8568A
SPECTRUM ANALYZER
100 Hz to 1.5 GHz

volume 4

Section IX
RF SECTION
SERVICE

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TABLES

SECTION IX
RF SECTION
SERVICE

9-1. INTRODUCTION

9-2. This volume of the Operating and Service Manual contains information for troubleshooting and repair of the RF Section of the instrument. This information is combined in package form as service sheets and indexed with tabs for quick reference. Also included, separate from the service sheets, are repair procedures for removal and replacement of assemblies to be repaired and/or replaced, and overall troubleshooting information for the RF Section.

9-3. SERVICE SHEETS

9-4. The service sheets in this manual are organized in alpha-numeric order and are indexed with tabs to make it easy to locate a specific service sheet. Each of the service sheets contains the following information:

- Circuit Description (where practical)
- Troubleshooting Hints (where practical)
- Replaceable Parts List
- Component Location Illustration
- Block Diagram (where practical)
- Schematic Diagram

Also included, where applicable, are Signature Analysis Troubleshooting Diagrams for troubleshooting of digital circuits using signature analysis.

9-5. REPAIR PROCEDURES

9-6. Repair procedures are included in this volume of the manual for use in removing and replacing assemblies for repair. These procedures are located near the front of this volume and are referenced in the CONTENTS in this volume. These procedures include such items as RF Converter removal, front-panel LED replacement, and internal fuse replacement.

9-7. MAJOR ASSEMBLY AND COMPONENT LOCATIONS

9-8. Major assembly and component location illustrations for the RF Section are located at the rear of this volume and the rear of Volume 2.

9-9. TROUBLESHOOTING

9-10. Troubleshooting information for the RF Section is divided into three levels in this volume as follows:

Instrument Level. Spectrum Analyzer Overall Troubleshooting and Spectrum Analyzer Overall Block Diagram (both indexed by tab).

Section Level. RF Section Analog Block Diagram, RF Section Digital Block Diagram, and Pilot Third Local Oscillator Block Diagram (all indexed by tab).

Assembly Level. Troubleshooting Hints located immediately following circuit descriptions, assembly level block diagrams, and notes, dc voltages, and waveforms on schematics. (All assemblies are indexed by tab.)

9-11. SIGNATURE ANALYSIS USING THE HP MODEL 5004A SIGNATURE ANALYZER

9-12. General Description

9-13. This instrument has been designed to incorporate signature analysis. Troubleshooting the instrument using signature analysis requires the use of the HP Model 5004A Signature Analyzer. The HP Model 5004A Signature Analyzer is a service tool. It receives signals from the circuit under test, compresses them, and displays the result in the form of digital signatures associated with data nodes in the circuit under test.

9-14. Features (Refer to HP 5004A Signature Analyzer Operating and Service Manual.)

9-15. Front Panel. On the front panel are four large seven-segment displays. A light to the left of the display indicates gate (measurement window) activity and another light on the right indicates the presence of an unstable signature. Six pushbutton switches control power on/off, start, stop, and clock edge polarities, a hold mode for single cycle events or freezing the signature, and self-test mode. Stop, start, clock, and data test sockets on the right-hand side of the front panel are for a self-test diagnostic setup.

9-16. Data Probe. The active Data Probe (more commonly referred to as simply probe) is a hand-held probe. Its main function is to accept logic information inputs although, it is also a logic probe. The lamp at the probe tip reacts the same as the lamp of the HP 545A Logic Probe. The lamp glows bright for a logic high, turns off for a logic low, and glows dimly for a bad logic level, open circuit, or open state of a 3-state device.

9-17. Active Test Pod. The Active Test Pod (more commonly referred to as simply pod) houses three identical channels for start, stop, and clock control inputs. The input wires can be plugged directly into a 0.03-inch round socket or connected to a "grabber" which can be connected to a test point, component lead, or IC pin. It may be necessary to extend the length of the input wires of the pod. This can be accomplished by connecting wires of the desired length, with "grabbers" already present at the pod. HP Part Numbers for the "grabbers" are: Red, 1400-0833; Black, 1400-0832.

9-18. Operation

9-19. Signature Display. The Signature Analyzer uses a compression technique that reduces any long, complex data stream on a logic node into a four-digit signature. The digits used for this signature display are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, C, F, H, P, U. The last six digits (letters) were chosen rather than the hexadecimal A, B, C, D, E, F because the Signature Analyzer uses seven-segment displays and letters were chosen which could not be confused with similar numerals. For example, an 8 and a B would appear exactly the same on a seven segment display.

9-20. Logic data is input to the Signature Analyzer through the probe for each and every circuit clock cycle that occurs within a circuit controlled time window. Within the Signature Analyzer is a 16-bit shift register. There are 2^{16} possible states to which the shift register can become set to during a measurement window. These states are encoded an displayed as a signature. This signature is a unique number representing time dependent logic activity during a specified measurement interval for the node being monitored. This signature will always be the same for that node provided the circuit is functioning properly. Any change in the behavior of the node will produce a different signature indicating a circuit malfunction. The signal that causes the node to produce a signature is the stimulus. The stimulus is provided by the instrument under test in the form of stop, start, and clock signals. Location of these signals to be used for troubleshooting is indicated on the signature analysis diagrams. Refer to Figure 9-1.

9-21. When the probe is connected to a logic node whose correct signature is known, a comparison is made, with the circuit functioning at normal operating speed, between the signature displayed on the Signature Analyzer and the correct signature provided on the signature analysis diagram. Refer to Figure 9-1. The comparison of these signature is the means by which a defective component is located on a printed circuit board. Refer to Figure 9-1 for detailed explanation of the content and use of the signature analysis diagrams.

9-22. Unstable Signature. Signature analysis can detect intermittent faults if they occur within a measurement window. However, the Signature Analyzer may not indicate an unstable signature if the measurement cycle time is too short. The

UNSTABLE SIGNATURE indicator lamp on the Signature Analyzer will blink indicating an unstable signature if there is a difference between successive signatures input to the analyzer.

9-23. Hold Mode. The hold mode of the Signature Analyzer holds the signature present on the display, preventing the gate control from starting another cycle. This mode is useful in testing single-shot events such as start-up sequence. Hold mode is initiated by pushing in the HOLD switch on the front panel of the Signature Analyzer and begins at the end of the current measurement window.

9-24. Self-Test. The HP 5004A Signature Analyzer has a built-in self-test function which tests the entire instrument except the clock edge select circuit and the ground wire at the pod input. Refer to the Operation section of the HP 5004A Signature Analyzer Operating and Service Manual for detailed self-test procedure.

SIGNATURE ANALYSIS TROUBLESHOOTING DIAGRAMS

The Signature Analysis Troubleshooting Diagrams are printed in three colors with each color having a particular significance. In general, black is used for general information such as test titles and equipment connections, green is used to show the main verification path, and red is used for instructions and paths to follow when a bad signature has been located on the main verification path. A more detailed description follows:

BLACK:

Pad	IC output pin
Diamond	IC Open collector (3-State) output pin
Line	indicates physical connection between IC pins; also, indicates border between tests
Lettering	General Information and Instructions for the test

GREEN:

Line	Main Verification Path
Lettering	Information and Instructions for Main Verification Path

RED:

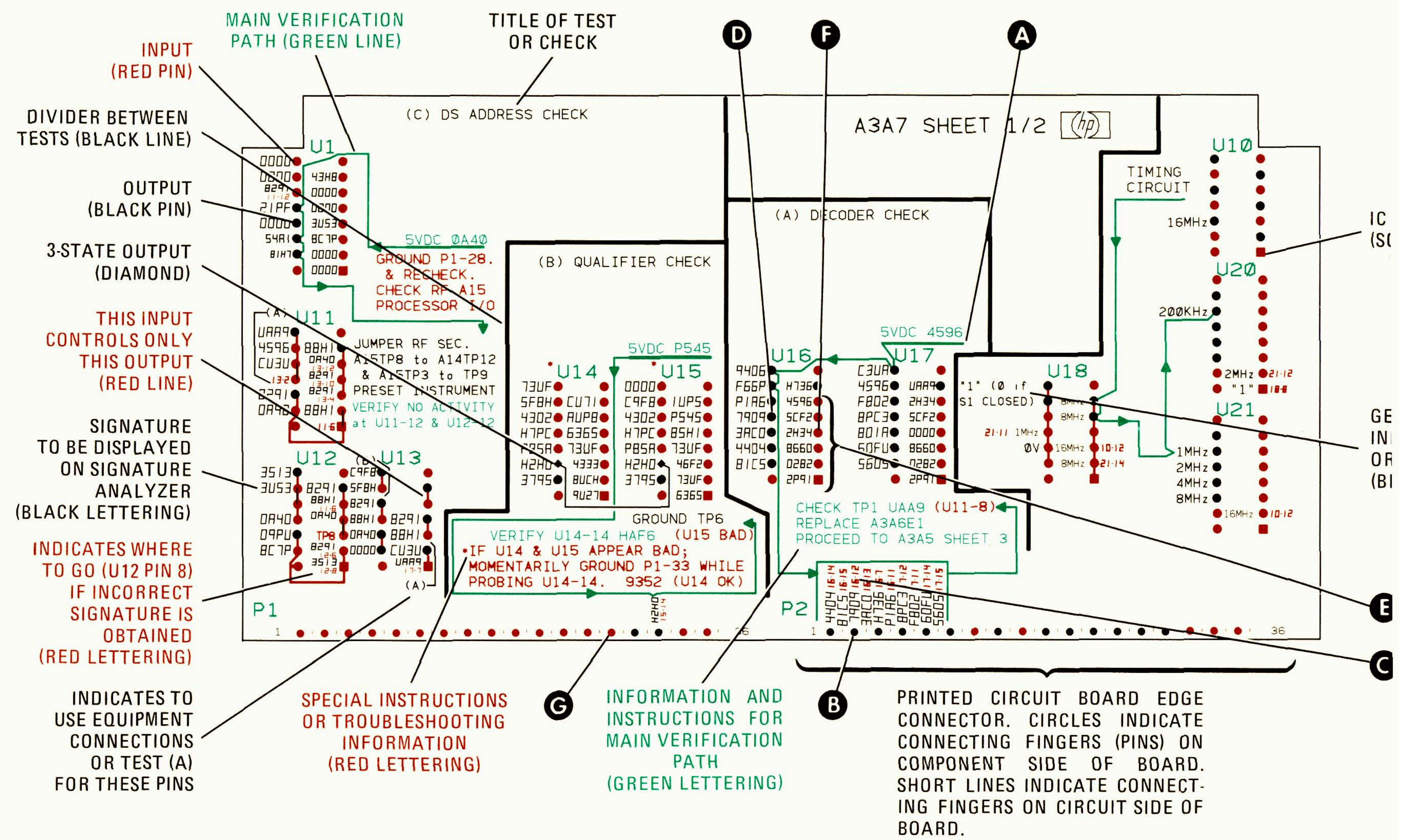
Pad	IC input pin
Line	used between input and output of IC to indicate that input effects only the output to which the red line is connected; used between ICs to indicate path to follow when a bad signature has been located
Lettering	Troubleshooting information and instructions to follow when bad signature has been located

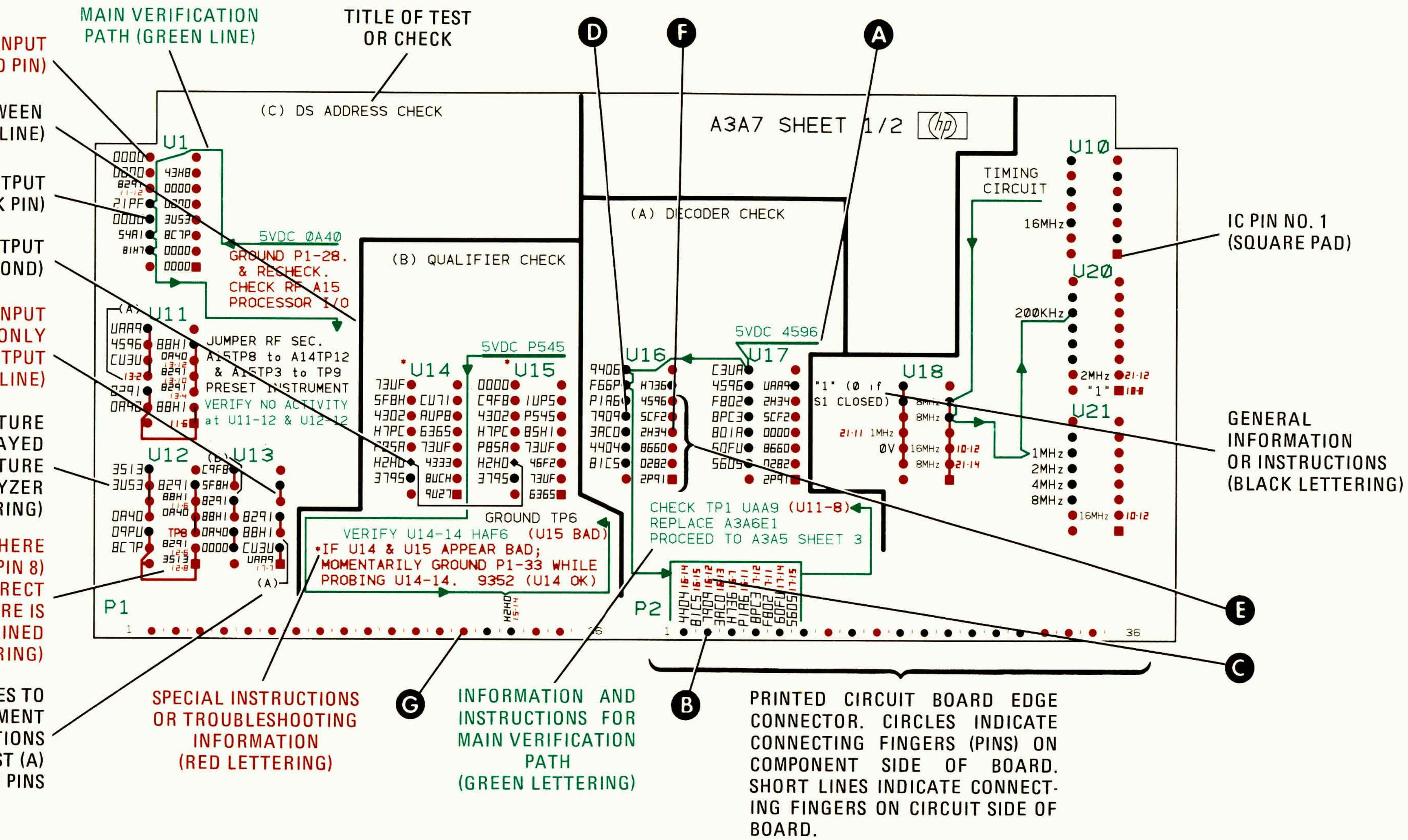
Use of Signature Analysis Troubleshooting Diagrams

1. Connect Signature Analyzer and set controls as indicated in instructions below diagram.

2. Set up test configuration as indicated below diagram such as jumpering test points or removing test jumpers.

3. Verify the +5 Vdc signature for the test being performed as indicated in green lettering on main verification path. This signature can be verified by either probing the +5 Vdc supply or by pushing and releasing the reset key on the signature analyze probe. If +5 Vdc signature is incorrect, check equipment settings and connections, then check for activity at CLOCK, START, and STOP connections using signature analyzer probe. If no activity, refer to schematic for troubleshooting.





SIGNATURE ANALYSIS TROUBLESHOOTING DIAGRAMS (CONT'D)

4. Begin probing the printed circuit board at the begining of the green line on the diagram. (Point A in the sample.)

5. Probe every point indicated by the green line.

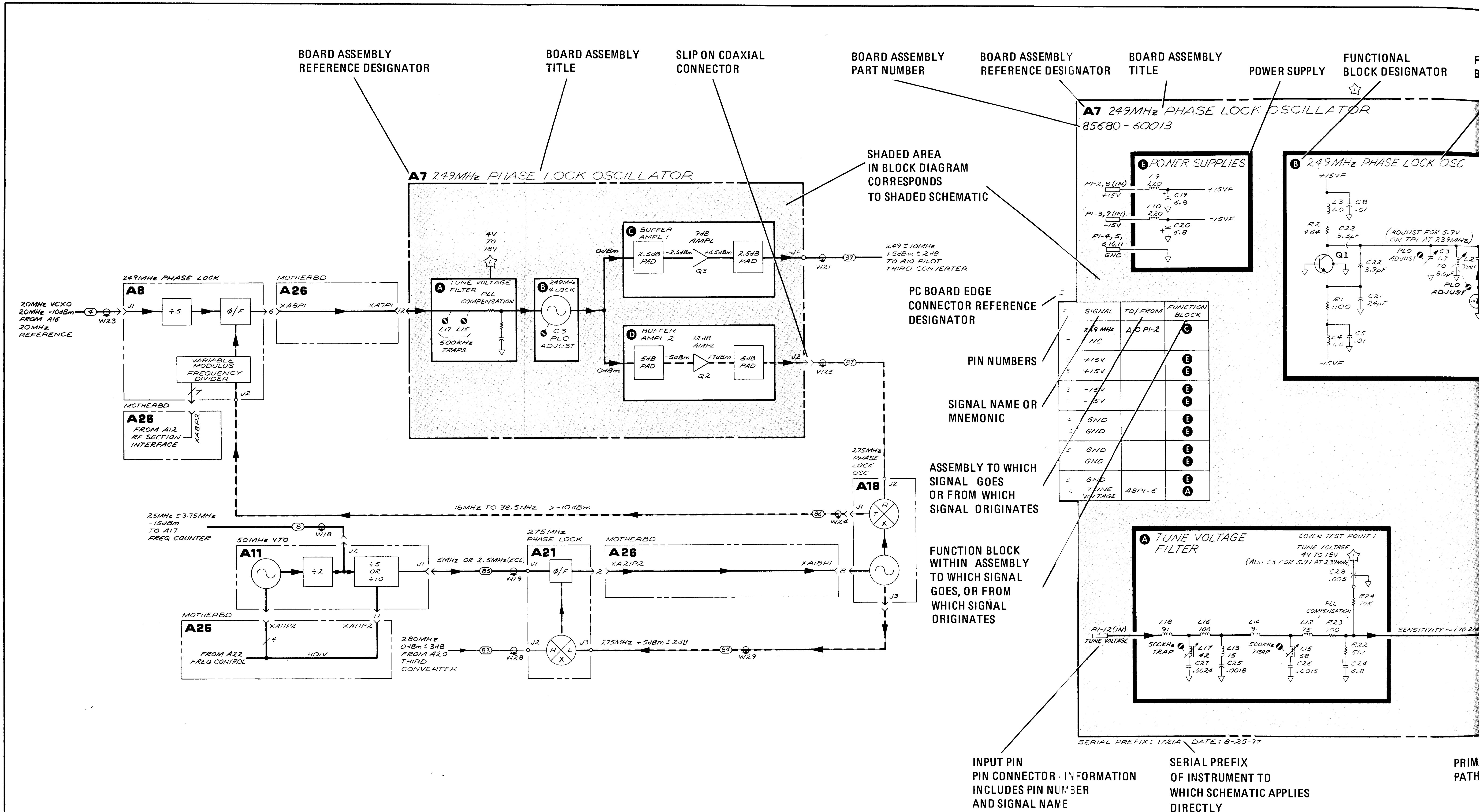
6. If a bad signature is located (point B in the sample), follow instruction (C in the sample) to the IC indicated. The instruction 16-12 indicates to go to U16 pin 12.

7. Check signature at new location (D in the sample). If signature is still bad, go to input pin(s) related to that output (E in the sample). A red line connecting the input to the output indicates that the output is effected by only that input. If signature(s) is (are) good, defective IC has been located (U16 in the sample). If any input signature is bad, refer to schematic to determine origin of input pin (F in sample) with bad signature.

8. Probe new location (G in sample) for correct signature. If signature is good, fault must lie in the printed circuit trace between first location and second (U16 pin 4 and P1 pin 14 in sample). Since the two points are physically connected together, the same signature must appear at both points. If signature is bad, refer to schematic to determine origin of signal. In this example, the signal originates or the A3A6 Main Control. This requires that you go to the A3A6 signature analysis troubleshooting diagram to continue troubleshooting.

9. Before replacing any component on the PC board, note any instructions in red. These red lettered instructions contain additional troubleshooting information which should be followed before replacing a suspected defective component. These special instructions are generally referenced by an asterisk (*).

Figure 9-1. Signal Analysis Troubleshooting Diagram Format


BOARD ASSEMBLY REFERENCE DESIGNATOR
BOARD ASSEMBLY TITLE
SLIP ON COAXIAL CONNECTOR
BOARD ASSEMBLY PART NUMBER
BOARD ASSEMBLY REFERENCE DESIGNATOR
BOARD ASSEMBLY TITLE
POWER SUPPLY
FUNCTIONAL BLOCK DESIGNATOR
SHADED AREA IN BLOCK DIAGRAM CORRESPONDS TO SHADED SCHEMATIC
A7 249MHz PHASE LOCK OSCILLATOR
A7 249MHz PHASE LOCK OSCILLATOR
85680-60013
POWER SUPPLIES
249MHz PHASE LOCK OSC
TUNE VOLTAGE FILTER
BUFFER AMPL 1
BUFFER AMPL 2
249MHz PHASE LOCK
A8
A26
A11
A18
A21
50MHz VTO
275MHz PHASE LOCK
275MHz PHASE LOCK OSC
MOTHERBD
VARIABLE MODULUS FREQUENCY DIVIDER
FROM A12 RF SECTION INTERFACE
FROM A22 FREQ CONTROL
20MHz VCXO 20MHz -10dBm FROM A16 20MHz REFERENCE
249 ± 10MHz +5dBm ± 2dB TO A10 PILOT THIRD CONVERTER
16MHz TO 38.5MHz >-10dBm
25MHz ± 3.75MHz -15dBm TO A17 FREQ COUNTER
5MHz OR 2.5MHz(ECL)
280MHz ± 3dB 0dBm ± 3dB FROM A20 THIRD CONVERTER
275MHz +5dBm ± 2dB
PC BOARD EDGE CONNECTOR REFERENCE DESIGNATOR
PIN NUMBERS
SIGNAL NAME OR MNEMONIC
ASSEMBLY TO WHICH SIGNAL GOES OR FROM WHICH SIGNAL ORIGINATES
FUNCTION BLOCK WITHIN ASSEMBLY TO WHICH SIGNAL GOES, OR FROM WHICH SIGNAL ORIGINATES
SIGNAL
TO/FROM
FUNCTION BLOCK
INPUT PIN
PIN CONNECTOR INFORMATION INCLUDES PIN NUMBER AND SIGNAL NAME
SERIAL PREFIX OF INSTRUMENT TO WHICH SCHEMATIC APPLIES DIRECTLY
SERIAL PREFIX: 1721A DATE: 8-25-77
PRIM
PATH

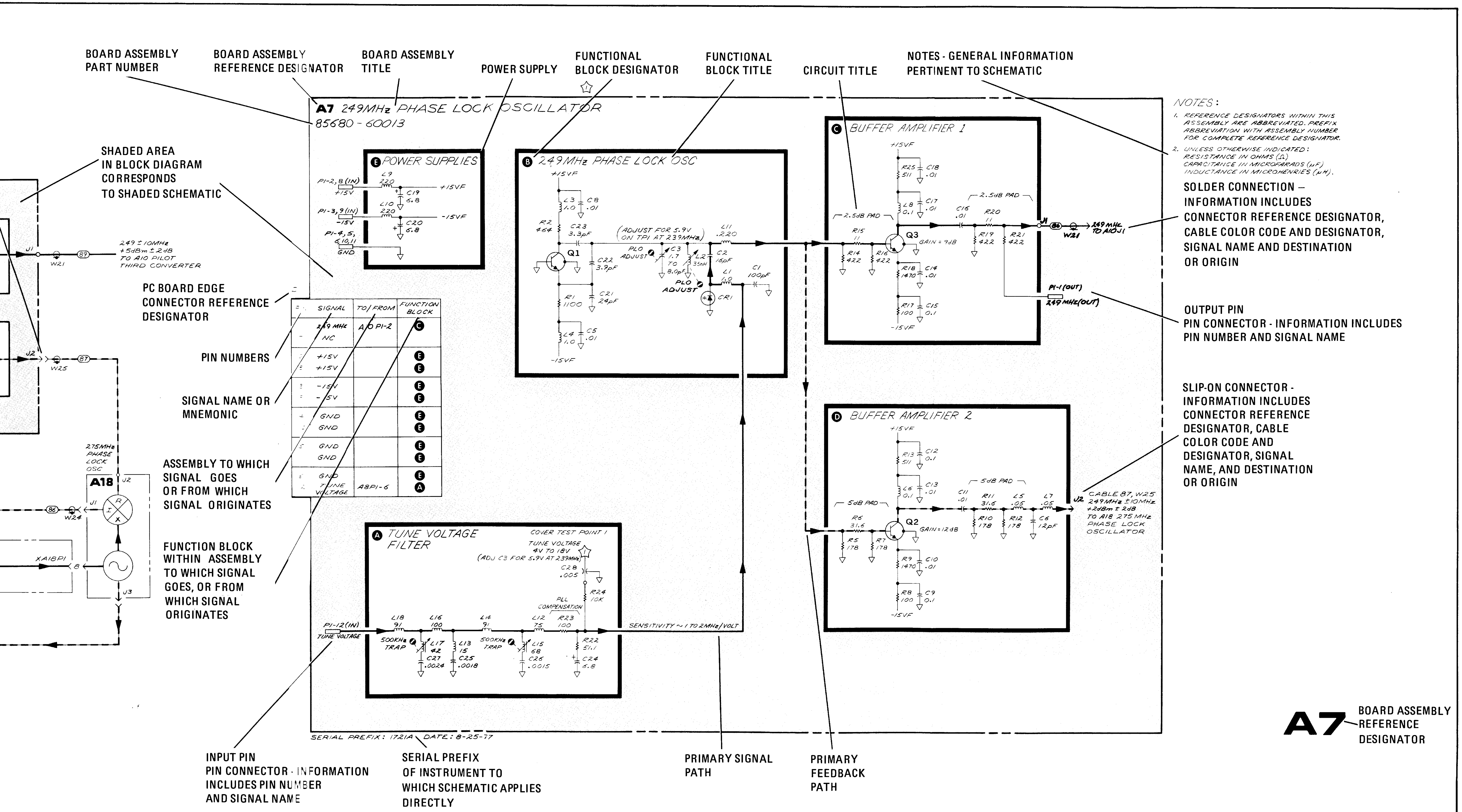


Figure 9-2. Schematic and Block Diagram Format

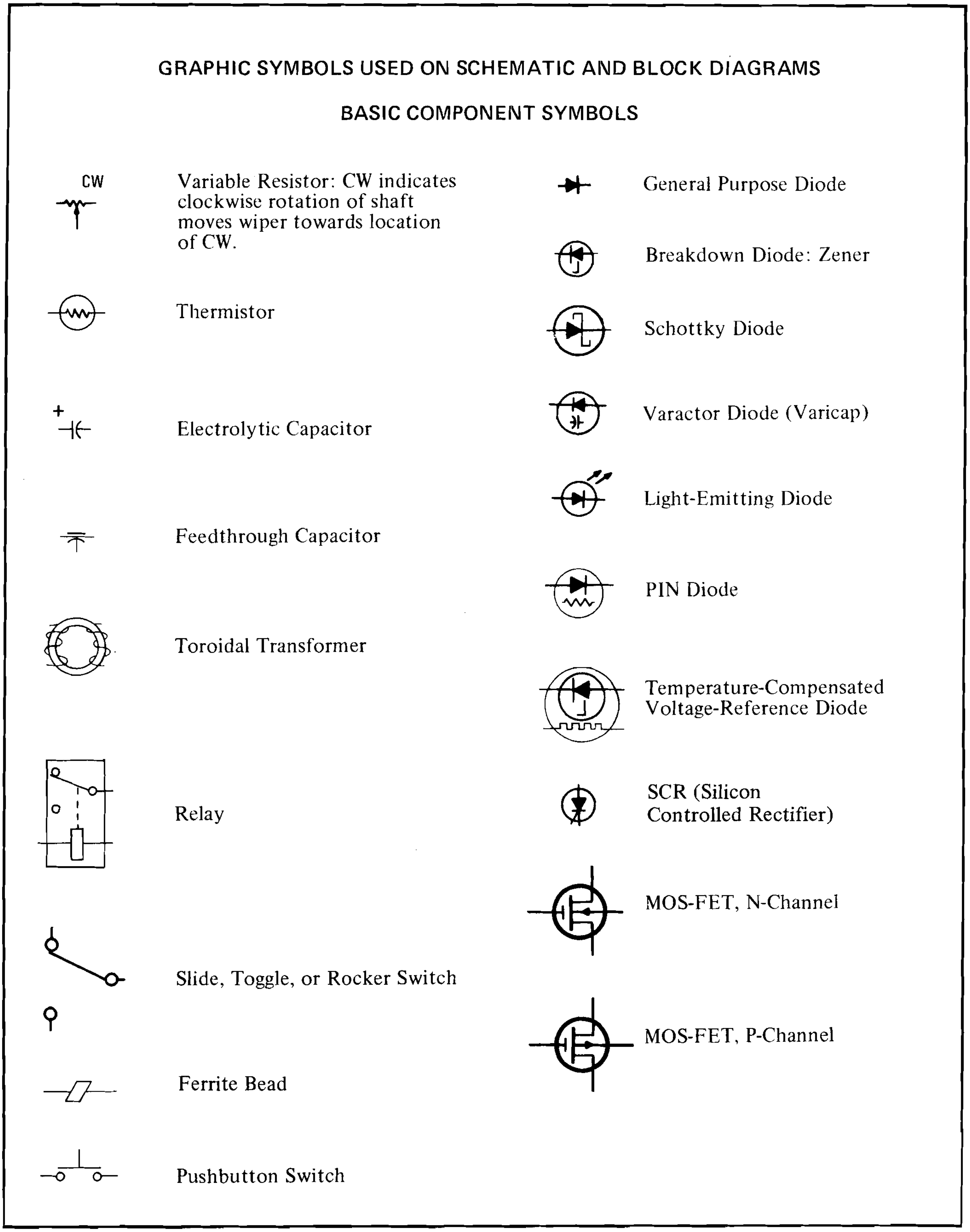
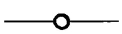
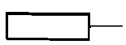
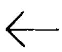
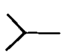
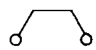


Figure 9-3. Graphic Symbols (1 of 2)

GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS

BASIC COMPONENT SYMBOLS (Cont'd)

*	Indicates a factory selected component
	Indicates shielding conductor for cables
	Indicates a plug-in connection
	Indicates a soldered or mechanical connection
	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)
	Test Point: Terminal provided for test probe connection
	Measurement Point: Used to indicate a convenient point for measurement. No terminal provided for test probe.
	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.
	Jumper wire
	Earth ground symbol
	Instrument chassis ground. May be accompanied by a number or letter to specify a particular ground.
	Screwdriver adjustment
	Panel control

COMMONLY USED ASSEMBLY AND CIRCUIT SYMBOLS

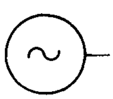
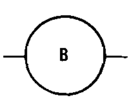
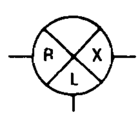
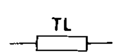
	Oscillator, RPG (Rotary Pulse Generator)
	Fan, Motor
	Mixer
	Transmission Line

Figure 9-3. 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 upon American National Standard ANSI Y32.14, *Graphic Symbols for Logic Diagrams (Two-State Devices)*, but does not strictly follow the standard. This figure should be consulted for the explanation of digital IC symbols used in Sections VIII and IX.

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 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.).

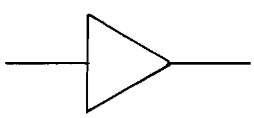
Line Label: The symbol or abbreviation associated with an output or input line that defines the action of the line.

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

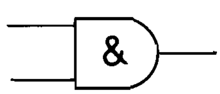
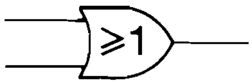


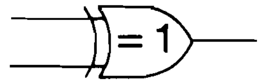
Figure 9-4. Schematic Symbols for Digital Integrated Circuits (1 of 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

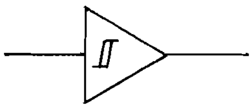
OR Gate



EXCLUSIVE OR Gate

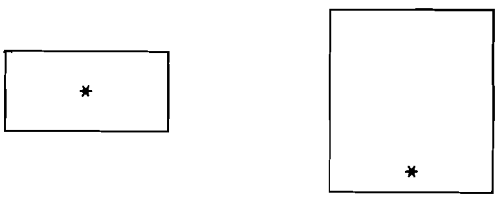


Schmitt Trigger



Rectangular Symbols

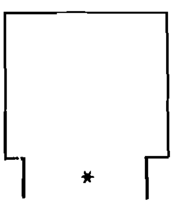
General Logic Element



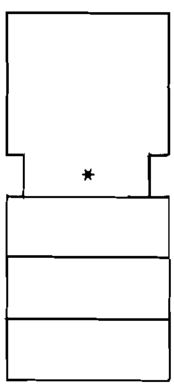
NOTE

The asterisk indicates where the function label is placed

Control Block



Logic Elements with Common Control Block



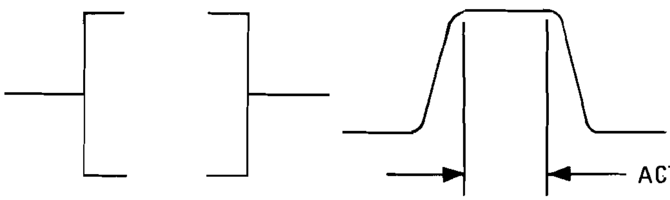
NOTE

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

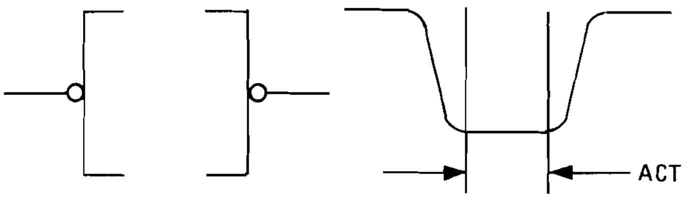
Figure 9-4. Schematic Symbols for Digital Integrated Circuits (2 of 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

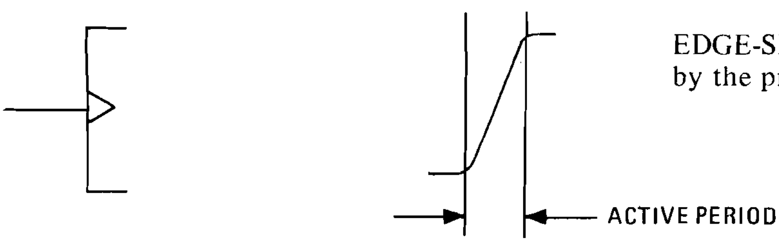
INDICATOR SYMBOLS (positive logic assumed)



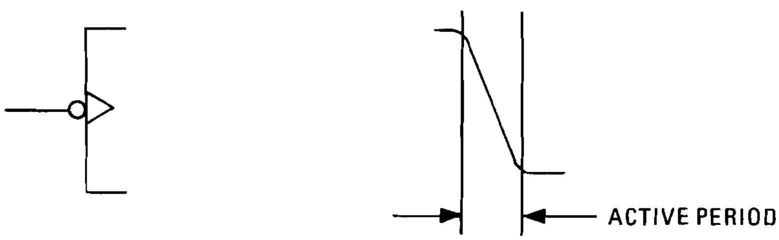
ACTIVE-HIGH inputs and outputs are indicated by the absence of the negation symbol, **O**.

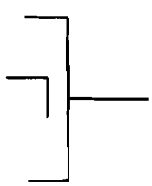


ACTIVE-LOW inputs and outputs are indicated by the presence of the negation symbol, **O**.

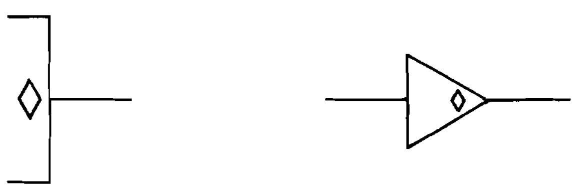


EDGE-SENSITIVE (Dynamic) inputs are indicated by the presence of the dynamic input symbol,





TRAILING-EDGE ACTIVATED outputs are indicated by the output delay symbol, ˥ . These outputs become active when the signal that initiates the change returns to its original state (example: the outputs of a J-K master-slave flip-flop).



OPEN-COLLECTOR outputs are indicated by the presence of the open-collector symbol, ◊

Figure 9-4. 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
▷	AMPLIFIER/BUFFER
1 	MONOSTABLE MULTIVIBRATOR (ONE-SHOT)
&	AND GATE
⩾1	OR GATE
= 1	EXCLUSIVE OR GATE
X→Y	ENCODER, DECODER
XMAX→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 9-4. 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)
An	nTH ADDRESS BIT (ROM, RAM)
C	CLOCK INPUT
D	DATA OR DELAY INPUT (FLIP-FLOP)
Dn	nth 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)
Yn	nth DATA BIT OUTPUT OR I/O
3-ST (placed by function label)	3-STATE

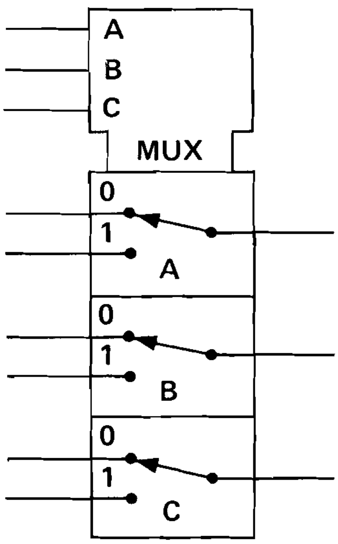
Figure 9-4. Schematic Symbols for Digital Integrated Circuits (5 of 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

NOTES

1. The suffix or subscript 0 denotes the least significant bit (LSB) of 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:

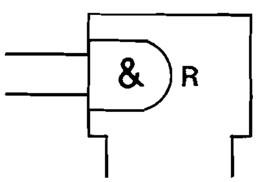


Triple 2-Channel Multiplexer

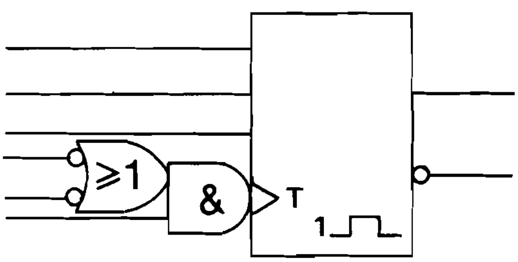
Letters are used to relate control inputs to logic elements. The numerals 0 and 1 indicate 0-state and 1-state, respectively, and relate the position of a "switch" to the logic state of the corresponding control line.

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 9-4. Schematic Symbols for Digital Integrated Circuits (6 of 8)

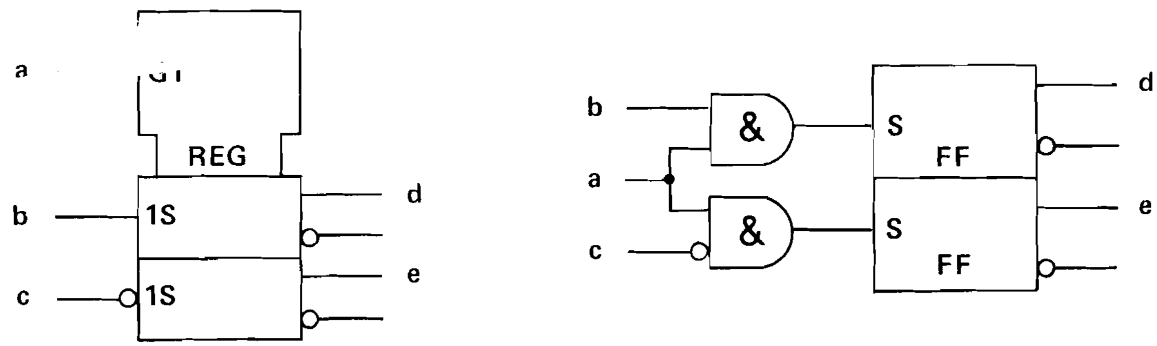
SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

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

IC Symbol

Equivalent



2-to-4-Line Decoder

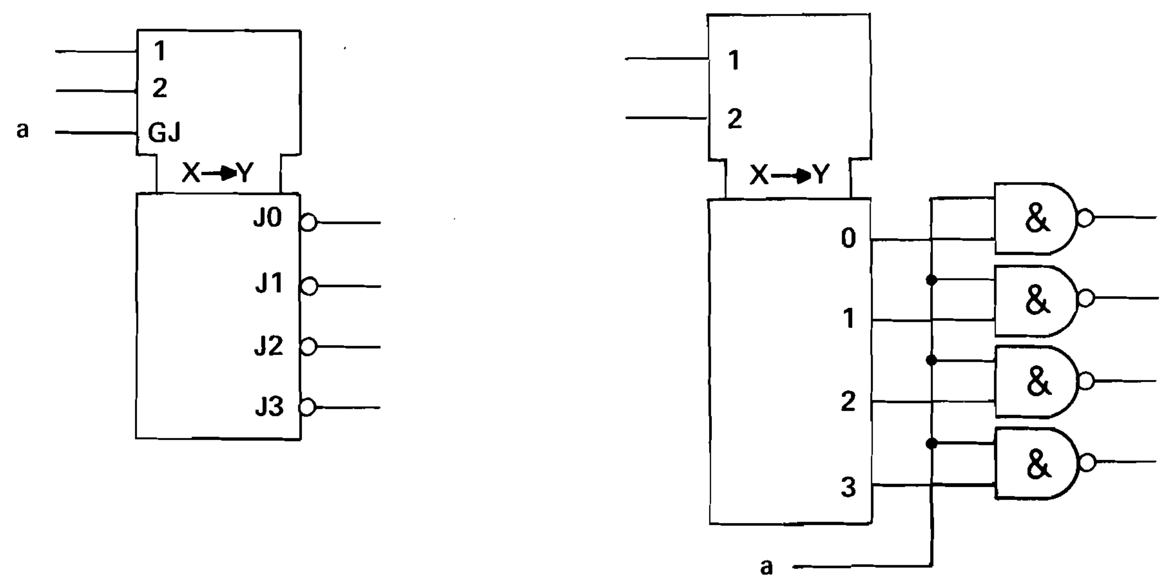
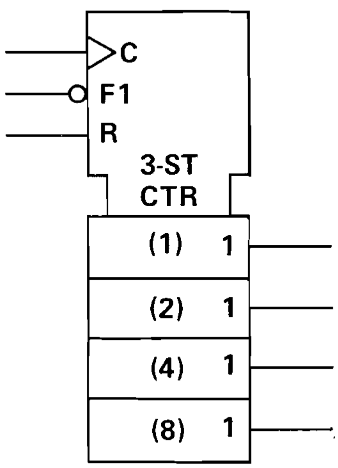


Figure 9-4. Schematic Symbols for Digital Integrated Circuits (7 of 8)

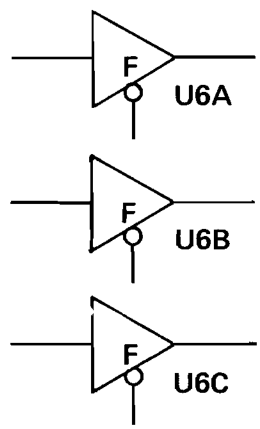
SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

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:

Counter with
3-State Outputs



3-State Buffers



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 9-4. Schematic Symbols for Digital Integrated Circuits (8 of 8)

FRONT-PANEL LED REPLACEMENT

NOTE

This procedure does not cover replacement of SIGNAL INPUT ❷, INSTR CHECK ❸, or STANDBY ❹ 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) ❶ 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.

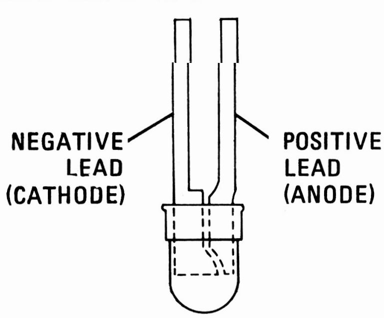
4. For instrument sections with serial numbers prefixed 1803A and above, the front panel is fastened to the sub-panel by four (4) studs with snap fasteners. These fasteners may be removed using needle-nose pliers to allow removal of front dress panel. After front dress panel is removed, front-panel LEDs 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



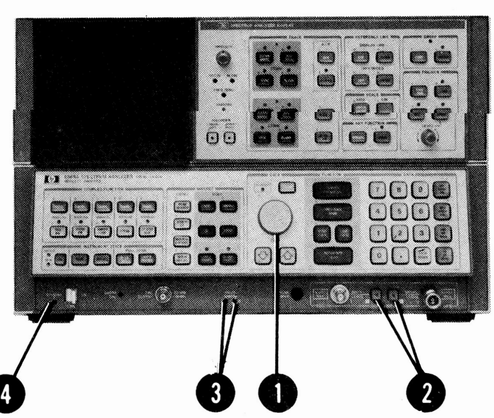


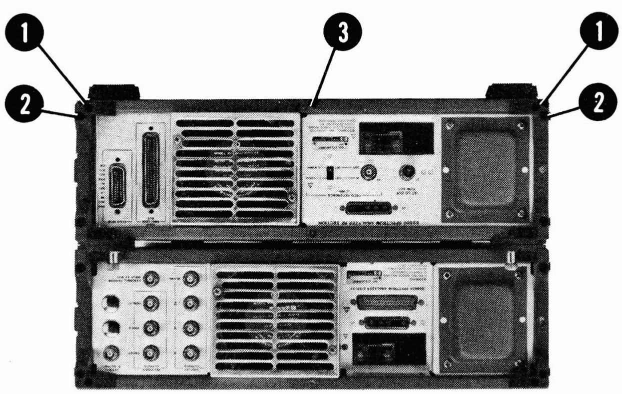
Figure 9-5. Front-Panel LED Replacement

RF SECTION INTERNAL FUSE REPLACEMENT

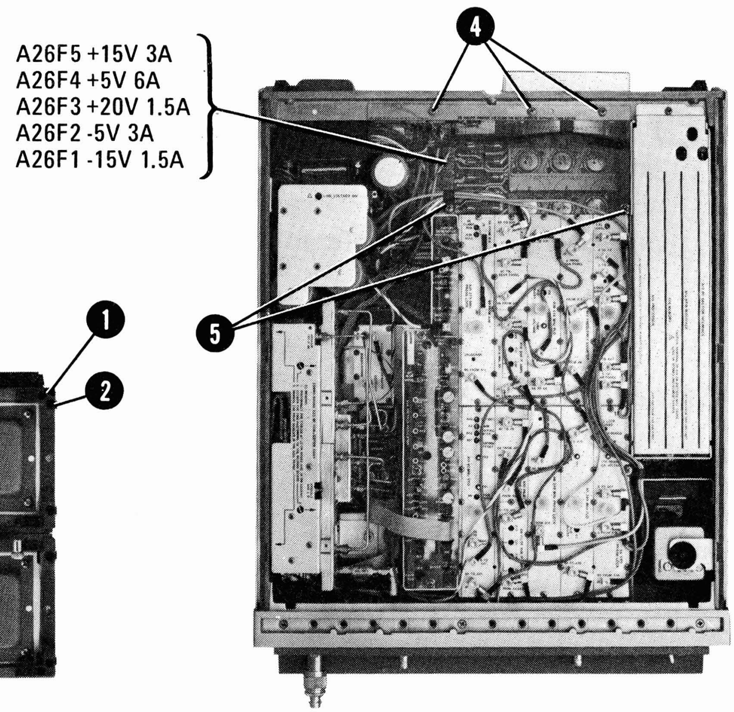
WARNING

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.
6. Part number information is located in Volume 2, Section VI.



View A



View B

Figure 9-6. RF Section Internal Fuse Replacement

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. Remove feet 1 by removing screws 2 .

4. Remove cover from bottom of RF Section by loosening screw 3 .

5. Loosen thumbscrews 4 and separate instruments by holding IF-Display Section in place while pushing the RF Section at the front panel.

6. After separating instruments, slide RF Section away from IF-Display Section far enough to remove screws 5 holding front panel to frame. (Refer to View B.)

7. Remove screws 6 from other side of instrument. (Refer to View C.)

8. Pull front-panel out of frame as shown in View D.

9. 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.)

10. To replace INSTR CHECK and STANDBY LEDs proceed as follows: (Refer to View E.)

    a. Disconnect cable at connector 16 .

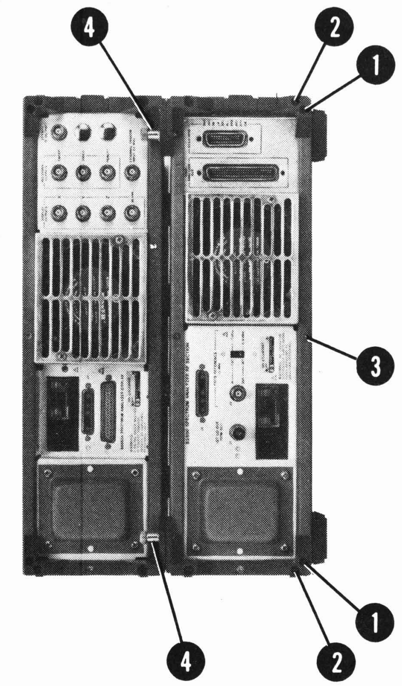
    b. Remove nut 17 and remove SIGNAL INPUT 2 connector from front panel.

    c. Remove three screws 18 .

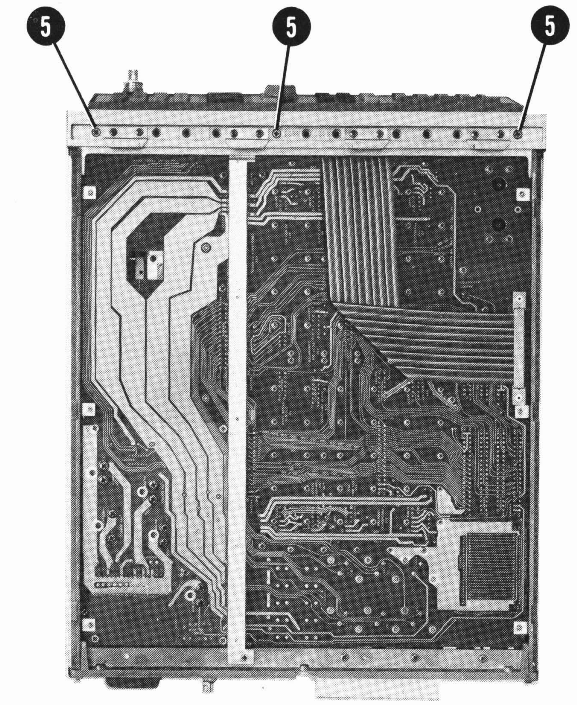
    d. Disconnect connector 19 , remove nut 20 , and remove SIGNAL INPUT 1 connector from front panel.

    e. Remove nut and washer from PROBE POWER connector 21 .

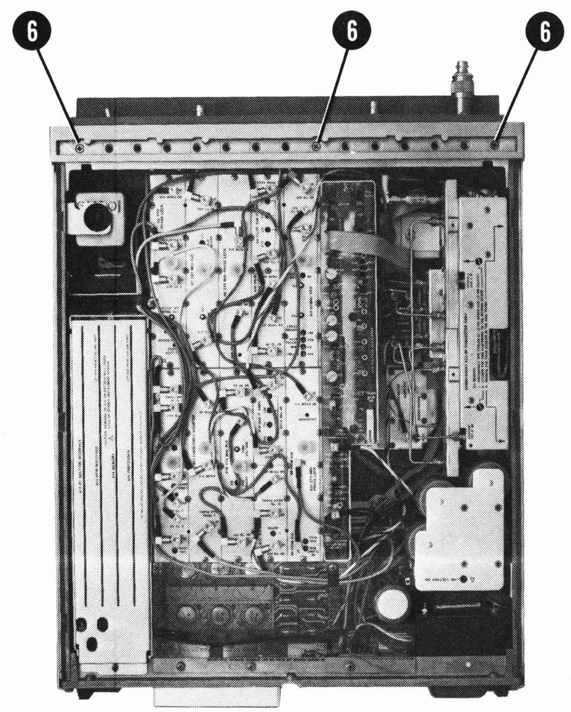
    f. Remove knurl-nut (located on front panel) from CAL OUTPUT connector 22 and remove connector from front panel.



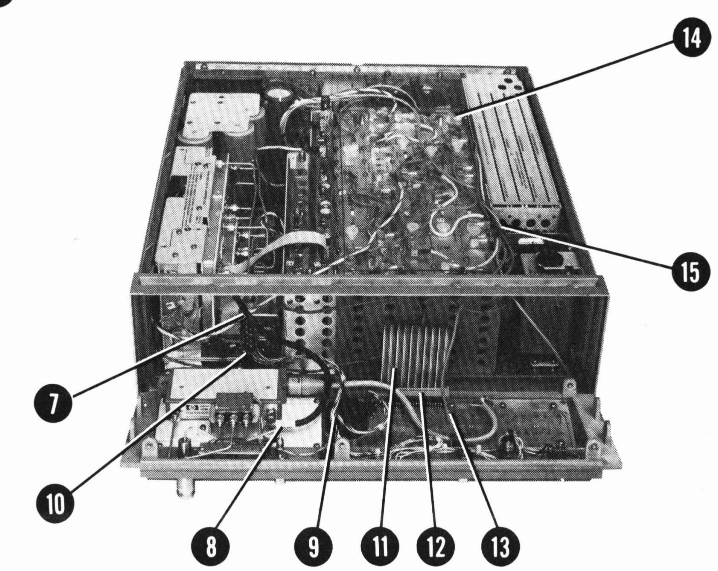
View A



View B



View C



View D

FRONT PANEL F

g. Lower front panel should no necessary to cut the cable wra to allow the connector to be defective LEDs.

h. To replace the defective LED on the leads with a soldering the front panel. Insert a new follows: (Refer to View F.) cathode; INST CHECK I LE CHECK II LED –93 wire to

i. Reassemble lower front panel.

11. To replace SIGNAL INPUT LEDs,

    a. Disconnect connectors 16 , circuit board where LEDs, swi

    b. Remove three screws 18 an

    c. To remove defective LED, leads from printed circuit bo through printed circuit board

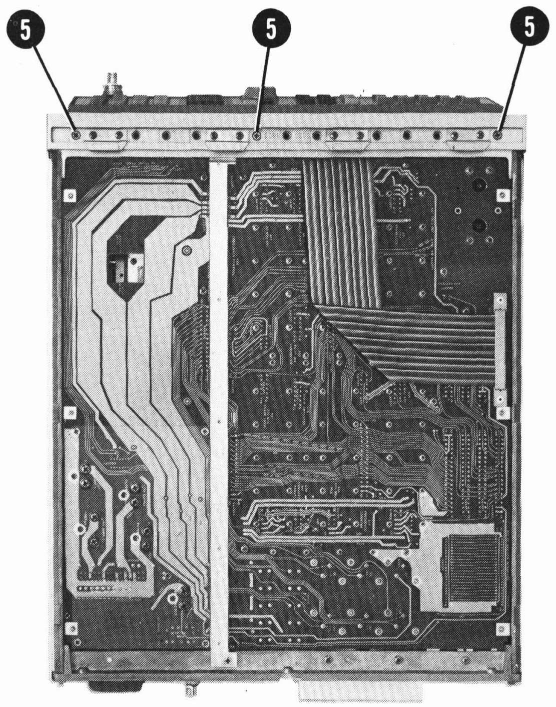
    d. To replace defective LED, ins through printed circuit boar PC Board (Refer to View F.) LED is far enough into swit to rear of printed circuit boar

    e. To remove defective switch, switch to printed circuit boa printed circuit board.

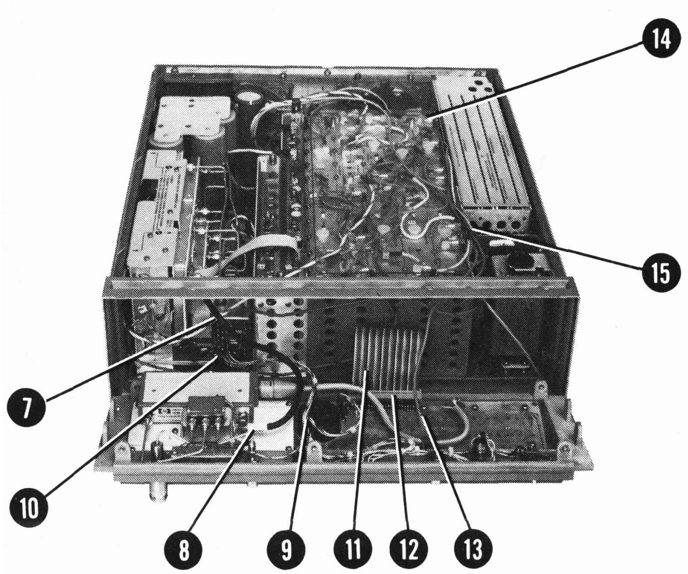
    f. To replace switch, insert plas and melt the pins with a sol enough to secure switch. Repl

    g. Reassemble printed circuit bo

FRONT PANEL REMOVAL AND REPAIR (Cont'd)



View B



View 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.

11. 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.

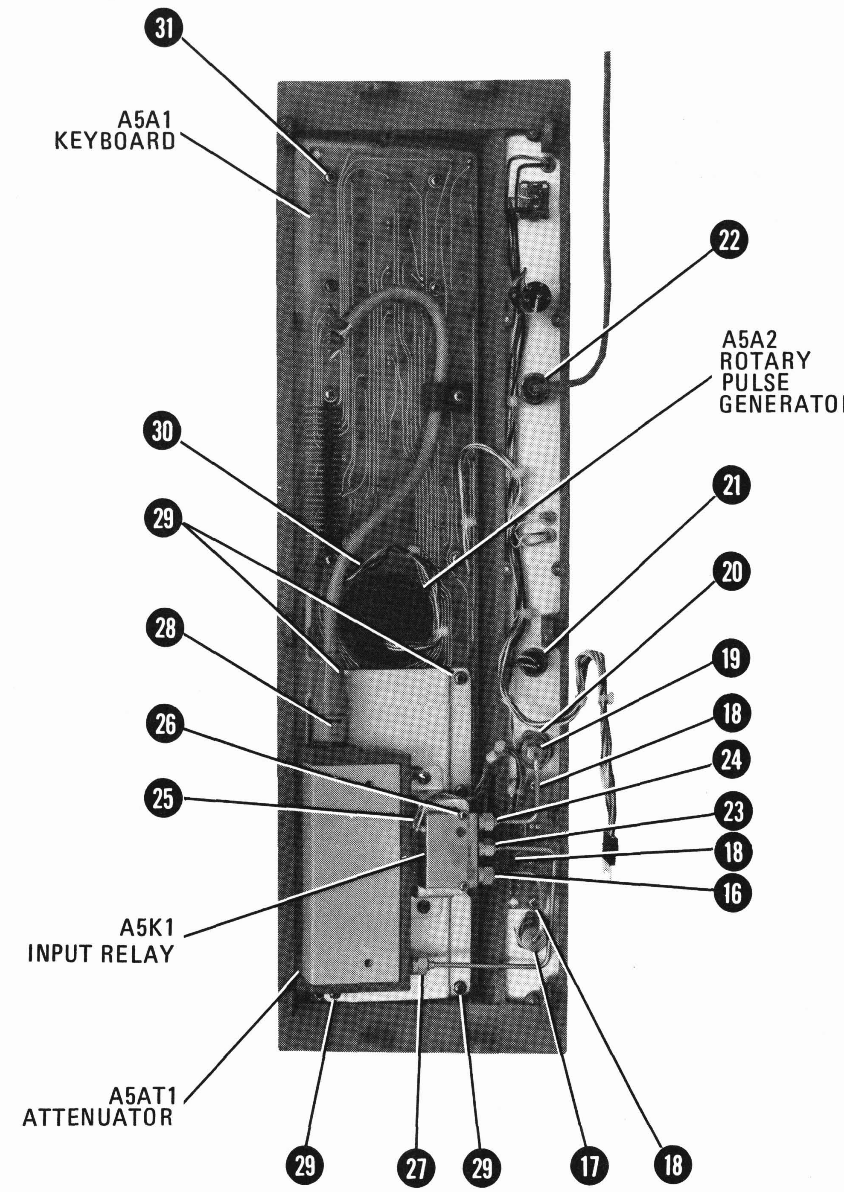
c. To remove defective LED, remove key from front of switch, unsolder LED leads from printed circuit board, free leads with a soldering aid, and push leads through printed circuit board so that LED is forced out of switch.

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 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.

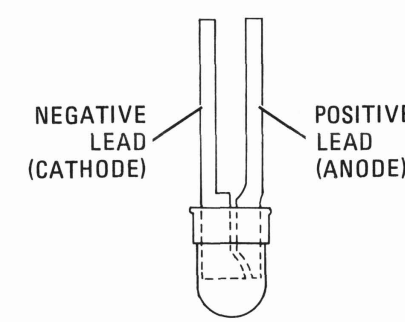
e. To remove defective switch, remove key from switch, melt plastic pins holding switch to printed circuit board using a soldering iron, and remove switch from printed circuit board.

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 E



View F

12.

13.

14.

15.

16.

AL AND REPAIR (Cont'd)

ate from front panel assembly. It may be e cable near the PROBE POWER connector d from the panel far enough to replace the

der the wires from the LED leads and push force the LED out of the socket through nd resolder the wires to the LED leads as DBY LED –905 wire to anode, 0 wire to wire to anode, 95 wire to cathode; INST 96 wire to cathode. Trim excess lead length.

, or keys, proceed as follows: (Refer to View E.)

and 24 and move cables from over printed d keys are located.

rinted circuit board away from front panel.

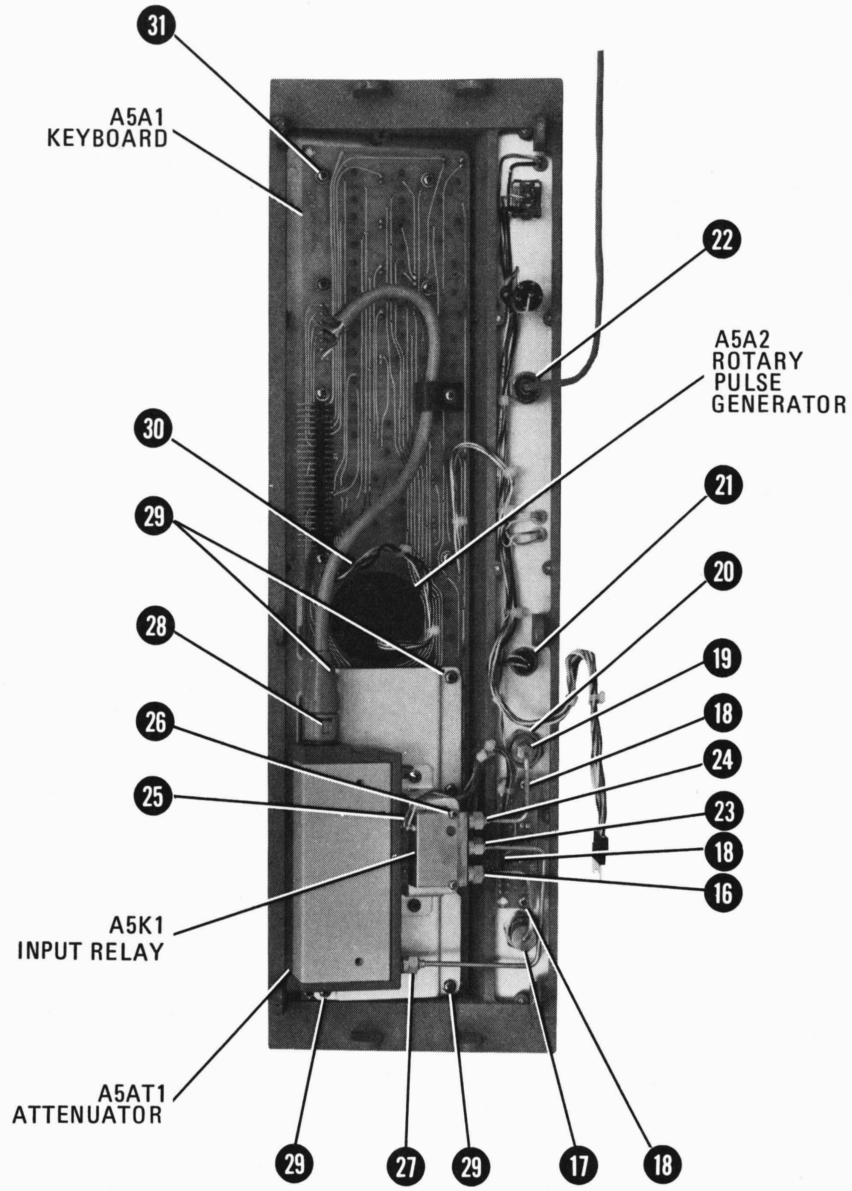
key from front of switch, unsolder LED e leads with a soldering aid, and push leads LED is forced out of switch.

w LED through switch so that leads extend tive (cathode) lead goes to square pad on ls with fingers or needlenose pliers to ensure low room for reinstalling key. Solder leads nstall key on switch.

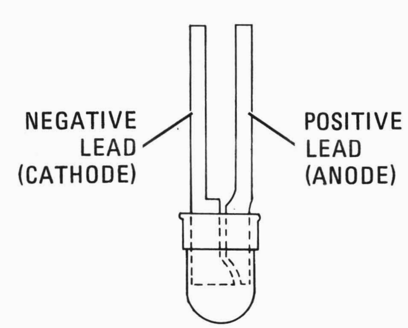
key from switch, melt plastic pins holding a soldering iron, and remove switch from

of new switch through printed circuit board on on the rear of the printed circuit board

ont panel and reconnect cables.



View E



View F

FRONT PANEL REMOVAL AND REPAIR (Cont'd)

12. 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 .

13. 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 four 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 .

14. 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 9-5 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 9-5.

    e. Reconnect wires 30 to A5A1 Keyboard.

15. To replace switches on A5A1 Keyboard, refer to Figure 9-5 for front panel removal and see procedure in Steps 11 e and f of this figure for switch replacement.

16. The A5A1 Keyboard may be removed by first removing the input attenuator and mounting bracket as described in Step 13 of this procedure and then removing screws securing Keyboard to front panel frame (31 shows typical location of screws).

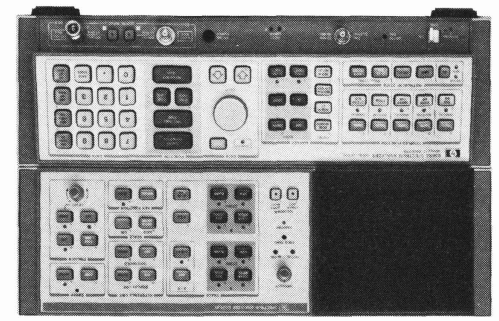
Figure 9-7. Front Panel Removal and Repair

REMOVAL

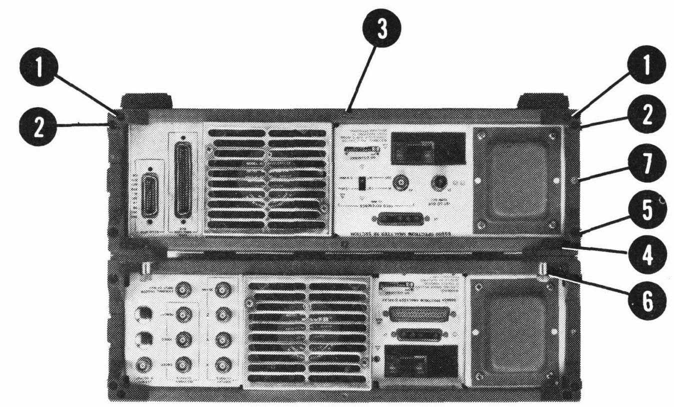
WARNING

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

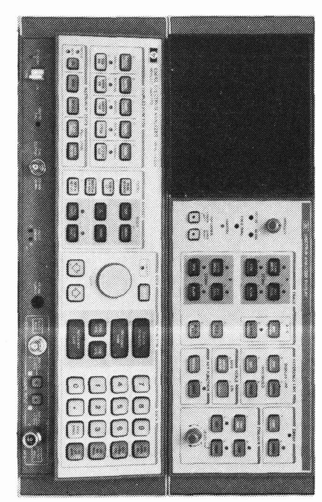
1. Position instrument upside down as shown in View A. Remove feet 1 by removing screws 2 as shown in View B.
2. Remove cover from bottom of RF Section (now on top of instrument) by loosening pozi-drive screw 3 .
3. Remove foot 4 indicated in View B from rear of instrument by first removing screw 5 , 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 A23A4A1J4 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 wi

1. Position instrument on right side as shown in View C with bo from RF Section. Refer to Removal procedure Steps 1 through 7 i
2. Place RF Converter next to instrument and connect cables if black) cable to A23A3J6, 92 (white/red) cable to A23A to A23A6J1, 90 (white/black) cable to A23A4A1J4, ribbon ca uency Control to A23A1 YTO, and ribbon cable from Mothe RF Converter Bias assembly.
3. Position RF Converter so that A23A3 Second Converter is facing
4. Slide RF Converter into instrument being careful not to pinch or b
5. Insert straight-slot screws (location indicated on top of RF Conv threaded holes in Motherboard and screw in slightly. Do not tigh
6. Position instrument upside-down as shown in View A.
7. Replace four pozi-drive screws RF Section side frame (location 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 i
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 9-8. RF Conver

REMOVAL

WARNING

from both instruments before proceeding with this procedure.

upside down as shown in View A. Remove feet 1 by removing in View B.

bottom of RF Section (now on top of instrument) by loosening .

indicated in View B from rear of instrument by first removing ening thumbscrew 6 .

right side cover by loosening pozi-drive screw 7 shown in

ive screws from RF Section right side frame used to attach RF me. Location of these screws is indicated on top of RF Converter

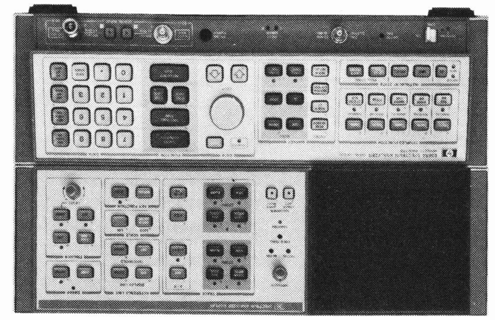
t-slot screws, (location indicated on top of RF Converter as- ch RF Converter to Motherboard.

n right side as shown in View C.

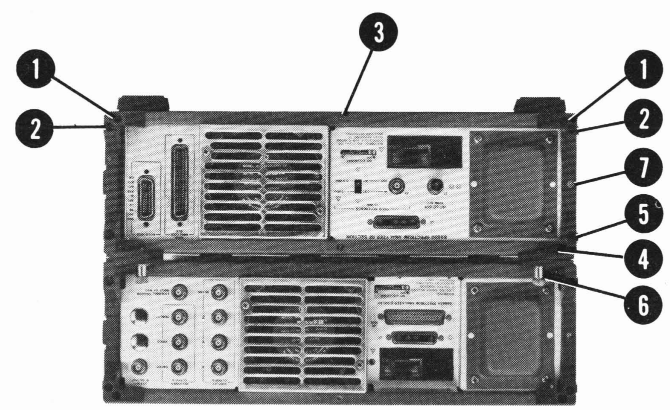
ut of instrument slowly being careful not to pinch or bind cables.

erter for adjustment, turn Converter upside-down so that Second s are facing upwards.

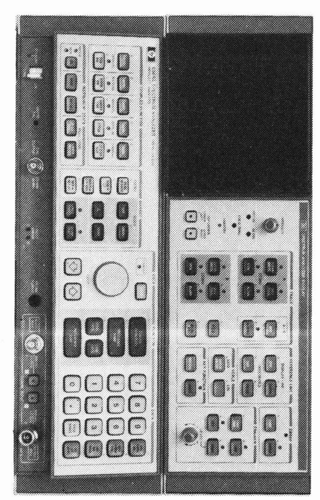
verter for repair or replacement, disconnect all cables from the black) cable from A23A3J6, 92 (white/red) cable from A23A3J5, A23A6J1, RF input cable from Limiter, 90 (white/black) cable nd two ribbon cables; one from the YTO A23A1 and the other rter Bias assembly A23A4A2. (Note position in which ribbon 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 9-8. RF Converter Removal and Installation

Table 9-1. Troubleshooting Index (1 of 2)

Troubleshooting Information	Tab Title	Vol.
Center Frequency Tuning Equations and Phase Lock	RF Section Analog Troubleshooting Block Diagram	4
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Display System	Spectrum Analyzer Overall Troubleshooting A1 Display Section Block Diagram	3, 4 3
Error Correction Routine	Spectrum Analyzer Overall Troubleshooting	3, 4
RF Section Digital (includes INSTR CHECK LEDs)	A3 Digital Storage Block Diagram RF Section Digital Troubleshooting Block Diagram A15 Processor	3 4
Special Messages	Spectrum Analyzer Overall Troubleshooting	3, 4
Sweep System	Spectrum Analyzer Overall Troubleshooting	3, 4
A1A1 Keyboard	A12 RF Section Interface	4
A3 Digital Storage	Spectrum Analyzer Overall Troubleshooting A3 Digital Storage Block Diagram	3, 4 3
A3A1 Trigger*	Spectrum Analyzer Overall Troubleshooting (Sweep System) A3 Digital Storage Block Diagram	3, 4 3
A3A2 Intensity Control*	A1 Display Section Block Diagram A3 Digital Storage Block Diagram	3 3
A3A3 Line Generator*	A1 Display Section Block Diagram A3 Digital Storage Block Diagram	3 3
A3A4 Memory	A1 Display Section Block Diagram A3 Digital Storage Block Diagram	3 3
A3A5 Data Manipulator A3A6 Main Control A3A7 Interface	A3 Digital Storage Block Diagram	3
A3A8 Analog-Digital Converter*	Spectrum Analyzer Overall Troubleshooting (Sweep System) A1 Display Section Block Diagram A3 Digital Storage Block Diagram	3, 4 3 3
A3A9 Track and Hold*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions) A1 Display Section Block Diagram A3 Digital Storage Block Diagram	3, 4 3 3

Table 9-1. Troubleshooting Index (2 of 2)

Troubleshooting Information	Tab Title	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)	3, 4
A5 Front Panel	A12 RF Section Interface A15 Processor	4 4
A6 YTO Phase Lock* A8 249 MHz Phase Lock* A11 50 MHz Voltage-Tuned Oscillator	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions)	3, 4
A12 RF Section Interface*	Spectrum Analyzer Overall Troubleshooting (Sweep System) A15 Processor	3, 4 4
A13 HP-IB Interface*	RF Section Digital Troubleshooting Block Diagram	4
A14 Memory	A15 Processor	4
A15 Processor*	Spectrum Analyzer Overall Troubleshooting (Sweep System)	3, 4
A17 Frequency Counter*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions) RF Section Digital Troubleshooting Block Diagram	3, 4 4
A22 Frequency Control*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions, Sweep System)	3, 4
A23 RF Converter	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions, Error Correction Routine)	3, 4

*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 8-9.) 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 Block Diagram 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 A14 Memory 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. The battery warning can be caused by too low a voltage from the A28 Battery Pack or a problem with the A14 CMOS memory power supply circuit. Removing the A14 Memory 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. The HP-IB Address is also lost. A fully charged battery pack should maintain the stored instrument states for up to 30 days.

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 [SHIFT] [MKR→ CF] (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 on 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 Processor 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 [SHIFT] [CF STEP SIZE] (KSJ).
- Pilot RF to IF converter A23

- A9 Pilot Second IF Amplifier and A10 Pilot Third Converter
- A6 YTO Phaselock, Pilot IF output to A17 Frequency Counter [SHIFT] [PEAK SEARCH] (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

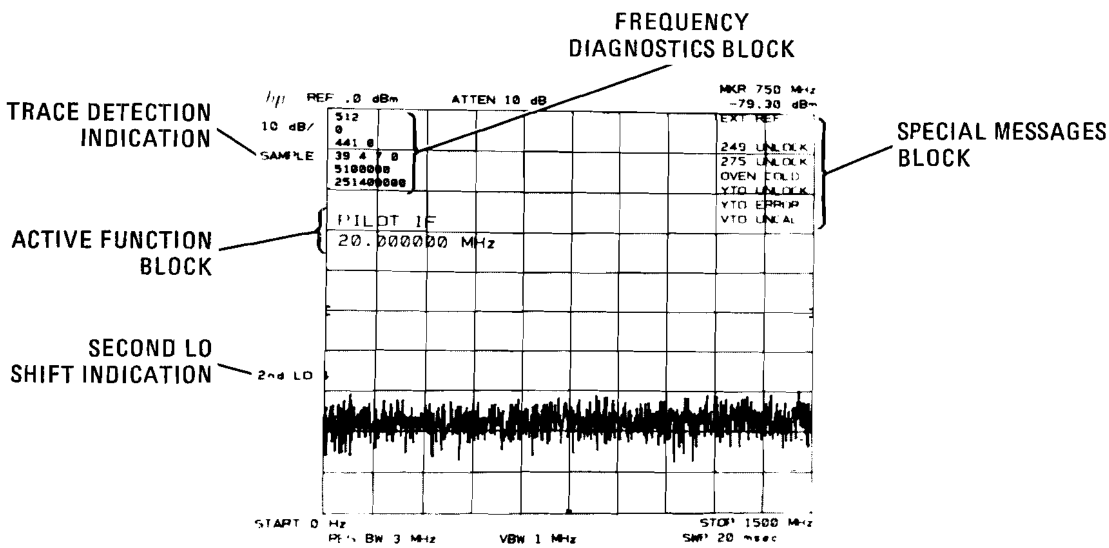


Figure 9-9. CRT Locations of Special Messages and Diagnostic Function Indicators

DIAGNOSTIC FUNCTIONS

The Diagnostic Functions are accessible through the blue SHIFT 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. They are also used in Section V as an aid in performing necessary adjustments. A summary of the Diagnostic Functions follows. More information on their use can be found in the troubleshooting procedures.

Frequency Diagnostics SHIFT MKR→ REF LVL (KSR)

This function displays many of the internal frequency control parameters in the upper left corner of the CRT display. (See Figure 8-9.) These parameters are the programmed values determined by the A15 Processor. For example, following an INSTR PRESET, a SHIFT MKR→ REF LVL (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 the center frequency of 0 Hz to 89 at a center frequency of 1739 MHz. The next 2 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; with a 1 indicating that the 2nd LO is shifted up 5 MHz in frequency (1753.6 MHz), and a 0 indicating 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 [SHIFT] [FREE RUN] (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 8-9.)

Sometimes a YTO lock problem at turn on will prevent the operator from performing a [SHIFT] [FREE RUN] (KSv) for about the first 3 minutes. In this case, a jumper can be placed from A15TP8 (STS) to A14TP11 (T1). When [INSTR PRESET] 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 [INSTR PRESET] is pushed. If the analyzer then stops sweeping, troubleshoot A17 Frequency Counter.

Manual DAC Control [SHIFT] [CF STEP SIZE] (KSJ)

This function permits direct control of the frequency control DACs on A22 Frequency Control in the analyzer. This permits easier and faster verification of these DACs over trying to indirectly set them by varying the center frequency and span. When [SHIFT] [CF STEP SIZE] (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, GHz units 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 3 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 SHIFT PEAK SEARCH (KSK)

Counts and displays the Pilot IF frequency. In nonphase-locked modes (spans greater than 1 MHz), it will vary from approximately 8 MHz to 32 MHz. In phase-lock 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 SHIFT MKR/Δ→ STP SIZE (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 SHIFT MKR→ CF (KSN)

Counts and displays the A11 50 MHz VTO output. This frequency should be 25 MHz ±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.

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

Use SHIFT CF STEP SIZE (KSJ) to set the VTO Tune DACs to 0 kHz

Use SHIFT MKR→ CF (KSN) to verify the high end frequency of the VTO

Use SHIFT CF STEP SIZE (KSJ) and set VTO Tune DACs to 1012 kHz

Use SHIFT MKR→ CF (KSN) to verify low end frequency of the VTO

Sweep Time Measure SHIFT RES BW (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 which must be subtracted to determine the exact sweep times. This function is also useful in troubleshooting the A17 Frequency Counter. By setting a 1500 second sweep time and pushing SHIFT RES BW (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 [SHIFT] [⇧] [⇩] (KSU) (KST)

Three functions can be used to control the 5 MHz Second LO shift, which is normally automatically switched by the processor depending on center frequency and span. The state is indicated on the left side of the CRT display. (See Figure 8-9.) The 2nd LO output can be monitored at A23A3J3.

[SHIFT] [⇧] (KSU) forces the 2nd LO to shift up (1753.6 MHz)

[SHIFT] [⇩] (KST) forces the 2nd LO to shift down (1748.6 MHz)

[SHIFT] [SIGNAL TRACK] (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 [SHIFT] [⇧] (KSU) or [SHIFT] [⇩] (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 8-9.) 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 3 modes are properly aligned. All 3 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.

[SHIFT] Trace A [MAX HOLD] (KSb) displays positive peaks

[SHIFT] Trace A [VIEW] (KSd) displays negative peaks

[SHIFT] Trace A [BLANK] (KSe) displays sampled data

[SHIFT] Trace A [CLEAR-WRITE] (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, ATTEN, REF LEVEL, LOG/LIN, etc) when the failure occured. If the routine runs, the correction factors can be displayed by pressing [SHIFT] [LINE] (KSw). Figure 8-10 displays the data for a typical instrument. Table 8-2 gives the parametric information, specifications and a place to start the troubleshooting procedure.

Caution must be exercised in interpretting 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.

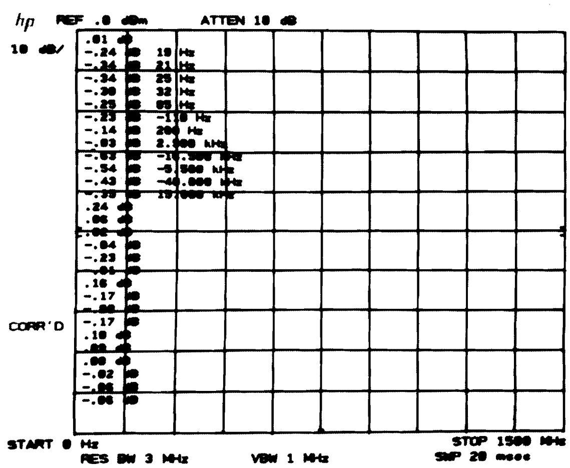


Figure 9-10. Error Correction Routine Data

Table 9-2. 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		A4A7/A4A6/A4A5
5	300 Hz		
6	1 kHz		
7	3 kHz	± 0.5 dB*	
8	10 kHz		
9	30 kHz		
10	100 kHz		A4A8/A4A4/A4A6
11	300 kHz		
12	1 MHz	*	
13	3 MHz	± 1 dB*	
14	LOG and LIN scale, BW ≥ 100 kHz	± 1 dB typical	A4A3/A4A2
15	2nd local oscillator frequency shift	± 1.0 dB	A23
16	30 dB gain		A4A3/A4A2
17	20 dB gain — LIN operation only	± 1 dB	A4A2
18	10 dB gain		A4A3
19	50 dB step gain errors		
20	40 dB step gain errors		
21	30 dB step gain errors		A4A5
22	20 dB step gain errors	± 0.6 dB	
23	10 dB step gain errors		
24	0 dB step gain errors		
25	−10 dB step gain errors		A4A8
26	−20 dB step gain errors		
27	offset error 2 dB/ LOG	± 0.5 dB	
28	offset error 5 dB/ LOG	± 0.5 dB	A4A1
29	offset error 10 dB/ LOG	± 0.5 dB	

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

SWEEP SYSTEM BLOCK DIAGRAM DESCRIPTON

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

Continuous Sweep; Free Run Trigger

Several different assemblies are involved in the 8568A sweep system. The sweep generator portion of the A22 Frequency Control generates the 0 to 10 volt 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 transistion 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 Processor. The Processor then reads the sweep address from the Digital Storage Processor. If it corresponds to the end of the sweep, the A15 Processor outputs a sweep reset command to the sweep generator on A22, resetting the sweep ramp to 0 volts. After all service requests have been handled (LSRQ is high), the A15 Processor starts the sweep by issuing a set HSWP command to the A3A1 Trigger. The A15 Processor then issues a stop command to the A12 RF Section Interface assembly that forces LSTP low, stopping the Processor. After a 500 μsec 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 a sweep is in progress.

Frequency Count at Marker

If the 8568A 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 Processor 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 but 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 8-11 for an example of the sweep system timing.

Triggered Sweep

The triggered sweep modes are very similar to free run operation except that instead of the A15 Processor 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 [SINGLE] key is pressed, the A15 Processor 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 10 volts until the single key is again pressed.

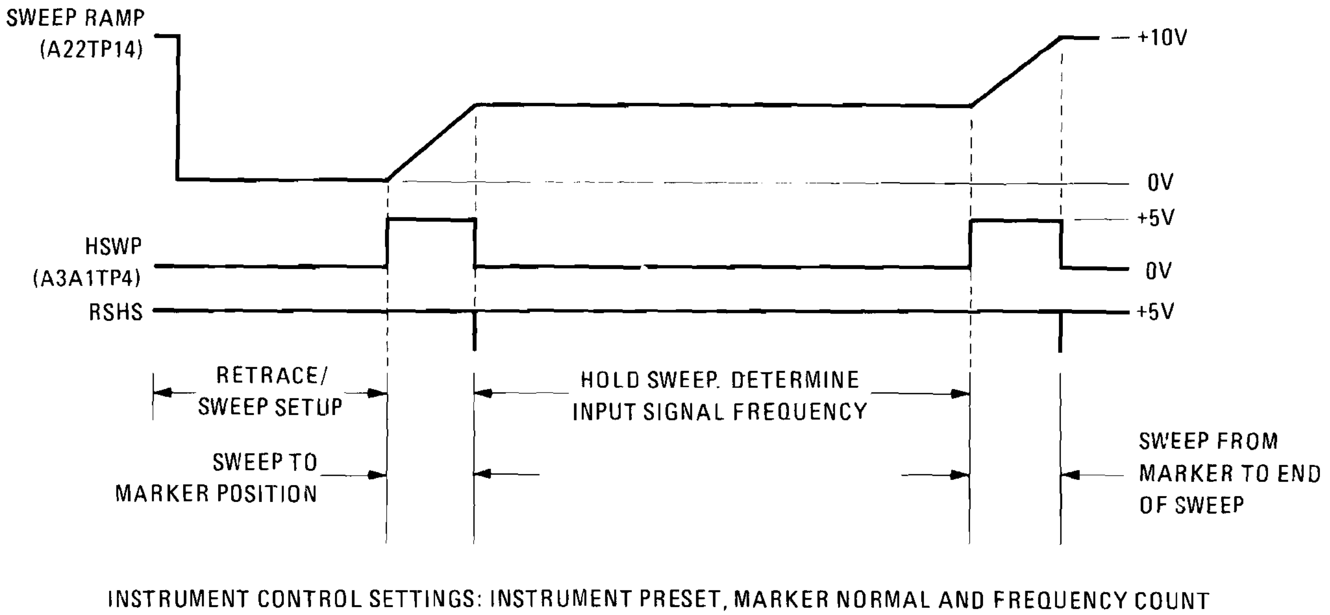


Figure 9-11. Sweep System Timing Example

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 Processor 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 disorted as the sweep time is slowed down.) If this works, the Digital Storage and A15 Processors, 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 second and press the single sweep key. The ramp waveform will start at greater than 10 volts, go to 0V when single sweep key is pressed, and ramp back up to greater than 10 volts. 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 A15TP8 (STS) to A14TP11 (T1) and push INSTR PRESET. This causes the A15 Processor 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 HP 5004A 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 A15TP8 to A14TP11 jumper in place, check the LSRQ output. It should be high. If not, find out which input is requesting service. Troubleshoot A12 using the Signature Analyzer diagrams. (A13 can be removed to isolate the HP-IB service request.)

See A3A1 Trigger Troubleshooting Procedure

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

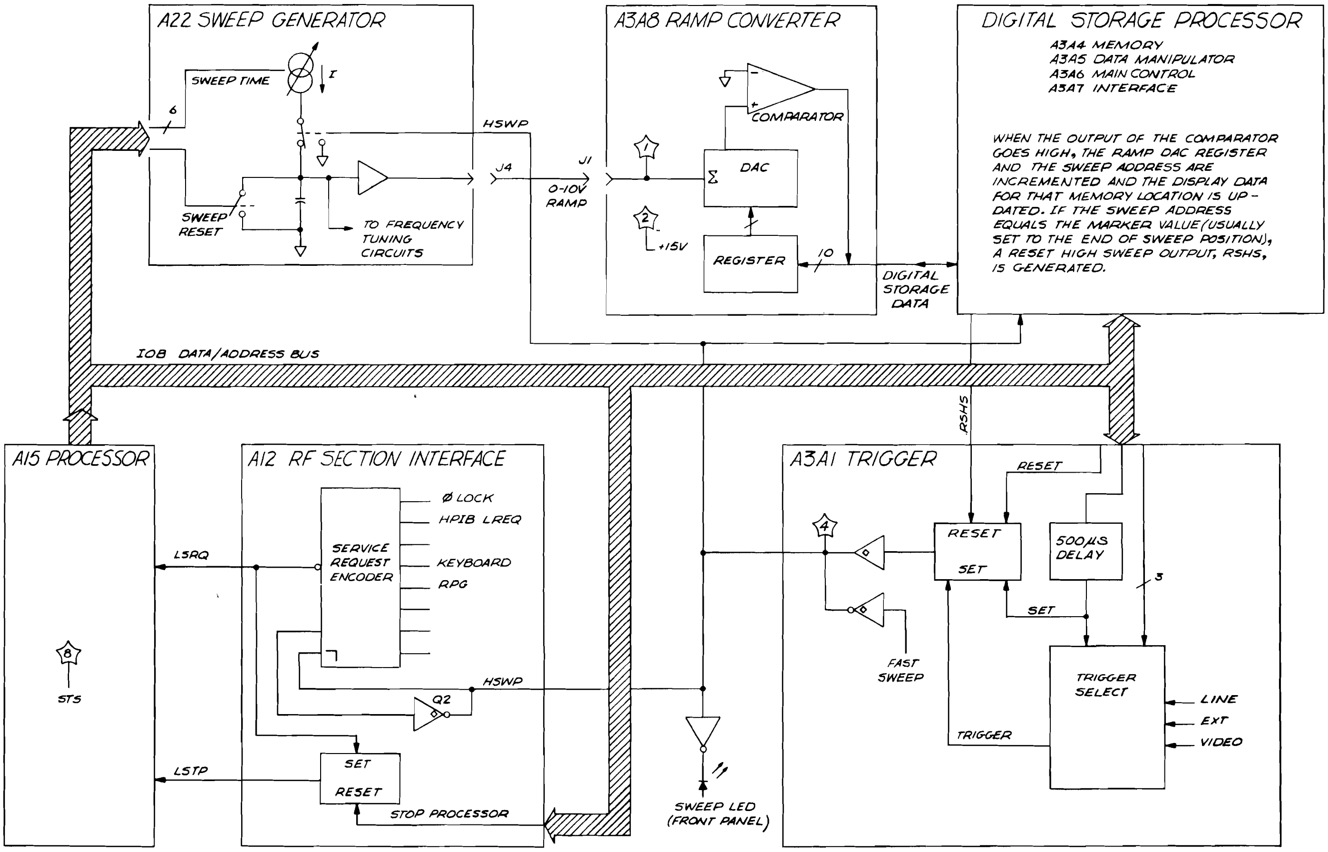
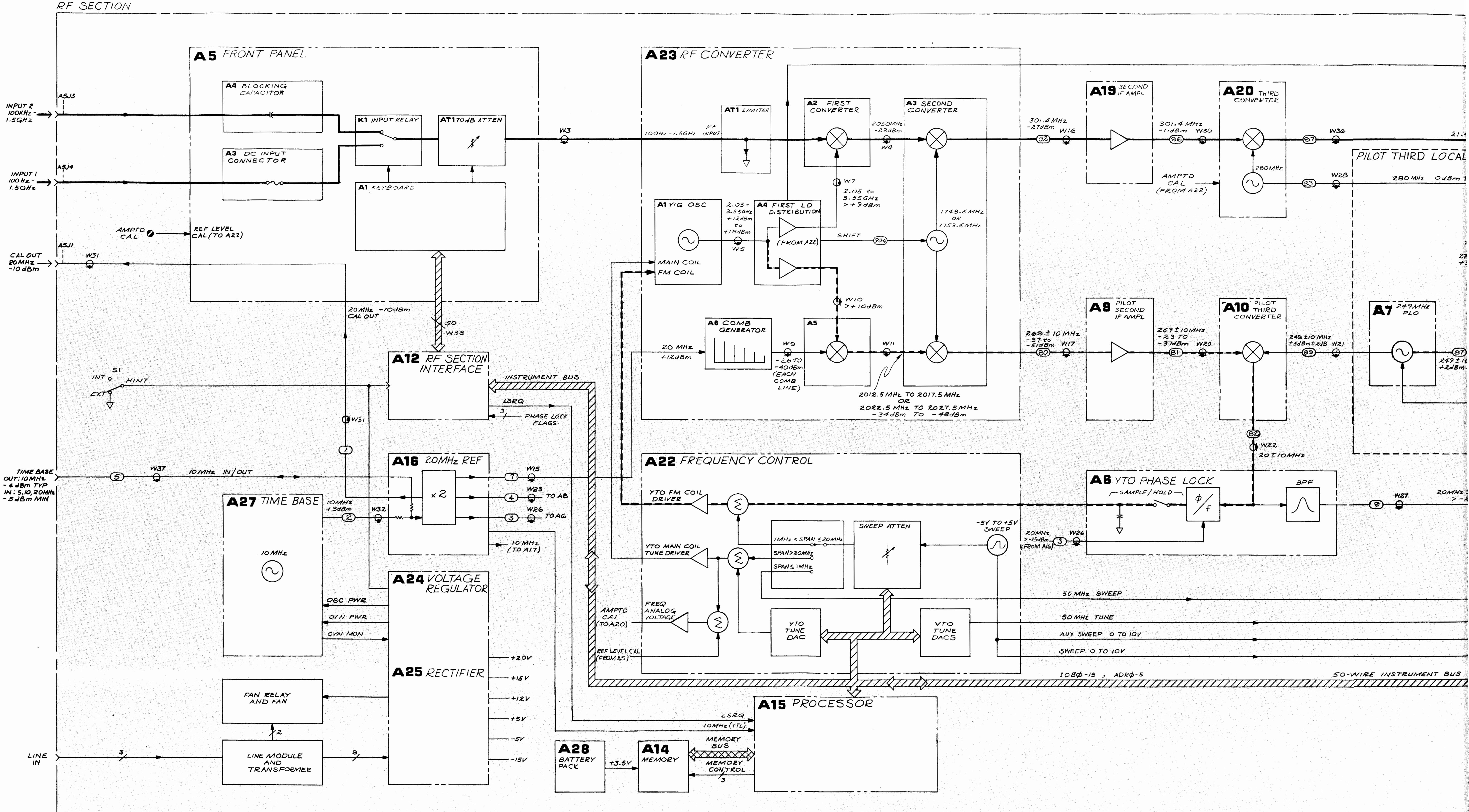


Figure 9-12. Sweep System Block Diagram

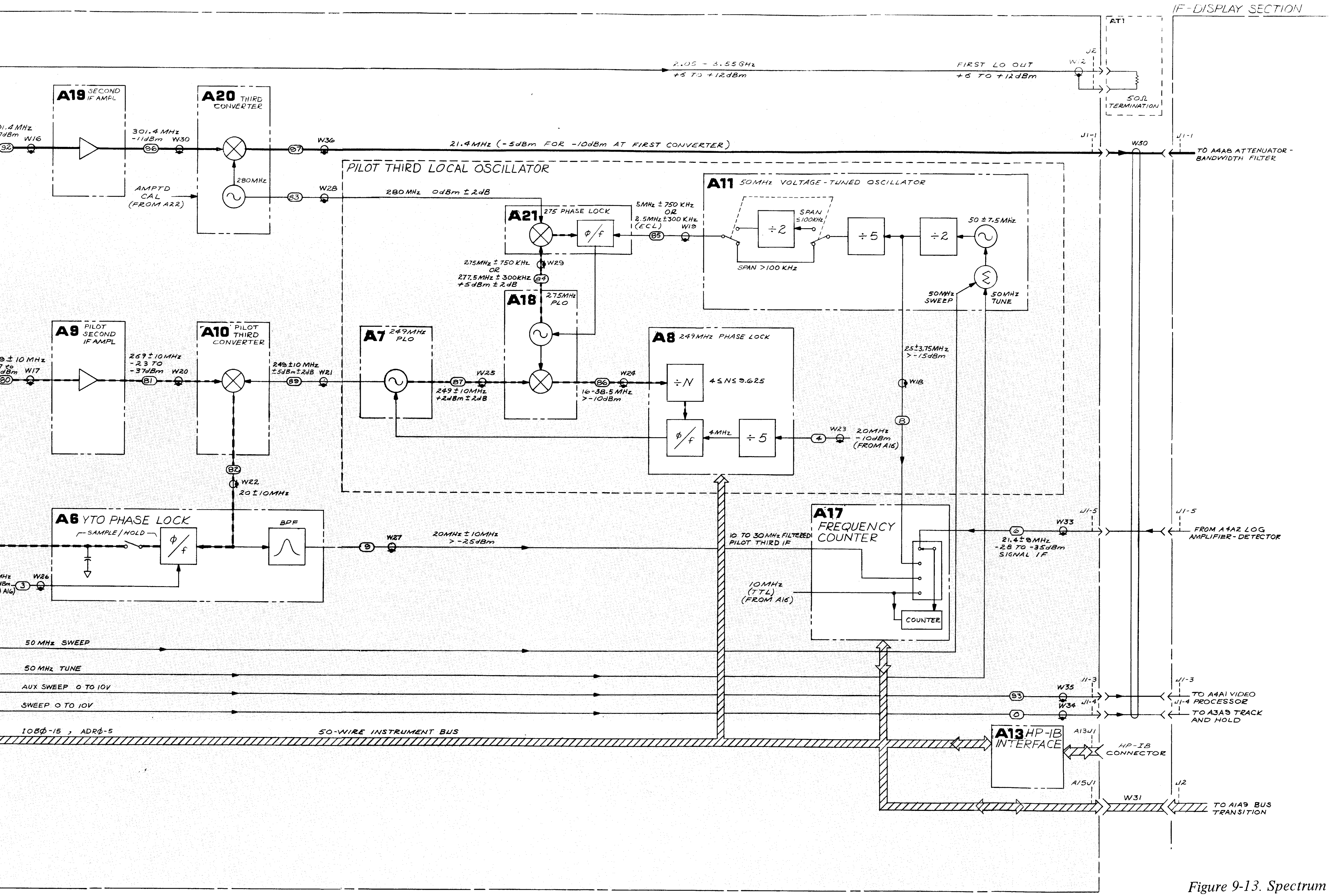
Table 9-3. 50-Wire Instrument Bus Pin Connection Table for IF-Display Section

Pin	Signal	Description
1	GND	Ground
2	NC	No Connection
3	IOBØ	Instrument Bus Data Bits Ø – 15
4	IOB1	
5	IOB2	
6	IOB3	
7	IOB4	
8	IOB5	
9	IOB6	
10	IOB7	
11	IOB8	
12	IOB9	
13	IOB10	
14	IOB11	
15	IOB12	
16	IOB13	
17	IOB14	
18	IOB15	
19	NC	No Connection
20	NC	No Connection
21	NC	No Connection
22	HPON	HIGH=IF-Display Section Power ON
23	ADRØ	Instrument Bus Address Bits Ø – 4
24	ADR1	
25	ADR2	
26	ADR3	
27	ADR4	
28	ADR5	Address Bit 5 not used
29	NC	No Connection
30	NC	No Connection
31	KR8	Key Rows 8 – 11
32	KR9	
33	KR10	
34	KR11	
35	KCØ	Key Columns Ø – 7
36	KC1	
37	KC2	
38	KC3	
39	KC4	
40	KC5	
41	KC6	
42	KC7	
43	LSTP	LOW=Stop Processor
44	HSWP	HIGH=Sweeping
45	LSRQ	LOW=Service Request
46	LDSR	LOW=Digital Storage Ready
47	LBIO	LOW=RF Section I/O Strobe
48	GND	Ground
49	LTIO	LOW=IF-Display Section I/O Strobe
50	GND	Ground

RF SECTION



SERIAL PREFIX: 1611A DATE: APRIL 1978



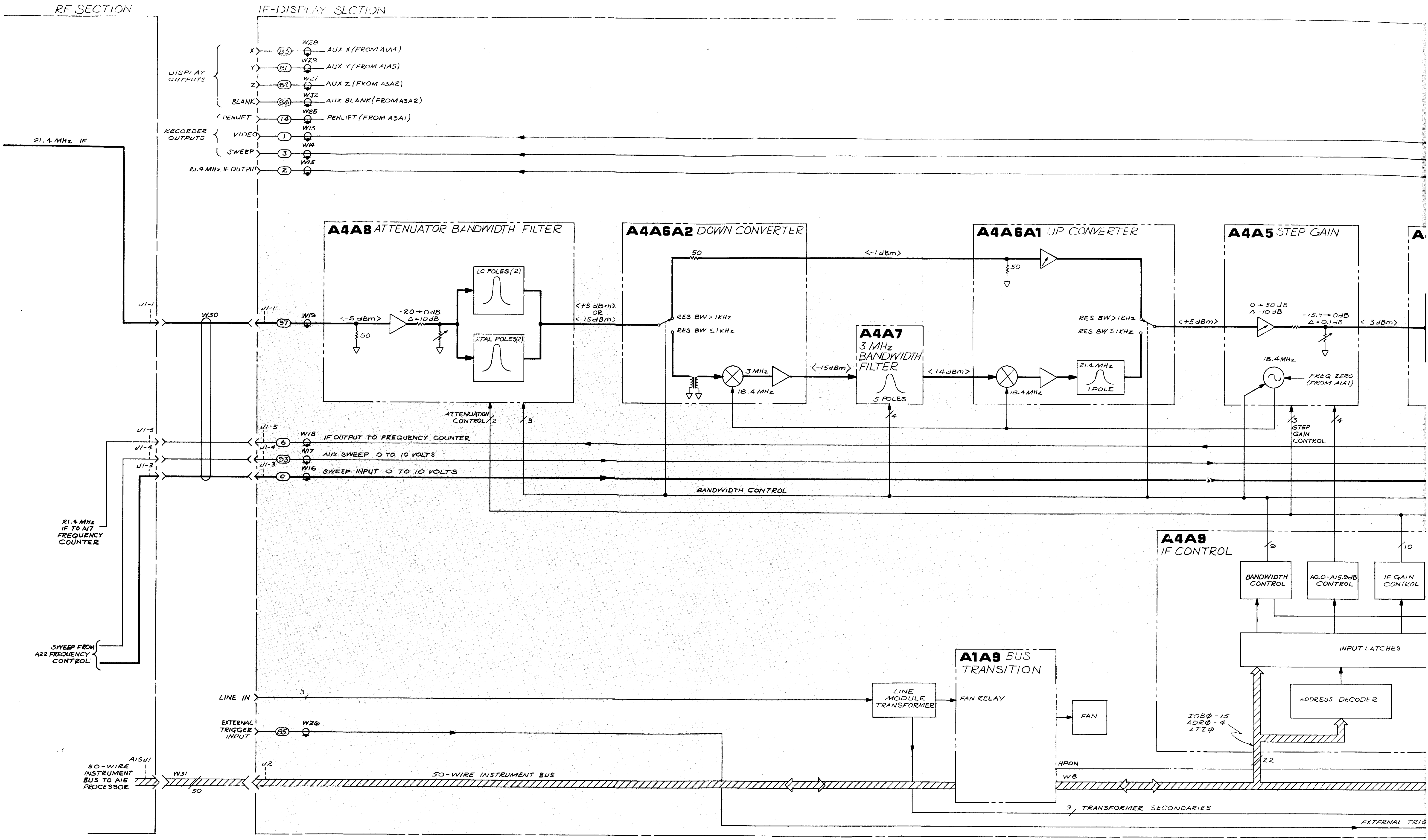
NOTE

1. UNLESS OTHERWISE INDICATED POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND THE SPECTRUM ANALYZER:

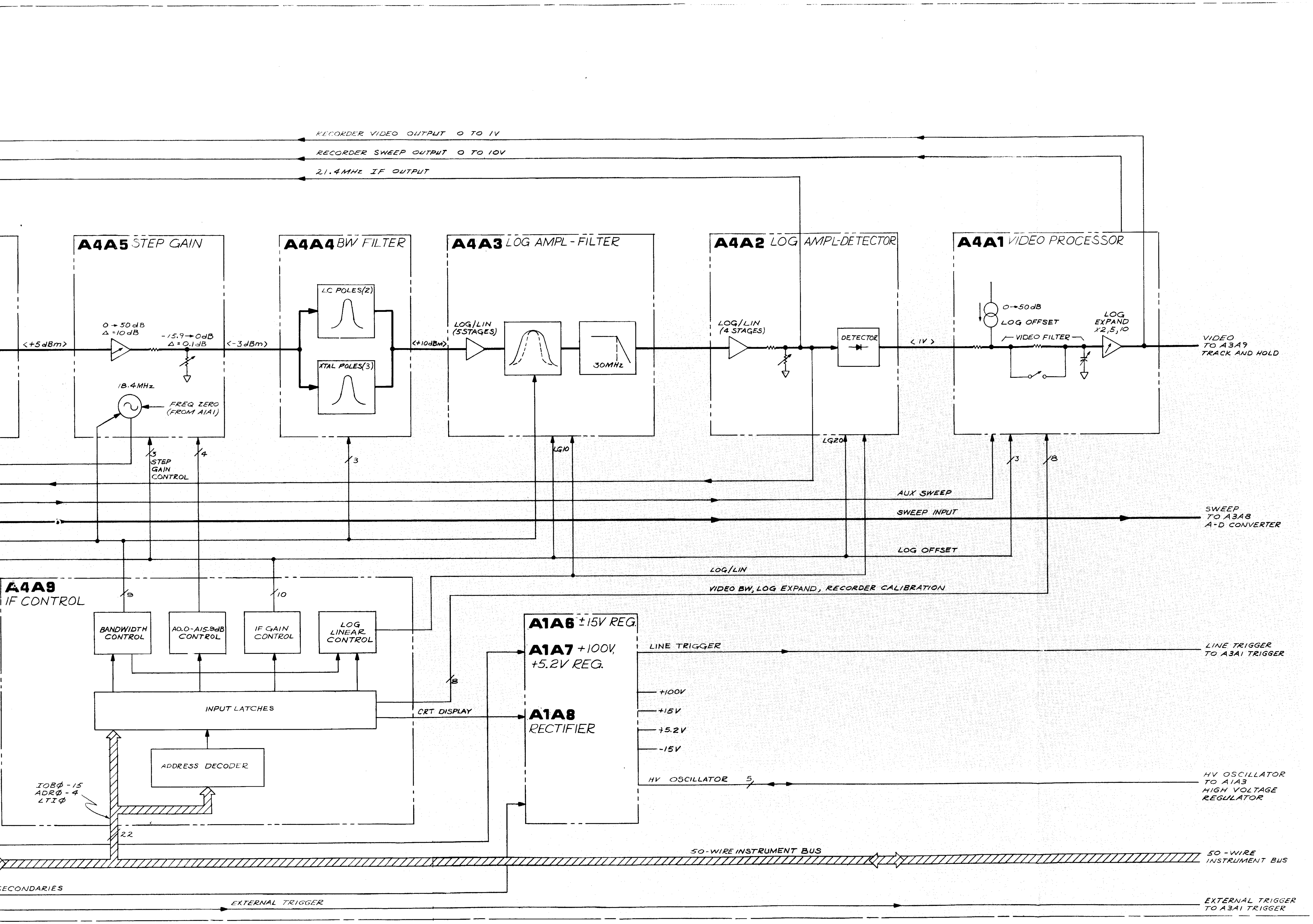
INSTRUMENT PRESET

CENTER FREQUENCY	20 MHz
FREQUENCY SPAN	0 Hz
ATTENUATION	0 dB
RESOLUTION BANDWIDTH	3 KHz

Figure 9-13. Spectrum Analyzer Overall Block Diagram (1 of 3)



RF SECTION
IF-DISPLAY SECTION
DISPLAY OUTPUTS
X
Y
Z
BLANK
AUX X (FROM A1A4)
AUX Y (FROM A1A5)
AUX Z (FROM A3A2)
AUX BLANK (FROM A3A2)
RECORDER OUTPUTS
PENLIFT
VIDEO
SWEEP
PENLIFT (FROM A3A1)
21.4 MHz IF OUTPUT
21.4 MHz IF
W30
A4A8 ATTENUATOR BANDWIDTH FILTER
LC POLES (2)
XTAL POLES (2)
-20 → 0dB Δ=10dB
(-5 dBm)
(+5 dBm) OR (-15dBm)
ATTENUATION CONTROL
A4A6A2 DOWN CONVERTER
RES BW > 1KHz
RES BW ≤ 1KHz
3 MHz
18.4 MHz
(-15dBm)
A4A7 3 MHz BANDWIDTH FILTER
5 POLES
(+4 dBm)
(-1 dBm)
A4A6A1 UP CONVERTER
21.4 MHz
1 POLE
(+5 dBm)
A4A5 STEP GAIN
0 → 50 dB Δ=10 dB
-15.9 → 0dB Δ=0.1dB
(-3 dBm)
18.4 MHz
FREQ ZERO (FROM A1A1)
STEP GAIN CONTROL
IF OUTPUT TO FREQUENCY COUNTER
AUX SWEEP 0 TO 10 VOLTS
SWEEP INPUT 0 TO 10 VOLTS
BANDWIDTH CONTROL
21.4 MHz IF TO A17 FREQUENCY COUNTER
SWEEP FROM A22 FREQUENCY CONTROL
A4A9 IF CONTROL
BANDWIDTH CONTROL
A0.0-A15.9dB CONTROL
IF GAIN CONTROL
INPUT LATCHES
ADDRESS DECODER
IOBØ-15 ADRØ-4 LTIØ
LINE IN
LINE MODULE TRANSFORMER
A1A9 BUS TRANSITION
FAN RELAY
FAN
EXTERNAL TRIGGER INPUT
50-WIRE INSTRUMENT BUS TO A15 PROCESSOR
A15J1
W31
50-WIRE INSTRUMENT BUS
HPON
W8
TRANSFORMER SECONDARIES
EXTERNAL TRIG



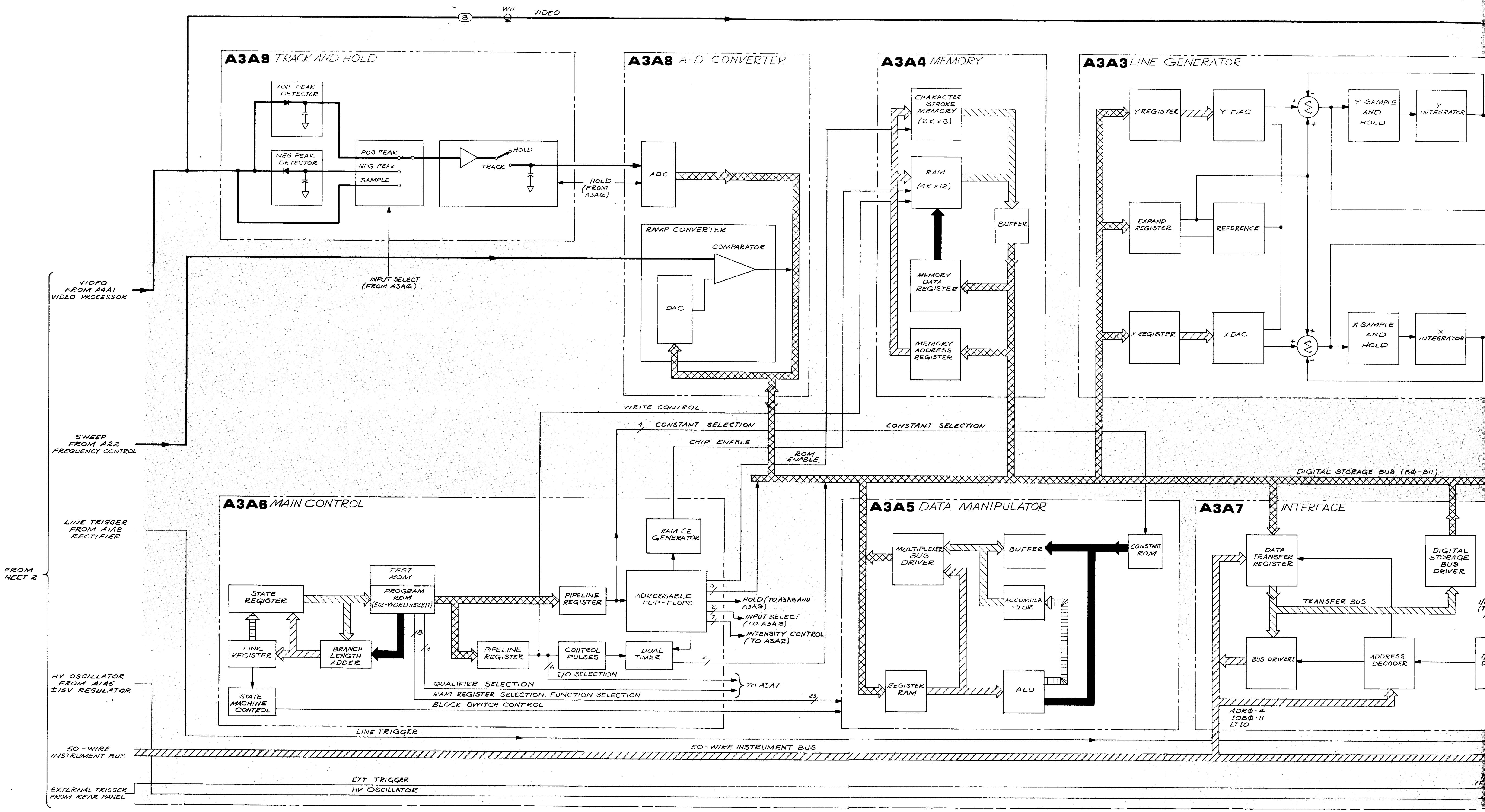
NOTE

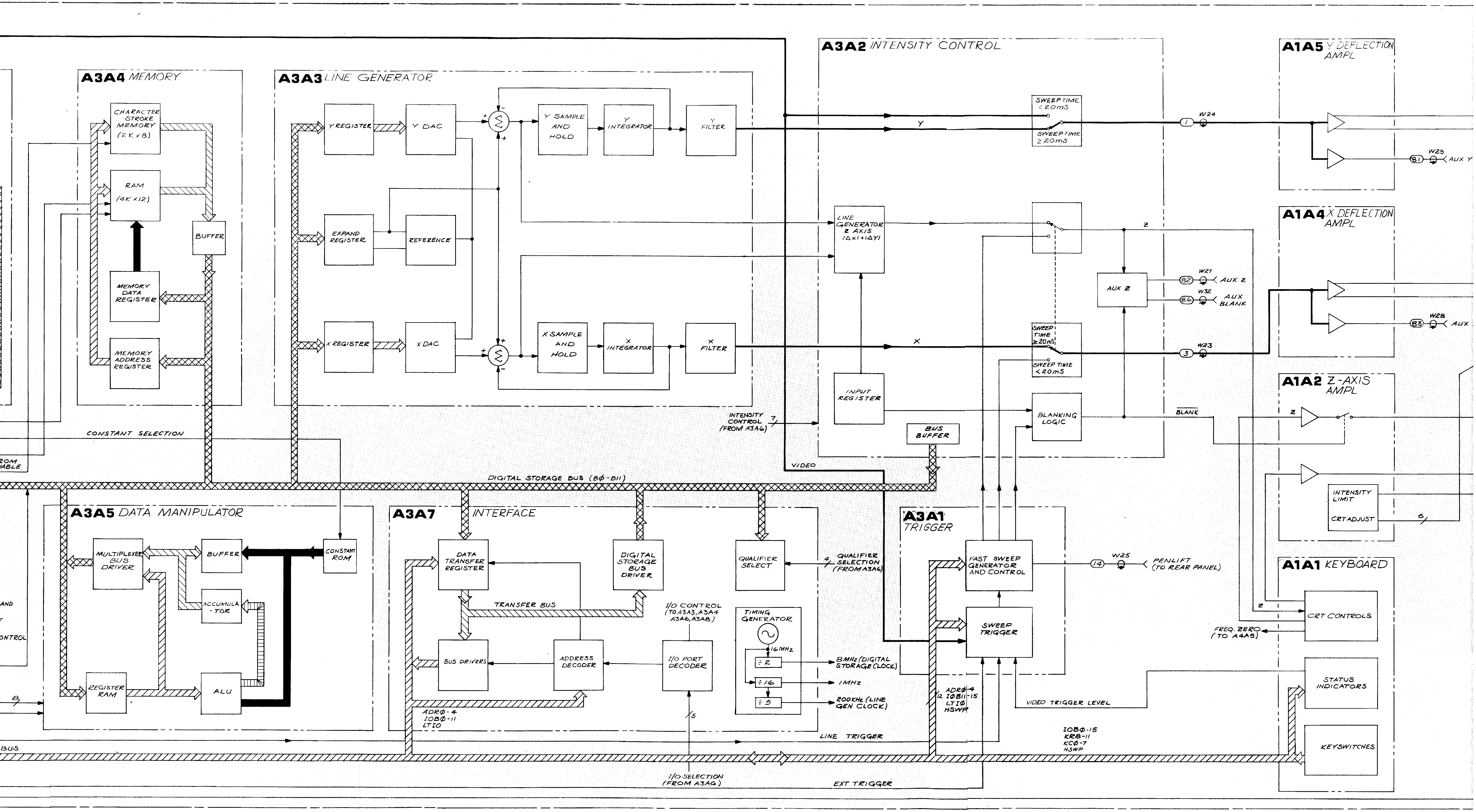
1. UNLESS OTHERWISE INDICATED, POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND THE SPECTRUM ANALYZER:

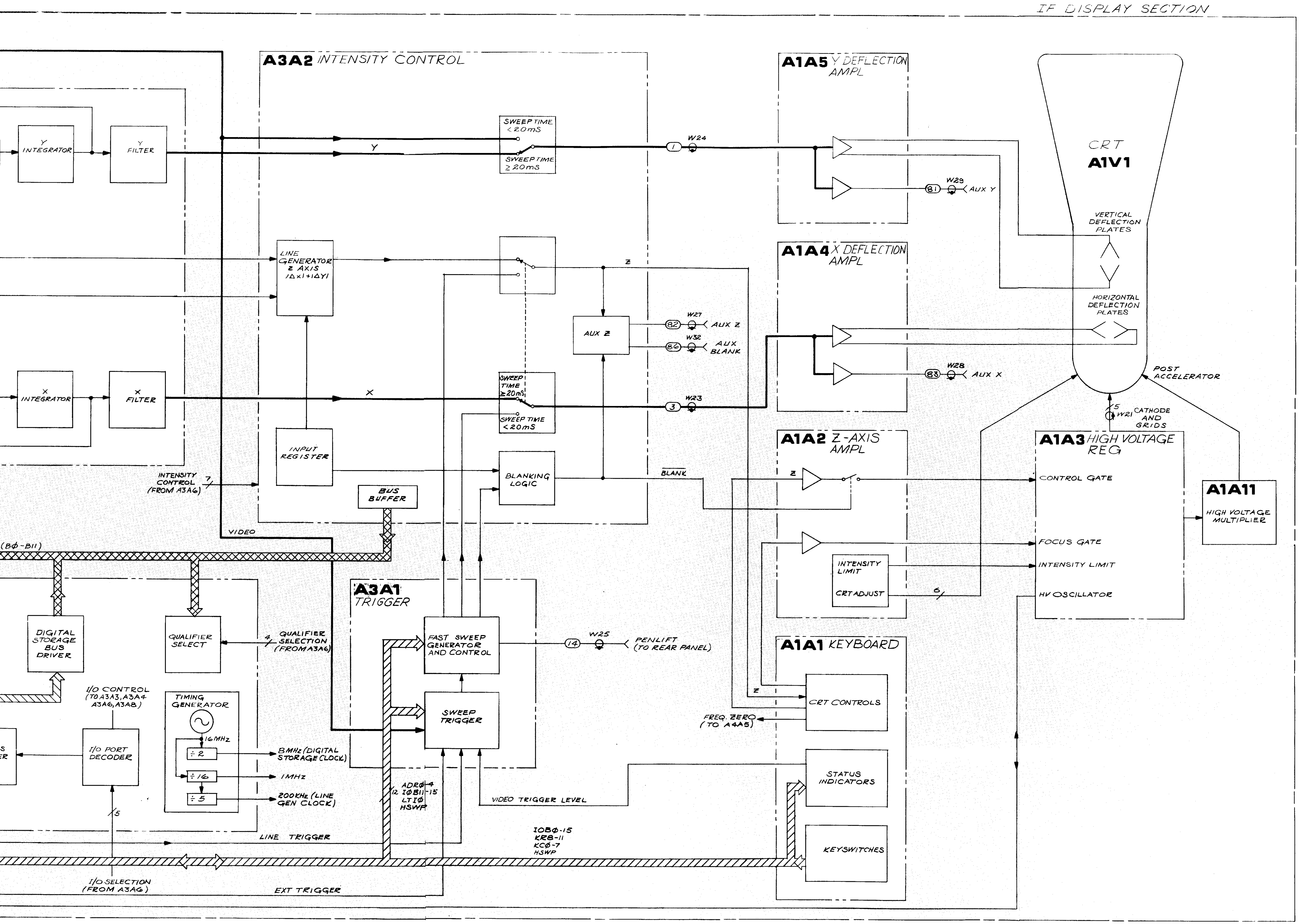
INSTRUMENT PRESET

CENTER FREQUENCY	20 MHz
FREQUENCY SPAN	0 Hz
ATTENUATION	0 dB
RESOLUTION BANDWIDTH	3 KHz

Figure 9-13. Spectrum Analyzer Overall Block Diagram (2 of 3)


VIDEO
W11
A3A9 TRACK AND HOLD
POS PEAK DETECTOR
NEG PEAK DETECTOR
POS PEAK
NEG PEAK
SAMPLE
HOLD
TRACK
HOLD (FROM A3A6)
INPUT SELECT (FROM A3A6)
A3A8 A-D CONVERTER
ADC
RAMP CONVERTER
COMPARATOR
DAC
A3A4 MEMORY
CHARACTER STROKE MEMORY (2K x 8)
RAM (4K x 12)
BUFFER
MEMORY DATA REGISTER
MEMORY ADDRESS REGISTER
A3A3 LINE GENERATOR
Y REGISTER
Y DAC
Y SAMPLE AND HOLD
Y INTEGRATOR
EXPAND REGISTER
REFERENCE
X REGISTER
X DAC
X SAMPLE AND HOLD
X INTEGRATOR
VIDEO FROM A4A1 VIDEO PROCESSOR
SWEEP FROM A22 FREQUENCY CONTROL
LINE TRIGGER FROM A1A8 RECTIFIER
FROM SHEET 2
HV OSCILLATOR FROM A1A6 ±15V REGULATOR
50-WIRE INSTRUMENT BUS
EXTERNAL TRIGGER FROM REAR PANEL
WRITE CONTROL
CONSTANT SELECTION
CHIP ENABLE
ROM ENABLE
CONSTANT SELECTION
DIGITAL STORAGE BUS (B0-B11)
A3A6 MAIN CONTROL
RAM CE GENERATOR
TEST ROM
PROGRAM ROM (512-WORD x 32 BIT)
STATE REGISTER
PIPELINE REGISTER
ADRESSABLE FLIP-FLOPS
HOLD (TO A3A8 AND A3A9)
INPUT SELECT (TO A3A9)
INTENSITY CONTROL (TO A3A2)
LINK REGISTER
BRANCH LENGTH ADDER
PIPELINE REGISTER
CONTROL PULSES
DUAL TIMER
STATE MACHINE CONTROL
I/O SELECTION
QUALIFIER SELECTION
RAM REGISTER SELECTION, FUNCTION SELECTION
BLOCK SWITCH CONTROL
TO A3A7
A3A5 DATA MANIPULATOR
MULTIPLEXER BUS DRIVER
BUFFER
CONSTANT ROM
ACCUMULATOR
REGISTER RAM
ALU
A3A7 INTERFACE
DATA TRANSFER REGISTER
DIGITAL STORAGE BUS DRIVER
TRANSFER BUS
BUS DRIVERS
ADDRESS DECODER
ADR0-4
IOB0-11
LTIO
LINE TRIGGER
50-WIRE INSTRUMENT BUS
EXT TRIGGER
HV OSCILLATOR


A3A4 MEMORY
CHARACTER STROKE MEMORY (2K x 8)
RAM (4K x 12)
BUFFER
MEMORY DATA REGISTER
MEMORY ADDRESS REGISTER
A3A3 LINE GENERATOR
Y REGISTER
Y DAC
Y SAMPLE AND HOLD
Y INTEGRATOR
Y FILTER
EXPAND REGISTER
REFERENCE
X REGISTER
X DAC
X SAMPLE AND HOLD
X INTEGRATOR
X FILTER
A3A2 INTENSITY CONTROL
SWEEP TIME <20mS
SWEEP TIME ≥20mS
Y
X
Z
LINE GENERATOR Z AXIS |ΔX|+|ΔY|
INPUT REGISTER
AUX Z
BLANKING LOGIC
BUS BUFFER
INTENSITY CONTROL (FROM A3A6)
VIDEO
W24
W29
AUX Y
W27
AUX Z
W32
AUX BLANK
W28
AUX
W23
BLANK
A1A5 Y DEFLECTION AMPL
A1A4 X DEFLECTION AMPL
A1A2 Z-AXIS AMPL
INTENSITY LIMIT
CRT ADJUST
A1A1 KEYBOARD
CRT CONTROLS
FREQ. ZERO (TO A4A5)
STATUS INDICATORS
KEYSWITCHES
CONSTANT SELECTION
DIGITAL STORAGE BUS (BØ-B11)
A3A5 DATA MANIPULATOR
MULTIPLEXER BUS DRIVER
BUFFER
CONSTANT ROM
ACCUMULATOR
REGISTER RAM
ALU
A3A7 INTERFACE
DATA TRANSFER REGISTER
DIGITAL STORAGE BUS DRIVER
QUALIFIER SELECT
QUALIFIER SELECTION (FROM A3A6)
TRANSFER BUS
I/O CONTROL (TO A3A3, A3A4 A3A6, A3A8)
TIMING GENERATOR
16 MHz
÷2
÷16
÷5
8MHz (DIGITAL STORAGE CLOCK)
1MHz
200KHz (LINE GEN CLOCK)
BUS DRIVERS
ADDRESS DECODER
I/O PORT DECODER
ADRØ-4 IOBØ-11 LTIØ
I/O SELECTION (FROM A3A6)
A3A1 TRIGGER
FAST SWEEP GENERATOR AND CONTROL
SWEEP TRIGGER
W25
PENLIFT (TO REAR PANEL)
ADRØ-4 IØB11-15 LTIØ HSWP
VIDEO TRIGGER LEVEL
IOBØ-15 KR8-11 KCØ-7 HSWP
LINE TRIGGER
EXT TRIGGER
BUS



NOTE

UNLESS OTHERWISE INDICATED, POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND THE SPECTRUM ANALYZER:

INSTRUMENT PRESET

CENTER FREQUENCY	20 MHz
FREQUENCY SPAN	0 Hz
ATTENUATION	0 dB
RESOLUTION BANDWIDTH	3 kHz

Figure 9-13. Spectrum Analyzer Overall Block Diagram (3 of 3)

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 9-14 shows a simplified block diagram of the assemblies involved in setting the center frequency. The 8568A 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 the 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 200 kHz or less, or 10 for spans greater than 200 kHz. KSN counts the 50 MHz VTO frequency divided by 2. The range is 25 MHz ±3.75 MHz.

f_{REF} = 4 MHz

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

N = Harmonic fo 20 MHz comb to which analyzer is locked. KSR displays value of N whch 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 [INSTR PRESET].

f_{PILOT} = 20 MHz
f_{VTO} = 5.1 MHz

N = 39   M = 4   P = 7

Substituting these values into the equation.

f_{CF} = 20 MHz · 39 + 20 MHz −5.1 MHz −(9−4 + .125 · 7) · 4 MHz −21.4 MHz = 750 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 9-14. 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 Processor 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 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 processor. Because the [NORMAL] Marker is a display marker, after the center frequency is calculated, the position of the marker on the display is determined. By knowing that the display consists of 1000 points and the programmed frequency span, the Processor 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 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 misadjusted Comb Generator, A23A6; or on the A22 Frequency Control, a misadjustment 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.

