are TTL levels. The voltage levels on the last two waveforms will vary depending on the center frequency and the frequency span that is selected.

The lock and roll sequence begins with LHL D (A6P2-9) going high. It is assumed that the center frequency is not being tuned.

The YTO loop is closed when LHL D goes high. The sweep lines on A22 Sweep Generator are grounded. The YTO LOCK (A6TP8) voltage is set to 0V by the following:

- HGND (A6P2-10), which is high, shorts the Loop-Amplifier **(C)** and the Loop Filter **(D)**.
- HBWW (A6P2-12), which is low, opens JFET switch U3D further ensuring that the loop filter input is 0V. This is necessary as the Phase Frequency Detector **(B)** is on.

The A15 Controller counts the Pilot IF and calculates whether the YTO DAC needs to be readjusted.

When HGND goes low, HBWW goes high. This turns on the Loop Amplifier **(C)** and the Loop Filter Sample/Hold **(D)**. A YTO Lock voltage proportional to the phase error between the 20 MHz Reference and the Pilot IF is derived and sent to the YTO FM Coil Driver on the A22 Frequency Control.

LHLD goes low, turning off the phase detector, and HGND now goes high, shorting out the loop integrator and loop filter. This insures that the YTO LOCK voltage does not change. The A15 Controller then starts the sweep on the A22 Frequency Control. Several milliseconds after the sweep has been completed, LHLD goes high and the procedure is started over again.

Troubleshooting

For frequency spans greater than 1 MHz, the YTO Loop CLOSED and YTO UNLOCKED LEDs should be flashing. This is an indication that the lock and roll is working. In the lock and roll mode, the PILOT IF (KSK,  ) should be very close to 20 MHz when the marker is placed at mid-screen. The smaller the frequency span, the closer it will be to 20 MHz. (For 1500 MHz span, ± 3 MHz is typical; for 2 MHz span, ± 3 kHz is typical.)

If the Sample and Hold **(D)** circuitry is defective, the displayed signals will often appear to be drifting when in spans greater than 1 MHz. This is especially true in the  mode. This causes an offset in the marker readout of the signal frequency.

If either the YTO UNLOCK or the YTO ERROR messages appear, the sweep rate will be very slow as the A15 Controller spends most of its time trying to lock the system. A jumper from A15TP8 (STS) to A15TP11 (T1) followed by  will start the analyzer sweeping. If the jumper is then removed, the A17 Frequency Counter can be used for troubleshooting.

First check to see if signals are present at TP1 and TP2. Use KSK to count the Pilot IF signal. A signal in the 10 – 30 MHz range indicates A23, A7, A9, and A10 are working properly. If a signal outside of this range is present (often less than 1 MHz), either the loop is broken or the A17 Frequency counter is defective. A Tee connector can be inserted into the loop at any point to measure the frequencies present. The overall RF Section Analog Block diagram indicates the signal levels that are present.

In the phase locked spans of 1 MHz or less, the YTO Loop CLOSED LED remains on. The PILOT IF should always be 20 MHz. HBWW and LHLD will be high and HGND will be low. The ramp waveforms at TP3 and TP8 are indicated on the schematic. The ramp is caused by the phase voltage tracking the frequency sweep of the 50 MHz VTO.

TABLE 1. A6 YIG-TUNED OSCILLATOR PHASE LOCK, REPLACEABLE PARTS (1 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	85680-60011	5	1	YIG-TUNED OSCILLATOR PHASE LOCK	28480	85680-60011
A6C1	0160-2055	9	19	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C2	0160-2203	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2203
A6C3	0160-2202	8	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2202
A6C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C11	0140-0193	0	4	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C12	0160-2255	1	1	CAPACITOR-FXD 8.2PF +-25PF 500VDC CER	28480	0160-2255
A6C13	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C15	0160-4084	8	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C16	0140-0196	3	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A6C17	0140-0194	1	2	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A6C18	0140-0194	1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A6C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C21				NOT ASSIGNED		
A6C22	0160-0301	4	1	CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0160-0301
A6C23				NOT ASSIGNED		
A6C24	0160-0163	6	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A6C25	0160-0127	2	1	CAPACITOR-FXD .1UF +-20% 25VDC CER	28480	0160-0127
A6C26	0160-0945	2	2	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A6C27	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C28	0140-0192	9	2	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A6C29	0160-2264	2	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A6C30	0160-2254	0	1	CAPACITOR-FXD 7.5PF +-25PF 500VDC CER	28480	0160-2254
A6C31	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C32	0140-0192	9		CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A6C33	0160-0945	2		CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A6C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C36	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C37	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C38	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C39	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C40	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C41	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C42	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A6C43	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C44				NOT ASSIGNED		
A6C45				NOT ASSIGNED		
A6C46	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 280V	28480	0160-2437
A6C47	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A6CR1	1901-0040	1	7	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR4-						
A6CR13				NOT ASSIGNED		
A6CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6DS1	1990-0487	7	3	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A6DS2	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A6DS3	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A6J1				NOT ASSIGNED		
A6J2	1250-0690	6	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A6J3	1250-0690	6		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A6L1				NOT ASSIGNED		
A6L2	9100-2257	6	1	INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A6L3	9100-3319	3	2	INDUCTOR RF-CH-MLD 740NH 2% .166DX.385LG	28480	9100-3319
A6L4	9100-1619	2	2	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A6L5	9100-3319	3		INDUCTOR RF-CH-MLD 740NH 2% .166DX.385LG	28480	9100-3319
A6L6	9100-2259	8	2	INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A6L7	9100-2256	5	2	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A6L8	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A6L9	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A6L10	9100-2259	8		INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259

*Indicates factory selected value

TABLE 1. A6 YIG-TUNED OSCILLATOR PHASE LOCK, REPLACEABLE PARTS (2 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6L11	9100-2256	5	2	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A6L12	9100-1620	5		INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A6L13	9100-1620	5	3	INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A6L14	9140-0096	1		INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A6L15	9140-0096	1		INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A6L16	9140-0096	1		INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A6Q1	1854-0019	3	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q3	1853-0007	7	4	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q4	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q5	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q6	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q7	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q8	1854-0404	8		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q9	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A6Q10	1854-0009	1	1	TRANSISTOR NPN SI PD=300MW FT=600MHZ	04713	2N709
A6Q11	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01225	2N3799
A6Q12	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A6Q13	1855-0049	1	1	TRANSISTOR J-FET DUAL N-CHAN D-MODE SI	28480	1855-0049
A6R1	0757-1094	9	13	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R2	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A6R3	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A6R4	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R5	0698-3132	4	4	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R6	0757-1094	9	4	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R7	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R8	0757-0316	6	2	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A6R9	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A6R10	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A6R11	0698-3441	8	8	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R12	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R13	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A6R14	0698-3446	3	2	RESISTOR 303 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R15	0757-0316	6		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A6R16	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A6R17	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A6R18	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A6R19	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R20	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R21	0757-0442	9	8	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R23	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R24	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R25	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R26	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R27	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R28	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A6R29	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R30	0698-3152	0	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A6R31	0757-1094	9	9	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R32	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R33	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R34	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R35	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A6R36	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A6R37				NOT ASSIGNED		
A6R38				NOT ASSIGNED		
A6R39	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A6R40	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R41	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R42	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R43	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A6R44	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A6R45	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R46				NOT ASSIGNED		
A6R47				NOT ASSIGNED		
A6R48	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A6R49	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A6R50				NOT ASSIGNED		
A6R51	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R52	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R53	0698-0084	9	5	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R54	0603-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A6R55	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

*Indicates factory selected value

TABLE 1. A6 YIG-TUNED OSCILLATOR PHASE LOCK, REPLACEABLE PARTS (3 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R56	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R57	0757-0294	9		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1780-F
A6R58	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R59	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A6R60	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A6R61				NOT ASSIGNED		
A6R62	0757-0290	5	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A6R63	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A6R64	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R65	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R66	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R67	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A6R68	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R69	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R70	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A6R71	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R72	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R73	0757-0450	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A6R74	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R75	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6TP1	0360-0124	3	7	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP4				NOT ASSIGNED		
A6TP5	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP6	0360-0124	3	3	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP7	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP8	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6U1	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A6U2	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U3	1826-0416	5		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A6U4	1826-1007	2		IC OP AMP PRON 8-T0-99	28480	1826-0007
A6U5	1826-0161	7		IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P
A6U7	1820-1212	9	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112AN
A6VR1	1902-3234	3	1	DIODE-ZNR 19.6V 5% D0-35 PD=.4W	28480	1902-3234
A6VR2	1902-0049	2		DIODE-ZNR 6.19V 5% D0-35 PD=.4W	28480	1902-0049
A6VR3	1902-3059	0		DIODE-ZNR 3.83V 5% D0-35 PD=.4W	28480	1902-3059
A6VR4				NOT ASSIGNED		
A6VR5	1902-0126	6	1	DIODE-ZNR 2.61V 5% D0-7 PD=.4W TC=-.072%	28480	1902-0126
A6VR6				NOT ASSIGNED		
A6VR7	1902-3082	9	1	DIODE-ZNR 4.64V 5% D0-35 PD=.4W	28480	1902-3082
				MISCELLANEOUS PARTS		
	B6701-40001	9	1	EXTRACTOR PC	28480	B6701-40001

*Indicates factory selected value

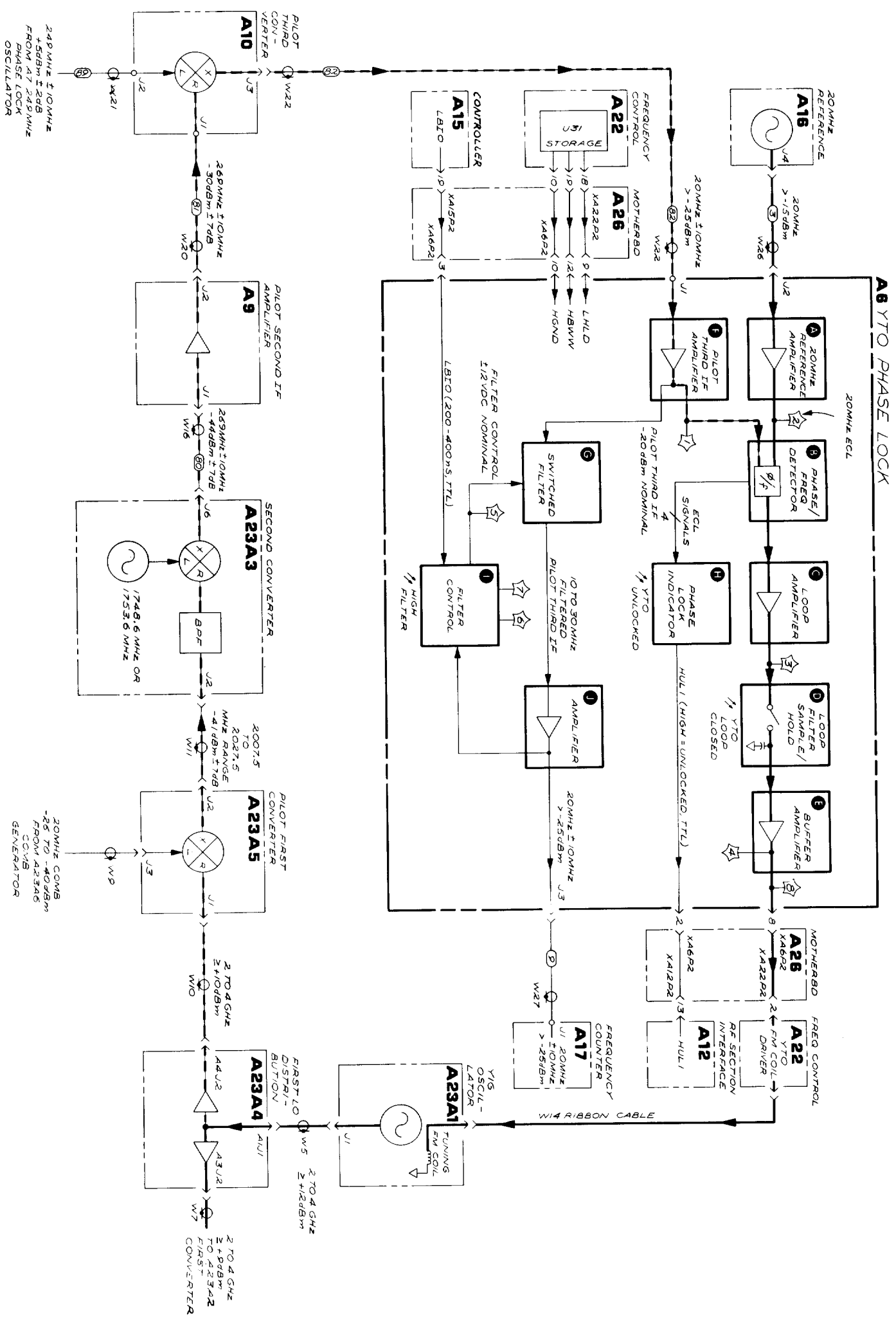
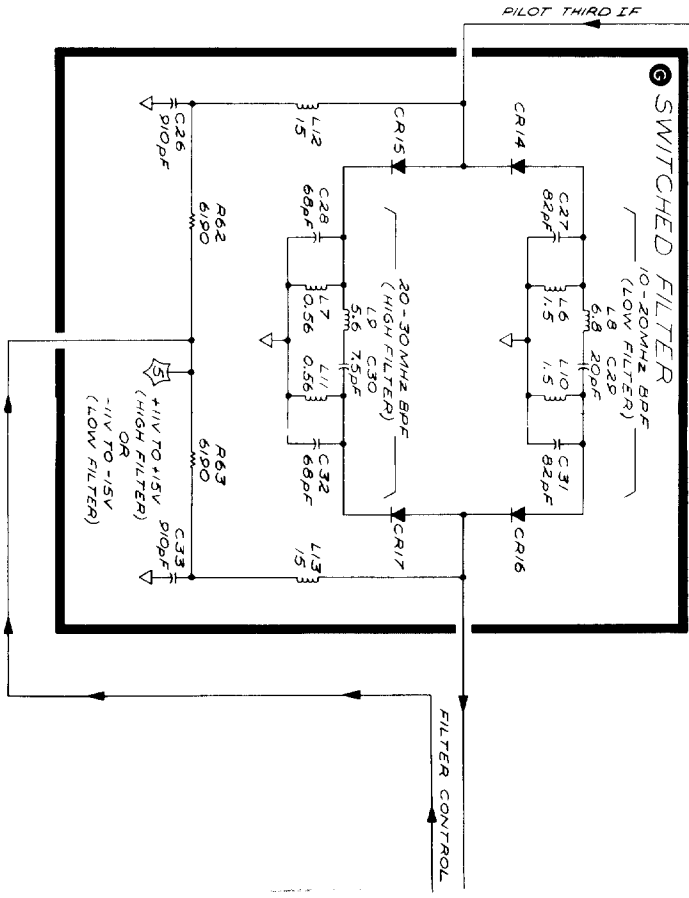
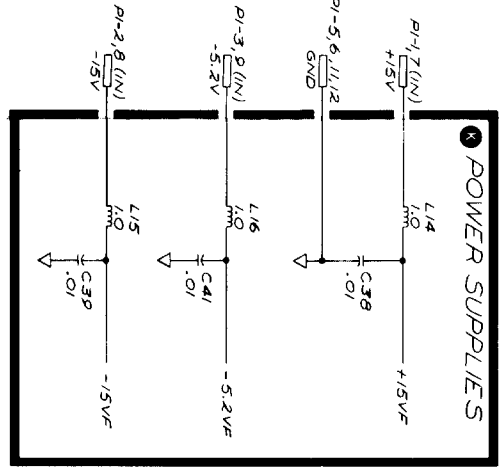
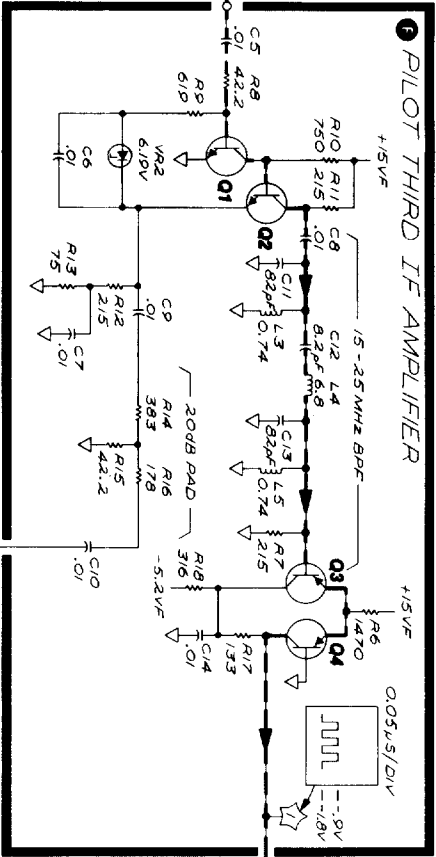
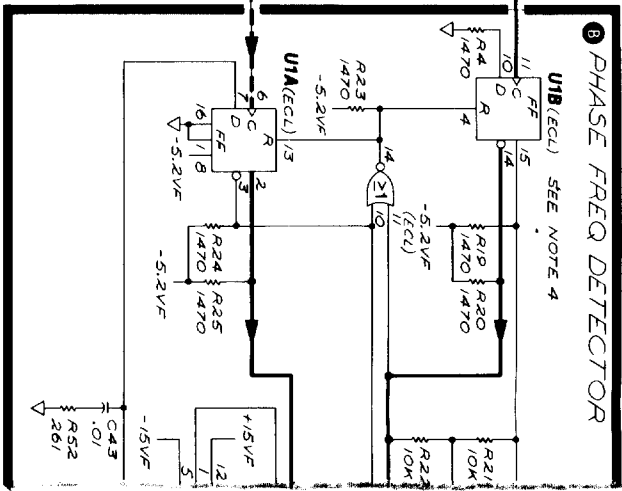
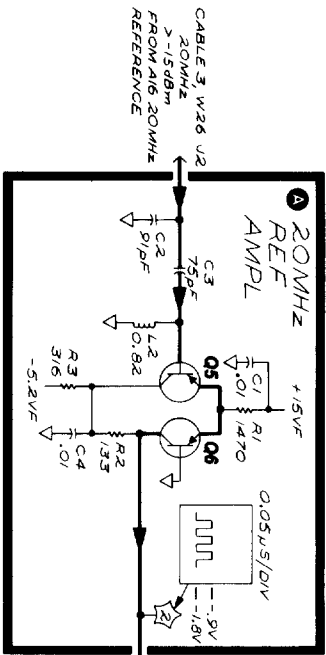


FIGURE 2. A6 YIG-TUNED OSCILLATOR PHASE LOCK, BLOCK DIAGRAM

A6 11/12

A8 YTO PHASE LOCK
85680-60011

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15V		(K)
7	+15V		(K)
2	-15V		(K)
8	-15V		(K)
3	-5.2V		(K)
9	-5.2V		(K)
4	NC		
10	NC		
5	GND		(K)
11	GND		(K)
6	GND		(K)
12	GND		(K)



PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
7	NC		
2	HULL	A12, P2-13	(H)
8	YTO LOCK	A22, P2-2	(E)
3	LHLD	A15, P2-10	(I)
9	LHLD	A22, P2-10	(D)
4	NC		
10	MGND	A22, P2-10	(G)
5	NC		
11	NC		
6	NC		
12	HBWW	A22, P2-10	(J)

SERIAL PREFIX: 2408A

A7 249 MHz PHASE LOCK OSCILLATOR, CIRCUIT DESCRIPTION

A7 249 MHz Phase Lock Oscillator has two outputs in the range 239 MHz to 259 MHz. One output goes to A10 Pilot Third Converter. The other goes to A18 275 MHz Phase Lock Oscillator, where it is mixed with 275 MHz to provide a 16 MHz to 38.5 MHz signal (variable in 500-kHz steps) to A8 249 MHz Phase Lock. A7 consists of the 249 MHz Phase Lock Oscillator, a Tune Voltage Filter (which also provides phase lock loop compensation), and two common-emitter Buffer Amplifiers.

249 MHz Phase Lock Oscillator (B)

Transistor Q1 and its associated circuitry form a modified Colpitts oscillator with C21 through C23 providing the feedback signal. The tank circuit capacitance is provided by the feedback capacitors and by PLO ADJUST C3, C2, and varactor diode CR1. The tank circuit inductance is provided by PLO ADJUST L2 and L11. R1 and R2 set the operating bias for Q1. L1, L3, L4, C1, C5, and C8 are high-frequency bypass elements.

Tune Voltage Filter (A)

The Tune Voltage Filter receives a +4V to +18V signal (called 249 MHz TUNE) from A8 249 Phase Lock. This tune voltage is derived in A8 by the Phase/Frequency Detector. The amount of frequency offset is determined by the Variable Modulo Frequency Divider, which operates at a 500 kHz rate. The 500 kHz component of the tune voltage is filtered out before it is sent to the 249 MHz Phase Lock Oscillator. The tune voltage may be measured at TP1.

The Tune Voltage Filter consists of L12, L13, L14, L15, L16, L17, L18, C25, C26, and C27. The 500 kHz TRAP inductors L17 and L15 are adjusted to shunt 500 kHz to ground. R23, R22, and C24 provide phase lock loop compensation.

Buffer Amplifier 1 (C)

Buffer Amplifier 1 provides isolation for the 249 MHz (± 10 MHz) signal to A10 Pilot Third Converter. Q3 is a common-emitter amplifier with a gain of approximately 9 dB. The bias for Q3 is set by R8, R19, and R13. The amplifier has a 2 dB resistive pad on both the input and the output for additional isolation.

Buffer Amplifier 2 (D)

Buffer Amplifier 2 provides isolation for the 249 MHz (± 10 MHz) signal to A18 275 MHz Phase Lock Oscillator. Q2 is a common-emitter amplifier with a gain of approximately 12 dB. R17, R18, and R25 provide dc bias for Q2. The amplifier has a 5 dB resistive pad on both the input and the output for additional isolation. The output signal then passes through a 300-MHz low-pass filter (L5, L7, and C6) to eliminate crossing spurs in A8 249 MHz Phase Lock.

TABLE 1. A7 249 MHz PHASE LOCK OSCILLATOR, REPLACEABLE PARTS (1 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	85680-60013	7	1	249MHZ PHASE LOCK OSCILLATOR	28480	85680-60013
A7C1	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A7C2	0160-2262	0	1	CAPACITOR-FXD 16PF +-5% 500VDC CER 0+-30	28480	0160-2262
A7C3	0121-0457	9	1	CAPACITOR-V TRMR-PSTN .0-8.5PF 750V	18736	TP9
A7C4				NOT ASSIGNED		
A7C5	0160-2055	9	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C6	0160-2259	5	1	CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A7C7				NOT ASSIGNED		
A7C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C9	0160-4084	8	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C10	0160-3879	7	4	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C12	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C15	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C18	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C19	0180-0116	1	3	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C20	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C21	0160-2266	4	1	CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A7C22	0160-2247	1	1	CAPACITOR-FXD 3.9PF +- .25PF 500VDC CER	28480	0160-2247
A7C23	0150-0059	8	1	CAPACITOR-FXD 3.3PF +- .25PF 500VDC CER	28480	0150-0059
A7C24	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C25	0160-2224	4	1	CAPACITOR-FXD 1800PF +-5% 300VDC MICA	28480	0160-2224
A7C26	0160-2221	1	1	CAPACITOR-FXD 1300PF +-5% 300VDC MICA	28480	0160-2221
A7C27	0160-2227	7	1	CAPACITOR-FXD 2400PF +-5% 300VDC MICA	28480	0160-2227
A7C28	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A7CR1	0122-0072	6	1	DIODE-VVC 2.2PF 5% C3/C25-MIN=4.5	04713	BB105B
A7J1	1250-0690	6	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A7J2	1250-0690	6		CONNECTOR-RF SMD M SGL-HOLE-FR 50-OHM	28480	1250-0690
A7L1	9140-0158	6	3	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A7L2	85680-80005	9	1	COIL-OSCILLATOR	28480	85680-80005
A7L3	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A7L4	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A7L5	9100-2891	4	2	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A7L6	9100-2247	4	2	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A7L7	9100-2891	4		INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A7L8	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A7L9	9140-0129	1	2	INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A7L10	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A7L11	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A7L12	9100-1634	1	1	INDUCTOR RF-CH-MLD 75UH 5% .166DX.385LG	28480	9100-1634
A7L13	9100-1620	5	1	INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A7L14	9100-1635	2	2	INDUCTOR RF-CH-MLD 91UH 5% .166DX.385LG	28480	9100-1635
A7L15	85680-80007	1	1	INDUCTOR 60 UH	28480	85680-80007
A7L16	9140-0210	0	1	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A7L17	85680-80006	1	1	INDUCTOR 42 UH	28480	85680-80006
A7L18	9100-1635	2		INDUCTOR RF-CH-MLD 91UH 5% .166DX.385LG	28480	9100-1635
A7Q1	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A7Q2	1854-0686	0	2	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A7Q3	1854-0686	0		TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A7R1	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A7R2	0698-3447	4	5	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R3				NOT ASSIGNED		
A7R4				NOT ASSIGNED		
A7R5	0698-3439	4	4	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R6	0757-0180	2	2	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A7R7	0698-3439	4		RESISTOR 170 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R8	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101 F
A7R9	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A7R10	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R11	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A7R12	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R13	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R14	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R15	0757-0378	0	2	RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A7R16	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R17	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R18	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A7R19	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R20	0757-0378	0		RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F

*Indicates factory selected value

TABLE 1. A7 249 MHz PHASE LOCK OSCILLATOR, REPLACEABLE PARTS (2 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7R21	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R22	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A7R23	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R24	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R25	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
				MISCELLANEOUS PARTS		
	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001

*Indicates factory selected value

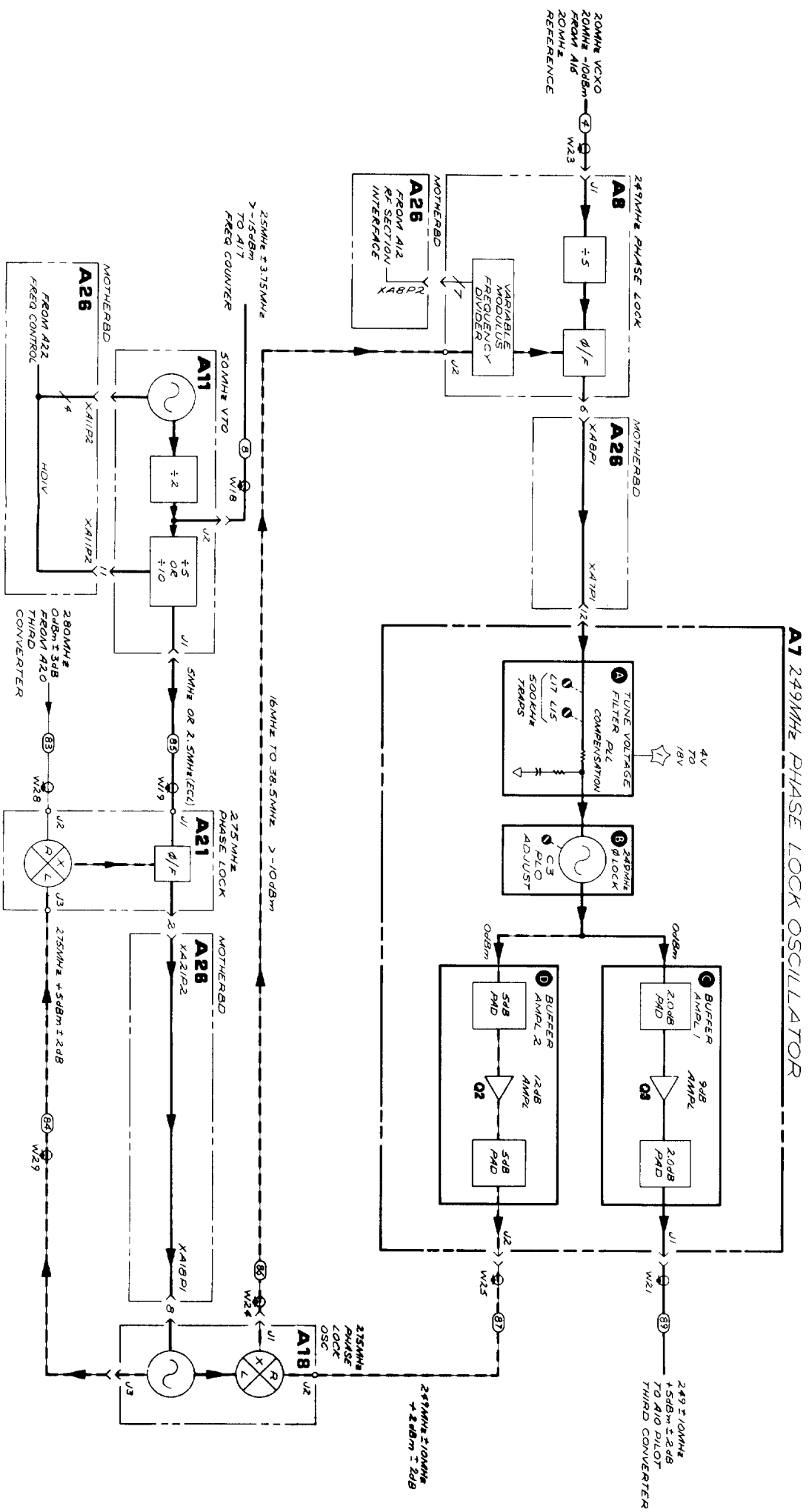


FIGURE 1. A7 249MHz Phase Lock Oscillator, Block Diagram

A7
249 MHz PHASE LOCK OSCILLATOR
85680-60013

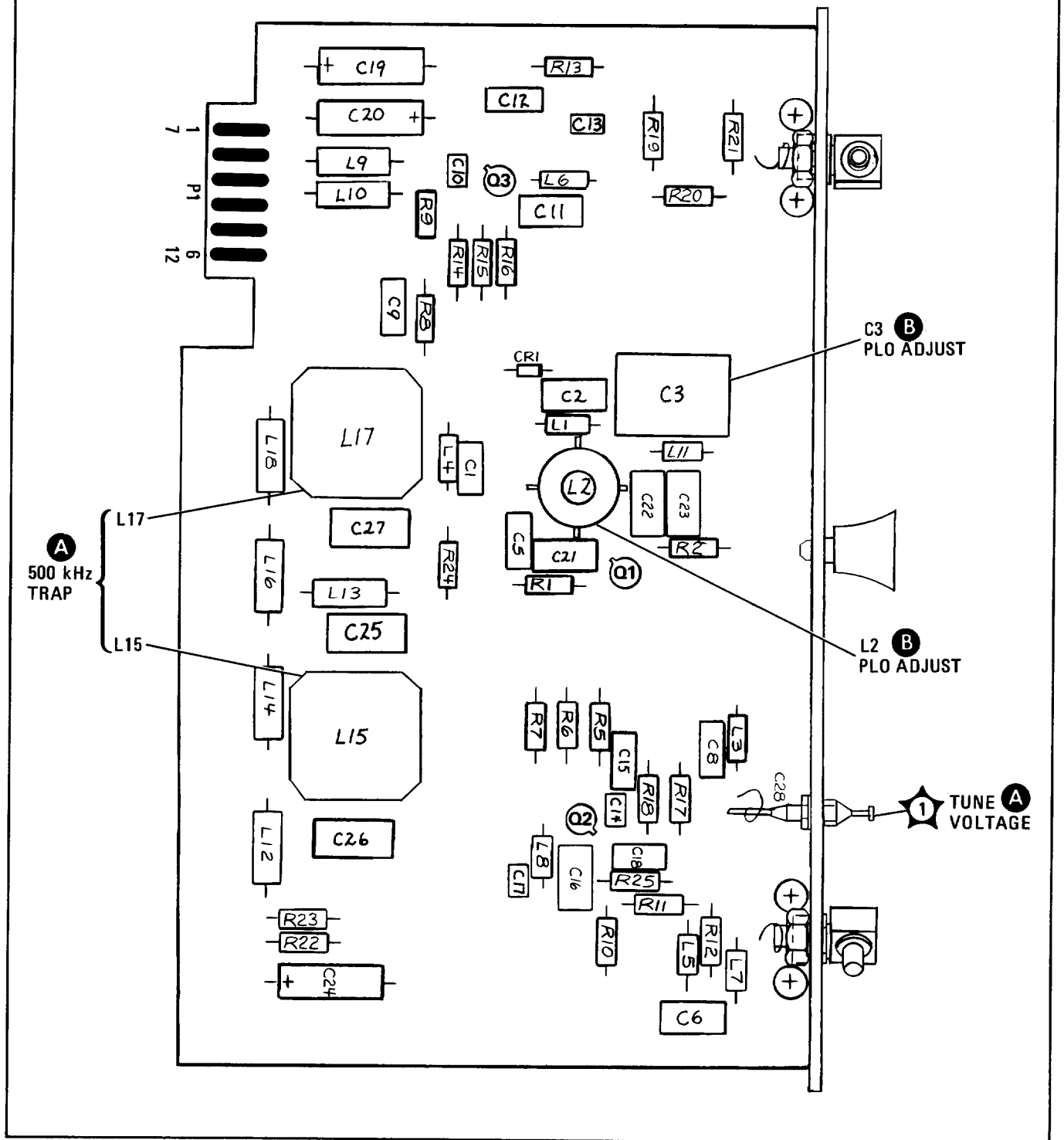


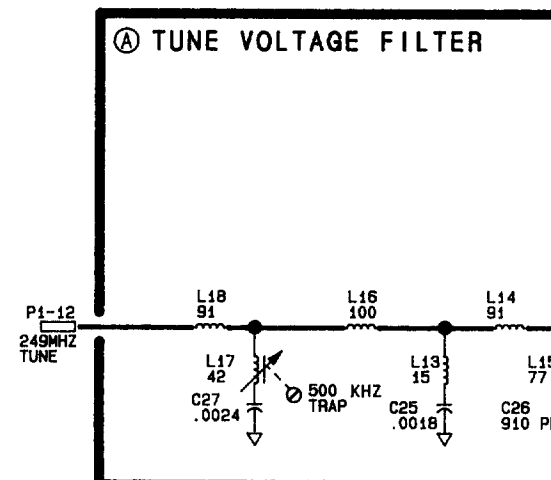
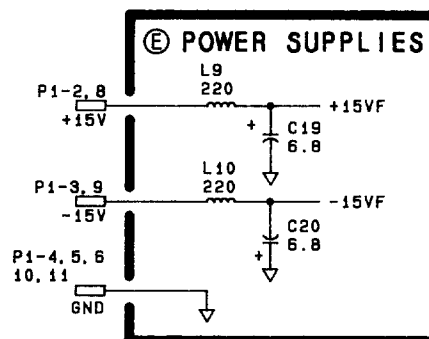
FIGURE 2. A7 249 MHz PHASE LOCK OSCILLATOR, COMPONENT LOCATIONS

RF SECTION

A7 249 MHz PHASE LOCK OSCILLATOR
085680-60013

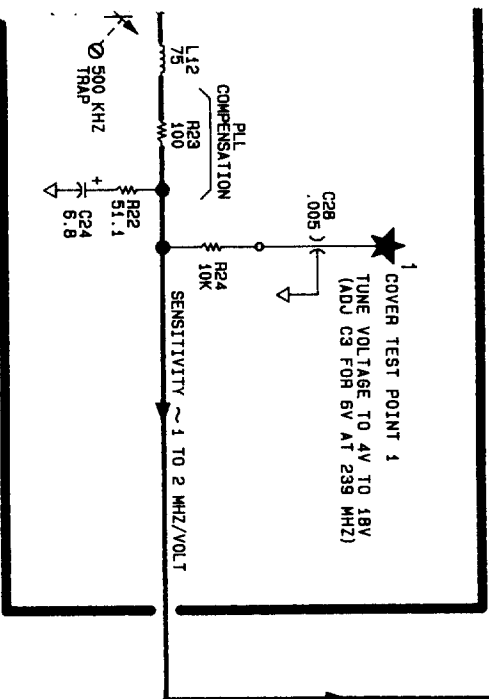
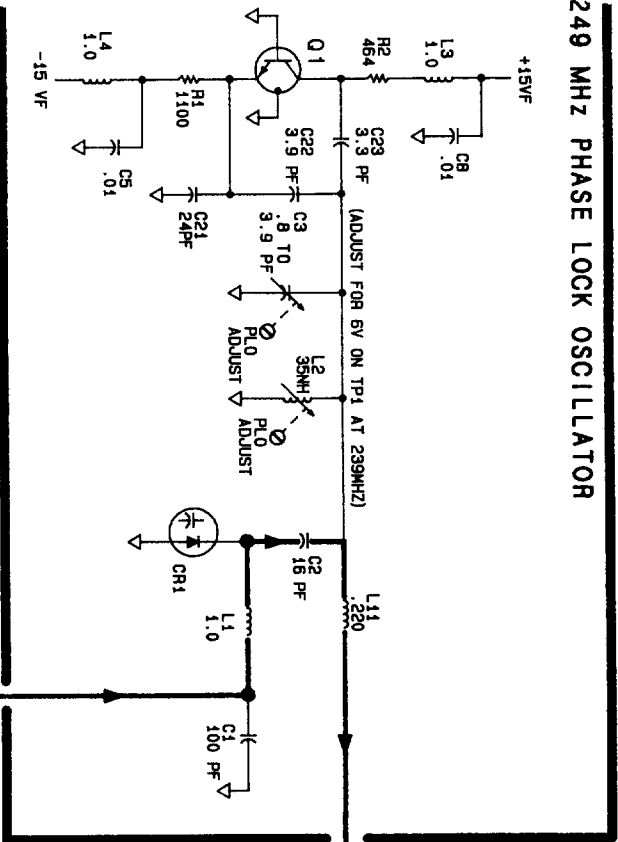
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
7	NC		
2	+15V		E
8	+15V		E
3	-15V		E
9	-15V		E
4	GND		E
10	GND		E
5	GND		E
11	GND		E
6	GND		E
12	249MHz TUNE	A8P1-6	A

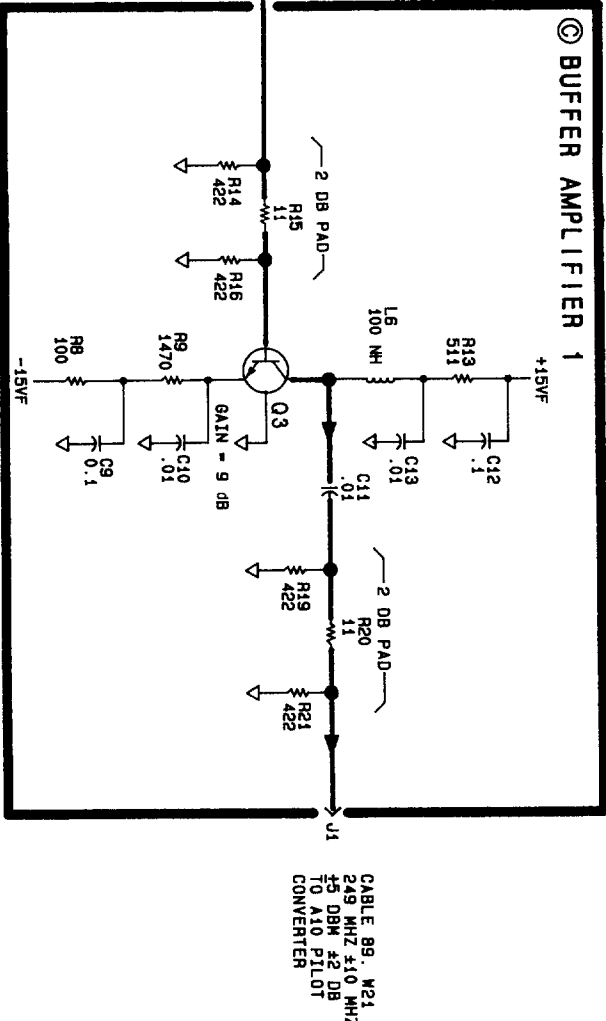


SERIAL PREFIX: 2408A

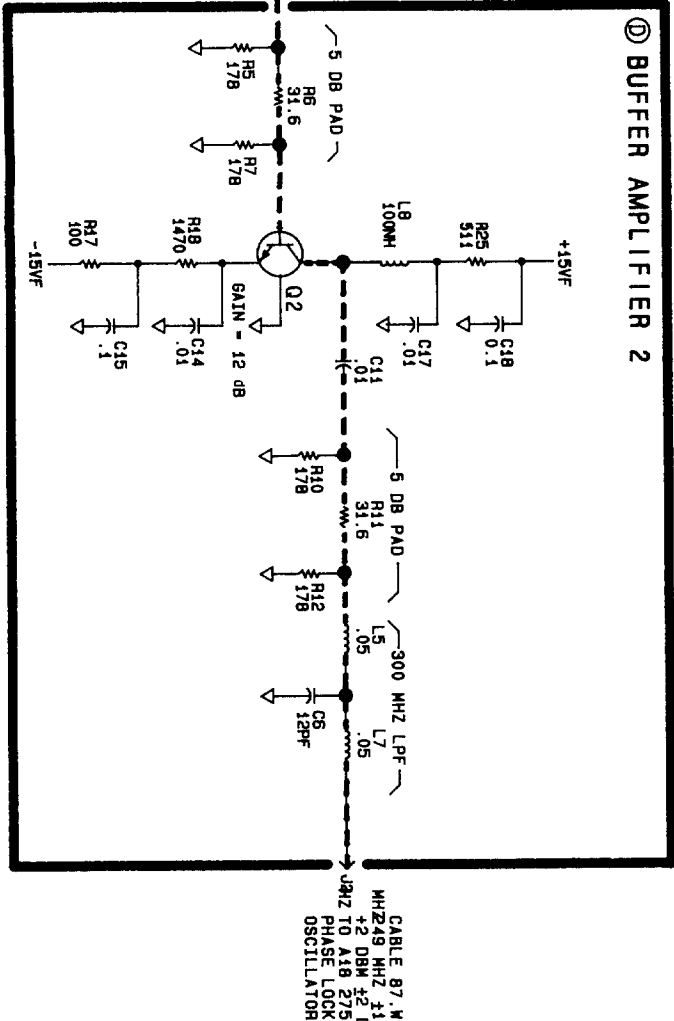
249 MHZ PHASE LOCK OSCILLATOR



Ⓢ BUFFER AMPLIFIER 1



Ⓢ BUFFER AMPLIFIER 2



- NOTES:
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PRE-FIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
 2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
 3. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.

FIGURE 3. A7 249 MHZ PHASE LOCK OSCILLATOR, SCHEMATIC DIAGRAM

A8 249 MHz PHASE LOCK, CIRCUIT DESCRIPTION

The frequency from A18 275 MHz Phase Lock Oscillator (16 MHz to 38.5 MHz) is divided in A8 249 MHz Phase Lock to produce one of the two frequency inputs to a Phase/Frequency Detector. The other input is a 4 MHz reference signal (20 MHz divided by 5) from A16 20 MHz Reference. If the two inputs to the Phase/Frequency Detector are out of phase, a control voltage is generated to force a change in the frequency of A7 249 MHz Phase Lock Oscillator until the inputs are in phase.

Reference $\div 5$ (B)

A 20 MHz, -10 dBm signal from A16 20 MHz Reference is amplified by Q1, Q2, and associated circuitry, and the level is shifted to ECL at the collector of Q2 (TP5). The ECL 20 MHz signal goes to the divider U4 pin 7 and is divided by 5. The ECL 4 MHz signal at U4 pin 2 is the reference (REF) signal to the Phase/Frequency Detector.

Variable Modulo Frequency Divider (A)

The Variable Modulo Frequency Divider provides a means to divide by numbers that are not integers (e.g., 3.125, 5.875, etc.). This results in a better signal-to-noise ratio in the phase-locked oscillator, since the signal-to-noise ratio is directly proportional to the divide number in phase lock circuits.

The 16–38.5 MHz, -10 dBm input to the Variable Modulo Frequency Divider is the result of mixing the signal from A7 249 MHz Phase Lock Oscillator with 275 MHz in A18 275 MHz Phase Lock Oscillator, where the lower sideband, 16–38.5 MHz, is filtered off and sent to A8. C24, C25, and L1 provide further low-pass filtering. Q3 and associated circuitry buffer the 16–38.5 MHz to ECL level on the collector of Q3 (TP6), providing clock pulses to binary counter U5 pin 13 and D flip-flop U8B pin 11.

Hex D flip-flop U15 is connected to the Instrument Bus and latches data bits 10 through 15 from A15 Controller when the LLDD line is pulled low. Data bits 13 through 15 are latched and go through the TTL to ECL Level Shift (R5 through R10 and R14 through R16) to the three low-order D inputs of U5. The high-order D input is always at ground (high). Data bits 10, 11, and 12 are latched and go to binary rate multiplier U14 inputs D_3 , D_4 , and D_5 . D_0 , D_1 , and D_2 are tied to ground (low).

At the start of the count cycle, U5 is loaded from the Data Latch U15 and counts up (SEL1 low, SEL2 high). When the count reaches 1110, U13A pin 3 and U13B pin 14 (which are wired OR) go low, driving U6B, which is used as an ECL-to-TTL buffer. U6B pin 15 drives the CLK input at U14 pin 9. At count 1111, U5 pin 4 (carry out) goes low and the carry out is connected to NOR gate U10C pin 10. If U5 is allowed to continue counting, it will cause NOR gate U10D pin 12 to go low. Therefore, one of the following events will occur: (1) U5 starts at its pre-load number and counts to 1111 (U10C pin 10 goes low); or (2) U5 starts at its pre-load number and counts one count past 1111 to 0000 (U10D pin 12 goes low). U14 selects the signal (U10C pin 10 or U10D pin 12) that will be used to reset U5 and start over through U13C. U14 pin 5 will pulse n times for every 8 of its clock pulses, where $n = (D_5 \times 2^2) + (D_4 \times 2^1) + D_3$. If U14 pin 5 is high, the carry out from U5 will reset U5. If this pin is low, 0000 (carry out plus 1) will reset U5. U13C, U10C, and U10D are arranged so that the selected reset signal is at U10A pin 2. The signal goes to the D input (pin 10) of flip-flop U8 and is clocked through on the next pulse of the main clock. The divided signal out is then at U8 pin 14, and U5 is reset because SEL2 (U5 pin 7) is low.

The 16 to 38.5 MHz input from A18 275 MHz Phase Lock Oscillator is divided in the Variable Modulo Frequency Divider to provide one of the frequency inputs to the Phase/Frequency Detector. (The other input is

4 MHz from the Reference $\div$ 5 circuit.) The signal is divided according to the following equation:

$$N = 9 - M + 0.125P$$

where N is the divide number, M is the number obtained by the M0, M1, and M2 outputs of U15, and P is the number obtained by the P0, P1, and P2 outputs of U15. M0 through M2 are inputs to U5, and P0 through P2 are inputs to U14. For the frequency range 16 to 38.5 MHz, M is never 6 or 7.

Table 1 gives N, M, and P for some selected frequencies:

TABLE 1. N, M, AND P NUMBERS FOR SELECTED FREQUENCIES

Frequency (MHz)	N	M	P
16.0	4.000	5	0
19.5	4.875	5	7
23.0	5.750	4	6
36.0	9.000	0	0
38.5	9.625	0	5

The M and P numbers for a specific frequency of the 249 MHz Phase Lock Oscillator may be displayed on the CRT. Press **SHIFT** **MNR-REF LVL**. The diagnostic data is displayed in the upper left-hand corner of the CRT as shown in Figure 1. A description of each number is given in Table 2.

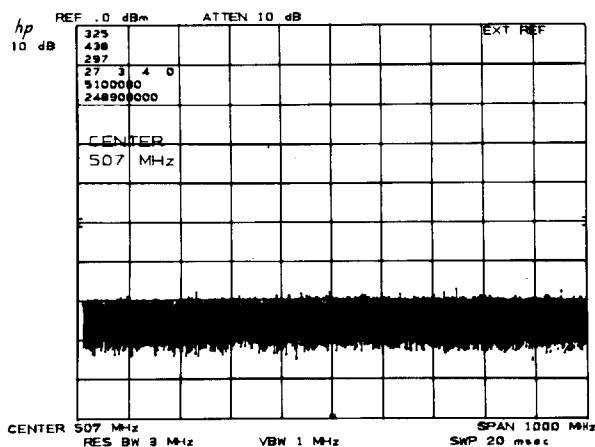


FIGURE 1. CRT DISPLAY SHOWING LOCATION OF DIAGNOSTIC DATA

TABLE 2. EXPLANATION OF DIAGNOSTIC NUMBERS

Number	Description
325	LSB, 50 MHz VTO DAC
438	MSB, 50 MHz VTO DAC
297	YTO DAC
27	Harmonic, 20 MHz Reference
3	M number
4	P number
0	No Second LO shift
51000000	50 MHz VTO reference frequency (5.1 MHz)
2489000000	249 MHz PLO frequency (248.9 MHz)

Phase/Frequency Detector (C)

The divided signal from the Variable Modulo Frequency Divider goes to the clock input of U3A. The divided REF signal from the Reference $\div 5$ goes to the clock input of U3B. The D inputs of the flip-flops are tied to ground through R21 and are held high. The active low (LQ) outputs of the flip-flops are tied to the inputs (pins 7 and 8) of NOR gate U1A, and the resets are tied to the output, U1A pin 3. The first low-to-high transition to either the flip-flop U3A or the REF flip-flop U3B sets the active high (Q) output of that flip-flop high. The active low output remains low until the second flip-flop is set; then NOR gate U1A resets both flip-flops. Thus, the signal that leads in phase will have a pulse on the active high and active low outputs of its flip-flop, and the pulse length will be proportional to the amount of phase lead.

Lock Indicator (D)

The active low output (pin 3) of U3A and the active low output (pin 14) of U3B are inputs to NOR gate U1C. The remaining outputs (U3A pin 2 and U3B pin 15) are inputs to NOR gate U1B. When the loop is locked, the PILOT divided signal and the REF divided signal are in phase, the active high outputs of the flip-flops are in phase, and the active low outputs are in phase (but opposite in state to the active high outputs). The outputs of U1B and U1C are wired OR, so when the loop is locked, one or the other of the gates is high. When the loop is unlocked, the gates are no longer in phase, so the output goes low an average of half the time. This output goes to U6A pins 5, 6, and 7. A low on the inputs to U6A causes pin 1 to go high, and a TTL high on the base of Q5 lights LED indicator DS1 to give a 249 MHz UNLOCKED indication. A low on pins 5, 6, and 7 of U6A gives a corresponding low on output pins 2, 3, and 4, activating the positive feedback circuit R24, R23, and C9 to increase the high-to-low transition speed. When the loop is unlocked, the HUL2 signal is sent to A12 RF Section Interface.

Loop Amplifier (E)

The active high or active low outputs of U3A and U3B are summed at the bases of differential pair Q6, Q7. The amplified signals are connected to comparator U7 to produce the 249 MHz TUNE signal to A7 MHz Phase Lock Oscillator.

A8 249 MHz PHASE LOCK, TROUBLESHOOTING

The 249 MHz Phase Lock assembly is used to produce steps of either 500 kHz or 4 MHz in the Center Frequency of the analyzer.

If the 249 UNLOCK message is flashing or a constant center frequency offset of a multiple of 500 kHz or 4 MHz exists, start the troubleshooting procedure with this assembly.

First, turn on the Diagnostic Function by keying in KSR ( ). The last line is the programmed frequency of the 249 MHz PLO. A Tee connector can be placed in the 249 MHz loop and the actual frequency can be counted. The second and third numbers in the fourth row are the M and P numbers used in the Variable Modulo Frequency Divider (**A**).

Verify the waveforms shown on the schematic. The following procedure simplifies troubleshooting of the Variable Modulo Frequency Divider. Jumper A15TP8 (STS) to A15TP11 (T1) and push  . Remove cable 1 from A16J6 and connect cable 86 from A8J2 to A16J6. This inputs a constant 20 MHz signal to the Variable Modulo Frequency Divider.

Table 3 lists the instrument settings necessary to exercise the circuitry on this assembly. Verify that the M and P inputs are the same as those shown by KSR. The frequency readings at TP1, 2, and 4 are taken by using a 10:1 oscilloscope probe into the high impedance input of a frequency counter. A 1:1 probe causes excessive loading of the ECL circuitry. The frequency at TP4 is 20 MHz divided by N, where $N = 9 - M + .125P$. During this test, the Loop Amplifier (**E**) output, TP7, is at its extremes. It is +4V when TP4 is less than 4 MHz, and +18V when TP4 is greater than 4 MHz.

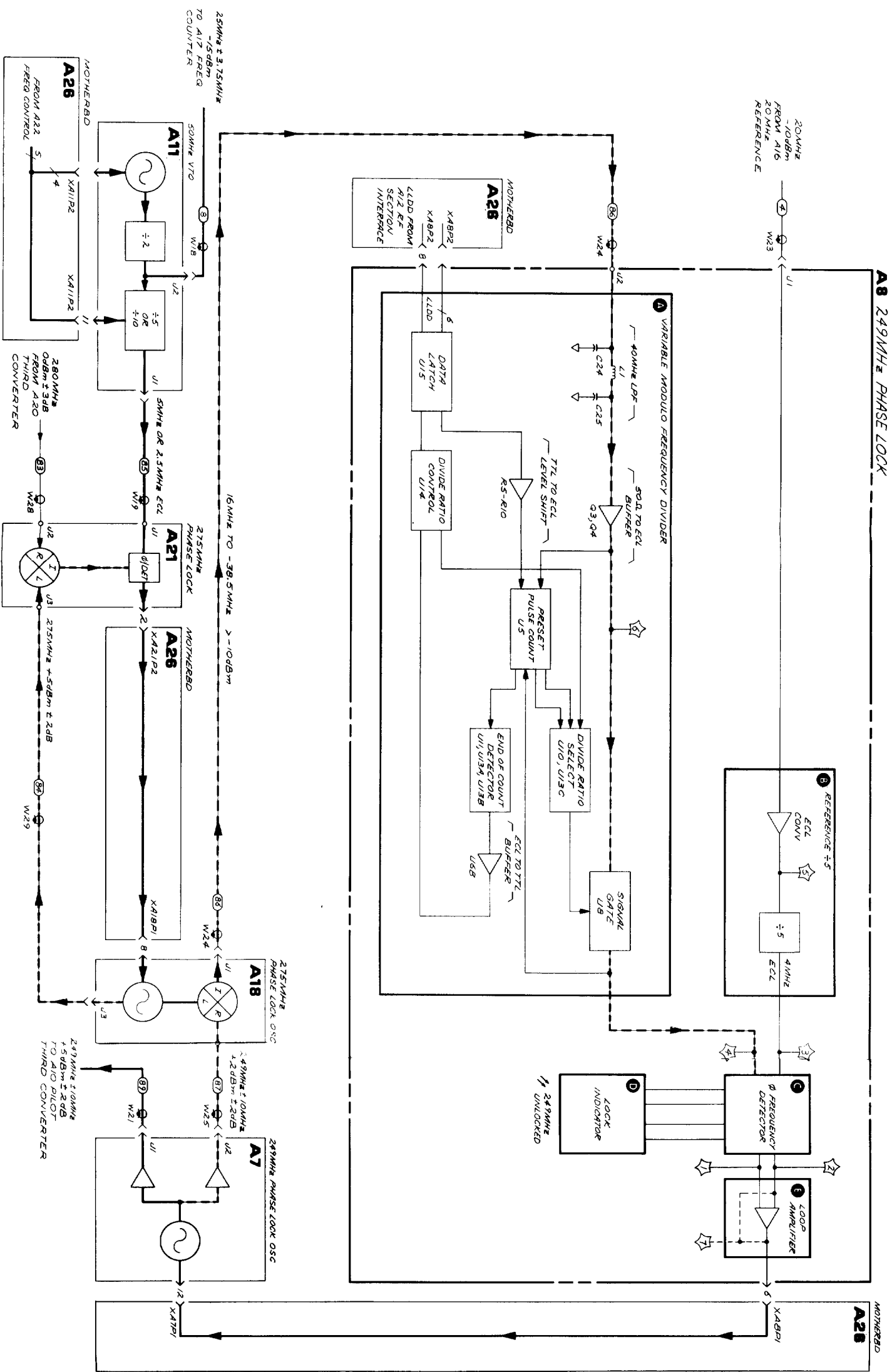
TABLE 3. M AND P NUMBERS FOR VARIABLE MODULO FREQUENCY DIVIDER

Center Frequency (MHz)	Frequency Span (MHz)	M	P	TP1, 2, 4 (MHz)	TP7 (V)
1.6	50	1	0	2.500	+4
5.6	50	2	0	2.857	+4
13.6	50	4	0	4.000	—
17.6	50	0	0	2.222	+4
14.1	50	5	7	4.103	+18
18.0	100 kHz	0	4	2.105	+4
19.0	100 kHz	0	2	2.162	+4
19.5	100 kHz	0	1	2.192	+4

TABLE 4. A8 249 MHz PHASE LOCK, REPLACEABLE PARTS

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
AB	85680-60123	0	1	249MHZ PHASE LOCK	28480	85680-60123
ABC1	0160-2055	9	12	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC9	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 250VDC CER	28480	0160-0127
ABC10	0140-0198	5	4	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
ABC11	0140-0198	5		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
ABC12	0140-0198	5		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
ABC13	0140-0198	5		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
ABC14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC16	0160-2201	7	4	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
ABC17	0160-0161	4	2	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
ABC21	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
ABC22	0160-2201	7		CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
ABC23	0160-0161	4		CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
ABC24	0160-2201	7		CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
ABC25	0160-2201	7		CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
ABC26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
ABC27	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
ABC28	0160-2202	8	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
ABC29	0160-2203	9	1	CAPACITOR-FXD 91PF +-5% 300VDC MICA 0+70	28480	0160-2203
ABC30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
AGDS1	1970-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
ABJ1	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
ABL1-				NOT ASSIGNED		
ABL3				FILTER COIL BLUE	28480	08558-80011
ABL4	08558-80011	6	2	FILTER COIL BLUE	28480	08558-80011
ABL5	08558-80011	6				
ABQ1	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
ABQ2	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
ABQ3	1853-0018	0	1	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
ABQ4				NOT ASSIGNED		
ABQ5	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
ABQ6	1854-0023	9	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
ABQ7	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
ABR1-				NOT ASSIGNED		
ABR40				RESISTOR 100 1% .125W F TC=0+ -100	24546	C4-1/B-T0-101-F
ABR41	0757-0401	0	1			
ABTP1	0360-0124	3	7	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
ABTP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
ABTP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
ABTP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
ABTP5	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
ABTP6	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
ABTP7	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
ABU1	1820-0802	1	3	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
ABU2	1810-0204	6	3	NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
ABU3	1820-0817	8	2	IC FF ECL D-M/S DUAL	04713	MC10131P
ABU4	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
ABU5	1820-0821	4	1	IC CNTR ECL BIN UP/DOWN SYNCHRO	04713	MC10136L
ABU6	1820-0807	6	1	IC GATE ECL OR DUAL 3-INP	04713	MC10110P
ABU7	1826-1007	2	1	IC DP AMP PRGM 8-TO-99 PKG	28480	1826-1007
ABU8	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
ABU9	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
ABU10	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
ABU11	1820-0801	0	1	IC GATE ECL OR-NOR QUAD 2-INP	04713	MC10101P
ABU12	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
ABU13	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
ABU14	1820-0744	0	1	IC CNTR TTL BIN SYNCHRO POS-EDGE-TRIG	01295	SN7497N
ABU15	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
	06701-40001	9	1	MISCELLANEOUS PARTS EXTRACTOR PC	28480	86701-40001

*Indicates factory selected value



A8
249 MHz PHASE LOCK
85680-60123

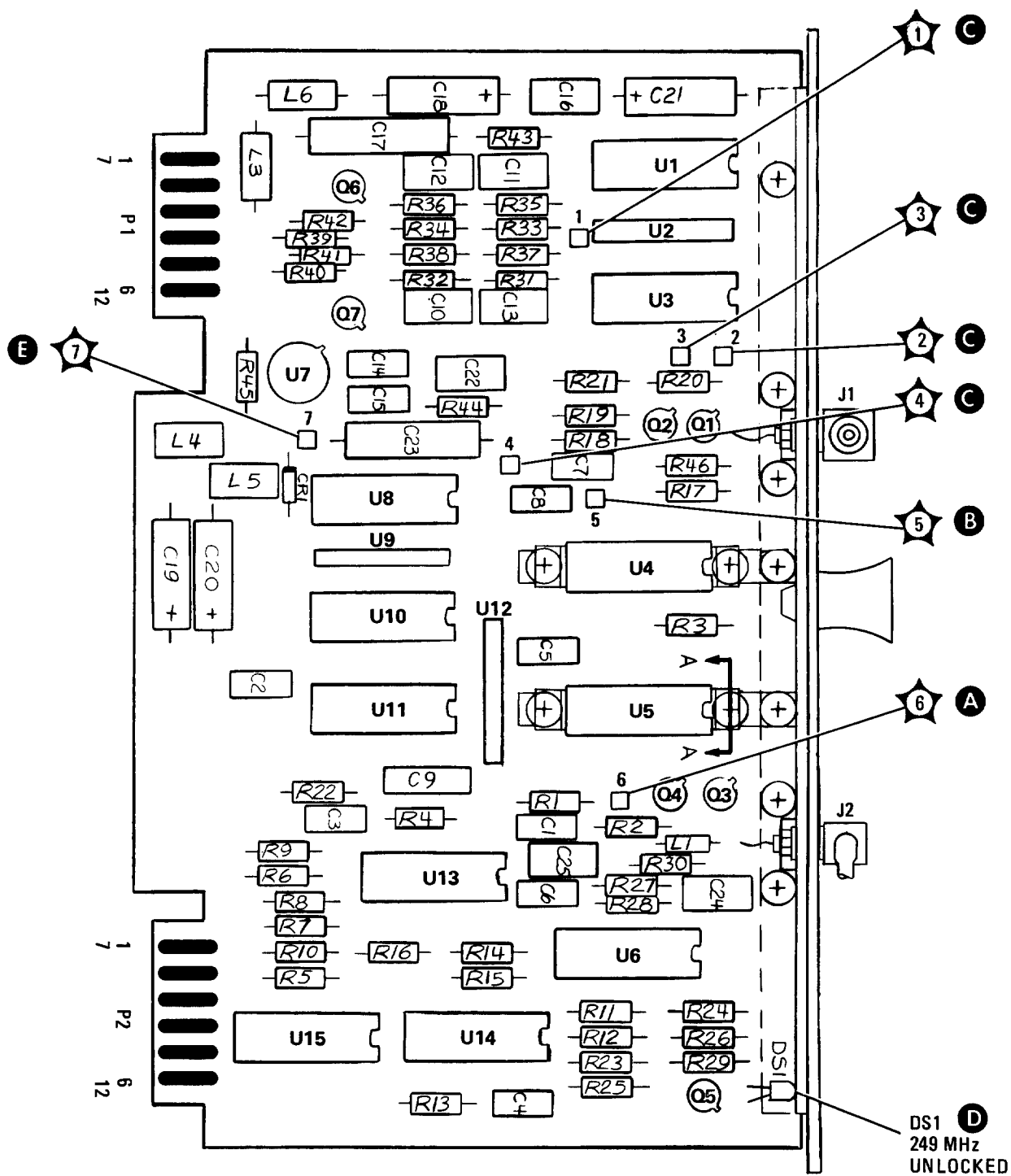


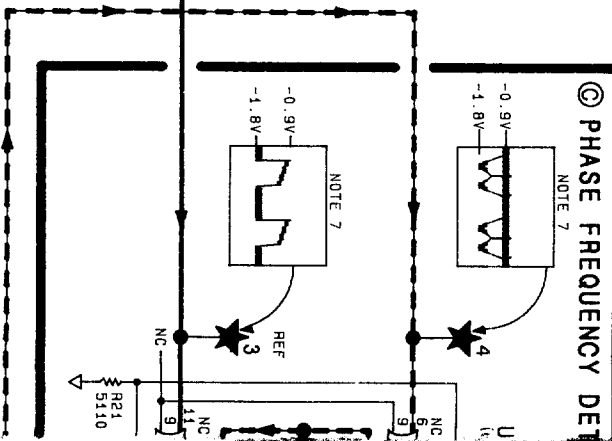
FIGURE 3. A8 249 MHz PHASE LOCK, COMPONENT LOCATIONS

POWER SUPPLIES

The diagram illustrates the power supply connections for a vacuum tube circuit. The power supplies are connected to the following pins:

- +20V:** P1-1, P2-1, P3-1
- +5V:** P1-4, P2-2
- 0V (GND):** P1-5, P2-3, P3-2
- 5V:** P1-3, P3-3
- 15V:** P1-2, P3-4

Each power supply line includes a series resistor (L6, L5, L4, L3) and a bypass capacitor (C24, C20, C18) connected to ground.



① VARIABLE

1.5V

1.5V

DATA LAT +5VF

1145

50 OH

50 OH

51 PF

1.00 nH

C24

C50

C50

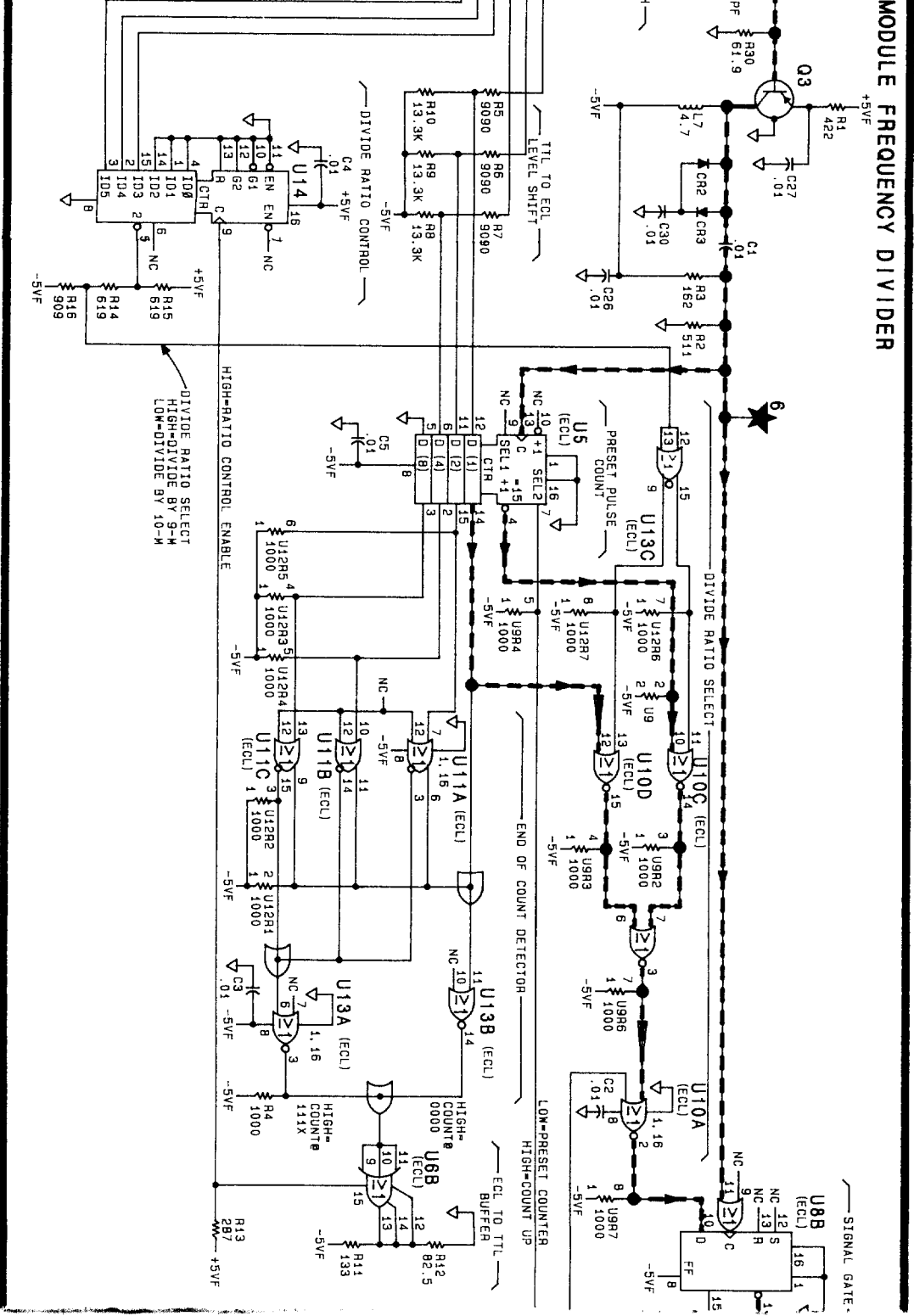
8.5MHz

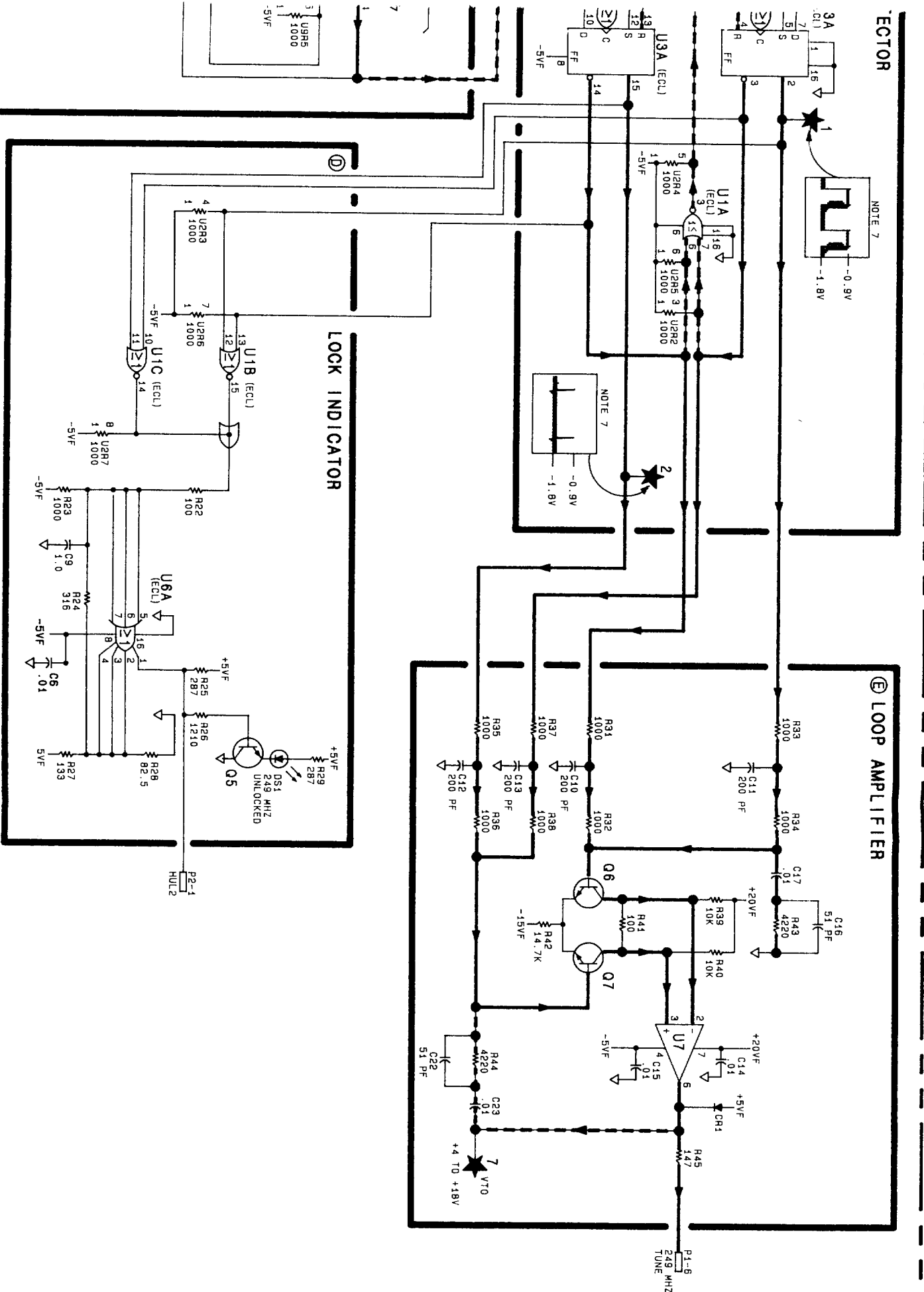
BASE LOCK

85

W24

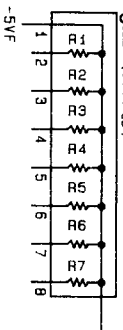
J2





NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PLEASE ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS, CAPACITANCE IS IN MICROFARADS (UF).
3. UNLESS OTHERWISE INDICATED, SYMBOLS ARE LOCATED AT TOP AND BOTTOM OF FUNCTION BLOCKS.
4. ECL LOGIC LEVELS ARE TYPICALLY: -0.8V=LOGIC "1"=HIGH -1.8V=LOGIC "0"=LOW
5. U2, U3, AND U4 ARE 1000 OHM 8-PIN RESISTOR NETWORKS:



MNEUMONIC TABLE:

MNEUMONIC	DESCRIPTION
LLDD	LOW-LOAD 249 DIVIDER
10818-15	NUMBERS INSTRUMENT BUS DATA, (HIGH-TRUE) IS
HULL2	HIGH-249 MHZ LOOP UNLOCKED

7. CONTROL SETTINGS FOR WAVEFORMS: 8568: INSTRUMENT PRESET OSCILLOSCOPE: 0.1 V/DIV

FIGURE 4. A8 249 MHZ PHASE LOCK, SCHEMATIC DIAGRAM

A8

A9 PILOT SECOND IF AMPLIFIER, CIRCUIT DESCRIPTION

A9 Pilot Second IF Amplifier contains a Low-Pass Filter, a common-emitter Amplifier, and a 269 MHz Bandpass Filter. The Low-Pass Filter has a cutoff of approximately 500 MHz and gives less than 1 dB loss at 269 MHz. The amplifier has a gain of 19 dB and the Bandpass Filter has an insertion loss of 5 dB, giving the assembly an overall gain of 14 dB.

Amplifier (B)

The common-emitter amplifier consists of Q1 as the amplifier and Q2 for active bias. Capacitors C6, C8, C13, and C14 serve as high frequency bypass elements. Inductor L3 and capacitor C7 transform the output impedance of Q1 to 50 Ω , which couples into the 269 MHz Bandpass Filter through the tapped inductor L4.

269 MHz Bandpass Filter (A)

The 269 MHz Bandpass Filter has a 3 dB bandwidth of approximately 23 MHz. The filter is made of L4, C9, L5, C10, L6, C11, L7, C12, and coupling capacitors made of traces on the printed circuit board. The shielding strips between the resonators serve to reduce inductive coupling from one section to another. The tapped inductors L4 and L7 transform the impedance to 50 Ω for the filter.

A10 PILOT THIRD CONVERTER, CIRCUIT DESCRIPTION

A10 Pilot Third Converter consists of a Balanced Mixer, two transistor amplifiers, and a Low-Pass Filter. The signal from A7 249 MHz Phase Lock Oscillator is mixed with the signal from A9 Pilot Second IF Amplifier to produce the 20 MHz signal to the A6 YIG-Tuned Oscillator Phase Lock. The Balanced Mixer has a conversion loss of 8 dB and the gain of the two-stage amplifier is 30 dB, which yields an overall gain of 22 dB.

Balanced Mixer (C)

The 249 MHz signal from A7 is applied to the LO port of the Balanced Mixer at a level of approximately +5 dBm. The level of the 269 MHz signal from A9 is between -42 dBm and -32 dBm. The output from the Balanced Mixer is the difference frequency, 20 MHz. The Balanced Mixer has a conversion loss of approximately 8 dB.

Amplifier + 30 dB Gain (B)

The 20 MHz amplifier consists of transistors Q1 and Q2 as cascaded, common-emitter amplifiers. The first stage has a voltage gain of about 8, which is determined by R4, L3, and Q1. Capacitors C2 and C3 are bypass elements. The second stage has a voltage gain of approximately 4, which is determined by R9, R10, and Q2. Capacitors C5 and C7 are bypass elements.

Low-Pass Filter (A)

C8, L1, C9, L2, and C10 form the output Low-Pass filter. The filter has a cutoff frequency of approximately 55 MHz and less than 1 dB loss at 30 MHz. The filter attenuates the 269 MHz Second IF signal and the 249 MHz LO signal from the desired 20 MHz signal being sent to A6.

