8568A
SPECTRUM ANALYZER
100 Hz to 1.5 GHz

volume 3

Section VIII
IF-DISPLAY SECTION
SERVICE

–VOLUME 3–

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SECTION VIII
IF-DISPLAY SECTION
SERVICE

8-1. INTRODUCTION

8-2. This volume of the Operating and Service Manual contains information for troubleshooting and repair of the IF-Display 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.

8-3. SERVICE SHEETS

8-4. The service sheets in this manual are organized in alpha-numeric order by assembly number 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.

8-5. REPAIR PROCEDURES

8-6. 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 indexed with a tab for quick reference. These procedures include such items as CRT Replacement, front-panel LED replacement, and internal fuse replacement.

8-7. MAJOR ASSEMBLY AND COMPONENT LOCATIONS

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

8-9. TROUBLESHOOTING

8-10. Troubleshooting information for the IF-Display 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. A1 Display Section Block Diagram, A3 Digital Storage Block Diagram, and A4 IF Section 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.)

8-11. SIGNATURE ANALYSIS USING THE HP MODEL 5004A SIGNATURE ANALYZER

8-12. General Description

8-13. 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.

8-14. Features (Refer to HP 5004A Signature Analyzer Operating and Service Manual.)

8-15. 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 a 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.

8-16. Data Probe. The active Data Probe (more commonly referred to as simply probe) is a handheld probe. Its main function is to accept signature information, however, 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.

8-17. 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'' at each end, to the "grabbers" already present at the pod. HP Part Numbers for the "grabbers" are: Red, 1400-0833; Black, 1400-0832.

8-18. Operation

8-19. 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 chosed 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.

8-20. 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 and 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 8-1.

8-21. 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 8-1. The comparison of these signatures is the means by which a defective component is located on a printed circuit board. Refer to Figure 8-1 for detailed explanation of the content and use of the signature analysis diagrams.

8-22. 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.

8-23. 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.

8-24. 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.

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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:

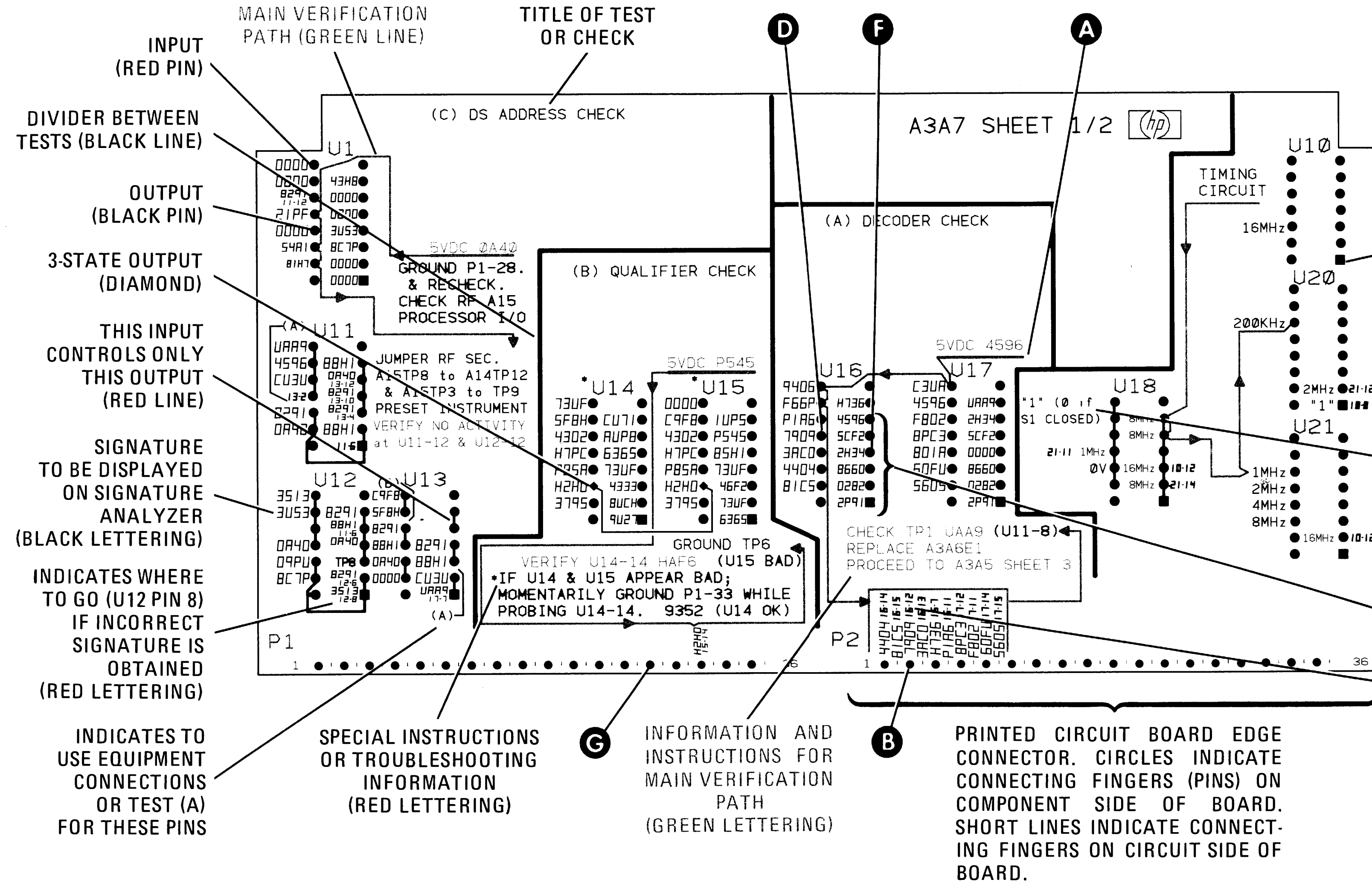
Line	Main Verification Path
Lettering	Information and Instructions for Main Verification Path

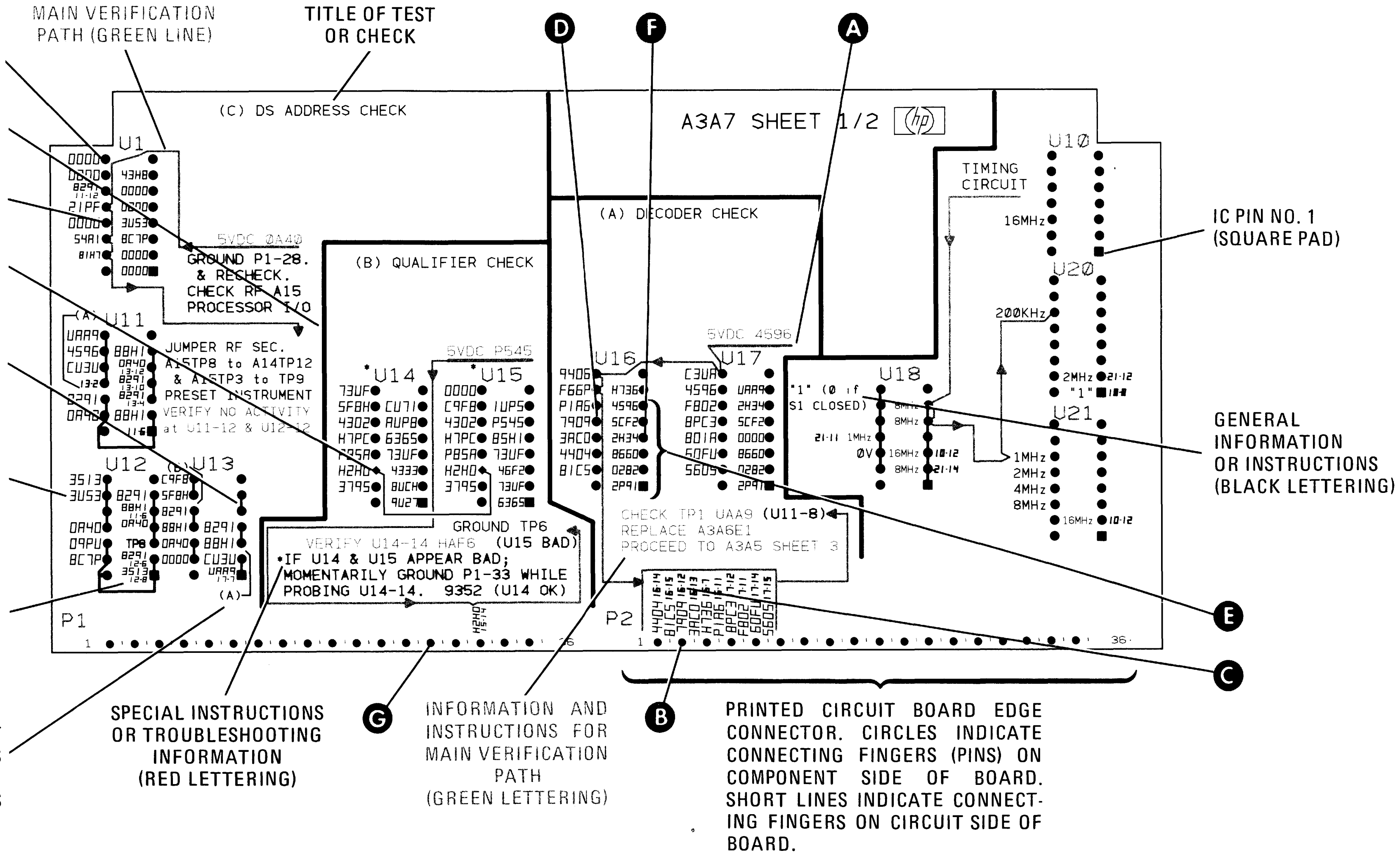
RED:

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.

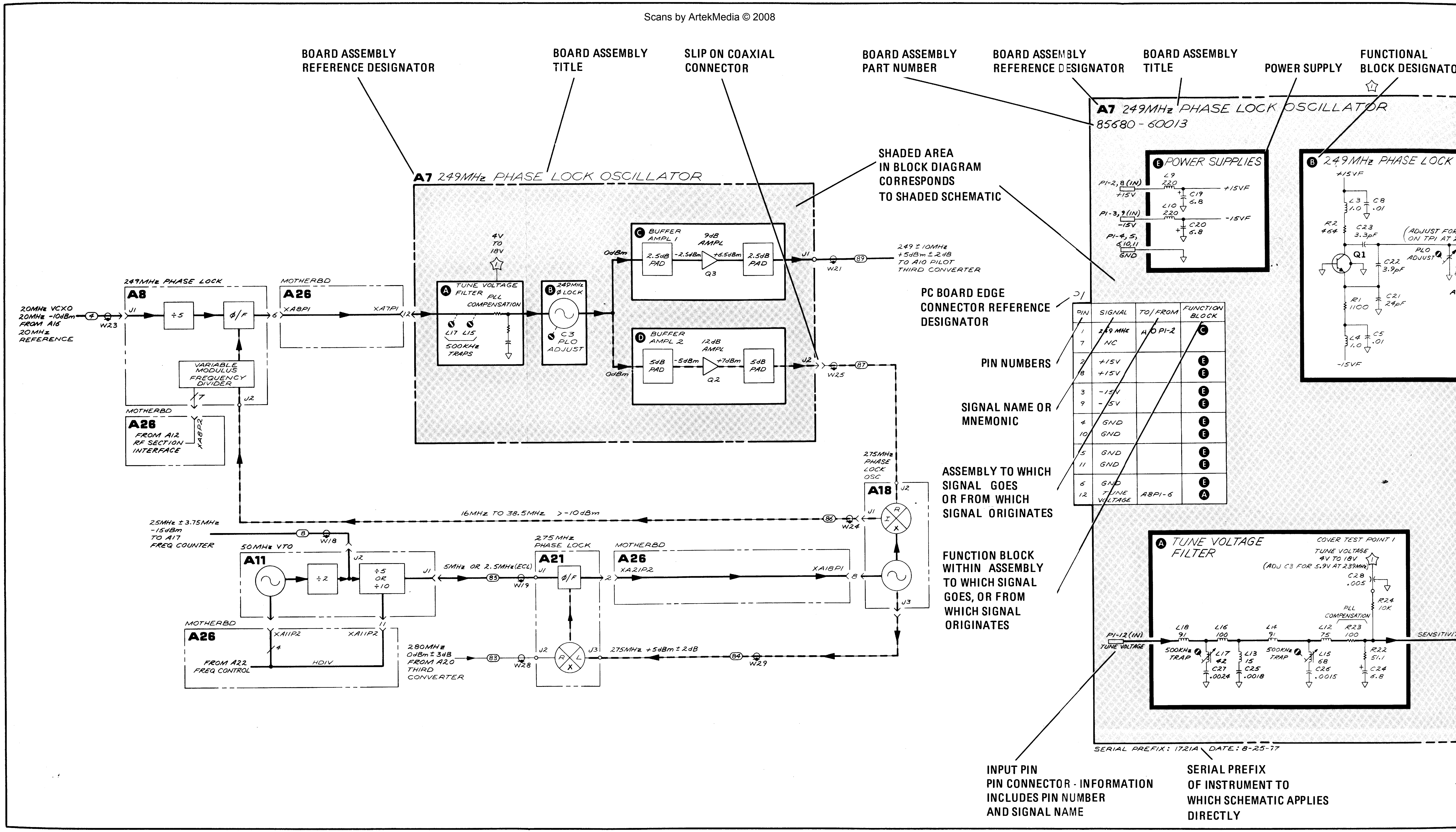
6. If a bad signature is located (point B in the sample), follow instruction (C in the sample) to the IC indicated. The instruction 16-12 indicates to go to U16 pin 12.

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 8-1. Signature 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 DESIGNATO
SHADED AREA IN BLOCK DIAGRAM CORRESPONDS TO SHADED SCHEMATIC
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
INPUT PIN
PIN CONNECTOR - INFORMATION INCLUDES PIN NUMBER AND SIGNAL NAME
SERIAL PREFIX OF INSTRUMENT TO WHICH SCHEMATIC APPLIES DIRECTLY
A7 249MHz PHASE LOCK OSCILLATOR
85680-60013
POWER SUPPLIES
249MHz PHASE LOCK
TUNE VOLTAGE FILTER
BUFFER AMPL 1
BUFFER AMPL 2
PLO ADJUST
500KHz TRAPS
PLL COMPENSATION
20MHz VCXO 20MHz -10dBm FROM A16 20MHz REFERENCE
249 ± 10MHz +5dBm ± 2dB TO A10 PILOT THIRD CONVERTER
249MHz PHASE LOCK A8
MOTHERBD A26
VARIABLE MODULUS FREQUENCY DIVIDER
FROM A12 RF SECTION INTERFACE
16MHz TO 38.5MHz >-10dBm
25MHz ± 3.75MHz -15dBm TO A17 FREQ COUNTER
50MHz VTO A11
275MHz PHASE LOCK A21
275MHz PHASE LOCK OSC A18
FROM A22 FREQ CONTROL
280MHz 0dBm ± 3dB FROM A20 THIRD CONVERTER
275MHz +5dBm ± 2dB
5MHz OR 2.5MHz(ECL)
SERIAL PREFIX: 1721A DATE: 8-25-77

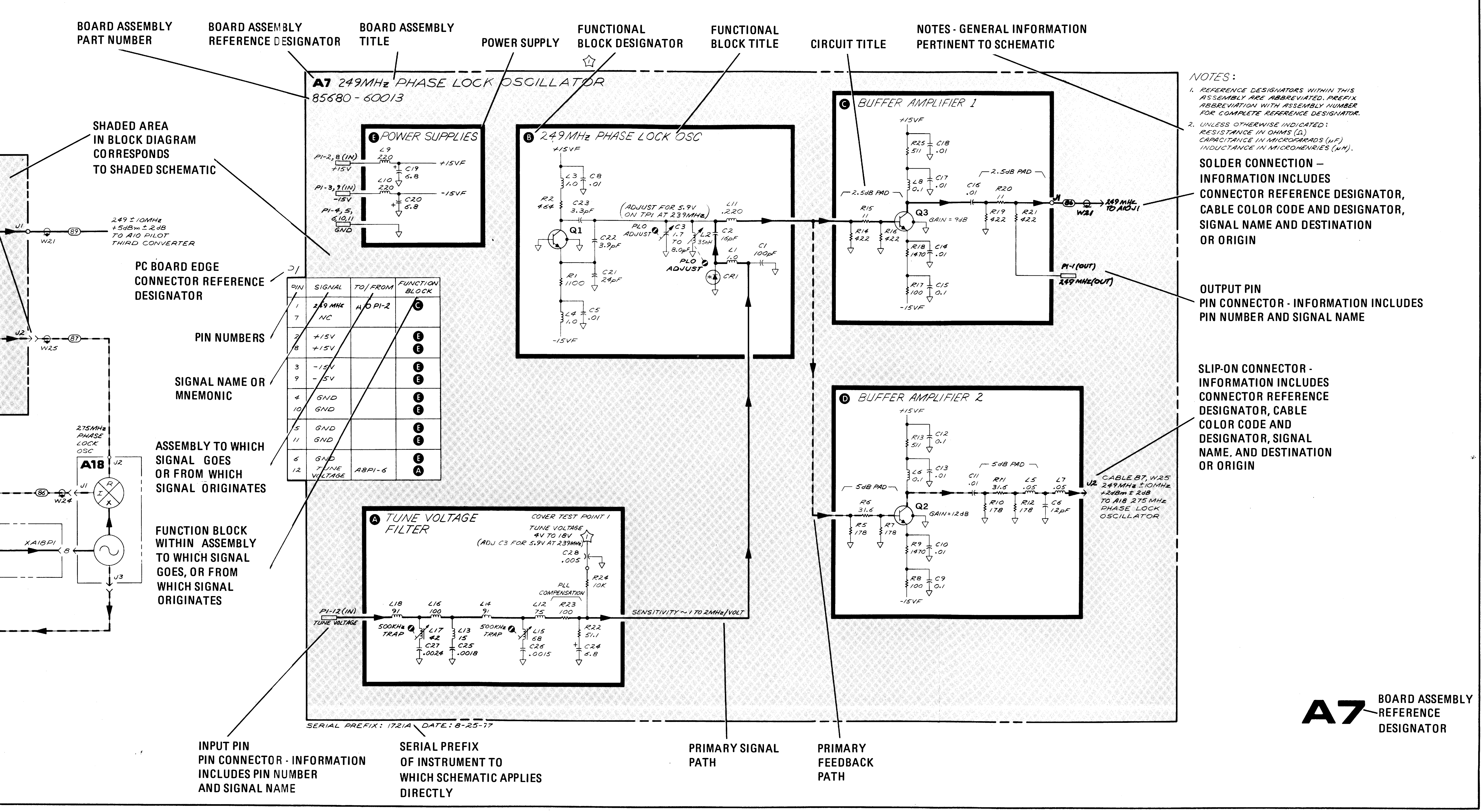
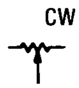


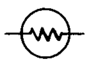
Figure 8-2. Schematic and Block Diagram Format

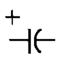
GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS

BASIC COMPONENT SYMBOLS



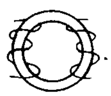
Variable Resistor: CW indicates clockwise rotation of shaft moves wiper towards location of CW.