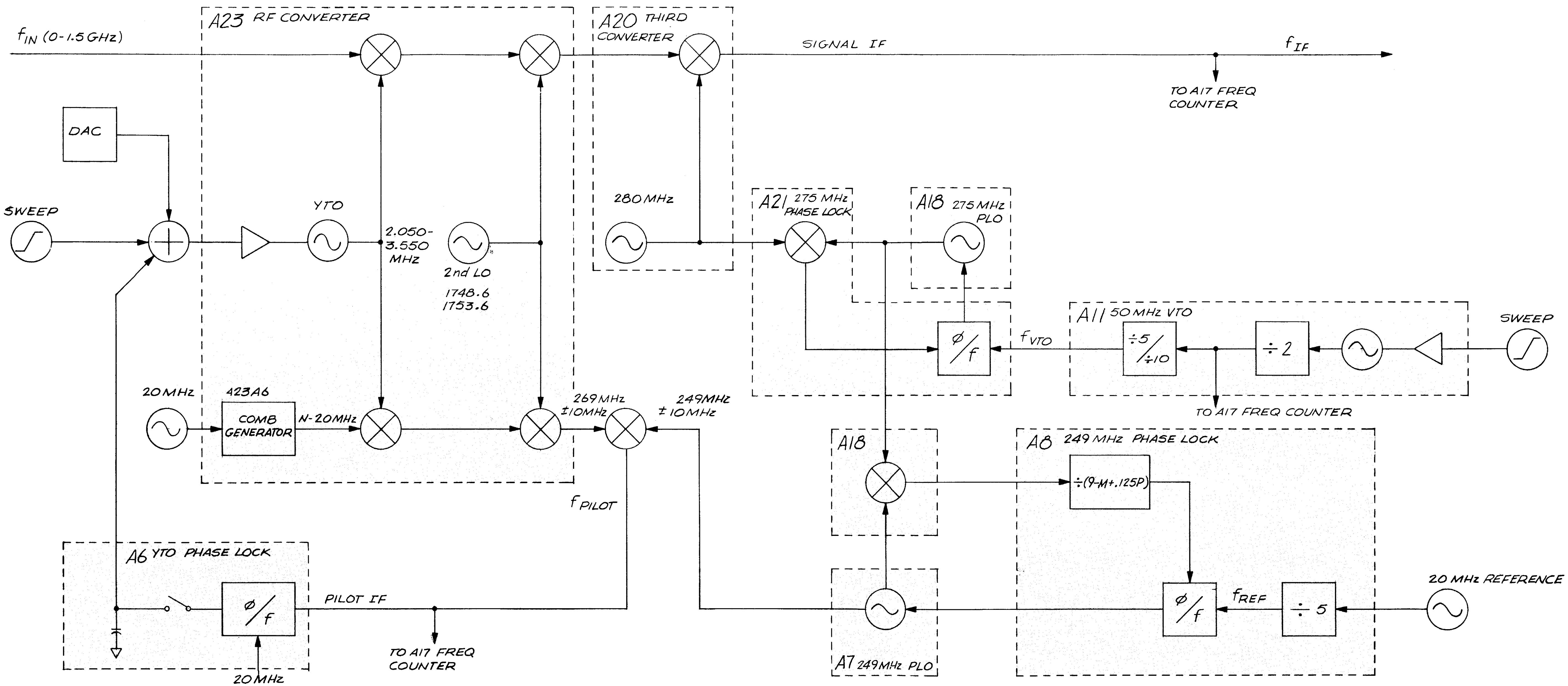
c. 21.4 MHz

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 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.

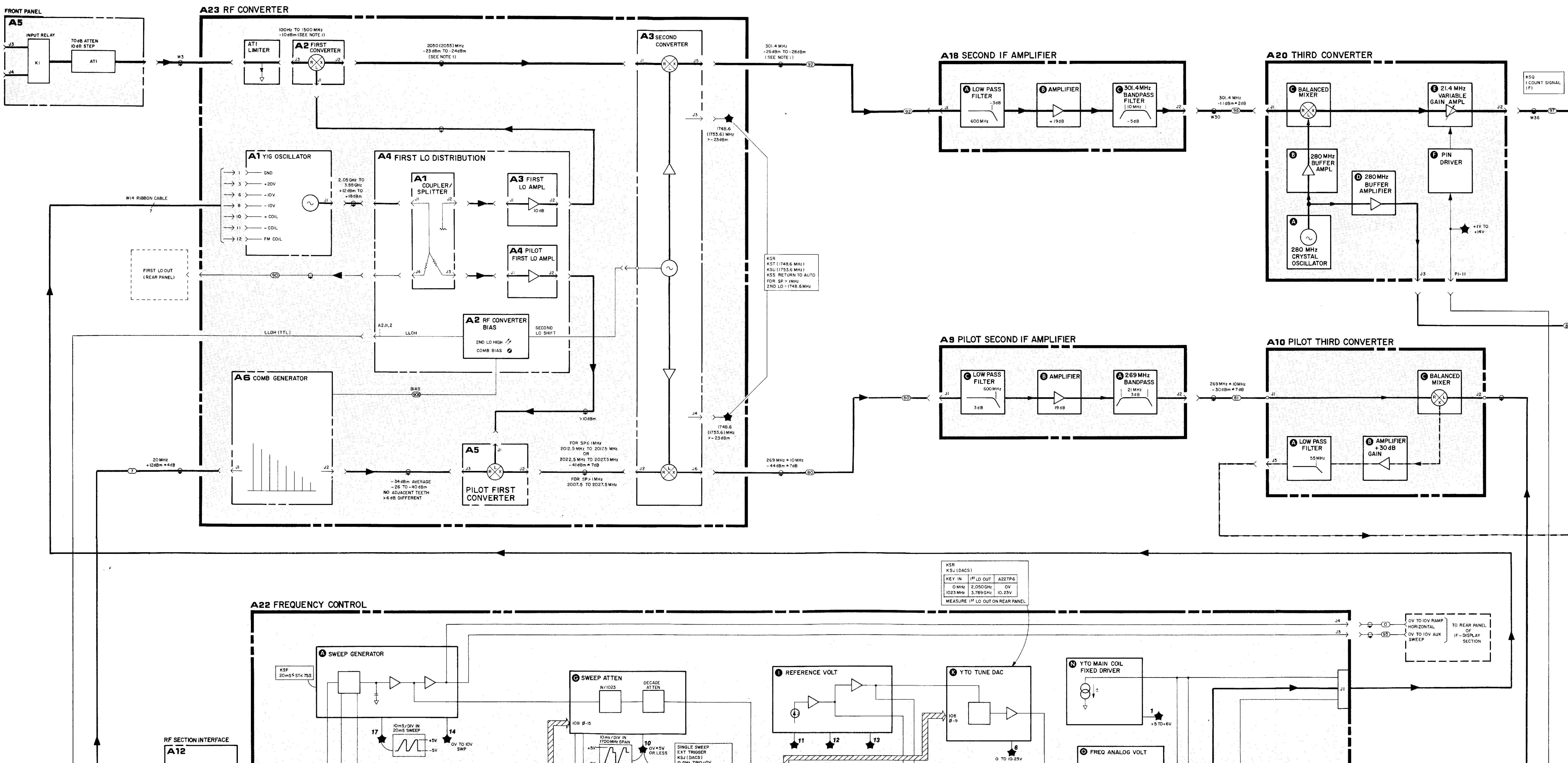


FREQUENCY SPANS : SWEEP
SPAN > 20 MHz : MAIN COIL
1 MHz < SPAN ≤ 20 MHz : FM COIL
100 KHz < SPAN ≤ 1 MHz : f_{VTO} = 5 MHz
SPAN ≤ 100 KHz : f_{VTO} = 2.5 MHz

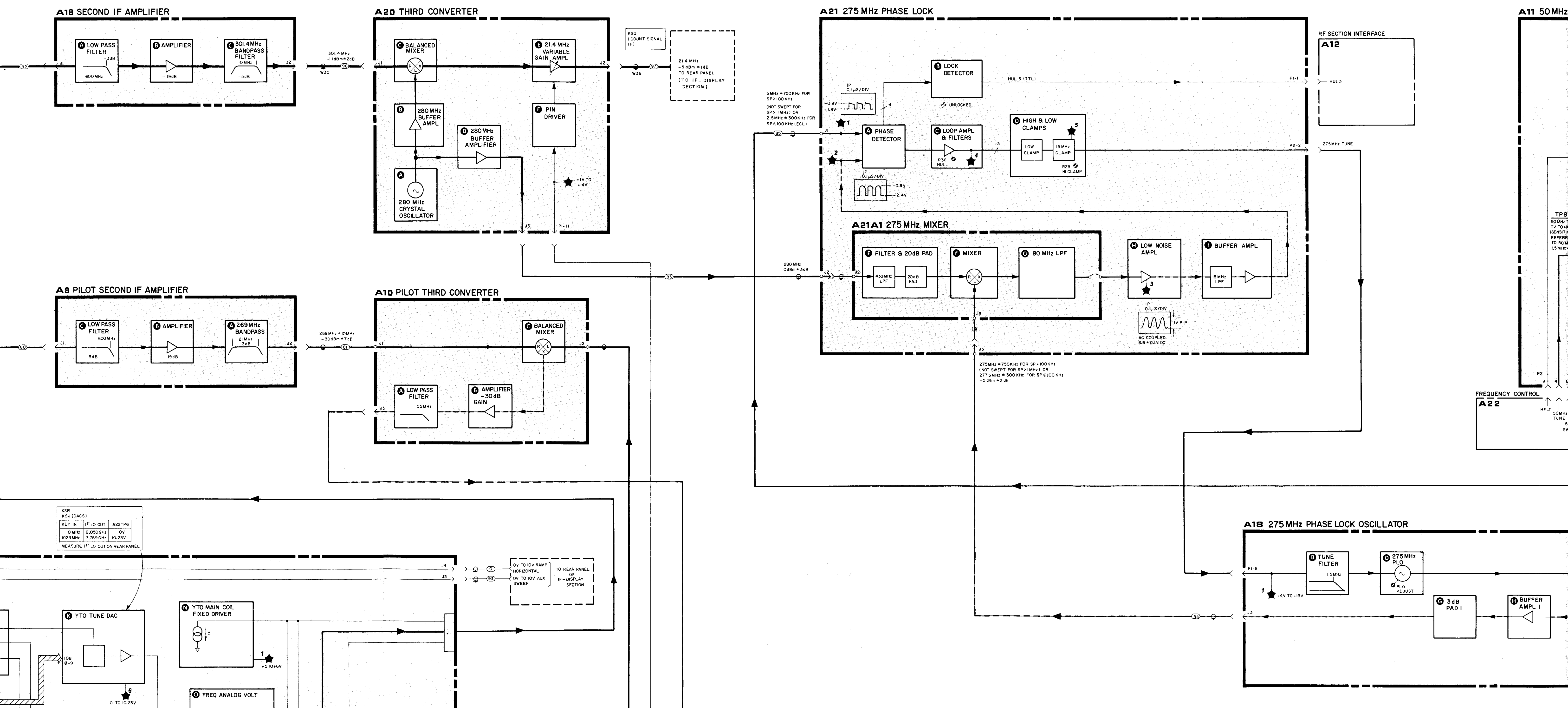
$$f_{CF} = 20MHz \cdot N + f_{PILOT} - f_{VTO} - (9-M+.125P) \cdot f_{REF} - f_{IF}$$

COUNTER MODES
KSK PILOT IF FREQUENCY
KSQ SIGNAL IF FREQUENCY
KSN 50 MHz VTO FREQUENCY (DIVIDED BY TWO)

Figure 9-14. Simplified RF Block Diagram



FRONT PANEL
A5
INPUT RELAY
70dB ATTEN 10dB STEP
A23 RF CONVERTER
ATI LIMITER
A2 FIRST CONVERTER
A3 SECOND CONVERTER
A1 YIG OSCILLATOR
A4 FIRST LO DISTRIBUTION
A1 COUPLER/ SPLITTER
A3 FIRST LO AMPL
A4 PILOT FIRST LO AMPL
A2 RF CONVERTER BIAS
2ND LO HIGH
COMB BIAS
FIRST LO OUT (REAR PANEL)
W14 RIBBON CABLE
A6 COMB GENERATOR
A5 PILOT FIRST CONVERTER
A18 SECOND IF AMPLIFIER
LOW PASS FILTER
AMPLIFIER
301.4MHz BANDPASS FILTER
A20 THIRD CONVERTER
BALANCED MIXER
280 MHz BUFFER AMPL
280MHz BUFFER AMPLIFIER
280 MHz CRYSTAL OSCILLATOR
21.4 MHz VARIABLE GAIN AMPL
PIN DRIVER
A9 PILOT SECOND IF AMPLIFIER
269MHz BANDPASS
A10 PILOT THIRD CONVERTER
LOW PASS FILTER
AMPLIFIER +30dB GAIN
A22 FREQUENCY CONTROL
SWEEP GENERATOR
SWEEP ATTEN
REFERENCE VOLT
YTO TUNE DAC
YTO MAIN COIL FIXED DRIVER
FREQ ANALOG VOLT
RF SECTION INTERFACE
A12
TO REAR PANEL OF IF-DISPLAY SECTION
MEASURE 1ST LO OUT ON REAR PANEL



A18 SECOND IF AMPLIFIER
LOW PASS FILTER
AMPLIFIER
301.4MHz BANDPASS FILTER
A20 THIRD CONVERTER
BALANCED MIXER
21.4 MHz VARIABLE GAIN AMPL
280 MHz BUFFER AMPL
280 MHz BUFFER AMPLIFIER
PIN DRIVER
280 MHz CRYSTAL OSCILLATOR
21.4 MHz -5 dBm ± 1dB TO REAR PANEL (TO IF-DISPLAY SECTION)
A21 275 MHz PHASE LOCK
LOCK DETECTOR
PHASE DETECTOR
LOOP AMPL & FILTERS
HIGH & LOW CLAMPS
RF SECTION INTERFACE
A12
A21A1 275 MHz MIXER
FILTER & 20dB PAD
MIXER
80 MHz LPF
LOW NOISE AMPL
BUFFER AMPL
A9 PILOT SECOND IF AMPLIFIER
LOW PASS FILTER
AMPLIFIER
269 MHz BANDPASS
A10 PILOT THIRD CONVERTER
BALANCED MIXER
LOW PASS FILTER
AMPLIFIER +30 dB GAIN
A11 50 MHz
FREQUENCY CONTROL
A22
A18 275 MHz PHASE LOCK OSCILLATOR
TUNE FILTER
275 MHz PLO
3 dB PAD I
BUFFER AMPL I
YTO TUNE DAC
YTO MAIN COIL FIXED DRIVER
FREQ ANALOG VOLT
MEASURE 1ST LO OUT ON REAR PANEL
TO REAR PANEL OF IF-DISPLAY SECTION

NOTES:

1. SIGNAL LEVELS ARE MEASURED WITH −10 dBm SIGNAL APPLIED TO A13A2J3.
2. MNEMONICS TABLE

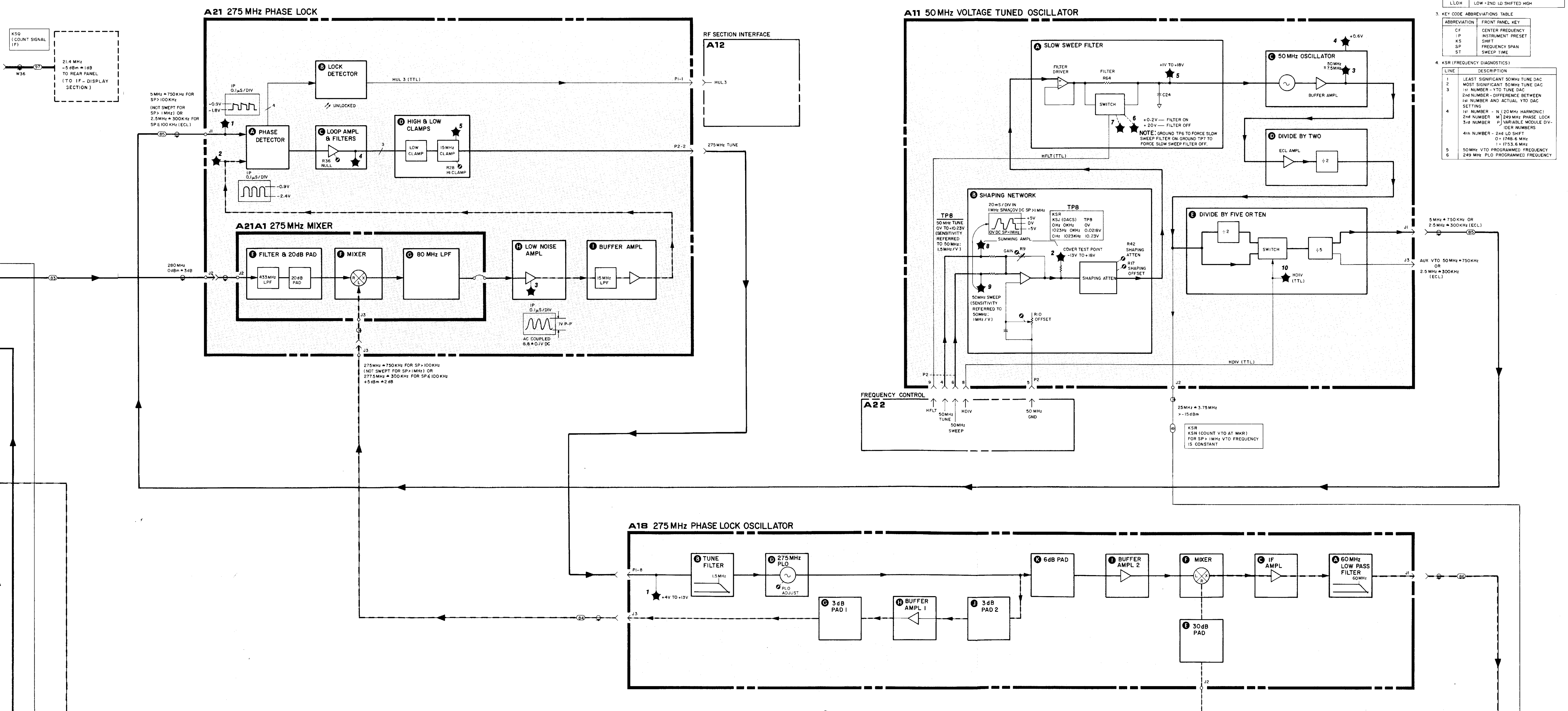
MNEMONIC	DESCRIPTION
HBWW	HIGH = WIDE LOOP BANDWIDTH
HDIV	HIGH = DIVIDE 50 MHz VTO BY 2
HFLT	HIGH = 50 MHz VTO TUNE FILTER ON
HGND	HIGH = GROUND YTO PHASE-LOCK VOLTAGE
HINT	HIGH = INTERNAL FREQUENCY REFERENCE
HSWP	HIGH = SWEEPING
HTVH	HIGH = YTO TUNE VOLTAGE HIGH
HTVL	HIGH = YTO TUNE VOLTAGE LOW
HUL 1	HIGH = YTO LOOP UNLOCKED
HUL 2	HIGH = 249 MHz LOOP UNLOCKED
HUL 3	HIGH = 275 MHz LOOP UNLOCKED
LBIO	LOW = BOTTOM BOX I/O STROBE
LCBZ	LOW = FREQUENCY COUNTER BUSY
LHLD	LOW = HOLD YTO PHASE-LOCK VOLTAGE
LLDD	LOW = LOAD 249 DIVIDER NUMBERS
LLOH	LOW = 2ND LO SHIFTED HIGH

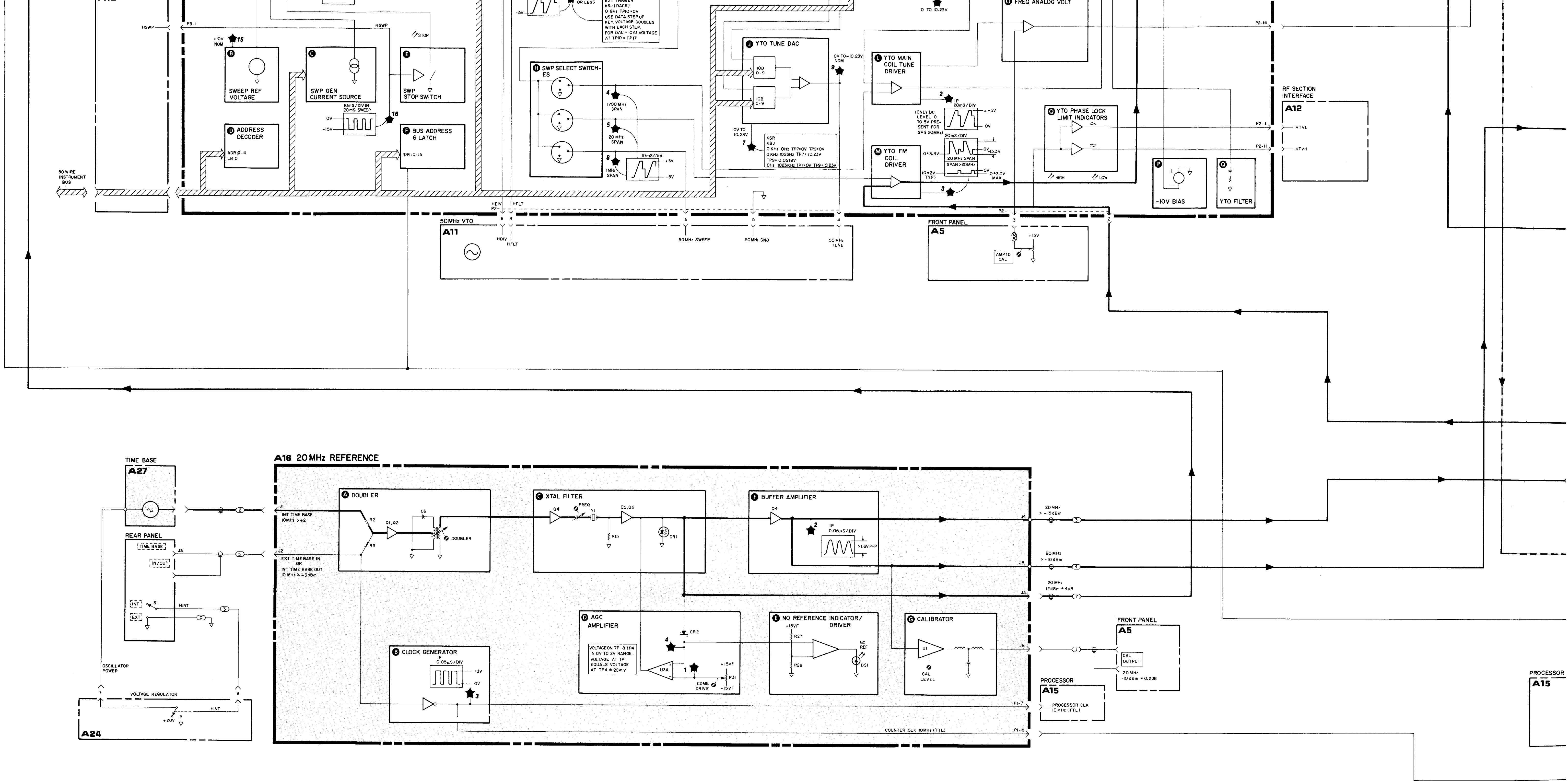
3. KEY CODE ABBREVIATIONS TABLE

ABBREVIATION	FRONT PANEL KEY
CF	CENTER FREQUENCY
IP	INSTRUMENT PRESET
KS	SHIFT
SP	FREQUENCY SPAN
ST	SWEEP TIME

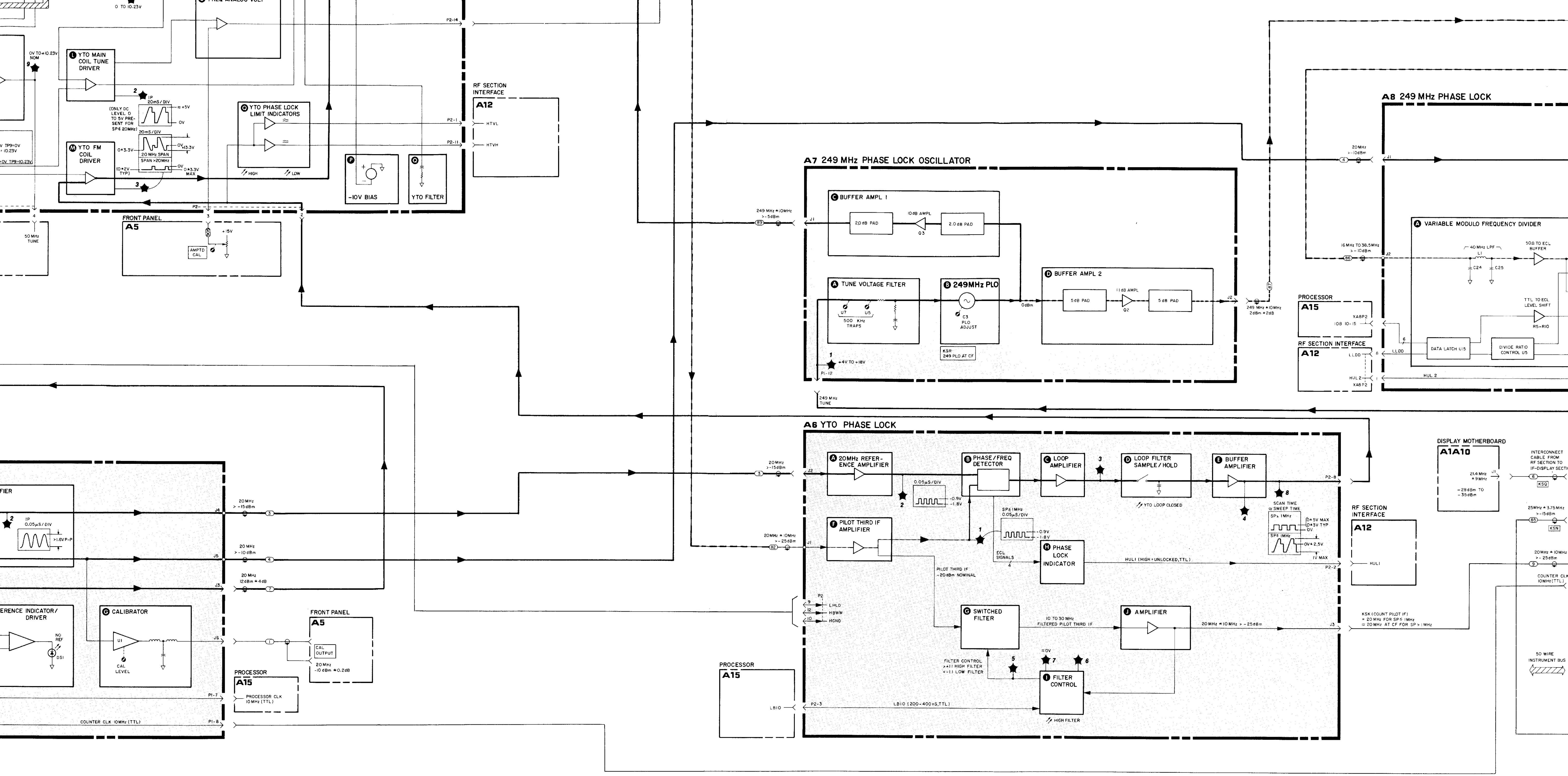
4. KSR (FREQUENCY DIAGNOSTICS)

LINE	DESCRIPTION
1	LEAST SIGNIFICANT 50 MHz TUNE DAC
2	MOST SIGNIFICANT 50 MHz TUNE DAC
3	1st NUMBER – YTO TUNE DAC 2nd NUMBER – DIFFERENCE BETWEEN 1st NUMBER AND ACTUAL YTO DAC SETTING
4	1st NUMBER – N (20 MHz HARMONIC) 2nd NUMBER M, 3rd NUMBER P: 249 MHz PHASE LOCK VARIABLE MODULE DIVIDER NUMBERS 4th NUMBER – 2nd LO SHIFT 0 = 1748.6 MHz 1 = 1753.6 MHz
5	50 MHz VTO PROGRAMMED FREQUENCY
6	249 MHz PLO PROGRAMMED FREQUENCY





SWEEP REF VOLTAGE
SWP GEN CURRENT SOURCE
SWP STOP SWITCH
ADDRESS DECODER
BUS ADDRESS 6 LATCH
SWP SELECT SWITCHES
YTO TUNE DAC
YTO MAIN COIL TUNE DRIVER
YTO FM COIL DRIVER
FREQ ANALOG VOLT
YTO PHASE LOCK LIMIT INDICATORS
-10V BIAS
YTO FILTER
RF SECTION INTERFACE
A12
50 WIRE INSTRUMENT BUS
50MHz VTO
A11
FRONT PANEL
A5
AMPTD CAL
TIME BASE
A27
REAR PANEL
A16 20MHz REFERENCE
DOUBLER
XTAL FILTER
BUFFER AMPLIFIER
AGC AMPLIFIER
NO REFERENCE INDICATOR/DRIVER
CALIBRATOR
CLOCK GENERATOR
VOLTAGE REGULATOR
A24
PROCESSOR
A15
PROCESSOR CLK 10MHz (TTL)
COUNTER CLK 10MHz (TTL)
CAL OUTPUT
20MHz -10dBm ±0.2dB



YTO MAIN COIL TUNE DRIVER
YTO FM COIL DRIVER
YTO PHASE LOCK LIMIT INDICATORS
-10V BIAS
YTO FILTER
RF SECTION INTERFACE
A12
FRONT PANEL
A5
A7 249 MHz PHASE LOCK OSCILLATOR
BUFFER AMPL 1
TUNE VOLTAGE FILTER
249MHz PLO
BUFFER AMPL 2
A8 249 MHz PHASE LOCK
VARIABLE MODULO FREQUENCY DIVIDER
PROCESSOR
A15
A6 YTO PHASE LOCK
20MHz REFERENCE AMPLIFIER
PHASE/FREQ DETECTOR
LOOP AMPLIFIER
LOOP FILTER SAMPLE/HOLD
BUFFER AMPLIFIER
PILOT THIRD IF AMPLIFIER
PHASE LOCK INDICATOR
SWITCHED FILTER
AMPLIFIER
FILTER CONTROL
CALIBRATOR
DISPLAY MOTHERBOARD
A1A10
50 WIRE INSTRUMENT BUS

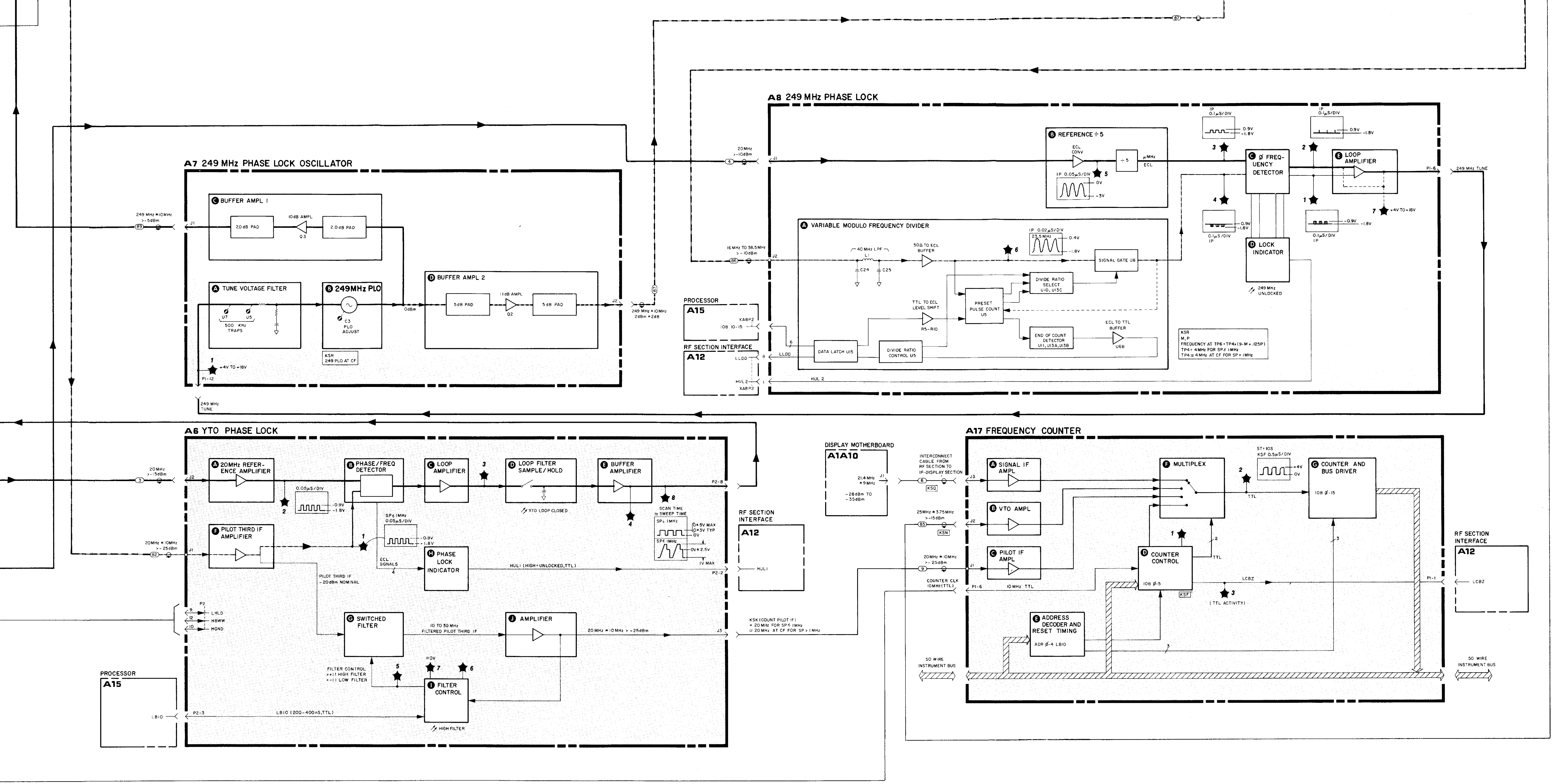


Figure 9-15. RF Section Analog Troubleshooting Block Diagram

PRELIMINARY CHECKS

Instrument Preset Check

The two red INSTR CHECK LEDs are forced on whenever the instrument is turned on or [INSTR PRESET] is pushed. The A15 Processor then performs a self check of itself, a checksum verification of all the ROMs on A14 Memory, a partial check of the IOB interface 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.

a. Both LEDs on indicates an A14 Memory or A15 Processor problem. First check to see that A14 and A15 are pushed completely into their edge connectors.

b. 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.

c. 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 [LCL], is pressed when the [INSTR PRESET] 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 Fault Tables listed in A14/A15 Troubleshooting to further isolate the source of the failure.

"LONG POP" Instrument Preset Check (Jumper A15TP8 [STS] to A14TP9 [T3])

This check is very similar to the normal INSTR PRESET check; an additional A15 Processor check is performed, all of the RAM locations in Digital Storage are checked, and the CMOS memory on A14 is verified.

HP-IB Verification

When the instrument is turned on, keep the [INSTR PRESET] key pressed. The ADRS'D LED should flash until the [INSTR PRESET] key is released and the A15 Processor acknowledges the HP-IB request. If it doesn't flash, the A13 HP-IB Processor is malfunctioning. All cables must be removed from the HP-IB connector, A13J1. All normal front panel operations should work with A13 removed to further enable failure isolation.

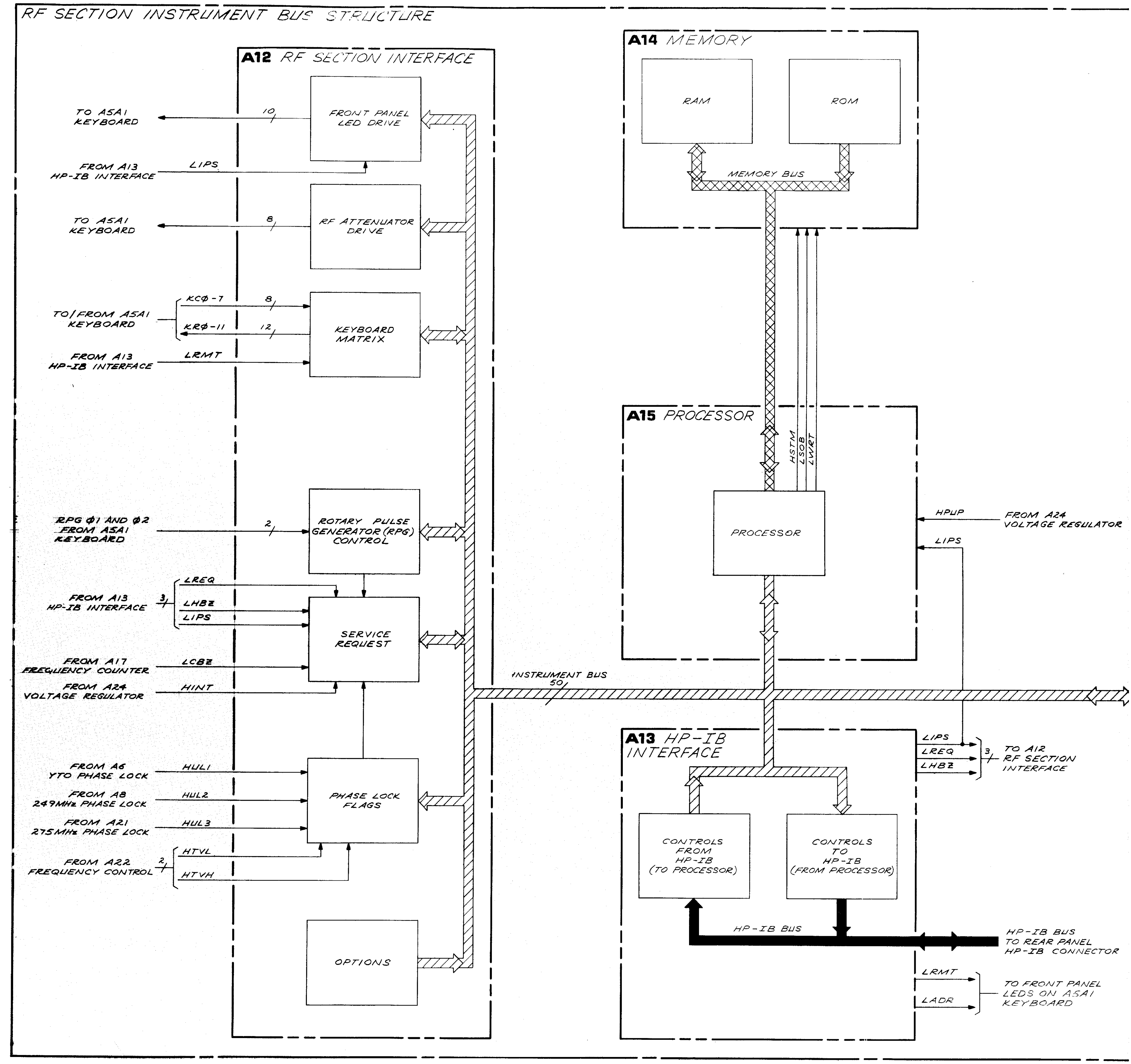
See the listing of HP-IB "bugs" in Section III for modes of operation which may be other than what would normally be expected.

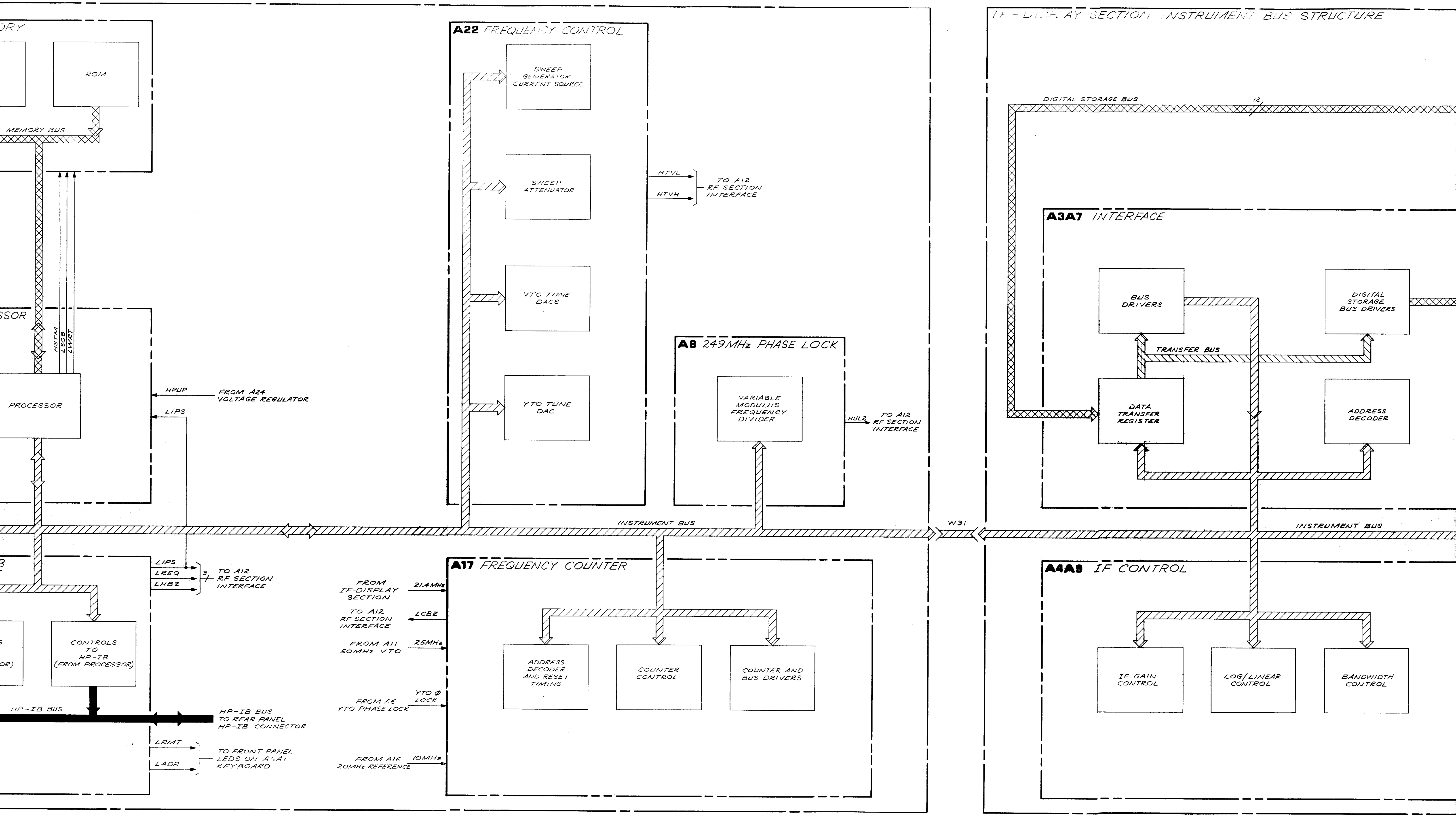
Phase Lock and Counter Inhibit (Jumper A15TP8 [STS] to A14TP11 [T1])

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 Processor.


RF SECTION INSTRUMENT BUS STRUCTURE
A12 RF SECTION INTERFACE
TO A5A1 KEYBOARD
10
FRONT PANEL LED DRIVE
FROM A13 HP-IB INTERFACE
LIPS
TO A5A1 KEYBOARD
8
RF ATTENUATOR DRIVE
TO/FROM A5A1 KEYBOARD
KCØ-7
8
KRØ-11
12
KEYBOARD MATRIX
FROM A13 HP-IB INTERFACE
LRMT
RPG Ø1 AND Ø2 FROM A5A1 KEYBOARD
2
ROTARY PULSE GENERATOR (RPG) CONTROL
FROM A13 HP-IB INTERFACE
3
LREQ
LHBZ
LIPS
SERVICE REQUEST
FROM A17 FREQUENCY COUNTER
LCBZ
FROM A24 VOLTAGE REGULATOR
HINT
FROM A6 YTO PHASE LOCK
HUL1
FROM A8 249MHz PHASE LOCK
HUL2
FROM A21 275MHz PHASE LOCK
HUL3
FROM A22 FREQUENCY CONTROL
2
HTVL
HTVH
PHASE LOCK FLAGS
OPTIONS
INSTRUMENT BUS
50
A14 MEMORY
RAM
ROM
MEMORY BUS
A15 PROCESSOR
HSTM
LSOB
LWRT
PROCESSOR
HPUP
FROM A24 VOLTAGE REGULATOR
LIPS
A13 HP-IB INTERFACE
LIPS
LREQ
LHBZ
3
TO A12 RF SECTION INTERFACE
CONTROLS FROM HP-IB (TO PROCESSOR)
CONTROLS TO HP-IB (FROM PROCESSOR)
HP-IB BUS
HP-IB BUS TO REAR PANEL HP-IB CONNECTOR
LRMT
LADR
TO FRONT PANEL LEDS ON A5A1 KEYBOARD



ORY
ROM
MEMORY BUS
HSTM
LSOB
LWRT
SSOR
PROCESSOR
HPUP
FROM A24 VOLTAGE REGULATOR
LIPS
LIPS
LREQ
LHBZ
3
TO A12 RF SECTION INTERFACE
CONTROLS TO HP-IB (FROM PROCESSOR)
HP-IB BUS
HP-IB BUS TO REAR PANEL HP-IB CONNECTOR
LRMT
LADR
TO FRONT PANEL LEDS ON A5A1 KEYBOARD
A22 FREQUENCY CONTROL
SWEEP GENERATOR CURRENT SOURCE
SWEEP ATTENUATOR
VTO TUNE DACS
YTO TUNE DAC
HTVL
HTVH
TO A12 RF SECTION INTERFACE
A8 249MHz PHASE LOCK
VARIABLE MODULUS FREQUENCY DIVIDER
HULZ
TO A12 RF SECTION INTERFACE
INSTRUMENT BUS
W31
A17 FREQUENCY COUNTER
FROM IF-DISPLAY SECTION
21.4MHz
TO A12 RF SECTION INTERFACE
LCBZ
FROM A11 50MHz VTO
25MHz
FROM A6 YTO PHASE LOCK
YTO Φ LOCK
FROM A16 20MHz REFERENCE
10MHz
ADDRESS DECODER AND RESET TIMING
COUNTER CONTROL
COUNTER AND BUS DRIVERS
IF-DISPLAY SECTION INSTRUMENT BUS STRUCTURE
DIGITAL STORAGE BUS
12
A3A7 INTERFACE
BUS DRIVERS
DIGITAL STORAGE BUS DRIVERS
TRANSFER BUS
DATA TRANSFER REGISTER
ADDRESS DECODER
INSTRUMENT BUS
A4A8 IF CONTROL
IF GAIN CONTROL
LOG/LINEAR CONTROL
BANDWIDTH CONTROL

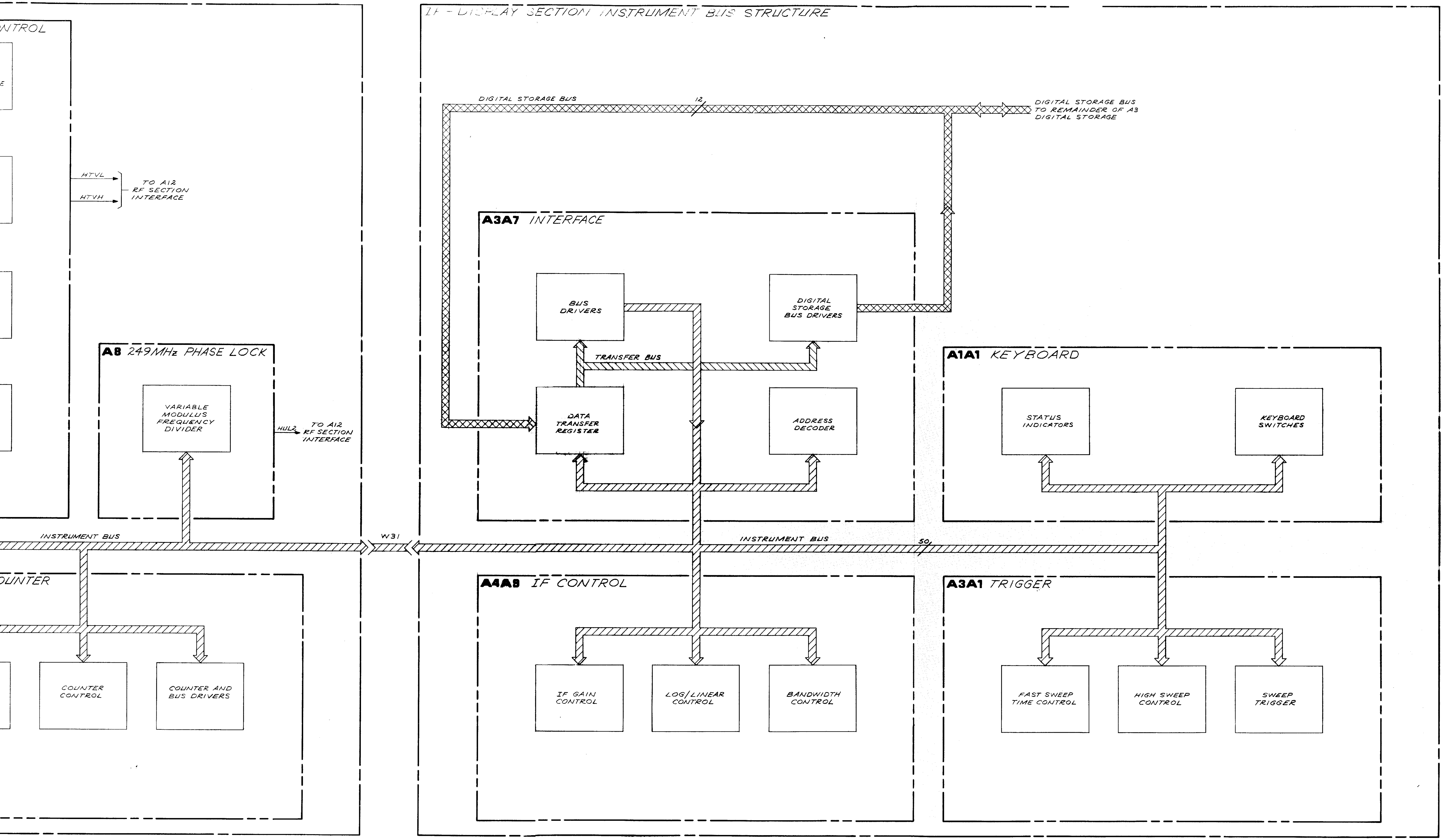


Figure 9-16. RF Section Digital Troubleshooting Block Diagram

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 comprises 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.

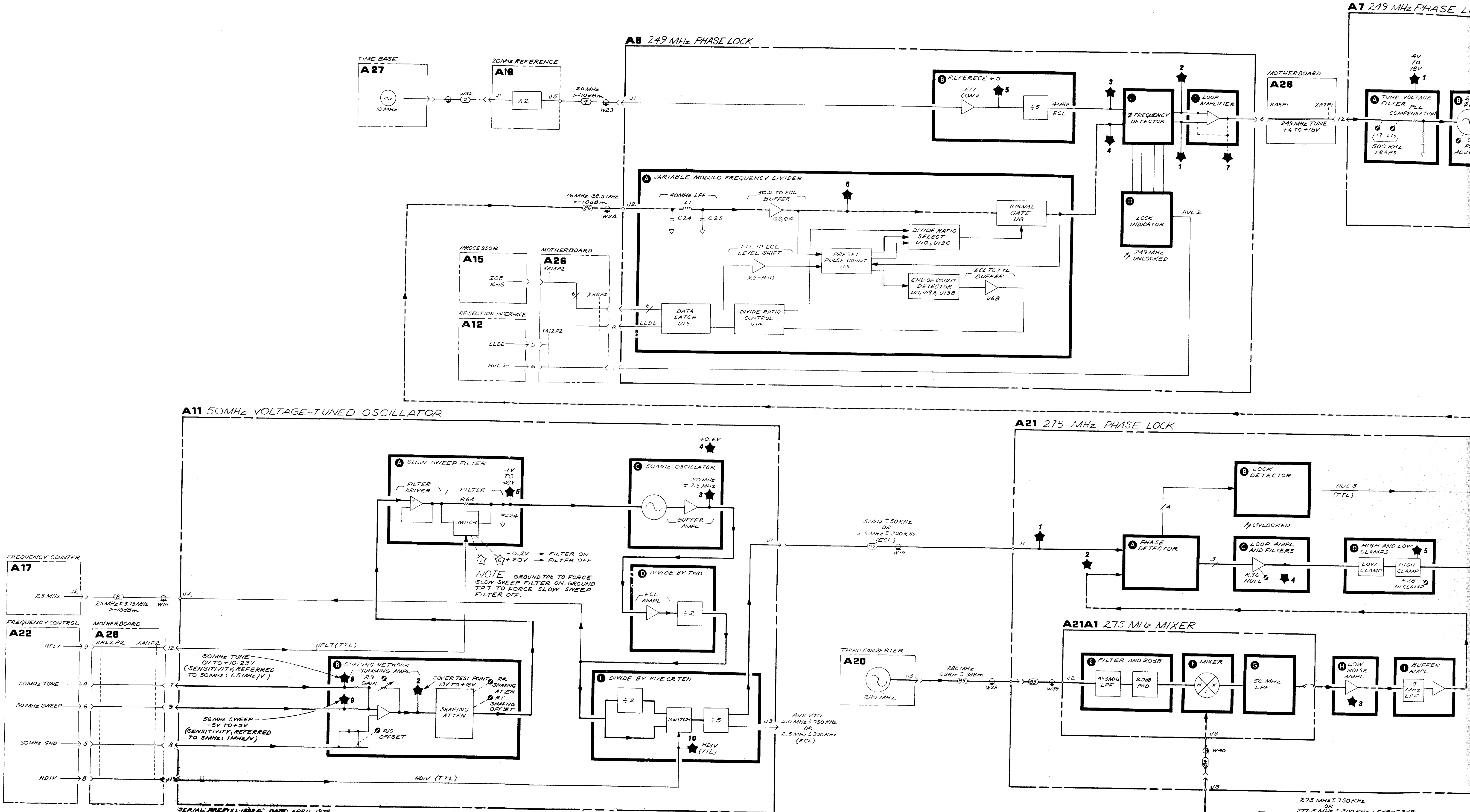
A21 275 MHz Phase Lock

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 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.



A8 249 MHz PHASE LOCK
A7 249 MHz PHASE L
TIME BASE
A27
10 MHz
W32
20MHz REFERENCE
A16
J1
X2
J5
20 MHz
>-10dBm
W23
B REFERECE ÷5
ECL CONV
÷5
4MHz ECL
C φ FREQUENCY DETECTOR
E LOOP AMPLIFIER
D LOCK INDICATOR
249 MHz UNLOCKED
HUL 2
MOTHERBOARD
A26
XA8P1
XA7P1
249 MHz TUNE +4 TO +18V
A TUNE VOLTAGE FILTER
PLL COMPENSATION
L17 L15
500 KHz TRAPS
4V TO 18V
A VARIABLE MODULO FREQUENCY DIVIDER
16 MHz 38.5 MHz
>-10dBm
W24
J2
40MHz LPF
L1
C24
C25
50Ω TO ECL BUFFER
Q3,Q4
SIGNAL GATE
U8
DIVIDE RATIO SELECT
U10, U13C
PRESET PULSE COUNT
U5
TTL TO ECL LEVEL SHIFT
R5-R10
END OF COUNT DETECTOR
U11, U13A, U13B
ECL TO TTL BUFFER
U6B
DATA LATCH
U15
DIVIDE RATIO CONTROL
U14
LLDD
PROCESSOR
A15
IOB 10-15
MOTHERBOARD
A26
XA15P2
XA8P2
RF SECTION INTERFACE
A12
XA12P2
LLDD
HUL 2
A11 50MHz VOLTAGE-TUNED OSCILLATOR
A SLOW SWEEP FILTER
FILTER DRIVER
FILTER
R64
SWITCH
C24
-1V TO +18V
+0.2V → FILTER ON
+20V → FILTER OFF
NOTE: GROUND TP6 TO FORCE SLOW SWEEP FILTER ON. GROUND TP7 TO FORCE SLOW SWEEP FILTER OFF.
C 50MHz OSCILLATOR
50MHz ± 7.5MHz
BUFFER AMPL
+0.6V
D DIVIDE BY TWO
ECL AMPL
÷2
E DIVIDE BY FIVE OR TEN
÷2
SWITCH
÷5
HDIV (TTL)
AUX VTO
5.0 MHz ± 750 KHz OR 2.5 MHz ± 300 KHz (ECL)
B SHAPING NETWORK
SUMMING AMPL
R9 GAIN
COVER TEST POINT +3V TO +18V
R4 SHAPING ATTEN
R1 SHAPING OFFSET
SHAPING ATTEN
R10 OFFSET
50MHz TUNE 0V TO +10.23V (SENSITIVITY, REFERRED TO 50MHz: 1.5MHz/V)
50MHz SWEEP -5V TO +5V (SENSITIVITY, REFERRED TO 5MHz: 1MHz/V)
HFLT (TTL)
HDIV (TTL)
FREQUENCY COUNTER
A17
2.5 MHz
2.5 MHz ± 3.75 MHz >-15dBm
W18
FREQUENCY CONTROL
A22
HFLT
50MHz TUNE
50MHz SWEEP
50MHz GND
HDIV
MOTHERBOARD
A28
XA22P2
XA11P2
5MHz ± 50KHz OR 2.5 MHz ± 300KHz (ECL)
W19
A21 275 MHz PHASE LOCK
A PHASE DETECTOR
B LOCK DETECTOR
HUL 3 (TTL)
UNLOCKED
C LOOP AMPL AND FILTERS
R36 NULL
D HIGH AND LOW CLAMPS
LOW CLAMP
HIGH CLAMP
R28 HI CLAMP
A21A1 275 MHz MIXER
E FILTER AND 20dB
433MHz LPF
20dB PAD
F MIXER
G 50 MHz LPF
H LOW NOISE AMPL
I BUFFER AMPL
15 MHz LPF
THIRD CONVERTER
A20
280 MHz
280 MHz 0dBm ± 3dBm
W28
W39
W40
275 MHz ± 750 KHz OR 277.5 MHz ± 300 KHz +5dBm ± 2dB
SERIAL PREFIX: DATE: APRIL 1978

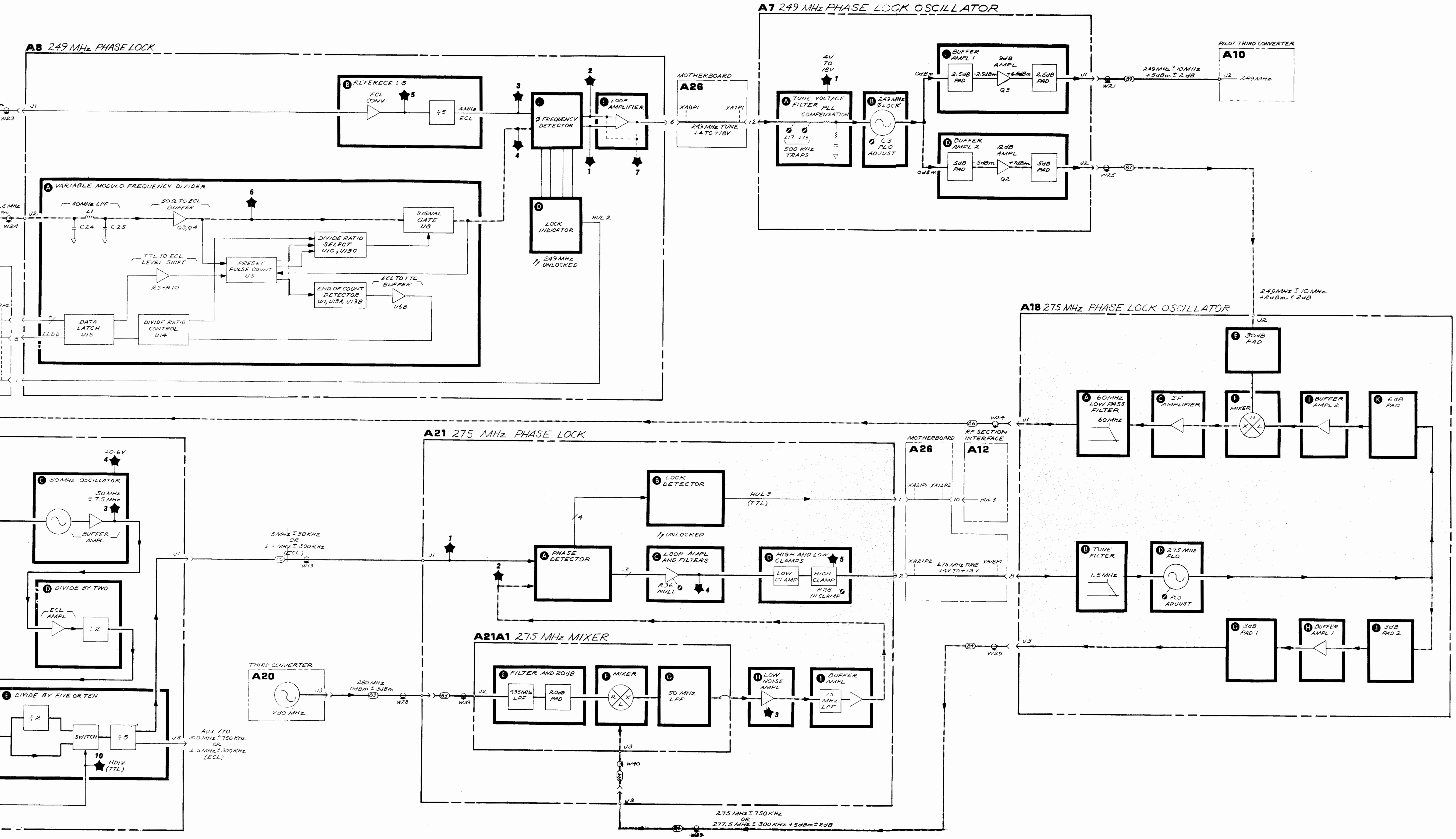


Figure 9-17. Pilot Third Local Oscillator, Block Diagram

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 INSTR PRESET key is pressed. The self-test routine checks the digital circuitry in A14 Memory, A15 Processor, 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 A14 or 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 deenergized). 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 deenergized, 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.

Table 9-4. A5 Front Panel, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5	85680-60051	1	FRONT PANEL(INCLUDES A5A1 KEYBOARD, A5A3 CONNECTOR ASSY:DC INPUT, A5A4 BLOCKING CAPACITOR, W1-W3, AND W31)	28480	85680-60051
A5	85680-60050		75-OHM VERSION OF 85680-60051	28480	85680-60050
A5AT1	08568-60117	1	INPUT ATTENUATOR/ERROR CORRECTION ROM REPLACEMENT ASSEMBLY (INCLUDES W42 AND A12U17)	28480	08568-60117
A5DS1	1990-0487	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5DS2	1990-0486	2	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A5DS3	1990-0486		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A5J1			P/O W31-NOT SEPARATELY REPLACEABLE		
A5J2	5060-0467	1	CONNECTOR, MALE, PROBE POWER	28480	5060-0467
A5J3			P/O A5A3-NOT SEPARATELY REPLACEABLE		
A5J4		1	P/O A5A4-NOT SEPARATELY REPLACEABLE		
A5J5			P/O A5AT1-NOT SEPARATELY REPLACEABLE		
A5J6		1	P/O A5AT1-NOT SEPARATELY REPLACEABLE		
A5J7		1	P/O A5AT1-NOT SEPARATELY REPLACEABLE		
A5J8			P/O A5K1-NOT SEPARATELY REPLACEABLE		
A5J9		1	P/O A5K1-NOT SEPARATELY REPLACEABLE		
A5J10			P/O A5K1-NOT SEPARATELY REPLACEABLE		
A5K1	3106-0024	1	SWITCH, COAX SMA 0-2G	28480	3106-0024
A5R1	2100-2488	1	RESISTOR-VAR CONTROL CCP 10K 10% LIN	28480	2100-2488
A5RPG1	5060-0329	1	ROTARY PULSE GENERATOR	28480	5060-0329
A5S1	3101-2193	1	SWITCH, ROCKER SPDT	28480	3101-2193
A5A1	85680-60019	1	BOARD ASSEMBLY, KEYBOARD	28480	85680-60019
A5A1DS1	1990-0487	10	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS2	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS3	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS4	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS5	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS6	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS7	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS8	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS9	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1DS10	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A1J1	1251-4828	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-4828
A5A1S1-A5A1S49	5060-9436	49	SWITCH, PC BOARD (SEE FIGURE 6-7 FOR KEYS)	28480	5060-9436
A5A1U1	1810-0203	2	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R470
A5A1U2	1810-0203		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R470
A5A1XDS1	1200-0010	10	SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS2	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS3	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS4	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS5	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS6	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS7	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS8	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS9	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A1XDS10	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010
A5A2	5060-0329		ROTARY PULSE GENERATOR (RPG)	28480	5060-0329
A5A3	85680-60059		CONNECTOR ASSEMBLY, DC INPUT	28480	85680-60059
A5A3	85680-60116		CONNECTOR ASSEMBLY, DC INPUT 75Ω (OPTION 001)	28480	85680-60116
A5A3F1	1535-3716	1	FUSE, 1/8AMP	28480	1535-3716
A5A3J1	1250-1557	1	CONNECTOR, BNC FEMALE TO SMC FEMALE	28480	1250-1557
A5A4	85680-60053	1	BLOCKING CAPACITOR ASSEMBLY (REFER TO FIGURE 6-11)	28480	85680-60053
A5A5	85680-60117	1	BOARD ASSEMBLY, INPUT SELECT	28480	85680-60117
A5A5DS1	1990-0487	2	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A5DS2	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A5A5R1	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A5A5R2	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A5A5S1	5060-9436	2	SWITCH, PC BOARD (SEE FIGURE 6-7 FOR KEYS)	28480	5060-9436
A5A5S2	5060-9436		SWITCH, PC BOARD (SEE FIGURE 6-7 FOR KEYS)	28480	5060-9436

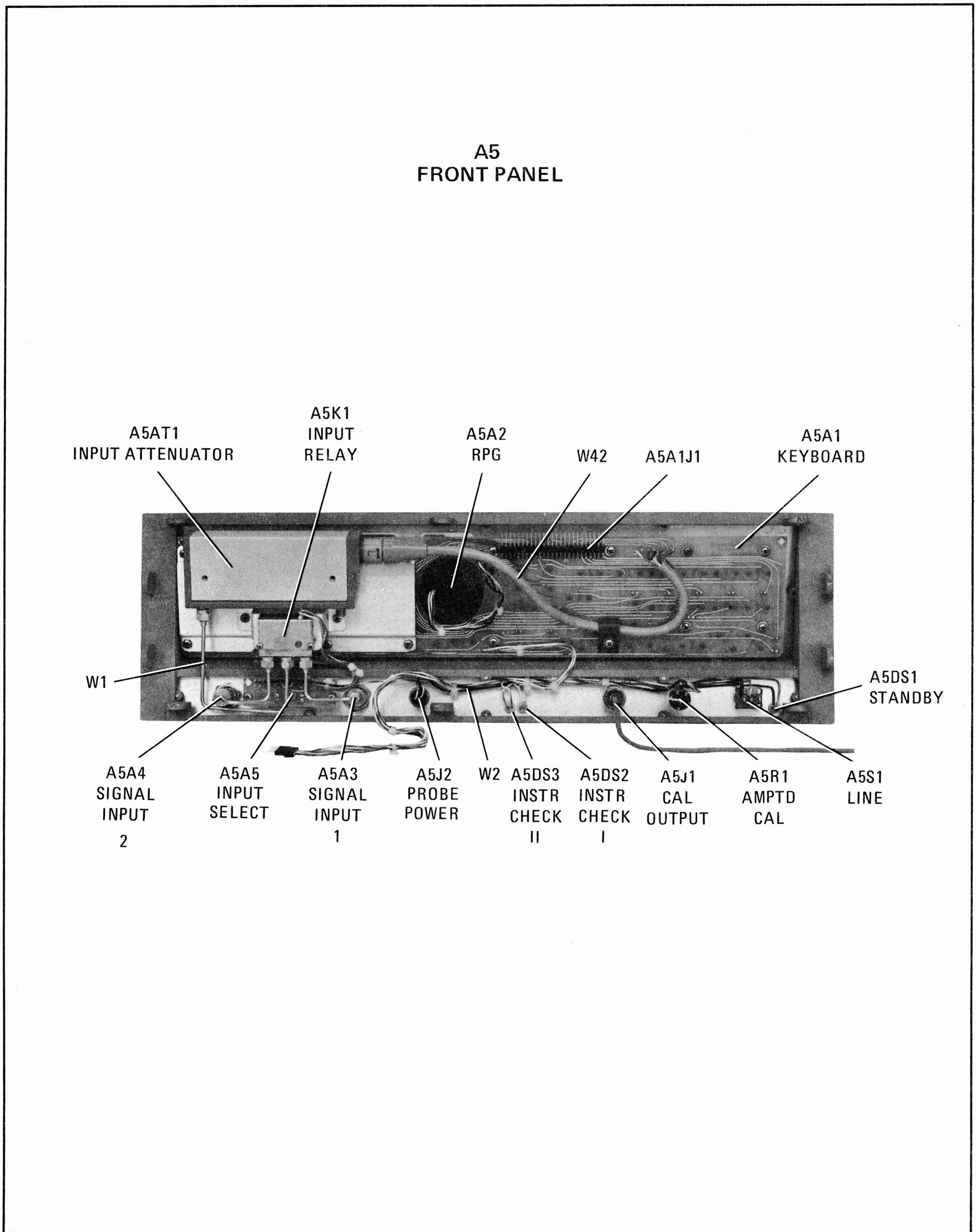


Figure 9-18. A5 Front Panel, Assembly and Component Locations

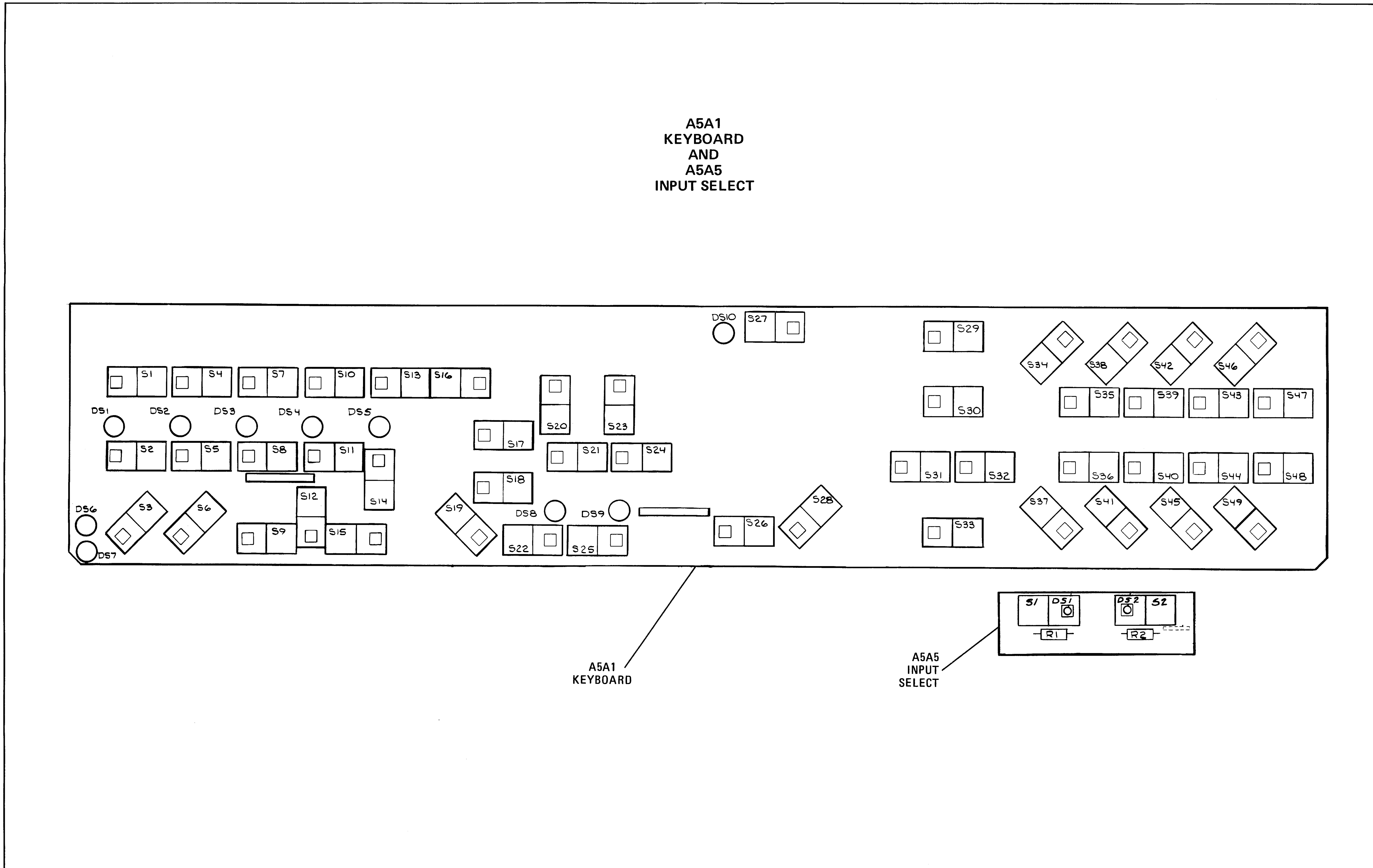
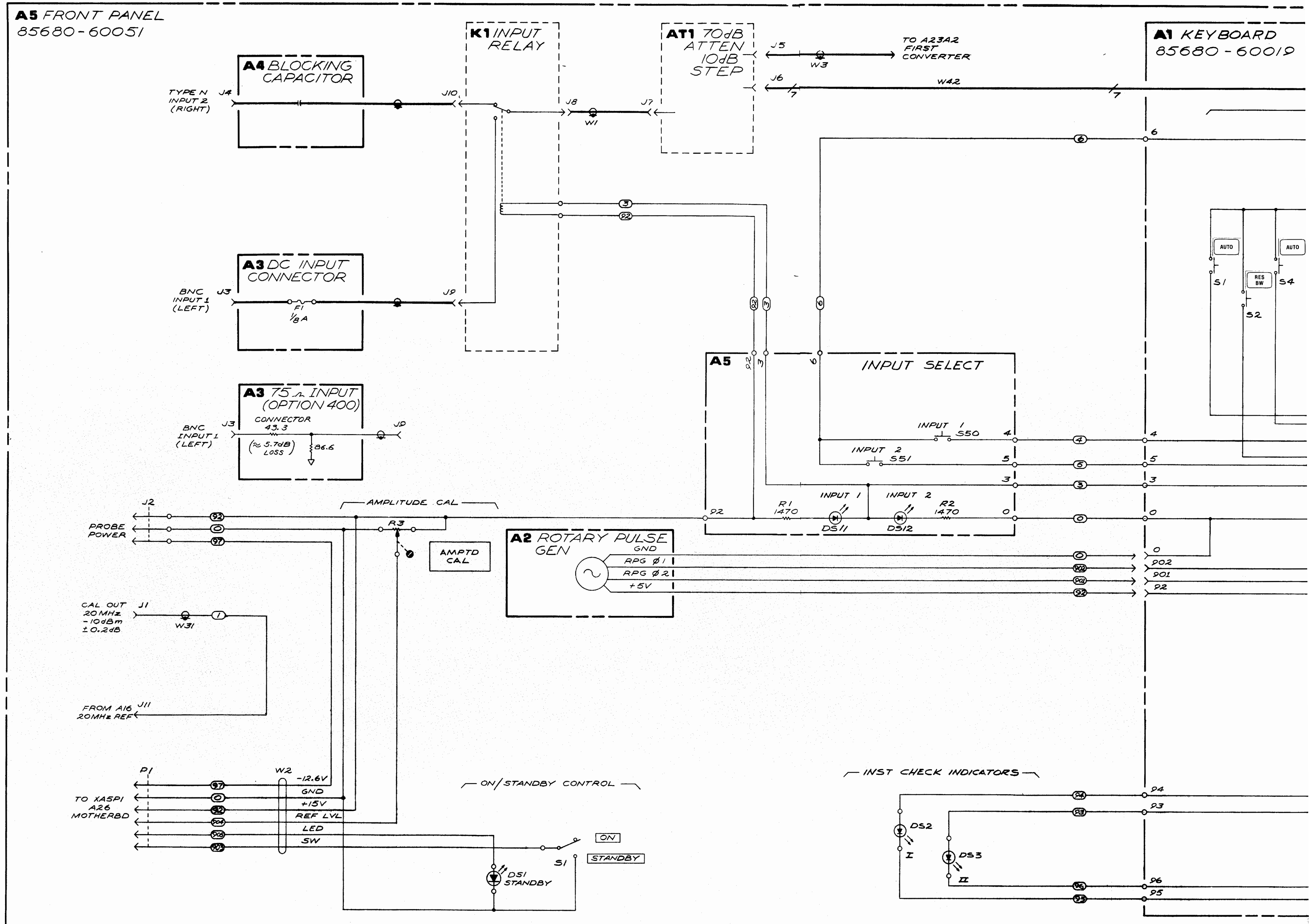
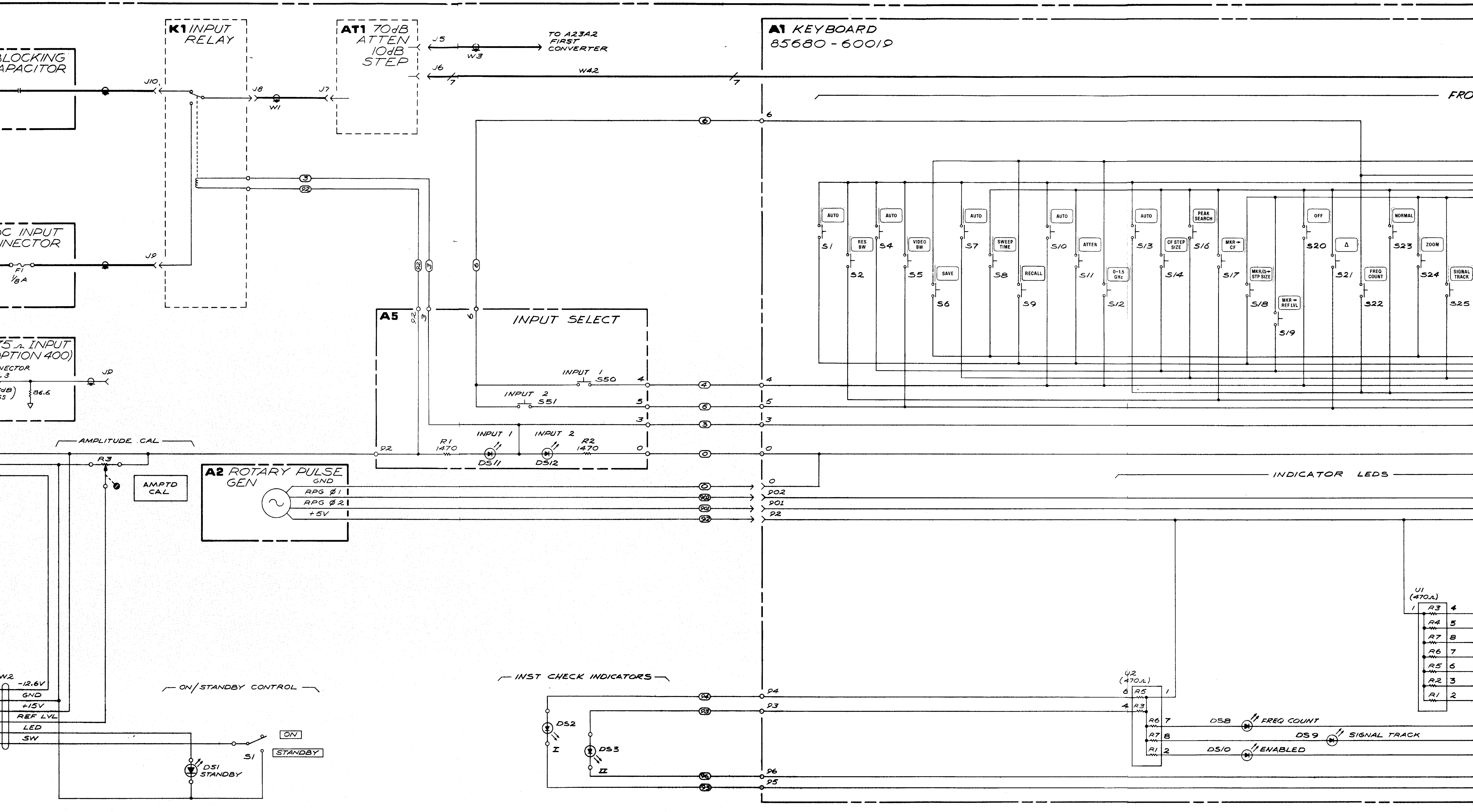


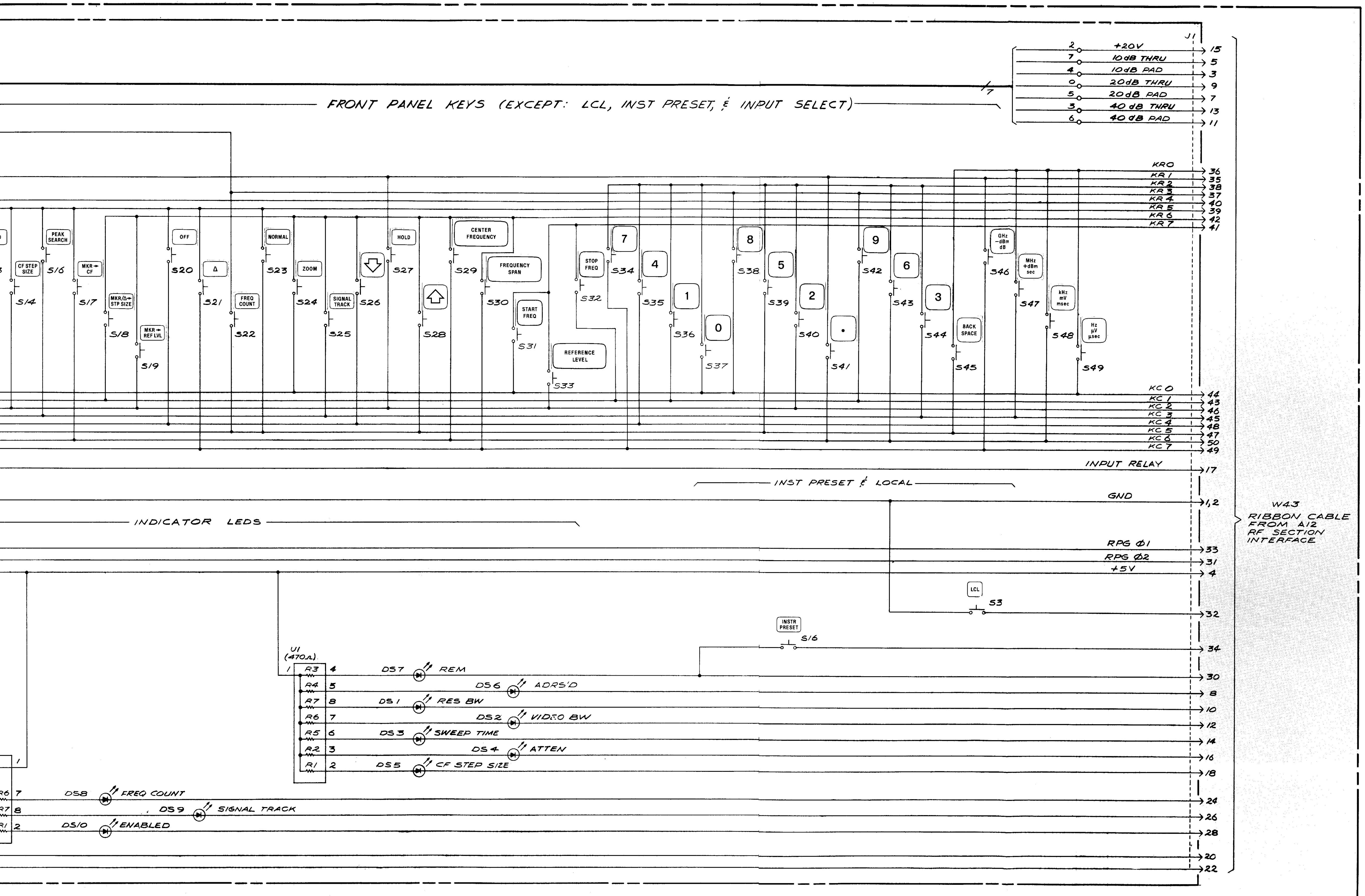
Figure 9-19. A5A1 Keyboard and A5A5 Input Select, Component Locations



SERIAL PREFIX: 1828A DATE: APRIL 1978

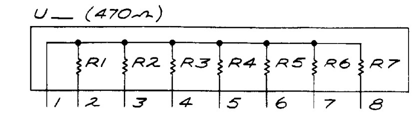


BLOCKING CAPACITOR
K1 INPUT RELAY
AT1 70dB ATTEN 10dB STEP
TO A23A2 FIRST CONVERTER
A1 KEYBOARD
85680-60019
DC INPUT CONNECTOR
F1 1/8A
75Ω INPUT (OPTION 400)
A5
INPUT SELECT
INPUT 1 S50
INPUT 2 S51
INPUT 1
INPUT 2
R1 1470
R2 1470
DS11
DS12
AMPLITUDE CAL
R3
AMPTD CAL
A2 ROTARY PULSE GEN
GND
RPG Ø1
RPG Ø2
+5V
INDICATOR LEDS
INST CHECK INDICATORS
DS2
DS3
ON/STANDBY CONTROL
-12.6V
GND
+15V
REF LVL
LED
SW
DS1 STANDBY
S1
ON
STANDBY
U2 (470Ω)
U1 (470Ω)
DS8 FREQ COUNT
DS9 SIGNAL TRACK
DS10 ENABLED
AUTO
RES BW
VIDEO BW
SAVE
SWEEP TIME
RECALL
ATTEN
0-1.5 GHz
CF STEP SIZE
PEAK SEARCH
MKR→ CF
MKR/Δ→ STP SIZE
MKR→ REF LVL
OFF
Δ
FREQ COUNT
NORMAL
ZOOM
SIGNAL TRACK
S1 S2 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25
FRO



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω) CAPACITANCE IN MICROFARADS (μF)
3. U1 AND U2 PIN CONFIGURATION:



4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
KRØ-7	KEY ROWS Ø-7
KCØ-7	KEY COLUMNS Ø-7

Figure 9-20. A5 Front Panel, Schematic Diagram

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 signals 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 (non-inverting 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.

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 9-21 and in the schematic for this assembly should be consulted.

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 Processor to do certain tasks. The transistions 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 LHLD (A6P2-9) going high. It is assumed that the center frequency is not being tuned.

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

a. HGND, (A6P2-10), which is high, shorts the Loop-Amplfier C and the Loop Filter D .

b. 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 Processor 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 Processor 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, [SHIFT] [PEAK SEARCH]) 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 MHz 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 [SIGNAL TRACK] mode. This causes an offset in the marker readout of the signal frequency.