TABLE 1. A9 PILOT SECOND IF AMPLIFIER, REPLACEABLE PARTS

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9	85680-60140	1	1	PILOT SECOND IF AMPLIFIER	28480	85680-60140
A9C1	0160-3873	1	3	CAPACITOR-FXD 4.7PF +- .5PF 200VDC CER	28480	0160-3873
A9C2	0160-3874	2	1	CAPACITOR-FXD 10PF +- .5PF 200VDC CER	28480	0160-3874
A9C3	0160-3873	1	1	CAPACITOR-FXD 4.7PF +- .5PF 200VDC CER	28480	0160-3873
A9C4	0160-3873	1	1	CAPACITOR-FXD 4.7PF +- .5PF 200VDC CER	28480	0160-3873
A9C5	0160-3466	8	2	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A9C6	0160-2055	9	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C7	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A9C8	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A9C9	0121-0493	3	4	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A9C10	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A9C11	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A9C12	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A9C13	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C14	0160-3466	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3466
A9J1	1250-0690	6	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A9J2	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A9L1	85680-80009	3	2	INDUCTOR 35 NH	28480	85680-80009
A9L2	85680-80009	3	1	INDUCTOR 35 NH	28480	85680-80009
A9L3	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A9L4	85680-80015	1	2	TRANSFORMER	28480	85680-80015
A9L5	85680-80008	2	2	INDUCTOR 50 NH	28480	85680-80008
A9L6	85680-80008	2	1	INDUCTOR 50 NH	28480	85680-80008
A9L7	85680-80015	1	1	TRANSFORMER	28480	85680-80015
A9L8	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A9MP1	85680-00038	0	4	STRIP-SHIELDING	28480	85680-00038
A9MP2	85680-00038	0	1	STRIP-SHIELDING	28480	85680-00038
A9MP3	85680-00038	0	1	STRIP-SHIELDING	28480	85680-00038
A9MP4	85680-00038	0	1	STRIP-SHIELDING	28480	85680-00038
A9Q1	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A9Q2	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01275	2N3799
A9R1	0757-0200	7	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A9R2	0757-0288	1	1	RESISTOR 7.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A9R3	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A9R4	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F

*Indicates factory selected value

TABLE 2. A10 PILOT THIRD CONVERTER, REPLACEABLE PARTS

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10	85680-60010	4	1	PILOT THIRD CONVERTER	28480	85680-60010
A10C1	0160-3456	6	2	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A10C2	0160-2055	9	6	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C6	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A10C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C8	0140-0190	7	1	CAPACITOR-FXD 39PF +-5% 300VDC MICA	72136	DM15E390J0300WV1CR
A10C9	0140-0195	2	1	CAPACITOR-FXD 130PF +-5% 300VDC MICA	72136	DM15F131J0300WV1CR
A10C10				NOT ASSIGNED		
A10C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C12	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10J1				PART OF W20		
A10J2				PART OF W21		
A10J3	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A10L1	9100-2252	1	2	INDUCTOR RF-CH-MLD 270NH 10% .105DX.26LG	28480	9100-2252
A10L2	9100-2252	1		INDUCTOR RF-CH-MLD 270NH 10% .105DX.26LG	28480	9100-2252
A10L3	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A10L4	9140-0179	1	1	INDUCTOR RF-CH-MLD 220H 10% .166DX.38SLG	28480	9140-0179
A10Q1	1854-0247	9	1	TRANSISTOR NPN SI T0-39 PD=1W FT=800MHZ	28480	1854-0247
A10Q2	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI T0-72 PD=200MW	04713	2N5179
A10R1	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A10R2	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R3	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A10R4	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A10R5	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A10R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R8	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A10R9*	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A10R10	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10U1	0955-0063	0	1	MIXER-DOUBLE BALANCE PWR INP=200MW; PK	28480	0955-0063

*Indicates factory selected value

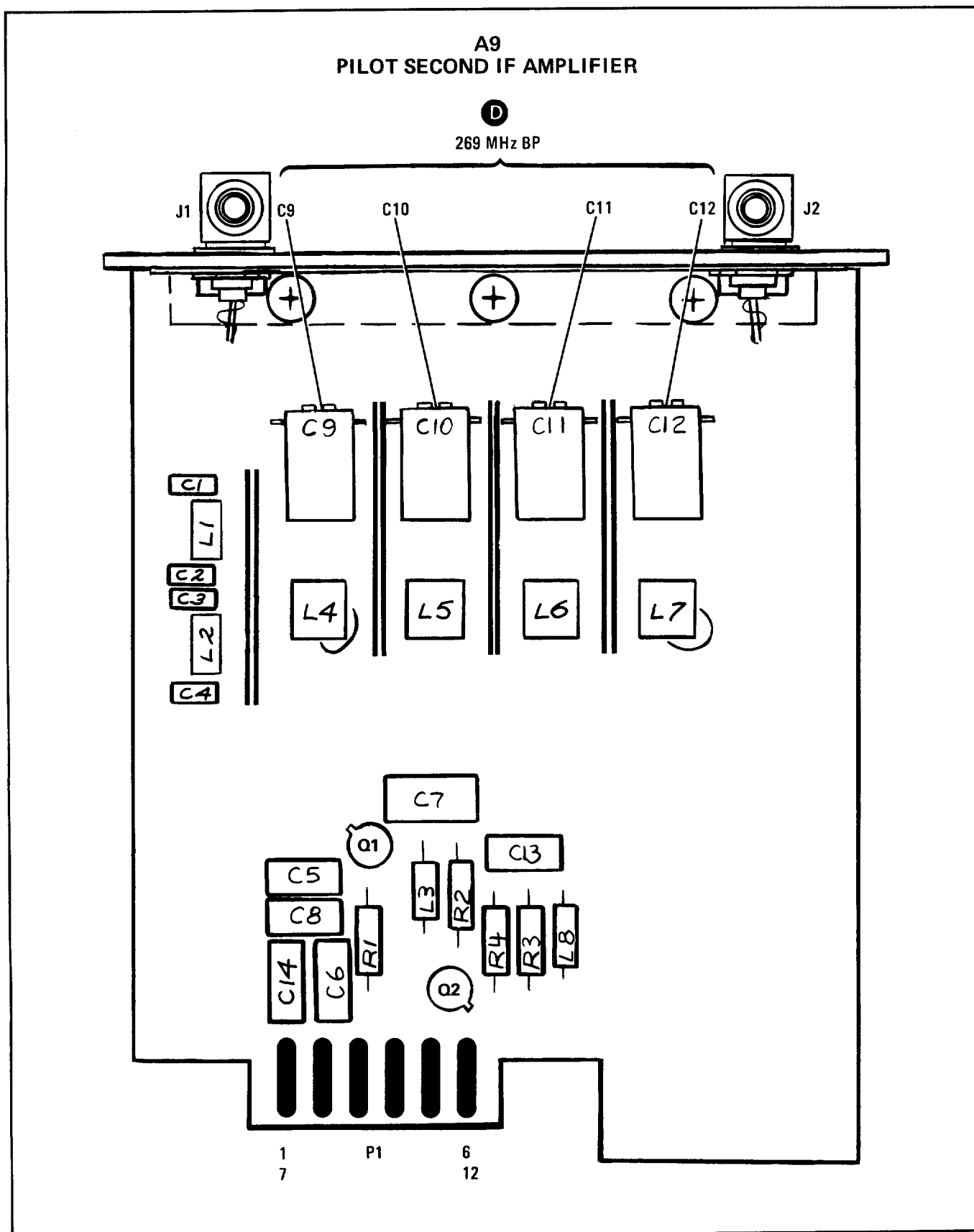


FIGURE 2. A9 PILOT SECOND IF AMPLIFIER, COMPONENT LOCATIONS

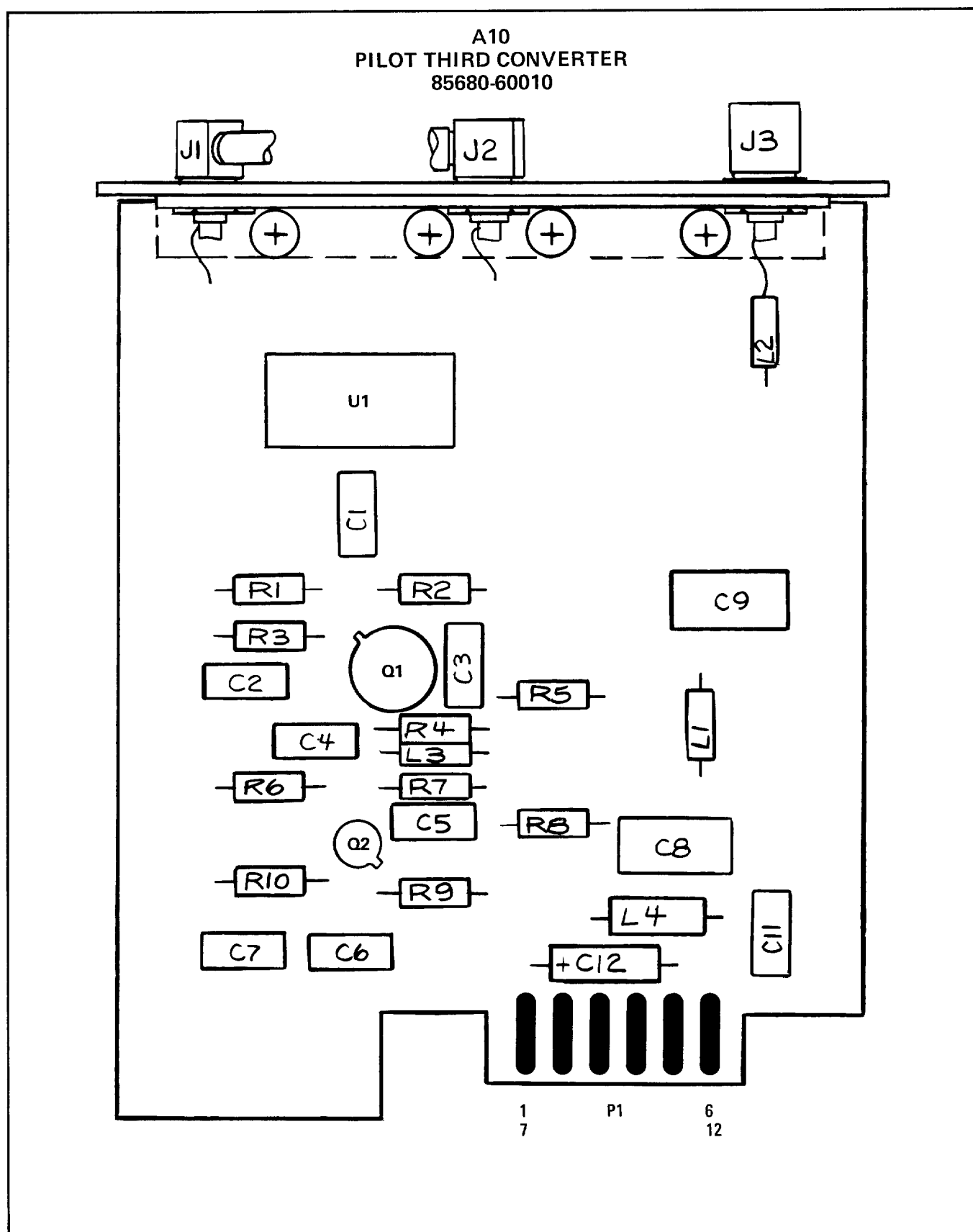
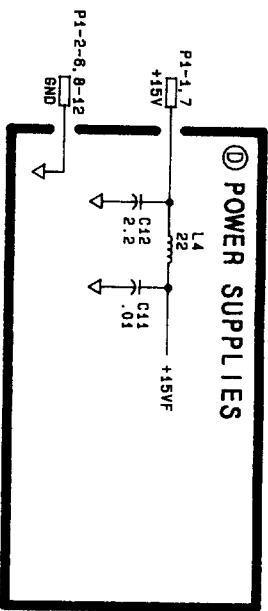


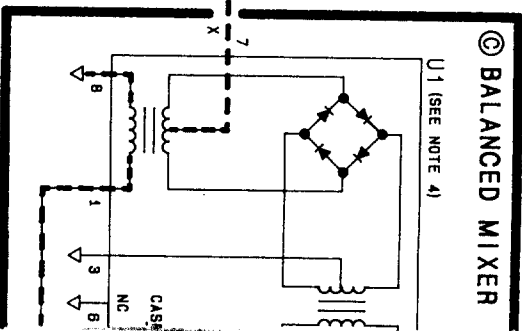
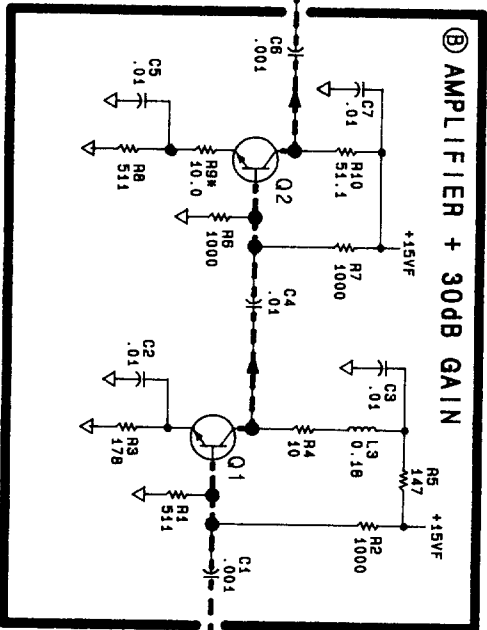
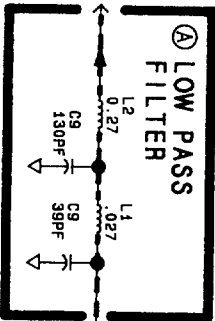
FIGURE 3. A10 PILOT THIRD CONVERTER, COMPONENT LOCATIONS

A9 PILOT THIRD CONVERTER
085680-60140



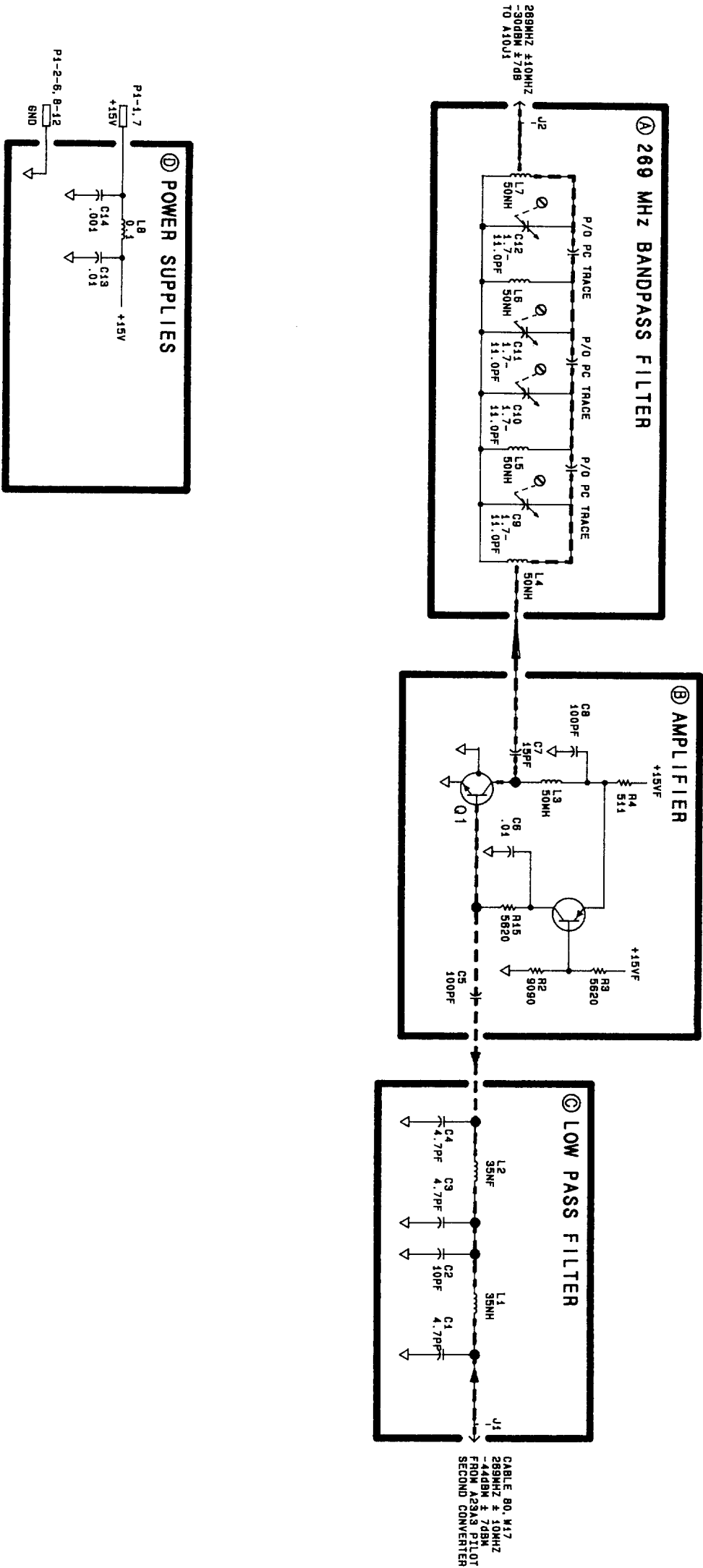
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15V		D
7	+15V		D
2	GND		D
8	GND		D
3	GND		D
9	GND		D
4	GND		D
10	GND		D
5	GND		D
11	GND		D
6	GND		D
12	GND		D

CABLE B2, M22
20MHZ + 10MHZ
>-25DBM
TO AB YTO
PHASE LOCK



A10 PILOTSECOND IF AMPLIFIER
085680-60140

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15V		D
7	+15V		D
2	GND		D
8	GND		D
3	GND		D
9	GND		D
4	GND		D
10	GND		D
5	GND		D
11	GND		D
6	GND		D
12	GND		D



SERIAL PREFIX: 2408A

FIGURE 4. A9 PILOT SECOND IF AMPLIFIER AND A10 THIRD

A11 50 MHz VOLTAGE-TUNED OSCILLATOR, CIRCUIT DESCRIPTION

A11 50 MHz Voltage-Tuned Oscillator (VTO) is used to tune the Pilot Third Local Oscillator ± 250 kHz corresponding to the spacing between the lock points in A7 249 MHz Phase Lock Oscillator. This is accomplished by providing a reference frequency to the Phase/Frequency Detector of A21 275 MHz Phase Lock. The reference frequency is either $5 (\pm 0.75)$ MHz or $2.5 (\pm 0.300)$ MHz, depending on the selected frequency span. For spans >100 kHz but ≤ 1 MHz, the $50 (\pm 7.5)$ MHz oscillator frequency is divided by 10; for spans of 100 kHz or less, the frequency is divided by 20. For spans greater than 1 MHz, the VTO is not swept; the sweep is applied to A23A1 YIG-Tuned Oscillator (the first LO).

The frequency to which the 50 MHz oscillator is tuned is determined by the output of the Summing Amplifier, whose inputs are the 50 MHz SWEEP and 50 MHz TUNE signals from A22 Frequency Control. For sweep times of 10 sec or longer, the Slow Sweep Filter is switched into the circuit to filter off low-frequency components (on the 50 MHz SWEEP and 50 MHz TUNE lines) which in the most narrow bandwidths (30 Hz and 10 Hz) might cause spurious responses.

Shaping Network (B)

The Shaping Network is composed of a Summing Amplifier and a Shaping Attenuator. The 50 MHz TUNE and 50 MHz SWEEP lines, received from A22 Frequency Control, are summed through R43 and R46. The ratio of these resistors is such that the frequency of the 50 MHz oscillator varies at the rate of 1.1 MHz per volt on the 50 MHz TUNE line and at the rate of 1.0 MHz per volt on the 50 MHz SWEEP line when the shaping network is properly adjusted. The gain around U6 is set by R45 and GAIN adjustment R9. The output is offset by the action of R47, R48, and OFFSET adjustment R10. C14 heavily filters the offset voltage. R9 sets the overall sensitivity of the oscillator, and R10 offsets its frequency.

The output of the Summing Amplifier is shaped by the Shaping Attenuator to fit the characteristics of the 50 MHz Oscillator tuning diodes CR15 and CR16. R18 through R28, R71, R17, and CR2 form a voltage divider setting the voltages at which diodes CR3 through CR14 and CR18 turn on. When the output of U6 is at its high end, corresponding to the 50 MHz Oscillator being tuned to its upper end around 57.5 MHz, all these diodes are turned off and the signal passes unattenuated through the Shaping Attenuator. As the oscillator is swept down in frequency, the voltage from U6 is swept down and successive diodes turn on, starting with CR14. As diodes are successively turned on, the attenuating action of R29 through R40 and R72 against R41 and R42 tends to pull back on the downward movement of the output voltage. As the Shaping Attenuator begins to act, the gain through it is controlled by SHAPING ATTN adjustment R42. The points at which the diodes turn on are adjusted by SHAPING OFFSET adjustment R17 and POSITIVE SUPPLY adjustment R6 in the Power Supplies. CR2 is always on and compensates the remaining diodes for temperature variations.

Slow Sweep Filter (A)

The output of the Shaping Network passes through the Slow Sweep Filter. This filter is turned on for instrument sweep times of 10 seconds or greater. Q4 is a unity gain amplifier. When the filter is off, Q4 shorts out R64 so that U5 drives C24 directly, and no filtering takes place. When the filter is on, Q4 is open, and the action of R64 and C24 filters the signal. The filter is controlled by the HFLT line from A22 Frequency Control. To turn the filter on, HFLT goes high. This puts current through R14 to saturate Q6, which pulls current through R16 to saturate Q7. Q7, in turn, puts current through R61 to saturate Q5. This pulls the gate of Q4 to -15 V, turning it off and allowing R64 and C24 to act as a filter. The filter is turned off by a low signal on HFLT, which turns off Q6, Q7, and Q5, allowing R59 to pull the gate of Q4 to the voltage of the source. This turns Q4 on, thus shorting out R64 and disabling the filter.

50 MHz Oscillator (C)

The 50 MHz Oscillator frequency is set by the tank circuit made up of L4 and tuning diodes CR15 and CR16. As the voltage on the line to the diodes is lowered, their capacitance is increased, thus lowering the frequency of

oscillation. The range of the oscillator is 50 (± 7.5) MHz. L6 and C23 isolate the tank from the tuning circuitry at the frequency of oscillation. C18 couples the tank to the transistor Q3. Q3 operates in common-base configuration with its collector driving the tank, and C19 and C20 forming a voltage divider to feed back some of the signal to the emitter. This signal also goes to the Buffer Amplifier composed of Q2, R49, and R50. R8, C6, C16, L3, R52, and R55 properly bias Q3. R51, R57, C7, and C17 properly bias Q2. R56 biases CR17, which compensates CR15 and CR16 for temperature variations.

Divide By Two (D)

The Divide By Two circuit receives the signal from the 50 MHz Oscillator. ECL NOR gate U2C acts as a limiting amplifier, producing ECL output levels to drive the flip-flop U3A, which divides the frequency by 2. R65, R66, and C26 feed back a voltage to bias the amplifier to the center of the ECL voltage range (approximately -1.3V). R68 and R69 attenuate the divided signal as it is sent to A17 Frequency Counter. R67, R70, R68, and R69 properly bias the ECL outputs.

Divide By Five Or Ten (E)

The Divide By Five Or Ten circuit contains a Divide By Two circuit (U1A) and a Divide By Five circuit (U1B). The Divide By Two circuit is connected to an output of the previous Divide By Two circuit. U1A is either bypassed or used, as selected by the switch composed of NOR gates U2A, U2B, and U2D. The signal selected by the switch is then divided by 5 and sent to A21 275 MHz Phase lock, which locks onto it as its reference. The net result of all the divisions is to divide the 50 MHz Oscillator output frequency by 10 or 20. Division by 10 is used for spans greater than 100 kHz, and division by 20 for spans of 100 kHz or less. This gives frequencies centered about 5 MHz or about 2.5 MHz. The division used is controlled by the HDIV line from A22 Frequency Control. R11, R12, and R13 translate the TTL levels to ECL levels to control U2D. When HDIV is high, U2D disables U2B and enables U2A, thus selecting the output of Divide By Two circuit, U1A. When HDIV is low, U2D disables U2A and enables U2B, thus bypassing this Divide By Two circuit and directly selecting the output of the first Divide By Two circuit, U3A. R4, R44, R58, R60, R63, and R73 properly bias the ECL outputs used.

Power Supplies (F)

The Power Supplies circuit supplies regulated current to both the Shaping Network and the 50 MHz Oscillator. R1 supplies current to reference diode VR1, whose voltage is filtered by R2 and C3 and fed to U4. The output voltage is set by R7, R5, and the POSITIVE SUPPLY adjustment R6. C5 provides further filtering, and CR1 compensates for temperature variation of the diodes in the shaping network. Q1 increases the current capability of the supply, and R3 limits the current for momentary short circuits.

TABLE 1. A11 50 MHz VOLTAGE-TUNED OSCILLATOR, REPLACEABLE PARTS (1 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11	85680-60017	1	1	50MHZ VOLTAGE-TUNED OSCILLATOR	28480	85680-60017
A11C1	0160-2055	9	17	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C2	0180-0116	1	1	CAPACITOR-FXD 6.0UF +-10% 35VDC TA	56289	150D685X9035B2
A11C3	0180-0229	7	3	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A11C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C5				NOT ASSIGNED		
A11C6	0180-1746	5	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A11C7	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A11C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C10	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A11C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C14	0160-3787	6	1	CAPACITOR-FXD 1UF +-10% 50VDC MET-POLYC	28480	0160-3787
A11C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C18	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A11C19	0160-0949	6	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	28480	0160-0949
A11C20	0160-2016	2	1	CAPACITOR-FXD 62PF +-5% 500VDC MICA	28480	0160-2016
A11C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C23	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A11C24	0160-3402	2	1	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A11C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C28	0160-4084	8	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A11C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C30	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A11C31	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A11C32	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C33	0160-2437	1	2	CAPACITOR-FDTHRU 5000PF +00 -20% 200V	28480	0160-2437
A11C34	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A11CR1	1901-0040	1	16	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR15	0122-0300	3	2	DIODE-VVC 100PF 5% C2/C20-MIN=2 BVR=20V	28480	0122-0300
A11CR16	0122-0300	3		DIODE-VVC 100PF 5% C2/C20-MIN=2 BVR=20V	28480	0122-0300
A11CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR18	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11J1	1250-0690	6	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A11J2				PART OF W18		
A11J3	1250-0690	6		CONNECTOR-RF SMD M SGL-HOLE-FR 50-OHM	28480	1250-0690
A11L1	9100-1618	1	3	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A11L2	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A11L3	9100-1621	6	1	INDUCTOR RF-CH-MLD 18UH 10% .166DX.385LG	28480	9100-1621
A11L4	9100-2811	8	1	INDUCTOR 200NH 10% .312DX1.016LG Q=160	28480	9100-2811
A11L5	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A11L6	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A11Q1	1854-0477	7	2	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A11Q2	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A11Q3	1853-0018	0	1	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A11Q4	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A11Q5	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A11Q6	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A11Q7	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799

*Indicates factory selected value

TABLE 1. A11 50 MHz VOLTAGE-TUNED OSCILLATOR, REPLACEABLE PARTS (2 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R1	0757-0278	7	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-17B1-F
A11R2	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A11R3	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A11R4	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R5	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R6	2100-1739	0	1	RESISTOR-TRMR 5K 10% WW SIDE-ADJ 20-TRN	02660	3B10P-502
A11R7*	0757-0288	1	2	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9071-F
A11R7*	0757-0443	0	3	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A11R8	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A11R9	2100-1972	3	1	RESISTOR-TRMR 20K 10% WW SIDE-ADJ 20-TRN	02660	3B10P-203
A11R10	2100-2850	8	2	RESISTOR-TRMR 10K 10% WW SIDE-ADJ 20-TRN	02660	3B10P-103
A11R11	0757-0439	4	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A11R12	0698-0883	8	2	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A11R13	0698-0883	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A11R14	0698-3160	8	3	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A11R15	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R16	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A11R17	2100-1799	2	1	RESISTOR-TRMR 500 10% WW SIDE-ADJ 20-TRN	02660	3B10P-501
A11R18	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A11R19	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A11R20	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A11R21	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A11R22	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A11R23	0757-0399	5	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A11R24	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A11R25	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A11R26	0757-0402	1	2	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A11R27	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A11R28	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R29	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A11R30	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A11R31	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A11R32	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R33	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A11R34	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A11R35	0698-3161	9	1	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A11R36	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A11R37	0757-0458	7	3	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R38	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A11R39	0757-0461	2	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A11R40	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A11R41	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A11R42	2100-2850	8	1	RESISTOR-TRMR 10K 10% WW SIDE-ADJ 20-TRN	02660	3B10P-103
A11R43	0698-6630	3	1	RESISTOR 20K 1% .125W F TC=0+-25	0698-6630	0698-6630
A11R44	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R45	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A11R46	0698-6977	1	1	RESISTOR 30K 1% .125W F TC=0+-25	28480	0698-6977
A11R47	0698-3158	4	1	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A11R48	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A11R49	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A11R50	0698-7205	0	1	RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A11R51	0698-3151	7	4	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A11R52	0698-7239	0	1	RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-F
A11R53	0698-7188	8	1	RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A11R54	0698-7201	6	1	RESISTOR 34.8 1% .05W F TC=0+-100	24546	C3-1/8-T0-34R0-F
A11R55	0698-7252	7	1	RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A11R56	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A11R57	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A11R58	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R59	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28400	0698-3260
A11R60	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R61	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R62	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R63	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A11R64	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R65	0698-3441	8	2	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A11R66	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A11R67	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A11R68	0698-0082	7	2	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-464R-F
A11R69	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-464R-F
A11R70	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R71	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A11R72	0757-0289	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9071-F
A11R73	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A11R74	0757-0402	1	1	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F

*Indicates factory selected value

TABLE 1. A1150 MHz VOLTAGE-TUNED OSCILLATOR, REPLACEABLE PARTS (3 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R75	0698-3151	7		RESISTOR 2.07K 1% .125W F TC=0+-100	24546	C4 1/8-T0-2871-F
A11R76	0698-3151	7		RESISTOR 2.07K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A11TP1				PART OF C33		
A11TP2				PART OF C34		
A11TP3	0360-0124	3	8	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP5	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP6	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP7	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP8	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP9	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP10	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11U1	1820-1383	5	1	IC CNTR ECL RCD POS-EDGE-TRIG	04713	MC10138L
A11U2	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A11U3	1820-0820	3	1	IC FF ECL J-BAR K-BAR COM CLOCK DUAL	04713	MC10135L
A11U4	1826-1058	3	1	IC OP AMP GP 8-TO-99 PKG	28480	1826-1058
A11U5	5180-2315	1	2	IC OSC M1 OP AMP	28480	5180-2315
	5180-2314	0	2	IC OSC M1 OP AMP	28480	5180-2314
				NOTE:USE AS ALTERNATE FOR 5180-2315		
A11U6	5180-2315	1		IC OSC M1 OP AMP	28480	5180-2315
	5180-2314	0		IC OSC M1 OP AMP	28480	5180-2314
				NOTE:USE AS ALTERNATE FOR 5180-2315		
A11VR1	1902-0680	7	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.4W	24046	1N827
				MISCELLANEOUS PARTS		
	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001

*Indicates factory selected value

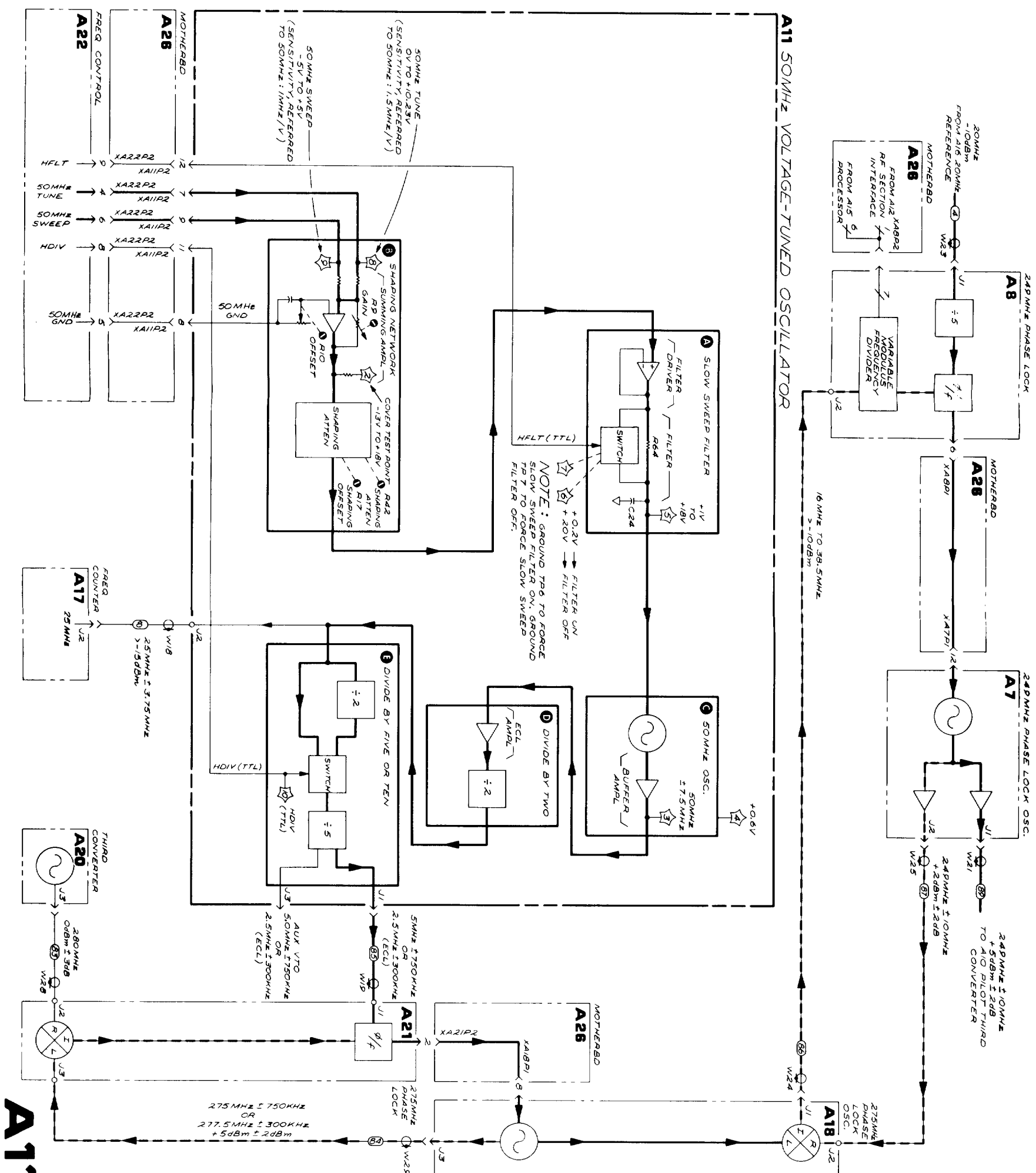


FIGURE 1. A11 50 MHz VOLTAGE-TUNED OSCILLATOR, BLOCK DIAGRAM

A11
50 MHz VOLTAGE-TUNED OSCILLATOR
85680-60017

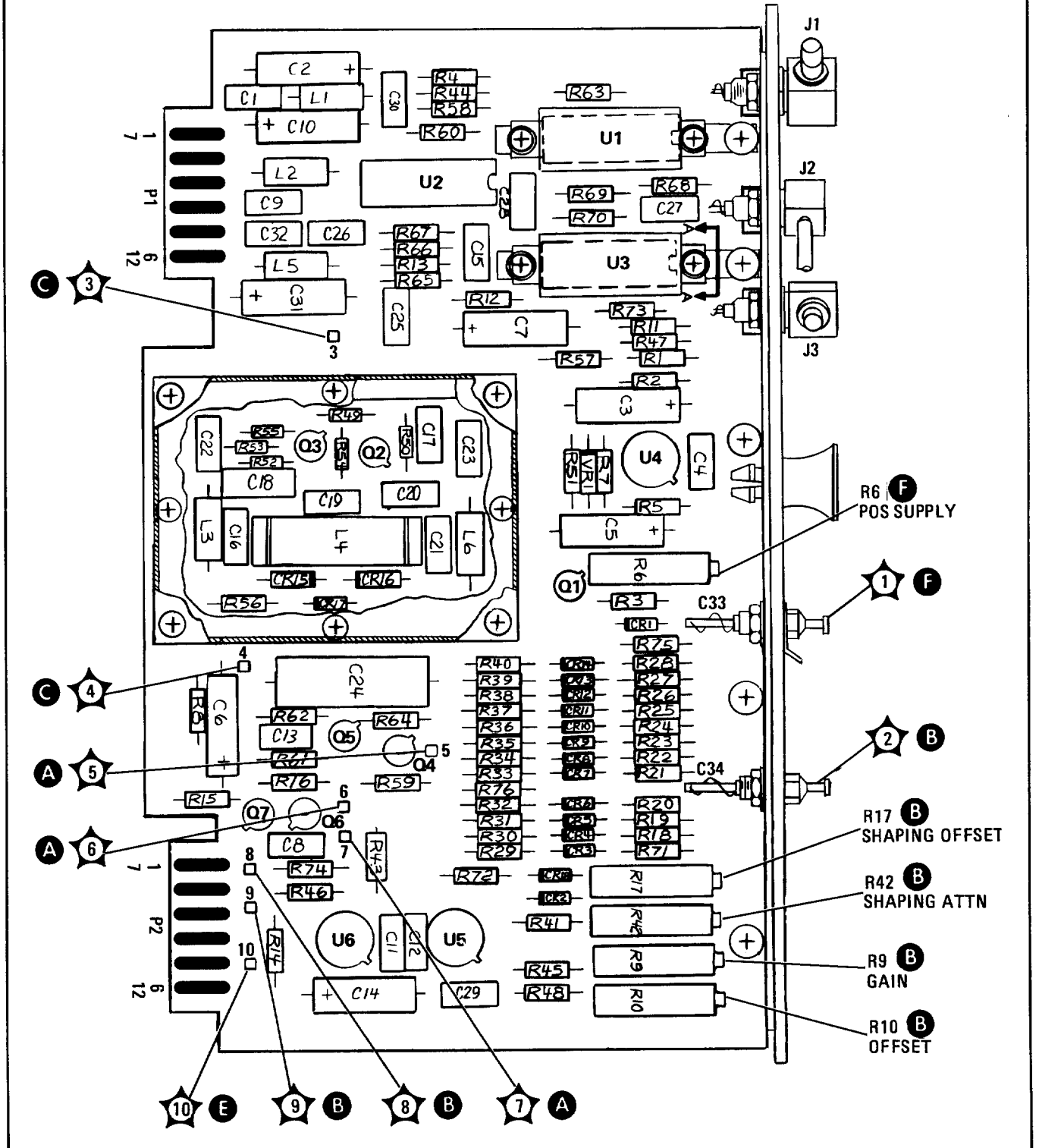
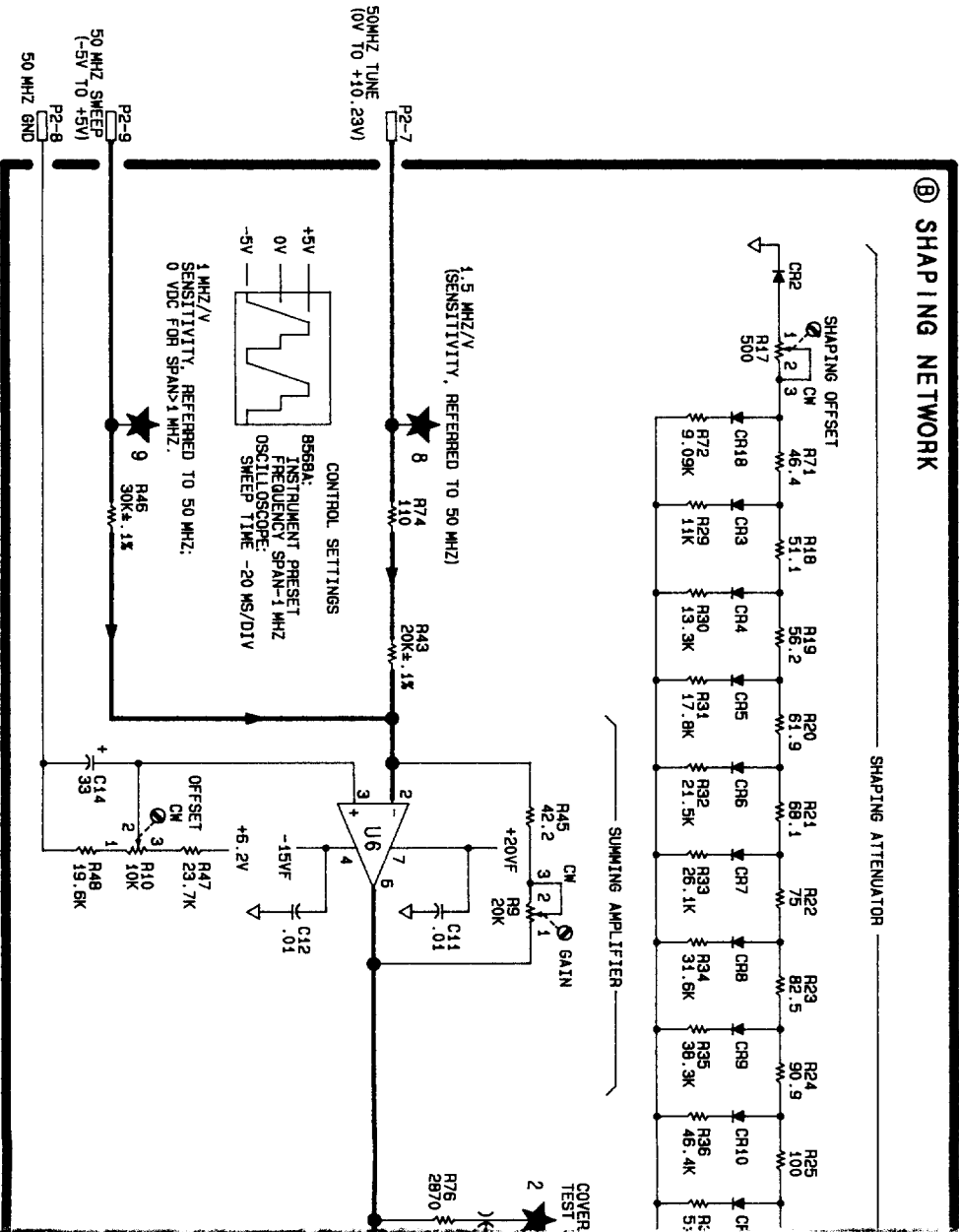
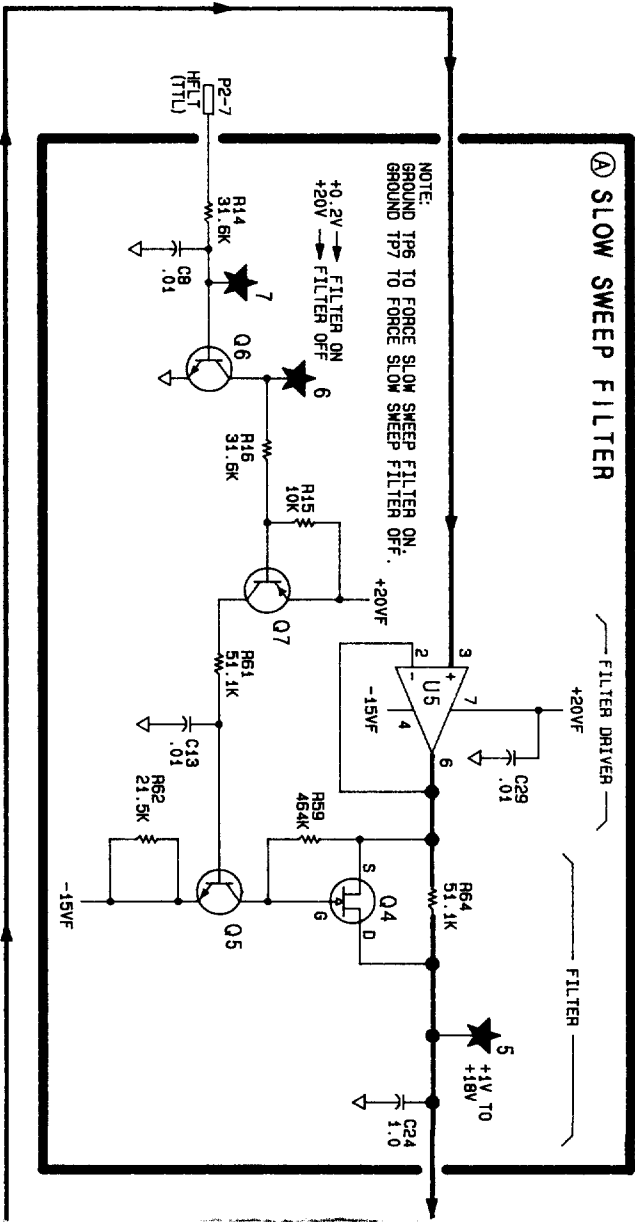
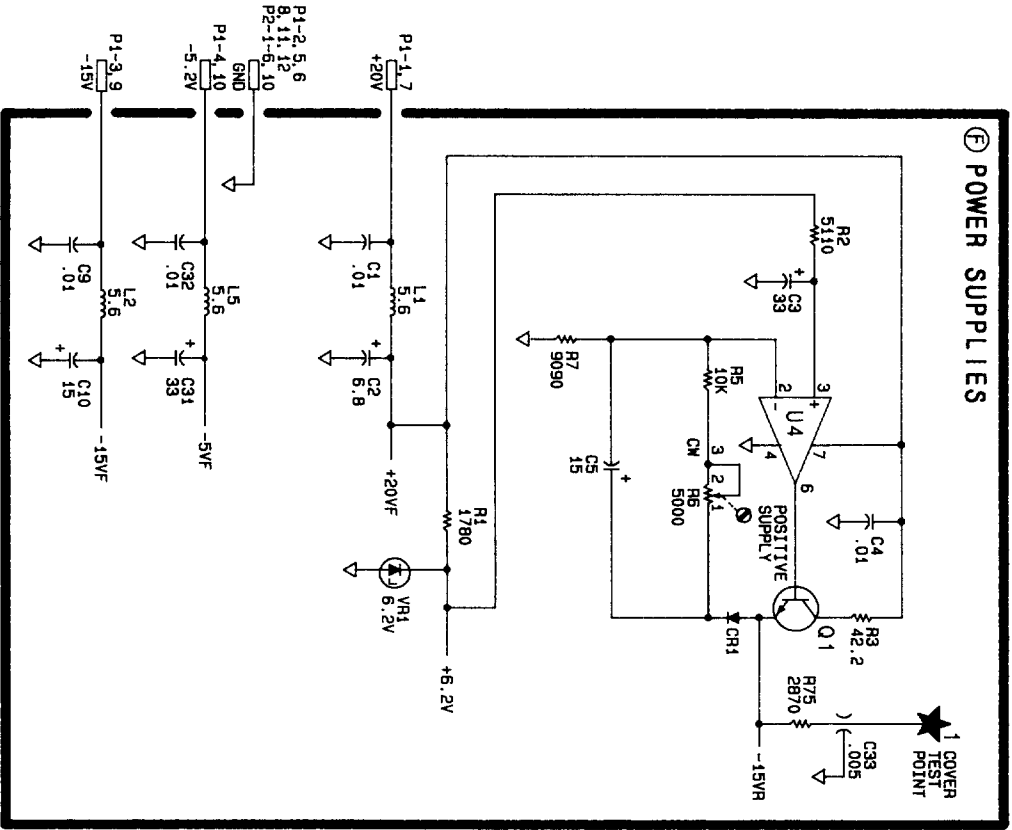


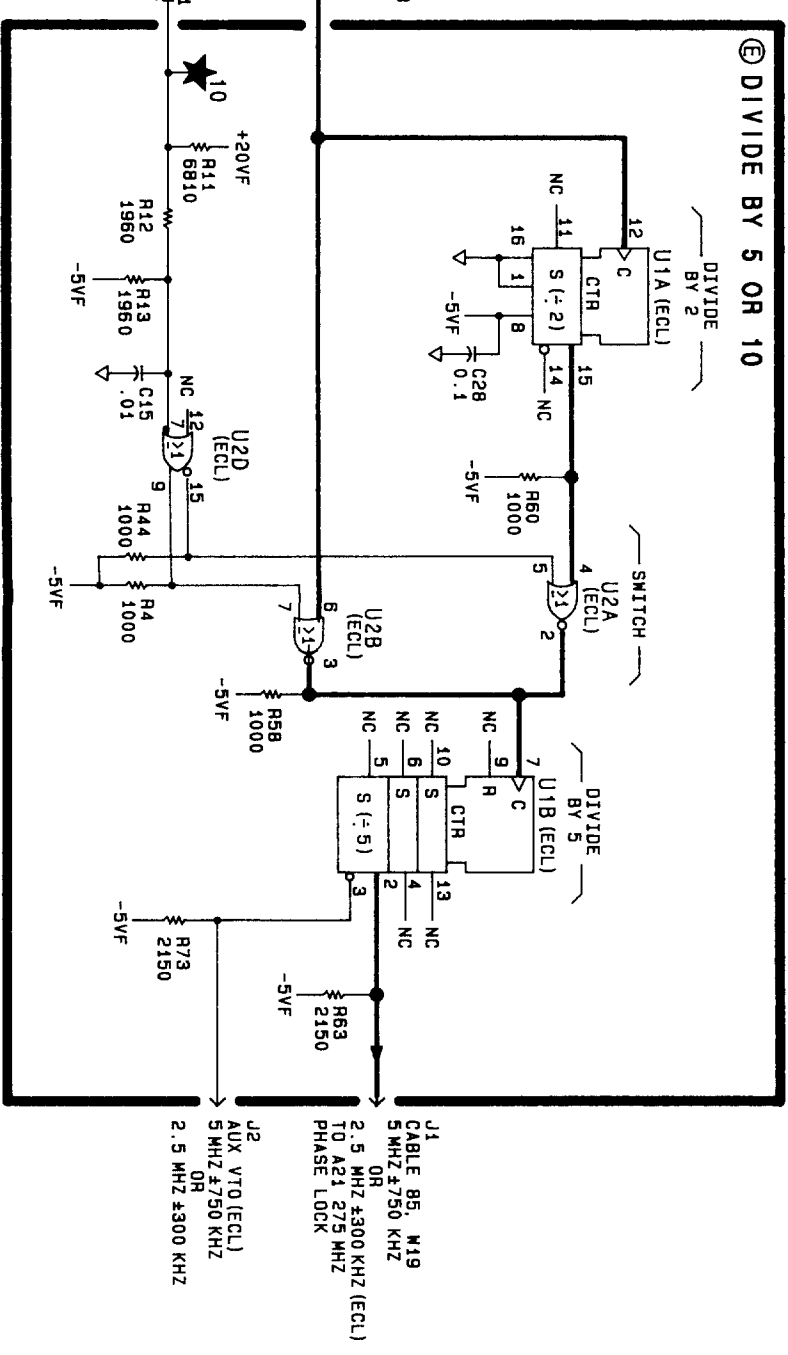
FIGURE 2. A11 50 MHz VOLTAGE-TUNED OSCILLATOR, COMPONENT LOCATIONS

A11 50 MHZ VOLTAGE-TUNED OSCILLATOR
85680-60017

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+20V		F
7	+20V		F
2	GND		F
8	GND		F
3	-15V		F
9	-15V		F
4	-5.2V		F
10	-5.2V		F
5	GND		F
11	GND		F
6	GND		F
12	GND		F

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND	A22, P2-4	B
7	50 MHZ TUNE		B
2	GND	A22, P2-5	F
8	50 MHZ GND		B
3	GND	A22, P2-6	F
9	50 MHZ/SWEEP		B
4	GND		F
10	GND		F
5	GND	A22, P2-8	F
11	HDIV		E
6	GND	A22, P2-9	F
12	PLT		A





© 50 MHZ OSCILLATOR

A12 RF SECTION INTERFACE, CIRCUIT DESCRIPTION

The A12 RF Section Interface Assembly contains digital functions that allow the front-panel controls to interface with the A15 Controller assembly.

Keyboard Matrix

The main processor in the A15 Controller assembly polls the keyboard by selectively enabling the key rows. The keyboard is organized as a matrix (rows and columns) of normally-open SPST switches. The rows are driven by U19 and U30. U16 and U34 gate the columns to the Data Bus. U23 detects when any key is in the down position (closed). Q12 and associated circuitry debounce the key switches.

Rotary Pulse Generator (RPG) Control

The front panel knob is rotary pulse generator (RPG) that generates pulses proportional to the speed and direction of its rotation. The RPG has two outputs: RPG phase 1, and RPG phase 2. When the knob is turned, the outputs are square waves that are 90 degrees out of phase.

The rate and direction of rotation determines the frequency and phase of the square waves. When the knob is turned clockwise, RPG phase 1 leads RPG phase 2 by 90 degrees. Conversely, when the knob is turned counterclockwise, RPG phase 1 lags RPG phase 2 by 90 degrees.

The RPG control circuitry is enabled when U4B is set. The logic high output of U4B is ANDed (with inversion) with RPG phase 1 by U5C, providing a clock signal for the RPG control circuitry.

The main processor senses clockwise RPG rotation as follows: When the trailing edge of RPG phase 1 occurs, the output of U5C is rising; the value of RPG phase 2 is clocked into U6A. RPG phase 1 is leading RPG phase 2, so the value of RPG phase 2 is high. The output of U6A, a high, tells the main processor that the rotation is clockwise.

If RPG rotation is counterclockwise, RPG phase 1 lags RPG phase 2. The output of U6A is now low, because RPG phase 2 is low during the trailing edge of RPG phase 1, telling the main processor that RPG rotation is counterclockwise.

RPG clock signal (U5C output) is counted by U13 and U12. The main processor determines how much the RPG knob was turned by reading the count. After each reading, the processor resets the counters through U5B.

When the count reaches 255, the counters are disabled by the U12 overflow signal (pin 7), inverted by U5A.

The RPG clock signal also clocks U6B. When the RPG circuit is reset, the output of monostable multivibrator U14 is high for about 90 msec. After this period, the output returns low, and a clock to U6B resets the flip-flop, providing the active low RPG request output. The RPG reset signal sets U6B, driving the active low RPG request to a high state.

Service Request

The Service Request block includes several functions. Flip-flop U10A controls the execution of the main processor in the A15 Controller assembly. After the main processor initiates the sweep, but before a sweep can start, U10A is reset, driving Q1 to saturation and placing the main processor in an idle mode. The processor is activated when the low service request signal (LSRQ) sets U10A.

U3 and U2 latch the internal or external frequency reference, and local or remote (HP-IB) status of the spectrum analyzer. C5 and C4 form RC delaying networks with R10 and R9. The outputs of U3C or U3D are high until the voltages at C5 or C4 have stabilized. U3B and U3A act as inverters that provide a negative pulse which resets the corresponding flip-flop in U2.

U5D and U4A are an end-of-sweep detector for the main processor. The high sweep signal (HWP), after inversion by U5D, clocks and sets U4A. This produces an interrupt signal (through the priority encoder) that alerts the main processor of impending processing.

The priority encoder, U1, collects the outputs of all interface functions, such as keyboard, RPG, sweep, HP-IB, phase lock errors, etc. When any input is active (low), the priority encoder:

1. stops the sweep.
2. alerts the main processor with the high state of LSTP (via LSRQ, U10A, and Q1).
3. requests system service via LSRQ.
4. prioritizes multiple request.
5. encodes the function "number" that the main processor reads to determine which function to service.

The phase lock function has the highest priority. Of second priority is LREQ. The sweep function has the lowest priority.

The third highest priority, LTGR, is not used, but sometimes is a source of instrument failure. This line goes to the 50-wire bus and the interconnect cable between 85680B and the 85662A. A pinched wire in the cable may interfere with proper instrument operation. The priority encoder is a common focal point during instrument failure diagnosis.

RF Attenuator (ATTEN) Drive

This circuit switches input attenuator and input selection relay, A5K1. Switching transients are suppressed by U24, U25, and U26. The HPUP signal resets U7. When the instrument is set to standby mode, the power supply voltages decrease, and HPUP goes low. This resets U7, enabling all three pads – 10 dB, 20 dB, and 40 dB – producing 70 dB of input attenuation.

Phase Lock Flags

This circuit monitors the reference oscillator oven temperature sensor, the YTO tuning voltage comparators, and various unlock error signals for phase lock. Any input(s) to the circuit can be disabled from the main processor by the input AND gates and flip-flops in U21. Eventually, any inputs not disabled are ORed together by U31B, inverted by U20D, and applied to the priority encoder. The main processor determines which error message(s) are active. Note that the YTO TUNE voltage comparator inputs are disabled when the YTO is unlocked. (See U20B.)

Address Decoder

Primary address decoding is done by U18. The decoder is enabled when U18 pin 6 is high, and pins 5 and 4 are low. The outputs, pins 7, 9 – 15, go low singly, according to the inputs at pins 1 – 3. Note that output 4 (pin 11) enables address decoder U9 of the Service Request circuit.

Options

The jumpers are set to represent the instrument configurations. For example, the Input 1 jumper is set for 50 ohms. The main processor corrects the displayed information according to the jumper settings.

The correction data for input attenuation is stored in ROM U17. This data is unique for each attenuator. Thus, U17 must be replaced whenever the attenuator is replaced.

KEYBOARD MATRIX

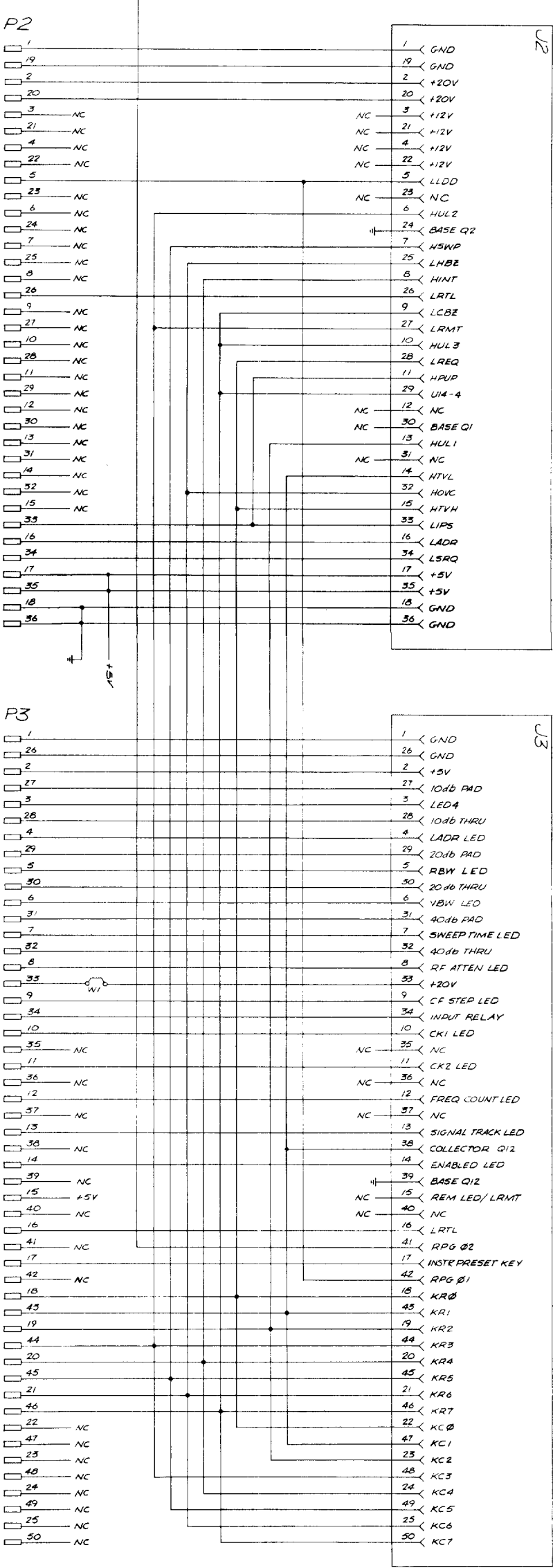
	KC0	KC1	KC2	KC3	KC4	KC5	KC6	KC7	
KR0	SPACE 			# 		BACK SPACE	& 		RF SECTION
KR1	(SAVE	) RECALL	- HOLD		f 0-2.5 GHz		.	/ GHz + dBm dB	
KR2	0	1	2	3	4	5	6	7	
KR3	8	9			SIGNAL INPUT 1 	= PRESEL PEAK	SIGNAL INPUT 2 		
KR4		A AUTO	B AUTO	C AUTO	D AUTO	E AUTO	F RES BW	G VIDEO BW	
KR5	H SWEEP TIME	I ATTEN	J CF STEP SIZE	K PEAK SEARCH	MARKER L OFF	MARKER M NORMAL	N MKR → CF	O Δ	
KR6	P ZOOM	Q MKR/Δ → STP SIZE	R MKR → REF LVL	S SIGNAL TRACK	T 	U 	V CENTER FREQUENCY	W FREQUENCY SPAN	
KR7	X START FREQ	Y STOP FREQ	Z REFERENCE LEVEL						IF-DISPLAY SECTION
KR8	NORMAL	a CLEAR- WRITE TRACE A	b MAX HOLD TRACE A	c OFF A-B	d VIEW TRACE A	e BLANK TRACE A	f A-B-A	g CLEAR- WRITE TRACE B	
KR9	h MAX HOLD TRACE B	i A-B	j VIEW TRACE B	k BLANK TRACE B	l B-DL →B	m OFF DISPLAY LINE	n ENTER DISPLAY LINE	o OFF THRESHOLD	
KR10	p ENTER THRESHOLD	q ENTER dB/OV	r LIN 	s SHIFT	t CONT	u SINGLE	v FREE RUN	w LINE	
KR11	x EXT	y VIDEO	z LOWER LEFT		 UPPER RIGHT				
NOTE: AND ARE NOT PART OF THE MATRIX.									

FIGURE 1. KEYBOARD MATRIX

P1	1	1	GND	
	26	26	LTIO	
	2	2	GND	
	27	27	LBIO	
	3	3	NC	
	28	28	NC	
	4	4	HSWP	
	29	29	LSWP	
	5	5	KC7	
	30	30	AC6	
	6	6	AC5	
	31	31	KC4	
	7	7	KC3	
	32	32	KC2	
	8	8	KC1	
	33	33	KC0	
	9	9	KR11	
	34	34	KR10	
	10	10	KR9	
	35	35	KR8	
	11	11	NC	
	36	36	NC	
	12	12	NC	
	37	37	ADR4	
	13	13	ADR3	
	38	38	ADR2	
	14	14	ADR1	
	39	39	ADR0	
	15	15	NC	
	40	40	NC	
	16	16	NC	
	41	41	NC	
	17	17	IOB15	
	42	42	IOB14	
	18	18	IOB13	
	43	43	IOB12	
	19	19	IOB11	
	44	44	IOB10	
	20	20	IOB9	
	45	45	IOB8	
	21	21	IOB7	
	46	46	IOB6	
	22	22	IOB5	
	47	47	IOB4	
	23	23	IOB3	
	48	48	IOB2	
	24	24	IOB1	
	49	49	IOB0	
	25	25	LTGR	
	50	50	NC	

J1

RI
10K
5V



NOTE:
LW1 IS OPENED TO DISABLE
THE ATTENUATOR DRIVERS.

FIGURE 2. RF SECTION INTERFACE, EXTENDER BOARD, SCHEMATIC DIAGRAM

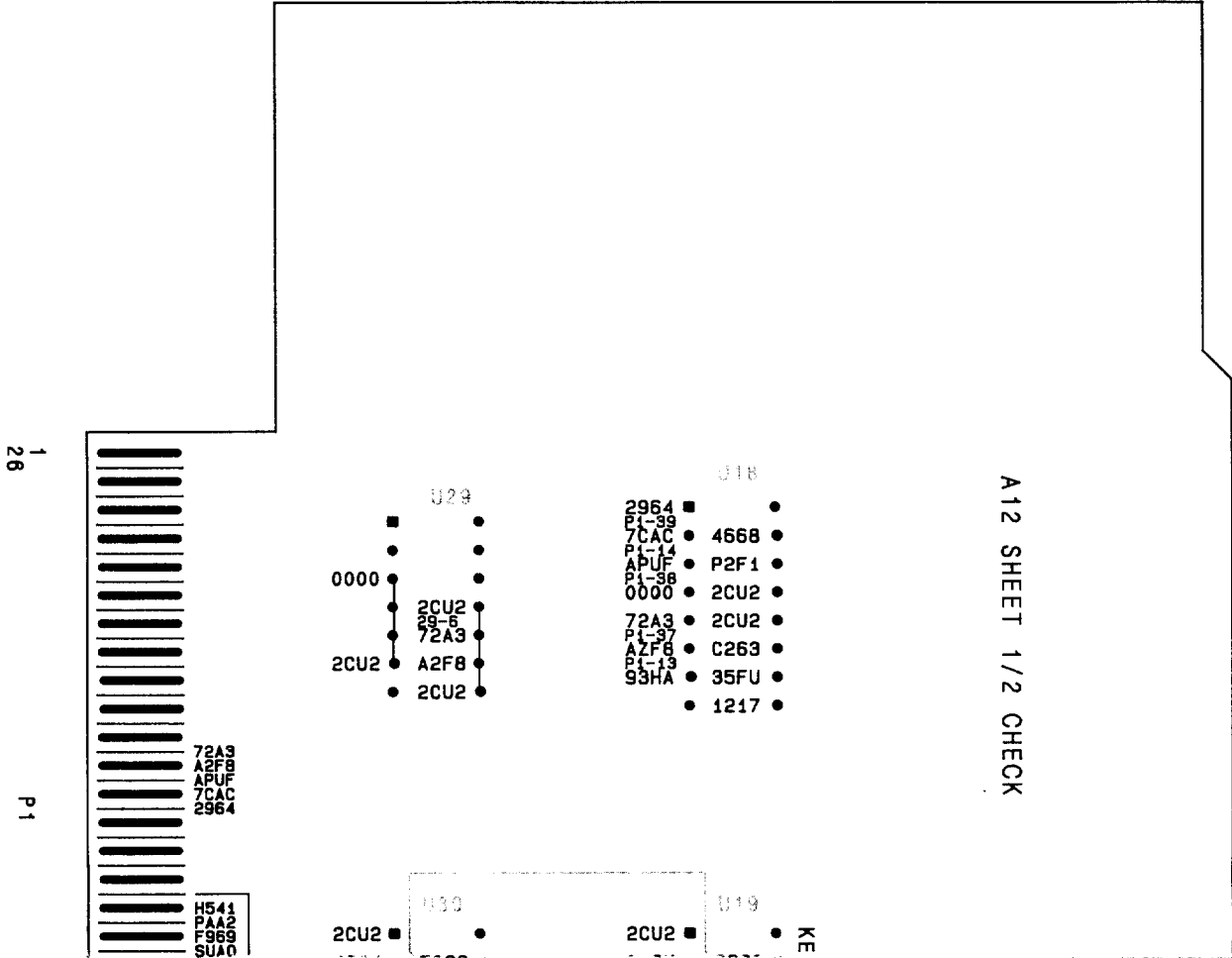
NOTE

- FOR INSTRUCTIONS ON THE USE OF SIGNATURE ANALYSIS DIAGRAMS
- READ THE SIGNATURE ANALYSIS DESCRIPTION SECTION OF THIS MANUAL.
- FOR TROUBLESHOOTING INFORMATION REFER TO THE A3 DIGITAL STORAGE SECTION.

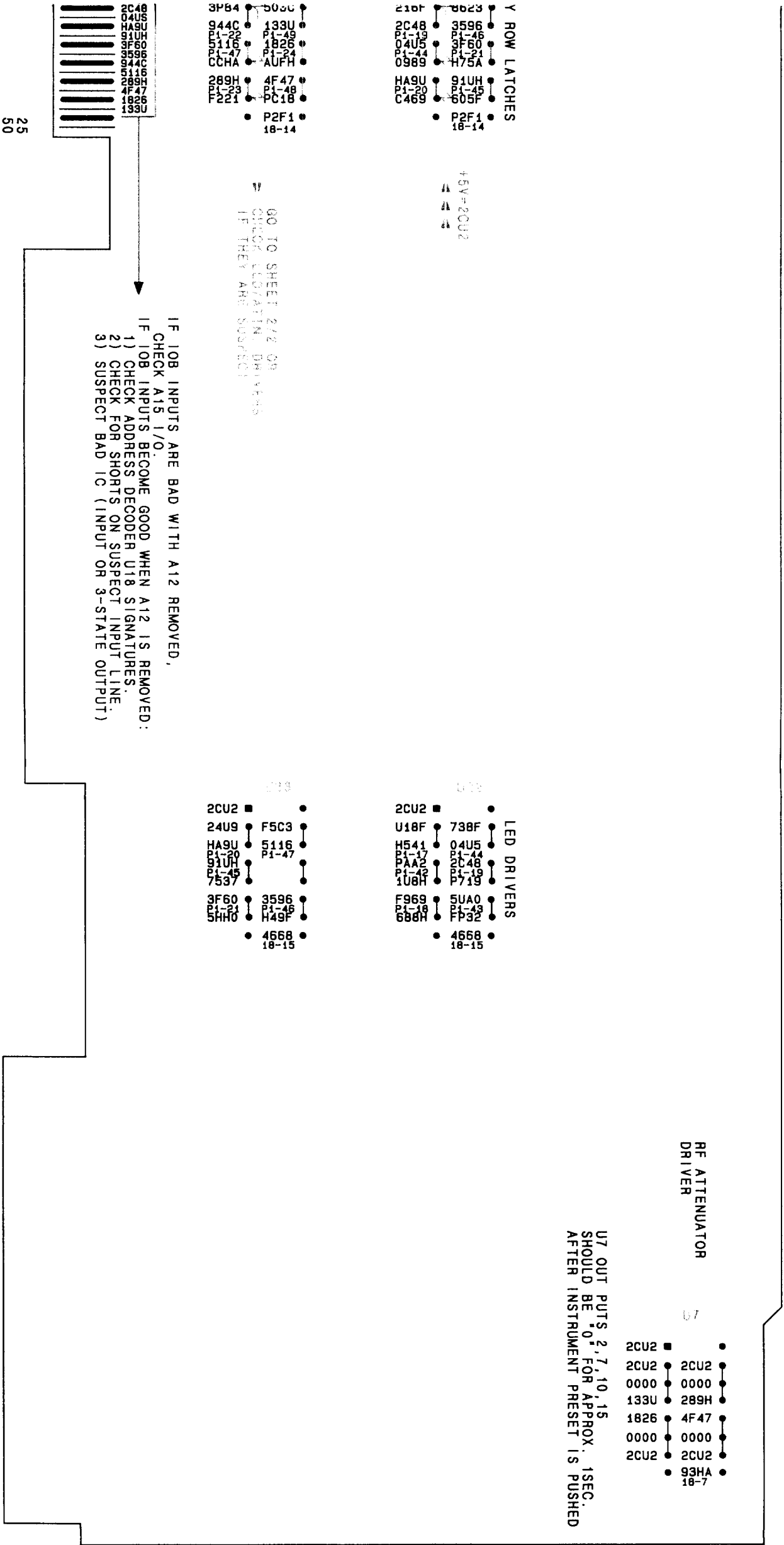
(A) A12 SHEET 1/2 CHECK

SPECTRUM ANALYZER CONNECTIONS:
INSTALL A12 BOARD ON A12 RF SECTION INTERFACE
EXTENDER BOARD;
JUMPER A15TP4(T0) TO A15TP2(STS)

SIGNATURE ANALYZER CONNECTIONS:
CLOCK  TO A15TP1-1 (B)
START  TO A15TP1-4 (T0)
STOP  TO A15TP1-5 (T1)
POD GND TO A15TP3



A12
RF SECTION INTERFACE
85680-60168



A12
FIGURE 3. A12 RF SECTION INTERFACE, SIGNATURE ANALYSIS TROUBLESHOOTING DIAGRAM (1 OF 2)
A12 7/8

NOTE

- FOR INSTRUCTIONS ON THE USE OF SIGNATURE ANALYSIS DIAGRAMS
- READ THE SIGNATURE ANALYSIS DESCRIPTION SECTION OF THIS MANUAL.
- FOR TROUBLESHOOTING INFORMATION REFER TO THE A3 DIGITAL STORAGE SECTION.

(B) SRQ RFG PHASE-LOCK CHECK

SPECTRUM ANALYZER CONNECTIONS:
INSTALL A12 BOARD ON A12 RF SECTION INTERFACE EXTENDER BOARD,
HP PART NO. 85680-60035.
JUMPER A15TP4 (T0) TO A15TP8 (STS).

SIGNATURE ANALYZER CONNECTIONS:

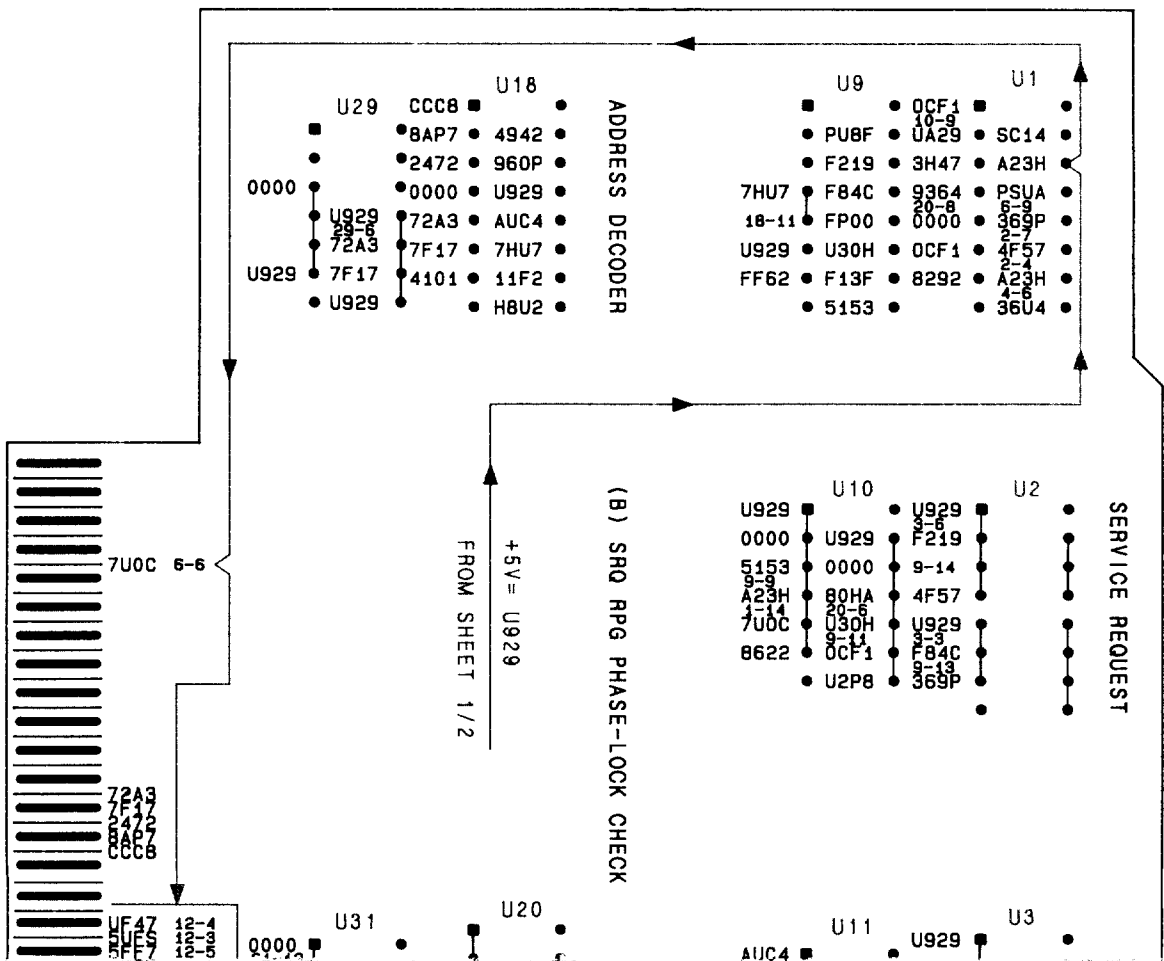
CLOCK — TO A15TP1-1 (B)
START — TO A15TP1-6 (T2)
STOP — TO A15TP1-7 (T3)
POD GND TO A15TP3 (GND)

(C) KEY COLUMN CHECK

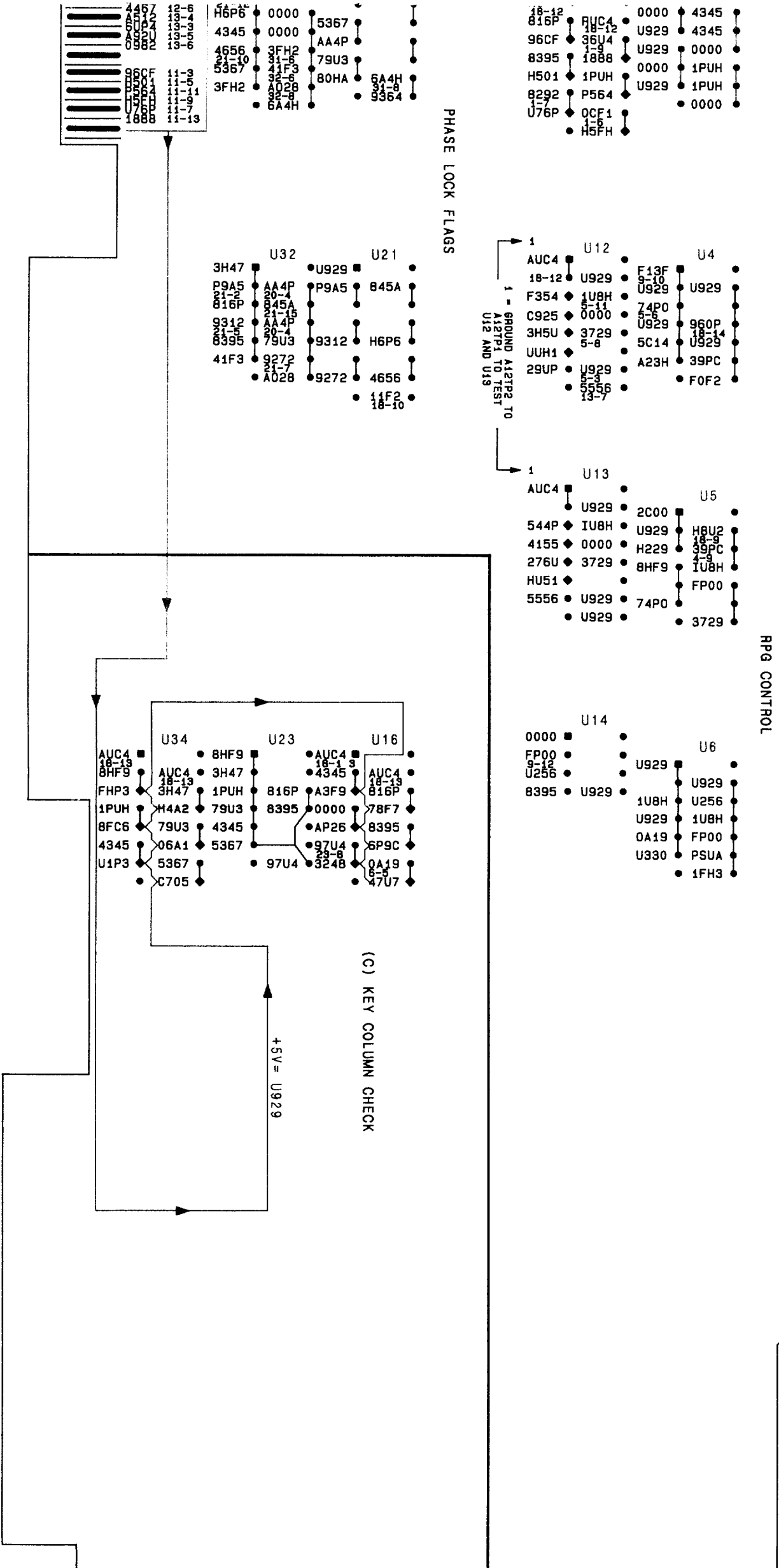
SPECTRUM ANALYZER CONNECTIONS:
INSTALL A12 BOARD ON A12 RF SECTION INTERFACE EXTENDER BOARD,
HP PART NO. 85680-60035.
JUMPER A15TP4 (T0) TO A15TP8 (STS).