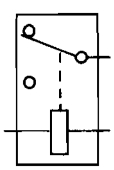

Thermistor

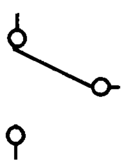


Electrolytic Capacitor

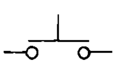

Feedthrough Capacitor


Toroidal Transformer


Relay

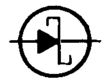

Slide, Toggle, or Rocker Switch


Ferrite Bead

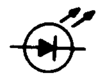

Pushbutton Switch

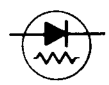

General Purpose Diode

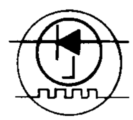

Breakdown Diode: Zener


Schottky Diode


Varactor Diode (Varicap)


Light-Emitting Diode


PIN Diode


Temperature-Compensated Voltage-Reference Diode


SCR (Silicon Controlled Rectifier)

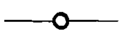
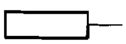
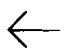
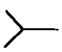

MOS-FET, N-Channel


MOS-FET, P-Channel

Figure 8-3. 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

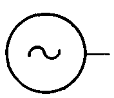
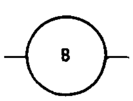
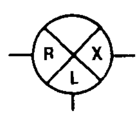
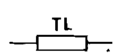
	Oscillator, RPG (Rotary Pulse Generator)
	Fan, Motor
	Mixer
	Transmission Line

Figure 8-3. 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.).

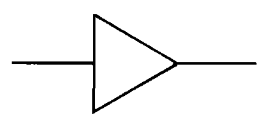
Line Label: The symbol or abbreviation associated with an output or input line that defines the action of the line.

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

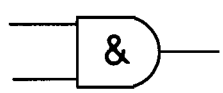
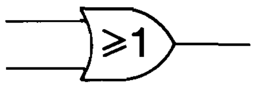


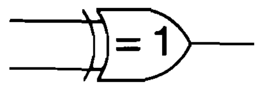
Figure 8-4. Schematic Symbols for Digital Integrated Circuits (1 of 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

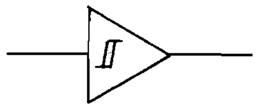
OR Gate



EXCLUSIVE OR Gate

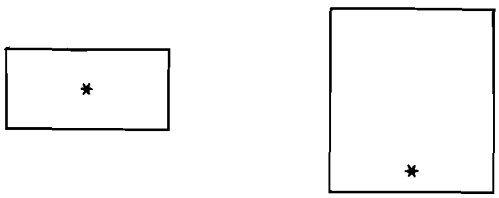


Schmitt Trigger



Rectangular Symbols

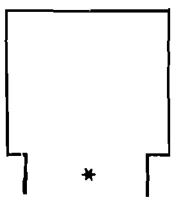
General Logic Element



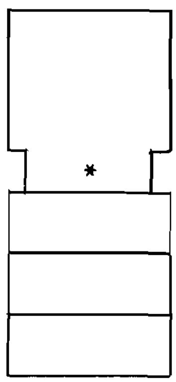
NOTE

The asterisk indicates where the function label is placed

Control Block



Logic Elements with Common Control Block



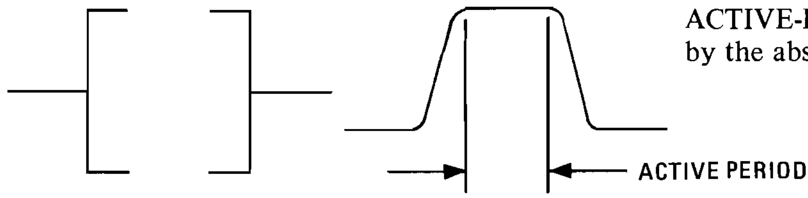
NOTE

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

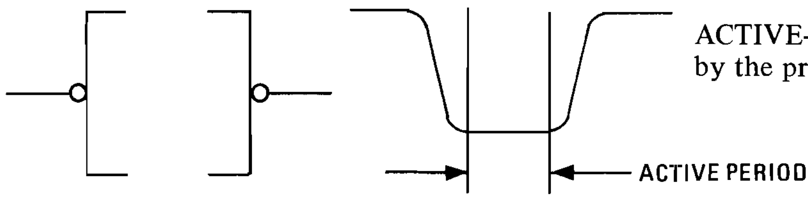
Figure 8-4. Schematic Symbols for Digital Integrated Circuits (2 of 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

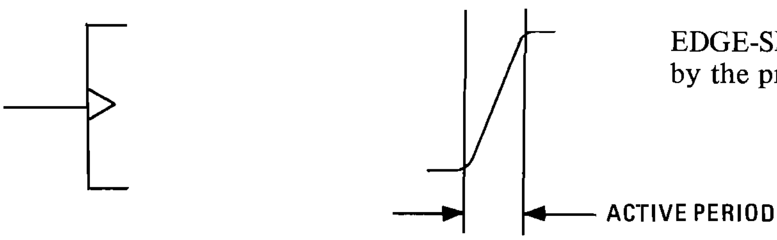
INDICATOR SYMBOLS (positive logic assumed)



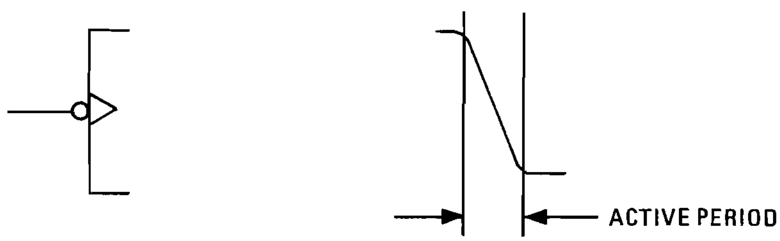
ACTIVE-HIGH inputs and outputs are indicated by the absence of the negation symbol, O.

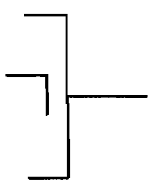


ACTIVE-LOW inputs and outputs are indicated by the presence of the negation symbol, O.

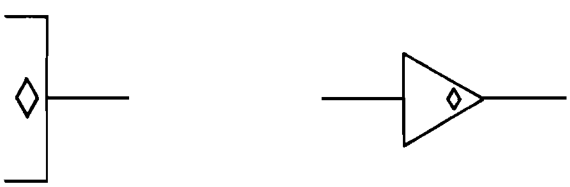


EDGE-SENSITIVE (Dynamic) inputs are indicated by the presence of the dynamic input symbol,





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

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

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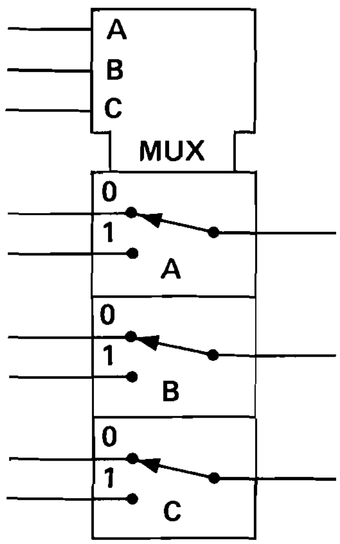
SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

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:

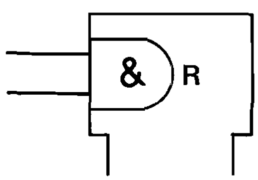


Triple 2-Channel Multiplexer

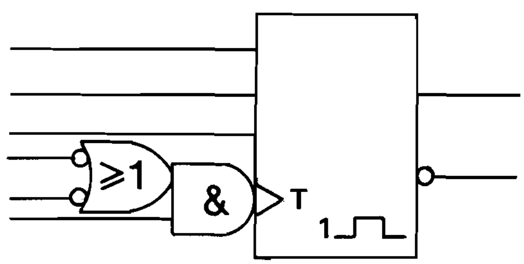
Letters are used to relate control inputs to logic elements. The numerals 0 and 1 indicate 0-state and 1-state, respectively, and relate the position of a "switch" to the logic state of the corresponding control line.

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

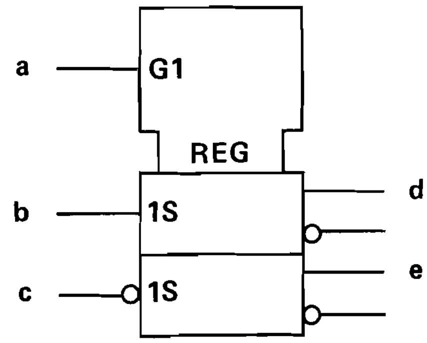
Figure 8-4. Schematic Symbols for Digital Integrated Circuits (6 of 8)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

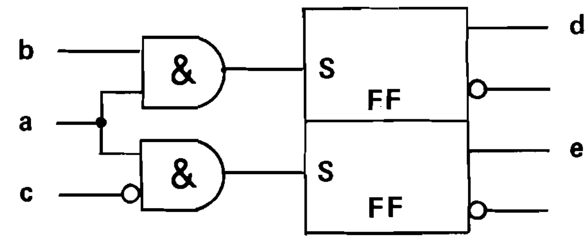
When the G label is used, the gating input is labelled with a G followed by a numeral or letter. The line labels of the gated inputs or outputs are prefixed with the same numeral or letter. Two examples are:

2-Bit Register

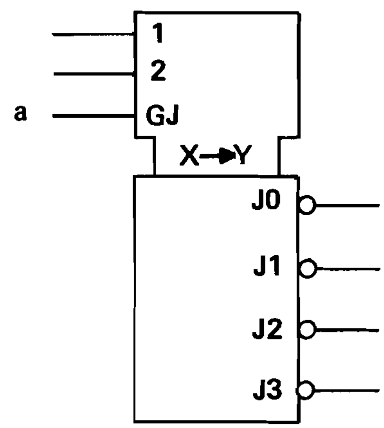
IC Symbol



Equivalent



2-to-4-Line Decoder



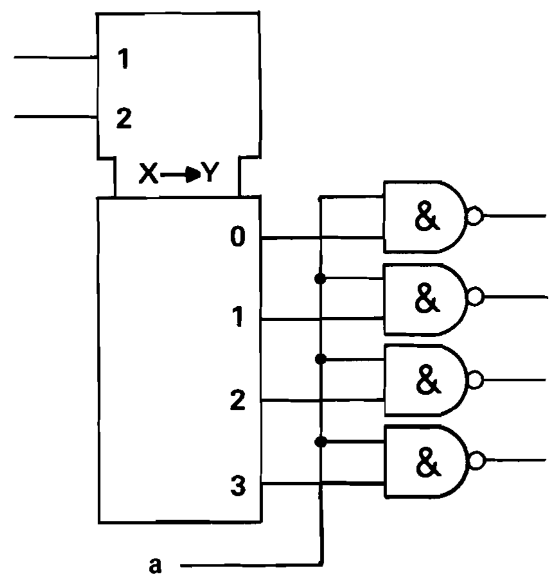
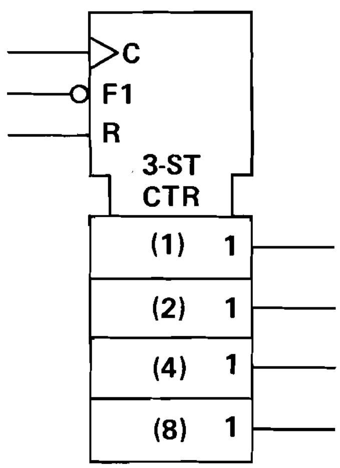


Figure 8-4. Schematic Symbols for Digital Integrated Circuits (7 of 8)

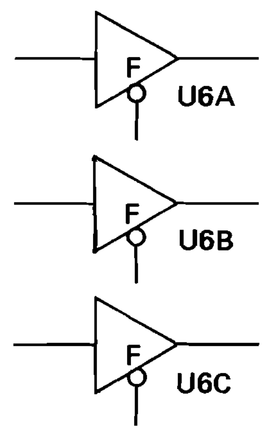
SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

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.

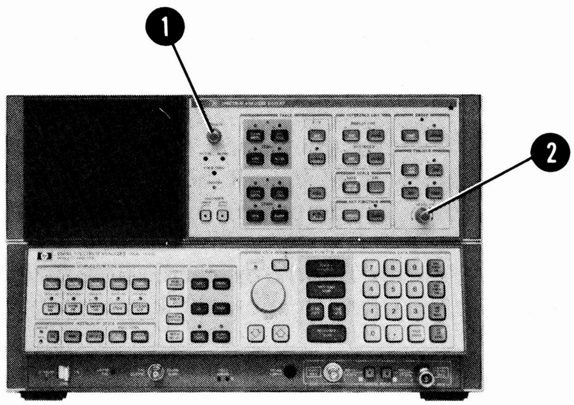
Figure 8-4. Schematic Symbols for Digital Integrated Circuits (8 of 8)

FRONT-PANEL LED REPLACEMENT

1. Set instrument LINE switch to STANDBY.

2. Loosen set screws in INTENSITY control and Video Trigger LEVEL control knobs 1 and 2 using a No. 2 allen wrench (HP Part Number 8710-0892) and remove knobs.

FRONT PANEL VIEW



3. Remove nut from INTENSITY control and from Video Trigger LEVEL control using a 5/16-inch wrench.

4. Front panel is now loose. It may be necessary to pry front panel out slightly using a sharp instrument such as a knife blade along the edge of the panel.

5. Front-panel LEDs are now accessible for replacement. To replace LED, pull out defective LED with fingers (it may be necessary to pry slightly with a pointed instrument such as a soldering aid), trim both leads of 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 illustration on next page for identification of LED leads.

Figure 8-5. Front-Panel LED Replacement (1 of 2)

FRONT-PANEL LED REPLACEMENT (Cont'd)

6. The RECORDER pushbutton LEDs 3, LOWER LEFT and UPPER RIGHT cannot be replaced as described in Step 5. To replace these LEDs, it is necessary to remove the pushbutton keys and the A1A1 Keyboard:

   a. Remove key housing the defective LED by prying the key outward using a pointed instrument such as a soldering aid.

   b. Remove sub-panel and A1A1 Keyboard by removing the screws 4 from the perimeter and prying forward if necessary with a pointed instrument.

   c. Unsolder the defective LED from the rear of the A1A1 Keyboard.

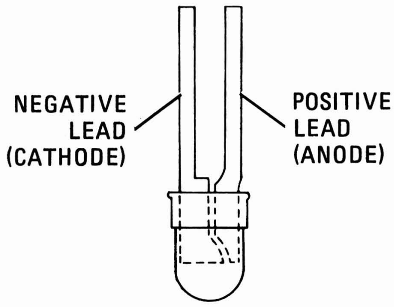
   d. Loosen the leads from the printed circuit board using a soldering aid and push on the leads to force LED out of switch through the front of the panel.

   e. Insert new LED through the switch from the front of the panel so that leads extend through the printed circuit board at the rear of the Keyboard. Negative (cathode) lead goes to square pad on printed circuit board.

   f. Pull leads of LED with fingers or needle-nose pliers to ensure that LED is far enough inside of the switch to allow the key to be reinstalled.

   g. Solder LED leads to printed circuit board, trim excess lead length, and reassemble front panel.