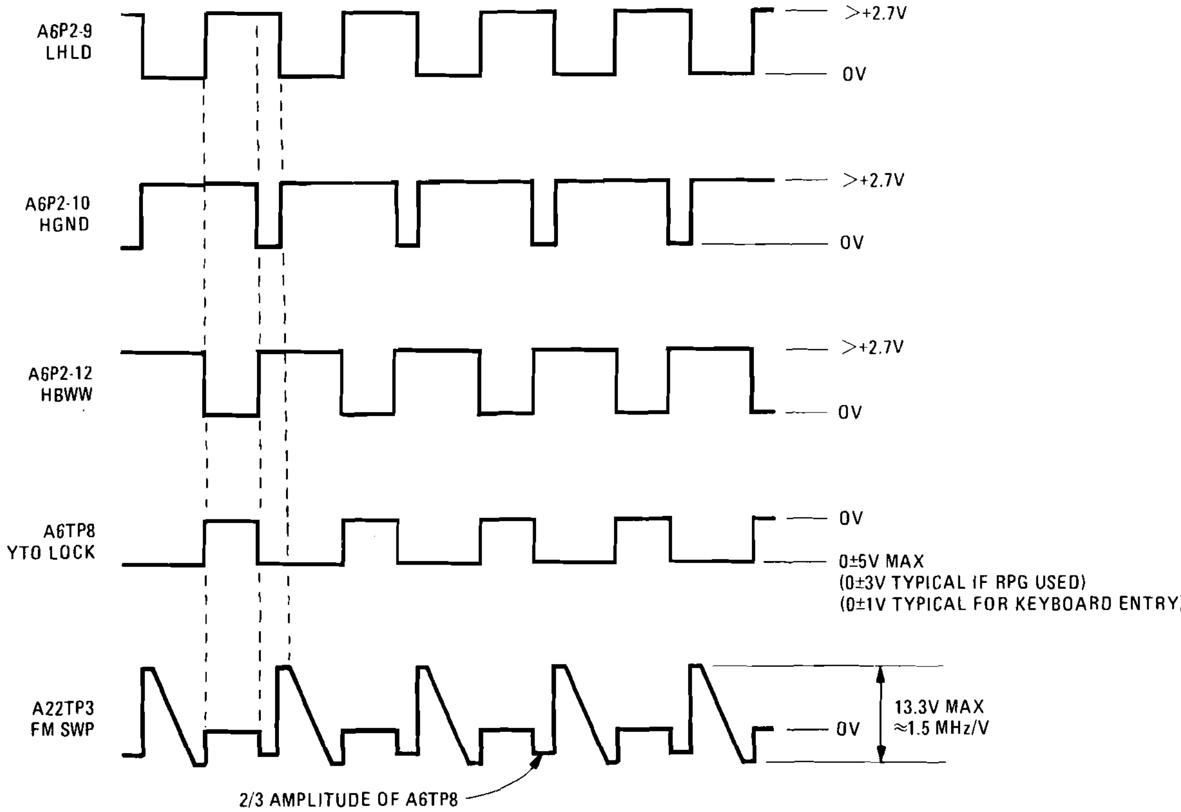


Figure 9-21. A6 YTO Phase Lock Timing Waveforms

If either the YTO UNLOCK or the YTO ERROR messages appear, the sweep rate will be very slow as the A15 Processor spends most of its time trying to lock the system. A jumper from A15TP8 (STS) to A15TP11 (T1) followed by [INSTR PRESET] 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 9-5. A6 YIG-Tuned Oscillator Phase Lock, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6	85680-60011	1	BOARD ASSEMBLY, YIG-TUNED OSCILLATOR PHASE LOCK (INCLUDES W22)	28480	85680-60011
A6C1	0160-2055	19	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C2	0160-2203	1	CAPACITOR-FXD 91PF +-5% 300VDC MICA 0+70	28480	0160-2203
A6C3	0160-2202	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
A6C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C11	0140-0193	4	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C12	0160-2255	1	CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A6C13	0140-0193		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C15	0160-4084	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C16	0140-0196	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A6C17	0140-0194	2	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A6C18	0140-0194		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A6C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C21			NOT ASSIGNED		
A6C22	0160-0301	1	CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0160-0301
A6C23			NOT ASSIGNED		
A6C24	0160-0163	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A6C25	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C26	0160-0945	2	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A6C27	0140-0193		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C28	0140-0192	2	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A6C29	0160-2264	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A6C30	0160-2254	1	CAPACITOR-FXD 7.5PF +-.25PF 500VDC CER	28480	0160-2254
A6C31	0140-0193		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C32	0140-0192		CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A6C33	0160-0945		CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A6C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C37	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C39	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C40	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C41	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C42	0160-3456	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A6C43	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C44			NOT ASSIGNED		
A6C45			NOT ASSIGNED		
A6C46	0160-2437	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A6C47	0160-2199	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A6CR1	1901-0040	7	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR4-A6CR13			NOT ASSIGNED		
A6CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6DS1	1990-0487	3	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A6DS2	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A6DS3	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A6J1			PART OF W22		
A6J2	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A6J3	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A6L1			NOT ASSIGNED		
A6L2	9100-2257	1	COIL-MLD 820NH 10% Q=32 .095DX.25LG-NOM	28480	9100-2257
A6L3	9100-3319	2	COIL-MLD 740NH 2% .155DX.375LG-NOM	28480	9100-3319
A6L4	9100-1619	2	COIL-MLD 6.8UH 10% Q=50 .155DX.375LG-NOM	28480	9100-1619
A6L5	9100-3319		COIL-MLD 740NH 2% .155DX.375LG-NOM	28480	9100-3319
A6L6	9100-2259	2	COIL-MLD 1.5UH 10% Q=32 .095DX.25LG-NOM	28480	9100-2259
A6L7	9100-2256	2	COIL-MLD 560NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2256
A6L8	9100-1619		COIL-MLD 6.8UH 10% Q=50 .155DX.375LG-NOM	28480	9100-1619
A6L9	9100-1618	1	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A6L10	9100-2259		COIL-MLD 1.5UH 10% Q=32 .095DX.25LG-NOM	28480	9100-2259

Table 9-5. A6 YIG-Tuned Oscillator Phase Lock, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6L11	9100-2256		COIL-MLD 560NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2256
A6L12	9100-1620	2	COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A6L13	9100-1620		COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A6L14	9140-0096	3	COIL-MLD 1UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0096
A6L15	9140-0096		COIL-MLD 1UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0096
A6L16	9140-0096		COIL-MLD 1UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0096
A6Q1	1854-0019	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q2	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q3	1853-0007	4	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q4	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q5	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q7	1854-0404	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q8	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q9	1854-0345	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A6Q10	1854-0009	1	TRANSISTOR NPN 2N709 SI TO-18 PD=300MW	28480	1854-0009
A6Q11	1853-0050	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A6Q12	1855-0020	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A6Q13	1855-0049	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A6R1	0757-1094	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	2	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A6R4	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R5	0698-3132	4	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R6	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R7	0698-3441	4	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R8	0757-0316	2	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A6R9	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A6R10	0757-0420	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A6R11	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R12	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R13	0757-0398	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A6R14	0698-3446	2	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R15	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A6R16	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A6R17	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A6R18	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A6R19	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R20	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R21	0757-0442	8	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R23	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R24	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R25	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R26	0757-0280	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R27	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R28	0757-0424	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A6R29	0757-0447	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R30	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A6R31	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R32	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R33	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R34	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R35	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A6R36	0698-3151	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	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A6R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R41	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R42	0698-0084	3	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R43	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A6R44	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A6R45	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R46			NOT ASSIGNED		
A6R47			NOT ASSIGNED		
A6R48	0698-3162	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A6R49	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A6R50			NOT ASSIGNED		
A6R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R52	0698-3132		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R53	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R54	0683-1055	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A6R55	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

See introduction to this section for ordering information

Table 9-5. A6 YIG-Tuned Oscillator Phase Lock, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R56	0698-3132		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R57	0757-0294	1	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A6R58	0698-3132		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R59	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A6R60	0757-0274	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A6R61			NOT ASSIGNED		
A6R62	0757-0290	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A6R63	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A6R64	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R65	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R66	0698-3150	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		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R69	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R70	0757-0123	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A6R71	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R72	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R73	0757-0458	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A6R74	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R75	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6TP1	0360-1514	7	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A6TP2	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A6TP3	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A6TP4			PART OF C46		
A6TP5	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A6TP6	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A6TP7	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A6TP8	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A6U1	1820-0817	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	1	IC SWITCH 16-DIP-C	27014	LF13331D
A6U4	1826-0089	1	IC 2525 OP AMP TO-99	29832	1322
A6U5			NOT ASSIGNED		
A6U6	1826-0161	1	IC 324 OP AMP 14-DIP-P	18324	LM324-A
A6U7	1820-1212	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112N
A6VR1	1902-3234	1	DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	28480	1902-3234
A6VR2	1902-0049	1	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A6VR3	1902-3059	1	DIODE-ZNR 3.83V 5% DO-7 PD=.4W TC=-.051%	28480	1902-3059
A6VR4			NOT ASSIGNED		
A6VR5	1902-0126	1	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	28480	1902-0126
A6VR6			NOT ASSIGNED		
A6VR7	1902-3082	1	DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
			A6 MISCELLANEOUS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001

Table 9-6. A6 YTO Phase-Lock, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C2	DS1	D3	R14	B1	R71	A3
C2	C2	DS2	D4	R15	B1	R72	A3
C3	C2	DS3	D4	R16	B1	R73	B3
C4	C2			R17	C1	R74	B3
C5	C1	J1	D1	R18	B1	R75	B3
C6	C1	J2	D2	R19	B2		
C7	B1	J3	D3	R20	B2	TP1	C2
C8	C1			R21	B2	TP2	C2
C9	B1	L2	C2	R22	B2	TP3	C3
C10	B2	L3	C1	R23	B2	TP4	D3
C11	C1	L4	C2	R24	B2	TP5	A2
C12	C1	L5	C1	R25	B2	TP6	B3
C13	C1	L6	B2	R26	B3	TP7	B3
C14	C1	L7	B2	R27	B3	TP8	B4
C15	C3	L8	B2	R28	B3		
C16	C3	L9	B2	R29	B3	U1	C2
C17	C2	L10	B2	R30	C3	U2	C2
C18	C2	L11	B2	R31	C2	U3	C3
C19	B3	L12	B2	R32	C2	U4	C3
C20	C3	L13	A2	R33	C2	U6	B3
C22	C3	L14	B1	R34	C2	U7	B3
C24	B4	L15	B1	R35	C3		
C25	B3	L16	B1	R36	C3	VR1	C4
C26	A2			R39	C4	VR2	C1
C27	B2	Q1	C1	R40	C3	VR3	A3
C28	B2	Q2	C1	R41	C3	VR5	C4
C29	B2	Q3	C1	R42	B3	VR7	B3
C30	B2	Q4	C2	R43	B3		
C31	B2	Q5	C2	R44	B4		
C32	B2	Q6	C2	R45	B4		
C33	A2	Q7	C4	R48	B4		
C34	B2	Q8	C4	R49	B4		
C35	A3	Q9	B2	R51	B4		
C36	A3	Q10	B3	R52	C2		
C37	B3	Q11	B4	R53	B4		
C38	B1	Q12	B4	R54	B4		
C39	B1	Q13	B4	R55	B2		
C40	C3			R56	C3		
C41	B1	R1	C2	R57	C3		
C42	B3	R2	C2	R58	C3		
C43	C3	R3	C2	R59	B3		
C46	C3	R4	C2	R60	B3		
C47	B4	R5	C4	R62	A2		
		R6	C1	R63	A2		
CR1	C3	R7	C1	R64	B2		
CR2	B3	R8	C1	R65	B3		
CR3	C3	R9	C1	R66	B3		
CR14	B2	R10	C1	R67	A3		
CR15	B2	R11	C1	R68	A3		
CR16	B2	R12	B1	R69	A3		
CR17	B2	R13	B1	R70	A3		

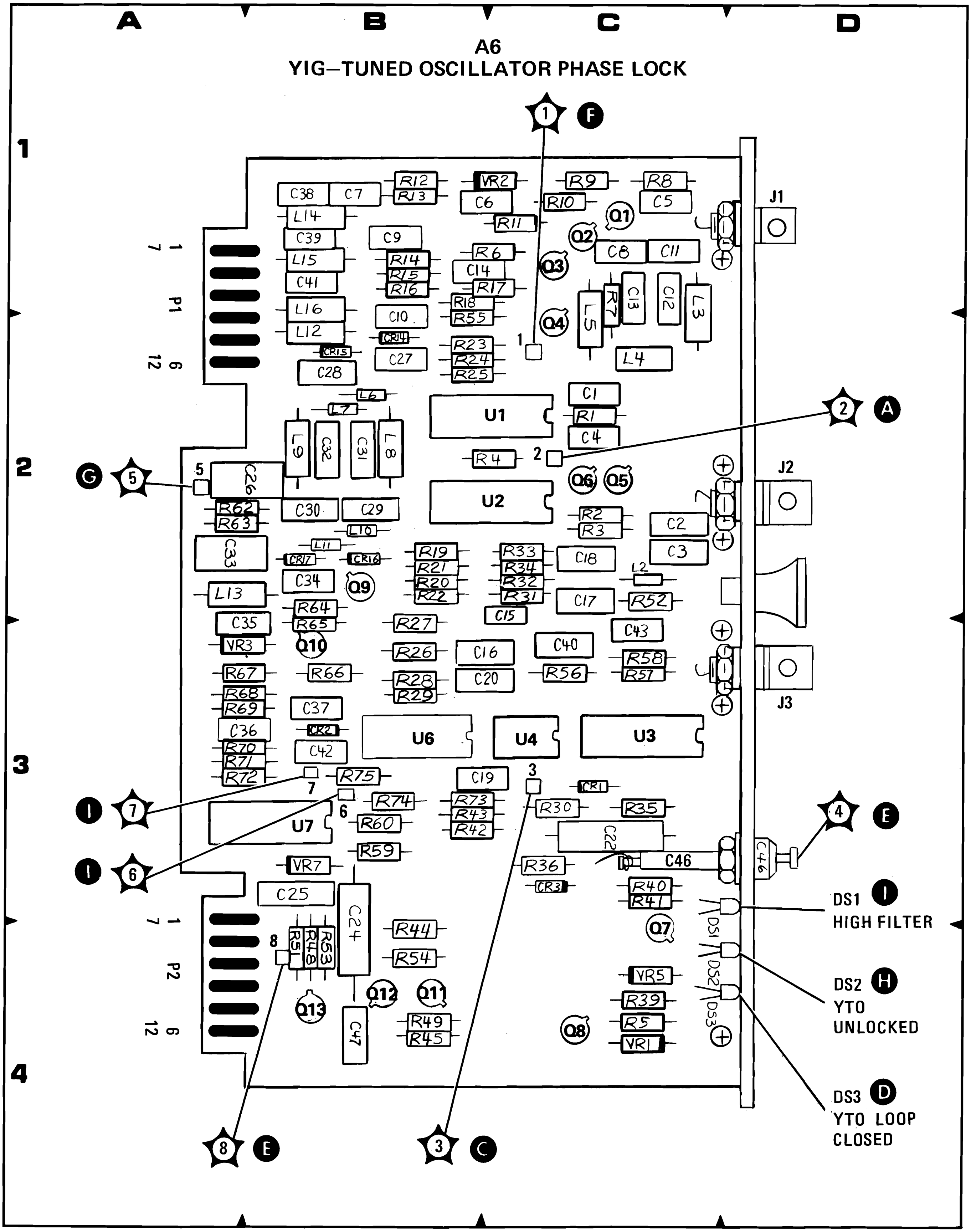
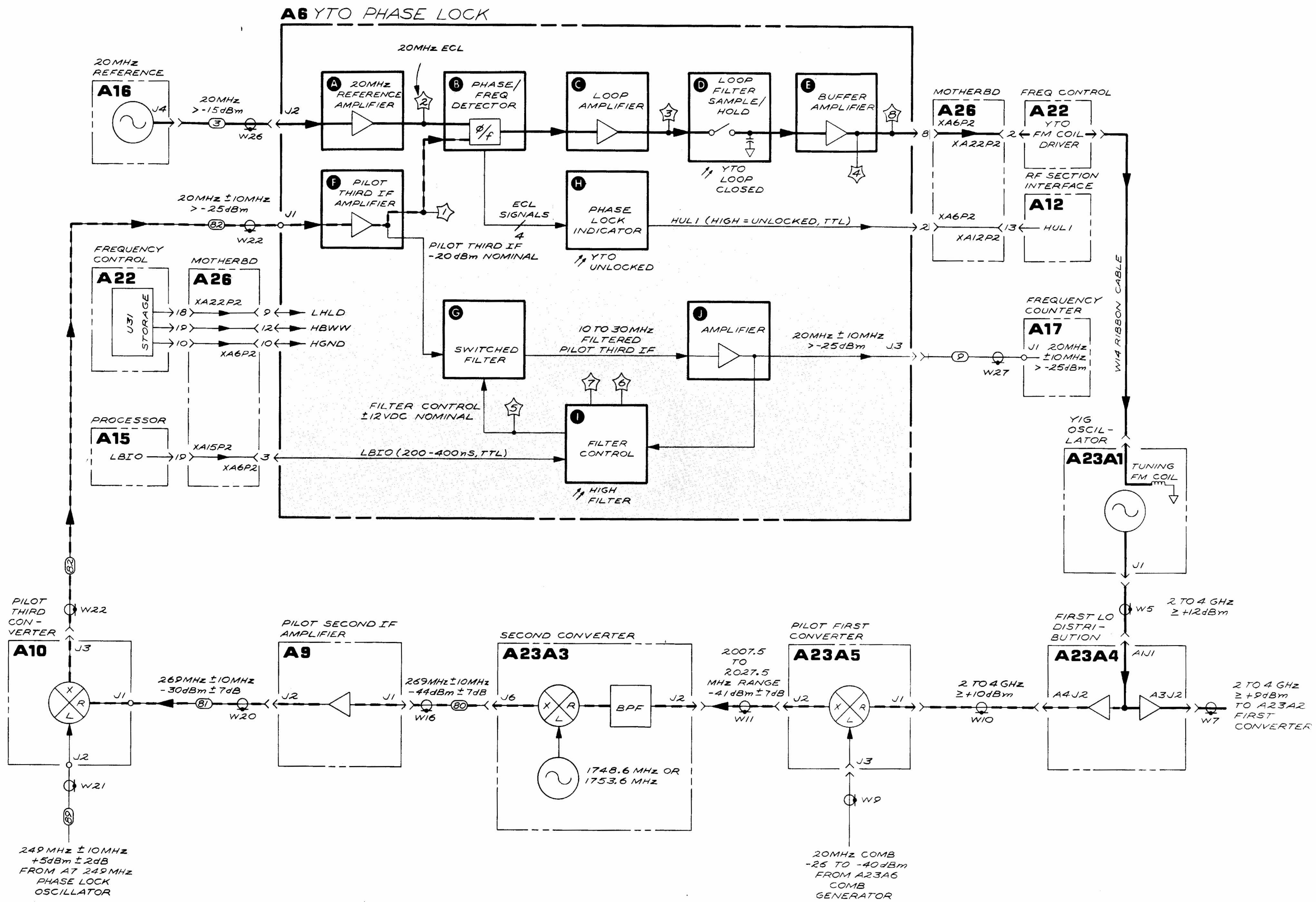
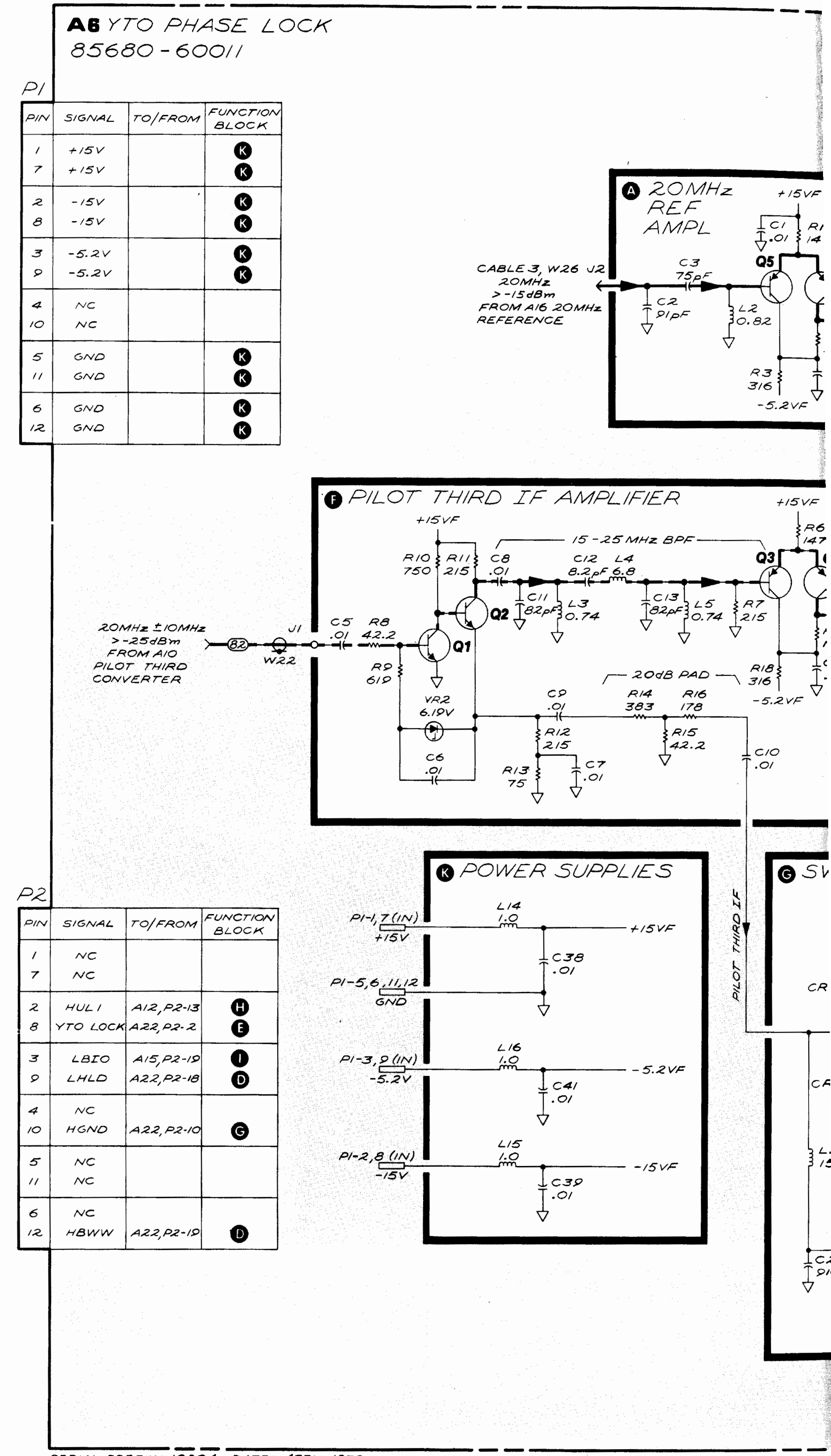


Figure 9-22. A6 YIG-Tuned Oscillator Phase Lock, Component Locations





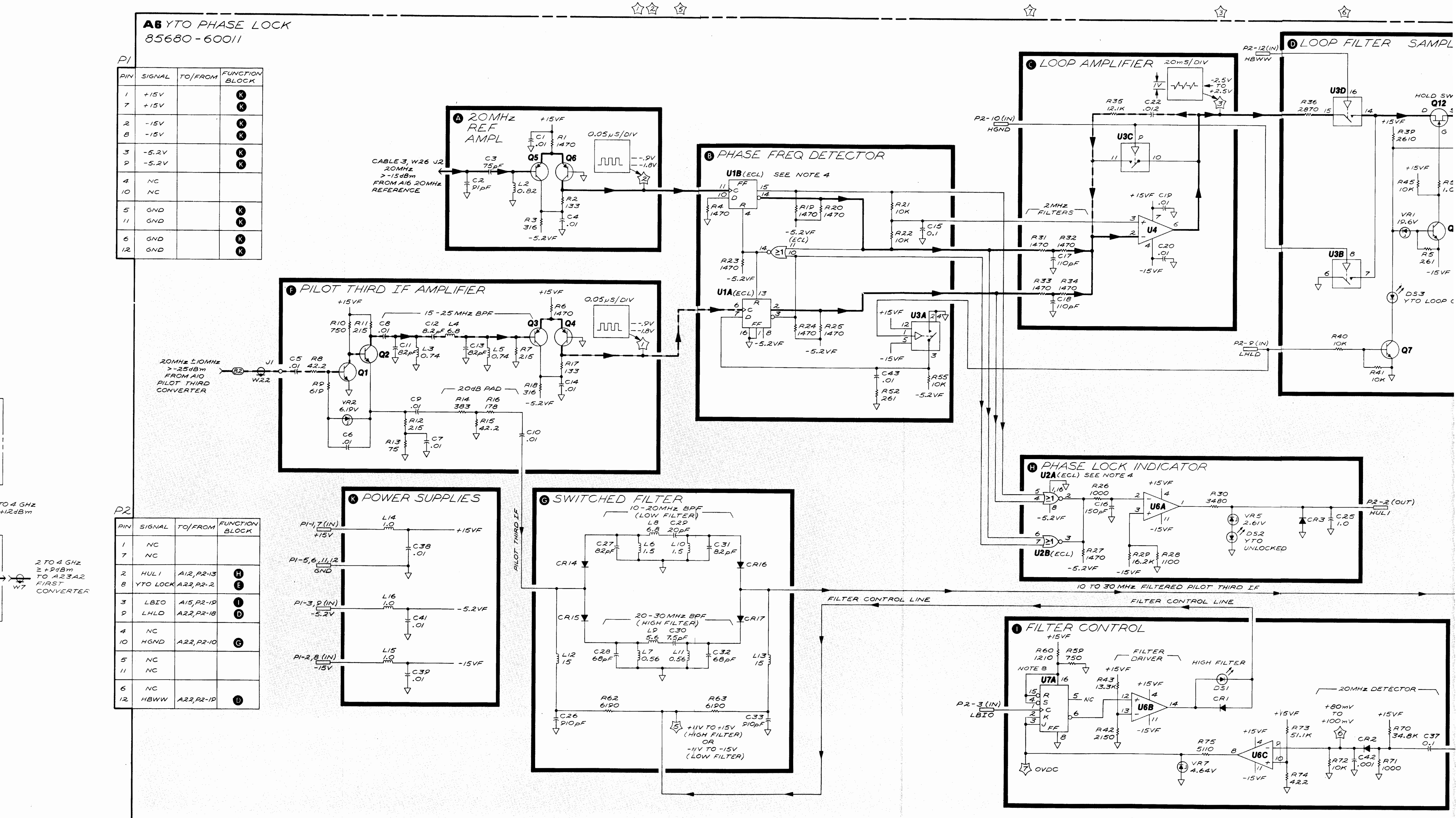
P1

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

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
7	NC		
2	HUL1	A12,P2-13	H
8	YTO LOCK	A22,P2-2	E
3	LBIO	A15,P2-19	I
9	LHLD	A22,P2-18	D
4	NC		
10	HGND	A22,P2-10	G
5	NC		
11	NC		
6	NC		
12	HBWW	A22,P2-19	D

Figure 9-23. A6 YIG-Tuned Oscillator Phase Lock, Block Diagram



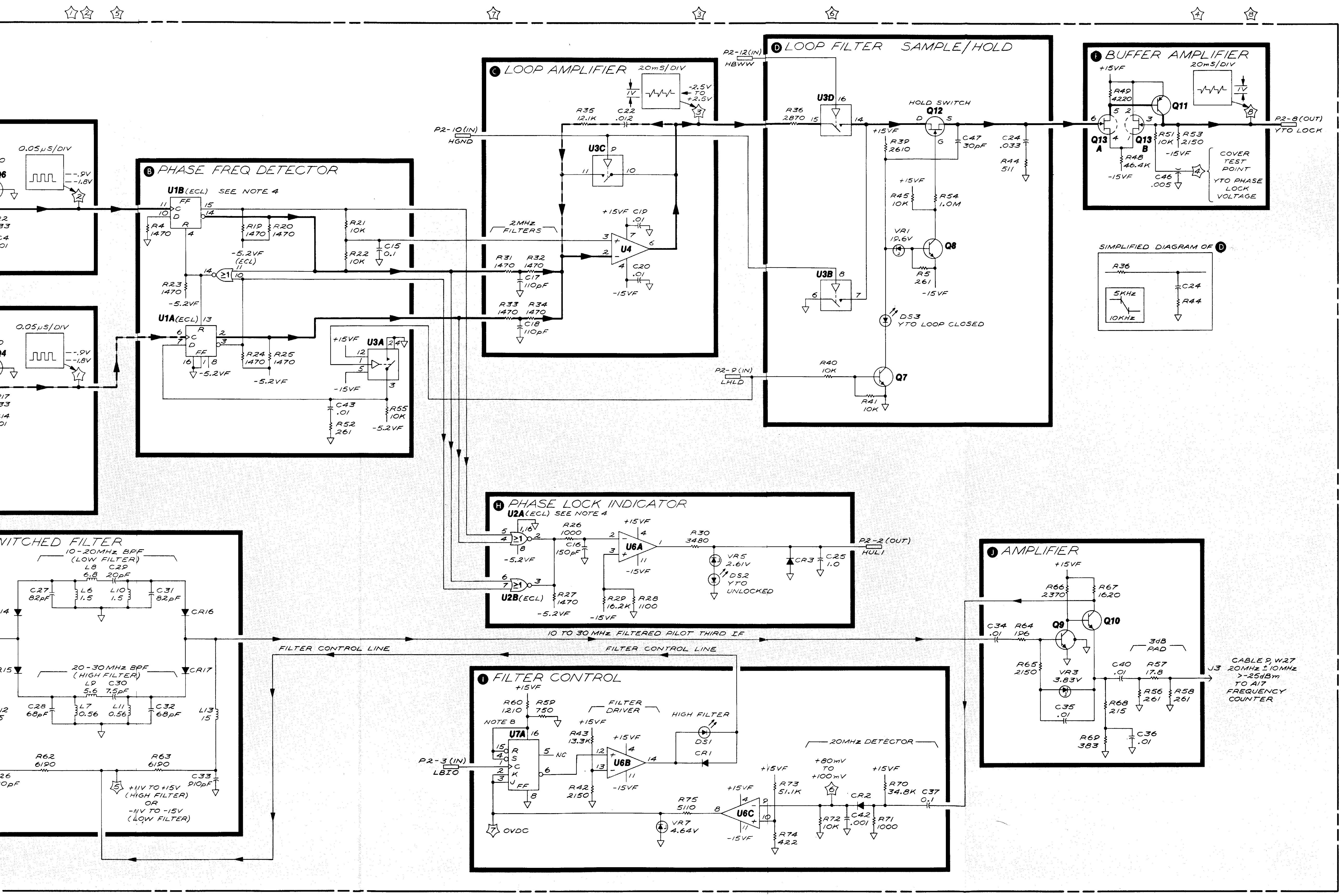
P1

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

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
7	NC		
2	HUL I	A12, P2-13	H
8	YTO LOCK	A22, P2-2	E
3	LBIO	A15, P2-19	I
9	LHLD	A22, P2-18	D
4	NC		
10	HGND	A22, P2-10	G
5	NC		
11	NC		
6	NC		
12	HBWW	A22, P2-19	D

SERIAL PREFIX: 1828A DATE: APRIL, 1978



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.

2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

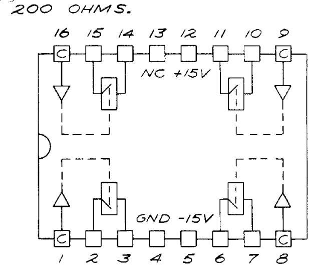
3. TEST POINT VOLTAGES ASSUME 1MHz SCAN; ALL OTHER SETTINGS AUTO UNLESS NOTED.

4. ECL LOGIC LEVELS ARE TYPICALLY:
   HIGH = -0.9V
   LOW = -1.8V
   AN UNCONNECTED ECL INPUT IS LOW.

5. MNEMONICS TABLE:

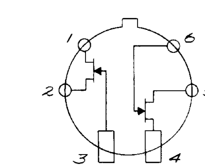
MNEMONIC	DESCRIPTION
HULI	HIGH INDICATES UNLOCKED YTO LOOP
LBIO	LOW = BOTTOM BOX I/O STROBE
LHLD	LOW = HOLD PHASE LOCK VOLTAGE
HGND	HIGH GROUNDS OUTPUT OF PHASE DETECTOR
HBWW	HIGH = WIDE (100KHz) LOOP BW

6. U3 IS A SET OF FOUR JFET ANALOG SWITCHES WHICH ARE OPEN WHEN THE LOGIC INPUTS (TTL) ARE LOW AND CLOSED WHEN THE INPUTS ARE HIGH. CLOSED RESISTANCE FROM INPUT TO OUTPUT IS TYPICALLY 150-200 OHMS.



TOP VIEW

7. TOP VIEW OF Q13.



8. U7B IS NOT USED. PINS 14 AND 10 ARE CONNECTED TO PIN 16.

Figure 9-24. A6 YIG-Tuned Oscillator Phase Lock, Schematic Diagram

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 10 dB. The bias for Q3 is set by R18, R17, and R25. 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 11 db. R8, R9, and R13 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 9-7. A7 249 MHz Phase Lock Oscillator, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	85680-60013	1	BOARD ASSEMBLY, 249MHZ PHASE LOCK OSC.	28480	85680-60013
A7C1	0160-3466	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A7C2	0160-2262	1	CAPACITOR-FXD 16PF +-5% 500VDC CER 0+-30	28480	0160-2262
A7C3	0121-0457	1	CAPACITOR-V TRMR-PSTN .8-8.5PF 750V	18736	TP9
A7C4			NOT ASSIGNED		
A7C5	0160-2055	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C6	0160-2259	1	CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A7C7			NOT ASSIGNED		
A7C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C9	0160-4084	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C10	0160-3879	4	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C12	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C13	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C14	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C15	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C17	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C18	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A7C19	0180-0116	3	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C20	0180-0116		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C21	0160-2266	1	CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A7C22	0160-2247	1	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	28480	0160-2247
A7C23	0150-0059	1	CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0150-0059
A7C24	0180-0116		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C25	0160-2224	1	CAPACITOR-FXD 1800PF +-5% 300VDC MICA	28480	0160-2224
A7C26	0160-0945	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A7C27	0160-2227	1	CAPACITOR-FXD 2400PF +-5% 300VDC MICA	28480	0160-2227
A7C28	0160-2437	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A7CR1	0122-0072	1	DIODE-VVC 2.2PF 5% C3/C25-MIN=4.5	04713	BB105B
A7J1	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A7J2	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A7L1	9140-0158	3	COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A7L2	85680-8000	1	OSCILLATOR COIL	28480	85680-80005
A7L3	9140-0158		COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A7L4	9140-0158		COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A7L5	9100-0346	2	COIL-MLD 50NH 20% Q=40 .095DX.25LG-NOM	28480	9100-0346
A7L6	9100-2247	2	COIL-MLD 100NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2247
A7L7	9100-0346		COIL-MLD 50NH 20% Q=40 .095DX.25LG-NOM	28480	9100-0346
A7L8	9100-2247		COIL-MLD 100NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2247
A7L9	9140-0129	2	COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A7L10	9140-0129		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A7L11	9100-2251	1	COIL-MLD 220NH 10% Q=32 .095DX.25LG-NOM	28480	9100-2251
A7L12	9100-1634	1	COIL-MLD 75UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1634
A7L13	9100-1620	1	COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A7L14	9100-1635	2	COIL-MLD 91UH 5% Q=50 .155DX.375LG-NOM	28480	9100-1635
A7L15	85680-8000	1	INDUCTOR, 68 UH	28480	85680-80007
A7L16	9140-0210	1	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A7L17	85680-8000	1	INDUCTOR, 42 UH	28480	85680-80006
A7L18	9100-1635		COIL-MLD 91UH 5% Q=50 .155DX.375LG-NOM	28480	9100-1635
A7Q1	1854-0345	3	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A7Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A7Q3	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A7R1	0757-0424	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A7R2	0698-3447	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	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R6	0757-0180	2	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A7R7	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R8	0757-0401	3	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R9	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A7R10	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R11	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A7R12	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A7R13	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R14	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R15	0757-0378	2	RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A7R16	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R17	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R18	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A7R19	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R20	0757-0378		RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F

Table 9-7. A7 249 MHz Phase Lock Oscillator, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R21	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R22	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A7R23	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R24	0757-0442	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R25	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7TP1			PART OF C28		
			A7 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001

See introduction to this section for ordering information

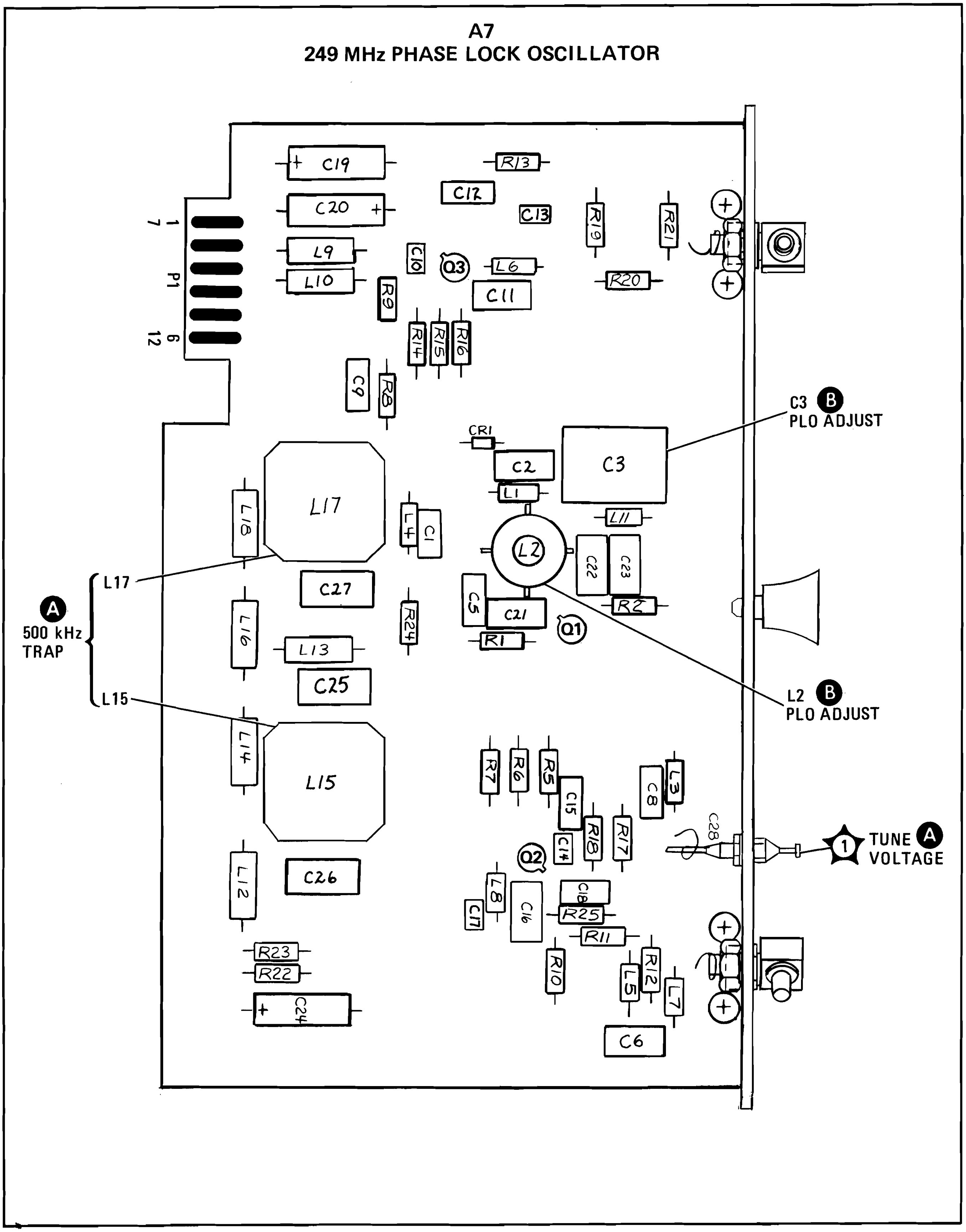
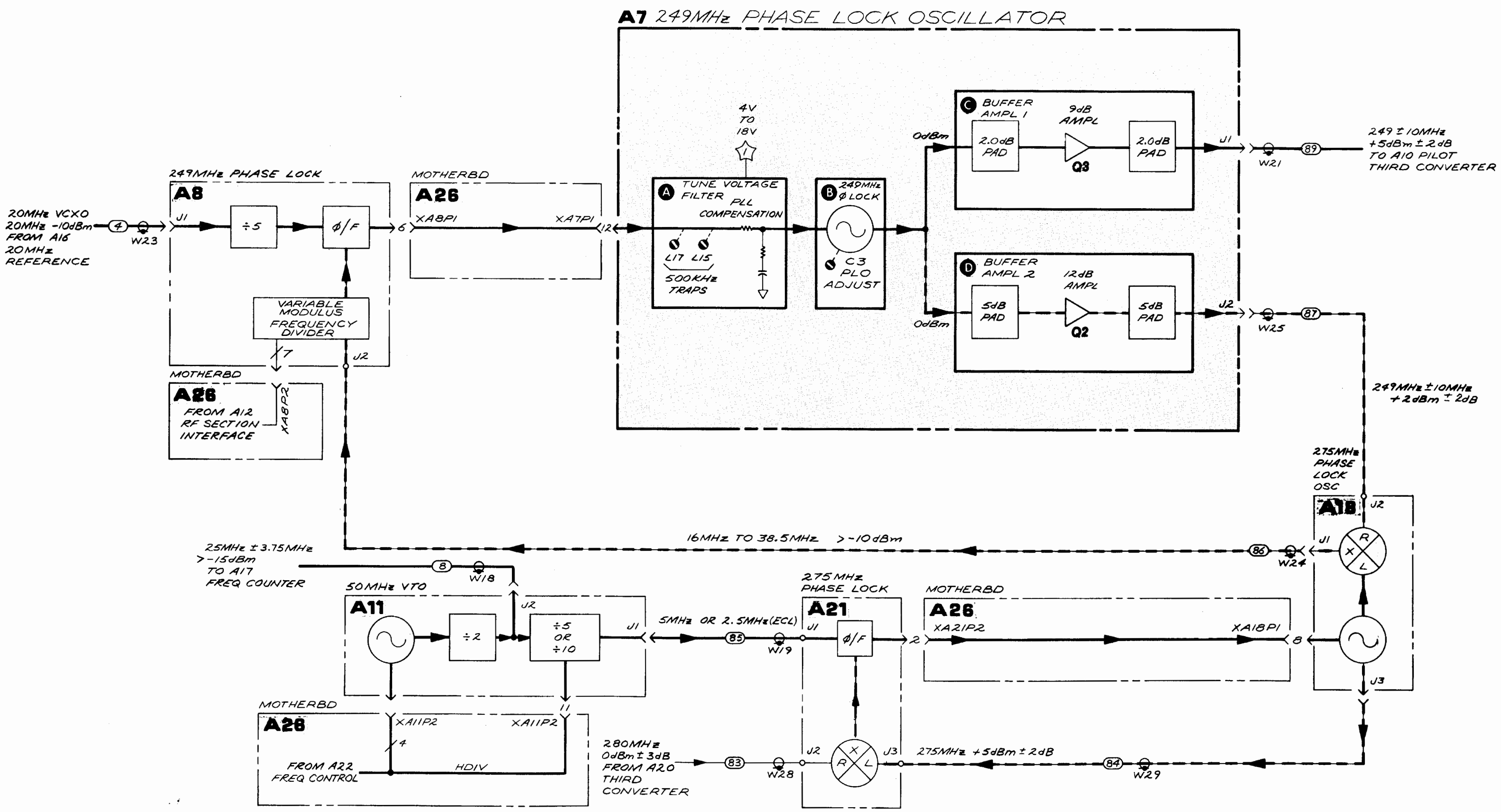
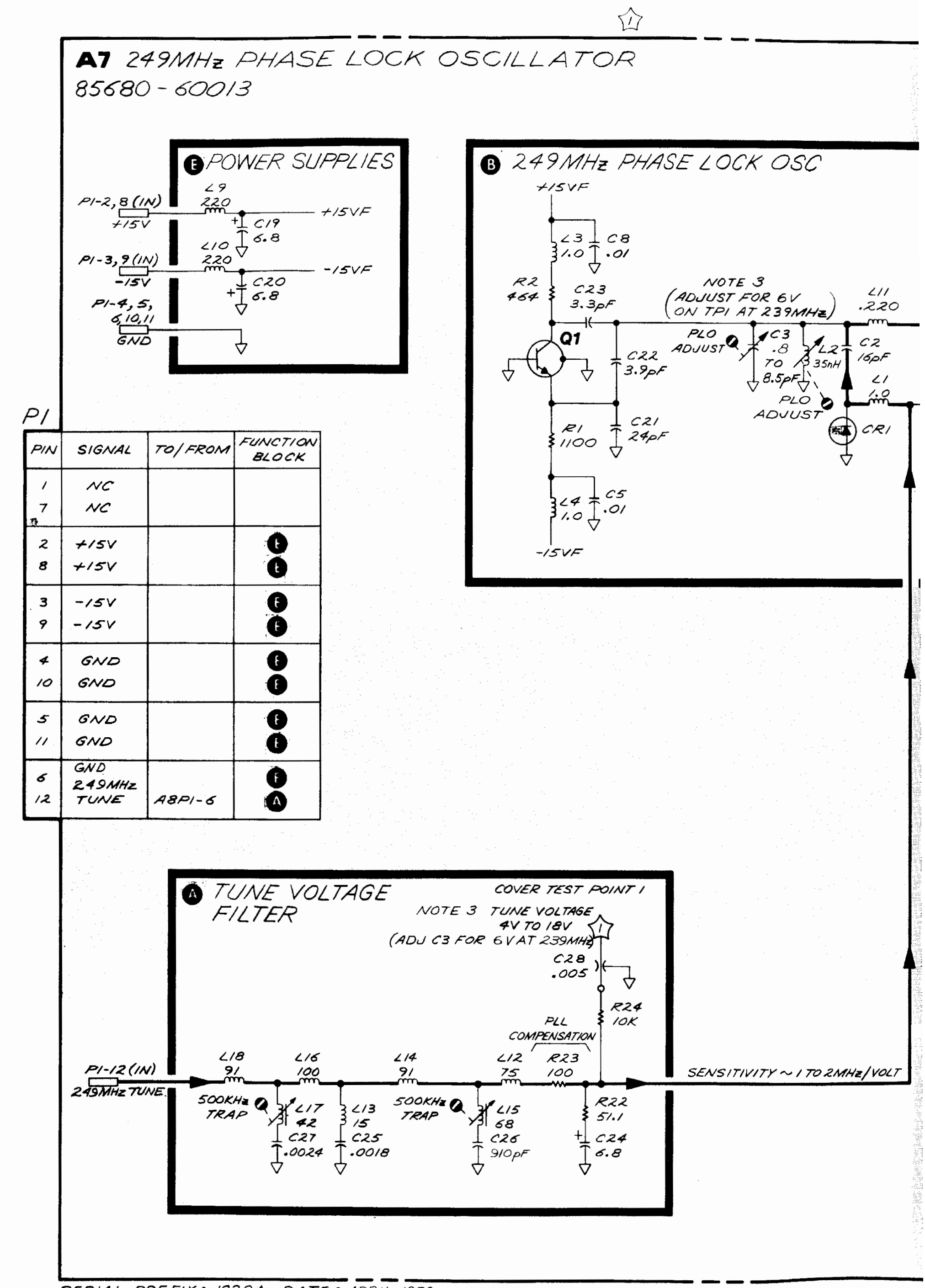


Figure 9-25. A7 249 MHz Phase Lock Oscillator, Component Locations

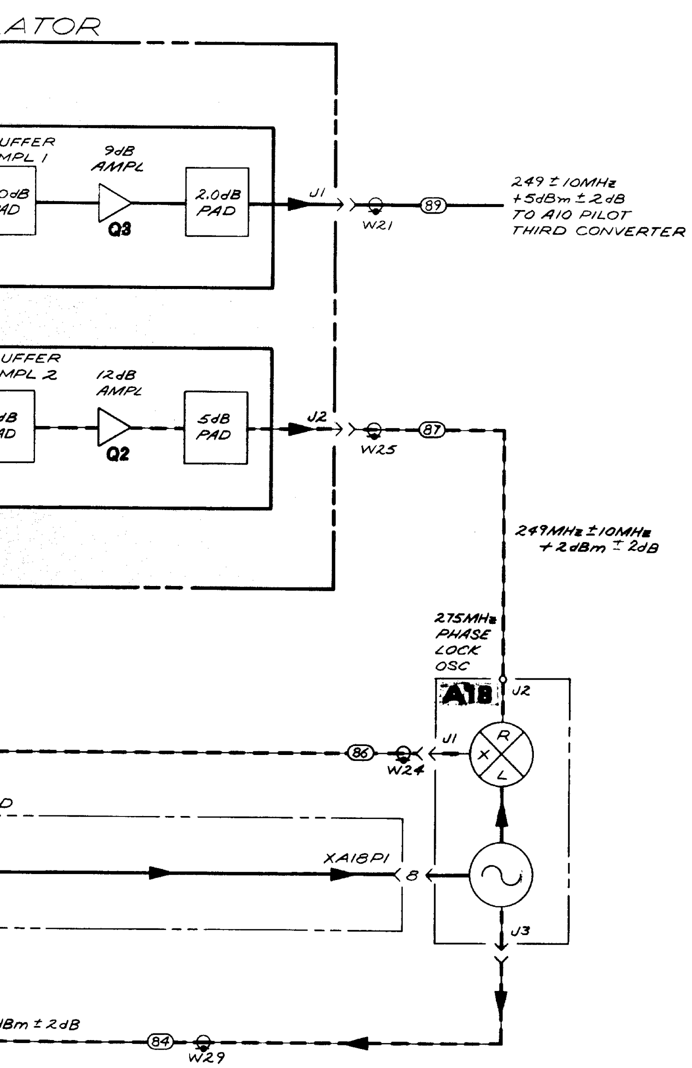




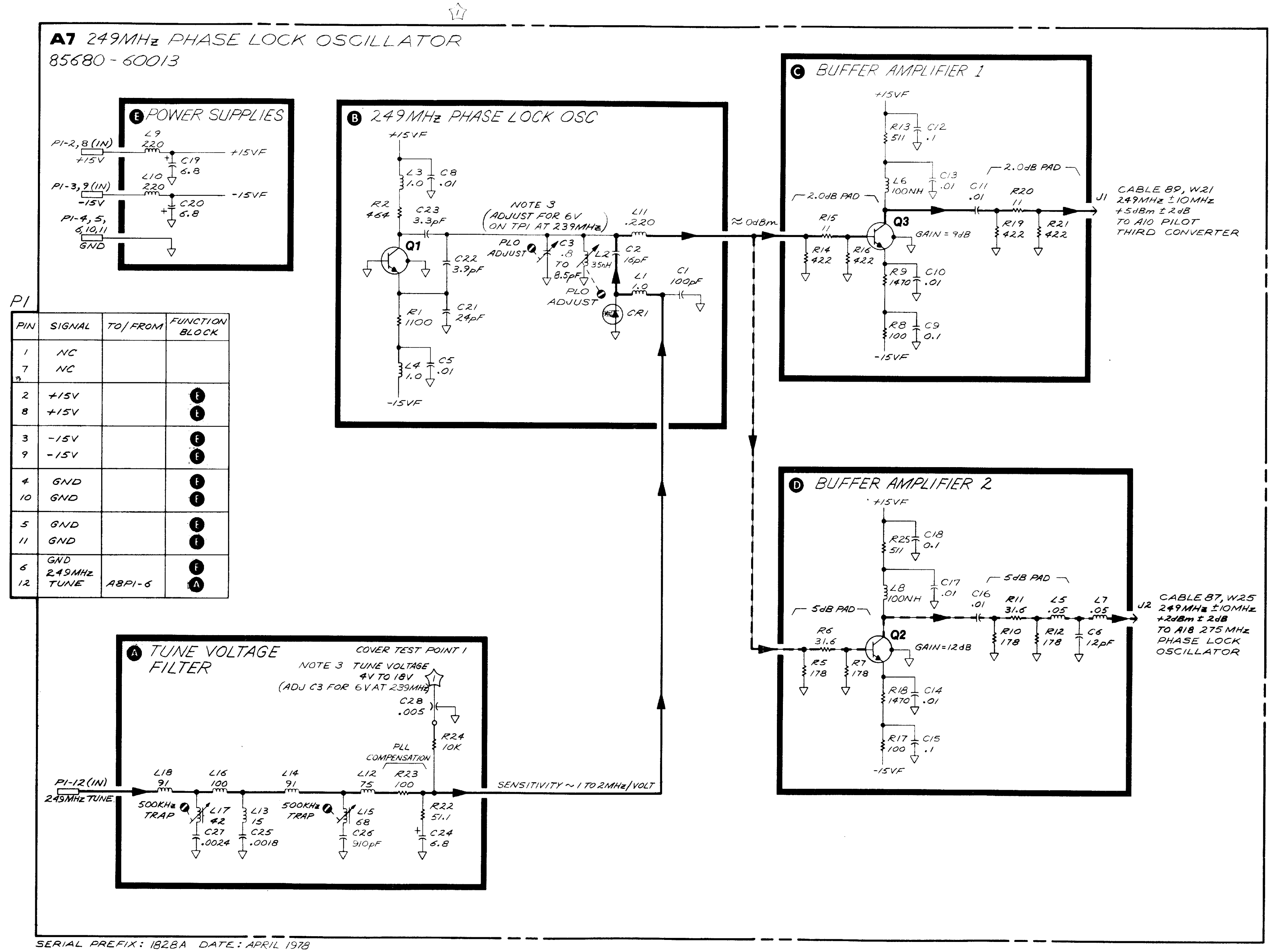
P1

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

Figure 9-26. A7 249 MHz Phase Lock Oscillator, Block Diagram



249 MHz Phase Lock Oscillator, Block Diagram



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

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω) CAPACITANCE IN MICROFARADS (μF) INDUCTANCE IN MICROHENRIES (μH).

A7

Figure 9-27. A7 249 MHz Phase Lock Oscillator, Schematic Diagram

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 ÷ 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 of 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, Q4 and associated circuitry buffer the 16 - 38.5 MHz to ECL level on the collector of Q4 (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 Processor 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 6 will pulse n times for every 8 of its clock pulses, where $n = (D_5 \times 2^1) + (D_4 \times 2^1) + D_3$. If U14 pin 6 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 ÷ 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 9-8 gives N, M, and P for some selected frequencies:

Table 9-8. 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] [MKR→ REF LVL]. The diagnostic data is displayed in the upper left-hand corner of the CRT as shown in Figure 9-28. A description of each number is given in Table 9-9.

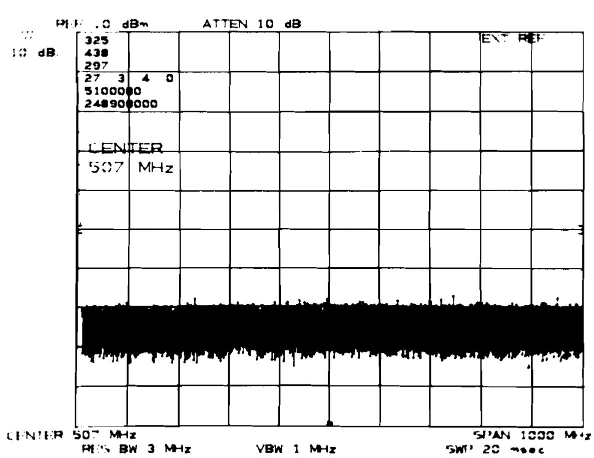


Figure 9-28. CRT Display Showing Location of Diagnostic Data

Table 9-9. 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
Ø	No Second LO shift
51ØØØØØ	50 MHz VTO reference frequency (5.1 MHz)
2489ØØØØØØ	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 ÷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 ($\bar{Q}$) 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 high output (pin 15) of U3B are inputs to NOR gate U1C. The remaining outputs (U3A pin 2 and U3B pin 14) 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 (SHIFT MKR→ REF LVL). 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 INSTR PRESET . 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 9-10 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 9-10. 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 9-11. A8 249 MHz Phase Lock, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8	85680-60014	1	BOARD ASSEMBLY, 249MHZ PHASE LOCK (INCLUDES W24)	28480	85680-60014
A8C1	0160-2055	10	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C9	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A8C10	0140-0198	4	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A8C11	0140-0198		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A8C12	0140-0198		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A8C13	0140-0198		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A8C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C16	0160-2201	4	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A8C17	0160-0161	2	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A8C18	0180-0100	2	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X903582
A8C19	0180-0229	2	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X901082
A8C20	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X901082
A8C21	0180-0100		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X903582
A8C22	0160-2201		CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A8C23	0160-0161		CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A8C24	0160-2201		CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A8C25	0160-2201		CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A8CR1	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8DS1	1990-0486	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A8J1	1250-0690	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A8J2			PART OF W24		
A8L1	9100-2247	1	COIL-MLD 100NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2247
A8L2			NOT ASSIGNED		
A8L3	9100-1618	2	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A8L4	08558-80011	2	FILTER, COIL, BLUE	28480	08558-80011
A8L5	08558-80011		FILTER, COIL, BLUE	28480	08558-80011
A8L6	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A8Q1	1853-0007	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A8Q2	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A8Q3	1853-0018	2	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A8Q4	1853-0018		TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A8Q5	1854-0404	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A8Q6	1854-0023	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A8Q7	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A8R1	0757-0405	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A8R2	0757-0401	3	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A8R3	0757-0280	12	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R5	0757-0288	3	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R6	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R7	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R8	0757-0289	3	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A8R9	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A8R10	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A8R11	0698-3437	2	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A8R12	0757-0399	5	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A8R13	0698-3443	3	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A8R14	0757-0418	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A8R15	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A8R16	0757-0422	1	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A8R17	0757-0402	1	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A8R18	0698-3441	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A8R19	0757-0424	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A8R20	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R21	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R22	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A8R23	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R24	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A8R25	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F

Table 9-11. A8 249 MHz Phase Lock, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R26	0757-0274	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A8R27	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A8R28	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A8R29	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A8R30	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A8R31	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R32	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R33	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R34	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R35	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R36	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R37	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R38	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R39	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R41	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A8R42	0698-3156	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A8R43	0698-3154	2	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A8R44	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A8R45	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A8R46	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A8TP1	0360-0124	7	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A8TP2	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A8TP3	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A8TP4	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A8TP5	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A8TP6	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A8TP7	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A8U1	1820-0802	3	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A8U2	1810-0204	3	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R1K
A8U3	1820-0817	2	IC FF ECL D-M/S DUAL	04713	MC10131P
A8U4	1820-1383	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A8U5	1820-0821	1	IC CNTR ECL BIN UP/DOWN SYNCHRO	04713	MC10136L
A8U6	1820-0807	1	IC GATE ECL OR DUAL 3-INP	04713	MC10110P
A8U7	1826-0319	1	IC OP AMP TO-99	27014	LF356H
A8U8	1820-0817		IC FF ECL D-M/S DUAL	04713	MC10131P
A8U9	1810-0204		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R1K
A8U10	1820-0802		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A8U11	1820-0801	1	IC GATE ECL OR-NOR QUAD 2-INP	04713	MC10101P
A8U12	1810-0204		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R1K
A8U13	1820-0802		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A8U14	1820-0744	1	IC CNTR TTL BIN SYNCHRO POS-EDGE-TRIG	01295	SN7497N
A8U15	1820-1196	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
			A8 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001

Table 9-12. A8 249 MHz Phase Lock, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C3	R4	B3	TP6	C3		
C2	B3	R5	B4	TP7	B2		
C3	B3	R6	B3				
C4	C4	R7	B3	U1	C1		
C5	C3	R8	B3	U2	C1		
C6	C3	R9	B3	U3	C2		
C7	C2	R10	B4	U4	C2		
C8	C2	R11	C4	U5	C3		
C9	B3	R12	C4	U6	C4		
C10	B2	R13	B4	U7	B2		
C11	B1	R14	B4	U8	B2		
C12	B1	R15	B4	U9	B2		
C13	C2	R16	B4	U10	B3		
C14	B2	R17	C2	U11	B3		
C15	B2	R18	C2	U12	B3		
C16	C1	R19	C2	U13	B3		
C17	B1	R20	C2	U14	B4		
C18	B1	R21	C2	U15	B4		
C19	A2	R22	B3				
C20	A2	R23	C4				
C21	C1	R24	C4				
C22	B2	R25	C4				
C23	B2	R26	C4				
C24	C3	R27	C3				
C25	C3	R28	C3				
		R29	C4				
CR1	B2	R30	C3				
		R31	C2				
DS1	C4	R32	B2				
		R33	C1				
J1	D2	R34	B1				
J2	D3	R35	C1				
		R36	B1				
L1	C3	R37	C1				
L3	B1	R38	B2				
L4	A2	R39	B1				
L5	A2	R40	B2				
L6	B1	R41	B2				
		R42	B1				
Q1	C2	R43	B1				
Q2	C2	R44	B2				
Q3	C3	R45	B2				
Q4	C3	R46	C2				
Q5	C4	R47	C2				
Q6	B1						
Q7	B2	TP1	C1				
		TP2	C2				
R1	C3	TP3	C2				
R2	C3	TP4	B2				
R3	C3	TP5	C2				

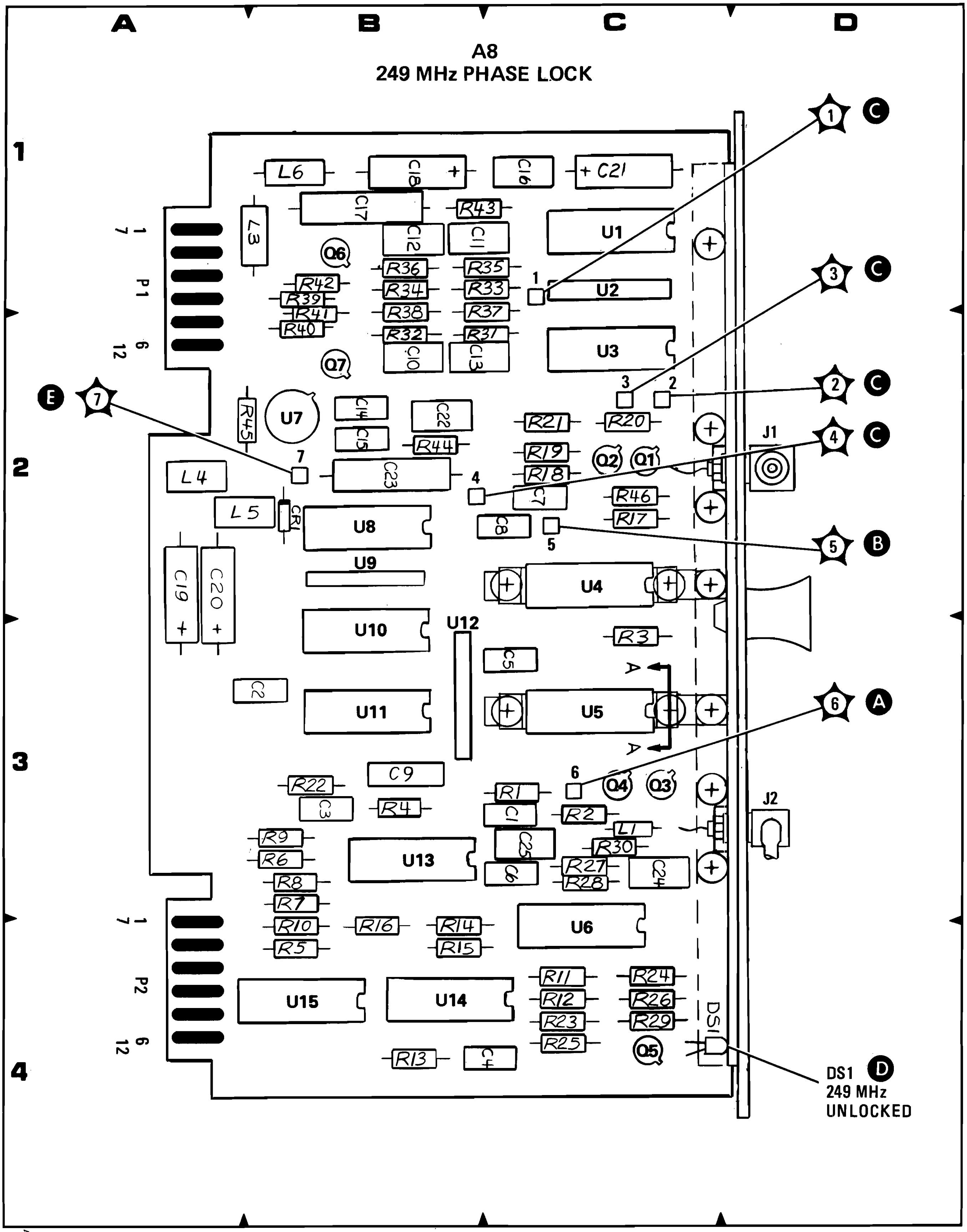
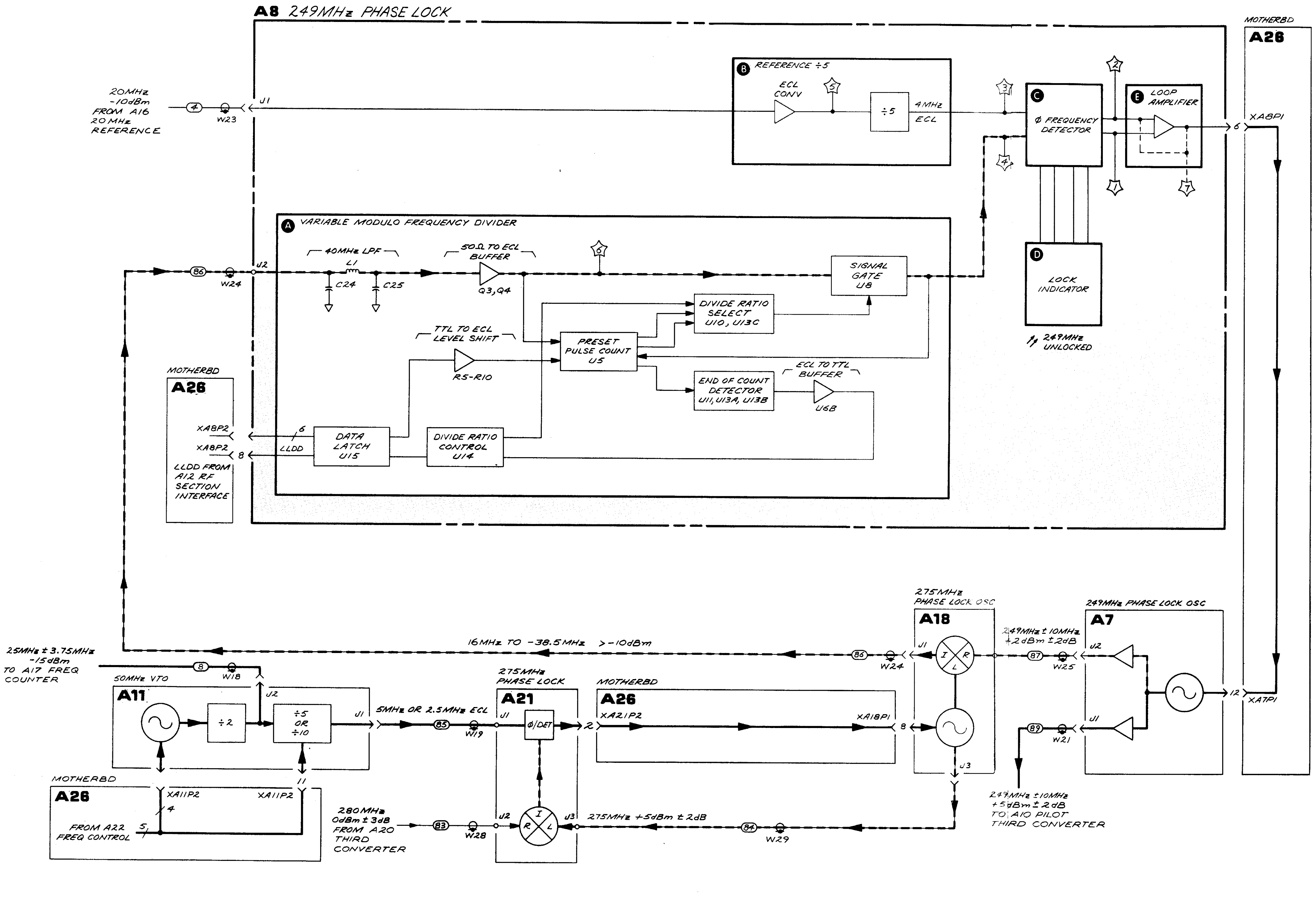


Figure 9-29. A8 249 MHz Phase Lock, Component Locations



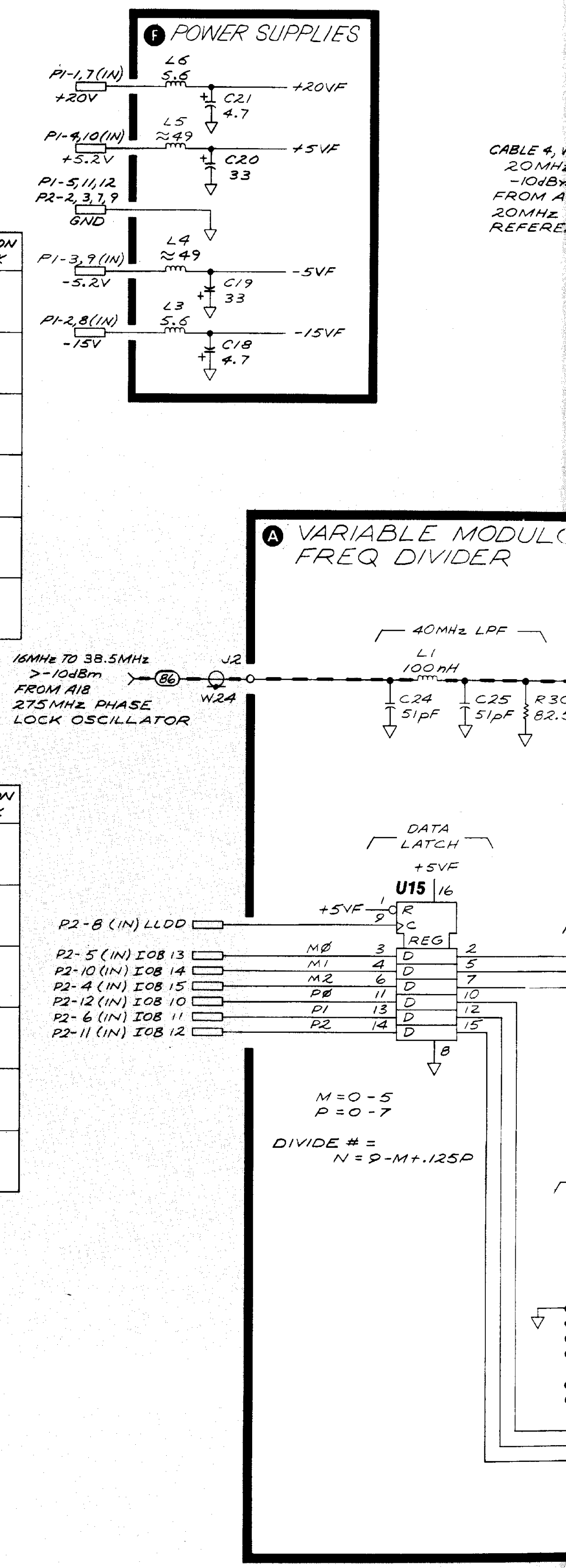
A8 249MHz PHASE LOCK
85680-60014

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+20V		F
7	+20V		F
2	-15V		F
8	-15V		F
3	-5.2V		F
9	-5.2V		F
4	+5.2V		F
10	+5.2V		F
5	GND		F
11	GND		F
6	249MHz TUNE	A7P1-12	E
12	GND		F

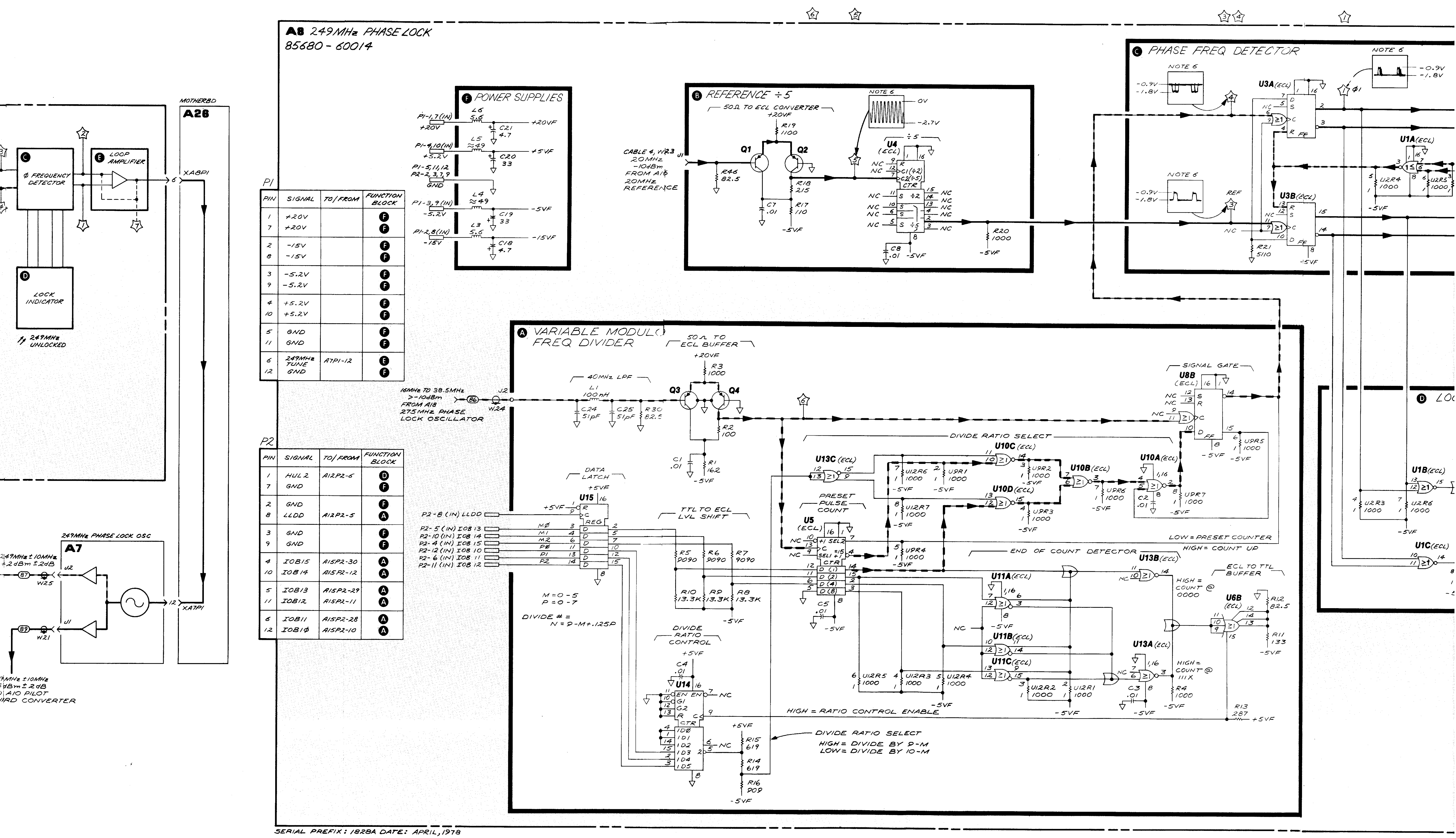
P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HUL 2	A12P2-6	D
7	GND		F
2	GND		F
8	LLDD	A12P2-5	A
3	GND		F
9	GND		F
4	IOB15	A15P2-30	A
10	IOB14	A15P2-12	A
5	IOB13	A15P2-29	A
11	IOB12	A15P2-11	A
6	IOB11	A15P2-28	A
12	IOB1Φ	A15P2-10	A



SERIAL PREFIX: 1828A DATE: APRIL, 1978

Figure 9-30. A8 249 MHz Phase Lock, Block Diagram



P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+20V		F
7	+20V		F
2	-15V		F
8	-15V		F
3	-5.2V		F
9	-5.2V		F
4	+5.2V		F
10	+5.2V		F
5	GND		F
11	GND		F
6	249MHz TUNE	A7P1-12	E
12	GND		E

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HUL 2	A12P2-6	D
7	GND		F
2	GND		F
8	LLDD	A12P2-5	A
3	GND		F
9	GND		F
4	IOB15	A15P2-30	A
10	IOB14	A15P2-12	A
5	IOB13	A15P2-29	A
11	IOB12	A15P2-11	A
6	IOB11	A15P2-28	A
12	IOB10	A15P2-10	A

A8 249 MHz Phase Lock, Block Diagram

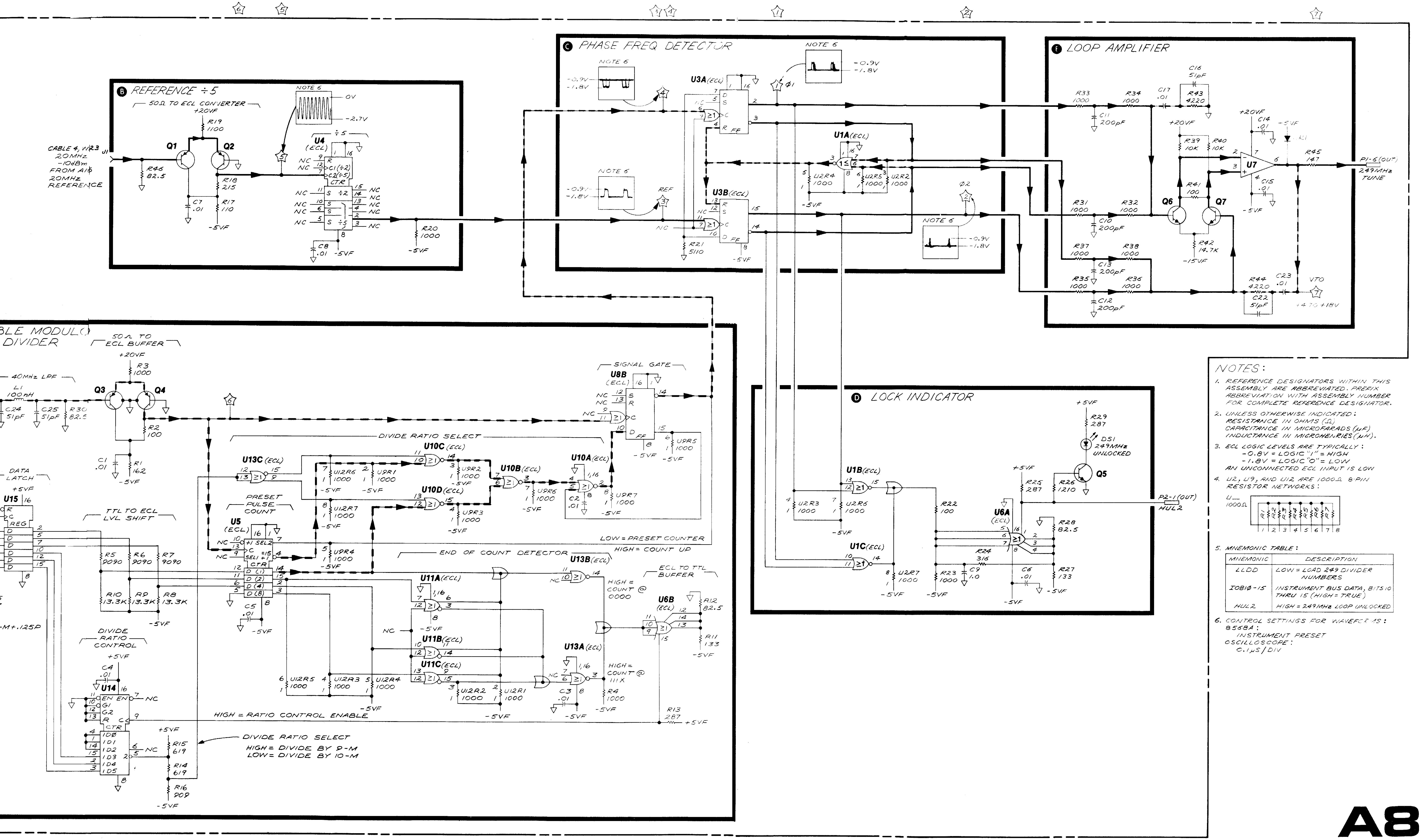


Figure 9-31. A8 249 MHz Phase Lock, Schematic Diagram

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 50Ω 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 9-13. A9 Pilot Second IF Amplifier, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9	85680-60009	1	BOARD ASSEMBLY, PILOT SECOND IF AMPL	28480	85680-60009
A9C1	0160-3873	3	CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A9C2	0160-3874	1	CAPACITOR-FXD 10PF +-.5PF 200VDC	28480	0160-3874
A9C3	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A9C4	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A9C5	0160-3466	2	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A9C6	0160-2055	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C7	0160-2261	1	CAPACITOR-FXD 15PF +-5% 500VDC CER0+-30	28480	0160-2261
A9C8	0160-3466		CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A9C9	0121-0493	4	CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A9C10	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A9C11	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A9C12	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A9C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A9C14	0160-3456	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A9J1	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A9J2	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A9L1	85680-80009	2	INDUCTOR, 35 NH	28480	85680-80009
A9L2	85680-80009		INDUCTOR, 35 NH	28480	85680-80009
A9L3	9100-0346	1	COIL-MLD 50NH 20% Q=40 .095DX.25LG	28480	9100-0346
A9L4	85680-80015	2	TRANSFORMER	28480	85680-80015
A9L5	85680-80008	2	INDUCTOR, 50 NH	28480	85680-80008
A9L6	85680-80008		INDUCTOR, 50 NH	28480	85680-80008
A9L7	85680-80015		TRANSFORMER	28480	85680-80015
A9L8	9100-2247	1	COIL-MLD 100NH 10% Q=34 .095DX.25LG	02178	09-4416-1K
A9Q1	1854-0686	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A9Q2	1853-0050	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A9R1	0757-0200	2	RESISTOR 5.62K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5621-F
A9R2	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-9091-F
A9R3	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5621-F
A9R4	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F

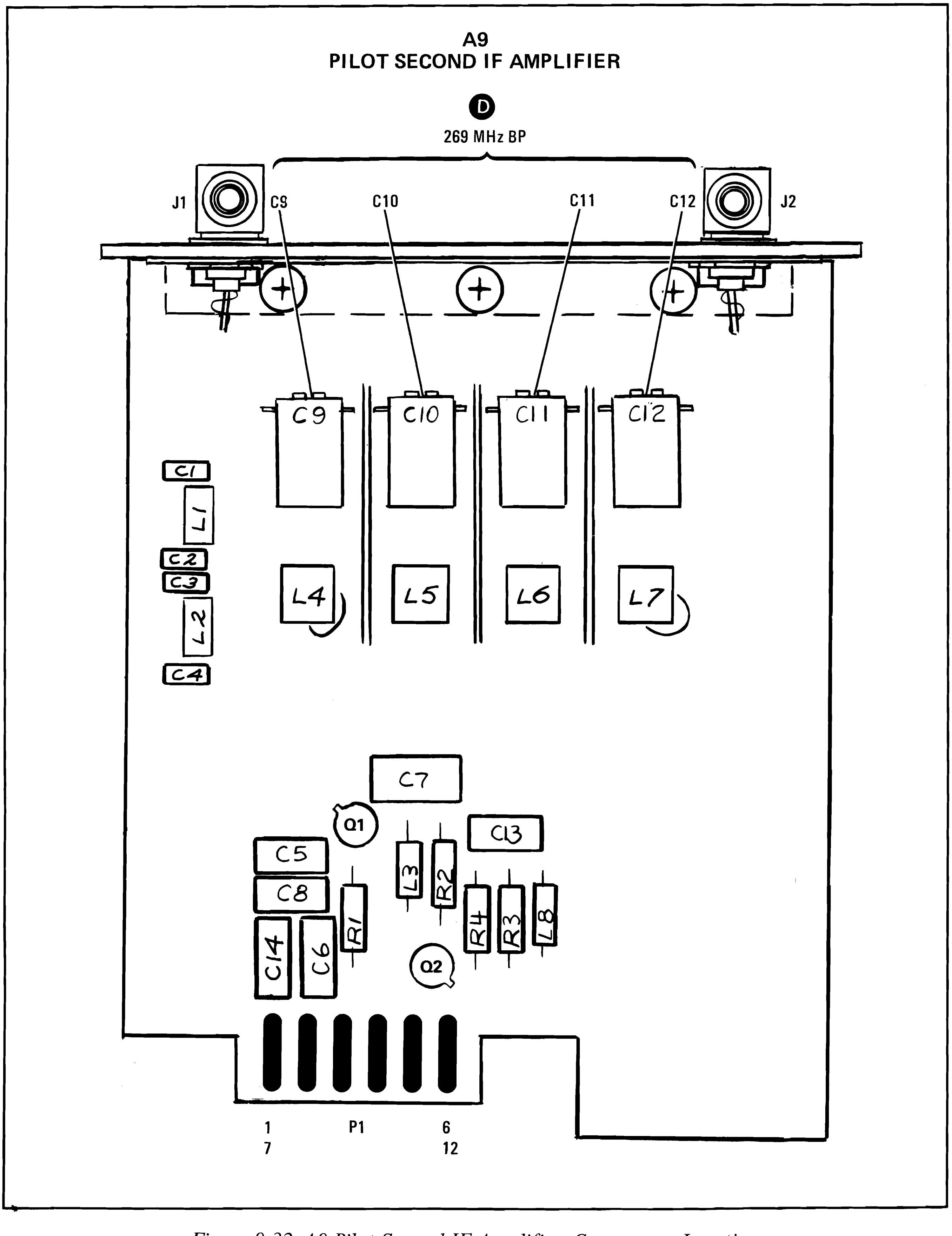


Figure 9-32. A9 Pilot Second IF Amplifier, Component Locations

Table 9-14. A10 Pilot Third Converter, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10	85680-60010	1	BOARD ASSEMBLY, PILOT THIRD CONVERTER	28480	85680-60010
A10C1	0160-3456	2	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A10C2	0160-2055	6	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C6	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A10C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C8	0140-0190	1	CAPACITOR-FXD 39PF +-5% 300VDC MICA	72136	DM15E390J0300WV1CR
A10C9	0140-0195	1	CAPACITOR-FXD 130PF +-5% 300VDC MICA	72136	DM15F131J0300WV1CR
A10C10			NOT ASSIGNED		
A10C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C12	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10J1			PART OF W20		
A10J2			PART OF W21		
A10J3	1250-0690	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A10L1	9100-2252	2	COIL-MLD 270NH 10% Q=30 .095DX.25LG-NOM	28480	9100-2252
A10L2	9100-2252		COIL-MLD 270NH 10% Q=30 .095DX.25LG-NOM	28480	9100-2252
A10L3	9100-2250	1	COIL-MLD 180NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2250
A10L4	9140-0179	1	COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A10Q1	1854-0247	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A10Q2	1854-0345	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A10R1	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A10R2	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R3	0698-3439	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	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A10R6	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R7	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R8	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A10R9*	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A10R10	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10U1	0955-0063	1	MIXER, DOUBLE BALANCE 200 MW	28480	0955-0063

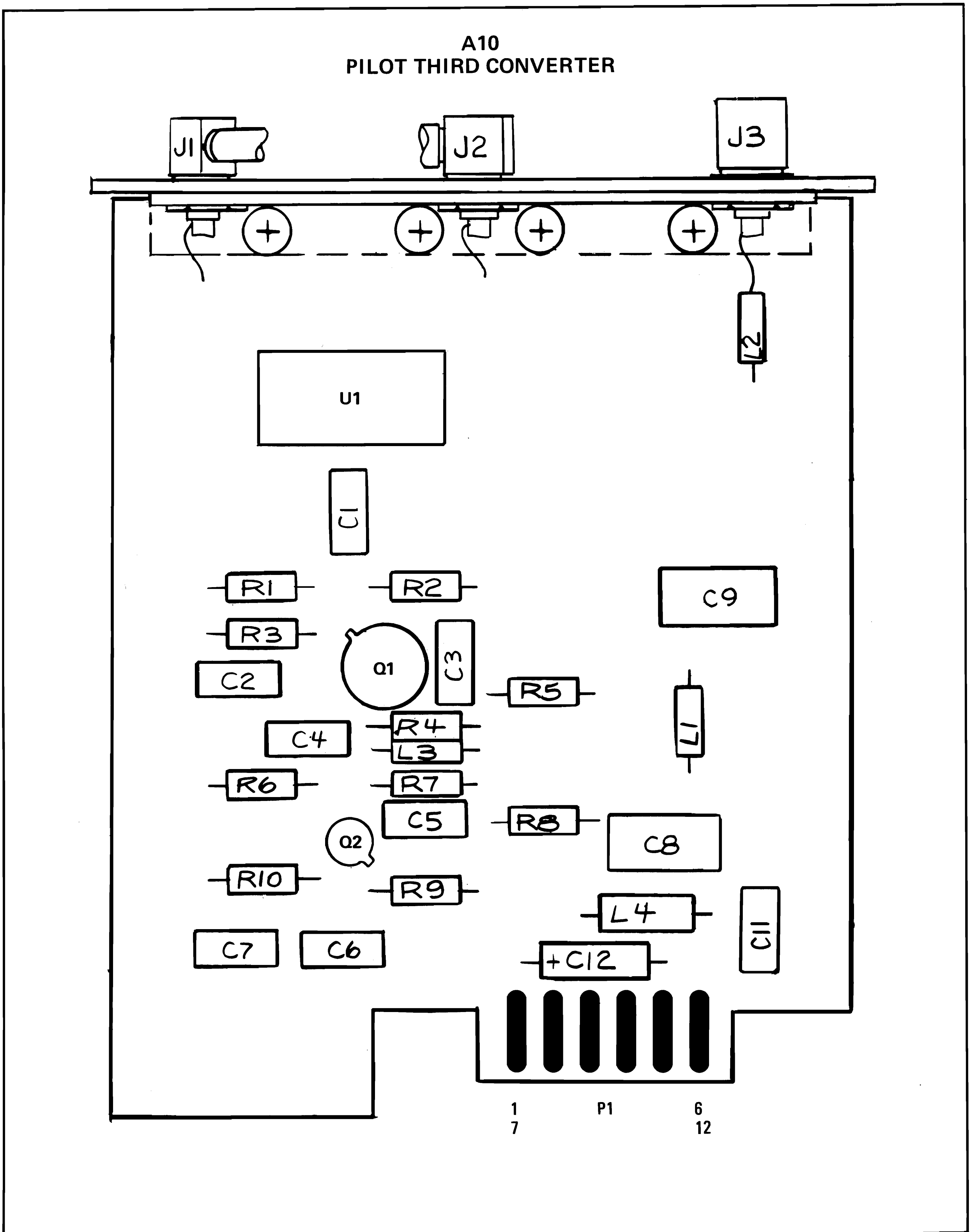
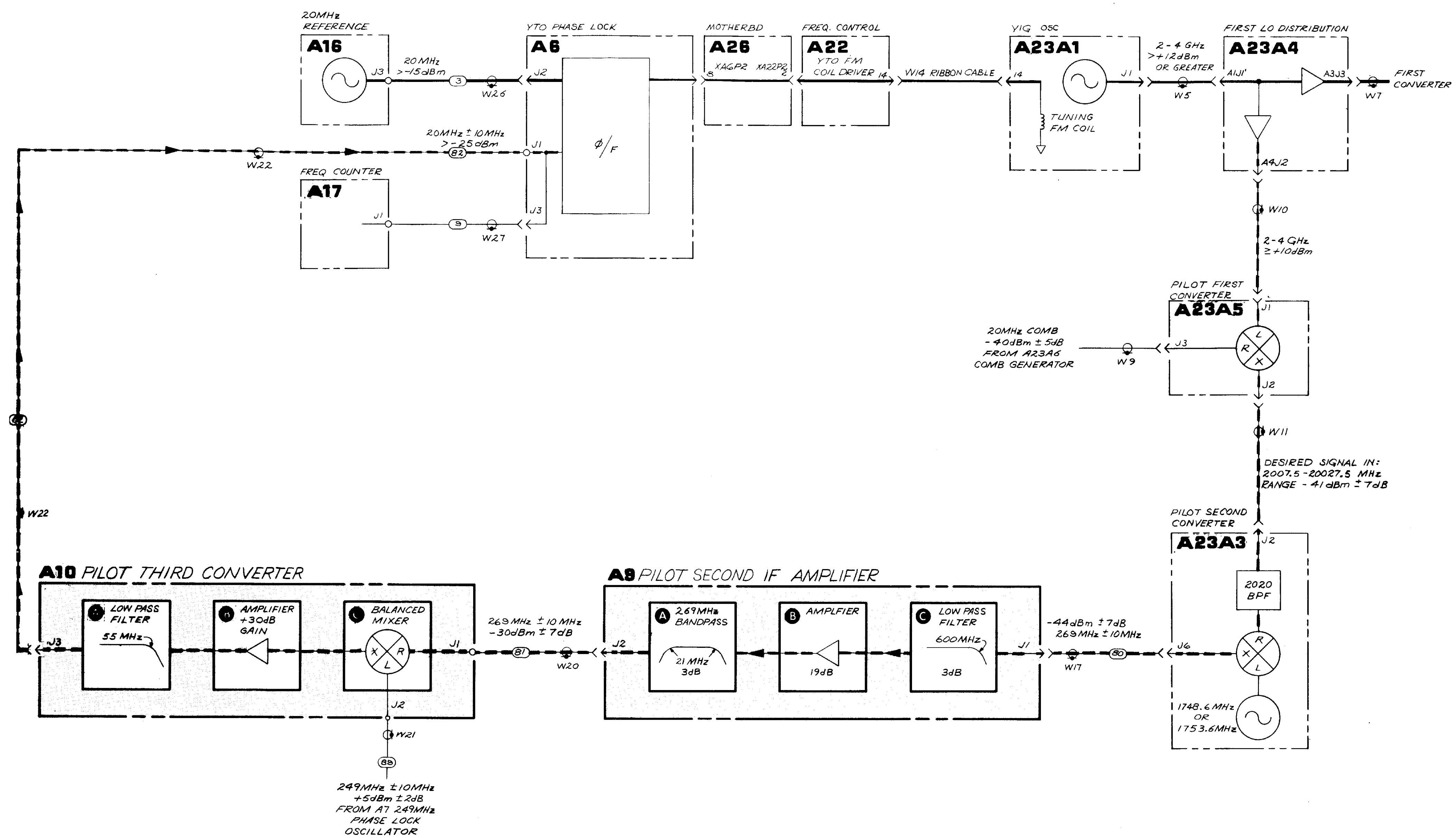


Figure 9-33. A10 Pilot Third Converter, Component Locations



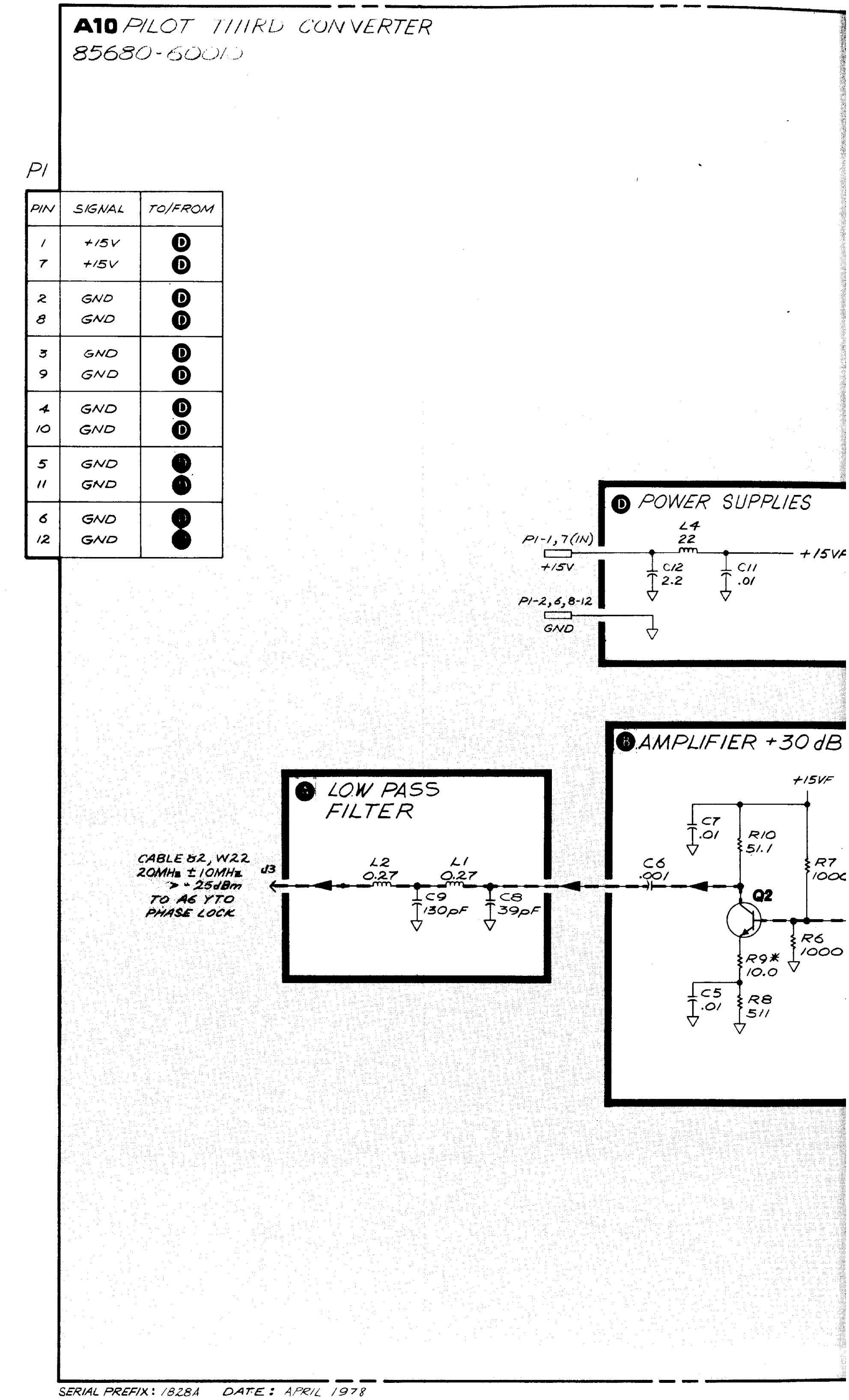
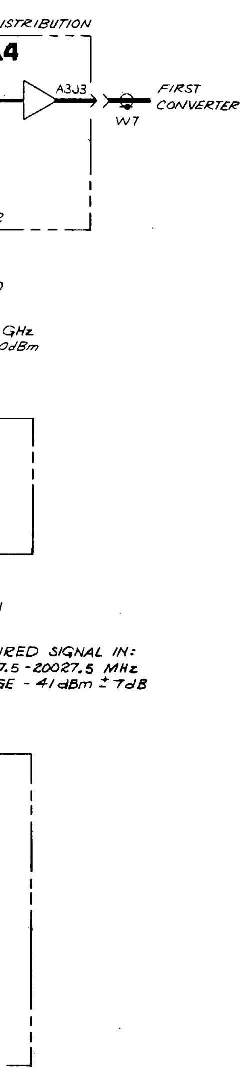
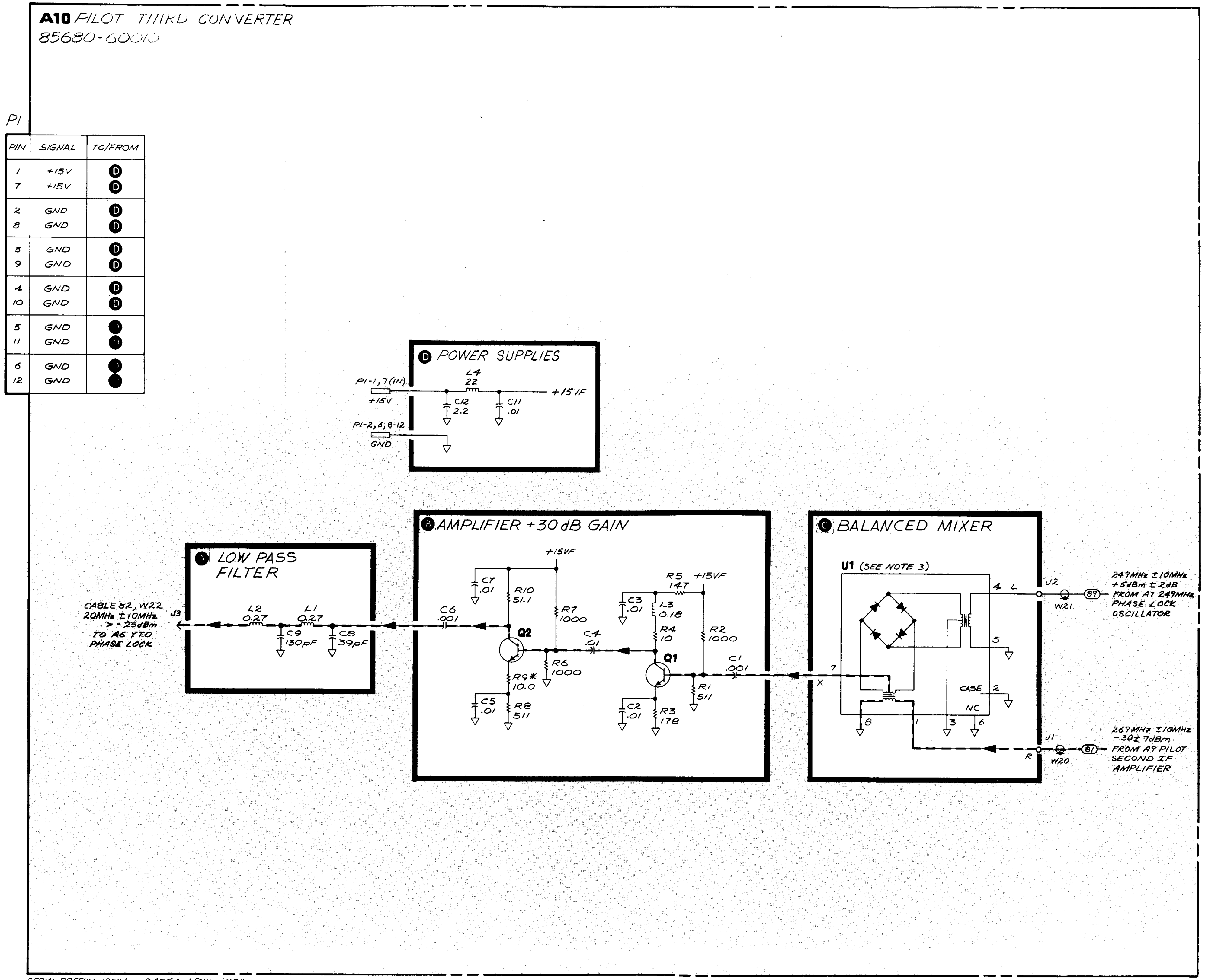
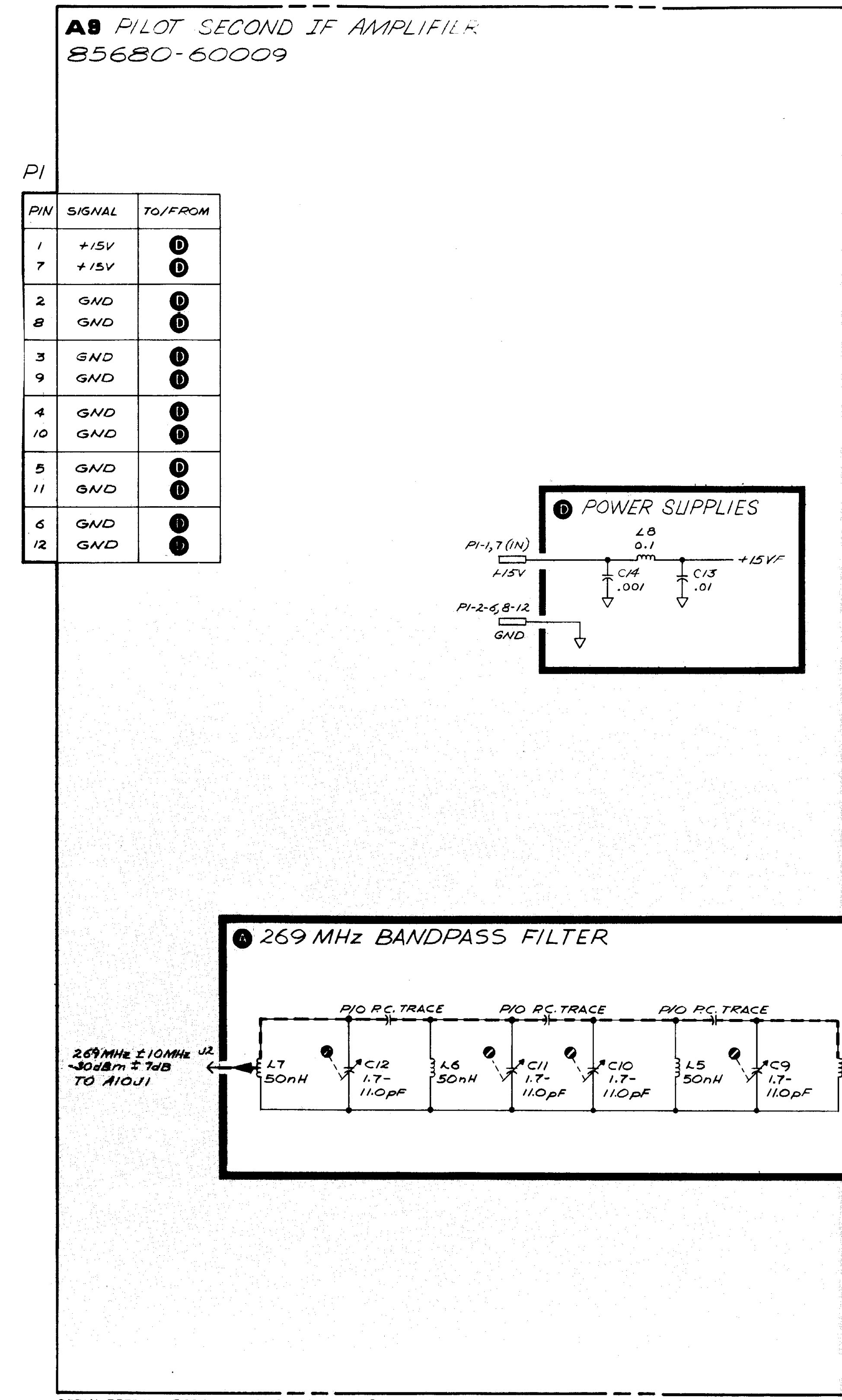


Figure 9-34. A9 Pilot Second IF Amplifier and A10 Pilot Third Converter, Block Diagram





SERIAL PREFIX: 1828A DATE: APRIL 1978



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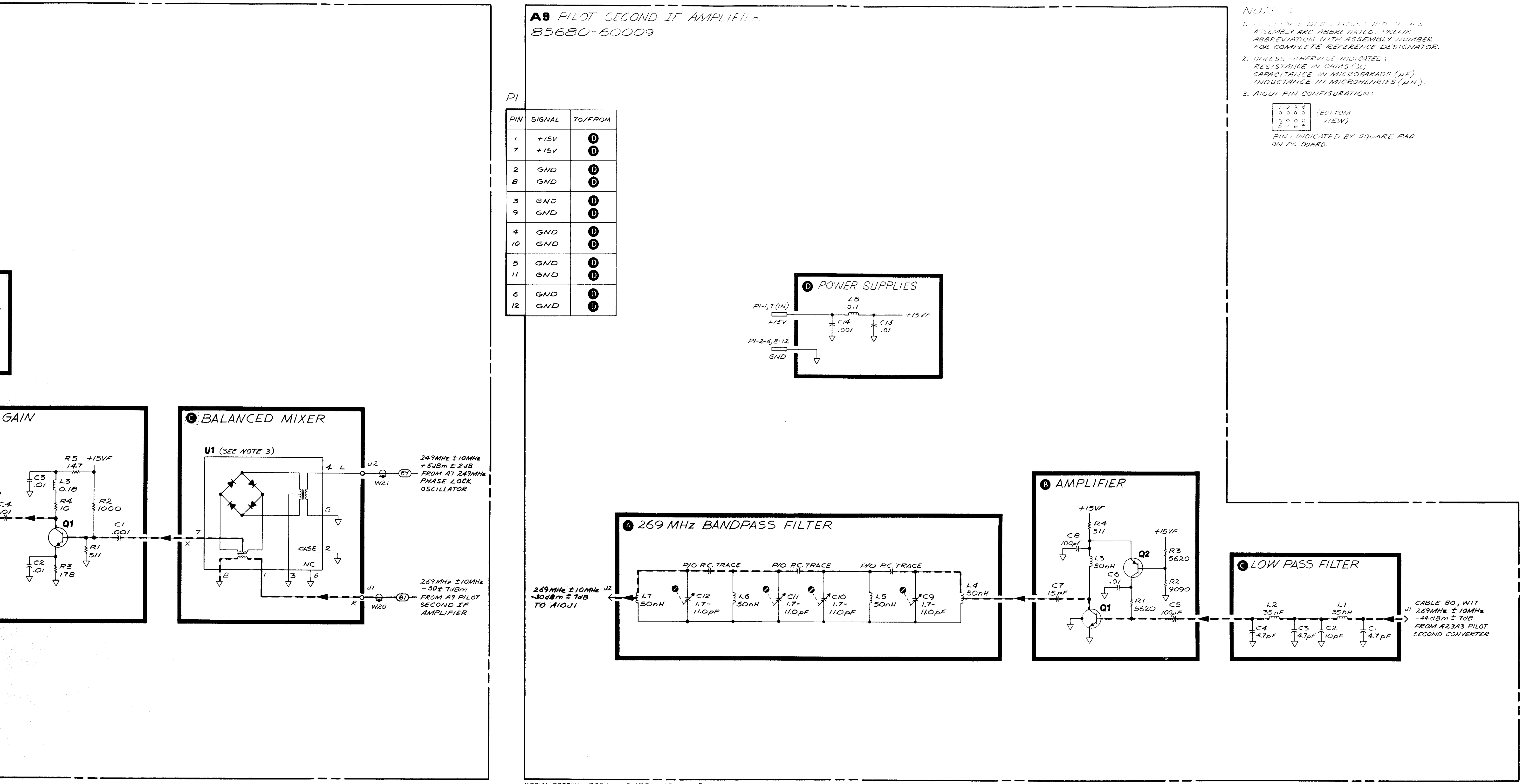


A9

A10

Figure 9-35. A9 Pilot Second IF Amplifier and A10 Pilot Third Converter, Schematic Diagram

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 (±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 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 −15V, 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 9-15. A11 50 MHz Voltage-Tuned Oscillator, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11	85680-60017	1	BOARD ASSEMBLY, 50 MHZ VOLTAGE-TUNED OSC (INCLUDES W18)	28480	85680-60017
A11C1	0160-2055	17	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C2	0180-0116	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A11C3	0180-0229	4	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A11C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C5	0180-1746	3	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A11C6	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A11C7	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A11C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C10	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A11C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C14	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A11C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C18	0160-2261	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A11C19	0160-0949	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	28480	0160-0949
A11C20	0160-2016	1	CAPACITOR-FXD 62PF +-5% 500VDC MICA	28480	0160-2016
A11C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C23	0160-3456	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A11C24	0160-3402	1	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A11C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C28	0160-4084	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A11C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C30	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A11C31	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A11C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C33	0160-2437	2	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A11C34	0160-2437		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A11CR1	1901-0040	16	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR15	0122-0300	2	DIODE-VVC 100PF 5% C2/C20-MIN=2 BVR=20V	28480	0122-0300
A11CR16	0122-0300		DIODE-VVC 100PF 5% C2/C20-MIN=2 BVR=20V	28480	0122-0300
A11CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR18	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11J1	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A11J2			PART OF W18		
A11J3	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A11L1	9100-1618	3	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A11L2	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A11L3	9100-1621	1	COIL-MLD 18UH 10% Q=75 .155DX.375LG-NOM	28480	9100-1621
A11L4	9100-2811	1	COIL 200NH 5% Q=160 .312DX.875LG-NOM	28480	9100-2811
A11L5	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A11L6	9140-0114	1	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A11Q1	1854-0477	2	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A11Q2	1854-0404	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A11Q3	1853-0018	1	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A11Q4	1855-0020	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A11Q5	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A11Q6	1854-0023	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A11Q7	1853-0451	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799

See introduction to this section for ordering information

Table 9-15. A11 50 MHz Voltage-Tuned Oscillator, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R1	0757-0278	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A11R2	0757-0438	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A11R3	0757-0316	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A11R4	0757-0280	5	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R5	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R6	2100-1739	1	RESISTOR-TRMR 5K 10% WW SIDE-ADJ 20-TRN	02660	3810P-502
A11R7	0757-0288	2	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A11R8	0757-0317	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A11R9	2100-1972	1	RESISTOR-TRMR 20K 10% WW SIDE-ADJ 20-TRN	02660	3810P-203
A11R10	2100-2850	1	RESISTOR-TRMR 10K 10% WW SIDE-ADJ 20-TRN	02660	3810P-103
A11R11	0757-0439	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A11R12	0698-0083	2	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A11R13	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A11R14	0698-3160	3	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A11R15	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R16	0698-3160		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A11R17	2100-3123	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A11R18	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A11R19	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A11R20	0757-0276	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A11R21	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A11R22	0757-0398	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A11R23	0757-0399	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A11R24	0757-0400	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A11R25	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A11R26	0757-0402	2	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A11R27	0757-0403	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A11R28	0698-3437	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R29	0757-0443	2	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A11R30	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A11R31	0698-3136	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A11R32	0757-0199	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R33	0698-3159	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A11R34	0698-3160		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A11R35	0698-3161	1	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A11R36	0698-3162	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A11R37	0757-0458	3	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R38	0757-0460	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A11R39	0757-0461	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A11R40	0757-0462	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A11R41	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A11R42	2100-3103	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A11R43	0698-6630	1	RESISTOR 20K .1% .125W F TC=0+-25	28480	0698-6630
A11R44	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R45	0698-3450	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A11R46	0698-6977	1	RESISTOR 30K .1% .125W F TC=0+-25	28480	0698-6977
A11R47	0698-3158	1	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A11R48	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A11R49	0698-7236	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-G
A11R50	0698-7205	2	RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G
A11R51	0698-3151	4	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A11R52	0698-7239	1	RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-G
A11R53	0698-7188	1	RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A11R54	0698-7204	1	RESISTOR 46.4 .05W F TC=0±100	03292	C3-1/8-T00-46R4-G
A11R55	0698-7252	1	RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-G
A11R56	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A11R57	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A11R58	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R59	0698-3260	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A11R60	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R61	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R62	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R63	0698-0084	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A11R64	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R65	0698-3441	2	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A11R66	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A11R67	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A11R68	0698-0082	2	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A11R69	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A11R70	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R71	0698-4037	1	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A11R72	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A11R73	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A11R74	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A11R75	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F

Table 9-15. A11 50 MHz Voltage-Tuned Oscillator, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R76	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A11TP1			PART OF C33		
A11TP2			PART OF C34		
A11TP3	0360-0124	8	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP4	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP5	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP6	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP7	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP8	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP9	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11TP10	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A11U1	1820-1383	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A11U2	1820-0802	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A11U3	1820-0820	1	IC FF ECL J-BAR K-BAR COM CLOCK DUAL	04713	MC10135L
A11U4	1826-0261	1	IC 741 OP AMP TO-99	28480	1826-0261
A11U5	1826-0229	2	IC OP AMP TO-99	06665	OP-05CJ
A11U6	1826-0229		IC OP AMP TO-99	06665	OP-05CJ
A11VR1	1902-0680	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	24046	1N827
			A11 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001

Table 9-16. A11 50 MHz Voltage-Tuned Oscillator, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	B1	CR16	B3	R28	C3	TP1	D3
C2	B1	CR17	B3	R29	C3	TP2	D3
C3	C2	CR18	C4	R30	C3	TP3	B2
C4	C2			R31		TP4	B3
C5	C2	J1	D1	R32	C3	TP5	B3
C6	A3	J2	D1	R33	C3	TP6	B3
C7	C2	J3	D2	R34	C3	TP7	B3
C8	B3			R35	C3	TP8	B4
C9	B1	L1	B1	R36	C3	TP9	B4
C10	B1	L2	B1	R37	C3	TP10	B4
C11	B4	L3	A2	R38	C3		
C12	B4	L4	B3	R39	C3	U1	C1
C13	B3	L5	B2	R40	C3	U2	B1
C14	B4	L6	B3	R41	C4	U3	C2
C15	B2			R42	C4	U4	C2
C16	A2	Q1	C3	R43	B3	U5	B4
C17	B2	Q2	B2	R44	B1	U6	B4
C18	B2	Q3	B2	R45	C4		
C19	B2	Q4	B3	R46	B4	VR1	C2
C20	B2	Q5	B3	R47	C2		
C21	B3	Q6	B3	R48	C4		
C22	A2	Q7	B3	R49	B2		
C23	B2			R50	B2		
C24	B3	R1	C2	R51	C2		
C25	B2	R2	C2	R52	B2		
C26	B2	R3	C3	R53	B2		
C27	C1	R4	B1	R54	B2		
C28	C1	R5	C2	R55	B2		
C29	B4	R6	C3	R56	B3		
C30	B1	R7	C2	R57	C2		
C31	B2	R8	A3	R58	B1		
C32	B2	R9	C4	R59	B3		
C33	C3	R10	C4	R60	B1		
C34	C3	R11	C2	R61	B3		
		R12	C2	R62	B3		
CR1	C3	R13	B2	R63	C1		
CR2	C4	R14	B4	R64	B3		
CR3	C3	R15	A3	R65	B2		
CR4	C3	R16	B3	R66	B2		
CR5	C3	R17	C4	R67	B2		
CR6	C3	R18	C3	R68	C1		
CR7	C3	R19	C3	R69	C1		
CR8	C3	R20	C3	R70	C2		
CR9	C3	R21	C3	R71	C3		
CR10	C3	R22	C3	R72	B4		
CR11	C3	R23	C3	R73	C2		
CR12	C3	R24	C3	R74	B4		
CR13	C3	R25	C3	R75	C3		
CR14	C3	R26	C3	R76	C3		
CR15	B3	R27	C3				

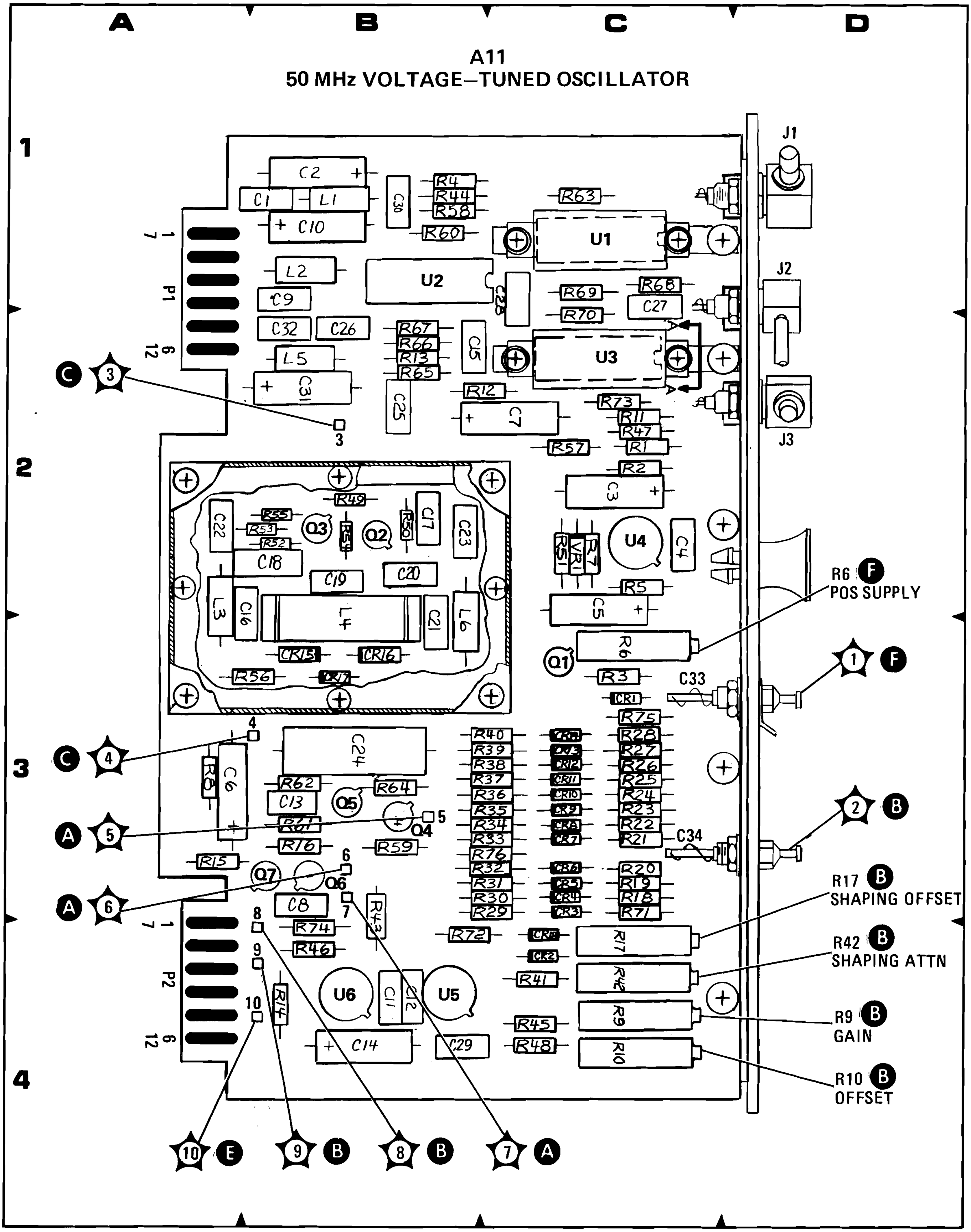
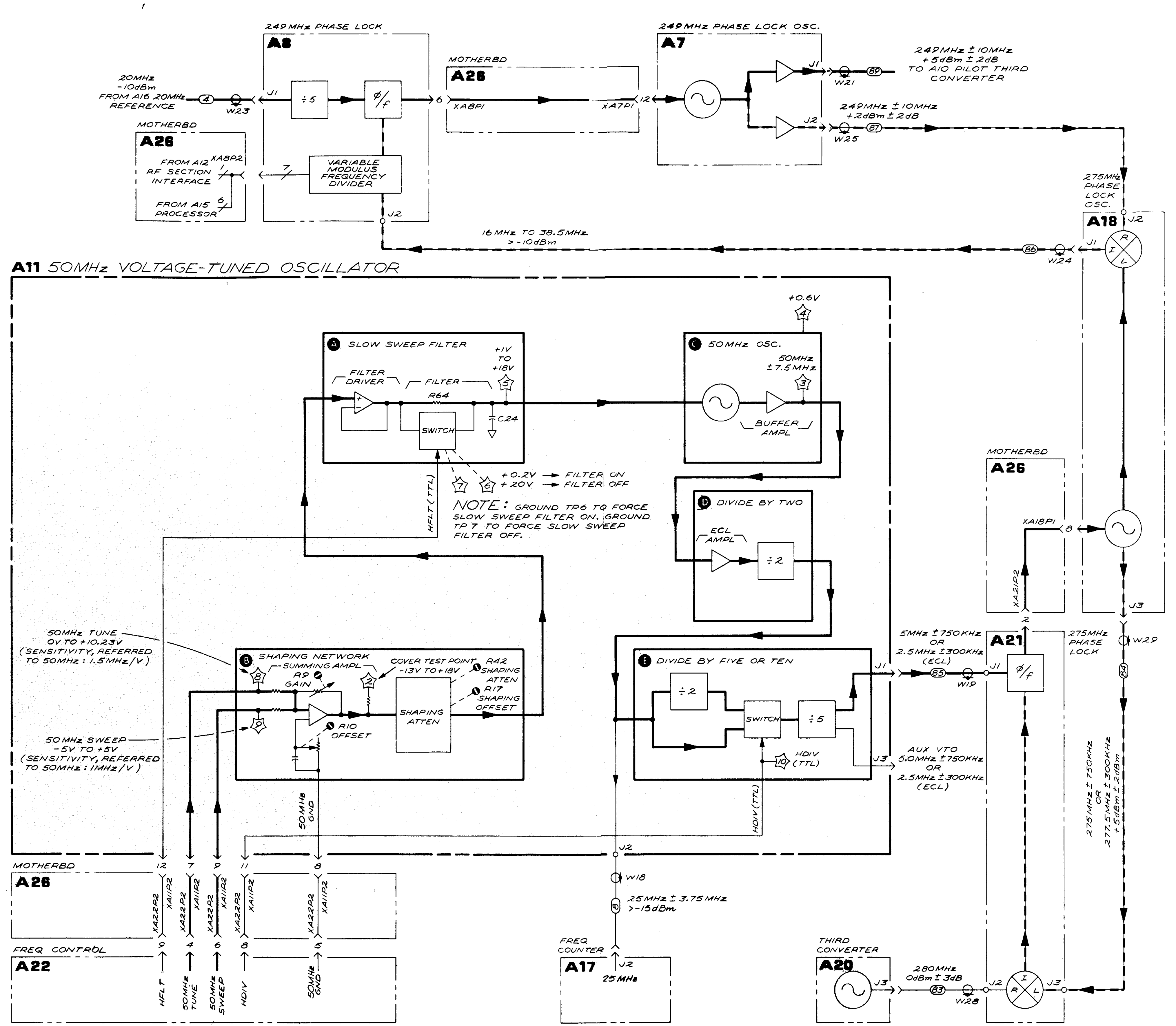


Figure 9-36. A11 50 MHz Voltage-Tuned Oscillator, Component Locations



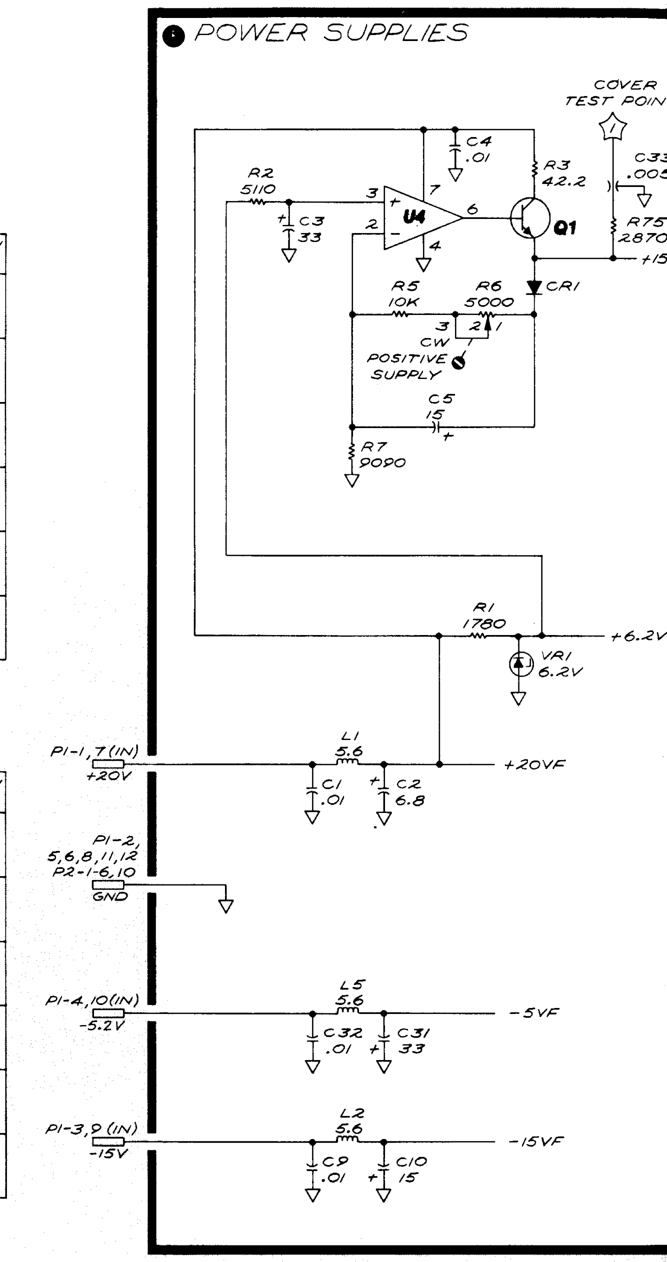
A11 50 MHz VOLTAGE-TUNED OSCILLATOR
85680-60017

P1

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

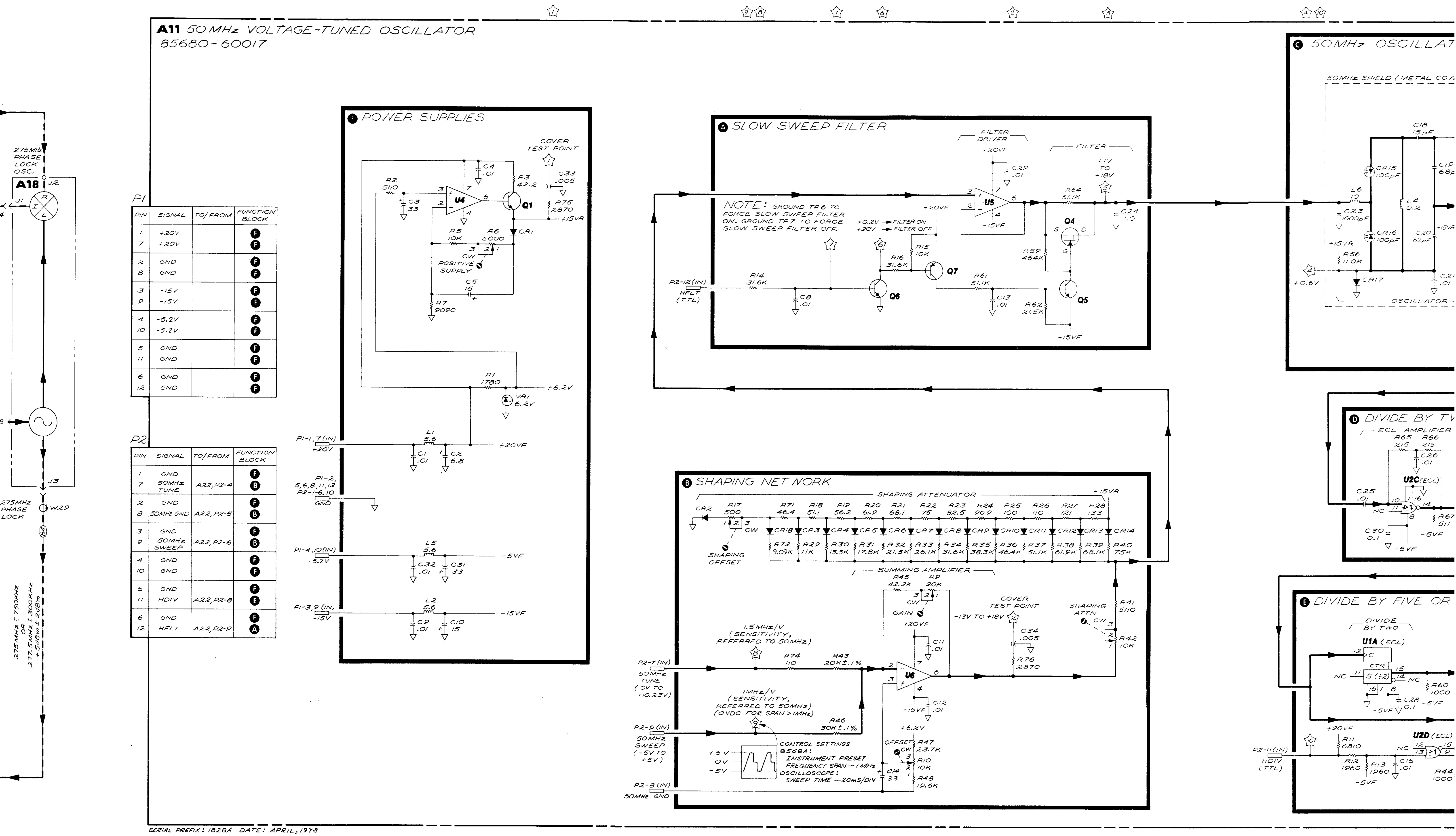
P2

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



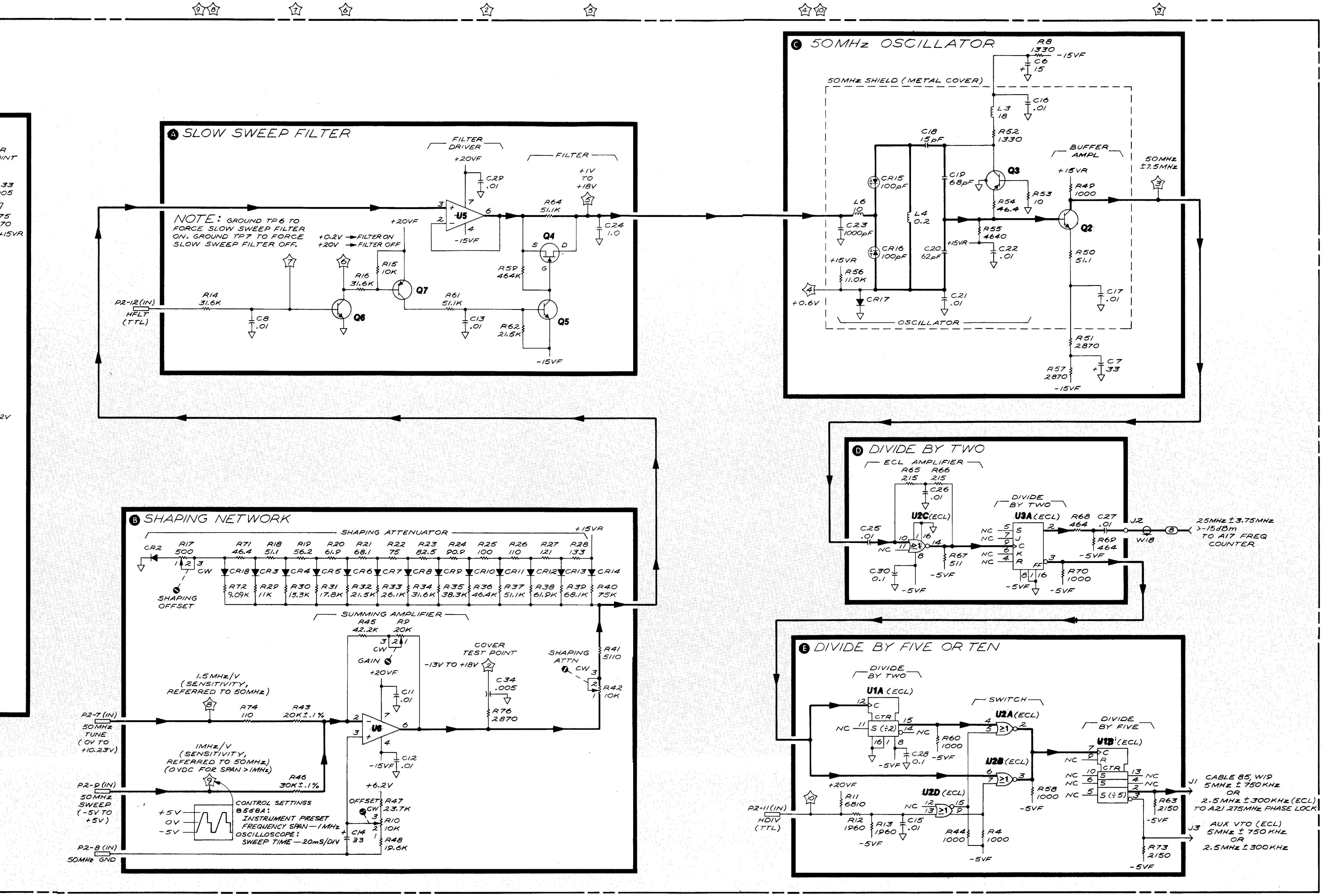
SERIAL PREFIX: 1828A DATE: APRIL, 1978

Figure 9-37. A11 50 MHz Voltage-Tuned Oscillator, Block Diagram



A11 50 MHz VOLTAGE-TUNED OSCILLATOR
85680-60017
A18
275MHz PHASE LOCK OSC.
275MHz PHASE LOCK
W29
275 MHz ± 750 kHz OR 277.5 MHz ± 300 kHz +5dBm ± 2dBm
P1
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
P2
PIN | SIGNAL | TO/FROM | FUNCTION BLOCK
1 GND F
7 50MHz TUNE A22,P2-4 B
2 GND F
8 50MHz GND A22,P2-5 B
3 GND F
9 50MHz SWEEP A22,P2-6 B
4 GND F
10 GND F
5 GND F
11 HDIV A22,P2-8 E
6 GND F
12 HFLT A22,P2-9 A
F POWER SUPPLIES
COVER TEST POINT
POSITIVE SUPPLY
A SLOW SWEEP FILTER
FILTER DRIVER
FILTER
NOTE: GROUND TP6 TO FORCE SLOW SWEEP FILTER ON. GROUND TP7 TO FORCE SLOW SWEEP FILTER OFF.
+0.2V → FILTER ON
+20V → FILTER OFF
P2-12(IN) HFLT (TTL)
B SHAPING NETWORK
SHAPING ATTENUATOR
SHAPING OFFSET
SUMMING AMPLIFIER
GAIN
COVER TEST POINT
-13V TO +18V
SHAPING ATTN
1.5MHz/V (SENSITIVITY, REFERRED TO 50MHz)
1MHz/V (SENSITIVITY, REFERRED TO 50MHz) (0VDC FOR SPAN > 1MHz)
P2-7 (IN) 50MHz TUNE (0V TO +10.23V)
P2-9 (IN) 50MHz SWEEP (-5V TO +5V)
P2-8 (IN) 50MHz GND
CONTROL SETTINGS
8568A:
INSTRUMENT PRESET
FREQUENCY SPAN — 1MHz
OSCILLOSCOPE:
SWEEP TIME — 20mS/DIV
OFFSET
C 50MHz OSCILLAT
50MHz SHIELD (METAL COV
OSCILLATOR
D DIVIDE BY TW
ECL AMPLIFIER
E DIVIDE BY FIVE OR
DIVIDE BY TWO
P2-11(IN) HDIV (TTL)
SERIAL PREFIX: 1828A DATE: APRIL, 1978

ock Diagram



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω) CAPACITANCE IN MICROFARADS (μF) INDUCTANCE IN MICROHENRIES (μH)
3. ECL LOGIC LEVELS ARE TYPICALLY: -0.9V = LOGIC "1" = HIGH; -1.8V = LOGIC "0" = LOW. AN UNCONNECTED ECL INPUT IS LOW
4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
HFLT	HIGH = SLOW SWEEP FILTER ON
HDIV	HIGH = TOTAL DIVIDE BY 20 LOW = TOTAL DIVIDE BY 10

A11

Figure 9-38. A11 50 MHz Voltage-Tuned Oscillator, Schematic

A12 RF SECTION INTERFACE, CIRCUIT DESCRIPTION

A12 RF Section Interface contains the miscellaneous digital functions for interfacing with A15 Processor.