SIGNATURE ANALYZER CONNECTIONS:

CLOCK — TO A15TP1-1 (B)
START — TO A15TP1-5 (T1)
STOP — TO A15TP1-6 (T2)
POD GND TO A15TP3 (GND)



A12
RF SECTION INTERFACE
85680-60168



RF SECTION

TABLE 1. A12 RF SECTION INTERFACE, REPLACEABLE PARTS (1 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12	85680-60168	3	1	RF SECTION INTERFACE	28480	85680-60168
A12C1	0180-0100	3	1	CAPACITOR-FXD 4.7UF +-10% 35VDC TA	56289	150D475X9035B2
A12C2	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A12C3	0160-2291	5	1	CAPACITOR-FXD .10UF +-10% 80VDC POLYE	28480	0160-2291
A12C4	0160-0153	4	2	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A12C5	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A12C6	0180-0116	1	1	CAPACITOR-FXD 6.8UF +-10% 35VDC TA	56289	150D685X9035B2
A12C7				NOT ASSIGNED		
A12C8	0160-4832	4	6	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A12C9	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A12C10	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A12C11	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A12C12	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A12C13	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A12C14				NOT ASSIGNED		
A12C15	0180-0229	7	1	CAPACITOR-FXD 33UF +-10% 10VDC TA	56289	150D336X9010B2
A12C16	0160-3454	4	1	CAPACITOR-FXD 220PF +-10% 1KVDC CER	28480	0160-3454
A12C17	0160-4574	1	2	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A12C18	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A12CR1	1901-0028	5	1	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A12CR2	1901-0535	9	6	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A12CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A12CR4	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A12CR5	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A12CR6	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A12CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A12CR8				NOT ASSIGNED		
A12CR23				DIODE-FW BRDG 200V 1A	28480	1901-0364
A12CR24	1901-0364	2	6	DIODE-FW BRDG 200V 1A	28480	1901-0364
A12CR25	1901-0364	2		DIODE-FW BRDG 200V 1A	28480	1901-0364
A12CR26	1901-0364	2		DIODE-FW BRDG 200V 1A	28480	1901-0364
A12L1	08558-80011	6	2	FILTER COIL BLUE	28480	08558-80011
A12L2	08558-80011	6		FILTER COIL BLUE	28480	08558-80011
A12Q1	1854-0404	0	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q2	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q3	1854-0637	1	1	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A12Q4	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A12Q5	1854-0477	7	6	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A12Q6	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A12Q7	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A12Q8	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A12Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A12Q10	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A12Q11	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q12	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12R1				NOT ASSIGNED		
A12R2	0698-0083	8	14	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R3	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R4	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A12R5	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R6	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R8	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A12R9	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R10	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R11	0757-0442	9	12	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R12	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R13	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R14	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R15	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R16	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R17	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R19	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R22	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A12R23				NOT ASSIGNED		
A12R24				RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R27				NOT ASSIGNED		
A12R31				NOT ASSIGNED		
A12R32				NOT ASSIGNED		
A12R37	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

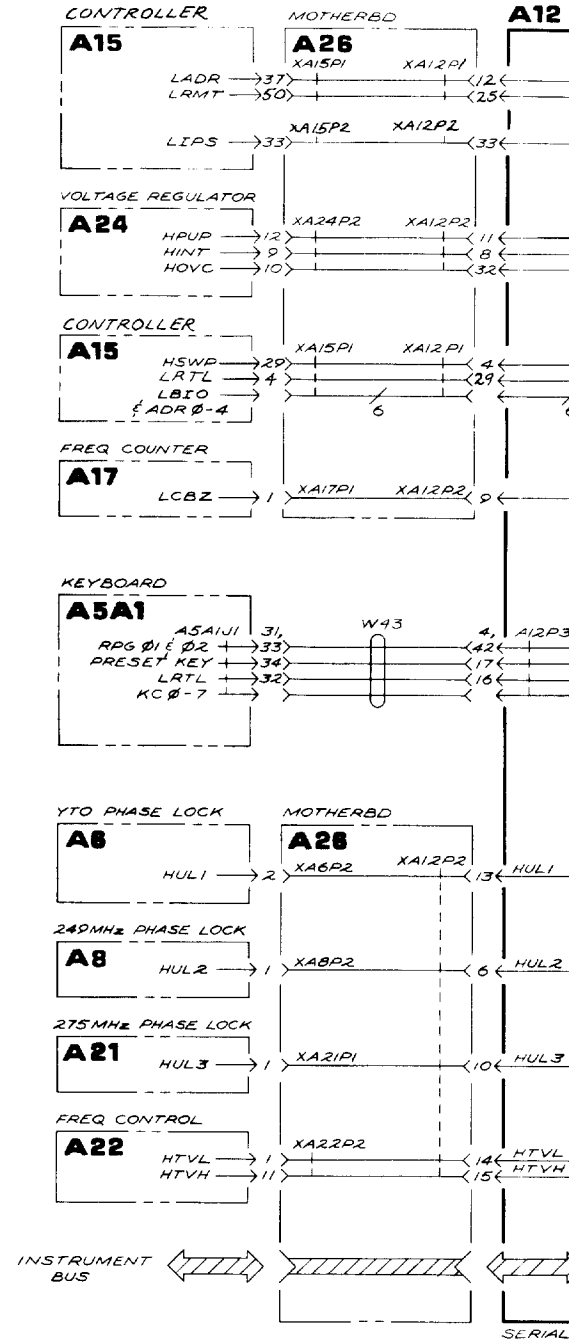
*Indicates factory selected value

TABLE 1. A12 RF SECTION INTERFACE, REPLACEABLE PARTS (2 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12R38	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12R39-						
A12R45	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12R46	0698-7217	4	1	RESISTOR 162 1% .05W F TC=0+-100	24546	C3-1/8-T0-162R-F
A12TP1	1251-5177	6	4	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12TP2	1251-5177	6		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12TP3	1251-5177	6		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12TP4	1251-5177	6		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12U1	1820-0987	3	1	IC ENCDR TTL L B-INP	07263	93L18PC
A12U2	1820-1440	5	1	IC LCH TTL LS QUAD	01295	SN74LS279N
A12U3	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A12U4	1820-1112	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A12U5	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A12U6	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A12U7	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A12U8	1820-1438	1	1	IC MUXR/DATA-SEL TTL LS 2-T0-1-LINE QUAD	01295	SN74LS257AN
A12U9	1820-1216	3	2	IC DCDR TTL LS 3-T0-8-LINE 3-INP	01295	SN74LS138N
A12U10	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A12U11	1820-1492	7	1	IC BFR TTL LS INV HEX 1-INP	01295	SN74LS368AN
A12U12	1820-2270	1	2	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	34335	AM25LS2569DC
A12U13	1820-2270	1		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	34335	AM25LS2569DC
A12U14	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	01295	NE555P
A12U15	1810-0206	8	3	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A12U16	1820-1491	6	2	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A12U17				NOT ASSIGNED		
A12U18	1820-1216	3		IC DCDR TTL LS 3-T0-8-LINE 3-INP	01295	SN74LS138N
A12U19	1820-1196	8	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U20	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A12U21	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U22	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U23	1820-1207	2	1	IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A12U24-						
A12U26	1901-0364	2		DIODE-FW BRDG 200V 1A	28480	1901-0364
A12U27	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A12U28	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A12U29	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A12U30	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U31	1820-1210	7	2	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U32	1820-1210	7		IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U33	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U34	1820-1491	6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A12U35	1810-0398	9	1	NETWORK-RES 10-SIP22.0K OHM X 9	11236	750-101-R22K
A12W1*	0757-0346	2	13	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12W2*	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12W3*	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12W4*	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A12W5*	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
MISCELLANEOUS PARTS						
	4040-0749	4	1	EXTR PC BD BRN	28480	4040-0749
	4040-0750	7	1	EXTR PC BD RED	28480	4040-0750
	1200-0607	0	1	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
	1480-0073	6	1	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073

*Indicates factory selected value

RF SECTION



SECTION INTERFACE

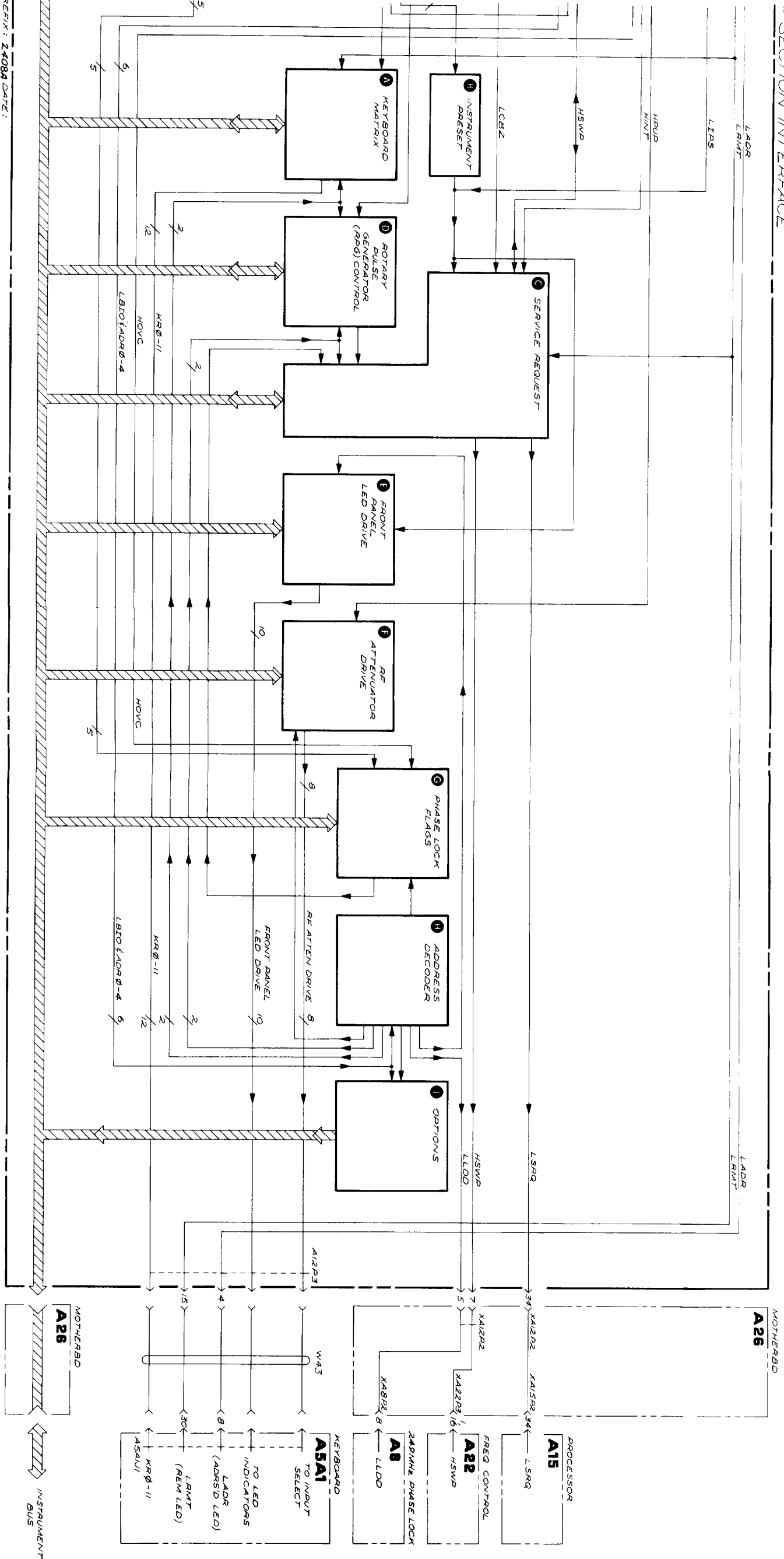


FIGURE 4. A12RF SECTION INTERFACE, BLOCK DIAGRAM

A12
RF SECTION INTERFACE
85680-60168

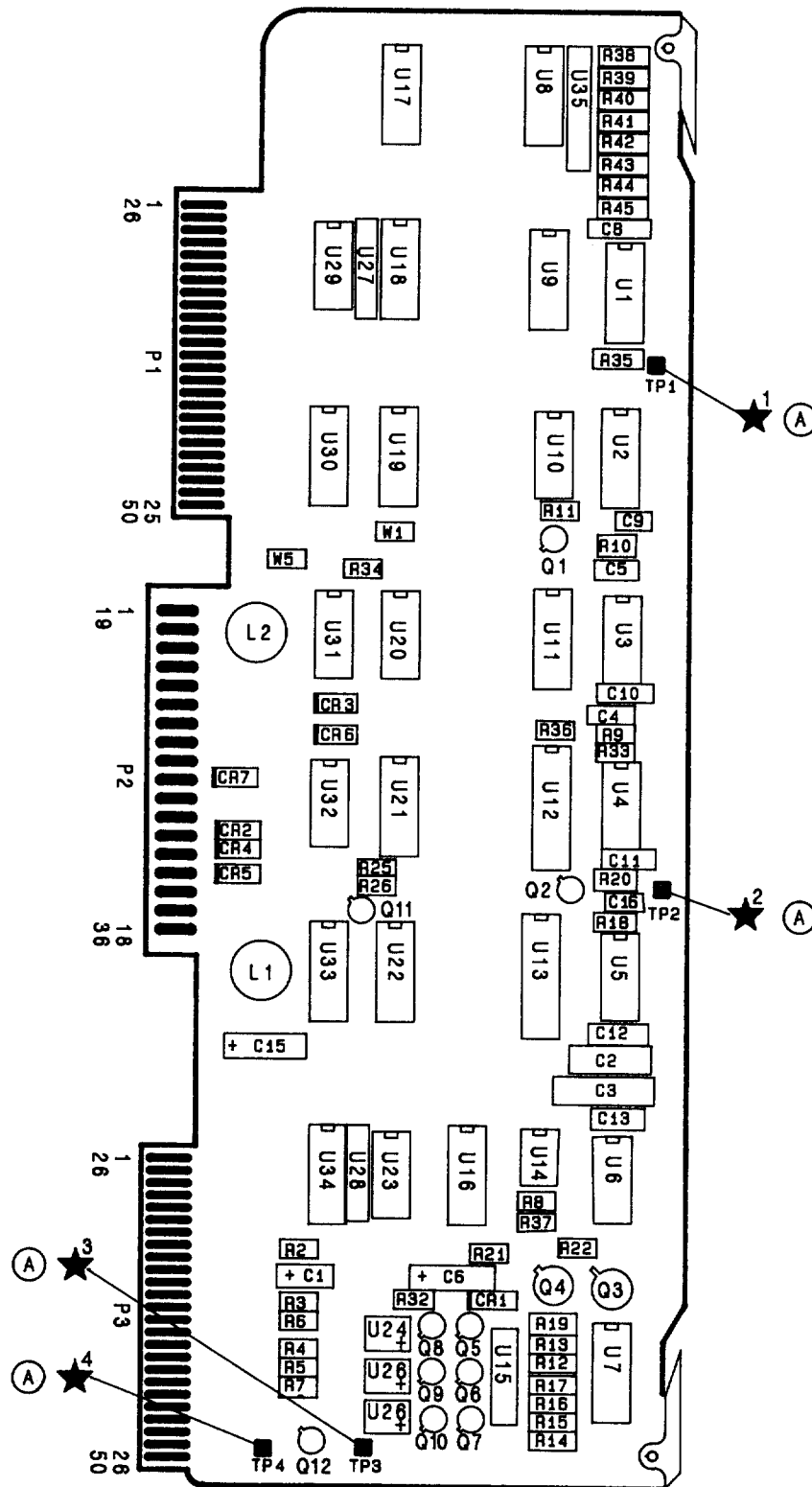


FIGURE 5. A12 RF SECTION INTERFACE, COMPONENT LOCATIONS

A12 RF SECTION INTERFACE (SHEET 1 OF 2)

85680-60168

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
26	LT10	A15P1-1	NC
2	GND		J
27	LB10	A15P1-2	H
3	NC		
28	NC		
4	HSWP	A15P1-29	C
29	LRTL	A15P1-4	C
5	KC7	A15P1-30	A
30	KC6	A15P1-5	A
6	KC5	A15P1-31	A
31	KC4	A15P1-6	A
7	KC3	A15P1-32	A
32	KC2	A15P1-7	A
8	KC1	A15P1-33	A
33	KC0	A15P1-8	A
9	KR11	A15P1-34	A
34	KR10	A15P1-9	A
10	KR9	A15P1-35	A
35	KR8	A15P1-10	A
11	NC		
36	NC		
12	LADR	A15P1-37	A
37	ADR4	A15P1-12	H
13	ADR3	A15P1-38	H
38	ADR2	A15P1-13	H
14	ADR1	A15P1-39	H
39	ADR0	A15P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	IOB15	A15P1-42	D
42	IOB14	A15P1-17	A, D
18	IOB13	A15P1-43	A, D
43	IOB12	A15P1-18	A, D
19	IOB11	A15P1-44	A, D
44	IOB10	A15P1-19	A, D
20	IOB9	A15P1-45	A, D
45	IOB8	A15P1-20	A, D
21	IOB7	A15P1-46	A
46	IOB6	A15P1-21	A
22	IOB5	A15P1-47	A, C
47	IOB4	A15P1-22	A, C
23	IOB3	A15P1-48	A, C
48	IOB2	A15P1-23	A, C
24	IOB1	A15P1-49	A, C
49	IOB0	A15P1-24	A, C
25	LRMT	A15P1-50	A, C
50	NC		

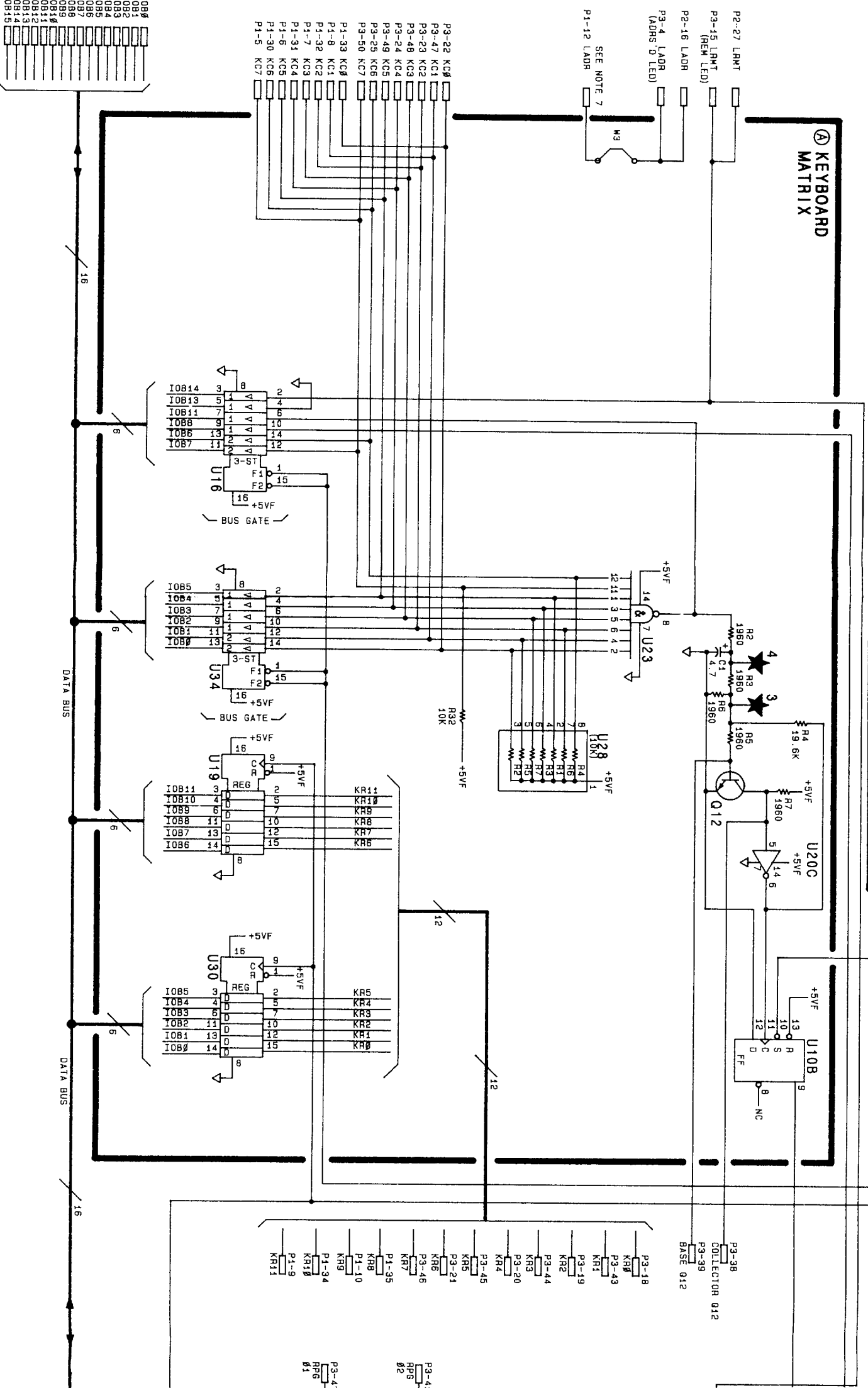
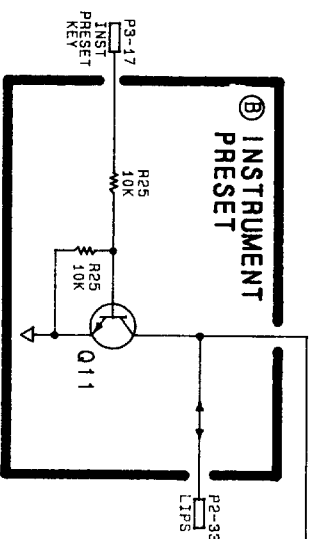
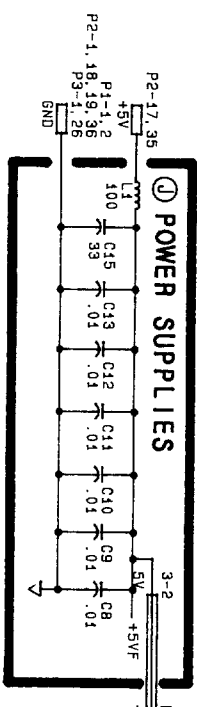
P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
19	GND		J
2	+20V		F
20	+20V		F
3	+12V		NC
21	+12V		NC
4	+12V		NC
22	+12V		NC
5	LLDD	A8P2-8	H
23	NC		
6	HUL2	A8P2-1	G
24	BASE Q2		C
7	HSWP	A22P3-1, 16	C
25	LHBZ	NC	C
8	HINT	A24P2-9	C
26	LRTL	NC	A
9	LCBZ	A17P1-1	C
27	LRMT	NC	A
10	HUL3	A21P1-1	G
28	LREQ	NC	C
11	HPUP	A24P2-12	F
29	U14-4		D
12	NC		
30	BASE Q1		C
13	HUL1	A6P2-2	G
31	NC		
14	HTVL	A22P2-1	G
32	HOVC	A24P2-10	G
15	HTVH	A22P2-11	G
33	LIPS	A15P2-33	B
16	LADR	NC	A
34	LSRQ	A15P2-34	C
17	+5V		J
35	+5V		J
18	GND		J
36	GND		J

P3

PIN	SIGNAL	TO/FROM
1	GND	A5A1
26	GND	A5A1
2	+5V	A5A1
27	10 dB PAD	A5A1
3	LED 4	A5A1
28	10 dB THRU	A5A1
4	LADR (ADRS'D LED)	A5A1
29	20 dB PAD	A5A1
5	RES BW LED	A5A1
30	20 dB THRU	A5A1
6	VIDEO BW LED	A5A1
31	40 dB PAD	A5A1
7	SWEEP TIME LED	A5A1
32	40 dB THRU	A5A1
8	ATTEN LED	A5A1
33	+20V	A5A1
9	CF STEP SIZE LED	A5A1
34	INPUT RELAY	A5A1
10	CKI1	A5A1
35	NC	
11	CKI LED	A5A1
36	NC	
12	FREQ COUNT LED	A5A1
37	NC	
13	SIGNAL TRACK LED	A5A1
38	COLLECTOR 12	
14	ENABLED LED	A5A1
39	BASE Q12	
15	LRMT (REM LED)	A5A1
40	NC	
16	LRTL	A5A1
41	RPQ #2	A5A1
17	INST PRESET KEY	A5A1
42	RPQ #1	A5A1
18	KR0	A5A1
43	KR1	A5A1
19	KR2	A5A1
44	KR3	A5A1
20	KR4	A5A1
45	KR5	A5A1
21	KR6	A5A1
46	KR7	A5A1
22	KC0	A5A1
47	KC1	A5A1
23	KC2	A5A1
48	KC3	A5A1
24	KC4	A5A1
49	KC5	A5A1
25	KC6	A5A1
50	KC7	A5A1

1M	FUNCTION BLOCK
-2	J
-2	J
-4	J
-3	F
5	F
-8	A
-7	F
-10	F
-9	F
-12	E
-11	F
-14	E
-13	F
-16	E
-15	F
-18	E
-17	F
-20	E
-22	E
24	E
26	E
28	E
30	A
32	C
31	D
34	B
33	D
36	A
35	A
38	A
37	A
40	A
39	A
42	A
41	A
44	A
43	A
46	A
45	A
48	A
47	A
50	A
49	A





A12 17/18

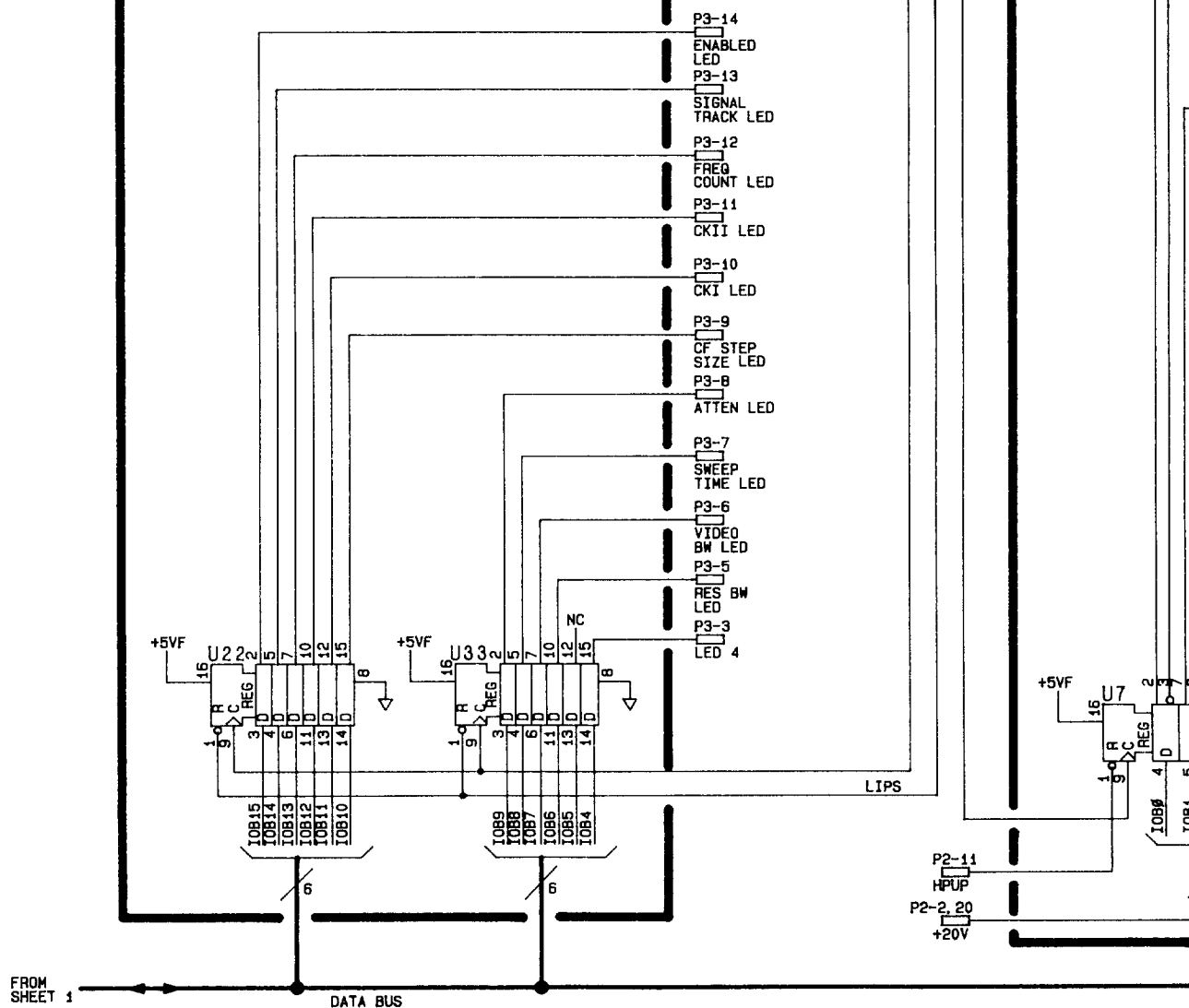
A12 RF SECTION INTERFACE 85680-60121 (SHEET 2 OF 2)

FROM
SHEET 1

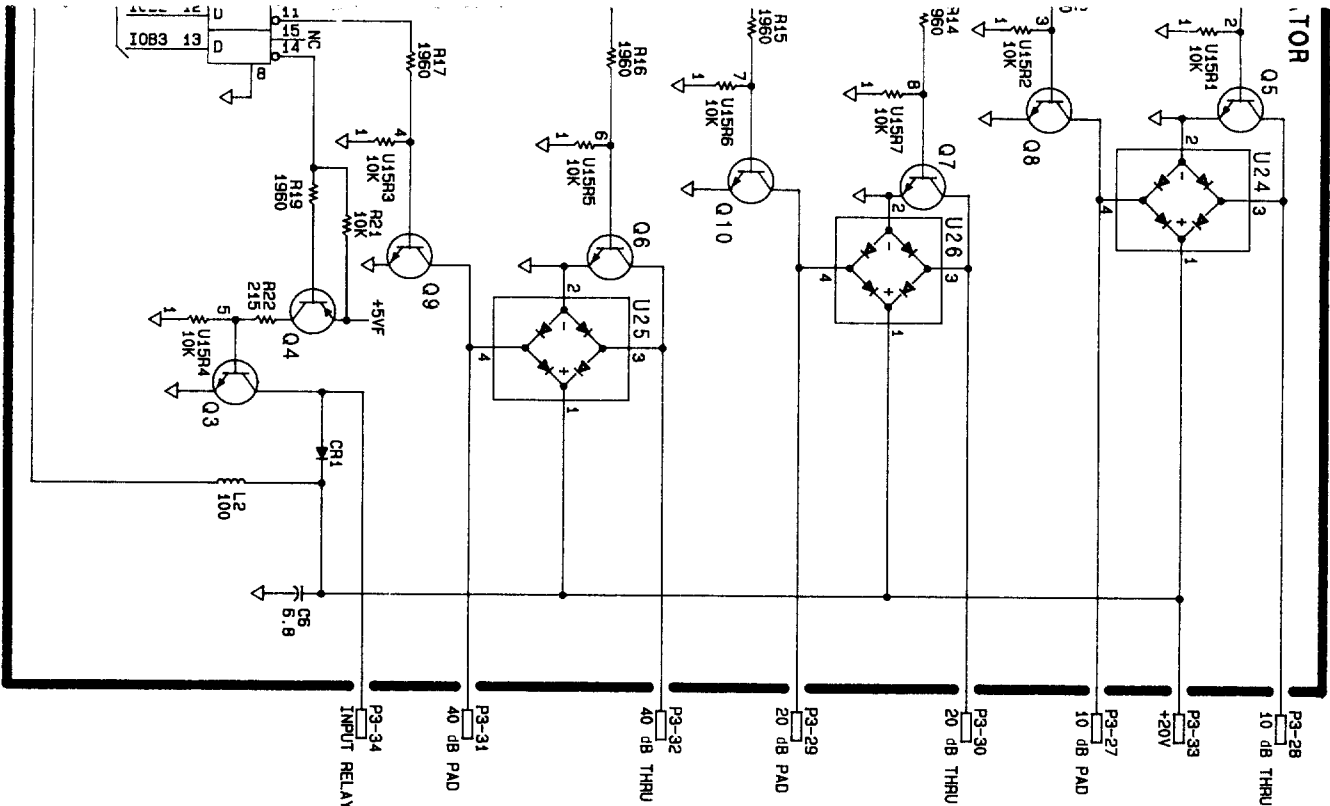
LIPS

LOCK

⑤ FRONT PANEL LED DRIVE



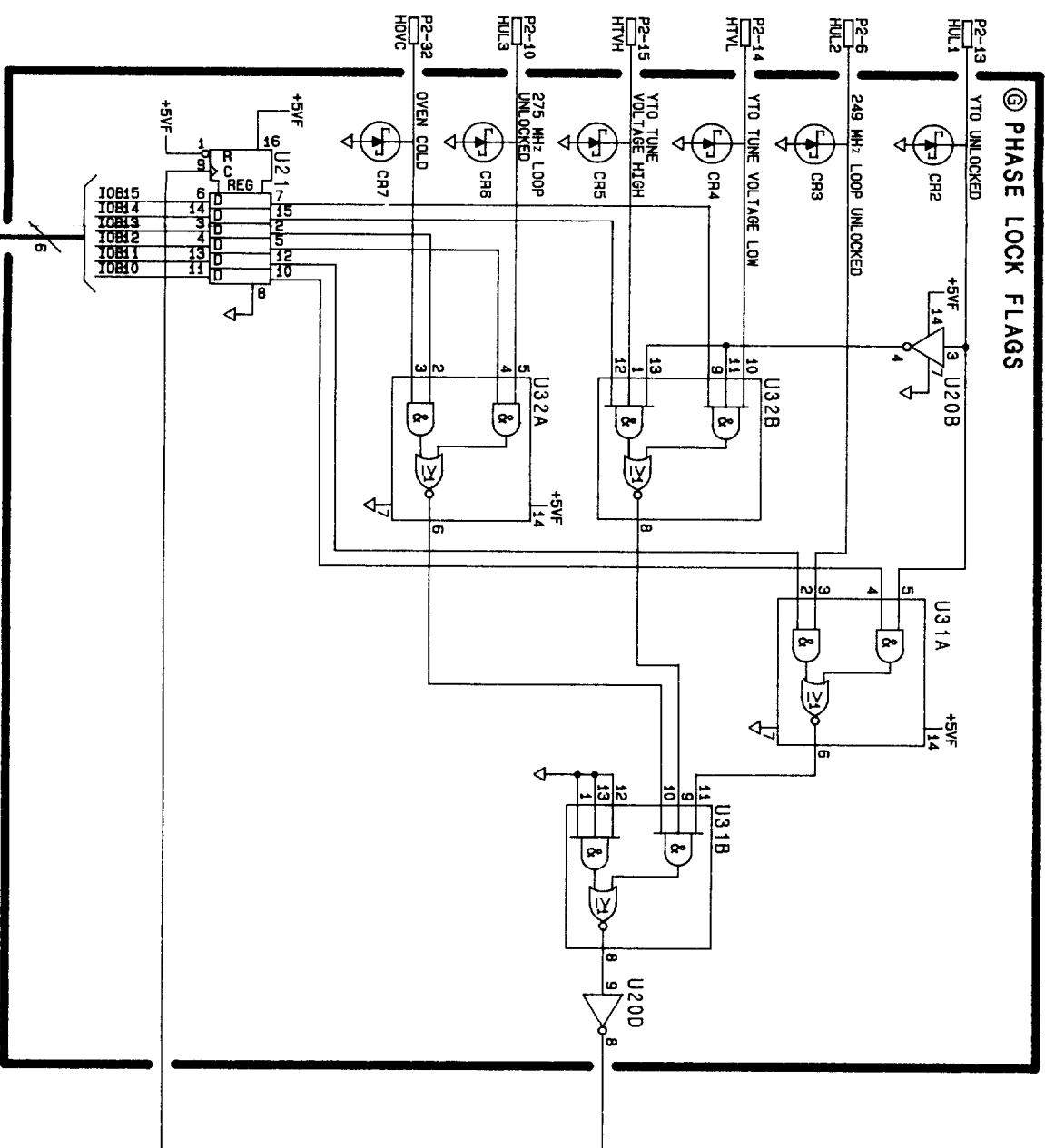
LOCK



DATA BUS

DATA BUS

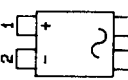
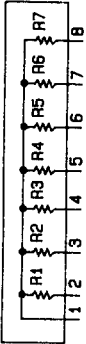
DATA



P1-39 ADDR
P1-34 ADDR
P1-38 ADDR
P1-27 LRU
P1-37 ADDR
P1-13 ADDR

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED: LOGIC LEVELS ARE TTL: 2.0V TO +5.0V = LOGIC "1" = HIGH 0V TO +0.8V = LOGIC "0" = LOW
4. PIN CONFIGURATION FOR U15, 27, 28 U- (10K)
5. U24, 25, 26: FULL WAVE RECTIFIER PACKAGES



TOP VIEW

6. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
LB10	LOW-BOTTOM BOX I/O STROBE
HPUP	HIGH-POWER UP
HUL1	HIGH-YTO LOOP UNLOCKED
HUL2	HIGH-249 MHz LOOP UNLOCKED
HUL3	HIGH-275 MHz LOOP UNLOCKED
HTVL	HIGH-YTO TUNE VOLTAGE LOW
HTVH	HIGH-YTO TUNE VOLTAGE HIGH
HINT	HIGH-INTERNAL FREQ REF
HOVC	HIGH-FREQ REF OVEN COLD
LLD0	LOW-LOAD 249 DIVIDER NUMBERS
LRTL	LOW-RETURN TO LOCAL REQUEST
LTGR	LOW-TRACKING GENERATOR REQUEST
HSWP	HIGH-SWEEPING
CK1	CHECK ONE FRONT PANEL
CK2	CHECK TWO CHECK LEDS
VBM	VIDEO BANDWIDTH
RBM	RESOLUTION BANDWIDTH
RP6 #1	ROTARY PULSE FRONT GENERATOR ONE PANEL
RP6 #2	ROTARY PULSE DATA GENERATOR TWO CONTROL
LSTP	LOW-STOP PROCESSOR

① OPTIONS

INPUT 1
50Ω
75Ω
INPUT 1 ABSENT

REMOVE JUMPER
NONE
D
D & C

INPUT 2
50Ω
75Ω
INPUT 2 ABSENT

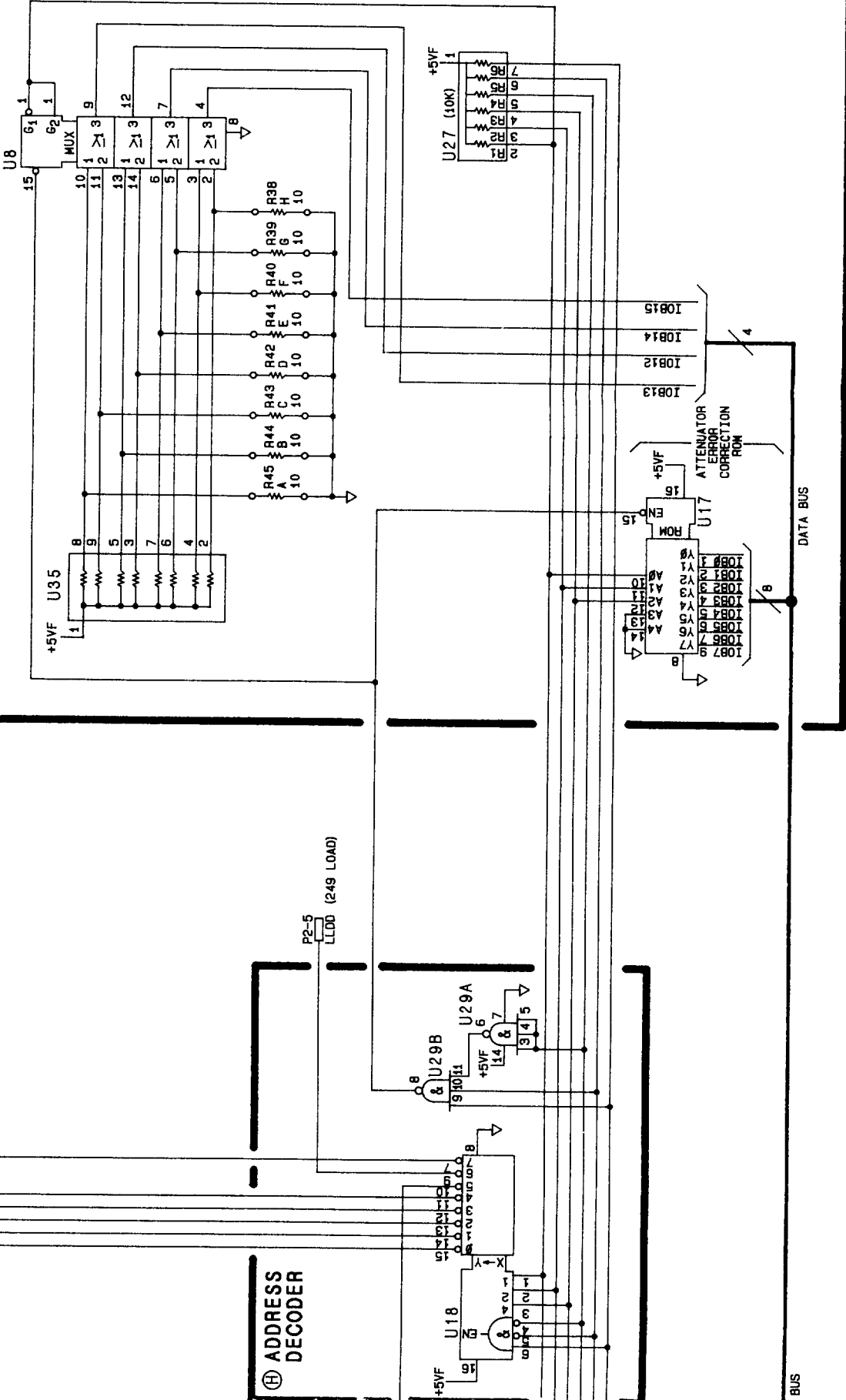
REMOVE JUMPER
NONE
G
G & H

PREAMP PRESENT
NO
YES

REMOVE JUMPER
NONE
A

INSTRUMENT PRESENT
DISPLAY UNITS
dBm
dBmV
dBμV
VOLTS

REMOVE JUMPER
NONE
E
F
E & F



A12

FIGURE 6. RF SECTION INTERFACE ASSEMBLY A12, SCHEMATIC (2 OF 2)

A15 CONTROLLER, CIRCUIT DESCRIPTION

The A15 Controller Assembly performs the main control functions of the spectrum analyzer. The board includes a 16-bit microprocessor (the instrument's main processor), read-only memory (ROMs), random-access memory (RAMs), and HP-IB circuitry.

The schematic shows how the main processor, memory, HP-IB, and other circuits on the A15 Controller assembly are interconnected via the microprocessor's 23-bit address bus and the 16-bit data bus. To control signal flow on these buses, various signals must be derived from the address bus signals and the microprocessor's remaining output signals. These control signals are generated by two programmable-array-logic integrated circuits (PALs) and other discrete logic (R/W DECODE, ADDRESS DECODE, ADDRESS DECODE, and LTIO/LBIO blocks). The signals are used by the microprocessor to control data flow and address decoding on the A15 Controller assembly and to control signal flow over the Instrument Bus.

The 16-bit, 8 MHz MC68000 microprocessor is the main processor used to control the spectrum analyzer. It receives input through the front-panel keyboard or from HP-IB, performs the necessary decoding and calculations, and outputs the proper control signals to execute a specific spectrum analyzer operation. Typical main processor tasks include phase-locking the YTO, selecting the correct sweep time and frequency span, setting the IF-Display Section resolution bandwidth and sensitivity, and displaying the current control settings on the CRT through the A3 Digital Storage section. Instructions that tell the microprocessor how to accomplish these tasks, the firmware, are stored in ROMs located on the A15 Controller assembly. In addition, custom commands and programming can be down-loaded into RAM, permitting specialized operation without requiring a dedicated controller.

The microprocessor performs a brief power-on pretest (POP) at instrument turn-on, verifying operation of critical circuits and lighting front-panel check LEDs I and II. In addition, LEDs located on the top edge of the A15 Controller assembly provide information to help identify particular faulty circuit components should a failure occur.

The instrument's main memory consists of read-only memory (ROM) and random-access memory (RAM), which are located on the A15 Controller assembly. Each 16-bit word in memory is composed of two 8-bit bytes. The ROM, used to provide permanent storage of the firmware, is composed of four 32K-byte erasable programmable read-only memories (EPROMs). This provides a total of 64K-words of ROM. The RAM, used for erasable storage of custom instructions and programs, is composed of four 8K-byte static CMOS memory integrated circuits for a total of 16K-words of RAM. A lithium battery located on the A15 Controller assembly provides battery back-up power to the CMOS RAM to preserve the contents of memory when power is removed from the instrument. The typical incircuit life expectancy of the non-rechargeable battery is at least 3 years.

The HP-IB allows the spectrum analyzer to communicate with external devices. It is implemented using four ICs: A data latch, an HP-IB processor, and two bus transceivers.

The A15 Controller clock circuit generates an 8-MHz clock signal for the 16-bit microprocessor and a synchronous 4-MHz clock signal for the HP-IB processor. The appropriate clock frequency is derived from division of the output signal of a 14.7456 MHz hybrid crystal clock oscillator.

The A15 Controller assembly firmware includes extensive diagnostics, which are executed whenever the instrument is powered up or INSTR PRESET is pressed; the microprocessor executes a self-test routine and indicates the results via LEDs. A memory failure, microprocessor failure, or Instrument Bus failure can usually be pinpointed to the failed component using these indicators.

HP-IB Address Switch

The position of the address switch on the A15 Controller (A15SW1) determines what read/write address is used by the analyzer when the line power is turned on.

The address switch is preset to 31 (switches A1 through A5 pressed up) at the factory. If the CMOS backup battery is not discharged, the last read/write address used by the analyzer is active with power on. If the backup battery is discharged, the analyzer will default to a read/write address of 18 with power on.

If the address switch is set to any address from 0 to 30, this address will be used as the read/write address by the analyzer with power on.

Switch A6 is also set in the “up” position (logic 1) at the factory. A6 in this position does a checksum verification of the two pairs of ROMs on the A15 Controller as part of the self-test routine with power on.

HP-IB Signal Ground (A29)

The A29 assembly provides chassis ground for the HP-IB shield. Pins 12 and 18 through 24 of the HP-IB connector J2 are immediately grounded to the chassis upon entering the instrument.

HP-IB Address Labels

HP-IB address labels are available by ordering HP Part Number 7120-6853. (See Figure 1). These labels allow easy reference to the HP-IB address of each system component.

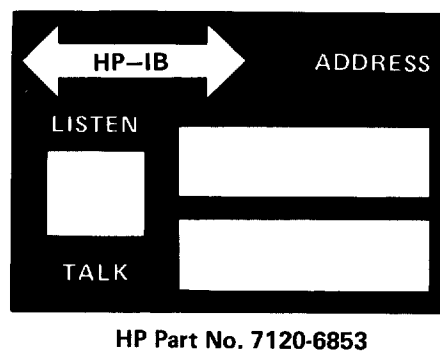


FIGURE 1. HP-IB ADDRESS LABEL

A15 CONTROLLER, TROUBLESHOOTING

Troubleshooting the A15 Controller is divided into three levels:

Level 1 is Self Test which uses the built-in diagnostics of the spectrum analyzer to isolate the failure. No external test equipment is required.

Level 2 is Signature Analysis which requires the use of a signature analyzer such as an HP 5005A, 5005B, or 5006A. This level of troubleshooting should be performed to further isolate the problem or when Self Test will not run.

Level 3 is Manual Tests which require the use of general troubleshooting equipment, such as digital voltmeter and oscilloscope. This level is required when neither Self Test nor Signature Analysis can isolate the failure.

Level 1 SELF TEST

The Self Test is run on power-up and after pushing INSTR PRESET. Two front panel LEDs, INSTR CHECK I and II, give an indication of Self Test results (without removing any covers from the instrument). There are also 15 LEDs on the A15 Controller assembly (DS1 through DS15) that will help isolate a problem.

Front Panel INSTR I and II LEDs

The two red INSTR CHECK LEDs are forced on whenever the instrument is turned on or INSTR PRESET is pushed. The main processor then performs a check of itself, a checksum verification of all ROMs on the A15 Controller, a partial check of the Instrument Bus (50-wire bus), and a read-write check of the RAMs and A34A Memory in the IF-Display Section.

If all the checks pass, both INSTR CHECK LEDs are turned off.

If the checks fail, one or both INSTR CHECK LEDs remain on.

- a. **Both INSTR CHECK LEDs** on indicates a problem on the A15 Controller. First remove the A15 Controller and make sure that the 50-wire ribbon cable and HP-IB ribbon cable are pressed all the way onto A15J1 and A15J2 connectors. Reinstall A15 Controller. If both front panel INSTR CHECK LEDs still remain on when instrument is turned on, follow procedure under A15 Controller Self Test.
- b. **Left LED (INSTR CHECK I)** on indicates a failure occurred when checking Digital Storage Memory (A3A4). First check to ensure that a LINE power cord is connected to the IF-Display Section. Also check to see that the rear-panel Analyzer Bus Interconnect Cable, W31, is properly connected. If INSTR CHECK I still remains on when instrument is turned on, troubleshoot the A3 Digital Storage in the IF-Display Section.
- c. **Right LED (INSTR CHECK II)** on indicates a failure occurred during the partial check of the Instrument Bus.

NOTE

The partial interface check reads the key column lines (KC0 through KC7) from the A1 and A5 front panels. If any front panel key is shorted or stuck closed, INSTR CHECK II LED should remain on after the Self Test is completed. This part of the Self Test can easily be verified by pushing any key, except LCL, and holding the key in while pushing INSTR PRESET. If the I/O interface check routine is working, INSTR CHECK II LED will stay on.

- d. Suspected digital failure but no INSTR CHECK LEDs on may indicate a RAM or I/O bus failure which is not checked in the normal Self Check or "POP" (Power on Preset). If the two front panel INSTR CHECK LEDs turn on when LINE switch is set to ON, and within a few seconds turn off (indicating no digital problems), but symptoms (such as improper CRT display or improper response to particular commands) indicate that the problem is in the digital area, a "LONG POP" can be performed. LONG POP is very similar to the normal POP except an additional processor check is performed, all of the RAM locations in Digital Storage (A3A4 Memory) are checked, and the memory (RAM) on the A15 Controller is verified.

Since these more extensive checks require altering information that has been stored in RAM, LONG POP requires an internal jumper from A15TP4 (STS) to A15TP1-7 (T3). To perform a LONG POP, set LINE switch to STANDBY and jumper A15TP4 to A15TP1-7. (Refer to A15 component locations diagram for location of test points). When LINE switch is then set to ON, the two red INSTR CHECK LEDs are forced on and the main processor steps through the Self Test routine, expanding the normal POP by the additional tests mentioned. The expected results for a LONG POP are exactly the same as for the normal POP of INSTR PRESET as described in paragraphs a, b, and c under "Front Panel INSTR CHECK I and II LEDs".

Because LONG POP is a "destructive test" (it alters any information that has been stored in RAM), it should be performed only as a last resort effort in troubleshooting what appears to be a memory- or processor-related problem.

A15 Controller Self Test

The A15 Controller Self Test is run on power-up and after pushing INSTR PRESET. Fourteen LEDs (A15DS1 through A15DS14) on the A15 Controller Assembly give an indication of the self test results. All fourteen LEDs are forced on whenever the instrument is turned on or INSTR PRESET is pushed. The main processor (A15U26) then performs a check of itself, a check of the Peripheral Interface and Timer chip, a checksum verification of all the ROMs on the A15 Controller, a read-write check of the RAMs on the A15 Controller, and an Instrument Bus check that checks the I/O Bus, Address Bus, and Data Bus for stuck lines.

If all the checks pass, the fourteen LEDs are turned off serially as each check is completed. If the checks fail, one or more LEDs remain on. Refer to Self Test Fail Indicators Table at the end of this troubleshooting section.

Other failure modes to look for are:

- a. If the fourteen LEDs do not turn on when the spectrum analyzer is turned on or INSTR PRESET is pushed, use Signature Analysis (troubleshooting Level 2) to determine the probable failure.
Hint: Check U39 and U40 ROM signatures and U42 PAL signatures before taking the green path.
- b. If the fourteen LEDs turn on but are all turned off at the same time (instead of sequentially), the Peripheral Interface and Timer chip has most likely failed.
- c. When an I/O failure is indicated (DS3, DS4, or a combination of these LEDs remain on), it may become necessary to use an oscilloscope to locate a stuck line if the faulty component cannot be located using Signature Analysis.
Hint: Try replacing U20 and U42 PALs first, then try replacing U39 and U40 ROMs. If I/O failure still occurs, probe I/O lines with oscilloscope.

Level 2 SIGNATURE ANALYSIS

Signature Analysis has been designed into the A15 Controller to permit troubleshooting to the component level without totally understanding the detailed circuitry of the A15 Controller. Most of the A15 Controller failures (80 to 90%) can be isolated to a component or small group of components using Signature Analysis. Data Bus, Address Bus, and I/O Bus problems will usually require the use of an oscilloscope as a troubleshooting aid. Refer to MANUAL TESTS (Level 3).

To proceed with Signature Analysis, follow the procedures on the Signature Analysis Diagram.

Level 3 MANUAL TESTS

If neither the Self Test nor Signature Analysis leads to a failed component, it will be necessary to use a DVM and/or oscilloscope. The following procedure may help locate the failed component:

- a. Check all power supply voltages that supply power to the A15 Controller.
- b. Check processor clock by connecting oscilloscope to A15TP2-4 (CK). The clock frequency should be approximately 7.36 MHz. The amplitude should be approximately +5V (HIGH) and 0V (LOW). Also check for I OLK at pin 76 of A15U27B.
- c. Check HP-IB clock at pin 5 of A15U27A. The HP-IB clock frequency should be approximately 3.68 MHz. The amplitude should be approximately +5V (HIGH) and 0V (LOW).
- d. Some intermittent failures may require the use of heat (hair dryer) or cold (freeze mist) to isolate the failure.

CAUTION

Care should be exercised to avoid getting components too hot. Excessive heat may cause permanent damage of good components. Also, avoid spraying freeze mist directly on PC boards. Failures due to high-resistance paths between traces on PC boards have been caused by spraying the boards with freeze mist.

TABLE 1. A15 CONTROLLER SELF TEST FAIL INDICATORS

A15 LED On	Affected Circuitry	Probable Failure
DS1	Processor	A15U26
DS2	Top Box Address	Use Signature Analysis or oscilloscope to isolate failure.
DS3	Bottom Box Address	Use Signature Analysis or oscilloscope to isolate failure.
DS4	I/O, Data Bus	Use Signature Analysis or oscilloscope to isolate failure.
DS5	RAM	A15U18
DS6	RAM	A15U15
DS7	RAM	A15U17
DS8	RAM	A15U14
*DS9	ROM	A15U19
*DS10	ROM	A15U16
DS11	ROM	A15U39
DS12	ROM	A15U37
DS13	ROM	A15U40
DS14	ROM	A15U38
**DS15	RAM	Power Supply (VRAM)
* A15U16 and A15U19 are loaded when 128K ROMs (set of 6) are installed. A15U16 and A15U19 are not loaded when 256K ROMs (set of 4) are used. ** DS15 should normally stay on. If DS15 is not on, suspect power supply that supplies VRAM.		

TABLE 2. A15 CONTROLLER, REPLACEABLE PARTS (1 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15	85680-60174	1	1	BOARD ASSEMBLY, CONTROLLER	28480	85680-60174
A15BT1	1420-0331	3	1	BATTERY 3.4V 1.75A-HR LITHIUM THIONYL	28480	1420-0331
A15C1	0160-4554	7	19	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C2	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C3	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C4	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C5	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C6	0160-4554	7	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C7	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C8	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C9				NOT ASSIGNED		
A15C10	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C11	0160-4554	7	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C12	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C13	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C14				NOT ASSIGNED		
A15C15	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C16			7	NOT ASSIGNED		
A15C17	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C18	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C19	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C20	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C21			7	NOT ASSIGNED		
A15C22	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C23	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C24	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A15C25	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A15C26-			2	NOT ASSIGNED		
A15C28				CAPACITOR-FXD 4.7UF +-10% 100VDC CER	28480	0180-0100
A15C29	0180-0100	2		CAPACITOR-FXD 47UF+-20% 20VDC TA	28480	0180-0500
A15C30	0180-0500	7		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A15C31	0180-0197	8				
A15C32	0180-0552	9	1	CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A15C33	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A15C34	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A15C35				NOT ASSIGNED		
A15CR1	1901-0620	3	2	DIODE-SWITCHING 60V 400MA DO-35	79171	NDP250
A15CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2N5 DO-35	28480	1901-0050
A15CR3	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A15CR4	1901-0620	3		DIODE SWITCHING 60V 400MA DO-35	79171	NDP250
A15DS1	1990-0958	7	14	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS2	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS3	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS4	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS5	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS6	1990-0958	7	7	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS7	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS8	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS9	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS10	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS11	1990-0958	7	7	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS12	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS13	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS14	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS15	1990-0957	6		LED-LAMP LUM-INT=1MCD IF=7MA-MAX BVR=5V	28480	1990-0957
A15E1	1251-4787	2	1	SHUNT DIP 8-POSITION	28480	1251-4787
A15J1	1251-5926	3	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5926
A15J2	1251-5905	8		CONNECTOR 24-PIN M POST TYPE	28480	1251-5905
A15J3				NOT ASSIGNED		
A15J4				NOT ASSIGNED		
A15J5	1251-5619	1		CONNECTOR 4-PIN M POST TYPE	28480	1251-5619
A15L1	9100-1788	6	2	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A15L2	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A15MP1	1251-8616	4	1	CONN-POST TYPE .150-PIN-SPCG 4-CONT	28480	1251-8616
A15MP2				NOT ASSIGNED		
A15MP3	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A15MP4	4040-0749	4		EXTR-PC BD BRN POLYC .062-BD-THKNS	28480	4040-0749
A15MP5	4040-0753	0		EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A15MP6			4	NOT ASSIGNED		
A15MP7	2200-0139	4		SCREW-MACH 4-40 .25-IN-LG PAN-IND-POZI	28480	2200-0139
A15MP8	3050-0105	6		WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
A15MP9	2170-0003	8		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2170-0003
A15MP10	2260-0001	5		NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	28480	2260-0001

*Indicates factory selected value

TABLE 2. A15 CONTROLLER, REPLACEABLE PARTS (2 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15Q1	1853-0201	9	1	TRANSISTOR PNP 2N2707A SI TO-18 PD=400MW	04713	2N2707A
A15R1				NOT ASSIGNED		
A15R2	0698-0289	6	1	RESISTOR 13.3K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3162-F
A15R3	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A15R4	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A15R5	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A15R6	0698-3260	9	3	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R7	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R8	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A15R9	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R10	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R12	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R13	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A15R14	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R15	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-025R-F
A15R16	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A15R17	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A15R18	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R19	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A15R20	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A15SW1	3101-2197	9	1	SWITCH-RKR DIP-RKR-ASSY 6-1A .05A 30VDC	28400	3101-2197
A15TP1	1251-8096	4	1	HEADER ASSY 7PIN	28480	1251-8096
A15TP2				NOT ASSIGNED		
A15TP3	0360-1682	0	2	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15TP5	1251-5177	6	2	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A15TP6	1251-5177	6		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A15U1	1810-0446	0	3	NETWORK-RES 8-SIP1.5K OHM X 7	11236	750-81-1.5K
A15U2	1810-0446	8		NETWORK-RES 8-SIP1.5K OHM X 7	11236	750-81-1.5K
A15U3	1810-0446	8		NETWORK-RES 8-SIP1.5K OHM X 7	11236	750-81-1.5K
A15U4	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2 INP	01295	SN74LS00N
A15U5	1820-3401	2	1	IC BFR TTL ALS OR QUAD 2 INP	28480	1820-3401
A15U6	1820-2551	1	1	IC GENERAL PURPOSE INTERFACE BUS ADAPTER	28480	1820-2551
A15U7	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U8	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A15U9	1820-3449	8	1	IC PARALLEL INTERFACE/TIMER/8MHZ/MC68000	28480	1820-3449
A15U10	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A15U11	1820-1997	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U12	1820-1208	3	2	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A15U13	1820-1203	8	1	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A15U14	1818-3183	2	4	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U14	1818-3305	0	4	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3305
A15U15	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U15	1818-3305	0		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3305
A15U16	85680-80052	6	1	EPROM PRGMD U16	28480	85680-80052
A15U17	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U17	1818-3305	0		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3305
A15U18	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U18	1818-3305	0		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3305
A15U19	85680-80053	7	1	EPROM PRGMD U19	28480	85680-80053
A15U20	5100-2330	0	1	IC16R4 PAL PRGMD	28480	5100-2330
A15U21	1810-0205	7	5	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U22	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A15U23	1810-0394	5	1	NETWORK-RES 8-SIP6.8K OHM X 7	01121	208A602
A15U24	1820-1851	2	1	IC ENCDR TTL LS	01295	SN74LS148N
A15U25	1810-0205	7		NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U26	1820-2505	5	1	IC-MPU; CLK FREQ=8MHZ, INSTRUCTION	28480	1820-2505
A15U27	1820-3173	5	1	IC FF CMOS/74HC J-K NEG-EDGE-TRIG	28480	1820-3173
A15U28	1820-1281	2	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2-INP	01295	SN74LS139N
A15U29	1810-0205	7		NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U30	1820-2483	8	1	IC RCVR TTL LS BUS OCTL	01295	SN75161N
A15U31	1820-3431	8	1	IC TRANSCIEVER TTL 5 INSTR-BUS IEEE-488	28480	1820-3431
A15U32	1820-2675	0	2	IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A15U33	1810-0279	5	1	NETWORK-RES 10-SIP4.7K OHM X 9	01121	210A472
A15U34	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U35	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U36	1820-2675	0		IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A15U37	85680-80054	8	1	EPROM PRGMD U37	28480	85680-80054
A15U38	85680-80056	0	1	EPROM PRGMD U38	28480	85680-80056
A15U39	85680-80055	9	1	EPROM PRGMD U39	28480	85680-80055
A15U40	85680-80057	1	1	EPROM PRGMD U40	28480	85680-80057
A15U41	1810-0344	5	1	NETWORK-RES 10-SIP6.8K OHM X 9	01121	210A682

*Indicates factory selected value

TABLE 2. A15 CONTROLLER, REPLACEABLE PARTS (3 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15U42	85680-80068	4	1	IC16L8 PAL PRGMD	28480	85680-80068
A15U43	1826-0759	9	1	IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A15U44	1810-0205	7		NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U45	1820-3562	6	1	IC BFR TTL ALS INV HEX	28480	1820-3562
A15U46	1810-0205	7		NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U47	1820-1208	3		IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A15U48	1826-0393	7	1	IC V RGLTR-AJD POS 1.2/37V TO-220 PKG	27014	LM317T
A15W1*	B159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	B159-0005
A15Y1	1813-0129	0	1	IC OSC HYBRID	34344	SP6235B
A15Y1	1813-0196	1	1	XTAL-CLOCK-OSCILLATOR 14.7456-MHZ	28480	1813-0196

*Indicates factory selected value

- FOR INSTRUCTIONS ON THE USE OF SIGNATURE ANALYSIS DIAGRAMS READ THE SIGNATURE ANALYSIS DESCRIPTION SECTION OF THIS MANUAL.
- FOR TROUBLESHOOTING INFORMATION REFER TO THE A3 DIGITAL STORAGE SECTION.

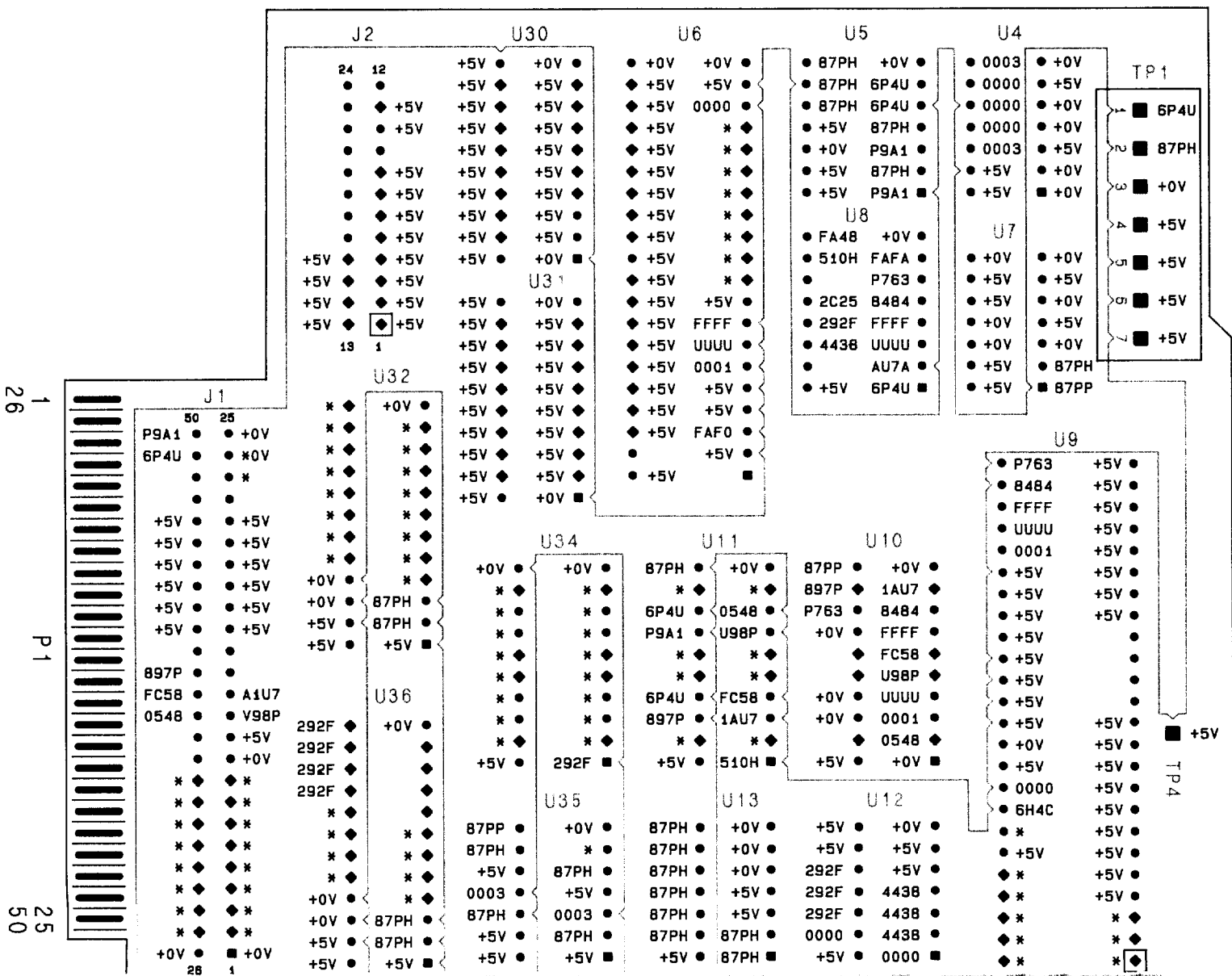
SPECTRUM ANALYZER CONNECTIONS:

GROUND	A15J5	PIN 4	TO	A15J5	PIN 3
REMOVE	JUMPER	A15E1			
GROUND	A15TP1-3	(T)	TO	A15TP3	(GND)

SIGNATURE ANALYZER CONNECTIONS:

CLOCK — TO A15TP2-3 (AS)
 START — TO A15TP2-1 (R/S)
 STOP — TO A15TP2-1 (R/S)
 POD GND TO A15TP3 (GND)
 PROBE GND TO A15TP3 (GND)

- REEER TO SIGNATURE ANALYSIS DESCRIPTION SECTION FOR EXPLANATION OF SIGNATURE ANALYSIS TROUBLESHOOTING DIAGRAMS.
- REEER TO RF SECTION DIGITAL BLOCK DIAGRAM FOR ADDITIONAL TROUBLESHOOTING INFORMATION



A15
CONTROLLER
85680-60180

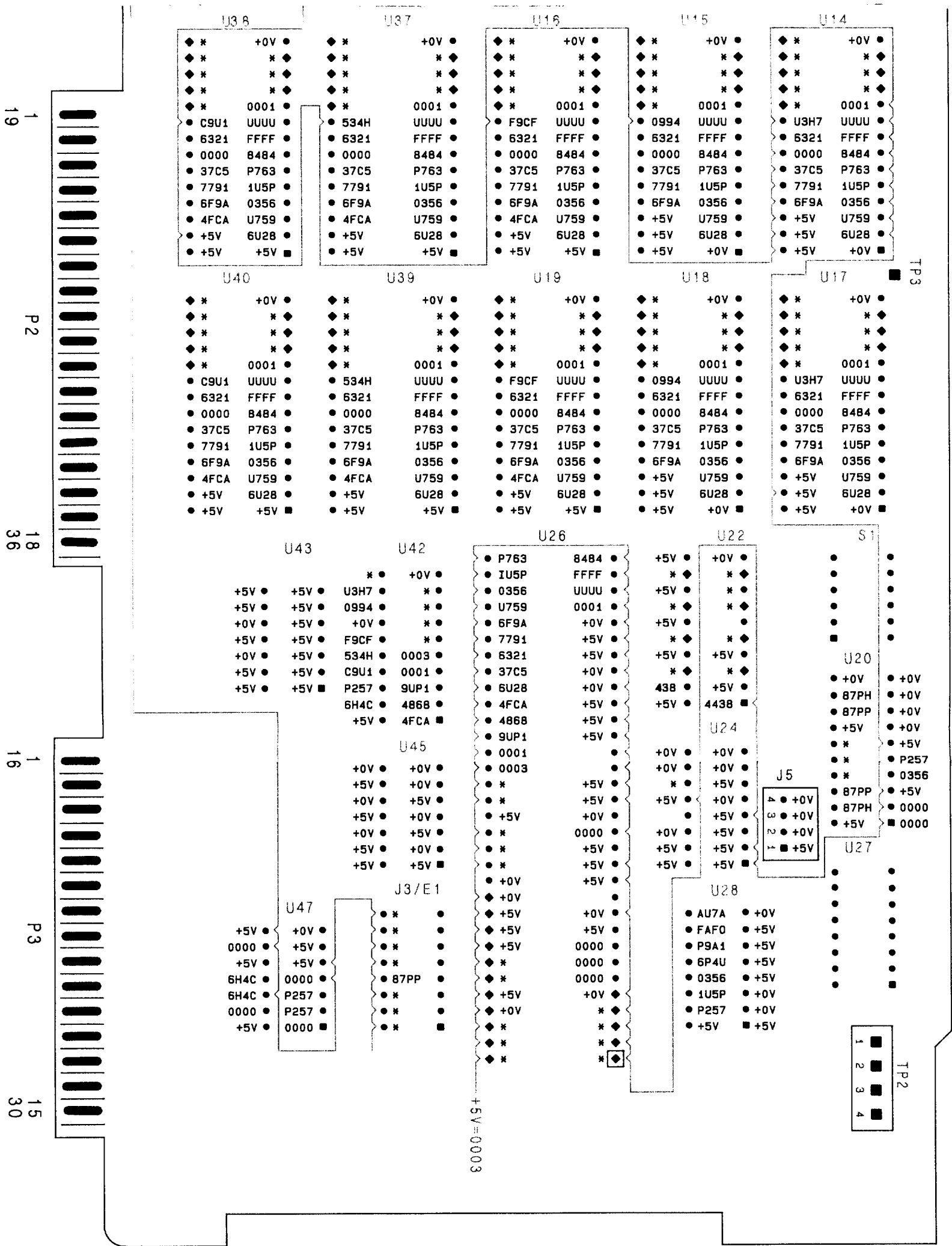
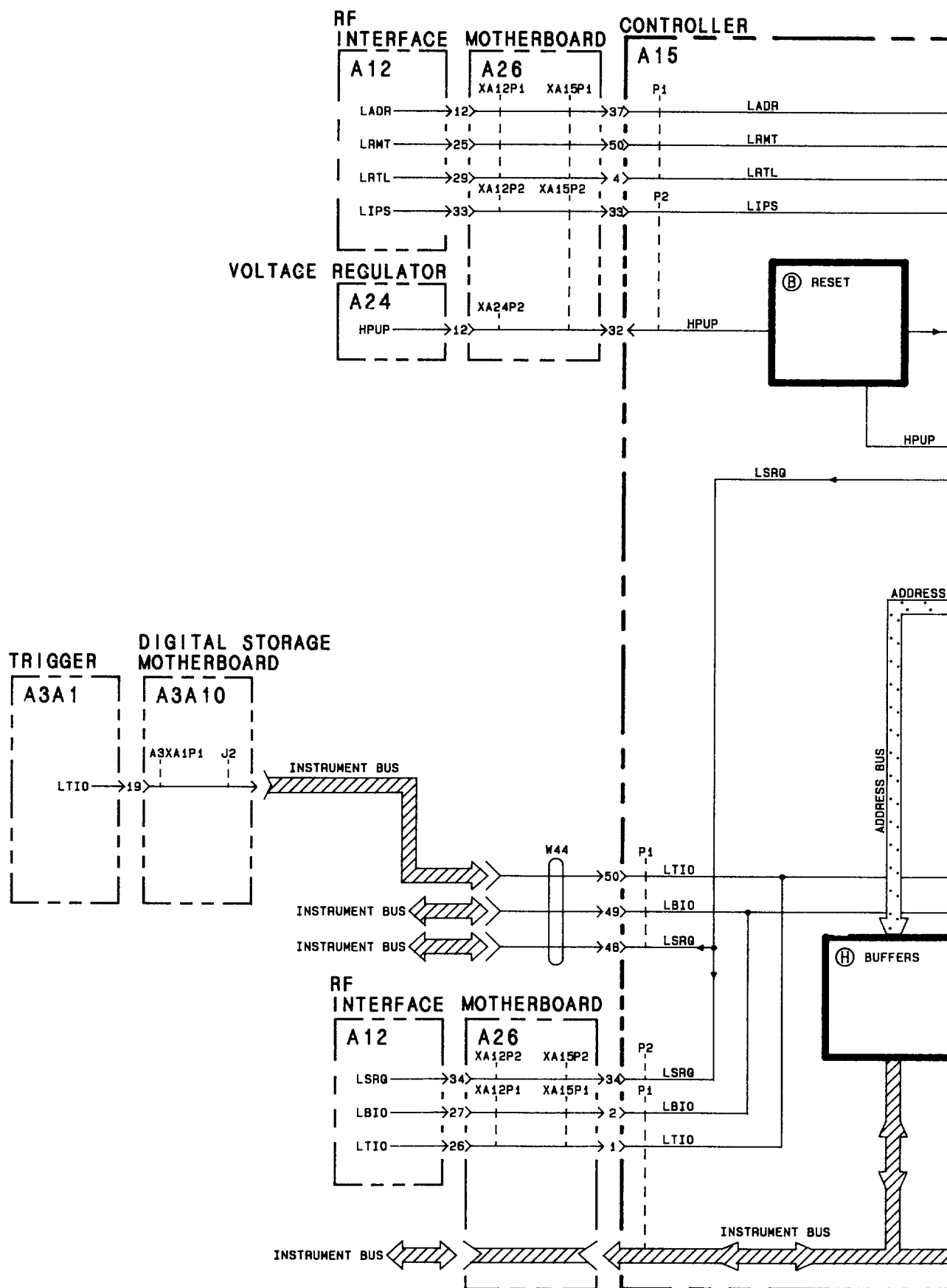


FIGURE 2. A15 CONTROLLER SIGNATURE ANALYSIS DIAGRAM
A15 11/12

A15



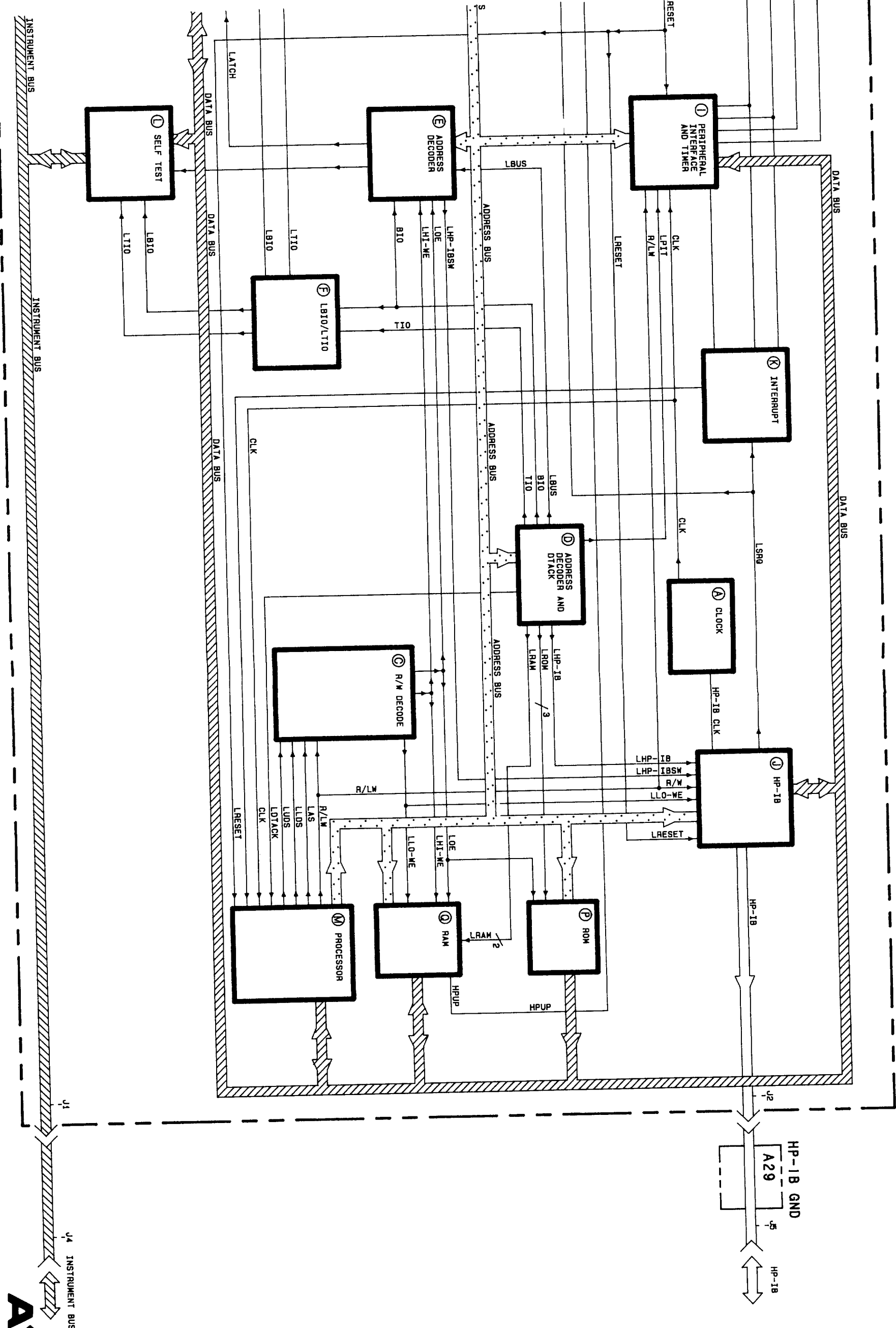
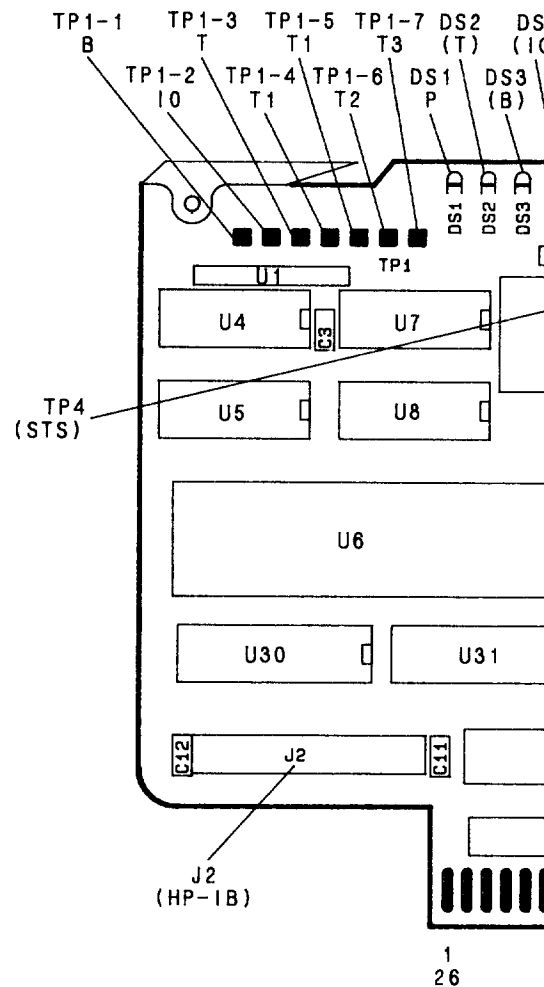


FIGURE 3. A15 CONTROLLER, BLOCK DIAGRAM
A15 13/14



(50-

NOTES
1. JUM
ROMS (I
W2 IS
(SET 0

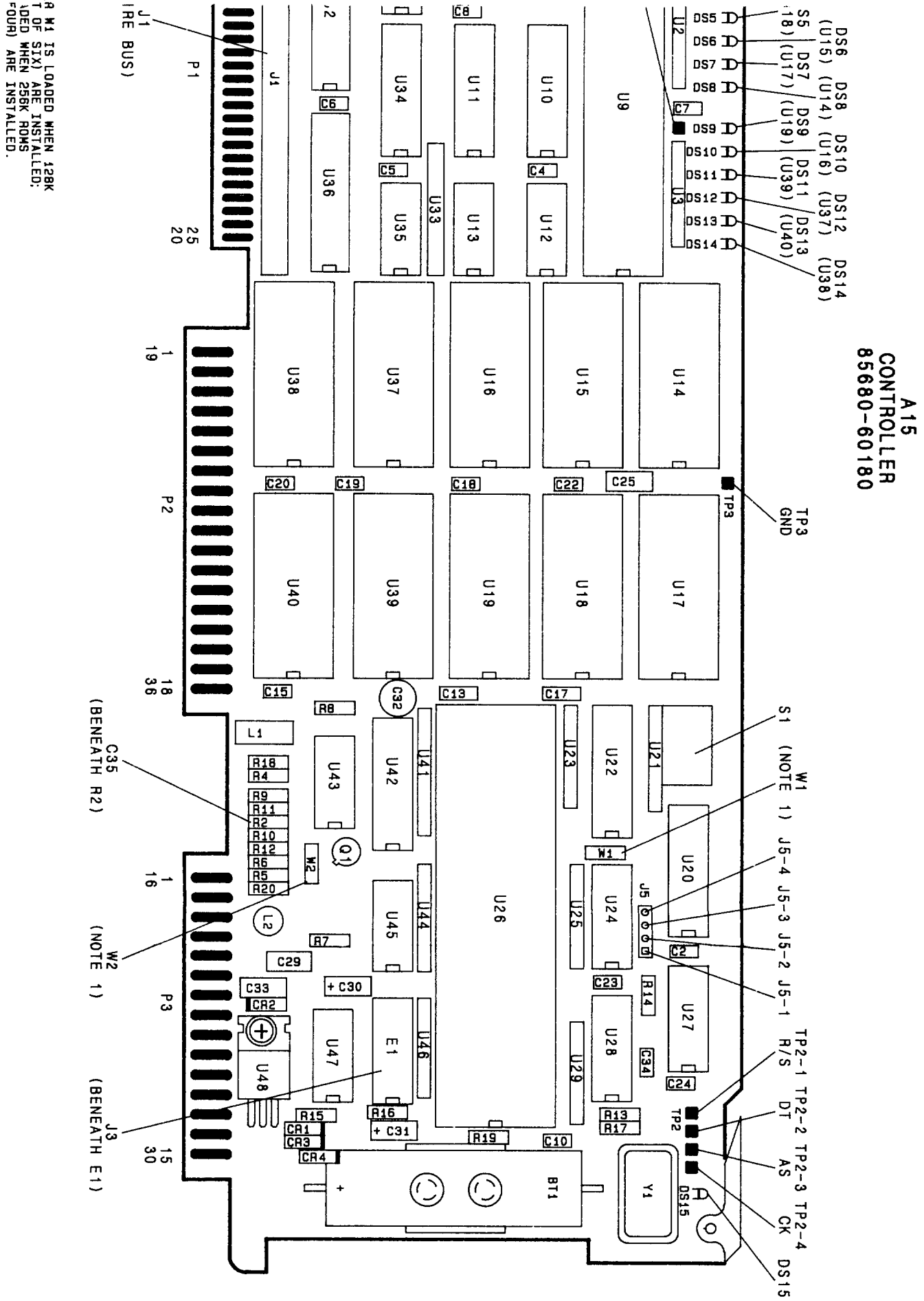


FIGURE 4. A15 CONTROLLER, COMPONENT LOCATIONS

A15 CONTROLLER

85680-60180
(SHEET 1 OF 4)

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LTIO	A12P1-26	F
26	GND		R
2	LBIO	A12P1-27	F
27	GND		R
3	NC		
28	NC		
4	LRTL	A12P1-29	I
29	HSWP	A12P1-4	S
5	KC6	A12P1-30	S
30	KC7	A12P1-5	S
6	KC4	A12P1-31	S
31	KC5	A12P1-6	S
7	KC2	A12P1-32	S
32	KC3	A12P1-7	S
8	KC8	A12P1-33	S
33	KC1	A12P1-8	S
9	KR18	A12P1-34	S
34	KR11	A12P1-9	S
10	KR8	A12P1-35	S
35	KR9	A12P1-10	S
11	NC		
36	NC		
12	ADR4	A12P1-37	H
37	LADR	A12P1-12	
13	ADR2	A12P1-38	H
38	ADR3	A12P1-13	H
14	ADR8	A12P1-39	H
39	ADR1	A12P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	IOB14	A12P1-42	H
42	IOB15	A12P1-17	H
18	IOB12	A12P1-43	H
43	IOB13	A12P1-18	H
19	IOB18	A12P1-44	H
44	IOB11	A12P1-19	H
20	IOB8	A12P1-45	H
45	IOB9	A12P1-20	H
21	IOB6	A12P1-46	H
46	IOB7	A12P1-21	H
22	IOB4	A12P1-47	H
47	IOB5	A12P1-22	H
23	IOB2	A12P1-48	H
48	IOB3	A12P1-23	H
24	IOB8	A12P1-49	H
49	IOB1	A12P1-24	H
25	GND		R
50	LRMT	A12P1-25	I

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		R
19	LBIO		F
2	ADR8		H
20	ADR1		H
3	ADR2		H
21	ADR3		H
4	ADR4		H
22	NC		H
5	IOB8		H
23	IOB1		H
6	IOB2		H
24	IOB3		H
7	IOB4		H
25	IOB5		H
8	IOB6		H
26	IOB7		H
9	IOB8		H
27	IOB9		H
10	IOB18		H
28	IOB11		H
11	IOB12		H
29	IOB13		H
12	IOB14		H
30	IOB15		H
13	NC		
31	NC		
14	GND		R
32	HPUP	A24P2-12	B
15	NC		
33	LIPS	A12P2-33	I
16	NC		
34	LSRQ	A12P2-34	J
17	+5.2V		R
35	+5.2V		R
18	GND		R
36	GND		R

P3

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
16	NC		
2	GND		R
17	GND		R
3	+12V		R
18	+12V		R
4	NC		
19	NC		
5	NC		
20	NC		
6	NC		
21	NC		
7	NC		
22	NC		
8	NC		
23	NC		
9	NC		
24	NC		
10	NC		
25	NC		
11	NC		
26	NC		
12	NC		
27	NC		
13	NC		
28	NC		
14	NC		
29	NC		
15	GND		R
30	GND		R

SERIAL NUMBER PREFIX: 2408A

A15

FIGURE 5. A15 CONTROLLER, SCHEMATIC DIAGRAM (1 OF 4)

A15 CONTROLLER 85680-60180 (SHEET 2 OF 4)

J1

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	NC		
2	IOB1	A4A10J1-4	H
3	IOB3	A4A10J1-6	H
4	IOB5	A4A10J1-8	H
5	IOB7	A4A10J1-10	H
6	IOB9	A4A10J1-12	H
7	IOB11	A4A10J1-14	H
8	IOB13	A4A10J1-16	H
9	IOB15	A4A10J1-18	H
10	LADR	NC	I
11	HPON	A1A9J1-22	R
12	ADR1	A4A10J1-24	H
13	ADR3	A4A10J1-26	H
14	NC		
15	NC		
16	KR9	A1A1J1-33	S
17	KR11	A1A1J1-31	S
18	KC1	A1A1J1-41	S
19	KC3	A1A1J1-39	S
20	KC5	A1A1J1-37	S
21	KC7	A1A1J1-35	S
22	HSWP	A3A1P1-21	S
23	LDSR	A3A10J1-46	J
24	GND		R
25	GND		R
26	GND		R
27	IOB0	A4A10J1-3	H
28	IOB2	A4A10J1-5	H
29	IOB4	A4A10J1-7	H
30	IOB6	A4A10J1-9	H
31	IOB8	A4A10J1-11	H
32	IOB10	A4A10J1-13	H
33	IOB12	A4A10J1-15	H
34	IOB14	A4A10J1-17	H
35	NC		
36	NC		
37	ADR0	A4A10J1-23	H
38	ADR2	A4A10J1-25	H
39	ADR4	A4A10J1-27	H
40	NC		
41	KR8	A1A1J1-34	S
42	KR10	A1A1J1-32	S
43	KC0	A1A1J1-42	S
44	KC2	A1A1J1-40	S
45	KC4	A1A1J1-38	S
46	KC6	A1A1J1-36	S
47	NC		
48	LSR0	A1A9J1-45	J
49	LB10	A1A9J1-47	F
50	LT10	A3A10J2-49	F

J2

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	D101	J5-1	J
2	D102	J5-2	J
3	D103	J5-3	J
4	D104	J5-4	J
5	E01	J5-5	J
6	DAV	J5-6	J
7	NRFD	J5-7	J
8	NDAC	J5-8	J
9	IFC	J5-9	J
10	SRQ	J5-10	J
11	ATN	J5-11	J
12	NC	SEE NOTE 5	
13	D105	J5-13	J
14	D106	J5-14	J
15	D107	J5-15	J
16	D108	J5-16	J
17	REN	J5-17	J
18	NC	SEE NOTE 5	
19	NC	SEE NOTE 5	
20	NC	SEE NOTE 5	
21	NC	SEE NOTE 5	
22	NC	SEE NOTE 5	
23	NC	SEE NOTE 5	
24	NC	SEE NOTE 5	

NOTES:

- REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
- UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω), CAPACITANCE IS IN MICROFARADS (μ F), INDUCTANCE IS IN MICROHENRIES (μ H).
- UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
- JUMPER W1 IS LOADED WHEN 128K ROMS (SET OF SIX) ARE INSTALLED; W2 IS LOADED WHEN 256K ROMS (SET OF FOUR) ARE INSTALLED.
- PINS 12, 18-24 ARE CHASSIS GROUNDED THRU A29.