LED LEAD IDENTIFICATION



SUB PANEL VIEW

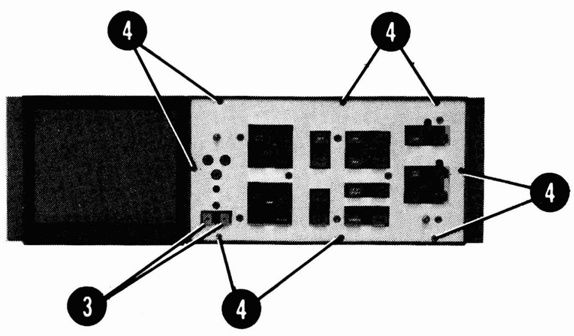


Figure 8-5. Front-Panel LED Replacement (2 of 2)

IF-DISPLAY SECTION INTERNAL FUSE REPLACEMENT

WARNING

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

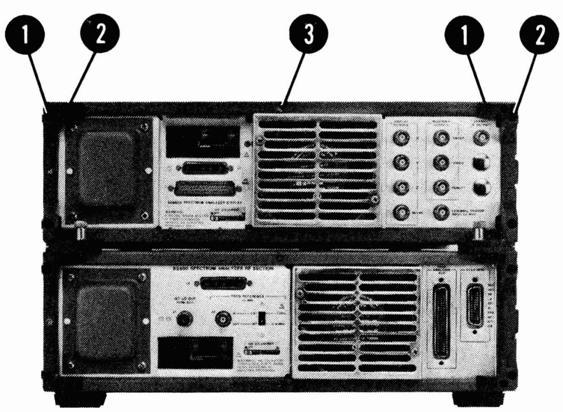
1. Remove feet 1 from rear of instrument by removing screws 2 shown in View A.

2. Remove top cover from IF-Display Section by loosening screw 3 shown in View A.

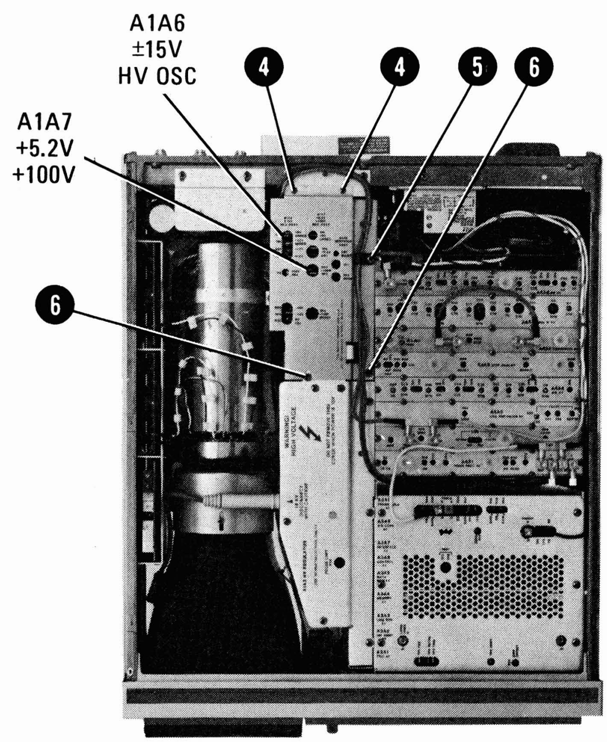
3. Remove metal cover from Low Voltage Power Supply section by removing rear screws 4, cable clamp and screw 5, and front screws 6 shown in View B.

4. The fuses for the +15 Vdc, -15 Vdc, and HV oscillator are located on the A1A6 ±15V Regulator and the fuses for the +5.2 Vdc and +100 Vdc supplies are located on the A1A7 +5.2V, +100V Regulator. Locations are shown in View B.

5. Part number information is located in Volume 1, Section VI and location of fuses on printed circuit boards can be found on component location illustrations for A1A6 and A1A7 assemblies in this volume.



VIEW A



VIEW B

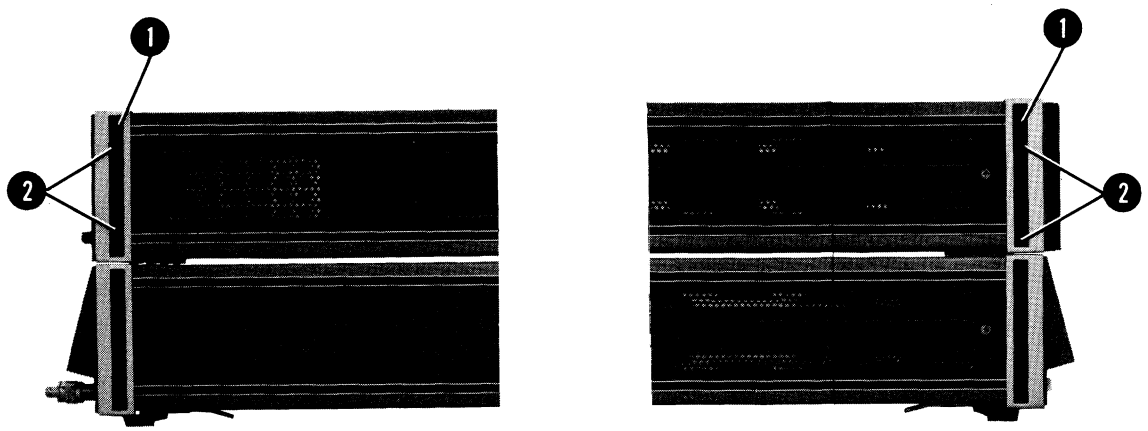
Figure 8-6. IF-Display Section Internal Fuse Replacement

IN THE ORIGINAL MANUAL THIS PAGE WAS INTENTIONALLY LEFT BLANK. THE BLANK PAGE HAS BEEN RETAINED IN THIS DIGITAL COPY TO FACILITATE REPRINTING OF THE MANUAL

FRONT PANEL REMOVAL AND REPAIR

1. Remove adhesive trim strip 1 from both sides of instrument.

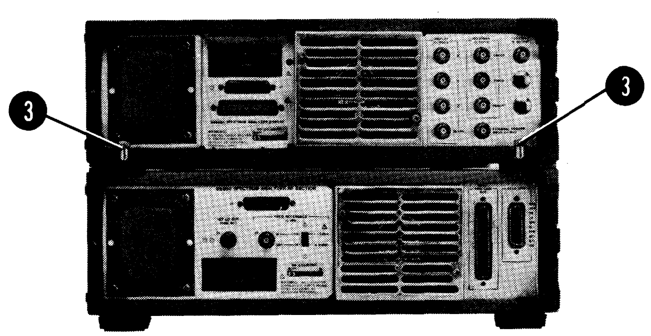
2. Remove two screws 2 located under trim strip 1 as shown in View A.



VIEW A

3. Loosen thumbscrews 3 shown in View B used to fasten instrument sections together.

4. Separate instrument sections by holding RF Section in place while pulling forward toward front panel on IF-Display Section.



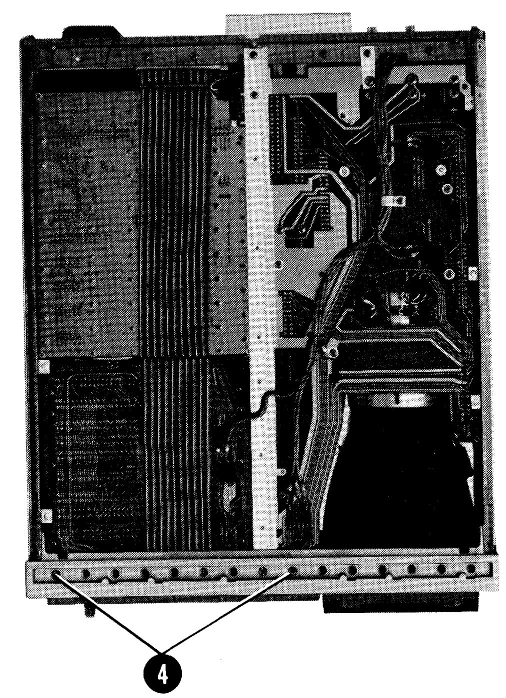
VIEW B

5. After instruments have been separated, lift IF-Display Section off of RF Section and place on left side as shown in View C.

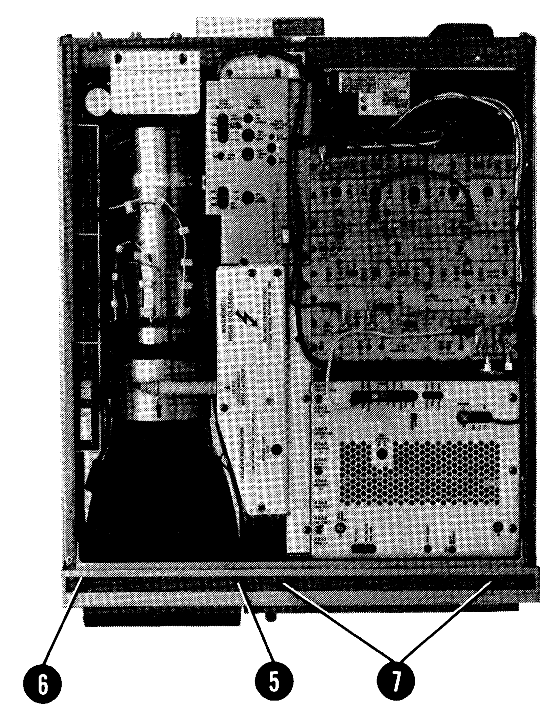
6. Remove two screws 4 from bottom of instrument used to secure front panel to frame.

7. Remove trim strip 5 shown in View D by inserting blade of small flat blade screw-driver into slot 6 and lifting upwards.

8. Remove two screws 7 located under trim strip 5 as shown in View D.



VIEW C



VIEW D

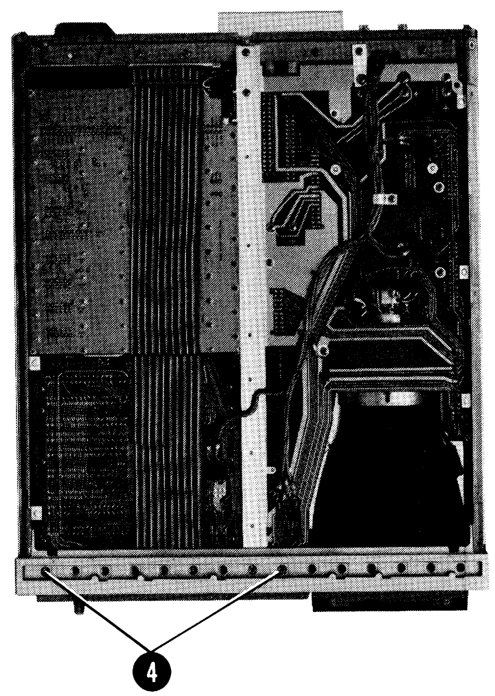
Scans by ArtekMedia © 2008

5. After instruments have been separated, lift IF-Display Section off of RF Section and place on left side as shown in View C.

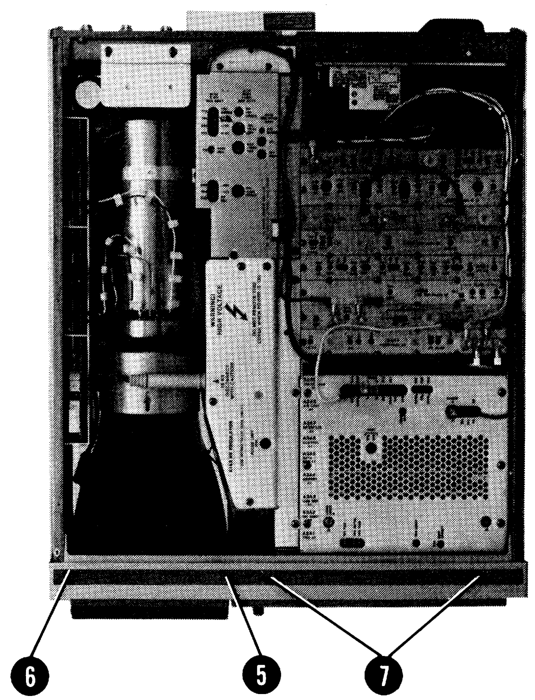
6. Remove two screws (4) from bottom of instrument used to secure front panel to frame.

7. Remove trim strip (5) shown in View D by inserting blade of small flat blade screwdriver into slot (6) and lifting upwards.

8. Remove two screws (7) located under trim strip (5) as shown in View D.



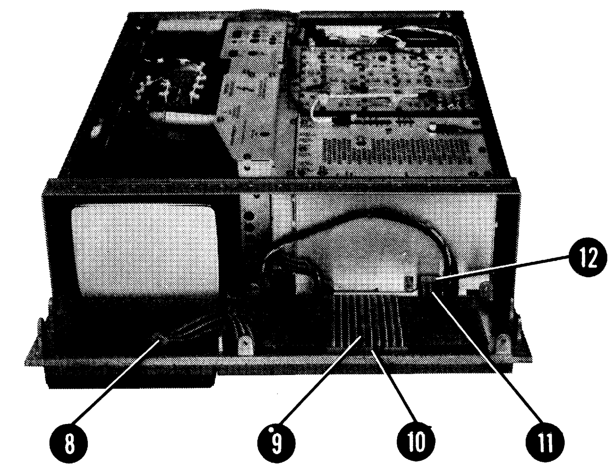
VIEW C



VIEW D

9. Place instrument in position shown in View E and pull front panel forward to position shown.

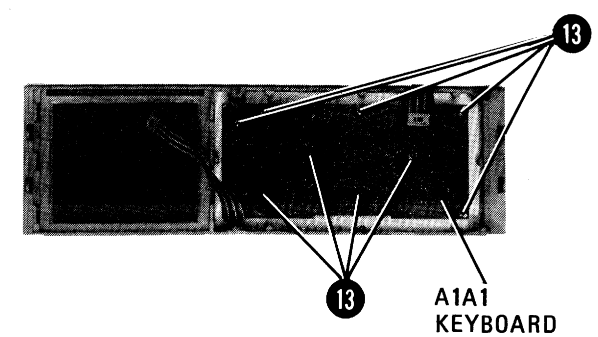
10. Disconnect cable (8) from A1A10 Motherboard as shown in View E. Disconnect cable (9) at connector (10) and cable (11) at connector (12) on A3A10 Motherboard.



VIEW E

11. Front panel is now loose from instrument as shown in View F.

12. To remove A1A1 Keyboard, remove nine screws (13) used to fasten Keyboard to frame.



VIEW F

Figure 8-7. Front Panel Removal and Repair

CRT REPLACEMENT

REMOVAL

1. Remove feet 1 from rear of instrument by removing screws 2 shown in View A. Remove feet 3 by removing screws 4 and loosening thumbscrews 5 .

2. Separate instruments by holding RF Section in place and pulling forward toward front panel on IF-Display Section.

3. When instruments have been separated, remove top cover from IF-Display Section by loosening screw 6 and remove bottom cover by loosening screw 7 .

4. Turn instrument upside down as shown in View B. Disconnect wire 8 ACC and wire 9 MESH from neck of CRT. Disconnect wires 10 TA and wires 11 ORTHO from A1A10 Motherboard.

5. Turn instrument over as shown in View C. Unplug high voltage cable at connector 12 . Remove wires 13 from neck of CRT noting location of connections for reconnection to new CRT.

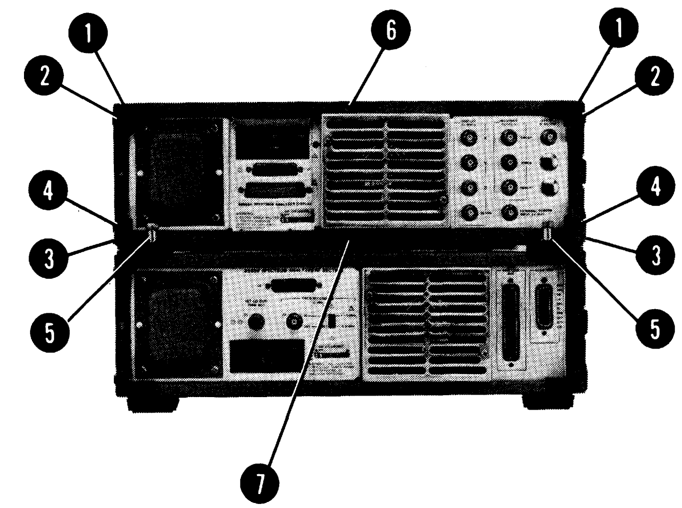
6. Loosen two screws 14 in CRT clamp. (It is not necessary to remove these screws; CRT can be removed if they have been loosened.) It may be necessary to remove cover 15 by removing screws 16 to gain access to clamp screw 14 next to cover.

7. CRT is now loose and can be removed. It is necessary to remove the front panel to remove the CRT from the instrument. Refer to Figure 8-7 for procedure to remove front panel.

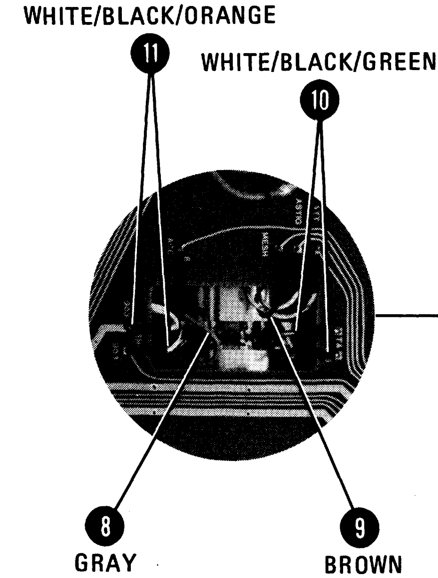
8. When front panel has been removed, pull CRT out through front of instrument far enough to allow room at rear of CRT to disconnect plug 17 from socket at rear of CRT.

9. When cable has been disconnected from rear of CRT, tube can be removed from instrument by pulling it out through front of instrument.