Keyboard Matrix A

The keyboard is organized as a matrix (rows and columns) of normally open SPST switches. The rows are driven by U19 and U30. U23 functions as a key-down detector, Q12 and associated circuitry debounce the key switches, and U10B latches the key-down condition. U16 and U34 gate the key columns onto the Data Bus. By selectively enabling the key rows, A15 Processor can poll the keyboard.

Instrument Preset B

Q11 inverts the sense of the front-panel key and provides an open-collector output LIPS so that A13 HP-IB Interface can also assert this condition. The LIPS signal causes A15 Processor to restart at memory address 32.

Service Request C

This circuit encodes the various requests for service for A15 Processor.

U1 encodes the service request, U3 is a change detector (HINT or LRMT), and U2 latches these changes. U4A detects and latches the falling edge of HSWP.

U10A asserts LSTP, which stops A15 Processor (puts it in idle) when set by a pulse from U9. U9 also provides the reset pulses for clearing the request latches U2, U4A, U6B, U10B, U12, U13, and U14. U10A is cleared by any pending request (that is, it restarts A15 Processor) by U1.

Q2 pulls HSWP low whenever a request is pending.

U11 gates the encoded request and then places HINT,LCBZ, or LHBZ on the Data Bus.

Rotary Pulse Generator (RPG) Control D

U4A enables the RPG, allowing the pulses to be counted. U6A detects the direction of rotation of the RPG (rotation of the DATA knob on the front panel). U12 and U13 count the number of RPG pulses since the last RPG RESET. U14 provides a holdoff of about 70 msec, during which U6B is not allowed to request service, giving the instrument time to respond to the last request and to continue to sweep before the next request occurs; that is, to give the operator visual feedback.

Front Panel LED Drive E

U22 and U33 latch the state of the front-panel LEDs and sink the current to light them. LIPS clears these registers, lighting the LEDs any time the [INSTR PRESET] key is pressed.

RF Attenuator Drive F

U7 latches the state of the RF Attenuator and the input relay. Q3 and Q4 drive the input relay, and Q5 through Q10 drive the RF Attenuator. The bridge rectifiers U24 through U26 act as transient suppressors for the RF Attenuator solenoids. U7 is cleared (setting the RF Attenuator to 70 dB) whenever HPUP goes low, protecting the instrument during power on/off conditions.

Phase Lock Flags G

Each flag can be enabled (interrogated) or all flags can be interrogated. U31 and U32 provide the logic, and U21 stores the state of the enabled flags.

Address Decoder H

U18 and U29 decode the address lines, enabling the appropriate ICs to gate or store data for the Data Bus.

Options I

U8 gates the options jumpers onto the Data Bus. U17 is a PROM (programmable read-only memory) that contains the attenuation errors (calibration data) of the RF Attenuator.

A12 RF SECTION INTERFACE, TROUBLESHOOTING

The A12 RF Section Interface contains a number of circuits which are used by the instrument for interfacing with the main processor. Most of these circuits can be verified by using the keyboard. The right INSTR CHECK LED being on may indicate a failure on this assembly. To perform Signature Analysis, a special extender board (see Figure 9-40), 85680-60035, which is part of the Service Accessories, is needed.

The first SA Check verifies the key row lines and IOB input lines. The key row line outputs are then used as inputs to verify the Service Request C, Phase Lock Flags G, and Key Columns on Sheet 2/2. Because the Key Row lines are directly connected to these blocks on the extender board (see Figure 9-40 for a schematic of the RF Section Interface Extender Board), a defective input on a component could cause an incorrect signature on the Key Row outputs.

The signatures on Sheet 1/2 are valid only when using standard extender boards provided that A15TP3 (LSTP) is jumpered to A15TP9 (+5V). This eliminates the interconnections between the Key Rows and the other functional blocks.

The Keyboard Matrix A can be verified by another method. This method is especially useful if the keyboard is locked out by a shorted key. Note that a shorted key causes the right INSTR CHECK LED to turn on. To eliminate a shorted key in the IF-Display Section, disconnect the rear-panel 50-wire bus cable. If the right INSTR CHECK LED turns off after [INSTR PRESET] is pressed, then the defective key is in the IF-Display Section. Reconnect the bus cable and check the voltage on KCØ-7. It should be +5V except when a key is pressed. After finding the Key Column (KC) line that is low, momentarily touch +5V to each Key Row (KRØ–11) line. (Do not leave the Key Row lines tied to +5V as this may damage some components.) When the correct KR line is touched, the grounded KC line will rise to +5V. Use the Keyboard Matrix in Figure 9-39 to find the defective key, trace, or associated circuitry. Note that Q12 in the key down detector is not tested.

A simple method exists to determine if a key is open. The Title Mode (KSE, [SHIFT] CF STEP SIZE [AUTO]) is useful for this. After putting the analyzer in the Title Mode, press the keys that are suspected of being defective. If they are working, the blue letter listed above the key is displayed at the top of the CRT display.

The Front Panel LED Drivers E and RF ATTEN Driver F can be checked initially without the diagram. When [INSTR PRESET] is pressed, all LEDs in the RF Section turn on. After the key is released, the LEDs turn off. The RF ATTEN Driver F can be checked by stepping the attenuator thru its range and observing the 20 MHz calibrator signal. If the attenuator is working properly, the signal will remain at one reference level. (It is best to use RL–10 dBm so that ATTEN = 0 dB can be used.)

The Service Request C and Phase Lock Flags G are tested by using the special extender board. The test program uses the outputs of the Key Rows to provide the stimulus for the inputs to these blocks. Note that Q2 is not checked. If the HSWP line appears to be shorted and no other fault can be found, check Q2 to see if it is shorted.

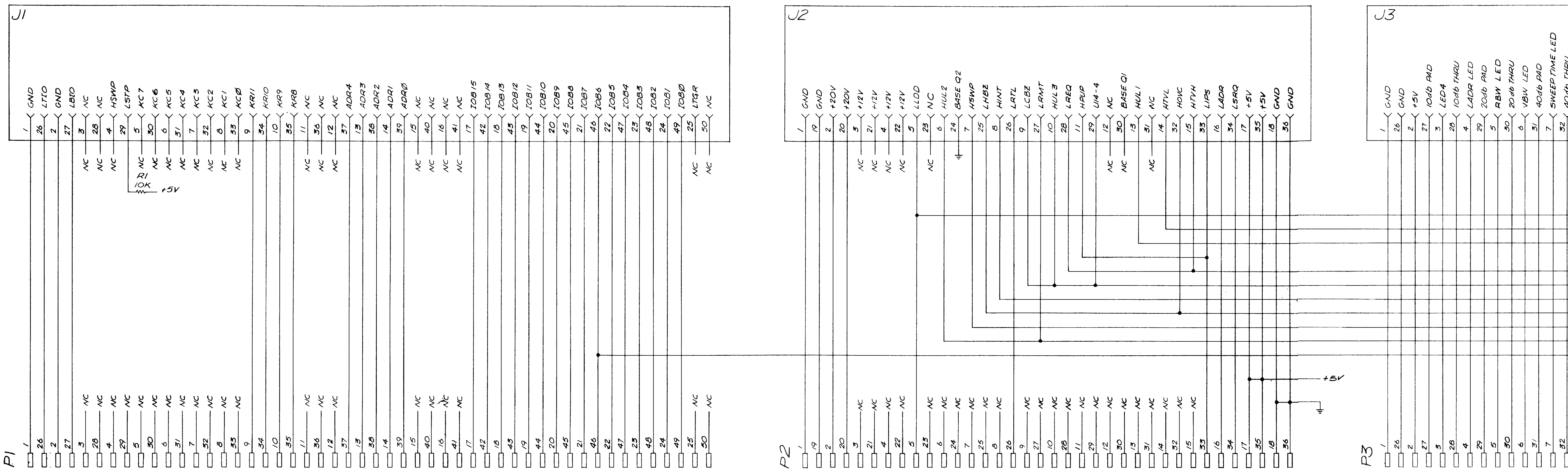
Options I are not tested by Signature Analysis. The Attenuator ROM U17 is used only when the correction data (KSX) is requested. It is factory programmed for each instrument. Note that the Attenuator ROM U17 must be replaced if the Input Attenuator A5AT1 is replaced. The options MUX U8 is also not tested. If this component is defective, the most likely symptom will be incorrect reference level readouts, which are in error by 5.7 dB.

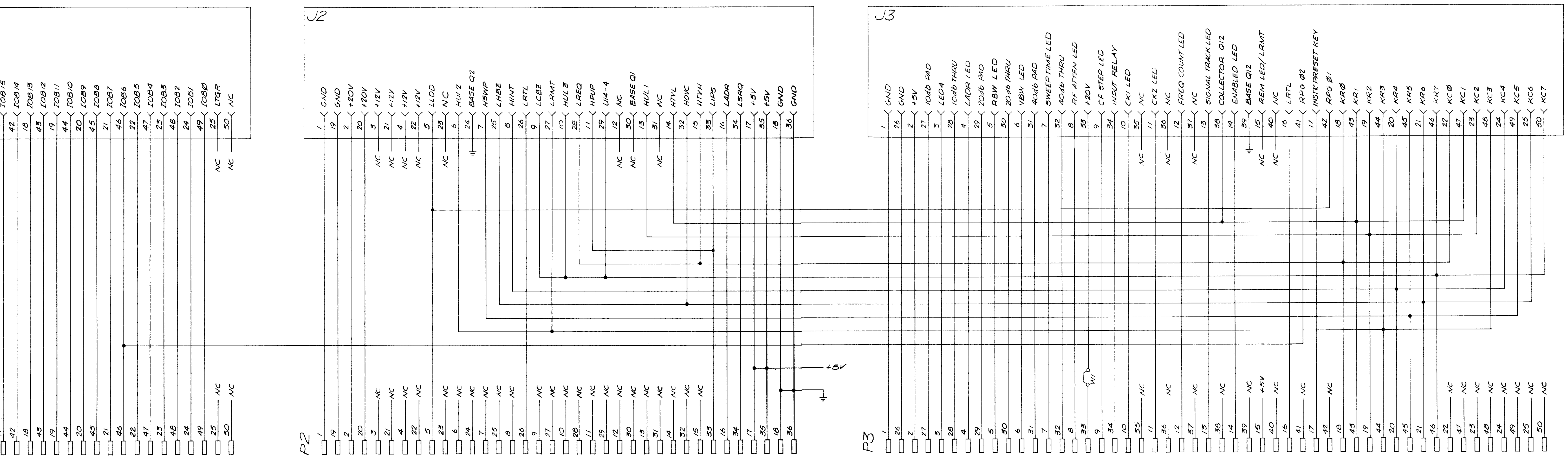
KEYBOARD MATRIX

	KC0	KC1	KC2	KC3	KC4	KC5	KC6	KC7	
KR0	SPACE Hz µV µsec			# MHz −dBm sec		BACK SPACE	& kHz mV msec		RF SECTION
KR1	(SAVE	) RECALL	_ HOLD		, 0–1.5 GHz		•	/ GHz +dBm dB	RF SECTION
KR2	0	1	2	3	4	5	6	7	RF SECTION
KR3	8	9			SIGNAL INPUT 1 ●	= FREQ COUNT	SIGNAL INPUT 2 ●		RF SECTION
KR4		A AUTO	B AUTO	C AUTO	D AUTO	E AUTO	F RES BW	G VIDEO BW	RF SECTION
KR5	H SWEEP TIME	I ATTEN	J CF STEP SIZE	K PEAK SEARCH	MARKER L OFF	MARKER M NORMAL	N MKR→CF	O VIDEO BW	RF SECTION
KR6	P ZOOM	Q MKR/Δ→STP SIZE	R MKR→REF LVL	S SIGNAL TRACK	T ⇩	U ⇧	V CENTER FREQUENCY	W FREQUENCY SPAN	RF SECTION
KR7	X START FREQ	Y STOP FREQ	Z REFERENCE LEVEL						RF 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	IF-DISPLAY SECTION
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	IF-DISPLAY SECTION
KR10	p ENTER THRESHOLD	q ENTER dB/DIV	r LIN	s SHIFT	t CONT	u SINGLE	v FREE RUN	w LINE	IF-DISPLAY SECTION
KR11	x EXT	y VIDEO	z ● LOWER LEFT		I ● UPPER RIGHT				IF-DISPLAY SECTION

NOTE: INSTR PRESET AND LCL ARE NOT PART OF THE MATRIX.

Figure 9-39. 8568A Keyboard Matrix


J1
GND
LTIO
GND
LBIO
NC
NC
HSWP
LSTP
KC7
KC6
KC5
KC4
KC3
KC2
KC1
KCØ
KR11
KR10
KR9
KR8
NC
NC
NC
ADR4
ADR3
ADR2
ADR1
ADRØ
NC
NC
NC
NC
IOB15
IOB14
IOB13
IOB12
IOB11
IOB10
IOB9
IOB8
IOB7
IOB6
IOB5
IOB4
IOB3
IOB2
IOB1
IOBØ
LTGR
NC
R1
10K
+5V
P1
J2
GND
GND
+20V
+20V
+12V
+12V
+12V
+12V
LLDD
NC
HUL2
BASE Q2
HSWP
LHBZ
HINT
LRTL
LCBZ
LRMT
HUL3
LREQ
HPUP
U14-4
NC
BASE Q1
HUL1
NC
HTVL
HOVC
HTVH
LIPS
LADR
LSRQ
+5V
+5V
GND
GND
+5V
P2
J3
GND
GND
+5V
10db PAD
LED4
10db THRU
LADR LED
20db PAD
RBW LED
20db THRU
VBW LED
40db PAD
SWEEP TIME LED
P3



NOTE:

1. W1 IS OPENED TO DISABLE THE ATTENUATOR DRIVERS.

Figure 9-40. A12 RF Section Interface, Extender Board, Schematic Diagram

Table 9-17. A12 RF Section Interface, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12	85680-60038	1	BOARD ASSEMBLY, RF SECTION INTERFACE	28480	85680-60038
A12C1	0180-0100	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A12C2	0160-0161	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A12C3	0160-2291	1	CAPACITOR-FXD .18UF +-10% 80VDC POLYE	28480	0160-2291
A12C4	0160-0153	2	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A12C5	0160-0153		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A12C6	0180-0116	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A12C7			NOT ASSIGNED		
A12C8	0160-2055	6	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C14			NOT ASSIGNED		
A12C15	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A12C16	0160-3454	1	CAPACITOR-FXD 220PF +-10% 1KVDC CER	28480	0160-3454
A12CR1	1901-0039	1	DIODE-SWITCHING 50V 300MA 8NS	28480	1901-0039
A12L1	08558-8001	2	FILTER, COIL, BLUE	28480	08558-80011
A12L2	08558-8001		FILTER, COIL, BLUE	28480	08558-80011
A12Q1	1854-0404	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q2	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q3	1854-0232	2	TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A12Q4	1854-0232		TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A12Q5	1854-0477	6	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A12Q6	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A12Q7	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A12Q8	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A12Q9	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A12Q10	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A12Q11	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12R1			NOT ASSIGNED		
A12R2	0698-0083	14	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R3	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R4	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1962-F
A12R5	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R6	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R7	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R8	0698-3260	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A12R9	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R10	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R11	0757-0442	10	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R12	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R13	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R14	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R15	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R16	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R17	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R19	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A12R20	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R21-A12R24			NOT ASSIGNED		
A12R25	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R26	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R27-A12R31			NOT ASSIGNED		
A12R32	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R33	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R35	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R36	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12R37	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A12TP1	1251-5177	4	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12TP2	1251-5177		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12TP3	1251-5177		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12TP4	1251-5177		CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	28480	1251-5177
A12U1	1820-0987	1	IC ENCDR TTL L 8-INP	07263	93L18PC
A12U2	1820-1440	1	IC LCH TTL LS QUAD	01295	SN74LS279N
A12U3	1820-1211	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A12U4	1820-1112	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A12U5	1820-1425	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N

Table 9-17. A12 RF Section Interface, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12U6	1820-1112		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A12U7	1820-1195	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A12U8	1820-1438	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257N
A12U9	1820-1216	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A12U10	1820-1112		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A12U11	1820-1492	1	IC BFR TTL LS INV HEX 1-INP	01295	SN74LS368N
A12U12	1820-1291	2	IC CNTR TTL BIN SYNCHRO 4-BIT	27014	DM8554N
A12U13	1820-1291		IC CNTR TTL BIN SYNCHRO 4-BIT	27014	DM8554N
A12U14	1826-0180	1	IC 555 8-DIP-P	18324	NE555V
A12U15	1810-0206	3	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R10K
A12U16	1820-1491	2	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A12U17			PART OF A5AT1		
A12U18	1820-1216		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A12U19	1820-1196	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U20	1820-1199	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A12U21	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U22	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U23	1820-1207	1	IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A12U24	1901-0364	3	DIODE-FW BRDG 200V 1A	28480	1901-0364
A12U25	1901-0364		DIODE-FW BRDG 200V 1A	28480	1901-0364
A12U26	1901-0364		DIODE-FW BRDG 200V 1A	28480	1901-0364
A12U27	1810-0206		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R10K
A12U28	1810-0206		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R10K
A12U29	1820-1202	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A12U30	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U31	1820-1210	2	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U32	1820-1210		IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U33	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A12U34	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
			A12 MISCELLANEOUS PARTS		
	4040-0749	1	EXTRACTOR-PC BOARD BRN POLYC	28480	4040-0749
	4040-0750	1	EXTRACTOR-PC BOARD RED POLYC	28480	4040-0750
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073

A12
RF SECTION INTERFACE

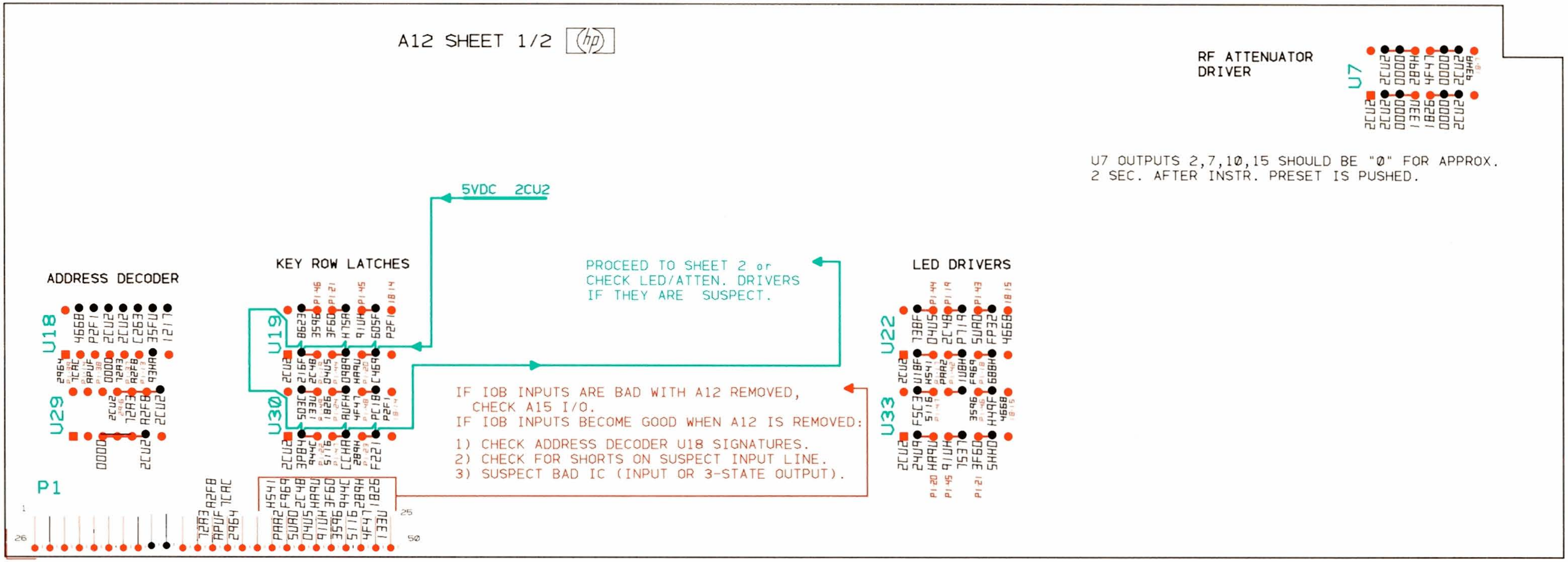


Figure 9-41. A12 RF Section Interface, Signature Analysis Troubleshooting Diagram (1 of 2)

A12 SHEET 1/2 CHECK

Signature Analyzer Connections:

CLOCK ⟋ to A14TP1
START ⟋ to A14TP12
STOP ⟋ to A14TP11

Spectrum Analyzer Connections:

Install A12 board on A12 RF Section Interface Extender Board, HP Part No. 85680-60035.
Jumper A14TP12 to A15TP8.

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.
- Refer to RF Section Digital Block Diagram for additional troubleshooting information.

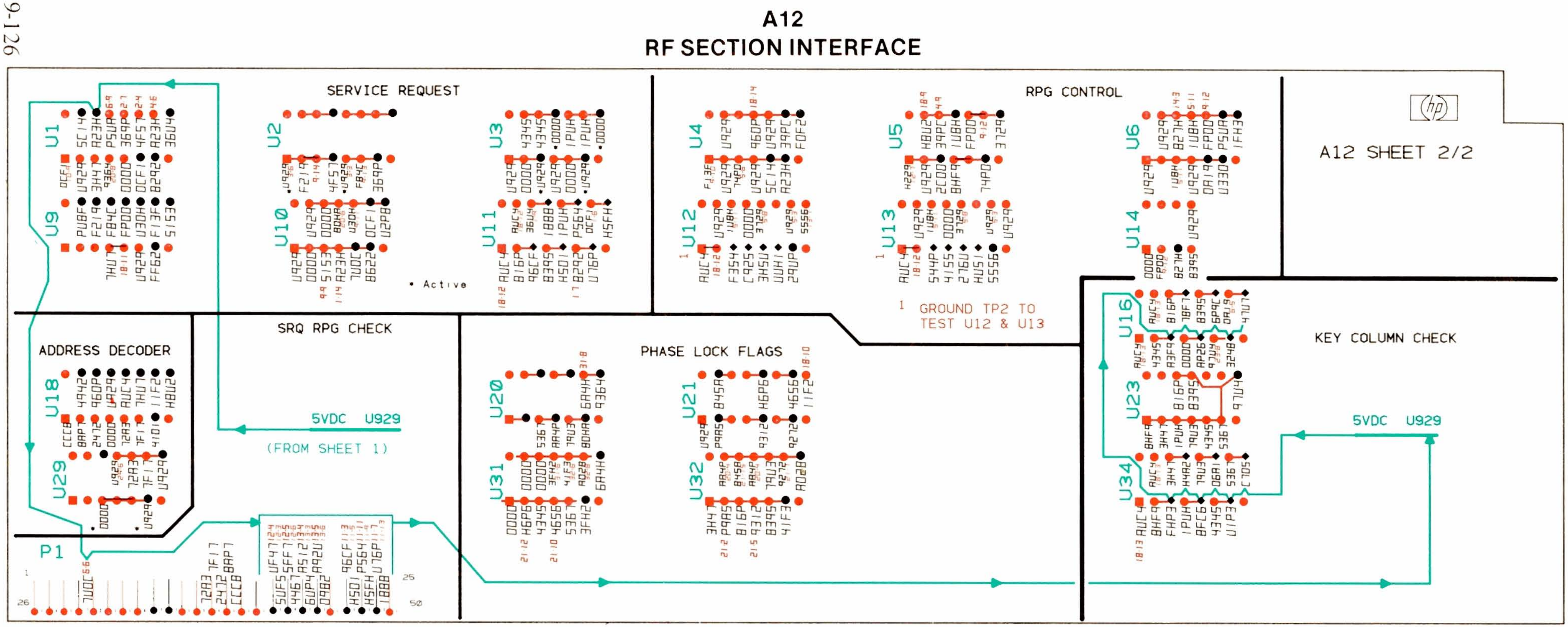


Figure 9-41. A12 RF Section Interface, Signature Analysis Troubleshooting Diagram (2 of 2)

KEY COLUMN CHECK

Signature Analyzer Connections:

CLOCK ⌐ to A14TP1
START ⌐ to A14TP11
STOP ⌐ to A14TP10

Spectrum Analyzer Connections:

Install A12 board on A12 RF Section Interface Extender board, HP Part No. 85680-60035.
Jumper A14TP12 to A15TP8

SRQ RPG CHECK

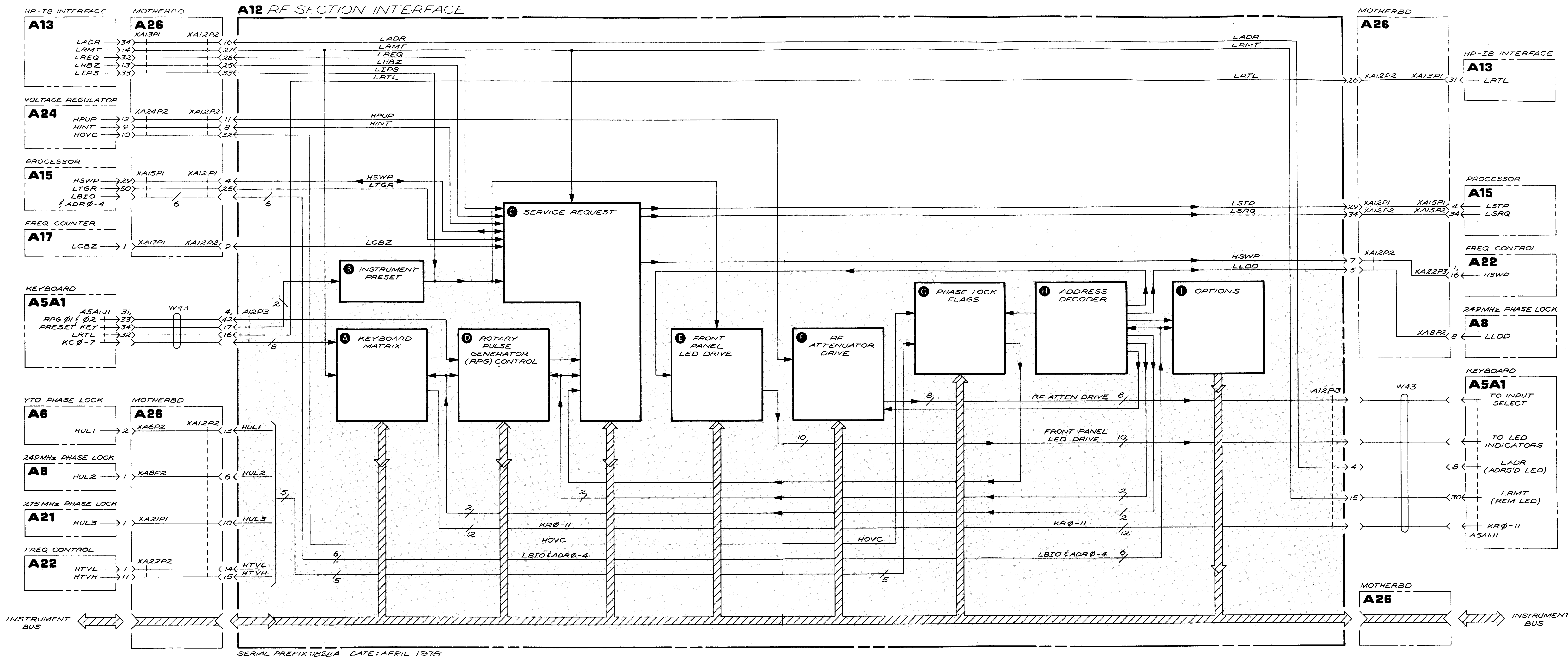
Signature Analyzer Connections:

CLOCK ⌐ to A14TP1
START ⌐ to A14TP10
STOP ⌐ to A14TP9

Spectrum Analyzer Connections:

Install A12 board on A12 RF Section Interface Extender board, HP Part No. 85680-60035.
Jumper A14TP12 to A15TP8

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.
- Refer to RF Section Digital Block Diagram for additional troubleshooting information.



A12

Figure 9-42. A12 RF Section Interface, Block Diagr

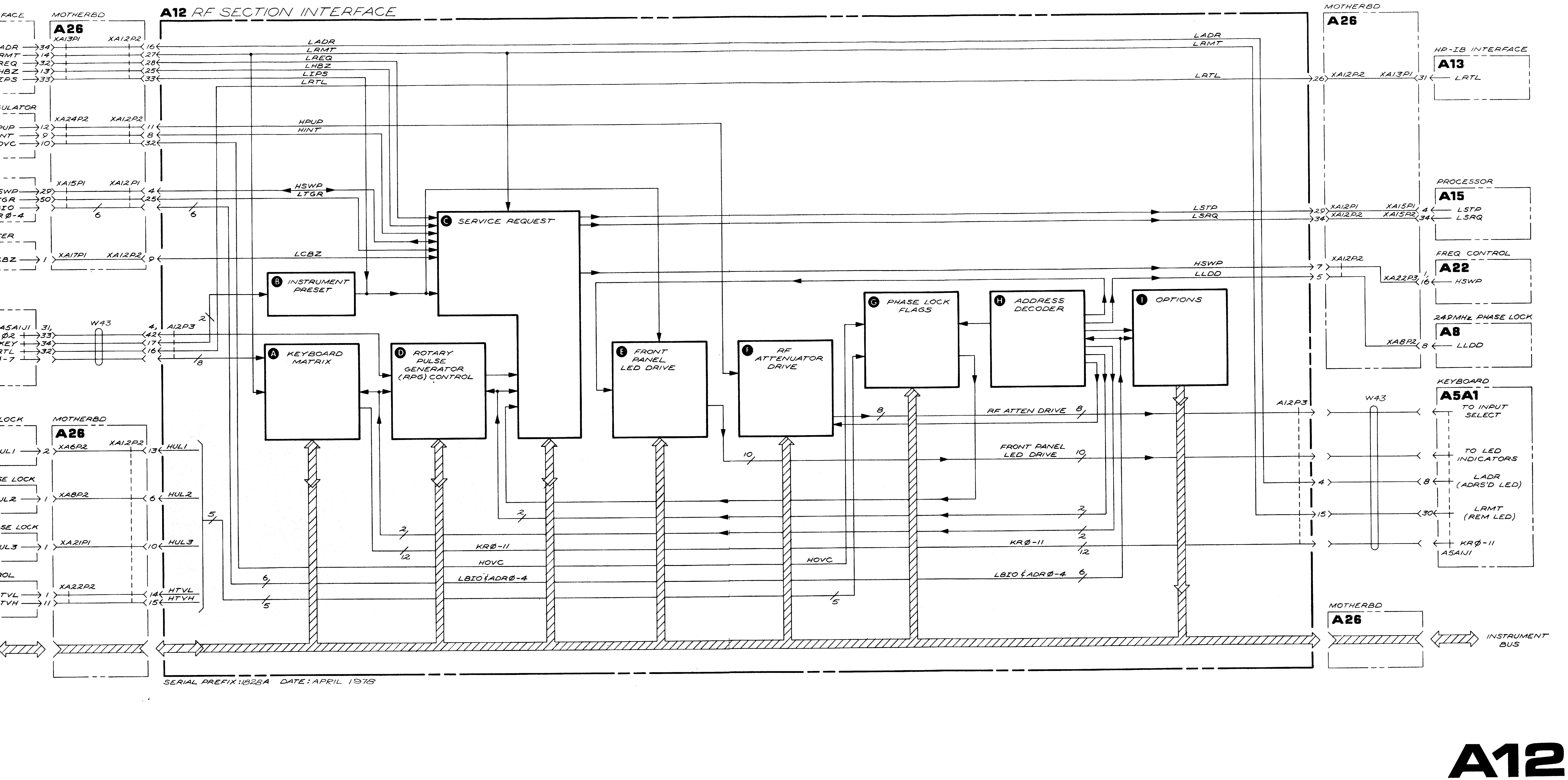


Figure 9-42. A12 RF Section Interface, Block Diagram

A12
RF SECTION INTERFACE

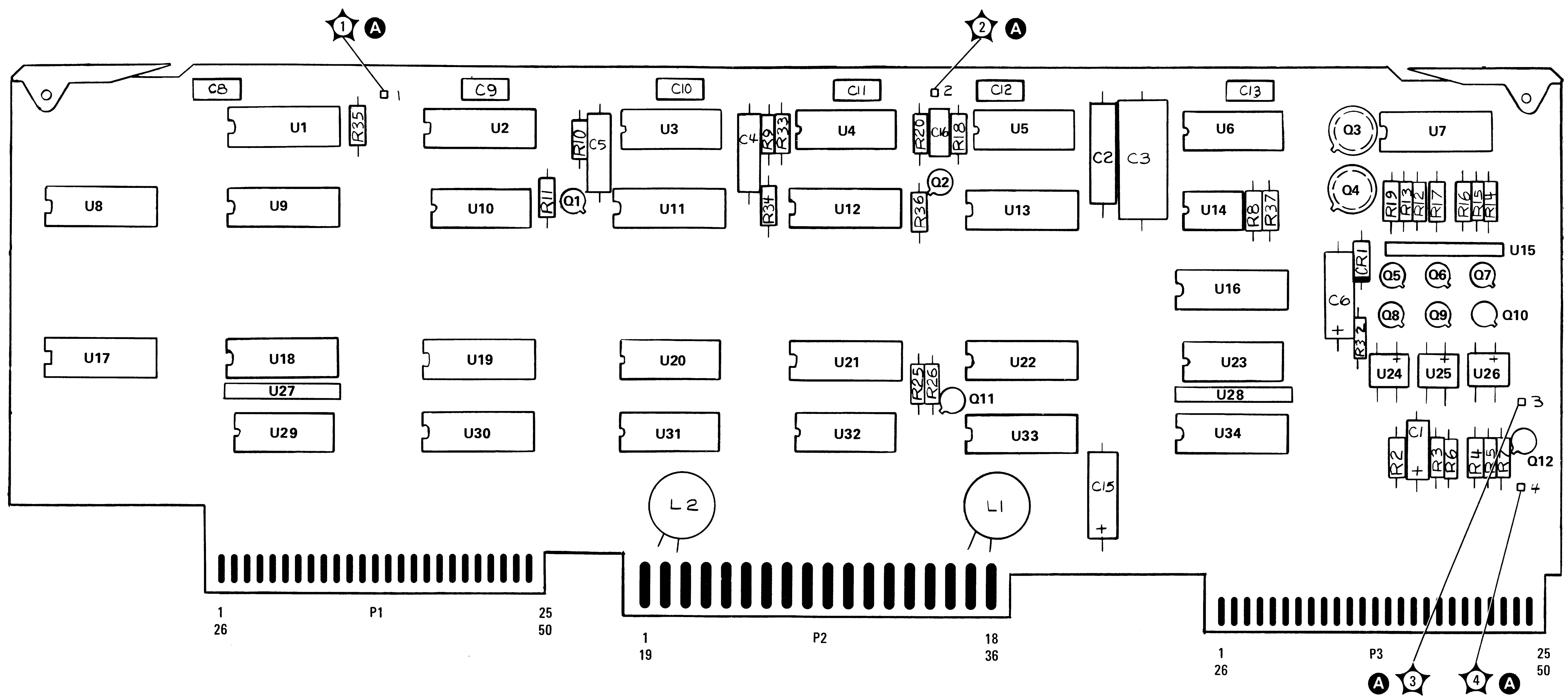


Figure 9-43. A12 RF Section Interface, Component Locations

A12 RF SECTION INTERFACE (SHEET 1 OF 2)

85680-60038

P1

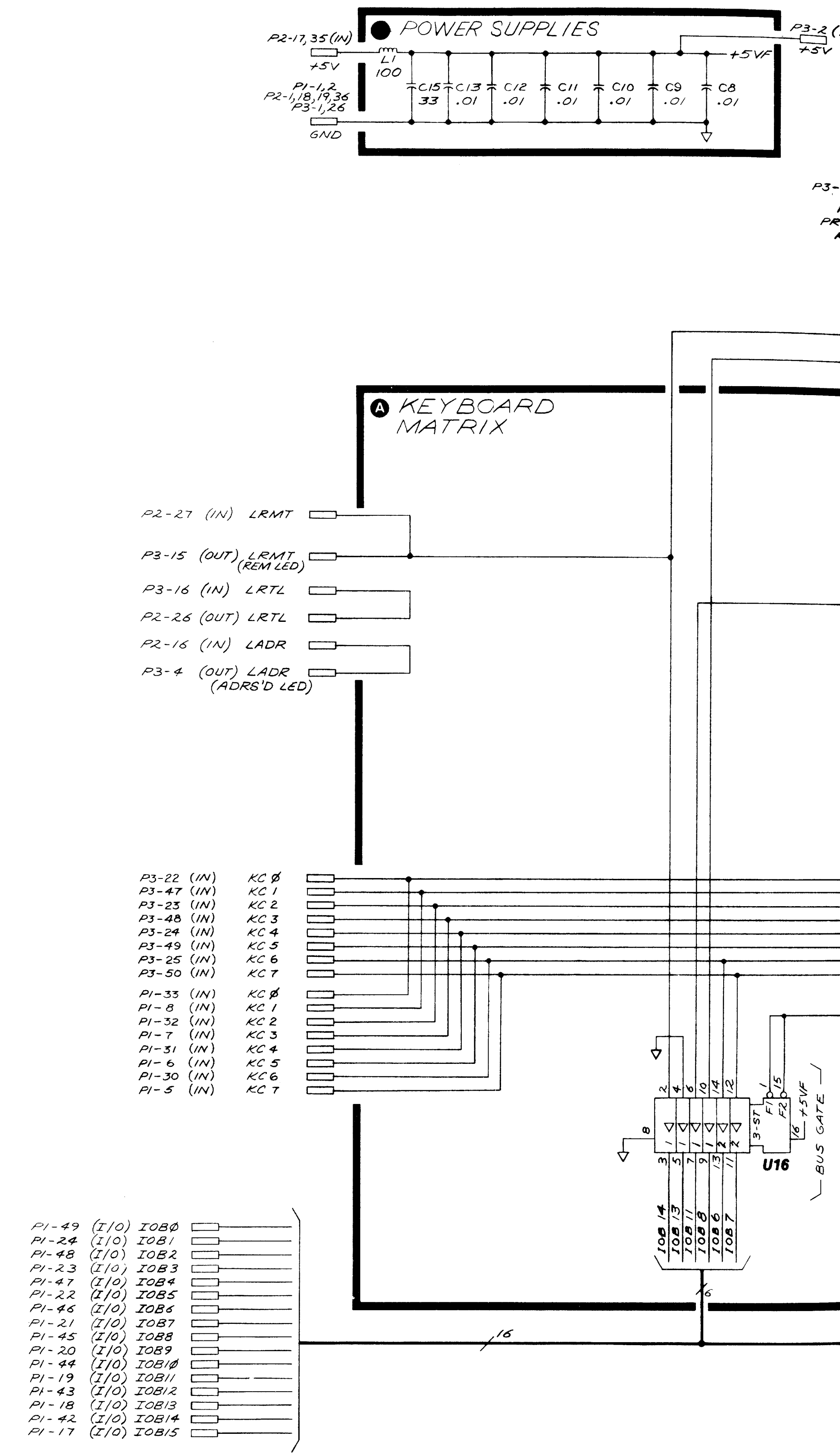
PIN	SIGNAL	TO/ FROM	FUNCTION BLOCK
1	GND		●
26	LTIO	A15P1-1	NC
2	GND		●
27	LBIO	A15P1-2	H
3	NC		
28	NC		
4	HSWP	A15P1-29	C
29	LSTP	A15P1-4	C
5	KC7	A15P1-30	A
30	KC6	A15P1-5	A
6	KC5	A15P1-31	A
31	KC4	A15P1-6	A
7	KC3	A15P1-32	A
32	KC2	A15P1-7	A
8	KC1	A15P1-33	A
33	KCØ	A15P1-8	A
9	KR11	A15P1-34	A
34	KR1Ø	A15P1-9	A
10	KR9	A15P1-35	A
35	KR8	A15P1-10	A
11	NC		
36	NC		
12	NC		
37	ADR 4	A15P1-12	H
13	ADR 3	A15P1-38	H
38	ADR 2	A15P1-13	H
14	ADR 1	A15P1-39	H
39	ADR Ø	A15P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	IOB 15	A15P1-42	A
42	IOB 14	A15P1-17	A
18	IOB 13	A15P1-43	A
43	IOB 12	A15P1-18	A
19	IOB 11	A15P1-44	A
44	IOB 10	A15P1-19	A
20	IOB 9	A15P1-45	A
45	IOB 8	A15P1-20	A
21	IOB 7	A15P1-46	A
46	IOB 6	A15P1-21	A
22	IOB 5	A15P1-47	A
47	IOB 4	A15P1-22	A
23	IOB 3	A15P1-48	A
48	IOB 2	A15P1-23	A
24	IOB 1	A15P1-49	A
49	IOB Ø	A15P1-24	A
25	LTGR	A15P1-50	C
50	NC		

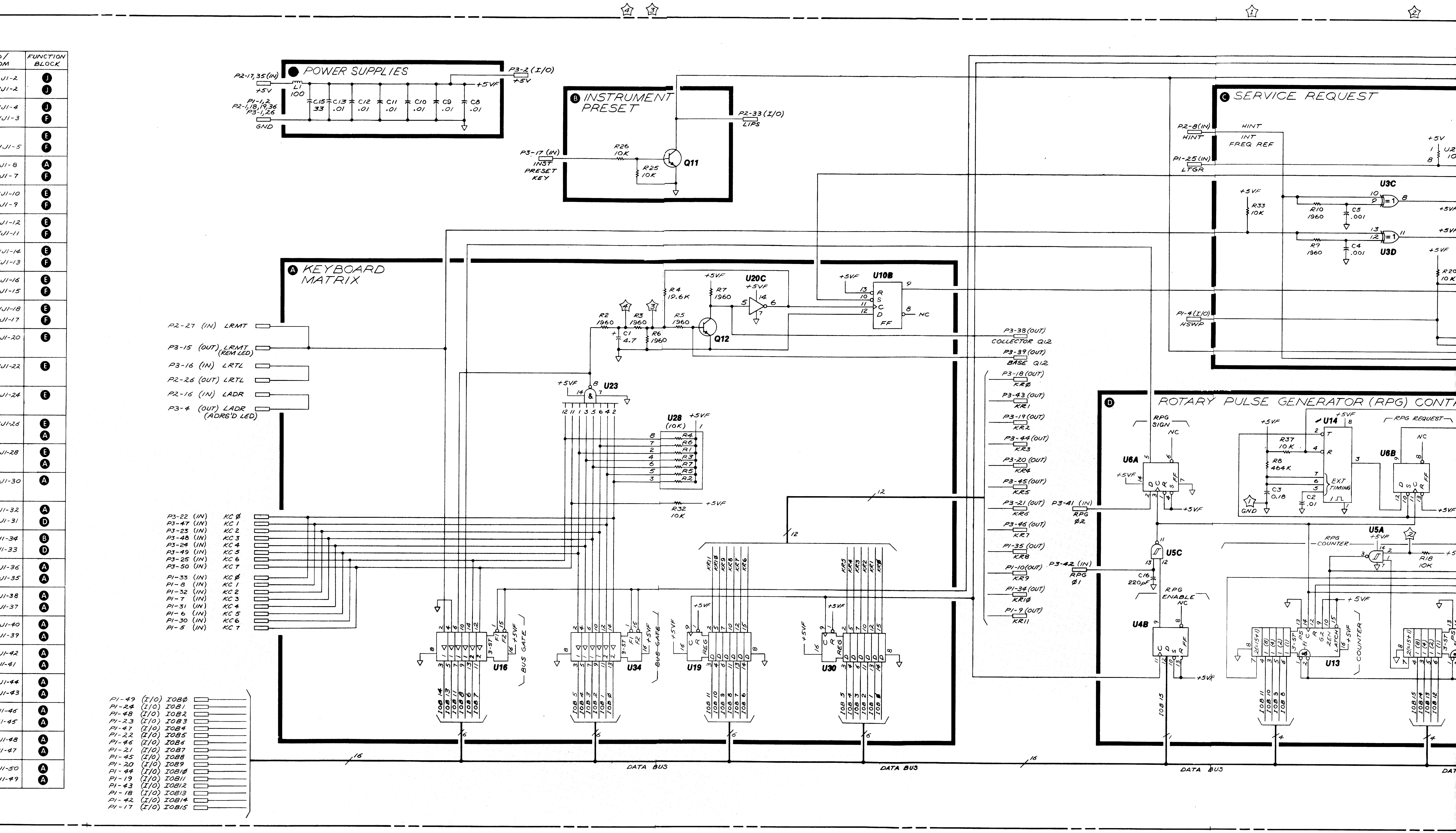
P2

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	A13P1-13	C
8	HINT	A24P2-9	C
26	LRTL	A13P1-31	A
9	LCBZ	A17P1-1	C
27	LRMT	A13P1-14	A
10	HUL3	A21P1-1	G
28	LREQ	A13P1-32	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	A13P1-33	B
16	LADR	A13P1-34	A
34	LSRQ	A15P2-34	C
17	+5V		J
35	+5V		J
18	GND		J
36	GND		J

P3

PIN	SIGNAL	TO/ FROM	FUNCTION BLOCK
1	GND	A5A1J1-2	J
26	GND	A5A1J1-2	J
2	+5V	A5A1J1-4	J
27	10dB PAD	A5A1J1-3	F
3	LED 4		E
28	10dB THRU	A5A1J1-5	F
4	LADR (ADRS'D LED)	A5A1J1-8	A
29	20 dB PAD	A5A1J1-7	F
5	RES BW LED	A5A1J1-10	E
30	20dB THRU	A5A1J1-9	F
6	VIDEO BW LED	A5A1J1-12	E
31	40dB PAD	A5A1J1-11	F
7	SWEEP TIME LED	A5A1J1-14	E
32	40dB THRU	A5A1J1-13	F
8	ATTEN LED	A5A1J1-16	E
33	+20V	A5A1J1-15	F
9	CF STEP SIZE LED	A5A1J1-18	E
34	INPUT RELAY	A5A1J1-17	F
10	CKII LED	A5A1J1-20	E
35	NC		
11	CKI LED	A5A1J1-22	E
36	NC		
12	FREQ COUNT LED	A5A1J1-24	E
37	NC		
13	SIGNAL TRACK LED	A5A1J1-26	E
38	COLLECTOR Q8		A
14	ENABLED LED	A5A1J1-28	E
39	BASE Q12		A
15	LRMT (REM LED)	A5A1J1-30	A
40	NC		
16	LRTL	A5A1J1-32	A
41	RPG Ø2	A5A1J1-31	D
17	INST PRESET KEY	A5A1J1-34	B
42	RPG Ø1	A5A1J1-33	D
18	KRØ	A5A1J1-36	A
43	KR1	A5A1J1-35	A
19	KR2	A5A1J1-38	A
44	KR3	A5A1J1-37	A
20	KR4	A5A1J1-40	A
45	KR5	A5A1J1-39	A
21	KR6	A5A1J1-42	A
46	KR7	A5A1J1-41	A
22	KCØ	A5A1J1-44	A
47	KC1	A5A1J1-43	A
23	KC2	A5A1J1-46	A
48	KC3	A5A1J1-45	A
24	KC4	A5A1J1-48	A
49	KC5	A5A1J1-47	A
25	KC6	A5A1J1-50	A
50	KC7	A5A1J1-49	A





FUNCTION BLOCK
POWER SUPPLIES
INSTRUMENT PRESET
SERVICE REQUEST
KEYBOARD MATRIX
ROTARY PULSE GENERATOR (RPG) CONT
P2-17,35 (IN) +5V
P1-1,2 P2-1,18,19,36 P3-1,26 GND
P3-2 (I/O) +5V
+5VF
P3-17 (IN) INST PRESET KEY
P2-33 (I/O) LIPS
Q11
Q12
U20C
U10B
U23
U28 (10K)
U16
U34
U19
U30
U3C
U3D
U6A
U6B
U14
U5A
U5C
U4B
U13
P2-27 (IN) LRMT
P3-15 (OUT) LRMT (REM LED)
P3-16 (IN) LRTL
P2-26 (OUT) LRTL
P2-16 (IN) LADR
P3-4 (OUT) LADR (ADRS'D LED)
P2-8 (IN) HINT
INT FREQ REF
P1-25 (IN) LTGR
P1-4 (I/O) HSWP
P3-38 (OUT) COLLECTOR Q12
P3-39 (OUT) BASE Q12
P3-41 (IN) RPG Ø2
P3-42 (IN) RPG Ø1
RPG SIGN
RPG ENABLE
RPG COUNTER
RPG REQUEST
EXT TIMING
COUNTER
BUS GATE
DATA BUS

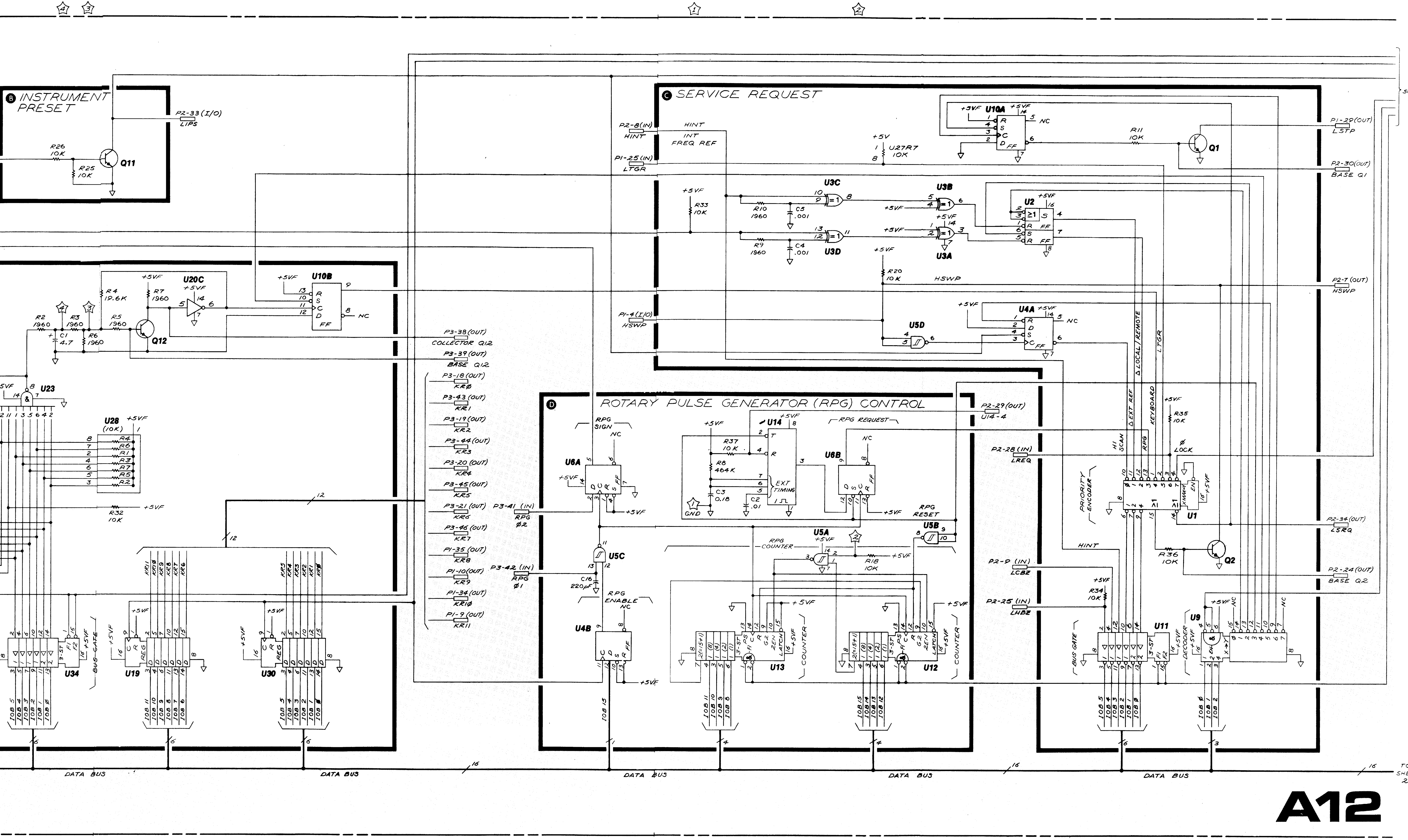
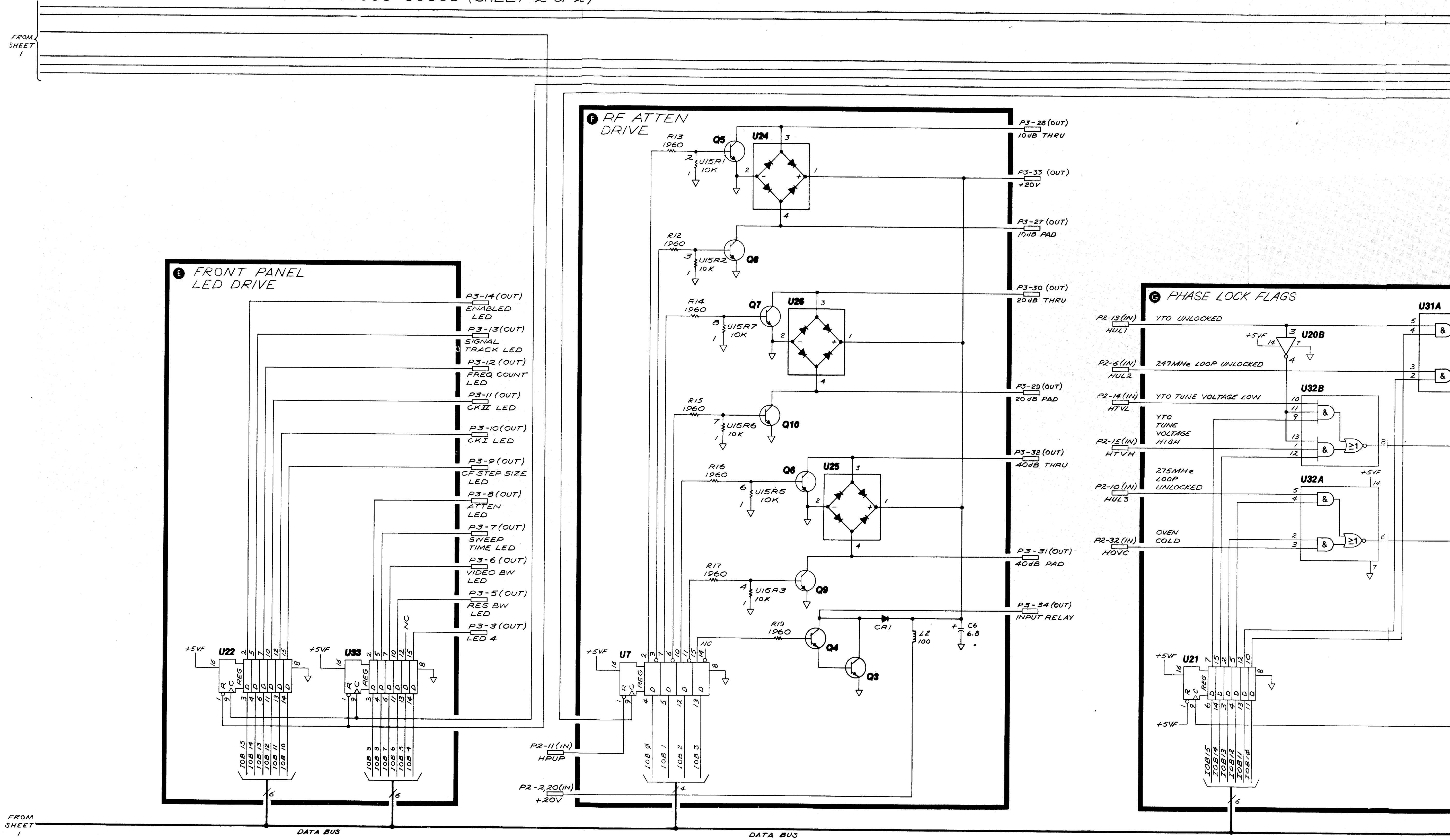
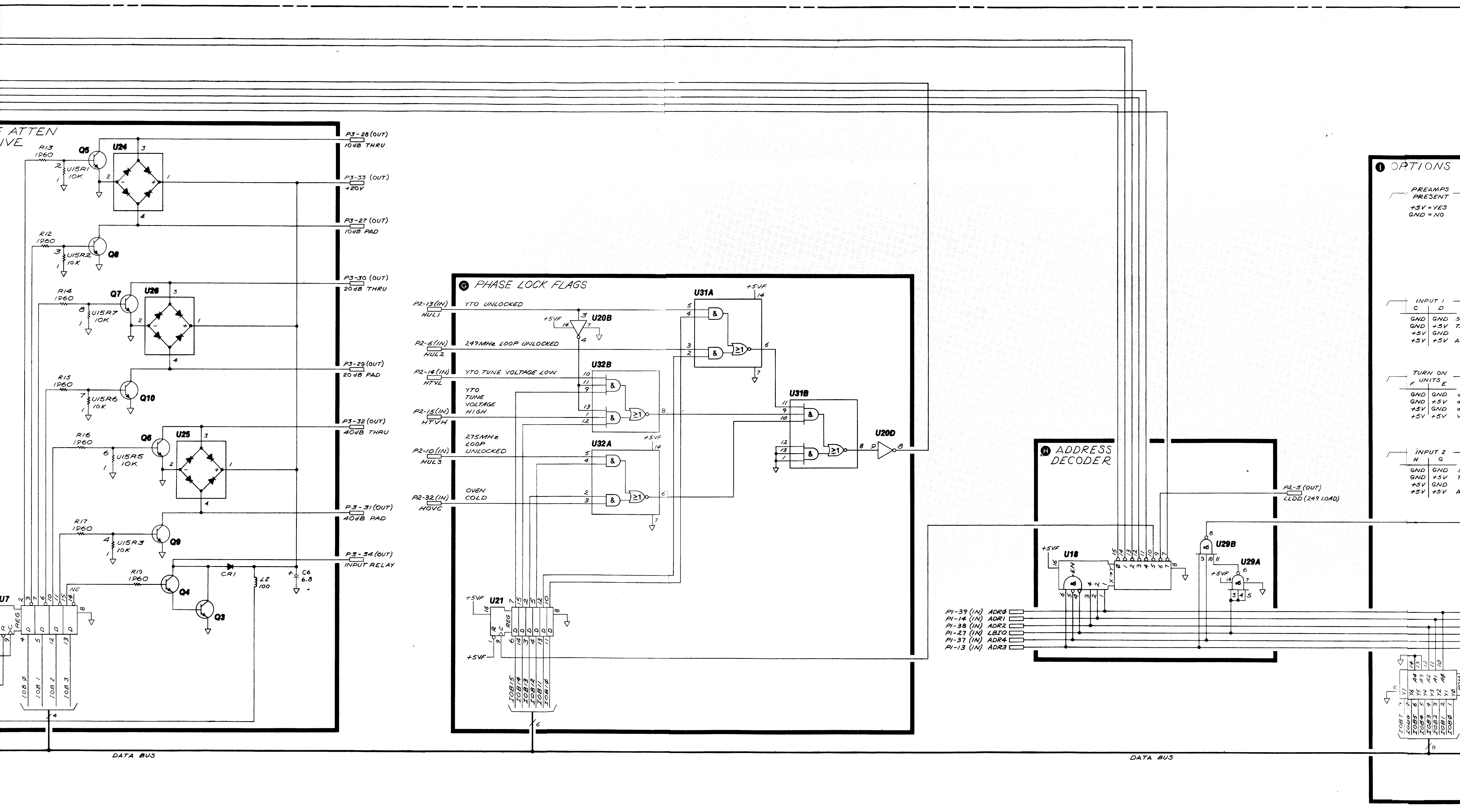


Figure 9-44. A12 RF Section Interface, Schematic Diagram (1 of 2)

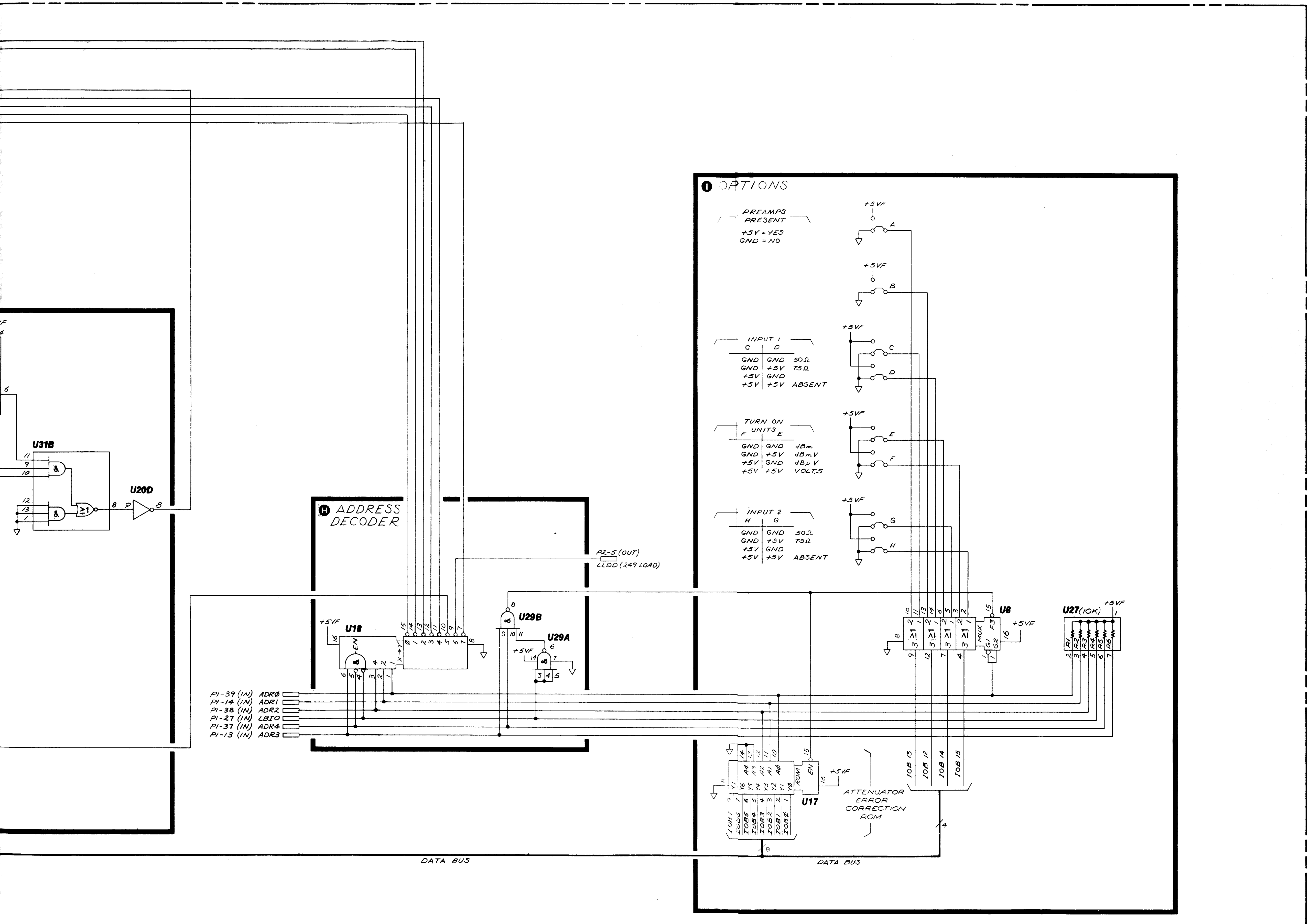
A12 RF SECTION INTERFACE 85680-60038 (SHEET 2 OF 2)



SERIAL PREFIX: 1721A DATE: 8-11-77

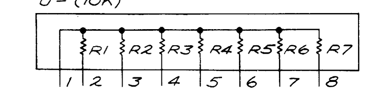


ATTEN
IVE
PHASE LOCK FLAGS
ADDRESS DECODER
OPTIONS
P3-28 (OUT) 10dB THRU
P3-33 (OUT) +20V
P3-27 (OUT) 10dB PAD
P3-30 (OUT) 20dB THRU
P3-29 (OUT) 20dB PAD
P3-32 (OUT) 40dB THRU
P3-31 (OUT) 40dB PAD
P3-34 (OUT) INPUT RELAY
P2-13 (IN) HUL1 YTO UNLOCKED
P2-6 (IN) HUL2 249MHz LOOP UNLOCKED
P2-14 (IN) HTVL YTO TUNE VOLTAGE LOW
P2-15 (IN) HTVH YTO TUNE VOLTAGE HIGH
P2-10 (IN) HUL3 275MHz LOOP UNLOCKED
P2-32 (IN) HOVC OVEN COLD
P2-5 (OUT) LLDD (249 LOAD)
P1-39 (IN) ADRØ
P1-14 (IN) ADR1
P1-38 (IN) ADR2
P1-27 (IN) LBIO
P1-37 (IN) ADR4
P1-13 (IN) ADR3
PREAMPS PRESENT
+5V = YES
GND = NO
INPUT 1
TURN ON UNITS
INPUT 2
DATA BUS

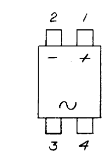


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE 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. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
LBIO	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
LLDD	LOW = LOAD 249 DIVIDER NUMBERS
LRTL	LOW = RETURN TO LOCAL
LTGR	LOW = TRACKING GENERATOR REQUEST
HSWP	HIGH = SWEEPING
CK1	CHECK ONE } FRONT PANEL CHECK LEDS
CK2	CHECK TWO } FRONT PANEL CHECK LEDS
VBW	VIDEO BANDWIDTH
RBW	RESOLUTION BANDWIDTH
RPG Ø1	ROTARY PULSE GENERATOR ONE } FRONT PANEL DATA CONTROL
RPG Ø2	ROTARY PULSE GENERATOR TWO } FRONT PANEL DATA CONTROL
LSTP	LOW = STOP PROCESSOR

A12

Figure 9-44. A12 RF Section Interface, Schematic Diagram (2 of 2)

A13 HP-IB INTERFACE, CIRCUIT DESCRIPTION

A13 HP-IB Interface coordinates communication between the Hewlett-Packard Interface Bus and A15 Processor in the spectrum analyzer. A13 comprises a microprocessor, a read-only memory (ROM), a clock, control circuitry, and data transfer circuitry.

A13 consists of the following circuits:

- Ⓐ HP-IB Transceiver 1
- Ⓑ Controls from HP-IB
- Ⓒ Data from HP-IB
- Ⓓ HP-IB Address Switch
- Ⓔ Program Memory
- Ⓕ Instrument Bus to Microprocessor Data
- Ⓖ Signature Analysis (SA) Test Jumper Plug
- Ⓗ Interrupts
- Ⓘ Clock
- Ⓙ Microprocessor
- Ⓚ Microprocessor Supply Control
- Ⓛ Bus Pullup/Clamp
- Ⓜ HP-IB Transceiver Control
- Ⓝ Controls to Instrument
- Ⓞ Device Select Decoder
- Ⓟ Controls to HP-IB
- Ⓠ Microprocessor to Instrument Handshake
- Ⓡ Data to HP-IB
- Ⓢ Instrument Bus Address Decoder

T HP-IB Transceiver 2

U Microprocessor to Instrument Bus Data

V Power Supplies

Communication with HP-IB

The Microprocessor J communciates with the HP-IB by reading through three-state buffers U18 and U10 B C and by writing into registers U9, U17A, and U17B R P N. These buffers and registers interface with the HP-IB through transceivers U5, U8, U15, and U16 A T.

Communication with A15 Processor

The Microprocessor J communicates with A15 Processor by reading from register U22 F and by writing into register U21 U. Two handshake lines (LREQ and LHBZ) Q are also used. LREQ goes true to indicate that valid data has been loaded into register U21 U by the Microprocessor J. LHBZ goes true to indicate that valid data has been loaded into register U22 F by A15 Processor. Both lines are reset when the data is read by the destination processor.

Controls to Instrument N

The Controls to Instrument circuit N controls the front-panel ADRS'D and REM LEDs. LADR lights the ADRS'D LED, and LRMT lights the REM LED. This circuit also controls LIPS, which is equivalent to pressing [INSTR PRESET].

Instrument Bus Address Decoder S

Three Instrument Bus addresses are decoded by the Instrument Bus Address Decoder S. Two of these addresses strobe data from the Instrument Bus into register U22 F. The remaining address enables the three-state register U21 U onto the Instrument Bus. U25A Q differentiates between the two addresses strobed into U22.

Interrupts H

A13 has circuitry to interrupt the Microprocessor J under the following conditions:

- REN goes false (U14D).
- IFC goes true (U14C).
- ATN goes true (U1A pin 1).
- LRTL goes true (U25B pin 10); [LCL] pressed on front panel.
- Input received from Instrument Bus (U14A).

Device Select Decoder O

The Device Select Decoder selects the register or buffer to be written into or read by the Processor J.

Bus Pullup/Clamp L

The Bus Pullup/Clamp is a resistor-diode network used to improve the rise time of the A13 Data Bus.

HP-IB Transceiver Control M

The TALK and $\overline{\text{LISTEN}}$ control lines from the Processor J are not affected by HP-IB Transceiver Control when ATN is false on the HP-IB. When ATN is true, a LISTEN condition is forced to the HP-IB Transceiver drivers T.

HP-IB Address Switch D

The HP-IB Address Switch, when selected by the Device Select Decoder O, puts the switch setting on the A13 Data Bus. The normal setting is 31 (all switches closed). Another setting is used only when a specific address is desired on every power-up.

Microprocessor Supply Control K

The Microprocessor Supply Control K sets the back gate voltage (V_{BG}) of the Microprocessor J with R6 and R7. Q3 is used to regulate +12V down to +9V. Q4 holds off the +9V until the instrument power-up (HPUP) line is true.

The Microprocessor is designed so that it begins operation at ROM location Ø of the Program Memory E when +9V is turned on. Thus when HPUP goes true, indicating that all power supplies are ready, operation begins at a known point.

Microprocessor J

Pins 31 through 36 of Microprocessor U11 are called Direct Control Lines. Each has an internal pullup and an active pulldown; in addition, the condition of each line can be tested by the Microprocessor. These lines can also be pulled down externally. Each pin except for power and ground has an internal pullup.

Signature Analysis

The Signature Analysis (SA) test begins at location Ø of the ROM E and takes advantage of the power-up characteristics described above. (Refer to paragraph 9-11 for a further description of Signature Analysis.) U20 K is used only with the SA Test Extender Board. However, the SA test routine is executed once at every power-up. This test "wiggles" all HP-IB lines; therefore, the spectrum analyzer will abort any current operation when it is turned on.

A13 HP-IB INTERFACE, TROUBLESHOOTING

Front Panel Checks

With power off, hold INSTR PRESET and turn power on. This prevents the A15 instrument controller processor from running but allows the A13 micro-processor J to run. After about 2 secs, the ADRS'D LED should start flashing.

The A13 micro-processor flashes the ADRS'D LED when power is turned on until communication with the controller processor is established. Releasing the INSTR PRESET key allows this communication to start.

Therefore, turning power on with INSTR PRESET pressed is a partial test of the A13 assembly. Also if the ADRS'D LED flashes without INSTR PRESET pressed it indicates the A13 micro-processor is functioning but cannot communicate with the controller processor.

Another indicator of proper operation is the presence of the following message in the Active Function block.

HP-IB ADRS: XX XX
"DATE"

If this message does not appear when power is turned on and all cables have been removed from the HP-IB connector, A13J1, a fault exists on A13. This message is sent to A15 by A13 upon power on (or a SHIFT ZOOM (KSP) with a terminated entry). Too many HP-IB devices without power on connected to the HP-IB connector can prevent display of this message.

Test Philosophy

The Front Panel checks previously described are easy to perform indicators of performance. When more detailed troubleshooting is indicated, a method for component level troubleshooting is described below.

The A13 board is tested independently of the instrument or the HP-IB. Only power is supplied to the board from the instrument or from separate supplies. Do not connect a cable to J1 (HP-IB connector).

The HP-IB Test Extender Board (85680-60036) makes and breaks the necessary connections to put the A13 assembly into test mode. See Figure 9-45.

First, the power, clock, and test circuits are checked to determine if Signature Analysis can be performed.

If so, Signature Analysis is done with 5 signature diagrams which are used with the HP 5004A Signature Analyzer.

The data bus is checked first in each test setup. Only one new device is outputting onto the bus in each test. This is identified in red in the test description on each diagram. Refer to Figure 9-1 for general information on use of the Signature Analysis diagrams. The test points on this board have been designed so that the leads from the HP 5004A test pod can be slipped over them. It is not necessary to use the grabber connectors.

When a bad output is found, it is implied that all inputs affecting that particular output should be checked. Do not forget enable and clock inputs. These are usually indicated by red pads without red lines to them.

Also, much information can be obtained by looking at a bad node with an oscilloscope.

Basic Assumptions

A wrong +5V signature indicates an incorrect test setup. However, Test 2 and Test 6 have added meanings which are described on their diagrams. The +5V signature must be good before proceeding.

Each Test block describes the proper HP 5004A connections. Except for Test 1, the only difference between test setups is the STOP test point.

All cables are removed from J1 (HP-IB connector)

Signatures on J1 are sensitive to hand capacitance. Very few of the internal functions of the A13 microprocessor are checked, therefore when a problem cannot be diagnosed by signature analysis, replace U11.

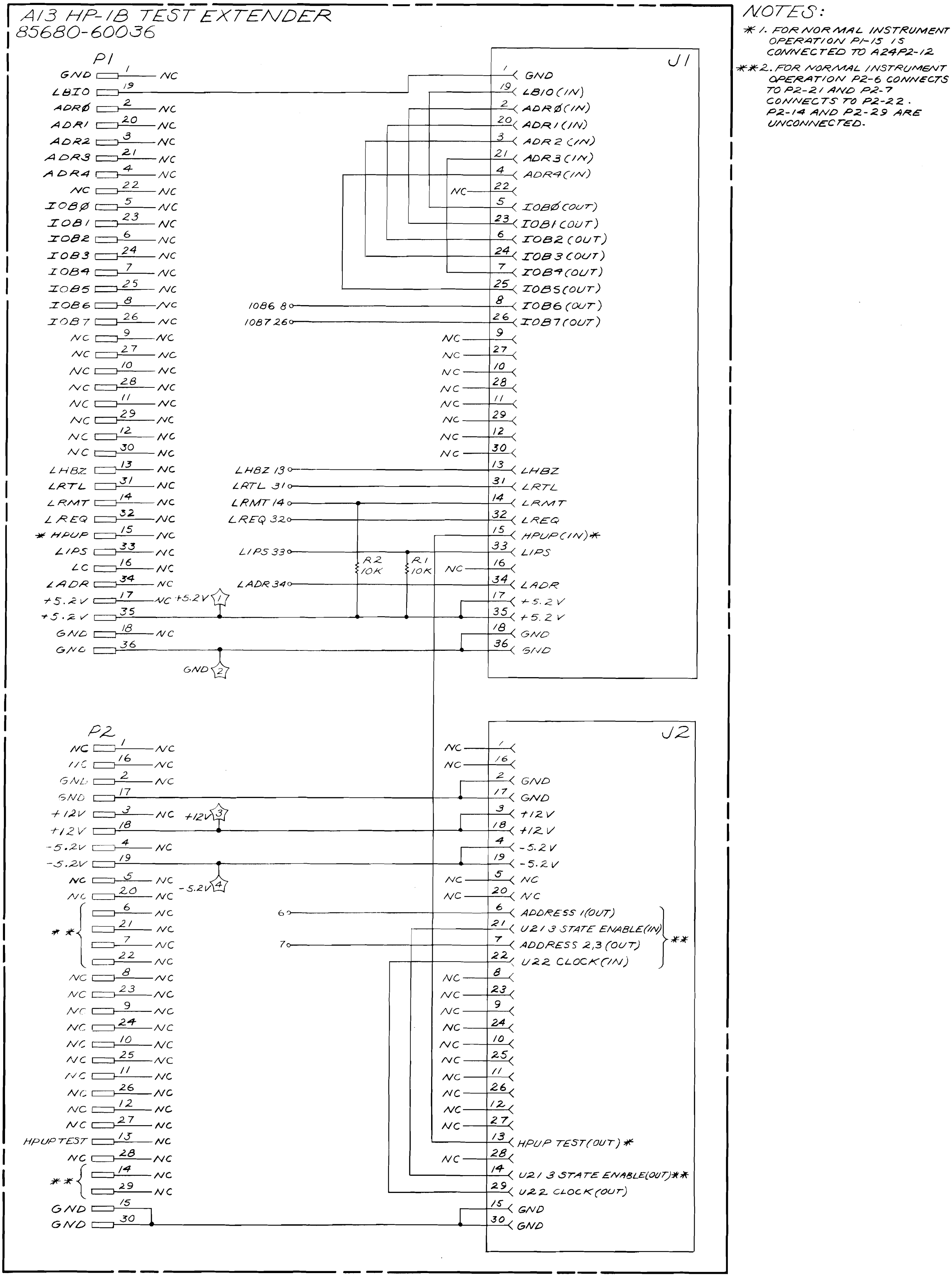


Figure 9-45. HP-IB Test Extender Board (85680-60036)

Test Procedure

1. Install A13 board in the Test Extender Board (85680-60036).

   Verify the following:

   U11 pin 40 = +9.0V ±0.45V
   U11 pin 39 = +5.0V ±0.25V
   U11 pin 38 = V_{BG} stamped on U11 ±5%
   U11 pin 40 has a pulse to 0V approximately 40 μs wide approximately every 200 ns.

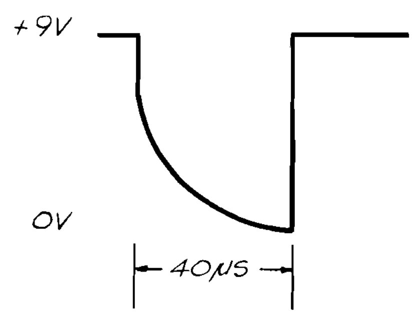


Figure 9-46. Power Up - SA Test Pulse

This pulse is generated by U20 (K) and routed through J2 (G) and through P2-13 to P1-15 (HPUP) (K) through the extender board. The microprocessor (U11) (J) re-executes the test routine each time U11 pin 40 is pulsed.

2. Check clock A13TP16.

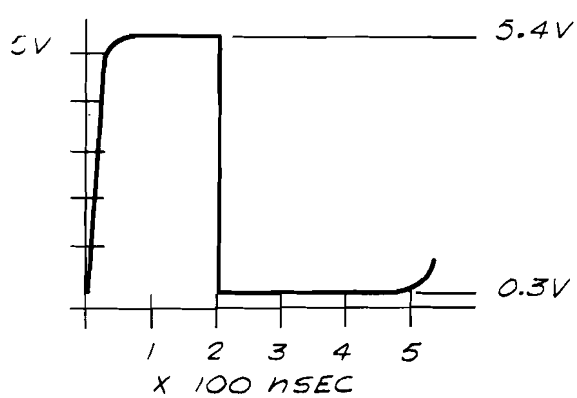


Figure 9-47. HP-IB Clock Waveform

rise time to +4.0V <50 μs (45 ns typ)
fall time <75 ns (15 μs typ)
150 ns < Ton <250 ns (180 ns typ at 0.3V)
300 ns <Toff <400 ns (320 ns typ at 0.3V)
5.0V <Von <6.0V (5.4V typ)
0V <Voff <0.5V (0.3V typ)

If the above conditions are met, the Test routine is probably running and signature analysis can now be performed.

SIGNATURE ANALYSIS DIAGRAM DESCRIPTIONS

Test 1 (Sheet 1/5)

This tests the micro-processor (U11) J program counter (pins 1-11), the program gate (pin 26), U13D E , and the ROMs U3 and U2 E .

Removing J2 G forces the micro-processor to free run through all locations of memory. (When removing J2, pry it up slowly and carefully to prevent bending the end pins.)

Since the program stored in memory is being checked, it is necessary to make sure the part numbers of the ROMs agrees with those on the SA Diagram. If they do not agree, only the output signatures of the memories need be disregarded. These are pins 11 to 14 of U3 and U12 and the green path of Test 1. All other signatures are valid for all serial prefixes.

Test 2 (Sheet 1/5)

This test checks the micro-processor (U11) J , internal memory (RAM) and the data bus traces.

U11 does an internal RAM check and outputs the results onto the data bus. The bus is checked at the far ends of the bus traces at U21 and U22. A bad signature that is also bad at U11 implies a defective U11. Also a bad +5V signature with a correct setup implies U11 is at fault.

Note that U21 and U22 are not being tested here, only the traces leading to these IC's.

Test 3 (Sheet 2/5)

This test verifies operation of the control function lines of the HP-IB Transceivers A I , the transceiver controls and the Device Select Decoder O . The pads located in the box in the lower right hand corner of the diagram are actually located directly below J2 on the extender board. These are edge connector pads placed and labeled on the extender board for convenience.

If a wrong signature leads to Block M , Transceiver Controls, note that an input is the ATN line from U15 pin 10 A . This is a tricky loop that one wrong signature will cause all the others in the loop to be incorrect. Figure 9-48 is a simplified diagram of the loop.

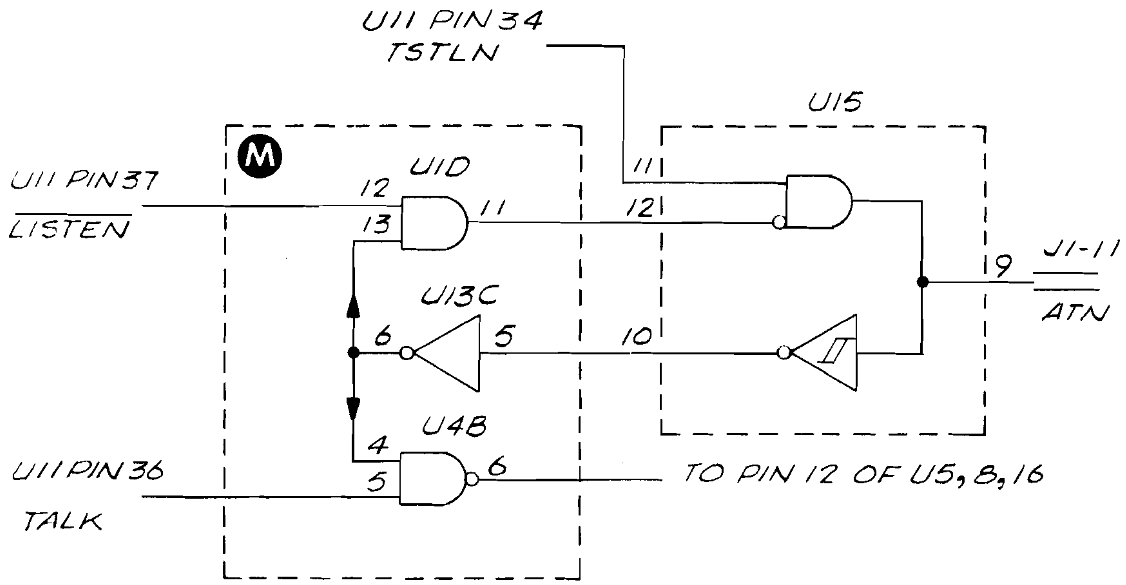


Figure 9-48. Simplified HP-IB Transceiver Control Schematic

There are only 2 inputs to this loop, U11 pin 37 and U11 pin 34. Therefore, if these inputs are good and all signatures around the loop are bad, the defective component can then be found with an oscilloscope.

Test 4 (Sheet 3/5)

This test verifies operation of the data I/0 section of the HP-IB transceivers A I , the transceiver controls and the Device Select Decoder O .

If a bad signature leads to Block M Transceiver Controls, refer to Figure 9-48 and the troubleshooting information on this loop listed under Test 3.

Test 5 (Sheet 4/5)

This test verifies that the microprocessor J can read and write data from the IOB lines. The handshake controls Q and its decoder S are checked.

The Interrupt circuits H that are not checked in this test are U14E and U4C.

Connections to U22 pin 11 and U2 pin 1 are routed through the extender board as designated on the diagram. The pads located in the box in the lower right hand corner of the diagram are located directly below J2 on the extender board and are labeled for convenience.

If a bad signature leads to Block M Transceiver Controls, refer to Figure 9-48 and the troubleshooting information on this loop listed under Test 3.

Note that unstable signatures on U4 or U25 can be stabilized with a short jumper from A13TP14 to A13TP15.

Test 6 (Sheet 5/5)

This test checks the HP-IB Address Switch D. The switch, S1, should initially be set to address 0 (switches in down position). Only one switch section should be on at a time to ensure that a valid signature is obtained at U7. All other signatures are independent of switch position. If the +5V signature is bad and the setup is correct, suspect the remaining interrupt circuits U14E and U4C or U11. Also, jumper A13TP14 to A13TP15 to stabilize signatures.

Table 9-18. A13 HP-IB Interface, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13	85680-60118	1	BOARD ASSY: HP-IB INTERFACE	28480	85680-60118
A13C1	0180-0229	4	CAPACITOR-FXD 33UF ±10% 10VDC	04200	150D336X9010B2
A13C2	0160-2055	13	CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C3	0180-0229		CAPACITOR-FXD 33UF ±10% 10VDC	04200	150D336X9010B2
A13C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C7			NOT ASSIGNED		
A13C8	0180-0229		CAPACITOR-FXD 33UF ±10% 10VDC	04200	150D336X9010B2
A13C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C11	0180-0229		CAPACITOR-FXD 33UF ±10% 10VDC	04200	150D336X9010B2
A13C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C15	0180-0116	1	CAPACITOR-FXD 6.8UF ±10% 35VDC	04200	150D685X9035B2
A13C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C17	0160-4298	1	CAPACITOR-FXD 4700PF ±20% 250VDC	04200	C067F251H472M522-CDH
A13C18	0180-0228	1	CAPACITOR-FXD 22UF ±10% 15VDC	04200	150D226X9015B2
A13C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC	28480	0160-2055
A13C21			NOT ASSIGNED		
A13C22	0160-0945	1	CAPACITOR-FXD 910PF ±5% 300VDC	28480	0160-0945
A13C23	0160-2055		CAPACITOR-RXD .01UF +80-20% 100VDC	28480	0160-2055
A13CR1			NOT ASSIGNED		
A13CR2			NOT ASSIGNED		
A13CR3			NOT ASSIGNED		
A13CR4			NOT ASSIGNED		
A13CR5	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS	28480	1901-0040
A13CR6			NOT ASSIGNED		
A13CR7			NOT ASSIGNED		
A13CR8	1901-0518	1	DIODE-SCHOTTKY	28480	1901-0518
A13E1	1251-4832	1	JUMPER-PROGRAMMING	28480	1251-4832
A13J1	1251-3283	1	CONNECTOR-24-PIN F MICRORIBBON	28480	1251-3283
A13J2	1200-0655	1	SOCKET-18-CONTACT	28480	1200-0655
A13L1	08558-80011	3	COIL-FILTER BLUE	28480	08558-80011
A13L2	08558-80011		COIL-FILTER BLUE	28480	08558-80011
A13L3	08558-80011		COIL-FILTER BLUE	28480	08558-80011
MP1	85680-60115	2	STANDOFF-METRIC THREAD	28480	85680-60115
MP2	2190-0034	2	WASHER-LOCK HLCL NO. 10 .194 IN ID	28480	2190-0034
MP3	1530-1098	2	CLEVIS–.070 IN SLIT. .454 IN PIN CTR	28480	1530-1098
MP4	2200-0143	2	SCREW-MACH 4-40 .375 IN LG PAN HD-POZI-DRIV	28480	2200-0143
MP5	2260-0002	2	NUT-HEX DBL CHAM 4-40 .062 IN THK	28480	2260-0002
MP6	2190-0004	2	WASHER-LOCK INT T NO. 6 .115 IN ID	28480	2190-0004
MP7	85680-00053	1	GROUND SPRING—HP-IB	28480	85680-00053
A13Q1	1854-0477	4	TRANSISTOR-NPN 2N2222A TO-18	02237	2N2222A
A13Q2	1854-0477		TRANSISTOR-NPN 2N2222A TO-18	02237	2N2222A
A13Q3	1854-0477		TRANSISTOR-NPN 2N2222A TO-18	02237	2N2222A
A13Q4	1854-0477		TRANSISTOR-NPN 2N2222A TO-18	02237	2N2222A
A13R1			NOT ASSIGNED		
A13R2			NOT ASSIGNED		
A13R3	0698-3150	1	RESISTOR-2.37K 1% .125W	03292	C4-1/8-TO-2371-F
A13R4	0757-0420	1	RESISTOR-750 1% .125W	03292	C4-1/8-TO-750R-F
A13R5	0757-0394	1	RESISTOR-51.1 1% .125W	03292	C4-1/8-TO-51R1-F
A13R6	0757-0428	1	RESISTOR-1.62K 1% .125W	03292	C4-1/8-TO-1621-F
A13R7*	0757-0280	1	RESISTOR-FXD 1.0K V_{BG}=–2.0V	03292	C4-1/8-TO-1001-F
A13R7*	0757-1094		RESISTOR-FXD 1.47K V_{BG}=–2.5V	03292	C4-1/8-TO-1471-F
A13R7*	0698-0084		RESISTOR-FXD 2.15K V_{BG}=–3.0V	03292	C4-1/8-TO-2151-F
A13R7*	0698-3152		RESISTOR-FXD 3.48K V_{BG}=–3.5V	03292	C4-1/8-TO-3481-F
A13R7*	0757-0200		RESISTOR-FXD 5.62K V_{BG}=–4.0V	03292	C4-1/8-TO-5621-F
A13R7*	0757-0443		RESISTOR-FXD 11K V_{BG}=–4.5V	03292	C4-1/8-TO-1102-F
A13R7*	0698-3450		RESISTOR-FXD 42.2K V_{BG}=–5.0V	03292	C4-1/8-TO-4222-F
A13R8			NOT ASSIGNED		
A13R9	0698-3159	2	RESISTOR-26.1K 1% .125W	03292	C4-1/8-TO-2612-F

Table 9-18. A13 HP-IB Interface, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13R10	0757-0442	1	RESISTOR-10K 1% .125W	03292	C4-1/8-TO-1002-F
A13R11			NOT ASSIGNED		
A13R12			NOT ASSIGNED		
A13R13	0698-3334		RESISTOR-178 1% .5W	05524	MFF-1/2-10
A13R14	0757-0280	1	RESISTOR-1K 1% .125W	03292	C4-1/8-TO-1001-F
A13R15	0757-0438	2	RESISTOR-5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A13R16	0757-0438		RESISTOR-5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A13R17	0757-0417	1	RESISTOR-562 1% .125W F TC=0±100	03292	C4-1/8-TO-562R-F
A13R18	0698-0083	1	RESISTOR-1.96K 1% .125W	03292	C4-1/8-TO-1961-F
A13R19	0757-0418	1	RESISTOR-619 1% .125W	03292	C4-1/8-TO-619R-F
A13R20	0698-3159		RESISTOR-26.1K 1% .125W	03292	C4-1/8-2612-F
A13S1	3101-2206		SWITCH-TGL DIP 5 SWITCH	28480	3101-2206
A13TP1– A13TP10			NOT ASSIGNED		
A13TP11	1251-5177	9	CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP12	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP13	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP14	1460-1489	2	WIREFORM	28480	1460-1489
A13TP15	1460-1489		WIREFORM	28480	1460-1489
A13TP16	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP17			NOT ASSIGNED		
A13TP18			NOT ASSIGNED		
A13TP19	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP20			NOT ASSIGNED		
A13TP21	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP22			NOT ASSIGNED		
A13TP23			NOT ASSIGNED		
A13TP24	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP25			NOT ASSIGNED		
A13TP26			NOT ASSIGNED		
A13TP27			NOT ASSIGNED		
A13TP28	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13TP29	1251-5177		CONNECTOR-SGL CONT .031 IN	28480	1251-5177
A13U1	1820-1201	1	IC-TTL 2 INPUT QUAD AND GATE	01698	SN74LS08N
A13U2	1820-1216	2	IC-TTL 3 INPUT 3-TO-8 DECODER	01698	SN74LS138N
A13U3	1816-1172	1	IC-TTL ROM 2048 x 4	28480	1816-1172
A13U4	1820-1197	1	IC-TTL 2 INPUT QUAD NAND GATE	01698	SN74LS00N
A13U5	1820-1558	3	IC-TTL QUAD TRANSCEIVER	02037	MC3441P
A13U6	1820-1112	3	IC-TTL D-TYPE FF POS EDGE TRIG	01698	SN74LS74N
A13U7	1810-0326	1	DIODE ARRAY-CLAMP	28480	1810-0326
A13U8	1820-1558		IC-TTL QUAD TRANSCEIVER	02037	MC3441P
A13U9	1820-1730	2	IC-TTL D-TYPE FF POS-EDGE TRIG	01698	SN74LS273
A13U10	1820-1917	2	IC-TTL BFR LINE DRVR OCTAL	01698	SN74LS240N
A13U11	1820-1691	1	IC-MOS MICROPROCESSOR	28480	1820-1691
A13U12	1816-1173	1	IC-TTL ROM 2048 x 4	28480	1816-1173
A13U13	1820-1416	1	IC-TTL SCHEMITT-TRIG HEX INV	01698	SN74LS14N
A13U14	1820-1199	1	IC-TTL HEX INV	01698	SN74LS04N
A13U15	1820-1558		IC-TTL QUAD TRANSCEIVER	02037	MC3441P
A13U16	1820-1522	1	IC-TTL QUAD TRANSCEIVER	02037	MC3440P
A13U17	1820-1730		IC-TTL D-TYPE FF POS-EDGE-TRIG	01698	SN74LS273
A13U18	1820-1917		IC-TTL BFR LINE DRVR OCTAL	01698	SN74LS240N
A13U19	1820-1491	1	IC-BFR TTL LS NON-INV HEX 1-INP	01698	SN74LS367N
A13U20	1820-1423	1	IC-TTL RETRIG DUAL MONOSTBL MV	01698	SN74LS123N
A13U21	1820-1997	2	IC-TTL 8 SEGMENT FF	28480	1820-1997
A13U22	1820-1997		IC-TTL 8 SEGMENT FF	28480	1820-1997
A13U23	1820-1216		IC-TTL 3-INPUT 3-TO-8 DECODER	01698	SN74LS138N
A13U24	1820-1112		IC-TTL D-TYPE FF POS-EDGE TRIG	01698	SN74LS74N
A13U25	1820-1112		IC-TTL D-TYPE FF POS-EDGE TRIG	01698	SN74LS74N
A13VR1	1902-3158	1	DIODE-BREAKDOWN 9.76V 2% .4W	02237	FZ7459
A13XU11	1200-0694	1	SKT-DIL 40-CONTACT	28480	1200-0694
			MISCELLANEOUS PARTS		
	1480-0073	2	PIN-RLL .062 IN DIA	28480	1480-0073
	4040-0749	1	EXTRACTOR-PC BOARD BROWN	28480	4040-0749
	4040-0751	1	EXTRACTOR-PC BOARD ORANGE	28480	4040-0751

A13
HP-IB INTERFACE

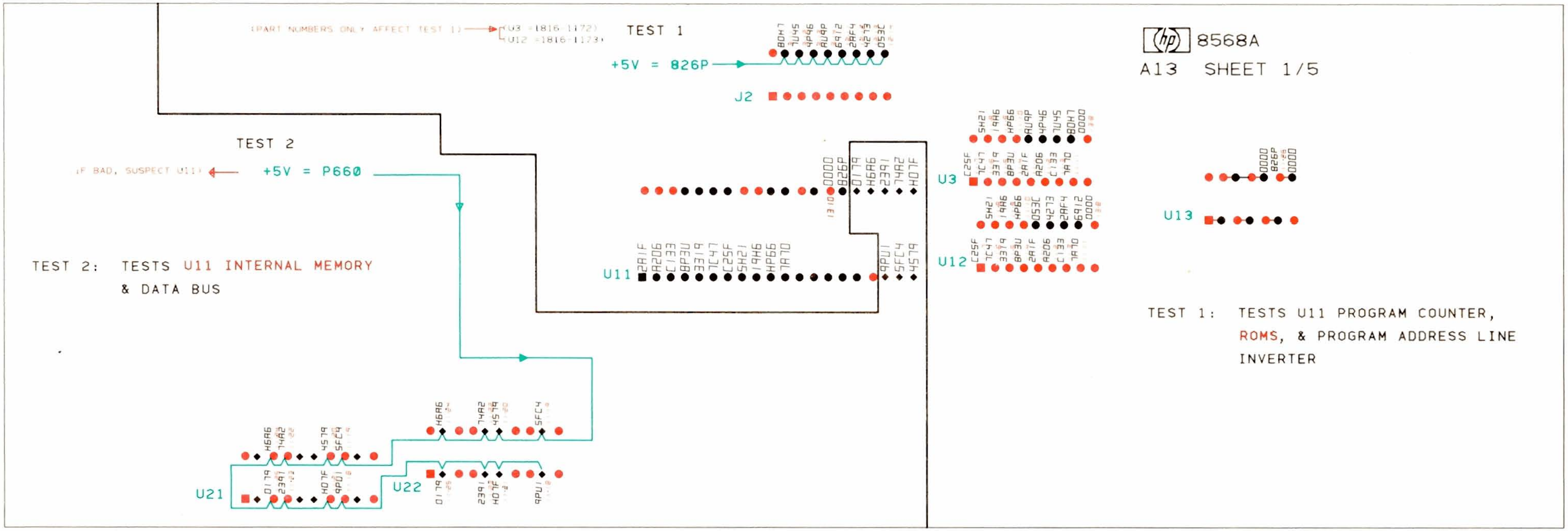


Figure 9-49. A13 HP-IB Interface, Signature Analysis Troubleshooting Diagram (1 of 5)

TEST 1

Signature Analyzer Connections:

CLOCK _/ to A13TP16
START ‾_ to A13TP11
STOP ‾_ to A13TP28

Spectrum Analyzer Connections:

Remove jumper from A13J2
Install A13 board on A13 HP-IB Interface Extender board, HP Part No. 85680-60036.

TEST 2

Signature Analyzer Connections:

CLOCK _/ to A13TP16
START ‾_ to A13TP29
STOP ‾_ to A13TP13

Spectrum Analyzer Connections:

Install jumper in A13J2
Install A13 board on A13 HP-IB Interface Extender board, HP Part No. 85680-60036.

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.

A13
HP-IB INTERFACE

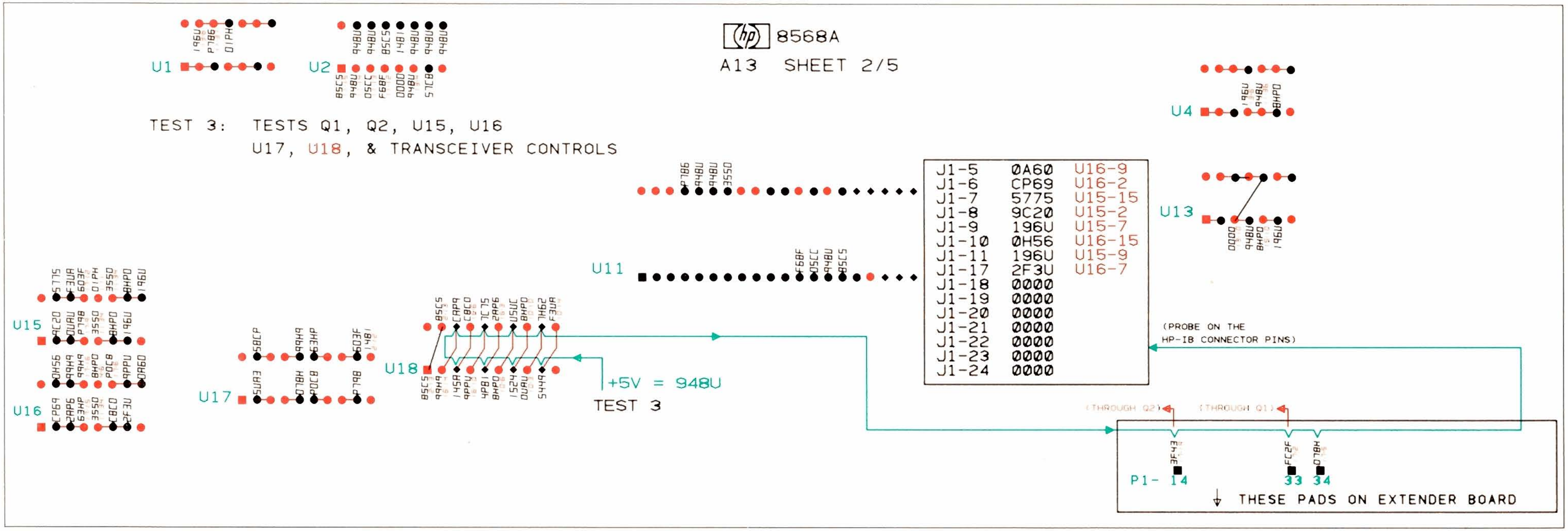


Figure 9-49. A13 HP-IB Interface, Signature Analysis Troubleshooting Diagram (2 of 5)

TEST 3

Signature Analyzer Connections:

CLOCK ⟋ to A13TP16
START ⟍ to A13TP29
STOP ⟍ to A13TP24

Spectrum Analyzer Connections:

A13J2 jumper installed.
Install A13 board on A13 HP-IB Interface Extender board, HP Part No. 85680-60036.

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.

A13
HP-IB INTERFACE

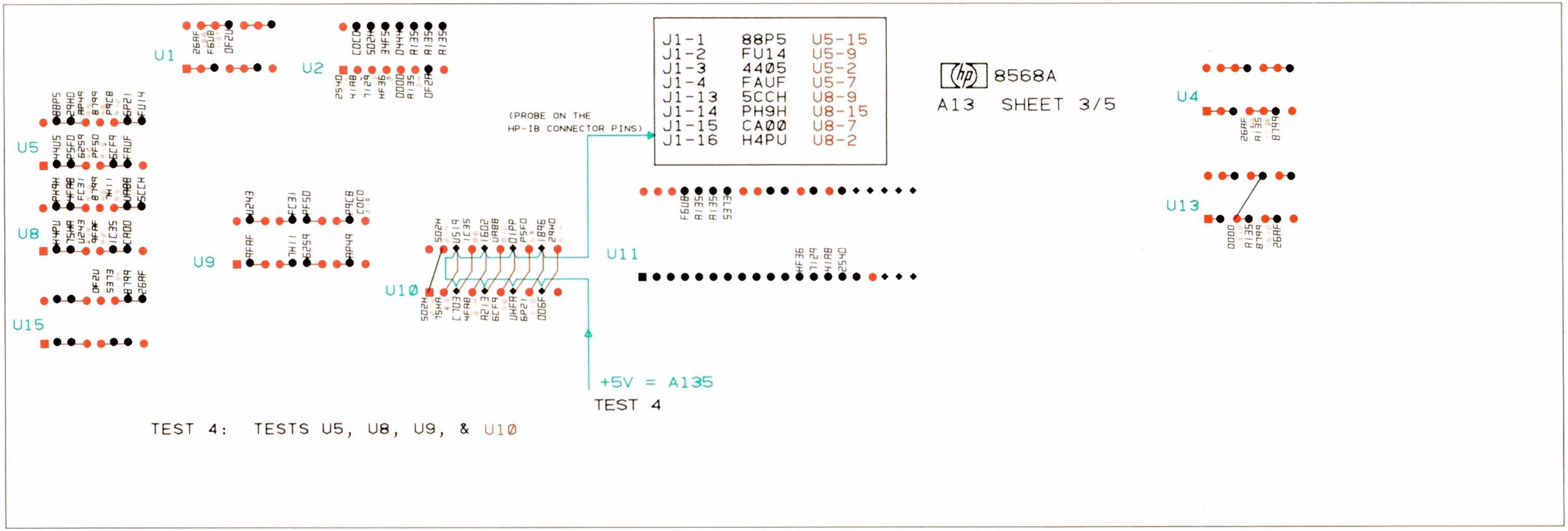


Figure 9-49. A13 HP-IB Interface, Signature Analysis Troubleshooting Diagram (3 of 5)

TEST 4

Signature Analyzer Connections:

CLOCK ⌐ to A13TP16
START ⌐ to A13TP29
STOP ⌐ to A13TP21

Spectrum Analyzer Connections:

A13J2 jumper installed.
Install A13 board on A13 HP-IB Interface Extender board, HP Part No. 85680-60036.

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.

A13
HP-IB INTERFACE

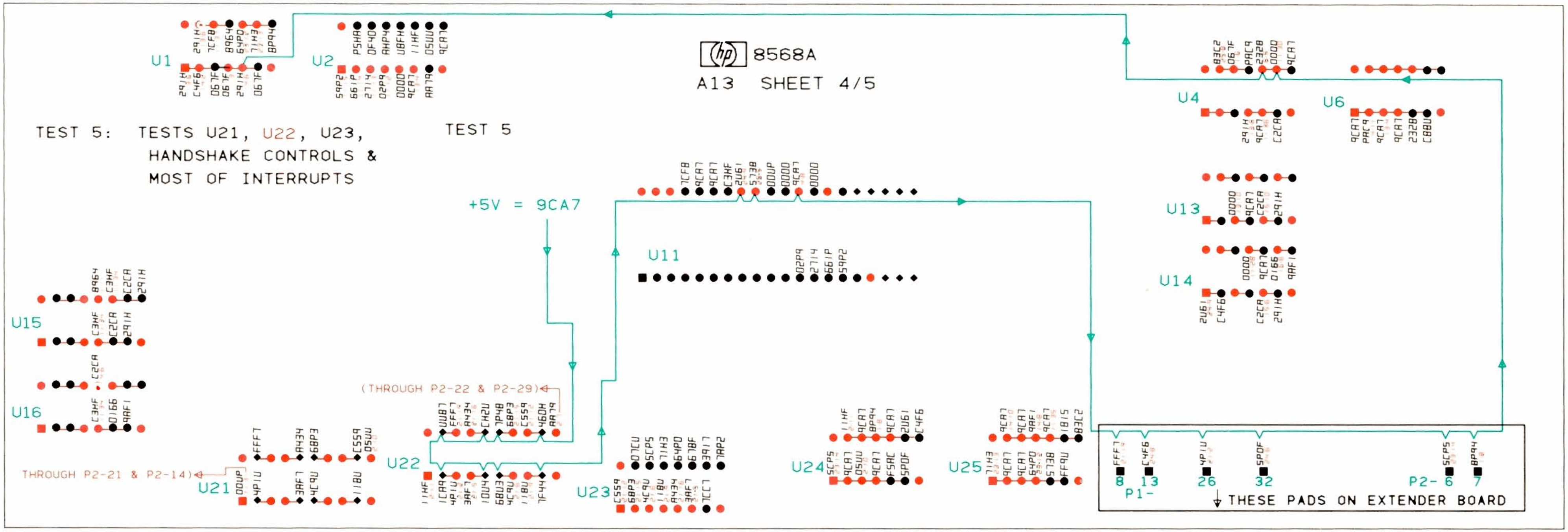


Figure 9-49. A13 HP-IB Interface, Signature Analysis Troubleshooting Diagram (4 of 5)

TEST 5

Signature Analyzer Connections:

CLOCK ⟋ to A13TP16
START ⟍ to A13TP29
STOP ⟍ to A13TP19

Spectrum Analyzer Connections:

A13J2 jumper installed.
Install A13 board on A13 HP-IB Interface Extender board, HP Part No. 85680-60036.

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.