6. MNEMONIC TABLE:

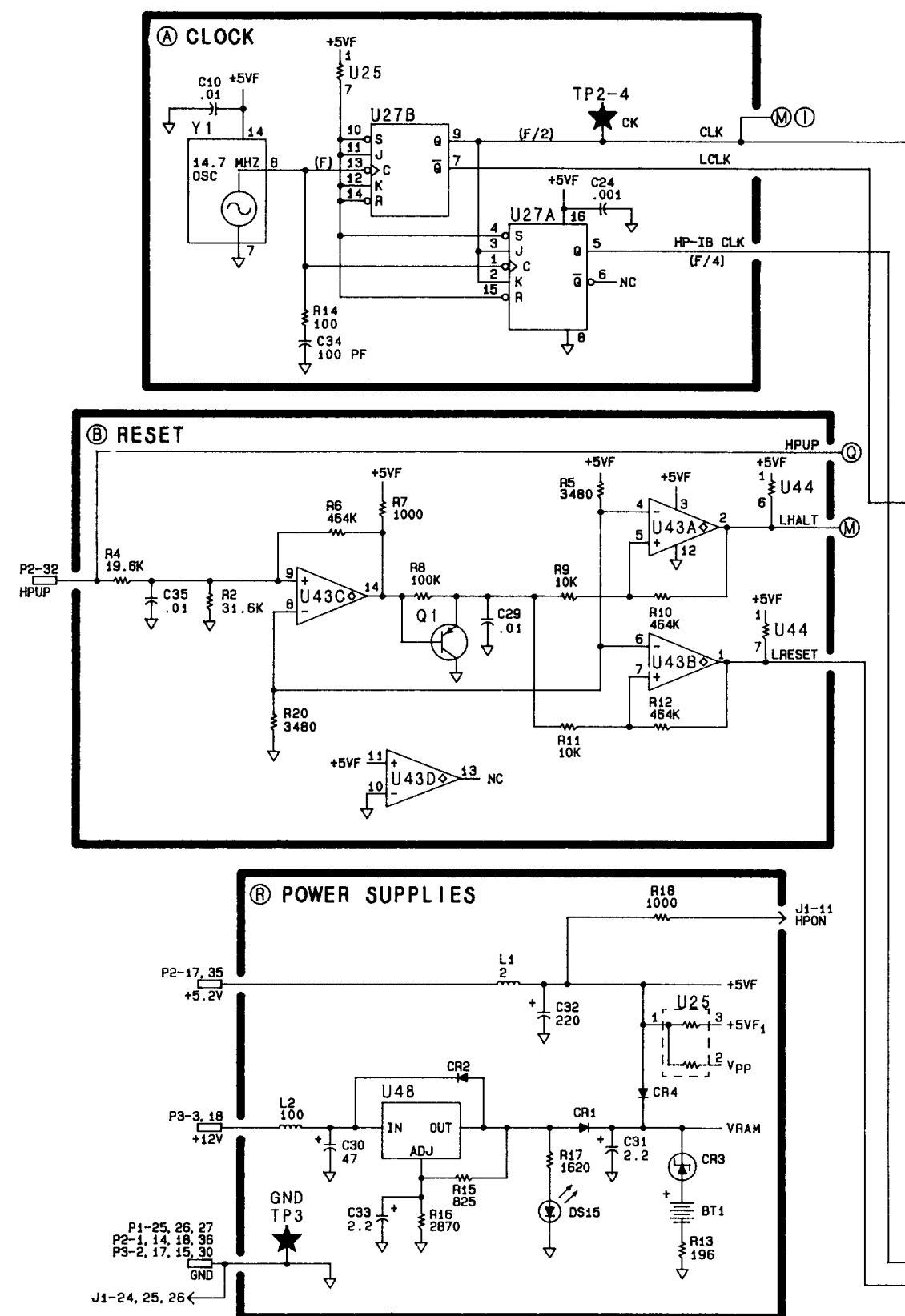
MNEMONIC	DESCRIPTION
ADR0	INSTRUMENT BUS ADDRESS BIT 0
ADR1	INSTRUMENT BUS ADDRESS BIT 1
ADR2	INSTRUMENT BUS ADDRESS BIT 2
ADR3	INSTRUMENT BUS ADDRESS BIT 3
ADR4	INSTRUMENT BUS ADDRESS BIT 4
ATN	HP-IB CONTROL
DAV	HP-IB CONTROL
D101	DATA INPUT/OUTPUT
D102	DATA INPUT/OUTPUT
D103	DATA INPUT/OUTPUT
D104	DATA INPUT/OUTPUT
D105	DATA INPUT/OUTPUT
D106	DATA INPUT/OUTPUT
D107	DATA INPUT/OUTPUT
D108	DATA INPUT/OUTPUT
E01	HP-IB CONTROL
HPON	HIGH-IF-DISPLAY SECTION POWER ON
HPUP	HIGH-POWER ON
IFC	HP-IB CONTROL
IOB0	INSTRUMENT BUS DATA BIT 0
IOB1	INSTRUMENT BUS DATA BIT 1
IOB2	INSTRUMENT BUS DATA BIT 2
IOB3	INSTRUMENT BUS DATA BIT 3
IOB4	INSTRUMENT BUS DATA BIT 4
IOB5	INSTRUMENT BUS DATA BIT 5
IOB6	INSTRUMENT BUS DATA BIT 6
IOB7	INSTRUMENT BUS DATA BIT 7
IOB8	INSTRUMENT BUS DATA BIT 8
IOB9	INSTRUMENT BUS DATA BIT 9
IOB10	INSTRUMENT BUS DATA BIT 10
IOB11	INSTRUMENT BUS DATA BIT 11
IOB12	INSTRUMENT BUS DATA BIT 12
IOB13	INSTRUMENT BUS DATA BIT 13
IOB14	INSTRUMENT BUS DATA BIT 14
IOB15	INSTRUMENT BUS DATA BIT 15
LADR	LOW-ADDRESS LED ON
LB10	LOW-BOTTOM BOX INPUT/OUTPUT
LDSR	LOW-DIGITAL STORAGE READY
LIPS	LOW-INSTRUMENT PRESET
LRMT	LOW-REMOTE
LRTL	LOW-RETURN TO LOCAL
LSR0	LOW-SERVICE REQUEST
LT10	LOW-TOP BOX I/O
NDAC	HP-IB CONTROL
NRFD	HP-IB CONTROL
REN	HP-IB CONTROL
SRQ	HP-IB CONTROL

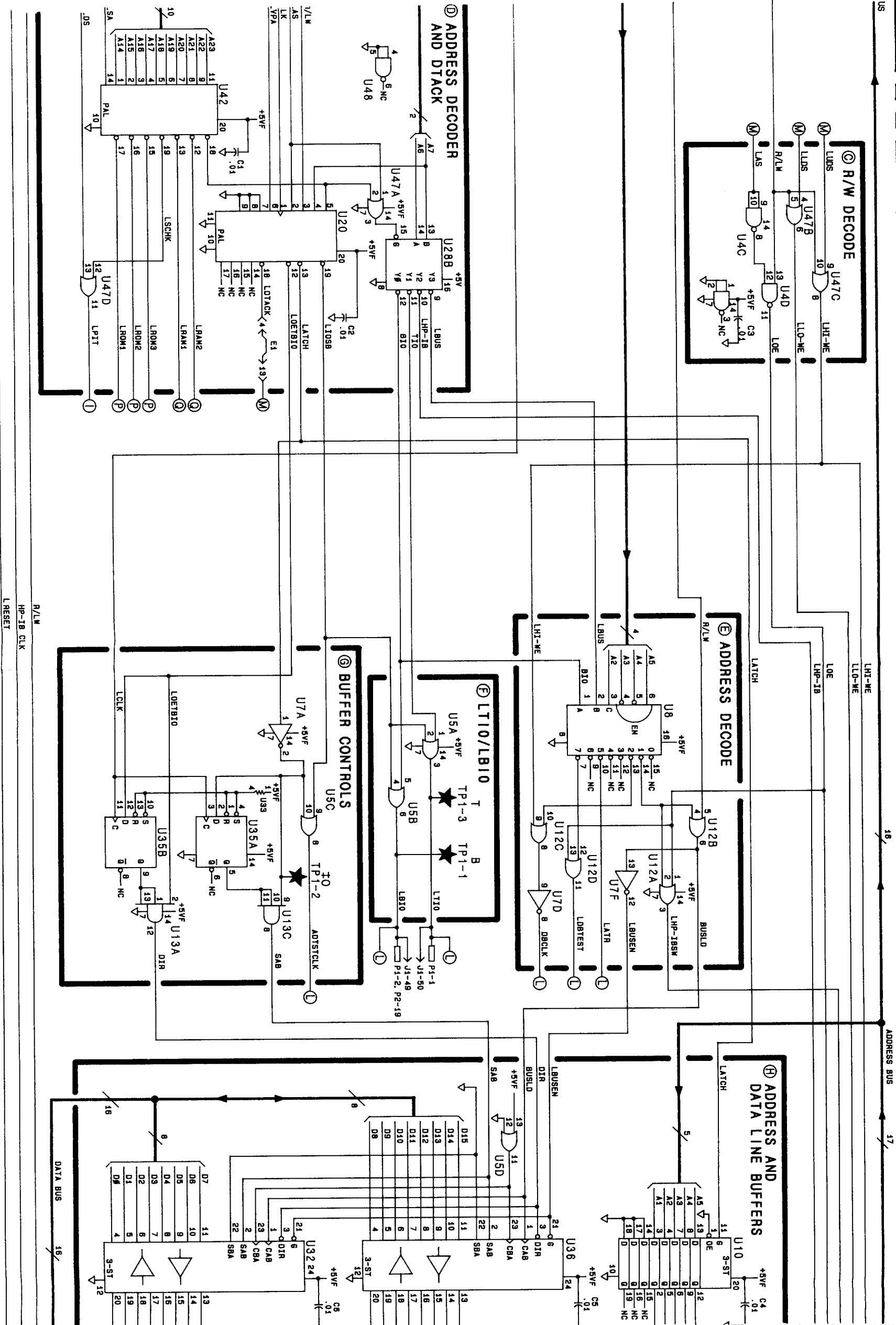
SERIAL NUMBER PREFIX: 2408A

A15

FIGURE 5. A15 CONTROLLER, SCHEMATIC DIAGRAM (2 OF 4)

A15 CONTROLLER
85680-60180 (SHEET 3 OF 4)







A15 19/20

A15 CONTROLLER
85680-60180
(SHEET 4 OF 4)

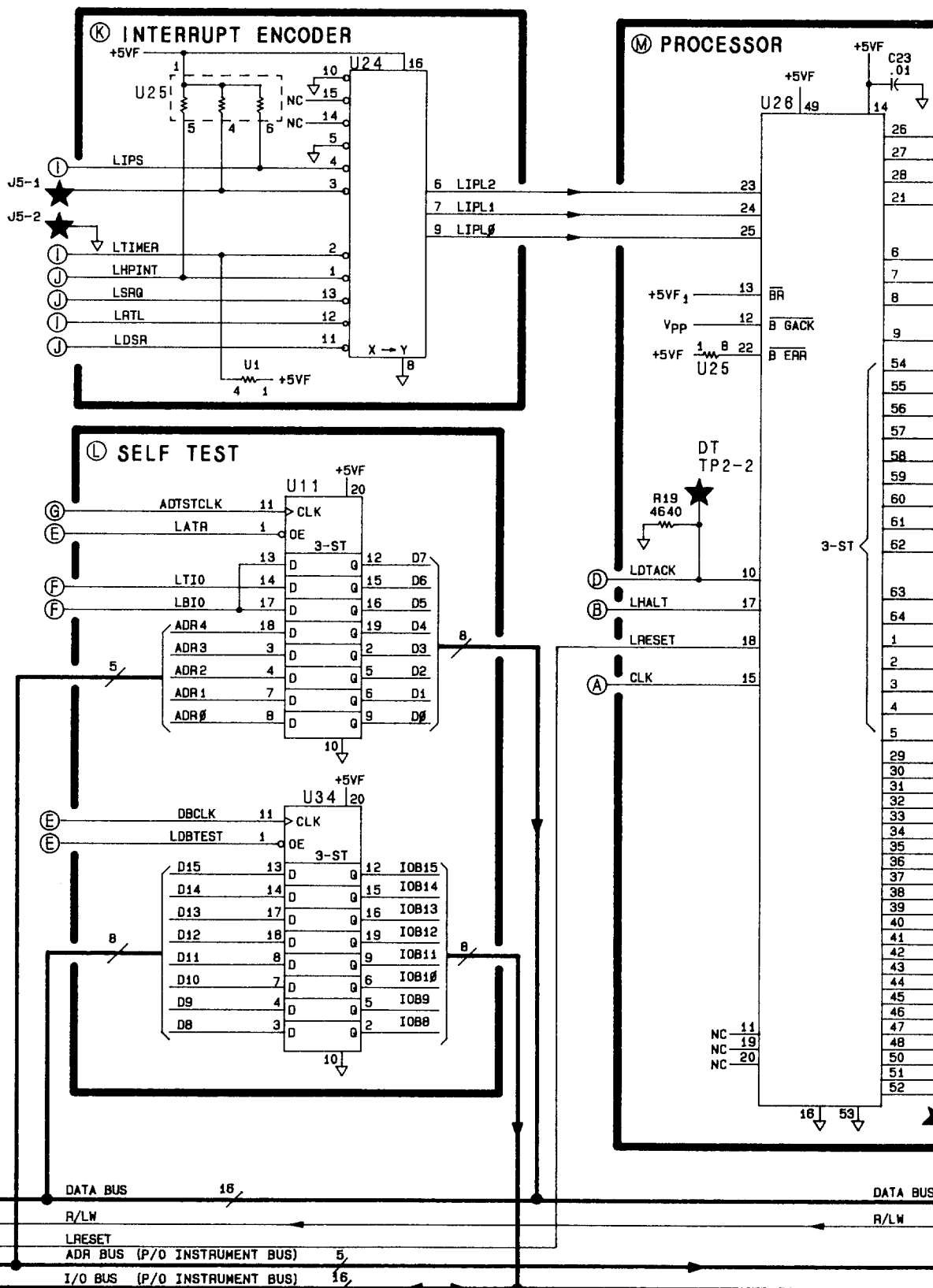
FROM SHEET 3

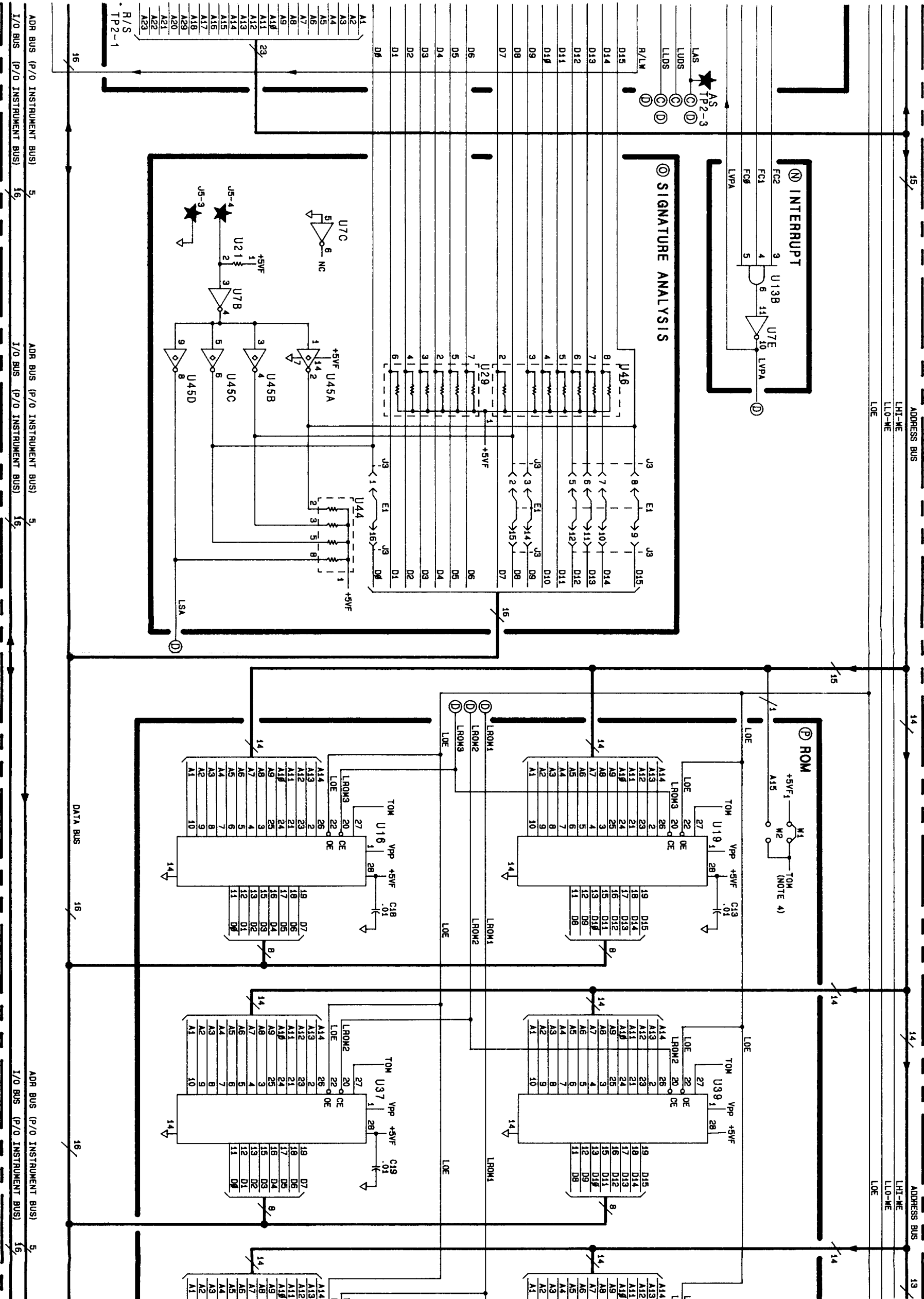
ADDRESS BUS 17

LHI-WE

LLO-WE

LOE





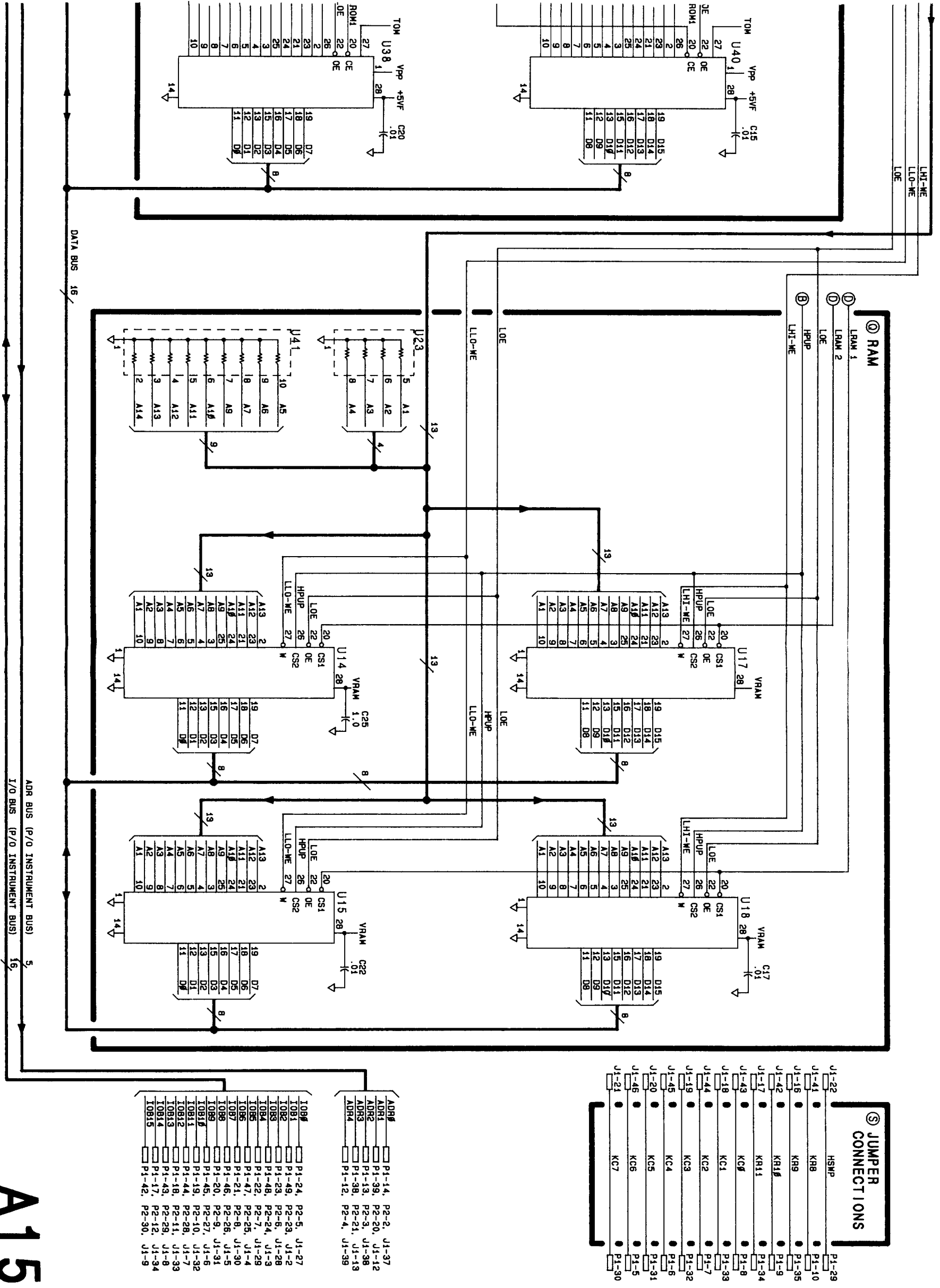


FIGURE 5. A15 SCHEMATIC DIAGRAM (4 OF 4)

A16 20 MHz REFERENCE, CIRCUIT DESCRIPTION

A16 20 MHz Reference takes a 10 MHz signal from A27 Time Base and processes it into 20 MHz reference signals to A5 Front Panel, A6 YIG-Tuned Oscillator Phase Lock, A8 249 MHz Phase Lock, and A23A6 Comb Generator.

Reference Selection

During internal time base operation of the instrument, a 10 MHz signal at $\approx +3$ dBm is applied to the Doubler from A27 Time Base. This signal is split by the resistor network of R1 through R5. The power is applied to the Clock Generator, to the Doubler buffer amplifier Q1, and to the rear panel, where it is available as INT TIME BASE OUT. When EXT TIME BASE operation is selected on the rear panel, A27 is shut off and the 10 MHz, 0 dBm EXT TIME BASE signal is applied to the Doubler. This power is split between the Doubler buffer amp and the Clock Generator.

Doubler (A)

A 10 MHz signal to the Doubler is amplified by buffer Q1 and then drives Q2 through the impedance-matching network Q2 through C4 and L1. The pulse output from Q2 is coupled into the 20 MHz resonator T1 and C6 to produce a 20 MHz output from the Doubler.

Clock Generator (B)

The 10 MHz signal from the Time Base is applied through C33 to the isolation amplifier Q3. The amplified signal is converted to TTL levels by Q7, which drives the NOR gate U2, which in turn drives the 10 MHz TTL bus to clock A15 Processor and A17 Frequency Counter.

Crystal Filter (C)

The output of the Doubler drives the emitter follower Q4, which provides a low output impedance driver for the Crystal Filter. CENTER FREQ adjustment C11 varies the center frequency of the filter. Some of the 20 MHz signal is fed back through the inverting transformer T2 to cancel the case capacitance of Y1. The 20.34 MHz NULL adjustment C12 adjusts the proper amount of feedback. The filtered signal is amplified by Q5. L16 and C16 match the impedance to PIN diode CR1. The current through CR1 sets the attenuation for the desired comb drive level at J3, which is applied to A23A6 Comb Generator.

AGC Amplifier (D)

A small amount of the comb drive signal is fed through R24, C18, and L4 to the detector diode CR2. The rectified voltage across R25 is proportional to the comb drive power. Op amp U3A compares the drive level to a reference set by COMB DRIVE adjustment R31. The output from U3A is then set to bias CR1 for a value of attenuation that will cause the rectified drive voltage to equal the reference voltage.

NO REFERENCE Indicator/Driver (E)

Comparator U3B compares the rectified drive voltage from CR2 with a fixed voltage. If the drive drops too low, U3B turns on the NO REF indicator LED DS1.

Buffer Amplifier (F)

A small amount of 20 MHz comb drive signal is fed through R35 to Q6. L5 and C22 match the impedances and R37 is a feedback element to stabilize the gain of Q6. R40 through R47 and R54 form an aggregate network of splitters and pads to provide a 20 MHz, -15 dBm reference signal to A6 YIG-Tuned Oscillator Phase Lock, a 20 MHz, -10 dBm signal to A8 249 MHz Phase Lock, and drive for the Calibrator.

Calibrator (G)

The 20 MHz signal from the Buffer Amplifier is amplified by an emitter-coupled pair, U1A. This signal is clipped by U1B to set a precise level. The output goes through a low-pass filter L8, L9, L10, C29, and C30 to reduce the harmonic content. CAL LEVEL adjustment R51 varies the amount of emitter current, U1C provides temperature compensation.

TABLE 1. A16 20 MHz REFERENCE, REPLACEABLE PARTS (1 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16	85680-60005	7	1	20MHZ REFERENCE	28480	85680-60005
A16C1	0160-2055	9	28	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C4	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A16C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C6	0140-0205	5	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A16C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C10	0160-2264	2	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A16C11	0121-0457	9	1	CAPACITOR-V TRMR-PSTN .8-B.5PF 750V	10736	TP9
A16C12	0121-0451	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187 0106-028
A16C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C16	0160-2202	8	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
A16C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C18	0160-2260	8	1	CAPACITOR-FXD 13PF +-5% 500VDC CER 0+-30	28480	0160-2260
A16C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C20	0100-0197	8	4	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C21	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C22	0140-0198	5	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A16C23	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C24	0140-0210	2	1	CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A16C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C29	0160-2204	0	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A16C30	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A16C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C32	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C33	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C36	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C37	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C38	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C39	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C40	0160-3879	7	3	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C41	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C42	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C43	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C44	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C45	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C46	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C47	0160-2247	1	1	CAPACITOR-FXD 3.9PF +- .25PF 500VDC CER	28480	0160-2247
A16CR1	1901-0639	4	1	DIODE-PIN	28480	5082-3080
A16CR2	1901-0535	9	1	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A16CR3	1901-0040	1	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16DS1	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX FVR=5V	28480	5082-4684
A16E1	9170-0029	3	2	CORE-SHIELDING BEAD	28480	9170-0029
A16E2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A16J1	1250-0690	6	4	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16J2	1250-0690	6		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16J3	1250-0690	6		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16J4				PART OF W26		
A16J5				PART OF W23		
A16J6	1250-0690	6		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16L1	9140-0143	9	1	INDUCTOR RF-CH-MLD 3.3UH 10% .105DX.26LG	28480	9140-0143
A16L2	9140-0179	1	8	INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L3	9140-0142	8	1	INDUCTOR RF-CH-MLD 2.2UH 10% .105DX.26LG	28480	9140-0142
A16L4	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A16L5	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A16L6	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L7	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L8	9100-2256	5	2	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A16L9	9100-2259	8	1	INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A16L10	9100-2256	5		INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256

*Indicates factory selected value

TABLE 1. A16 20 MHz REFERENCE, REPLACEABLE PARTS (2 OF 3)

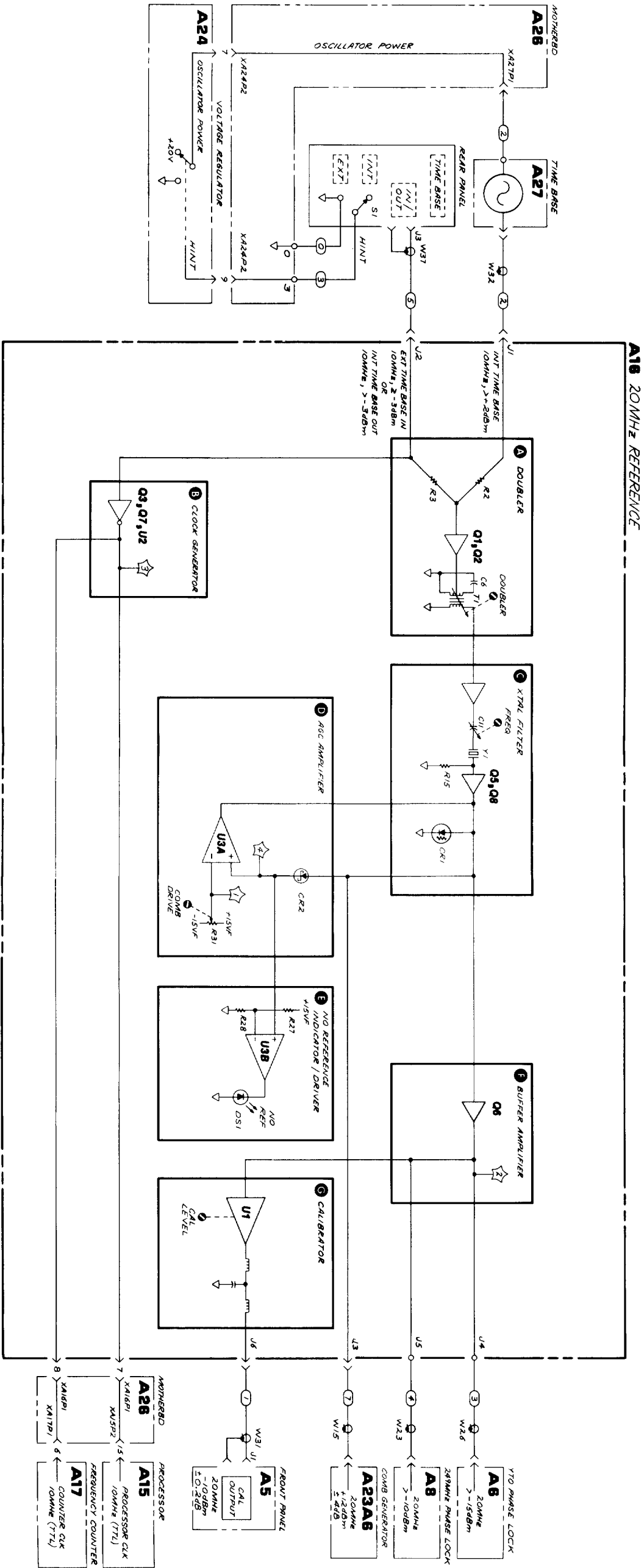
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16L11	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L12	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L13	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L14	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L15	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A16L16	9100-2257	6	1	INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A16Q1	1854-0023	9	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A16Q2	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A16Q3	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A16Q4	1854-0247	9	3	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A16Q5	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A16Q6	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A16Q7	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A16Q8	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A16R1	0757-0398	4	3	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A16R2	0757-0378	0	3	RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A16R3	0757-0378	0		RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A16R4	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R5	0757-0422	5	8	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R6	0698-3157	3	4	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A16R7	0757-0442	0		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R8	0698-3443	2		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R9	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R10	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A16R11	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A16R12*	0698-3443	0	5	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R13	0698-3404	3	1	RESISTOR 393 1% .5W F TC=0+-100	28480	0698-3404
A16R14	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A16R15	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A16R16	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A16R17	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A16R18	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R19	0757-0401	0	5	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R20	0698-3446	3	1	RESISTOR 393 1% .125W F TC=0+-100	24546	C4-1/8-T0-393R-F
A16R21	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A16R22	0757-0378	0		RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A16R23	0698-0882	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A16R24	0757-0274	5	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A16R25	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A16R26	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A16R27	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A16R28	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A16R29	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A16R30	0757-0459	8	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A16R31	2100-3161	6	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A16R32	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A16R33	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A16R34	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A16R35	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R36	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A16R37	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R38	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R39	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R40	0698-7196	8	3	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-21R5-F
A16R41	0698-7207	2	1	RESISTOR 61.9 1% .05W F TC=0+-100	24546	C3-1/8-T0-61R9-F
A16R42	0698-7201	6	2	RESISTOR 34.8 1% .05W F TC=0+-100	24546	C3-1/8-T0-34R8-F
A16R43	0698-7196	8		RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-21R5-F
A16R44	0698-7203	8	1	RESISTOR 42.2 1% .05W F TC=0+-100	24546	C3-1/8-T0-42R2-F
A16R45	0698-7201	6		RESISTOR 34.8 1% .05W F TC=0+-100	24546	C3-1/8-T0-34R8-F
A16R46	0698-7196	8		RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-21R5-F
A16R47	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A16R48	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A16R49	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A16R50	0698-3437	2	2	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A16R51	2100-3123	0	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A16R52	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A16R53	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A16R54	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R55	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R56	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-61R9-F
A16R57	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R58	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R59	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R60	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F

*Indicates factory selected value

TABLE 1. A16 20 MHz REFERENCE, REPLACEABLE PARTS (3 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16R61	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A16R62	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16T1	85680-80004	8	1	TRANSFORMER RF	28480	85680-80004
A16T2	85662-80002	4	1	COIL ASSY X-FER	28480	85662-80002
A16TP1	0360-0124	3	4	CONNECTOR-SGL CNT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A16TP2	0360-0124	3		CONNECTOR-SGL CNT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A16TP3	0360-0124	3		CONNECTOR-SGL CNT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A16TP4	0360-0124	3		CONNECTOR-SGL CNT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A16U1	1858-0032	8	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	3L585	CA3146E
A16U2	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A16U3	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A16VR1	1902-0048	1	1	DIODE-ZNR 6.81V 5% DO-35 PD=.4W	28480	1902-0048
A16Y1	0410-1103	7	1	CRYSTAL-QUARTZ 20.00000 MHZ	28480	0410-1103
				MISCELLANEOUS PARTS		
	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001

*Indicates factory selected value



A16

FIGURE 1. A16 20MHz REFERENCE, BLOCK DIAGRAM

A16 7/8

A16
20 MHz REFERENCE
85680-60005

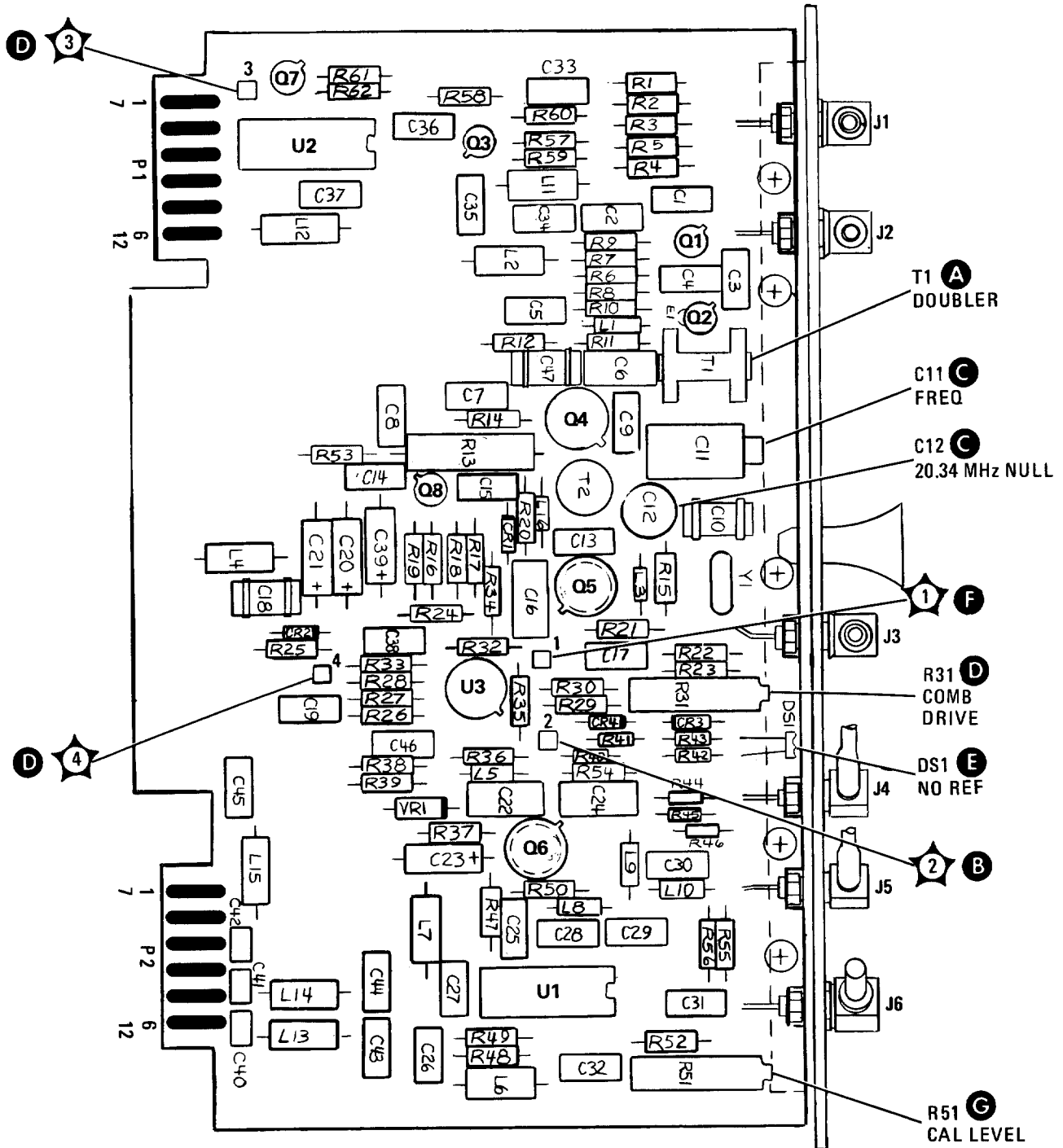


FIGURE 2. A16 20 MHz REFERENCE, COMPONENT LOCATIONS

RF SECTION

A16 20 MHZ REFERENCE
85680-60005

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		H
7	CONTROLLER CLK	A15P2-15	B
2	GND		H
8	COUNTER CLK	A17P4-6	B
3	GND		H
9	GND		H
4	GND		H
10	GND		H
5	GND		H
11	HOVC		NC
6	GND		H
12	GND		H

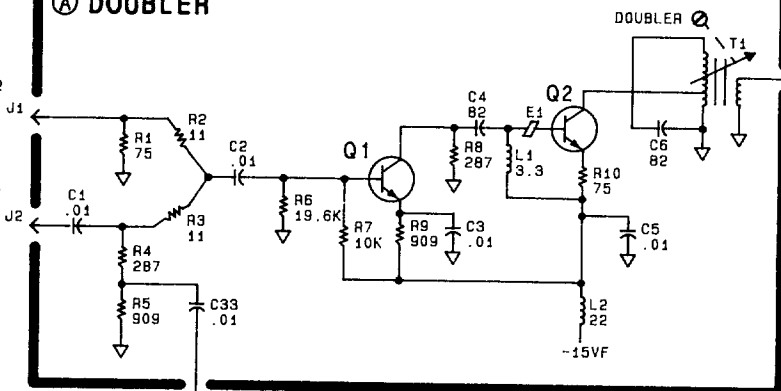
P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		H
7	GND		H
2	GND		H
8	GND		H
3	+5.2V		H
9	+5.2V		H
4	-5.2V		NC
10	-5.2V		NC
5	-15V		H
11	-15V		H
6	+15V		H
12	+15V		H

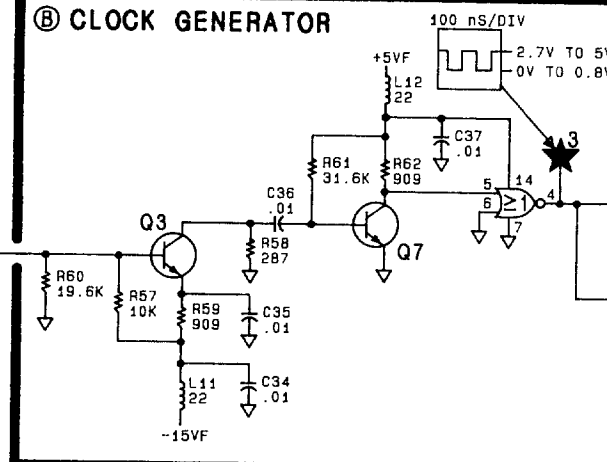
CABLE 2, W32
10 MHZ
>+2 DBM
FROM A27
TIME BASE

CABLE 5, W37
10 MHZ
>-3 DBM
TO/FROM
REAR PANEL

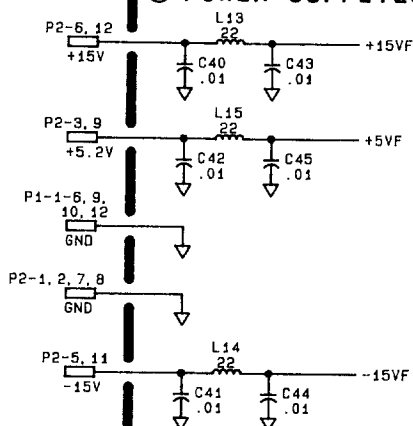
A DOUBLER



B CLOCK GENERATOR



H POWER SUPPLIES



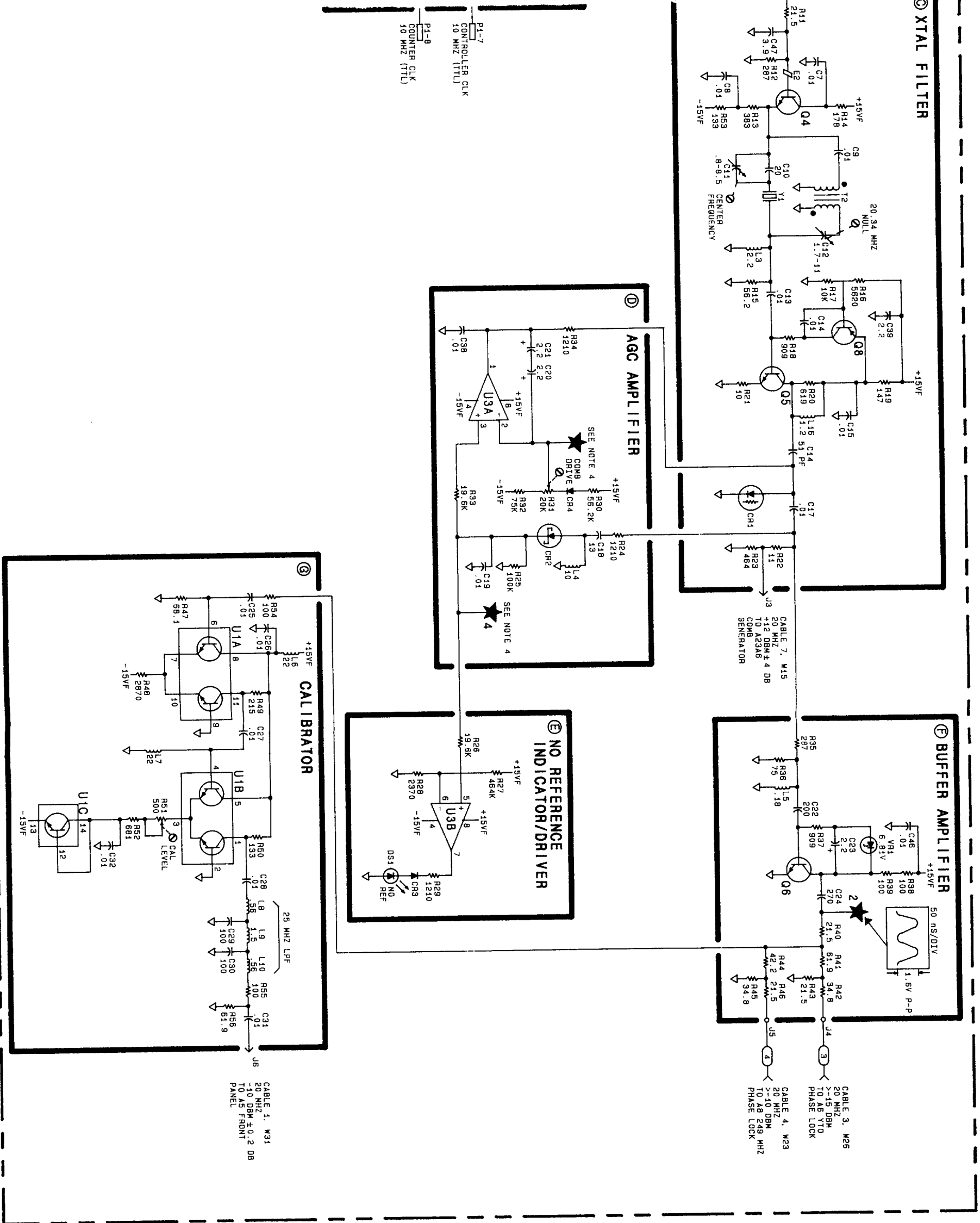
NOTES:

- 1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
- 2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS AND CAPACITANCE IS IN MICROGRAMS (UF) INDUCTANCE IS IN MICROHENRIES (UH)
- 3. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
- 4. VOLTAGES AT TP4 AND TP4 VARY BETWEEN 0V AND 20V UPON THE SETTING OF AGC DURING NORMAL AGC OPERATION. THE VOLTAGE OF TP4 EQUALS THAT OF TP4 +20 MV. TO DISABLE AGC, GROUND TP4.
- 5. WHEN INT IS SELECTED AT REAR PANEL, 10 MHZ AT -3 DBM MINIMUM IS PRESENT AT A1602. WHEN EXT IS SELECTED, A27 TIME BASE IS DISABLED AND A1602 BECOMES AN INPUT REQUIRING 10 MHZ AT -3 DBM MINIMUM.

6. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
HOVC	HIGH-OVEN COLD
HINT	HIGH-INTERNAL TIME BASE

LANR LOW: ANALYZER RESET



A17 FREQUENCY COUNTER, CIRCUIT DESCRIPTION

A17 Frequency Counter counts the following frequencies:

- 50 MHz VTO (nominal 25 MHz after division by 2)
- Signal IF (nominal 21.4 MHz)
- Pilot IF (nominal 20 MHz)

A17 consists of three input buffer amplifiers, a multiplexer, an eight-decade counter, and control circuitry. The 10 MHz reference frequency for the counter comes from the Clock Generator in A16 20 MHz Reference. The counter can be used as a timer by causing it to count its clock. In all cases, the outputs are buffered to the Instrument Bus.

Signal IF Amplifier (A)

The Signal IF Amplifier consists of a simple cascode transistor (Q11, Q12) driving a differential amplifier (Q13, Q14) which provides TTL voltage levels to the digital multiplexer U1. R3, R4, R28, C4, and C5 provide the bias, and, with Q11, 50 Ω input impedance. R1, C1, and C6 decouple the +5V supply from the amplifier, and R2, L1, C2, L2, R31, and C29 provide a bandpass filter and matching network between Q12 and Q13. CR1 and CR2 inhibit doubling of frequency of large input signals. For isolation when the counter is not used, the entire amplifier is turned off by Q9, Q10, and their associated circuitry. The amplifier is sensitive to -35 dBm or lower over 21.4 ± 8 MHz.

VTO Amplifier (B)

The VTO Amplifier uses a differential pair (Q5 and Q6) to convert an attenuated ECL signal at about 200 Ω impedance to a TTL signal. Its sensitivity is about -15 dBm in the range of 25 ± 3.75 MHz.

Pilot IF Amplifier (C)

The Pilot IF Amplifier is almost identical to the Signal IF Amplifier, but the frequency range is 20 ± 10 MHz, sensitivity is approximately -28 dBm, and additional decoupling is provided by R18 and C15, since the amplifier is not turned off.

Multiplexer (F)

The Multiplexer U1 brings all three inputs and the 10 MHz internal reference to the counter string. Depending upon which bits on the data bus have been held in latch U6, one of these four inputs is selected. When the enable line is low to U1 pins 1 and 15, the signal at the selected input is routed through U7C to U12, the least significant digit counter.

Counter Control and Address Decoder (D) (E)

Dual JK flip-flop U4 sets the state of the counter. The receipt of an octal address 24 and a strobe resets both U4A and U4B to zero, triggers the one-shot multivibrator (Q7/Q8), and loads data into latch U6. Notice that U4 pin 9 goes low and indicates counter busy, and U4 pin 7 goes high to gate on the 10 MHz reference, which is divided by 10 by U14.

U8, U13, and U18 serve as internal start/stop counters. They are reset to all 9 by octal address 24 through the one-shot multivibrator (Q7/Q8). The reference 1 MHz then clocks the counters and the falling edge of the bit selected by multiplexer U1. U2 clocks U4A to signify the start and stop of the count interval. U4 pin 6 then goes high to disable multiplexer U1, U4B is clocked by U4 pin 5, the busy line (LCBZ) goes high, and the reference is gated off. Normally, state of U4A will be 0 and that of U4B will be 1 when the counter is not being used but has been addressed.

Counter and Bus Driver (G)

This circuit is composed of an eight-decade counter and 32 bits of 3-state bus driver. U11 and U12 are low power Schottky counters, while U3, U5, and U10 are CMOS counters. All are reset by the address 24 strobe signal. Address 25 causes the high order 4 digits to be read, while address 26 gates the low order 4 digits to the bus.

A17 FREQUENCY COUNTER, TROUBLESHOOTING

Five front panel diagnostic functions are available as an aid in troubleshooting A17. These same functions are useful when trying to determine the cause of constant frequency offsets and phase locking problems. The key functions are:

KSF	SHIFT	RES BW	.....	Sweep Generator Time
KSK	SHIFT	PEAK SEARCH	.....	Count Pilot IF at Marker
KSN	SHIFT	MKR - CF	.....	Count 50 MHz VTO at Marker
KSQ	SHIFT	MKR/STP SIZE	.....	Count Signal IF at Marker
KS =	SHIFT	FREQ COUNT	.....	Set Counter Resolution (1 Hz to 100 kHz)

If the analyzer is not sweeping due to a phase lock problem, the counter could be at fault. To determine this, jumper A15TP8 to A14TP11, push **INSTR PRESET**, and then remove the jumper. If the sweep stops, A17 is probably faulty.

Although a Signature Analysis Diagram is supplied for A17, troubleshooting this assembly with the aid of an oscilloscope is more efficient. The best use of the SA Diagram is to verify the inputs from the 50-wire Instrument Bus.

The input amplifiers can be checked with the following conditions:

INSTR PRESET	.....	1500 seconds
SWEEP TIME	.....	
SHIFT RES BW (KSF)	.....	

With these conditions, TP3 is low and signal activity should exist at the multiplexer U1 inputs. When the RES BW **AUTO** key is pressed, U1 pin 4 goes high, turning off the Signal IF Amplifier.

The Counter Control and Multiplexer can be verified by using the **FREQ COUNT** mode. Key in the following:

INSTR PRESET	.....	1 sec
SWEEP TIME	.....	
SHIFT FREQ COUNT (KS =)	.....	1 Hz
FREQ COUNT	.....	

Four signals will now be multiplexing at TP2. The order is 1 MHz time base, signal IF, pilot IF, and 50 MHz VTO. Figure 1 shows the corresponding waveform at TP1. TTL activity will be present at TP3.

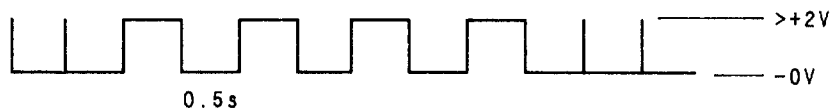
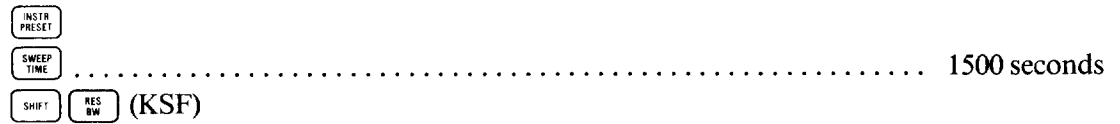


FIGURE 1. TIME BASE WAVEFORM

If one of the signals is missing, use the **SHIFT** functions in the first paragraph to trace the problem. The Marker should be turned off before activating each function.

Proper operation of the Counter and Bus Drivers can be determined with the following procedure.



First, check for a 1 MHz signal at U1 pin 7 and TP2. Check the MSB at the output of each decade counter in the string for 100 kHz at U12 pin 12 to 0.01 Hz at U3 pin 6.

Next, short U19 pin 10 to ground. This simulates an octal address of 25 and enables the bus drivers for the 16 high order bits. A 10 Hz signal is present at P2-7. The other IOB lines are then checked for the appropriate TTL activity.

Finally, short U19 pin 9 to ground. This simulates an octal address of 26 and enables the bus drivers for the 16 low order bits. A 100 kHz signal is present at P2-7.

TABLE 2. A17 FREQUENCY COUNTER, REPLACEABLE PARTS (1 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17	85680-60131	0	1	FREQUENCY COUNTER	28480	85680-60131
A17C1	0160-2055	9	22	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C2	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A17C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C20				NOT ASSIGNED		
A17C21	0160-0945	2	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A17C22	0160-4084	0	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A17C23				NOT ASSIGNED		
A17C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C27				NOT ASSIGNED		
A17C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C29	0160-2308	5	1	CAPACITOR-FXD 36PF +-5% 300VDC MICA	28480	0160-2308
A17C30	0160-2257	3	1	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A17C31	0140-0205	5	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E20J0300WV1CR
A17J1				PART OF W27		
A17J2	1250-0690	6	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A17J3	1250-0690	6		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A17L1				NOT ASSIGNED		
A17L2	9100-2258	7	1	INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A17L3				NOT ASSIGNED		
A17L4	9100-1617	0	1	INDUCTOR RF-CH-MLD 3.9UH 10%	28480	9100-1617
A17L5	9100-2261	2	1	INDUCTOR RF-CH-MLD 2.7UH 10% .105DX.26LG	28480	9100-2261
A17Q1	1854-0023	9	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q2	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q3	1854-0019	3	8	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q4	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q5	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q6	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q7	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q8	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q9	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A17Q10	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A17Q11	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q12	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q13	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q14	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17R1-				NOT ASSIGNED		
A17R30				NOT ASSIGNED		
A17R31	0757-0294	9	1	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A17R32				NOT ASSIGNED		
A17R33				NOT ASSIGNED		
A17R34	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A17TP1	0360-0124	3	4	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17U1	1820-1244	7	1	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN74LS153N
A17U2	1820-1217	4	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS151N
A17U3	1820-1122	0	3	IC CNTR CMDS ECD SYNCHRO DUAL	04713	MC14518BCP
A17U4	1820-1212	9	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112AN
A17U5	1820-1122	0		IC CNTR CMDS ECD SYNCHRO DUAL	04713	MC14518BCP

*Indicates factory selected value

TABLE 2. A17 FREQUENCY COUNTER, REPLACEABLE PARTS (2 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17U6	1820-1196	0	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG CDM	01295	SN74LS174N
A17U7	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A17U8	1820-2078	7	3	IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS490N
A17U9	1820-1759	9	4	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U10	1820-1122	0		IC CNTR CMOS BCD SYNCHRD DUAL	04713	MC14518BCP
A17U11	1820-1251	6	3	IC CNTR TTL LS DECD ASYNCHRD	01295	SN74LS196N
A17U12	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRD	01295	SN74LS196N
A17U13	1820-2078	7		IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS490N
A17U14	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRD	01295	SN74LS196N
A17U15	1820-1759	9		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U16	1820-1759	9		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U17	1820-1759	9		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U18	1820-2078	7		IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS490N
A17U19	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
				MISCELLANEOUS PARTS		
	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001

*Indicates factory selected value

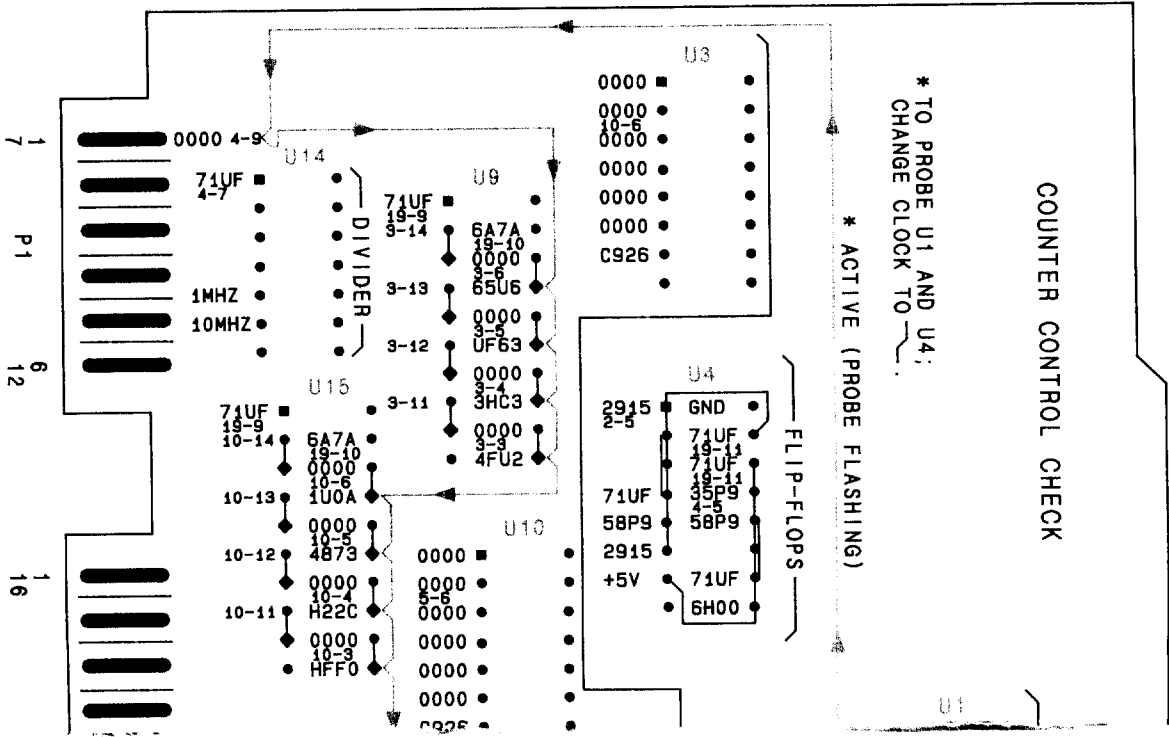
NOTE

- FOR INSTRUCTIONS ON THE USE OF SIGNATURE ANALYSIS DIAGRAMS
- READ THE SIGNATURE ANALYSIS DESCRIPTION SECTION OF THIS MANUAL.
- FOR TROUBLESHOOTING INFORMATION REFER TO THE A17 FREQUENCY CONTROL SECTION.

COUNTER CONTROL CHECK

SPECTRUM ANALYZER CONNECTIONS:
JUMPER A15TP1-4(T0) TO A15TP2 (STS)

SIGNATURE ANALYZER CONNECTIONS:
CLOCK — TO A15TP1-2 (I/O)
START — TO A15TP1-7 (T3)
STOP — TO A15TP1-4 (T0)
POD GND TO A15TP3 (GND)



MULTIPLEXER

TIME BASE

+5V=71UF

COUNTERS/BUS DRIVERS

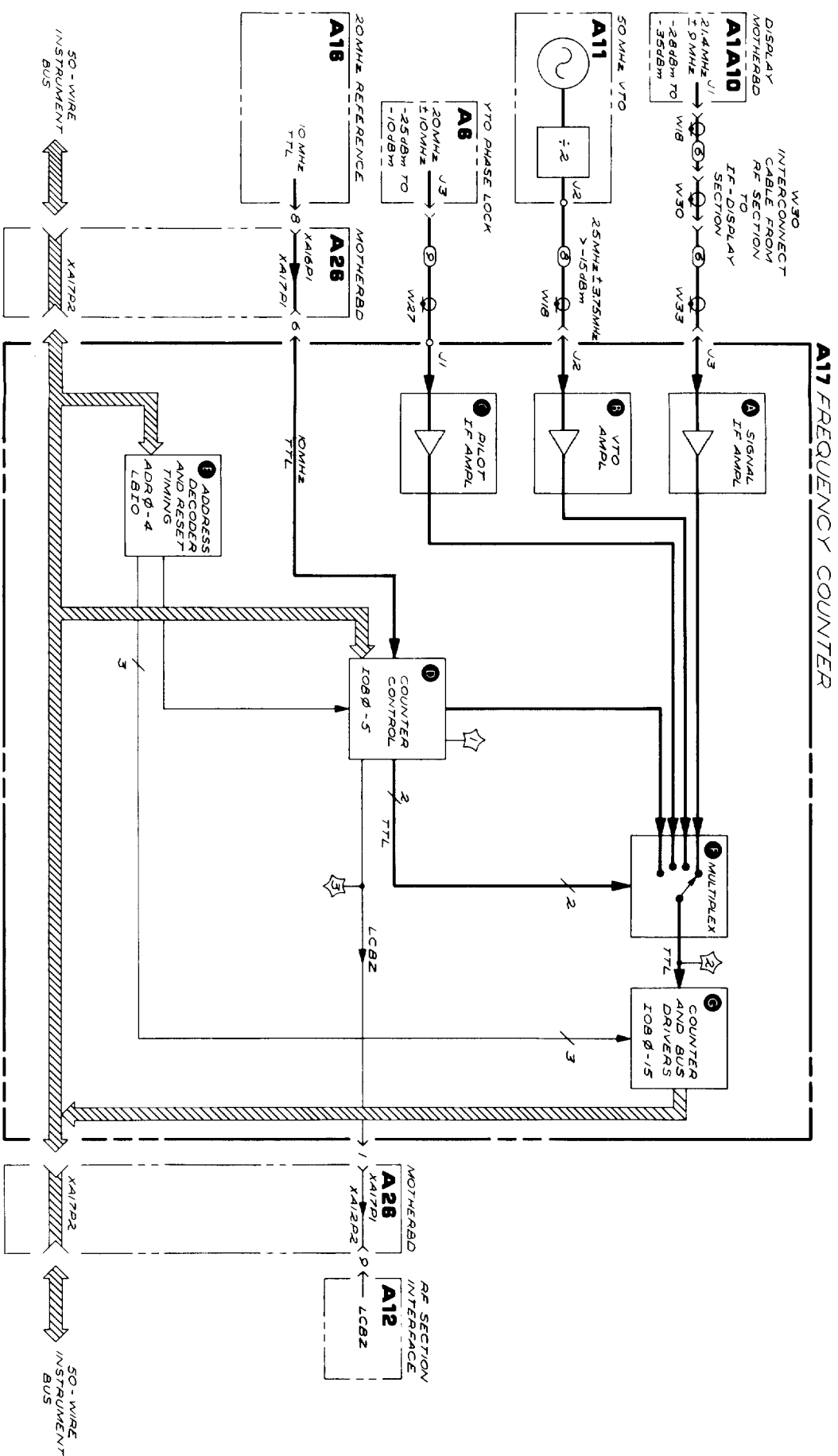
REFER TO A17 TROUBLESHOOTING

ADDRESS DECODER

15
30

P2

A17 7/8



A17

FIGURE 3. A17 FREQUENCY COUNTER, BLOCK DIAGRAM
A17 9/10

A17
FREQUENCY COUNTER
85680-60131

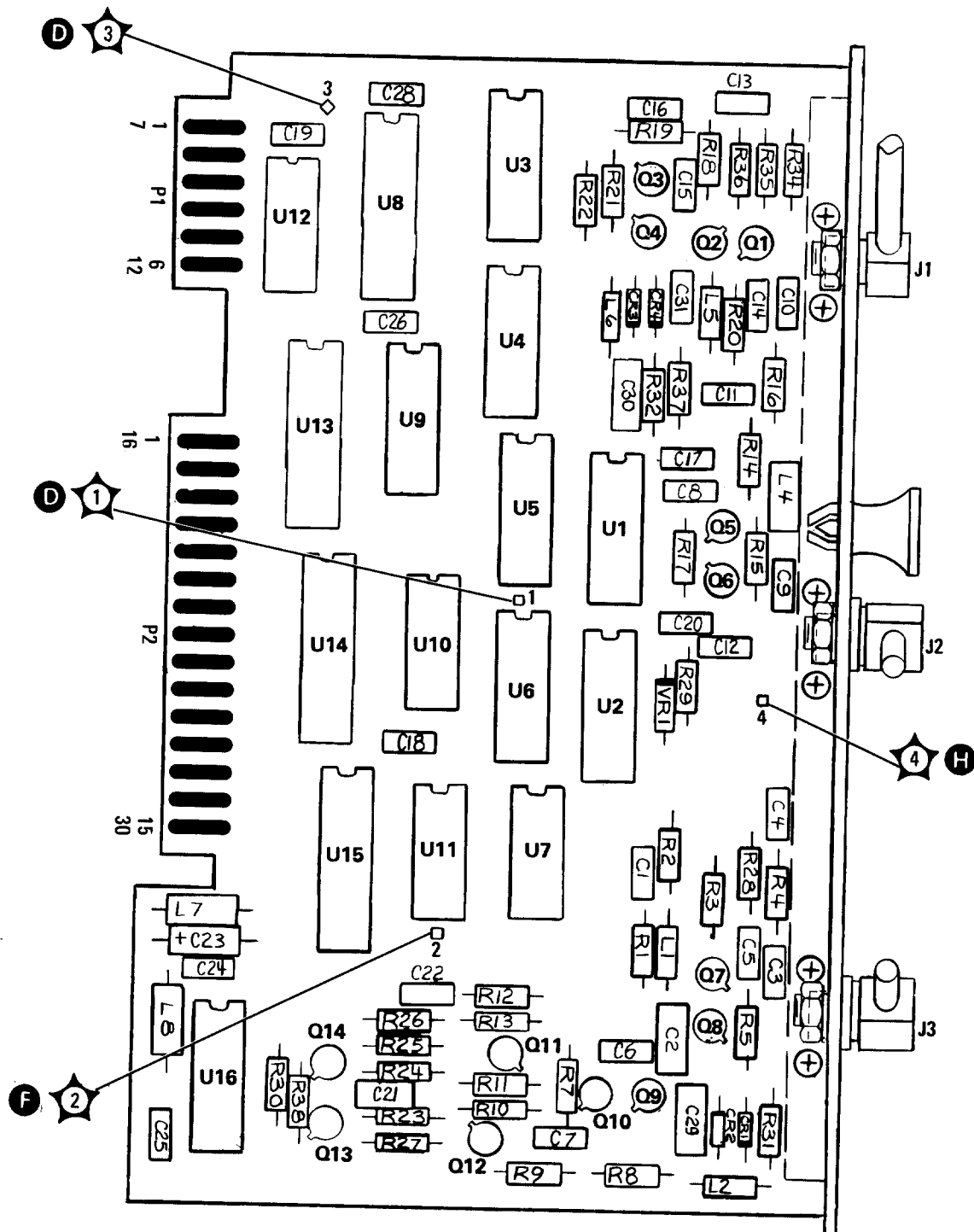


FIGURE 4. A17 FREQUENCY COUNTER, COMPONENT LOCATIONS

A17 FREQUENCY COUNTER 85680-60131

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LCBZ	A12P2-9	D
7	NC		
8	NC		
2	NC		
9	NC		
4	NC		
10	NC		
5	GND		H
11	GND		H
6	10 MHZ	A16, P1-8	D
12	GND		H

P2

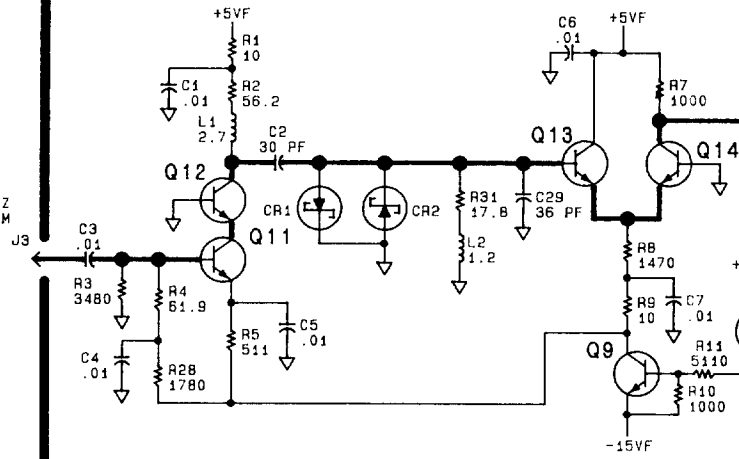
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
-	IOB15	A15, P2-30	G
16	IOB14	A15, P2-12	G
2	IOB13	A15, P2-29	G
17	IOB12	A15, P2-11	G
3	IOB11	A15, P2-28	G
18	IOB10	A15, P2-10	G
4	IOB9	A15, P2-27	G
19	IOB8	A15, P2-9	G
5	IOB7	A15, P2-26	G
20	IOB6	A15, P2-8	G
6	IOB5	A15, P2-25	G
21	IOB4	A15, P2-7	G
7	IOB3	A15, P2-24	G
22	IOB2	A15, P2-6	G
8	IOB1	A15, P2-23	G
23	IOB0	A15, P2-5	G
9	NC		
24	ADR4	A15, P2-4	E
10	ADR3	A15, P2-21	E
25	ADR2	A15, P2-3	E
11	ADR1	A15, P2-20	E
26	ADR0	A15, P2-2	E
12	LB10	A15, P2-19	E
27	LB10	A15, P2-19	E
13	GND		H
28	GND		H
14	+5.2V		H
29	+5.2V		H
15	-15V		H
30	-15V		H

CABLE 6, W33
21.4 MHZ TO ± 9 MHZ
-28 DBM TO -35 DBM
FROM A4A2
LOG AMPLIFIER
DETECTOR

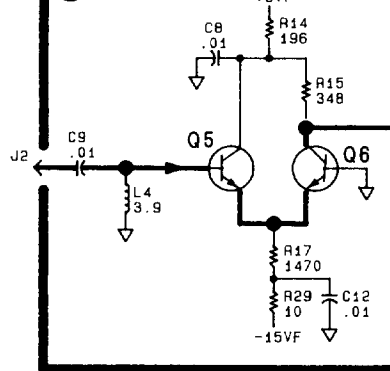
CABLE 8, W18
25 MHZ ± 3.75 MHZ
> -15 DBM
FROM A11
50 MHZ VOLTAGE
TUNED OSCILLATOR

20 MHZ ± 10 MHZ
-10 DBM TO -25 DBM
FROM A6 YTO
PHASE LOCK

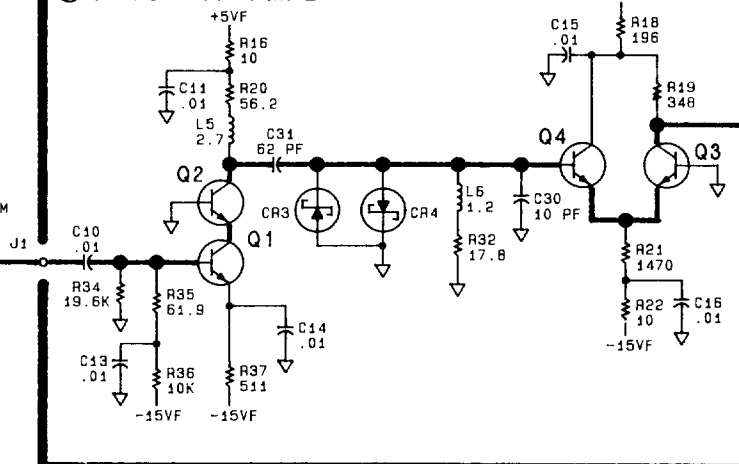
Ⓐ SIGNAL IF AMPL



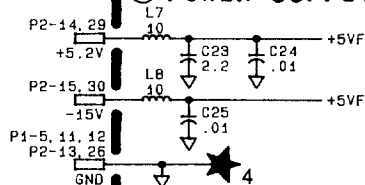
Ⓑ VTO AMPL

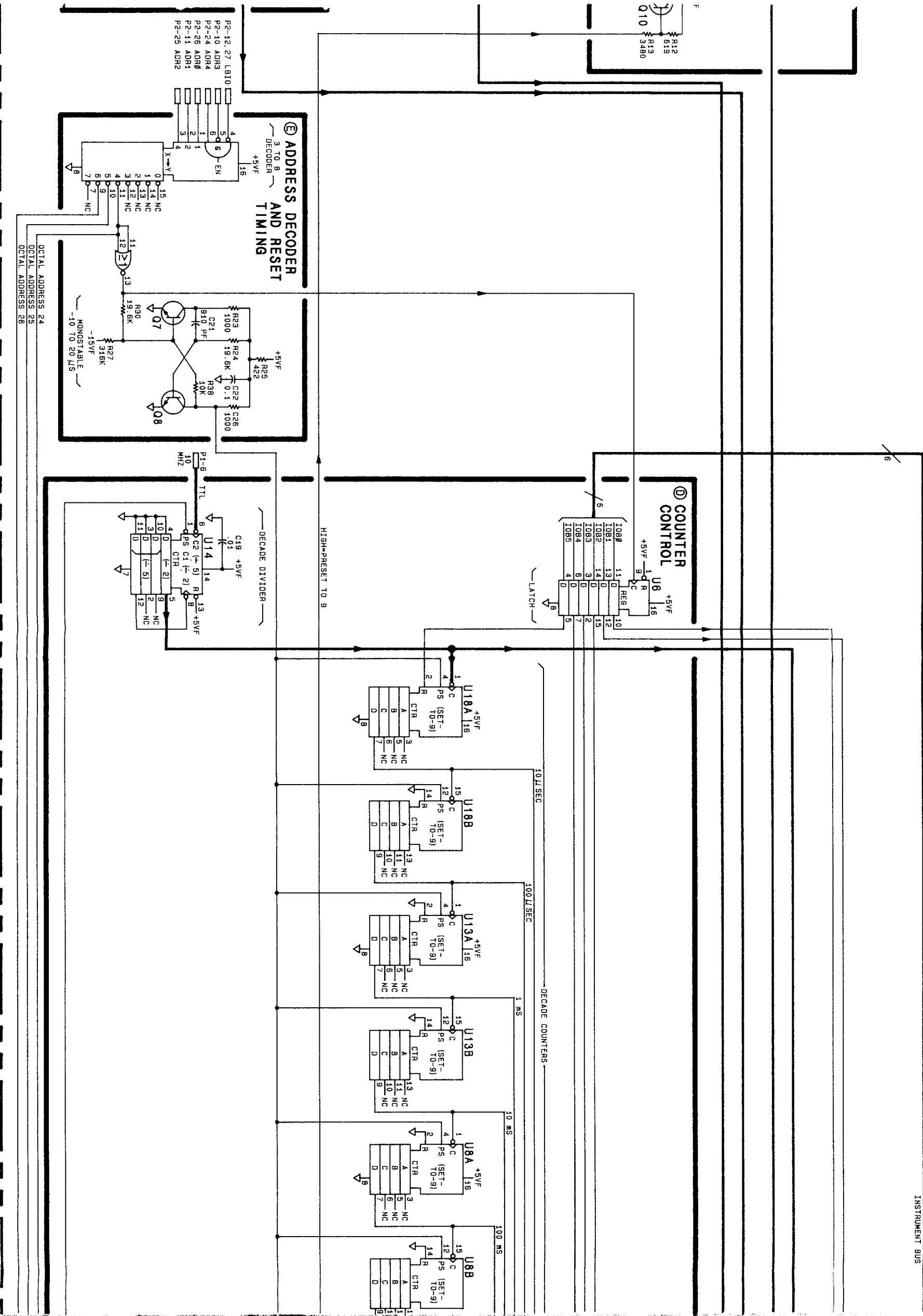


Ⓒ PILOT IF AMPL



Ⓓ POWER SUPPLIES







A17 13/14

A18 275 MHz PHASE LOCK OSCILLATOR, CIRCUIT DESCRIPTION

A18 275 MHz Phase Lock Oscillator provides a variable offset from the nominal 280 MHz supplied by A20 Third Converter. The amount of the offset is equal to the signal supplied by A11 50 MHz Voltage-Tuned Oscillator to A21 275 MHz Phase Lock. This signal is either 2.5 MHz (± 375 kHz) for frequency spans of 100 kHz or less or 5.0 MHz (± 750 kHz) for frequency spans greater than 100 kHz.