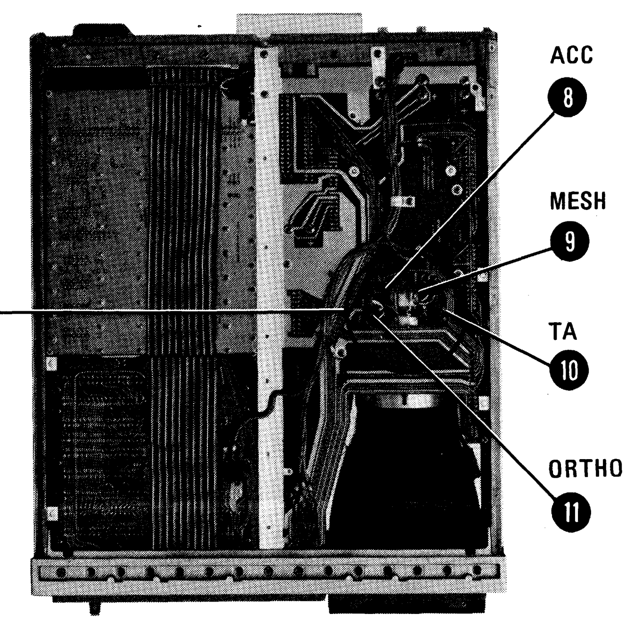
10. Remove CRT shield from tube by first removing foam spacer at rear of shield between tube socket and shield then pull tube out of shield.



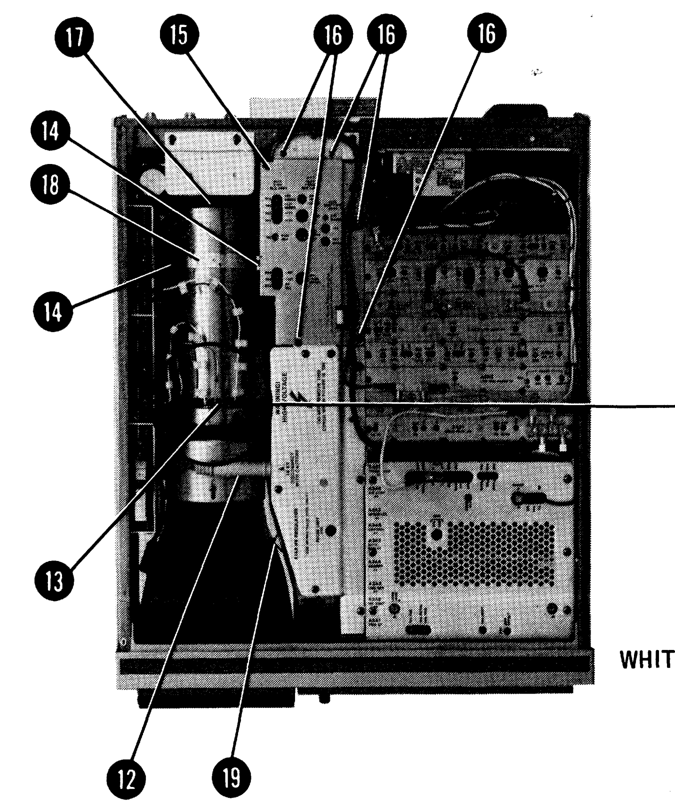
View A



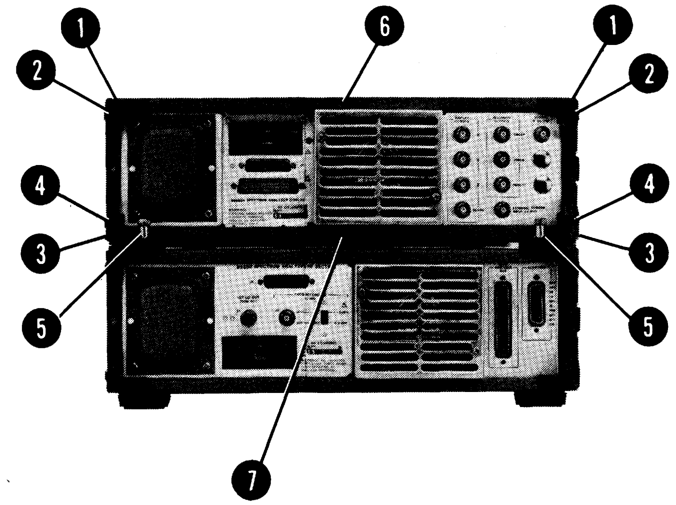
View E



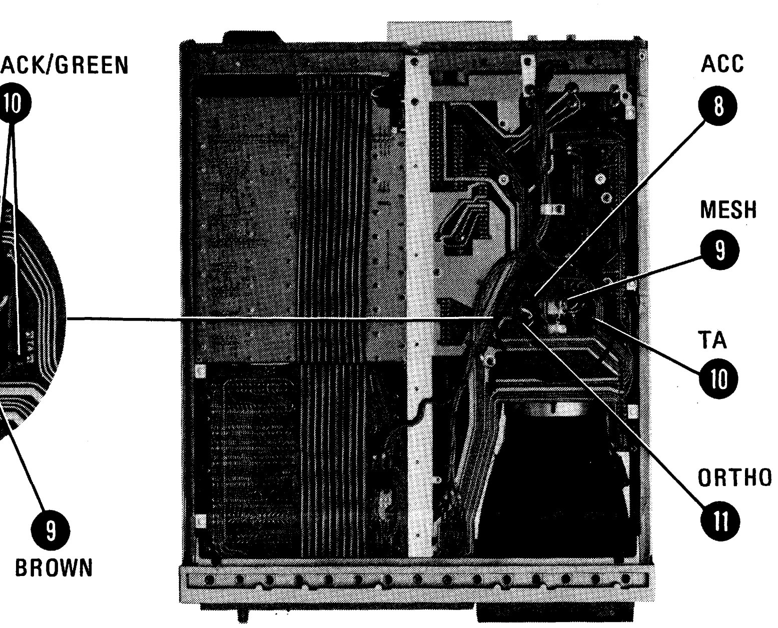
View B



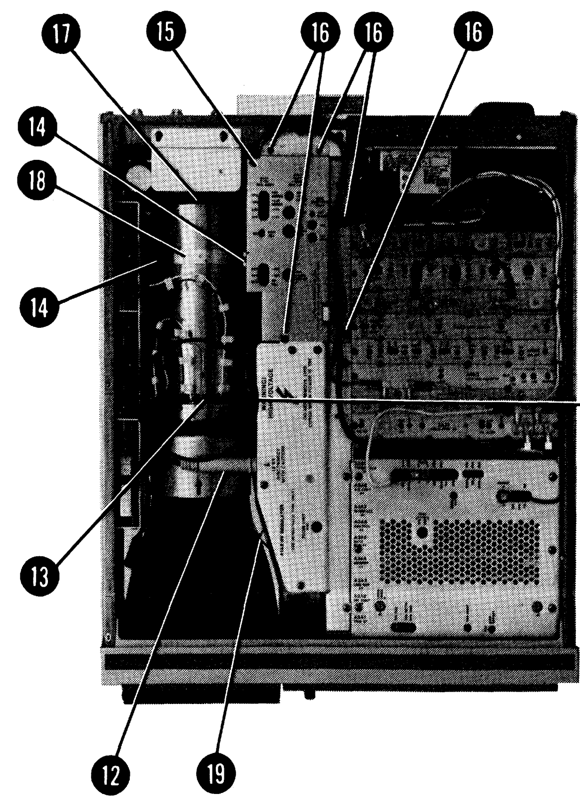
View C



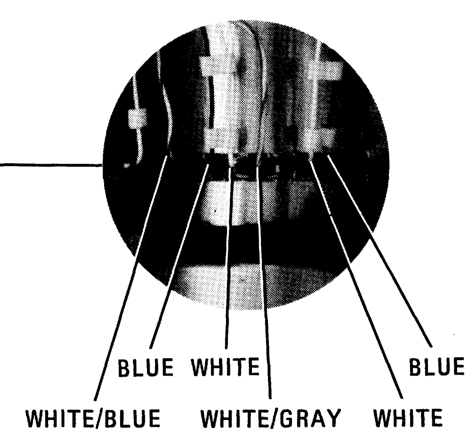
View A



View B



View C



View D

CRT REPLACEMENT

INSTALLATION

1. Install CRT shield on new CRT and insert foam spacer at rear of shield.

2. Insert new CRT into instrument through front panel frame so that rear of tube passes through clamp (18). Make sure grounding strap (19) makes contact with conductive strip on side of CRT. (Refer to View C.)

3. Reconnect plug (17) to socket at rear of new CRT. (Refer to View C.)

4. Replace front panel. Refer to Figure 8-7 if necessary.

5. Pull forward towards front panel on rear of CRT to ensure that CRT is properly mated with front panel and then tighten screws (14) in clamp (18). (Refer to View C.)

6. Replace cover (15) and install screws (16) if they were removed during removal of CRT.

7. Connect wires (13) to neck of CRT and connect high voltage cable to CRT at connector (12). (Refer to Views C and D.)

8. Turn instrument over as shown in View B and connect wires (8) and (9) to neck of CRT and wires (10) and (11) to A1A10 Motherboard. (Refer to View E.)

9. Replace top and bottom covers on instrument, install feet (1) and (2), and join instruments together as shown in View A by tightening thumbscrews (5).

Figure 8-8. Cathode Ray Tube (CRT) Replacement

Table 8-1. Troubleshooting Index (1 of 2)

Troubleshooting Information	Tab Title	Vol.
Center Frequency Tuning Equations and Phase Lock	RF Section Analog Troubleshooting Block Diagram	4
Diagnostic Functions	Spectrum Analyzer Overall Troubleshooting	3, 4
Digital Storage	A3 Digital Storage Block Diagram	3
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 8-1. 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.

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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

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- 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

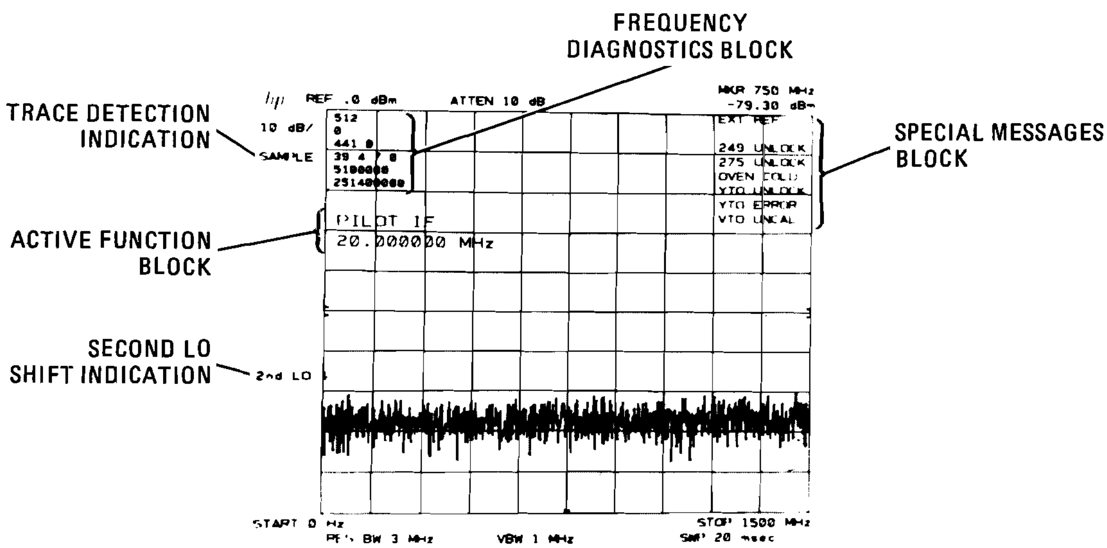

Figure 8-9. CRT Locations of Special Messages and Diagnostic Function Indicators

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.

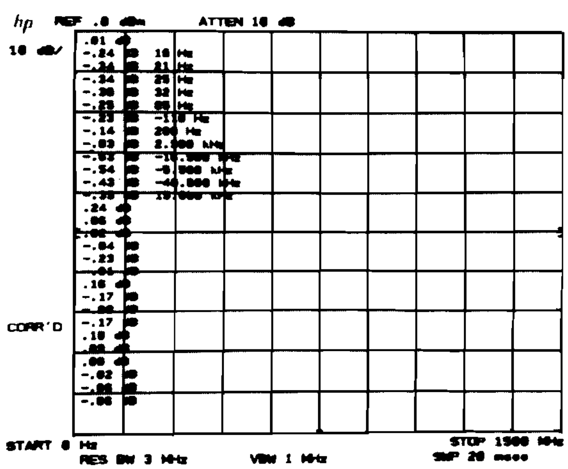

Figure 8-10. Error Correction Routine Data

Table 8-2. 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*	A4A7/A4A6/A4A5
3	30 Hz	± 0.5 dB*	A4A7/A4A6/A4A5
4	100 Hz	± 0.5 dB*	A4A7/A4A6/A4A5
5	300 Hz	± 0.5 dB*	A4A7/A4A6/A4A5
6	1 kHz	± 0.5 dB*	A4A7/A4A6/A4A5
7	3 kHz	± 0.5 dB*	A4A8/A4A4/A4A6
8	10 kHz	± 0.5 dB*	A4A8/A4A4/A4A6
9	30 kHz	± 0.5 dB*	A4A8/A4A4/A4A6
10	100 kHz	± 0.5 dB*	A4A8/A4A4/A4A6
11	300 kHz	± 0.5 dB*	A4A8/A4A4/A4A6
12	1 MHz	*	A4A8/A4A4/A4A6
13	3 MHz	± 1 dB*	A4A8/A4A4/A4A6
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 (LIN operation only)	± 1 dB	A4A3/A4A2
17	20 dB gain (LIN operation only)	± 1 dB	A4A2
18	10 dB gain (LIN operation only)	± 1 dB	A4A3
19	50 dB step gain errors	± 0.6 dB	A4A5
20	40 dB step gain errors	± 0.6 dB	A4A5
21	30 dB step gain errors	± 0.6 dB	A4A5
22	20 dB step gain errors	± 0.6 dB	A4A5
23	10 dB step gain errors	± 0.6 dB	A4A5
24	0 dB step gain errors	± 0.6 dB	A4A8
25	–10 dB step gain errors	± 0.6 dB	A4A8
26	–20 dB step gain errors	± 0.6 dB	A4A8
27	offset error 2 dB/ LOG	± 0.5 dB	A4A1
28	offset error 5 dB/ LOG	± 0.5 dB	A4A1
29	offset error 10 dB/ LOG	± 0.5 dB	A4A1

*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.

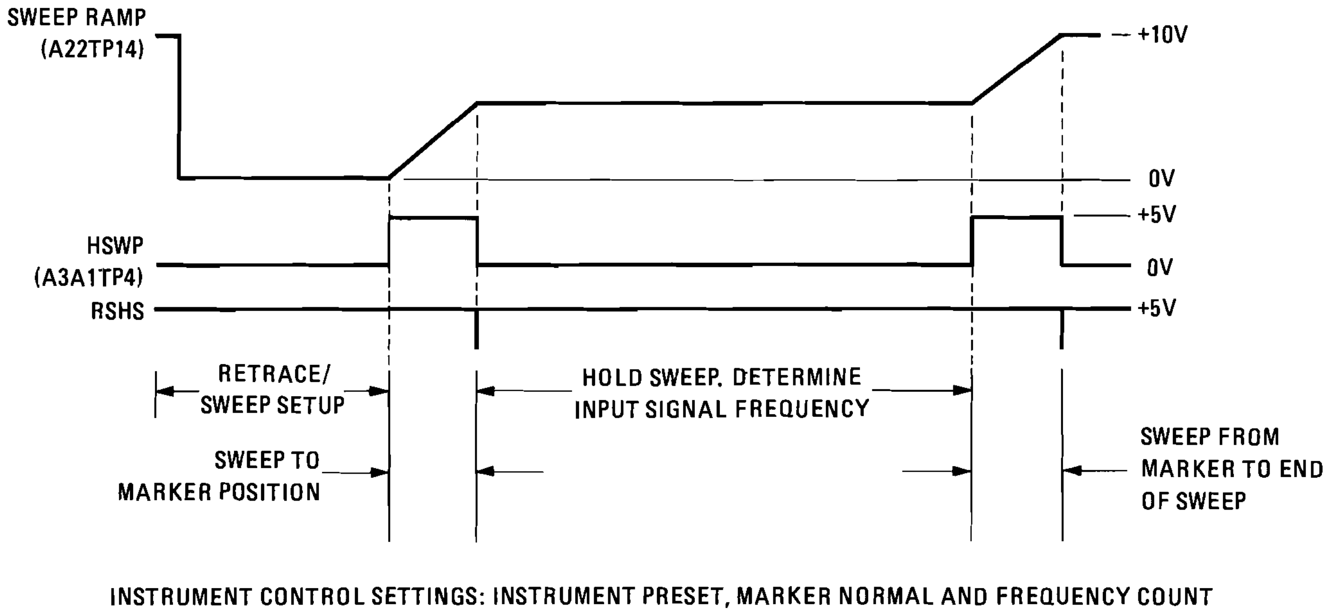

Figure 8-11. Sweep System Timing Example

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).