A13
HP-IB INTERFACE

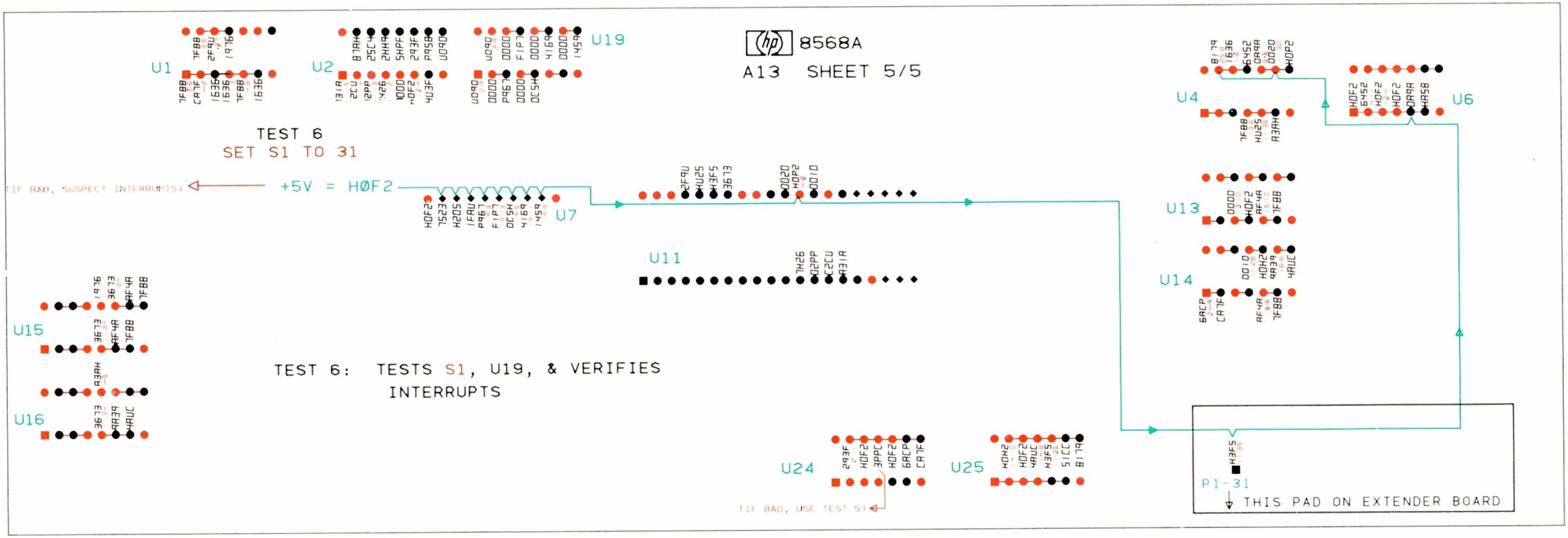


Figure 9-49. A13 HP-IB Interface, Signature Analysis Troubleshooting Diagram (5 of 5)

TEST 6

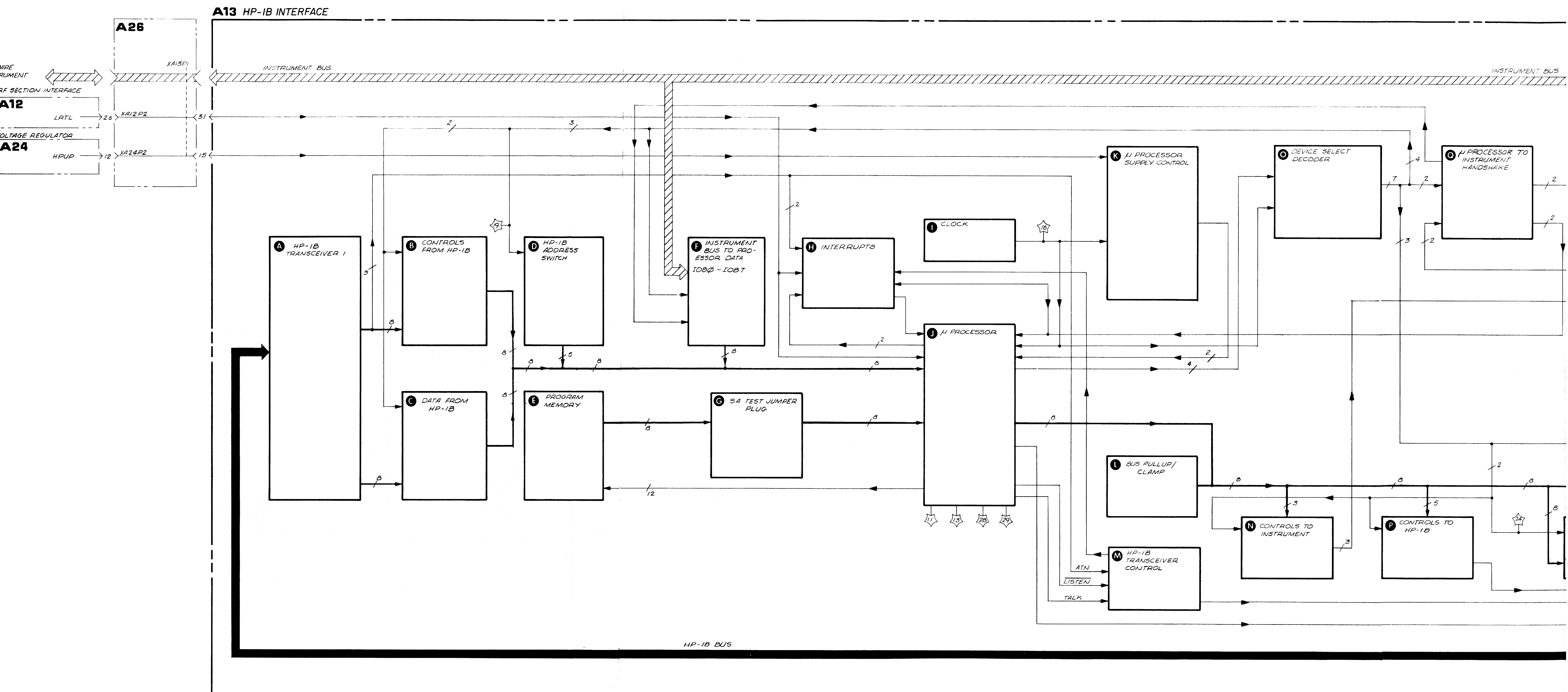
Signature Analyzer Connections:

CLOCK ⌐ to A13TP16
START ⌐ to A13TP29
STOP ⌐ to A13TP11

Spectrum Analyzer Connections:

A13J2 jumper installed.
Install A13 board on A13 HP-IB Interface Extender board, HP Part No. 85680-60036.

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.



SERIAL PREFIX: 1828A DATE: APRIL 1978

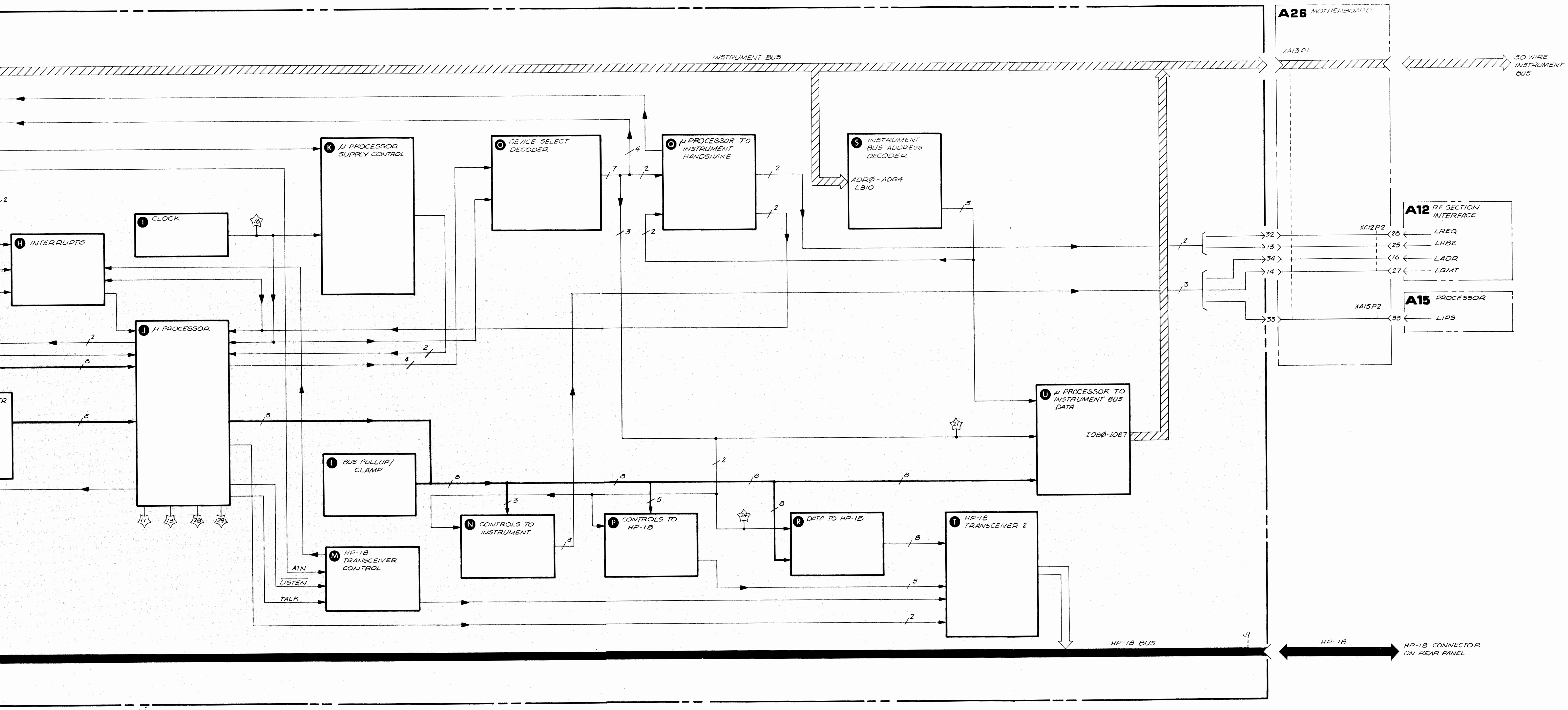


Figure 9-50. A13 HP-IB Interface, Block Diagram

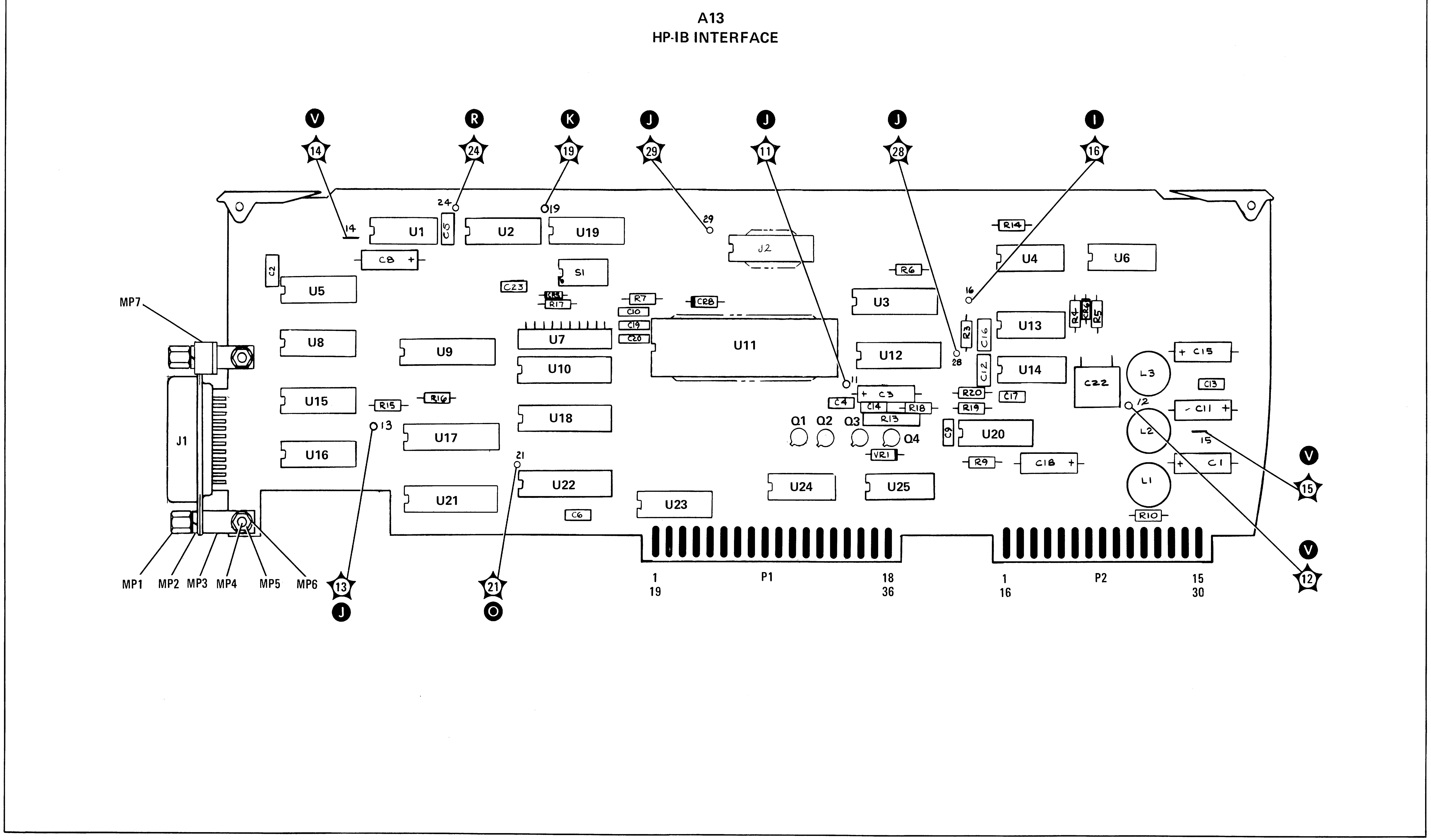


Figure 9-51. A13 HP-IB Interface, Component Locations

A13 HP-IB INTERFACE
85680-60118
(SHEET 1 OF 2)

P1

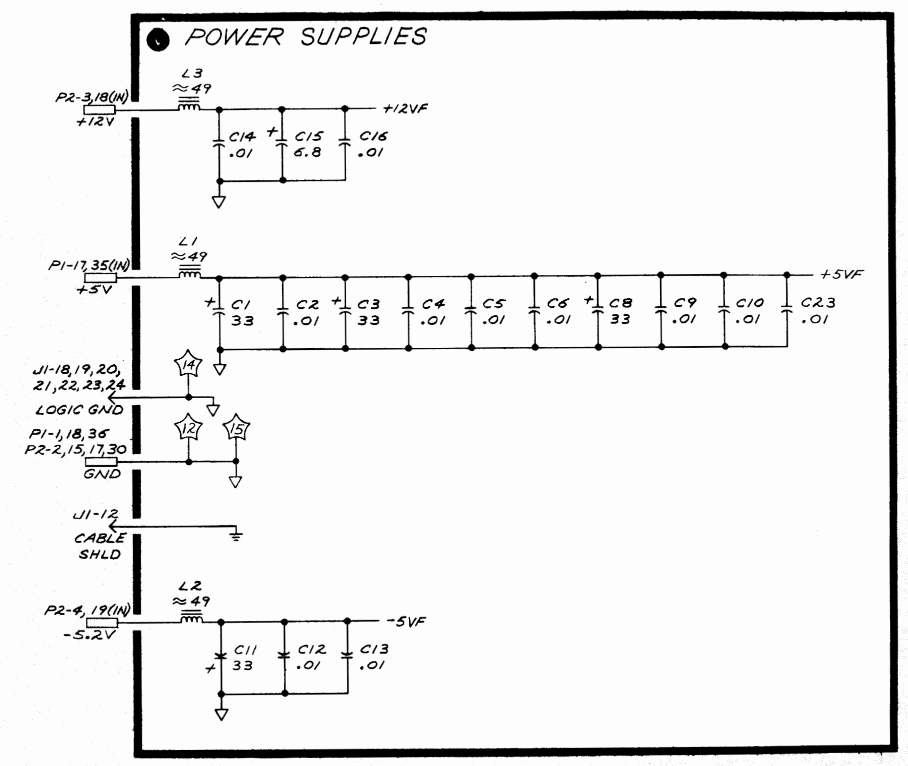
PIN	SIGNAL	TO/FROM	FUNTION BLOCK
1 19	GND LBI0	INSTRUMENT BUS	V S
2 20	ADR0 ADR1		S S
3 21	ADR2 ADR3		S S
4 22	ADR4 NC		S
5 23	IOB0 IOB1		U F U F
6 24	IOB2 IOB3		U F U F
7 25	IOB4 IOB5		U F U F
8 26	IOB6 IOB7		U F U F
9 27	NC NC		
10 28	NC NC		
11 29	NC NC		
12 30	NC NC		
13 31	LHBZ LRTL	A12P2-25 A12P2-26	O H
14 32	LRMT LREQ	A12P2-27 A12P2-28	N O
15 33	HPUP LIPS	A24P2-12 A15P2-33	K N
16 34	NC LADR	 A12P2-16	 N
17 35	+5V +5V		V V
18 36	GND GND		V V

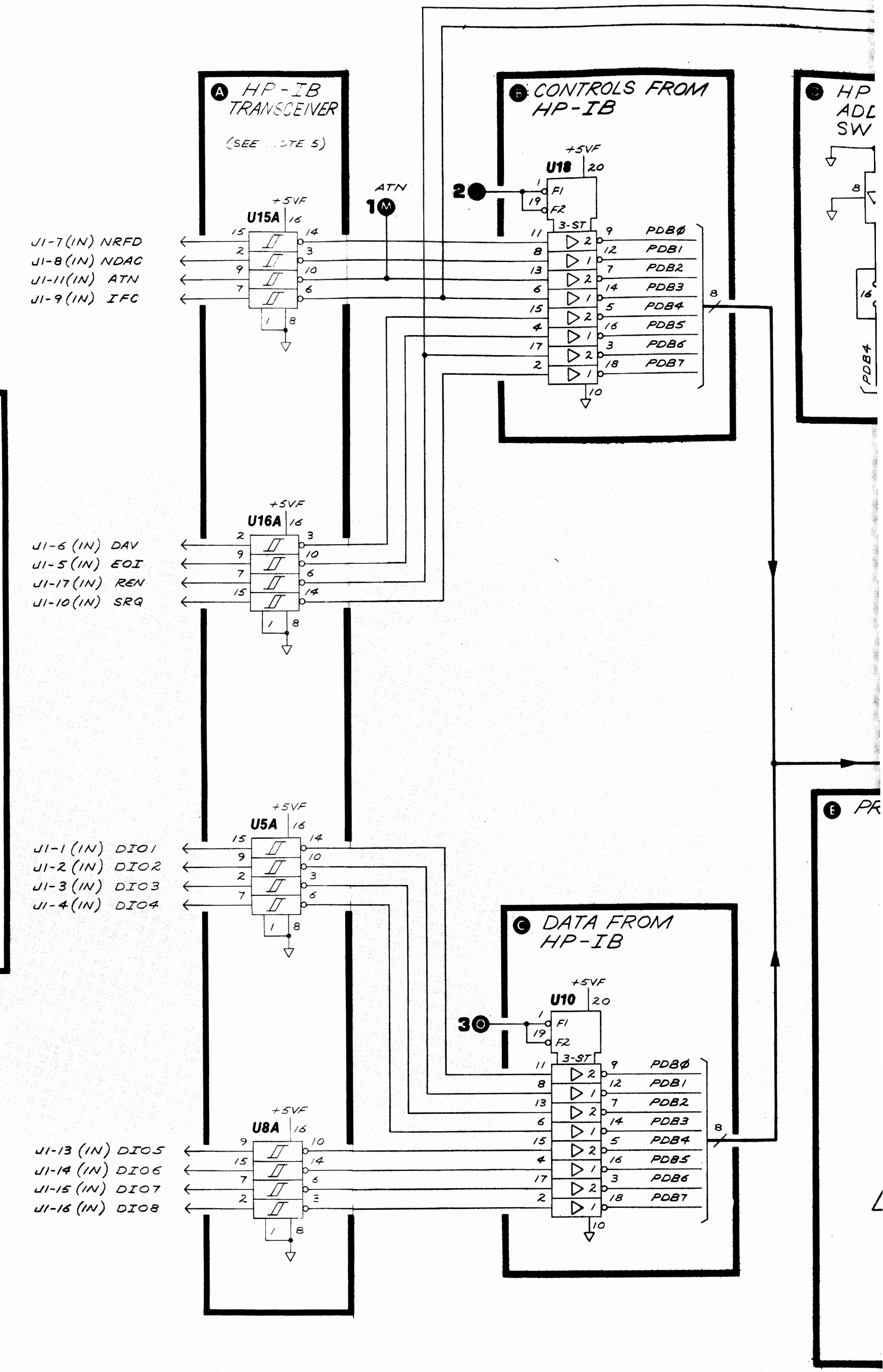
P2

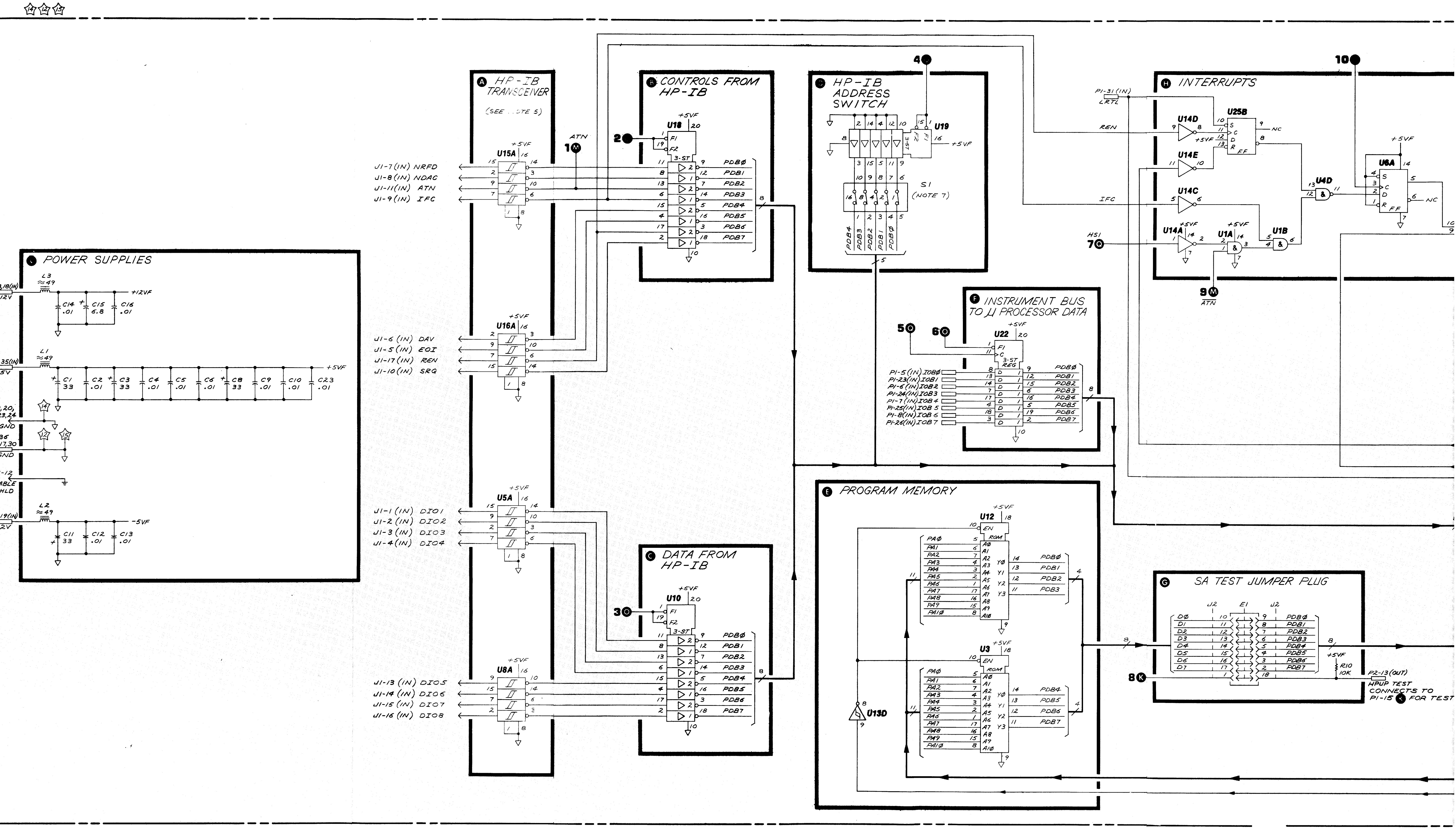
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 16	NC NC		
2 17	GND GND		V V
3 18	+12V +12V		V V
4 19	-5.2V -5.2V		V V
5 20	NC NC		
6 21	SEE NOTE 9		S U
7 22	SEE NOTE 9		Q Q
8 23	NC NC		
9 24	NC NC		
10 25	NC NC		
11 26	NC NC		
12 27	NC NC		
13 28	HPUP TEST NC		G
14 29	SEE NOTE 9		J O
15 30	GND GND		V V

J1 HP-IB CONNECTOR

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 13	DIO1 DIO5		A T A T
2 14	DIO2 DIO6		A T A T
3 15	DIO3 DIO7		A T A T
4 16	DIO4 DIO8		A T A T
5 17	EOI REN		A T A T
6 18	DAV DAV GND		A T V
7 19	NRFD NRFD GND		A T V
8 20	NDAC NDAC GND		A T V
9 21	IFC IFC GND		A T V
10 22	SRQ SRQ GND		A T V
11 23	ATN ATN GND		A T V
12 24	CABLE SHLD LOGIC GND		V V







POWER SUPPLIES
HP-IB TRANSCEIVER
CONTROLS FROM HP-IB
HP-IB ADDRESS SWITCH
INTERRUPTS
INSTRUMENT BUS TO µ PROCESSOR DATA
PROGRAM MEMORY
DATA FROM HP-IB
SA TEST JUMPER PLUG
HPUP TEST CONNECTS TO P1-15 FOR TEST

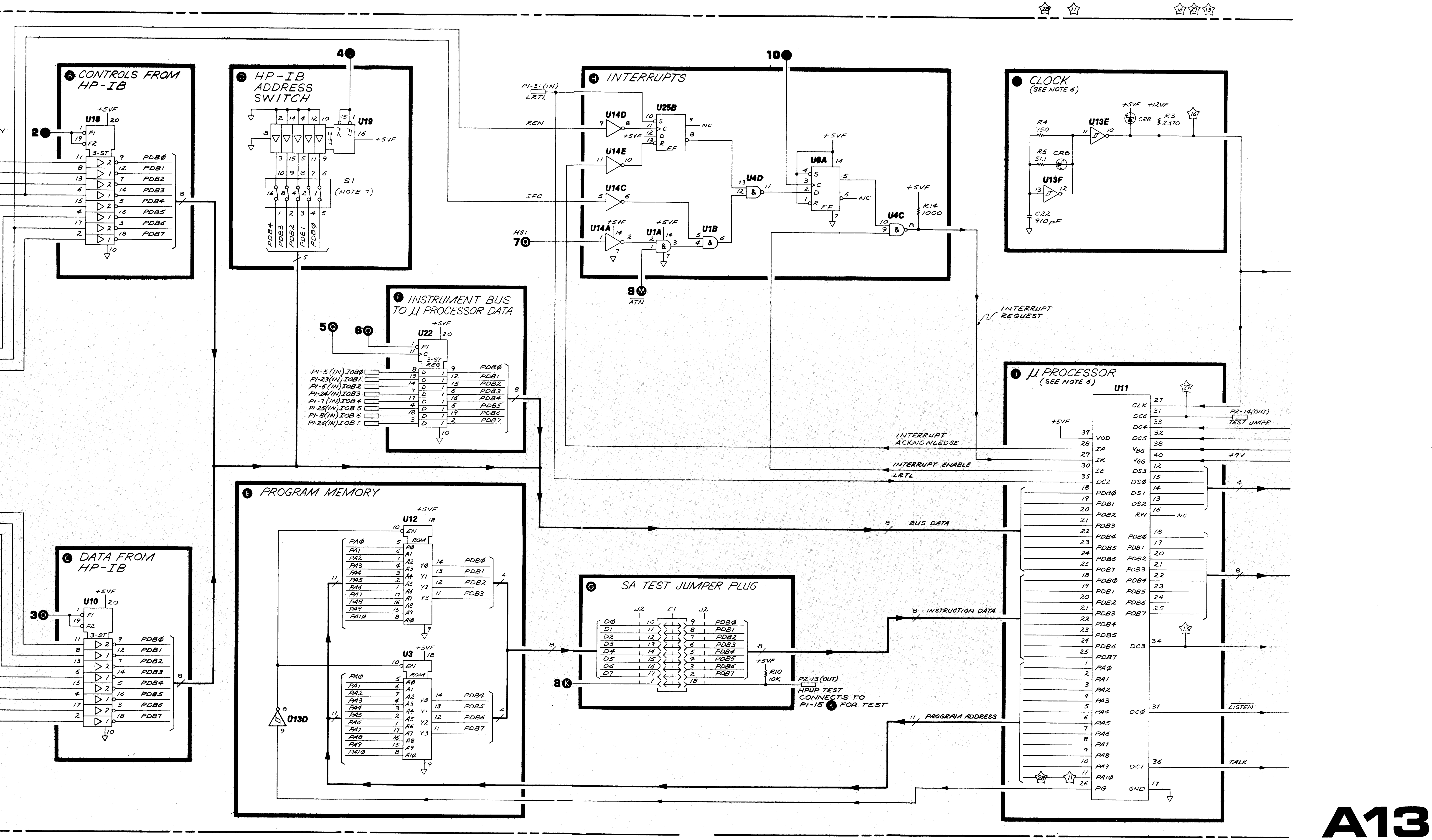
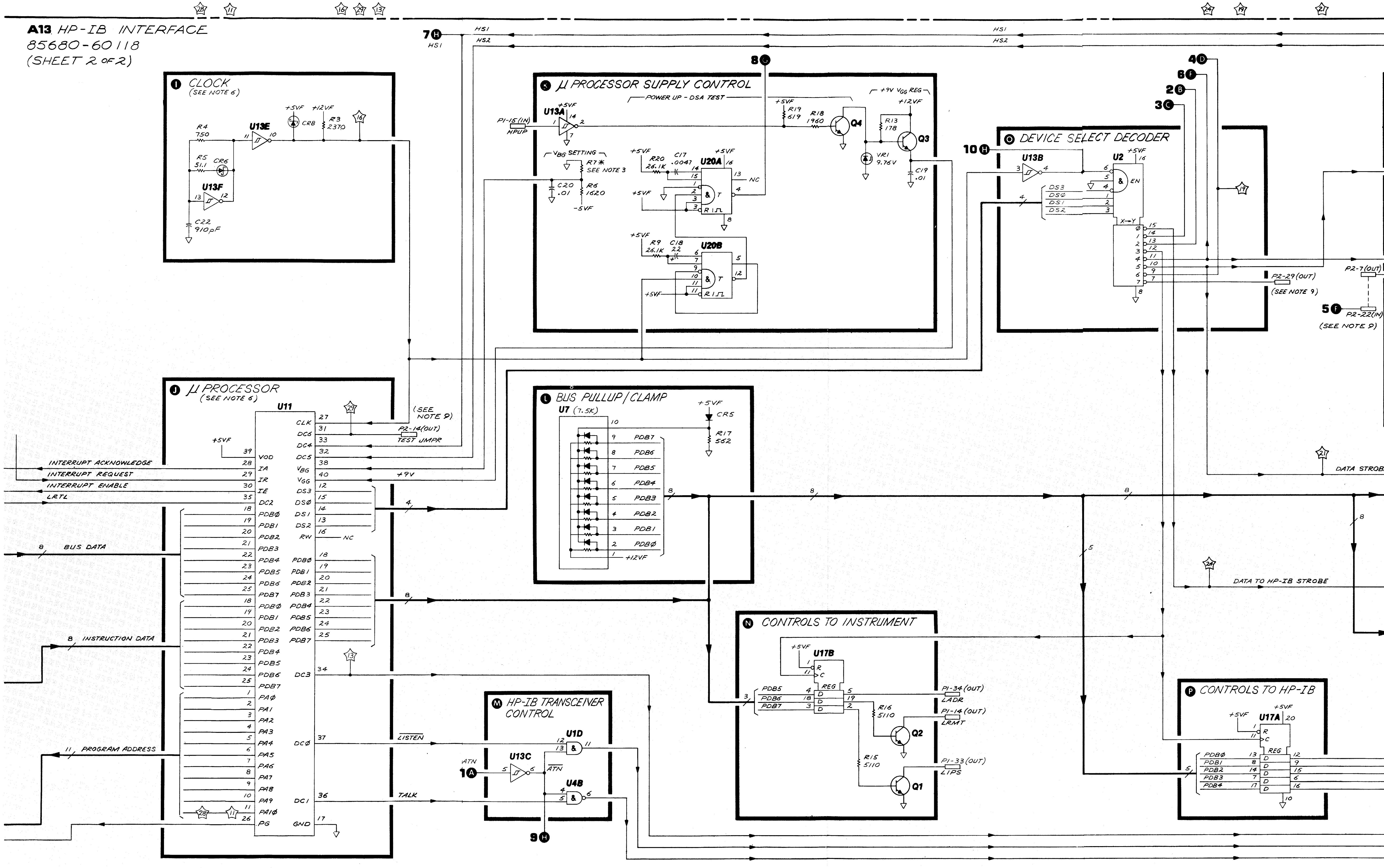
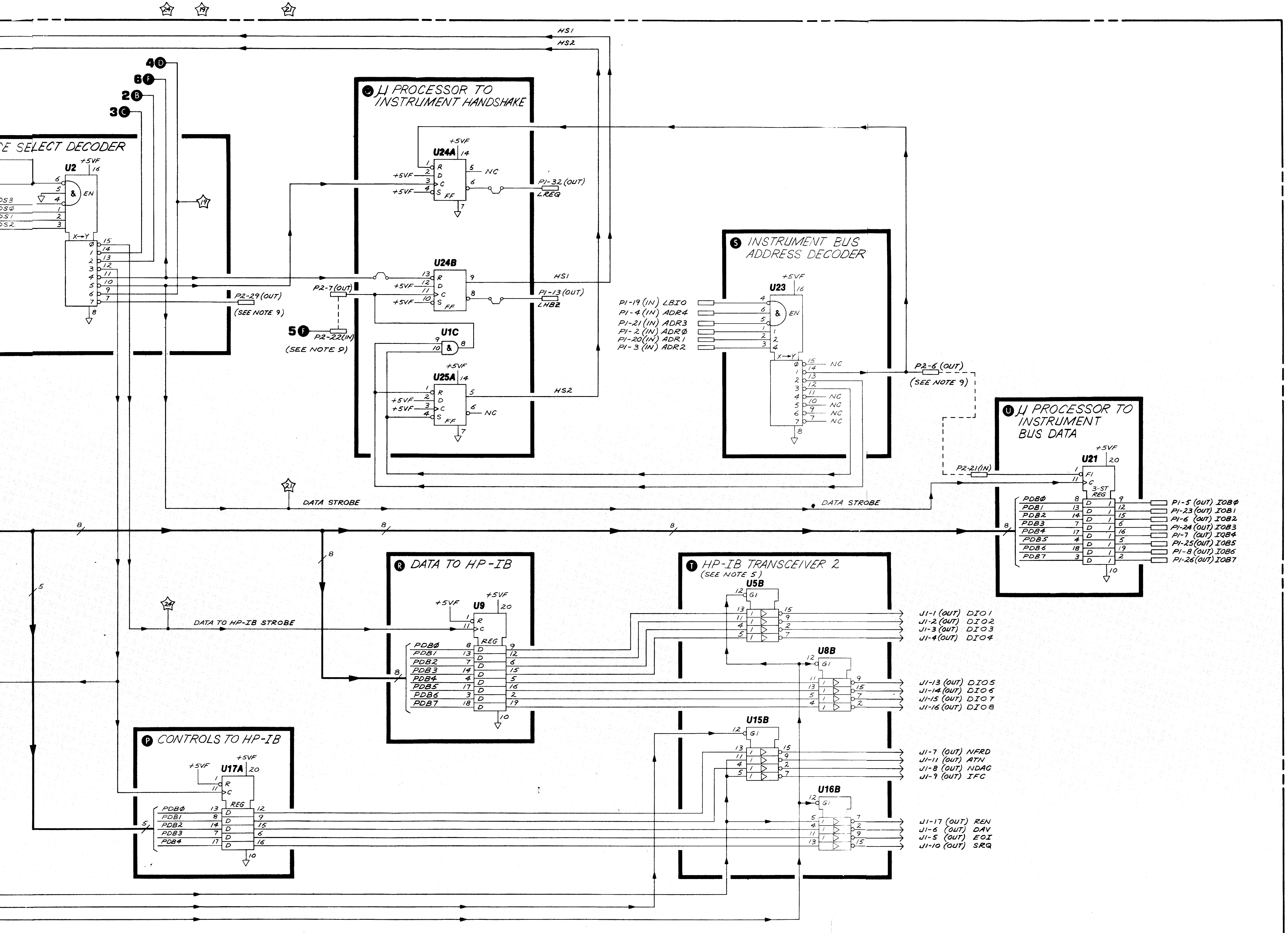


Figure 9-52. A13 HP-IB Interface, Schematic Diagram (1 of 2)


A13 HP-IB INTERFACE
85680-60118
(SHEET 2 OF 2)
CLOCK (SEE NOTE 6)
µ PROCESSOR SUPPLY CONTROL
POWER UP - DSA TEST
DEVICE SELECT DECODER
µ PROCESSOR (SEE NOTE 6)
BUS PULLUP/CLAMP
CONTROLS TO INSTRUMENT
HP-IB TRANSCEIVER CONTROL
CONTROLS TO HP-IB
INTERRUPT ACKNOWLEDGE
INTERRUPT REQUEST
INTERRUPT ENABLE
LRTL
BUS DATA
INSTRUCTION DATA
PROGRAM ADDRESS
DATA STROBE
DATA TO HP-IB STROBE
TEST JMPR
LISTEN
TALK
(SEE NOTE 9)



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. REFER TO PARTS LIST FOR THE VALUE OF R7. THE VALUE OF V_{BG} IS STAMPED ON U11.
4. UNLESS OTHERWISE INDICATED:
   LOGIC LEVELS ARE TTL:
   +2.0V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW
5. THE INPUT TERMINALS OF U5A, U8A, U15A, AND U16A IN ●, ARE ALSO THE OUTPUT TERMINALS OF U5B, U8B, U15B, AND U16B IN ●.
6. THE μPROCESSOR AND THE CLOCK ARE SHOWN ON BOTH PAGES OF THE SCHEMATIC.
7. FACTORY HP-IB ADDRESS SWITCH SETTING IS 31, (ALL SWITCHES UP) SEE MANUAL FOR OPERATIONAL DETAILS.
8. MNEMONICS TABLE

MNEMONIC	DESCRIPTION
ADRØ-4	INSTRUMENT BUS ADDRESS BITS, HIGH = TRUE
ATN *	LOW = ATTENTION TRUE
DIO1-8	HP-IB DATA BITS, LOW = TRUE
DAV *	LOW = DATA VALID
DSØ-3	μ PROCESSOR INPUT/OUTPUT DEVICE SELECT BITS HIGH = TRUE
EOI *	LOW = END OR IDENTIFY
HPUP	HIGH = POWER UP
HS1,2	HANDSHAKE 1, 2
IFC *	LOW = INTERFACE CLEAR TRUE
IOBØ-7	INSTRUMENT BUS DATA BITS, HIGH = TRUE
LADR	LOW = ADRS'D LED ON
LBIO	LOW = RF SECTION I/O STROBE
LHBZ	LOW = WORD READY FROM A15 PROCESSOR HIGH = REQUEST A WORD FROM A15 PROCESSOR
LIPS	LOW = INSTRUMENT PRESET
LREQ	LOW = WORD READY TO A15 PROCESSOR
LRMT	LOW = REMOTE HIGH = LOCAL
LRTL	LOW = LOCAL BUTTON PUSHED
NDAC *	HIGH = DATA ACCEPTED
PDBØ-7	μPROCESSOR DATA BITS, HIGH = TRUE
NRFD *	HIGH = READY FOR DATA
REN *	LOW = REMOTE ENABLE
SRQ *	LOW = SERVICE REQUEST

* HP-IB MNEMONIC

9. FOR NORMAL OPERATION P2-6 CONNECTS TO P2-21 AND P2-7 CONNECTS TO P2-22. P2-14 AND P2-29 ARE UNCONNECTED.

TEST POINT INFORMATION TABLE:

T. P.	SIGNAL PRESENT
11	PROGRAM ADDRESS 1Ø
13	μPROCESSOR TEST LINE
14, 15	GROUND
16	CLOCK
19	ADDRESS SWITCH STROBE
21	μPROCESSOR TO INSTRUMENT BUS DATA STROBE
24	DATA TO HP-IB STROBE
27	HP-IB CABLE SHIELD
28	μPROCESSOR ADDRESS BIT 1Ø (PA1Ø)
29	μPROCESSOR (DC6)

A13

Figure 9-52. A13 HP-IB Interface, Schematic Diagram (2 of 2)

A14 MEMORY, CIRCUIT DESCRIPTION

A14 Memory stores the program for A15 Processor in read-only memory (ROM). The CMOS random-access memory (RAM) is used by A15 Processor for data storage. A14 communicates with A15 by the 16-bit LIDA Bus. (Refer to the table on the schematic for definitions of mnemonics.)

Program ROM

At the start of a memory fetch, HSTM goes high. This clocks the address on the LIDA lines into the Memory Address Register (MAR) A . The lower 11 bits (MARØ through MAR10) become the address for all the ROM ICs (chips) E . The next 3 bits (MAR11 through MAR13) are decoded by the Chip Select decoder U37 C to generate a select line for each of the eight sets of two ROM chips each. (Since each ROM is only 8 bits wide, two ROMs are connected in parallel to generate the 16-bit word.) The ROMs are enabled by LROMEN generated by $\overline{\text{MAR15}}$ and LSOB through U22A. U22A is enabled only when LSOB goes high, indicating that the memory is to put data on the bus.

Read-Write Memory

The CMOS RAM D consists of 16 1K by 1 chips. The lower 10 LIDA lines (LIDA Ø through 9) are connected directly to the address inputs, since the chips contain built-in address registers that are clocked by the LRAMCE signal. U22D inverts HSTM to generate LRAMCE C .

The write control input on the RAMs is connected to the LWRT signal from A15 Processor. LWRT indicates that data on the LIDA lines is to be written into the RAM memory. To read the RAM contents, a LRAMEN signal is generated by U38A C whenever MAR14 and LSOB are high. This enables the three-state RAM buffers U11 and U21 D to drive the LIDA lines. The +5V supply to the CMOS RAMs +5VP, is normally generated by VR1 F , which is biased from the +12V supply. When power is turned off, the battery voltage (A28 Battery Pack) is ORed into the CMOS supply through Schottky diode CR2, keeping the RAM at >2V. This saves the instrument state settings and calibration data stored in the CMOS memory when the instrument is off.

Signature Circuit

In the Signature Circuit B , 4-bit ring counter U12, controlled by LWRT, $\overline{\text{MAR13}}$, and MAR 3 signals, generates four trigger signals that are used in troubleshooting the instrument.

A14 MEMORY, TROUBLESHOOTING

Since the A14 Memory and A15 Processor operate together as basically one assembly, troubleshooting information for the two assemblies has been combined and is located in the A15 Processor service section.

Table 9-19. A14 Memory, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14	85680-60119	1	BOARD ASSEMBLY, MEMORY	28480	85680-60119
A14C1	0160-4084	1	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A14C2	0180-0229	2	CAPACITOR-FXD 33UF ±10% 10VDC TA	04200	150D336X9010B2
A14C3	0160-3879	15	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C4	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C5	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C6	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C7	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C8	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C9	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C10	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C11	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C12	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C13	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C14	0180-0229		CAPACITOR-FXD 33UF ±10% 10VDC TA	04200	150336X9010B2
A14C15	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C16	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C17	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14C18	0160-3879		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14CR1	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS	28480	1901-0050
A14CR2	1901-0050		DIODE-SWITCHING 80V 200MA 2NS	28480	1901-0050
A14CR3	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A14CR4	1901-0050		DIODE-SWITCHING 80V 200MA 2NS	28480	1901-0050
A14L1	08558-80011	1	FILTER-COIL, CODE BLUE	28480	08558-80011
A14R1	0757-0401	1	RESISTOR 100 1% .125W F TC=0±100	03292	C4-1/8-TO-101-F
A14R2	0757-0416	1	RESISTOR 511 1% .125W F TC=Ø±100	03292	C4-1/8-TO-511R-F
A14R3	0698-0083	3	RESISTOR 1.96K 1% .125W F TC=Ø±100	03292	C4-1/8-TO-1961-F
A14R4	0698-0083		RESISTOR 1.96K 1% .125W F TC=Ø±100	03292	C4-1/8-TO-1961-F
A14R5	0698-0083		RESISTOR 1.96K 1% .125W F TC=0±100	03292	C4-1/8-TO-1961-F
A14TP1	1251-5177	12	CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP2	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP3	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP4	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP5	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP6	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP7	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP8	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP9	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP10	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP11	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14TP12	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A14U1	1818-0712	1	IC: ROM	28480	1818-0712
A14U2	1818-0713	1	IC: ROM	28480	1818-0713
A14U3	1818-0714	1	IC: ROM	28480	1818-0714
A14U4	1818-0715	1	IC: ROM	28480	1818-0715
A14U5	1818-0716	1	IC: ROM	28480	1818-0716
A14U6	1818-0717	1	IC: ROM	28480	1818-0717
A14U7	1818-0718	1	IC: ROM	28480	1818-0718
A14U8	1818-0719	1	IC: ROM	28480	1818-0719
A14U9	1820-1195	4	IC: FF TTL LS D-TYPE POS-EDGE-TRIG	01698	SN74LS175N
A14U10	1820-1195		IC: FF TTL LS D-TYPE POS-EDGE-TRIG	01698	SN74LS175N
A14U11	1820-2024	2	IC: DRVR TTL LS LINE DRVR OCTAL	01698	SN74LS244N
A14U12	1820-1446	1	IC: SHFT RGTR TTL LS R-S PRL-IN PRL-OUT	01698	SN74LS395N
A14U13	1818-0390	16	IC: 1K RAM CMOS	03714	IM6508IDE
A14U14	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U15	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U16	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U17	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE

Table 9-19. A14 Memory, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14U18	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U19	1820-1195		IC: FF TTL LS D-TYPE POS-EDGE-TRIG	01698	SN74LS175N
A14U20	1920-1195		IC: FF TTL LS D-TYPE POS-EDGE-TRIG	01698	SN74LS175N
A14U21	1820-2024		IC: DRVR TTL LS LINE DRVR OCTAL	01698	SN74LS244N
A14U22	1820-1197	2	IC: GATE TTL LS NAND QUAD 2-INP	01698	SN74LS00N
A14U23	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U24	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U25	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U26	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U27	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U28	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U29	1818-0720	1	IC: ROM	28480	1818-0720
A14U30	1818-0721	1	IC: ROM	28480	1818-0721
A14U31	1818-0722	1	IC: ROM	28480	1818-0722
A14U32	1818-0723	1	IC: ROM	28480	1818-0723
A14U33	1818-0724	1	IC: ROM	28480	1818-0724
A14U34	1818-0725	1	IC: ROM	28480	1818-0725
A14U35	1818-0726	1	IC: ROM	28480	1818-0726
A14U36	1818-0727	1	IC: ROM	28480	1818-0727
A14U37	1820-1216	1	IC: DCDR TTL 3-TO-8 LINE 3-INP	01698	SN74LS138N
A14U38	1820-1197		IC: GATE TTL LS NAND QUAD 2-INP	01698	SN74LS00N
A14U39	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U40	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U41	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14U42	1818-0390		IC: 1K RAM CMOS	03714	IM6508IDE
A14VR1	1902-0041	1	DIODE: ZNR 5.11V 5% PD=.4W TC=.009%	28480	1902-0041
			A14 MISCELLANEOUS PARTS		
	1480-0073	2	PIN RLL .062 IN DIA .25 IN LG	28480	1480-0073
	4040-0749	1	EXTRACTOR: PC BOARD BROWN	28480	4040-0749
	4040-0752	1	EXTRACTOR: PC BOARD YELLOW	28480	4040-0752

A14
MEMORY

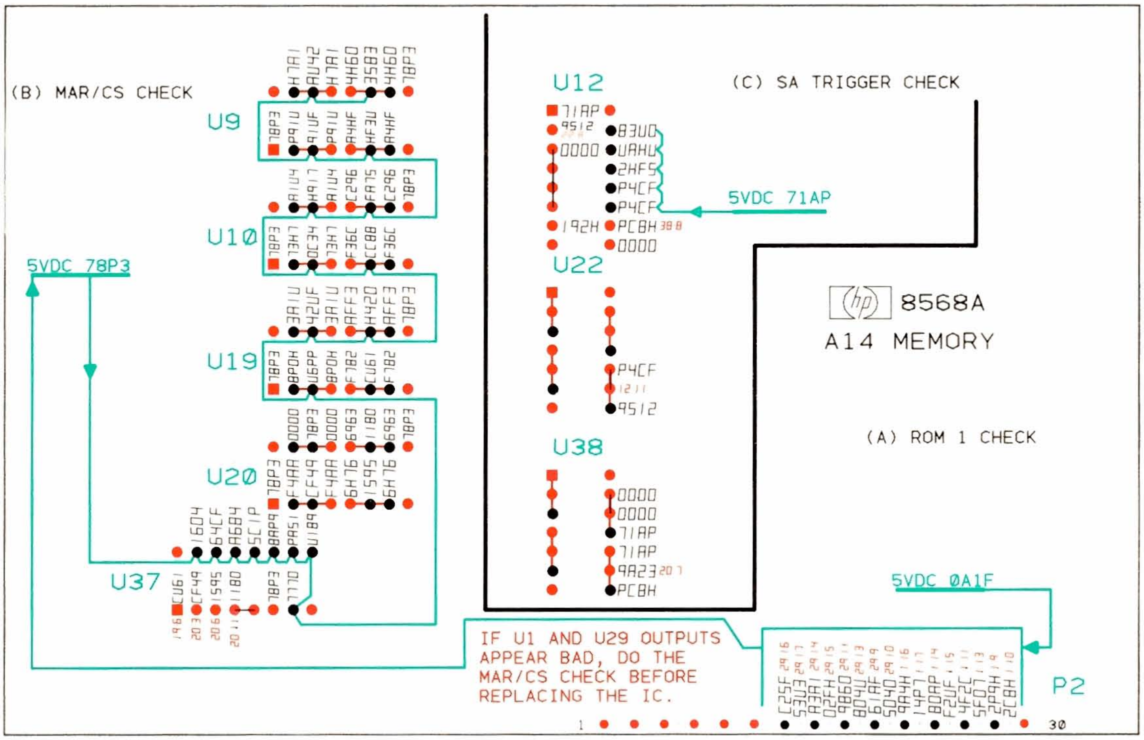


Figure 9-53. A14 Memory, Signature Analysis Troubleshooting Diagram

(A) ROM 1 CHECK

Signature Analyzer Connections:

CLOCK ⎍ to A14TP7
START ⎍ to A14TP2
STOP ⎍ to A14TP2

Spectrum Analyzer Connections:

Jumper A15TP1 to A15TP9(+5V)
Jumper A15TP4 to A15TP7

(B) MAR/CS CHECK

Signature Analzyer Connections:

CLOCK ⎍ to A14TP7
START ⎍ to A14P2-7
STOP ⎍ to A14P2-7

Spectrum Analyzer Connections

Jumper A15TP1 to A15TP9(+5V)
Jumper A15TP4 to A15TP7

(C) SA TRIGGER CHECK

Signature Analyzer Connections:

CLOCK ⎍ to A14TP5
START ⎍ to A14U20-7
STOP ⎍ to A14U20-7

Spectrum Analyzer Connections:

Ground A15TP8

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground lead to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.

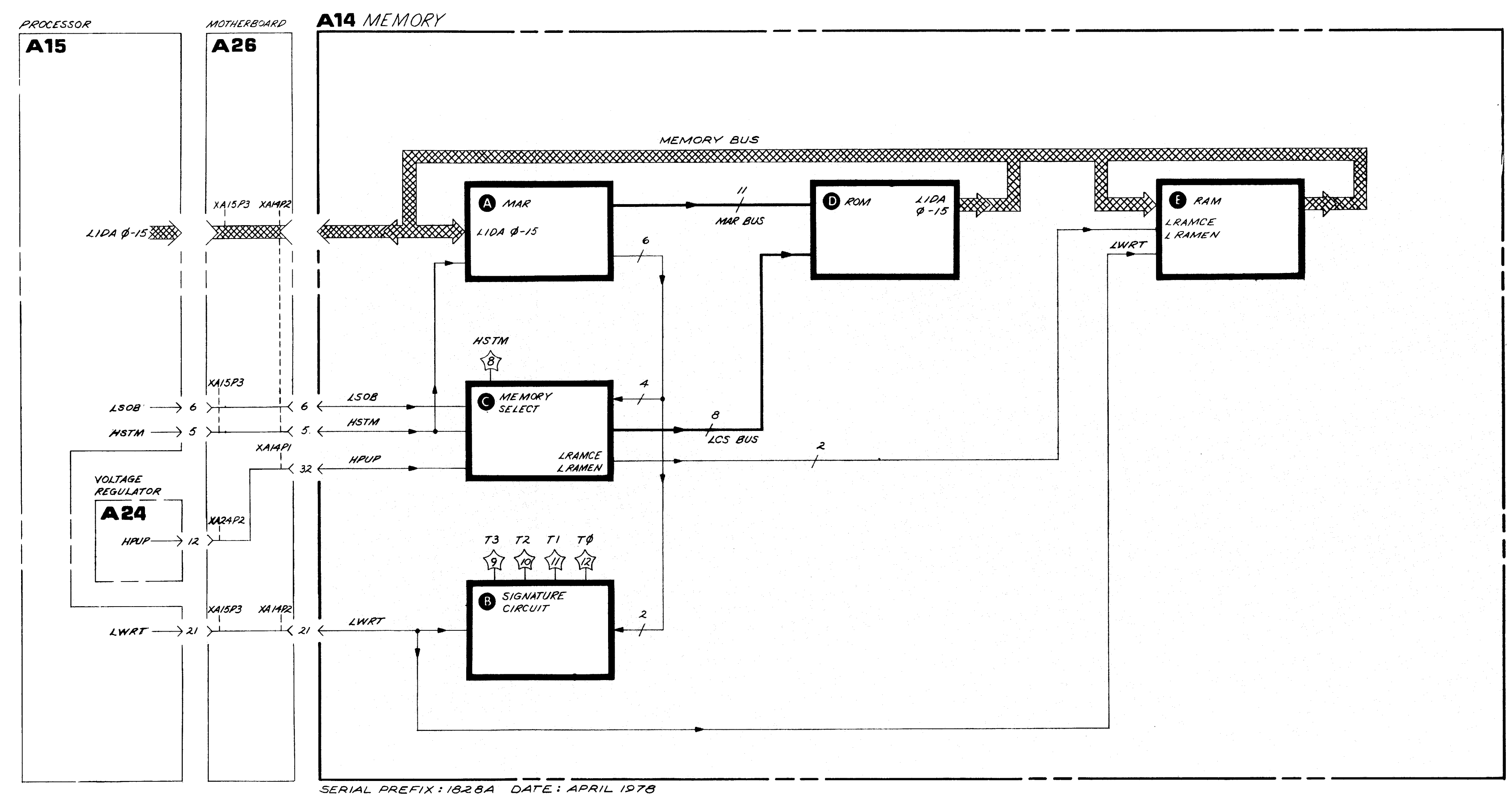


Figure 9-54. A14 Memory, Block Diagram

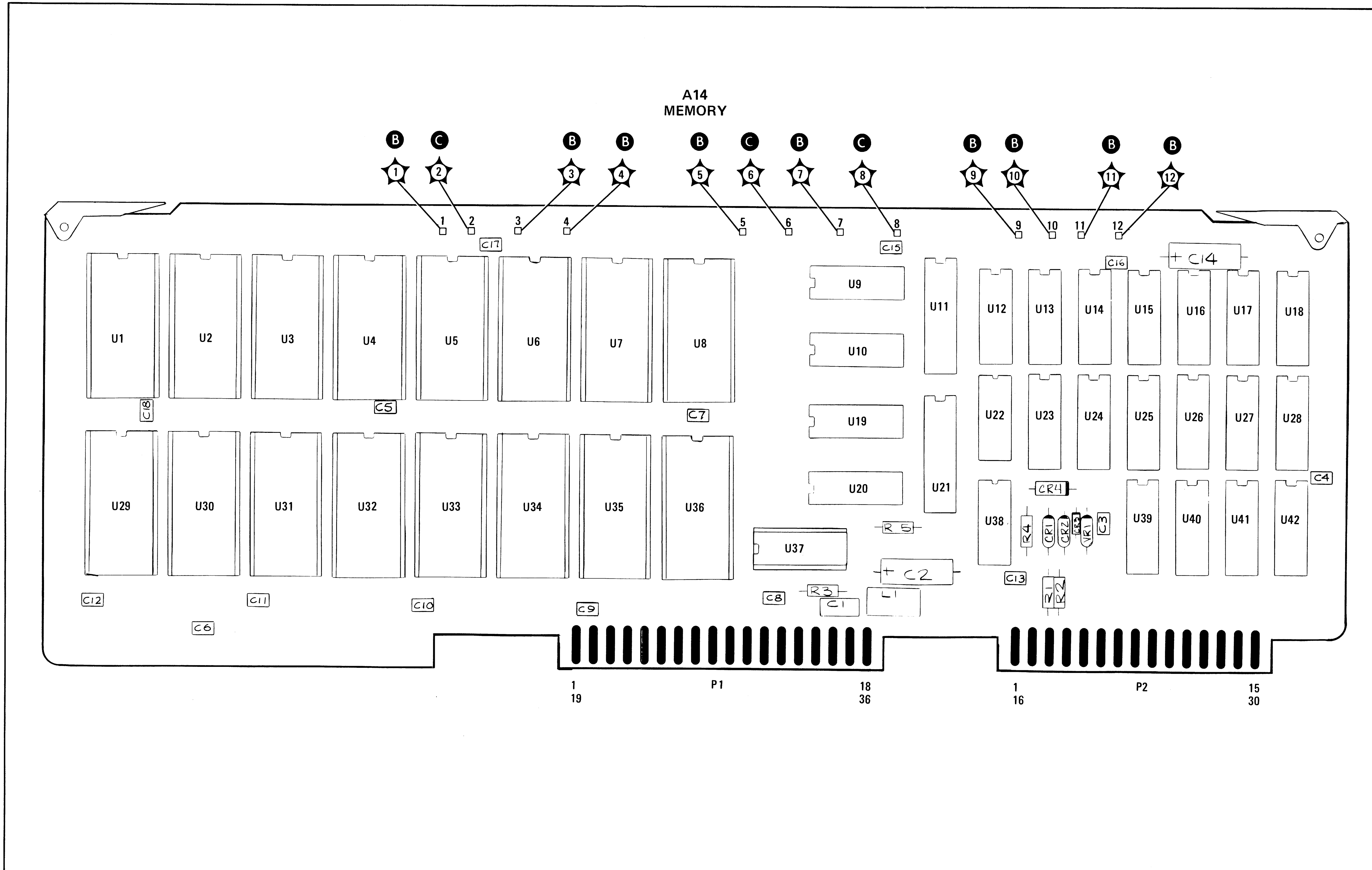


Figure 9-55. A14 Memory, Component Locations

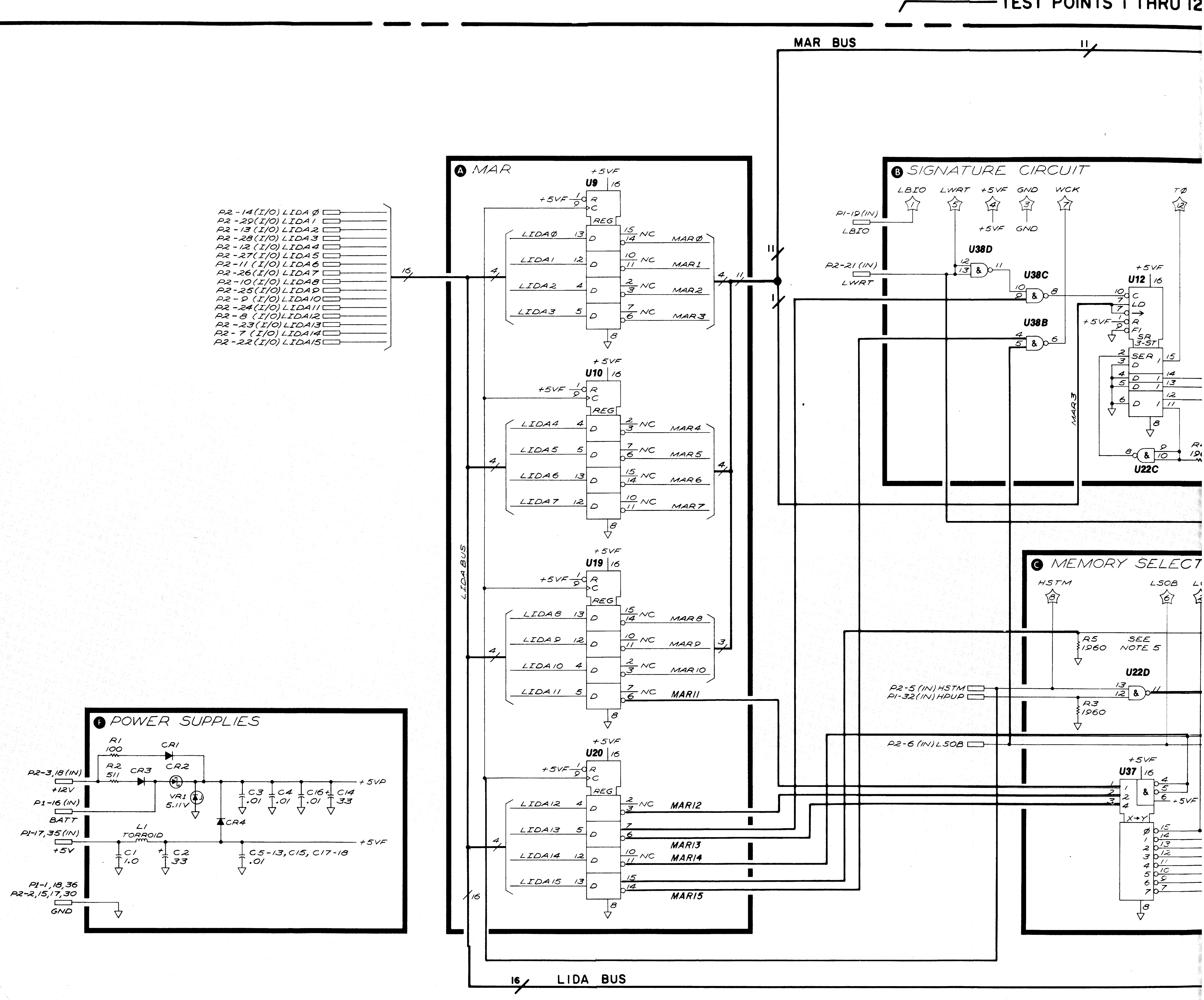
A14 MEMORY (SHEET 1 of 2)
85680-60119

P1

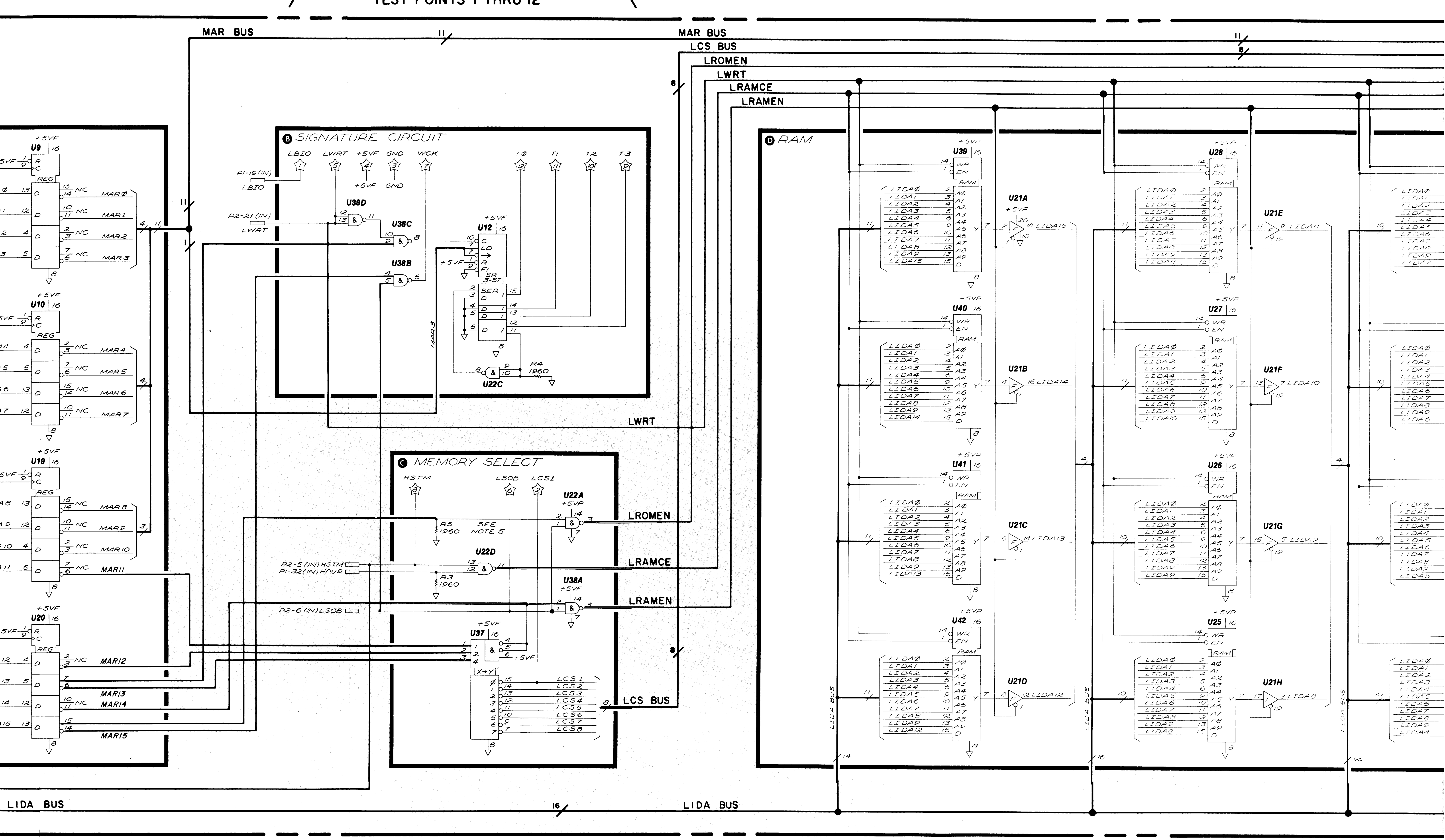
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 19	GND LBIO		F B
2 20	N.C.		
3 21	N.C.		
4 22	N.C.		
5 23	N.C.		
6 24	N.C.		
7 25	N.C.		
8 26	N.C.		
9 27	N.C.		
10 28	N.C.		
11 29	N.C.		
12 30	N.C.		
13 31	N.C.		
14 32	N.C. HPUP	A24P2-12	C
15 33	N.C.		
16 34	BATT N.C.	A28	F
17 35	+5V		F
18 36	GND		F

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 16	N.C.		
2 17	GND		F
3 18	+12V		F
4 19	N.C.		
5 20	HSTM N.C.	A15P3-5	C
6 21	LSOB LWRT	A15P3-6 A15P3-21	C B
7 22	LIDA14 LIDA15	A15P3-7 A15P3-22	A
8 23	LIDA12 LIDA13	A15P3-8 A15P3-23	A
9 24	LIDA10 LIDA11	A15P3-9 A15P3-24	A
10 25	LIDA8 LIDA9	A15P3-10 A15P3-25	A
11 26	LIDA6 LIDA7	A15P3-11 A15P3-26	A
12 27	LIDA4 LIDA5	A15P3-12 A15P3-27	A
13 28	LIDA2 LIDA3	A15P3-13 A15P3-28	A
14 29	LIDAØ LIDA1	A15P3-14 A15P3-29	A
15 30	GND		F



SERIAL PREFIX: 1828A DATE: APRIL 1978


TEST POINTS 1 THRU 12
MAR BUS
LCS BUS
LROMEN
LWRT
LRAMCE
LRAMEN
B SIGNATURE CIRCUIT
LBIO
LWRT
+5VF
GND
WCK
TØ
T1
T2
T3
P1-19(IN) LBIO
P2-21(IN) LWRT
U38D
U38C
U38B
U12
SR 3-ST
U22C
R4 1960
MAR3
C MEMORY SELECT
HSTM
LSOB
LCS1
U22A
R5 1960
SEE NOTE 5
U22D
R3 1960
U38A
P2-5(IN) HSTM
P1-32(IN) HPUP
P2-6(IN) LSOB
U37
LCS1
LCS2
LCS3
LCS4
LCS5
LCS6
LCS7
LCS8
D RAM
U39
U40
U41
U42
U28
U27
U26
U25
U21A
U21B
U21C
U21D
U21E
U21F
U21G
U21H
LIDA15
LIDA14
LIDA13
LIDA12
LIDA11
LIDA10
LIDA9
LIDA8
U9
U10
U19
U20
MARØ
MAR1
MAR2
MAR3
MAR4
MAR5
MAR6
MAR7
MAR8
MAR9
MAR10
MAR11
MAR12
MAR13
MAR14
MAR15
LIDA BUS

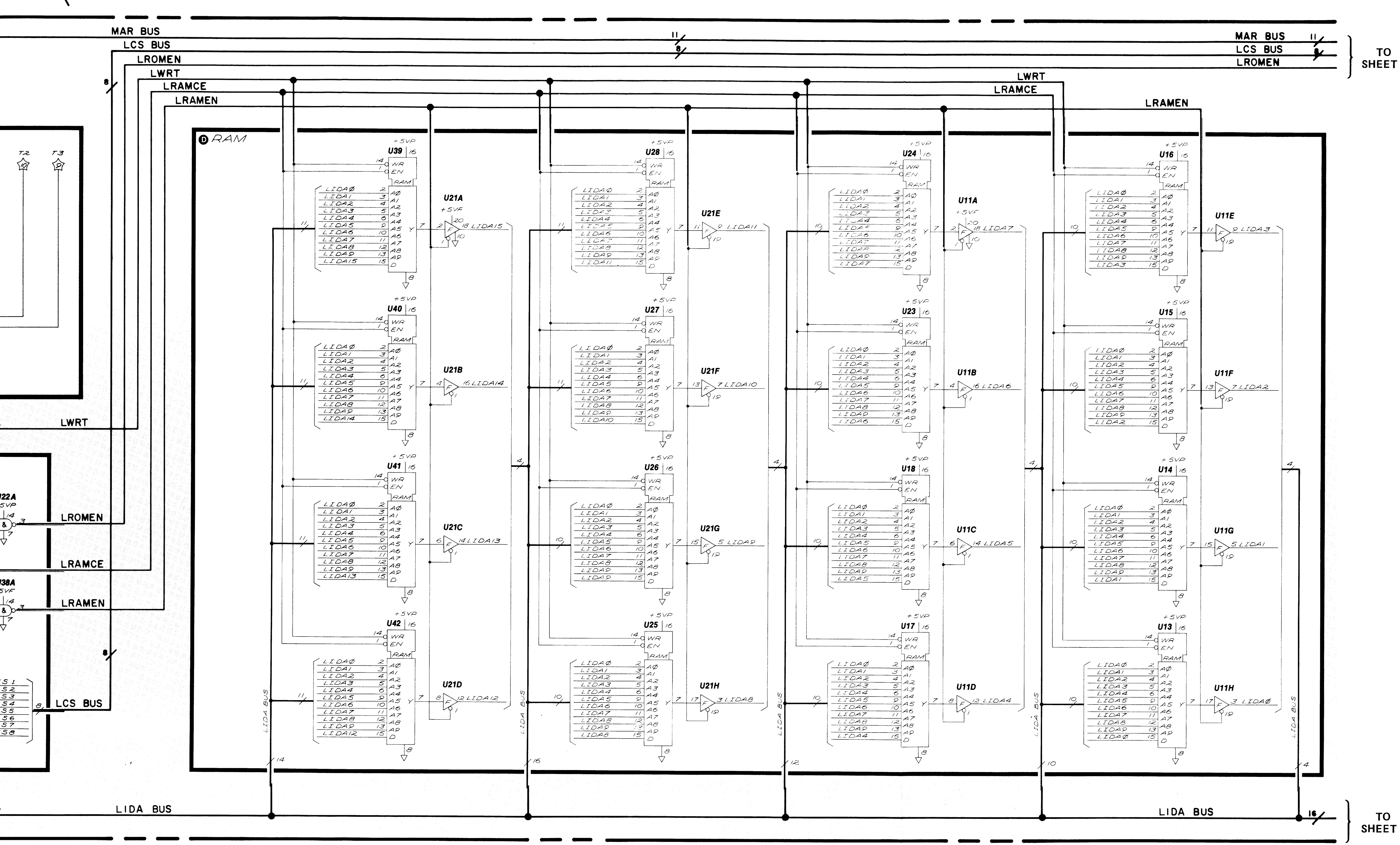
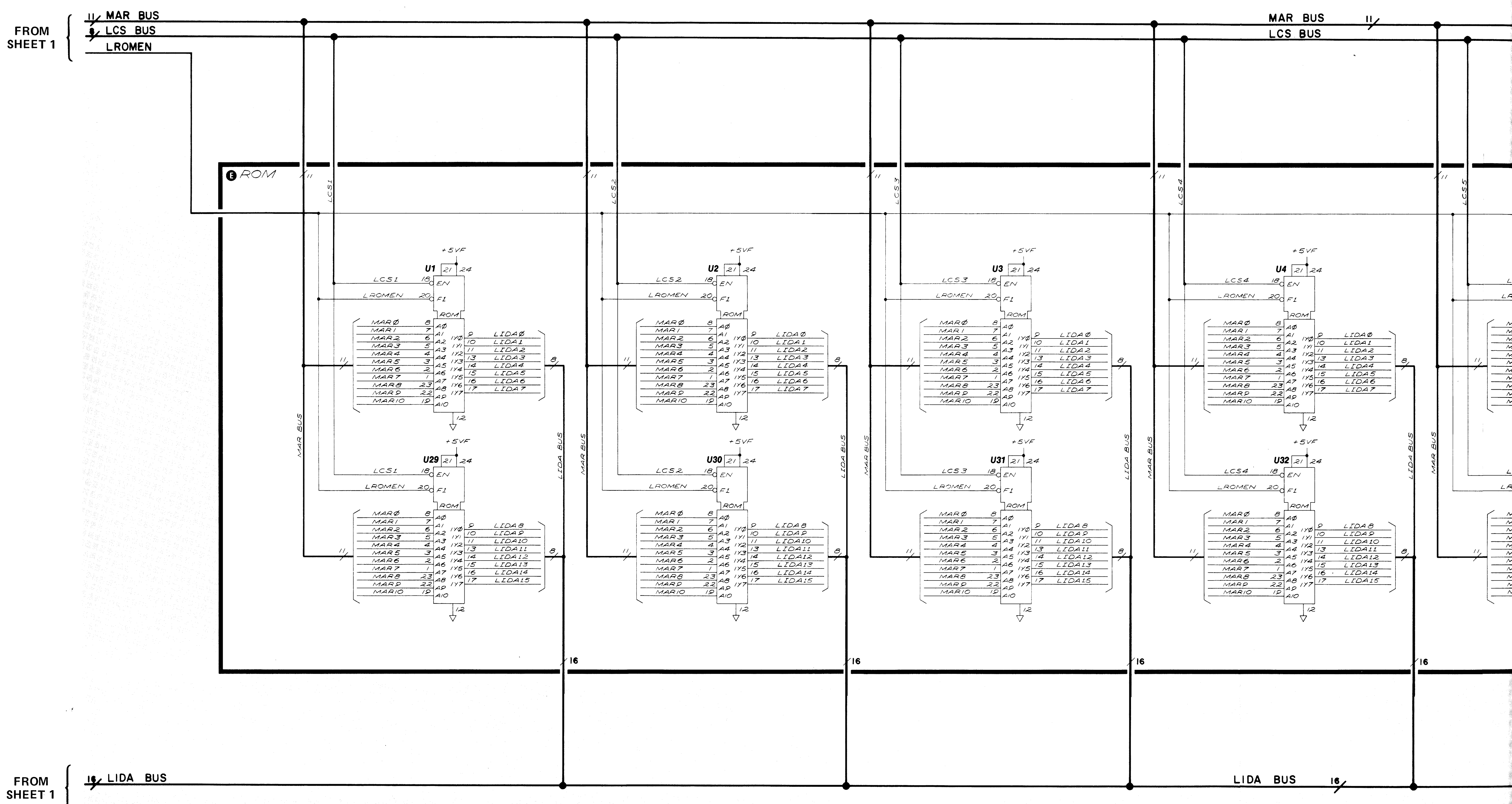
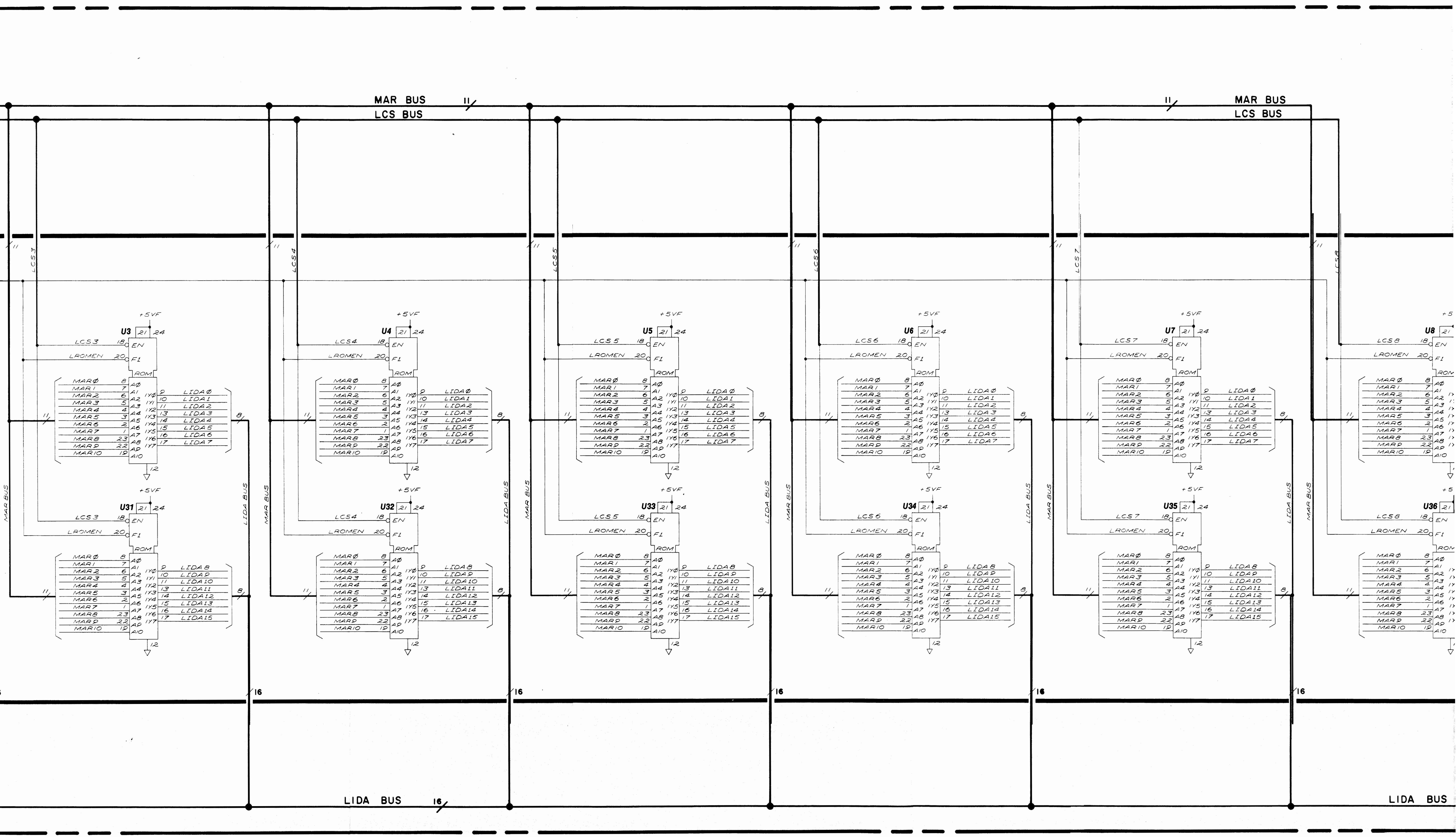


Figure 9-56. A14 Memory, Schematic Diagram (1 of 2)

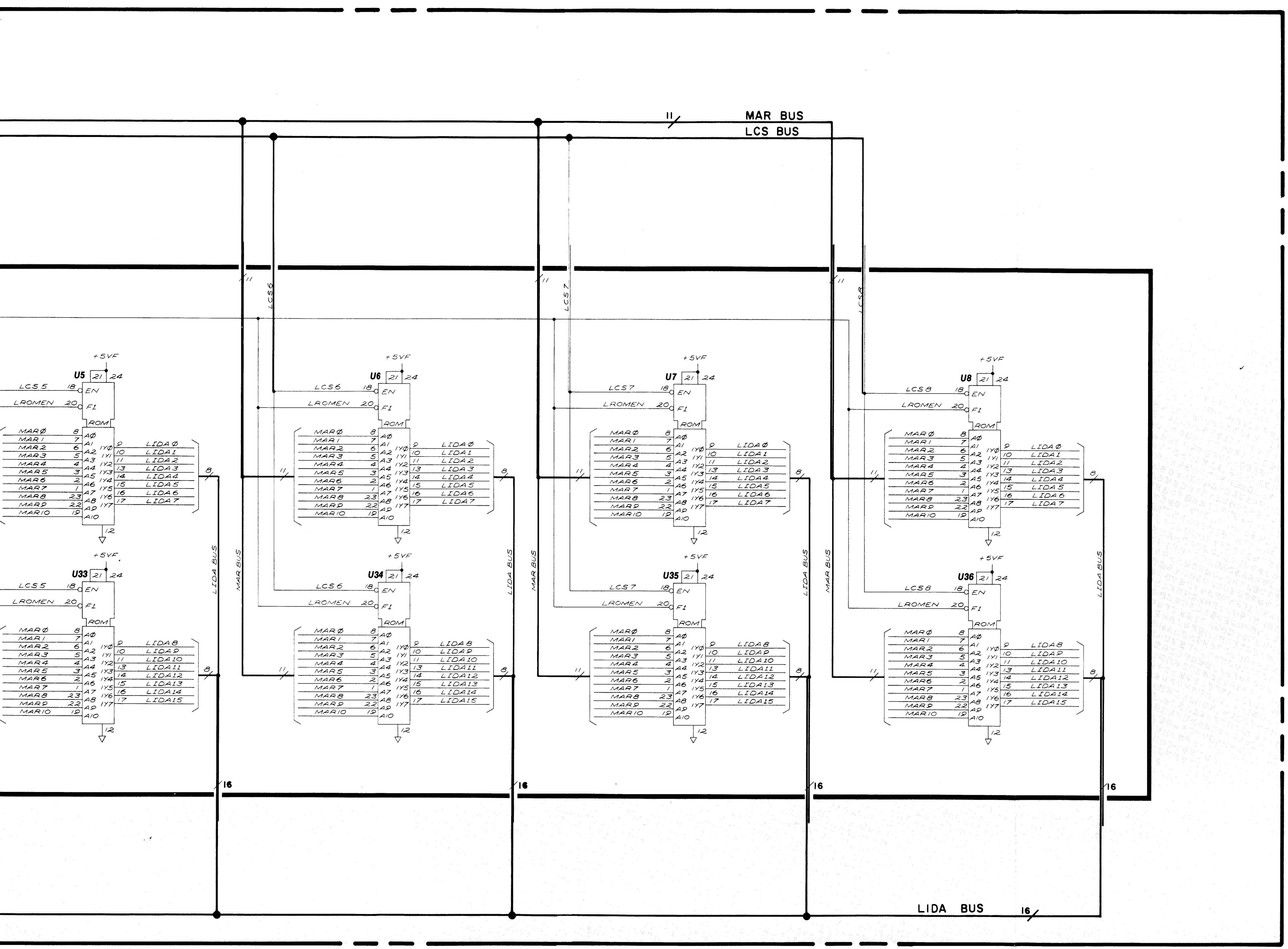
A14 MEMORY (SHEET 2 of 2)
85680-60119



SERIAL PREFIX: 1828A DATE: APRIL 1978



MAR BUS
LCS BUS
LIDA BUS
U3
U4
U5
U6
U7
U8
U31
U32
U33
U34
U35
U36
+5VF
LCS3
LCS4
LCS5
LCS6
LCS7
LCS8
LROMEN
ROM
EN
F1
MARØ
MAR1
MAR2
MAR3
MAR4
MAR5
MAR6
MAR7
MAR8
MAR9
MAR10
LIDAØ
LIDA1
LIDA2
LIDA3
LIDA4
LIDA5
LIDA6
LIDA7
LIDA8
LIDA9
LIDA10
LIDA11
LIDA12
LIDA13
LIDA14
LIDA15



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE 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. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
LBIO	LOW = BOTTOM BOX I/O STROBE
HPUP	HIGH = POWER UP
BATT	BATTERY
HSTM	HIGH = START MEMORY
LSOB	LOW = STAY OFF BUS
LWRT	LOW = WRITE MEMORY
LIDAØ THRU LIDA 15	INSTRUCTION, DATA AND ADDRESS BUS BITS (LOW = TRUE)
MARØ THRU MAR10	MEMORY ADDRESS BITS
LCS1 THRU LCS8	LOW = CHIP SELECT FOR ROMS
LRAMCE	LOW = CHIP ENABLE FOR RAMS
LRAMEN	LOW = ENABLE RAM OUTPUT BUFFERS
LROMEN	LOW = ENABLE ROM TRI-STATE OUTPUTS

5. U22B IS NOT USED. PINS 4 AND 5 ARE GROUNDED.

A14

Figure 9-56. A14 Memory, Schematic Diagram (2 of 2)

A15 PROCESSOR, CIRCUIT DESCRIPTION

A15 Processor contains a 16-bit MOS hybrid processor that controls the spectrum analyzer. It receives the operator's inputs from the keyboard, does all the necessary decoding and calculations, and then outputs the proper controls to execute a specific operation. Some examples of such an operation are: phase lock the YIG-Tuned Oscillator (YTO), tune the Voltage-Tuned Oscillator (VTO), select the correct scan time, and frequency span width, set the IF Section to the correct bandwidth and sensitivity, and display the control settings on the CRT through A3 Digital Storage. A15 also controls and reads the output of an 8-digit counter that is used in tuning and phase locking the spectrum analyzer and in determining the input signal frequency. A15 can communicate with an external controller (such as the HP 9825A Calculator) via A13 HP-IB Interface.

Memory Interface

The instructions that determine how to perform the above mentioned functions are stored in Read-Only Memory (ROM) in A14 Memory. A15 communicates with A14 via the 16-bit bidirectional LIDA (Low Instruction Data Address) Bus and three control lines: HSTM, LSOB, and LWRT. At the beginning of an instruction sequence, the Processor outputs the address of the next instruction onto the LIDA Bus and forces HSTM (High Start Memory) high. This positive edge of HSTM is used to clock the Memory Address Register in A14 Memory. LSOB (Low Stay Off Bus) next goes high, the Processor no longer drives the bus, and A14 outputs the 16-bit instruction onto the bus lines, where it is read by the Processor. U11A decodes the LSOB signal from HSTM, $\overline{\text{PDR}}$ (Processor Data Read), $\overline{\text{WR}}$ (Write), and $\overline{\text{RAL}}$ (Register Address Line). The time between the positive edge of HSTM and the time the Processor reads the data from the bus is determined by the Delay After STM circuit. The BCD counter U6 is preset to 6 (0110). Two clock pulses after STM goes high (counter = 8), $\overline{\text{UMC}}$ (Unsynchronous Memory Complete) is pulled low by U8 pin 12, indicating memory complete. The instruction read by the Processor is now decoded and executed. If the instruction requires a memory fetch, the above sequence is repeated, but data is read from memory instead of an instruction. If a write to the CMOS RAM (Random Access Memory) in A14 Memory is required, the $\overline{\text{WR}}$ line from the hybrid Processor goes low, forcing LSOB to stay low, and U11B decodes the write pulse (LWRT).

Processor Clock

The clock for the processor is generated by U10F and associated components. Basically, C10* charges through R41 until the threshold of U10F is reached. Then the output of U10F switches to a low state thereby discharging C10*. The frequency is set to 10 MHz ±.75 MHz by selecting C10*. The diodes, C24, and R43 have been included to ensure that C10* is discharged below the input threshold of U10F.

The Noise Generator is used to spread the spectrum of the processor clock and its harmonics to lower their visibility as spurious signals. The noise source is VR3 which is biased at the point where breakdown begins to occur. The noise which is generated is amplified by Q1 and Q2, then limited by CR6 and CR7 to maintain a fairly constant peak noise voltage for variations in VR3. R44 couples the proper amount of noise current to the Clock Generator.

Power Supplies L

The power supplies for the Processor are +12V, +7V, +5V, and −5V. The +7V is obtained from +12V by Q2 and VR1. The LIDA Bus lines are clamped by diodes U13 and U15 to a +3.5V supply generated by VR2. The resistor arrays U14 and U16 provide damping on the LIDA lines to prevent excessive ringing and overshooting in A14 Memory.

Processor Reset

The hybrid Processor reset line is $\overline{\text{POP}}$ (Power On Preset). Whenever this line goes low, the hybrid Processor is reset and forced to execute instruction 40_8 as soon as the line returns high. Whenever INSTR PRESET is pressed on the front panel (when the instrument is not in remote),, the LIPS (Low Instrument Preset) signal goes low. It is ANDed with HPUP (High Power Up) by diodes CR1 and CR2. U7 synchronizes this signal and drives the POP line.

A 555 timer U5 is used in A15 Processor to assist in troubleshooting the hybrid Processor and the memory handshake logic. The timer, normally off, is enabled by jumpering +5V to TP1. The timer output, TP7, is then jumpered to LIPS, TP4.

Input/Output Interface

The Processor outputs and reads information to and from the rest of the instrument on the 16-bidirectional IOB Lines, using five address lines (ADRØ through ADR4) and two strobe lines: LTIO for the IF-Display Section and LBIO for the RF Section. Each device on the bus has one or more addresses assigned to it. To talk to the device, the Processor outputs the data on the Instrument Bus and the address on the ADR lines, which are buffered by U3. It then generates a strobe pulse, decoded by U1 and U2, to clock the data into the listening device. If it is a read address, the Processor does not enable its data outputs but instead reads the data which the addressed device puts on the bus during the strobe pulse.

Four additional lines are used by the Processor. The LDSR (Low Digital Storage Ready) line is the handshake line with A3 Digital Storage in the IF-Display Section. The line is normally low, indicating that digital storage is ready to accept/output additional data from/to the Processor. The second line, STATUS, is connected to TP8 in A15 Processor and is used to enable test modes in the instrument. The third line is the LSRQ (Service Request) line from A12 RF Section Interface. When low, it indicates that some device, such as the keyboard, Rotary Pulse Generator (RPG), HP-IB, etc., needs servicing. These three lines are directly tested by the Processor. The fourth line, LSTP, is used to actually stop and start the Processor. During retrace, the Processor services the bus devices; that is, it updates digital storage, phase locks the YTO, etc. When everything is completed and LSRQ is high, the Processor starts the sweep (in FREE RUN mode) by issuing a trigger to A3A1 Trigger in the IF-Display Section. It then issues the command to A12 RF Section Interface that forces LSTP low, shutting the Processor off. LSTP is buffered and synchronized in A15 Processor by U1 and U7. U9A, an open-collector gate, then pulls SYNC low during half of each clock cycle, stopping the hybrid Processor. The Processor remains shut off during the sweep until service is requested (i.e., HSWP is forced low by digital storage at the end of the sweep or a front-panel key is pressed), LSRQ is forced low, and LSTP goes high. The LSTP line also goes to the IF-Display Section, where it is pulled low if the +5V supply is down. A15TP3 can be jumpered high during troubleshooting to prevent the Processor from being stopped.

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 [INSTR PRESET] is pushed. The A15 Processor then performs a self check of itself, a checksum verification of all the ROMs on A14 Memory, a partial check of the IOB interface 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.

a. Both LEDs on indicates an A14 Memory or A15 Processor problem. First check to see that A14 and A15 are pushed completely into their edge connectors.

b. 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.

c. 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 [LCL], is pressed when the [INSTR PRESET] 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 Fault Tables listed in A14/A15 Troubleshooting to further isolate the source of the failure.

"LONG POP" Instrument Preset Check (Jumper A15TP8 [STS] to A14TP9 [T3])

This check is very similar to the normal INSTR PRESET check; an additional A15 Processor check is performed, all of the RAM locations in Digital Storage are checked, and the CMOS memory on A14 is verified.

HP-IB Verification

When the instrument is turned on, keep the [INSTR PRESET] key pressed. The ADRS'D LED should flash until the [INSTR PRESET] key is released and the A15 Processor acknowledges the HP-IB request. If it doesn't flash, the A13 HP-IB Processor is malfunctioning. All cables must be removed from the HP-IB connector, A13J1. All normal front panel operations should work with A13 removed to further enable failure isolation.

See the listing of HP-IB "bugs" in Section III for modes of operation which may be other than what would normally be expected.

Phase Lock and Counter Inhibit (Jumper A15TP8 [STS] to A14TP11 [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 Processor.

A14 MEMORY AND A15 PROCESSOR TROUBLESHOOTING (FAULT TABLES)

ROM/Processor Check (Both INSTR CHECK LEDs on.)

SIGNATURE ANALYZER SETUP: CLOCK A14TP8 (HSTM)
START A14TP12 (T0)
STOP A14TP11 (T1)

GROUND A15TP8 (STS). PUSH [INSTR PRESET]. NOTE 5VDC SIGNATURE.

Table 9-20. ROM Fault Table

5 VDC SIGNATURE	COURSE OF ACTION	
UCF4	ROM IS GOOD. PROCEED TO RAM CHECK.	
U789	REPLACE HYBRID PROCESSOR A15U13.	
	Suspect ROM[1]	**ROM Chip Select Signature[1]**
05C7	U34	929U at U37 PIN 10
095A	U3	
0F25	U31	9COH at U37 PIN 13
2986	U35	CPAP at U37 PIN 9
2HP3	U29[2]	
31HP	U32	A6U6 at U37 PIN 12
34P5	U33	A3FH at U37 PIN 11
394U	U5	
512U	U2	
5PUC	U36	F9H3 at U37 PIN 7
61A0	U7	
6HF5	U6	
77A0	U4	
78FP	U1	
CH44	U30	2A6F at U37 PIN 14
CPU1	U8	

[1] Before replacing any ROMs, verify that the ROM Chip Select Signature is correct.

If the Chip Select Signature is incorrect, the "Free-Running POP" test listed in the A14 Memory/A15 Processor Troubleshooting must be performed to check the Memory Address Register (MAR) and the Memory Select Decoder. 500 ns pulses will be present on the LCS0-7 lines (U37) of the Memory Select Decoder. At the rising edge of the 2nd HSTM pulse 1.25 μs pulses will be present on the MAR lines. Except for MAR5, all will be positive going transitions. (See Figure 9-59 for A14 Memory Timing Waveforms.)

If no signature can be obtained after double checking the setup, refer to A14/A15 Memory Timing Sequence and A14/A15 Troubleshooting.

[2] or BAD MEMORY ADDRESS REGISTER (See A14/A15 Troubleshooting)

RAM Check (Both INSTR CHECK LEDs on following a "LONG POP")

SIGNATURE ANALYZER SETUP: CLOCK ⏷ A14TP8 (HSTM)
START ⏶ A14TP11 (T1)
STOP ⏶ A14TP10 (T2)

GROUND A15TP8 (STS). PUSH [INSTR PRESET] . NOTE 5 VDC SIGNATURE.

Table 9-21. RAM Fault Table

5 VDC SIGNATURE	COURSE OF ACTION			
PF59	RAM IS GOOD. PROCEED TO PARTIAL INTERFACE CHECK.			
	Bad Bit	**RAM IC**	**RAM Pin 7[1] Signature**	**RAM Buffer**
OF71	11	U28	F76F	U21
11HC	5	U18	10FA	U11
30U7	0[2]	U13	H767	U11
3C75	4	U17	546P	U11
6520	14	U40	PUC8	U21
6PA4	3	U16	U210	U11
708P	6	U23	U87P	U11
8063	12	U42	8HFA	U21
8C29	15	U39	2U0C	U21
8P3H	10	U27	7HF5	U21
9187	1	U14	3139	U11
A403	13	U41	2H16	U21
F7CP	9	U26	1961	U21
H48F	2	U15	H4P1	U11
U7HF	8	U25	1C13	U21
UC84	7	U24	P2AP	U11

[1]Check the output signature of the suspect RAM. If it is good, then suspect the three-state buffer on that bit.

[2]Check RAM interface and timing before replacing U18. (If all the RAMs were defective, due to an incorrect common input signal, the lowest bit to fail (bit 0) will be indicated by the 5 Vdc signature.) Perform the "free-running POP" test and note the following waveforms.

U18 pin 16 +5V CMOS supply.
U18 pin 1 LRAMCE (LOW RAM CHIP ENABLE) will be an inverted HSTM signal.
U18 pin 14 LWRT (LOW WRITE) – 200 ns pulses, approximately 15 μs cycle.
U38 pin 3 LRAMEN (LOW RAM ENABLE) – 500 ns pulses, approximately 15 μs cycle. The falling edge of LRAMEN coincides with the falling edge of 2nd HSTM pulse.

Partial Interface check (Right INSTR CHECK LED on)

SIGNATURE ANALYZER SETUP: CLOCK ⌝ A14TP8 (HSTM)
START ⌐ A14TP9 (T3)
STOP ⌐ A14TP12 (T0)

GROUND A15TP8 (STS). PUSH [INSTR PRESET]. NOTE 5 VDC SIGNATURE.

Table 9-22. Interface Fault Table

5 VDC SIGNATURE	COURSE OF ACTION
5669	CHECK PASSED. PROCEED TO DIGITAL STORAGE CHECK.
C349	LSRQ LINE APPEARS TO BE HIGH.*
6692	A KEY COLUMN LINE IS LOW OR AN RPG COUNTER LINE IS HIGH.*
*Troubleshoot A12 RF Interface or A5 Front Panel.	

Digital Storage Check (Left INSTR CHECK LED on)

SIGNATURE ANALYZER SETUP: CLOCK A14TP8 (HSTM)
START A14TP10 (T2)
STOP A14TP9 (T3)

GROUND A15TP8 (STS). PUSH [INSTR PRESET]. NOTE 5 VDC SIGNATURE.

Table 9-23. Digital Storage Fault Table

5 VDC SIGNATURE	COURSE OF ACTION	
211A	CHECK PASSED.	
CP48	LDSR LINE APPEARS TO BE HIGH. (CHECK INTERCONNECT CABLE.) (SEE A3 DIGITAL STORAGE TROUBLESHOOTING.)	
	Bad Bit	
0443	4	THESE FAILURES ARE PROBABLY DUE TO EITHER THE A3A4 MEMORY BOARD OR THE A3A7 IOB INTERFACE. IF THE DIGITAL STORAGE TEST PATTERN IS OK, IT MIGHT ALSO BE CAUSED BY AN IOB BIT FAILURE.
2875	6	
34PH	11	
3643	8	
60F4	2	
8614	7	
8630	3	
88U3	1	
A41C	9	
HA52	10	
P6FP	0[1]	
PC02	5	

[1] (or a failure in all bits)

IOB Interface Troubleshooting

After the ROM and RAM checks have been passed, a special IOB interface check program can now be used to check the interface bus. This routine basically outputs various bit patterns to the IOB bus and to the various devices on the bus. Use the test setup shown in the following table.

IOB Interface Check

SIGNATURE ANALYZER SETUP:

CLOCK ⎍ A15TP2 ($\overline{\text{IOSB}}$)
START ⎍ A14TP12 (T0)
STOP ⎍ A14TP11 (T1)

JUMPER A14TP12 (T0) to A15TP8 (STS).
JUMPER A15TP3 (LSTP) to A15TP9 (+5V).
NOTE 5 VDC SIGNATURE, 747H.

a. Refer to the table on the A15 Signature Analysis Troubleshooting Diagram for the IOB bus output signatures.

   If an IOB/Address Line is loaded down, remove assemblies on Bus to isolate fault:

   Analyzer Bus Interconnect Cable, W31; A12 RF Section Interface; A13 HP-IB Interface; A22 Frequency Control; A17 Frequency Counter; and A8 249 MHz Phase Lock.

b. This same routine is used to verify the A12 RF Interface board, and its outputs onto the bus, as well as the A22, A17, A4A9 and A3A1 boards.

c. The last item that might have to be checked is to verify that the A15 Processor can read data from the IOB bus. This is done by reading the outputs from A12 and then outputting them onto the LIDA bus. The A15 SA Diagram shows the signatures of the LIDA lines.

A14 MEMORY AND A15 PROCESSOR TROUBLESHOOTING

First try the Fault Table check for the ROM and RAM, since they will isolate most of the failures on the A14 Memory and verify the A15 Processor. However, the first set of ROMs that contain the self-check program, the Memory Address Register and Memory Select decoder, as well as part of the A15 Processor must be working in order for the self check to work; so, if no 5V signature is obtained (the self-check program is not cycling), the following checks must be performed.

Preliminary Checks:

Power Supplies — 12V, 7V, 5V, −5.2V, 5 VCMOS
Processor Clocks — 12 V, 5 MHz. Phase 1 and Phase 2 (A15U13 Pins 20, 21)
$\overline{\text{POP}}$ — (A15U13 Pin 11) low when [INSTR PRESET] pushed, high normally
LSTP — (A15TP3) high (check A12 if bad)
SYMC — (A15U13 Pin 29) high when [INSTR PRESET] pushed
$\overline{\text{UMC}}$ — (A15U13 Pin 25) high when [INSTR PRESET] pushed

"Free-Running POP" Test Setup

To check the LIDA bus, the Memory address Register and the first ROM outputs, a "free running POP" check is set up. A 555 timer is turned on by jumpering A15TP9 (+5V) to A15TP1. The timer output (TP7) is connected to the LIPS input (TP4). This continually resets the Processor to a known state: it continually executes this first instruction (at location octal 40) which in turn reads all the rest of the ROM memory.

a. Jumper A15TP1 (TIMER ON) to A15TP9 (+5V).

b. Jumper A15TP7 (TIMEOUT) to A15TP4 (LIPS).

c. Externally trigger oscilloscope off the falling edge of A15TP5 (POP OUT).

d. Monitor A14TP8 (HSTM) on one channel of an oscilloscope.

At the rising edge of the 2nd HSTM pulse 1.25 μs pulses should be present on the MAR lines. Except for MAR5, all will be positive going transitions.

If the MAR lines are working properly, use an oscilloscope and check the waveforms as described in the A14/A15 Timing Sequence.

A14 Memory/A15 Processor Timing Sequence

Use the "Free-running POP" setup.

- — Jumper A15TP1 (TIMER ON) to (+5V) A15TP9.
- — Jumper the A15TP7 (TIME OUT) to A15TP4 (LIPS).
- — Externally trigger the scope off $\searrow$ A15TP5 (POPOUT).

Refer to Figures 9-58 and 9-59 for the timing waveforms. Figure 9-60 shows the 5 MHz two phase clock waveform.

1. $\overline{\text{POP}}$ input to Hybrid goes high. (Start of sequence.)

2. Processor outputs the starting memory address (octal 40) onto the LIDA bus. Processor also outputs $\overline{\text{WR}}$ (Write) and RAL (Internal Register Address).

3. Processor forces HSTM high, clocking the address from the LIDA bus into the MAR (Memory Address Register) on A14. (See Figure 9-57.)

4. LSOB goes high when processor output $\overline{\text{PDR}}$ (Processor Data Read) goes high, indicating that the processor no longer drives the LIDA bus. The A14 memory chip selects are enabled by LSOB and the memory data appears on the LIDA bus.

5. $\overline{\text{UMC}}$ from the A15 Delay after STM circuit goes low indicating memory complete.

6. The Processor reads the instruction and forces HSTM low which also forces LSOB low.

7. To execute this first instruction, steps 2 through 6 are repeated, only the address output is an indexed address that is continually decremented so all possible addresses are exercised.

   — At the rising edge of the 2nd HSTM, go high and low logic levels should be on all LIDA lines.

   — At the falling edge of the 2nd HSTM, memory data is on the LIDA lines. They should show good high and low logic levels and may also show some open, intermediate states.

8. At the 3rd HSTM, no LSOB is generated since it is an internal address. RAL line goes high keeping LSOB low.

9. During a write operation (5th HSTM), $\overline{\text{WR}}$ is low. This keeps LSOB low and a 200 nsec LWRT pulse is generated. The processor outputs data onto the LIDA bus which is written into the CMOS RAMs on A14.

Suggestions: After connecting the jumpers, check the HSTM (A14TP8) and LSOB (A14TP6) lines for activity. If they appear good, go ahead and check the LIDA lines when the indexed address and data are on the bus at the 2nd HSTM as described in step 7. If HSTM or LSOB is bad, then begin with sequence step 1 and verify each step.

To help isolate a stuck LIDA line:

— Grounding LSOB (A14TP6) should force all drivers on A14 into the high impedance third state, and

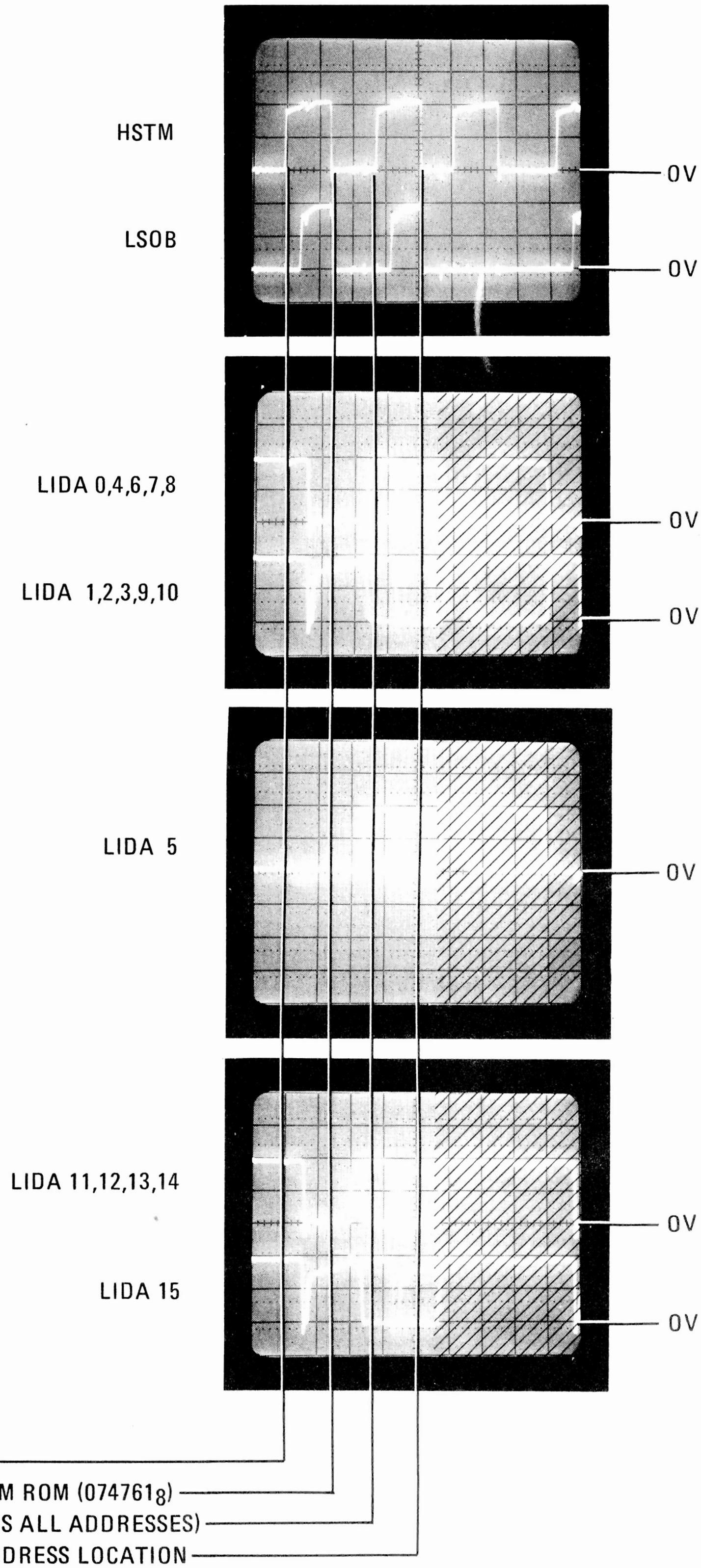
— Jumpering A15TP11 ($\overline{\text{EN}}$ [BUS]) to A15TP9 (+5V) should force the Hybrid LIDA output into the high impedance third state.

Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 500 ns/div
External trigger:
⇂ A15TP5 (POPOUT)

Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 500 ns/div
External trigger:
⇂ A15TP5 (POPOUT)

Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 500 ns/div
External trigger:
⇂ A15TP5 (POPOUT)

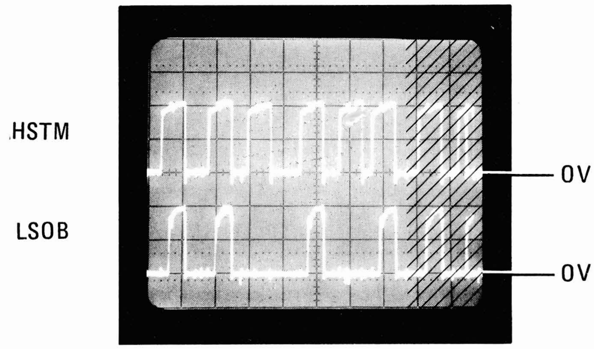
Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 500 ns/div
External trigger:
⇂ A15TP5 (POPOUT)



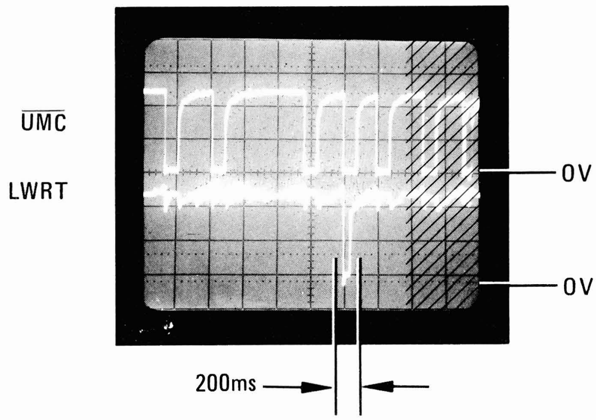
NOTE:
Disregard shaded areas of waveform photographs. The R-C time constant of the SA timer used during the "Free-Running POP" test causes the waveforms in these time intervals to vary from instrument to instrument.

Figure 9-57. LIDA Bus Timing

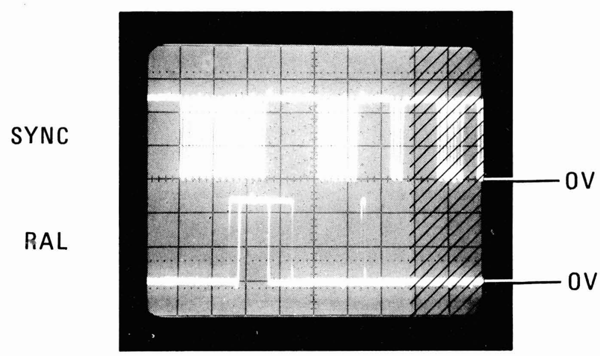
Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 1μs/div
Ext trigger:
⎤_ A15TP5 (POPOUT)



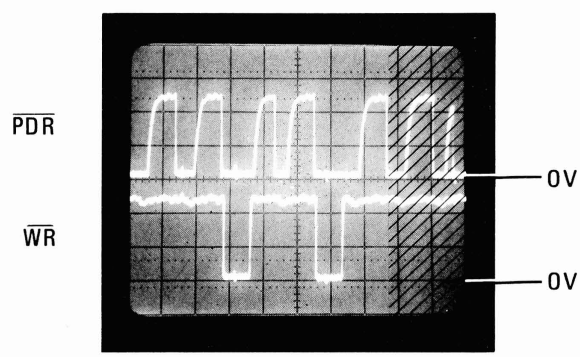
Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 1μs/div
Ext trigger:
⎤_ A15TP5 (POPOUT)



Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 1μs/div
Ext trigger:
⎤_ A15TP5 (POPOUT)



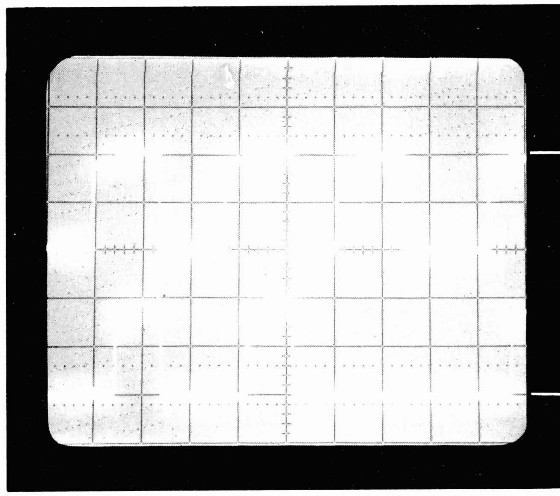
Oscilloscope Settings:
Vertical: 2V/div
Horizontal: 1μs/div
Ext trigger:
A15TP5 (POPOUT)



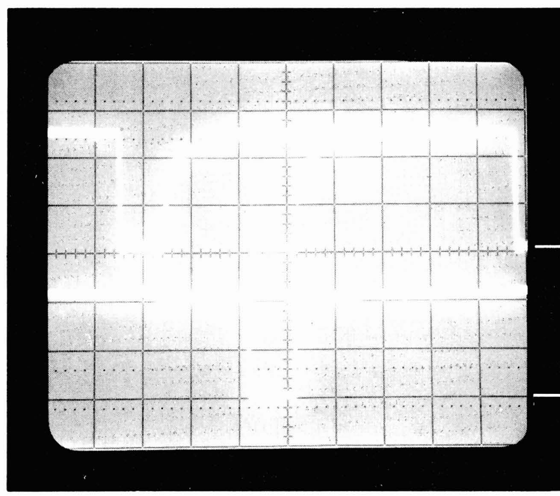
NOTE:
Disregard shaded areas of waveform photographs. The R-C time constant of the SA timer used during the "Free-Running POP" test causes the waveforms in these time intervals to vary from instrument ot instrument.