A18 also sends a 16 MHz to 38.5 MHz signal to A8 249 MHz Phase Lock. The frequency is determined by the divide number (4.0 through 9.625 in steps of 0.125) used by the Variable Modulo Frequency Divider circuit in A8.

275 MHz Phase Lock Oscillator (D)

Transistor Q5 and its associated circuitry form a modified Colpitts oscillator with C9 through C11 providing the feedback signal. The tank circuit capacitance is provided by the feedback capacitors and by PLO ADJUST C8, C7, and varactor diode CR1. The tank circuit inductance is provided by L4 and L27. R4 and R5 set the operating bias for Q5. L5, L6, C14, C15, C12, and C13 are high-frequency bypass elements.

Tune Filter (B)

The Tune Filter receives a +5V to +13V signal (called 275 MHz TUNE) from A21 275 MHz Phase Lock. This voltage controls the frequency of the 275 MHz Phase Lock Oscillator. The Tune Filter is a 1.5 MHz low-pass filter that eliminates any 2.5 MHz or 5.0 MHz component that might be impressed on the output of the Phase/Frequency Detector in A21. The tune voltage may be measured at TP1.

Buffer Amplifier 1 (H)

Buffer Amplifier 1 provides isolation for the 275 MHz signal to A21. R29 and R28 set the operating bias for Q2. The gain of the stage, determined by Q2, L14, and C31, is approximately 11 dB. The amplifier has a 3 dB resistive pad on both the input and the output for additional isolation.

Buffer Amplifier 2 (I)

Buffer Amplifier 2 provides isolation for the 275 MHz signal to the Mixer. A 3 dB resistive pad on the input provides additional isolation. R11 and R12 set the operating bias for Q1. The gain of the stage, determined by Q2, L8, and C19, is approximately 11 dB. The output of Q1 drives the LO port of the Balanced Mixer U1.

Balanced Mixer (F)

The Balanced Mixer U1 receives (through a 30 dB pad) the 249 MHz signal from A7 249 Phase Lock Oscillator, mixes it with the signal from the 275 MHz Phase Lock Oscillator, and sends the difference to the IF Amplifier.

IF Amplifier (C)

The IF Amplifier has two stages, Q4 and Q3, with a gain of approximately 30 dB. It receives a 16 MHz to 38.5 MHz signal from the Balanced Mixer and sends it through the 60 MHz Low-Pass Filter to A8 249 MHz Phase Lock.

R15, R14, R13, and R17 provide dc bias for Q4. The voltage gain of the first stage, approximately 10, is determined by Q4, R16, and L10.

R35, R34, R33, and R38 set the bias for the second stage transistor, Q3. The voltage gain of about 3 is determined by Q3, R37, and R36.

60 MHz Low-Pass Filter (A)

The 60 MHz Low-Pass Filter eliminates the 249 MHz and 275 MHz signals, which cause crossing spurs in A8 249 MHz Phase Lock.

TABLE 1. A18 275 MHz PHASE LOCK OSCILLATOR, REPLACEABLE PARTS (1 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18	85680-60015	9	1	275MHZ PHASE LOCK OSCILLATOR	20480	85680-60015
A18C1	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A18C2	0140-0191	0	1	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A18C3	0160-2207	3	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	20480	0160-2207
A18C4	0160-2206	2	1	CAPACITOR-FXD 160PF +-5% 300VDC MICA	20480	0160-2206
A18C5	0140-0196	3	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A18C6	0160-3466	0	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER	20480	0160-3466
A18C7	0160-2248	2	1	CAPACITOR-FXD 4.3PF +- .25PF 500VDC CER	20480	0160-2248
A18C8	0121-0457	9	1	CAPACITOR-V TRMR-PS1N .08-.5PF 750V	18736	TP9
A18C9	0160-2266	4	1	CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	20480	0160-2266
A18C10	0160-2247	1	1	CAPACITOR-FXD 3.9PF +- .25PF 500VDC CER	20480	0160-2247
A18C11	0150-0059	8	1	CAPACITOR-FXD 3.3PF +- .25PF 500VDC CER	20480	0150-0059
A18C12	0160-2055	9	16	CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C13				NOT ASSIGNED		
A18C14	0160-2259	5	1	CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	20480	0160-2259
A18C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C19	0160-2261	9	2	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	20480	0160-2261
A18C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	20480	0160-2055
A18C31	0160-2261	9		CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	20480	0160-2261
A18C32	0180-0116	1	2	CAPACITOR-FXD 6.8UF +-10% 35VDC TA	56289	1500685X9035B2
A18C33	0180-0116	1		CAPACITOR-FXD 6.8UF +-10% 35VDC TA	56289	1500685X9035B2
A18C34	0160-3876	4	1	CAPACITOR-FXD 47PF +-20% 200VDC CER	20480	0160-3876
A18C35	0140-0193	0	2	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A18C36	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A18C37				NOT ASSIGNED		
A18C38	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	20480	0160-2437
A18CR1	0122-0072	6	1	DIODE-VVC 2.2PF 5% C3/C25-MIN=4.5	04713	BD105B
A18J1	1250-0690	6	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	20480	1250-0690
A18J2				PART OF W25		
A18J3	1250-0690	6		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	20480	1250-0690
A18L1	9140-0129	1	1	INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	20480	9140-0129
A18L2	9100-1639	6	1	INDUCTOR RF-CH-MLD 150UH 5% .166DX.385LG	20480	9100-1639
A18L3	9140-0158	6	3	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	20480	9140-0158
A18L4	85680-80005	9	1	COIL-OSCILLATOR	20480	85680-80005
A18L5	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	20480	9140-0158
A18L6	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	20480	9140-0158
A18L7	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH 10% .105DX.26LG	20480	9100-2252
A18L8	9100-0346	0	2	INDUCTOR RF-CH-MLD 50NH 20% .105DX.26LG	20480	9100-0346
A18L9				NOT ASSIGNED		
A18L10	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	20480	9100-2251
A18L11	9100-2249	6	3	INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	20480	9100-2249
A18L12	9100-2249	6		INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	20480	9100-2249
A18L13	9100-2249	6		INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	20480	9100-2249
A18L14	9100-0346	0		INDUCTOR RF-CH-MLD 50NH 20% .105DX.26LG	20480	9100-0346
A18L15				NOT ASSIGNED		
A18L16	9100-1788	6	2	CHOKE-WIDE BAND ZMAX=680 OHMS 100 MHZ	02114	VK200 20/48
A18L17	9100-1788	6		CHOKE-WIDE BAND ZMAX=600 OHMS 180 MHZ	02114	VK200 20/48
A18L18	9100-2256	5	1	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	20480	9100-2256
A18Q1	1854-0686	0		TRANSISTOR NPN SI TO-72 PD=200MW FT=4CHZ	20480	1854-0686
A18Q2	1854-0686	0		TRANSISTOR NPN SI TO-72 PD=200MW FT=4CHZ	20480	1854-0686
A18Q3	1854-0345	8	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18Q4	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	20480	1854-0247
A18Q5	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18R1	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R2	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R3	0757-0374	0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A18R4	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A18R5	0698-3446	3	1	RESISTOR 303 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F

*Indicates factory selected value

TABLE 1. A18 275 MHz PHASE LOCK OSCILLATOR, REPLACEABLE PARTS (2 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18R6				NOT ASSIGNED		
A18R7				NOT ASSIGNED		
A18R8	0698-3438	3	6	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R9	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A18R10	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R11	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A18R12	0698-0882	7	2	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A18R13	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A18R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R15	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R16	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A18R17	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A18R18				NOT ASSIGNED		
A18R19				NOT ASSIGNED		
A18R20	0757-0398	4	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A18R21	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R22	0698-3434	9	1	RESISTOR 34.8 1% .125W F TC=0+-100	24546	C4-1/8-T0-3480-F
A18R23	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R24	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A18R25	0698-3443	0	4	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R26	0757-0294	9	2	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-178R-F
A18R27	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R28	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A18R29	0698-0882	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A18R30	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R31	0757-0294	9		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-178R-F
A18R32	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R33	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R35	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R36	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A18R37	0698-0822	9	1	RESISTOR 6.81 1% .125W F TC=0+-100	28480	0698-0822
A18R38	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A18TP1				PART OF C38		
A18U1	0955-0063	0	1	MIXER-DOUBLE BALANCE PWR INP=200MW; PK	28480	0955-0063
				MISCELLANEOUS PARTS		
	06701-40001	7	1	EXTRACTOR PC	28480	86701-40001

*Indicates factory selected value

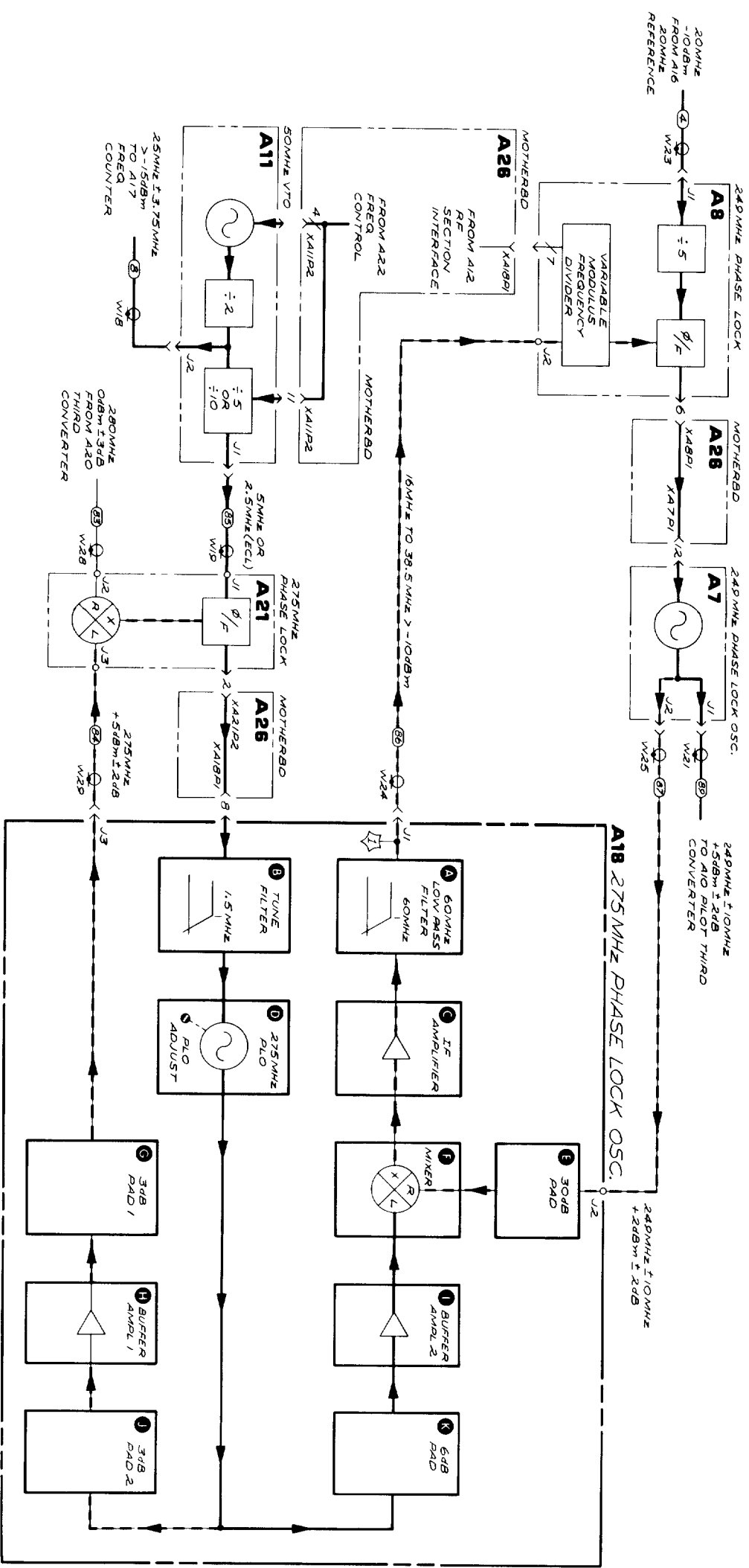


FIGURE 1. A18 275 MHz PHASE LOCK OSCILLATOR, BLOCK DIAGRAM

A18

A18
275 MHz PHASE LOCK OSCILLATOR
85680-60015

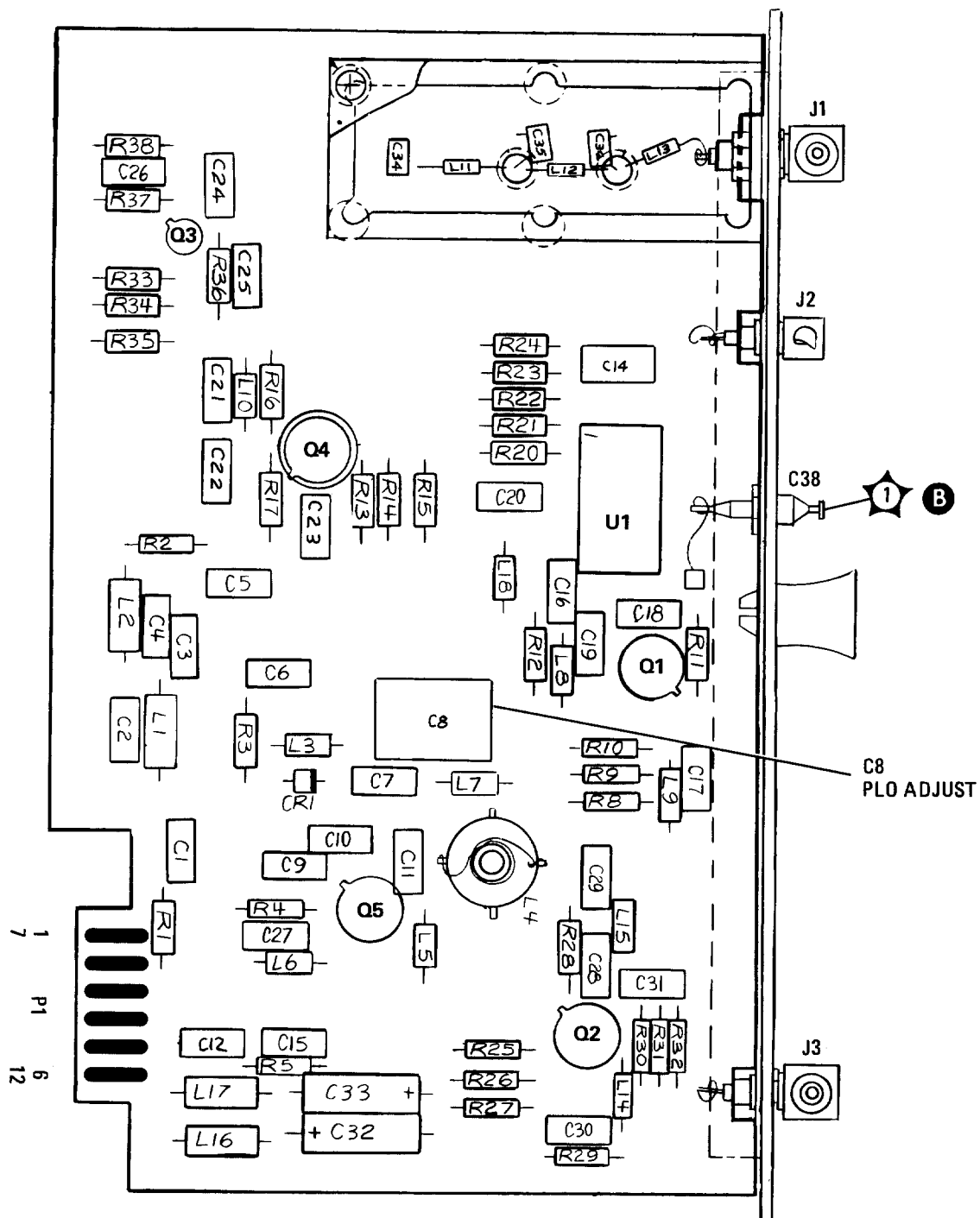


FIGURE 2. A18 275 MHz PHASE LOCK OSCILLATOR, COMPONENT LOCATIONS

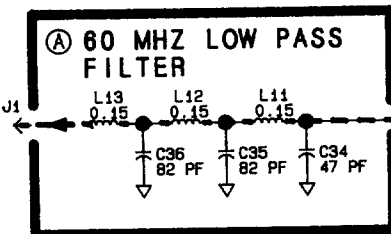
RF SECTION

A18 275 MHZ PHASE LOCK OSCILLATOR
85680-60015

P 1

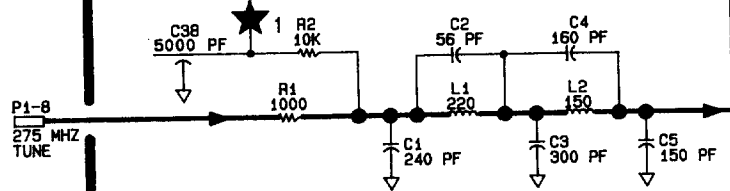
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		L
7	GND		L
2	GND		L
8	275 MHZ TUNE	A21P2-2	B
3	GND		L
9	GND		L
4	GND		L
10	GND		L
5	-15V		L
11	-15V		L
6	+15V		L
12	+15V		L

CABLE 86, W24
16 MHZ TO 38.5 MHZ
>-10 DBM
TO A8 249 MHZ
PHASE LOCK

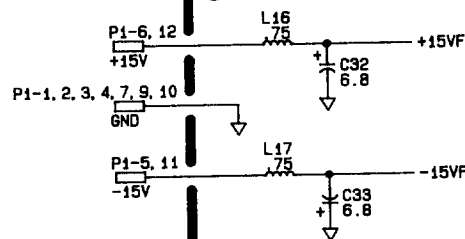


② TUNE FILTER

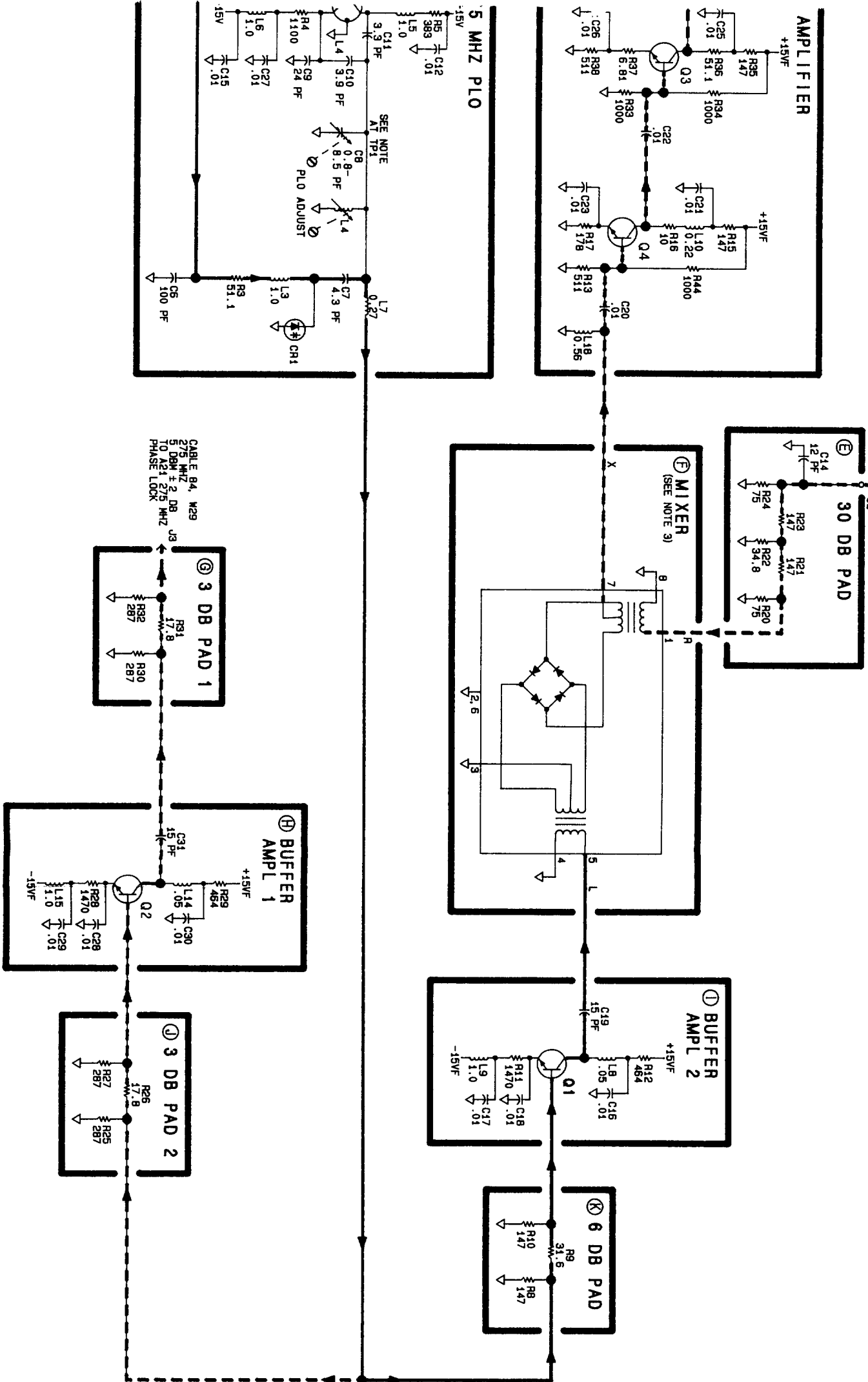
4-13 VOLTS
ADJUST C8 FOR
7.5 VOLTS AT 275 MHZ
(SEE NOTE 4)



③ POWER SUPPLIES



249 MHz $\pm$ 10 MHz $\pm$ 2 DB $\pm$ 2 DB
FROM A7 249 MHz PHASE LOCK
OSCILLATOR



- NOTES:
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PRE-FIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
 2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω), CAPACITANCE IS IN MICROFARADS (μ F), INDUCTANCE IS IN MICROHENRIES (μ H)
 3. U1 PIN CONFIGURATION:

1	2	3	4
•	•	•	•
8	7	6	5

(BOTTOM VIEW)
 4. INSTRUMENT CONTROL SETTINGS:
INSTRUMENT PRESET
CENTER FREQUENCY-17.1 MHz
 5. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.

A18

FIGURE 3. A18 275 MHz PHASE LOCK OSCILLATOR, SCHEMATIC DIAGRAM

A19 SECOND IF AMPLIFIER, CIRCUIT DESCRIPTION

A19 Second IF Amplifier receives 301.4 MHz from A23 Second Converter, filters it, and sends the amplified signal to A20 Third Converter. The overall gain of the assembly is about 14 dB.

Low-Pass Filter (A)

The Low-Pass Filter, which has a cutoff of about 500 MHz, filters out the LO frequency and its harmonics from A23 RF Converter. The filter has less than 1 dB loss at 301.4 MHz.

Amplifier (B)

The common-emitter amplifier circuit consists of Q1 for amplification and Q2 for active bias. The circuit gain is approximately 19 dB. C6, C8, C13, and C14 are high-frequency bypass capacitors. L3 and C7 transform the output impedance to 50 ohms coupling into the 301.4 MHz Bandpass Filter.

301.4 MHz Bandpass Filter (C)

The 301.4 MHz Bandpass Filter rejects the image frequency from A23A3 Second Converter. The 3 dB bandwidth of the filter is about 9 MHz. The coupling capacitance in the circuit is provided by the trace on the PC board. The 301.4 MHz output signal is sent to A20 Third Converter

A20 THIRD CONVERTER, CIRCUIT DESCRIPTION

A20 Third Converter receives 301.4 MHz from A19 Second IF Amplifier and mixes it with 280 MHz to provide the 21.4 MHz IF OUTPUT to the rear panel. It also sends 280 MHz to A21 275 MHz Phase Lock.

280 MHz Crystal Oscillator (A)

Q2 and associated circuitry form a modified Colpitts oscillator with the Surface-Acoustic-Wave Resonator Z1 in the feedback path. C3 and C4 form a capacitive voltage divider to set the feedback level. C5 and L3 provide the output path to the two buffer amplifiers.

280 MHz Buffer Amplifier 1 (D)

280 MHz Buffer Amplifier 1 isolates the signal to A21 275 MHz Phase Lock. The circuit is a common-emitter amplifier in which R6, R7, and R8 set the bias for Q5. The output of Q5 is sent through a 6 dB resistive pad to A21.

280 MHz Buffer Amplifier 2 (B)

280 MHz Buffer Amplifier 2 isolates the signal to the Balanced Mixer. R12, R13, and R14 set the bias for Q1. L6 and C12 transform the impedance to drive the LO port of U1.

Balanced Mixer (C)

The Balanced Mixer U1 mixes 301.4 MHz from A19 Second IF Amplifier with the signal from the 280 MHz Crystal Oscillator and sends the difference frequency to the 21.4 MHz Variable Gain Amplifier.

21.4 MHz Variable Gain Amplifier (E)

The 21.4 MHz Variable Gain Amplifier amplifies the signal from the Balanced Mixer and sends it to the rear panel. Q3 has a fixed gain that is set by R19. R16 through R18 and R20 set the bias of Q3. Q4, the second stage, has a variable gain determined by R21 and PIN diode CR1. The gain is varied by changing the current through CR1, which is driven by the PIN Driver.

PIN Driver (F)

The current drive for CR1 is supplied by the PIN Driver, which consists of Q6 and associated circuitry. The shaping network in the emitter circuit of Q6 shapes the AMP CAL signal to provide the proper gain variation with input voltage in the second stage of the 21.4 MHz Variable Gain Amplifier.

TABLE 1. A19 SECOND IF AMPLIFIER, REPLACEABLE PARTS

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A19	85600-60039	7	1	SECOND IF AMPLIFIER	28480	85600-60039
A19C1	0160-3876	4	1	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A19C2	0160-3879	7	4	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C3	0160-3877	5	3	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A19C4	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A19C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C6	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A19C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C8	0160-2247	1	1	CAPACITOR-FXD 3.9PF +-25% 503VDC CER	28480	0160-2247
A19C9	0121-0493	3	4	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A19C10	0121-0493	3		CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A19C11	0121-0493	3		CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A19C12	0121-0493	3		CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A19C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19J1	1250-0690	6	2	CONNECTOR-RF SMD M SGL-HOLE-FR 50-OHM	28480	1250-0690
A19J2	1250-0690	6		CONNECTOR-RF SMD M SGL-HOLE-FR 50-OHM	28480	1250-0690
A19L1	9100-2251	3	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A19L2	85680-80009	3	1	INDUCTOR 35 NH	28480	85680-80009
A19L3	85680-80014	0	1	TRANSFORMER	28480	85680-80014
A19L4	85680-80008	2	2	INDUCTOR 50 NH	28480	85680-80008
A19L5	85680-80008	2		INDUCTOR 50 NH	28480	85680-80008
A19L6	85680-80016	2	1	TRANSFORMER	28480	85680-80016
A19L7	9100-1738	6	1	CHOKE-WIDE BAND ZMAX=680 OHMS 100 MHZ	02114	UK200 20/48
A19L8	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A19Q1	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4CHZ	28480	1854-0686
A19Q2	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A19Q3	1854-0546	1	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A19R1	0757-0200	7	3	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A19R2	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A19R3	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A19R4	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A19R5*	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0+-100	24546	C4 1/8-T0-4640-F
A19R6*	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A19R7				NOT ASSIGNED		
A19R8	0698-3154	0	2	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4 1/8-T0-4221-F
A19R9	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A19R10	0757-0419	0	1	RESISTOR 601 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A19R11-				NOT ASSIGNED		
A19R56				RESISTOR 464 1% .125W F TC=0+-100	24546	C4 1/8-T0-4640-F
A19R57*	0698-0082	7				
				MISCELLANEOUS PARTS		
	85680-80019	5	5	CONNECTING FINGERS	28480	85680-80019

*Indicates factory selected value

TABLE 2. A20 THIRD CONVERTER, REPLACEABLE PARTS (1 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20	85680-60171	8	1	THIRD CONVERTER	28480	85680-60171
A20C1	0160-4574	1	5	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A20C2	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A20C3	0160-2262	0	1	CAPACITOR-FXD 16PF +-5% 500VDC CER 0+-30	28480	0160-2262
A20C4	0160-2250	6	1	CAPACITOR-FXD 5.1PF +- .25PF 500VDC CER	28480	0160-2250
A20C5	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A20C6	0160-3878	6	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A20C7	0160-4554	7	14	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C8	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C9	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A20C10	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C11				NOT ASSIGNED		
A20C12	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C13	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A20C14	0160-3565	8	1	CAPACITOR-FXD 6.8PF +- .5PF 100VDC CER	28480	0160-3565
A20C15	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C16				NOT ASSIGNED		
A20C17	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C18	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C19	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C20	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C21	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C22	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	1500685X903582
A20C23	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C24	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C25	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C26	0160-3874	2	1	CAPACITOR-FXD 10PF +- .5PF 200VDC CER	28480	0160-3874
A20C27	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A20C28	0160-4084	8	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A20CR1	1901-1070	9	1	DIODE-PIN 110V	28480	1901-1070
A20CR2	1901-0040	1	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20E1	9170-0029	3	1	CORE-SHIELDING BEAD	28480	9170-0029
A20J1				PART OF W30		
A20J2	1250-0690	6	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A20J3	1250-0690	6		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A20L1	85680-80013	9	1	AMPT. ADJ	28480	85680-80013
A20L2	9100-2891	4	2	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A20L3	9100-2248	5	1	INDUCTOR RF-CH-MLD 120NH 10% .105DX.26LG	28480	9100-2248
A20L4	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH 10% .105DX.26LG	28480	9100-2252
A20L5	9100-2255	4	2	INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A20L6	9100-2891	4		INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A20L7	9100-2255	4		INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A20L8				NOT ASSIGNED		
A20L9				NOT ASSIGNED		
A20L10	9140-0178	0	3	INDUCTOR RF-CH-MLD 12UH 10% .166DX.385LG	28480	9140-0178
A20L11	9140-0178	0		INDUCTOR RF-CH-MLD 12UH 10% .166DX.385LG	28480	9140-0178
A20L12	9140-0178	0		INDUCTOR RF-CH-MLD 12UH 10% .166DX.385LG	28480	9140-0178
A20L13	9100-1788	6	1	CHOK-WIDE BAND ZMAX=680 OHM@ 100 MHZ	02114	UK200 20/40
A20L14	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A20L15	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A20Q1	1854-0378	7	1	TRANSISTOR NPN 2N5139 SI TO-39 PD=800MW	3L565	2N5139
A20Q2	1854-0546	1	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A20Q3	1854-0247	9	2	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A20Q4	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A20Q5	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	34713	2N5179
A20Q6	1854-0218	6	1	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A20R1	0757-0278	9	1	RESISTOR 1.76K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A20R2	0698-7188	8	1	RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A20R3	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R4	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A20R5	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A20R6	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R7	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A20R8	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A20R9	0698-3431	6	2	RESISTOR 23.7 1% .125W F TC=0+-100	03808	PHE55-1/8-T0-23R7-F
A20R10	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A20R11	0698-3431	6		RESISTOR 23.7 1% .125W F TC=0+-100	03808	PHE55-1/8-T0-23R7-F
A20R12	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A20R13	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A20R14	0698-8812	7	1	RESISTOR 1 1% .125W F TC=0+-100	28480	0698-8812
A20R15	0698-3444	1	4	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F

*Indicates factory selected value

RF SECTION

TABLE 2. A20 THIRD CONVERTER, REPLACEABLE PARTS (2 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20R16	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A20R17	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R18	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A20R19*	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A20R20	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A20R21	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A20R22	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A20R23	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A20R24	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A20R25	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A20R26	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A20R27	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A20R28	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A20R29	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A20R30	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A20R31	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A20R32	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A20R33	0683-0275	9	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27C5
A20TP1	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A20U1	0955-0084	5	1	MIXER DBL BAL S BARR DIODE: P=200MW MAX	28480	0955-0084
A20Z1	1GA1-8000	2	1	SAW RESONATOR	28480	1GA1-8000
				MISCELLANEOUS PARTS		
	85680-00056	2	1	GROUND STRIP	28480	85680-00056

*Indicates factory selected value

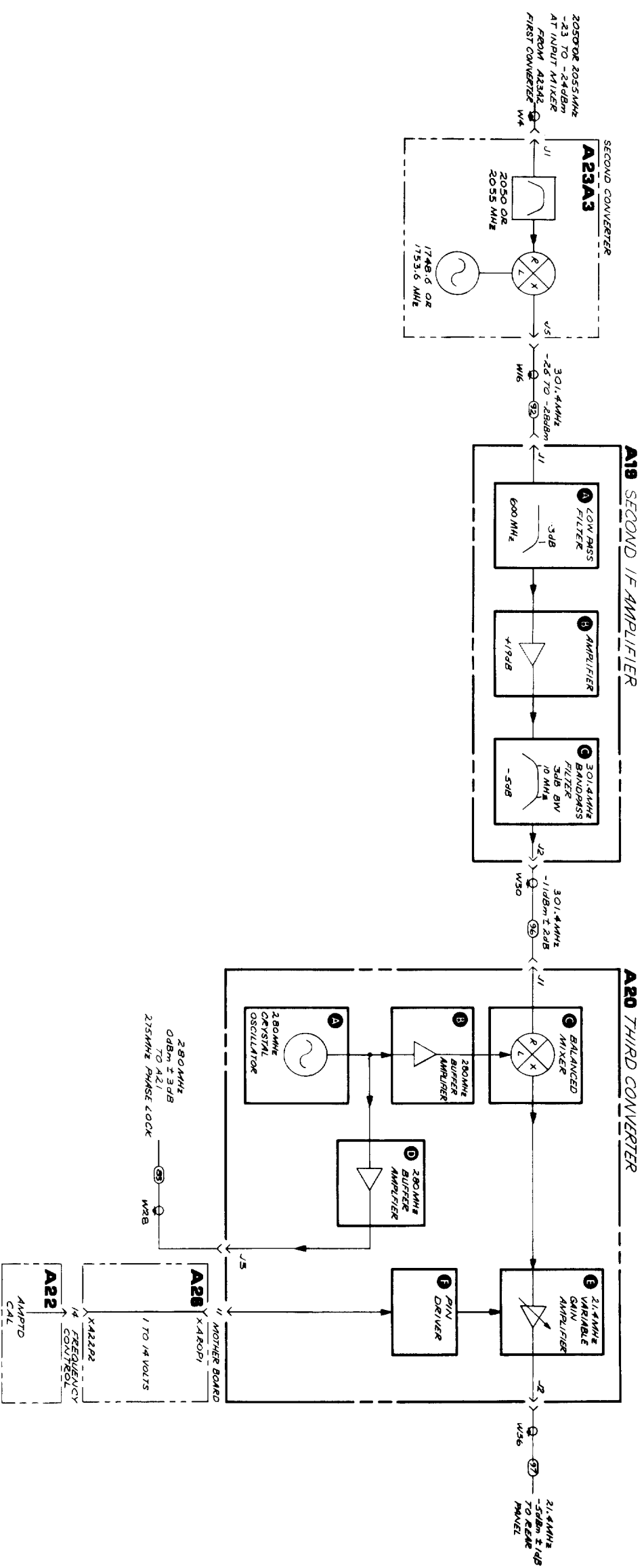


FIGURE 1. A19 SECOND IF AMPLIFIER AND A20 THIRD CONVERTER, BLOCK DIAGRAM

A19
SECOND IF AMPLIFIER
85680-60039

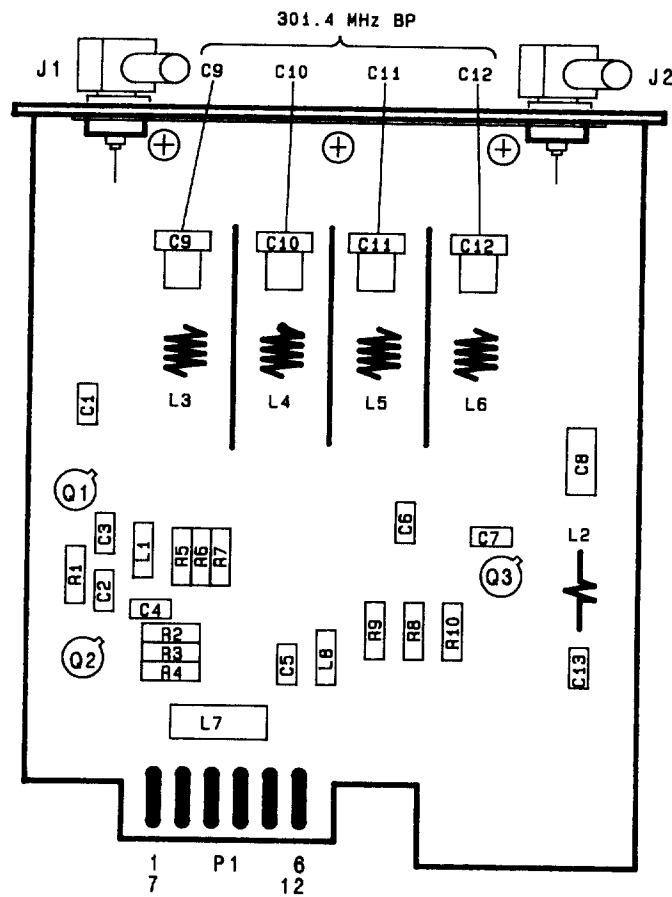


FIGURE 2. A19 SECOND IF AMPLIFIER, COMPONENT LOCATIONS

A20
THIRD CONVERTER
85680-60171

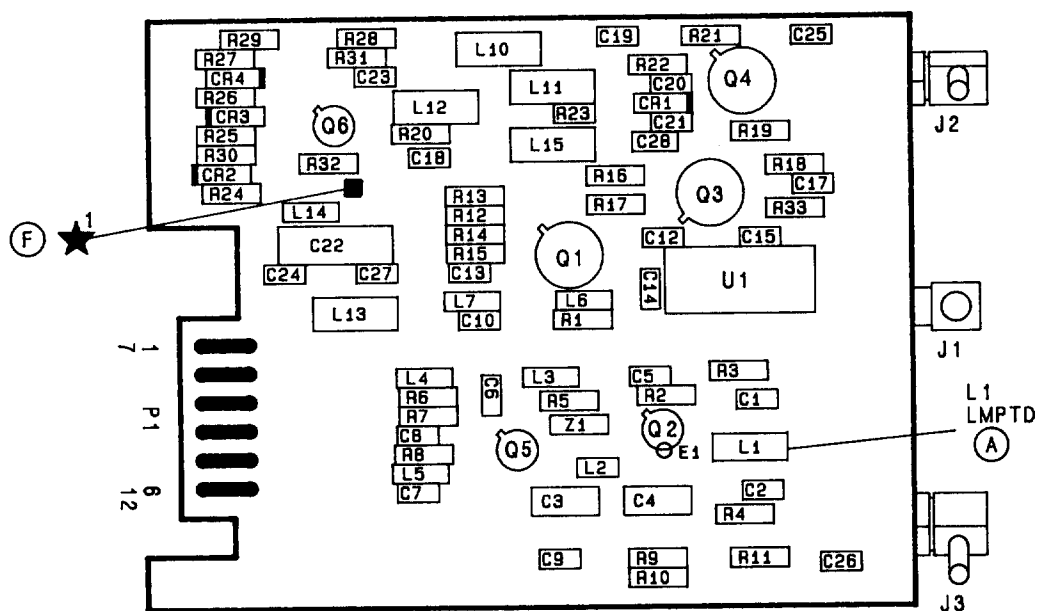
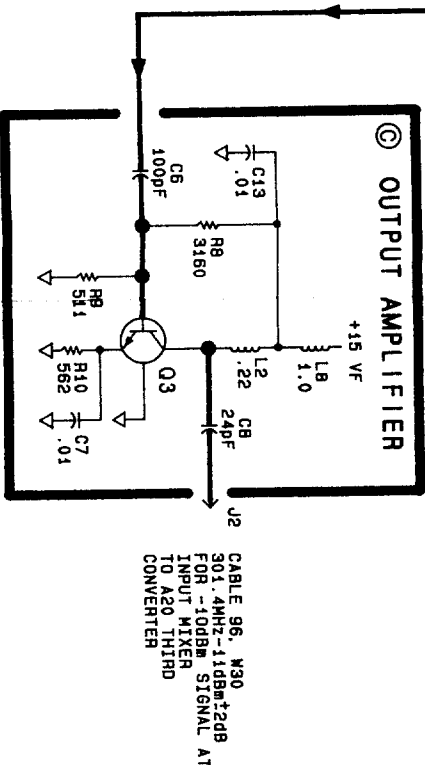
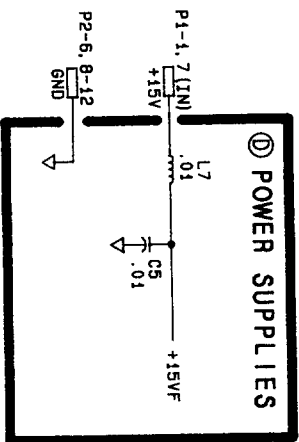
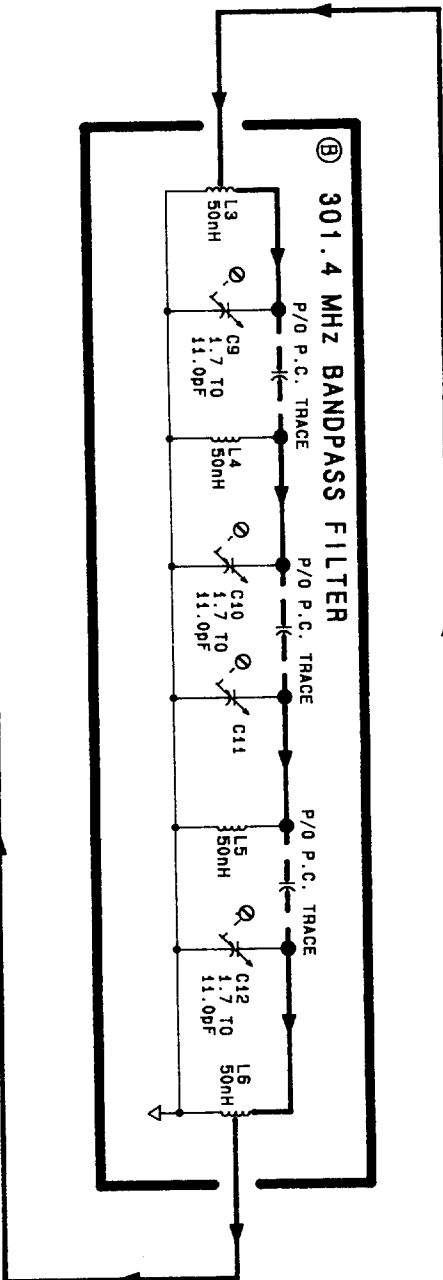
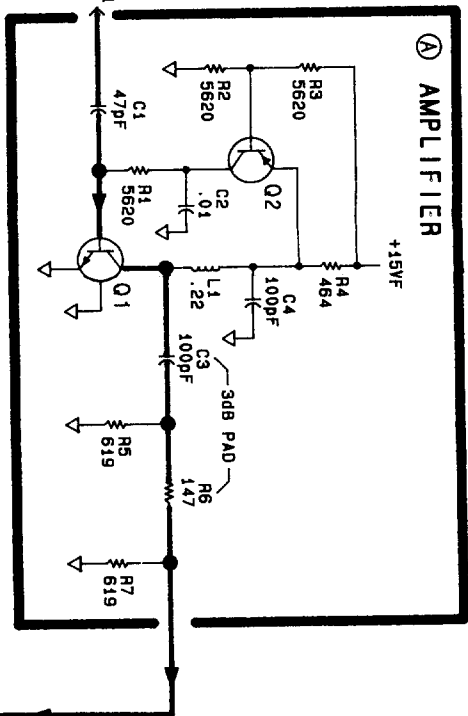


FIGURE 3. A20 THIRD CONVERTER, COMPONENT LOCATIONS

A19 SECOND IF AMPLIFIER
85680-60039

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15V		D
7	+15V		D
2	GND		D
8	GND		D
3	GND		D
9	GND		D
4	GND		D
10	GND		D
5	GND		D
11	GND		D
6	GND		D
12	GND		D

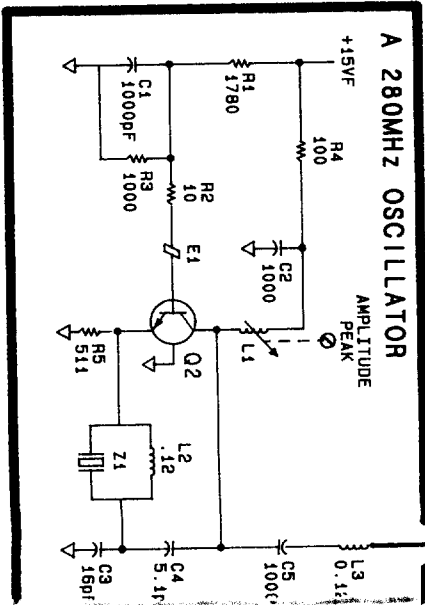
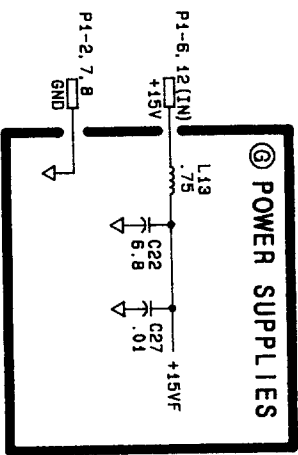
CABLE 92, N16
301.4MHZ
-26 TO -28dB
FOR -10dB SIGNAL
AT INPUT
MIXER FROM A29A4
SECOND CONV



A20 THIRD CONVERTER
85680-60171

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		6
7	GND		6
2	GND		6
8	GND		6
3			
9			
4			
10			
5	GND		6
11			
6	+15V		6
12	+15V		6

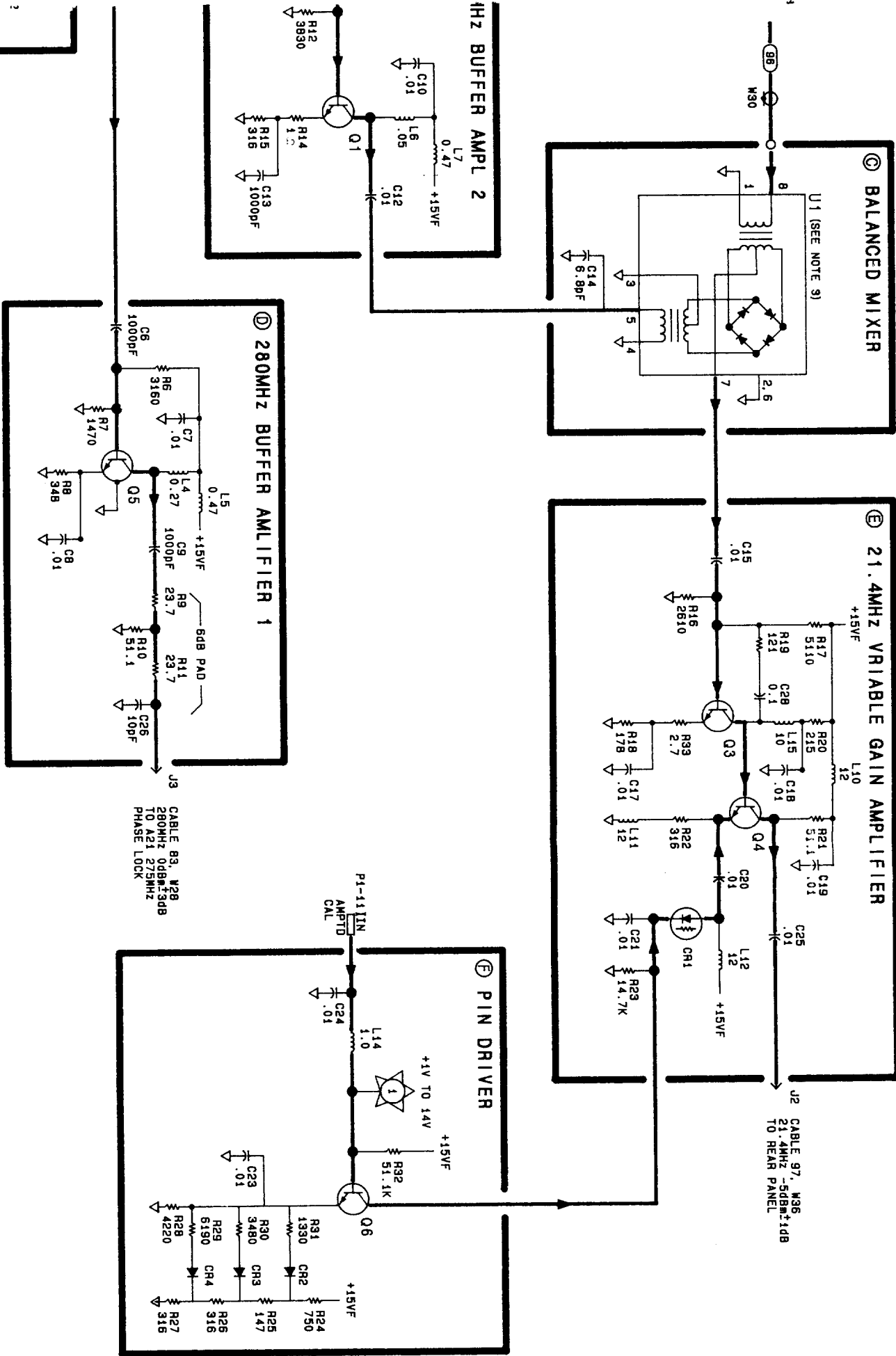
301.4MHZ -11dB
WITH 2N344
FROM A19 SECOND
IF AMPLIFIER





NOTES:

- 1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED FOR COMPLETE REFERENCE DESIGNATION. PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
- 2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
- 3. A20U1 PIN CONFIGURATION:
MARKED 1 2 3 4
0 0 0 0 BOTTOM
0 0 0 0 VIEW
8 7 6 5
- 4. PIN 1 INDICATED BY SQUARE PAD ON P.C. BOARD.
ASTERISK (*) DENOTES FACTORY SELECT COMPONENT. NOMINAL VALUE SHOWN.



A19
A20

FIGURE 4. A19 SECOND IF AMPLIFIER AND A20 THIRD CONVERTER, SCHEMATIC DIAGRAM
A19/A20 11/12

A21 275 MHz PHASE LOCK, CIRCUIT DESCRIPTION

In A21 275 MHz Phase Lock, the signal from A18 275 MHz Phase Lock Oscillator is mixed with 280 MHz from A20 Third Converter, and the difference frequency is compared with the reference signal from A11 50 MHz Voltage-Tuned Oscillator. (Refer to the circuit description of the Pilot Third Local Oscillator.)

A21A1 275 MHz Mixer (E) (F) (G)

A21A1 275 MHz Mixer is mounted on a shielding support forming a shielding box to keep higher frequency components isolated from the phase detector circuitry. The signal from A18 275 MHz Phase Lock Oscillator is nominally either 275 MHz or 277.5 MHz (depending on the reference frequency from A11 50 MHz Voltage-Tuned Oscillator) and is fed directly to the Mixer U6. The signal from A20 Third Converter is fixed at 280 MHz. This is filtered and attenuated before being fed to the Mixer U6. C28 and C29 act with the 50-ohm input and output impedances to form a 433 MHz low-pass filter. R30, R31, and R32 attenuate the signal 20 dB. The output of the Mixer is nominally at 5 MHz or 2.5 MHz, the difference of the input frequencies, and this is filtered by the 80 MHz LPF to remove high frequency components. This filter is made up of L7, L8, C23, C24, and C25.

Low Noise Amplifier (H)

The signal from the 275 MHz Mixer is amplified by the Low Noise Amplifier. R19, R22, R23, C27, and Q2 form a circuit to actively bias Q5. Q5, R38, C8, and R21 form the first stage of amplification, and Q1, R20, R24, R25, and C10 form the second stage.

Buffer Amplifier (I)

L1, C11, and C12 form a 15 MHz low-pass filter in the Buffer Amplifier. C13 couples the signal to the limiting amplifier consisting of Q4, Q3, R15, L2, R18, R17, R16, and C14. This amplifier limits to produce output voltage levels compatible with ECL logic.

Phase Detector (A)

The Phase Detector compares the output frequency of the 275 MHz Mixer with the reference frequency from A11 50 MHz Voltage-Tuned Oscillator to generate the 275 MHz TUNE signal.

The Phase Detector is composed of dual D flip-flop U1 and NOR gate U3A. U2R1 through U2R6, R1, and R2 bias the ECL lines. C15 is a bypass capacitor. R33 ties the D inputs of the flip-flops high so that when a clock line goes high, it triggers the matching flip-flop, causing its positive output to go high and its inverted output to go low. U3A resets both flip-flops together whenever both become set.

Lock Detector (B)

Signals from the positive and inverted outputs of both flip-flops of U1 are fed to NOR gates U3B and U3C. The outputs of these gates are tied together and biased by resistor U2R4. R4 and C22 filter this to provide a signal whose voltage, whenever the loop is locked, is higher than the threshold voltage set by R5 and R6. When the loop is locked, the output of U4 goes low, turning off unlocked LED DS1. CR1 limits this low level on HUL3 to -0.6V . Whenever the loop is unlocked, the filtered voltage from R4 and C22 is less than the threshold voltage, and the output of U4 goes high. R7 limits the current through DS1, which lights to indicate UNLOCKED. VR2 and DS1 set the high level on HUL3 to approximately $+3.2\text{V}$. Line HUL3 goes to A12 RF Section Interface to indicate to A15 Controller the status of the loop.

Loop Amplifier and Filters (C)

The Loop Amplifier receives signals from the Phase Detector flip-flops of U1. Signals from the positive output of one flip-flop and the negative output of the other flip-flop are filtered and summed together in the Loop Amplifier. Since opposite flip-flop output polarities are summed, an error current will be produced to charge or discharge C26 if the flip-flop input signals differ in frequency or phase. R10, R11, C16, R12, R13, and C17 filter the signals to the Loop Amplifier. C21, C26, and R14 filter the summed signal. R8, R9, and C18 bias the amplifier to the center of the ECL voltage level range, approximately -1.3V .

High and Low Clamps (D)

The High and Low Clamps limit the output of the Loop Amplifier to the range required by A18 275 MHz Phase Lock Oscillator. VR3 and VR4 form the Low Clamp and limit the low voltage to about $+4\text{V}$. CR3 limits the low voltage to -0.6V for transients during turn-on. R27, Q6, R29, and R28 form the High Clamp. The upper voltage limit is set by R28. CR2 protects Q6. R39 limits the current in the 275 MHz TUNE line as it is sent to A18.

TABLE 1. A21 275 MHz PHASE LOCK, REPLACEABLE PARTS (1 OF 2)

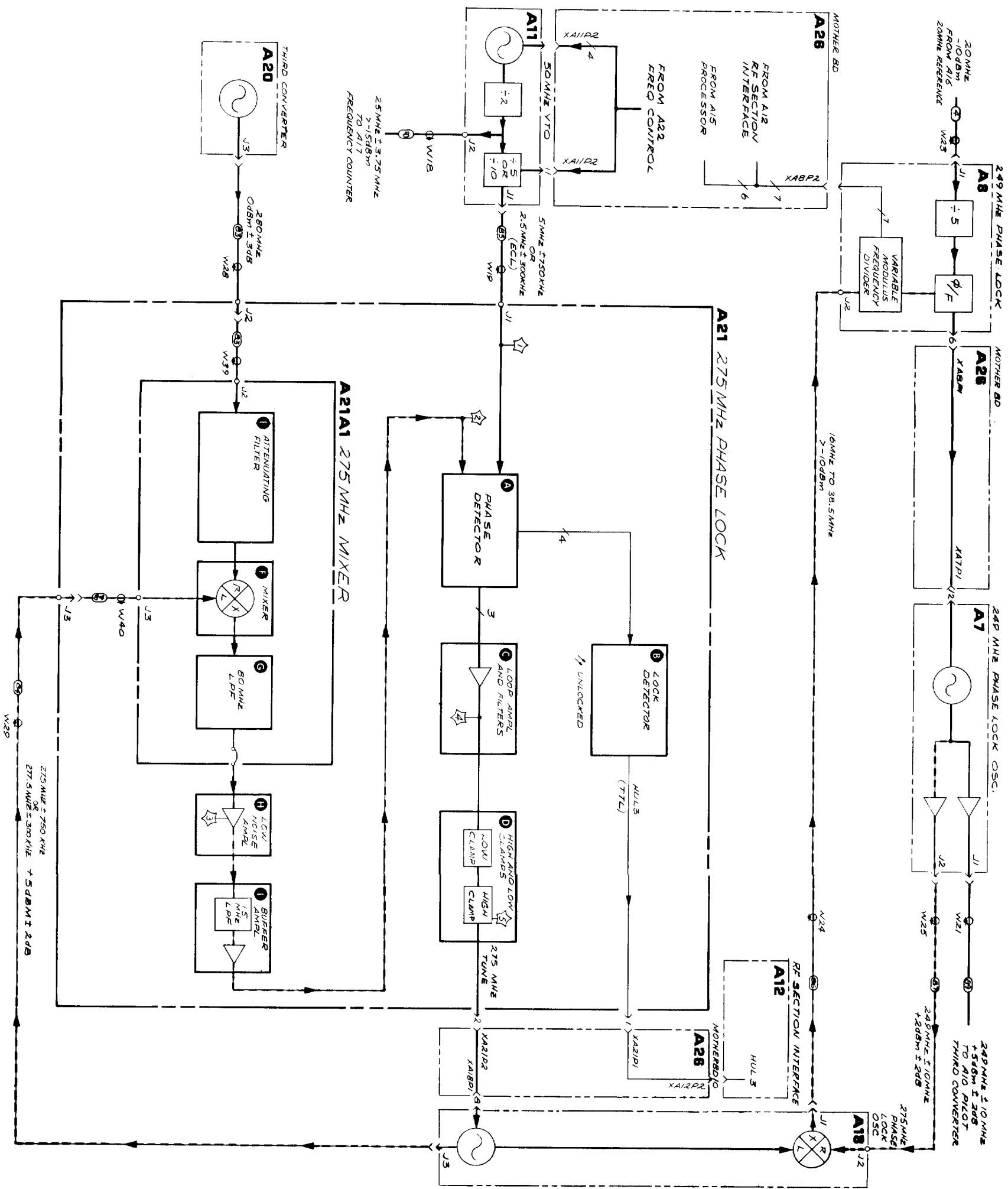
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21	85680-60016	0	1	275MHZ PHASE LOCK	28480	85680-60016
A21C1				NOT ASSIGNED		
A21C2	0160-2055	9	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C3				NOT ASSIGNED		
A21C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C5				NOT ASSIGNED		
A21C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C7				NOT ASSIGNED		
A21C8	0160-0174	9	6	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C9	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C9	0160-4084	8	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A21C10	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C11	0160-2307	4	1	CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A21C12	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A21C13	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C14				NOT ASSIGNED		
A21C15	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C16	0160-3536	3	2	CAPACITOR-FXD 620PF +-5% 100VDC MICA	28480	0160-3536
A21C17	0160-3536	3		CAPACITOR-FXD 620PF +-5% 100VDC MICA	28480	0160-3536
A21C19	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A21C20	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A21C21	0140-0196	3	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A21C22	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C23				NOT ASSIGNED		
A21C25	0160-0194	3	1	CAPACITOR-FXD .015UF +-10% 200VDC POLYE	28480	0160-0194
A21C26				CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21DS1	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A21Q1	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A21Q2	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A21Q3	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A21Q4	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A21Q5	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A21Q6	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A21R1	0757-0399	5	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A21TP1	0360-0124	3	8	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP5	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP6	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP7	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP8	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21U1	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A21U2	1810-0204	6	1	NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A21U3	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10132P
A21U4	1820-0223	0	1	IC OP AMP GP TO-99 PKG	3L585	CA301AT
A21U5	1826-0371	1	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LF256H
MISCELLANEOUS PARTS						
	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001
A21A1	85680-60033	1	1	275 MHZ MIXER	28480	85680-60033
A21A1C1-				NOT ASSIGNED		
A21A1C22				CAPACITOR-FDTHRU 56PF 10% 500V MICA	28480	0140-0074
A21A1C23	0140-0074	6	2	CAPACITOR-FDTHRU 100PF 10% 500V MICA	72902	666-053 01A0 101K
A21A1C24	0140-0077	9	1	CAPACITOR-FDTHRU 56PF 10% 500V MICA	28480	0140-0074
A21A1C25	0140-0074	6				
A21A1C26-				NOT ASSIGNED		
A21A1C28				CAPACITOR-FXD 15PF +-5% 200VDC CER 0+-30	28480	0160-4385
A21A1C29	0160-4385	2	1			
A21A1J1				NOT ASSIGNED		
A21A1J2				PART OF W39		
A21A1J3				PART OF W40		
A21A1L1-				NOT ASSIGNED		
A21A1L5				INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	28480	9100-2249
A21A1L6	9100-2249	6	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A21A1L7	9100-2250	9	2	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A21A1L8	9100-2250	9				

*Indicates factory selected value

TABLE 1. A21 275 MHz PHASE LOCK, REPLACEABLE PARTS (2 OF 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21A1R1-- A21A1R30 A21A1R31 A21A1R32	0698-7207 0698-7207	2 2	2	NOT ASSIGNED RESISTOR 61.9 1% .05W F TC=0+-100 RESISTOR 61.9 1% .05W F TC=0+-100	24546 24546	C3-1/8-T0-61R9-F C3-1/8-T0-61R9-F
A21A1U1-- A21A1U5 A21A1U6	0955-0063	0	1	NOT ASSIGNED MIXER-DOUBLE BALANCE PWR INP=200MW; PK	28480	0955-0063

*Indicates factory selected value



A21

FIGURE 1. A21 275 MHz PHASE LOCK, BLOCK DIAGRAM

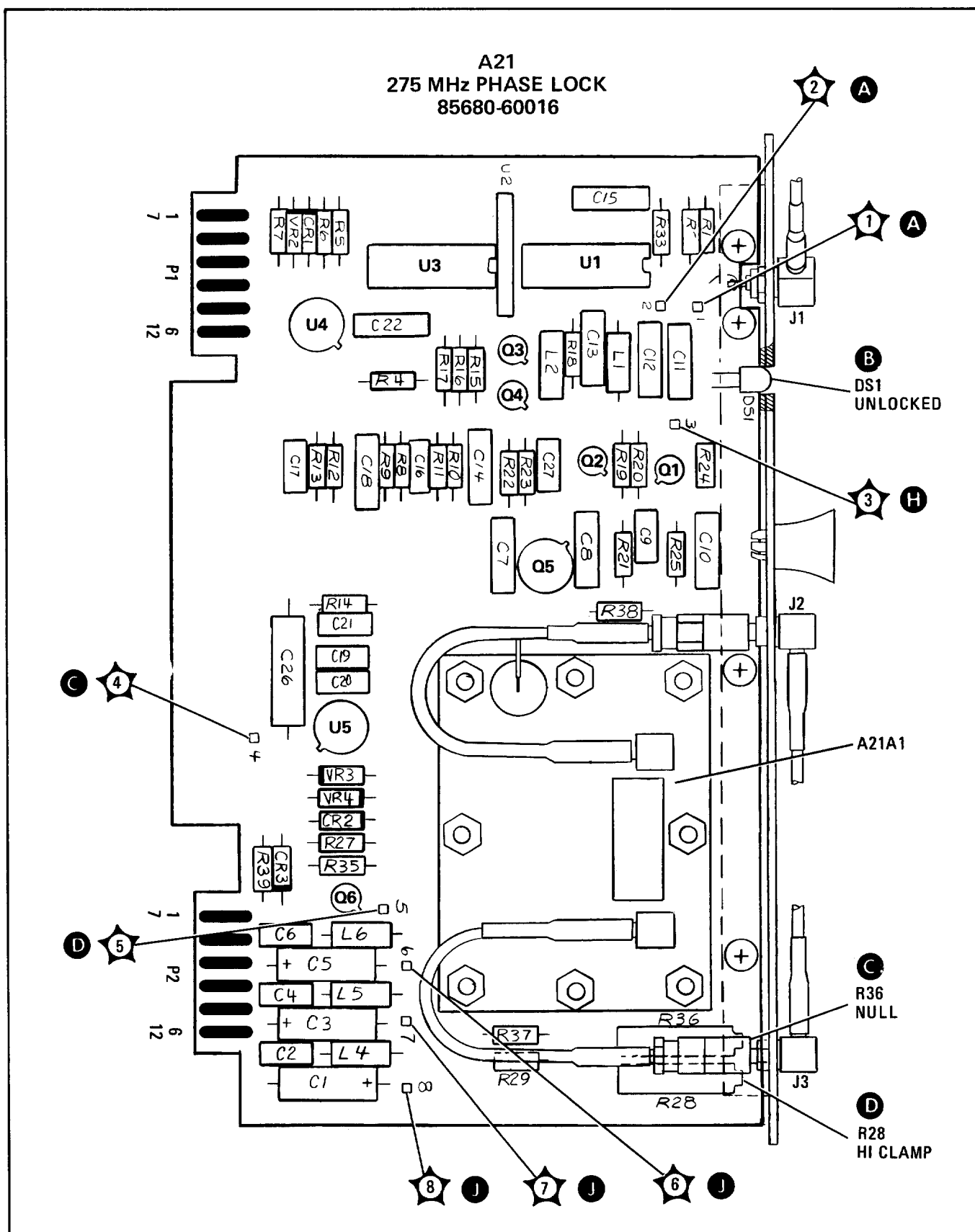
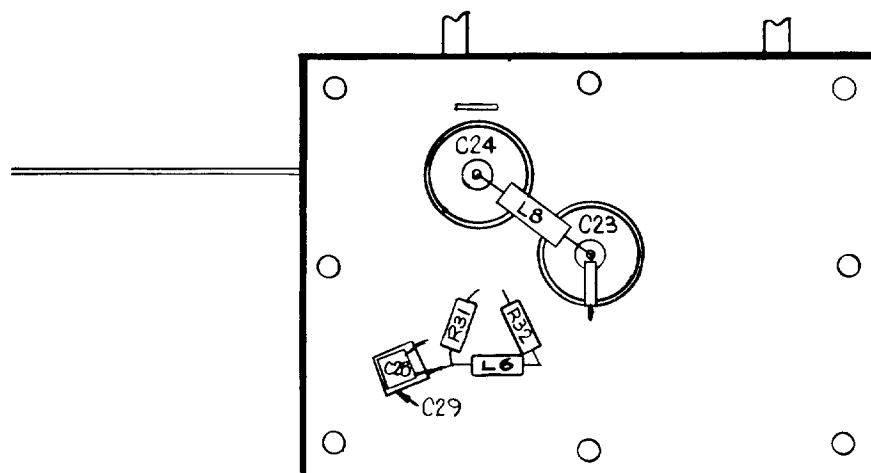
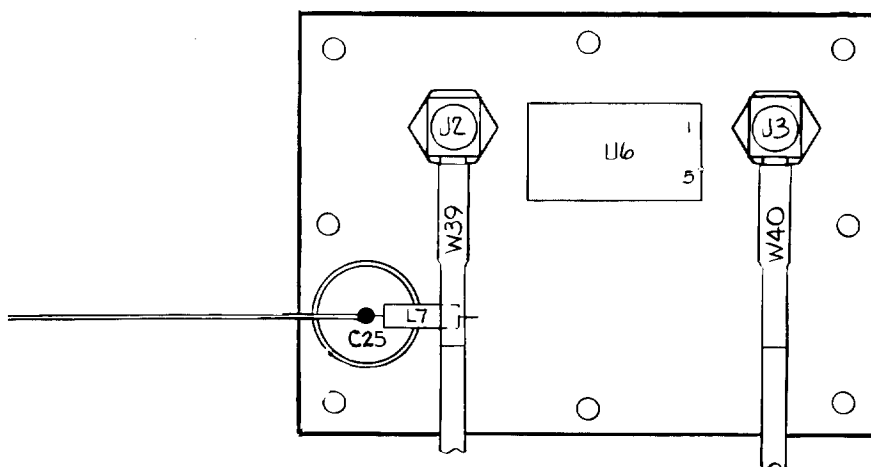


FIGURE 2. A21 275 MHz PHASE LOCK, COMPONENT LOCATIONS

A21A1
275 MHz MIXER
85680-60033



COMPONENT SIDE



CIRCUIT SIDE

FIGURE 3. A21A1 275 MHz PHASE LOCK, COMPONENT LOCATIONS

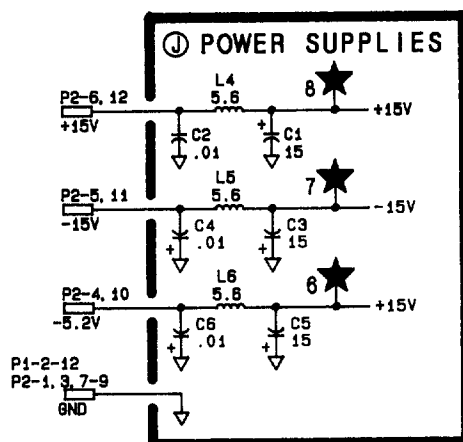
A21 275 MHZ PHASE LOCK 85680-60016

P 1

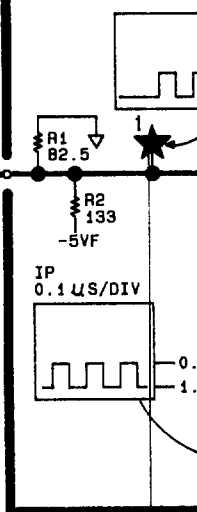
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HUL3	A12P2-10	B
7	GND		J
2	GND		J
8	GND		J
3	GND		J
9	GND		J
4	GND		J
10	GND		J
5	GND		J
11	GND		J
6	GND		J
12	GND		J

P 2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
7	GND		J
2	275 MHZ TUNE	A18, P1-8	D
8	GND		J
9	GND		J
4	-5.2V		J
10	-5.2V		J
5	-15V		J
11	-15V		J
6	+15V		J
12	+15V		J

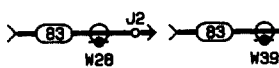
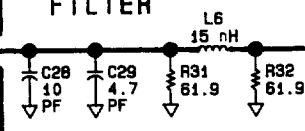
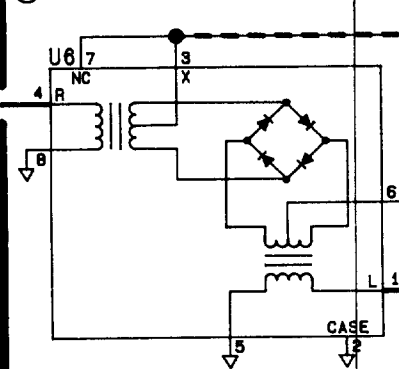


5 MHZ ± 750 KHZ OR
2.5 MHZ ± 300 KHZ
(ECL) FROM A11 50 MHZ
VOLTAGE TUNE
OSCILLATOR

PHASE DE

A21A1 275 MHZ MIXER 85680-60033

280 MHZ
0 DBM
 ± 3 DB
FROM A20
THIRD
CONVERTER

**ATTENUATING FILTER****MIXER (SEE NOTE 4)**



A21 9/10

- NOTES:
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
 2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROGRADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
 3. ECL LOGIC LEVELS ARE TYPICALLY:
-0.9V-LO $\overline{L}$ OBIC '1'-HIGH
-1.8V-LO $\overline{L}$ OBIC '0'-LOW
 4. UP PIN CONFIGURATION:
MARKED

1	2	3	4
$\square$	$\square$	$\square$	$\square$
0	0	0	0
5	6	7	8

 BOTTOM VIEW
 5. U2 (1000 Ω)
-
6. MNEMONIC TABLE:
- | MNEMONIC | DESCRIPTION |
|----------|----------------------------|
| HUL3 | HIGH-275 MHZ LOOP UNLOCKED |
7. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE AND EXIT RIGHT SIDE OF FUNCTION BLOCKS.

A22 FREQUENCY CONTROL, CIRCUIT DESCRIPTION

A22 Frequency Control provides tuning voltage to A11 50 MHz Voltage-Tuned Oscillator (VTO), current to A23A1 YIG-Tuned Oscillator (YTO), sweep to the selected oscillator, and bias to the YTO. It provides latching of data for A23 RF Converter, A6 YIG-Tuned Oscillator Phase Lock, and A11 50 MHz Voltage-Tuned Oscillator. It also indicates to A12 RF Section Interface an overrange of the phase lock voltage, and supplies a frequency analog voltage to A20 Third Converter.

Sweep Generator (A)

The Sweep Generator, with the Sweep Reference Voltage and the Sweep Generator Current Source, provides the sweep signal for the VTO and YTO and the horizontal display signal to the IF Section. A control line is provided so that the sweep may be stopped by A15 Controller.

The timing capacitor C16 is a stable polycarbonate capacitor which receives a constant drive current from Q11B to provide a ramp for sweeping frequency. The base-emitter voltage of Q11B sets the current. This voltage is determined by the Sweep Generator Current Source and by the output of U16A in the Sweep Reference Voltage circuit. U16A is offset and buffered by Q11A, Q9, and associated circuitry. Q11A and Q11B track thermally for temperature compensation. R90 and R92 provide gain to the op amp U16B. SLOW potentiometer R88 and FAST potentiometer R91 adjust sweep times to fit the particular characteristic curve of Q11. Q14 acts as a buffer when the sweep is stopped by the Sweep Stop Switch circuit (HSWP is low).

Q17, Q19, and associated circuitry buffer C16 and provide a usable drive for the Sweep.

Comparator U18 and associated circuitry detect the start voltage of the sweep and hold it at -5V when Reset Switch Q21 is turned off. R103 and C31 improve the stability of the feedback loop, and CR1 prevents leakage of the charge on C16 during sweep time.

U17B and associated circuitry provide an offset sweep of 0V to $+10\text{V}$ for horizontal display control to the IF Section.

Sweep Reference Voltage (B)

Voltage from Q10 is amplified to about $+10\text{V}$ and buffered by U16A. Q10 causes a variation in the voltage at TP15 of about $30\text{ mV}/^{\circ}\text{C}$ to aid in temperature compensation of the Sweep Generator. R96 and R97 provide gain, and C15 is a filter. R128 isolates TP15 from external loading at U16A pin 1. (During normal operation this voltage might vary from about $+9\text{V}$ to about $+11\text{V}$, depending on the ambient temperature.) SWP REF potentiometer R94 sets the positive input voltage to U16A.

Sweep Generator Current Source (C)

Q16, Q18, Q20, Q27, Q28, and Q29 are switches controlled by Latch U34, which is loaded by decoded address 5 (ADD 5). These transistors switch resistors to provide appropriate currents for selected sweep times. Current through Q12 (which is used for temperature compensation) causes a linear increase in the base-emitter voltage of Q11B, causing an exponential increase in sweep time. Thus when all six transistor switches are saturated, a 10-msec sweep will result, but if Q27 is *off*, a X10 multiplier is added, causing a 100-msec sweep (see schematic for other multipliers).

Sweep Stop Switch (E)

A logic 0 at the base of Q26 (HSWP is low) causes Q13 to divert charging current from timing capacitor C16 to ground, stopping the sweep. DS3 provides a sweep-stop indication on the board.

Address Decoder (D)

Decoder U35 decodes the Address Bus and routes a load pulse to each of the seven locations noted on the schematic. U36 inverts LBIO for U35.

Bus Address 6 Latch (F)

Latch U31 provides latching for functions elsewhere in the RF Section of the spectrum analyzer and turns on Reset Switch Q21 in the Sweep Generator. Decoded address 6 (ADD 6) loads U31.

Sweep Attenuator (G)

U17A, U14, and U13 provide an N/1023 Attenuator to the analog SWEEP voltage, while U29, U10 and associated circuitry provide attenuations of X1, X.1, and X.01. U14 is a multiplying digital-to-analog converter (DAC) whose reference (pin 17) sweeps $\pm 5V$ while its output, buffered by U13, sweeps $\pm 5V \times N/1023$, where N is the binary number at the U14 inputs. U30, U32, U33 latch data for the Sweep Attenuator and for A11 50 MHz Voltage-Tuned Oscillator. C27 narrows the bandwidth of U13 to lower noise in FM Coil sweeps.

Sweep Select Switches (H)

U24 latches control information for U7 and U20, which gate the attenuated sweep to a specific oscillator and ground unswept **lies**. The VTO SWEEP, YTO MAIN COIL SWEEP, and YTO FM COIL SWEEP are selectable.

Reference Voltages (I)

VR1 provides a voltage that is buffered and amplified by U12 and inverted by U15. These two op amp outputs provide tune reference voltages: $-10.285V$ YTO tuning reference and $+10.285V$ tuning reference. TUNE REF adjustment R17 sets these voltages. The $-10.285V$ YTO tuning reference is tested at TP13. C6, C7, and C12 provide noise filtering.

VTO Tune DAC (J)

U25, U26, U27, and U28 latch data for digital-to-analog converters (DACs) U9 and U6. U9, buffered by U8, converts the ten most-significant bits into a voltage which coarse-tunes the VTO. U6, buffered by U5, converts the ten least-significant bits. The output of U5 is attenuated approximately 1/500 by R6 through R9. R7 LSD VTO adjusts this attenuation. The attenuated voltage is used for fine tuning. U38 sums the voltages and provides the VTO tuning voltage. This tuning voltage should range from 0 to $+10.23V$ as observed at TP9. TP18 is used to measure the output of U9, TP7 the output of U6.

YTO Drive Circuits

The following circuits provide control currents or bias voltages to A23A1 YIG-Tuned Oscillator: YTO Tune DAC, YTO Main Coil Tune Driver, YTO FM Coil Driver, YTO Main Coil Fixed Driver, $-10V$ Bias, and YTO Filter.

YTO Tune DAC (K)

U4 is a 10-bit digital-to-analog converter (DAC) controlled by data latched in U22 and U23 and buffered by U3. Full scale output (adjusted by YTO potentiometer R25) should be $10.230V$ between zero setting and 1023 setting at the input to U4.

YTO Main Coil Tune Driver (L)

U1 sums SWEEP and YTO TUNE through R31 and R32. It drives Darlington pair Q8 and Q7 to provide a linear voltage-to-current function across R51. CR3 and CR4 are clamps. R35 and R36 provide gain. R48, VR7, and R49 provide 0V bias for Q8 and Q7. C24, R50, and CR8 provide startup compensation to the YTO magnet structure. STOP potentiometer R35 adjusts the stop point in YTO tuning.

YTO Main Coil Fixed Driver (N)

R34, R40, C18, and R41 provide a tuning reference voltage. U37 compares this to the voltage at the wiper of R39 START adjustment. The resulting voltage level is converted to a corresponding current by Q3 and Q4. This adjusts the start point of the YTO when the tuning DACs are set to zero.

YTO FM Coil Driver (M)

Q24 and Q25 provide a high-current voltage source for voltage-to-current conversion across FM SWP potentiometer R64 and R65 to drive the FM coil of the YTO. For spans ≥ 1 MHz and ≤ 20 MHz, the FM Coil Driver sweeps frequency. U19 drives Q24, Q25, R16, and R62 from the sweep- and phase-correction voltages summed by R30, R33 and R57, R58. C19, C20, C5, L4, and L5 filter a spurious response from the YTO phase lock loop.

– 10V Bias (P)

Differential pair Q23A and Q23B drive Q22 to provide a high-current – 10V bias to the YTO. R53 is a current source, and R55, R56 feed back the output voltage to the base of Q23B.

YTO Filter (R)

Q6 acts to switch Q5, which switches C26 and R47 across the main coil of the YTO. In FM COIL and VTO sweeps, this helps reduce open-loop noise in the YTO. VR6 and CR5 protect C26 and Q5 from inductive flyback. R45, R46, and VR5 are level-shifters.

Frequency Analog Voltage (O)

AMPL CAL is a voltage to compensate for gain rolloff in the signal first converter and to set IF gain. It results from the summing of the YTO TUNE and YTO MAIN COIL SWEEP voltages with the REF LEVEL CAL voltage from the front panel. U21C is a buffer, and U21D sums the two inputs. Potentiometer R66 provides the TILT adjustment in wide spans, and CR2 provides temperature compensation for IF gains.