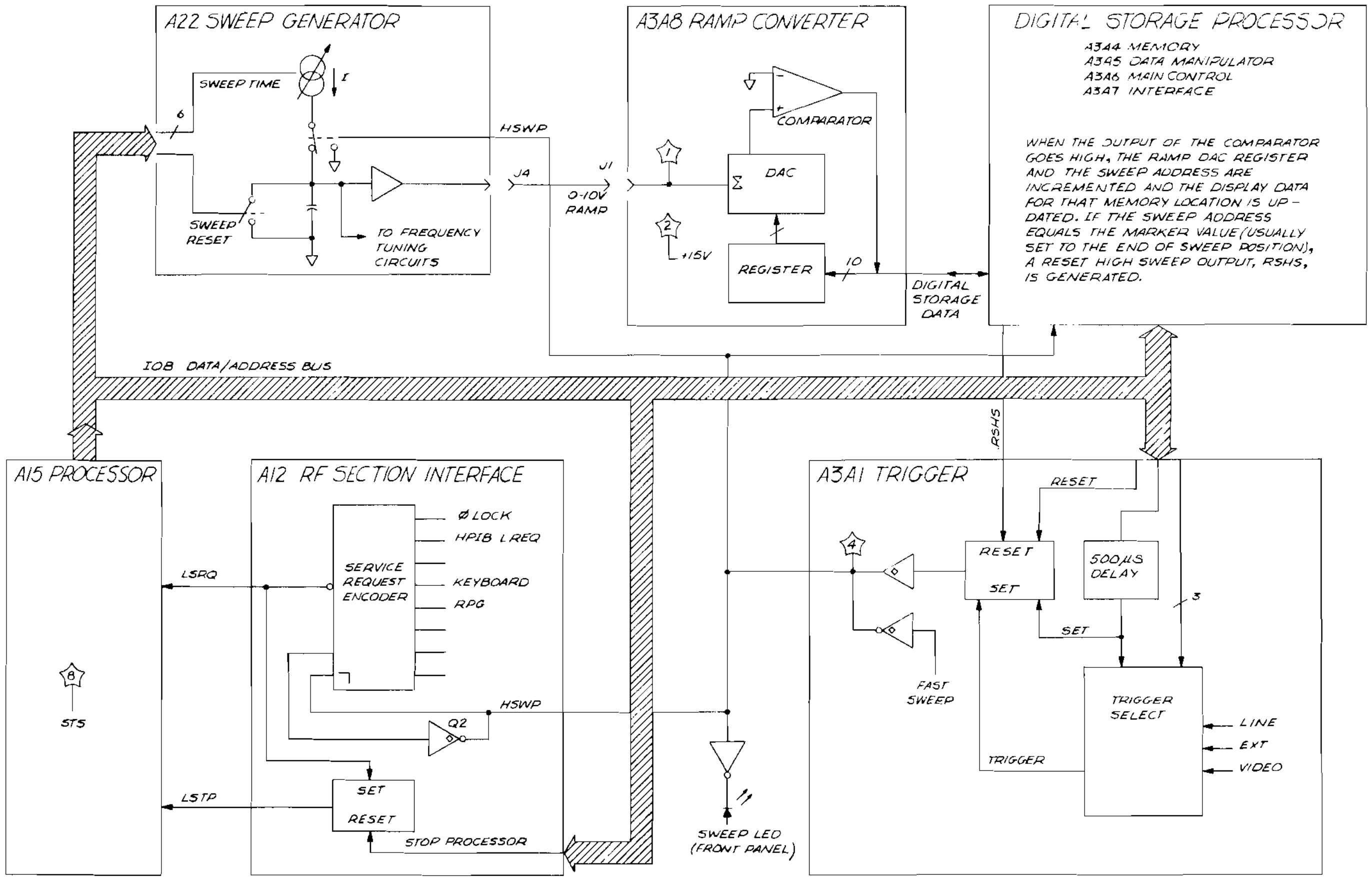

Figure 8-12. Sweep System Block Diagram

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Table 8-3. Mnemonics for IF-Display Section

Mnemonic	Description
IOBØ – IOB15	Instrument Bus Data Bits Ø through 15
ADRØ – ADR3	Instrument Bus Address Bits Ø through 3
BØ – B11	Digital Storage Bus Data Bits Ø through 11
FSOUT	Fast Sweep Output
HSWP	HIGH=Sweeping
PENLIFT	Recorder PENLIFT control
ICLK	Indicator Clock (Front-Panel LEDS)
LFSEN	LOW=Fast Sweep Enable
LRTRC	LOW=Retrace Signal
FSZ	Fast Sweep Z Axis
AUX BLANK	Auxiliary Blanking Output
BLANK	LOW=Blanking Control
HLDX	Hold X Position (Sample and Hold Control)
HLDY	Hold Y Position (Sample and Hold Control)
SMPL	Sample
AUX Z	Auxiliary Z Axis Output
X	Horizontal Signal to CRT
Y	Vertical Signal to CRT
Z	Intensity Signal to CRT
INTG	Integrator Control
INTG	LOW=Integrator Control
LL	Long Line
LL	LOW=Long Line
LGX	Line Generator Horizontal Signal
LGY	Line Generator Vertical Signal
ΔX	Delta X Position
ΔY	Delta Y Position
STROK8	Stroke 8 of Current Character
MAØ – MA11	Memory Address Bus Bits Ø through 11
POS	Sign of ALU Results
LZERO	Output of Zero Check on ALU Result
RØ – R11	Ram Bus Bits Ø through 11
AØ – A11	Accumulator Bus Bits Ø through 11
FØ – F11	Function Bus Bits Ø through 11
SØ – S11	Source Bus Bits Ø through 11
RMØ – RM2	Ram Register Select Bits Ø through 2
LDM EN	Data Manipulator Output Enable
FCØ – FC3	Data Manipulator Function Control Bits Ø through 3
QSØ – QS3	Qualifier Selection Bits Ø through 3
PSØ – PS3	I/O Port Selection Bits Ø through 3
IOC	I/O Port Input/Output Control
LWRITE	Memory Write Control
LCLRSA	LOW=Clear Stroke Address
RSHS	Reset High Sweep
LINCRSA	Increment Stroke Address
LRSTO	LOW=Reset Trigger Occurred
RSEN	Reset Peak Detectors Enable
CE	Memory Chip Enable
KSØ – KS3	Constant Selection Bits Ø through 3
INTR	Interrupt
INSELA	Input Selection Bit A
INSELB	Input Selection Bit B
DOTEN	Dot Enable
HOLD	Track and Hold Control
BRIGHT	Bright CRT Display Control
LLGBLANK	LOW=Line Generator Blanking Control
DIM	Dim CRT Display Control
BLINK	Blink CRT Display Control
CHAR	Character Mode Display Control
LROMEN	LOW=ROM Enable
BS	Block Switch Control
FS	Fast Sweep Mode
NSØ – NS7	Next State Bus Bits Ø through 7
LØ – L7	Link State Bus Bits Ø through 7
SØ – S7	State Bus Bits Ø through 7
BLØ – BL6	Branch Length Bus Bits Ø through 6
CLK	8MHz System Clock
LCLK	Inverted CLK
1MHZ	1MHz ADC Clock
LGCLK	200kHz Line Generator Clock
LTON	LOW=Turn On
LDX	Load X Position Register
LDCHAR	Load Character Register
LDMDR	Load Memory Data Register
LDY	Load Y Position Register
LDMAR	Load Memory Address Register
LDRMP	Load Ramp Register
LTSTA	LOW=Input Test A Data
LTSTB	LOW=Input Test B Data
LMEMEN	LOW=Enable Memory Output
LADC	LOW=Enable ADC Output
LRTN	LOW=Enable Interrupt Return
LDEXP	Load Expand Register
LQ	LOW=Selected Qualifier
LDSR	LOW=Digital Storage Ready
LTIO	LOW=IF-Display Section I/O Strobe
SG10 SG20-1 SG20-2	Step Gain Controls
OS10 OS20-1 OS20-2	Offset Gain Controls
LG10 LG20	Linear Gain Controls
VBWA VBWB VBWC VBWD	Video Bandwidth Controls
RBWA RBWB RBWC RBWD	Resolution Bandwidth Controls
VIDEO	Video Signal
SWITCH	Up/Down Converter Control
18.4MHz LO	18.4MHz Local Oscillator Signal
21.4MHz	21.4MHz IF Signal
3MHz	3MHz IF Signal
BW5 BW7 BW63 BW68	Bandwidth Controls
FREQ ZERO	Frequency Zero Control
CRT DSBL	CRT Disable Control
REC CAL	Recorder Calibrate
REC ZERO	Recorder Zero
A LOG B LOG	Log Expand Controls
LOG/LIN	Log/Linear Control
A2dB A4dB A8dB A10dB A20dB AVdB	Attenuation Controls

Table 8-4. 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

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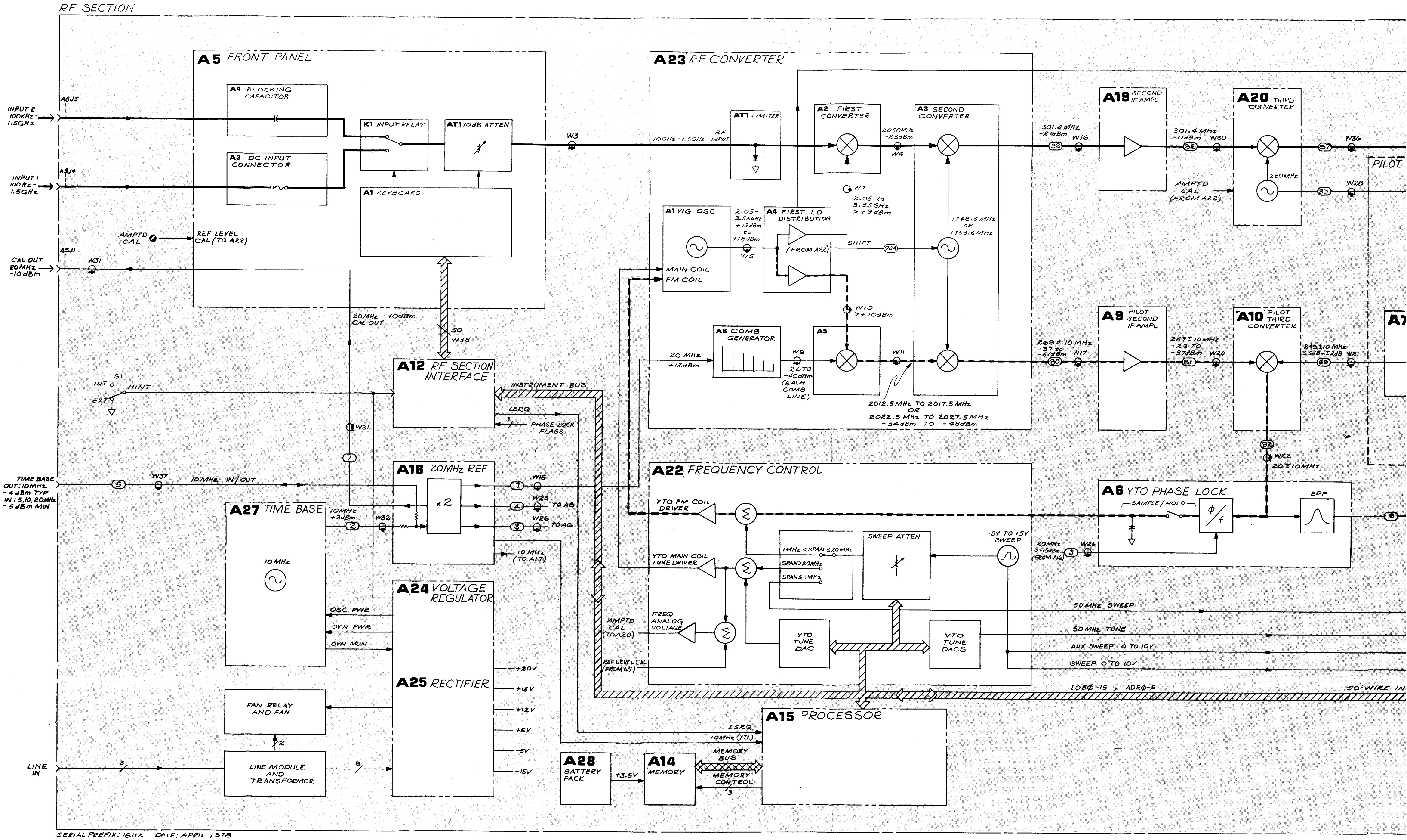
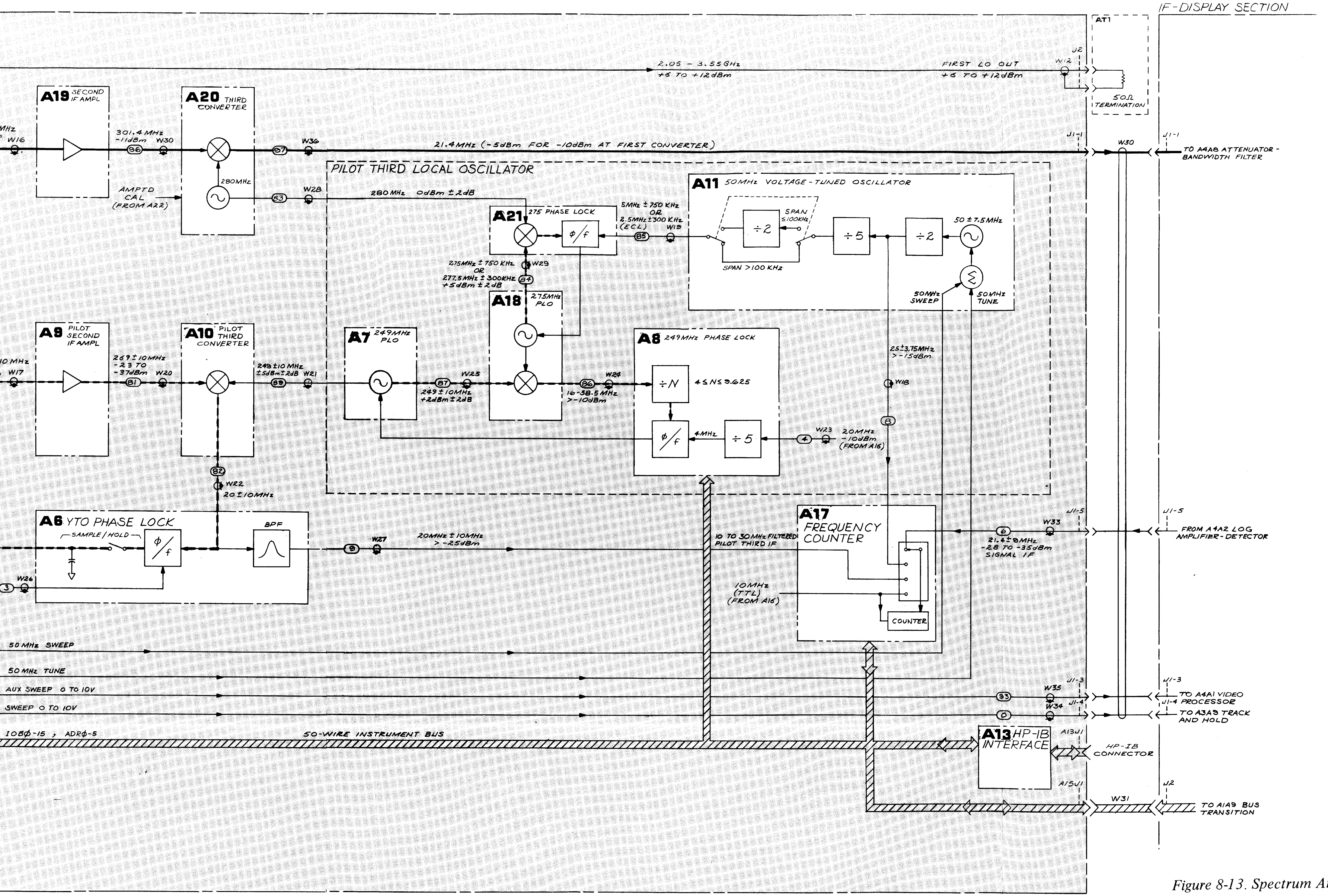

RF SECTION
A5 FRONT PANEL
A4 BLOCKING CAPACITOR
A3 DC INPUT CONNECTOR
K1 INPUT RELAY
AT1 70dB ATTEN
A1 KEYBOARD
INPUT 2 100KHz - 1.5GHz
INPUT 1 100Hz - 1.5GHz
CAL OUT 20MHz -10dBm
AMPTD CAL
REF LEVEL CAL (TO A22)
A23 RF CONVERTER
AT1 LIMITER
A2 FIRST CONVERTER
A3 SECOND CONVERTER
A1 YIG OSC
MAIN COIL
FM COIL
A4 FIRST LO DISTRIBUTION
(FROM A22)
SHIFT
A6 COMB GENERATOR
A5
20 MHz +12dBm
2012.5MHz TO 2017.5MHz OR 2022.5 MHz TO 2027.5MHz -34dBm TO -48dBm
1748.6MHz OR 1753.6MHz
A19 SECOND IF AMPL
A20 THIRD CONVERTER
280MHz
AMPTD CAL (FROM A22)
A9 PILOT SECOND IF AMPL
A10 PILOT THIRD CONVERTER
PILOT
A12 RF SECTION INTERFACE
INSTRUMENT BUS
LSRQ
PHASE LOCK FLAGS
A16 20MHz REF
A27 TIME BASE
10 MHz
TIME BASE OUT: 10MHz -4dBm TYP IN: 5,10,20MHz -5dBm MIN
10MHz IN/OUT
A24 VOLTAGE REGULATOR
A25 RECTIFIER
OSC PWR
OVN PWR
OVN MON
FAN RELAY AND FAN
LINE MODULE AND TRANSFORMER
LINE IN
A22 FREQUENCY CONTROL
YTO FM COIL DRIVER
YTO MAIN COIL TUNE DRIVER
SWEEP ATTEN
YTO TUNE DAC
VTO TUNE DACS
FREQ ANALOG VOLTAGE
AMPTD CAL (TO A20)
REF LEVEL CAL (FROM A5)
A6 YTO PHASE LOCK
SAMPLE/HOLD
BPF
50 MHz SWEEP
50 MHz TUNE
AUX SWEEP 0 TO 10V
SWEEP 0 TO 10V
50-WIRE IN
A15 PROCESSOR
A28 BATTERY PACK
A14 MEMORY
MEMORY BUS
MEMORY CONTROL
SERIAL PREFIX: 1811A DATE: APRIL 1978