Figure 9-58. A15 Processor Timing

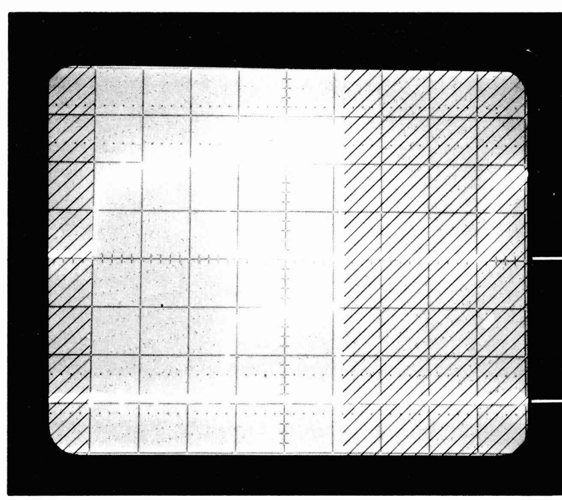
Oscilloscope settings:
Vertical: 2V/div
Horizontal: 500 ns/div
External trigger:
⎿ A15TP5 (POPOUT)



Oscilloscope settings:
Vertical: 2V/div
Horizontal: 500 ns/div
External trigger:
⎿ A15TP5 (POPOUT)



Oscilloscope settings:
Vertical: 2V/div
Horizontal: 500 ns/div
External trigger:
⎿ A15TP5 (POPOUT)



NOTE:
Disregard shaded areas of waveform photographs. The R-C time constant of the SA timer used during the "Free-Running POP" test causes the waveforms in these time intervals to vary from instrument to instrument.

Figure 9-59. Memory Timing

Oscilloscope settings:
Vertical: 5V/div
Horizontal: 50ns/div
External trigger:
⌝ A15TP5 (POPOUT)

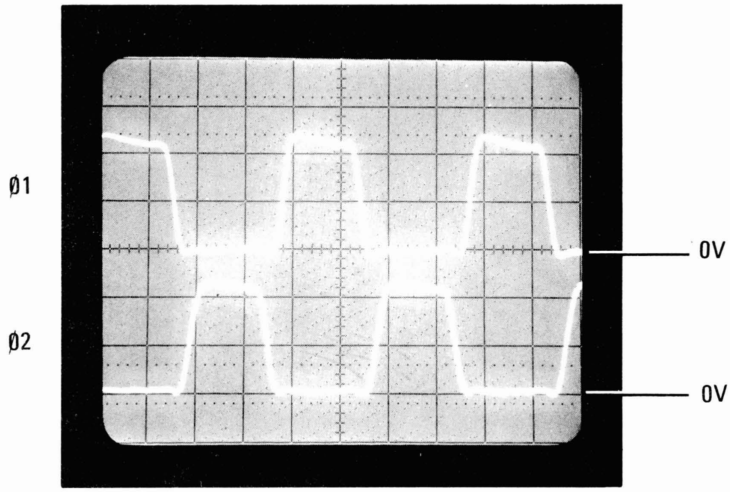


Figure 9-60. Processor Clocks

Table 9-24. A15 Processor, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15	85680-60037	1	BOARD ASSEMBLY, PROCESSOR	28480	85680-60037
A15C1	0160-4084	13	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C2	0180-0197	4	CAPACITOR-FXD 2.2UF ±10% 20VDC TA	04200	15ØD225X9Ø2ØA2
A15C3	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C4	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C5	0180-0197		CAPACITOR-FXD 2.2UF ±10% 20VDC TA	04200	15ØD225X9ØAØA2
A15C6	0180-0197		CAPACITOR-FXD 2.2UF ±10% 20VDC TA	04200	15ØD225X9ØAØA2
A15C7	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C8	0180-0197		CAPACITOR-FXD 2.2UF ±10% 20VDC TA	04200	15ØD225X9ØAØA2
A15C9	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C10*	0160-2202	1	CAPACITOR-FXD 75PF ±5% 300VDC MICA	28480	0160-2202
A15C11	0140-0197	2	CAPACITOR-FXD 180PF ±5% 300VDC MICA	04522	DM15F18WØ3ØØWVICR
A15C12	0140-0197		CAPACITOR-FXD 180PF ±5% 300VDC MICA	04522	DM15F18WØ3ØØWVICR
A15C13	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C14	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C15	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C16	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C17	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C18	0180-2214	1	CAPACITOR-FXD 90UF +75–10% 16VDC AL	04200	3ØD9Ø6GØ16CC2
A15C19	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C20	0160-3879	1	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A15C21	0160-2209	1	CAPACITOR-FXD 360PF ±5% 300VDC MICA	28480	0160-2209
A15C22	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C23	0160-0127	2	CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A15C24	0160-4084		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A15C25	0160-0127		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A15CR1	1901-0535	7	DIODE-SCHOTTKY	28480	1901-0535
A15CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A15CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A15CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A15CR5	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A15CR6	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A15CR7	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A15J1	1251-4222	1	CONNECTOR-50PIN F MICRO RIBBON	28480	1251-4222
A15MP1	85680-60114	2	STANDOFF-SAE THREAD	28480	85680-60114
A15MP2	2190-0034	2	WASHER-LOCK NO. 10	28480	2190-0034
A15MP3	1530-1098	2	CLEVIS-.070" SLIT .454" PIN CTR	28480	1530-1098
A15MP4	2200-0143	2	SCREW-MACH 4-40 PAN HD POZI	28480	2200-0143
A15MP5	2260-0002	2	NUT-HEX 4-40 .062" THK	28480	2260-0002
A15MP6	2190-0004	2	WASHER-LOCK INT T NO. 6	28480	2190-0004
A15Q1	1854-0404	1	TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0404
A15Q2	1854-0637	1	TRANSISTOR-NPN SI TO-5 PD=800MW	28480	1854-0637
A15Q3	1853-0007	1	TRANSISTOR-PNP SI TO-18 PD=360MW	02037	2N3251
A15R1	0698-7225	5	RESISTOR 348 1% .05WF TC=0±100	0329B	C3-1/8-TO-348R-G
A15R2	0698-3601	1	RESISTOR 10 5% 2W MO TC=0±200	0341B	FP42-2-TOO-10RØ-J
A15R3	0698-7260	7	RESISTOR 10K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ2-G
A15R4	0698-7260		RESISTOR 10K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ2-G
A15R5	0757-0442	6	RESISTOR 10K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1ØØ2-F
A15R6	0698-7260		RESISTOR 10K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ2-G
A15R7	0757-0442		RESISTOR 10K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1ØØ2-F
A15R8	0698-7264	2	RESISTOR 14.7K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1472-G
A15R9	0698-7260		RESISTOR 10K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ2-G
A15R10	0757-0442		RESISTOR 10K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1ØØ2-F
A15R11	0698-3437	1	RESISTOR 133 1% .125W F TC=0±100	0329B	C4-1/8-TO-133R-F
A15R12	0698-7264		RESISTOR 14.7K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1472-G
A15R13	0698-7268	2	RESISTOR 21.5K 1% .05W F TC=0±100	0329B	C3-1/8-TO-2152-G
A15R14	0698-7236	10	RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ1-G
A15R15	0698-7225		RESISTOR 348 1% .05W F TC=0±100	0329B	C3-1/8-TO-348R-G
A15R16	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ1-G

Table 9-24. A15 Processor, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15R17	0698-7236		RESISTOR 1K 1% .05W F TC= 0±100	0329B	C3-1/8-TO-1Ø01-G
A15R18	0698-7225		RESISTOR 348 1% .05W F TC=0±100	0329B	C3-1/8-TO-348R-G
A15R19	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1Ø01-G
A15R20	0757-0442		RESISTOR 10K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1ØØ2-F
A15R21	0698-7260		RESISTOR 10K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ2-G
A15R22	0698-7239	1	RESISTOR 1.33K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1331-G
A15R23	0698-7260		RESISTOR 10K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1ØØ2-G
A15R24	0757-0442		RESISTOR 10K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1ØØ2-F
A15R25	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1Ø01-G
A15R26	0698-7193	2	RESISTOR 16.21% .05W F TC=0±100	0329B	C3-1/8-TO-16R2-G
A15R27	0698-7193		RESISTOR 16.21% .05W F TC=0±100	0329B	C3-1/8-TO-16R2-G
A15R28	0757-0442		RESISTOR 10K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1ØØ2-F
A15R29	0698-7268		RESISTOR 21.5K 1% .05W F TC=0±100	0329B	C3-1/8-TO-2152-G
A15R30	0757-0280	2	RESISTOR 1K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1Ø01-F
A15R31	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1Ø01-G
A15R32	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1Ø01-G
A15R33	0698-7225		RESISTOR 348 1% .05W F TC=0±100	0329B	C3-1/8-TO-348R-G
A15R34	0757-0280		RESISTOR 1K 1% .125W F TC=0±100	0329B	C4-1/8-TO-1Ø01-F
A15R35	0698-7225		RESISTOR 348 1% .05W F TC=0±100	0329B	C3-1/8-TO-348R-G
A15R36	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1Ø01-G
A15R37	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1Ø01-G
A15R38	0698-7236		RESISTOR 1K 1% .05W F TC=0±100	0329B	C3-1/8-TO-1Ø01-G
A15R39	0698-7229	2	RESISTOR 511 1% .05W F TC=0±100	0329B	C3-1/8-TO-511R-G
A15R40	0698-7229		RESISTOR 511 1% .05W F TC=0±100	0329B	C3-1/8-TO-511R-G
A15R41	0698-7246	1	RESISTOR 2.61K 1% .05W F TC=0±100	0329B	C3-1/8-TO-2611-G
A15R42	0698-7234	1	RESISTOR 825 1% .05W F TC=0±100	0329B	C3-1/8-TO-825R-G
A15R43	0698-7245	1	RESISTOR 2.37K 1% .05W F TC=0±100	0329B	C3-1/8-TO-2371-G
A15R44	0698-7260		RESISTOR 10K 1% .05W F TC=0±100	0392B	C3-1/8-TO-1ØØ2-G
A15TP1	1251-5177	12	CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP2	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP3	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP4	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP5	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP6	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP7	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP8	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP9	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP10	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP11	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15TP12	1251-5177		CONNECTOR-SGL CONT PIN	28480	1251-5177
A15U1	1820-1144	1	IC-GATE TTL LS NOR QUAD 2-INP	0223G	9LSØ2PC
A15U2	1820-1492	2	IC-BFR TTL LS INV HEX 1-INP	0169H	SN74LS368N
A15U3	1820-1492		IC-BFR TTL LS INV HEX 1-INP	0169H	SN74LS368N
A15U4	1820-1288	1	IC-DRVR TTL/MOS CLOCK DRVR 1-INP	0203G	MMHØØ26CL
A15U5	1826-0180	1	IC-555	0291J	NE555V
A15U6	1820-1277	1	IC-CNTR TTL LS DECD UP/DOWN	0169H	SN74LS192N
A15U7	1820-1195	1	IC-FF TTL LS D-TYPE POS-EDGE-TRIG	0379D	AM74LS175A
A15U8	1820-1199	1	IC-INV TTL LS HEX 1-INP	0169H	SN74LSØ4N
A15U9	1820-1198	1	IC-GATE TTL LS NAND QUAD 2-INP	0169H	SN74LSØ3N
A15U10	1820-1416	1	IC-SCHMITT-TRIG TTL LS INV HEX 1-INP	0169H	SN74LS14N
A15U11	1820-1204	1	IC-GATE TTL LS NAND DUAL 4-INP	0169H	SN74LS2ØN
A15U12	1820-0681	1	IC-GATE TTL S NAND QUAD 2-INP	0223G	74SØØPC
A15U13	85680-60100	1	MICRO PROCESSOR	28480	85680-60100
A15U14	1906-0075	2	DIODE-ARRAY 40V 400MA	28480	1906-0075
A15U15	1810-0338	2	NETWORK-RES 16-PIN DIP	02483	761-3-R100
A15U16	1906-0075		DIODE-ARRAY 40V 400MA	28480	1906-0075
A15U17	1810-0338		NETWORK-RES 16-PIN DIP	02483	761-3-R100
A15VR1	1902-0072	1	DIODE-ZNR 7.87V 2% PD=.4W TC=+.051%	28480	1902-0072
A15VR2	1902-3048	1	DIODE-ZNR 3.48V 5% PD=.4W TC=–.058%	0203G	SZ 10939-50
A15VR3	1902-0551	1	DIODE-ZNR 6.19V 5% PD=1W TC=+.022%	28480	1902-0551

A15
PROCESSOR

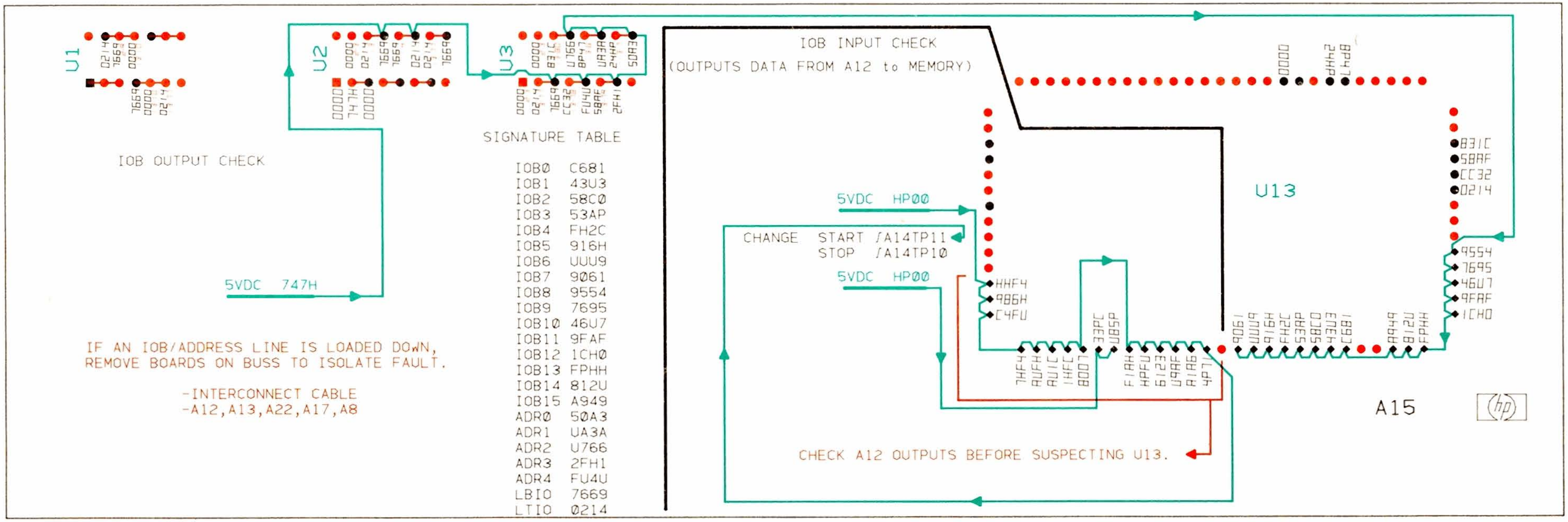


Figure 9-61. A15 Processor, Signature Analysis Troubleshooting Diagram

IOB INPUT CHECK

Signature Analyzer Connections:

CLOCK ⎍ to A14TP5
START ⎍ to A14TP10
STOP ⎍ to A14TP9

Spectrum Analyzer Connections:

Install A12 board on A12 RF Section Interface Extender board, HP Part No. 85680-60035.

Jumper A14TP12 to A15TP8

IOB OUTPUT CHECK

Signature Analyzer Connections:

CLOCK ⎍ to A15TP2
START ⎍ to A14TP12
STOP ⎍ to A14TP11

Spectrum Analyzer Connections:

Jumper A14TP12 to A15TP8
Jumper A15TP3 to A15TP9 (+5V)

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.

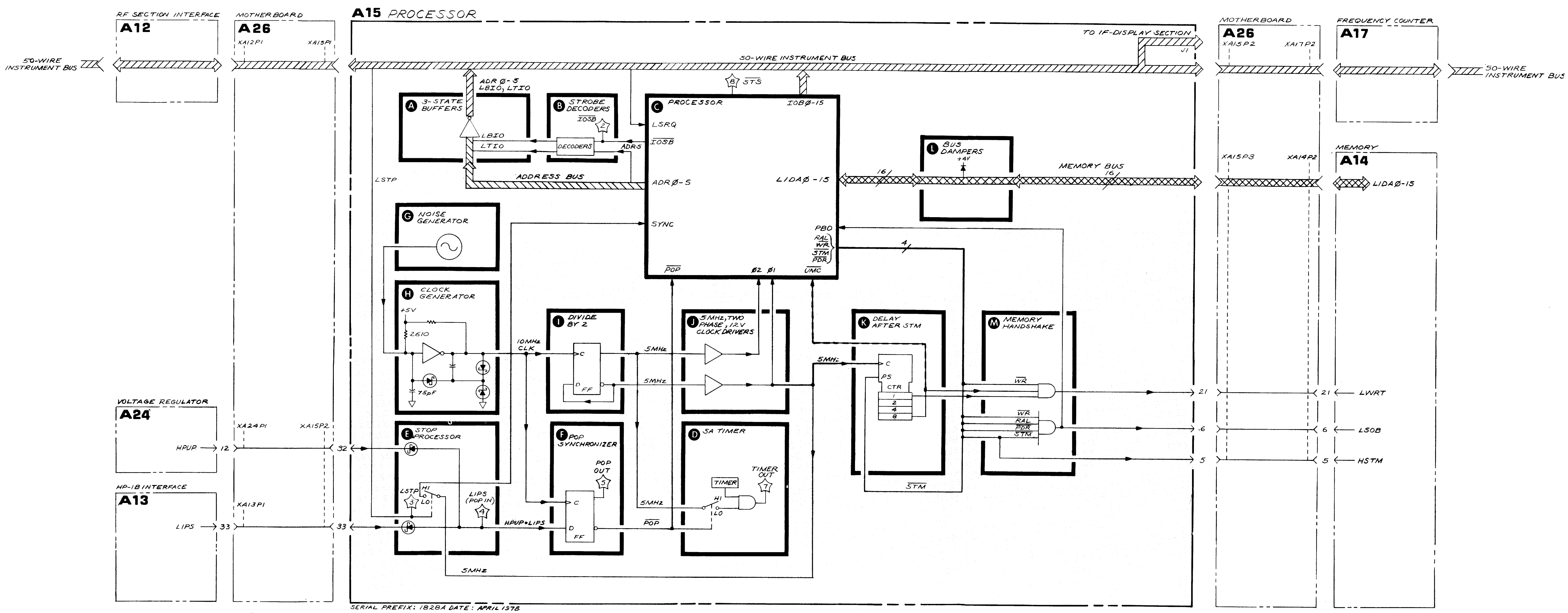


Figure 9-62. A15 Processor, Block Diagram

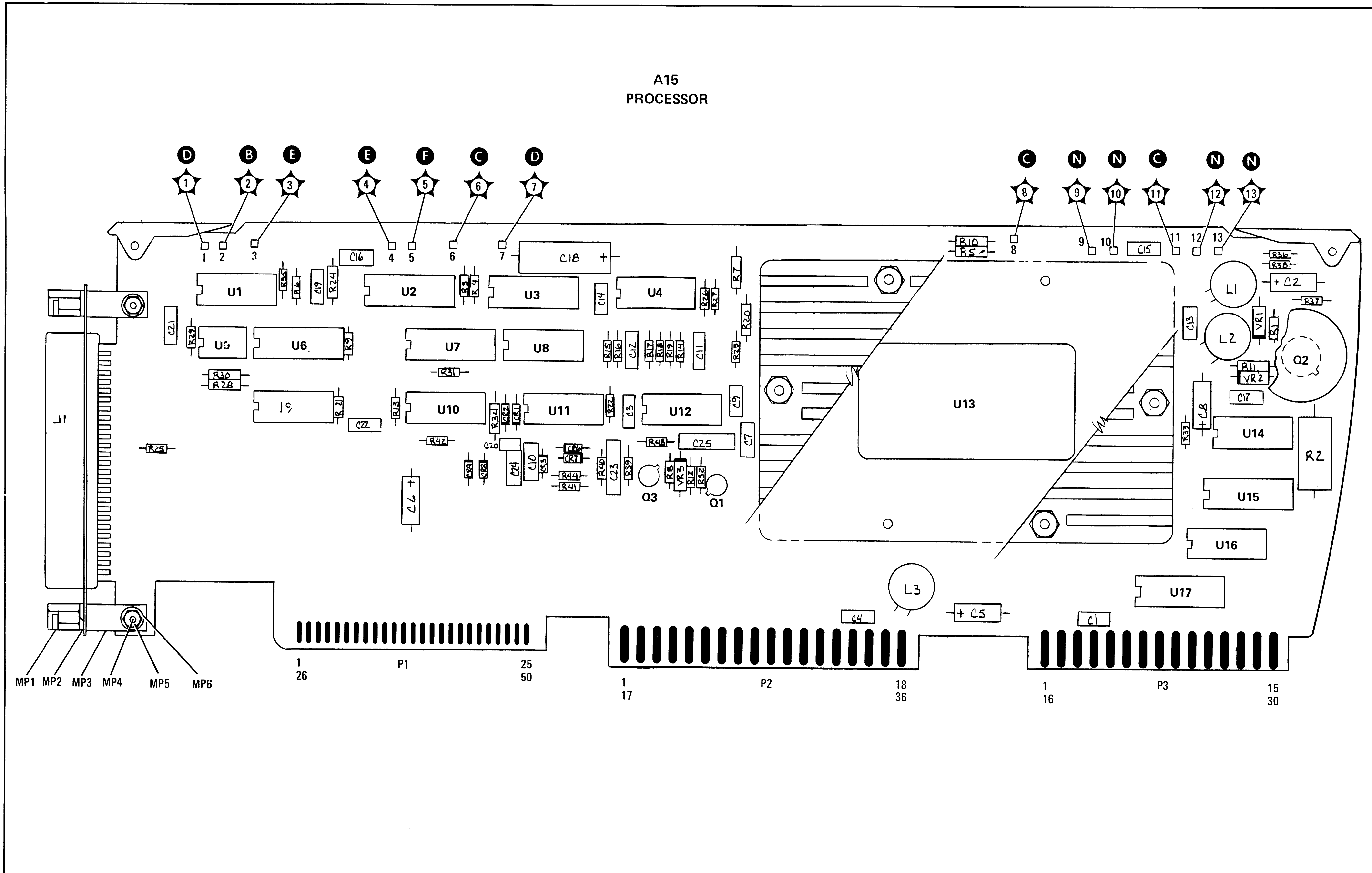


Figure 9-63. A15 Processor, Component Locations

A15 PROCESSOR
85680-60037

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LTIO	A12P1-26	A
26	GND		N
2	LBIO	A12P1-27	A
27	GND		N
3	NC		
28	NC		
4	LSTP	A12P1-29	E
29	HSWP	A12P1-4	O
5	KC6	A12P1-30	O
30	KC7	A12P1-5	O
6	KC4	A12P1-31	O
31	KC5	A12P1-6	O
7	KC2	A12P1-32	O
32	KC3	A12P1-7	O
8	KCØ	A12P1-33	O
33	KC1	A12P1-8	O
9	KR1Ø	A12P1-34	O
34	KR11	A12P1-9	O
10	KR8	A12P1-35	O
35	KR9	A12P1-10	O
11	NC		
36	NC		
12	ADR4	A12P1-37	A
37	ADR5	A12P1-12	A
13	ADR2	A12P1-38	A
38	ADR3	A12P1-13	A
14	ADRØ	A12P1-39	A
39	ADR1	A12P1-14	A
15	NC		
40	NC		
16	NC		
41	NC		
17	IOB14	A12P1-42	C
42	IOB15	A12P1-17	C
18	IOB12	A12P1-43	C
43	IOB13	A12P1-18	C
19	IOB1Ø	A12P1-44	C
44	IOB11	A12P1-17	C
20	IOB8	A12P1-45	C
45	IOB9	A12P1-20	C
21	IOB6	A12P1-46	C
46	IOB7	A12P1-21	C
22	IOB4	A12P1-47	C
47	IOB5	A12P1-22	C
23	IOB2	A12P1-48	C
48	IOB3	A12P1-23	C
24	IOBØ	A12P1-49	C
49	IOB1	A12P1-24	C
25	GND		N
50	LTGR	A12P1-25	O

P2

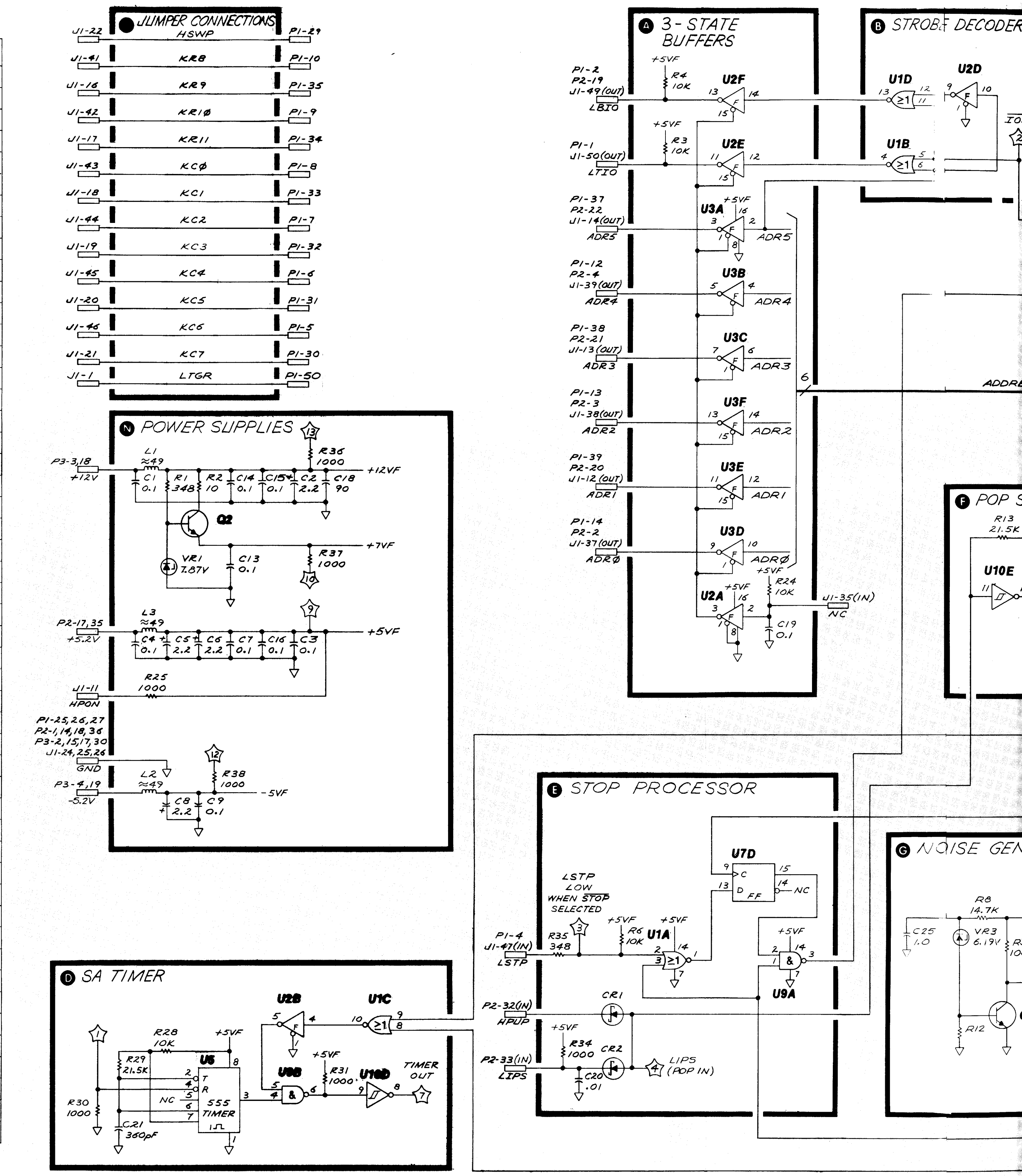
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		N
19	LBIO	A12P1-27	A
2	ADRØ	A17P2-26	A
20	ADR1	A17P2-11	A
3	ADR2	A17P2-25	A
21	ADR3	A17P2-10	A
4	ADR4	A17P2-24	A
22	ADR5		A
5	IOBØ	A17P2-23	C
23	IOB1	A17P2-8	C
6	IOB2	A17P2-22	C
24	IOB3	A17P2-7	C
7	IOB4	A17P2-21	C
25	IOB5	A17P2-6	C
8	IOB6	A17P2-20	C
26	IOB7	A17P2-5	C
9	IOB8	A17P2-19	C
27	IOB9	A17P2-4	C
10	IOB1Ø	A17P2-18	C
28	IOB11	A17P2-3	C
11	IOB12	A17P2-17	C
29	IOB13	A17P2-2	C
12	IOB14	A17P2-16	C
30	IOB15	A17P2-1	C
13	NC		
31	NC		
14	GND		N
32	HPUP	A24P2-11	E
15	10MHz	A16P1-7	NC
33	LIPS	A13P1-33	E
16	+5V BATT	BATTERY	NC
34	LSRQ	A12P2-34	C
17	+5.2V		N
35	+5.2V		N
18	GND		N
36	GND		N

P3

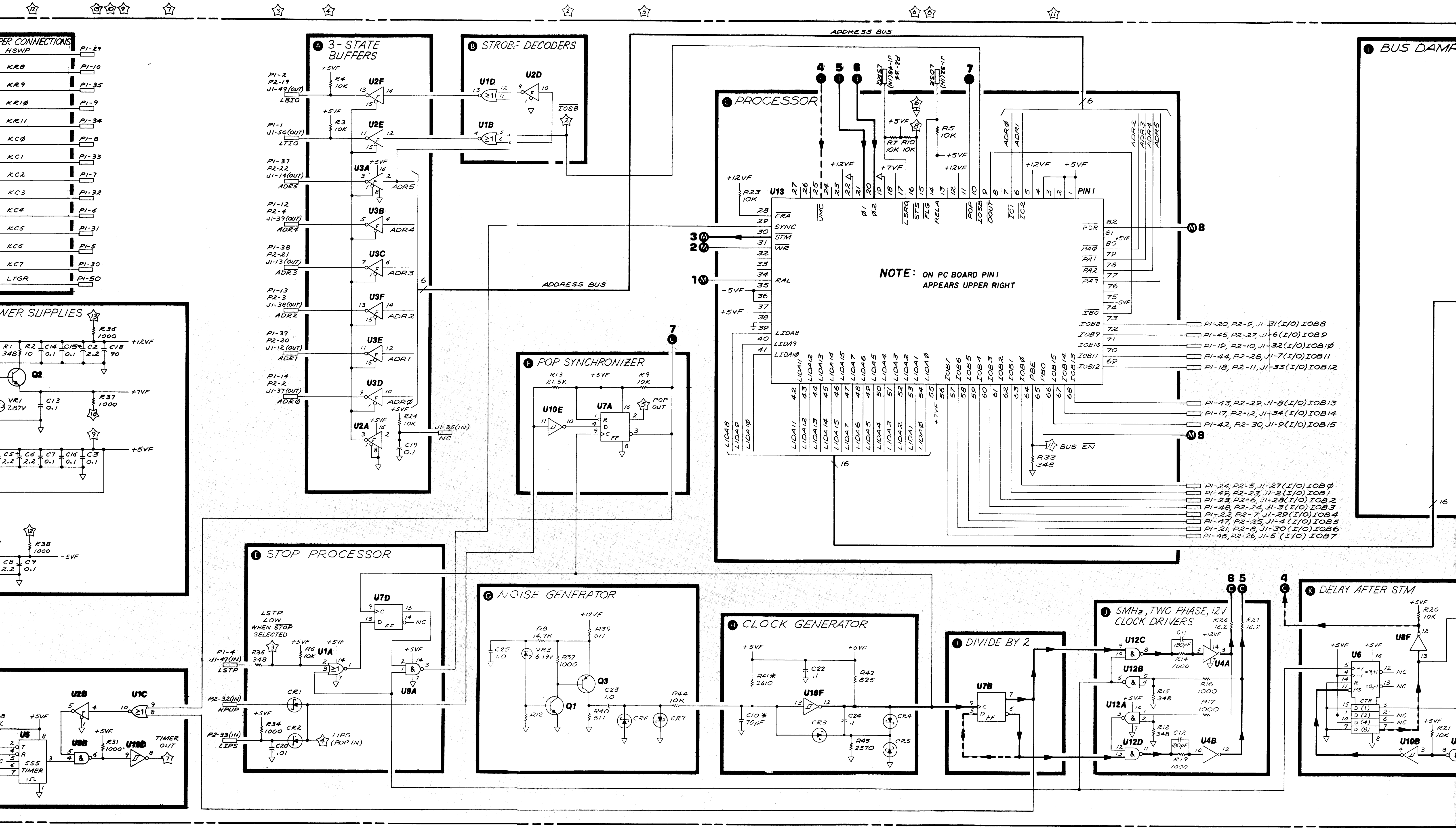
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
16	NC		
2	GND		N
17	GND		N
3	+12V		N
18	+12V		N
4	-5.2V		N
19	-5.2V		N
5	HSTM	A14P2-5	M
20	NC		M
6	LSOB	A14P2-6	M
21	LWRT	A14P2-21	M
7	LIDA14	A14P2-7	L
22	LIDA15	A14P2-22	L
8	LIDA12	A14P2-8	L
23	LIDA13	A14P2-23	L
9	LIDA1Ø	A14P2-9	L
24	LIDA11	A14P2-24	L
10	LIDA8	A14P2-10	L
25	LIDA9	A14P2-25	L
11	LIDA6	A14P2-11	L
26	LIDA7	A14P2-26	L
12	LIDA4	A14P2-12	L
27	LIDA5	A14P2-27	L
13	LIDA2	A14P2-13	L
28	LIDA3	A14P2-28	L
14	LIDAØ	A14P2-14	L
29	LIDA1	A14P2-29	L
15	GND		N
30	GND		N

J1

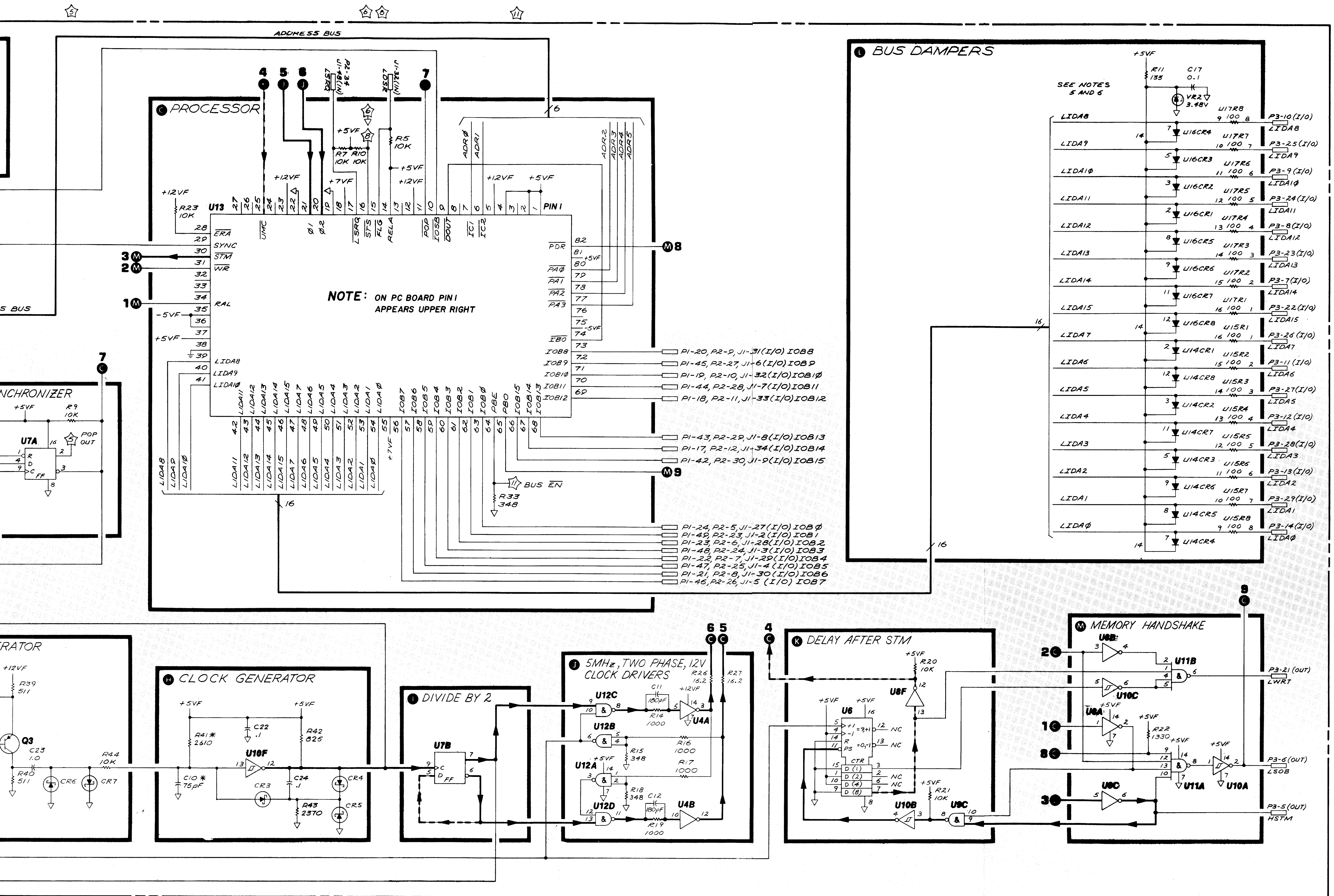
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LTGR		O
2	IOB1	A4A10J1-4	C
3	IOB3	A4A10J1-6	C
4	IOB5	A4A10J1-8	C
5	IOB7	A4A10J1-10	C
6	IOB9	A4A10J1-12	C
7	IOB11	A4A10J1-14	C
8	IOB13	A4A10J1-16	C
9	IOB15	A4A10J1-18	C
10	NC		
11	HPON	A1A9J1-22	N
12	ADR1	A4A10J1-24	A
13	ADR3	A4A10J1-26	A
14	ADR5	A4A10J1-28	A
15	NC		
16	KR9	A1A1J1-33	O
17	KR11	A1A1J1-31	O
18	KC1	A1A1J1-41	O
19	KC3	A1A1J1-39	O
20	KC5	A1A1J1-37	O
21	KC7	A1A1J1-35	O
22	HSWP	A3A1P1-21	O
23	LDSR	A3A10J1-46	O
24	GND		N
25	GND		N
26	GND		N
27	IOBØ	A4A10J1-3	C
28	IOB2	A4A10J1-5	C
29	IOB4	A4A10J1-7	C
30	IOB6	A4A10J1-9	C
31	IOB8	A4A10J1-11	C
32	IOB1Ø	A4A10J1-13	C
33	IOB12	A4A10J1-15	C
34	IOB14	A4A10J1-17	C
35	NC		
36	NC		
37	ADRØ	A4A10J1-23	A
38	ADR2	A4A10J1-25	A
39	ADR4	A4A10J1-27	A
40	NC		
41	KR8	A1A1J1-34	O
42	KR1Ø	A1A1J1-32	O
43	KCØ	A1A1J1-42	O
44	KC2	A1A1J1-40	O
45	KC4	A1A1J1-38	O
46	KC6	A1A1J1-36	O
47	LSTP	A1A9J1-43	E
48	LSRQ	A1A9J1-45	C
49	LBIO	A1A9J1-47	A
50	LTIO	A3A10J2-49	A



SERIAL PREFIX: 1828A DATE: APRIL, 1978



3-STATE BUFFERS
STROBE DECODERS
PROCESSOR
NOTE: ON PC BOARD PIN 1 APPEARS UPPER RIGHT
ADDRESS BUS
BUS DAMP
POWER SUPPLIES
POP SYNCHRONIZER
STOP PROCESSOR
NOISE GENERATOR
CLOCK GENERATOR
DIVIDE BY 2
5MHz, TWO PHASE, 12V CLOCK DRIVERS
DELAY AFTER STM
555 TIMER
TIMER OUT
LSTP LOW WHEN STOP SELECTED
LIPS (POP IN)
POP OUT
BUS EN

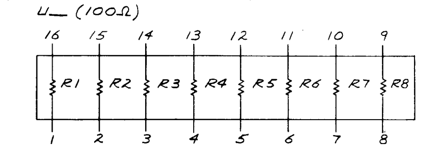


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE 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. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
ADRØ - 5	INSTRUMENT BUS ADDRESS BITS Ø - 5
HPON	HIGH = IF-DISPLAY SECTION POWER ON
HSWP	HIGH = SWEEPING
IOBØ - 15	INSTRUMENT BUS DATA BITS Ø - 15
KCØ - 7	KEY COLUMNS Ø - 7
KR8 - 11	KEY ROWS 8-11
LBIO	LOW = RF SECTION I/O STROBE
LDSR	LOW = DIGITAL STORAGE READY
LSRQ	LOW = SERVICE REQUEST
LSTP	LOW = STOP PROCESSOR
LTIO	LOW = IF-DISPLAY SECTION I/O STROBE
HPUP	HIGH = POWER UP
LIPS	LOW = INSTRUMENT PRESET
HSTM	HIGH = START MEMORY CYCLE
LSOB	LOW = STAY OFF BUS
LWRT	LOW = WRITE MEMORY
LIDAØ - 15	INTERNAL DATA AND ADDRESS BUS BITS Ø - 15

5. U15 AND U17 PIN CONFIGURATION:
   U__ (100Ω)



6. U14 AND U16 PIN CONFIGURATION:

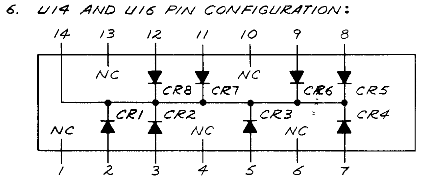


Figure 9-64. A15 Processor, Schematic Diagram

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 ≈ +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 voltge. 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 9-25. A16 20 MHz Reference, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16	85680-60005	1	20 MHZ REFERENCE (INCL W26 & W22)	28480	85680-60005
A16C1	0160-2055	28	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C4	0140-0193	2	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A16C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C6	0140-0193		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A16C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C10	0160-2264	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A16C11	0121-0457	1	CAPACITOR-V TRMR-PSTN .8-8.5PF 750V	18736	TP9
A16C12	0121-0451	1	CAPACITOR-V TRMR-AIR 1.7-11PF 250V	74970	187-0106-005
A16C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C16	0160-2201	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A16C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C18	0160-2260	1	CAPACITOR-FXD 13PF +-5% 500VDC CER 0+-30	28480	0160-2260
A16C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C20	0180-0197	4	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C21	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C22	0140-0198	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A16C23	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C24	0140-0210	1	CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A16C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C29	0160-2204	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A16C30	0160-2204		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A16C31	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C39	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C40	0160-3879	3	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C41	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C42	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C43	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C44	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C45	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C46	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C47	0160-2247	1	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	28480	0160-2247
A16CR1	1901-0639	1	DIODE-PIN 110V	28480	1901-0639
A16CR2	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A16CR3	1901-0040	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16DS1	1990-0486	1	LED-VISIBLE LUM-INT-1MCD IF=20MA-MAX	28480	1990-0486
A16E1	9170-0029	2	CORE-SHIELDING BEAD	28480	9170-0029
A16E2	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A16J1	1250-0690	4	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16J2	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16J3	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16J4			PART OF W26		
A16J5			PART OF W23		
A16J6	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A16L1	9140-0143	1	COIL-MLD 3.3UH 10% Q=45 .095DX.25LG-NOM	28480	9140-0143
A16L2	9140-0179	8	COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L3	9140-0142	1	COIL-MLD 2.2UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0142
A16L4	9140-0114	1	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A16L5	9100-2250	1	COIL-MLD 180NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2250
A16L6	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L7	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L8	9100-2256	2	COIL-MLD 560NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2256
A16L9	9100-2259	1	COIL-MLD 1.5UH 10% Q=32 .095DX.25LG-NOM	28480	9100-2259
A16L10	9100-2256		COIL-MLD 560NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2256

Table 9-25. A16 20 MHz Reference, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16L11	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L12	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L13	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L14	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L15	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A16L16	9100-2258	1	COIL-MLD 1.2UH 10% Q=32 .095DX.25LG-NOM	28480	9100-2258
A16Q1	1854-0023	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A16Q2	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A16Q3	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A16Q4	1854-0247	3	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A16Q5	1854-0247		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A16Q6	1854-0247		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A16Q7	1854-0019	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A16Q8	1853-0007	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A16R1	0757-0398	3	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A16R2	0757-0378	3	RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A16R3	0757-0378		RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A16R4	0698-3443	5	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R5	0757-0422	6	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R6	0698-3157	4	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A16R7	0757-0442	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R8	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R9	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R10	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A16R11	0698-3430	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A16R12	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R13	0698-3404	1	RESISTOR 383 1% .5W F TC=0+-100	28480	0698-3404
A16R14	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A16R15	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A16R16	0757-0200	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A16R17	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R18	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R19	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A16R20	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A16R21	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A16R22	0757-0378		RESISTOR 11 1% .125W F TC=0+-100	19701	MF4C1/8-T0-11R0-F
A16R23	0698-0082	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A16R24	0757-0274	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A16R25	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A16R26	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A16R27	0698-3260	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A16R28	0698-3150	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A16R29	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A16R30	0757-0459	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A16R31	2100-3161	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A16R32	0757-0462	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A16R33	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A16R34	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A16R35	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R36	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A16R37	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R38	0757-0401	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R39	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R40	0698-7196	3	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A16R41	0698-7207	1	RESISTOR 61.9 1% .05W F TC=0+-100	24546	C3-1/8-T00-61R9-G
A16R42	0698-7201	2	RESISTOR 34.8 1% .05W F TC=0+-100	24546	C3-1/8-T00-34R8-G
A16R43	0698-7196		RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A16R44	0698-7203	1	RESISTOR 42.2 1% .05W F TC=0+-100	24546	C3-1/8-T00-42R2-G
A16R45	0698-7201		RESISTOR 34.8 1% .05W F TC=0+-100	24546	C3-1/8-T00-34R8-G
A16R46	0698-7196		RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A16R47	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A16R48	0698-3151	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A16R49	0698-3441	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A16R50	0698-3437	2	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A16R51	2100-3123	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A16R52	0757-0419	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A16R53	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A16R54	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R55	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R56	0757-0276	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A16R57	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R58	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16R59	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16R60	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F

Table 9-25. A16 20 MHz Reference, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16R61	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A16R62	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A16T1	85680-80004	1	TRANSFORMER, RF	28480	85680-80004
A16T2	85662-80002	1	COIL ASSEMBLY, TRANSFORMER	28480	85662-80002
A16TP1	0360-0124	4	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A16TP2	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A16TP3	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A16TP4	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A16U1	1858-0032	1	TRANSISTOR ARRAY	01928	CA3146E
A16U2	1820-1144	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A16U3	1826-0092	1	IC OP AMP TO-99	28480	1826-0092
A16VR1	1902-0048	1	DIODE-ZNR 6.81V 5% DO-7 PD=.4W TC=+.043%	28480	1902-0048
A16Y1	0410-1103	1	CRYSTAL 20.0 MHZ	28480	0410-1103
			A16 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001

Table 9-26. A16 20 MHz Reference, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C1	CR3	C3	R10	C2	R60	C1
C2	C1	CR4	C3	R11	C2	R61	B1
C3	C2			R12	C2	R62	B1
C4	C2	DS1	C3	R13	B2		
C5	C2			R14	B2	T1	C2
C6	C2	E1	C2	R15	C3	T2	C2
C7	B2	E2	C2	R16	B2		
C8	B2			R17	B2	TP1	C3
C9	C2	J1	D1	R18	B2	TP2	C3
C10	C2	J2	D1	R19	B2	TP3	A1
C11	C2	J3	D3	R20	C2	TP4	B3
C12	C2	J4	D3	R21	C3		
C13	C2	J5	D3	R22	C3	U1	C4
C14	B2	J6	D4	R23	C3	U2	B1
C15	B2			R24	B3	U3	B3
C16	C3	L1	C2	R25	B3		
C17	C3	L2	B2	R26	B3	VR1	B3
C18	B3	L3	C3	R27	B3		
C19	B3	L4	A2	R28	B3	Y1	C3
C20	B2	L5	B3	R29	C3		
C21	B2	L6	B4	R30	C3		
C22	B3	L7	B4	R31	C3		
C23	B3	L8	C3	R32	B3		
C24	C3	L9	C3	R33	B3		
C25	B4	L10	C3	R34	B3		
C26	B4	L11	C1	R35	B3		
C27	B4	L12	B1	R36	B3		
C28	C4	L13	B4	R37	B3		
C29	C4	L14	B4	R38	B3		
C30	C3	L15	A3	R39	B3		
C31	C4	L16	C2	R40	C3		
C32	C4			R41	C3		
C33	C1	Q1	C2	R42	C3		
C34	C1	Q2	C2	R43	C3		
C35	B1	Q3	B1	R44	C3		
C36	B1	Q4	C2	R45	C3		
C37	B1	Q5	C3	R46	C3		
C38	B3	Q6	C3	R47	B3		
C39	B2	Q7	B1	R48	B4		
C40	A4	Q8	B2	R49	B4		
C41	A4			R50	C3		
C42	A4	R1	C1	R51	C4		
C43	B4	R2	C1	R52	C4		
C44	B4	R3	C1	R53	B2		
C45	A3	R4	C1	R54	C3		
C46	B3	R5	C1	R55	C4		
C47	C2	R6	C2	R56	C4		
		R7	C2	R57	C1		
CR1	B2	R8	C2	R58	B1		
CR2	B3	R9	C2	R59	C1		

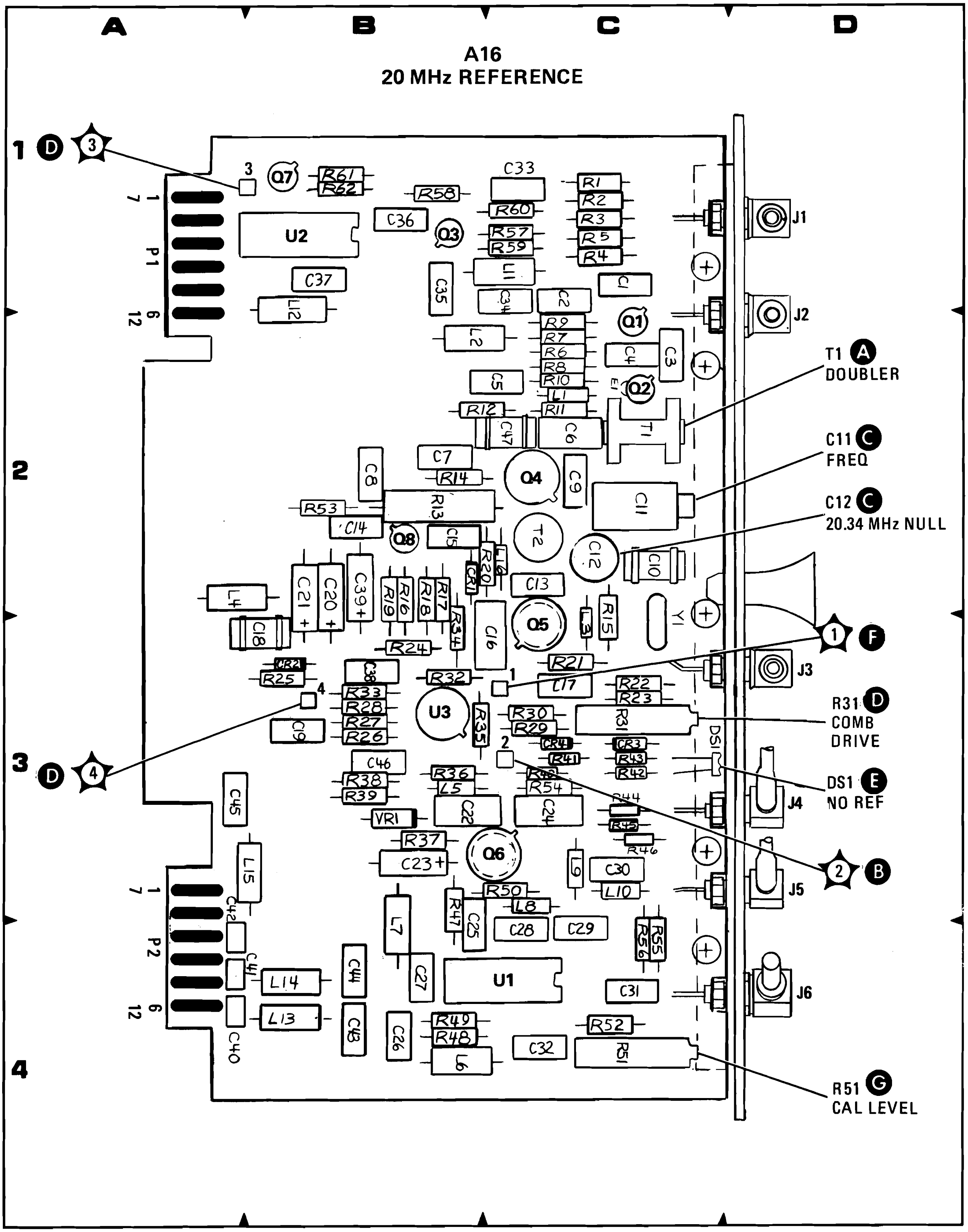


Figure 9-65. A16 20 MHz Reference, Component Locations

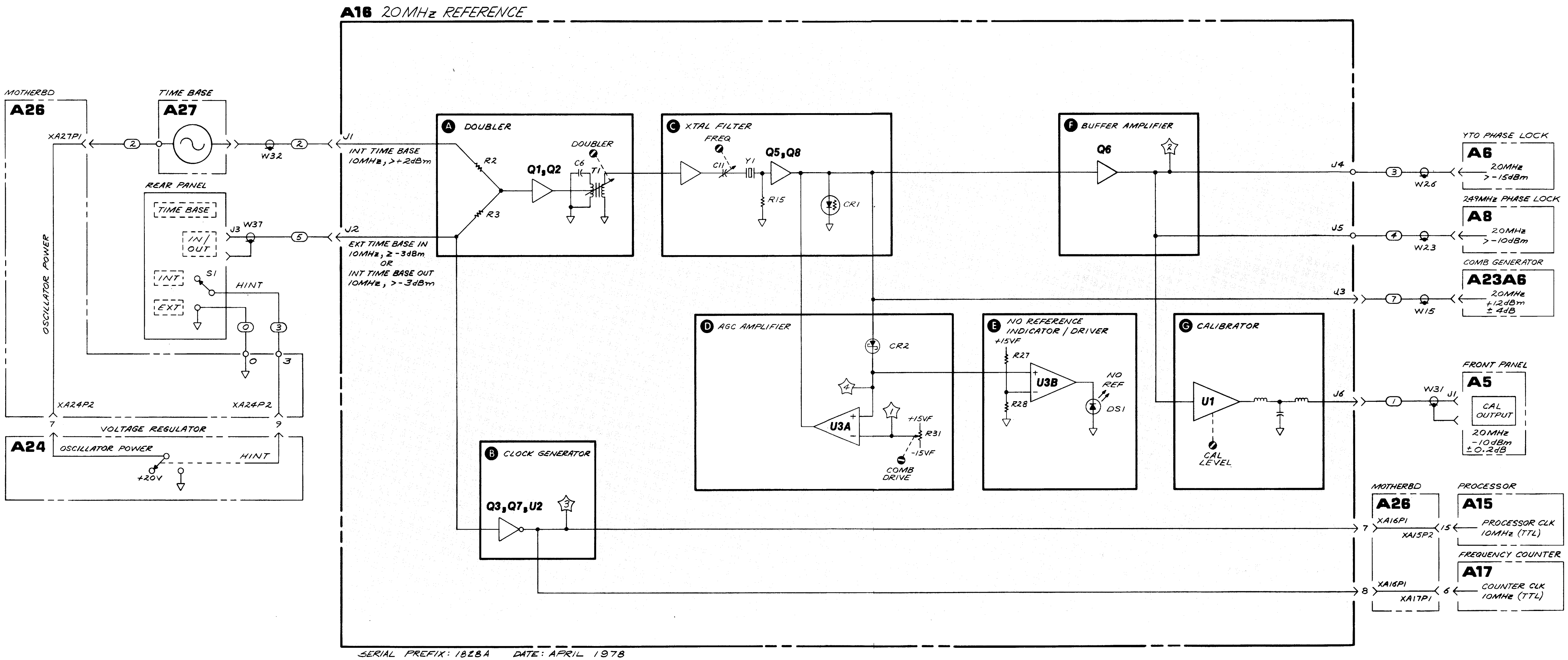


Figure 9-66. A16 20 MHz Reference, Block Diagram

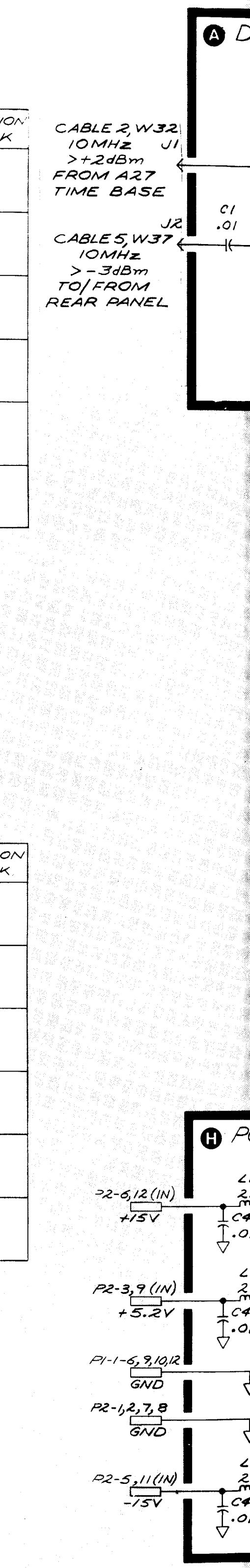
A16 20MHz REFERENCE
85680-60005

P1

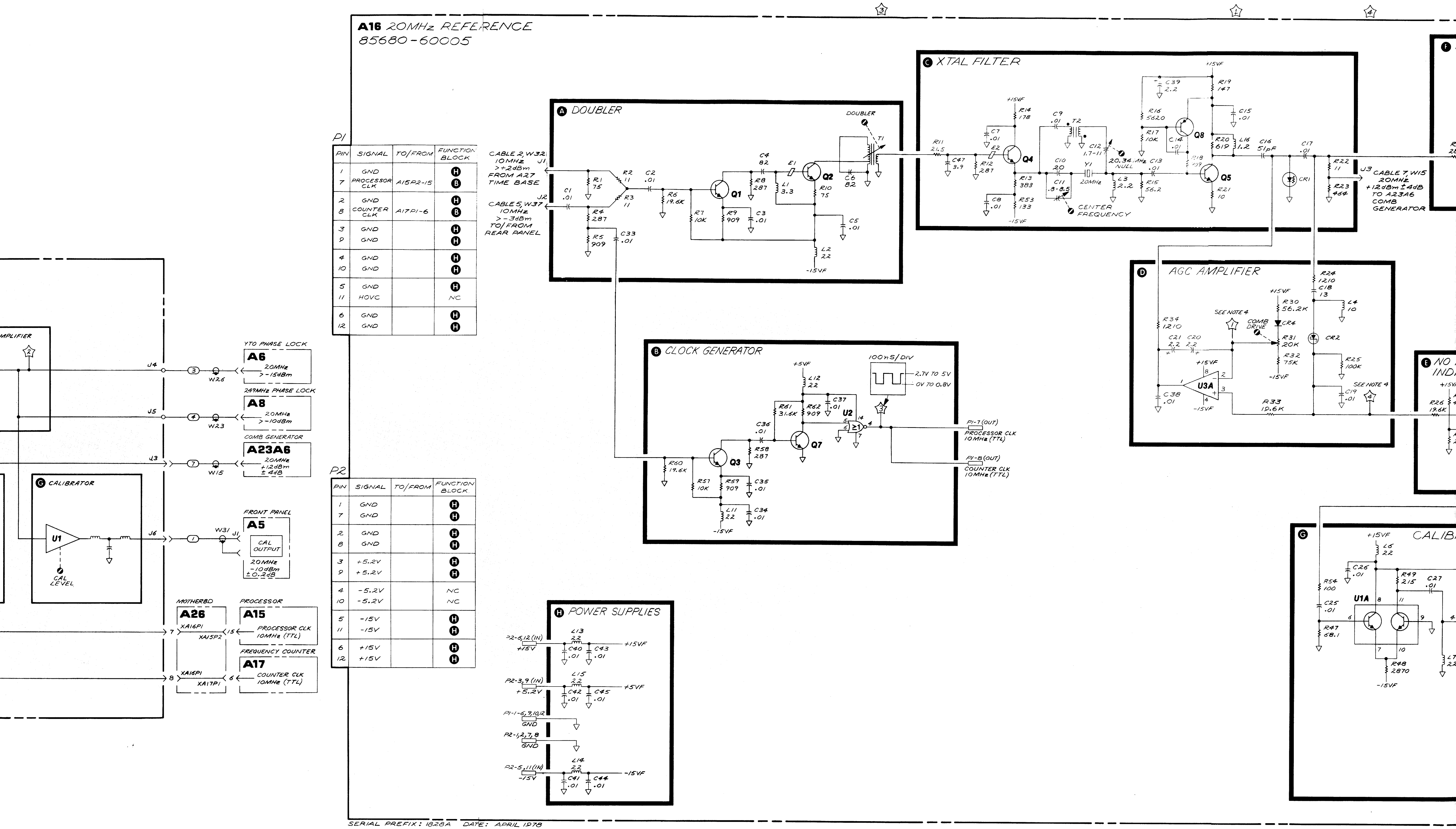
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		H
7	PROCESSOR CLK	A15P2-15	B
2	GND		H
8	COUNTER CLK	A17P1-6	B
3	GND		H
9	GND		H
4	GND		H
10	GND		H
5	GND		H
11	HOVC		NC
6	GND		H
12	GND		H

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



SERIAL PREFIX: 1828A DATE: APRIL 1978



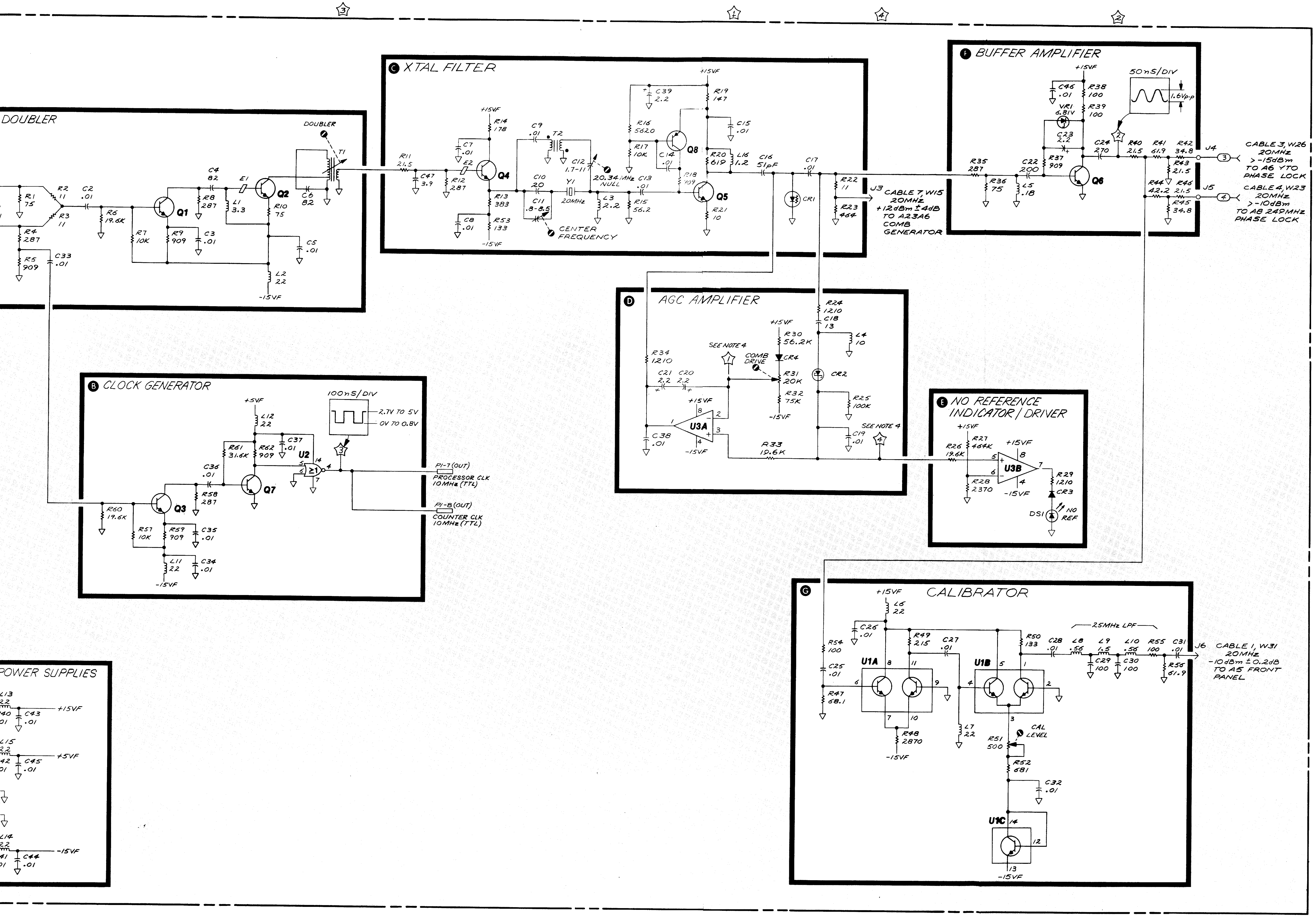
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		H
7	PROCESSOR CLK	A15P2-15	B
2	GND		H
8	COUNTER CLK	A17P1-6	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

MHz Reference, Block Diagram



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE 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. VOLTAGES AT TP1 AND TP4 VARY BETWEEN 0V AND 2V DEPENDING UPON THE SETTING OF R31. DURING NORMAL AGC OPERATION THE VOLTAGE OF TP1 EQUALS THAT OF TP4 ± 20mV. TO DISABLE AGC, GROUND TP4.
5. WHEN INT IS SELECTED AT REAR PANEL, 10MHz AT -3dBm MINIMUM IS PRESENT AT A16J2. WHEN EXT IS SELECTED, A27 TIME BASE IS DISABLED AND A16J2 BECOMES AN INPUT REQUIRING 10MHz AT -3dBm MINIMUM.
6. MNEMONICS TABLE:

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

A16

Figure 9-67. A16 20 MHz Reference, Schematic Diagram

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 (Q7, Q8) driving a differential amplifier (Q9, Q10) which provides TTL voltage levels to the digital multiplexer U1. R3, R4, R28, C4 and C5 provide the bias, and with Q7, 50Ω 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 Q8 and Q9. 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 Q11, Q12, 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 200Ω 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 U7A to U11, 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 (Q13, Q14), 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 U12. The falling edge of the reset max input (U2 pin 6) causes the start of the count interval by clocking U4A; the fall of U4 pin 6 gates the Multiplexer U1.

Counter time base U2 counts cycles of the reference input and clocks U4A again to signify the end of the count interval. U4 pin 6 then goes high to disable Multiplexer U1, U4B is clocked by U4 pin 5, the busy line (LBSY) goes high, and the reference is gated off. Normally the 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 Drivers G

This circuit is composed of an eight-decade counter and 32 bits of 3-state bus driver. U10 and U11 are low power Schottky counters, while U3, U5, and U9 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/Δ→ 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 oscillscope 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]
Sweep Time .... 1500 seconds
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 mode. Key in the following:

[INSTR PRESET]
[SWEEP TIME] .... 1 sec
[SHIFT] [FREQ COUNT] .... 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 9-68 shows the corresponding waveform at TP1. TTL activity will be present at TP3.

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.

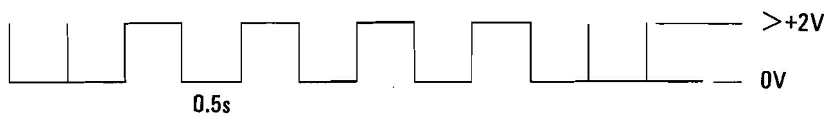


Figure 9-68. Time Base Waveform

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

[INSTR PRESET]

[SWEEP TIME] . . . . 1500 seconds

[SHIFT] [RES BW]

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 U11 pin 12 to 0.01 Hz at U3 pin 6.

Next, short U16 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 U16 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 9-27. A17 Frequency Counter, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17	85680-60018	1	BOARD ASSEMBLY, FREQUENCY COUNTER (INCLUDES W27)	28480	85680-60018
A17C1	0160-2055	23	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C2	0160-2199	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A17C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C21	0160-0945	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A17C22	0160-4084	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A17C23	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A17C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C27			NOT ASSIGNED		
A17C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C29	0160-2308	1	CAPACITOR-FXD 36PF +-5% 300VDC MICA	28480	0160-2308
A17C30	0160-2257	1	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A17C31	0140-0205	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A17CR1	1901-0535	4	DIODE-SCHOTTKY	28480	1901-0535
A17CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A17CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A17CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A17J1			PART OF W27		
A17J2	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A17J3	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A17L1	9100-2261	2	COIL-MLD 2.7UH 10% Q=40 .095DX.25LG-NOM	28480	9100-2261
A17L2	9100-2258	2	COIL-MLD 1.2UH 10% Q=32 .095DX.25LG-NOM	28480	9100-2258
A17L3			NOT ASSIGNED		
A17L4	9100-1617	1	COIL-MLD 3.9UH 10% Q=33 .155DX.375LG-NOM	28480	9100-1617
A17L5	9100-2261		COIL-MLD 2.7UH 10% Q=40 .095DX.25LG-NOM	28480	9100-2261
A17L6	9100-2258		COIL-MLD 1.2UH 10% Q=32 .095DX.25LG-NOM	28480	9100-2258
A17L7	9140-0114	2	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A17L8	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A17Q1	1854-0023	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q2	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q3	1854-0019	8	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q4	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q5	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q6	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q7	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q8	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A17Q9	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q10	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q11	1853-0007	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A17Q12	1854-0404	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A17Q13	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17Q14	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A17R1	0757-0346	5	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A17R2	0757-0395	2	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A17R3	0698-3152	2	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A17R4	0757-0276	2	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-61R9-F
A17R5	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A17R6			NOT ASSIGNED		
A17R7	0757-0280	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R8	0757-1094	3	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A17R9	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A17R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

Table 9-27. A17 Frequency Counter, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17R11	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A17R12	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A17R13	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A17R14	0698-3440	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A17R15	0698-3445	2	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A17R16	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A17R17	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A17R18	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A17R19	0698-3445		RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A17R20	0757-0395		RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A17R21	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A17R22	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A17R23	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R24	0698-3157	3	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A17R25	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A17R26	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R27	0698-3457	1	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A17R28	0757-0278	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A17R29	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A17R30	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A17R31	0757-0294	2	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A17R32	0757-0294		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A17R33			NOT ASSIGNED		
A17R34	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A17R35	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A17R36	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R37	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A17R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17TP1	0360-0124	4	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17TP2	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17TP3	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17TP4	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A17U1	1820-1244	1	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE	01295	SN74LS153N
A17U2	1820-1123	1	IC MISC MOS	50088	MK5009N
A17U3	1820-1122	3	IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A17U4	1820-1212	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112N
A17U5	1820-1122		IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A17U6	1820-1196	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A17U7	1820-1144	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A17U8	1820-1759	4	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U9	1820-1122		IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A17U10	1820-1251	3	IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A17U11	1820-1251		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A17U12	1820-1251		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A17U13	1820-1759		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U14	1820-1759		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U15	1820-1759		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U16	1820-1216	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A17VR1	1902-3036	1	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
			A17 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001

Table 9-28. A17 Frequency Counter, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C3	Q3	C1	TP1	B2		
C2	C4	Q4	C1	TP2	B3		
C3	C3	Q5	C2	TP3	B1		
C4	C3	Q6	C2	TP4	C3		
C5	C3	Q7	C3				
C6	C4	Q8	C4	U1	C2		
C7	C4	Q9	C4	U2	C3		
C8	C2	Q10	C4	U3	B1		
C9	C2	Q11	B4	U4	B2		
C10	C2	Q12	B4	U5	B2		
C11	C2	Q13	B4	U6	B3		
C12	C3	Q14	B4	U7	B3		
C13	B1			U8	B1		
C14	C2	R1	C3	U9	B2		
C15	B1	R2	C3	U10	B3		
C16	B1	R3	C3	U11	B3		
C17	C2	R4	C3	U12	B1		
C18	B3	R5	C4	U13	B2		
C19	B1	R7	C4	U14	B3		
C20	C2	R8	C4	U15	B3		
C21	B4	R9	B4	U16	A4		
C22	B4	R10	B4				
C23	A3	R11	B4	VR1	C3		
C24	A3	R12	B4				
C25	A4	R13	B4				
C26	B2	R14	C2				
C28	B1	R15	C2				
C29	C4	R16	C2				
C30	C2	R17	C2				
C31	C2	R18	B1				
		R19	B1				
CR1	C4	R20	C2				
CR2	C4	R21	B1				
CR3	C2	R22	B1				
CR4	C2	R23	B4				
		R24	B4				
J1	D1	R25	B4				
J2	D3	R26	B4				
J3	D4	R27	B4				
		R28	C3				
L1	C3	R29	C3				
L2	C4	R30	B4				
L4	C2	R31	C4				
L5	C2	R32	C2				
L6	C2	R34	B1				
L7	A3	R35	B1				
L8	A4	R36	B1				
		R37	C2				
Q1	C1	R38	B4				
Q2	C1						

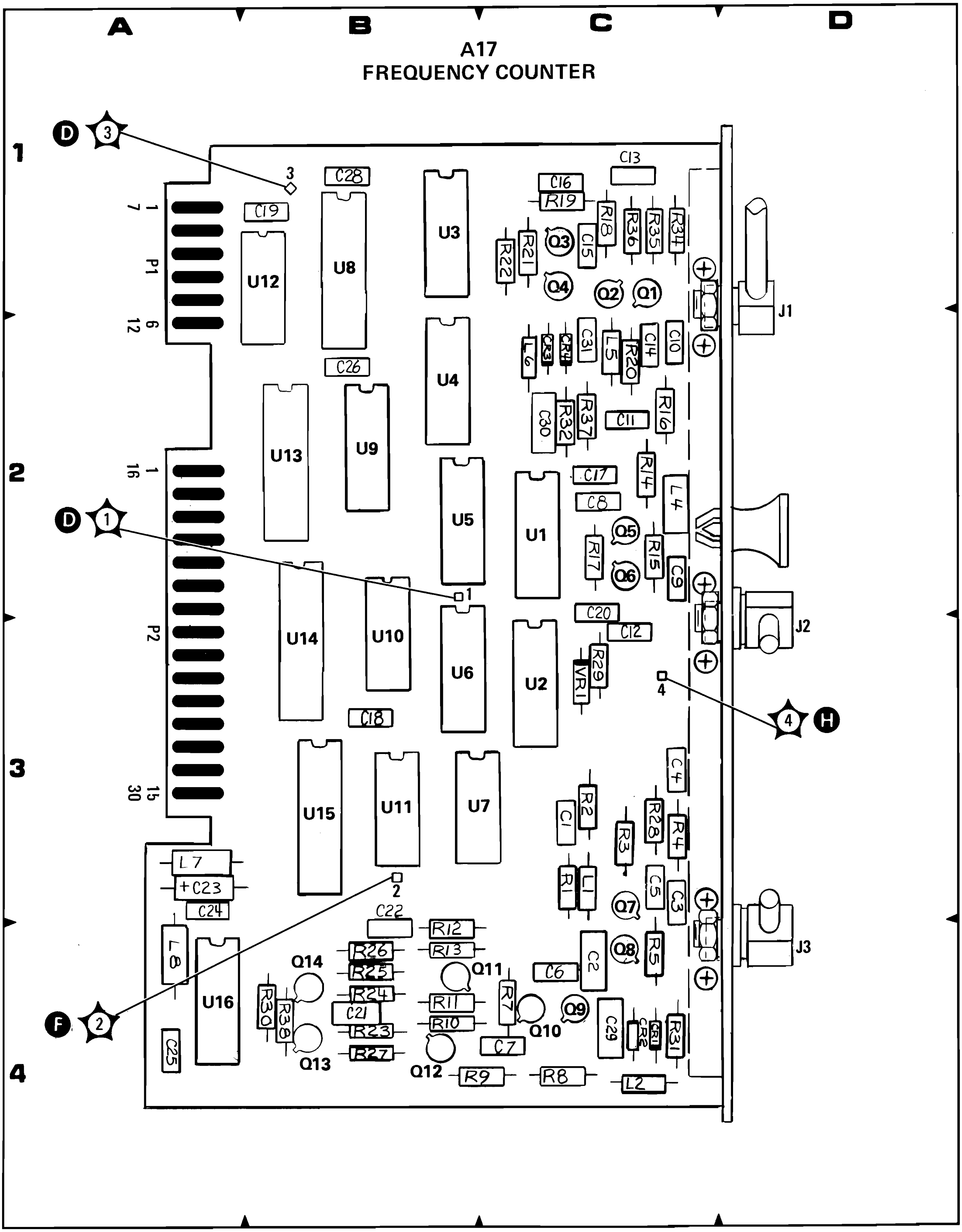


Figure 9-69. A17 Frequency Counter, Component Locations

A17
FREQUENCY COUNTER

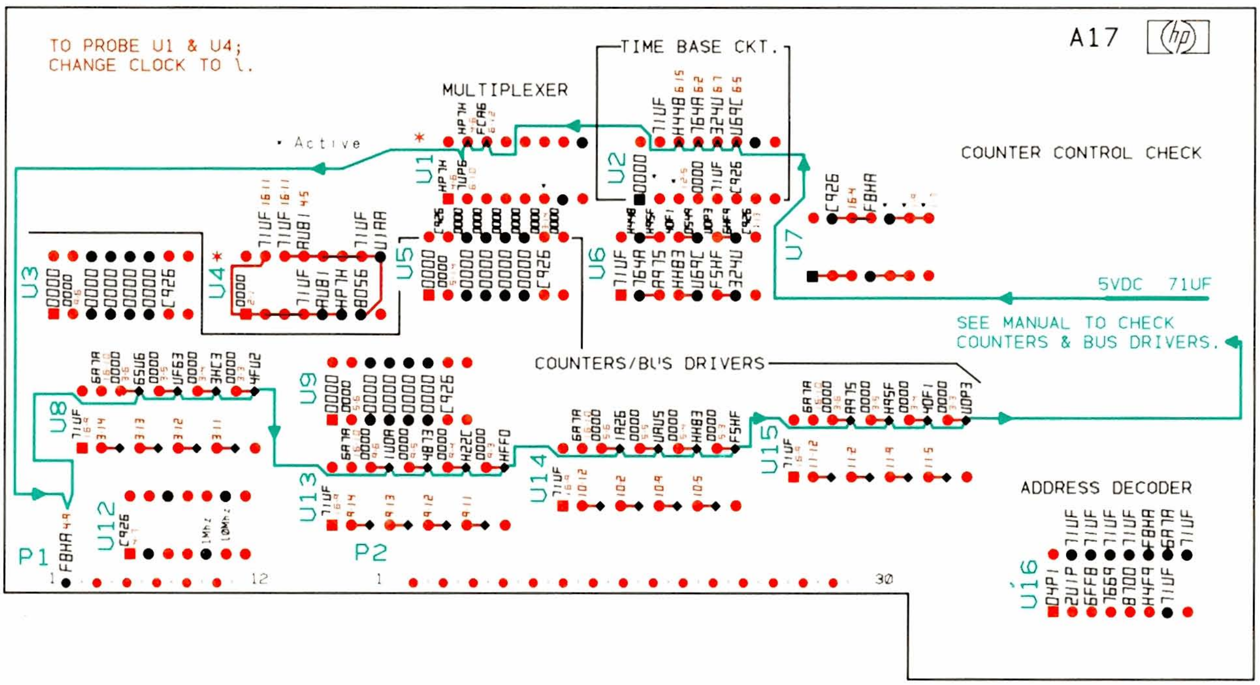


Figure 9-70. A17 Frequency Counter, Signature Analysis Troubleshooting Diagram

COUNTER CONTROL CHECK

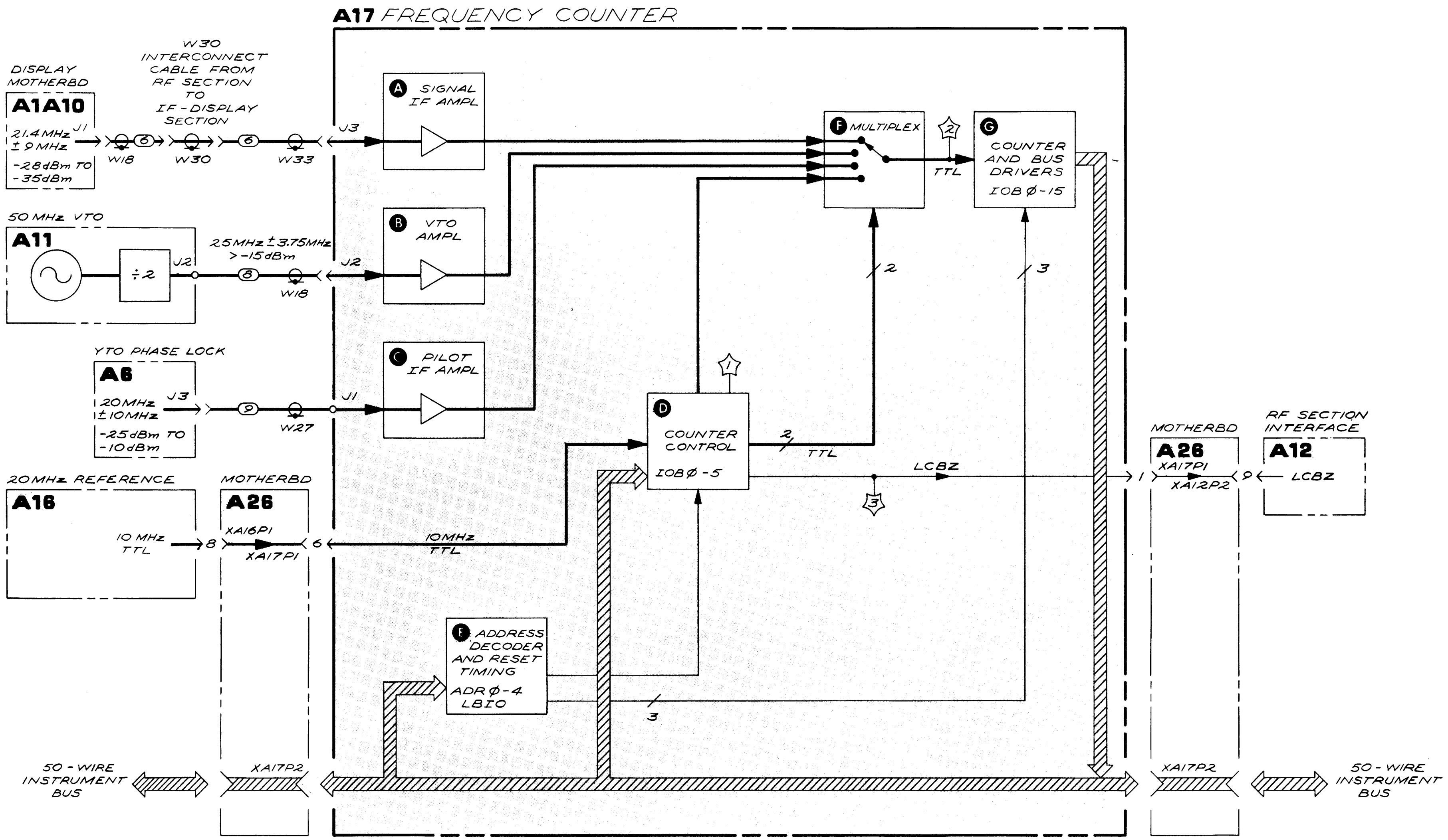
Signature Analyzer Connections:

CLOCK _/‾ to A15TP2
START _/‾ to A14TP9
STOP _/‾ to A14TP12

Spectrum Analyzer Connections:

Jumper A14TP12 to A15TP8
Jumper A15TP3 to A15TP9 (+5V)

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground lead to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagram.



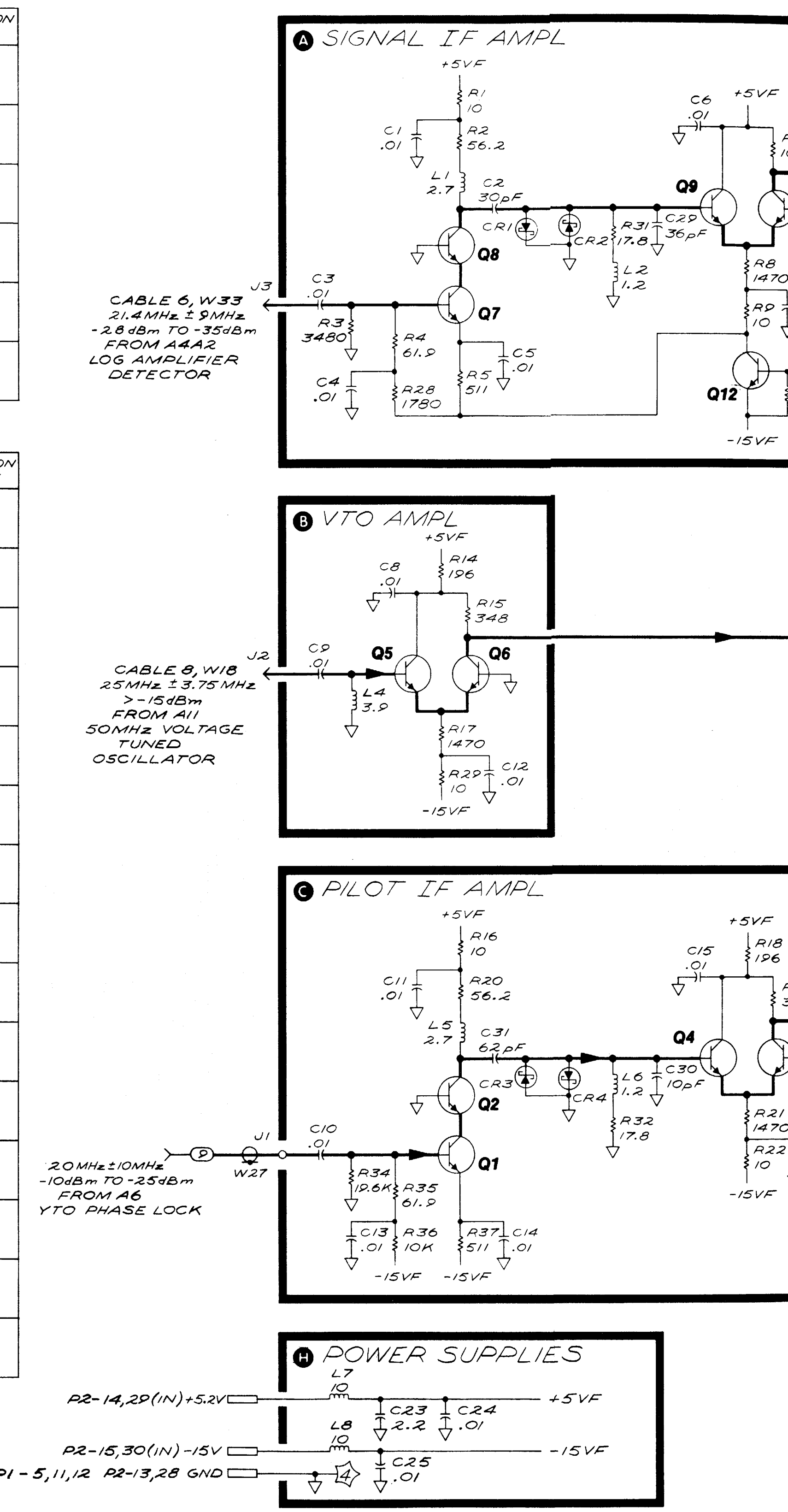
A17 FREQUENCY COUNTER
85680-60018

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LCBZ	A12, P2-9	●
7	NC		
2	NC		
8	NC		
3	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
1	IOB 15	A15, P2-30	G
16	IOB 14	A15, P2-12	G
2	IOB 13	A15, P2-29	G
17	IOB 12	A15, P2-11	G
3	IOB 11	A15, P2-28	G
18	IOB 10	A15, P2-10	G
4	IOB 9	A15, P2-27	G
19	IOB 8	A15, P2-9	G
5	IOB 7	A15, P2-26	G
20	IOB 6	A15, P2-8	G
6	IOB 5	A15, P2-25	G
21	IOB 4	A15, P2-7	G
7	IOB 3	A15, P2-24	G
22	IOB 2	A15, P2-6	G
8	IOB 1	A15, P2-23	G
23	IOB Ø	A15, P2-5	G
9	NC		
24	ADR 4	A15, P2-4	E
10	ADR 3	A15, P2-21	E
25	ADR 2	A15, P2-3	E
11	ADR 1	A15, P2-20	E
26	ADR Ø	A15, P2-2	E
12	LBIO	A15, P2-19	E
27	LBIO	A15, P2-19	E
13	GND		H
28	GND		H
14	+5.2V		H
29	+5.2V		H
15	-15V		H
30	-15V		H



SERIAL PREFIX: 1828A DATE: APRIL 1978

Figure 9-71. A17 Frequency Counter, Block Diagram

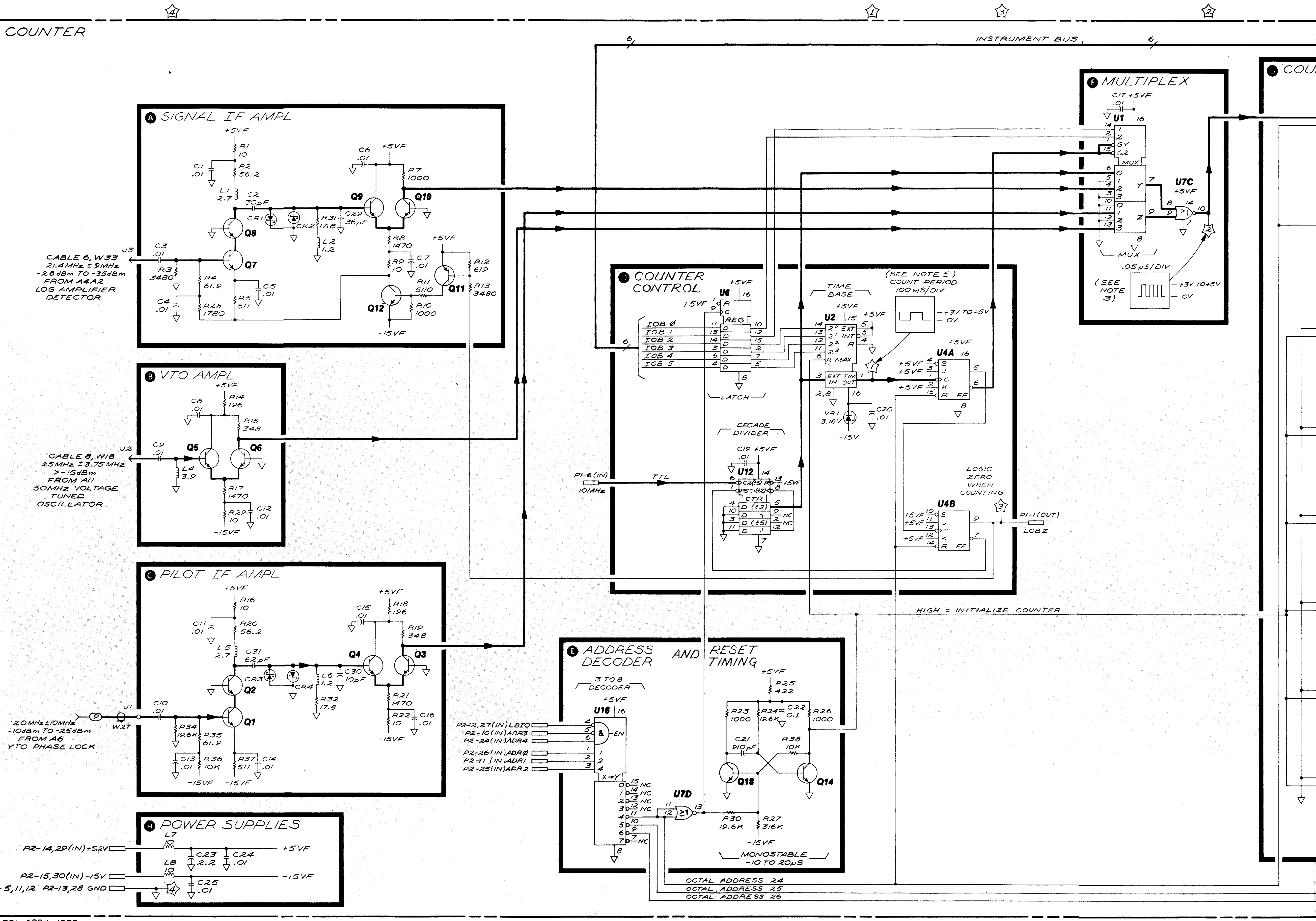
A17 FREQUENCY COUNTER
85680-60018

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LCBZ	A12, P2-9	●
7	NC		
2	NC		
8	NC		
3	NC		
9	NC		
4	NC		
10	NC		
5	GND		H
11	GND		H
6	10MHz	A16, P1-8	D
12	GND		H

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	IOB 15	A15, P2-30	G
16	IOB 14	A15, P2-12	G
2	IOB 13	A15, P2-29	G
17	IOB 12	A15, P2-11	G
3	IOB 11	A15, P2-28	G
18	IOB 10	A15, P2-10	G
4	IOB 9	A15, P2-27	G
19	IOB 8	A15, P2-9	G
5	IOB 7	A15, P2-26	G
20	IOB 6	A15, P2-8	G
6	IOB 5	A15, P2-25	G
21	IOB 4	A15, P2-7	G
7	IOB 3	A15, P2-24	G
22	IOB 2	A15, P2-6	G
8	IOB 1	A15, P2-23	G
23	IOB Ø	A15, P2-5	G
9	NC		
24	ADR 4	A15, P2-4	E
10	ADR 3	A15, P2-21	E
25	ADR 2	A15, P2-3	E
11	ADR 1	A15, P2-20	E
26	ADR Ø	A15, P2-2	E
12	LBIO	A15, P2-19	E
27	LBIO	A15, P2-19	E
13	GND		H
28	GND		H
14	+5.2V		H
29	+5.2V		H
15	-15V		H
30	-15V		H

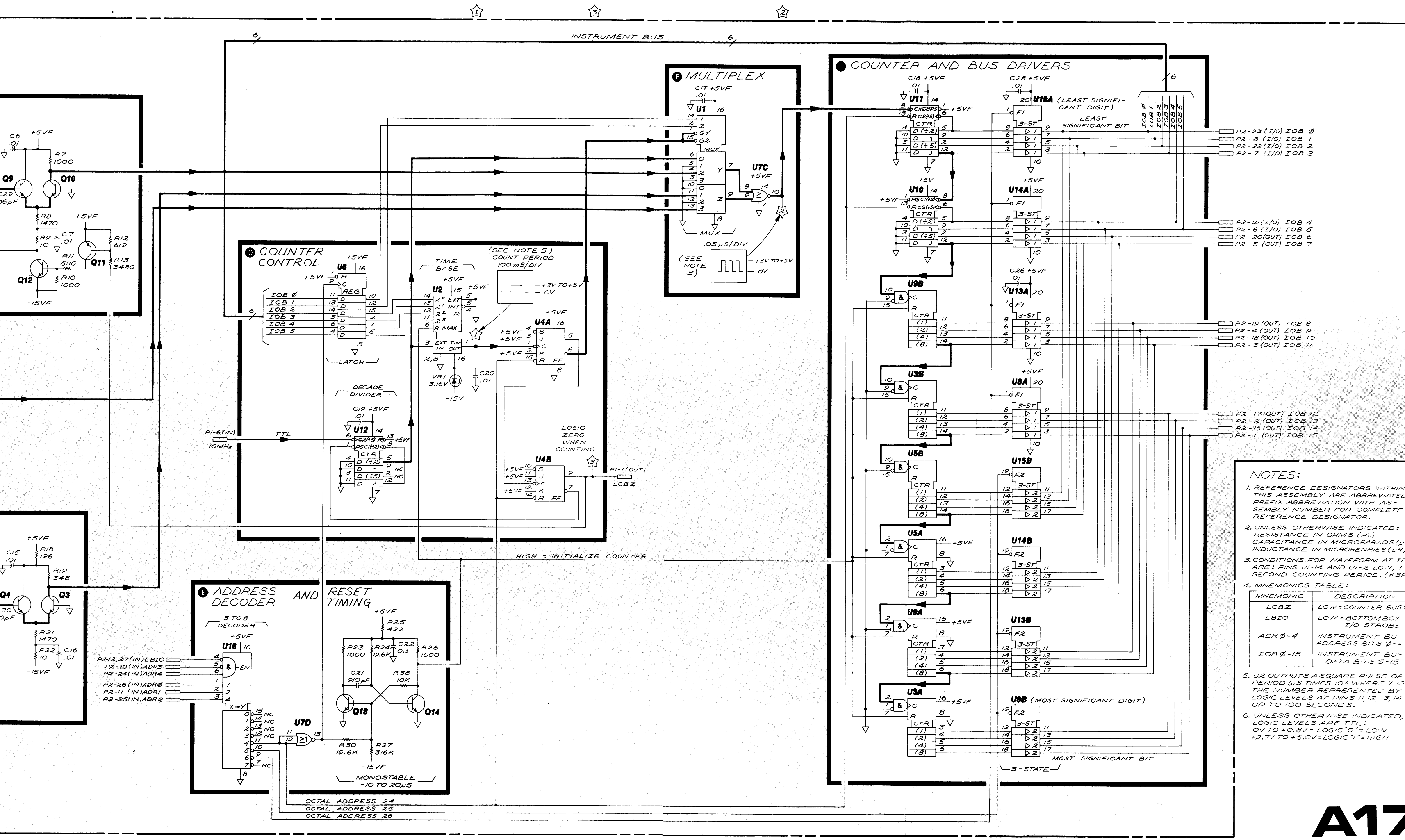


SERIAL PREFIX: 1828A DATE: APRIL 1978

...CTION ...FACE

50-WIRE INSTRUMENT BUS

Diagram



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω) CAPACITANCE IN MICROFARADS (μF) INDUCTANCE IN MICROHENRIES (μH)
3. CONDITIONS FOR WAVEFORM AT TP2 ARE: PINS U1-14 AND U1-2 LOW, 1 SECOND COUNTING PERIOD, (KSF).
4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
LCBZ	LOW = COUNTER BUSY
LBIO	LOW = BOTTOM BOX I/O STROBE
ADRØ-4	INSTRUMENT BUS ADDRESS BITS Ø-4
IOBØ-15	INSTRUMENT BUS DATA BITS Ø-15

5. U2 OUTPUTS A SQUARE PULSE OF PERIOD 1μS TIMES 10^X WHERE X IS THE NUMBER REPRESENTED BY LOGIC LEVELS AT PINS 11, 12, 13, 14 UP TO 100 SECONDS.
6. UNLESS OTHERWISE INDICATED, LOGIC LEVELS ARE TTL: 0V TO +0.8V = LOGIC "0" = LOW +2.7V TO +5.0V = LOGIC "1" = HIGH

Figure 9-72. A17 Frequency Counter, Schematic Diagram

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 MHz 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 9-29. A18 275 MHz Phase Lock Oscillator, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18	85680-60015	1	BOARD ASSEMBLY, 275MHZ PHASE LOCK OSC. (INCLUDES W25)	28480	85680-60015
A18C1	0140-0199	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A18C2	0140-0191	1	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A18C3	0160-2207	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A18C4	0160-2206	1	CAPACITOR-FXD 160PF +-5% 300VDC MICA	28480	0160-2206
A18C5	0140-0196	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A18C6	0160-3466	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A18C7	0160-2248	1	CAPACITOR-FXD 4.3PF +-.25PF 500VDC CER	28480	0160-2248
A18C8	0121-0457	1	CAPACITOR-V TRMR-PSTN .8-8.5PF 750V	18736	TP9
A18C9	0160-2266	1	CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A18C10	0160-2247	1	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	28480	0160-2247
A18C11	0150-0059	1	CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0150-0059
A18C12	0160-2055	16	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C13			NOT ASSIGNED		
A18C14	0160-2259	1	CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	28480	0160-2259
A18C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C19	0160-2261	2	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A18C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C31	0160-2261		CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A18C32	0180-0116	2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A18C33	0180-0116		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A18C34	0160-3876	1	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A18C35	0140-0193	2	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A18C36	0140-0193		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A18C37			NOT ASSIGNED		
A18C38	0160-2437	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A18CR1	0122-0072	1	DIODE-VVC 2.2PF 5% C3/C25-MIN=4.5	04713	BB105B
A18J1	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A18J2			PART OF W25		
A18J3	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A18L1	9140-0129	3	COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A18L2	9100-1639	1	COIL-MLD 150UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1639
A18L3	9140-0158	5	COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM,	28480	9140-0158
A18L4	85680-80005	1	OSCILLATOR COIL	28480	85680-80005
A18L5	9140-0158		COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A18L6	9140-0158		COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A18L7	9100-2252	1	COIL-MLD 270NH 10% Q=30 .095DX.25LG-NOM	28480	9100-2252
A18L8	9100-0346	2	COIL-MLD 50NH 20% Q=40 .095DX.25LG-NOM	28480	9100-0346
A18L9	9140-0158		COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A18L10	9100-2251	1	COIL-MLD 220NH 10% Q=32 .095DX.25LG-NOM	28480	9100-2251
A18L11	9100-2249	3	COIL-MLD 150NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2249
A18L12	9100-2249		COIL-MLD 150NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2249
A18L13	9100-2249		COIL-MLD 150NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2249
A18L14	9100-0346		COIL-MLD 50NH 20% Q=40 .095DX.25LG-NOM	28480	9100-0346
A18L15	9140-0158		COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A18L16	9140-0129		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A18L17	9140-0129		COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A18L18	9100-2256	1	COIL-MLD 560NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2256
A18Q1	1854-0345	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18Q3	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18Q4	1854-0247	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A18Q5	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18R1	0757-0280	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R2	0757-0442	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R3	0757-0394	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A18R4	0757-0424	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A18R5	0698-3446	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F

Table 9-29. A18 275 MHz Phase Lock Oscillator, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18R6			NOT ASSIGNED		
A18R7			NOT ASSIGNED		
A18R8	0698-3438	6	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R9	0757-0180	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A18R10	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R11	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A18R12	0698-0082	2	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A18R13	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A18R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R15	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R16	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A18R17	0698-3439	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	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A18R21	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R22	0698-3434	1	RESISTOR 34.8 1% .125W F TC=0+-100	24546	C4-1/8-T0-34R8-F
A18R23	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R24	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A18R25	0698-3443	4	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R26	0757-0294	2	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A18R27	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R28	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A18R29	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A18R30	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R31	0757-0294		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A18R32	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R33	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R34	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R35	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R36	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A18R37	0698-8822	1	RESISTOR 6.81 1% .125W F TC=0+-100	28480	0698-8822
A18R38	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A18TP1			PART OF C38		
A18U1	0955-0063	1	MIXER, DOUBLE BALANCE 200 MW	28480	0955-0063
			A18 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001

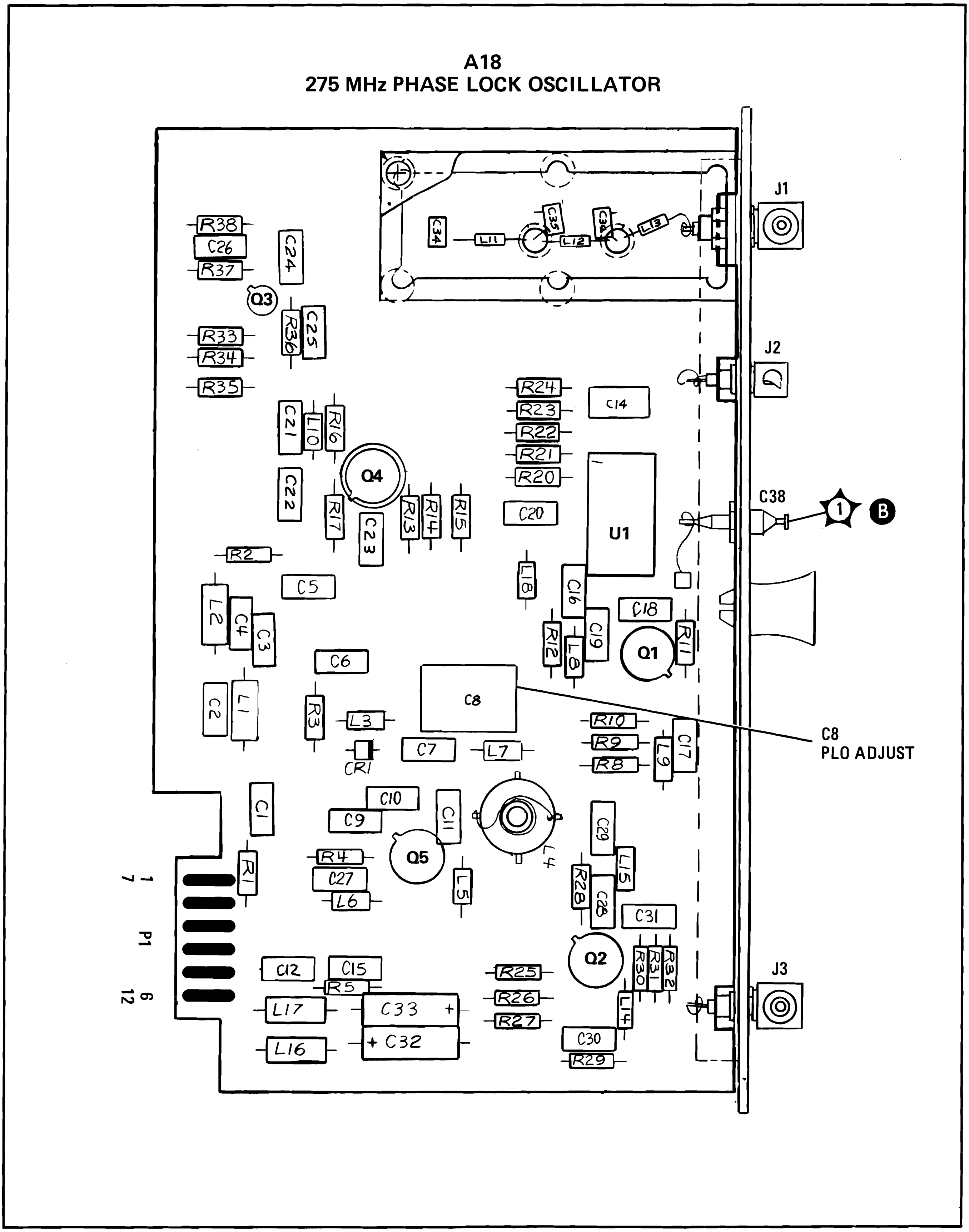
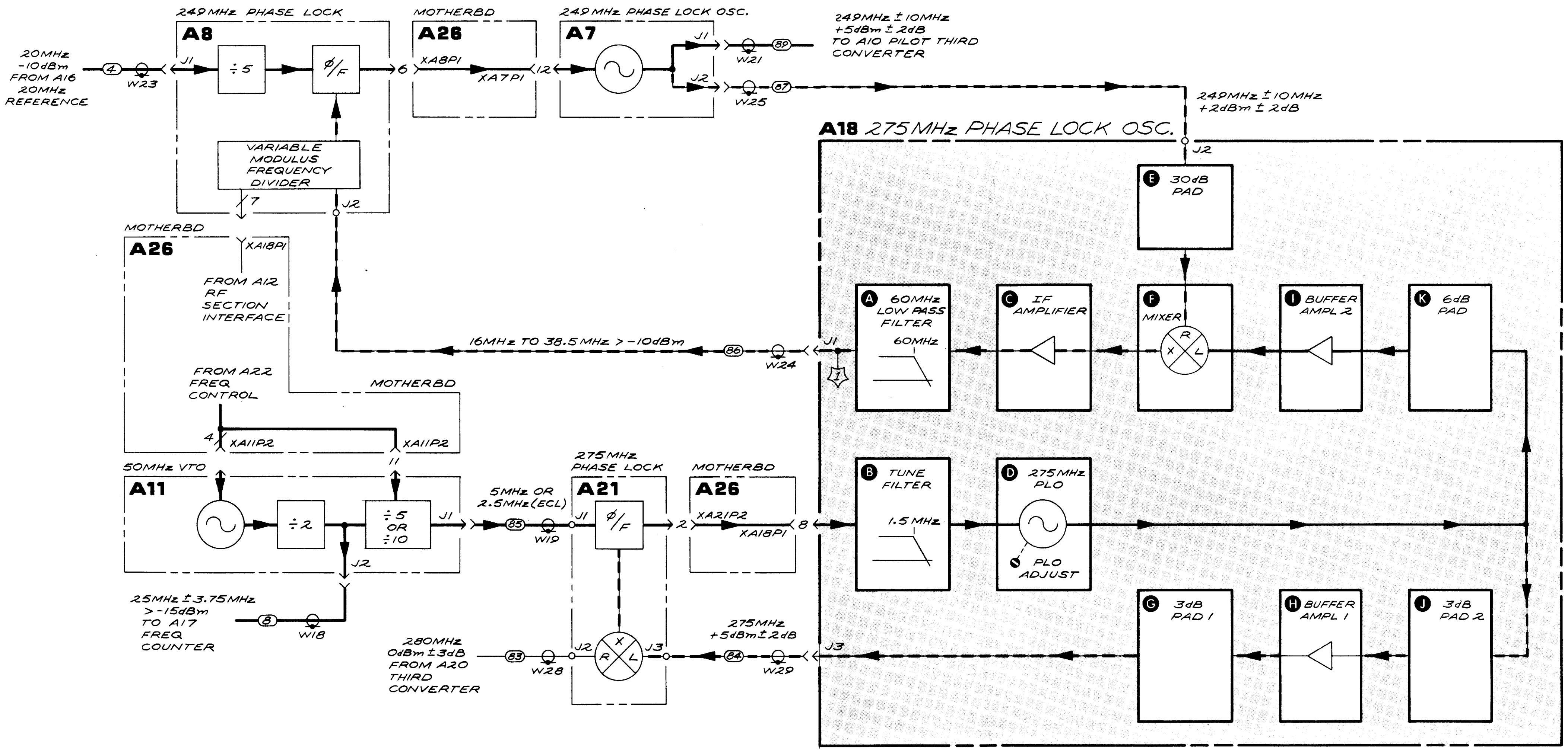


Figure 9-73. A18 275 MHz Phase Lock Oscillator, Component Locations



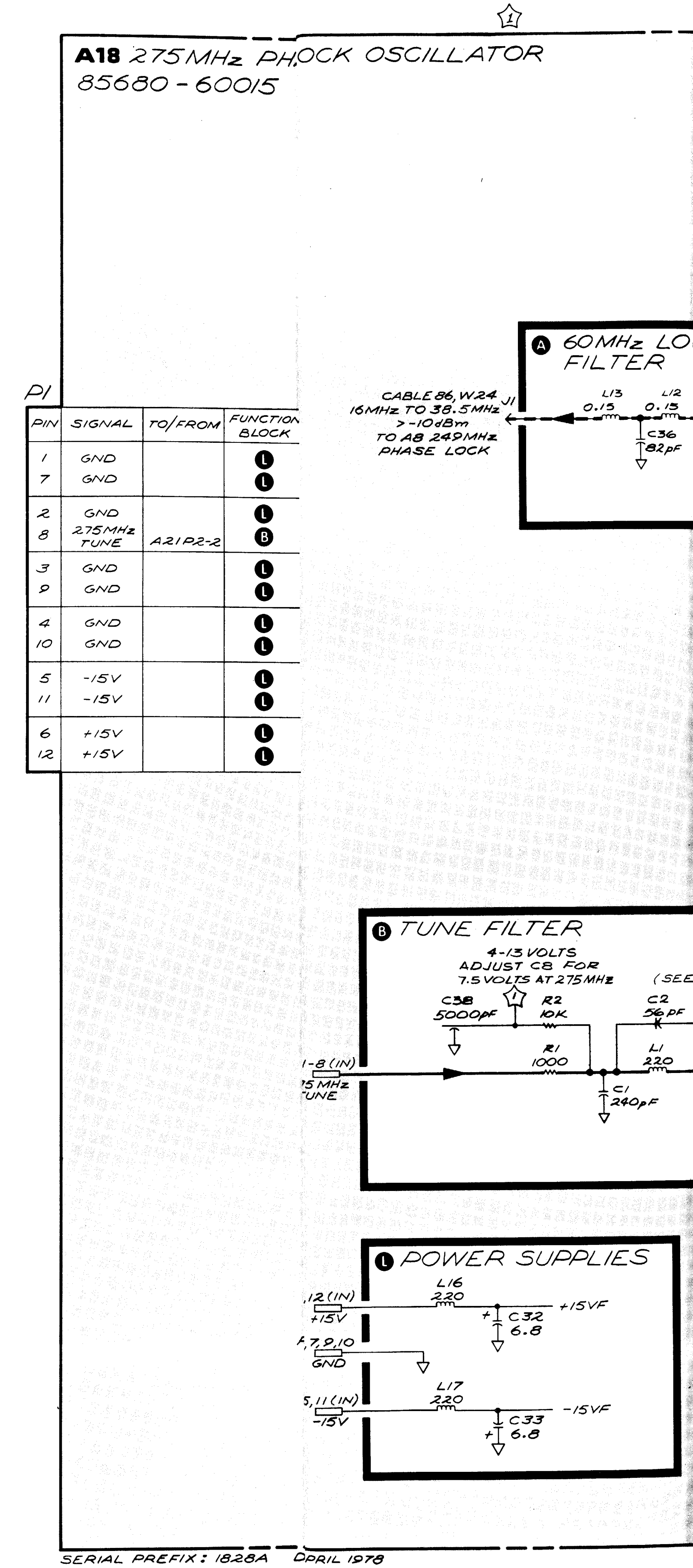
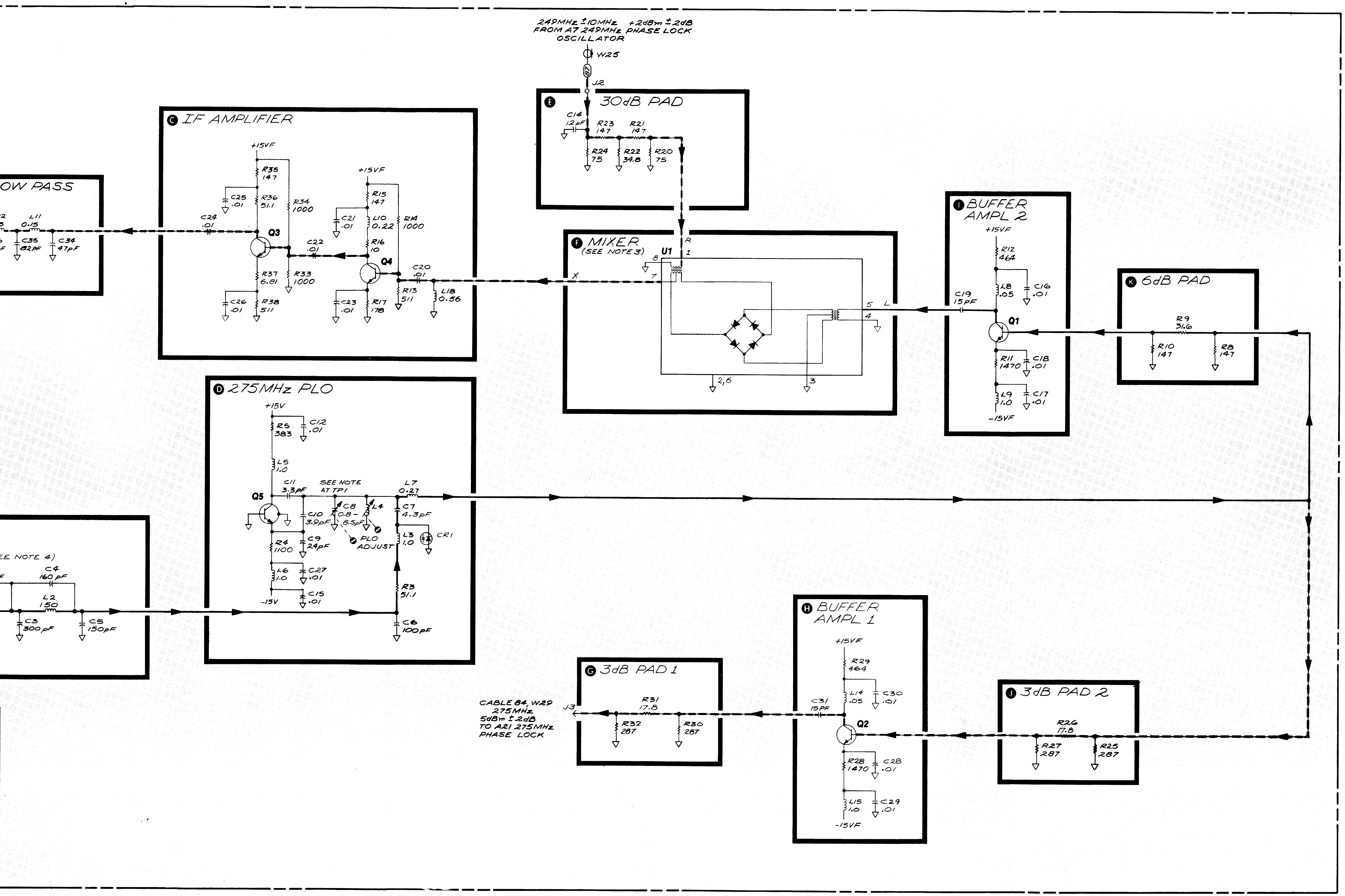


Figure 9-74. A18 275 MHz Phase Lock Oscillator, Block Diagram



NOTES:

1. REFERENCE DESIGNATORS WITHIN TH ASSEMBLY ARE ABBREVIATED. PREF ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. U1 PIN CONFIGURATION:

1	2	3	4
O	O	O	O
O	O	O	O
8	7	6	5

(BOTTOM VIEW)

PIN 1 INDICATED BY SQUARE PAD ON PC BOARD.