YTO Phase Lock Limit Indicators (Q)

The phase-correction voltage must not exceed ± 5 V for best operation, so U21A and U21B detect these limits and provide visual indications (DS1 and DS2) and logic levels to A12 RF Section Interface. VR8 and VR9 limit the positive swing of the output voltage, while CR6 and CR7 limit the negative swing.

A22 FREQUENCY CONTROL, TROUBLESHOOTING

The A22 Frequency Control assembly generates the sweep ramp and tune voltages used by the swept oscillators in the analyzer. A key element in this operation is the 10-bit DAC. At the end of this troubleshooting information is a short theory on 10-bit DACs. Verification of most functional blocks on this assembly can be made without removing it from the instrument.

Sweep Generator

Operation of the Sweep Generator can be checked with the KSF () function. Using sweep times of 20 msec, 30 msec, 50 msec, 100 msec, 1 sec, and 100 sec and KSF, the Sweep Generator Current Source (C) circuitry is exercised. The sweep time is 10 msec times the multiplier value for each switch that is off. The 100 sec measurement may show a reading such as 8 sec. The internal counter resets to zero at 100 sec. Thus, the proper reading would be 108 sec.

Figure 1 shows the waveforms in the Sweep Generator. The sweep ramp is generated in the following manner. Initially, C16 is charged to -5V and Q21 is on. Current from Q11B charges C16 until it reaches $+5\text{V}$. It is held at this level because HSWP goes low. The reset pulse turns Q21 off, causing U18 pin 6 to go negative, forward-biasing CR1 and discharging C16 to -5V (i.e., until U18 pin 6 reaches $+3.11\text{V}$). When HSWP goes high, a new sweep is started. LED DS3 is on when the sweep is stopped.

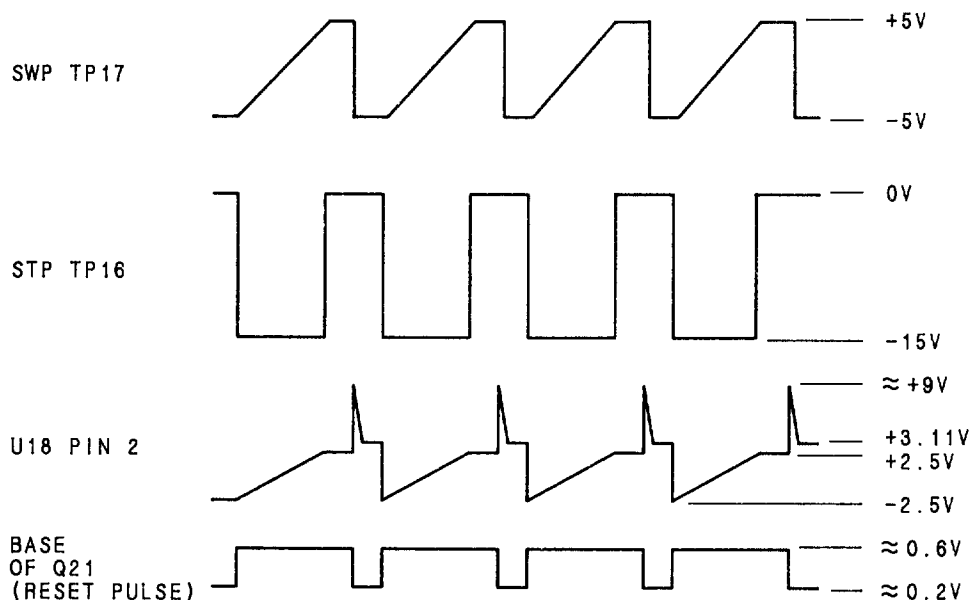


FIGURE 1. A22 SWEEP GENERATOR WAVEFORMS

Sweep Attenuator

The Sweep Attenuator is a 10-bit DAC whose reference voltage is swept from -5V to $+5\text{V}$. U13 pin 6 is the $\pm 5\text{V}$ sweep times $N/1024$, where N is supplied by the processor. This output is multiplied by 1, 0.1, or 0.01 as shown in Table 1, depending on the frequency span.

TABLE 1. SWEEP ATTENUATOR MULTIPLIERS vs FREQUENCY SPANS

Frequency Span	X1 (U29B)	X0.1 (U29A)	X0.01 (U29C)
Span > 170 MHz	ON		
20 MHz < Span ≤ 170 MHz		ON	
2 MHz < Span ≤ 20 MHz	ON		
1 MHz < Span ≤ 2 MHz		ON	
50 kHz < Span ≤ 1 MHz	ON		
5 kHz < Span ≤ 50 kHz		ON	
Span ≤ 5 kHz			ON

Each time a new multiplier is switched in, the output at U13 pin 6 will be the full $\pm 5V$ sweep ramp.

This attenuated sweep is routed to the appropriate sweep circuit depending on the frequency span, as shown in Table 2.

TABLE 2. SWEEP CIRCUIT vs FREQUENCY SPANS

Frequency Span	Sweep Circuit
Spans > 20 MHz	YTO Main Coil
1 MHz < Span ≤ 20 MHz	YTO FM Coil
Span ≤ 1 MHz	50 MHz VTO

Due to rounding error in the processor, the switching points of 20 MHz and 1 MHz are not exact when using the RPG to set the Frequency Span.

All lines are grounded when not used. The YTO is being phase locked during the 0V time period that occurs on the voltages at TP10, TP8, TP5, and TP4.

Operation of the Sweep Attenuator DAC can be verified by using   (KSJ). Measure the voltage at TP10. Set the analyzer to  Sweep,  Trigger. Key in KSJ and 0 GHz. Press the DATA  key repeatedly. The voltage at TP10 should start at approximately 0V and double with each step to $-5V$. If  Trigger is used, it will step to $+5V$. It is a good procedure to use the DATA keys when checking the various DACs. This way, each bit is checked for operation.

TABLE 3. A22 FREQUENCY CONTROL, REPLACEABLE PARTS (1 OF 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22	85600-60156	9	1	FREQUENCY CONTROL	28480	85600-60156
A22C1	0180-0197	8	9	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C2				NOT ASSIGNED		
A22C3				NOT ASSIGNED		
A22C4				NOT ASSIGNED		
A22C5	0160-2253	9	1	CAPACITOR-FXD 6.0PF +- .25PF 500VDC CER	28480	0160-2253
A22C6	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C7	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C8	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C9	0160-2055	9	7	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C10	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C12	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C13	0160-3448	6	3	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A22C14	0160-3448	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A22C15	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C16	0160-3402	2	1	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A22C17	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	300D107G025D02
A22C18	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C19	0160-2306	3	1	CAPACITOR-FXD 27PF +-5% 300VDC MICA	28480	0160-2306
A22C20	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A22C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C24	0180-1745	4	1	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A22C25				NOT ASSIGNED		
A22C26	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A22C27	0140-0198	5	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DK15F201T0300WV1CR
A22C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C29	0160-3448	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A22C30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C31	0160-2204	0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A22C32	0160-4298	6	1	CAPACITOR-FXD 4700PF +-20% 250VDC CER	56289	C067F251H472MG22-CDH
A22C33	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22CR1	1901-0586	0	1	DIODE-GEN PRP 30V 25MA TO-72	28480	1901-0586
A22CR2	1901-0040	1	6	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR5	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A22CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR9	1901-0535	9	4	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A22CR10	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A22CR11	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A22CR12	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A22DS1	1990-0487	7	3	LED-LAMP LUM-INT=1MCD IF=20MA-MAX IVR=5V	28480	5082-4584
A22DS2	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A22DS3	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A22J1	1200-0508	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A22J2				NOT ASSIGNED		
A22J3	1250-0543	8	2	CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A22J4	1250-0543	8		CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A22L1	08558-80011	6	3	FILTER COIL BLUE	28480	08558-80011
A22L2	08558-80011	6		FILTER COIL BLUE	28480	08558-80011
A22L3	08558-80011	6		FILTER COIL BLUE	28480	08558-80011
A22L4	9100-1651	2	1	INDUCTOR RF-CH-MLD 750UH 5% .2DX.45LG	28480	9100-1651
A22L5	9100-1648	7	1	INDUCTOR RF-CH-MLD 560UH 5% .2DX.45LG	28480	9100-1648
A22MP1	4040-0750	7	2	EXTR PC BD RED	28480	4040-0750
A22MP2	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A22MP3	4040-0750	0		EXTR PC BD RED	28480	4040-0750
A22MP4	1205-0011	0	3	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A22MP5	1251-4459	5	1	CLIP-CABLE PLUG RTNG-DUAL INLINE 14 CONT	28480	1251-4459
A22MP6				NOT ASSIGNED		
A22MP7				NOT ASSIGNED		
A22MP8	2190-0890	1	4	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A22Q1				NOT ASSIGNED		
A22Q2				NOT ASSIGNED		
A22Q3	1854-0023	9	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A22Q4	1854-0039	7	4	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	31585	2N3053S
A22Q5	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251

*Indicates factory selected value

TABLE 3. A22 FREQUENCY CONTROL, REPLACEABLE PARTS (2 OF 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22Q6	1853-0007	7	10	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A22Q7	1854-0039	7		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	3L505	2N3053S
A22Q8	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A22Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q10	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q11	1853-0388	7	1	TRANSISTOR-DUAL PNP PD=600MW	28480	1853-0388
A22Q12	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q13	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	20400	1855-0020
A22Q14	1855-0209	5	1	TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0209
A22Q15				NOT ASSIGNED		
A22Q16	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q17	1855-0385	2	1	TRANSISTOR J-FET 2N4117A N-CHAN D-MODE	17856	2N4117A
A22Q18	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q19	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A22Q20	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q21	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q22	1854-0039	7		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	3L505	2N3053S
A22Q23	1853-0316	1	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A22Q24	1854-0039	7		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	3L505	2N3053S
A22Q25	1853-0001	1	1	TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A22Q26	1853-0020	4	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A22Q27	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q28	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q29	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22R1-				NOT ASSIGNED		
A22R5				RESISTOR 9.09K 1% .125W F TC=0+-50	19701	MF4C1/8-T2-9091-B
A22R6	0698-7929	5	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A22R7	2100-2574	3	1	RESISTOR 100 1% .125W F TC=0+-25	28480	0698-6323
A22R8	0698-6323	1	1	RESISTOR 100 1% .125W F TC=0+-25	28480	0698-6323
A22R9	0698-6353	7	3	RESISTOR 50K 1% .125W F TC=0+-25	28480	0698-6353
A22R10	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A22R11	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R12				NOT ASSIGNED		
A22R13	0811-1185	5	9	RESISTOR 10K .01% .05W PWV TC=0+-10	20940	140-1/20-1002-T
A22R14	0811-1185	5		RESISTOR 10K .01% .05W PWV TC=0+-10	20940	140-1/20-1002-T
A22R15				NOT ASSIGNED		
A22R16	0698-3439	4	2	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A22R17	2100-4020	8	1	RESISTOR-TRMR 2K 10% HF SIDE-ADJ 26-TRN	28480	2100-4020
A22R18	0757-0274	5	4	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A22R19	0757-0442	9	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R20	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R21	0698-8889	8	1	RESISTOR 16K .01% .125W F TC=0+-10	28480	0698-8889
A22R22	0811-1185	5		RESISTOR 10K .01% .05W PWV TC=0+-10	20940	140-1/20-1002-T
A22R23	0811-1185	5		RESISTOR 10K .01% .05W PWV TC=0+-10	20940	140-1/20-1002-T
A22R24	0811-1185	5		RESISTOR 10K .01% .05W PWV TC=0+-10	20940	140-1/20-1002-T
A22R25	2100-1755	0	2	RESISTOR-TRMR 100 5% WW SIDE-ADJ 1-TRN	28480	2100-1755
A22R26				NOT ASSIGNED		
A22R27	0698-7794	2	1	RESISTOR 10K .25% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R28	0698-5439	8	1	RESISTOR 1K .25% .125W F TC=0+-50	28480	0698-5439
A22R29	0698-8322	4	1	RESISTOR 111 .25% .125W F TC=0+-100	19701	MF4C1/8-T0-111R-C
A22R30	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A22R31	0811-1185	5		RESISTOR 10K .01% .05W PWV TC=0+-10	20940	140-1/20-1002-T
A22R32	0811-1185	5		RESISTOR 10K .01% .05W PWV TC=0+-10	20940	140-1/20-1002-T
A22R33	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A22R34	0698-6348	0	1	RESISTOR 3K 1% .125W F TC=0+-25	28480	0698-6348
A22R35	2100-3962	5	2	RESISTOR-TRMR 5K 10% HF SIDE-ADJ 26-TRN	28480	2100-3962
A22R36	0698-6353	7		RESISTOR 50K 1% .125W F TC=0+-25	28480	0698-6353
A22R37	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R38	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R39	2100-3962	5		RESISTOR-TRMR 5K 10% HF SIDE-ADJ 26-TRN	28480	2100-3962
A22R40	0698-6353	7		RESISTOR 50K 1% .125W F TC=0+-25	28480	0698-6353
A22R41	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A22R42	0698-8885	4	1	RESISTOR 20K .01% .125W F TC=0+-10	28480	0698-8885
A22R43	0757-0401	0	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R44	0811-3492	1	2	RESISTOR 133 1% 12W PW TC=0+-2	28480	0811-3492
A22R45	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R46	0757-0417	8	1	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A22R47	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A22R48	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A22R49	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A22R50	0757-0279	0	6	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R51	0811-3492	1		RESISTOR 133 1% 12W PW TC=0+-2	28480	0811-3492
A22R52	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R53	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F

*Indicates factory selected value

TABLE 3. A22 FREQUENCY CONTROL, REPLACEABLE PARTS (3 OF 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22R54	0698-3393	9	1	RESISTOR 28.7 1% .5W F TC=0+-100	20480	0698-3393
A22R55	0698-3155	1	4	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R56	0698-7050	3	1	RESISTOR 4.46K .5% .125W F TC=0+-50	20480	0698-7050
A22R57	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R58	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R59	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R60				NOT ASSIGNED		
A22R61	0698-3398	4	2	RESISTOR 46.4 1% .5W F TC=0+-100	20480	0698-3398
A22R62	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R63	0698-3398	4		RESISTOR 46.4 1% .5W F TC=0+-100	20480	0698-3398
A22R64	2100-1755	0		RESISTOR-TRMR 100 5% WW SIDE-ADJ 1-TRN	20480	2100-1755
A22R65	0757-0795	5	1	RESISTOR 75 1% .5W F TC=0+-100	19701	MF-1/2-T0-75R0-F
A22R66	2100-2522	1	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A22R67	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A22R68	0757-0129	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R69	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R70	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R71	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R72	0698-3158	4	6	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R73	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R74	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R75	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R76	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R77	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R78	0698-7421	2	2	RESISTOR 40K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-4002-C
A22R79	0698-3454	3	1	RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A22R80	0690-3451	0	1	RESISTOR 133K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1333-F
A22R81	0698-8848	9	1	RESISTOR 57.2K .25% .125W F TC=0+-100	20480	0698-8848
A22R82	0698-7421	2		RESISTOR 40K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-4002-C
A22R83	0698-3194	8	1	RESISTOR 20K .25% .125W F TC=0+-50	03908	PMES5-1/8-T2-2002-C
A22R84	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A22R85	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R86	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R87	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A22R88	2100-3109	2	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A22R89	0698-3457	6	1	RESISTOR 316K 1% .125W F TC=0+-100	20480	0698-3457
A22R90	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A22R91	2100-3052	4	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	02111	43P500
A22R92	0698-3446	3	1	RESISTOR 303 1% .125W F TC=0+-100	24546	C4-1/8-T0-303R-F
A22R93	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A22R94	2100-3154	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A22R95	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R96	0698-3152	8	1	RESISTOR 3.46K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3461-F
A22R97	0757-0459	8	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A22R98	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A22R99	0603-3355	2	1	RESISTOR 3.3M 5% .25W FC TC=-900/+1100	01121	CB3355
A22R100	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R101	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A22R102	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R103	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R104	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R105	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A22R106	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A22R107	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A22R108	0698-6360	6	5	RESISTOR 10K .1% .125W F TC=0+-25	20480	0698-6360
A22R109	0698-6619	8	1	RESISTOR 15K .1% .125W F TC=0+-25	20480	0698-6619
A22R110	0698-6322	0	1	RESISTOR 4K .1% .125W F TC=0+-25	20480	0698-6322
A22R111	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	20480	0698-6360
A22R112	0698-8865	0	1	RESISTOR 4.45K .1% .125W F TC=0+-25	20480	0698-8865
A22R113				NOT ASSIGNED		
A22R114	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R115				NOT ASSIGNED		
A22R119				NOT ASSIGNED		
A22R120	0690-3161	9	3	RESISTOR 30.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3032-F
A22R121	0698-3161	9		RESISTOR 30.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3032-F
A22R122	0690-3161	9		RESISTOR 30.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3032-F
A22R123	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R124	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R125				NOT ASSIGNED		
A22R126	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R127	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A22R128	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R129	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A22R130	0811-1185	5		RESISTOR 10K .01% .05W PWM TC=0+-10	20940	140-1/20-1002-T
A22R131	0811-1185	5		RESISTOR 10K .01% .05W PWM TC=0+-10	20940	146-1/20-1002-T

*Indicates factory selected value

TABLE 3. A22 FREQUENCY CONTROL, REPLACEABLE PARTS (4 OF 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22R132	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	20480	0698-6360
A22R133	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	20480	0698-6360
A22R134	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	20480	0698-6360
A22R135	0698-8949	1	1	RESISTOR 20.57K .1% .125W F TC=0+-25	20480	0698-8949
A22R136	0698-8948	0	1	RESISTOR 19.46K .1% .125W F TC=0+-25	20480	0698-8948
A22U1	1026-0229	8	7	IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-05CJ
A22U2	1026-0229	8		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-05CJ
A22U3	1026-0229	8		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-05CJ
A22U4	1026-0604	9	4	IC CONV 12-B-D/A 18-DIP-C PKG	20480	1026-0604
A22U5	1026-0229	8		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-05CJ
A22U6	1026-0604	9		IC CONV 12-B-D/A 18-DIP-C PKG	20480	1026-0604
A22U7	1026-0416	5	2	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A22U8	5180-2314	0	2	IC OSC M1 OP AMP	20480	5180-2314
A22U9	1026-0604	9		IC CONV 12-B-D/A 18-DIP-C PKG	20480	1026-0604
A22U10	1026-0229	8		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-05CJ
A22U11				NOT ASSIGNED		
A22U12	1026-0471	2	2	IC OP AMP LOW-DRIFT TO-99 PKG	20480	1026-0471
A22U13	1026-0229	8		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-05CJ
A22U14	1026-0604	9		IC CONV 12-B-D/A 18-DIP-C PKG	20480	1026-0604
A22U15	1026-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	20480	1026-0471
A22U16	5081-8117	3	2	SCREEN 1026-0092	20480	5081-8117
A22U17	5081-8117	3		SCREEN 1026-0092	20480	5081-8117
A22U18	1026-0371	1	2	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LF256H
A22U19	1026-0371	1		IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LF256H
A22U20	1026-0417	6	1	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A22U21	1026-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P
A22U22	1020-1196	8	12	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U23	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U24	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U25	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U26	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U27	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U28	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U29	1026-0416	5		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A22U30	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U31	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U32	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U33	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U34	1020-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U35	1020-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS130N
A22U36	1020-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A22U37	1026-0229	8		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-05CJ
A22U38	5180-2314	0		IC OSC M1 OP AMP	20480	5180-2314
A22U39				NOT ASSIGNED		
A22VR1	1902-0625	0	1	DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829
A22VR2				NOT ASSIGNED		
A22VR3				NOT ASSIGNED		
A22VR4				NOT ASSIGNED		
A22VR5	1902-0184	6	1	DIODE-ZNR 16.2V 5% DO-35 PD=.4W	20480	1902-0184
A22VR6	1902-3059	0	1	DIODE-ZNR 3.03V 5% DO-35 PD=.4W	20480	1902-3059
A22VR7	1902-0033	4	1	DIODE-ZNR 1N823 6.2V 5% DO-7 PD=.4W	24046	1N823
A22VR8	1902-3036	3	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	20480	1902-3036
A22VR9	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	20480	1902-3036

*Indicates factory selected value

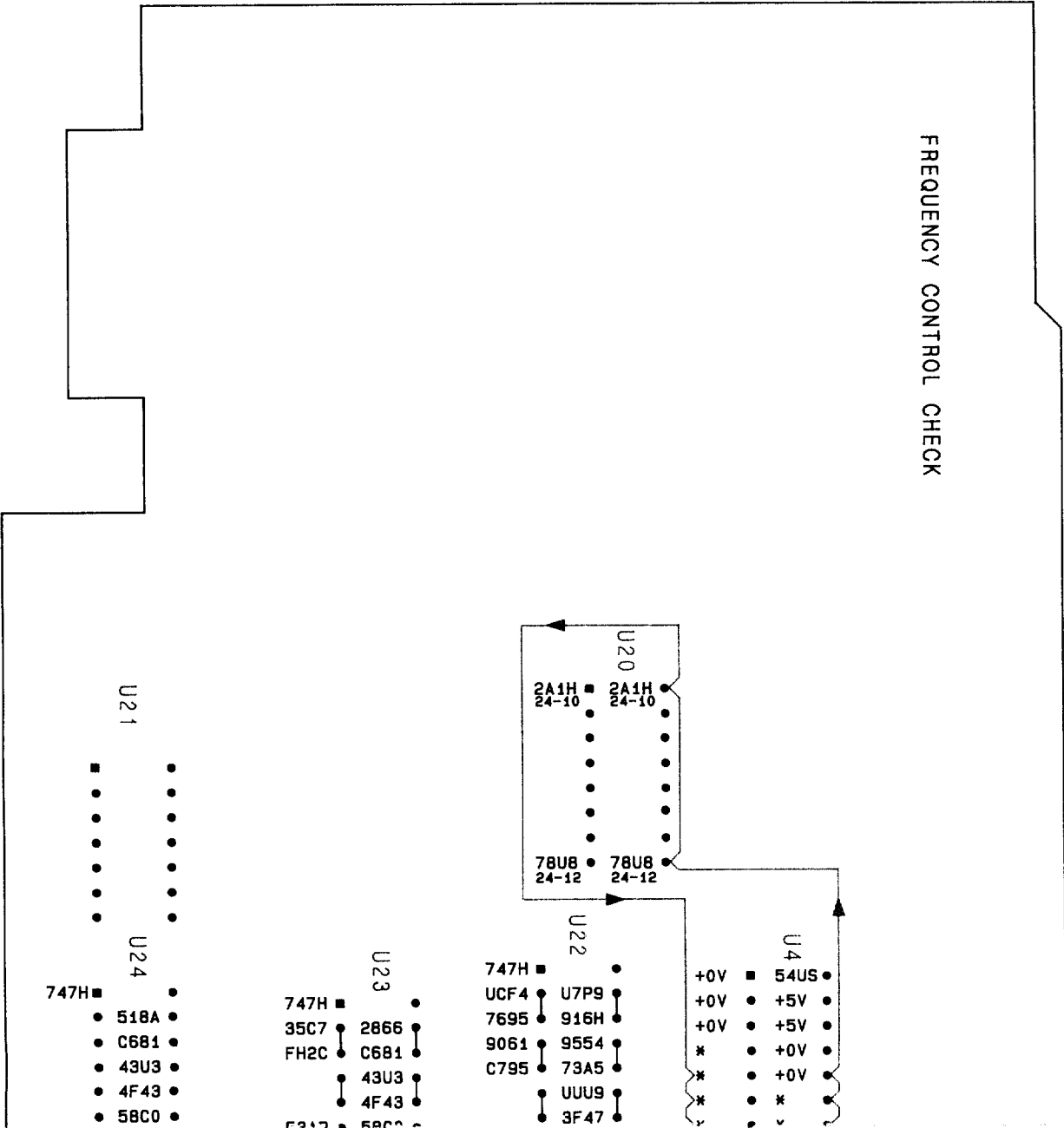
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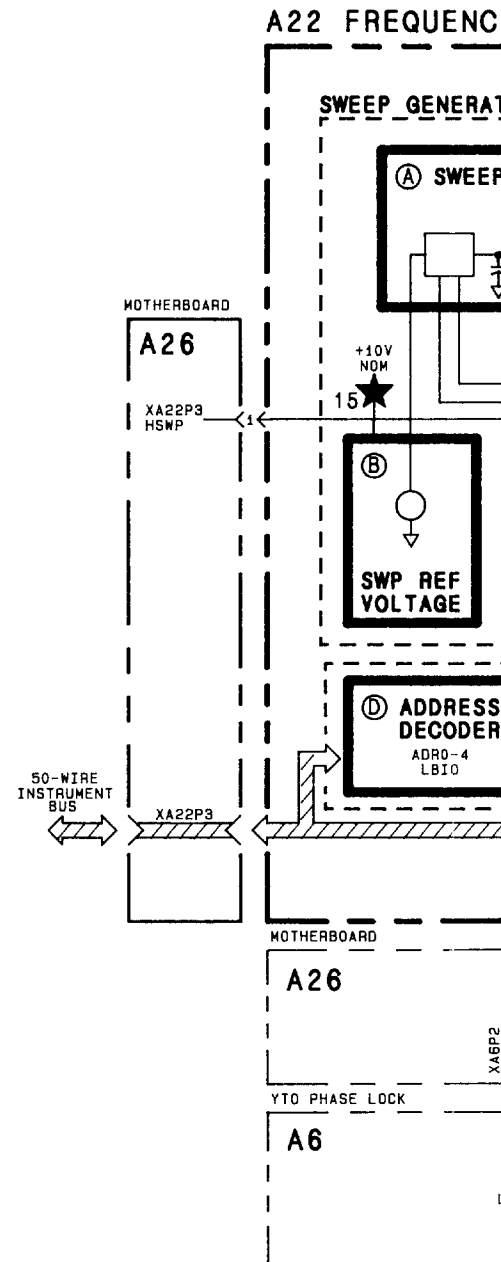
- FOR INSTRUCTIONS ON THE USE OF SIGNATURE ANALYSIS DIAGRAMS
- READ THE SIGNATURE ANALYSIS DESCRIPTION SECTION OF THIS MANUAL.
- FOR TROUBLESHOOTING INFORMATION REFER TO THE A3 DIGITAL STORAGE SECTION.

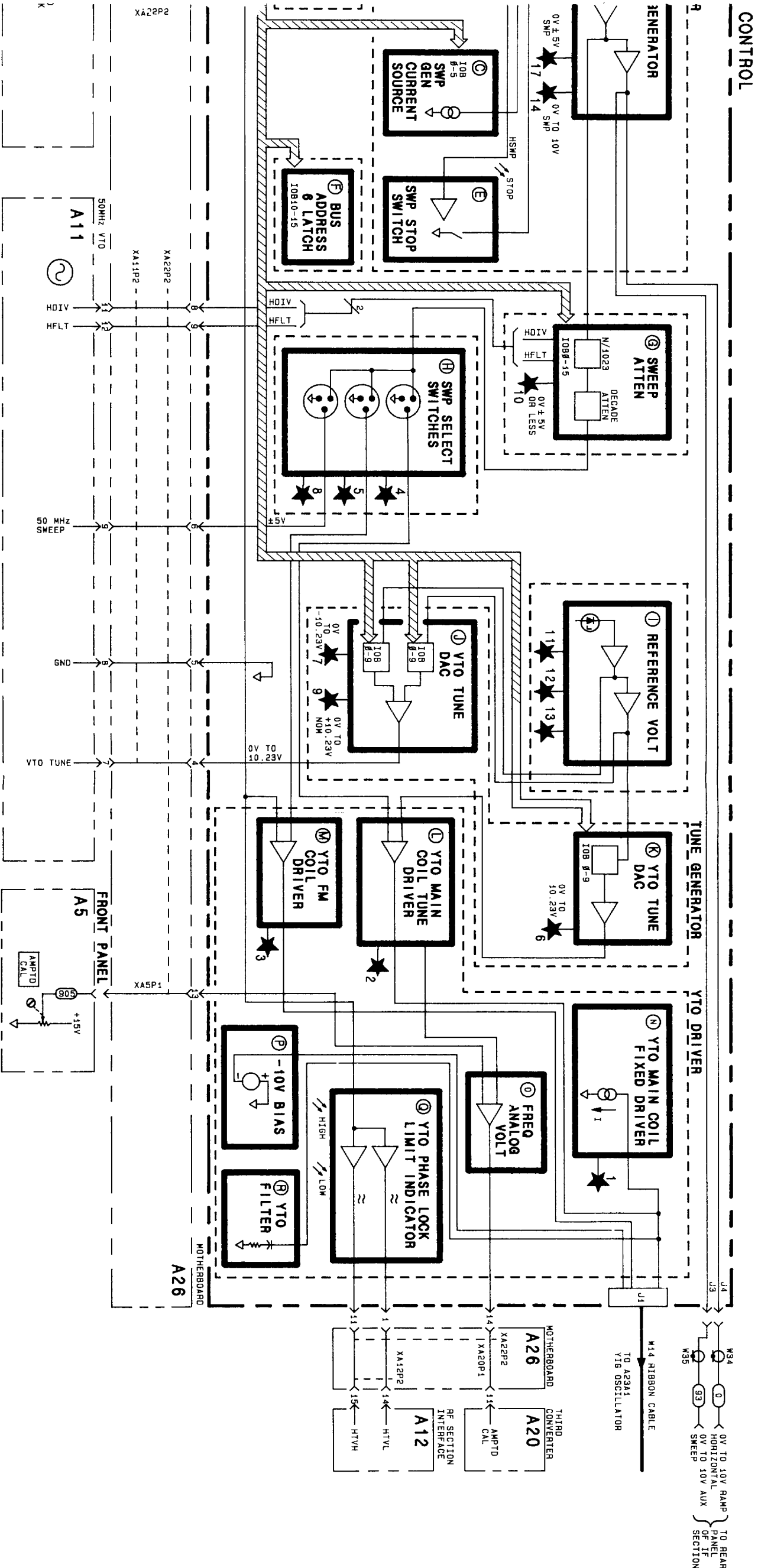
FREQUENCY CONTROL CHECK

SPECTRUM ANALYZER CONNECTIONS:
JUMPER A15TP4 (T0) TO A15TP8 (STS)
JUMPER A15TP1-4 (T0) TO A15TP2 (STS)

SIGNATURE ANALYZER CONNECTIONS:
CLOCK TO A15TP2 (I/O)
START A15TP4 (T0)
STOP TO A15TP5 (T1)
POD GND TO A15TP9
A15TP1-2 (I/O)
A15TP1-4 (T0)
A15TP1-5 (T1)
A15TP3 (GND)







A22

FIGURE 3. A22 FREQUENCY CONTROL, BLOCK DIAGRAM

A22 13/14

A22 15/16

RF SECTION

A22 FREQUENCY CONTROL

85680-60156 (SHEET 1 OF 2)

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		S
7	GND		S
2	+20V		R
8	+20V		R
3	NC		
9	NC		
4	-15V		S
10	-15V		S
5	NC		
11	NC		
6	+15V		S
12	+15V		S

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HTVL	A12, P2-14	Q
11	HTVH	A12, P2-15	Q
2	YTO LOCK	A6, P2-8	M
12	NC		
3	NC		
13	AMPTD CAL	A5, P1-1	O
4	50 MHz TUNE	A11, P2-7	J
14	AMPTD CAL	A20, P1-11	O
5	50 MHz GND	A11, P2-8	J
15	GND		S
6	50 MHz SWEEP	A11, P2-9	H
16	GND		S
7	NC		
17	LLOH	A23, P1-1, 2	F
8	HDIV	A11, P2-11	G
18	LHLD	A6, P2-9	F
9	HFLT	A11, P2-12	G
19	HBWM	A6, P2-12	F
10	HGND	A6, P2-10	F
20		NC	F

P3

PIN	SIGNAL
1	HSWP
16	HSWP
2	IOB15
17	IOB14
3	IOB13
18	IOB12
4	IOB11
19	IOB10
5	IOB9
20	IOB8
6	IOB7
21	IOB6
7	IOB5
22	IOB4
8	IOB3
23	IOB2
9	IOB1
24	IOB0
10	NC
25	ADR4
11	ADR3
26	ADR2
12	ADR1
27	ADR0
13	LBIC
28	LBIC
14	GND
29	GND
15	+5V
30	+5V

J1

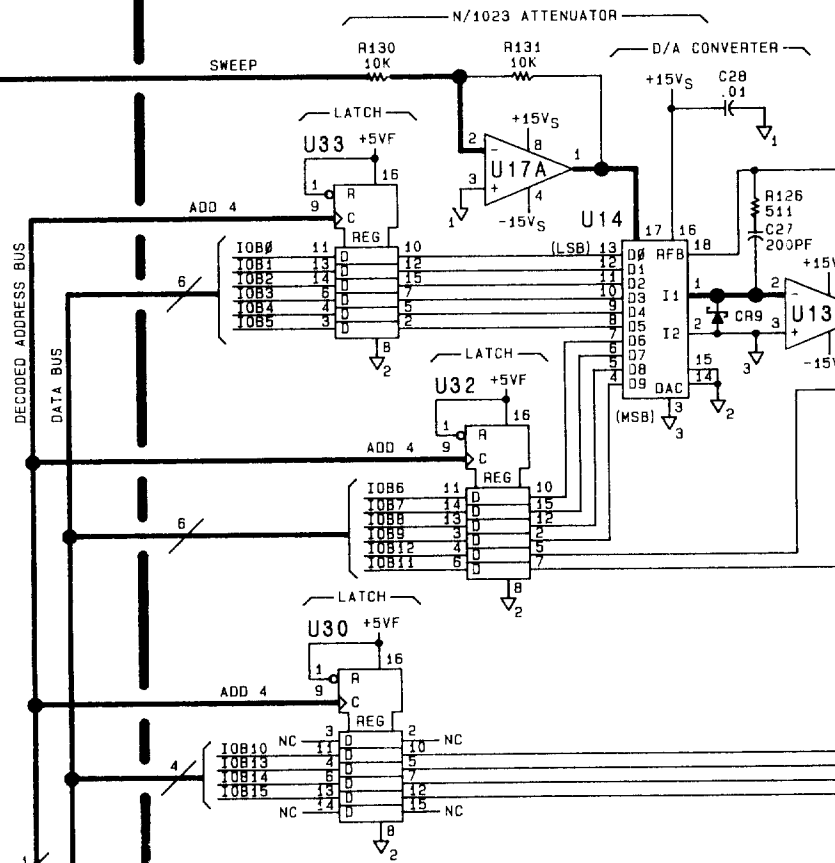
PIN	SIGNAL
1	GND
2	NC
3	+20V
4	NC
5	NC
6	-10V
7	NC
8	-10V
9	NC
10	+20V
11	MAIN COIL
12	NC
13	NC
14	FM COIL

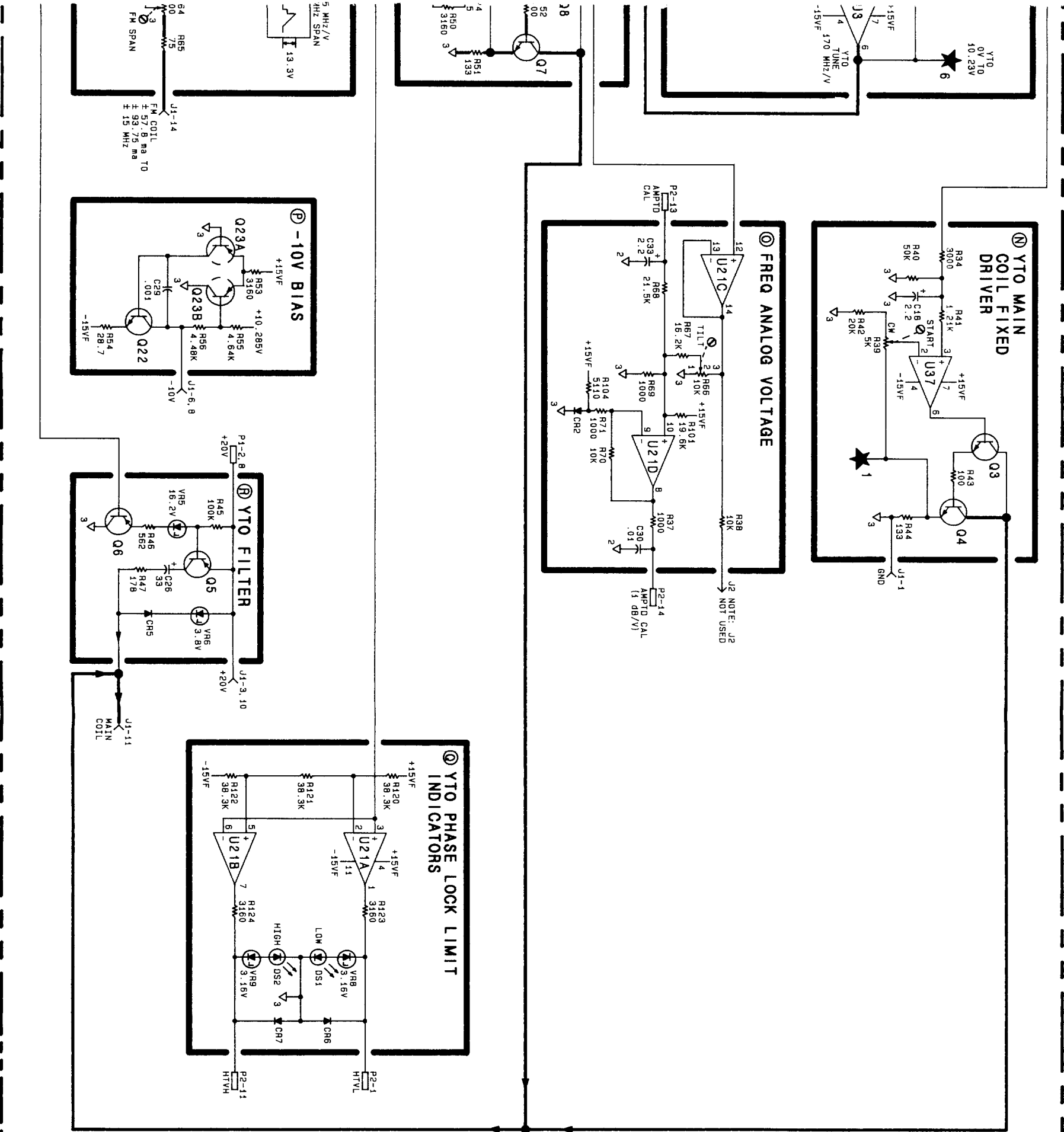
SERIAL PREFIX: 2408A

A22 FREQUENCY CONTROL 85680-60156 (SHEET 2 OF 2)

FROM 1ST
SHEET

⑥ SWEEP ATTENUATOR





NOTES:

- REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
- UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
- TEST VOLTAGES ASSUME INSTRUMENT PRESET (I.P.) CONDITION UNLESS NOTED.
- MEMORNIC TABLE:

MEMORNIC	DESCRIPTION
HTVL	HIGH-TUNE VOLTAGE LOW
HTVH	HIGH-TUNE VOLTAGE HIGH
LLOH	LOW INDICATES 2ND LO SHIFTED HIGH (1753.6 MHz)
HDIY	HIGH-TURN ON -2 ON A11 50 MHz YTO
LHLD	LOW-HOLD PHASE LOCK VOLTAGE ON AS YTO PHASE LOCK
HELT	HIGH-TURN ON FILTER ON 50 MHz YTO
HBMW	HIGH-WIDE YTO LOOP 84 (100 KHz) AS YTO PHASE LOCK
HGND	HIGH-GROUND OUTPUT OF PHASE DET., AS YTO PHASE LOCK
HSPN	HIGH-SWEEPING
IOB-15	INST. BUS DATA BITS 0-15
ADR-4	INST. BUS ADDRESS BITS 0-4
ADD-7	DECODED ADDRESS BUS BITS 0-7
LBIO	LOW-BOTTOM BOX I/O STROBE

- U7, 20 AND 29 ARE QUAD JFET ANALOG SWITCHES. THE SWITCHES IN U7 AND U29 ARE CLOSED WHEN THEIR CONTROL INPUTS (PINS 1, 8, 9, AND 16) ARE HIGH. U20A AND U20C ARE CLOSED WHEN THEIR CONTROL INPUTS ARE HIGH. U20B AND U20D ARE OPEN WHEN THEIR CONTROL INPUTS ARE HIGH. CLOSED RESISTANCE FROM INPUT TO OUTPUT IS TYPICALLY 150-200 OHMS.
- UNLESS OTHERWISE INDICATED, LOGIC LEVELS ARE TTL:
2V TO +5.0V = LOGIC "1" = HIGH
0V TO +0.8V = LOGIC "0" = LOW
- U36A, B, C ARE NOT USED. INPUT PINS MAY BE TIED TOGETHER.
- U7D NOT USED. INPUT PINS 6, 7, 8 NO CONNECTION.
- UNLESS OTHERWISE INDICATED, SIGNALS ENTER AT LEFT SIDE AND EXIT AT RIGHT SIDE OF FUNCTION BLOCKS.

FIGURE 5. A22 FREQUENCY CONTROL, SCHEMATIC DIAGRAM (2 OF 2)

A22

A23 RF CONVERTER, CIRCUIT DESCRIPTION

A23 RF Converter has two conversion paths. In the first, the signal from the RF Attenuator in A5 Front Panel is mixed with a signal from A23A4 First LO Distribution in A23A2 First Converter. The output is filtered, converted by A23A3 Second Converter, and the 301.4 MHz output delivered to A19 Second IF Amplifier.

The second conversion path starts with A23A6 Comb Generator. This assembly takes 20 MHz from A16 20 MHz Reference and forms a pulse containing the harmonics of 20 MHz. This pilot signal is applied to A23A5 Pilot First Converter, which mixes power from A23A4 First LO Distribution with the pilot signal. The output is filtered, down-converted by A23A3 Second Converter, and sent to A9 Pilot Second IF Amplifier.

A23A4 First LO Distribution takes power from A23A1 YIG-Tuned Oscillator and splits and amplifies it for delivery to A23A2 First Converter, A23A5 Pilot First Converter, and the auxiliary 1ST LO OUT on the rear panel. This assembly also contains the bias circuitry for A23A3 Second Converter and A23A6 Comb Generator.

NOTE

Reference designations in this circuit description are abbreviated. For the full reference designation, add the prefix of the assembly or subassembly in which it is located. For example, Q1 in A23A3A2 Second LO is actually A23A3A2Q1.

A23A2 First Converter

The input signal from A5 Front Panel travels through the 1700 MHz Low-Pass Filter that is formed by a series of traces on the printed circuit board. The diodes in U1 form a balanced mixer. The first LO signal from A23A4 First LO Distribution is attenuated by A23T2 and then fed to the diodes through a balun. One diode is fed from the center conductor; the other, from the shield. Thus the diodes are driven 180 degrees out of phase. The signal from the 1700 MHz Low-Pass Filter travels through the alternately-conducting diodes, mixing with the LO signal from A23A4. The resulting IF signal is fed through a split-output line that is covered by a small block of polyiron to improve the mixer balance and to absorb some of the unwanted higher-order mixing products. The 6-dB pad (R1, R2, and R3) provides a frequency-independent termination for the mixer. The output from the pad is fed through the 5 GHz Low-Pass Filter which further attenuates the unwanted mixing products. This filter is also formed by printed circuit board traces. The output from the filter is the first IF out.

A23T2 Attenuator

A23T2, a 2-dB attenuator, minimizes the interaction between the First Converter and the A23A4A3 LO FET Amplifier.

A23A5 Pilot First Converter

A23A5 Pilot First Converter is identical to A23A2 First Converter except that the pad is 2 dB instead of 6 dB.

A23A6 Comb Generator

A23A6 Comb Generator consists of a 20 MHz comb generator and equalization circuitry. The combs are generated by the step recovery diode CR1. A 20 MHz signal from A16 20 MHz Reference is applied to a high-pass filter formed by L1 and C1. C2 and L1 match the impedance of the input to the impedance of CR1. Forward bias is applied to the diode through R4 and L4. When the 20 MHz driving signal is in the positive part of its cycle, CR1 conducts and stores a charge determined by the amount of drive power and the magnitude of the bias. When the drive goes negative, the charge is removed from the diode until all the charge that was stored during the positive part of the cycle (less recombination losses) is gone. Then the voltage across the diode

abruptly changes, and a current pulse (generated in the loop formed by L3, C3, and CR1) causes a large, very narrow, negative-going pulse to be generated across CR1. This pulse is equalized in the frequency domain by the bridged pad formed by R1, R2, C4, C5, and the printed circuit board transmission line. R5 through R7 form a 12-dB pad for the proper output level. The comb is then available to A23A5 Pilot First Converter.

A23A4 First LO Distribution

A23A4 First LO Distribution consists of A23A4A1 Coupler/Splitter, A23A4A2 RF Converter Bias, A23A4A3 First LO Amplifier, and A23A4A4 Pilot First LO Amplifier.

A23A4A1 Coupler/Splitter. Power from A23A1 YIG-Tuned Oscillator is applied to A23A4A1 Coupler/Splitter. This power is propagated through a directional coupler which couples power to A23A4A3 First LO Amplifier. The directional coupler is formed by printed circuit board traces with R1 and R2 forming the termination for the coupled portion of the signal. The main power component travels through the directional coupler in a 3-dB power splitter (formed by printed circuit board traces and R3 and R4) which provides isolation between J4 and J3. One output of the splitter goes ultimately to the rear panel auxiliary 1ST LO OUT. The other output goes through a 6-dB pad (R5, R6, and R7) to A23A4A4 Pilot First LO Amplifier.

A23A4A4 Pilot First LO Amplifier. This amplifier boosts the LO drive by a nominal 10 dB, and its output drives A23A5 Pilot First Converter.

A23A4A3 First LO Amplifier. The power from the directional coupler is applied to A23A4A3 First LO Amplifier. This amplifier, identical to A23A4A4 Pilot First LO Amplifier, provides an LO signal to A23A2 First Converter.

A23A4A2 RF Converter Bias. This assembly contains the circuitry to bias A23A6 Comb Generator, A23A3 Second Converter, A23A4A3 First LO Amplifier, and A23A4A4 Pilot First LO Amplifier. Transistor Q1, with its associated circuitry, forms a variable current source to bias A23A6 Comb Generator. R4 and R5 form a voltage divider to fix the base voltage and hence the emitter voltage of Q1. The value of R6 determines the amount of emitter current flow. C2 provides low frequency filtering. E1, VR1, and C5 form a transient limiting network to protect the First LO Amplifier and the Pilot First LO Amplifier, which are easily rendered inoperative by small transients ($>5.1V$) on their power leads. R8, R9, and C7 provide filtered negative bias for A23A3A2 Second LO. Transistor Q2, with its associated circuitry, drives shift diode CR3 in A23A3 Second Converter. When the LLOH line from A22 Frequency Control is high, Q2 does not conduct and $-15V$ is present at its collector, back-biasing the shift diode in A23A3 Second Converter. When LLOH goes low, Q2 becomes a current source, forward biasing the shift diode and illuminating DS1 to indicate that the Second LO is in its high frequency state.

A23A3 Second Converter

A23A3 Second Converter consists of a first IF filter, pilot first IF filter, second mixer, pilot second mixer, and the following subassemblies: A23A3A1 Pilot Second LO Buffer, A23A3A2 Second LO, and A23A3A3 Second LO Buffer.

A23A3A2 Second LO. A23A3A2 Second LO is actually composed of Q1 on the printed circuit board A23A3A2 and the second LO cavity Z9. R1 and R2 provide bias for Q1. The inductance and capacitance of the printed circuit board traces make Q1 unstable enough to oscillate. The cavity Z9 determines the frequency of that oscillation. The frequency of Z9 can be changed by forward biasing CR3, which effectively shorts out a small part of the cavity, making its frequency higher.

A23A3A3 Second LO Buffer. A probe inserted into Z9 couples power into A23A3A3 Second LO Buffer. The printed circuit board transmission lines serve to match the cavity impedances to those of Q1. C3 provides an ac ground for one of the lines. Q2 and R1 provide bias for Q1. The output of this amplifier drives the second mixer cavity Z4.

A23A3A1 Pilot Second LO Buffer. A23A3A1 Pilot Second LO Buffer works in the same way as A23A3A3 Second LO Buffer, except that the output drives the pilot second mixer cavity Z8.

First IF. The 2050 MHz (or 2055 MHz, depending on the state of the Second LO) first IF signal is applied through J1 to the three-pole 2052.5 MHz Bandpass Filter. The resonant frequencies of the cavities Z1, Z2, and Z3 determine the shape and frequency of the filter output signal. The filter output is coupled to the second mixer diode CR1, where it is mixed with power from A23A3A3 Second LO Buffer. The resulting second IF, 301.4 MHz, goes into the Matching Filter (C6, C7, and L2), which matches the impedance of CR1 to 50Ω. L1 and R1 provide a dc return for the diode.

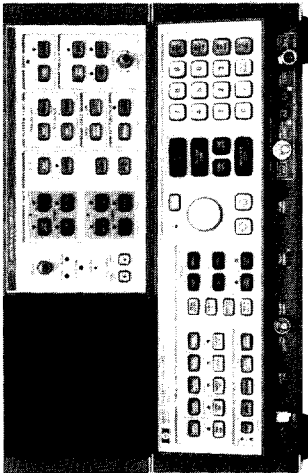
Pilot First IF. The pilot first IF is applied through J2 to the 2017.6 MHz Bandpass Filter composed of Z5, Z6, and Z7. The output of the filter is coupled into the pilot second mixer diode CR2, where it is mixed with power from A23A3A1 Pilot Second LO Buffer. The resulting pilot second IF, 269 (± 10) MHz goes into the Matching Filter (C8, C9, and L4), which matches the impedance of CR2 to 50Ω. L3 and R2 provide a dc return for the diode. C10, C11, and L5 form a 450 MHz low-pass filter.

REMOVAL

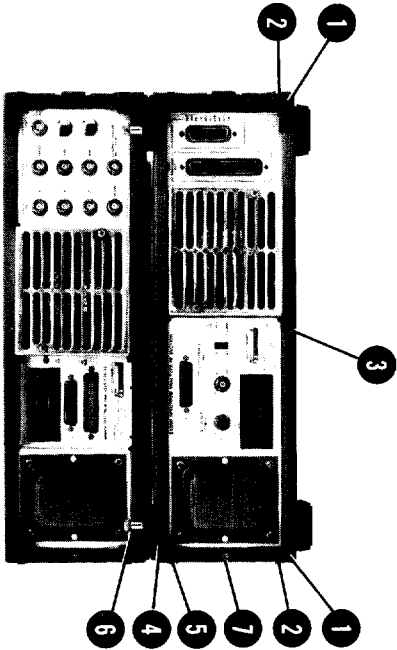
WARNING

Remove AC Line cord from both instruments before proceeding with this procedure.

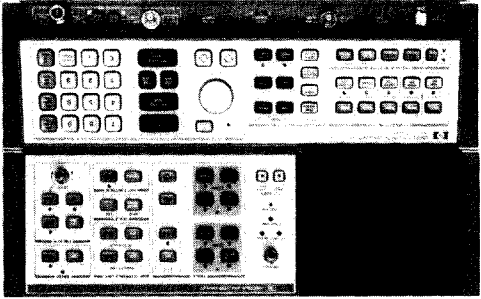
1. Position instrument upside down as shown in View A. Remove feet **1** by removing screws **2** as shown in View B.
2. Remove cover from bottom of RF Section (now on top of instrument) by loosening pozi-drive screw **3**.
3. Remove foot **4** indicated in View B from rear of instrument by first removing screw **5**, then loosening thumbscrew **6**.
4. Remove RF Section right side cover by loosening pozi-drive screw **7** shown in View B.
5. Remove four pozi-drive screws from RF Section right side frame used to attach RF Converter to side frame. Location of these screws is indicated on top of RF Converter Assembly.
6. Remove two straight-slot screws, (location indicated on top of RF Converter assembly), used to attach RF Converter to Motherboard.
7. Position instrument on right side as shown in View C.
8. Slide RF Converter out of instrument slowly being careful not to pinch or bind cables.
9. If removing RF Converter for adjustment, turn Converter upside-down so that Second Converter adjustments are facing upwards.
10. If removing RF Converter for repair or replacement, disconnect all cables from the Converter: 80 (gray/black) cable from A23A3J6, 92 (white/red) cable from A23A3J5, 7 (violet) cable from A23A6J1, RF input cable from Limiter, 90 (white/black) cable from A23A4AJ4 and two ribbon cables; one from the YTO A23A1 and the other from the RF Converter Bias assembly A23A4A2. (Note position in which ribbon cables are connected for reference when reinstalling RF Converter.)



View A



View B



View C

INSTALLATION

WARNING

Remove AC Line cord from both instruments before proceeding with this procedure.

1. Position instrument on right side as shown in View C with bottom cover removed from RF Section. Refer to Removal procedure Steps 1 through 7 if necessary.
2. Place RF Converter next to instrument and connect cables if necessary: 80 (gray/black) cable to A23A3J6, 92 (white/red) cable to A23A3J5, 7 (violet) cable to A23A6J1, 90 (white/black) cable to A23A4A1J4, ribbon cable from A22 Frequency Control to A23A1 YTO, and ribbon cable from Motherboard to A23A4A2 RF Converter Bias assembly.
3. Position RF Converter so that A23A3 Second Converter is facing downwards.
4. Slide RF Converter into instrument being careful not to pinch or bind cables.
5. Insert straight-slot screws (location indicated on top of RF Converter assembly) into threaded holes in Motherboard and screw in slightly. Do not tighten these screws yet.
6. Position instrument upside-down as shown in View A.
7. Replace four pozi-drive screws RF Section side frame (location indicated on top of RF Converter assembly) and tighten.
8. Tighten two straight-slot screws installed in Step 5.
9. Replace RF Section right-side cover and tighten screw 7 shown in View B.
10. Replace foot 4 and tighten screw 5 shown in View B.
11. Install and tighten thumbscrew 6 .
12. Replace cover on bottom of RF Section and tighten screw 3 .
13. Replace feet 1 and tighten screws 2 .
14. Position instrument upright.

FIGURE 1. RF CONVERTER REMOVAL AND INSTALLATION

TABLE 1. A23 RF CONVERTER, REPLACEABLE PARTS (1 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23	85680-60054	6	1	BOARD ASSEMBLY, RF CONVERTER (INCLUDES A23A1 YIG OSC., A23A2 FIRST CONVERTER, A23A3 SECOND CONVERTER, A23A4 FIRST LO DISTRIBUTION, A23A5 PILOT FIRST CONVERTER, A23A6 COMB GENERATOR)	28480	85680-60054
A23A1	5086-7246	7	1	Y OSC 2-4 GHZ	28480	5086-7246
A23A1	5086-7260	5	1	Y OSC 2-4 GHZ (ORDER 5086-7246)	28480	5086-7260
A23A1	5086-6246	5	1	Y OSC 2-4 GHZ, RESTORED 5086-7246	28480	5086-6246
A23A1	5086-7284	3	1	LIMITER 0-1.8GHZ	28480	5086-7284
A23A1	0955-0124	4	1	ATTENUATOR-COAXIAL ATTEN: 2+-0.3DB; FREQ	28480	0955-0124
A23FL1	9135-0104	1	1	FILTER-LOW PASS	28480	9135-0104
A23FL2	9135-0145	0	1	CABLE ASSEMBLY LOW PASS FILTER; PASSBAND	28480	9135-0145
A23 MISCELLANEOUS PARTS						
	85680-20059	7	1	CAVITY, COMB GEN	28480	85680-20059
	2200-0107	6	1	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI (TO ATTACH COMB GENERATOR LID TO CAVITY)	00000	ORDER BY DESCRIPTION
A23A2	85680-60060	4	1	FIRST CONVERTER	28480	85680-60060
A23A2J1	1250-1796	5	11	CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A2J2	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A2J3	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A2R1	0698-7216	3	2	RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-F
A23A2R2	0699-1109	3	1	RESISTOR 38.3 1% .05W F TC=0+-100	28480	0699-1109
A23A2R3	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-F
A23A2U1	08550-20095	0	2	DIODE ASSY	28480	08550-20095
A23A3	85680-60052	4	1	SECOND CONVERTER ASSEMBLY (INCLUDES A23A3A1 PILOT SECOND LO BUFFER A23A3A2 SECOND LO, A23A3A3 SECOND LO BUFFER, W16 AND W17)	28480	85680-60052
A23A3C1	0160-2437	1	4	CAPACITOR-FDTHRU 5000PF +00 -20% 200V	28480	0160-2437
A23A3C2	0160-2437	1		CAPACITOR-FDTHRU 5000PF +00 -20% 200V	28480	0160-2437
A23A3C3	0160-2437	1		CAPACITOR-FDTHRU 5000PF +00 -20% 200V	28480	0160-2437
A23A3C4	0160-2437	1		CAPACITOR-FDTHRU 5000PF +00 -20% 200V	28480	0160-2437
A23A3C5	0160-3036	8	2	CAPACITOR-FDTHRU 5000PF +00 -20% 200V	28480	0160-3036
A23A3C6	0160-5435	5	1	CAPACITOR-FDTHRU 0.5PF 8% 200V CER	28480	0160-5435
A23A3C7	0140-0075	7	1	CAPACITOR-FDTHRU 22PF 10% 500V MICA	72782	666-053-01A0-220K
A23A3C8	0160-4959	6	1	CAPACITOR-FDTHRU 10PF 5% 200V CER	33095	54-713-002-X5E-100J
A23A3C9	0160-3875	3	2	CAPACITOR-FXD 22PF +.5% 200VDC CER 0+-30	28480	0160-3875
A23A3C10	0160-3873	1	1	CAPACITOR-FXD 4.7PF +-1.5PF 200VDC CER	28480	0160-3873
A23A3C11	0160-4237	3	1	CAPACITOR-FDTHRU 6.2PF 10% 250V MICA	72962	2930-000-6.2PF+-10
A23A3CR1	1901-0951	3	2	DIODE-SM SIG SCHOTTKY	28480	1901-0951
A23A3CR2	1901-0951	3		DIODE-SM SIG SCHOTTKY	28480	1901-0951
A23A3CR3	1901-0639	4	1	DIODE-PIN	28480	5082-3080
A23A3J1	1250-1157	2	2	CONNECTOR-RF SMA FEM THD-HOLE 50-OHM	28480	1250-1157
A23A3J2	1250-1157	2		CONNECTOR-RF SMA FEM THD-HOLE 50-OHM	28480	1250-1157
A23A3J3	1250-0691	7	2	CONNECTOR-RF SMD M SGL-HOLE-FR 50-OHM	28480	1250-0691
A23A3J4	1250-0691	7		CONNECTOR-RF SMD M SGL-HOLE-FR 50-OHM	28480	1250-0691
A23A3J5	1250-1435	9	2	CONN:RF: 500 OHM: SMC	28480	1250-1435
A23A3J6	1250-1435	9		CONN:RF: 500 OHM: SMC	28480	1250-1435
A23A3L1	9100-1613	6	2	INDUCTOR RF-CH-MLD 470NH 20%	28480	9100-1613
A23A3L2	85680-80010	6	1	INDUCTOR MATCH	28480	85680-80010
A23A3L3	9100-1613	6		INDUCTOR RF-CH-MLD 470NH 20%	28480	9100-1613
A23A3L4	85680-80012	8	1	INDUCTOR-PILOT	28480	85680-80012
A23A3L5	85680-80011	7	1	INDUCTOR LP	28480	85680-80011
A23A3R1	0698-8818	3	2	RESISTOR 3.16 1% .125W F TC=0+-100	28480	0698-8818
A23A3R2	0698-8818	3		RESISTOR 3.16 1% .125W F TC=0+-100	28480	0698-8818
A23A3A1	85680-60129	6	1	PILOT SECOND LO BUFFER	28480	85680-60129
A23A3A1C1	0160-3879	7	6	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A3A1C2	0180-0291	3	2	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A23A3A1C3	0160-8562	9	2	CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-8562
A23A3A1Q1	5086-4201	8	2	TC 21A 200MIL PK	28480	5086-4201
A23A3A1Q2	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	91295	2N3799
A23A3A1R1	0698-3438	3	2	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A23A3A1R2	0698-7192	4	2	RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-F
A23A3A1R3	0698-7248	1	2	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A23A3A1R4	0698-7260	7	2	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A23A3A1R5	0698-7236	7	2	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F

*Indicates factory selected value

TABLE 1. A23 RF CONVERTER, REPLACEABLE PARTS (2 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23A3A2	85680-60029	5	1	SECOND LO	28480	85680-60029
A23A3A2Q1	5086-4218	7	1	TC21 IN T0-72 PKG	28480	5086-4218
A23A3A2R1	0683-2215	1	1	RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A23A3A2R2	0698-3377	9	1	RESISTOR 47 5% .125W CC TC=-270/+540	01121	BD4705
A23A3A3	85680-60128	5	1	PILOT SECOND LO BUFFER	28480	85680-60128
A23A3A3C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A3A3C2	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A23A3A3C3	0160-0562	9		CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-0562
A23A3A3Q1	5086-4201	8		TC 21A 200MIL PK	28480	5086-4201
A23A3A3Q2	1853-0451	5		TRANSISTOR PNP 2N3799 SI T0-18 PD=360MW	01295	2N3799
A23A3A3R1	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A23A3A3R2	0698-7192	4		RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-F
A23A3A3R3	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A23A3A3R4	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A23A3A3R5	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A23A4	85680-60057	9	1	BOARD ASSEMBLY, FIRST LO DISTRIBUTION (INCLUDES A23A4A1 COUPLER/SPLITTER, A23A4A2 RF CONVERTER BIAS, AND A23A4A3 AND A23A4A4 LO AMPLIFIERS)	28480	85680-60057
A23A4A1J1	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A4A1J2	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A4A1J3	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A4A1J4	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A4A1R1	0698-7212	9	4	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A23A4A1R2	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A23A4A1R3	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A23A4A1R4	0698-7221	0	1	RESISTOR 237 1% .05W F TC=0+-100	24546	C3-1/8-T0-237R-F
A23A4A1R5	0698-7227	6	2	RESISTOR 422 1% .05W F TC=0+-100	24546	C3-1/8-T0-422R-F
A23A4A1R6	0698-7190	2	1	RESISTOR 12.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-12R1-F
A23A4A1R7	0698-7227	6		RESISTOR 422 1% .05W F TC=0+-100	24546	C3-1/8-T0-422R-F
	85680-60055	7	1	COUPLER/SPLTR	28480	85680-60055
A23A4A2	85680-60032	0	1	RF CONVERTER BIAS	28480	85680-60032
A23A4A2C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A4A2C2	0180-0229	7	3	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A23A4A2C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A4A2C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A4A2C5	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A23A4A2C6	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23A4A2C7	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A23A4A2C8	0160-3878	6	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A23A4A2CR1	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23A4A2CR2	1901-0734	0	1	DIODE-PWR RECT 1N5818 30V 1A	04713	1N5818
A23A4A2DS1	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX EWR=5V	28480	5082-4584
A23A4A2E1	9170-0029	3	1	CORE-SHIELDING BEAD	28480	9170-0029
A23A4A2J1	1200-0508	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A23A4A2L1	9100-1623	8	1	INDUCTOR RF-CH-MLD 27UH 5% .166DX.385LG	28480	9100-1623
A23A4A2L2	9100-1788	6	1	CHOKES-WIDE BAND ZMAX=600 OHMS 180 MHZ	02114	VX200 20/48
A23A4A2MP1				NOT ASSIGNED		
A23A4A2MP2	0340-0628	0	2	INSULATOR-XSTR NYLON WHITE	28480	0340-0628
A23A4A2MP3	0340-0628	0		INSULATOR-XSTR NYLON WHITE	28480	0340-0628
A23A4A2Q1	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI T0-18 PD=360MW	04713	2N3251
A23A4A2Q2	1853-0007	7		TRANSISTOR PNP 2N3251 SI T0-18 PD=360MW	04713	2N3251
A23A4A2R1				NOT ASSIGNED		
A23A4A2R2	0757-0405	4	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A23A4A2R3	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-100K-F
A23A4A2R4	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A23A4A2R5	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A23A4A2R6	2100-1773	2	1	RESISTOR-TRMR 1K 5% WW TOP-ADJ 1-TRN	28480	2100-1773
A23A4A2R7	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A23A4A2R8	0698-3442	9	2	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A23A4A2R9	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A23A4A2TP1	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23A4A2VR1	1902-3104	6	1	DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104

*Indicates factory selected value

TABLE 1. A23 RF CONVERTER, REPLACEABLE PARTS (3 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23A4A3	5086-7244	5	2	AMPLIFIER, 2 TO 4GHZ	28480	5086-7244
A23A4A4	5086-7244	5		AMPLIFIER, 2 TO 4GHZ	28480	5086-7244
A23A5	85680-60061	5	1	PILOT FIRST CONVERTER	28480	85680-60061
A23A5J1	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A5J2	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A5J3	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A5R1	0698-7189	9	1	RESISTOR 11 1% .05W F TC=0+-100	24546	C3-1/8-T0-11R0-F
A23A5R2	0698-7228	7	2	RESISTOR 464 1% .05W F TC=0+-100	24546	C3-1/8-T0-464R-F
A23A5R3	0698-7228	7		RESISTOR 464 1% .05W F TC=0+-100	24546	C3-1/8-T0-464R-F
A23A5U1	08558-20095	0		DIODE ASSY	28480	08558-20095
A23A6	85680-60006	8	1	COMB GENERATOR	28480	85680-60006
A23A6C1	0160-2529	2	1	CAPACITOR-FXD 160PF +-2% 300VDC MICA	28480	0160-2529
A23A6C2	0160-2020	8	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-2020
A23A6C3	0160-0573	2	1	CAPACITOR-FXD 4700PF +-20% 100VDC CER	28480	0160-0573
A23A6C4	0160-0571	0	1	CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A23A6C5	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A23A6C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A6C7	0121-0507	0	1	CAPACITOR-V TRMR-PSTN .6-1.8PF 750V	28480	0121-0507
A23A6C8	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A23A6CR1	1901-0189	9	1	DIODE-STEP RECOVERY	28480	1901-0189
A23A6J1	1250-1220	0	1	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A23A6J2	1250-1796	5		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1796
A23A6L1	9100-2258	7	1	INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A23A6L2	85680-80002	6	1	INDUCTOR LVL ADJ	28480	85680-80002
A23A6L3	85680-80003	7	1	INDUCTOR COMB DR	28480	85680-80003
A23A6L4	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH 10% .166DX.395LG	28480	9140-0179
A23A6R1	0698-7205	0	1	RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A23A6R2	0698-7198	0	1	RESISTOR 26.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-26R1-F
A23A6R3				NOT ASSIGNED		
A23A6R4	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A23A6R5*	0698-7208	3	2	RESISTOR 68.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-68R1-F
A23A6R6*	0698-7218	5	1	RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A23A6R7*	0698-7208	3		RESISTOR 68.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-68R1-F
				A23A6 MISCELLANEOUS PARTS		
	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
	2190-0067	4	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
	2190-0124	4	1	WASHER-LK INTL T NO. 10 .175-IN-ID	28480	2190-0124
	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	28480	2580-0002
	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
	3050-0944	1	1	WASHER-FL MTLC 1/4 IN .25-IN-ID	28480	3050-0944
	3050-0945	2	1	WASHER-FL MTLC NO. 10 .2-IN-ID .33-IN-OD	28480	3050-0945
	85680-00016	4	1	LID COMB GEN	28480	85680-00016

*Indicates factory selected value

A23 RF CONVERTER

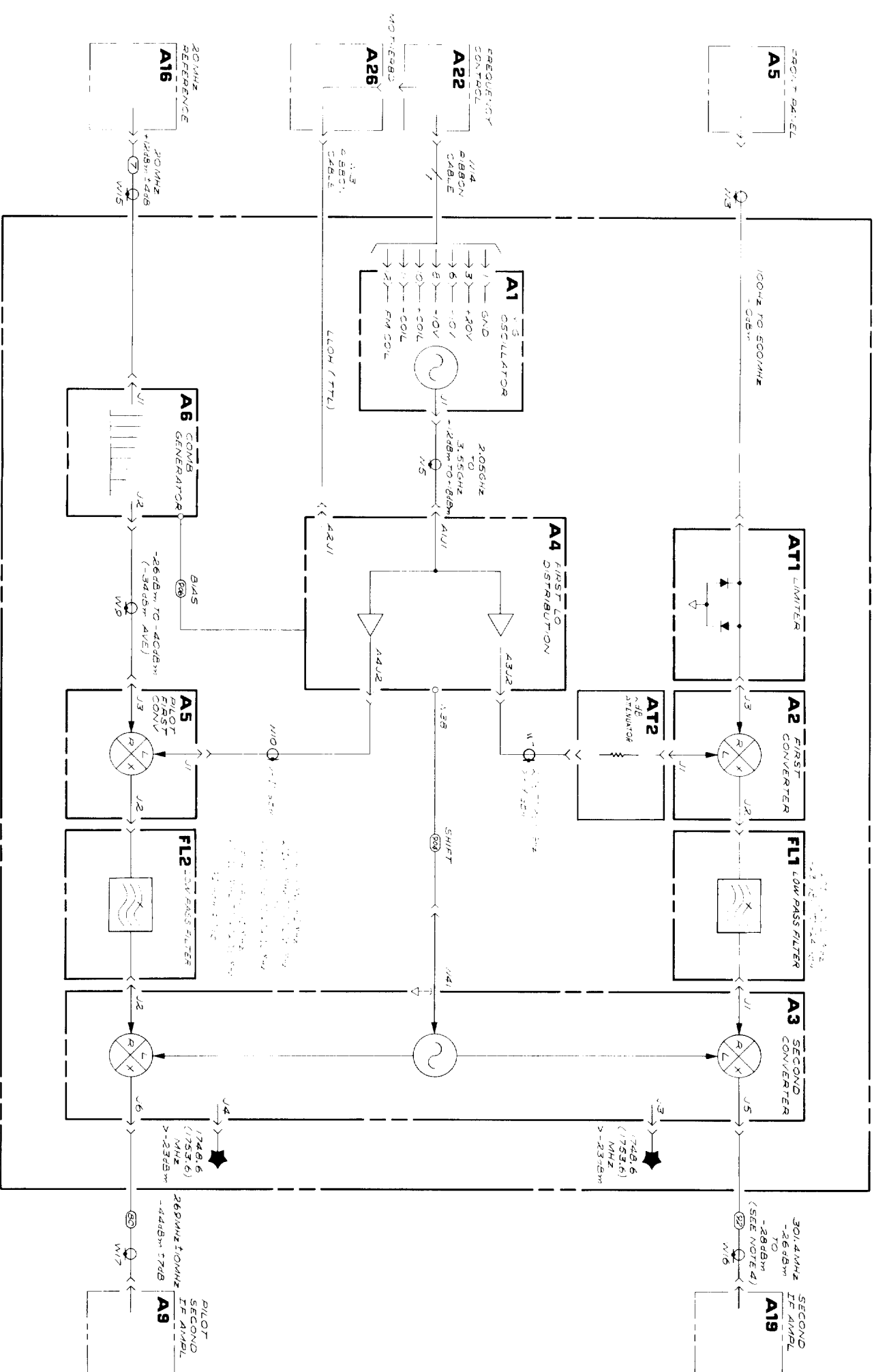


FIGURE 2. RF CONVERTER, BLOCK DIAGRAM

A23 11/12

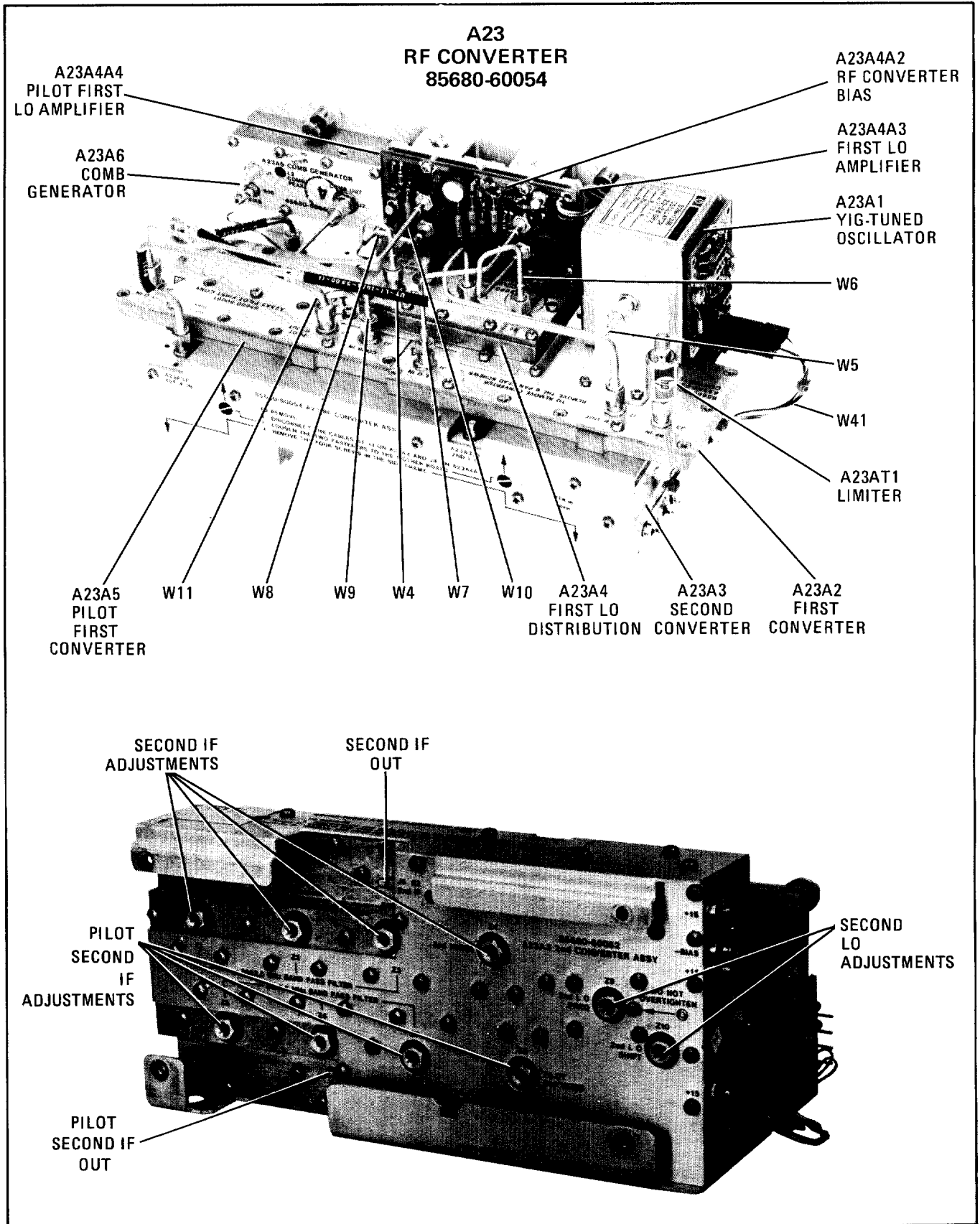


FIGURE 3. A23 RF CONVERTER, ASSEMBLY AND COMPONENT LOCATIONS

A23A2/A23A5
FIRST CONVERTER/PILOT FIRST CONVERTER

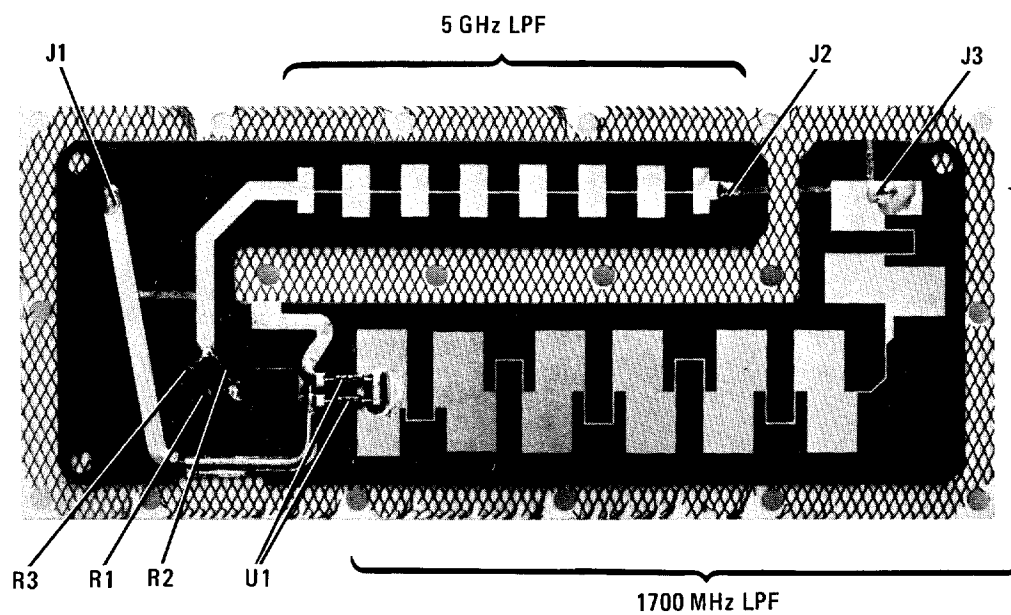


FIGURE 4. A23A2 FIRST CONVERTER AND A23A5 PILOT FIRST CONVERTER, COMPONENT LOCATIONS

**A23A3
SECOND CONVERTER
85680-60052**

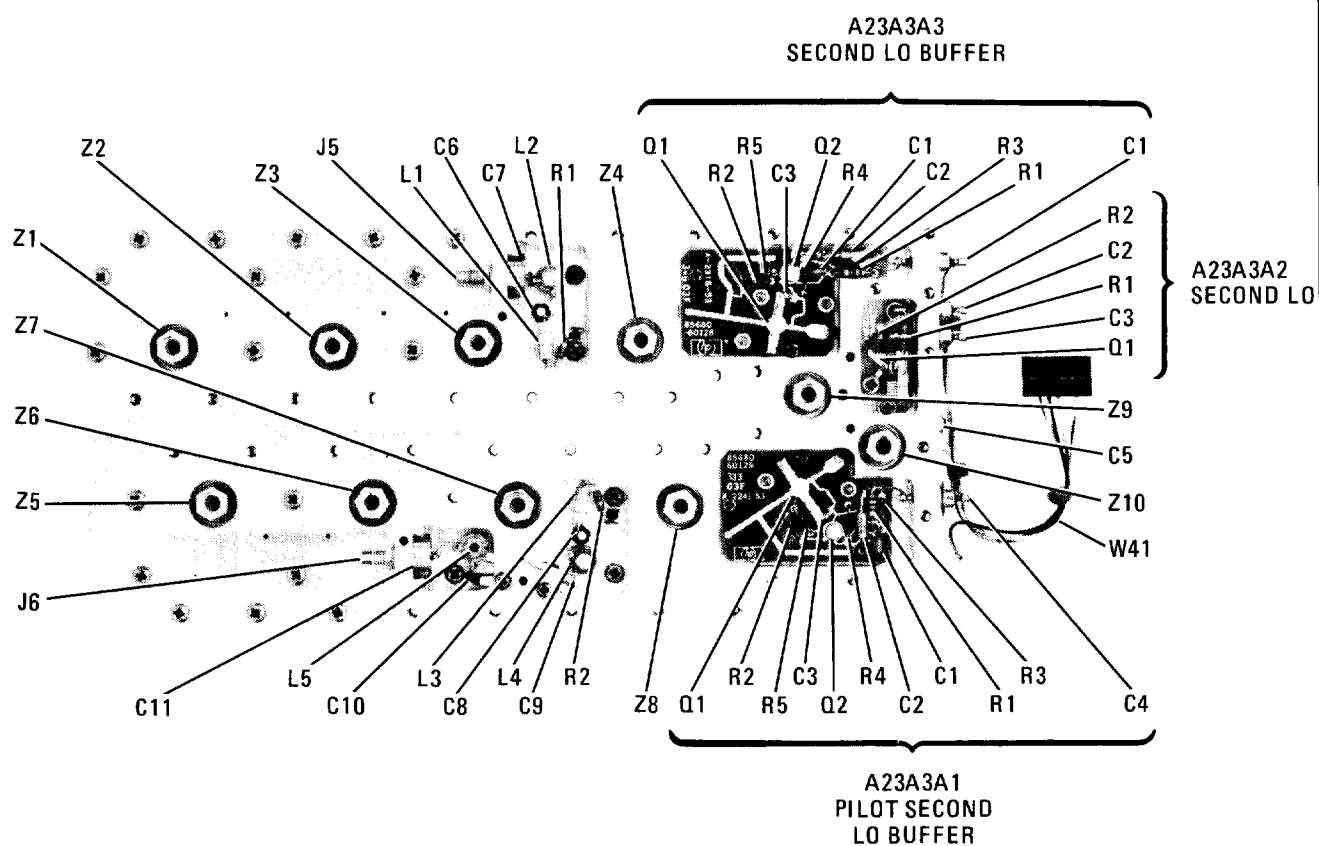
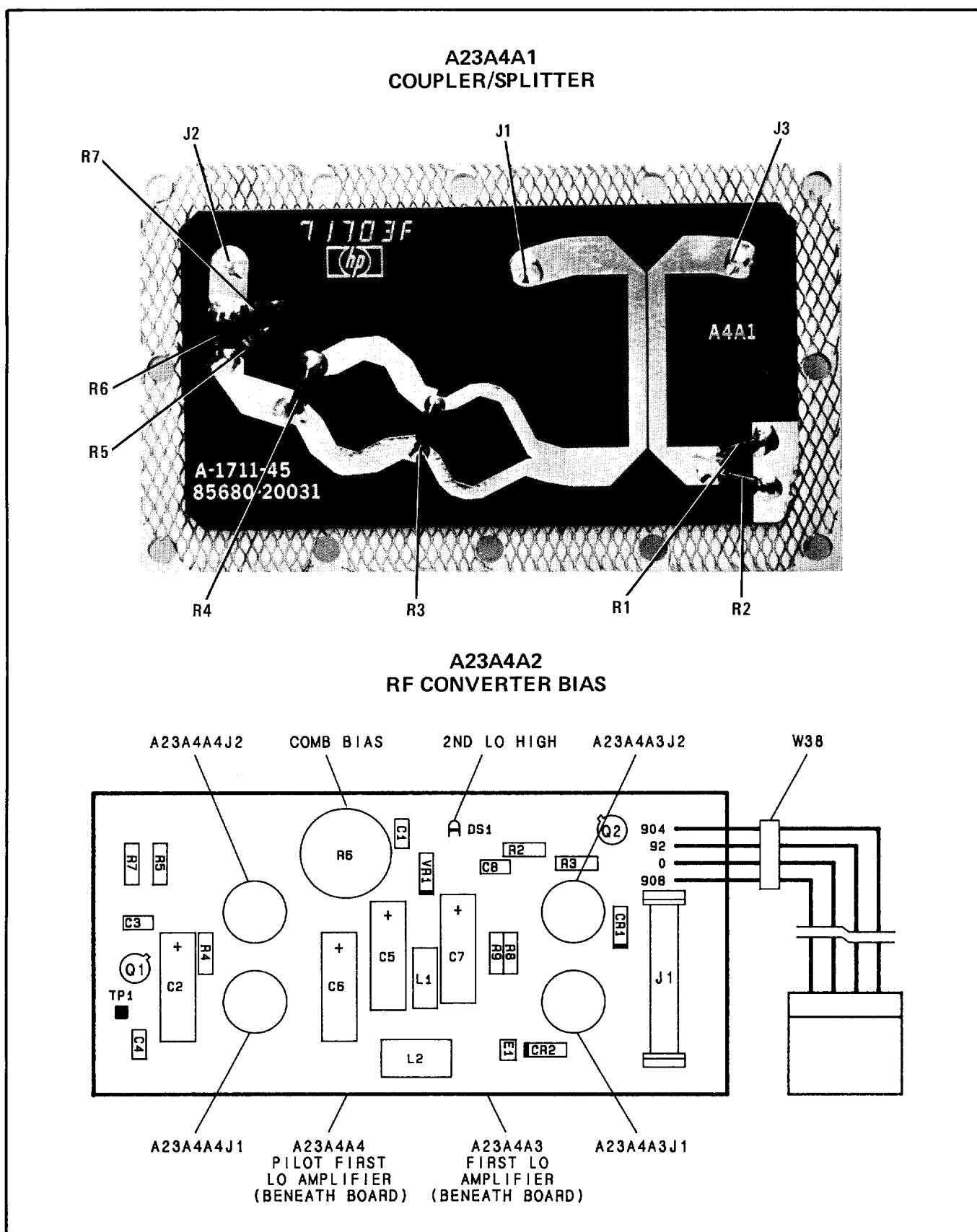