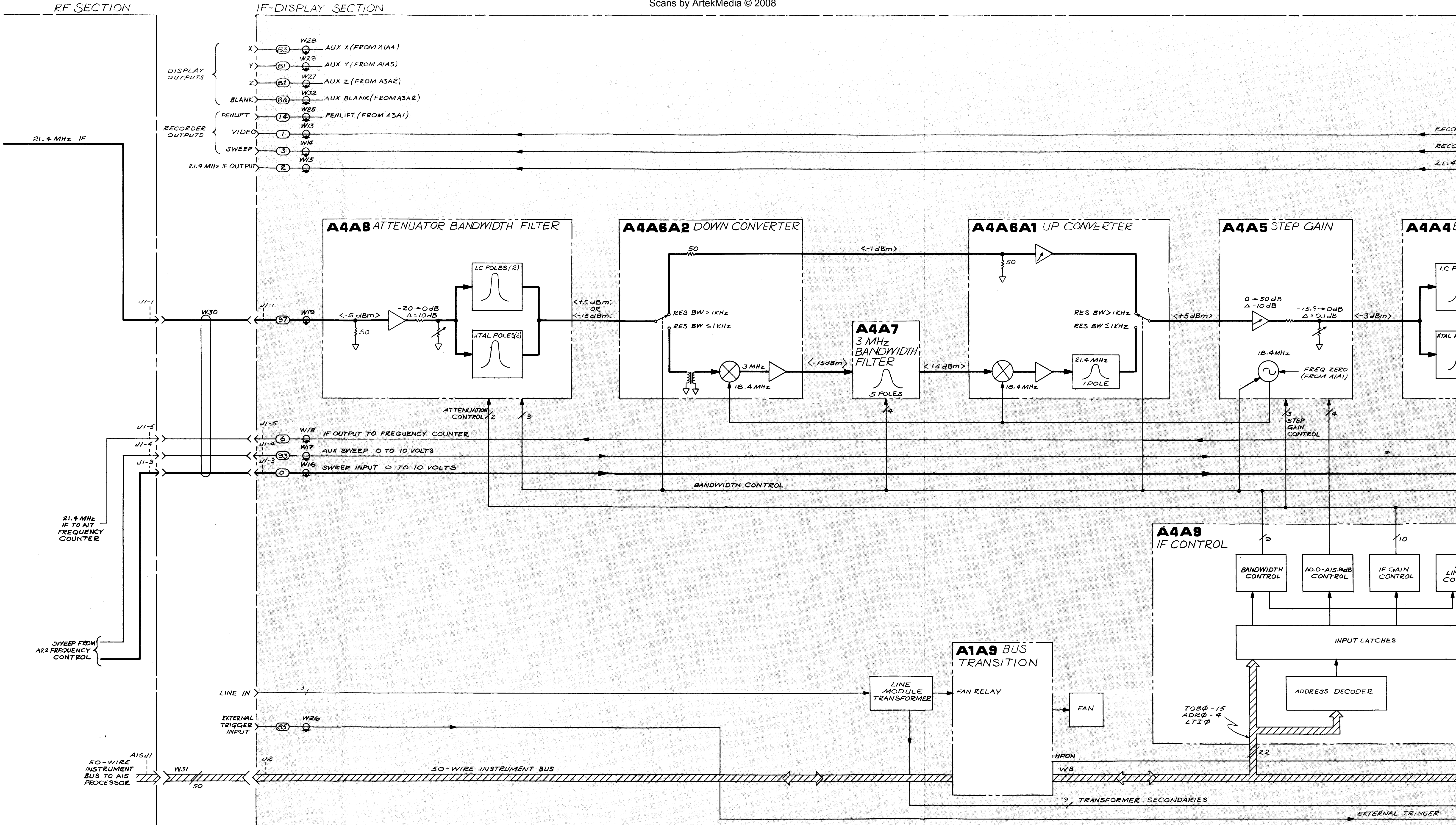
NOTE

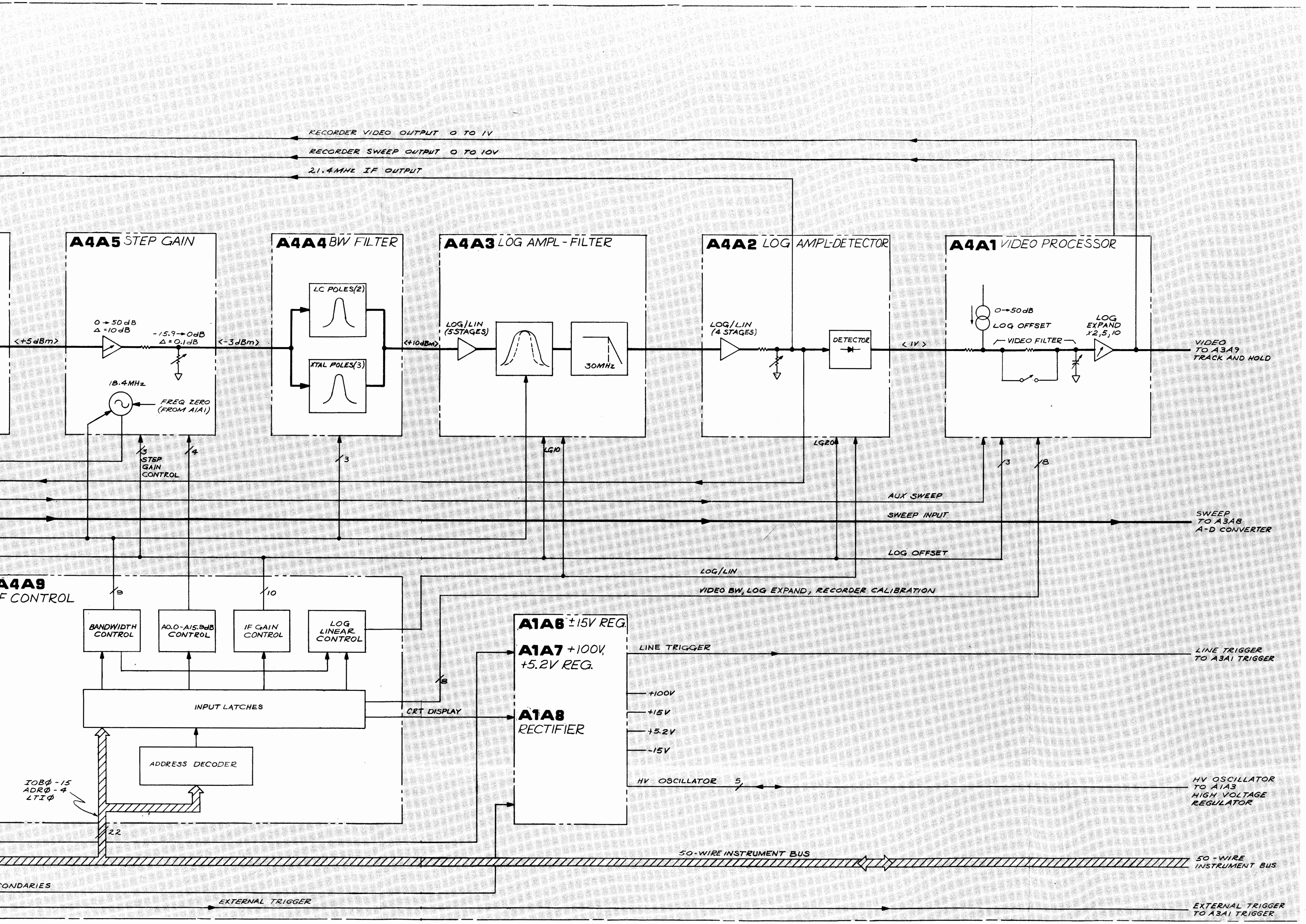
1. UNLESS OTHERWISE INDICATED POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND THE SPECTRUM ANALYZER:

INSTRUMENT PRESET

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

Figure 8-13. Spectrum Analyzer Overall Block Diagram (1 of 3)


RF SECTION
IF-DISPLAY SECTION
DISPLAY OUTPUTS
AUX X (FROM A1A4)
AUX Y (FROM A1A5)
AUX Z (FROM A3A2)
AUX BLANK (FROM A3A2)
RECORDER OUTPUTS
PENLIFT (FROM A3A1)
VIDEO
SWEEP
21.4 MHz IF OUTPUT
21.4 MHz IF
A4A8 ATTENUATOR BANDWIDTH FILTER
LC POLES (2)
XTAL POLES (2)
A4A6A2 DOWN CONVERTER
RES BW > 1KHz
RES BW ≤ 1KHz
A4A7 3 MHz BANDWIDTH FILTER
5 POLES
A4A6A1 UP CONVERTER
21.4 MHz 1 POLE
A4A5 STEP GAIN
FREQ ZERO (FROM A1A1)
STEP GAIN CONTROL
ATTENUATION 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
A1A9 BUS TRANSITION
FAN RELAY
FAN
LINE IN
LINE MODULE TRANSFORMER
EXTERNAL TRIGGER INPUT
50-WIRE INSTRUMENT BUS TO A15 PROCESSOR
50-WIRE INSTRUMENT BUS
TRANSFORMER SECONDARIES
EXTERNAL TRIGGER



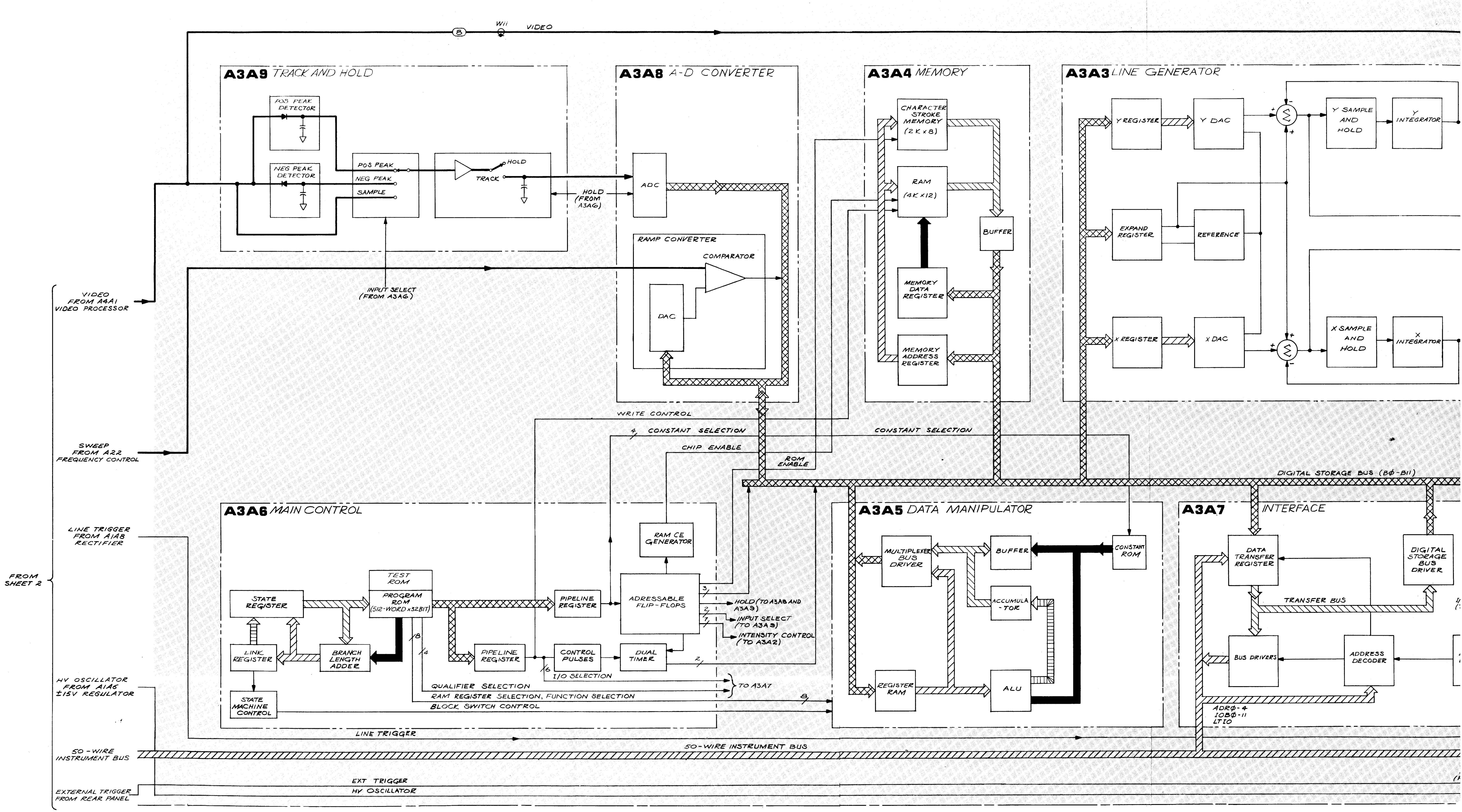
NOTE

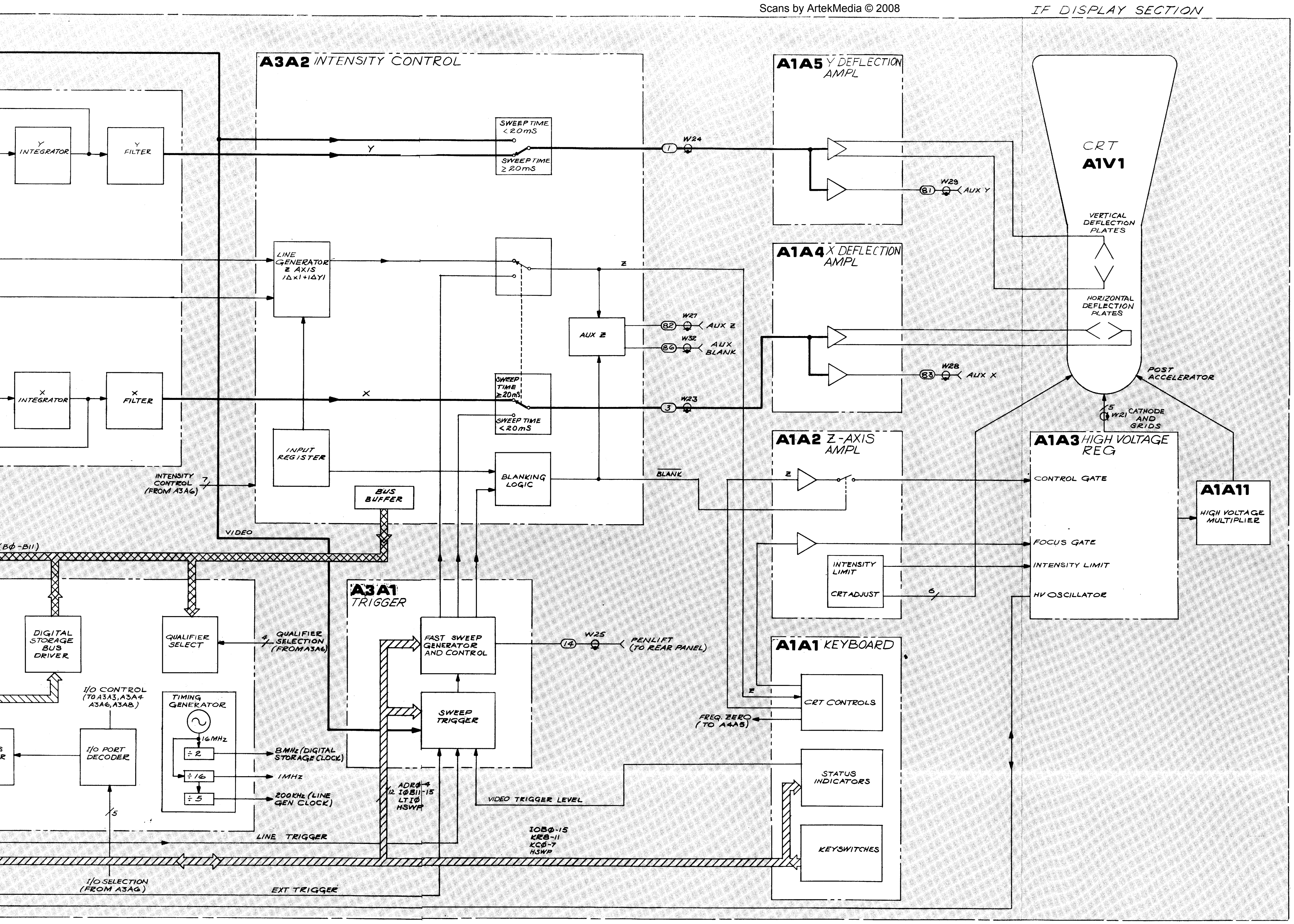
1. UNLESS OTHERWISE INDICATED, POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND THE SPECTRUM ANALYZER:

INSTRUMENT PRESET

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

Figure 8-13. Spectrum Analyzer Overall Block Diagram (2 of 3)


VIDEO
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
DIGITAL STORAGE BUS (B0-B11)
A3A6 MAIN CONTROL
STATE REGISTER
TEST ROM
PROGRAM ROM (512-WORD x 32 BIT)
PIPELINE REGISTER
ADRESSABLE FLIP-FLOPS
RAM CE GENERATOR
LINK REGISTER
BRANCH LENGTH ADDER
PIPELINE REGISTER
CONTROL PULSES
DUAL TIMER
STATE MACHINE CONTROL
HOLD (TO A3A8 AND A3A9)
INPUT SELECT (TO A3A9)
INTENSITY CONTROL (TO A3A2)
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



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 8-13. Spectrum Analyzer Overall Block Diagram (3 of 3)

DISPLAY TROUBLESHOOTING

The Display system consists of four sections:

- Input section: A3A8 Analog-Digital Converter and A3A9 Track and Hold.
- Processor section: A3A4 Memory, A3A5 Data Manipulator, A3A6 Main Control and A3A7 Interface.
- CRT Driver section: A3A1 Trigger, A3A2 Intensity Control and A3A3 Line Generator.
- CRT Amplifier section: A1A2 Z Axis Amplifier, A1A4/A5 X/Y Deflection Amplifier and A1A3 HV Regulator.