4. INSTRUMENT CONTROL SETTINGS:
   INSTRUMENT PRESET
   CENTER FREQUENCY — 17.1MHz

A18

Figure 9-75. 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 trequency 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.

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 crystal Y1 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 9-30. A19 Second IF Amplifier, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A19	85680-60007	1	BOARD ASSEMBLY, SECOND IF AMPLIFIER	28480	85680-60007
A19C1	0160-3873	3	CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A19C2	0160-3874	1	CAPACITOR-FXD 10PF +-.5PF 200VDC	28480	0160-3874
A19C3	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A19C4	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A19C5	0160-3466	2	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A19C6	0160-2055	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C7	0160-2261	1	CAPACITOR-FXD 15PF +-5% 500VDC CER0+-30	28480	0160-2261
A19C8	0160-3466		CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A19C9	0121-0493	4	CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A19C10	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A19C11	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A19C12	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A19C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C14	0160-3456	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A19J1	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A19J2	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A19L1	85680-80009	2	INDUCTOR, 35 NH	28480	85680-80009
A19L2	85680-80009		INDUCTOR, 35 NH	28480	85680-80009
A19L3	9100-0346	1	COIL-MLD 50NH 20% Q=40 .095DX.25LG	28480	9100-0346
A19L4	85680-80014	1	TRANSFORMER	28480	85680-80014
A19L5	85680-80008		INDUCTOR, 50 NH	28480	85680-80008
A19L6	85680-80008		INDUCTOR, 50 NH	28480	85680-80008
A19L7	85680-80015	1	TRANSFORMER	28480	85680-80015
A19L8	9100-2247	1	COIL-MLD 100NH 10% Q=34 .095DX.25LG	02178	09-4410-1K
A19Q1	1854-0686	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A19Q2	1853-0451	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0451
A19R1	0757-0200	2	RESISTOR 5.62K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5621-F
A19R2	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-9091-F
A19R3	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5621-F
A19R4	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F

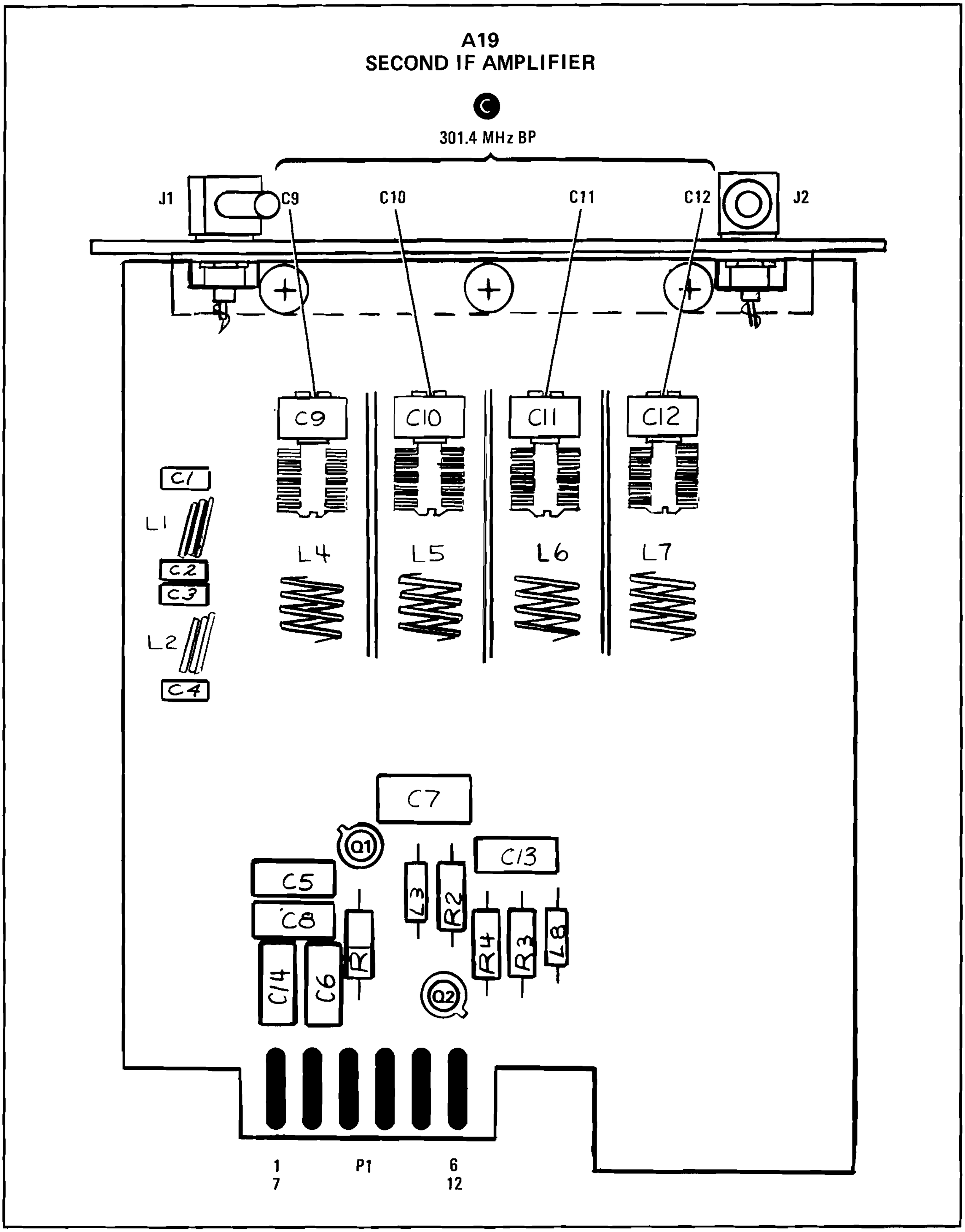


Figure 9-76. A19 Second IF Amplifier, Component Locations

Table 9-31. A20 Third Converter, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20	85680-60008	1	BOARD ASSEMBLY, THIRD CONVERTER	28480	85680-60008
A20C1	0160-3456	5	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A20C2	0160-2055	16	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C3	0160-2251	1	CAPACITOR-FXD 5.6PF +-.25PF 500VDC CER	28480	0160-2251
A20C4	0160-2244	1	CAPACITOR-FXD 3PF +-.25PF 500VDC CER	28480	0160-2244
A20C5	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A20C6	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A20C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C9	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A20C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C13	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A20C14	0160-3874	2	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A20C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C16			NOT ASSIGNED		
A20C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C22	0180-0116	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A20C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C26	0160-3874		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A20C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20C28	0160-4084	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A20CR1	1901-1070	1	DIODE:PIN	28480	1901-1070
A20CR2	1901-0040	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A20J1			PART OF W30		
A20J2	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A20J3	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A20L1	85680-80013	1	COIL, AMPTD ADJUST	28480	85680-80013
A20L2	08558-80002	1	COIL, NEUTRALIZING	28480	08558-80002
A20L3	9100-2250	1	COIL-MLD 180NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2250
A20L4	9100-2252	1	COIL-MLD 270NH 10% Q=30 .095DX.25LG-NOM	28480	9100-2252
A20L5	9100-2255	1	COIL-MLD 470NH 10% Q=35 .095DX.25LG-NOM	28480	9100-2255
A20L6	9100-0368	1	COIL-MLD 330NH 10% Q=28 .095DX.25LG-NOM	28480	9100-0368
A20L7	9100-2255		COIL-MLD 470NH 10% Q=35 .095DX.25LG-NOM	28480	9100-2255
A20L8			NOT ASSIGNED		
A20L9			NOT ASSIGNED		
A20L10	9140-0178	3	COIL-MLD 12UH 10% Q=65 .155DX.375LG-NOM	28480	9140-0178
A20L11	9140-0178		COIL-MLD 12UH 10% Q=65 .155DX.375LG-NOM	28480	9140-0178
A20L12	9140-0178		COIL-MLD 12UH 10% Q=65 .155DX.375LG-NOM	28480	9140-0178
A20L13	9140-0129	1	COIL-MLD 220UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0129
A20L14	9140-0158	1	COIL-MLD 1UH 10% Q=32 .095DX.25LG-NOM	28480	9140-0158
A20L15	9140-0114	1	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A20Q1	1854-0686	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A20Q2	1854-0345	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A20Q3	1854-0247	2	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A20Q4	1854-0247		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A20Q5	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A20Q6	1854-0210	1	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A20R1	0757-0428	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A20R2	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A20R3	0757-0280	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R4	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A20R5	0757-0422	1	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A20R6	0757-0279	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R7	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A20R8	0698-3445	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A20R9	0757-0382	2	RESISTOR 16.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-16R2-F
A20R10	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A20R11	0757-0382		RESISTOR 16.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-16R2-F
A20R12	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A20R13	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A20R14	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A20R15	0698-3444	3	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F

Table 9-31. A20 Third Converter, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20R16	0698-0085	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A20R17	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R18	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A20R19*	0698-3441	2	RESISTOR 215 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-215R-F
A20R20	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A20R21	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A20R22	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A20R23	0698-3156	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A20R24	0757-0420	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A20R25	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A20R26	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A20R27	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A20R28	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A20R29	0757-0290	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A20R30	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A20R31	0757-0317	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A20R32	0757-0458	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A20R33	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A20TP1	0360-0124	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A20U1	0955-0063	1	MIXER, DOUBLE BALANCE 200 MW	28480	0955-0063
A20Y1	0410-0447	1	CRYSTAL, 280 MHZ	00809	0410-0447-1

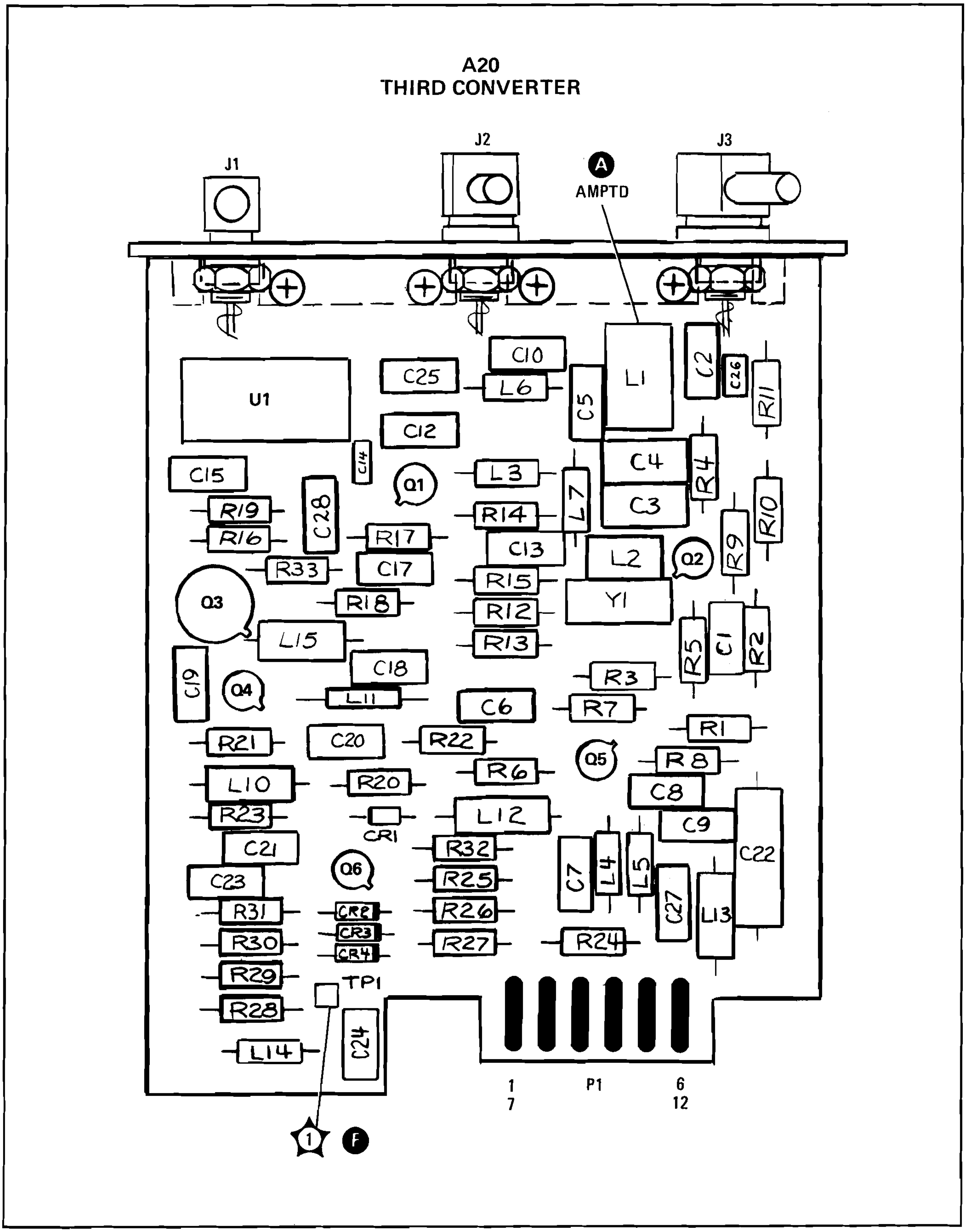
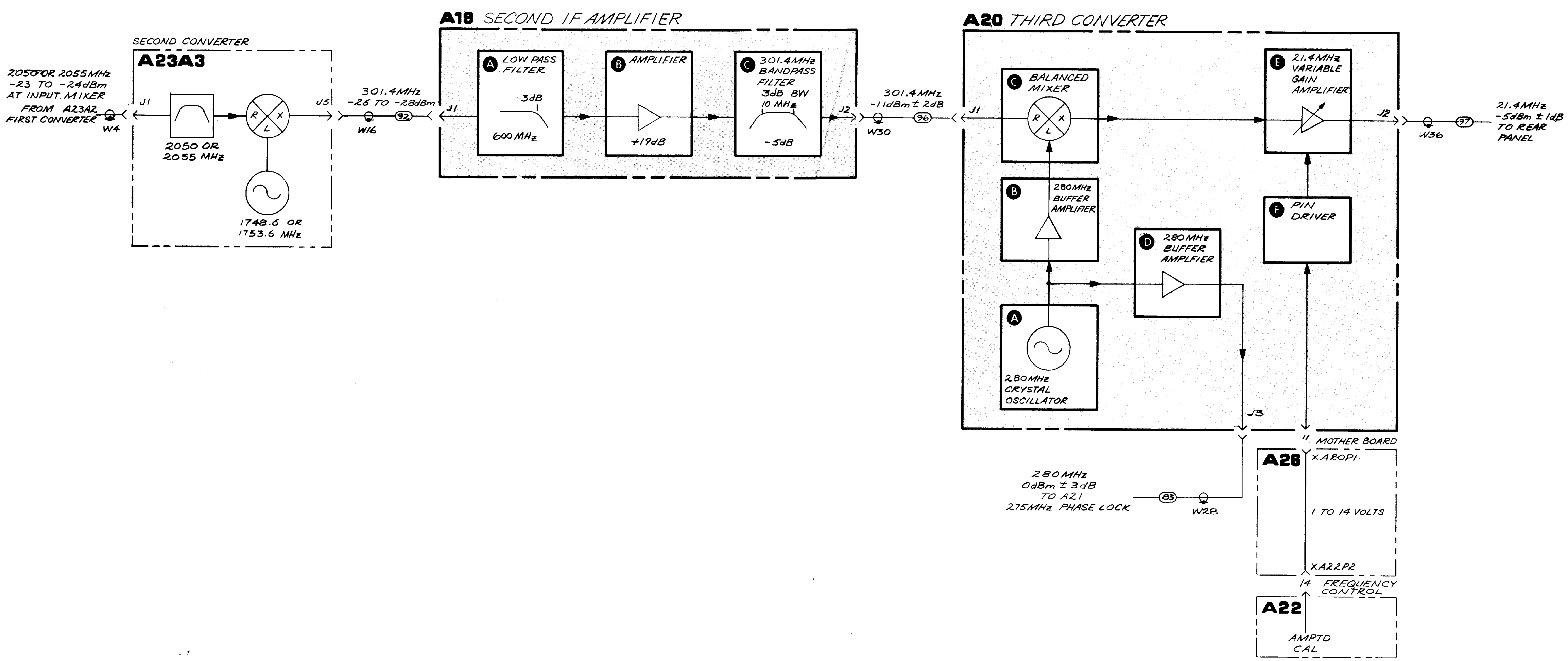
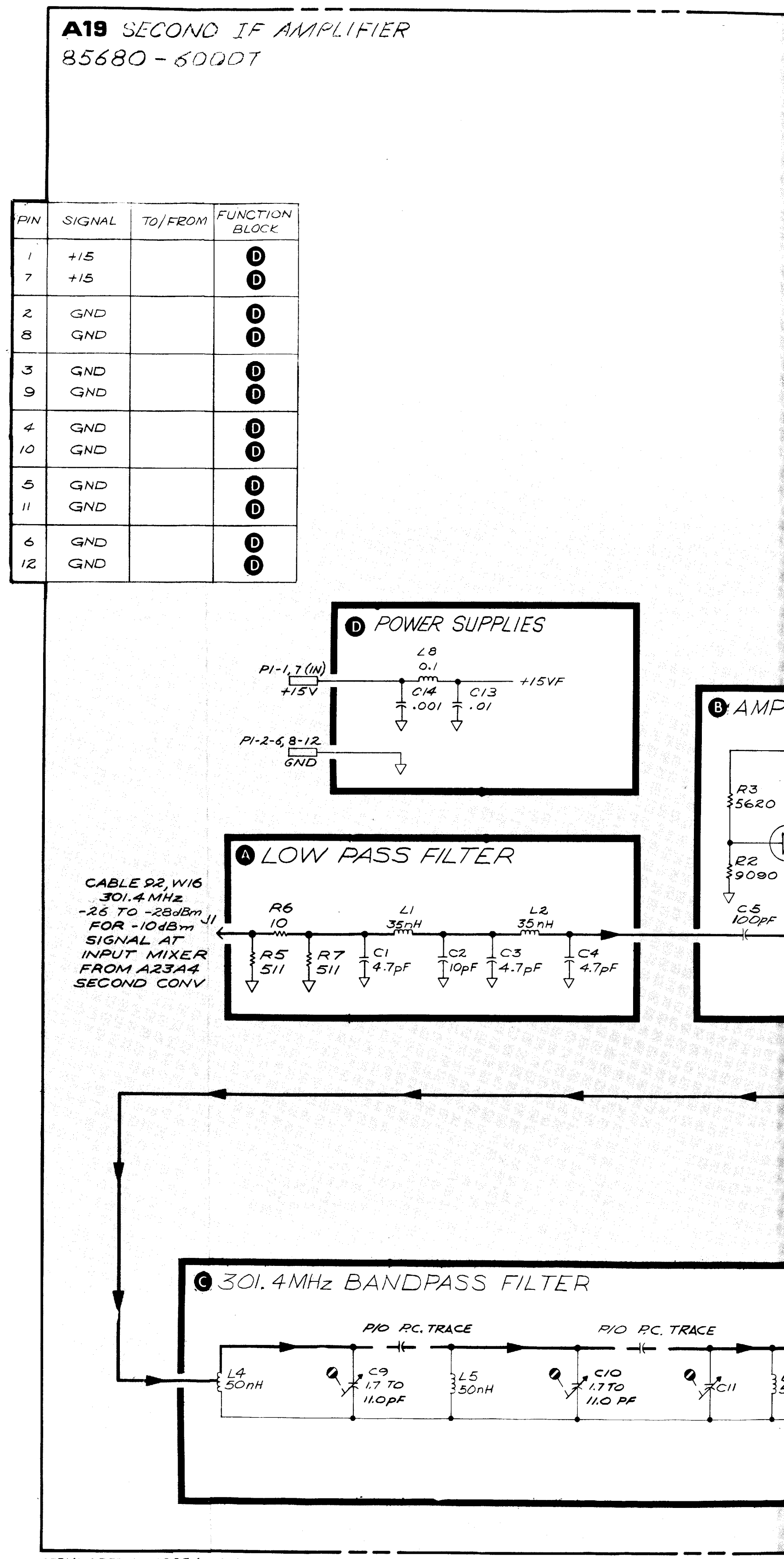


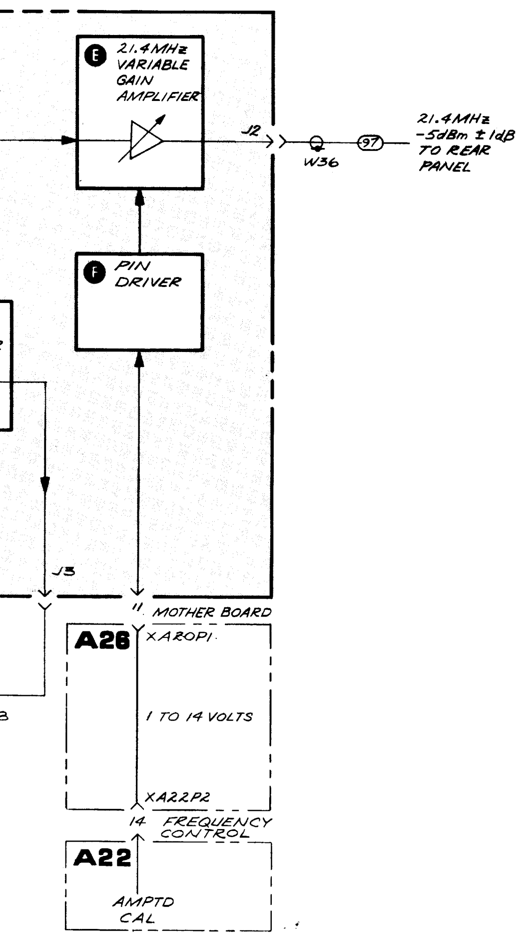
Figure 9-77. A20 Third Converter, Component Locations

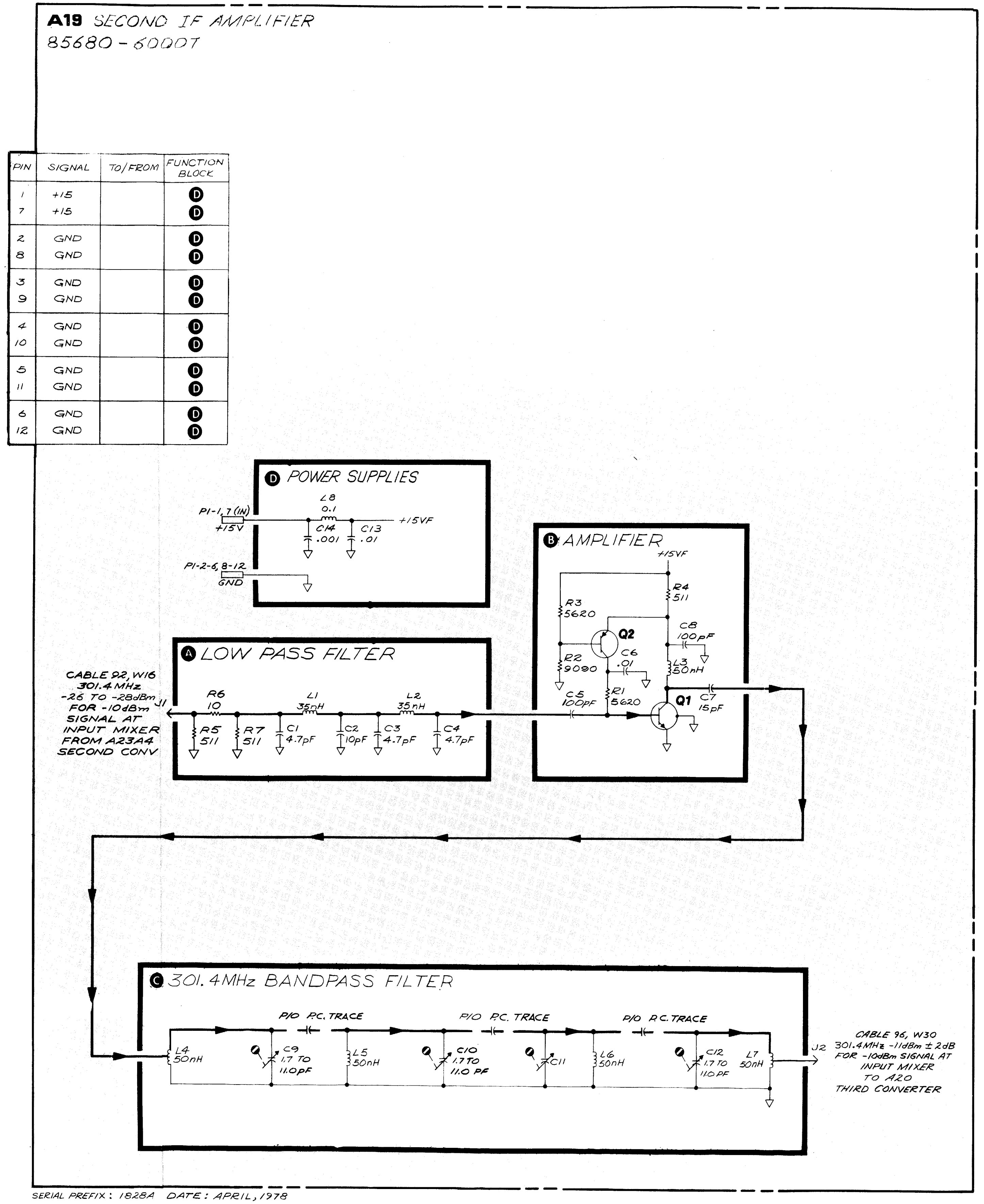


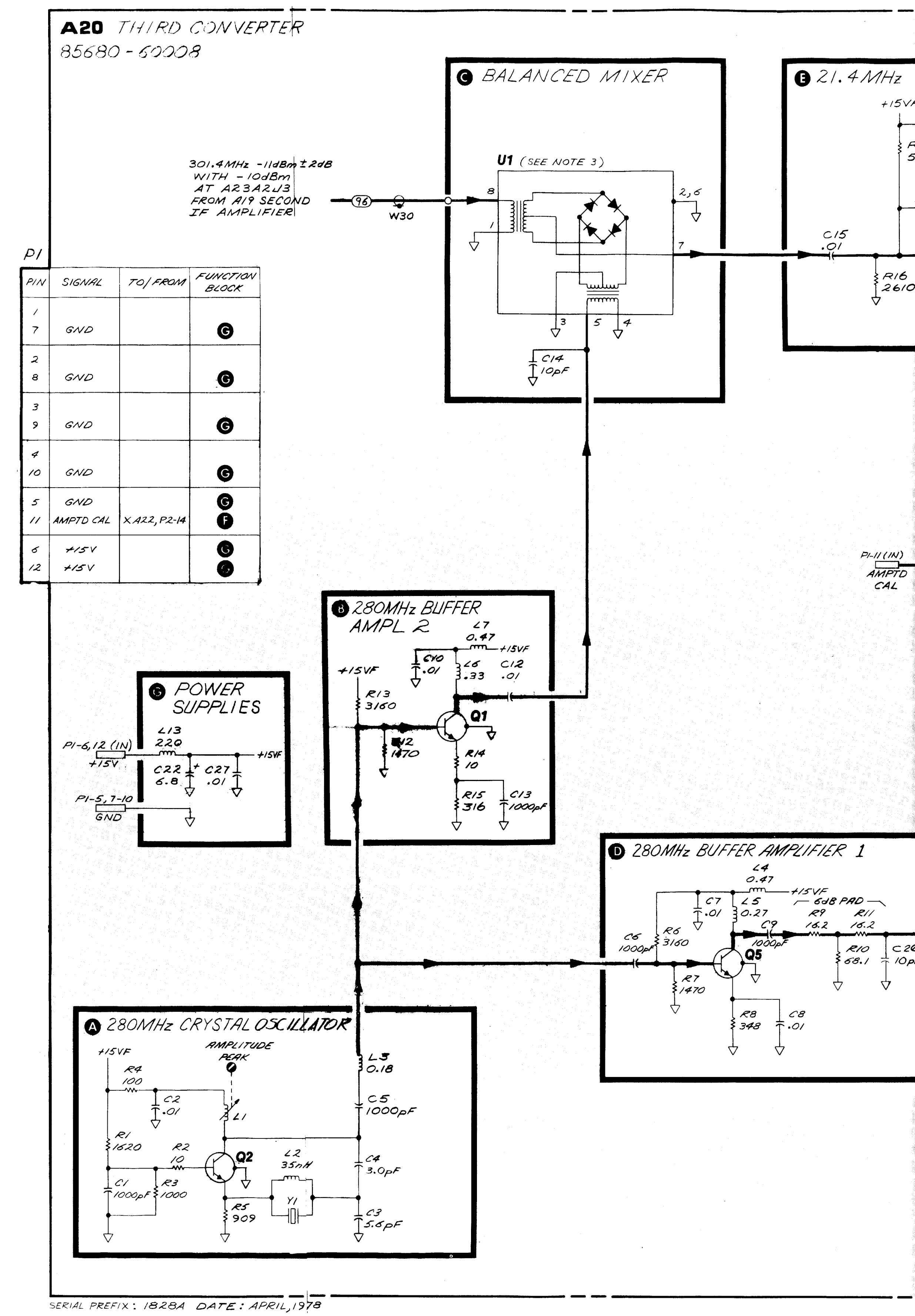


PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15		D
7	+15		D
2	GND		D
8	GND		D
3	GND		D
9	GND		D
4	GND		D
10	GND		D
5	GND		D
11	GND		D
6	GND		D
12	GND		D

Figure 9-78. A19 Second IF Amplifier and A20 Third Converter, Block Diagram







...nverter, Block Diagram

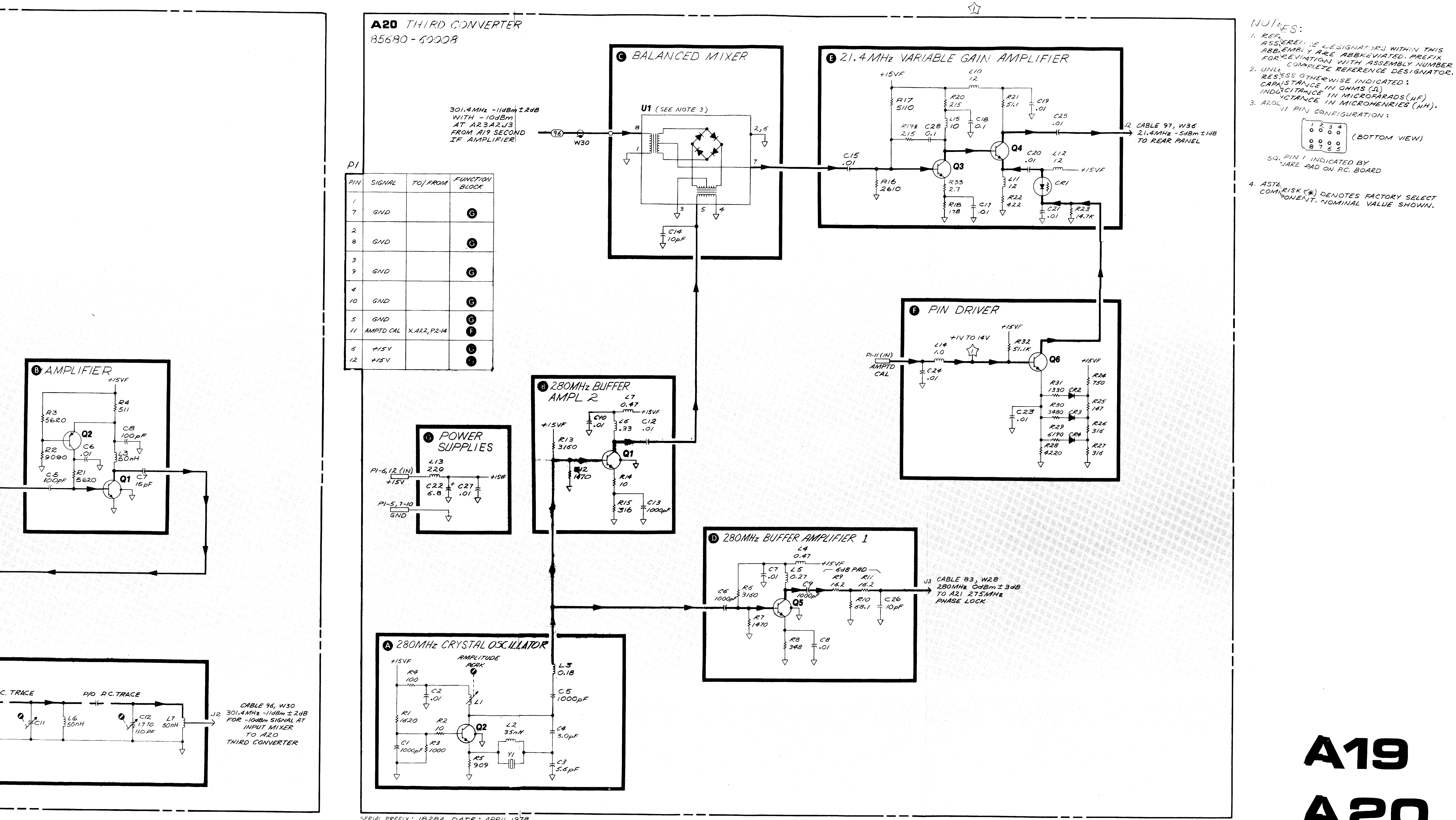


Figure 9-79. A19 Second IF Amplifier and A20 Third Converter, Schematic Diagram

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 +3.2V. Line HUL3 goes to A12 RF Section Interface to indicate to A15 Processor 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. NULL adjust R36, R35, and R37 allow this bias level to be adjusted for minimum 2.5 MHz feedthrough signal through the Loop Amplifier and Filters. C19 and C20 are bypass capacitors.

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 +4V. 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 HI CLAMP adjust R28. CR2 protects Q6. R39 limits the current in the 275 MHz TUNE line as it is sent to A18.

Table 9-32. A21 275 MHz Phase Lock, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A21	85680-60016	1	BOARD ASSEMBLY, 275 MHZ PHASE LOCK (INCLUDES A21A1, 275 MHZ MIXER, W28, W29, W19)	28480	85680-60016
A21C1	0180-1746	3	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A21C2	0160-2055	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A21C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C5	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A21C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21C7	0160-0174	8	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C8	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C9	0160-4084	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A21C10	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C11	0160-2307	1	CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A21C12	0140-0193	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A21C13	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C14	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C15	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C16	0160-3536	2	CAPACITOR-FXD 620PF +-5% 100VDC MICA	28480	0160-3536
A21C17	0160-3536		CAPACITOR-FXD 620PF +-5% 100VDC MICA	28480	0160-3536
A21C18	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C19	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A21C20	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A21C21	0140-0196	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A21C22	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A21C23			NOT ASSIGNED		
A21C24			NOT ASSIGNED		
A21C25			NOT ASSIGNED		
A21C26	0160-0194	1	CAPACITOR-FXD .015UF +-10% 200VDC POLYE	28480	0160-0194
A21C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A21CR1	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR2	1901-0050		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR3	1901-0050		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21DS1	1990-0486	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A21J1			PART OF W19		
A21J2			PART OF W28		
A21J3			PART OF W29		
A21L1	9140-0111	1	COIL-MLD 3.3UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0111
A21L2	9100-1644	1	COIL-MLD 330UH 5% Q=65 .19DX.44LG-NOM	28480	9100-1644
A21L3	9100-1618	3	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A21L4	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A21L5	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A21Q1	1854-0019	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A21Q2	1853-0007	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A21Q3	1853-0451	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A21Q4	1853-0451		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A21Q5	1854-0247	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A21Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A21R1	0757-0399	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A21R2	0698-3437	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A21R3			NOT ASSIGNED		
A21R4	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R5	0757-0424	2	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A21R6	0698-3156	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A21R7	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A21R8	0757-0442	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R10	0698-0082	4	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A21R11	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A21R12	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A21R13	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A21R14	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A21R15	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A21R16	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A21R17	0698-3132	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A21R18	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A21R19	0757-0290	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A21R20	0698-3440	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F

Table 9-32. A21 275 MHz Phase Lock, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A21R21	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A21R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R23	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R24	0698-3430	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A21R25	0757-0422	1	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A21R26			NOT ASSIGNED		
A21R27	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R28	0757-0274	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A21R29	0698-3153	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A21R30			NOT ASSIGNED		
A21R31			NOT ASSIGNED		
A21R32			NOT ASSIGNED		
A21R33	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R34			NOT ASSIGNED		
A21R35			NOT ASSIGNED		
A21R36			NOT ASSIGNED		
A21R37			NOT ASSIGNED		
A21R38	0757-0316	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A21R39	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A21TP1	0360-0124	8	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP2	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP3	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP4	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP5	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP6	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP7	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21TP8	0360-0124		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A21U1	1820-0817	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A21U2	1810-0204	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R1K
A21U3	1820-0802	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A21U4			NOT ASSIGNED		
A21U5	1826-0371	1	IC OP AMP	03406	LF-256H
A21VR1			NOT ASSIGNED		
A21VR2	1902-0126	1	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	28480	1902-0126
A21VR3	1902-3070	1	DIODE-ZNR 4.22V 5% DO-7 PD=.4W TC=-.036%	28480	1902-3070
A21VR4	1902-0048	1	DIODE-ZNR 6.81V 5% DO-7 PD=.4W TC=+.043%	28480	1902-0048
			A21 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001
A21A1	85680-60033	1	BOARD ASSEMBLY, 275 MHZ MIXER	28480	85680-60033
A21A1C1- A21A1C22			NOT ASSIGNED		
A21A1C23	0140-0074	2	CAPACITOR-FDTHRU 56PF 10% 500V MICA	28480	0140-0074
A21A1C24	0140-0077	1	CAPACITOR-FDTHRU 100PF 10% 500V MICA	72982	666-053 01A0 101K
A21A1C25	0140-0074		CAPACITOR-FDTHRU 56PF 10% 500V MICA	28480	0140-0074
A21A1C26			NOT ASSIGNED		
A21A1C27			NOT ASSIGNED		
A21A1C28	0160-3874	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A21A1C29	0160-3873	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A21A1J1			NOT ASSIGNED		
A21A1J2			PART OF W39		
A21A1J3			PART OF W40		
A21A1L1- A21A1L5			NOT ASSIGNED		
A21A1L6	9100-2249	1	COIL-MLD 150NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2249
A21A1L7	9100-2250	2	COIL-MLD 180NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2250
A21A1L8	9100-2250		COIL-MLD 180NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2250
A21A1R1- A21A1R30			NOT ASSIGNED		
A21A1R31	0698-7207	2	RESISTOR 61.9 1% .05W F TC=0+-100	24546	C3-1/8-T00-61R9-G
A21A1R32	0698-7207		RESISTOR 61.9 1% .05W F TC=0+-100	24546	C3-1/8-T00-61R9-G
A21A1U1- A21A1U5			NOT ASSIGNED		
A21A1U6	0955-0063	1	MIXER, DOUBLE BALANCE 200 MW	28480	0955-0063

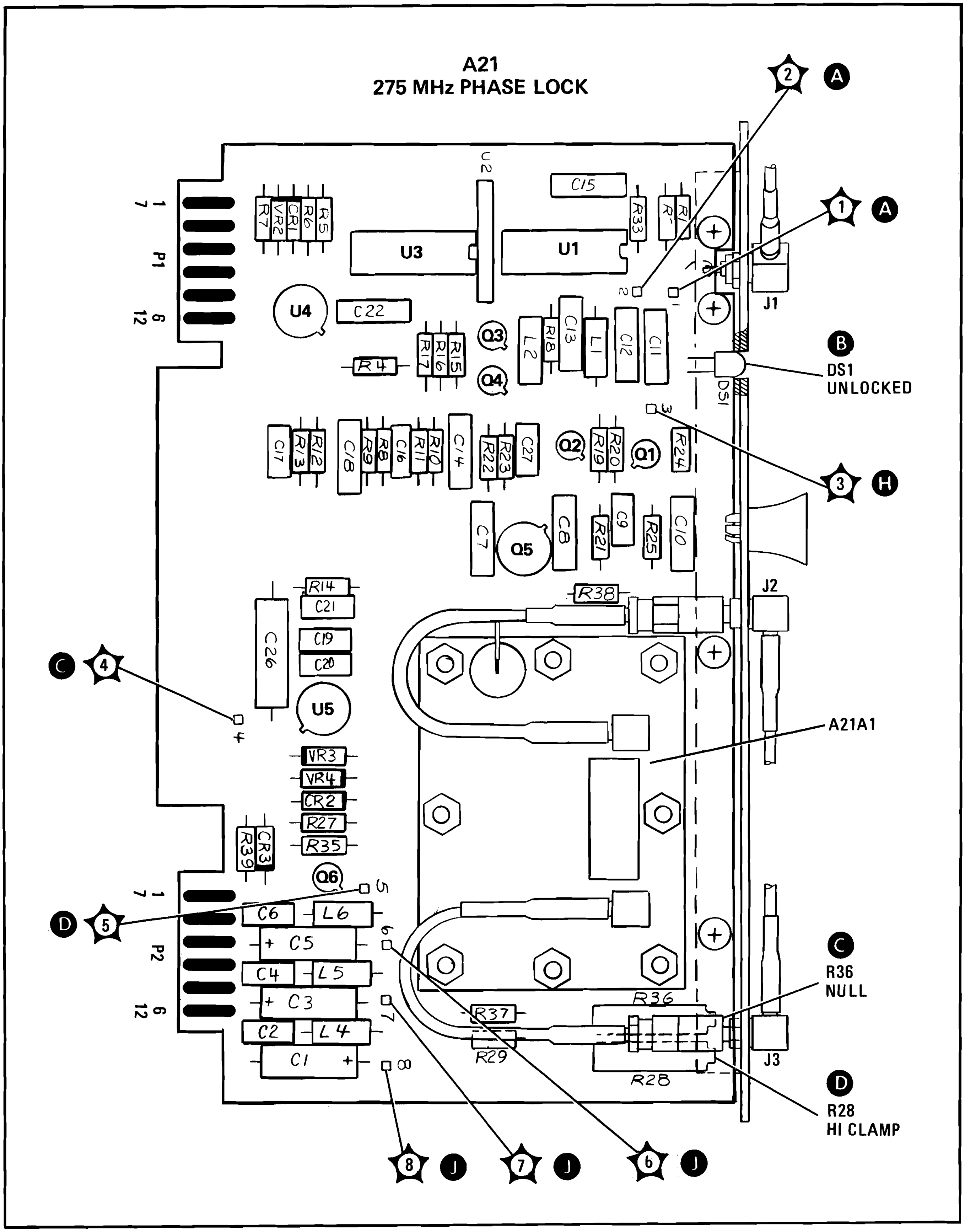
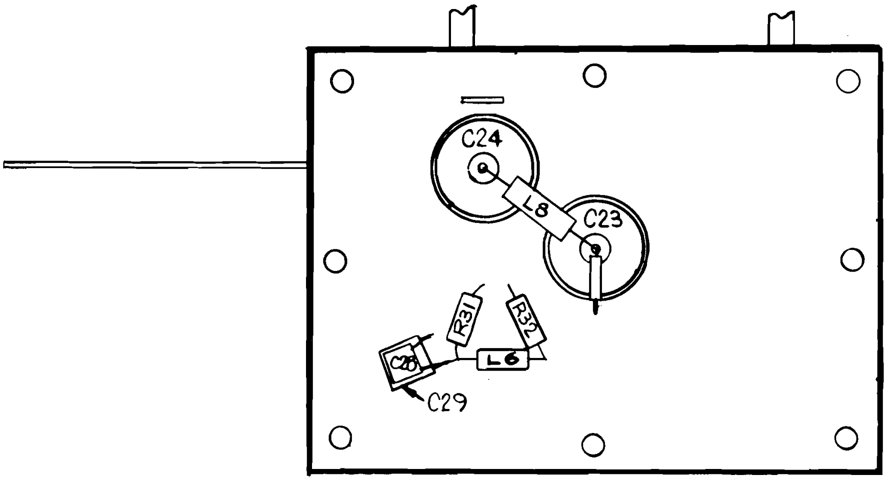
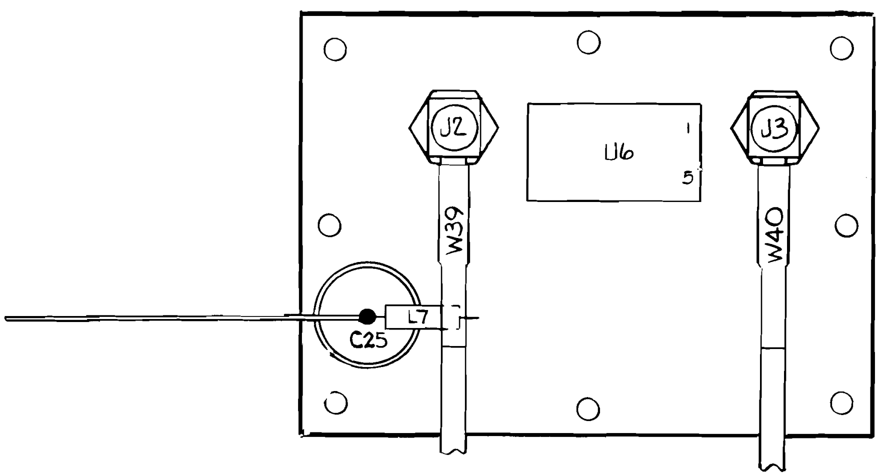


Figure 9-80. A21 275 MHz Phase Lock, Component Locations

A21A1
275 MHz MIXER



COMPONENT SIDE



CIRCUIT SIDE

Figure 9-81. A21A1 275 MHz Phase Lock, Component Locations

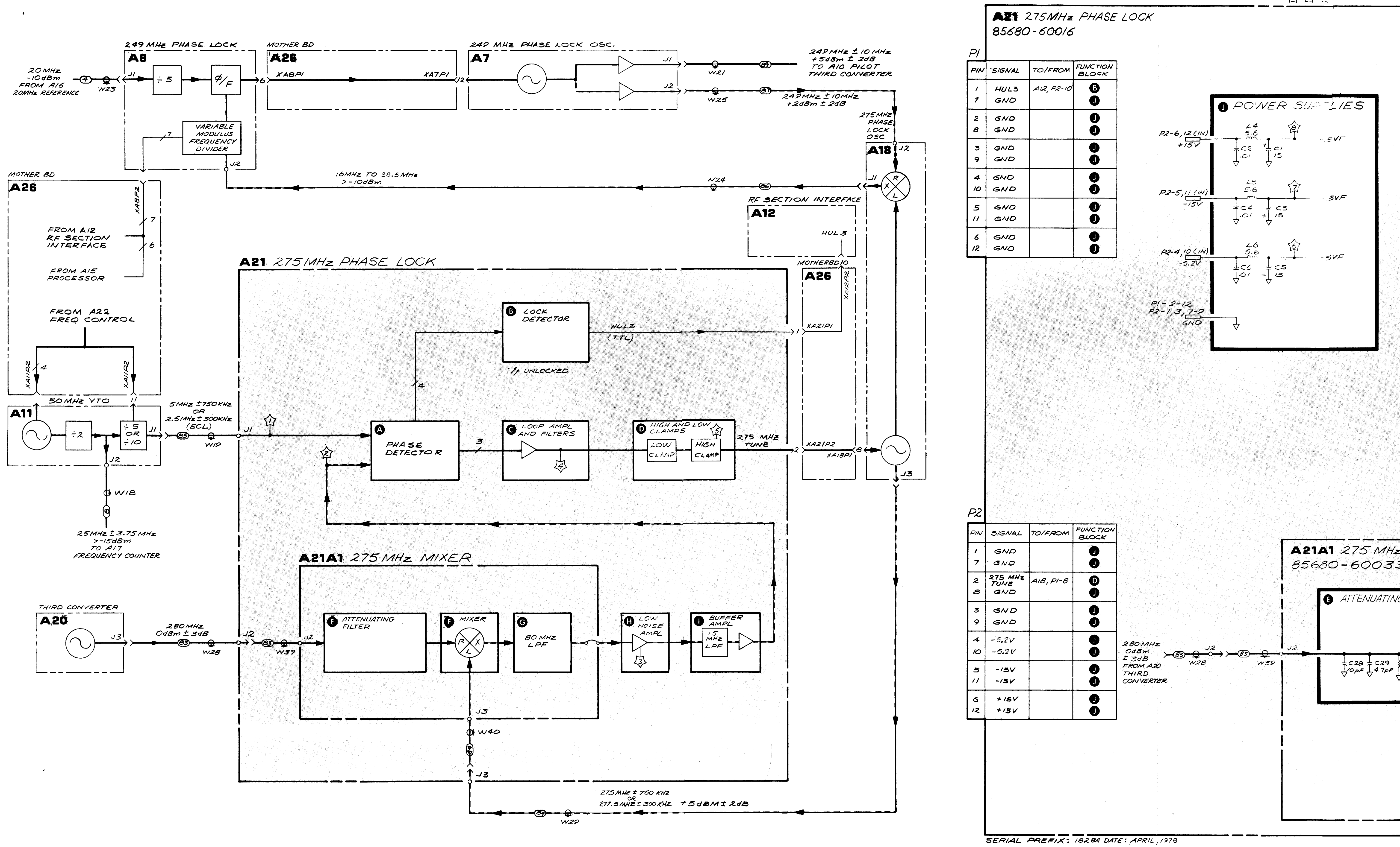
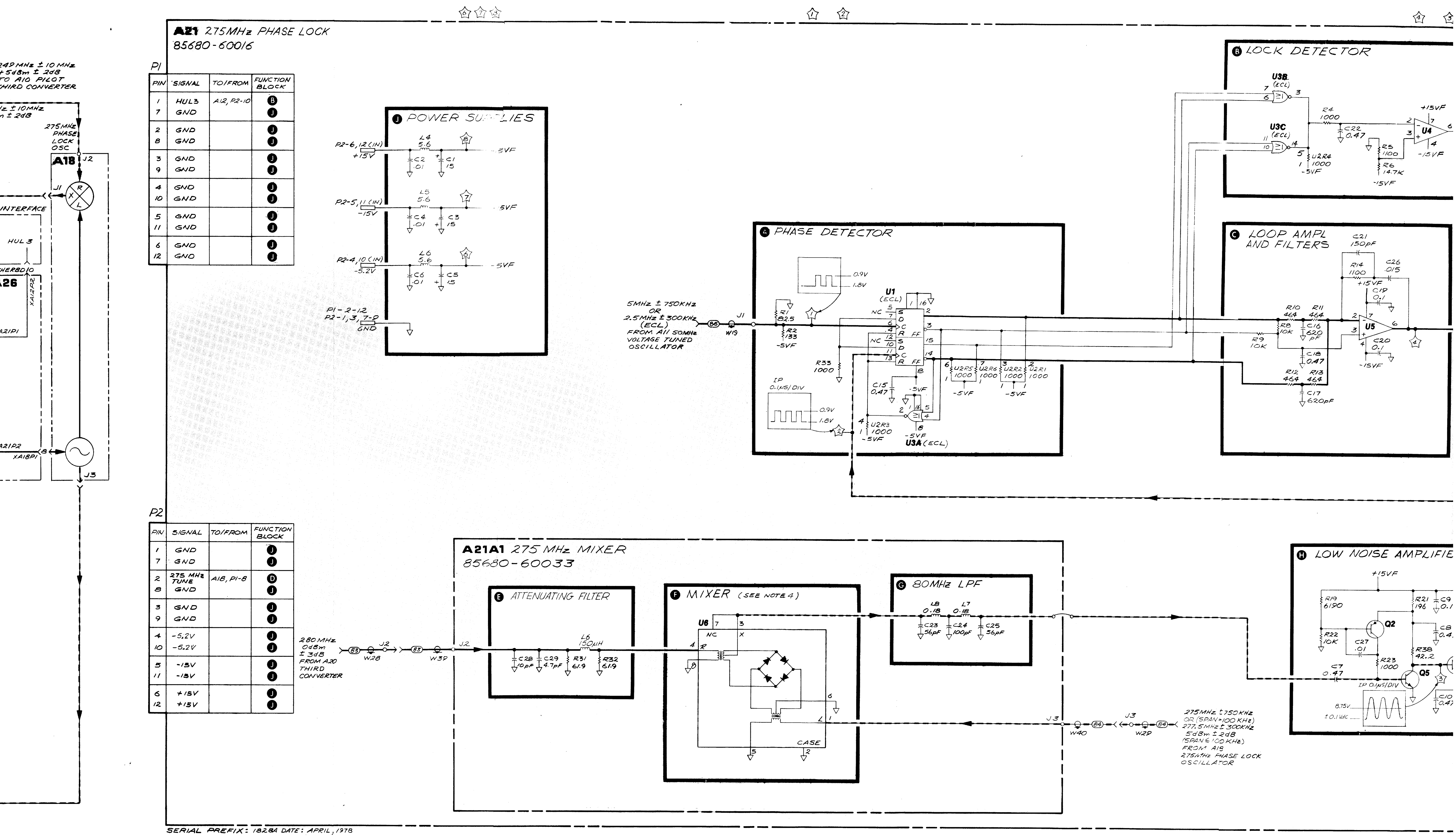


Figure 9-82. A21 275 MHz Phase Lock, Block Diagram



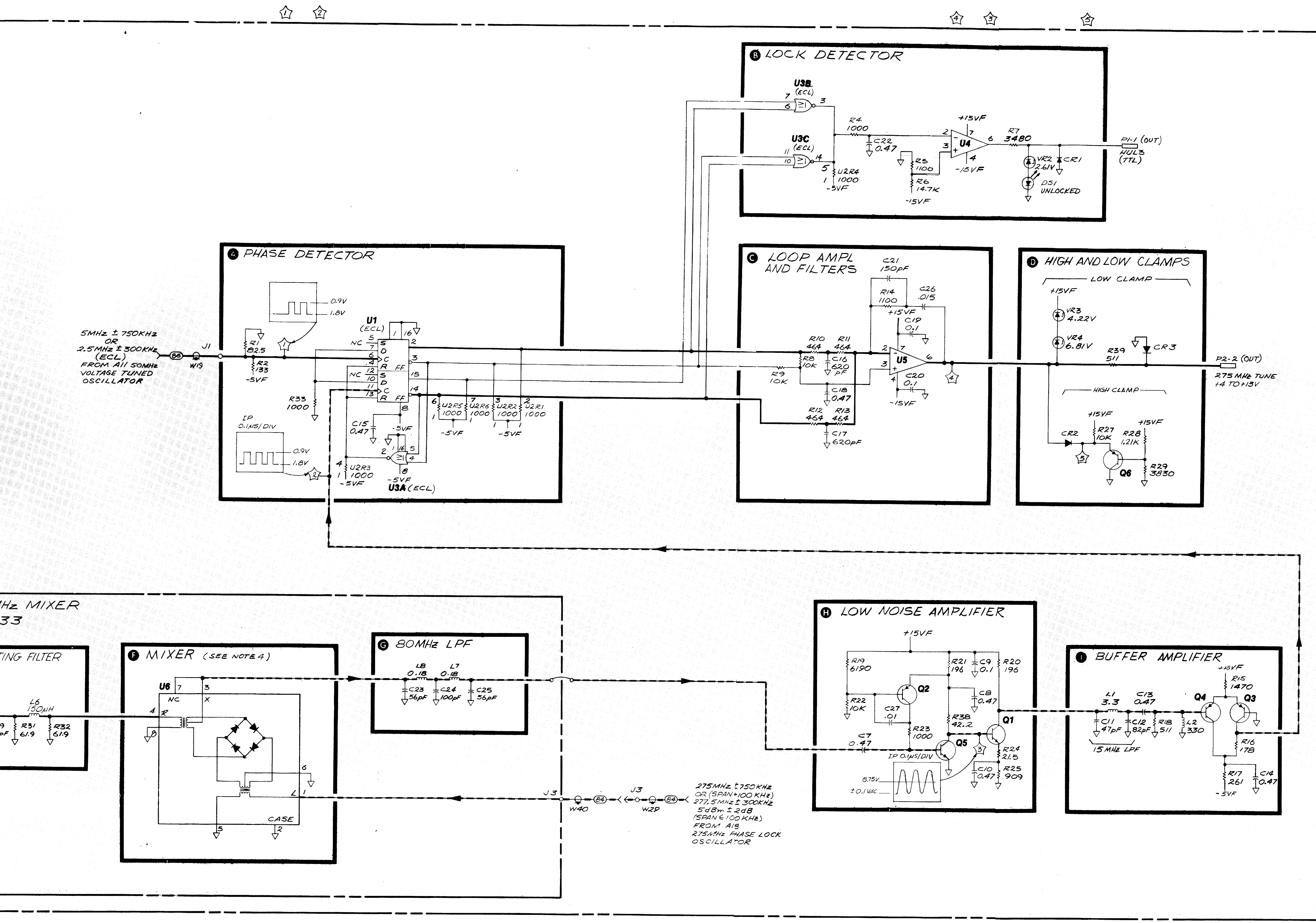
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HUL3	A12, P2-10	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

P2

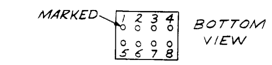
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
7	GND		J
2	275 MHz TUNE	A18, P1-8	D
8	GND		J
3	GND		J
9	GND		J
4	-5.2V		J
10	-5.2V		J
5	-15V		J
11	-15V		J
6	+15V		J
12	+15V		J

Block Diagram

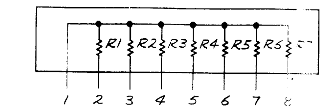


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH).
3. ECL LOGIC LEVELS ARE TYPICALLY:
   -0.9V = LOGIC "1" = HIGH
   -1.8V = LOGIC "0" = LOW
4. U6 PIN CONFIGURATION:



5. U2 (1000Ω)



6. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
HUL 3	HIGH = 275MHz LOOP UNLOCKED

A21

Figure 9-83. A21 275 MHz Phase Lock, Schematic Diagram

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 Processor.

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. FAST potentiometer R88 and SLOW 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 +10V for horizontal display control to the IF Section.

Sweep Reference Voltage B

Voltage from Q10 is amplified to about +10V and buffered by U16A. Q10 causes a variation in the voltage at TP15 of about 30 mV/°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 +9V to about +11V, depending on the ambient temperature.) SWP REF potentiometer R94 sets the positive input voltage to U16A.

Sweep Generator Current Source C

Q16, Q18, Q20, 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 15) sweeps ±5V while its output, buffered by U13, sweeps ±5V X 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

U11 is a zener diode with an internal heater for temperature compensation. TUNE REF adjustment R17 allows setting of the voltage and TP13 to −10.285V. U11 provides a voltage that is buffered and amplified by U12 and inverted by U15. These two op amp outputs provide tune reference voltages, −10V bias reference, and sweep offset reference. All capacitors provide noise filtering, and C4 and C13 reduce susceptibility to external RF interference.

VTO Tune DAC J

U25, U26, U27, and U28 latch data for digital-to-analog converters (DACs) U6 and U9. U9 is buffered by U8, which also acts as a current summing amplifier for the output of U5, the buffer for U6. R5 through R10 provide approximately 1/500 attenuation of the output of U5 as observed at TP9. Both U9 and U6 are 10-bit multiplying DACs. When the VTO TUNE voltage (measured at TP9) is adjusted with VTO potentiometer R3, the zero-setting voltage must be subtracted from the 1023-setting voltage to find +10.230V. R13 and R14 are current-limiting resistors for V_{CC} on U6 and U9.

The full range on U6, as adjusted by LSD VTO potentiometer R7, should yield a 21.8-mV change at TP9.

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 CR1 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, C18, R39, and R40 provide a reference voltage for differential amplifier Q2A and Q2B. Q1 and R42 provide a constant current, and R41, Q3, and Q4 provide voltage-to-current conversion across R44. C25 is a loop-compensation capacitor. START potentiometer R39 adjusts the start point in YTO tuning when the 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, and R62 from the sweep- and phase-correction voltages summed by 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 ±5V 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.

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 (SHIFT RES BW) function. Using sweep times of 20 ms, 30 ms, 50 ms, 100 ms, 1 sec, and 100 sec and KSF, the Sweep Generator Current Source C circuitry is exercised. The Sweep Time is 10 ms 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 9-84 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 +5V. 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 +3.11V). When HSWP goes high, a new sweep is started. LED DS3 is on when the sweep is stopped.

Sweep Attenuator

The Sweep Attenuator is a 10 bit DAC whose reference voltage is swept from −5V to +5V. U13 pin 6 is the ±5V 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 9-33 depending on the frequency span.

Table 9-33. 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

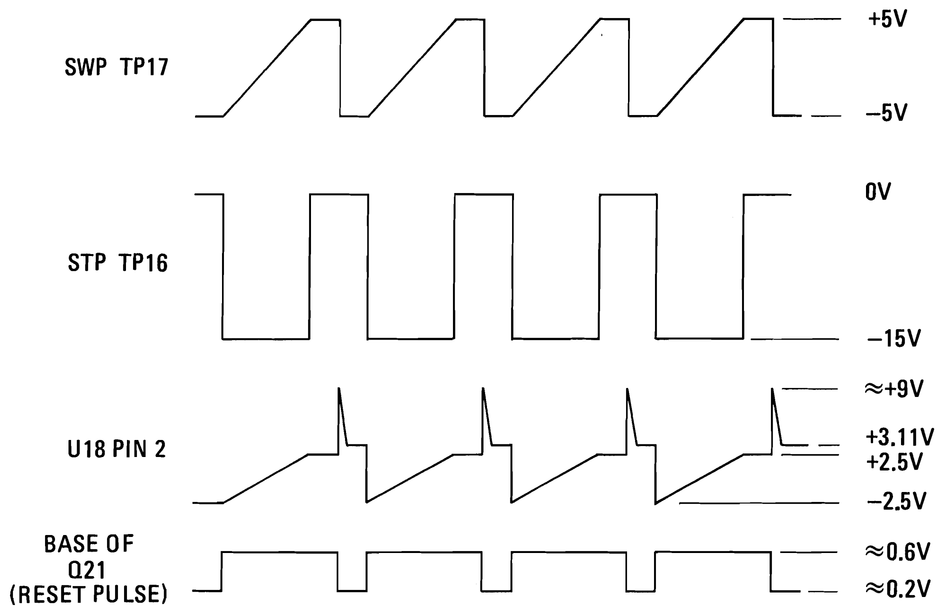


Figure 9-84. A22 Sweep Generator Waveforms

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

This attenuated sweep is routed to the appropriate sweep circuit depending on the frequency span as shown below:

Table 9-34. 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 TP 4.

Operation of the Sweep Attenuator DAC can be verified by using [SHIFT] [CF STEP SIZE] (KSJ). Measure the voltage at TP10. Set the analyzer to [SINGLE] Sweep, [EXT] Trigger. Key in KSJ and 0 GHz. Press the DATA [⇧] key repetitively. The voltage at TP10 should start at approximately 0V and double with each step to −5V. If [LINE] 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.

Be certain to check the sweep ramps if a frequency error exists. A ramp that is sweeping over the wrong range could produce subtle frequency offset errors.

The 50 MHz VTO Tune DACs work in a similar manner although two 10 bit DACS are used. After entering KSJ, data is entered into the LSB DAC through the Hz unit key while the kHz unit key sets the MSB DAC. Varying the LSB DAC from 0 to 1023 will cause a 21.8 mV change in the voltage at TP9. The DAC settings can be monitored with the KSR function. Line 1 is the VTO LSB DAC and Line 2 is the VTO MSB DAC.

The YTO Tune DAC works in a similar manner. After keying in KSJ, the MHz units key is used to enter information. The 1st LO OUTPUT can be monitored at the rear panel. For 0 [MHz -dBm sec] it is 2.050 GHz, for 1023 [MHz -dBm sec] it is 3.7891 GHz. Again, use the DATA Keys to verify that each bit works. The [SHIFT] [MKR→ REF LVL] (KSR) function, line 3, lists the YTO DAC setting.

If the START/STOP adjustments in the YTO Main Coil Drivers are misadjusted, the analyzer can lock up on the wrong comb tooth. This would cause a constant 20 MHz offset in the frequency reading. Note that TP2 is clamped to −0.6V whenever a "negative" frequency is displayed on the CRT. The YTO Main Coil is only swept for frequency spans greater than 20 MHz.

For frequency spans from 1 MHz to 20 MHz, the FM coil is swept. For spans less than 1 MHz the ramp waveform on TP3 is caused by the YTO phase lock error voltage tracking the 249 MHz PLO.

The AMPTD CAL (P2-14) is a 2V ramp when using a 1500 MHz frequency span. This compensates for the 2 dB roll off in the 1st converter. The sensitivity is approximately 1 dB/V. Rotating the front-panel AMPTD CAL adjustment through its range causes a 6V change in the DC level of P2-14.

Appendix

Throughout the analyzer, DACs are used to implement the R-2R ladder network. Typically they are connected as in Figure 9-85.

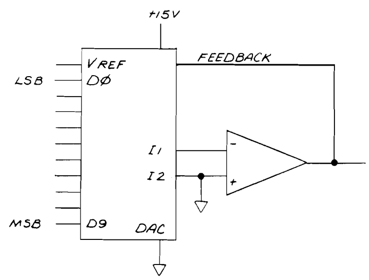


Figure 9-85. 10 Bit Binary Multiplying DAC

A simplified schematic of the circuitry is shown in Figure 9-86.

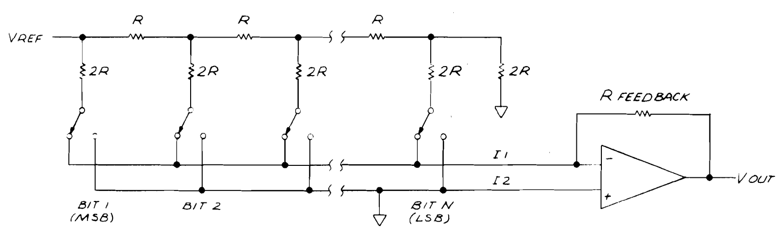


Figure 9-86. Simplified Schematic of 10 Bit DAC

The circuit is an inverting summing amplifier. The transfer equation is:

$$V_{OUT} = -R_{FB}\left(\frac{V_{REF}}{2R} + \frac{V_{REF}}{2\cdot 2R} + \ldots\ldots + \frac{V_{REF}}{2^N\cdot 2R}\right) = \frac{-R_{FB}\,V_{REF}}{2R}\sum_{n\emptyset=1}^{N}\frac{1}{2^{n-1}}$$

In the 8568A, R is 10K, N is 10 and R_{FB} is 10K, thus if all bits are selected:

$$V_{OUT} = -\frac{1023}{1024}V_{REF}$$

V_{REF} is generally a fixed voltage. In the Sweep Attenuator, a ±5V ramp is used for V_{REF}.

Note that gain error can cause an initial error of 0.3% in the maximum voltage.

Table 9-35. A22 Frequency Control, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22	85680-60012	1	BOARD ASSEMBLY, FREQUENCY CONTROL	28480	85680-60012
A22C1	0180-0197	9	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C2	0180-1746	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A22C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A22C4	0160-3448	4	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A22C5	0160-2253	1	CAPACITOR-FXD 6.8PF +-.25PF 500VDC CER	28480	0160-2253
A22C6	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C7	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C9	0160-2055	7	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C10	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C12	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C13	0160-3448		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A22C14	0160-3448		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A22C15	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C16	0160-3402	1	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A22C17	0180-0094	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A22C18	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C19	0160-2306	1	CAPACITOR-FXD 27PF +-5% 300VDC MICA	28480	0160-2306
A22C20	0160-2201	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A22C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C23			NOT ASSIGNED		
A22C24	0180-1745	1	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A22C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C26	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A22C27	0140-0198	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A22C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C29	0160-3448		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A22C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22C31	0160-2204	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A22C32	0160-4298	1	CAPACITOR-FXD 4700PF +-20% 250VDC CER	56289	C067F251H472MS22-CDH
A22C33	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22CR1	1901-0376	1	DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A22CR2	1901-0040	6	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR5	1901-0050	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A22CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22DS1	1990-0487	3	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A22DS2	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A22DS3	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A22J1	1200-0508	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A22J1MP1	1251-4459	1	CLIP-CABLE PLUG RETAINING-DUAL INLINE 14	28480	1251-4459
A22J2			NOT USED		
A22J3	1250-0543	2	CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A22J4	1250-0543		CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A22L1	08558-80011	3	FILTER, COIL, BLUE	28480	08558-80011
A22L2	08558-80011		FILTER, COIL, BLUE	28480	08558-80011
A22L3	08558-80011		FILTER, COIL, BLUE	28480	08558-80011
A22L4	9100-1651	1	COIL-MLD 750UH 5% Q=60 .19DX.44LG-NOM	28480	9100-1651
A22L5	9100-1648	1	COIL-MLD 560UH 5% Q=65 .19DX.44LG-NOM	28480	9100-1648
A22Q1	1854-0023	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A22Q2	1854-0475	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A22Q3	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A22Q4	1854-0039	4	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	04713	2N3053
A22Q5	1853-0007	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A22Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A22Q7	1854-0039		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	04713	2N3053
A22Q8	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A22Q9	1854-0071	9	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q11	1853-0316	2	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A22Q12	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q13	1855-0020	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A22Q14	1855-0209	1	TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0209
A22Q15			NOT ASSIGNED		

Table 9-35. A22 Frequency Control, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22Q16	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q17	1855-0305	1	TRANSISTOR J-FET 2N4117A N-CHAN D-MODE	17856	2N4117A
A22Q18	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q19	1853-0451	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A22Q20	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q21	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q22	1854-0039		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	04713	2N3053
A22Q23	1853-0316		TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A22Q24	1854-0039		TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	04713	2N3053
A22Q25	1853-0001	1	TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A22Q26	1853-0020	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A22Q27	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q28	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q29	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22R1			NOT ASSIGNED		
A22R2	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A22R3	2100-1755	3	RESISTOR-TRMR 100 5% WW SIDE-ADJ 1-TRN	28480	2100-1755
A22R4			NOT ASSIGNED		
A22R5	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A22R6	0757-0416	3	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R7	2100-1760	1	RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1760
A22R8	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A22R9	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R10	0757-0443	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A22R11	0757-0438	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R12	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A22R13	0757-0280	8	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R15	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R17	2100-1756	1	RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TRN	28480	2100-1756
A22R18	0757-0441	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A22R19	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R20	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R21	0811-3491	1	RESISTOR 24.7K 1% .05W PWW TC=0+-10	28480	0811-3491
A22R22	0811-1185	7	RESISTOR 10K .01% .0125W PWW TC=0+-10	20940	140-1/20-1002-T
A22R23	0811-1185		RESISTOR 10K .01% .0125W PWW TC=0+-10	20940	140-1/20-1002-T
A22R24	0811-1185		RESISTOR 10K .01% .0125W PWW TC=0+-10	20940	140-1/20-1002-T
A22R25	2100-1755		RESISTOR-TRMR 100 5% WW SIDE-ADJ 1-TRN	28480	2100-1755
A22R26			NOT ASSIGNED		
A22R27	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R28	0698-5439	1	RESISTOR 1K .25% .125W F TC=0+-50	28480	0698-5439
A22R29	0698-8322	1	RESISTOR 111 .25% .125W F TC=0+-100	19701	MF4C1/8-T0-111R-C
A22R30			NOT ASSIGNED		
A22R31	0811-1185		RESISTOR 10K .01% .0125W PWW TC=0+-10	20940	140-1/20-1002-T
A22R32	0811-1185		RESISTOR 10K .01% .0125W PWW TC=0+-10	20940	140-1/20-1002-T
A22R33	0698-3155	5	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R34	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R35	2100-3103	2	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A22R36	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R37	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R39	2100-3103		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A22R40	0757-0458	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A22R41	0757-0463		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A22R42	0757-0461	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A22R43	0757-0401	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R44	0811-3492	2	RESISTOR 133 1% 12W PW TC=0+-2	28480	0811-3492
A22R45	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R46	0757-0417	1	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A22R47	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A22R48	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A22R49	0757-0274	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A22R50	0757-0279	6	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R51	0811-3492		RESISTOR 133 1% 12W PW TC=0+-2	28480	0811-3492
A22R52	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R53	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R54	0698-3393	1	RESISTOR 28.7 1% .5W F TC=0+-100	28480	0698-3393
A22R55	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R56	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R57	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R58	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R59	0757-0290	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R60			NOT ASSIGNED		

Table 9-35. A22 Frequency Control, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22R61	0698-3398	2	RESISTOR 46.4 1% .5W F TC=0+-100	28480	0698-3398
A22R62	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R63	0698-3398		RESISTOR 46.4 1% .5W F TC=0+-100	28480	0698-3398
A22R64	2100-1755		RESISTOR-TRMR 100 5% WW SIDE-ADJ 1-TRN	28480	2100-1755
A22R65	0757-0795	1	RESISTOR 75 1% .5W F TC=0+-100	19701	MF-1/2-T0-75R0-F
A22R66	2100-2522	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A22R67	0757-0447	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A22R68	0757-0199	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A22R69	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R70	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R71	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R72	0698-3158	6	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R73	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R74	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R75	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R76	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R77	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A22R78	0698-7421	2	RESISTOR 40K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-4002-C
A22R79	0698-3454	1	RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A22R80	0698-3451	1	RESISTOR 133K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1333-F
A22R81	0698-8848	1	RESISTOR 57.2K .25% .125W F TC=0+-100	28480	0698-8848
A22R82	0698-7421		RESISTOR 40K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-4002-C
A22R83	0698-3194	1	RESISTOR 20K .25% .125W F TC=0+-50	03888	PME55-1/8-T2-2002-C
A22R84	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A22R85	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R86	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R87	0757-0444	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A22R88	2100-3109	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A22R89	0698-3457	1	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A22R90	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A22R91	2100-3052	1	RESISTOR-TRMR 50 20% C SIDE-ADJ 17-TRN	02111	43P500
A22R92	0698-3446	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A22R93	0698-3450	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A22R94	2100-3154	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A22R95	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R96	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A22R97	0757-0459	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A22R98	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A22R99	0683-3355	1	RESISTOR 3.3M 5% .25W FC TC=-900/+1100	01121	CB3355
A22R100	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R101	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A22R102	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R103	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A22R104	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R105	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A22R106	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A22R107	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A22R108	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R109	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R110	0757-0428	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A22R111	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R112	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A22R113*	0757-0463	2	RESISTOR 82.5K 1% .125W F TC=0+-100(V=6.6-6.73)	24546	C4-1/8-TO-8252-F
A22R113*	0757-0465	4	RESISTOR 100K 1% .125W F TC=0+-100(V=6.74-6.87)	24546	C4-1/8-TO-1003-F
A22R113*	0698-3243	1	RESISTOR 178K 1% .125W F TC=0+-100(V=6.88-7.03)	24546	C4-1/8-TO-1783-F
A22R113*	0698-3460	1	RESISTOR 422K 1% .125W F TC=0+-100(V=7.04-7.19)	28480	0698-3460
A22R113*			OPEN (V=GREATER THAN 7.19)		
A22R114	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A22R115-A22R119			NOT ASSIGNED		
A22R120	0698-3161	3	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A22R121	0698-3161		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A22R122	0698-3161		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A22R123	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R124	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A22R125			NOT ASSIGNED		
A22R126	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R127	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A22R128	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R129	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A22R130	0811-1185		RESISTOR 10K .01% .0125W PWW TC=0+-10	20940	140-1/20-1002-T
A22R131	0811-1185		RESISTOR 10K .01% .0125W PWW TC=0+-10	20940	140-1/20-1002-T
A22R132	0698-6360	3	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R133	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R134	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A22R135	0698-8949	1	RESISTOR 20.57K .1% .125W F TC=0+-25	28480	0698-8949
A22R136	0698-8948	1	RESISTOR 19.46K .1% .125W F TC=0+-25	28480	0698-8948

Table 9-35. A22 Frequency Control, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22TP1-A22TP17	0360-0124	17	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A22U1	1826-0229	7	IC OP AMP TO-99 05C	06665	OP-05CJ
A22U2	1826-0229		IC OP AMP TO-99 05C	06665	OP-05CJ
A22U3	1826-0229		IC OP AMP TO-99 05C	06665	OP-05CJ
A22U4	1826-0448	4		28480	1826-0448
A22U5	1826-0371	4	IC OP AMP TO-99	27014	LF256H
A22U6	1826-0448			28480	1826-0448
A22U7	1826-0416	2	IC SWITCH 16-DIP-C	27014	LF13331D
A22U8	1826-0229		IC OP AMP TO-99 05C	06665	OP-05CJ
A22U9	1826-0448			28480	1826-0448
A22U10	1826-0229		IC OP AMP TO-99 05C	06665	OP-05CJ
A22U11	1902-0908	1	DIODE-ZNR 6.95V 5% TC=+.0002%	27014	LM399H
A22U12	1826-0229		IC OP AMP TO-99 05C	06665	OP-05CJ
A22U13	1826-0229		IC OP AMP TO-99 05C	06665	OP-05CJ
A22U14	1826-0448			28480	1826-0448
A22U15	1826-0371		IC OP AMP TO-99	27014	LF256H
A22U16	1826-0092	2	IC OP AMP TO-99	28480	1826-0092
A22U17	1826-0092		IC OP AMP TO-99	28480	1826-0092
A22U18	1826-0371		IC OP AMP TO-99	27014	LF256H
A22U19	1826-0371	1	IC OP AMP TO-99	27014	LF256H
A22U20	1826-0417	1	IC SWITCH 16-DIP-C	27014	NF13333D
A22U21	1826-0161	1	IC 324 OP AMP 14-DIP-P	18324	LM324-A
A22U22	1820-1196	12	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U23	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U24	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U25	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U26	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U27	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U28	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U29	1826-0416		IC SWITCH 16-DIP-C	27014	LF13331D
A22U30	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U31	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U32	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U33	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U34	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A22U35	1820-1216	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A22U36	1820-1197	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A22VR1-A22VR4			NOT ASSIGNED		
A22VR5	1902-0184	1	DIODE-ZNR 16.2V 5% DO-7 PD=.4W TC=+.066%	28480	1902-0184
A22VR6	1902-3059	1	DIODE-ZNR 3.83V 5% DO-7 PD=.4W TC=-.051%	28480	1902-3059
A22VR7	1902-0033	1	DIODE-ZNR 1N823 6.2V 5% DO-7 PD=.4W	24046	1N823
A22VR8	1902-3036	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A22VR9	1902-3036		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
			A22 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0750	2	EXTRACTOR-PC BOARD RED POLYC	28480	4040-0750

Table 9-36. A22 Frequency Control, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	H3	L2	A3	R20	F2	R74	H3	R131	G3	U27	E3
C2	E2	L3	B3	R21	E2	R75	H3	R132	F3	U28	E3
C3	E2	L4	B3	R22	F2	R76	G3	R133	F3	U29	E3
C4	E2	L5	B3	R23	E2	R77	G3	R134	F2	U30	E3
C5	B3			R24	F2	R78	H3	R135	F2	U31	E3
C6	F2	Q1	A2	R25	C2	R79	H3	R136	F2	U32	F3
C7	E2	Q2	A2	R27	E3	R80	H3			U33	F3
C8	A3	Q3	A2	R28	E3	R81	H3	TP1	A2	U34	G3
C9	A3	Q4	A2	R29	E3	R82	H3	TP2	B2	U35	H3
C10	B3	Q5	A2	R31	C2	R83	G3	TP3	B2	U36	H3
C11	B3	Q6	B2	R32	C2	R84	G3	TP4	C3		
C12	E2	Q7	B2	R33	B2	R85	G2	TP5	C3	VR5	A2
C13	E2	Q8	B2	R34	C2	R86	G2	TP6	D2	VR6	A2
C14	G2	Q9	F2	R35	C2	R87	F2	TP7	D2	VR7	B3
C15	G2	Q10	G2	R36	C2	R88	F2	TP8	D2	VR8	C3
C16	G2	Q11	G2	R37	C3	R89	G2	TP9	D2	VR9	C3
C17	H2	Q12	G3	R38	D2	R90	G2	TP10	E2		
C18	C2	Q13	G2	R39	A2	R91	G2	TP11	E2		
C19	B3	Q14	G2	R40	B2	R92	G2	TP12	E2		
C20	B3	Q16	G2	R41	A3	R93	F2	TP13	E2		
C21	B3	Q17	G2	R42	A2	R94	F2	TP14	F2		
C22	B3	Q18	G2	R43	B2	R95	F2	TP15	G2		
C24	B2	Q19	H2	R44	A2	R96	G2	TP16	G2		
C25	A3	Q20	H2	R45	A2	R97	G2	TP17	H2		
C26	A2	Q21	H2	R46	A2	R98	F3				
C27	E2	Q22	A3	R47	A2	R99	G3	U1	C2		
C28	F2	Q23	A3	R48	B2	R100	G3	U2	C2		
C29	A3	Q24	B3	R49	B3	R101	C3	U3	C2		
C30	D3	Q25	B3	R50	B2	R102	H2	U4	C2		
C31	H2	Q26	G3	R51	B2	R103	H2	U5	D2		
C32	B2	Q27	H3	R52	B2	R104	C3	U6	D2		
C33	D3	Q28	H3	R53	A3	R105	H2	U7	D2		
		Q29	H3	R54	A3	R106	H2	U8	D2		
CR1	G2			R55	A3	R107	H2	U9	E2		
CR2	B3	R2	E2	R56	A3	R108	G2	U10	E2		
CR3	B3	R3	E2	R57	B3	R109	H2	U11	E2		
CR4	B2	R5	D2	R58	B3	R110	H2	U12	E2		
CR5	A2	R6	D2	R59	B2	R111	H2	U13	E2		
CR6	C3	R7	D2	R61	B3	R112	H2	U14	F2		
CR7	C3	R8	C2	R62	B3	R113	F2	U15	F2		
CR8	B2	R9	C2	R63	B3	R114	H3	U16	G2		
		R10	D2	R64	B2	R120	B3	U17	G3		
DS1	C2	R11	F2	R65	B2	R121	B3	U18	H2		
DS2	C2	R12	E2	R66	C2	R122	B3	U19	B3		
DS3	G2	R13	E2	R67	C3	R123	C3	U20	C2		
		R14	D2	R68	B3	R124	C3	U21	C3		
J1	B2	R15	C2	R69	C3	R126	E2	U22	C3		
J3	F2	R16	F2	R70	C3	R127	H3	U23	C3		
J4	G2	R17	F2	R71	C3	R128	G2	U24	C3		
		R18	F2	R72	H3	R129	F2	U25	D3		
L1	H3	R19	D2	R73	H3	R130	G3	U26	D3		

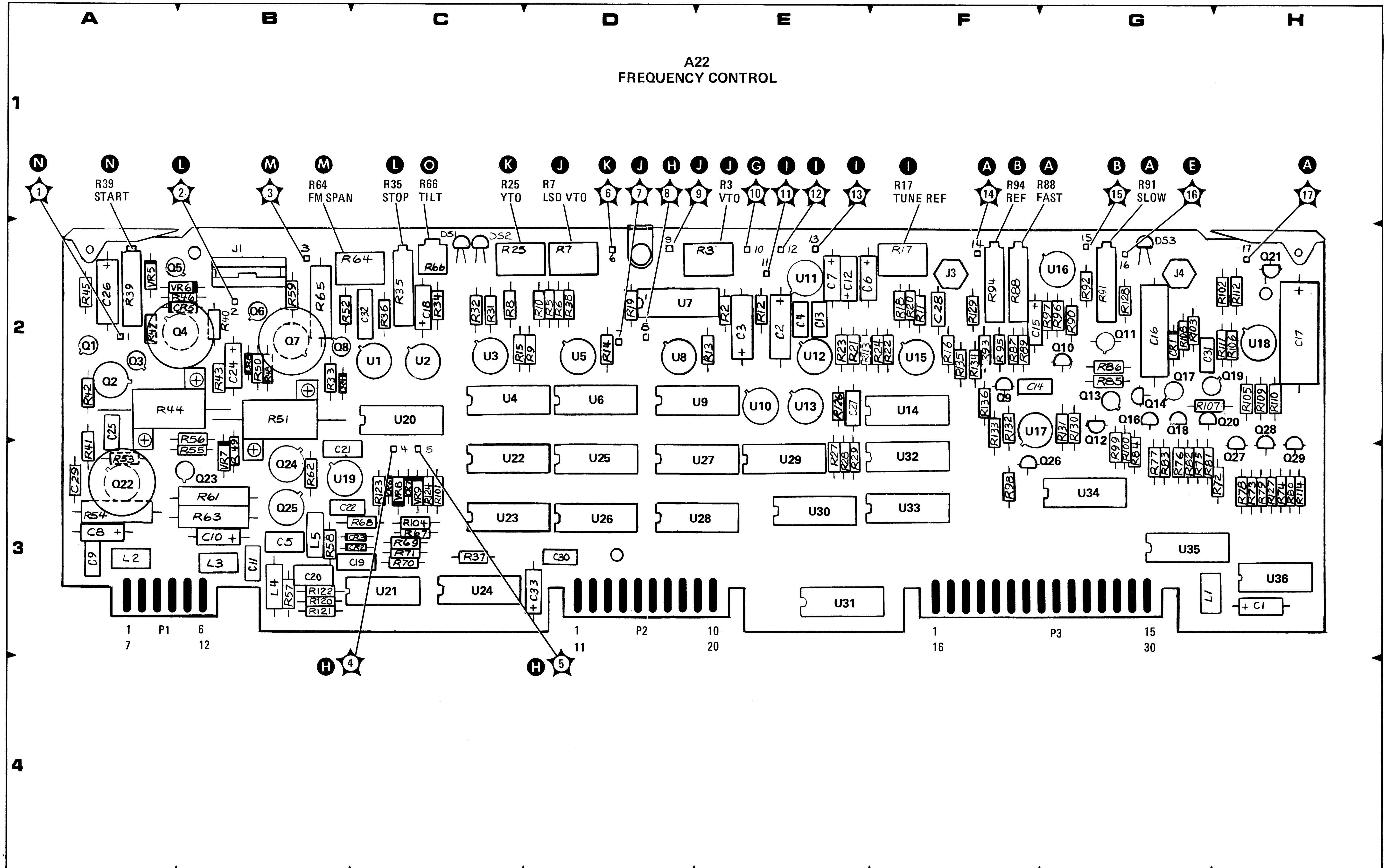


Figure 9-87. A22 Frequency Control, Component Locations

A22
FREQUENCY CONTROL

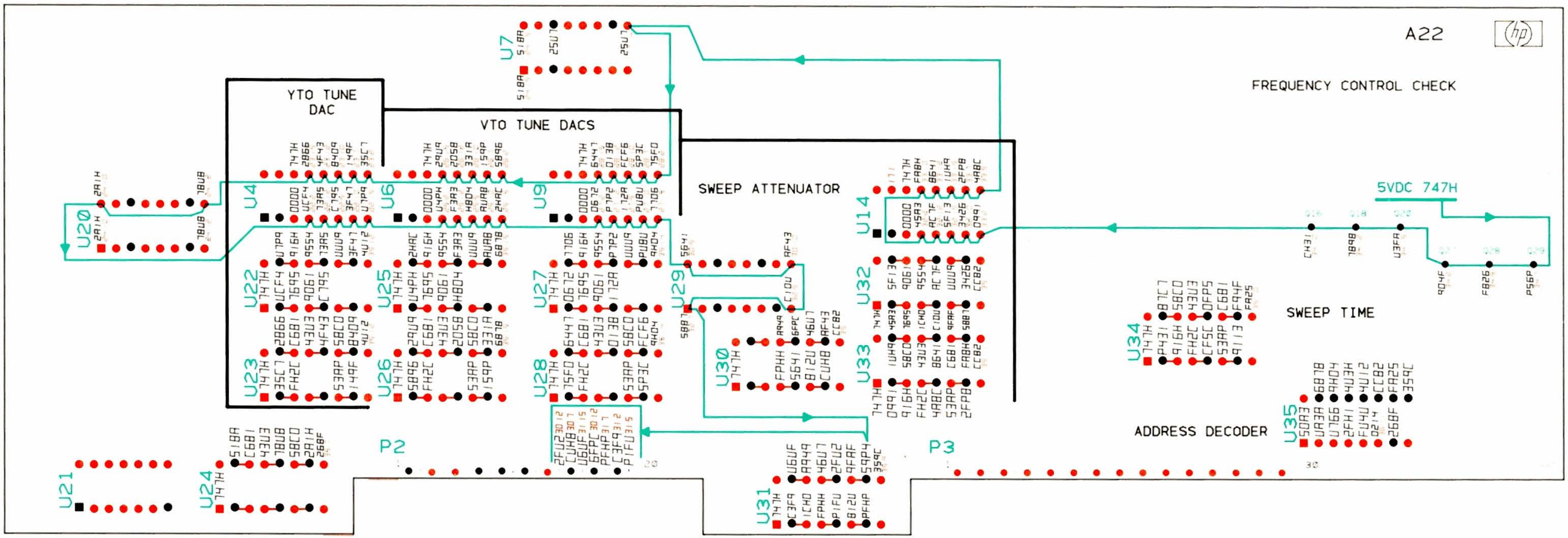


Figure 9-88. A22 Frequency Control, Signature Analysis Troubleshooting Diagram

FREQUENCY CONTROL CHECK

Signature Analyzer Connections:

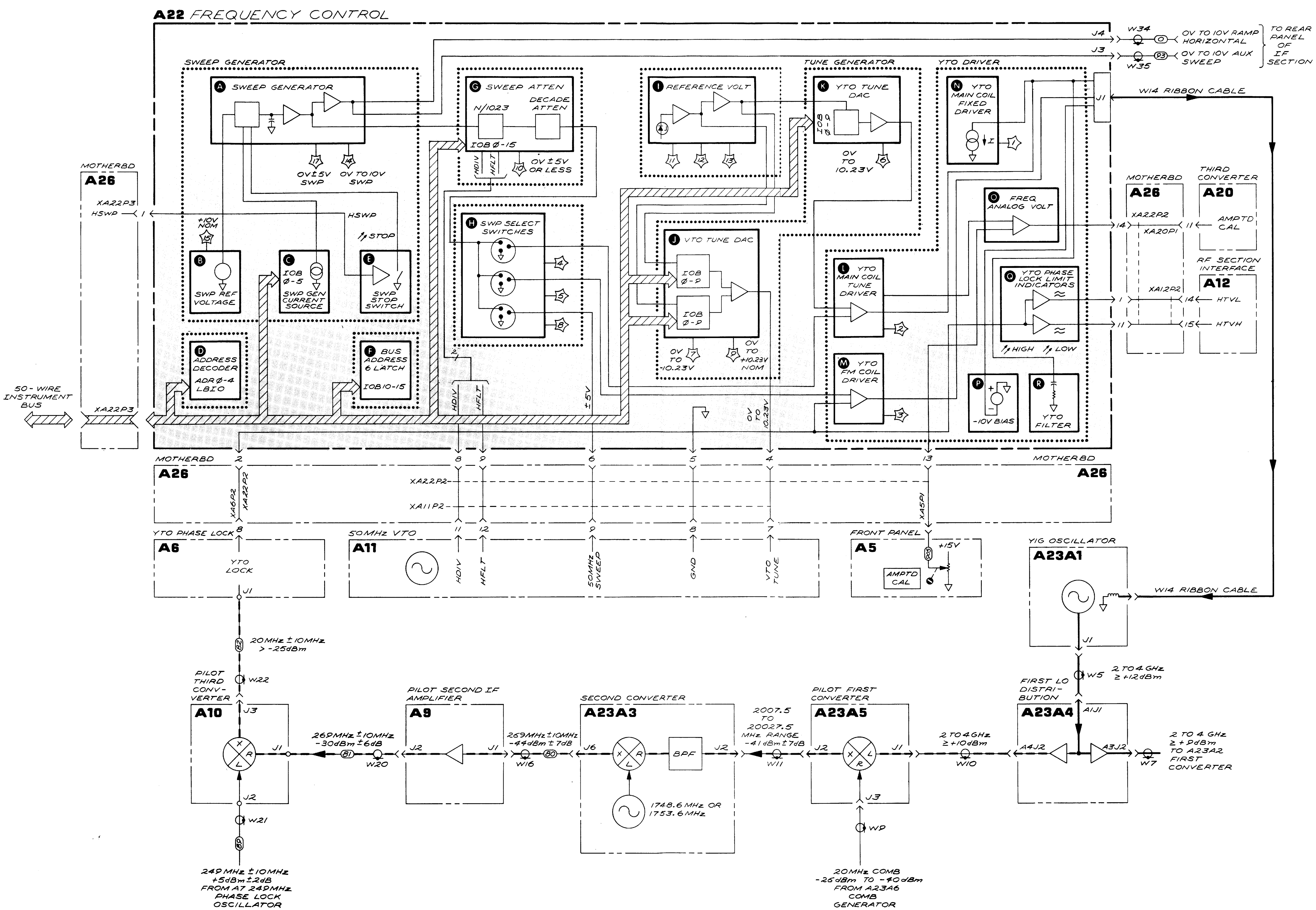
CLOCK ⌐ to A15TP2
START ⌐ to A14TP12
STOP ⌐ to A14TP11

Spectrum Analyzer Connections:

Jumper A14TP12 to A15TP8
Jumper A15TP3 to A15TP9 (+5V)

- Unless otherwise indicated, connect Signature Analyzer POD and Probe ground leads to any convenient ground, and make sure HOLD and SELF TEST pushbuttons are out.
- Refer to Figure 9-1 for explanation and instructions for use of signature analysis troubleshooting diagrams.

A22 *FREQUENCY CONTROL*
85680-60012
(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

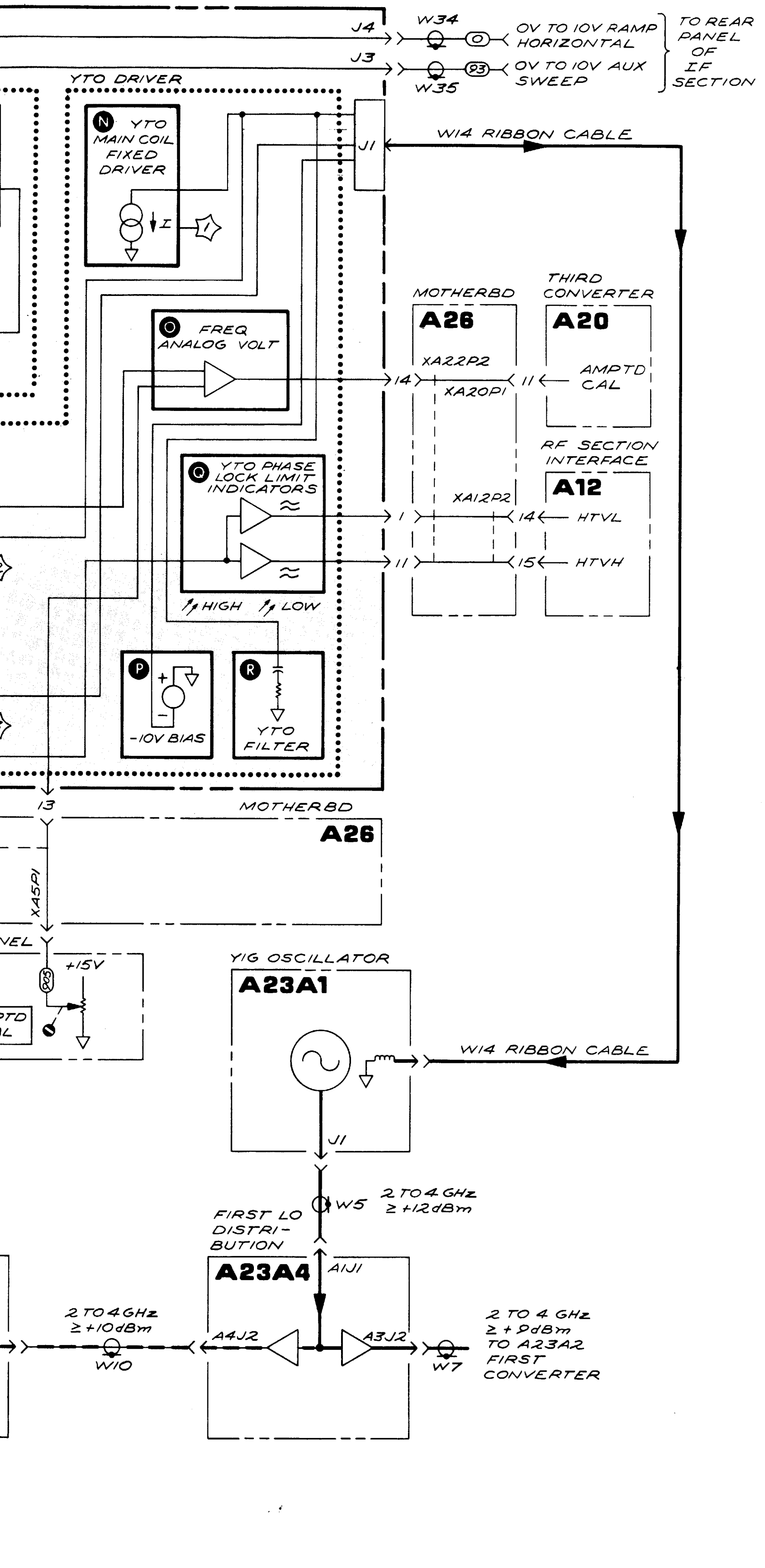
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HTVL	A12, P2-14	Q
11	HTVH	A12, P2-15	Q
2	YTO LOCK	A6, P2-8	M
12	NC		
3	NC		
13	AMPTD CAL	A5, P1-1	O
4	50MHz TUNE	A11, P2-7	J
14	AMPTD CAL	A20, P1-11	O
5	50MHz GND	A11, P2-8	J
15	GND		S
6	50MHz SWEEP	A11, P2-9	H
16	GND		S
7	NC		
17	LLOH	A23, P1-1, 2	F
8	HDIV	A11, P2-11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

P3

PIN	SIGNAL
1	HSWP
16	HSWP
2	IOB 15
17	IOB 14
3	IOB 13
18	IOB 12
4	IOB 11
19	IOB 10
5	IOB 9
20	IOB 8
6	IOB 7
21	IOB 6
7	IOB 5
22	IOB 4
8	IOB 3
23	IOB 2
9	IOB 1
24	IOB Ø
10	NC
25	ADR 4
11	ADR 3
26	ADR 2
12	ADR 1
27	ADR Ø
13	LBIO
28	LBIO
14	GND
29	GND
15	+5V
30	+5V

SERIAL PREFIX: 1828A DATE: APRIL, 1978

Figure 9-89. A22 Frequency Control, Block Diagram



A22 FREQUENCY CONTROL
85680-60012
(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

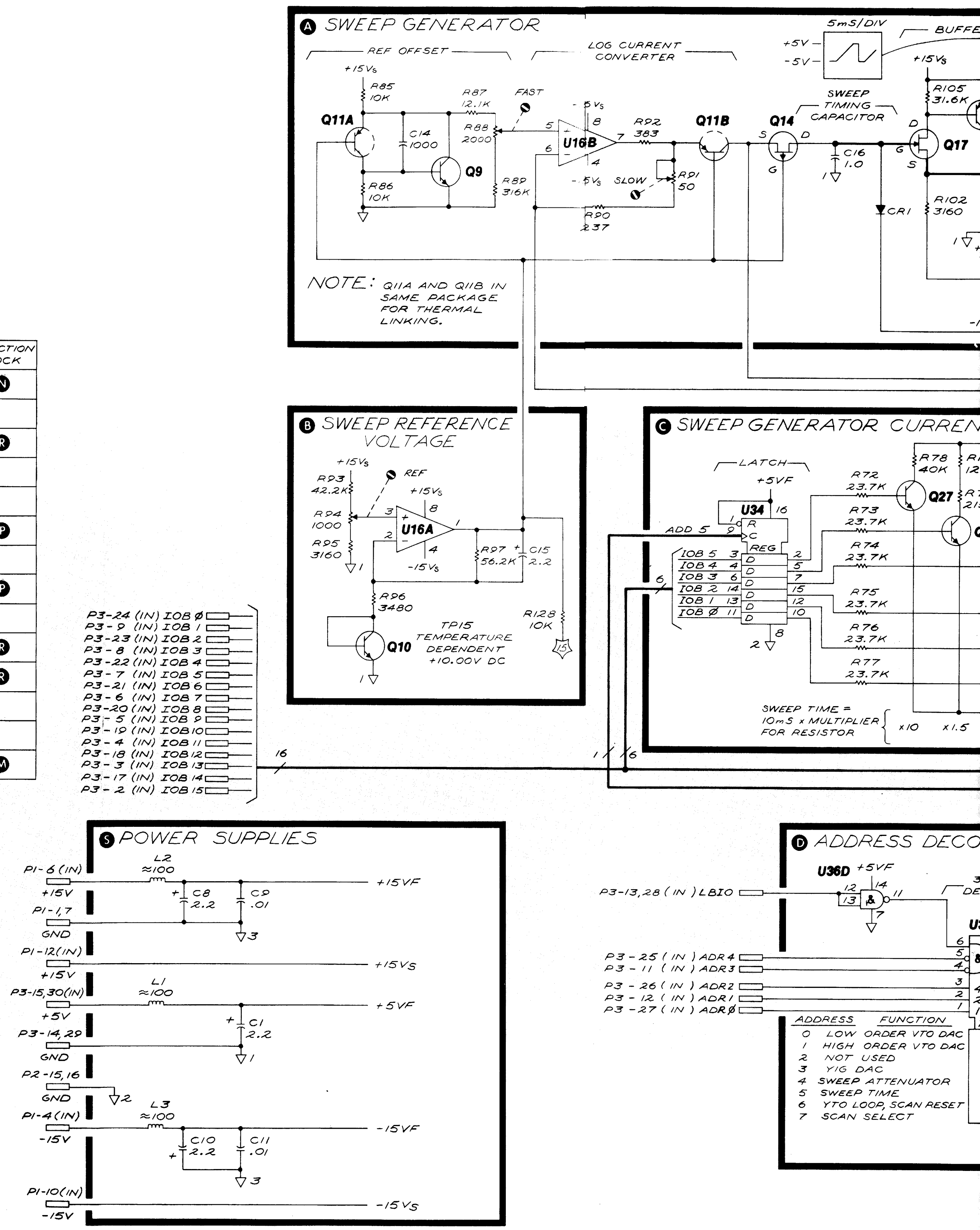
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HTVL	A12, P2-14	Q
11	HTVH	A12, P2-15	Q
2	YTO LOCK	A6, P2-8	M
12	NC		
3	NC		
13	AMPTD CAL	A5, P1-1	O
4	50MHz TUNE	A11, P2-7	J
14	AMPTD CAL	A20, P1-11	O
5	50MHz GND	A11, P2-8	J
15	GND		S
6	50MHz SWEEP	A11, P2-9	H
16	GND		S
7	NC		
17	LLOH	A23, P1-1, 2	F
8	HDIV	A11, P2-11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

P3

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HSWP	A12, P2-7	E
16	HSWP	A12, P2-7	E
2	IOB 15	A15, P2-30	C
17	IOB 14	A15, P2-12	C
3	IOB 13	A15, P2-29	C
18	IOB 12	A15, P2-11	C
4	IOB 11	A15, P2-28	C
19	IOB 10	A15, P2-10	C
5	IOB 9	A15, P2-27	C
20	IOB 8	A15, P2-9	C
6	IOB 7	A15, P2-26	C
21	IOB 6	A15, P2-8	C
7	IOB 5	A15, P2-25	C
22	IOB 4	A15, P2-7	C
8	IOB 3	A15, P2-24	C
23	IOB 2	A15, P2-6	C
9	IOB 1	A15, P2-23	C
24	IOB Ø	A15, P2-5	C
10	NC		
25	ADR 4	A15, P2-4	D
11	ADR 3	A15, P2-21	D
26	ADR 2	A15, P2-3	D
12	ADR 1	A15, P2-20	D
27	ADR Ø	A15, P2-2	D
13	LBIO	A15, P2-19	D
28	LBIO	A15, P2-19	D
14	GND		S
29	GND		S
15	+5V		S
30	+5V		S

J1

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



SERIAL PREFIX: 1828A DATE: APRIL, 1978

Figure 9-89. A22 Frequency Control, Block Diagram

SIGNAL	TO/FROM	FUNCTION BLOCK
HSWP	A12, P2-7	E
HSWP	A12, P2-7	E
IOB 15	A15,P2-30	C
IOB 14	A15,P2-12	C
IOB 13	A15,P2-29	C
IOB 12	A15,P2-11	C
IOB 11	A15,P2-28	C
IOB 10	A15,P2-10	C
IOB 9	A15,P2-27	C
IOB 8	A15,P2-9	C
IOB 7	A15,P2-26	C
IOB 6	A15,P2-8	C
IOB 5	A15,P2-25	C
IOB 4	A15,P2-7	C
IOB 3	A15,P2-24	C
IOB 2	A15,P2-6	C
IOB 1	A15,P2-23	C
IOB Ø	A15,P2-5	C
NC		
ADR 4	A15,P2-4	D
ADR 3	A15,P2-21	D
ADR 2	A15,P2-3	D
ADR 1	A15,P2-20	D
ADR Ø	A15,P2-2	D
LBIO	A15,P2-19	D
LBIO	A15,P2-19	D
GND		S
GND		S
+5V		S
+5V		S

J1

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

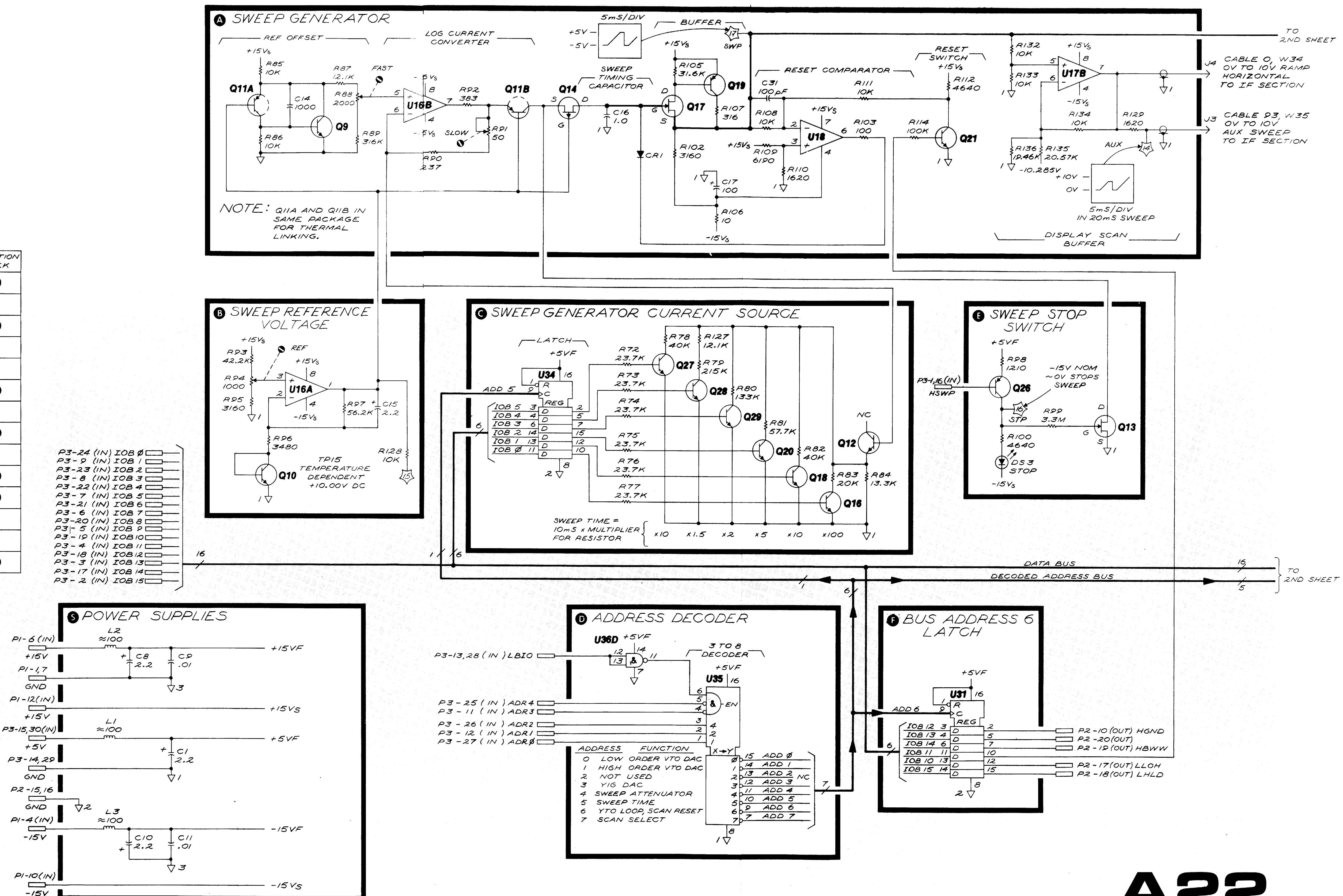
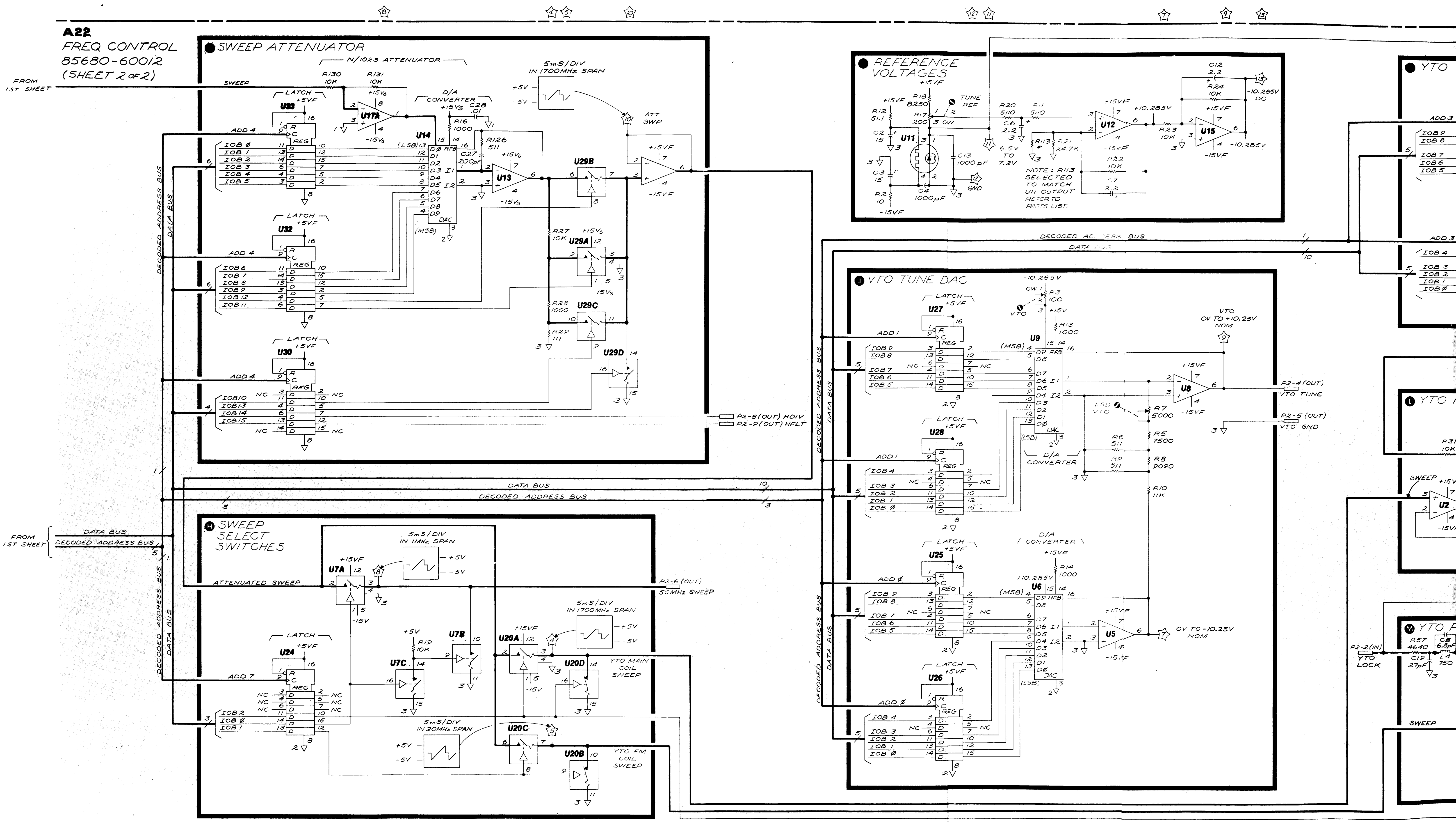
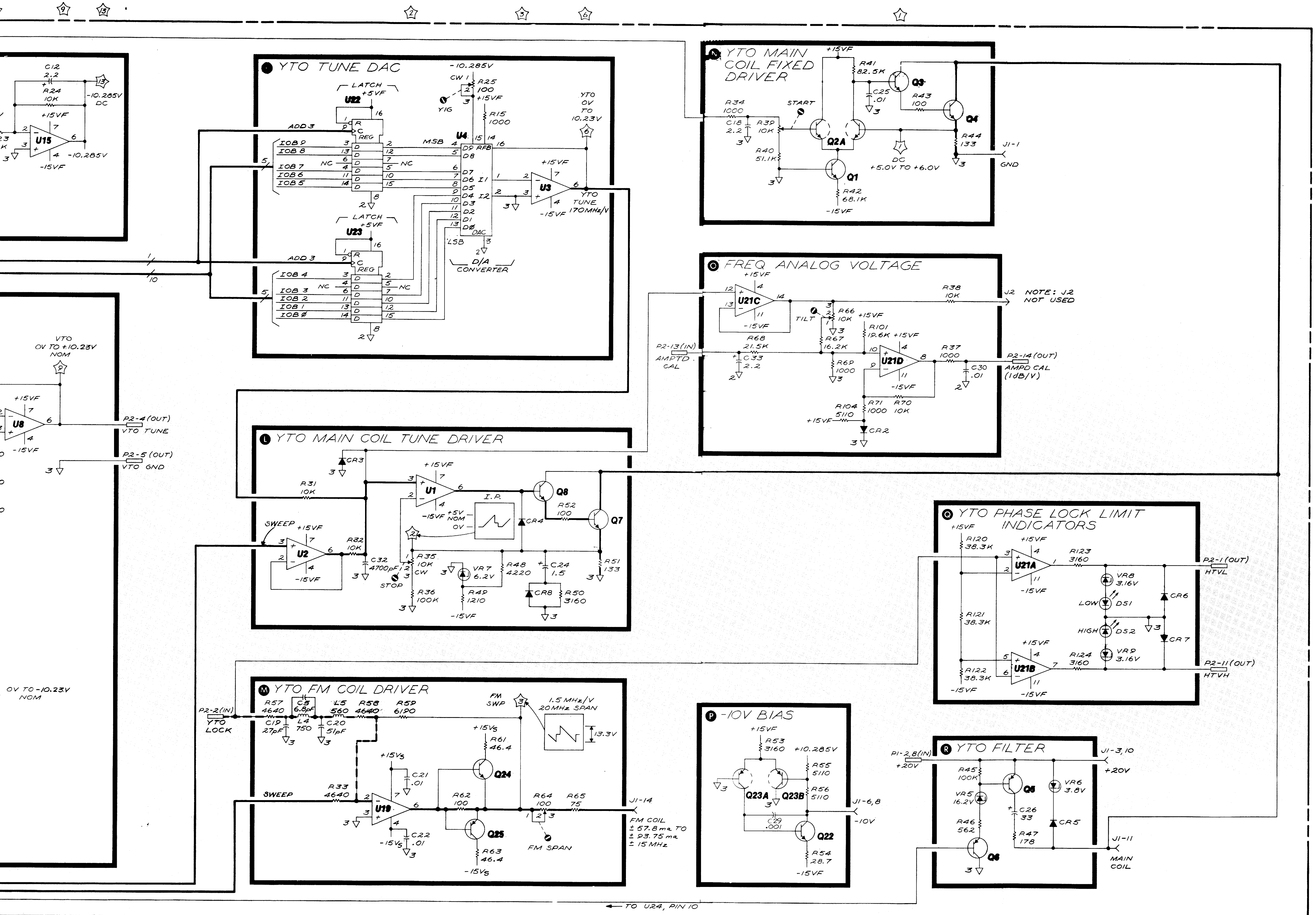


Figure 9-90. A22 Frequency Control, Schematic Diagram (1 of 2)

A22
FREQ CONTROL
85680-60012
(SHEET 2 OF 2)



SERIAL PREFIX: 1828A DATE: APRIL, 1978

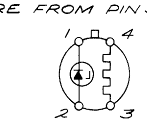


NOTES:

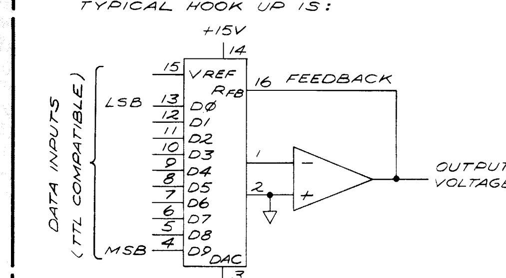
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. TEST VOLTAGES ASSUME INSTRUMENT PRESET (I.P.) CONDITION UNLESS NOTED.
4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
HTVL	HIGH = TUNE VOLTAGE LOW
HTVH	HIGH = TUNE VOLTAGE HIGH
LLOH	LOW INDICATES 2ND LO SHIFTED HIGH (1753.6MHz)
HDIV	HIGH = TURN ON ÷2 ON A11 50MHz VTO
LHLD	LOW = HOLD PHASE LOCK VOLTAGE ON A6 YTO PHASE LOCK
HFLT	HIGH = TURN ON FILTER ON A11, 50MHz VTO
HBWW	HIGH = WIDE YTO LOOP BW (100KHz) A6 YTO PHASE LOCK
HGND	HIGH = GROUND OUTPUT OF PHASE DET., A6 YTO PHASE LOCK
HSWP	HIGH = SWEEPING
IOBØ-15	INST. BUS DATA BITS Ø-15
ADRØ-4	INST. BUS ADDRESS BITS Ø-4
ADDØ-7	DECODED ADDRESS BUS BITS Ø-7
LBIO	LOW = BOTTOM BOX I/O STROBE

5. 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.
6. UNLESS OTHERWISE INDICATED, LOGIC LEVELS ARE TTL:
   2V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW
7. U11 IS A 6.95V REFERENCE WITH HEATER. HEATER DRAWS 200ma SURGE ON TURN ON. MUST HAVE 9V OR MORE FROM PIN 3 TO PIN 4.