FIGURE 5. A23A3 SECOND CONVERTER, ASSEMBLY AND COMPONENT LOCATIONS



A23A6
COMB GENERATOR
85680-60006

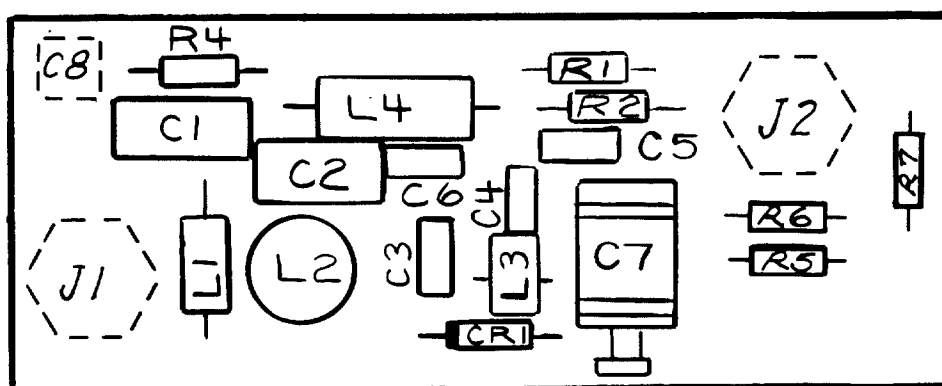
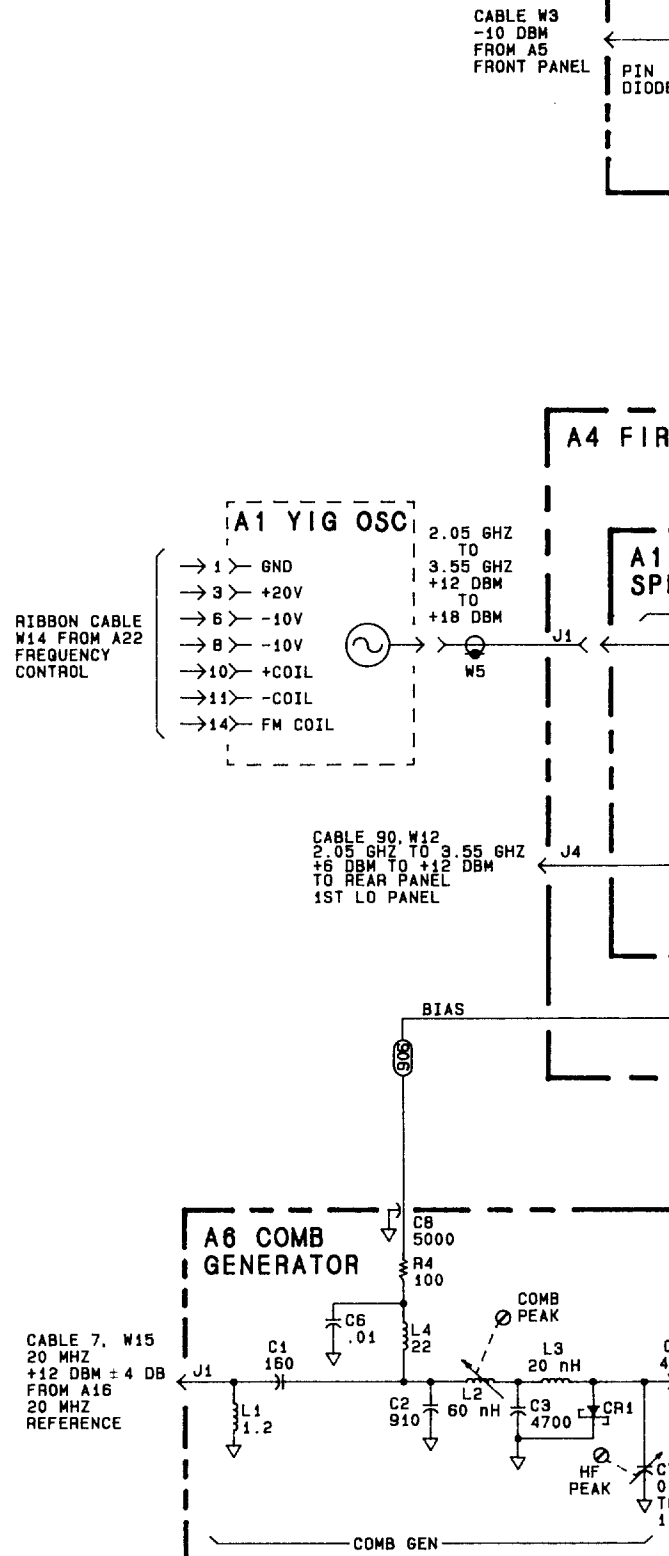


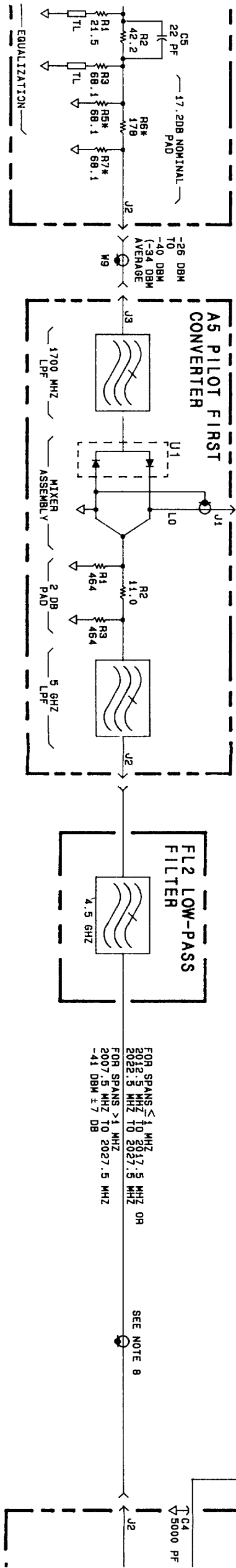
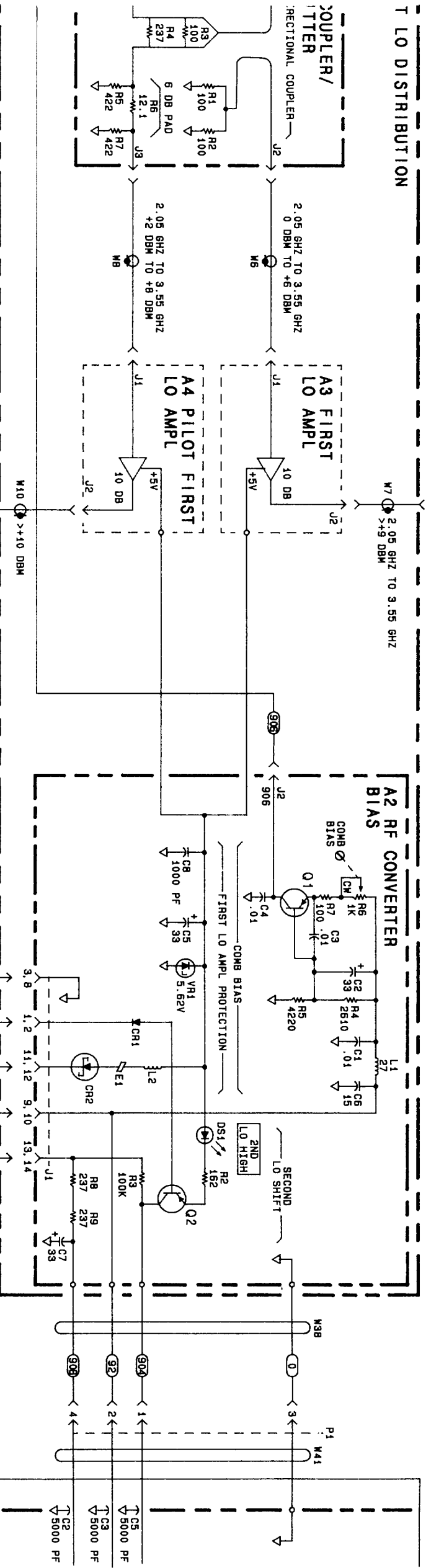
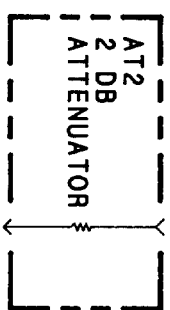
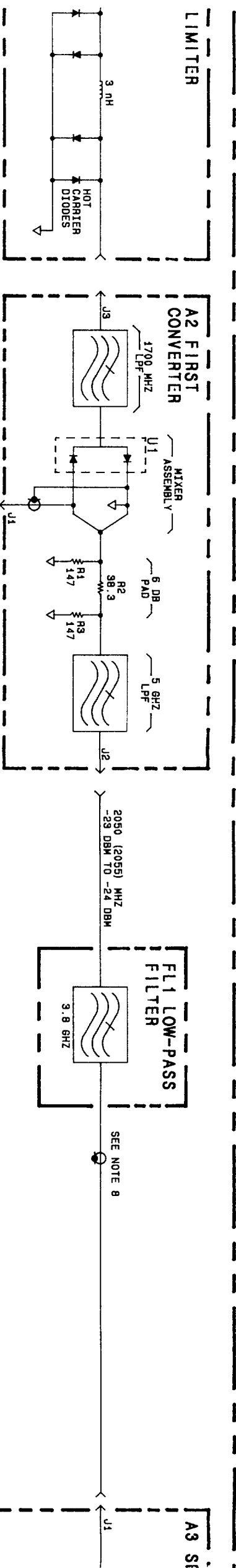
FIGURE 7. A23A6 COMB GENERATOR, COMPONENT LOCATIONS

RF SECTION

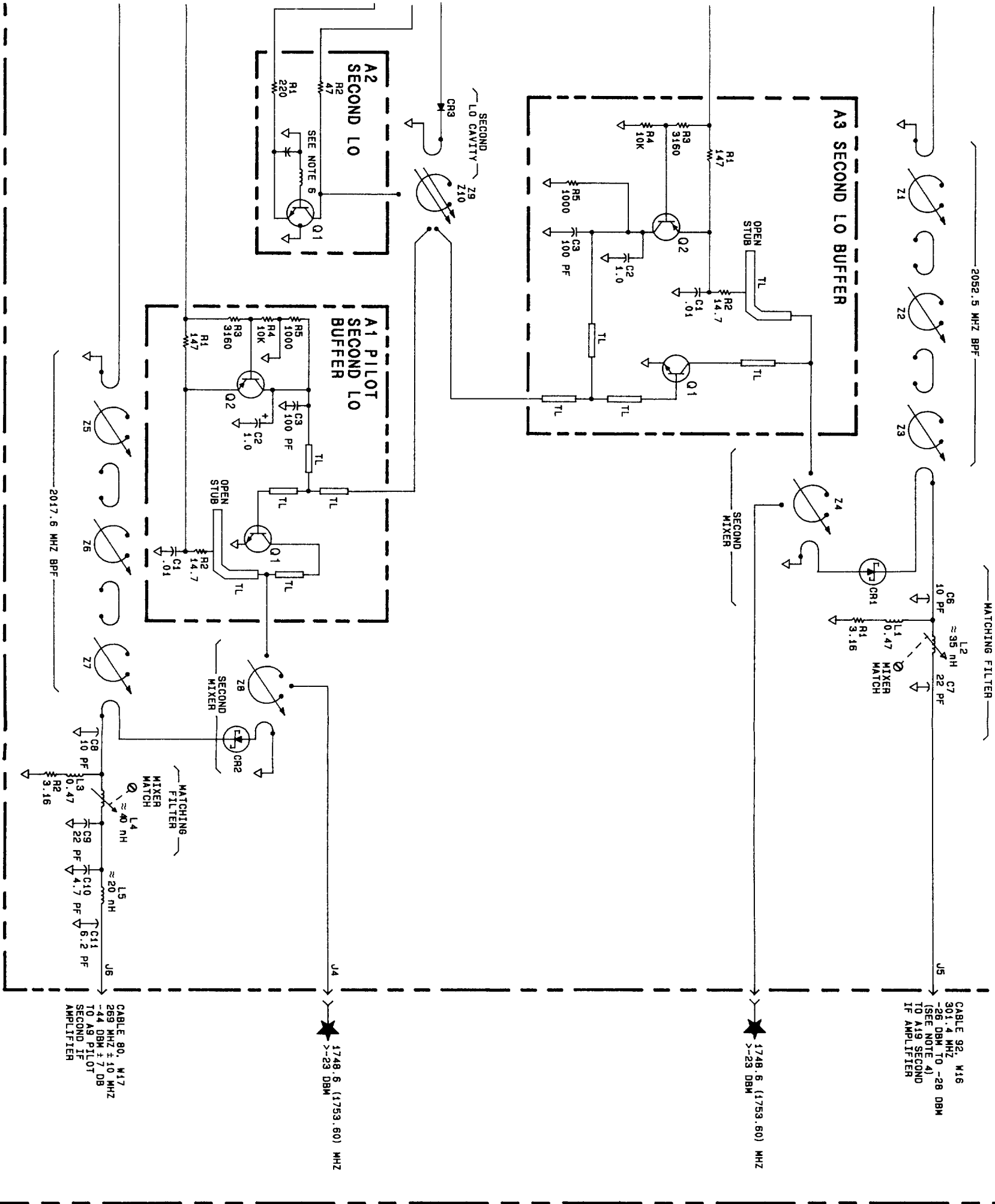
A23 RF CONVERTER
85680-60054



SERIAL PREFIX:2408A



SECOND CONVERTER



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PRE-FIX ABBREVIATION WITH ASSEMBLY DESIGNATION.

2. UNLESS OTHERWISE INDICATED:

RESISTANCE IS IN OHMS (Ω)
CAPACITANCE IS IN MICROFARADS (μ F)
INDUCTANCE IS IN MICROHENRIES (μ H)

3. TRANSMISSION LINES ARE SHOWN AS INDICATED BELOW:



4. SIGNAL LEVELS ARE MEASURED WITH -10 DBM SIGNAL APPLIED TO A203.

5. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
LLOH	LOW PLACES SECOND LO IN HIGH FREQUENCY STATE

6. L AND C PART OF PC BOARD.

7. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.

8. FILTER IS PART OF CABLE.

9. POWER MEASUREMENTS ARE TAKEN WITH A SPECTRUM ANALYZER USING A HIGH IMPEDANCE PROBE.

FIGURE 8. A23 RF CONVERTER, SCHEMATIC DIAGRAM

A23

A24 VOLTAGE REGULATOR, CIRCUIT DESCRIPTION

A24 Voltage Regulator provides +20V, +15V, +5V, -15V, and -5.2V regulated voltages to the RF Section. It also provides overvoltage protection, provides for thermal shutdown at temperatures above 85°C, controls fan operation, controls power to the oscillator and the oven in the A27 Time Base, and ensures power-up and power-down operation that will not invalidate data in the A15 Controller. (Figure 1 shows the relationship of A24 to A25 Rectifier and A26 Motherboard.)

Voltage Regulator Control (A)

When the front-panel LINE switch is in STANDBY, the STBY SW line is grounded, the Fan Relay on the Motherboard is energized through CR1, and the fan is turned off.

When the STBY SW line is grounded, Q7 is turned on through CR2, and Q5 is turned on, shutting off the current source to the -15V REG circuit. In the same manner, Q3 is turned on, which turns off the +20V REG circuit. When these two supplies are turned off, the remaining regulated supplies are also shut off.

When the operating temperature exceeds 85°C, the THERMISTOR lines are activated through thermistor A26RT1, unbalancing the bridge on the input of op amp U1. U1 senses the unbalance and drives Q8 to saturation, shutting off the regulated power supplies. TEMP indicator DS1 lights to indicate thermal shutdown.

+20V REG (D)

Q1 through Q3 and associated circuitry are a current source that drives the Darlington pair A26Q2B and A26Q2E on the Motherboard (see Figure 2). Q10 and associated circuitry are a Foldback Current Limit that monitors both sides of current sense resistor A26R9.

Q9, with its associated circuitry, forms a crowbar circuit. An overvoltage shorts the supply through Q9, which turns on the current limit transistor Q10. CR17 is a reverse protection diode that prohibits the voltage from being pulled negative, since the crowbar circuit protects against positive overvoltage only. DS2 is the +20V indicator LED on the board.

VR5 provides a voltage reference for the positive input of op amp U2. The divided +20V sense voltage is the negative input. The +20V ADJ potentiometer R60 adjusts the regulated voltage of the circuit. (The other regulator circuits are referenced from +20V REG, so if R60 is adjusted for +20V, the other regulated voltages will also be within tolerance.) VR3 and VR4 assure proper operating conditions for op amp U2 when the instrument is in STANDBY.

-15V REG, -5.2V REG, +5V REG, and +15V REG (C) (F) (G) (H)

These circuits are similar in operation to that of +20V REG.

Power UP (E)

The Power Up circuit is designed to provide the HPUP signal to the A15 Controller only after all regulated supplies are operating at correct voltages. If line power is lost, or if the front-panel LINE switch is placed in STANDBY, HPUP is deactivated before the supply voltages fall below operating levels.

If line power is removed from the instrument, the voltage at the positive input to U7B drops immediately, but voltage held on C13 reverse biases CR24, driving U7B low and unbalancing comparator U7A through CR22 to deactivate the HPUP line. If the LINE switch is placed in STANDBY, U7A is unbalanced through CR21. The short RC time constant provided by R90 and C11 provides enough time for the HPUP line to go low before power is removed.

When the LINE switch is placed ON, or when line power is restored, C11 slowly charges because of the long RC time constant provided by R96. Thus, all regulated supplies have time to reach their operating voltages before the HPUP line goes high.

Frequency Reference Supply and Control (B)

This circuit controls the oven and oscillator power in the A27 Time Base, signals A23 RF Section Interface when the oven is cold, and provides a front-panel LED indication when the LINE switch is in STANDBY. The circuit is designed so that oscillator power is removed but oven power remains on when the instrument is in STANDBY. Oscillator power is also removed when an external time base is used.

When the LINE switch is ON, +20V provides oven power (OVN PWR) through CR8. Q23 is turned on to provide oscillator power (OSC PWR). When the LINE switch is in STANDBY, the unregulated +25V provides oven power through diodes CR4 through CR7 and Q19, but +20V is removed from Q23, and the oscillator power is turned off.

When an external time base is used, the HINT line goes low, turning off Q22 and Q23 to remove oscillator power.

The oven monitor (OVN MTR) line from A27 Time Base keeps comparator U8 balanced when the oven is at operating temperature. If the oven is cold, U8 drives the HOVC lines high, signaling A12 RF Section Interface.

When the LINE switch is in STANDBY, -15V is removed from the base of Q21. Q21 turns on, sending the STBY LED signal to the front panel to turn on the STANDBY indicator LED. If the instrument has line power but the regulated power is off, the STANDBY indicator is lit.

Zener diode VR1 allows proper operation of the circuit when cable W2 is disconnected from the panel.

TABLE 1. A24 VOLTAGE REGULATOR, REPLACEABLE PARTS (1 OF 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A24	85680-60154	7	1	BOARD ASSEMBLY, VOLTAGE REGULATOR	28480	85680-60154
A24C1	0180-0197	8	7	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C2	0160-0154	5	1	CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	28480	0160-0154
A24C3	0180-0373	2	3	CAPACITOR-FXD .68UF+-10% 35VDC TA	56289	150D684X9035A2
A24C4	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A24C5	0180-2214	4	1	CAPACITOR-FXD 90UF+-75-10% 16VDC AL	56289	30D90G016CC2
A24C6	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C7	0160-0159	0	2	CAPACITOR-FXD 6800PF +-10% 200VDC POLYE	28480	0160-0159
A24C8	0180-1846	6	2	CAPACITOR-FXD 2.2UF+-10% 35VDC TA	56289	150D225X9035B2
A24C9	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C10	0160-2055	9	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C11	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C13				NOT ASSIGNED		
A24C14	0160-0159	0		CAPACITOR-FXD 6800PF +-10% 200VDC POLYE	28480	0160-0159
A24C15	0180-1846	6		CAPACITOR-FXD 2.2UF+-10% 35VDC TA	56289	150D225X9035B2
A24C16	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C17	0160-0157	8	2	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A24C18	0180-0373	2		CAPACITOR-FXD .68UF+-10% 35VDC TA	56289	150D684X9035A2
A24C19	0160-0157	8		CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A24C20	0180-0373	2		CAPACITOR-FXD .68UF+-10% 35VDC TA	56289	150D684X9035A2
A24C21	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C22	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C23	0160-4084	8	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A24CR1	1901-0028	5	11	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR2	1901-0040	1	11	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR4	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR5	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR6	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR7	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR8	1901-0020	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR10-				NOT ASSIGNED		
A24CR12				NOT ASSIGNED		
A24CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR17	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR18	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR19	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR20	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR21	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR22	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR23				NOT ASSIGNED		
A24CR24				NOT ASSIGNED		
A24CR25	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR26	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR27	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24DS1	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A24DS2	1990-0487	7	5	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A24DS3	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A24DS4	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A24DS5	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A24DS6	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A24Q1	1853-0281	9	7	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q2	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q3	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q4	1854-0477	7	10	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q5	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q6	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q7	1853-0457	1	1	TRANSISTOR PNP SI PD=350MW FT=100MHZ	01295	A5T5400
A24Q8	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q9	1884-0281	4	5	THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A24Q10	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q11	1884-0281	4		THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A24Q12	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q13	1884-0281	4		THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A24Q14	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q15	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A

*Indicates factory selected value

TABLE 1. A24 VOLTAGE REGULATOR, REPLACEABLE PARTS (2 OF 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A24Q16	1884-0281	4		THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A24Q17	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q18	1884-0281	4		THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A24Q19	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q20	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q21	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q22	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A24Q23	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24R1	0757-0442	9	12	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R2	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R3	0698-4405	6	1	RESISTOR 107 1% .125W F TC=0+-100	24546	C4-1/8-T0-107R-F
A24R4	0757-0438	3	8	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R5	0698-3150	6	3	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A24R6	0757-0199	3	4	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R7	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R8	0698-6362	8	6	RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R10	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R12	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R13	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R15-				NOT ASSIGNED		
A24R19				NOT ASSIGNED		
A24R20	0698-3440	7	3	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A24R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R22	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R23	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R24	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R25	0757-0346	2	6	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R26	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R27	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R29	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R31	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R32	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1033-F
A24R33	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A24R34	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A24R35	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R36-				NOT ASSIGNED		
A24R49				NOT ASSIGNED		
A24R50	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R51	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R52	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R53	0757-0428	1	4	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A24R54	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A24R55	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A24R56	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A24R57	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A24R58	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A24R59	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A24R60	2100-1973	4	1	RESISTOR-TRMR 200 10% WW TOP-ADJ 20-TRN	32660	3810P-201
A24R61	0698-5556	0	1	RESISTOR 3.3K 1% .125W F TC=0+-25	28480	0698-5556
A24R62	0757-0278	9	2	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A24R63	0757-0280	3	6	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R64	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A24R65	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R66	0698-3444	1	7	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R67-				NOT ASSIGNED		
A24R69				NOT ASSIGNED		
A24R70	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R71	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R72	0757-0399	5	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A24R73	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R74	0757-0294	9	2	RESISTOR 17.8 1% .125W F TC=0+-100	19731	MFAC1/8-T0-178R-F
A24R75	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A24R76	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R77	0698-6322	0	1	RESISTOR 4K .1% .125W F TC=0+-25	28480	0698-6322
A24R78	0698-6348	0	2	RESISTOR 3K .1% .125W F TC=0+-25	28480	0698-6348
A24R79	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A24R80	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R81	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R82-				NOT ASSIGNED		
A24R89				NOT ASSIGNED		

*Indicates factory selected value

TABLE 1. A24 VOLTAGE REGULATOR, REPLACEABLE PARTS (3 OF 4)

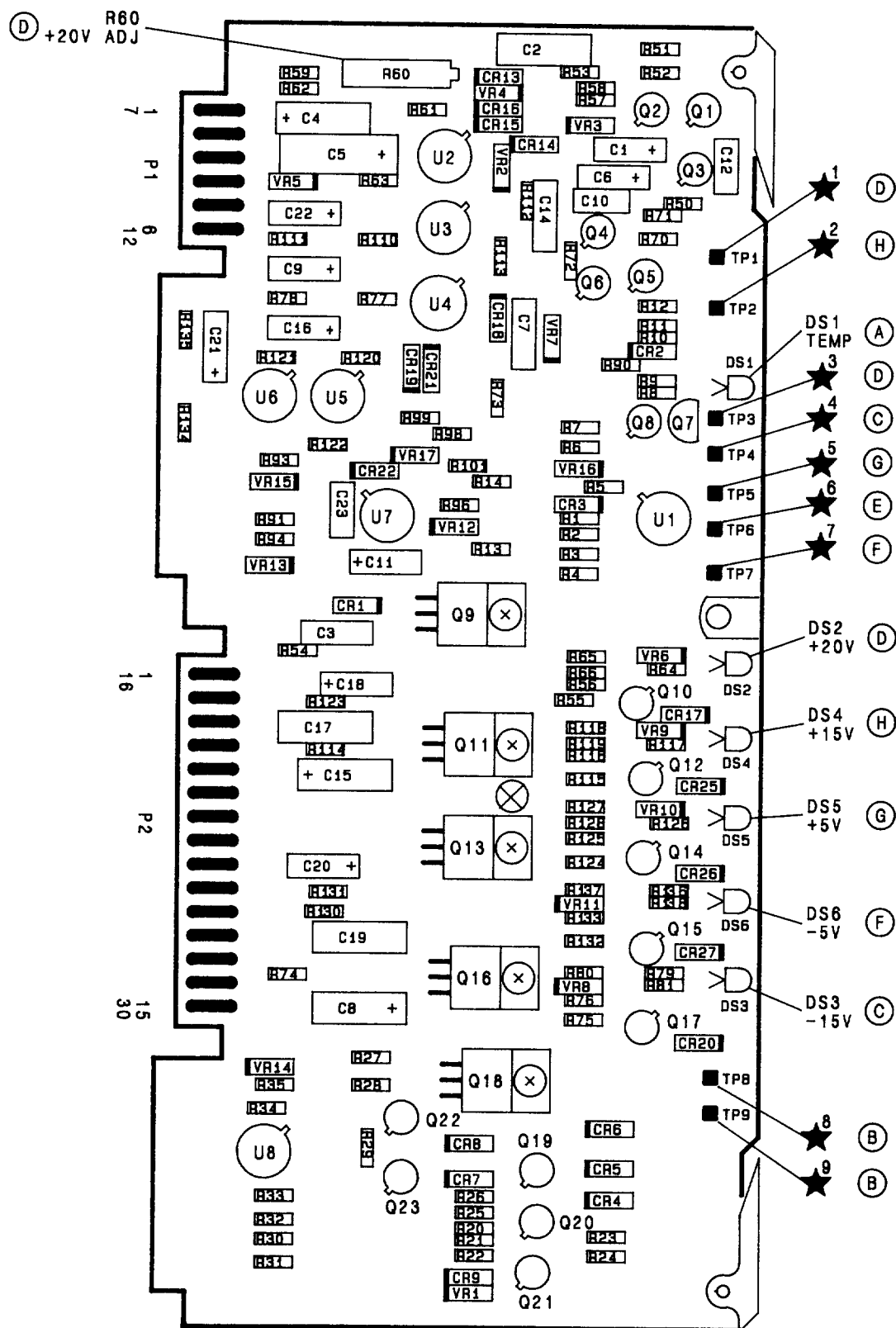
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A24R90	0757-0400	9	2	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A24R91	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A24R92				NOT ASSIGNED		
A24R93	0757-0442	9	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R94	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R95				NOT ASSIGNED		
A24R96	0698-8827	4	1	RESISTOR 1M 1% .125W F TC=0+-100	20480	0698-8827
A24R97				NOT ASSIGNED		
A24R98	0698-6360	6	1	RESISTOR 10K 1% .125W F TC=0+-25	20480	0698-6360
A24R99	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A24R100				NOT ASSIGNED		
A24R101	0698-6963	5	1	RESISTOR 5.55K 1% .125W F TC=0+-25	20480	0698-6963
A24R102				NOT ASSIGNED		
A24R109				RESISTOR 1K 1% .125W F TC=0+-25	20480	0698-6362
A24R110	0698-6362	8	3	RESISTOR 3K 1% .125W F TC=0+-25	20480	0698-6340
A24R111	0698-6340	8		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R112	0757-0280	3	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A24R113	0757-0416	7		RESISTOR 17.8 1% .125W F TC=0+-100	19731	MF4C1/8-T0-17R8-F
A24R114	0757-0294	9	9	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A24R115	0757-0400	9		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R116	0757-0280	3	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A24R117	0757-0428	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R118	0757-0346	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R119	0698-3444	1		RESISTOR 2.822K 1% .1W F TC=0+-5	20480	0698-5361
A24R120	0698-5361	5	2	RESISTOR 1K 1% .125W F TC=0+-25	20480	0698-6362
A24R121	0698-6362	8		RESISTOR 176 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A24R122	0698-3440	7	2	RESISTOR 19.6 1% .125W F TC=0+-100	03088	PME55-1/8-T0-19R6-F
A24R123	0698-3429	2		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A24R124	0698-3443	0	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R125	0757-0280	3		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R126	0698-3444	1	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R127	0757-0346	2		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R128	0698-3444	1	7	NOT ASSIGNED		
A24R129				RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A24R130	0698-3440	7	3	RESISTOR 19.6 1% .125W F TC=0+-100	03088	PME55-1/8-T0-19R6-F
A24R131	0698-3429	2		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A24R132	0698-3438	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R133	0757-0280	3		RESISTOR 5K 1% .125W F TC=0+-25	03680	PME55-1/8-T9-5001-B
A24R134	0698-6320	8	1	RESISTOR 1.3K 1% .125W F TC=0+-25	20480	0698-8911
A24R135	0698-8911	7		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R136	0698-3444	1	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R137	0757-0346	2		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R138	0698-3444	1	9	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP1	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP2	0360-0124	3	3	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP4	0360-0124	3	3	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP5	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP6	0360-0124	3	3	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP7	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP8	0360-0124	3	3	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24TP9	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	20480	0360-0124
A24U1	1826-1058	3	2	IC OP AMP GP B-T0-99 PKG	20480	1826-1058
A24U2	1826-0371	1		IC OP AMP LOW-BIAS-H-IMPD T0-99 PKG	27014	LF256H
A24U3	1826-0371	1	5	IC OP AMP LGW-BIAS-H-IMPD T0-99 PKG	27014	LF256H
A24U4	1826-0371	1		IC OP AMP LOW-BIAS-H-IMPD T0-99 PKG	27014	LF256H
A24U5	1826-0371	1		IC OP AMP LGW-BIAS-H-IMPD T0-99 PKG	27014	LF256H
A24U6	1826-0371	1	1	IC OP AMP LOW-BIAS-H-IMPD T0-99 PKG	27014	LF256H
A24U7	1826-0425	6		IC OP AMP GP DUAL T0-99 PKG	34371	HA2-2655-5
A24U8	1826-1058	3	5	IC OP AMP GP B-T0-99 PKG	20480	1826-1058
A24VR1	1902-3082	9		DIODE-ZNR 4.64V 5% D0-35 PD=.4W	20480	1902-3082
A24VR2	1902-0556	6	2	DIODE-ZNR 20V 5% PD=1W IR=5UA	20480	1902-0556
A24VR3	1902-0041	4		DIODE-ZNR 5.11V 5% D0-35 PD=.4W	20480	1902-0041
A24VR4	1902-3082	9	3	DIODE-ZNR 4.64V 5% D0-35 PD=.4W	20480	1902-3082
A24VR5	1902-0606	3		DIODE-ZNR 6.2V 2% D0-7 PD=.4W TC=+.002%	04713	1N825
A24VR6	1902-3256	9	1	DIODE-ZNR 23.7V 5% D0-35 PD=.4W	20480	1902-3256
A24VR7	1902-0556	6		DIODE-ZNR 20V 5% PD=1W IR=5UA	20480	1902-0556
A24VR8	1902-0184	6	3	DIODE-ZNR 16.2V 5% D0-35 PD=.4W	20480	1902-0184
A24VR9	1902-0184	6		DIODE-ZNR 16.2V 5% D0-35 PD=.4W	20480	1902-0184
A24VR10	1902-3104	6	2	DIODE-ZNR 5.62V 5% D0-35 PD=.4W	20480	1902-3104
A24VR11	1902-3104	6		DIODE-ZNR 5.62V 5% D0-35 PD=.4W	20480	1902-3104
A24VR12	1902-0184	6	9	DIODE-ZNR 16.2V 5% D0-35 PD=.4W	20480	1902-0184
A24VR13	1902-3082	9		DIODE-ZNR 4.64V 5% D0-35 PD=.4W	20480	1902-3082
A24VR14	1902-3082	9	1	DIODE-ZNR 4.64V 5% D0-35 PD=.4W	20480	1902-3082
A24VR15	1902-0064	1		DIODE-ZNR 7.5V 5% D0-35 PD=.4W TC=+.05%	20480	1902-0064

*Indicates factory selected value

TABLE 1. A24 VOLTAGE REGULATOR, REPLACEABLE PARTS (4 OF 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A24VR16 A24VR17	1902-3082	9		DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082
	1902-0686	3		DIODE-ZNR 6.2V 2% DO-7 PD=.4W TC=+.002%	04713	1N825
				A24 MISCELLANEOUS PARTS		
	2200-0105	4	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-1071	7	5	WASHER-RECTANGULAR 10.28 MM LG; 5.59MM	28480	3050-1071
	4040-0750	7	1	EXTR PC BD RED	28480	4040-0750
	4040-0752	9	1	EXTR PC BD YEL	28480	4040-0752

*Indicates factory selected value



A24 VOLTAGE REGULATOR 85680-60154

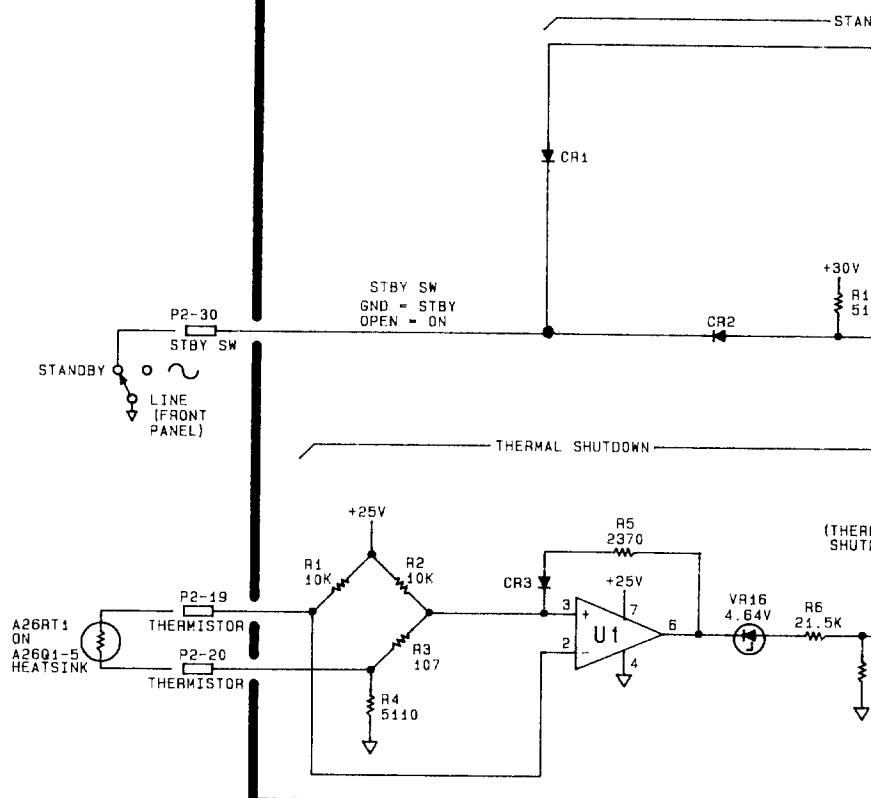
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+20V	A26	I D
7	+20V SENSE	A26	D
2	GND	A26	I
8	GND SENSE	A26	D
3	-15V	A26	I C
9	-15V SENSE	A26	C
4	+15V	A26	I H
10	+15V SENSE	A26	H
5	+5.2V	A26	I G
11	+5.2V SENSE	A26	G
6	-5.2V	A26	I F
12	-5.2V SENSE	A26	F

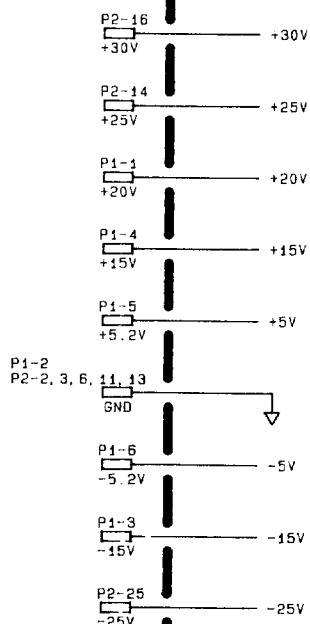
P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	FAN RELAY	A26, K1	A
16	+30V	A26	I
2	GND	A26, Q2	I D
17	Q2B	A26, Q2	D
3	GND	A26, Q4	I G
18	Q4B	A26, Q4	G
4	OVN PWR	A27, P1-1	B
19	THERMISTOR	A26, RT1	A
5	OVN MTR	A27, P1-3	B
20	THERMISTOR	A26, RT1	A
6	GND	A26, Q5	I H
21	Q5B	A26, Q5	H
7	OSC PWR	A27, P1-5	B
22	Q5E	A26, Q5	H
8	HOVC	A12, P2-32	B
23	Q4E	A26, Q4	G
9	HINT	INT/EXT SWITCH	B
24	Q2E	A26, Q2	D
10	HOVC	A16, P1-11	B
25	-25V	A26	I
11	GND	A26, Q1	I F
26	Q1B	A26, Q1	F
12	HPUP	A15, P2-32	E
27	Q1E	A26, Q3	F
13	GND	A26, Q3	I C
28	Q3B	A26, Q3	C
14	+25V	A26	I
29	Q3E	A26, Q3	C
15	STBY LED	A5, P1-2	B
30	STBY SW	A5, P1-3	A

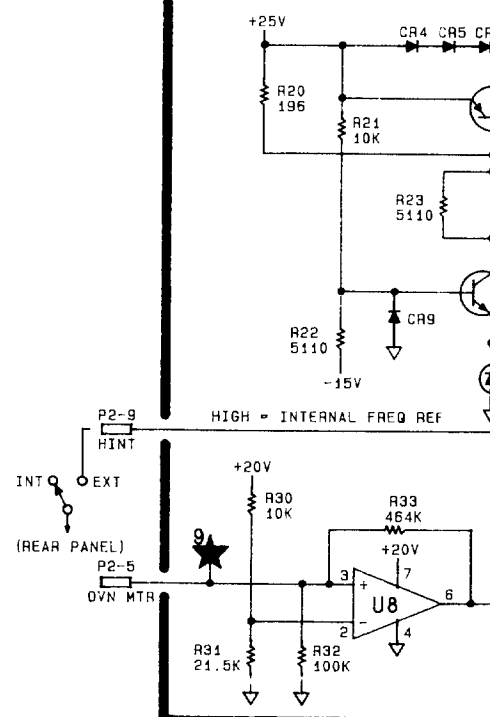
① VOLTAGE REGULATOR CONTROL

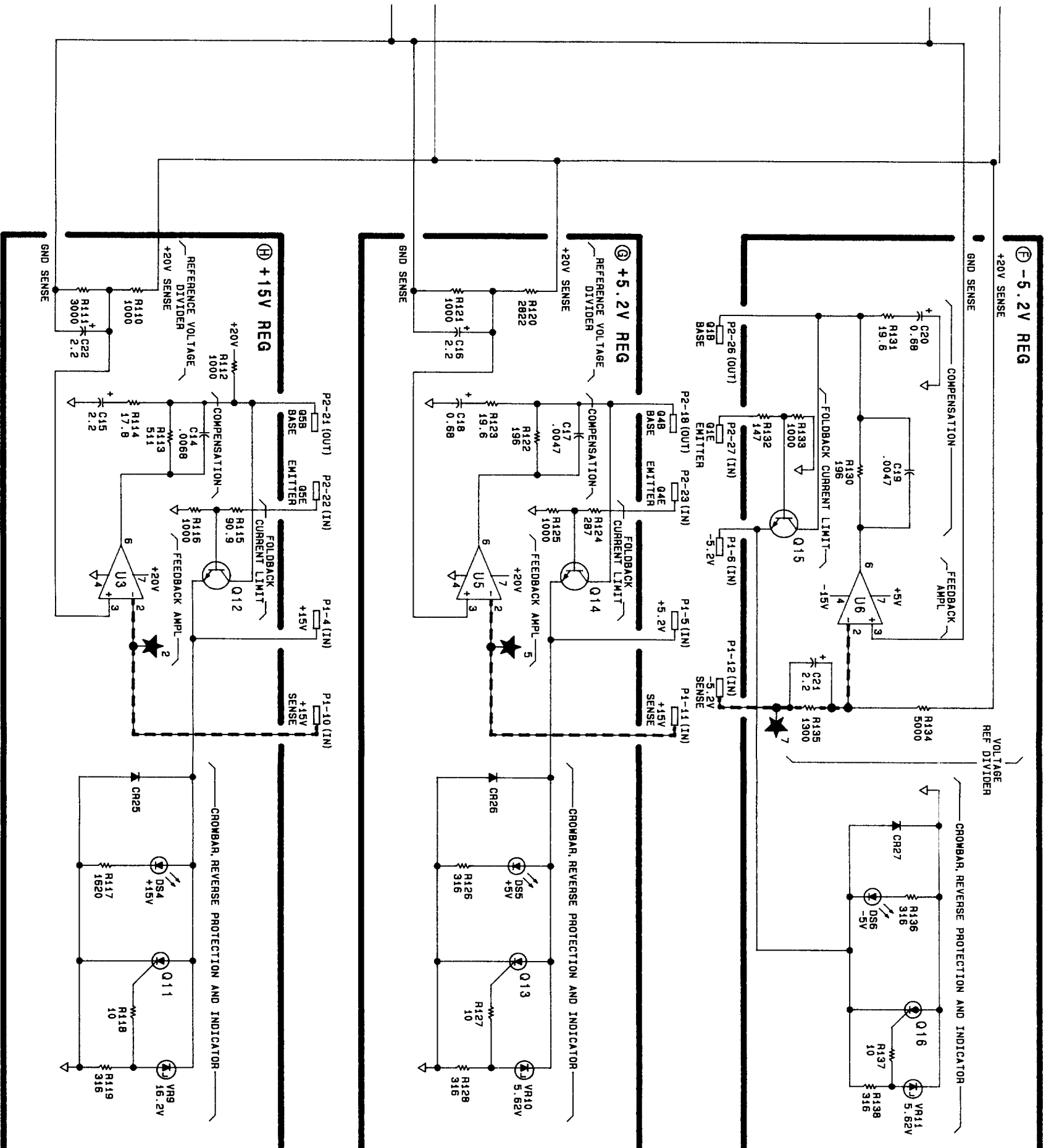


② POWER SUPPLIES



③ FREQUENCY REFERENCE





- NOTES:**
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.

2. UNLESS OTHERWISE INDICATED:
RESISTANCE IS IN OHMS (Ω)
CAPACITANCE IS IN MICROFARADS (μ F)
INDUCTANCE IS IN MICROHENRIES (μ H)

3. UNLESS OTHERWISE INDICATED:
SIGNALS ENTER AT LEFT SIDE AND EXIT AT
RIGHT SIDE OF FUNCTION BLOCKS.

- #### 4. MNEMONIC TABLE:

MEMORIC	DESCRIPTION
HINT	EXT. TIMEBASE 0V = EXT. INT +5V = INT
HPUP	POWER UP 0V = POWER UP +5V = POWER DOWN
HOVC	OVEN COOL 0V = OVEN COOL +5V = OVEN ON

FIGURE 2. A24 VOLTAGE REGULATOR, SCHEMATIC DIAGRAM

A24

A25 RECTIFIER, CIRCUIT DESCRIPTION

Power is supplied to the instrument through the Power Line Module and the Line Voltage Selector to the primary of transformer T1. Three center-tapped secondaries provide the rectified outputs.

Diodes CR1 through CR4 form a full-wave rectifier that provides an unregulated $\pm 10\text{V}$; CR5 through CR8, an unregulated $\pm 25\text{V}$; and CR9 and CR10, an unregulated $+ 30\text{V}$. These are regulated by A24 Voltage Regulator to $+ 5\text{V}$, $- 5.2\text{V}$, $+ 15\text{V}$, $- 15\text{V}$, and $+ 20\text{V}$. LED indicator DS1 indicates the presence of unregulated voltages.

CR1 and Q1 form a crowbar circuit for overvoltage protection. Fuses for the unregulated supplies are located on A26 Motherboard.

RF SECTION INTERNAL FUSE REPLACEMENT

WARNING

Remove AC Line cords from both instruments before proceeding with this procedure.

1. Position instrument upside-down as shown in View A.
2. Remove feet **1** from rear of RF Section by removing screws **2** shown in View A.
3. Remove bottom cover from RF Section by loosening screw **3** shown in View A.
4. Remove shield from over fuses by removing rear screws **4** and front screws **5** shown in View B.
5. Location of fuses is shown in View B.

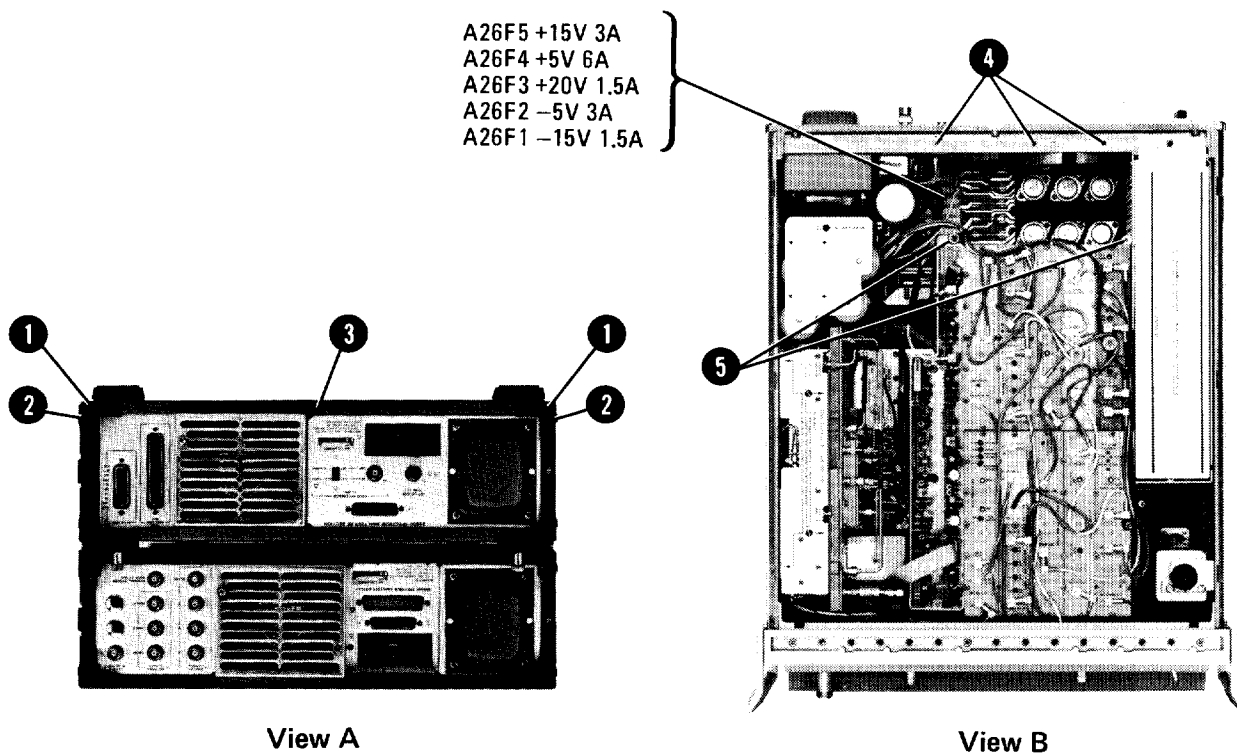


FIGURE 1. RF SECTION INTERNAL FUSE REPLACEMENT

TABLE 1. A25 RECTIFIER, REPLACEABLE PARTS

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A25	85680-60155	0	1	BOARD ASSEMBLY, RECTIFIER	20480	85680-60155
A25C1	0170-0064	7	3	CAPACITOR-FXD .47UF +-10% 100VDC POLYE	84411	663UW47491W
A25C2	0160-2055	9	3	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A25C3	0170-0064	7		CAPACITOR-FXD .47UF +-10% 100VDC POLYE	84411	663UW47491W
A25C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A25C5	0170-0064	7		CAPACITOR-FXD .47UF +-10% 100VDC POLYE	84411	663UW47491W
A25C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A25C7	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56209	150D225X9020A2
A25CR1	1901-0662	3	10	DIODE-PWR RECT 100V 6A	04713	MR751
A25CR2	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR3	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR4	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR5	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR6	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR7	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR8	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR9	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR10	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A25DS1	1990-0486	6	1	LED LAMP LUM-INT=1MCD IF=20MA-MAX ESR=5V	28480	5082-4684
A25F1	2110-0003	0	1	FUSE 3A 250V NTD 1.25X.25 UL	75915	312003
A25Q1	1884-0281	4	1	THYRISTOR-SCR 2N6505 TO 220AB VRRM=100	04713	2N6505
A25R1	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A25R2	0757-0405	4	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A25R3	0757-0818	3	1	RESISTOR 825 1% .5W F TC=0+-100	28480	0757-0818
A25VR1	1902-0657	8	1	DIODE-ZNR 43.2V 5% DO-15 PD=1W TC=+-100%	28480	1902-0657
				MISCELLANEOUS PARTS		
	2110-0269	0	2	FUSEHOLDER-CLIP TYPE .25D-FUSE	28480	2110-0269
	4040-0750	7	1	EXTR PC BD RED	28480	4040-0750
	4040-0753	0	1	EXTR PC BD GRN	28480	4040-0753

*Indicates factory selected value

TABLE 2. A26 MOTHERBOARD, REPLACEABLE PARTS (1 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A26	85680-60127	4	1	BOARD ASSEMBLY, MOTHERBOARD	28480	85680-60127
A26C1	0160-3456	6	42	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C2	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C3	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C4	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C5	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C6	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C7	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C8	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C9	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C10	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C11	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C12	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C13	0160-3448	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A26C14	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C15	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C16	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C17	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C18	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C19	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C20	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C21	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C22	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C23	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C24	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C25	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C26	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C27	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C28	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C29	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C30	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C31	0160-3456	6	4	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C32	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A26C33	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A26C34	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C35	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C36	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A26C37	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A26C38	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C39	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C40	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C41	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C42	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C43	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C44	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C45	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C46	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C47	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A26C48	0180-0116	1	5	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A26C49	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A26C50	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A26C51	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A26C52	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A26CR1	1901-0028	5	3	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A26CR2	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A26CR3	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A26F1	2110-0043	8	2	FUSE 1.5A 250V NTD 1.25X.25 UL	28480	2110-0043
A26F2	2110-0003	0	2	FUSE 3A 250V NTD 1.25X.25 UL	75915	312003
A26F3	2110-0043	8		FUSE 1.5A 250V NTD 1.25X.25 UL	28480	2110-0043
A26F4	2110-0056	3	1	FUSE 6A 250V NTD 1.25X.25 UL IEC	75915	312006
A26F5	2110-0003	0		FUSE 3A 250V NTD 1.25X.25 UL	75915	312003
A26K1	0490-0610	5	1	RELAY 2C 24VDC-COIL 5A 115VAC	28480	0490-0610
A26L1	9100-1788	6	28	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A26L2	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK230 20/48
A26L3	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A26L4	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK230 20/48
A26L5	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A26L6	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A26L7	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A26L8	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK230 20/48
A26L9	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A26L10	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK230 20/48

*Indicates factory selected value

TABLE 2. A26 MOTHERBOARD, REPLACEABLE PARTS (2 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A26L11	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L12	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L13	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L14	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L15	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L16	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L17	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L18	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L19	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L20	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L21	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L22	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L23	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L24	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L25	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L26	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L27	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26L28	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	32114	VK200 20/48
A26MP1				NOT ASSIGNED		
A26MP2	2110-0269	0	10	FUSEHOLDER-CLIP TYPE.25D-FUSE	20480	2110-0269
A26P1	1251-0600	0	4	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	20480	1251-0600
A26P2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	20480	1251-0600
A26P3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	20480	1251-0600
A26P4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	20480	1251-0600
A26Q1	1853-0351	4	2	TRANSISTOR PNP 2N6053 SI DARL TO-3	04713	2N6053
A26Q2	1854-0611	1	3	TRANSISTOR NPN 2N6055 SI DARL TO-3	04713	2N6055
A26Q3	1853-0351	4		TRANSISTOR PNP 2N6053 SI DARL TO-3	04713	2N6053
A26Q4	1854-0611	1		TRANSISTOR NPN 2N6055 SI DARL TO-3	04713	2N6055
A26Q5	1854-0611	1		TRANSISTOR NPN 2N6055 SI DARL TO-3	04713	2N6055
A26R1-				NOT ASSIGNED		
A26R3						
A26R4	0811-3493	2	3	RESISTOR .47 10% 7W PW TC=0+-800	20480	0811-3493
A26R5	0811-3493	2		RESISTOR .47 10% 7W PW TC=0+-800	20480	0811-3493
A26R6	0811-3493	2		RESISTOR .47 10% 7W PW TC=0+-800	20480	0811-3493
A26R7	0811-3494	3	4	RESISTOR 1.27 10% 7W PW TC=0+-600	20480	0811-3494
A26R8	0811-3494	3		RESISTOR 1.27 10% 7W PW TC=0+-600	20480	0811-3494
A26R9	0811-3494	3		RESISTOR 1.27 10% 7W PW TC=0+-600	20480	0811-3494
A26R10	0811-3494	3		RESISTOR 1.27 10% 7W PW TC=0+-600	20480	0811-3494
A26R11	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4 1/8-T0 5111-F
A26R12	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4 1/8-T0-5111-F
A26R13	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4 1/8-T0 5111-F
A26R14	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4 1/8-T0-5111-F
A26R15	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4 1/8-T0-5111-F
A26RT1	0837-0126	6	1	THERMISTOR DISC 1K OHM TC=-4.4%/C-DEG	20480	0837-0126
A26U1	1826-0117	3	1	IC 7812 V RGLTR TO-3	07263	7812KC
A26XA6P1	1251-0472	4	19	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA6P2	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA7P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA8P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA8P2	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA9P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA10P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA11P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA11P2	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA12P1	1251-7452	4	2	CONNECTOR-PC EDGE 25-CONT/ROW 2-ROWS	20480	1251-7452
A26XA12P2	1251-2026	0	2	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	20480	1251-2026
A26XA15P1	1251-7452	4		CONNECTOR-PC EDGE 25-CONT/ROW 2-ROWS	20480	1251-7452
A26XA15P2	1251-2026	0		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	20480	1251-2026
A26XA15P3	1251-2035	9	5	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	20480	1251-2035
A26XA16P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA16P2	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA17P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA17P2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	20480	1251-2035
A26XA18P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA19P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA20P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA21P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA21P2	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA22P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA22P2	1251-2034	0	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	20480	1251-2034
A26XA22P3	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	20480	1251-2035
A26XA24P1	1251-0472	4		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	20480	1251-0472
A26XA24P2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	20480	1251-2035
A26XA25P1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	20480	1251-2035

*Indicates factory selected value

TABLE 2. A26 MOTHERBOARD, REPLACEABLE PARTS (3 OF 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	1200-0043 3050-0011 85680-20055	8 3 3	1 1 1	MISCELLANEOUS PARTS INSULATOR-XSTR ALUMINUM WASHER-FL NM NO. 5 .13-IN-ID .25-IN-OD HEAT SINK PWR	28480 28480 28480	1200-0043 3050-0011 85680-20055

*Indicates factory selected value

A25
RECTIFIER
85680-60155

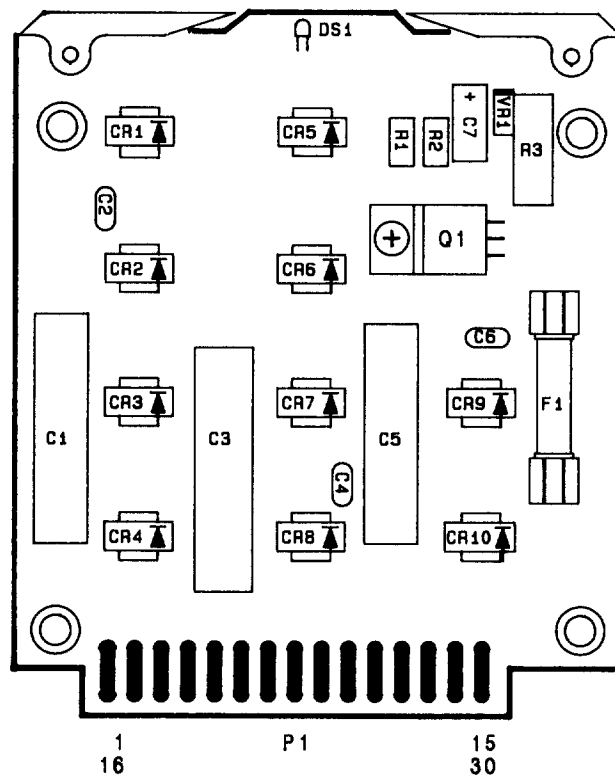
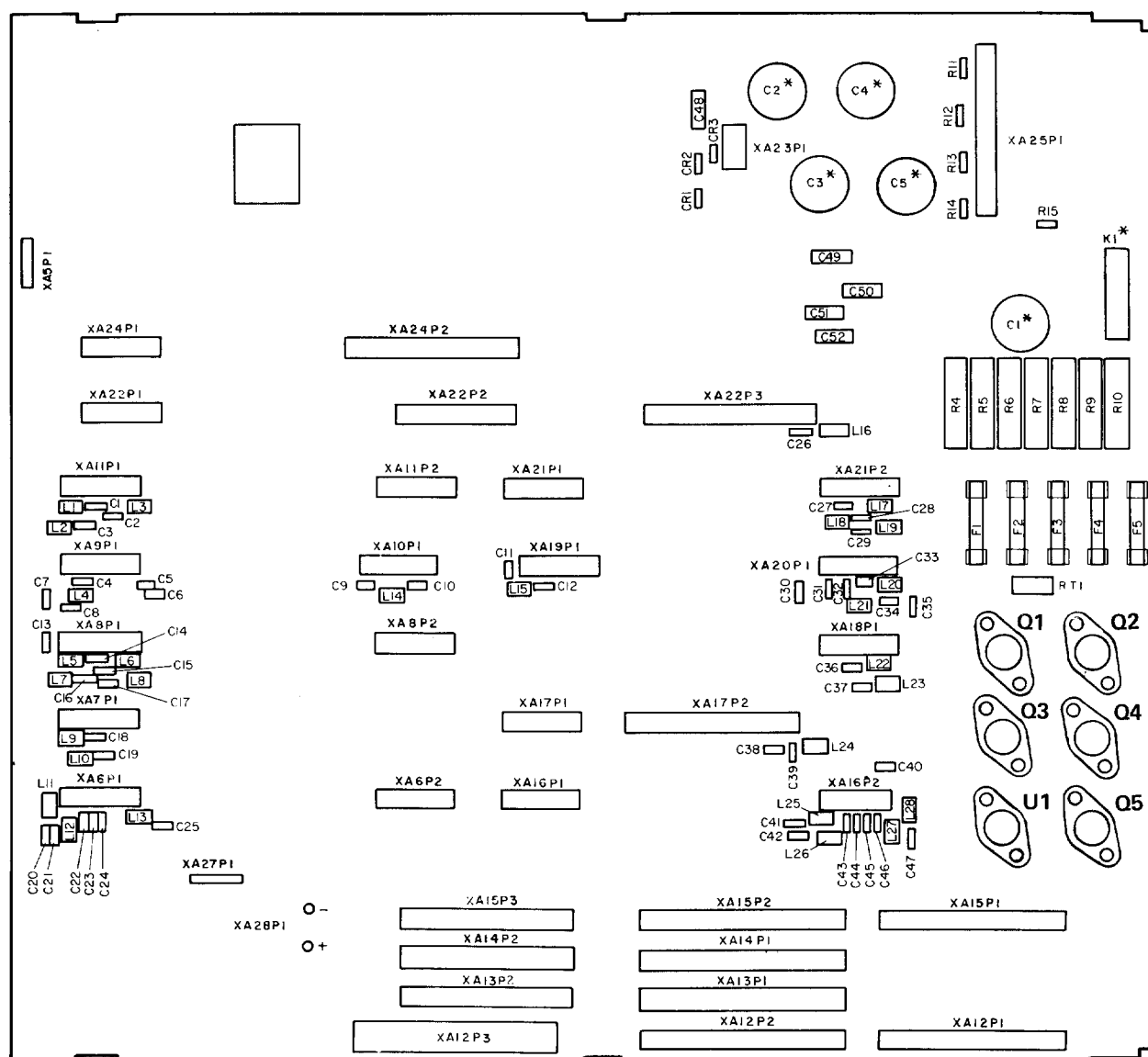


FIGURE 2. A25 RECTIFIER, COMPONENT LOCATIONS

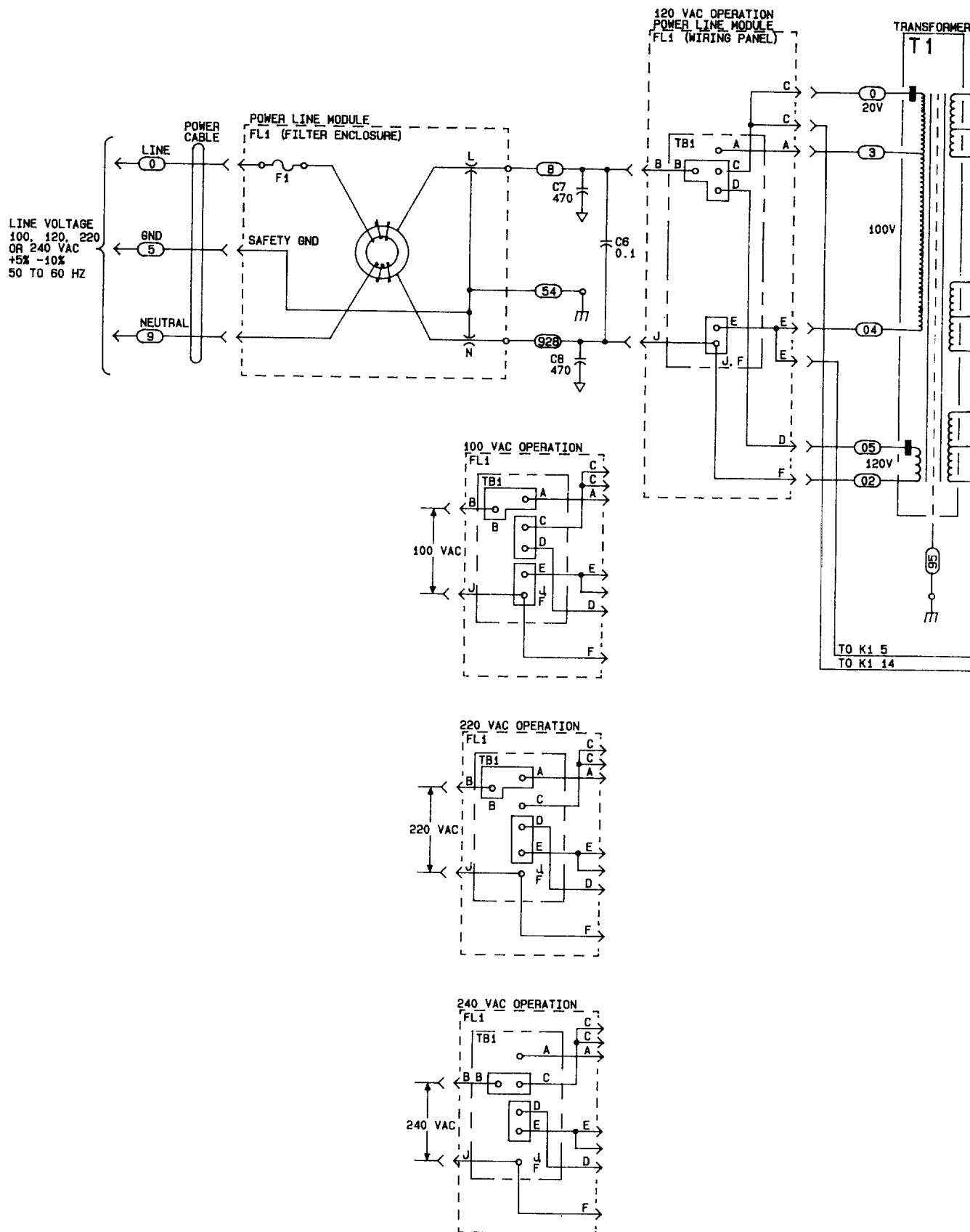
A26 MOTHERBOARD 85680-60127



* THESE COMPONENTS ARE NOT PART OF THE A26 MOTHERBOARD. REFER TO THE GENERAL PARTS LISTING TAB FOR PART NUMBER INFORMATION.

FIGURE 3. A26 MOTHERBOARD, COMPONENT LOCATIONS

RF SECTION



MOTHERBOARD

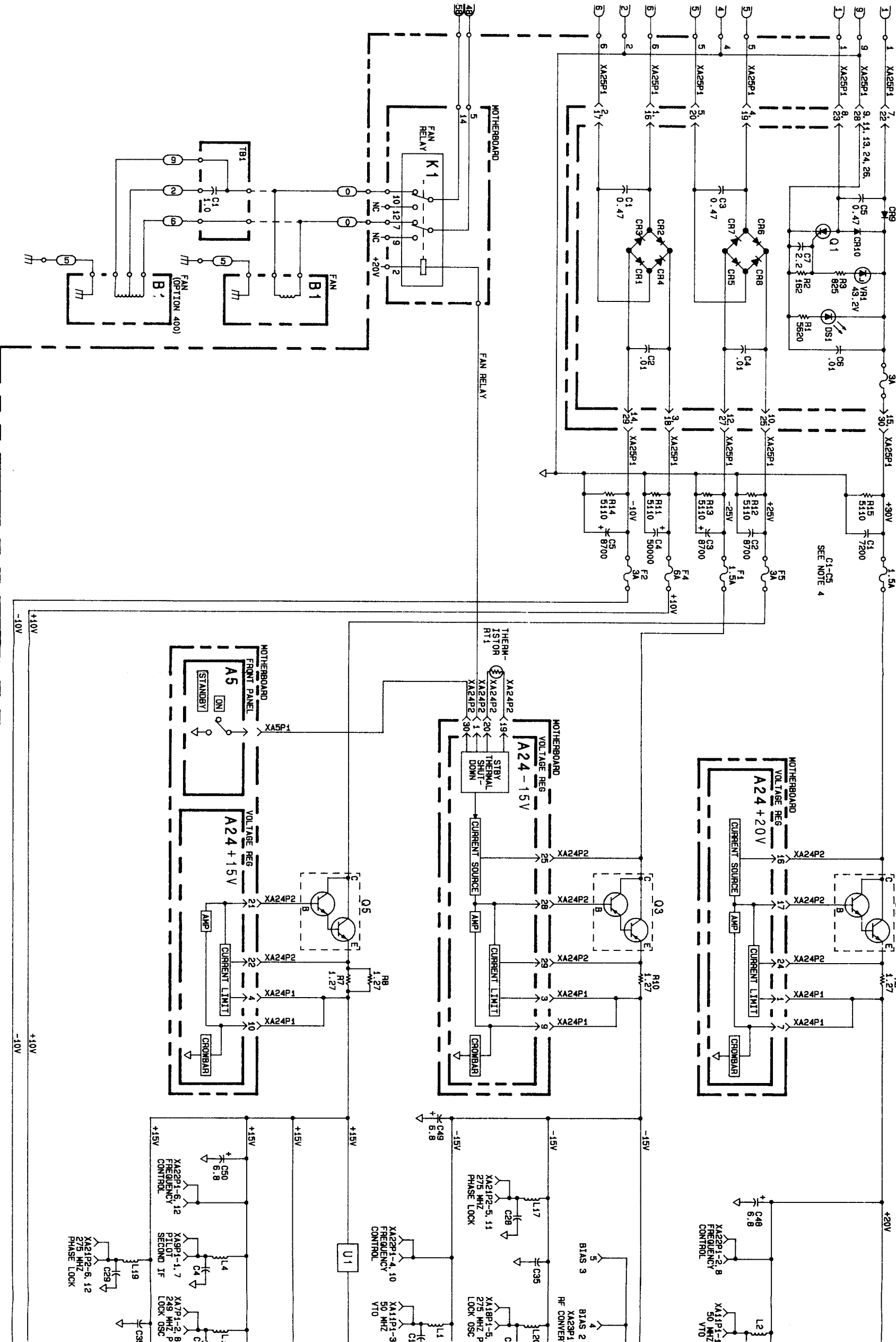
RECTIFIER

A26

A25 85680-60136

A26 MOTHERBOARD

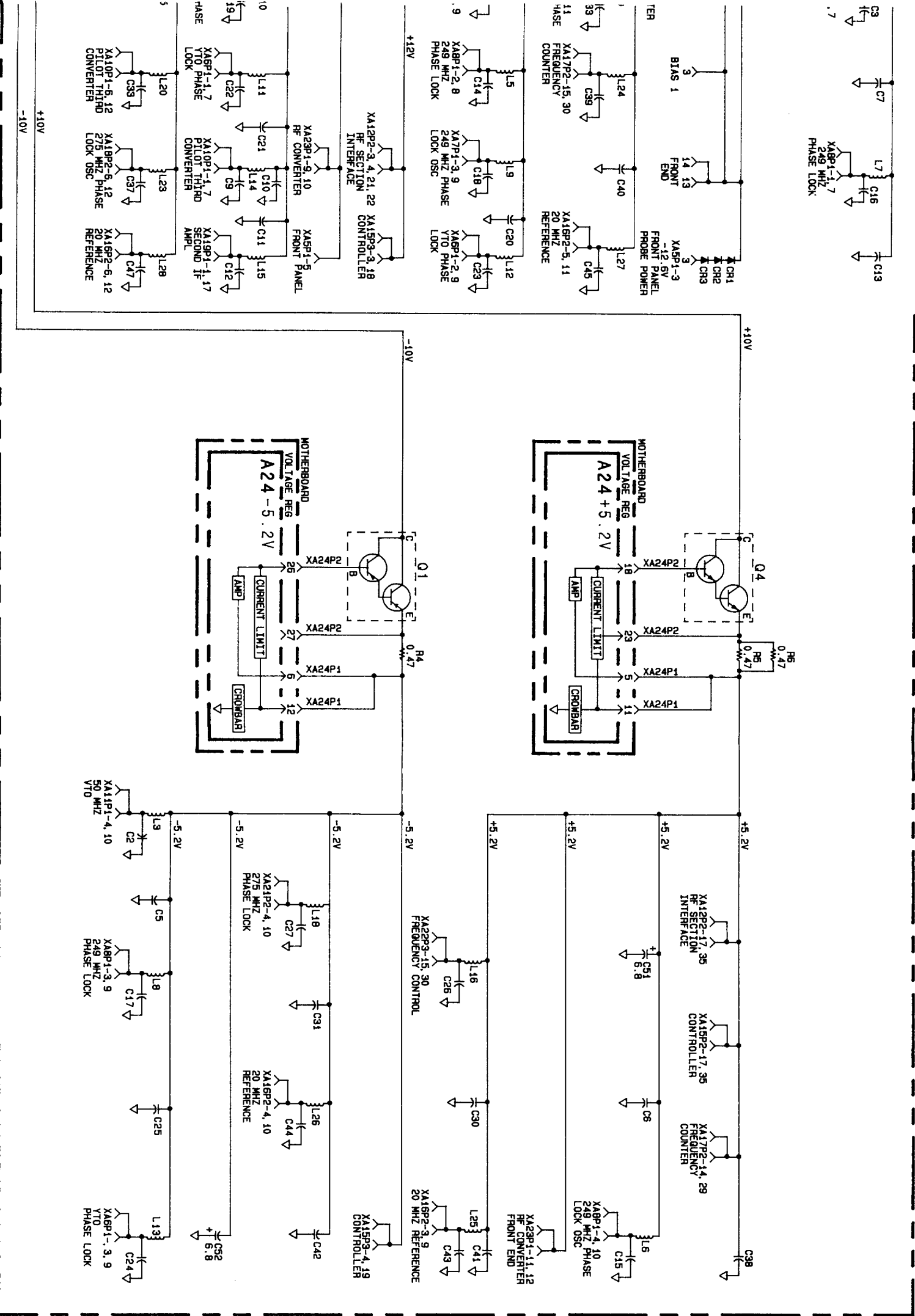
85680-60127



SERIAL PREFIX: 2408A

NOTES:

- 1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY REFERENCE THIS ASSEMBLY DESIGNATION WITH PREFIX ABBREVIATION.
- 2. UNLESS OTHERWISE INDICATED: CAPACITANCE IS IN OHMS (Ω), MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
- 3. CAPACITORS SHOWN WITHOUT VALUES ARE 1000 P.F. INDUCTORS SHOWN WITHOUT VALUES ARE 0.75μH.
- 4. FILTER CAPACITORS C1-C5 ARE CHASSIS PARTS. DO NOT PREFIX WITH A26.
- 5. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE AND EXIT AT RIGHT SIDE OF FUNCTION BLOCKS.