Isolation of a malfunction to one of the above sections is done with the use of rear-panel display outputs and the internal test programs.

If the left INSTR CHECK LED is on, a failure has occurred in Digital Storage. Refer to the Digital Storage Troubleshooting notes for the correct troubleshooting procedure.

The following paragraphs briefly describe the failure modes and appropriate places to begin the troubleshooting.

Characters Only

If only the characters on the CRT display are affected, the problem most likely exists on the A3A4 Memory. Perform the character ROM check on the SA Diagram.

Graticule and Characters Only

If the graticule and characters are incorrect but the video information appears to be correct, suspect the System ROMs on A3A6 first. Also the "long POP" test of the RF Section memory should be performed. Refer to the Digital Storage Troubleshooting notes for more information.

Video (Signal) Only

If only the video information is incorrect, suspect A4 IF Section, A3A8 or A3A9. To eliminate the IF, connect the rear-panel SWEEP and VIDEO RECORDER OUTPUTS to an oscilloscope. If the video is correct, then either A3A8 or A3A9 is defective.

Remove cable 0 from A3A9J1. Then jumper A3A8TP1 to A3A9TP3 and push [INSTR PRESET]. This substitutes the sweep ramp for the video input. The CRT display is similar to Figure 8-41. If the ramp is incorrect, remove A3A9, jumper A3A8TP1 to A3A8TP6 and push [INSTR PRESET]. The CRT display is the same as Figure 8-41. If the display is correct, the problem is in the A3A9 assembly. Refer to A3A9 Troubleshooting procedure. If ramp is incorrect, suspect ADC on A3A8. See the A3A8 Troubleshooting notes to verify this.

Don't rule out the sweep system, especially the ramp Converter on A3A8 when troubleshooting video failures. Some ramp converter failures produce CRT displays that are similar to those caused by ADC failures.

All CRT Information Blank or Distorted

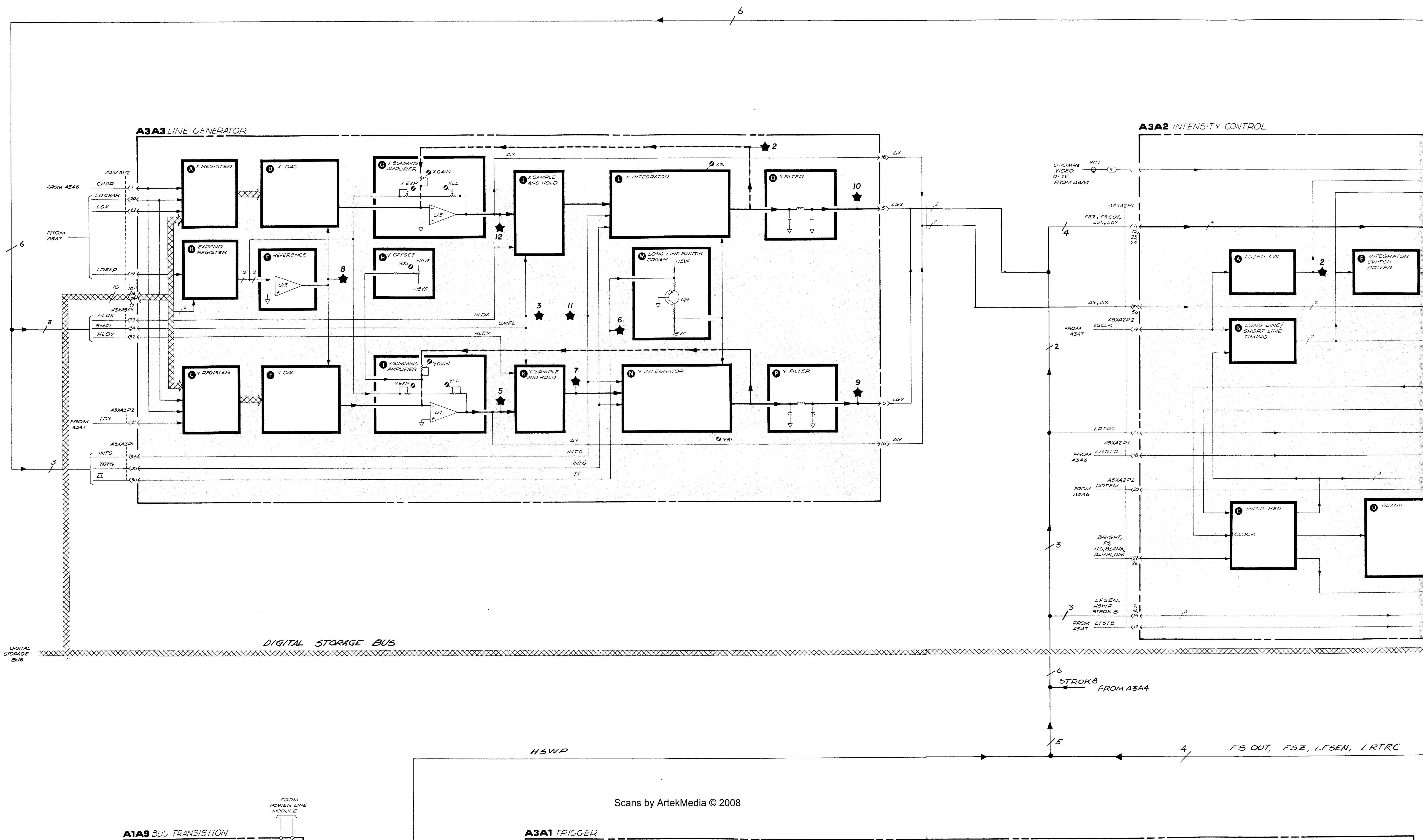
Check X, Y and Z DISPLAY OUTPUTS on rear panel. If these are correct, fault is most likely X/Y Deflection Amplifiers or Z Axis Amplifier. The following program, which places a dot at the center of the display, is helpful when troubleshooting the Deflection Amplifiers. It balances the voltages in both halves of the circuitry.

INSTR PRESET	
Blank Trace A	
SHIFT Recorder Lower Left	DSPL ADRS
0 Hz	
SHIFT Recorder Upper Right	WRITE:
1090 Hz	Vector Command
512 Hz 512 Hz	X, Y coordinates for center screen
1092 Hz	End of display

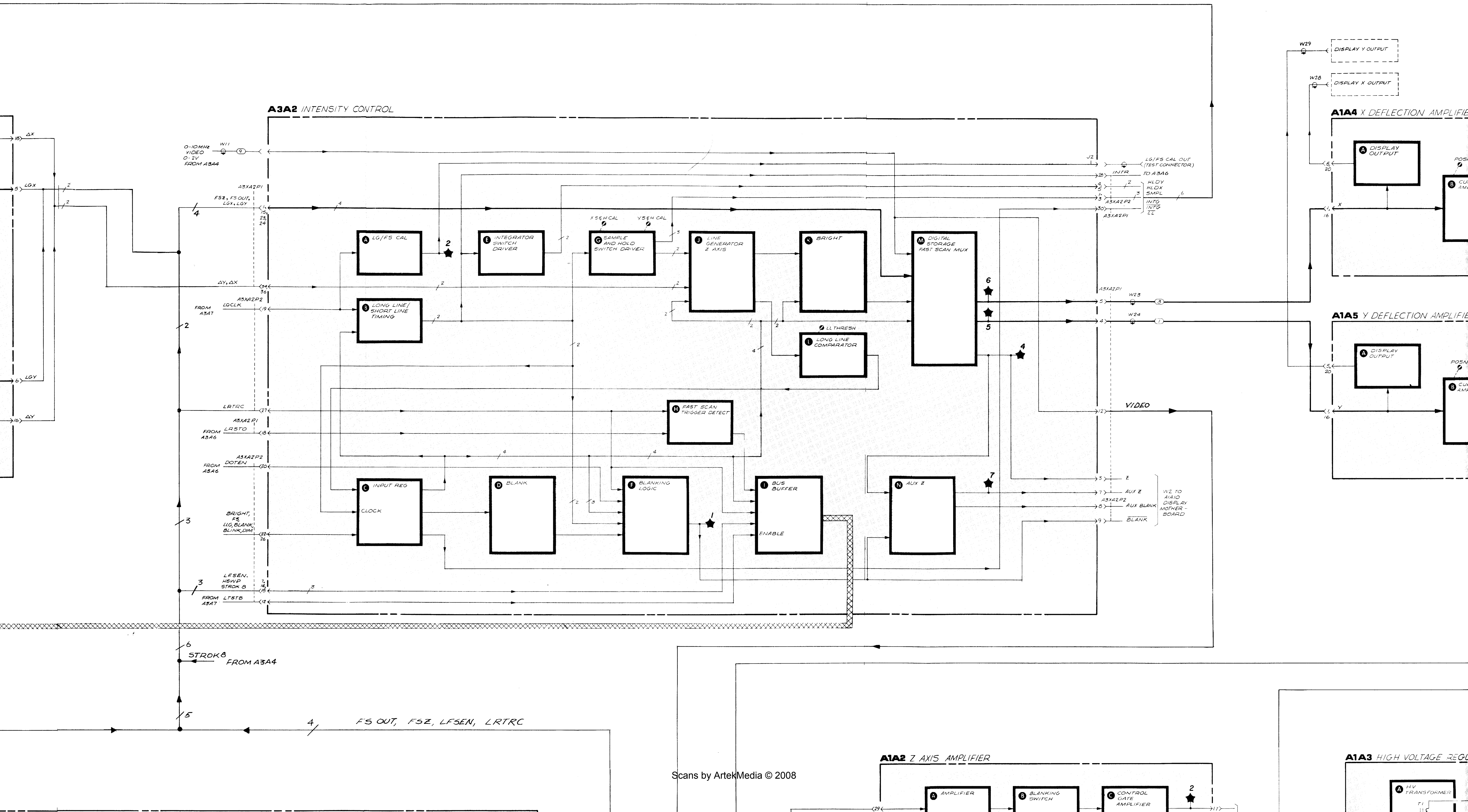
If the X, Y and Z DISPLAY OUTPUTS produce either distorted or no output, Digital Storage must be tested. Connect a jumper from A3A6TP3 to A3A6TP6 and push A3A7S1. The Digital Storage Test Pattern (Figure 8-37) results. Refer to the Digital Storage Troubleshooting procedures. If the test pattern is correct, start with the system ROMs check.

If the test pattern is incorrect, verify operation of A3A3 Line Generator and A3A2 Intensity Control. Refer to the troubleshooting information included with the schematics. If A3A3 and A3A2 are working properly, then all of Digital Storage will have to be checked starting with A3A6.

Whenever the display is blank, and the left INSTR CHECK LED is off, check the A1A6 ±15V Regulator and A1A7 +100V, +5.2V Regulator. The power supply LEDs indicate the presence of voltage but not regulation. Verify operation of A3A2 Intensity Control and A1A2 Z Axis Amplifier. If these are all working properly, carefully examine the A1A3 High Voltage Regulator assembly.



A3A3 LINE GENERATOR
A3A2 INTENSITY CONTROL
X REGISTER
X DAC
X SUMMING AMPLIFIER
X SAMPLE AND HOLD
X INTEGRATOR
X FILTER
EXPAND REGISTER
REFERENCE
Y OFFSET
LONG LINE SWITCH DRIVER
Y REGISTER
Y DAC
Y SUMMING AMPLIFIER
Y SAMPLE AND HOLD
Y INTEGRATOR
Y FILTER
LG/FS CAL
INTEGRATOR SWITCH DRIVER
LONG LINE/ SHORT LINE TIMING
INPUT REG
CLOCK
BLANK
FROM A3A6
FROM A3A7
CHAR
LD CHAR
LDX
LDEXP
HLDX
SMPL
HLDY
LDY
INTG
$\overline{INTG}$
$\overline{LL}$
DIGITAL STORAGE BUS
STROK8
FROM A3A4
HSWP
FS OUT, FSZ, LFSEN, LRTRC
0-10MHz VIDEO 0-2V FROM A3A4
LRTRC
LRSTO
DOTEN
BRIGHT, FS, LLG, BLANK, BLINK, DIM
LFSEN, HSWP, STROK 8
LTSTB
LGCLK
A1A9 BUS TRANSITION
FROM POWER LINE MODULE
A3A1 TRIGGER



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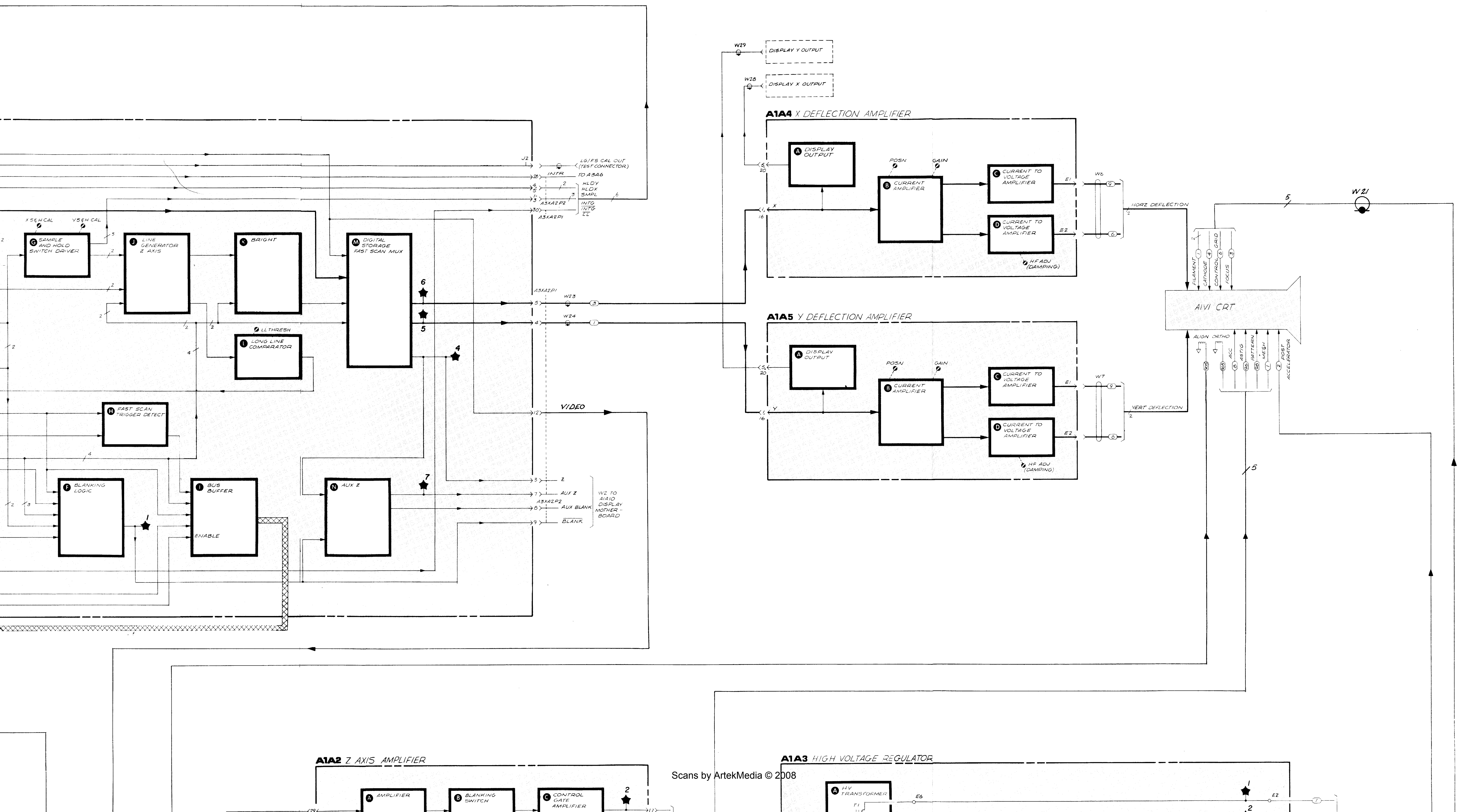