8. U4, 6, 9, AND 14 ARE 10-BIT BINARY MULTIPLYING D/A CONVERTERS. TYPICAL HOOK UP IS:



9. U36A, B, C ARE NOT USED; INPUT PINS MAY BE TIED TOGETHER

A22

Figure 9-90. A22 Frequency Control, Schematic Diagram (2 of 2)

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 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 unwanted mixing products. This filter is also formed by printed circuit board traces. The output from the filter is the first IF out.

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, R3, C4, C5, and two printed circuit board transmission lines. R5 through R7 form a 15-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 or 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 Ampl r, 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. VR1 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.

Table 9-37. A23 RF Converter, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23	85680-60054	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
A23AT1	5086-7284	1	LIMITER 0-1.8 GHZ	28480	5086-7284
A23A1	5086-7246	1	YIG OSCILLATOR, 2-4 GHZ	28480	5086-7246
A23A1	5086-7260	1	YIG OSCILLATOR, 2-4 GHZ (ORDER 5086-7246)	28480	5086-7260
A23A1	5086-6246	1	YIG OSCILLATOR,2-4GHZ,RESTORED 5086-7246	28480	5086-6246
A23A2	85680-60060	1	FIRST CONVERTER	28480	85680-60060
A23A2J1	1250-1020	3	CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A2J2	1250-1020		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A2J3	1250-1020		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A2R1	0698-7216	2	RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A23A2R2	0698-7202	1	RESISTOR 38.3 1% .05W F TC=0+-100	24546	C3-1/8-T00-38R3-G
A23A2R3	0698-7216		RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A23A2U1	08558-20095	1	DIODE ASSEMBLY	28480	08558-20095
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	4	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A23A3C2	0160-2437		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A23A3C3	0160-2437		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A23A3C4	0160-2437		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A23A3C5	0160-3036	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A23A3C6	0160-2436	2	CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
A23A3C7	0140-0075	1	CAPACITOR-FDTHRU 22PF 10% 500V MICA	72982	666-053-01A0-220K
A23A3C8	0160-2436		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
A23A3C9	0160-3875	1	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A23A3C10	0160-3873	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A23A3C11	0160-4237	1	CAPACITOR-FDTHRU 6.2PF 10% 250V MICA	72982	2930-000-6.2PF+-10
A23A3CR1	1901-0633	2	DIODE-SCHOTTKY	28480	1901-0633
A23A3CR2	1901-0633		DIODE-SCHOTTKY	28480	1901-0633
A23A3CR3	1901-0639	1	DIODE-PIN 110V	28480	5082-3080
A23A3J1	1250-1157	2	CONNECTOR-RF SMA FEM THD-HOLE 50-OHM	28480	1250-1157
A23A3J2	1250-1157		CONNECTOR-RF SMA FEM THD-HOLE 50-OHM	28480	1250-1157
A23A3J3	1250-0691	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0691
A23A3J4	1250-0691		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0691
A23A3J5	1250-1435	2	CONN;RF; 500 OHM; SMC	28480	1250-1435
A23A3J6	1250-1435		CONN;RF; 500 OHM; SMC	28480	1250-1435
A23A3L1	9100-2255	2	COIL-MLD 470NH 10% Q=35 .095DX.25LG-NOM	28480	9100-2255
A23A3L2	85680-80010	1	INDUCTOR, MATCH	28480	85680-80010
A23A3L3	9100-2255		COIL-MLD 470NH 10% Q=35 .095DX.25LG-NOM	28480	9100-2255
A23A3L4	85680-80012	1	INDUCTOR, PILOT	28480	85680-80012
A23A3L5	85680-80011	1	INDUCTOR, LP	28480	85680-80011
A23A3R1	0698-8818	2	RESISTOR 3.16 1% .125W F TC=0± 100	28480	0698-8818
A23A3R2	0698-8818		RESISTOR 3.16 1%.125W F TC=0± 100	28480	0698-8818
A23A3A1	85680-60004	1	BOARD ASSEMBLY, PILOT SECOND LO BUFFER	28480	85680-60004
A23A3A1C1	0160-3879	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A3A1C2	0180-1719	2	CAPACITOR-FXD 22UF +-10% 25VCD TA	28480	0180-1719
A23A3A1C3	0160-0562	2	CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-0562
A23A3A1CR1	1901-0040	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23A3A1Q1	1854-0769	2	TRANSISTOR NPN SI	28480	35821E
A23A3A1R1	0698-3437	2	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A23A3A1R2	0698-7192	2	RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-T00-14R7-G
A23A3A1VR1	1902-3182	2	DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	28480	1902-3182
A23A3A2	85680-60029	1	BOARD ASSEMBLY, SECOND LO	28480	85680-60029
A23A3A2Q1	5086-4218	1	TC21 IN TO-72 PKG	28480	5086-4218
A23A3A2R1	0683-2215	1	RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A23A3A2R2	0698-3377	1	RESISTOR 47 5% .125W CC TC=-270/+540	01121	BB4705
A23A3A3	85680-60003	1	BOARD ASSEMBLY, SECOND LO BUFFER	28480	85680-60003
A23A3A3C1	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A3A3C2	0180-1719		CAPACITOR-FXD 22UF +-10% 25VCD TA	28480	0180-1719
A23A3A3C3	0160-0562		CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-0562

Table 9-37. A23 RF Converter, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23A3A3CR1	1901-0040 1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23A3A3Q1	1854-0769 0		TRANSISTOR NPN SI	28480	35821E
A23A3A3R1	0698-3437 2		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A23A3A3R2	0698-7192 4		RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-T00-14R7-G
A23A3A3VR1	1902-3182 0		DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	28480	1902-3182
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
A23A4A1J1	1250-1020 8	4	CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A4A1J2	1250-1020 8		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A4A1J3	1250-1020 8		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A4A1J4	1250-1020 8		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A4A1R1	0698-7212 9	3	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A23A4A1R2	0698-7212 9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A23A4A1R3	0698-7212 9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A23A4A1R4	0698-7221 0	1	RESISTOR 237 1% .05W F TC=0+-100	24546	C3-1/8-T0-237R-G
A23A4A1R5	0698-7216 3	2	RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A23A4A1R6	0698-7202 7	1	RESISTOR 38.3 1% .05W F TC=0+-100	24546	C3-1/8-T00-38R3-G
A23A4A1R7	0698-7216 3		RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A23A4A2	85680-60032 0	1	BOARD ASSEMBLY, RF CONVERTER BIAS	28480	85680-60032
A23A4A2C1	0160-3879 7	3	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 DO-41	04713	1N5818
A23A4A2DS1	1990-0487 7	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	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
A23A4A2J2	1251-0600 0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23A4A2L1	9100-1623 8	1	COIL-MLD 27UH 5% Q=60 .155DX.375LG-NOM	28480	9100-1623
A23A4A2L2	9100-1788 6	1	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A23A4A2Q1	1853-0007 7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A23A4A2Q2	1853-0007 7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A23A4A2R1			NOT ASSIGNED		
A23A4A2R2	0757-0405 4	2	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-T0-1003-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	2100-1775 4	1	RESISTOR-TRMR 5K 5% WW TOP-ADJ 1-TRN	28480	2100-1775
A23A4A2R7	0757-0405 4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-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
A23A4A2VR1	1902-3104 6	1	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	28480	1902-3104
A23A4A3	5086-7244 5	2	AMPLIFIER, 2 TO 4 GHZ	28480	5086-7244
A23A4A4	5086-7244 5		AMPLIFIER, 2 TO 4 GHZ	28480	5086-7244
A23A5	85680-60061	1	PILOT FIRST CONVERTER	28480	85680-60061
A23A5J1	1250-1020	3	CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	0278H	08M 211
A23A5J2	1250-1020		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	0278H	08M 211
A23A5J3	1250-1020		CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	0278H	08M 211
A23A5R1	0698-7189	1	RESISTOR 11 1% .05W F TC=0+-100	03298	C3-1/8-T00-11R0-G
A23A5R2	0698-7228	2	RESISTOR 464 1% .05W F TC=0+-100	03298	C3-1/8-T0-464R-G
A23A5R3	0698-7228		RESISTOR 464 1% .05W F TC=0+-100	03298	C3-1/8-T0-464R-G
A23A5U1	08558-20095	1	DIODE ASSEMBLY	28480	08558-20095

Table 9-37. A23 RF Converter, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23A6	85680-60006	1	BOARD ASSEMBLY, COMB GENERATOR	28480	85680-60006
A23A6C1	0160-2206	1	CAPACITOR-FXD 160PF +-5% 300VDC MICA	28480	0160-2206
A23A6C2	0160-0945	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A23A6C3	0160-0573	1	CAPACITOR-FXD 4700PF +-20% 100VDC CER	28480	0160-0573
A23A6C4	0160-0571	1	CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A23A6C5	0160-3875	1	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A23A6C6	0160-3879	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23A6C7	0121-0507	1	CAPACITOR-V TRMR-PSTN .6-1.8PF 750V	28480	0121-0507
A23A6C8	0160-3036	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A23A6CR1	1901-0189	1	DIODE-STEP RCVY 20V 300PS DO-7	28480	1901-0189
A23A6J1	1250-1220	1	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A23A6J2	1250-1020	1	CONNECTOR-RF SMA FEM SGL-HOLE-RR 50-OHM	28480	1250-1020
A23A6L1	9100-2258	1	COIL-MLD 1.2UH 10% Q=32 .095DX.25LG-NOM	28480	9100-2258
A23A6L2	85680-80002	1	INDUCTOR, LEVEL ADJUST	28480	85680-80002
A23A6L3	85680-80003	1	INDUCTOR, COMB DRIVE	28480	85680-80003
A23A6L4	9140-0179	1	COIL-MLD 22UH 10% Q=75 .155DX.375LG-NOM	28480	9140-0179
A23A6R1	0698-7196	1	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A23A6R2	0698-7203	1	RESISTOR 42.2 1% .05W F TC=0+-100	24546	C3-1/8-T00-42R2-G
A23A6R3	0698-7208	1	RESISTOR 68.1 1% .05W F TC=0+-100	24546	C3-1/8-T00-68R1-G
A23A6R4	0698-7212	1	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A23A6R5	0698-7209	2	RESISTOR 75 1% .05W F TC=0+-100	24546	C3-1/8-T00-75R0-G
A23A6R6	0698-7214	1	RESISTOR 121 1% .05W F TC=0+-100	24546	C3-1/8-T0-121R-G
A23A6R7	0698-7209		RESISTOR 75 1% .05W F TC=0+-100	24546	C3-1/8-T00-75R0-G

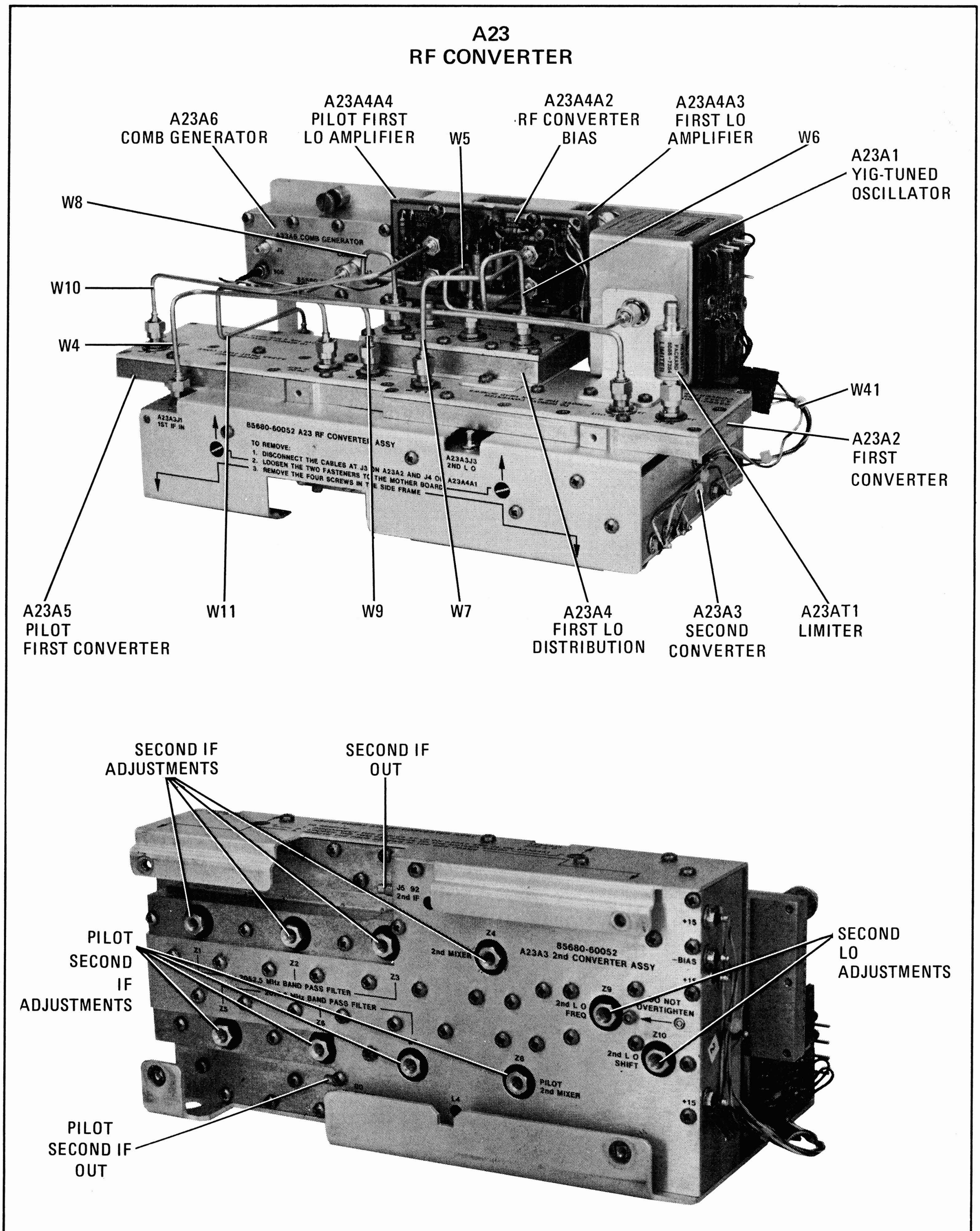


Figure 9-91. A23 RF Converter, Assembly and Component Locations

A23A2/A23A5
FIRST CONVERTER/PILOT FIRST CONVERTER

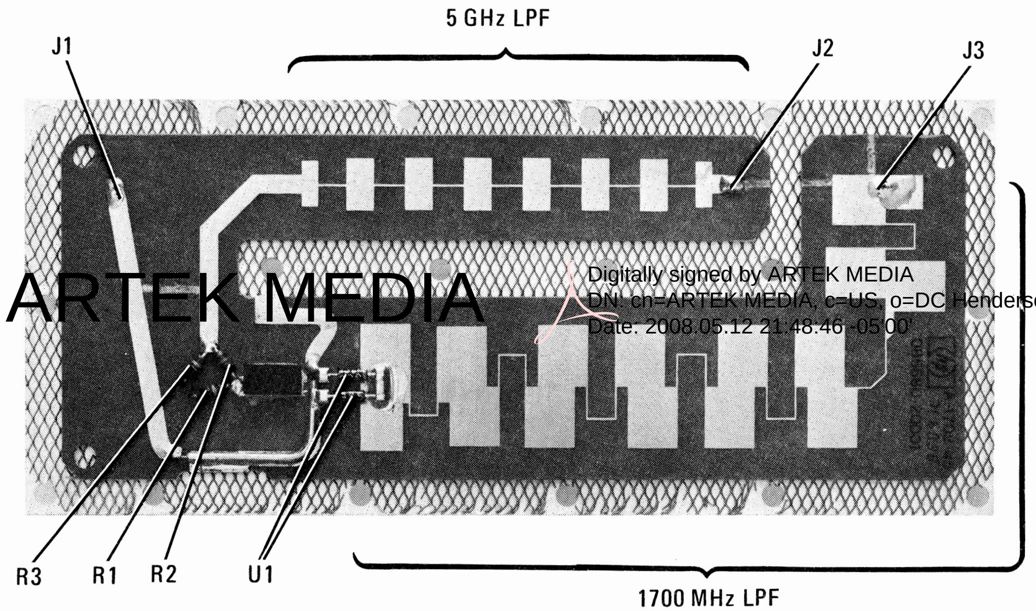


Figure 9-92. A23A2 First Converter and A23A5 Pilot First Converter, Component Loc... s

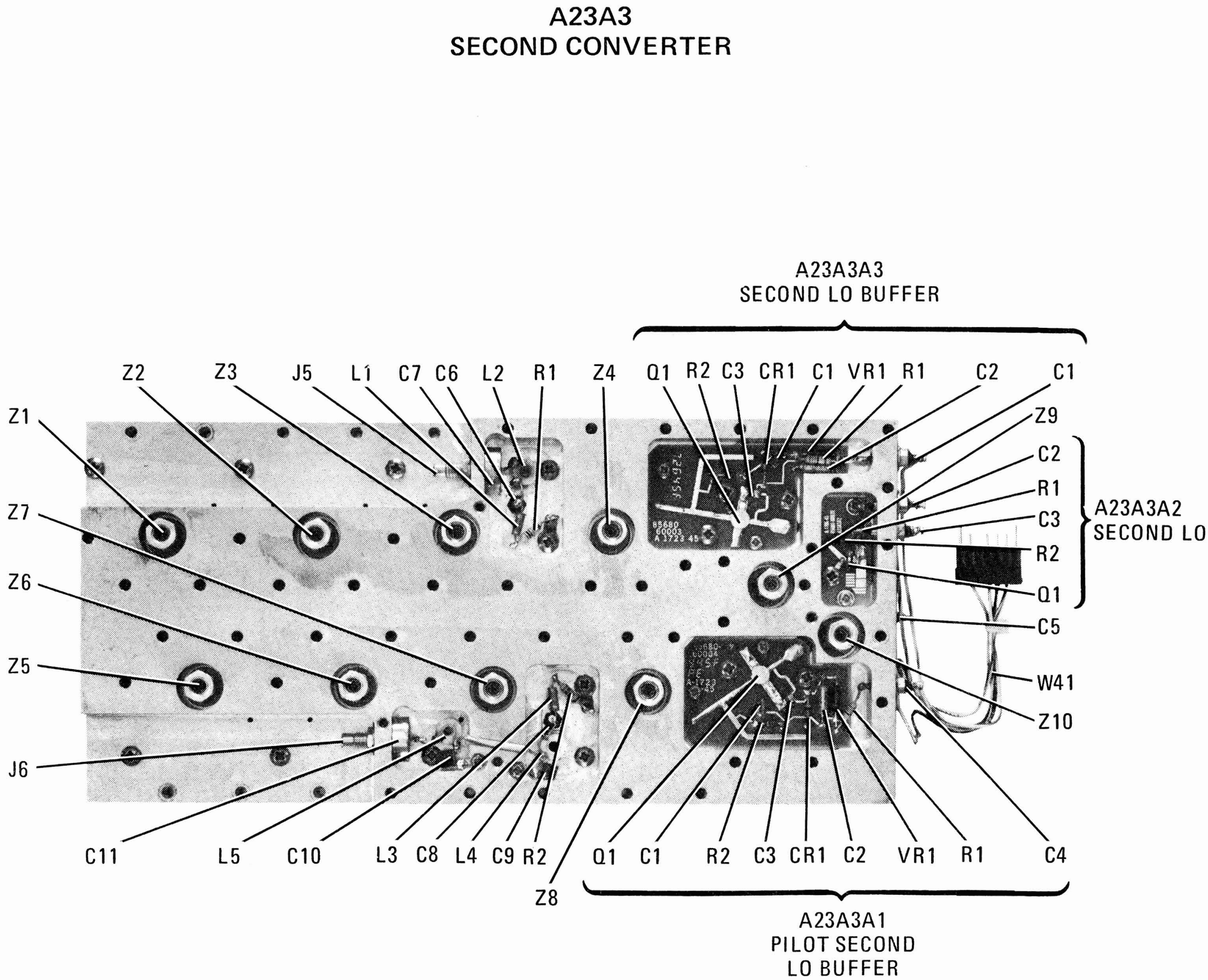


Figure 9-93. A23A3 Second Converter, Assembly and Component Locations

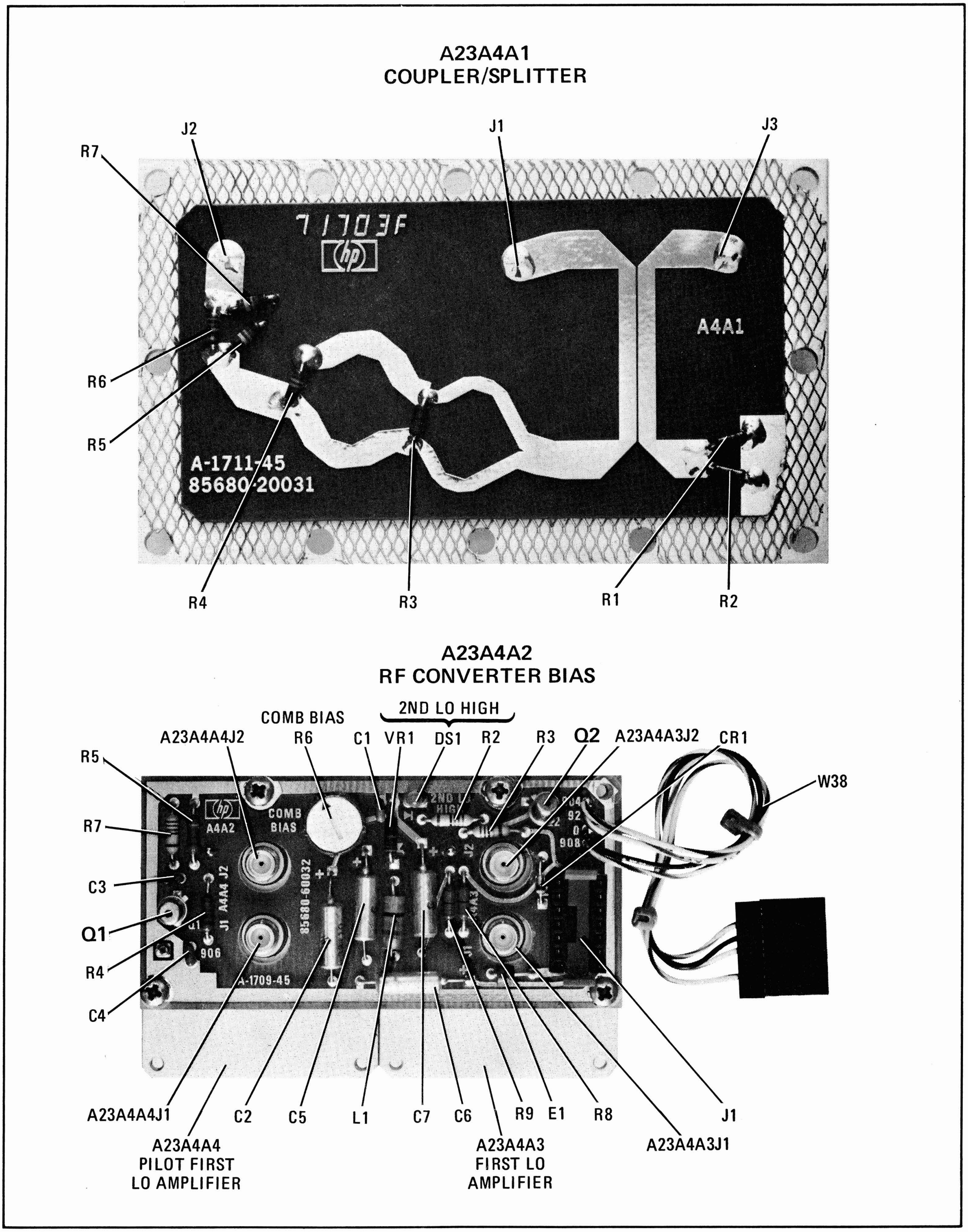


Figure 9-94. A23A4 First LO Distribution, Assembly and Component Locations

A23A6
COMB GENERATOR

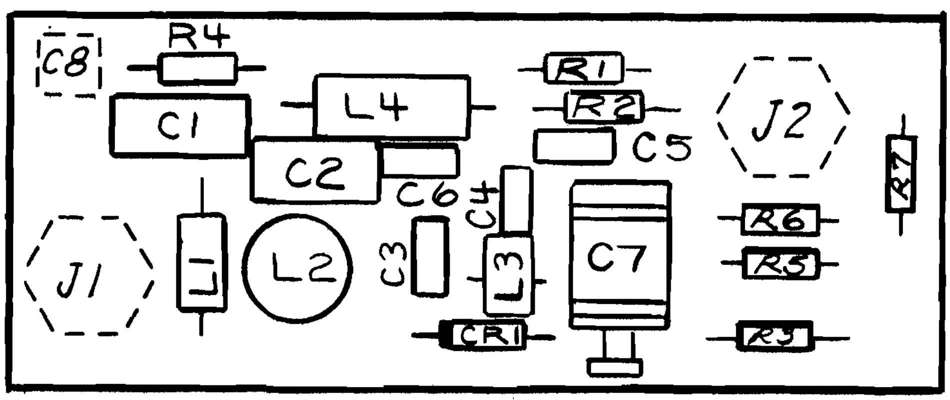
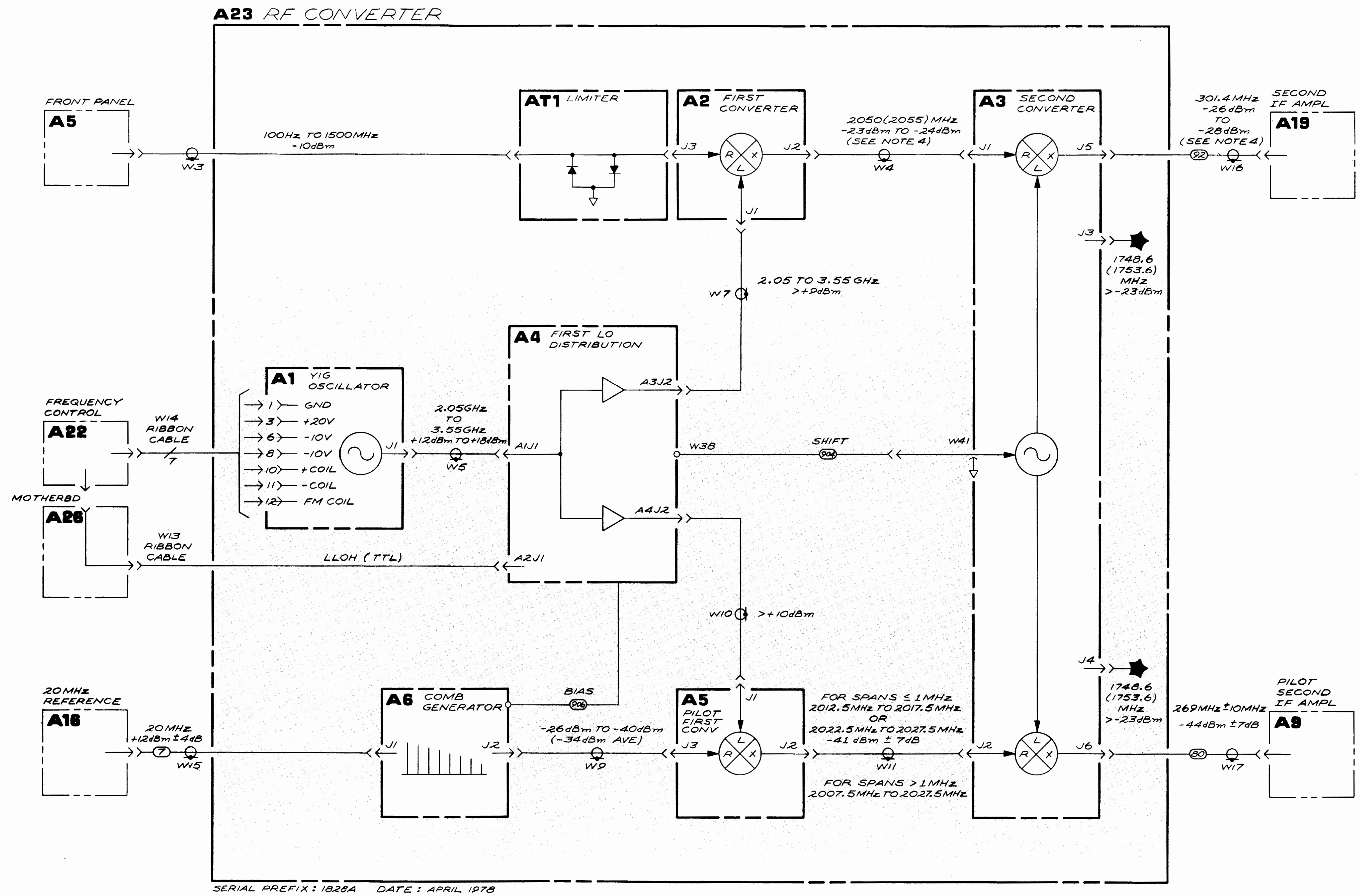
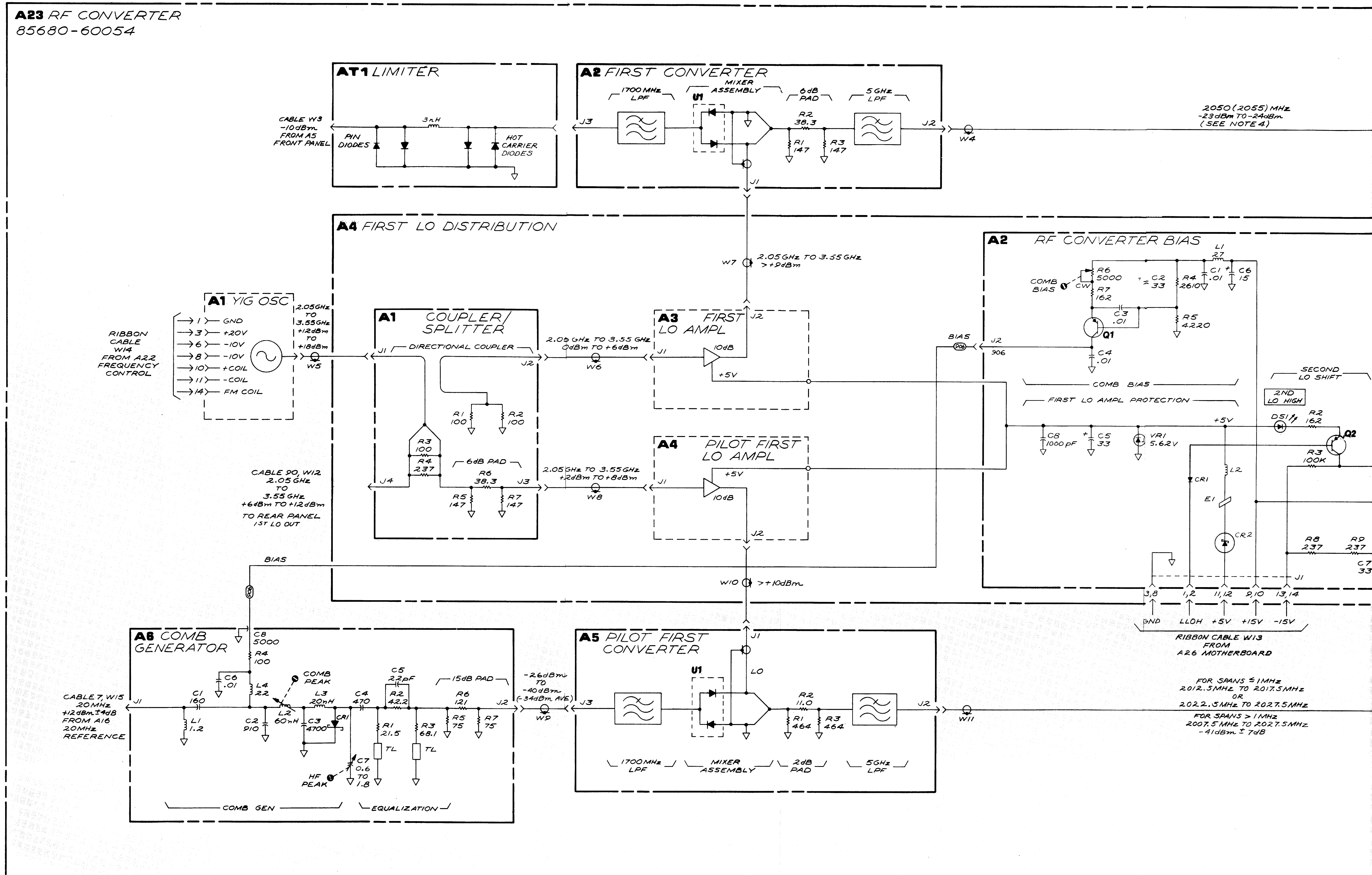


Figure 9-95. A23A6 Comb Generator, Component Locations

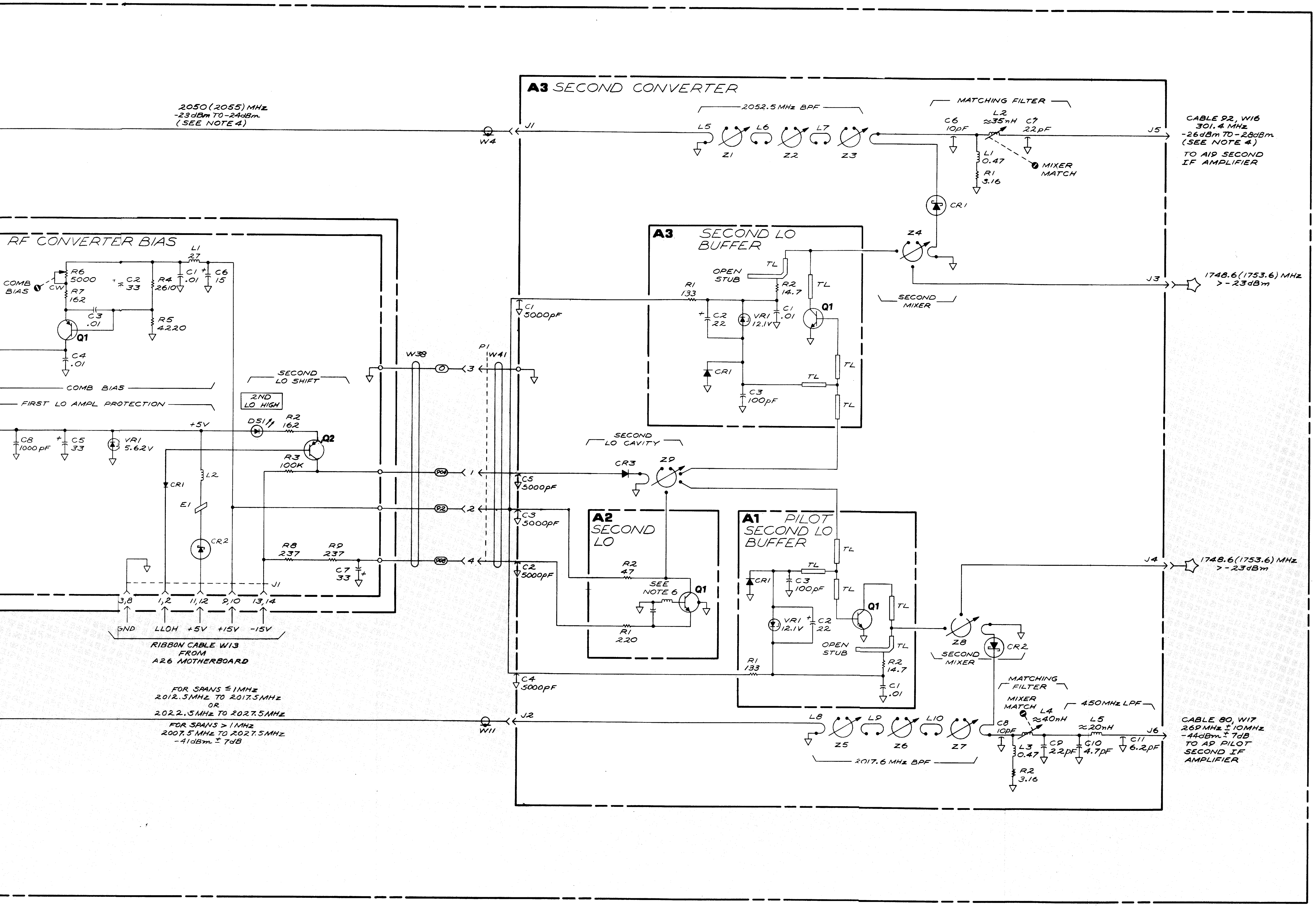


A23

Figure 9-96. A23 RF Converter, Block Diagram



SERIAL PREFIX: 1828A DATE: APRIL 1978



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. TRANSMISSION LINES ARE SHOWN AS INDICATED BELOW:
   TL
4. SIGNAL LEVELS ARE MEASURED WITH -10dBm SIGNAL APPLIED TO A2J3.
5. MNEMONICS:
   LLOH = LOW PLACES SECOND LO IN HIGH FREQUENCY STATE
6. L&C PART OF PC BOARD

A23

Figure 9-97. A23 RF Converter, Schematic Diagram

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 A14 Memory and A15 Processor. (Figure 9-102 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 9-102). 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 Ⓔ

The Power Up circuit is designed to provide the HPUP signal to A15 Processor and A14 Memory 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 Ⓑ

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 9-38. A24 Voltage Regulator, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24	85680-60024	1	BOARD ASSEMBLY, VOLTAGE REGULATOR	28480	85680-60024
A24C1	0180-0197	7	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C2	0160-0154	1	CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	28480	0160-0154
A24C3	0180-0373	3	CAPACITOR-FXD .68UF+-10% 35VDC TA	56289	150D684X9035A2
A24C4	0180-0116	2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A24C5	0180-2214	1	CAPACITOR-FXD 90UF+75-10% 16VDC AL	56289	30D906G016CC2
A24C6	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C7	0160-0159	2	CAPACITOR-FXD 6800PF +-10% 200VDC POLYE	28480	0160-0159
A24C8	0180-1846	2	CAPACITOR-FXD 2.2UF+-10% 35VDC TA	56289	150D225X9035B2
A24C9	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C10	0160-2055	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C11	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C13	0180-0116		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A24C14	0160-0159		CAPACITOR-FXD 6800PF +-10% 200VDC POLYE	28480	0160-0159
A24C15	0180-1846		CAPACITOR-FXD 2.2UF+-10% 35VDC TA	56289	150D225X9035B2
A24C16	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C17	0160-0157	2	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A24C18	0180-0373		CAPACITOR-FXD .68UF+-10% 35VDC TA	56289	150D684X9035A2
A24C19	0160-0157		CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A24C20	0180-0373		CAPACITOR-FXD .68UF+-10% 35VDC TA	56289	150D684X9035A2
A24C21	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C22	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A24C23	0160-4084	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A24CR1	1901-0028	11	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR2	1901-0040	12	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR4	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR5	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR6	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR7	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR8	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR10			NOT ASSIGNED		
A24CR11			NOT ASSIGNED		
A24CR12			NOT ASSIGNED		
A24CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR17	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR18	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR19	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR20	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR21	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR22	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR23			NOT ASSIGNED		
A24CR24	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A24CR25	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR26	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24CR27	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A24DS1	1990-0486	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A24DS2	1990-0487	5	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A24DS3	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A24DS4	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A24DS5	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A24DS6	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A24E1-A24E15	4330-0145	15	INSULATOR-BEAD GLASS	28480	4330-0145
A24Q1	1853-0281	7	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q2	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q3	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q4	1854-0477	10	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q5	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q6	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q7	1853-0457	1	TRANSISTOR PNP SI PD=350MW FT=100MHZ	01295	A5T5400
A24Q8	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q9	1884-0239	5	THYRISTOR-SCR TO-8 VRRM=200	0192B	824008
A24Q10	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A

Table 9-38. A24 Voltage Regulator, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24Q11	1884-0239		THYRISTOR-SCR TO-8 VRRM=200	01928	S2400B
A24Q12	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q13	1884-0239		THYRISTOR-SCR TO-8 VRRM=200	01928	S2400B
A24Q14	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q15	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q16	1884-0239		THYRISTOR-SCR TO-8 VRRM=200	01928	S2400B
A24Q17	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q18	1884-0239		THYRISTOR-SCR TO-8 VRRM=200	01928	S2400B
A24Q19	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q20	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q21	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q22	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q23	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24R1	0757-0442	14	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R3	0698-4405	1	RESISTOR 107 1% .125W F TC=0+-100	24546	C4-1/8-T0-107R-F
A24R4	0757-0438	10	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R5	0698-3150	3	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A24R6	0757-0199	4	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R7	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R8	0698-6362	6	RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R10	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R12	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R13	0757-0401	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R14	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R15- A24R19			NOT ASSIGNED		
A24R20	0698-3440	3	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A24R21	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R22	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R23	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R24	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R25	0757-0346	6	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R26	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R27	0698-6362		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R29	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R30	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R31	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A24R32	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A24R33	0698-3260	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A24R34	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A24R35	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R36- A24R49			NOT ASSIGNED		
A24R50	0698-6362		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R52	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A24R53	0757-0428	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1621-F
A24R54	0757-0395	2	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-TO-56R2-F
A24R55	0757-0395		RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A24R56	0757-0280	7	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R57	0757-0458	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A24R58	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A24R59	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A24R60	2100-1973	1	RESISTOR-TRMR 200 10% WW TOP-ADJ 20-TRN	02660	3810P-201
A24R61	0698-5556	1	RESISTOR 3.3K 1% .125W F TC=0+-25	28480	0698-5556
A24R62	0757-0278	2	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A24R63	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R64	0757-0278		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A24R65	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R66	0698-3444	7	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R67- A24R69			NOT ASSIGNED		
A24R70	0698-6362		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R71	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R72	0757-0399	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A24R73	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A24R74	0757-0294		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A24R75	0757-0398	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A24R76	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R77	0698-6322	1	RESISTOR 4K .1% .125W F TC=0+-25	28480	0698-6322

Table 9-38. A24 Voltage Regulator, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24R78	0698-6348	2	RESISTOR 3K .1% .125W F TC=0+-25	28480	0698-6348
A24R79	0757-0428	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A24R80	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R81	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R82- A24R89			NOT ASSIGNED		
A24R90	0757-0400	2	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A24R91	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A24R92			NOT ASSIGNED		
A24R93	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R94	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R95			NOT ASSIGNED		
A24R96	0698-8827	1	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A24R97			NOT ASSIGNED		
A24R98	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R99	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R100	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R101	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A24R102- A24R109			NOT ASSIGNED		
A24R110	0698-6362		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R111	0698-6348		RESISTOR 3K .1% .125W F TC=0+-25	28480	0698-6348
A24R112	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R113	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A24R114	0757-0294		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A24R115	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A24R116	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R117	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A24R118	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R119	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R120	0698-5361	1	RESISTOR 2.822K .1% .1W F TC=0+-5	28480	0698-5361
A24R121	0698-6362		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A24R122	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A24R123	0698-3429	2	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A24R124	0698-3443	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A24R125	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R126	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R127	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R128	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R129			NOT ASSIGNED		
A24R130	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A24R131	0698-3429		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A24R132	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A24R133	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R134	0698-6320	1	RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A24R135	0698-8911	1	RESISTOR 1.3K .1% .125W F TC=0+-25	28480	0698-8911
A24R136	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24R137	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R138	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A24TP1- A24TP9	0360-0124	9	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A24U1	1826-0261	2	IC 741 OP AMP TO-99	28480	1826-0261
A24U2	1826-0371	5	IC OP AMP TO-99	27014	LF256H
A24U3	1826-0371		IC OP AMP TO-99	27014	LF256H
A24U4	1826-0371		IC OP AMP TO-99	27014	LF256H
A24U5	1826-0371		IC OP AMP TO-99	27014	LF256H
A24U6	1826-0371		IC OP AMP TO-99	27014	LF256H
A24U7	1826-0425	1	IC OP AMP TO-99	34371	HA2-2655-5
A24U8	1826-0261		IC 741 OP AMP TO-99	28480	1826-0261
A24VR1	1902-3082	5	DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A24VR2	1902-0556	2	DIODE-ZNR 20V 5% DO-15 PD=1W TC=+.073%	28480	1902-0556
A24VR3	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A24VR4	1902-3082		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A24VR5	1902-0686	1	DIODE-ZNR 1N825 6.2V 2% DO-7 PD=.4W	04713	1N825
A24VR6	1902-3256	1	DIODE-ZNR 23.7V 5% DO-7 PD=.4W TC=+.076%	28480	1902-3256
A24VR7	1902-0556		DIODE-ZNR 20V 5% DO-15 PD=1W TC=+.073%	28480	1902-0556
A24VR8	1902-0184	3	DIODE-ZNR 16.2V 5% DO-7 PD=.4W TC=+.066%	28480	1902-0184
A24VR9	1902-0184		DIODE-ZNR 16.2V 5% DO-7 PD=.4W TC=+.066%	28480	1902-0184
A24VR10	1902-3104	2	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	28480	1902-3104
A24VR11	1902-3104		DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	28480	1902-3104
A24VR12	1902-0184		DIODE-ZNR 16.2V 5% DO-7 PD=.4W TC=+.066%	28480	1902-0184
A24VR13	1902-3082		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A24VR14	1902-3082		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
A24VR15	1902-0064	1	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	28480	1902-0064
A24VR16	1902-3082		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	28480	1902-3082
			A24 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0750	1	EXTRACTOR-PC BOARD RED POLYC	28480	4040-0750
	4040-0752	1	EXTRACTOR-PC BOARD YEL POLYC	28480	4040-0752

Table 9-39. A24 Voltage Regulator, Component Locator Table (1 of 2)

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C1	DS6	C3	R9	C2	R91	B2
C2	C1			R10	C2	R93	B2
C3	B2	E1	C2	R11	C2	R94	B2
C4	B1	E2	C2	R12	C1	R96	B2
C5	B1	E3	C2	R20	C4	R98	B2
C6	C1	E4	C3	R21	C4	R99	B2
C7	C2	E5	C3	R22	C4	R100	B2
C8	B3	E6	C3	R23	C4	R101	B2
C9	B1	E7	C3	R24	C4	R110	B1
C11	B2	E8	C3	R25	C4	R111	B1
C13	B2	E9	C3	R26	C4	R112	C1
C14	C1	E10	C3	R27	B4	R113	C1
C15	B3	E11	C3	R28	B4	R114	B3
C16	B2	E12	C3	R29	B4	R115	C3
C17	B3	E13	C4	R30	B4	R116	C3
C18	B3	E14	C4	R31	B4	R117	C3
C19	B3	E15	C4	R32	B4	R118	C3
C20	B3			R33	B4	R119	C3
C21	B2	Q1	C1	R34	B4	R120	B2
C22	B1	Q2	C1	R35	B4	R121	B2
		Q3	C1	R50	C1	R122	B2
CR1	B2	Q4	C1	R51	C1	R123	B3
CR2	C2	Q5	C1	R52	C1	R124	C3
CR3	C2	Q6	C1	R53	C1	R125	C3
CR4	C4	Q7	C2	R54	B2	R126	C3
CR5	C4	Q8	C2	R55	C3	R127	C3
CR6	C4	Q9	C2	R56	C3	R128	C3
CR7	C4	Q10	C3	R57	C1	R130	B3
CR8	C4	Q11	C3	R58	C1	R131	B3
CR9	C4	Q12	C3	R59	B1	R132	C3
CR13	C1	Q13	C3	R60	B1	R133	C3
CR14	C1	Q14	C3	R61	B1	R134	B2
CR15	C1	Q15	C3	R62	B1	R135	B2
CR16	C1	Q16	C3	R63	B1	R136	C3
CR17	C3	Q17	C4	R64	C3	R137	C3
CR18	C2	Q18	C4	R65	C3	R138	C3
CR19	B2	Q19	C4	R66	C3		
CR20	C4	Q20	C4	R70	C1	TP1	C1
CR21	B2	Q21	C4	R71	C1	TP2	C2
CR22	B2	Q22	B4	R72	C1	TP3	C2
CR24	C2	Q23	B4	R73	C2	TP4	C2
CR25	C3			R74	B3	TP5	C2
CR26	C3	R1	C2	R75	C4	TP6	C2
CR27	C3	R2	C2	R76	C3	TP7	C2
		R3	C2	R77	B1	TP8	C4
DS1	C2	R4	C2	R78	B1	TP9	C4
DS2	C3	R5	C2	R79	C3		
DS3	C3	R6	C2	R80	C3	U1	C2
DS4	C3	R7	C2	R81	C3	U2	B1
DS5	C3	R8	C2	R90	C2	U3	B1

Table 9-39. A24 Voltage Regulator, Component Locator Table (2 of 2)

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
U4	B1						
U5	B2						
U6	B2						
U7	B2						
U8	B4						
VR1	C4						
VR2	C1						
VR3	C1						
VR4	C1						
VR5	B1						
VR6	C3						
VR7	C2						
VR8	C3						
VR9	C3						
VR10	C3						
VR11	C3						
VR12	B2						
VR13	B2						
VR14	B4						
VR15	B2						
VR16	C2						

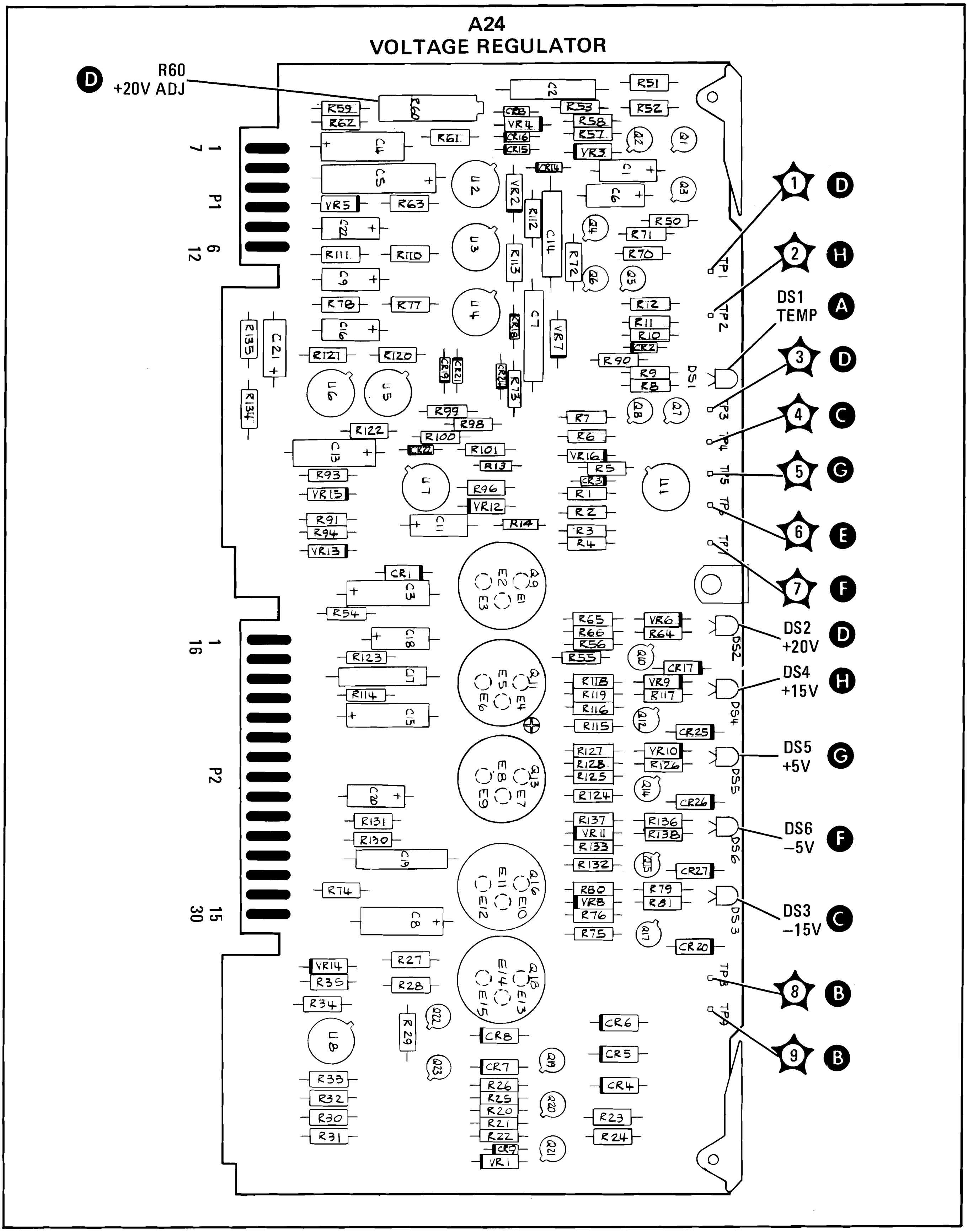


Figure 9-98. A24 Voltage Regulator, Component Locations

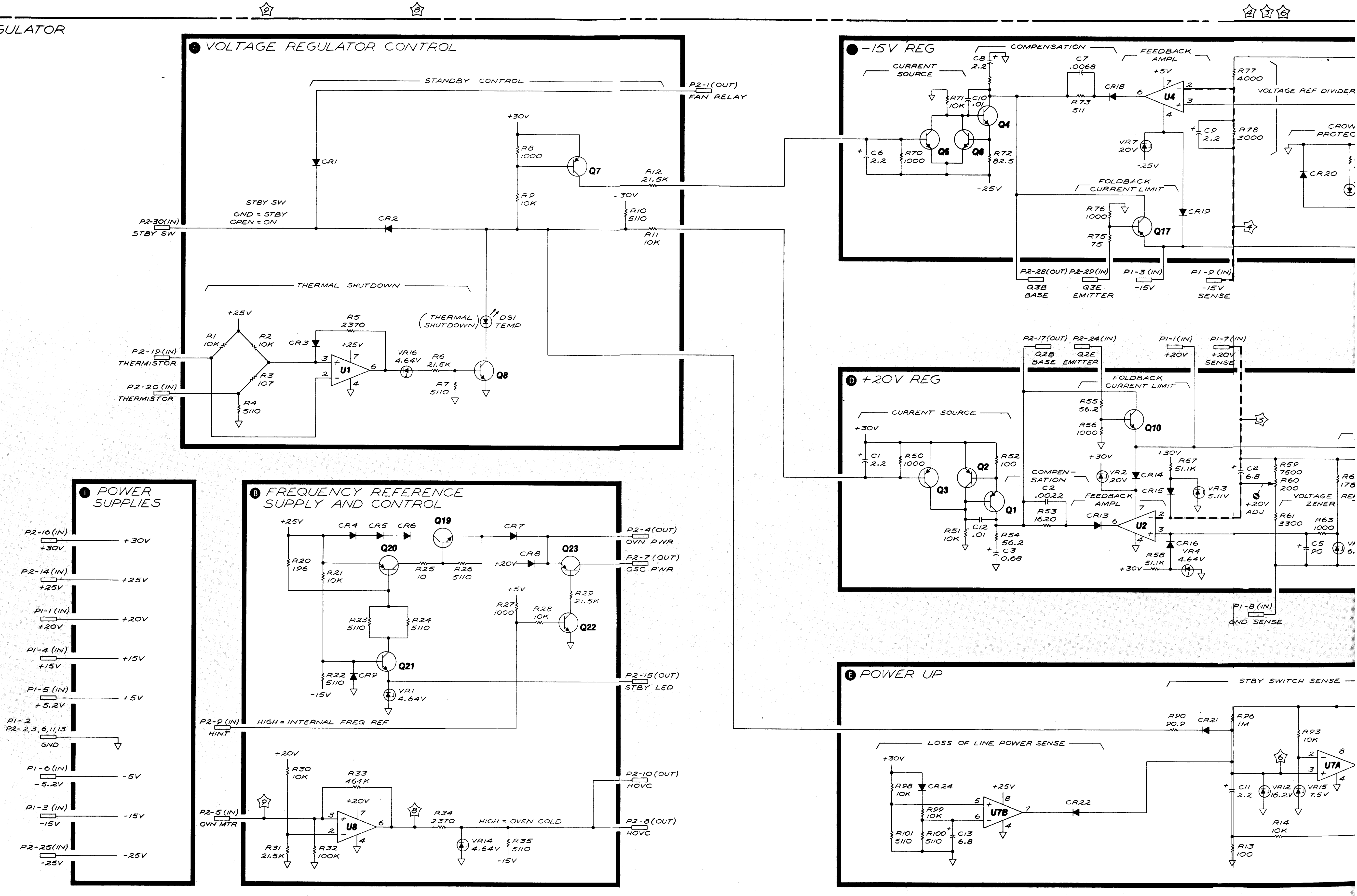
A24 VOLTAGE REGULATOR
85680-60024

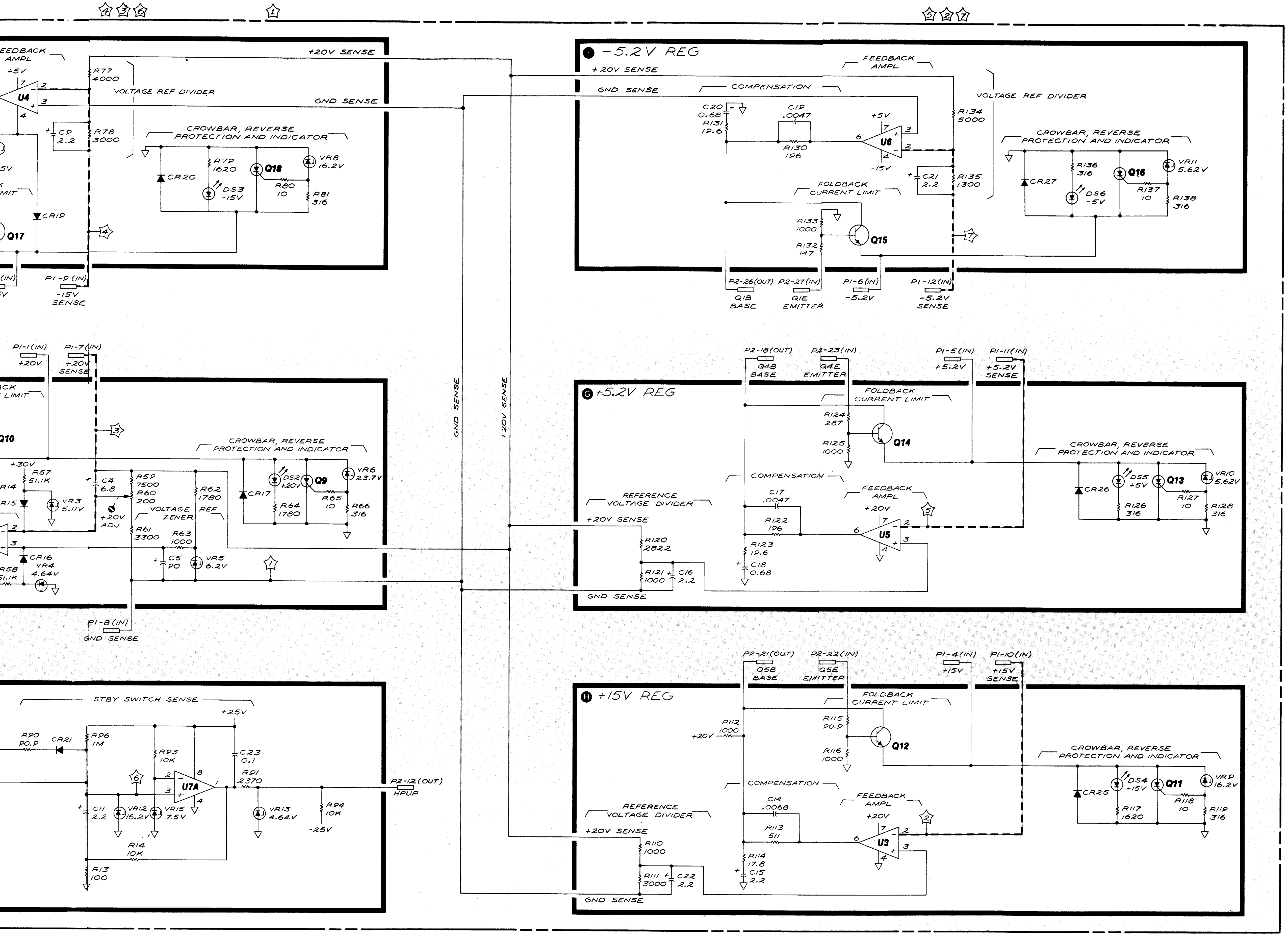
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+20V	A26	● 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		I
17	Q2B	A26, Q2	D
3	GND		I
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		I
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		I
26	Q1B	A26, Q1	F
12	HPUP	A15, P2-32	E
27	Q1E	A26, Q3	F
13	GND		I
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





NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω) CAPACITANCE IN MICROFARADS (μF)
3. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
HINT	EXT TIMEBASE 0V = EXT +5V = INT
HPUP	POWER UP +5V = POWER UP 0V = POWER DOWN
HOVC	OVEN COLD +5V = OVEN COLD 0V = OVEN ON

A24

Figure 9-99. A24 Voltage Regulator, Schematic

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 ±10V; CR5 through CR8, an unregulated ±25V; and CR9 and CR10, an unregulated +30V. These are regulated by A24 Voltage Regulator to +5V, —5.2V, +15V, —15V, and +20V. 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.

Table 9-40. A25 Rectifier, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A25	85680-60030	1	BOARD ASSEMBLY, RECTIFIER	28480	85680-60030
A25C1	0160-0970	3	CAPACITOR-FXD .47UF +-10% 80VDC POLYE	28480	0160-0970
A25C2	0160-2055	3	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A25C3	0160-0970		CAPACITOR-FXD .47UF +-10% 80VDC POLYE	28480	0160-0970
A25C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A25C5	0160-0970		CAPACITOR-FXD .47UF +-10% 80VDC POLYE	28480	0160-0970
A25C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A25C7	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A25CR1	1901-0662	10	DIODE-PWR RECT 100V 6A	04713	MR751
A25CR2	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR3	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR4	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR5	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR6	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR7	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR8	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR9	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25CR10	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A25DS1	1990-0486	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A25F1	2110-0003	1	FUSE 3A 250V FAST-BLO 1.25X.25 UL IEC	75915	312003
A25Q1	1884-0239	1	THYRISTOR-SCR TO-8 VRRM=200	01928	S2400B
A25R1	0698-0084	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A25R2	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A25VR1	1902-3323	1	DIODE-ZNR 42.2V 5% DO-7 PD=.4W TC=+.08%	28480	1902-3323
			A25 MISCELLANEOUS PARTS		
	4040-0750	1	EXTRACTOR-PC BOARD RED POLYC	28480	4040-0750
	4040-0753	1	EXTRACTOR-PC BOARD GRN POLYC	28480	4040-0753
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073

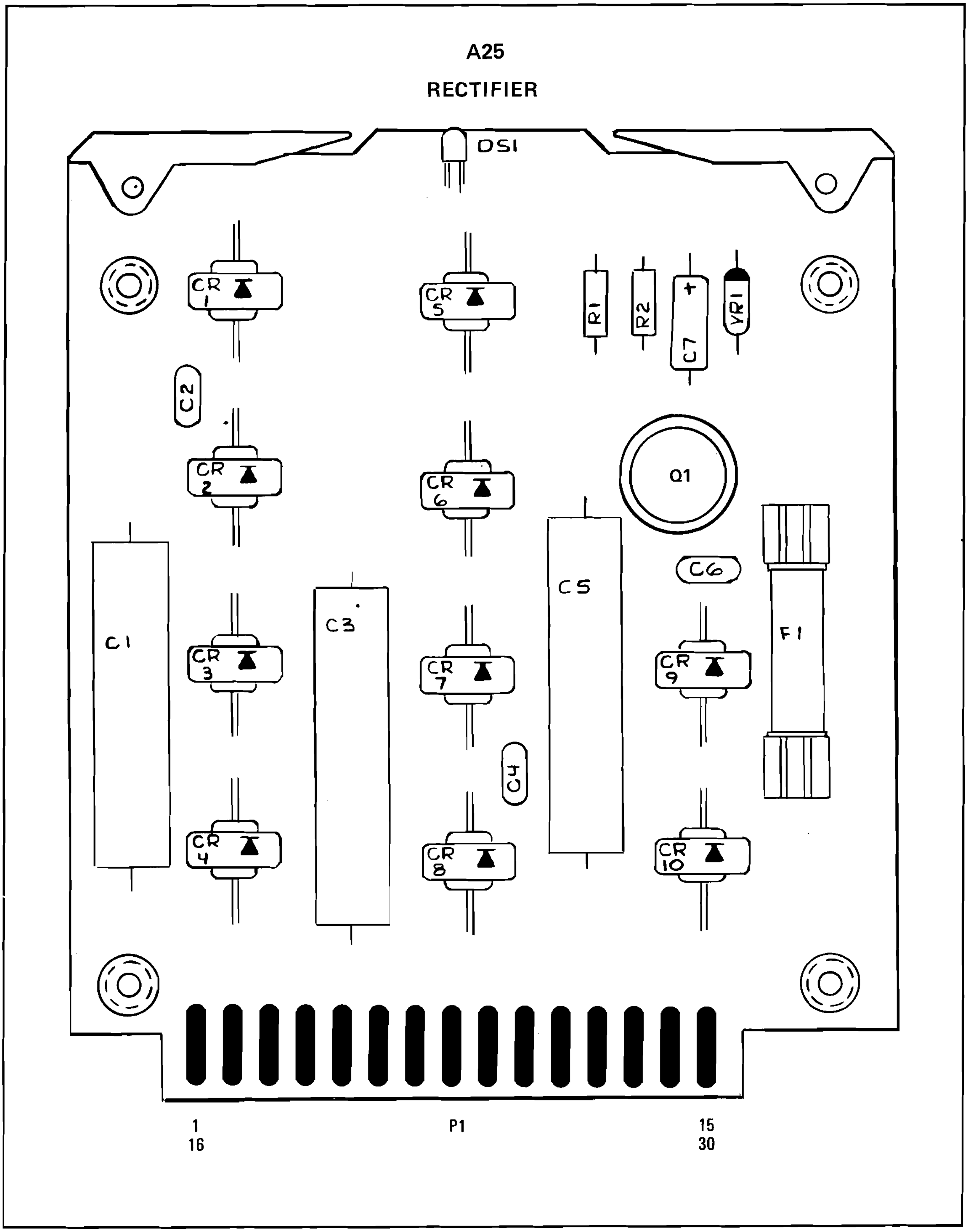


Figure 9-100. A25 Rectifier, Component Locations

Table 9-41. A26 Motherboard, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A26	85680-60027	1	BOARD ASSEMBLY, MOTHER BOARD	28480	85680-60027
A26C1- A26C47	0160-3456	47	CAPACITOR-FXD 1000PF ±10% 1KVDC CER	28480	0160-3456
A26C48	0180-0116	5	CAPACITOR-FXD 6.8UF ±10% 35VDC TA	0420J	150D685X9035B2
A26C49	0180-0116		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	0420J	150D685X9035B2
A26C50	0180-0116		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	0420J	150D685X9035B2
A26C51	0180-0116		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	0420J	150D685X9035B2
A26C52	0180-0116		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	0420J	150D685X9035B2
A26CR1	1901-0028	3	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A26CR2	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A26CR3	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A26F1	2110-0043	2	FUSE 1.5A 250V FAST-BLO 1.25X.25 UL IEC	0470C	31201.5
A26F2	2110-0003	2	FUSE 3A 250V FAST-BLO 1.25X.25 UL IEC	0470C	312003.
A26F3	2110-0043		FUSE 1.5A 250V FAST-BLO 1.25X.25 UL IEC	0470C	31201.5
A26F4	2110-0056	1	FUSE 6A 250V FAST-BLO 1.25X.25 UL IEC	0470C	312006.
A26F5	2110-0003		FUSE 3A 250V FAST-BLO 1.25X.25 UL IEC	0470C	312003.
A26L1- A26L28	9100-1788	28	COIL; FXD; NON-MOLDED RF CHOKE; .75UH	05674	VK200-20/48
A26Q1	1853-0351	2	TRANSISTOR PNP 2N6053 SI DARL TO-3	28480	1853-0351
A26Q2	1854-0611	3	TRANSISTOR NPN 2N6055 SI DARL TO-3	02037	2N6055
A26Q3	1853-0351		TRANSISTOR PNP 2N6053 SI DARL TO-3	28480	1853-0351
A26Q4	1854-0611		TRANSISTOR NPN 2N6055 SI DARL TO-3	02037	2N6055
A26Q5	1854-0611		TRANSISTOR NPN 2N6055 SI DARL TO-3	02037	2N6055
A26R1			NOT ASSIGNED		
A26R2			NOT ASSIGNED		
A26R3			NOT ASSIGNED		
A26R4	0811-3493	3	RESISTOR .47 10% 7W PW TC=0±800	28480	0811-3493
A26R5	0811-3493		RESISTOR .47 10% 7W PW TC=0±800	28480	0811-3493
A26R6	0811-3493		RESISTOR .47 10% 7W PW TC=0±800	28480	0811-3493
A26R7	0811-3494	4	RESISTOR 1.27 10% 7W PW TC=0±400	28480	0811-3494
A26R8	0811-3494		RESISTOR 1.27 10% 7W PW TC=0±400	28480	0811-3494
A26R9	0811-3494		RESISTOR 1.27 10% 7W PW TC=0±400	28480	0811-3494
A26R10	0811-3494		RESISTOR 1.27 10% 7W PW TC=0±400	28480	0811-3494
A26R11	0757-0438	5	RESISTOR 5.11K 1% .125W F TC=0±100	0329B	C4-1/8-T0-5111-F
A26R12	0757-0438		RESISTOR 5.11K 1% .125W F TC=0±100	0392B	C4-1/8-T0-5111-F
A26R13	0757-0438		RESISTOR 5.11K 1% .125W F TC=0±100	0329B	C4-1/8-T0-5111-F
A26R14	0757-0438		RESISTOR 5.11K 1% .125W F TC=0±100	0329B	C4-1/8-T0-5111-F
A26R15	0757-0438		RESISTOR 5.11K 1% .125W F TC=0±100	0329B	C4-1/8-T0-5111-F

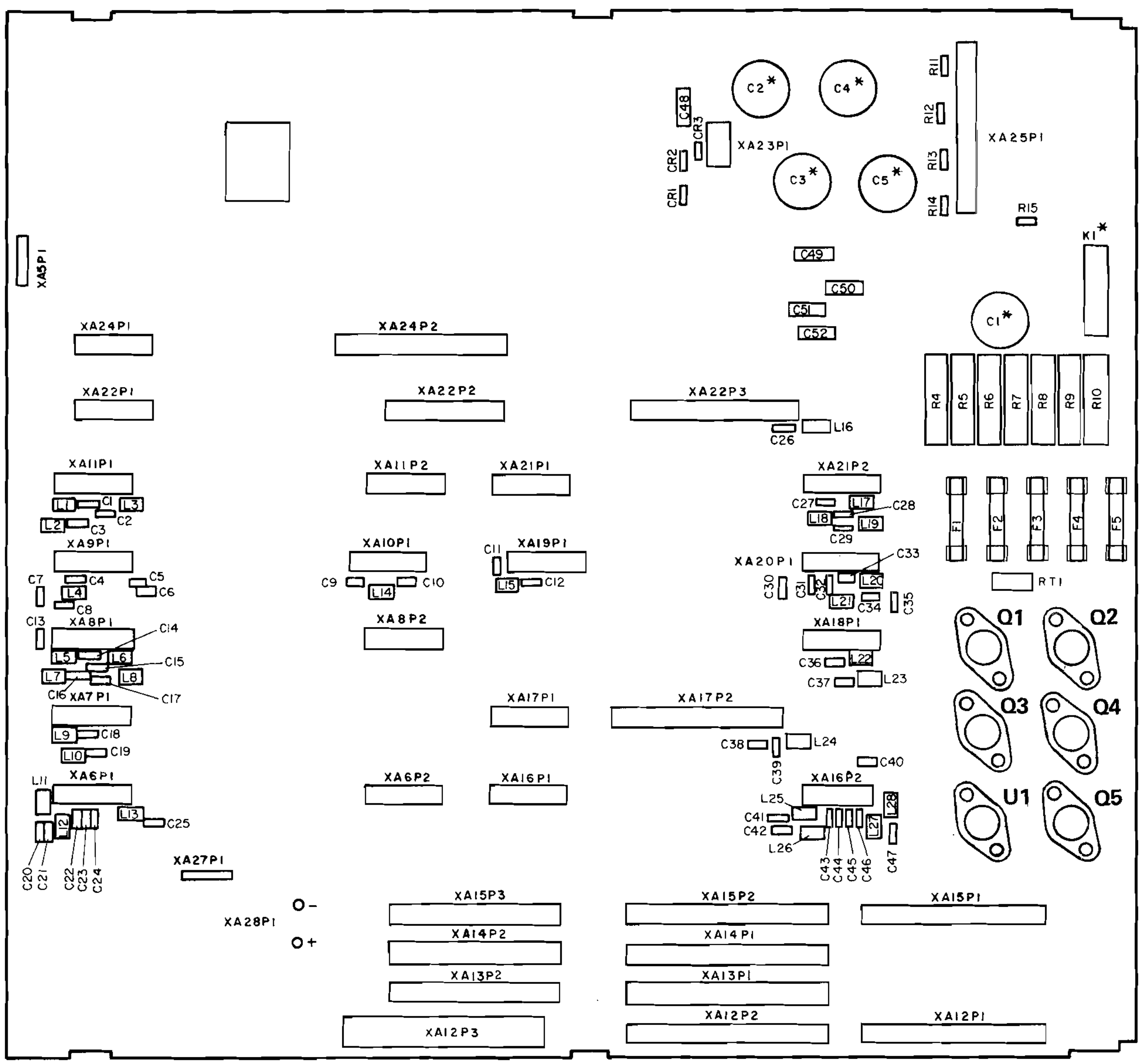
Table 9-41. A26 Motherboard, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A26RT1	0837-0126	1	THERMISTOR DISC 1K-OHM TC=4.4%/C-DEG	28480	0837-0126
A26U1	1826-0117	1	IC VOLTAGE REGULATOR	02237	7812KC
A26XA5P1	85680-60086	1	SOCKET ASSEMBLY: FRONT PANEL, PAIR	28480	85680-60086
A26XA6P1	1251-0472	19	CONNECTOR: PC EDGE 6-CONT/ROW 2-ROWS	0450G	252-06-30-300
A26XA6P2	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2-ROWS	0450G	252-06-30-300
A26XA7P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2-ROWS	0450G	252-06-30-300
A26XA8P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA8P2	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA9P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA10P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA11P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2ROWS	0450G	252-06-30-300
A26XA11P2	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA12P1	1251-4788	2	CONNECTOR: PC EDGE 25-CONT/ROW 2 ROWS	28480	1251-4788
A26XA12P2	1251-2026	4	CONNECTOR PC EDGE 18-CONT/ROW 2 ROWS	0450G	252-18-30-300
A26XA12P3			PART OF W43-NOT SEPARATELY REPLACEABLE		
A26XA13P1	1251-2026		CONNECTOR: PC EDGE 18-CONT/ROW 2 ROWS	0450G	252-18-30-300
A26XA13P2	1251-2035	8	CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA14P1	1251-2026		CONNECTOR: PC EDGE 18-CONT/ROW 2 ROWS	0450G	252-18-30-300
A26XA14P2	1251-2035		CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA15P1	1251-4788		CONNECTOR: PC EDGE 25-CONT/ROW 2 ROWS	28480	1251-4788
A26XA15P2	1251-2026		CONNECTOR:PC EDGE 18-CONT/ROW 2 ROWS	0450G	252-18-30-300
A26XA15P3	1251-2035		CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA16P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA16P2	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA17P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300

Table 9-41. A26 Motherboard, Replaceable Parts (3 of 3)

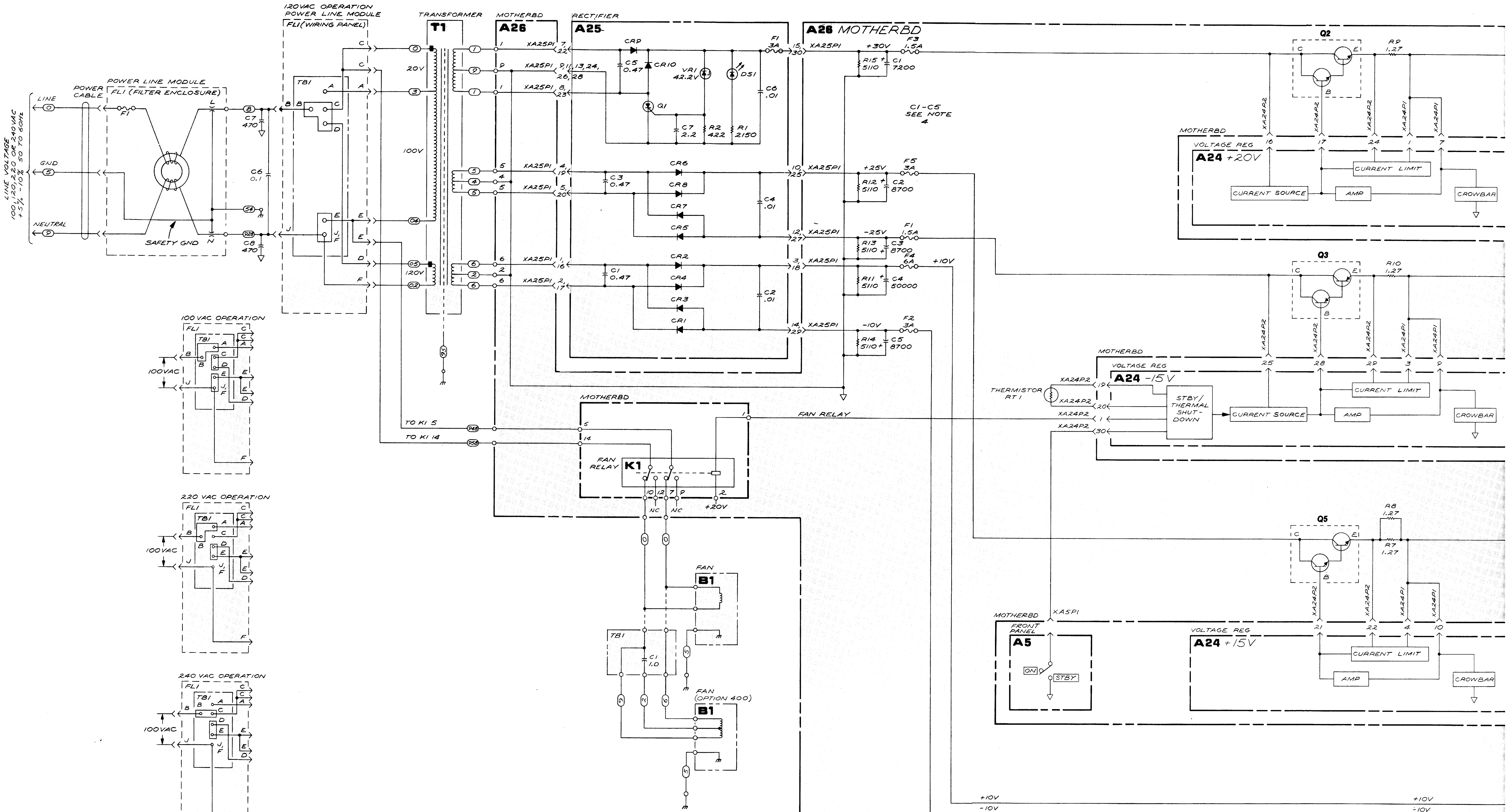
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A26XA17P2	1251-2035		CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA18P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA19P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA20P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA21P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA21P2	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA22P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA22P2	1251-2035		CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA22P3	1251-2035		CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA23P1	1200-0508	1	SOCKET: IC 14-CONT DIP SLDR	06776	0002812
A26XA24P1	1251-0472		CONNECTOR: PC EDGE 6-CONT/ROW 2 ROWS	0450G	252-06-30-300
A26XA24P2	1251-2035		CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA25P1	1251-2035		CONNECTOR: PC EDGE 15-CONT/ROW 2 ROWS	0450G	252-15-30-300
A26XA27P1	86701-60069	1	CONNECTOR ASSEMBLY 5-PIN	28480	86701-60069
A26XA28P1			PART OF A26 MOTHERBOARD		

A26
MOTHERBOARD



* THESE COMPONENTS ARE NOT PART OF THE A26 MOTHERBOARD. PART NUMBERS ARE IN TABLE 6-4, RF SECTION MISCELLANEOUS PARTS.

Figure 9-101. A26 Motherboard, Component Locations



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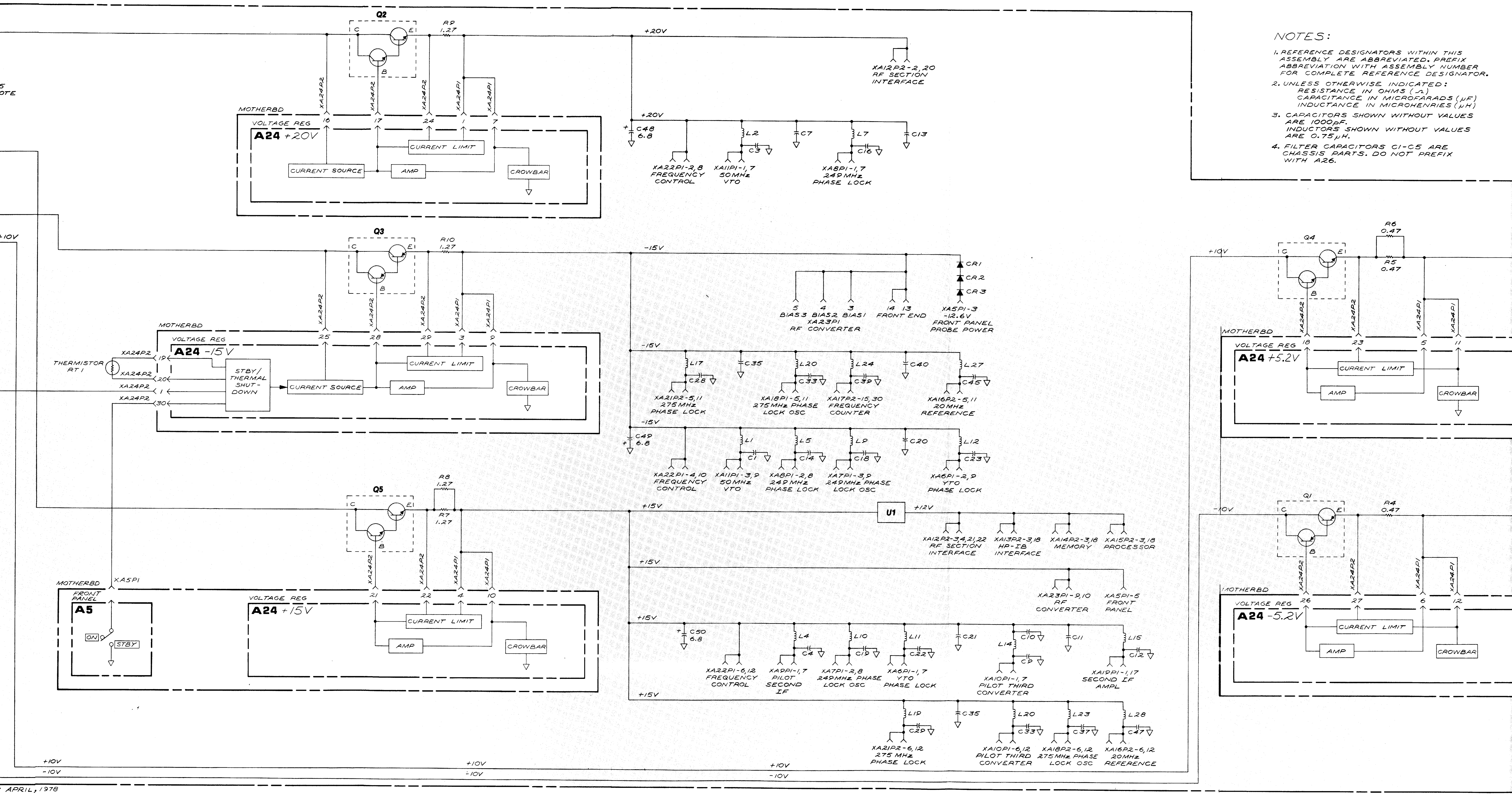
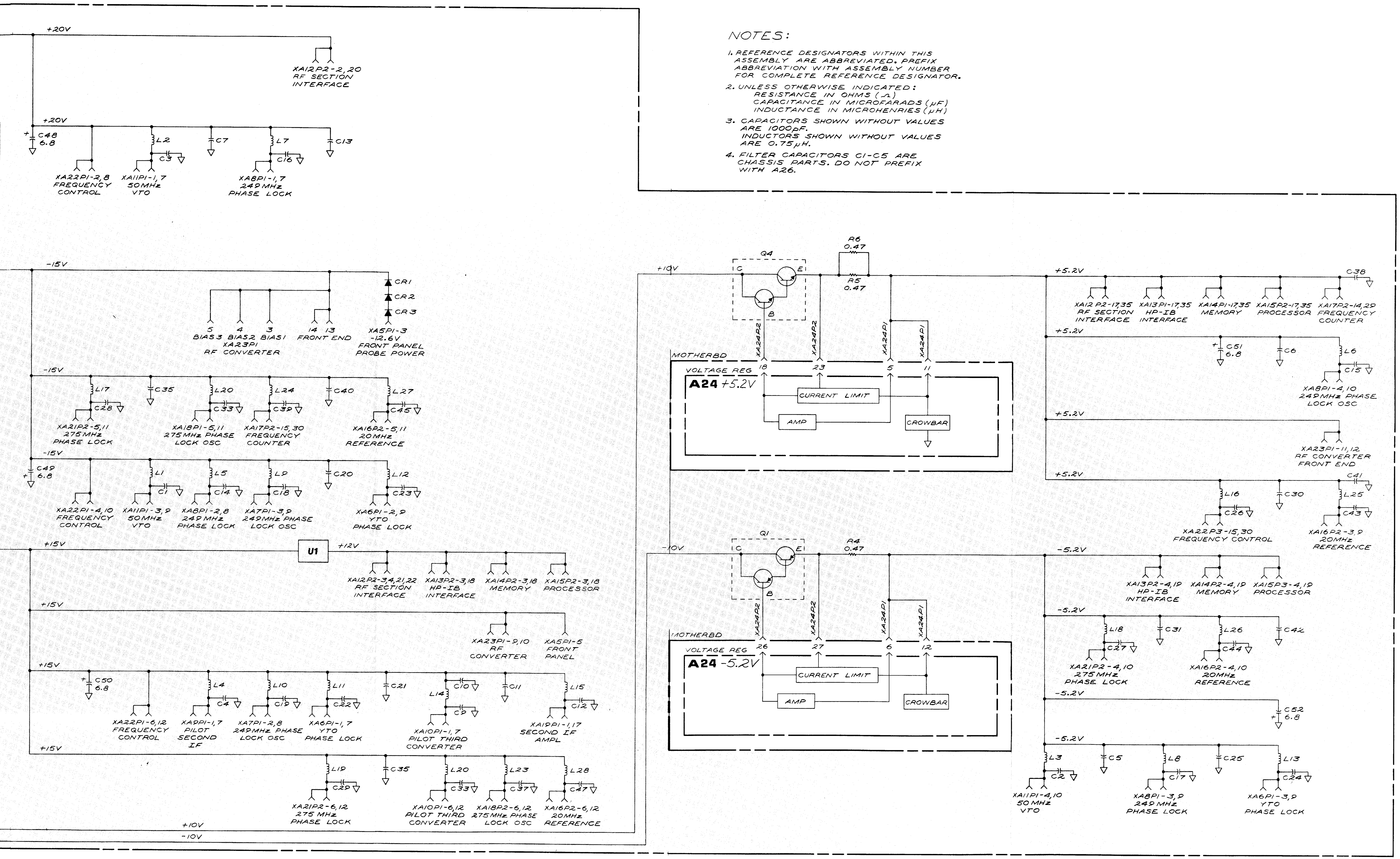


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. CAPACITORS SHOWN WITHOUT VALUES ARE 1000pF.
   INDUCTORS SHOWN WITHOUT VALUES ARE 0.75μH.
4. FILTER CAPACITORS C1-C5 ARE CHASSIS PARTS. DO NOT PREFIX WITH A26.

APRIL, 1978



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. CAPACITORS SHOWN WITHOUT VALUES ARE 1000pF. INDUCTORS SHOWN WITHOUT VALUES ARE 0.75μH.
4. FILTER CAPACITORS C1-C5 ARE CHASSIS PARTS. DO NOT PREFIX WITH A26.

A25

A26

Figure 9-102. A25 Rectifier and A26 Motherboard, Power Distribution Diagram

NOTES:

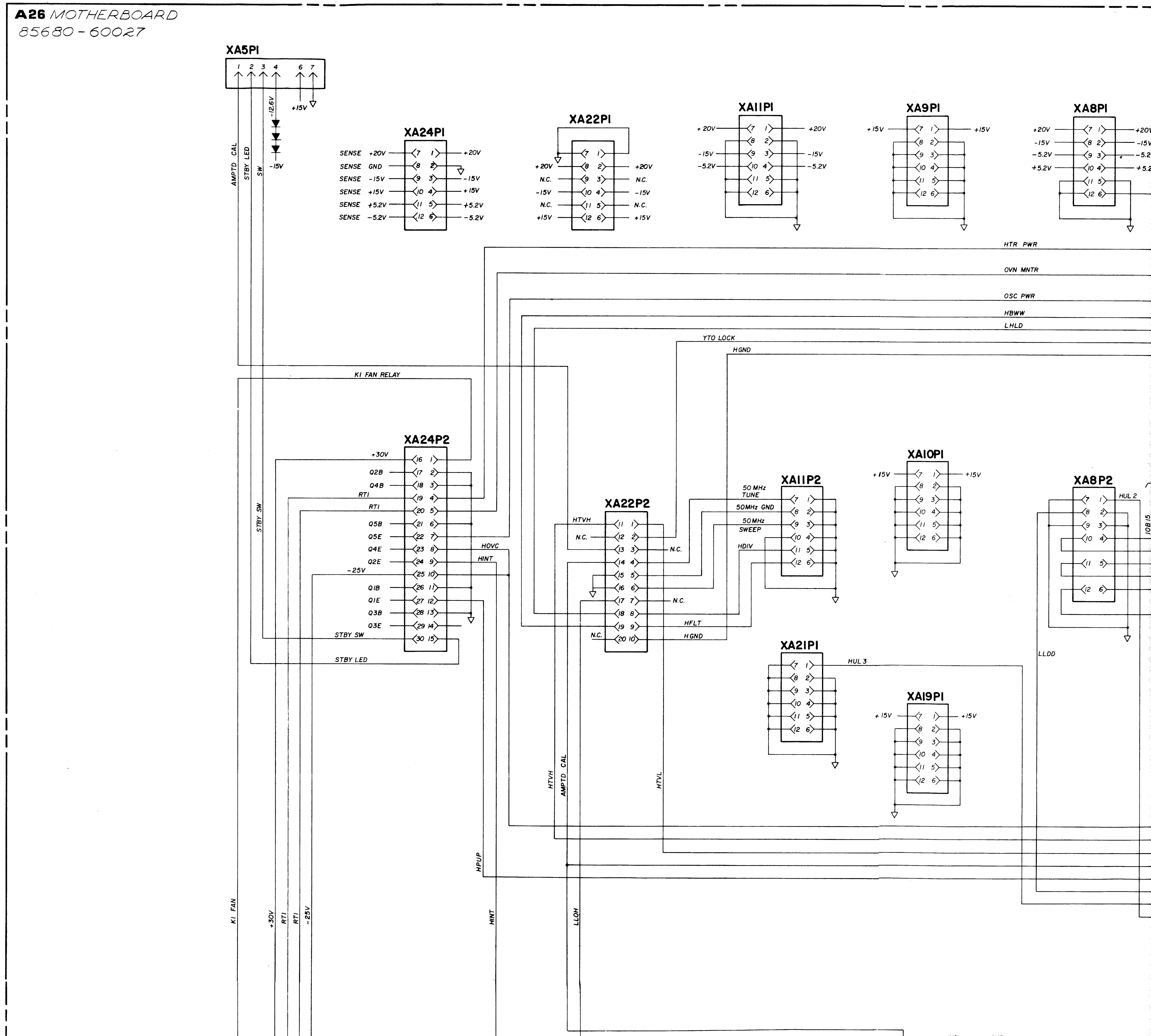
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR EXCEPT THE FOLLOWING DESIGNATORS: ALL CONNECTORS WITH X DESIGNATIONS AND C1 THRU C5.

2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

3. FOR NORMAL OPERATION P2-6 CONNECTS TO P2-21 AND P2-7 CONNECTS TO P2-22.

4. 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 VTO BY 2
HFLT	HIGH=VTO TUNE FILTER ON
HSWP	HIGH=SWEEPING
LSTP	LOW=STOP PROCESSOR
LLDD	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
IOBØ-15	INSTRUMENT BUS DATA BITS Ø THRU 15 (HIGH TRUE)
ADRØ-5	INSTRUMENT BUS ADDRESS BITS Ø THRU 5 (HIGH TRUE)
KR Ø-11	KEY ROW Ø THRU 11



NOTES:

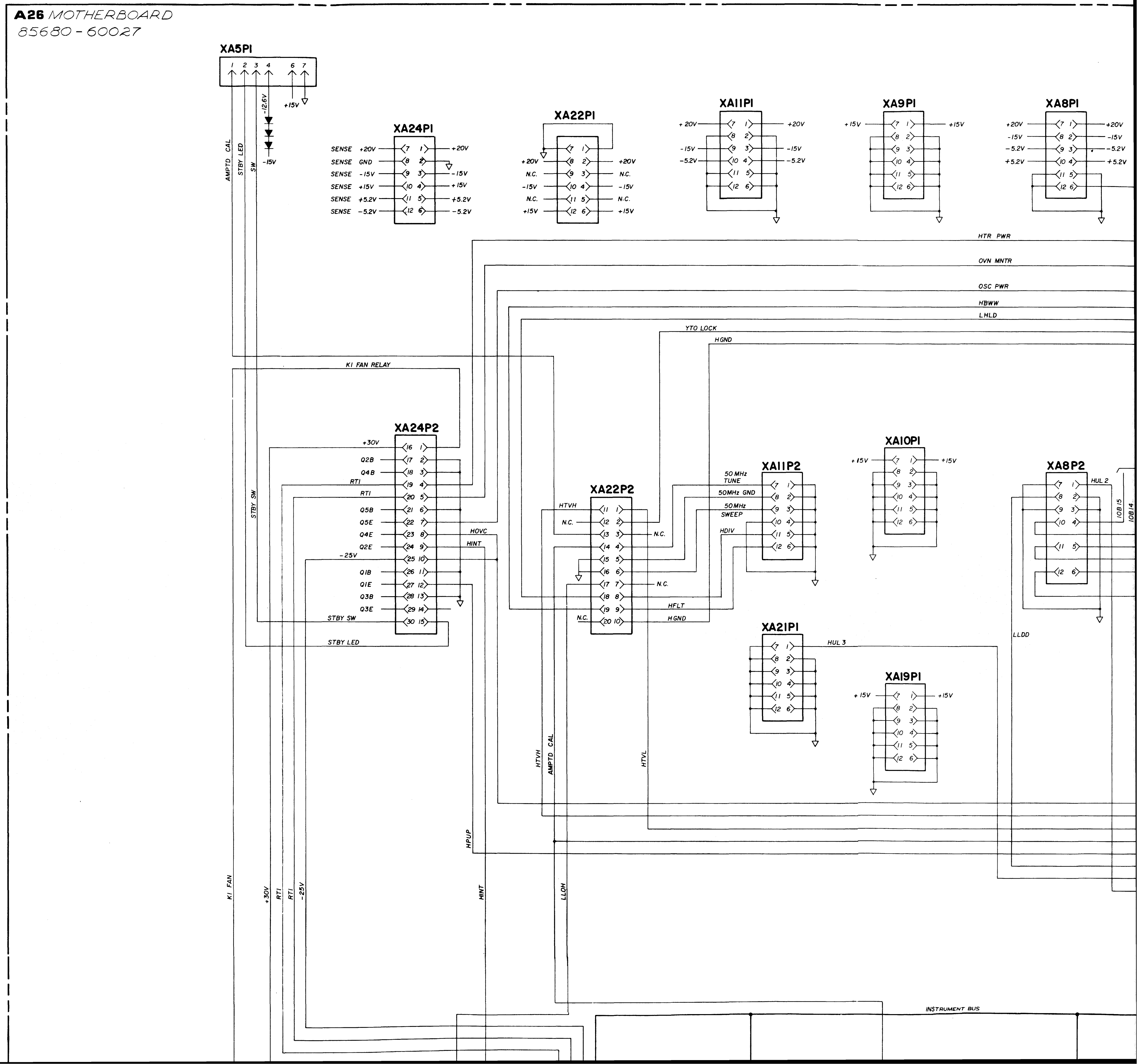
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR EXCEPT THE FOLLOWING DESIGNATORS: ALL CONNECTORS WITH X DESIGNATIONS AND C1 THRU C5.

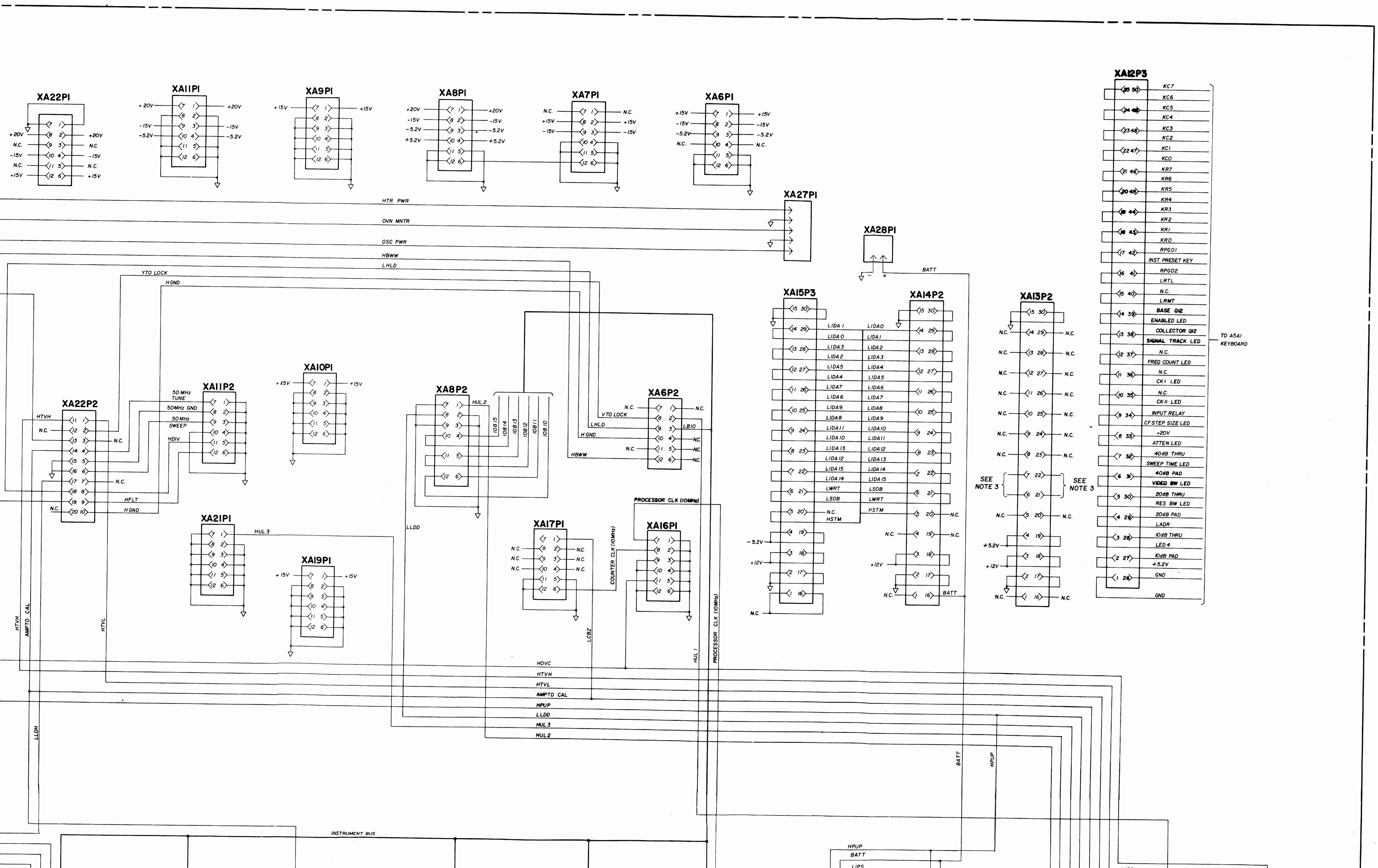
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

3. FOR NORMAL OPERATION P2-6 CONNECTS TO P2-21 AND P2-7 CONNECTS TO P2-22.

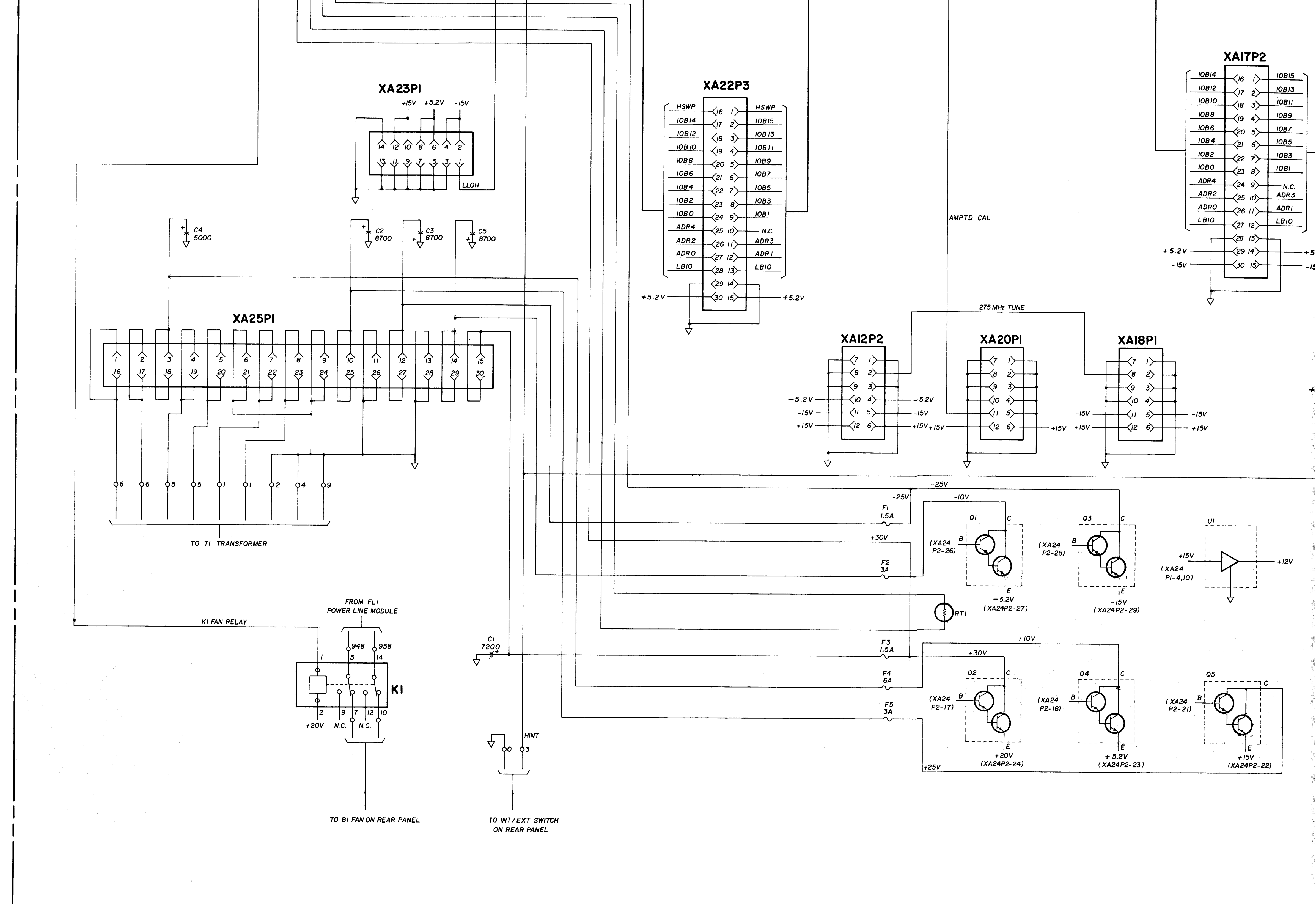
4. MNEMONICS TABLE:

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 VTO BY 2
HFLT	HIGH=VTO TUNE FILTER ON
HSWP	HIGH=SWEEPING
LSTP	LOW=STOP PROCESSOR
LLDD	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
IOBØ-15	INSTRUMENT BUS DATA BITS Ø THRU 15 (HIGH TRUE)
ADRØ-5	INSTRUMENT BUS ADDRESS BITS Ø THRU 5 (HIGH TRUE)
KR Ø-11	KEY ROW Ø THRU 11 LOW=ENABLE
KC Ø-7	KEY COLUMN Ø THRU 7 LOW=KEY DOWN
HOVC	HIGH=OVEN COLD
LTGR	LOW=TRACKING GEN-

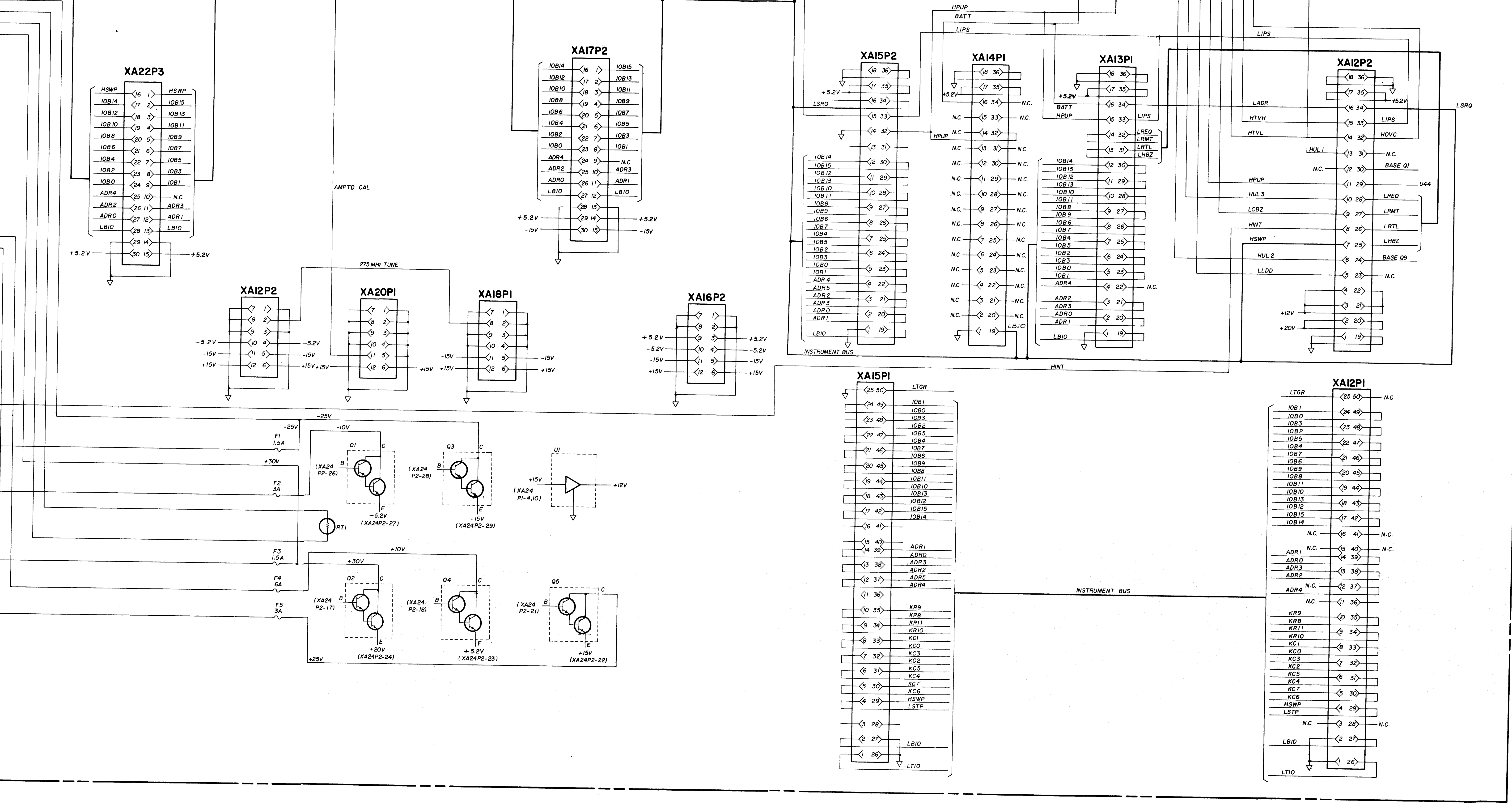



XA22P1
XA11P1
XA9P1
XA8P1
XA7P1
XA6P1
XA12P3
XA27P1
XA28P1
XA15P3
XA14P2
XA13P2
XA10P1
XA11P2
XA22P2
XA8P2
XA6P2
XA21P1
XA19P1
XA17P1
XA16P1
HTR PWR
OVN MNTR
OSC PWR
HBWW
LHLD
YTO LOCK
HGND
BATT
50 MHz TUNE
50MHz GND
50MHz SWEEP
HDIV
HTVH
HFLT
HUL 2
HUL 3
IOB 15
IOB 14
IOB 13
IOB 12
IOB 11
IOB 10
VTO LOCK
LB10
PROCESSOR CLK (10MHz)
COUNTER CLK (10MHz)
LLDD
LCBZ
HUL 1
HTVL
AMPTD CAL
LLOH
HOVC
HPUP
HUL 2
INSTRUMENT BUS
LIDA 0
LIDA 1
LIDA 2
LIDA 3
LIDA 4
LIDA 5
LIDA 6
LIDA 7
LIDA 8
LIDA 9
LIDA 10
LIDA 11
LIDA 12
LIDA 13
LIDA 14
LIDA 15
LWRT
LSOB
HSTM
SEE NOTE 3
KC7
KC6
KC5
KC4
KC3
KC2
KC1
KC0
KR7
KR6
KR5
KR4
KR3
KR2
KR1
KR0
RPG01
INST PRESET KEY
RPG02
LRTL
LRMT
BASE Q12
ENABLED LED
COLLECTOR Q12
SIGNAL TRACK LED
FREQ COUNT LED
CK I LED
CK II LED
INPUT RELAY
CF STEP SIZE LED
ATTEN LED
40dB THRU
SWEEP TIME LED
40dB PAD
VIDEO BW LED
20dB THRU
RES BW LED
20dB PAD
LADR
10dB THRU
LED 4
10dB PAD
GND
TO A5A1 KEYBOARD
+20V
-15V
+15V
-5.2V
+5.2V
+12V
N.C.

	LOW=KEY DOWN
HOVC	HIGH=OVEN COLD
LTGR	LOW=TRACKING GENERATOR REQUEST
LIDA	INTERNAL DATA AND ADDRESS BUS BITS (LOW TRUE)
HBWW	HIGH=WIDE LOOP BW



SERIAL PREFIX: 1828A DATE: APRIL 1978



A26

Figure 9-103. A26 Motherboard, Interconnect Diagram