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR EXCEPT THE FOLLOWING DESIGNATORS: ALL CONNECTORS WITH X DESIGNATIONS AND C1 THRU C5.
2. UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS (Ω)
CAPACITANCE IN MICRO-FARADS (μ F)
INDUCTANCE IN MICRO-HENRIES (μ H)

3. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
HUL1	HIGH=YTO LOOP UNLOCKED
HUL2	HIGH=249 MHz LOOP UNLOCKED
HUL3	HIGH=275 MHz LOOP UNLOCKED
LBIO	LOW=RF SECTION I/O STROBE
LTIO	LOW=IF DISPLAY SECTION I/O STROBE
LHLD	LOW=HOLD YTO PHASE-LOCK VOLTAGE
HGND	HIGH=GROUND YTO PHASE-LOCK VOLTAGE
HDIV	HIGH=DIVIDE YTO BY 2
HFLT	HIGH=YTO TUNE FILTER ON
HSWP	HIGH=SWEEPING
LSTP	LOW=STOP PROCESSOR
LDD	LOW=LOAD 249 DIVIDER NUMBERS
HINT	HIGH=INTERNAL FREQUENCY REFERENCE
LCBZ	LOW=COUNTER BUSY
HPUP	HIGH=POWER UP
LSRQ	LOW=SERVICE REQUEST
LRMT	LOW=REMOTE
LRTL	LOW=RETURN TO LOCAL
LREQ	LOW=REMOTE REQUEST
LIPS	LOW=INSTRUMENT PRESET
LADR	LOW=ADDRESSED
HSTM	HIGH=START MEMORY CYCLE
LSOB	LOW=STAY OFF BUS
LWRT	LOW=WRITE MEMORY
LDSR	LOW=DIGITAL STORAGE READY
HTVL	HIGH=YTO TUNE VOLTAGE LOW
HTVH	HIGH=YTO TUNE VOLTAGE HIGH
LLOH	LOW=2ND LO SHIFT HIGH
HPON	HIGH=POWER ON
IOB0-15	INSTRUMENT BUS DATA BITS 0 THRU 15 (HIGH TRUE)
ADR0-5	INSTRUMENT BUS ADDRESS BITS 0 THRU 5

A26 MOTHERBOARD
85680 - 60127

XAS-1

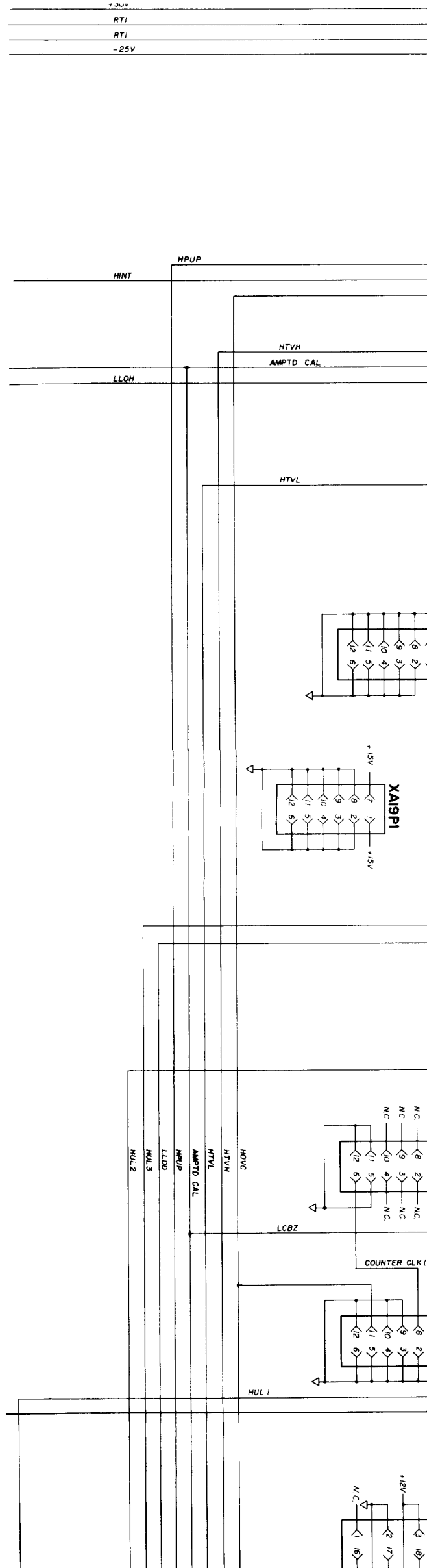
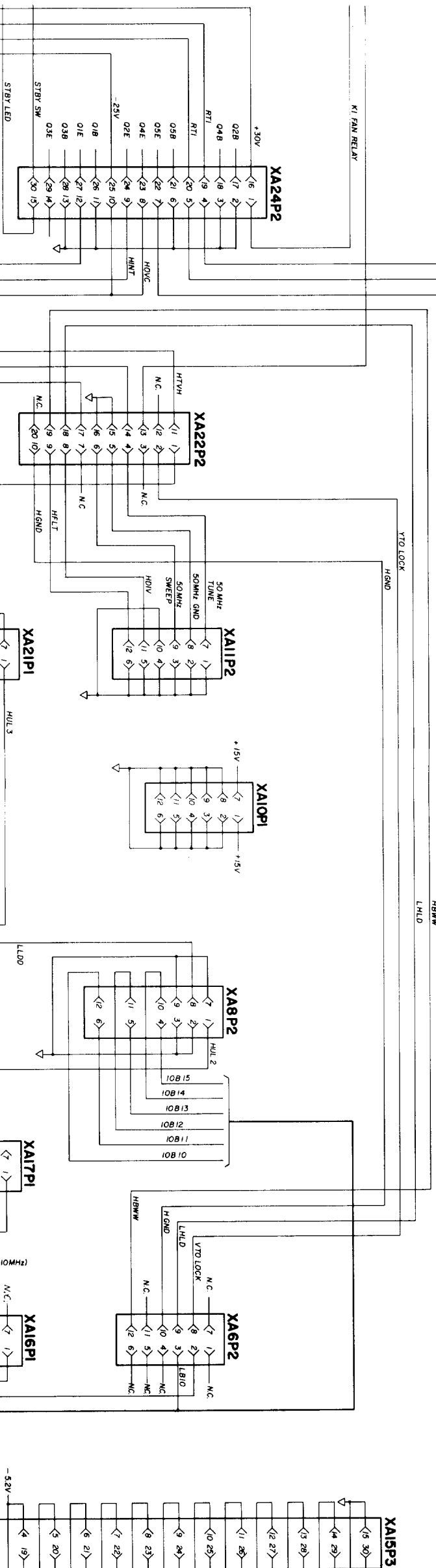
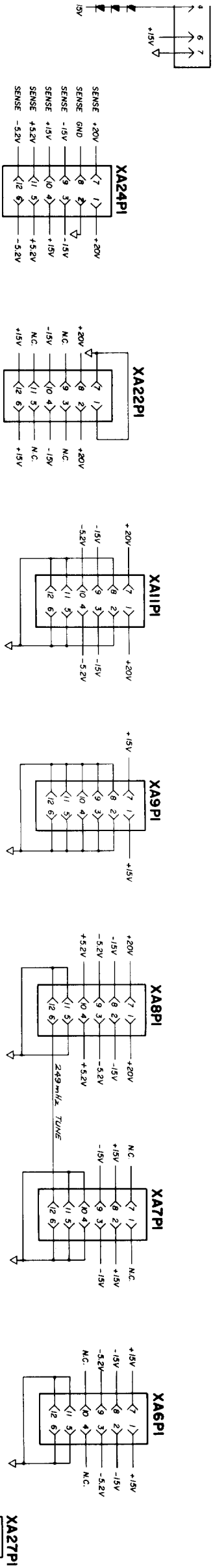


AMPTD CAL
STBY LED
SW

-12.6V

STBY SW

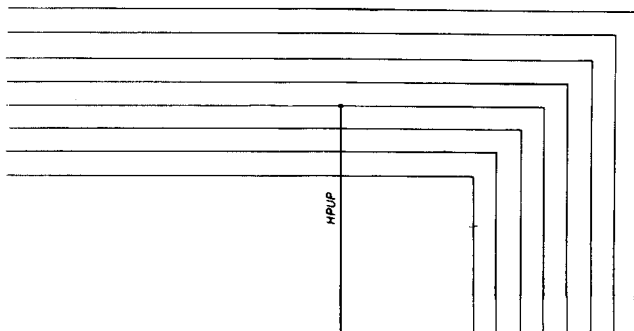
K1 FAN



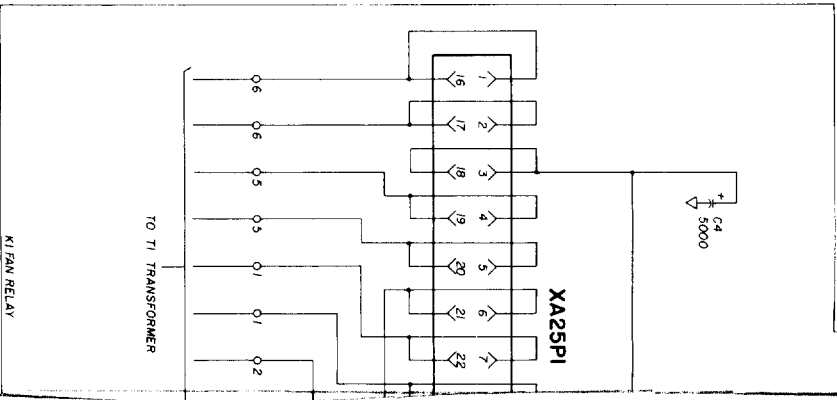
XA12P3

5 30	KC7
	KC6
24 12	KC5
	KC4
23 40	KC3
	KC2
22 47	KC1
	KC0
21 46	KR7
	KR6
20 43	KR5
	KR4
19 41	KR3
	KR2
18 43	KR1
	KR0
17 42	RPG01
	INST PRESET KEY
16 41	RPG02
	LRTL
15 40	N.C.
	LRMT
14 39	BASE Q12
	ENABLED LED
13 38	COLLECTOR Q12
	SIGNAL TRACK LED
12 37	N.C.
	FREQ COUNT LED
11 36	N.C.
	CK1 LED
10 35	N.C.
	CK11 LED
9 34	INPUT RELAY
	CFSTEP SIZE LED
8 33	+20V
	ATTEN LED
7 32	40dB THRU
	SWEEP TIME LED
6 31	40dB PAD
	VIDEO BW LED
5 30	20dB THRU
	RES BW LED
4 29	20dB PAD
	LADR
3 28	10dB THRU
	LED 4
2 27	10dB PAD
	+5.2V
1 26	GND
	GND

TO A5A1
KEYBOARD



KR 0-11	KEY ROW 0 THRU 11
	LOW=ENABLE
KC 0-7	KEY COLUMN 0 THRU 7
	LOW=KEY DOWN
HOVC	HIGH=OVEN COLD
LTGR	LOW=TRACKING GEN- ERATOR REQUEST
LIDA	INTERNAL DATA AND ADDRESS BUS BITS (LOW TRUE)
HBWW	HIGH=WIDE LOOP BW



SERIAL PREFIX: 2408A



GENERAL PARTS LISTING

INTRODUCTION

The replaceable parts list breakdown for each major assembly is located following the circuit description for the assembly. This section contains information for ordering the replacement parts not listed in the major assembly tabs. Table 1, Reference Designation and Abbreviations, includes a list of reference designations and a list of abbreviations used in the parts list. Table 2, Manufacturers Code List, lists names and addresses that correspond to the manufacturer code numbers in the parts list.

REPLACEABLE PARTS LIST

Replaceable Parts tables can be found in each assembly section and list the following information for each part in that assembly.

1. The Hewlett-Packard part number.
2. The part number check digit (CD).
3. The total quantity (Qty) in the instrument. This quantity is given only once, at the first appearance of the part in the list.
4. The description of the part.
5. A five-digit code indicating a typical manufacturer of the part.
6. The manufacturer's part number.

MISCELLANEOUS PARTS

Table 4, Miscellaneous Parts, lists parts of the instrument that are not directly related to any major assembly.

ORDERING INFORMATION

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

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

TABLE 1. REFERENCE DESIGNATIONS AND ABBREVIATIONS (1 OF 3)

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

A		CPRSN	Compression	FDTHRU	Feed Through
A	Across Flats, Acrylic, Air (Dry Method), Ampere	CUP-PT	Cup Point	FEM	Female
ADJ	Adjust, Adjustment	CW	Clockwise, Continuous Wave	FIL-HD	Fillister Head
ANSI	American National Standards Institute (formerly USASI-ASA)	D		FL	Flash, Flat, Fluid
ASSY	Assembly	D	Deep, Depletion, Depth, Diameter, Direct Current	FLAT-PT	Flat Point
AWG	American Wire Gage	DA	Darlington	FR	Front
B		DAP-GL	Diallyl Phthalate Glass	FREQ	Frequency
BCD	Binary Coded Decimal	DBL	Double	FT	Current Gain Bandwidth Product (Transition Frequency), Feet, Foot
BD	Board, Bundle	DCDR	Decoder	FXD	Fixed
BE-CU	Beryllium Copper	DEG	Degree	G	
BNC	Type of Connector	D-HOLE	D-Shaped Hole	GEN	General, Generator
BRG	Bearing, Boring	DIA	Diameter	GND	Ground
BRS	Brass	DIP	Dual In-Line Package	GP	General Purpose, Group
BSC	Basic	DIP-SLDR	Dip Solder	H	
BTN	Button	D-MODE	Depletion Mode	H	Henry, High
C		DO	Package Type Designation	HDW	Hardware
C	Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression	DP	Deep, Depth, Diametric Pitch, Dip	HEX	Hexadecimal, Hexagon, Hexagonal
CCP	Carbon Composition Plastic	DP3T	Double Pole Three Throw	HLCL	Helical
CD	Cadmium, Card, Cord	DPDT	Double Pole Double Throw	HP	Hewlett-Packard Company, High Pass
CER	Ceramic	DWL	Dowel	I	
CHAM	Chamfer	E		IC	Collector Current, Integrated Circuit
CHAR	Character, Characteristic, Charcoal	E-R	E-Ring	ID	Identification, Inside Diameter
CMOS	Complementary Metal Oxide Semiconductor	EXT	Extended, Extension, External, Extinguish	IF	Forward Current, Intermediate Frequency
CNDCT	Conducting, Conductive, Conductivity, Conductor	F		IN	Inch
CONT	Contact, Continuous, Control, Controller	F	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency	INCL	Including
CONV	Converter	FC	Carbon Film/Composition, Edge of Cutoff Frequency, Face	INT	Integral, Intensity, Internal

TABLE 1. REFERENCE DESIGNATIONS AND ABBREVIATIONS (2 OF 3)

J		
J-FET	Junction Field Effect Transistor	
JFET	Junction Field Effect Transistor	
K		
K	Kelvin, Key, Kilo, Potassium	
KNRLD	Knurled	
KVDC	Kilovolts Direct Current	
L		
LED	Light Emitting Diode	
LG	Length, Long	
LIN	Linear, Linearity	
LK	Link, Lock	
LKG	Leakage, Locking	
LUM	Luminous	
M		
M	Male, Maximum, Mega, Mil, Milli, Mode	
MA	Milliampere	
MACH	Machined	
MAX	Maximum	
MC	Molded Carbon Composition	
MET	Metal, Metallized	
MHZ	Megahertz	
MINTR	Miniature	
MIT	Miter	
MLD	Mold, Molded	
MM	Magnetized Material, Millimeter	
MOM	Momentary	
MTG	Mounting	
MTLC	Metallic	
MW	Milliwatt	
N		
N	Nano, None	
N-CHAN	N-Channel	
NH	Nanohenry	
NM	Nanometer, Nonmetallic	
NO	Normally Open, Number	
NOM	Nominal	
NPN	Negative Positive Negative (Transistor)	
NS	Nanosecond, Non-Shorting, Nose	
NUM	Numeric	
NYL	Nylon (Polyamide)	
O		
OA	Over-All	
OD	Outside Diameter	
OP AMP	Operational Amplifier	
OPT	Optical, Option, Optional	
P		
PA	Picoampere, Power Amplifier	
PAN-HD	Pan Head	
PAR	Parallel, Parity	
PB	Lead (Metal), Pushbutton	
PC	Printed Circuit	
PCB	Printed Circuit Board	
P-CHAN	P-Channel	
PD	Pad, Power Dissipation	
PF	Picofarad, Power Factor	
PKG	Package	
PLSTC	Plastic	
PNL	Panel	
PNP	Positive Negative Positive (Transistor)	
POLYC	Polycarbonate	
POLYE	Polyester	
POT	Potentiometer	
POZI	Pozidriv Recess	
PREC	Precision	
PRP	Purple, Purpose	
PSTN	Piston	
PT	Part, Point, Pulse Time	
PW	Pulse Width	
Q		
Q	Figure of Merit	
R		
R	Range, Red, Resistance, Resistor, Right, Ring	
REF	Reference	
RES	Resistance, Resistor	
RF	Radio Frequency	
RGD	Rigid	
RND	Round	
RR	Rear	
RVT	Rivet, Riveted	
S		
SAWR	Surface Acoustic Wave Resonator	
SEG	Segment	
SGL	Single	
SI	Silicon, Square Inch	
SL	Slide, Slow	
SLT	Slot, Slotted	
SMA	Subminiature, A Type (Threaded Connector)	
SMB	Subminiature, B Type (Slip-On Connector)	
SMC	Subminiature, C Type (Threaded Connector)	
SPCG	Spacing	
SPDT	Single Pole Double Throw	
SPST	Single Pole Single Throw	
SQ	Square	
SST	Stainless Steel	
STL	Steel	
SUBMIN	Subminiature	
SZ	Size	
T		
T	Teeth, Temperature, Thickness, Time, Timed, Tooth, Typical	
TA	Ambient Temperature, Tantalum	
TC	Temperature Coefficient	
THD	Thread, Threaded	
THK	Thick	
TO	Package Type Designation	
TPG	Tapping	
TR-HD	Truss Head	
TRMR	Trimmer	
TRN	Turn, Turns	
TRSN	Torsion	
U		
UCD	Microcandela	
UF	Microfarad	
UH	Microhenry	
UL	Microliter, Underwriters' Laboratories, Inc.	
UNHDND	Unhardened	
V		
V	Variable, Violet, Volt, Voltage	
VAC	Vacuum, Volts, Alternating Current	
VAR	Variable	
VDC	Volts, Direct Current	
W		
W	Watt, Wattage, White, Wide, Width	
W/SW	With Switch	
WW	Wire Wound	
X		
X	By (Used With Dimensions), Reactance	
Y		
YIG	Yttrium-Iron-Garnet	
Z		
ZNR	Zener	

TABLE 1. REFERENCE DESIGNATIONS AND ABBREVIATIONS (3 OF 3)

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

TABLE 2. MANUFACTURERS CODE LIST

Mfr. No.	Manufacturer Name	Address	Zip Code
00000	ANY SATISFACTORY SUPPLIER		
00115	ACE GLASS INC	VINELAND, NJ	08360
01121	ALLEN-BRADLEY CO	MILWAUKEE, WI	53204
01295	TEXAS INSTR INC SEMICONDUCTOR DIV	DALLAS, TX	75222
02111	SPECTROL ELECTRONICS CORP	CITY OF IND, CA	91745
02114	FERROXCUBE CORP	SAUGERTIES, NY	12477
02660	BUNKER RAMO CORP AMPHENOL CONN DIV	BROADVILLE, IL	60153
03888	K D I PYROFILM CORP	WHIPPANY, NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX, AZ	85008
06665	PRECISION MONOLITHICS INC	SANTA CLARA, CA	95050
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW, CA	94042
11236	CTS OF BERNE INC	BERNE, IN	46711
17856	SILICONIX INC	SANTA CLARA, CA	95054
18736	VOLTRONICS CORP	HANOVER, NJ	07936
19701	MEPCO/ELECTRA CORP	MINERAL WELLS, TX	76067
20940	MICRO-OHM CORP	EL MONTE, CA	91731
24046	TRANSITRON ELECTRONIC CORP	WAKEFIELD, MA	01880
24546	CORNING GLASS WORKS	BRADFORD, PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA, CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO, CA	94304
29832	TELEDYNE PHILBRICK NEXUS	DEDHAM, MA	02026
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE, NJ	
30983	MEPCO/ELECTRA CORP	SAN DIEGO, CA	92121
33095	SPECTRUM CONTROL INC	FAIRVIEW, PA	16415
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE, CA	94086
34371	HARRIS SEMICON DIV HARRIS-INTERTYPE	MELBOURNE, FL	32901
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS, MA	01247
72136	ELECTRO MOTIVE CORP	FLORENCE, SC	06226
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE, PA	16512
74970	JOHNSON E F CO	WASECA, MN	56093
75915	LITTELFUSE INC	DES PLAINES, IL	60016
84411	TRW CAPACITOR DIV	OGALLALA, NE	69153

TABLE 3. LIST OF MAJOR ASSEMBLIES

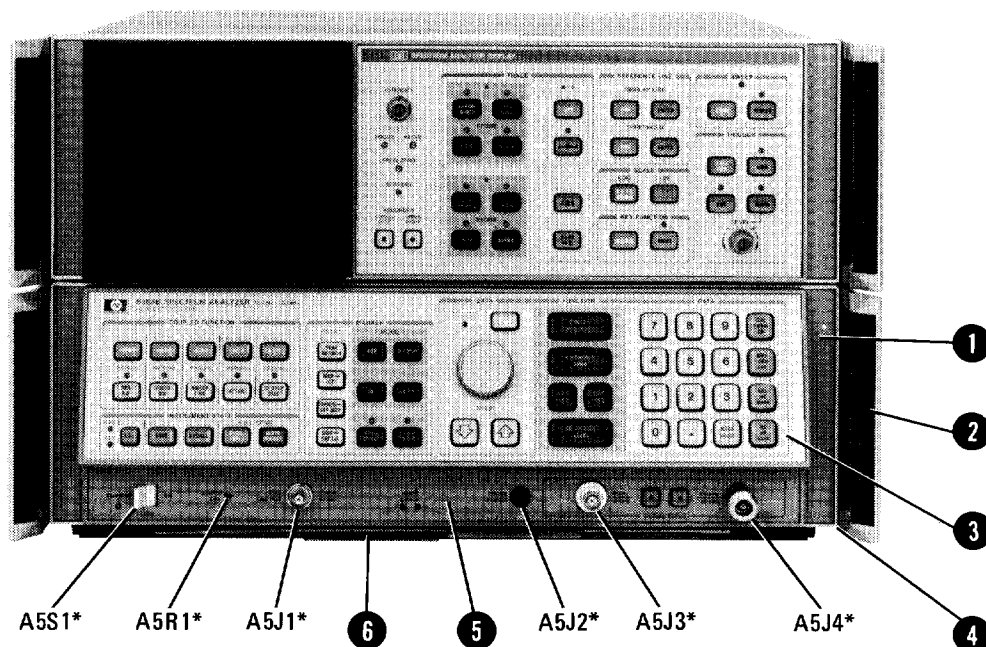
Reference Designator	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	85680-60051	3	1	FRONT PANEL (INCLUDES A5A1 KEYBOARD, A5A3 CONNECTOR, DC INPUT, A5A4 BLOCKING CAPACITOR, W1 - W3, AND W31)	28480	85680-60051
A5A1	85680-60019	3	1	BOARD ASSEMBLY, KEYBOARD	28480	85680-60019
A5A2	5060-0329	9	1	ROTARY PULSE GENERATOR (RPG)	28480	5060-0329
A5A3	85680-60059	1	1	CONNECTOR ASSEMBLY, DC INPUT	28480	85680-60059
A5A3	85680-60116	1	1	CONNECTOR ASSEMBLY, DC INPUT 75Ω (OPTION 001)	28480	85680-60116
A5A4	85680-60053	5	1	BLOCKING CAPACITOR ASSEMBLY	28480	85680-60053
A5A5	85680-60117	2	1	BOARD ASSEMBLY, INPUT SELECT	28480	85680-60117
A6	85680-60011	5	1	BOARD ASSEMBLY, YIG-TUNED OSCILLATOR PHASE LOCK	28480	85680-60011
A7	85680-60013	7	1	BOARD ASSEMBLY, 249 MHz PHASE LOCK OSCILLATOR	28480	85680-60013
A8	85680-60123	0	1	BOARD ASSEMBLY, 249 MHz PHASE LOCK OSCILLATOR	28480	85680-60123
A9	85680-60140	1	1	BOARD ASSEMBLY, PILOT SECOND IF AMPLIFIER	28480	85680-60140
A10	85680-60010	4	1	BOARD ASSEMBLY, PILOT THIRD CONVERTER	28480	85680-60010
A11	85680-60017	1	1	BOARD ASSEMBLY, 50 MHz VOLTAGE-TUNED OSCILLATOR	28480	85680-60017
A12	85680-60168	3	1	BOARD ASSEMBLY, RF SECTION INTERFACE	28480	85680-60168
A13				NOT ASSIGNED		
A14				NOT ASSIGNED		
A15	85680-60180	9	1	BOARD ASSEMBLY, CONTROLLER	28480	85680-60180
A16	85680-60005	7	1	BOARD ASSEMBLY, 20 MHz REFERENCE	28480	85680-60005
A17	85680-60131	0	1	BOARD ASSEMBLY, FREQUENCY COUNTER	28480	85680-60131
A18	85680-60015	9	1	BOARD ASSEMBLY, 275 MHz PHASE LOCK OSCILLATOR	28480	85680-60015
A19	85680-60039	7	1	BOARD ASSEMBLY, SECOND IF AMPLIFIER	28480	85680-60039
A20	85680-60171	8	1	BOARD ASSEMBLY, THIRD CONVERTER	28480	85680-60171
A21	85680-60016	0	1	BOARD ASSEMBLY, 275 MHz PHASE LOCK	28480	85680-60016
A21A1	85680-60033	1	1	BOARD ASSEMBLY, 275 MHz MIXER	28480	85680-60033
A22	85680-60156	9	1	BOARD ASSEMBLY, FREQUENCY CONTROL	28480	85680-60156
A23	85680-60054	6	1	BOARD ASSEMBLY, RF CONVERTER (INCLUDES A23A1 YIG-OSC., A23A2 FIRST CONVERTER, A23A3 SECOND CONVERTER, A23A4 FIRST LO DISTRIBUTION, A23A5 PILOT FIRST CONVERTER, A23A6 COMB GENERATOR)	28480	85680-60054
A23A1	5086-7246	7	1	YIG OSCILLATOR, 2 - 4 GHz	28480	5086-7246
A23A1	5086-7260	5	1	YIG OSCILLATOR, 2 - 4 GHz (ORDER 5086-7246)	28480	5086-7260
A23A1	5086-7246	7	1	YIG OSCILLATOR, 2 - 4 GHz, RESTORED	28480	5086-7246
A23A2	85680-60060	4	1	FIRST CONVERTER	28480	85680-60060
A23A3	85680-60052	4	1	SECOND CONVERTER ASSEMBLY (INCLUDES A23A3A1 PILOT SECOND LO BUFFER, A23A3A2 SECOND LO, A23A3A3 SECOND LO BUFFER, W16 AND W17)	28480	85680-60052
A23A3A1	85680-60129	6	1	BOARD ASSEMBLY, PILOT SECOND LO BUFFER	28480	85680-60129
A23A3A2	85680-60029	5	1	BOARD ASSEMBLY, SECOND LO	28480	85680-60029
A23A3A3	85680-60128	5	1	BOARD ASSEMBLY, PILOT SECOND LO BUFFER	28480	85680-60128
A23A4	85680-60057	9	1	BOARD ASSEMBLY, FIRST LO DISTRIBUTION (INCLUDES A23A4A1 COUPLER/SPLITTER, A23A4A2 RF CONVERTER BIAS, AND A23A4A3 AND A23A4A4 LO AMPLIFIERS)	28480	85680-60057
A23A4A1	85680-60055	7	1	COUPLER/SPLITTER	28480	85680-60055
A23A4A2	85680-60032	0	1	RF CONVERTER BIAS	28480	85680-60032
A23A4A3	5086-7244	5	2	AMPLIFIER, 2 TO 4 GHz	28480	5086-7244
A23A4A4	5086-7244	5	1	AMPLIFIER, 2 TO 4 GHz	28480	5086-7244
A23A5	85680-60061	5	1	PILOT FIRST CONVERTER	28480	85680-60061
A23A6	85680-60006	8	1	BOARD ASSEMBLY, COMB GENERATOR	28480	85680-60006
A24	85680-60154	7	1	BOARD ASSEMBLY, VOLTAGE REGULATOR	28480	85680-60154
A25	85680-60155	8	1	BOARD ASSEMBLY, RECTIFIER	28480	85680-60155
A26	85680-60127	4	1	BOARD ASSEMBLY, MOTHERBOARD	28480	85680-60127
A27	85680-60095	5	1	FREQUENCY STANDARD, 10 MHz (INCLUDES TOP AND BOTTOM MOUNTS, ISOLATION MOUNTS, CABLE ASSEMBLY A27W1, AND XTAL OSC. A27A1)	28480	85680-60095
A27A1	0960-0477	1	1	OSC-XTAL 10 MHz	28480	0960-0477
A27W1	85680-60089	7	1	CABLE ASSEMBLY, OSC OVEN PWR	28480	85680-60089
A28				NOT ASSIGNED		
A29	5021-3287	2	1	HP-IB GROUND (PC BOARD ONLY)	28480	5021-3287
				NOTE SEE W45 (HP-IB CABLE ASSEMBLY) IN TABLE 4 UNDER THIS TAB		

TABLE 4. MISCELLANEOUS PARTS (1 OF 2)

Reference Designator	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
AT1	11593A	9	1	50-OHM TERMINATION	28480	11593A
B1	3160-0296	9	1	FAN 115V 50-CFM	28480	3160-0296
B1	3160-0298	1	1	FAN 115V 60-CFM, 400 Hz (OPTION 400)	28480	3160-0298
C1	0180-2603	3	1	CAPACITOR-FXD 7200VF + 75 - 10% 50VDC AL	28480	0180-2603
C2	0180-0453	9	3	CAPACITOR-FXD 8700UF + 75 - 10% 40VDC AL	28480	0180-0453
C3	0180-0453	9	3	CAPACITOR-FXD 8700UF + 75 - 10% 40VDC AL	28480	0180-0453
C4	0180-2782	1	1	CAPACITOR-FXD .05F + 75 - 10% 15VDC AL	28480	0180-2782
C5	0180-0453	9	1	CAPACITOR-FXD 8700UF + 75 - 10% 40VDC AL	28480	0180-0453
C6	0160-4065	8	1	CAPACITOR-FXD .1UF ± 20% 250VDC PAP	28480	0160-4065
C7	0160-2636	2	2	CAPACITOR-FXD 470PF ± 20% 3K VDC CER	28480	0160-2636
C8	0160-2636	2	2	CAPACITOR-FXD 470PF ± 20% 3K VDC CER	28480	0160-2636
F1	2110-0007	4	1	FUSE 1A 250V SLOW-BLO 1.25 X .25 UL IEC	0470C	313001
F1	2110-0002	9	1	FUSE 2A 250V FAST-BLO 1.25 X .25 UL IEC	04480	MDX-2
FL1	0960-0448	6	1	LINE MODULE FILTER (DOES NOT INCLUDE FL1MP1)	28480	0960-0448
FL1MP1	7120-7671	8	1	LABEL, LINE MODULE (50 - 60 Hz)	28480	7120-7671
FL1MP1	7120-7716	2	1	LABEL, LINE MODULE (50 - 400 Hz) (OPTION 400)	28480	7120-7716
FL1TB1				PART OF FL1 AND NOT SEPARATELY REPLACEABLE		
J1	1251-7498	8		CONNECTOR 5-PIN F D SERIES (INTERCONNECT)	0450G	DBM-5W58
J2				1ST LO OUT, PART OF W12 AND NOT SEPARATELY REPLACEABLE		
J3				FREQ REFERENCE, PART OF W37 AND NOT SEPARATELY REPLACEABLE		
J4				CONNECTOR, 50-PIN 50-WIRE BUS, PART OF W44 AND NOT SEPARATELY REPLACEABLE		
J5	1251-6835	5		CONNECTOR, 24-PIN HP-18 (PART OF W45)	28480	1251-6835
K1	0490-0618	5		RELAY 2C 24VDC-COIL 5A 115VAC	28480	0490-0618
S1	3101-0530	8	1	SWITCH: DPDT (TIME BASE IN/EXT)	05057	11A-1451
TB1	85662-20086	8	1	TERMINAL BOARD, PC 400 Hz CAP (OPTION 400)	28480	85662-20086
TB1C1	0170-0073	8	1	CAPACITOR-FXD .1UF ± 10% 600VDC (OPTION 400)	28480	0170-0073
TB1MP1	85680-00051	3	1	BRACKET, TERMINAL BOARD/CAP (OPTION 400)	28480	85680-00051
T1	9100-3946	2	1	TRANSFORMER: POWER 110V 60 Hz	28480	9100-3946
W1	85680-20100	9		CABLE ASSEMBLY, A5K1 TO A5AT1	28480	85680-20100
W2	85680-60088	6		CABLE ASSEMBLY (PANEL POWER)	28480	85680-60088
W3	85680-60101	4		CABLE ASSEMBLY, A5AT1 TO A23AT1	28480	85680-60101
W4				NOT ASSIGNED		
W5	85680-20096	2		CABLE ASSEMBLY, A23A1 TO A23A4A1	28480	85680-20096
W6	85680-20097	3		CABLE ASSEMBLY, A23A4A1 TO A23A4A3	28480	85680-20097
W7	85680-20092	8		CABLE ASSEMBLY, A23AT2 TO A23A4A3	28480	85680-20092
W8	85680-20098	4		CABLE ASSEMBLY, A23A4A1 TO A23A4A4	28480	85680-20098
W9	85680-20093	9		CABLE ASSEMBLY, A23A6 TO A23A5	28480	85680-20093
W10	85680-20095	1		CABLE ASSEMBLY, A23A5 TO A23A4A4	28480	85680-20095
W11				NOT ASSIGNED		
W12	85680-60097	7		CABLE ASSEMBLY, COAX 90, A23A4A1 TO REAR PANEL J1 (1ST LO OUT)	28480	85680-60097
W13	85680-60090	0		CABLE ASSEMBLY, RF CONV POWER A23A4A2 TO A26 (RIBBON CABLE)	28480	85680-60090
W14	85680-60087	5		CABLE ASSEMBLY, YTO DVR, A22 TO A23A1 (RIBBON CABLE)	28480	85680-60087
W15	85680-60071	2		CABLE ASSEMBLY, COAX 7, A16 TO A23A6	28480	85680-60071
W16	85680-60083	1		CABLE ASSEMBLY, COAX 92, A23A3 TO A19	28480	85680-60083
W17	85680-60074	7		CABLE ASSEMBLY, COAX 80, A23A3 TO A9	28480	85680-60074
W18	85680-60072	8		CABLE ASSEMBLY, COAX 8, A11 TO A17	28480	85680-60072
W19	85680-60079	5		CABLE ASSEMBLY, COAX 85, A11 TO A21	28480	85680-60079
W20	85680-60075	1		CABLE ASSEMBLY, COAX 81, A9 TO A10	28480	85680-60075
W21	85680-60082	0		CABLE ASSEMBLY, COAX 89, A7 TO A10	28480	85680-60082
W22	85680-60076	2		CABLE ASSEMBLY, COAX 82, A10 TO A6	28480	85680-60076
W23	85680-60068	2		CABLE ASSEMBLY, COAX 4, A16 TO A8	28480	85680-60068
W24	85680-60080	6		CABLE ASSEMBLY, COAX 86, A18 TO A8	28480	85680-60080
W25	85680-60081	9		CABLE ASSEMBLY, COAX 87, A7 TO A18	28480	85680-60081
W26	85680-60067	1		CABLE ASSEMBLY, COAX 3, A16 TO A6	28480	85680-60067
W27	85680-60073	9		CABLE ASSEMBLY, COAX 9, A6 TO A17	28480	85680-60073
W28	85680-60077	3		CABLE ASSEMBLY, COAX 83, A20 TO A21	28480	85680-60077
W29	85680-60078	0		CABLE ASSEMBLY, COAX 85, A18 TO A21	28480	85680-60078
W30	85680-60084	2		CABLE ASSEMBLY, COAX 96, A19 TO A20	28480	85680-60084
W31	85680-60065	9		CABLE ASSEMBLY, COAX 1, A16 TO FRONT PANEL A6J1 (CAL OUTPUT)	28480	85680-60065
W32	85680-60066	0		CABLE ASSEMBLY, COAX 2, A27 TO A16	28480	85680-60066
W33	85680-60070	6		CABLE ASSEMBLY, COAX 6, A17 TO REAR PANEL J1 PIN 5 (COAX INTERCONNECT)	28480	85680-60070
W34	85680-60063	7		CABLE ASSEMBLY, COAX 0, A22 TO REAR PANEL J1 PIN 4 (COAX INTERCONNECT)	28480	85680-60063
W35	85680-60064	8		CABLE ASSEMBLY, COAX 93, A22 TO REAR PANEL J1 PIN 3 (COAX INTERCONNECT)	28480	85680-60064
W36	85680-60085	3		CABLE ASSEMBLY, COAX 97, A20 TO REAR PANEL J1 PIN 1 (COAX INTERCONNECT)	28480	85680-60085
W37	85680-60069	3		CABLE ASSEMBLY, COAX 5, A16 TO REAR PANEL J3 (TIME BASE IN/OUT)	28480	85680-60069
W38	85680-60099	9		CABLE ASSEMBLY, BIAS, A23A4A2 TO W41	28480	85680-60099
W39	85680-60091	1		CABLE ASSEMBLY, SHORT 83, A21 TO A21A1	28480	85680-60091
W40	85680-60092	2		CABLE ASSEMBLY, SHORT 84, A21 TO A21A1	28480	85680-60092
W41	85680-60098	8		CABLE ASSEMBLY, BIAS, A23A3 TO W38	28480	85680-60098
W42				PART OF A5AT1 AND NOT SEPARATELY REPLACEABLE		
W43	85680-60056	8		CABLE ASSEMBLY, A5A1J1 TO A12P3	28480	85680-60056

TABLE 4. MISCELLANEOUS PARTS (2 OF 2)

Reference Designator	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W44	5061-5466	7		ANALY BUS CBL AY (A15 CONTROLLER TO REAR PANEL. INCLUDES J4 AND W44P1)	28480	5061-5466
W44P1				PART OF W44 AND NOT SEPARATELY REPLACEABLE		
W45	5061-5465	6		HP-1B CABLE ASSEMBLY (A15 CONTROLLER TO REAR PANEL. INCLUDES A29, J5, W45P1, AND W45P2)	28480	5061-5465
W45P1	1251-7759	4		CONNECTOR, 24-PIN, PART OF W45	28480	1251-7759
W45P2	0360-2165	6		CONNECTOR, 14-PIN, PART OF W45	28480	0360-2165
	5061-0089	0		FRONT HANDLE KIT (CONTAINS A PAIR OF 5-1/4 INCH HIGH HANDLES AND NECESSARY HARDWARE)	28480	5061-0089
	5061-0077	6		RACK MOUNT KIT (CONTAINS A PAIR OF 5-1/4 INCH HIGH FLANGES AND NECESSARY HARDWARE)	28480	5061-0077
	5061-0083	4		RACK MOUNT KIT WITH FRONT HANDLES (CONTAINS A PAIR OF 5-1/4 INCH HIGH HANDLES, A PAIR OF 5-1/4 INCH HIGH FLANGES, AND NECESSARY HARDWARE)	28480	5061-0083
	1494-0016	6		SLIDE ADAPTER KIT (CONTAINS A PAIR OF 20 INCH DEEP SLIDES AND NECESSARY HARDWARE)	28480	1494-0016
	5061-0086	7		RACK MOUNT KIT WITH FRONT HANDLES (CONTAINS A PAIR OF 10-1/2 INCH HIGH HANDLES, A PAIR OF 10-1/2 INCH FLANGES, AND NECESSARY HARDWARE (TO BE USED WITH SLIDE ADAPTER KIT)	28480	5061-0086
	5061-2071	4		RACK MOUNT KIT FOR OPTION 913 (CONTAINS A PAIR OF 5-1/4 INCH HIGH FLANGES AND NECESSARY HARDWARE)	28480	5061-2071
	85680-90029	6	1	INFORMATION CARD, ENGLISH (MANUAL)	28480	85680-90029
	85680-90030	1	1	INFORMATION CARD, ENGLISH (REMOTE)	28480	85680-90030
	85680-90031	2	1	INFORMATION CARD, JAPANESE (MANUAL)	28480	85680-90031
	85680-90032	3	1	INFORMATION CARD, JAPANESE (REMOTE)	28480	85680-90032
	85680-90033	4	1	INFORMATION CARD, FRENCH (MANUAL)	28480	85680-90033
	85680-90034	5	1	INFORMATION CARD, FRENCH (REMOTE)	28480	85680-90034
	5061-2033	8	1	TRAY ASSEMBLY - INFORMATION PULL-OUT CARDS	28480	5061-2033



* REFER TO TABLE 1 UNDER THE A5 FRONT PANEL TAB FOR PART NUMBER INFORMATION.
 ** REFER TO THE GENERAL PARTS LISTING TAB FOR PART NUMBER INFORMATION.

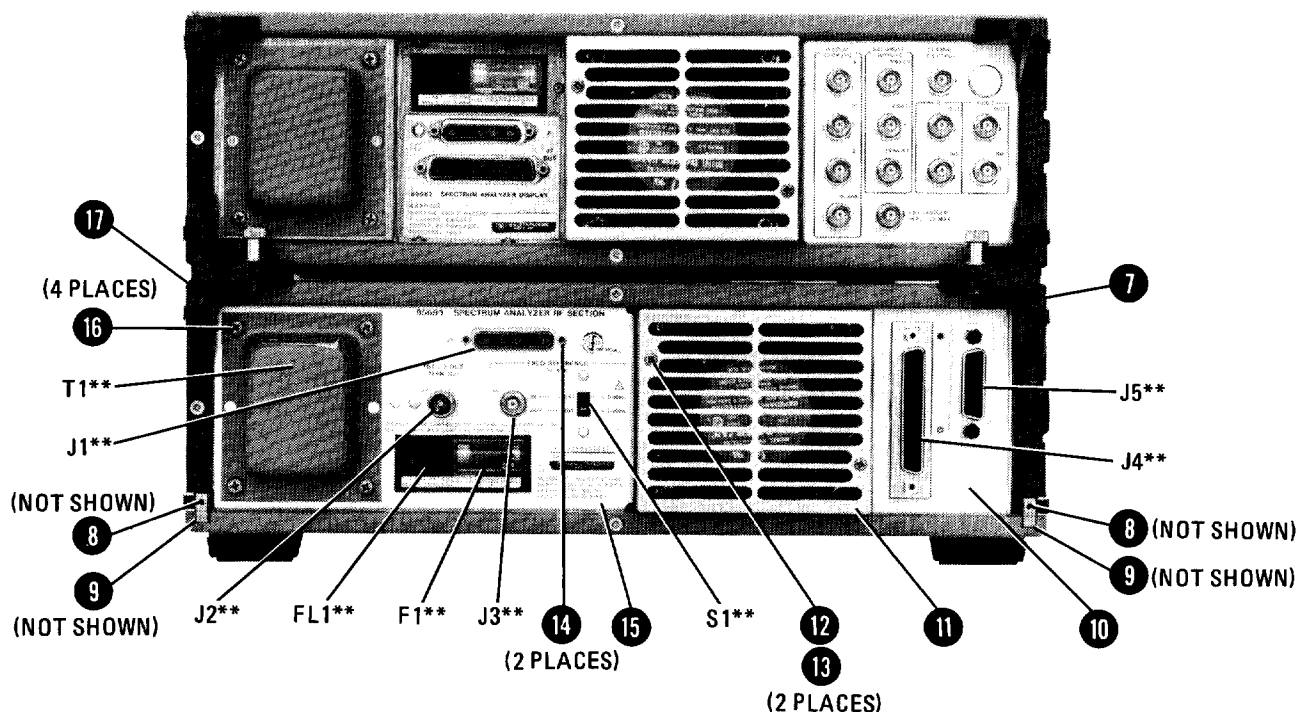


FIGURE 1. OVERALL INSTRUMENT PARTS IDENTIFICATION, FRONT AND REAR VIEW (1 OF 2)

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	85680-20125	8	1	Bezel, Front	28480	85680-20125
2	5061-0089	0	1	Kit, Front Handles	28480	5061-0089
3	85680-00049	3	1	Panel, Upper Dress	28480	85680-00049
4	5020-8803	6	1	Frame, Front	28480	5020-8803
5	85680-00048	2	1	Panel, Lower Dress	28480	85680-00048
5	85680-00025	5	1	Panel, Lower Dress (Option 001)	28480	85680-00025
6	5061-2033	8	1	Tray Assembly – Information Pullout Cards	28480	5061-2033
7	5020-8940	2	1	Lock Foot, Lower Right	28480	5020-8940
8	2360-0332	7	2	Screw, 6-32, .312-IN-LG PAN HD	28480	2360-0332
9	5040-7221	2	2	Foot, Lower Right/Left	28480	5040-7221
10	85680-20063	3	1	Support, PC, Rear	28480	85680-20063
11	86701-00007	1	1	Guard Fan	28480	86701-00007
12	2360-0219	9	2	Screw, 6-32, 1.375-IN-LG PAN HD	28480	2360-0219
13	2190-0018	5	2	Washer, LK	28480	2190-0018
14	1251-2942	7	2	Screw, 4-40 (includes nut & washer)	28480	1251-2942
15	85680-00007	3	1	Panel, Rear	28480	85680-00007
16	2510-0137	9	4	Screw, 8-32 PAN HD	28480	2510-0137
17	5020-8938	8	1	Lock Foot, Lower Left	28480	5020-8938

FIGURE 1. OVERALL INSTRUMENT PARTS IDENTIFICATION, FRONT AND REAR VIEW (2 OF 2)

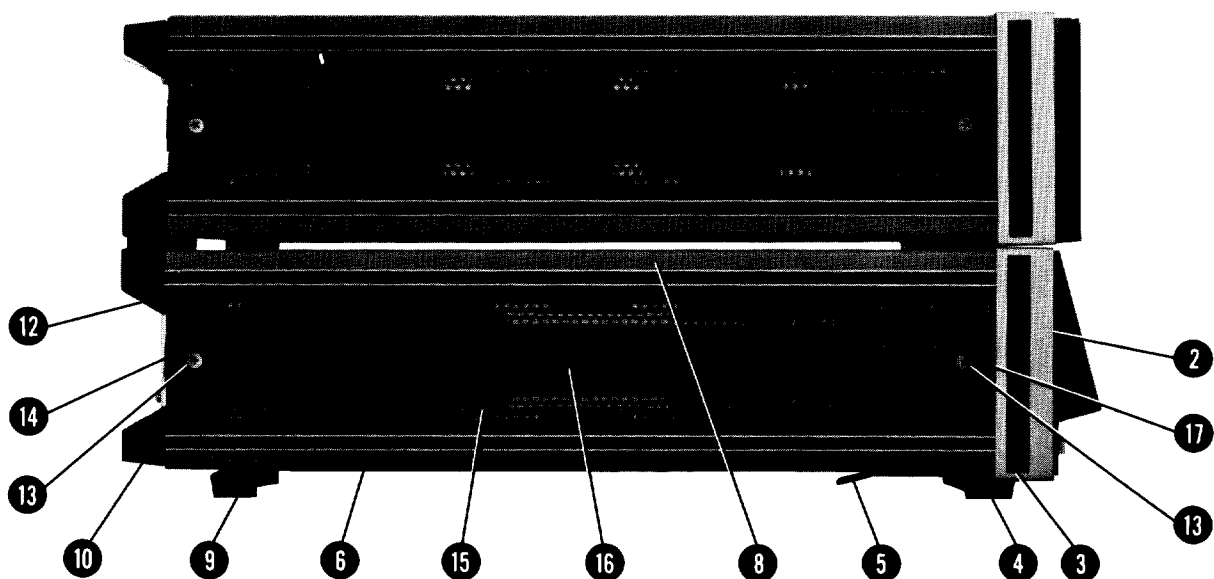
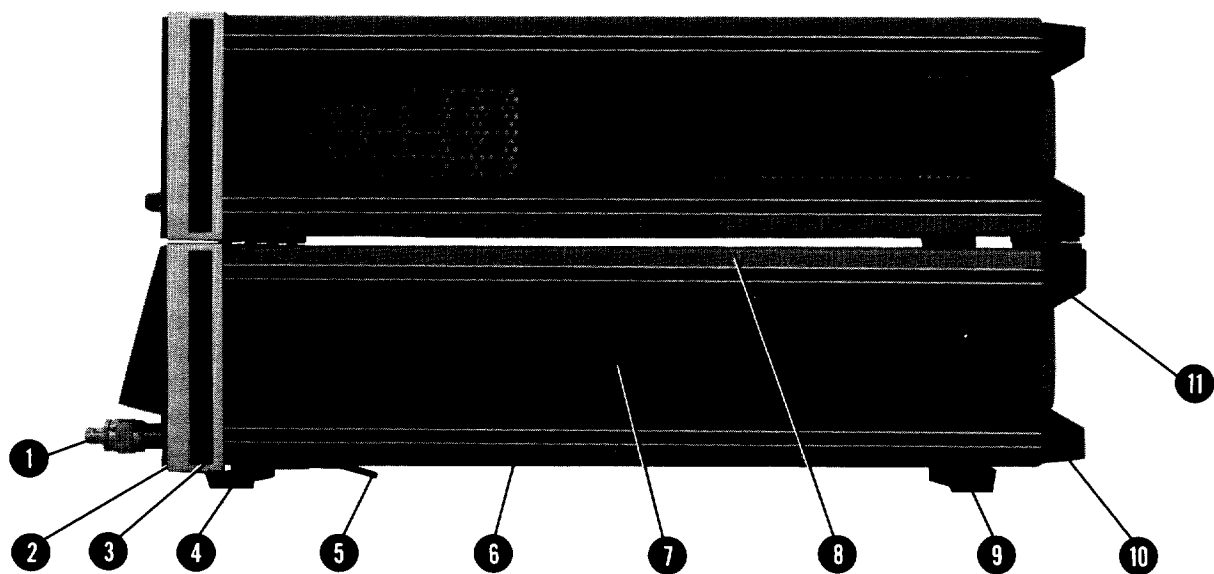


FIGURE 2. OVERALL INSTRUMENT PARTS IDENTIFICATION, RIGHT SIDE VIEW AND LEFT SIDE VIEW (1 OF 2)

RF SECTION

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	1250-0780	5	1	Adapter, Coax Type N (m) to BNC (f)	90949	31-216-1020
2	5020-8803	6	1	Frame, Front	28480	5020-8803
3	5001-0439	8	2	Trim Strip	28480	5001-0439
4	5040-7201	8	2	Foot, Bottom	28480	5040-7201
5	1460-1345	3	1	Tilt Stand	28480	1460-1345
6	5060-9847	4	1	Cover, Bottom 18"	28480	5060-9847
7	5060-9857	6	1	Cover, Side	28480	5060-9857
8	5060-9835	0	1	Cover – 18"	28480	5060-9835
9	5040-7201	8	2	Foot, Bottom	28480	5040-7201
10	5040-7221	2	2	Foot, Rear	28480	5040-7221
11	5020-8938	8	1	Lock Foot, Lower Left	28480	5020-8938
12	5020-8940	2	1	Lock Foot, Lower Right	28480	5020-8940
13	2680-0172	1	2	Screw, 10-32, .375-IN-LG FL HD	28480	2680-0172
14	5040-7220	1	1	Cover, Strap Handle, Rear	28480	5040-7220
15	5060-9937	3	1	Cover, Side, Perf.	28480	5060-9937
16	5060-9804	3	1	Strap Handle Assy – 18"	28480	5060-9804
17	5040-7219	8	1	Cover, Strap Handle, Front	28480	5040-7219

FIGURE 2. OVERALL INSTRUMENT PARTS IDENTIFICATION, RIGHT SIDE VIEW AND LEFT SIDE VIEW (2 OF 2)

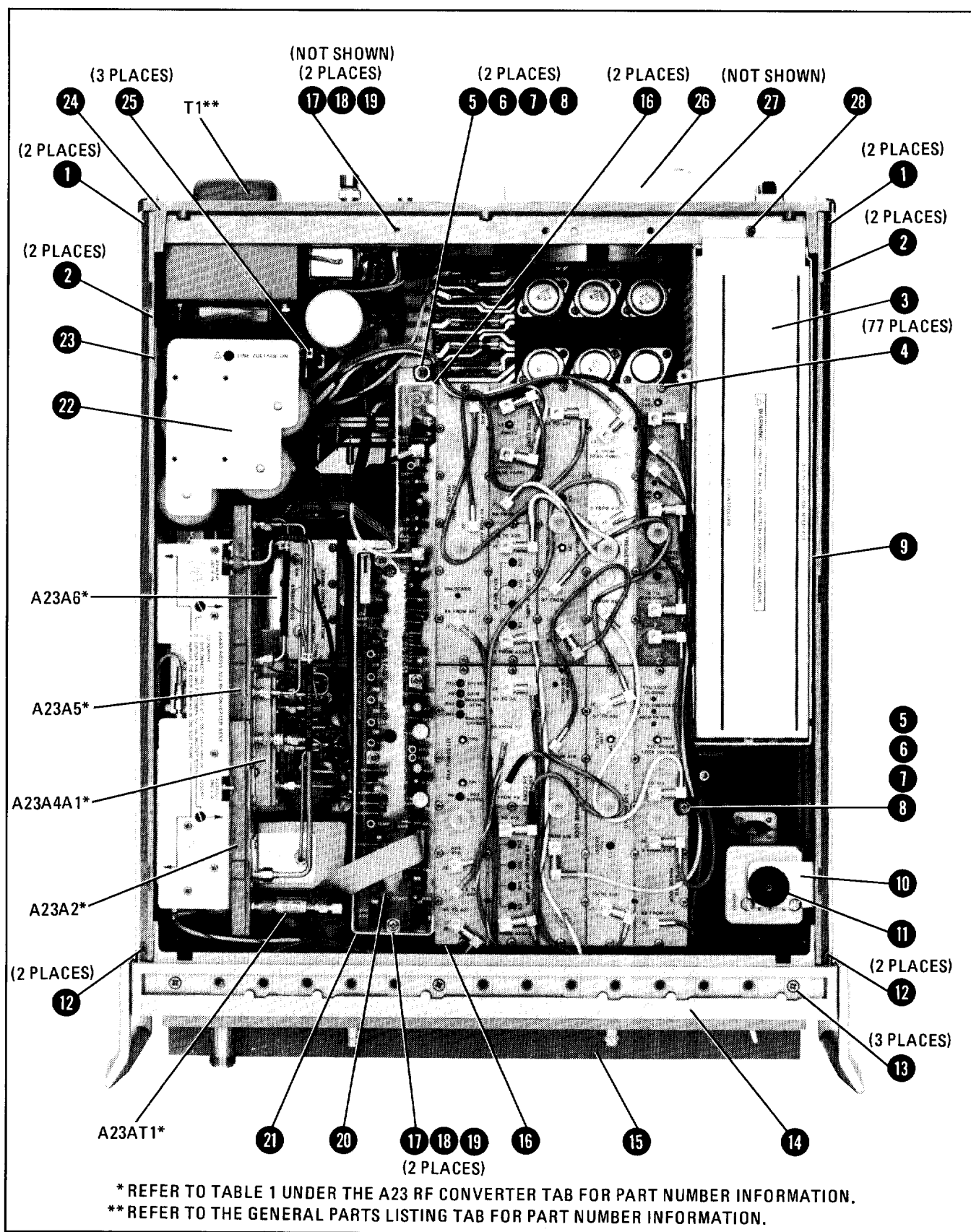


FIGURE 3. RF SECTION PARTS IDENTIFICATION, BOTTOM VIEW (1 OF 2)

RF SECTION

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	2510-0195	9	2	Screw, 8-32, .375-IN-LG 100 DEG	28480	2510-0195
2	5020-8837	6	2	Strut, Corner, 18"	28480	5020-8837
3	85680-00005	1	1	Cover, Controller	28480	85680-00005
4	2200-0107	6	77	Screw, 4-40, .375-IN-LG, PAN HD	28480	2200-0107
5	2200-0147	4	2	Screw, 4-40, .5-IN-LG, PAN HD	28480	2200-0147
6	3050-0105	6	2	Washer, FL for Screw (5)	28480	3050-0105
7	2190-0003	8	2	Washer-LK for Screw (5)	28480	2190-0003
8	1400-0017	4	2	Clamp-Cable .312-Dia, .375-Wide	28480	1400-0017
9	85680-00034	6	1	Shield, Controller	28480	85680-00034
10	85680-00037	9	1	Top Mount, Timebase	28480	85680-00037
11	1520-0094	7	1	Isolation Mount	28480	1520-0094
12	2510-0192	6	2	Screw, 8-32, .25-IN-LG 100 DEG	28480	2510-0192
13	2360-0116	5	3	Screw, 6-32, .312-IN-LG 82 DEG	28480	2360-0116
14	5020-8803	6	1	Frame, Front	28480	5020-8803
15	85680-20125	8	1	Bezel, Mainframe	28480	85680-20125
16	85680-20056	4	1	Shielding Box	28480	85680-20056
17	2360-0196	1	2	Screw, 6-32, .375-IN-LG, 100 DEG	28480	2360-0196
18	2190-0018	5	2	Washer, LK for Screw (17)	28480	2190-0018
19	3050-0010	0	2	Washer, FL for Screw (17)	28480	3050-0010
20	85680-00033	5	1	Cover, Frequency Control	28480	85680-00033
21	85680-00006	2	1	Shield, Frequency Control	28480	85680-00006
22	85680-00019	7	1	Cover, Capacitor	28480	85680-00019
23	85680-00022	2	1	Guide, Rectifier Board	28480	85680-00022
24	85680-20072	0	1	Frame, Rear	28480	85680-20072
25	85680-20066	6	3	Guide, PC Board	28480	85680-20066
26	86701-00007	1	1	Guard, Fan	28480	86701-00007
27	85680-00032	4	1	Shield, Power Xstr	28480	85680-00032
28	2360-0115	8	1	Screw, 6-32, .312-IN-LG, PAN HD	28480	2360-0115

FIGURE 3. RF SECTION PARTS IDENTIFICATION, BOTTOM VIEW (2 OF 2)

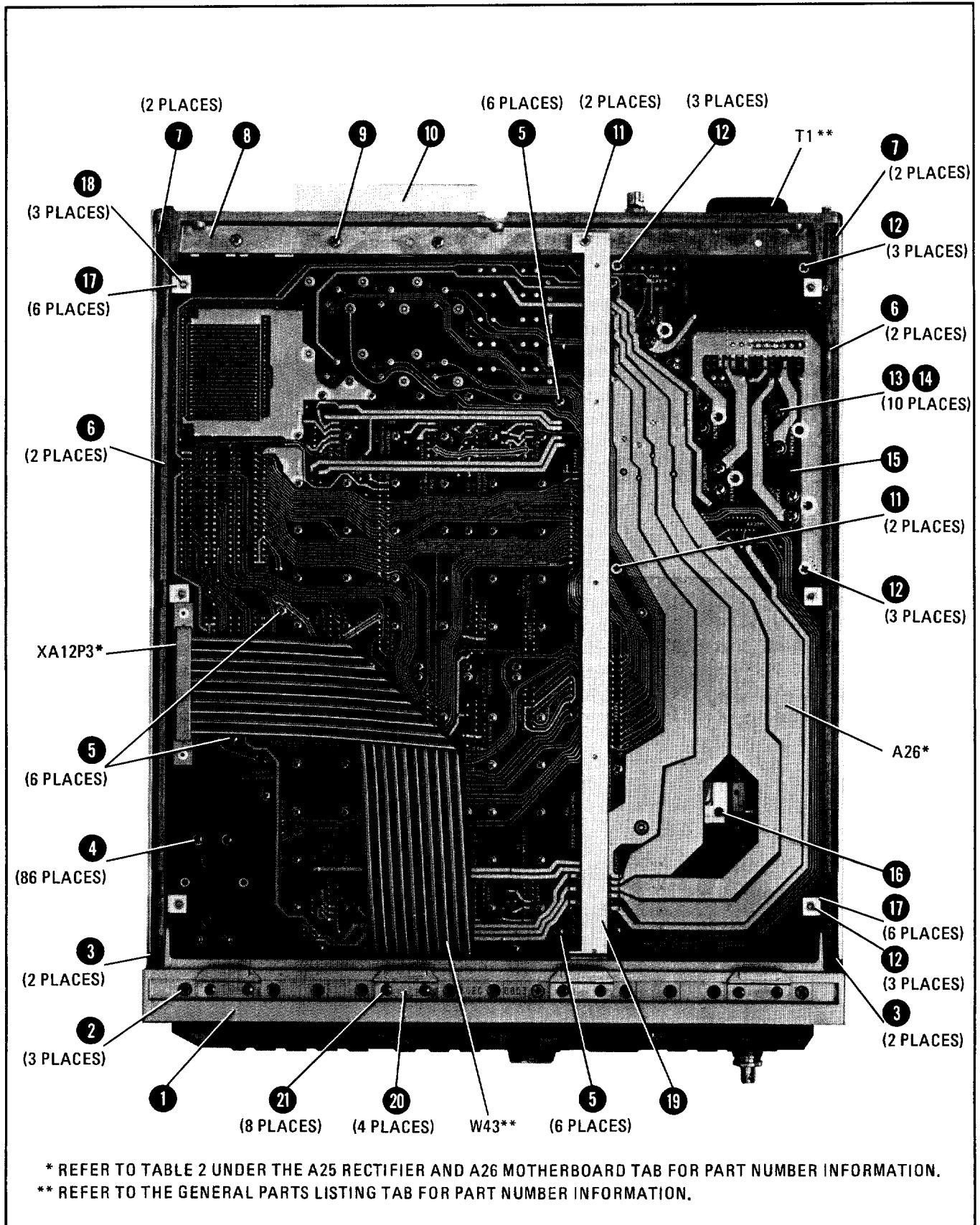


FIGURE 4. RF SECTION PARTS IDENTIFICATION, TOP VIEW (1 OF 2)

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	5020-8803	7	1	Frame, Front	28480	5020-8803
2	2360-0116	5	3	Screw, 6-32, .312-IN-LG 82 DEG	28480	2360-0116
3	2510-0192	6	2	Screw, 8-32, .25-IN-LG 100 DEG	28480	2510-0192
4	2200-0107	6	86	Screw, 4-40, .375-IN-LG PAN HD	28480	2200-0107
5	2360-0113	2	6	Screw, 6-32, .25-IN-LG PAN HD	28480	2360-0113
6	5020-8837	6	2	Strut, Corner, 18"	28480	5020-8837
7	2510-0195	9	2	Screw, 8-32, .375-IN-LG 100 DEG	28480	2510-0195
8	85680-20072	4	1	Frame, Rear	28480	85680-20072
9	2360-0117	6	1	Screw, 6-32, .375-IN-LG PAN HD	28480	2360-0117
10	86701-00007	1	1	Guard, Fan	28480	86701-00007
11	2360-0360	1	2	Screw, 6-32, .438-IN-LG 100 DEG	28480	2360-0360
12	2360-0333	8	3	Screw, 6-32, .25-IN-LG 100 DEG	28480	2360-0333
13	2680-0099	1	10	Screw, 10-32, .375-IN-LG PAN HD	28480	2680-0099
14	2190-0011	8	10	Washer, LK for Screw (13)	02440	1022
15	85680-00031	3	1	Shield, Power Supply	28480	85680-00031
16	2200-0103	2	1	Screw, 4-40, .25-IN-LG PAN HD	28480	2200-0103
17	85680-00001	7	6	Bracket, Motherboard Mount	28480	85680-00001
18	2360-0115	4	3	Screw, 6-32, .312-IN-LG PAN HD	28480	2360-0115
19	85680-20062	2	1	Support, Motherboard	28480	85680-20062
20	1600-0367	7	4	Lock Link	28480	1600-0367
21	2360-0330	5	8	Screw, 6-32, .188-IN-LG PAN HD	28480	2360-0330

FIGURE 4. RF SECTION PARTS IDENTIFICATION, TOP VIEW (2 OF 2)

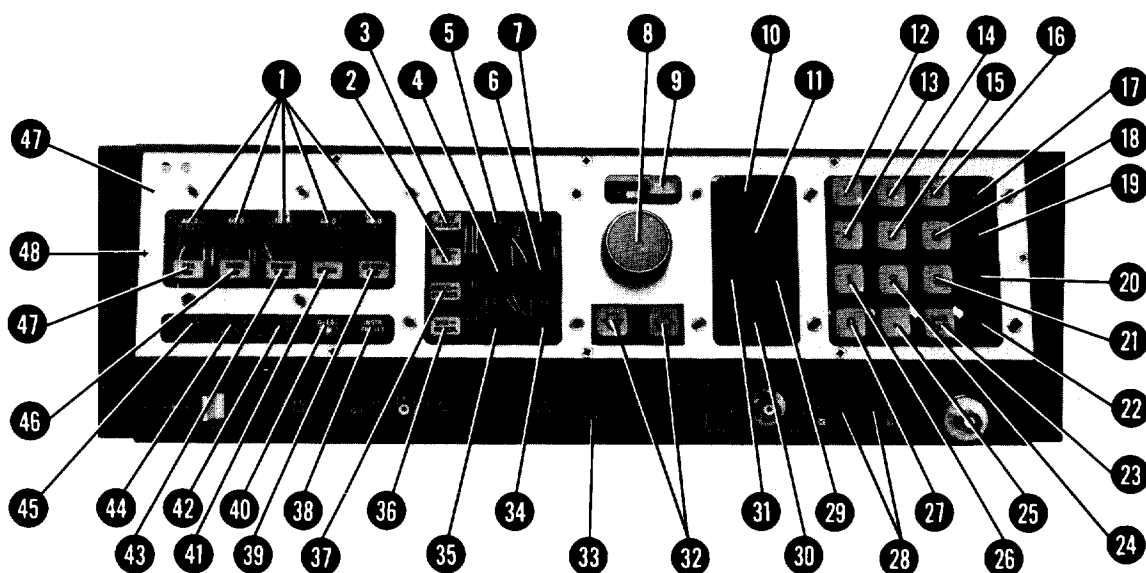


FIGURE 5. RF SECTION PARTS IDENTIFICATION, FRONT PANEL (1 OF 4)

RF SECTION

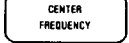
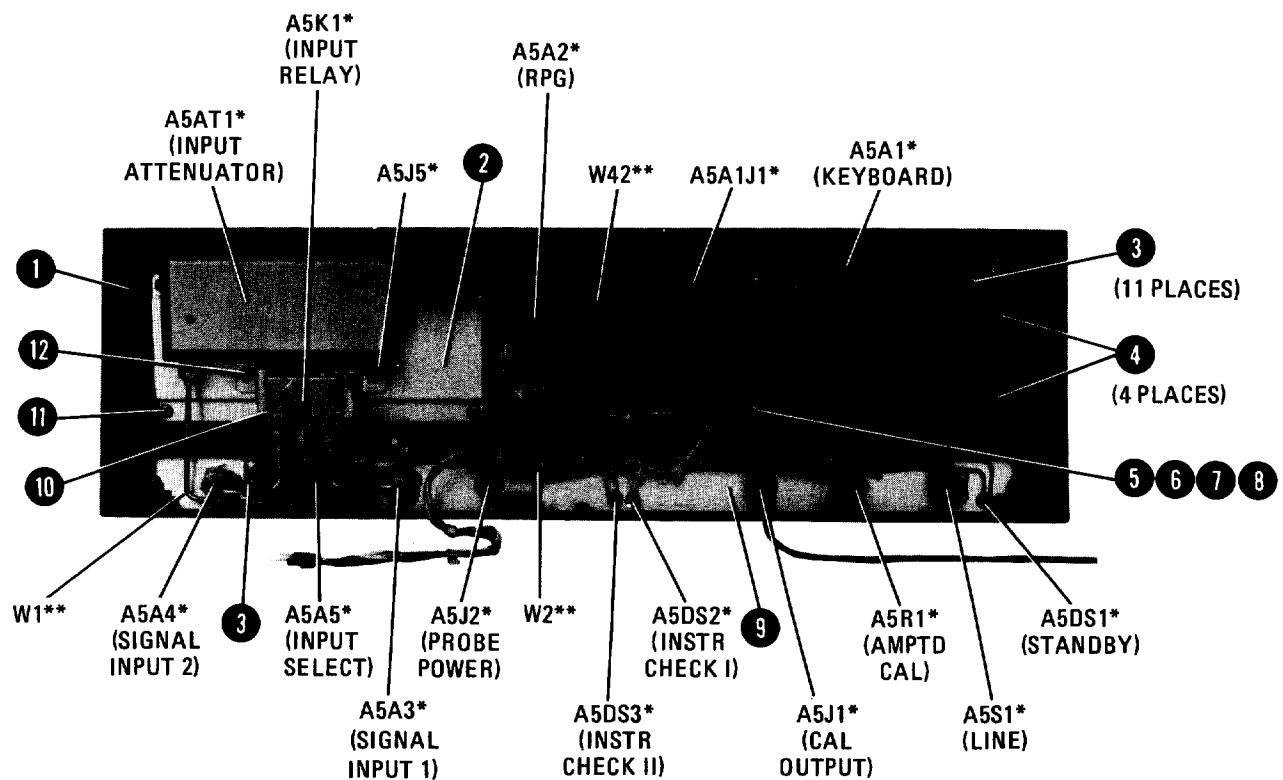
Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	5041-0706	6	5	Key, 	28480	5041-0706
2	5041-0712	4	1	Key, 	28480	5041-0712
3	5041-0938	6	1	Key, 	28480	5041-0938
4	5041-0716	8	1	Key, 	28480	5041-0716
5	5041-0692	9	1	Key, 	28480	5041-0692
6	5041-0717	9	1	Key, 	28480	5041-0717
7	5041-0698	5	1	Key, 	28480	5041-0698
8	0370-2992	8	1	Knob, Round	28480	0370-2992
9	5041-0725	9	1	Key, 	28480	5041-0725
10	5041-0673	6	1	Key, 	28480	5041-0673
11	5041-0674	7	1	Key, 	28480	5041-0674
12	5041-0751	1	1	Key, 	28480	5041-0751
13	5041-0748	6	1	Key, 	28480	5041-0748
14	5041-0752	2	1	Key, 	28480	5041-0752
15	5041-0749	7	1	Key, 	28480	5041-0749
16	5041-0753	3	1	Key, 	28480	5041-0753
17	5041-0727	1	1	Key, 	28480	5041-0727
18	5041-0750	0	1	Key, 	28480	5041-0750
19	5041-0728	2	1	Key, 	28480	5041-0728
20	5041-0729	3	1	Key, 	28480	5041-0729
21	5041-0828	3	1	Key, 	28480	5041-0828
22	5041-0730	6	1	Key, 	28480	5041-0730
23	5041-0757	7	1	Key, 	28480	5041-0757
24	5041-0827	2	1	Key, 	28480	5041-0827
25	5041-0755	5	1	Key, 	28480	5041-0755
26	5041-0826	1	1	Key, 	28480	5041-0826
27	5041-0754	4	1	Key, 	28480	5041-0754
28	5041-0318	3	2	Key, Signal Input 	28480	5041-0318
29	5041-0669	0	1	Key, 	28480	5041-0669
30	5041-0675	8	1	Key, 	28480	5041-0675
31	5041-0668	9	1	Key, 	28480	5041-0668

FIGURE 5. RF SECTION PARTS IDENTIFICATION, FRONT PANEL (2 OF 4)

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
32	5041-0756	6	2	Key,  	28480	5041-0756
33	85680-00048	2	1	Panel, Front Lower Dress	28480	85680-00048
33	85680-00025	5	1	Panel, Front Lower Dress (Option 001)	28480	85680-00025
34	5041-0937	5	1	Key, 	28480	5041-0937
35	5041-0718	0	1	Key, 	28480	5041-0718
36	5041-0715	7	1	Key, 	28480	5041-0715
37	5041-0714	6	1	Key, 	28480	5041-0714
38	5041-0720	4	1	Key, 	28480	5041-0720
39	5041-0711	3	1	Key, 	28480	5041-0711
40	5041-0721	5	1	Key, 	28480	5041-0721
41	5041-0710	2	1	Key, 	28480	5041-0710
42	5041-0775	9	1	Key, 	28480	5041-0775
43	5041-0709	9	1	Key, 	28480	5041-0709
44	5041-0095	6	1	Key, 	28480	5041-0095
45	5041-0726	0	1	Key, 	28480	5041-0726
46	5041-0708	8	1	Key, 	28480	5041-0708
47	5041-0707	7	1	Key, 	28480	5041-0707
48	0624-0203	9	1	Screw, 4-40, .312-IN-LG, 82 DEG FL HD	28480	0624-0203
49	85680-00011	1	1	Panel, Sub Upper	28480	85680-00011
1	85680-20125	8	1	Bezel, Front	28480	85680-20125
2	85680-00013	1	1	Bracket, Attenuator	28480	85680-00013
3	2200-0105	4	11	Screw, 4-40, .312-IN-LG PAN HD	28480	2200-0105
4	0510-1148	2	4	Retainer, Push-On	28480	0510-1148
5	2200-0147	4	1	Screw, 4-40, .500-IN-LG PAN HD	28480	2200-0147
6	2190-0003	8	1	Washer, LK for Screw (5)	28480	2190-0003
7	3050-0105	6	1	Washer, FL for Screw (5)	28480	3050-0105
8	1400-0619	8	1	Clamp, Cable	05683	5/16-HFR
9	85680-00009	5	1	Panel, Sub Lower	28480	85680-00009
10	0520-0136	0	1	Screw 2-56, .625-IN-LG PAN HD	28480	0520-0136
11	2200-0111	2	1	Screw, 4-40, .5-IN-LG PAN HD	28480	2200-0111
12	2200-0103	1	1	Screw, 4-40, .25-IN-LG PAN HD	28480	2200-0103

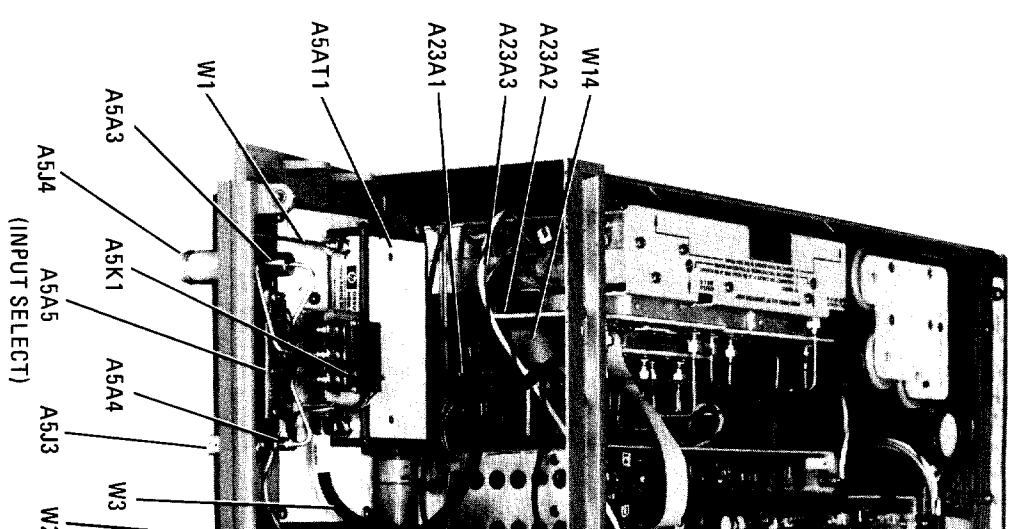
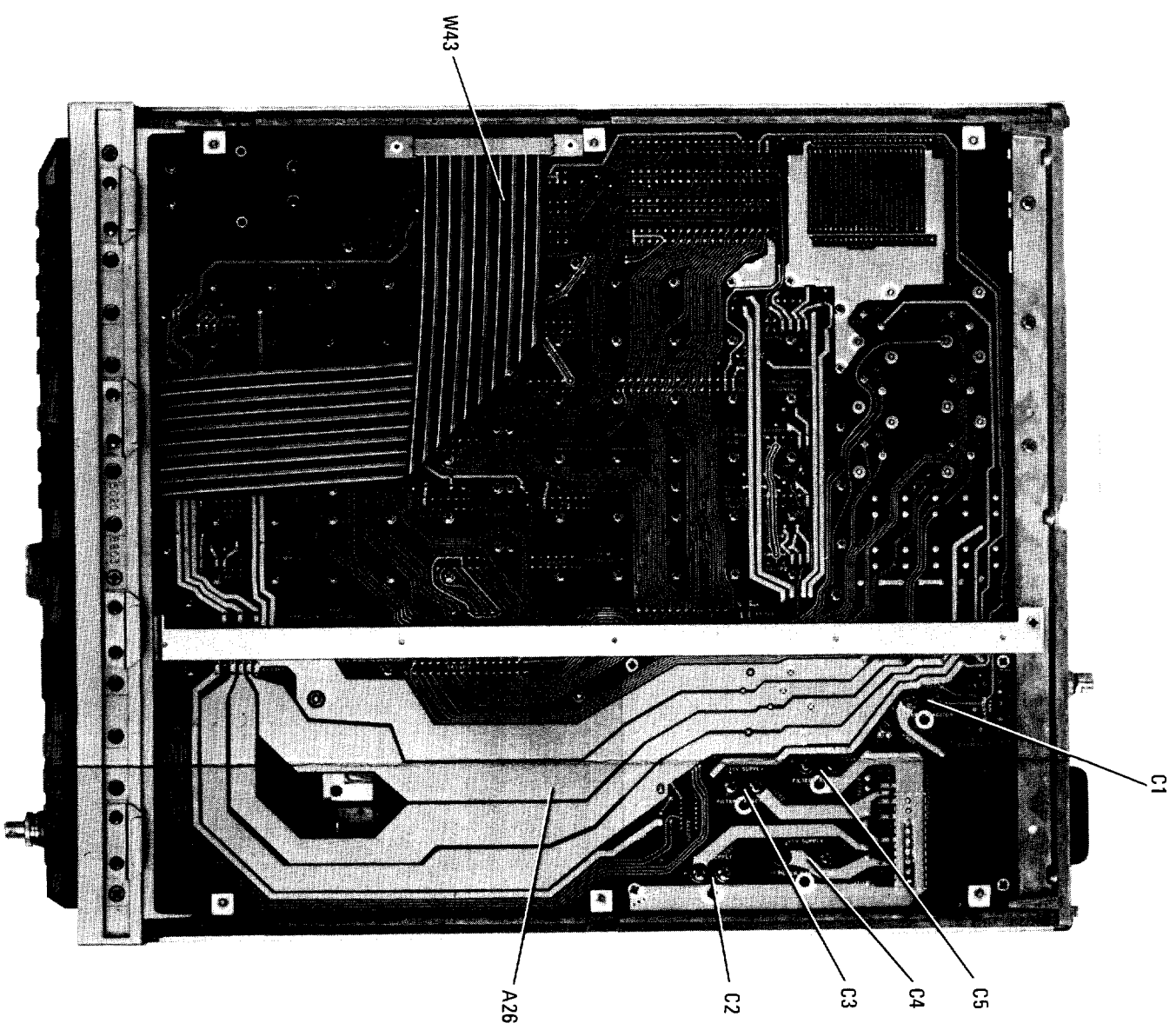
FIGURE 5. RF SECTION PARTS IDENTIFICATION, FRONT PANEL (3 OF 4)



* REFER TO TABLE 1 UNDER THE A5 FRONT PANEL TAB FOR PART NUMBER INFORMATION.
 ** REFER TO THE GENERAL PARTS LISTING TAB FOR PART NUMBER INFORMATION.

FIGURE 5. RF SECTION PARTS IDENTIFICATION, FRONT PANEL (4 OF 4)

Comb Generator	A23A6
Controller	A15
First Converter	A23A2
First LO Distribution	A23A4
Frequency Control	A22
Frequency Counter	A17
Front Panel	A5
Input Select	A5A5
Keyboard Assembly	A5A1
Motherboard	A26
Pilot First Converter	A23A5
Pilot Second IF Amplifier	A9
Pilot Third Converter	A10
Rectifier	A25
RF Converter	A23
RF Section Interface	A12
Second Converter	A23A3
Second IF Amplifier	A19
STANDBY/ON Switch	A5S1
Third Converter	A20
Time Base	A27
Voltage Regulator	A24
YIG-Tuned Oscillator	A23A1
YIG-Tuned Oscillator Phase Lock	A6
20 MHz Reference	A16
50 MHz Voltage-Tuned Oscillator	A11
249 MHz Phase Lock	A8
249 MHz Phase Lock Oscillator	A7
275 MHz Phase Lock	A21
275 MHz Phase Lock Oscillator	A18



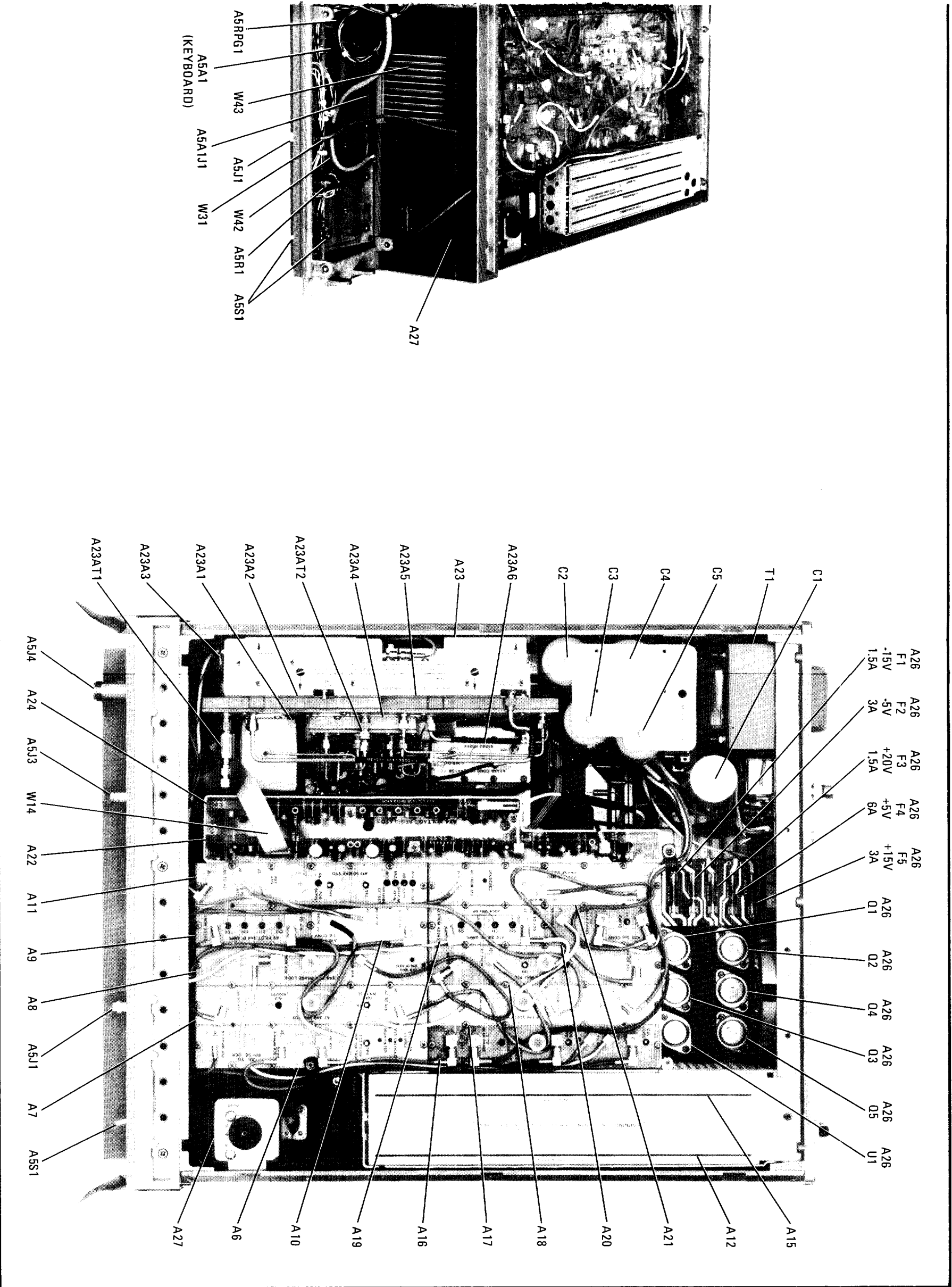


FIGURE 1. MAJOR ASSEMBLY AND COMPONENT LOCATIONS
Major Assembly and Component Locations 1/2

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To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in the HP Catalog, or contact the nearest regional office listed below:

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