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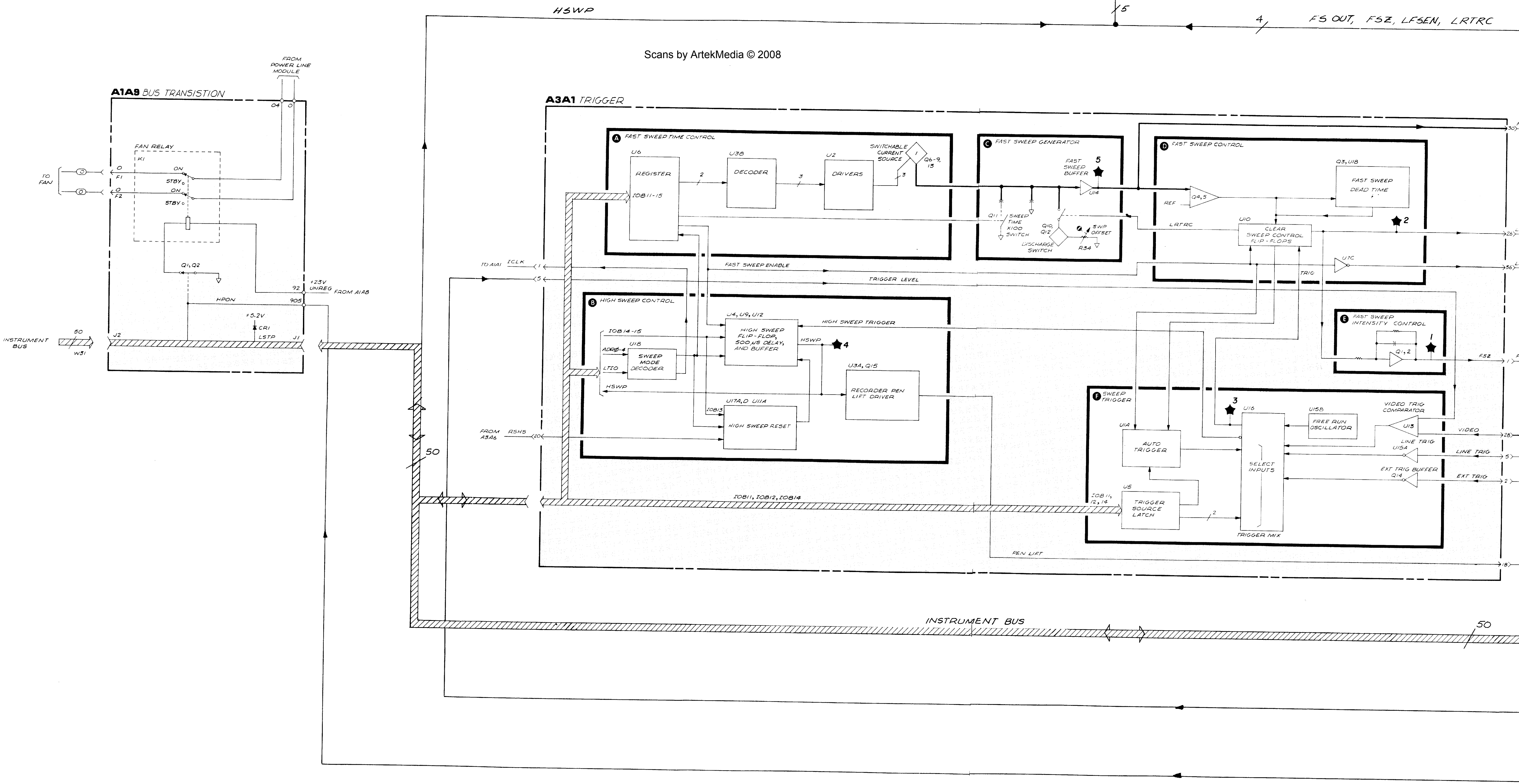

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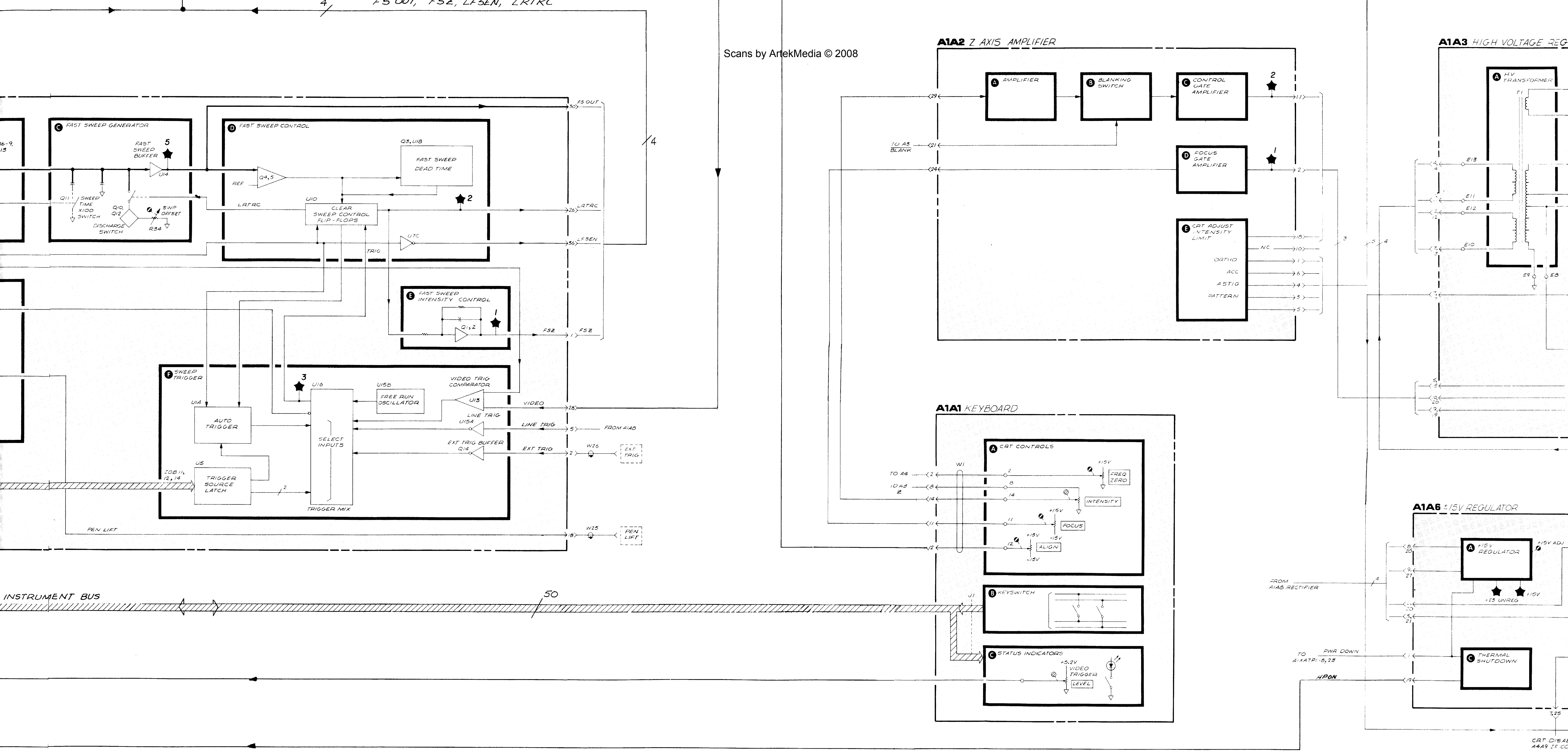
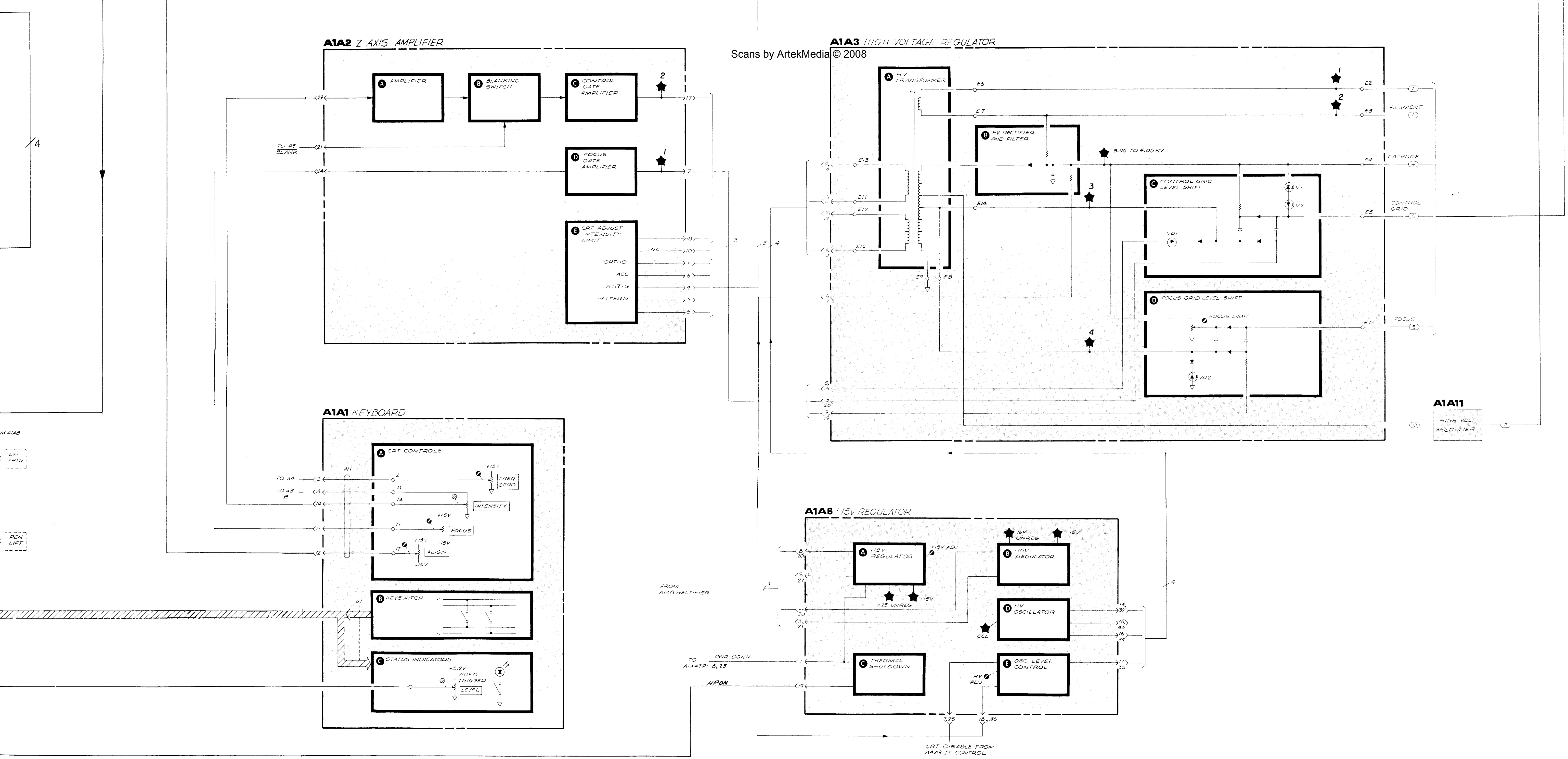

FS OUT, FS2, LFSEN, LRTRC
FAST SWEEP GENERATOR
FAST SWEEP BUFFER
U14
SWEEP TIME X100 SWITCH
DISCHARGE SWITCH
SWP OFFSET
R34
FAST SWEEP CONTROL
Q3,U18
FAST SWEEP DEAD TIME
REF
Q4,5
LRTRC
U10
CLEAR SWEEP CONTROL FLIP-FLOPS
U7C
TRIG
FS OUT
LRTRC
LFSEN
FAST SWEEP INTENSITY CONTROL
Q1,2
FS2
SWEEP TRIGGER
U1A
AUTO TRIGGER
U16
SELECT INPUTS
U15B
FREE RUN OSCILLATOR
VIDEO TRIG COMPARATOR
U13
LINE TRIG
U15A
EXT TRIG BUFFER
Q14
U5
TRIGGER SOURCE LATCH
TRIGGER MIX
VIDEO
LINE TRIG
FROM A1A6
EXT TRIG
W26
W25
PEN LIFT
INSTRUMENT BUS
50
A1A2 Z AXIS AMPLIFIER
AMPLIFIER
BLANKING SWITCH
CONTROL GATE AMPLIFIER
FOCUS GATE AMPLIFIER
CRT ADJUST INTENSITY LIMIT
NC
ORTHO
ACC
ASTIG
PATTERN
TO A3 BLANK
A1A1 KEYBOARD
CRT CONTROLS
TO A4
TO A5
FREQ ZERO
INTENSITY
FOCUS
ALIGN
+15V
-15V
W1
J1
KEYSWITCH
STATUS INDICATORS
+5.2V
VIDEO TRIGGER LEVEL
A1A3 HIGH VOLTAGE REGULA
HV TRANSFORMER
E13
E11
E12
E10
E9
E8
A1A6 ±15V REGULATOR
±15V REGULATOR
+15V ADJ
+25 UNREG
FROM A1A8 RECTIFIER
TO A1XA7P1-8,23
PWR DOWN
HPON
THERMAL SHUTDOWN
CRT DISABLE
A4A9 IF CONTR



A1

Figure 8-14. A1 Display Section Block Diagram

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A1A1 KEYBOARD, CIRCUIT DESCRIPTION

A1A1 Keyboard consists of three functional blocks: CRT Controls, Keyboard Switches, and Status Indicators.

CRT Controls A

The CRT Controls include the following front-panel potentiometers:

- INTENSITY control R1. Sets the level of the input to A1A2 Z Axis Amplifier.
- ALIGN screwdriver adjustment R8. Sets the CRT trace to horizontal.
- FOCUS screwdriver adjustment R2. Focuses the CRT trace.
- FREQ ZERO screwdriver adjustment R3. For resolution bandwidths of 1 kHz or less, adjusts the frequency of the 18.4 MHz oscillator (A4A5 Step Gain) to precisely align the IF passband to 21.400 MHz.

The front-panel STANDBY indicator, LED DS18, which is driven by the PWR DWN signal from A1A6 ± 15V Regulator, is activated when line power is applied while the power supply regulators are off.

Keyboard Switches B

The Keyboard Switches are a matrix of rows and columns connected to the RF Section keyboard by the 50-wire Instrument Bus W8. When a keyboard switch is activated, A15 Processor recognizes the switch and performs the indicated operation.

Status Indicators C

The Status Indicators, LEDs DS1 through DS17, show the states of the various keyboard functions. A15 Processor loads the latches U1 and U2 via the Instrument Bus W8. The latch address is decoded in A3A1 Trigger, which generates the ICLK strobe signal.

A1A2 Z AXIS AMPLIFIER, CIRCUIT DESCRIPTION

A1A2 Z Axis Amplifier receives from A3A2 Intensity Control two signals for control of the CRT: a 0V—2V Z signal proportional to the CRT writing rate, and a blanking signal $\overline{\text{BLANK}}$.

Amplifier Ⓐ

The Z signal, after attenuation by the front-panel INTENSITY potentiometer A1R1, drives the input stage Q9, Q10. This amplifier supplies a differential current output to the Focus Gate Amplifier and, through a Blanking Switch, to the Control Gate Amplifier.

Control Gate Amplifier Ⓒ

The input to the Control Gate Amplifier is a virtual-ground, current-summing junction. Its output voltage is given by:

$$V \cong I_{Q7}\ R25$$

where I_{Q7} is the current in Q7, which is determined by the Z-axis input when $\overline{\text{BLANK}}$ is high. When $\overline{\text{BLANK}}$ is low, Q7 is off, and the output of the Control Gate Amplifier drops to a few volts, blanking the CRT.

Focus Gate Amplifier Ⓓ

The Focus Gate Amplifier supplies a correction voltage to the FOCUS grid of the CRT to compensate for defocusing effects with varying intensity levels. The magnitude of this correction voltage is set by FOCUS GAIN potentiometer R30 and the front-panel FOCUS screwdriver adjustment A1R2. The output stage is identical to that of the Control Gate Amplifier except for the pulse response adjustments (HF GAIN potentiometer R22 and HF TRIM capacitor C10 in the Control Gate Amplifier). These components are fixed in the Focus Gate Amplifier.

CRT Adjustments Ⓔ

The CRT Adjustments set the bias voltages for the various CRT functions. Each adjustment name is indicated on the schematic.

Table 8-5. A1A1 Keyboard, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1T1	9100-4009	1	TRANSFORMER, MAIN POWER	28480	9100-4009
A1V1	5083-5791	1	CRT-P31 PHOSPHOR COATING	28480	5083-5791
A1A1	85662-60001	1	KEYBOARD ASSEMBLY (INCLUDES W1 & W9)	28480	85662-60001
A1A1C1	0160-4084	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A1DS1	1990-0485	1	LED-VISIBLE LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A1A1DS2- A1A1DS18	1990-0487	17	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A1A1J1	1251-4828	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-4828
A1A1Q1	1854-0404	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A1Q2	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A1R1	2100-3587	1	RESISTOR-VAR CONTROL CP 2K 10% 10CW	28480	2100-3587
A1A1R2	2100-2452	3	RESISTOR-TRMR 25K 20% CCP TOP-ADJ 1-TRN	28480	2100-2452
A1A1R3	2100-2452		RESISTOR-TRMR 25K 20% CCP TOP-ADJ 1-TRN	28480	2100-2452
A1A1R4	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1962-F
A1A1R5	0757-0420	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A1A1R6	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A1R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A1R8	2100-2452		RESISTOR-TRMR 25K 20% CCP TOP-ADJ 1-TRN	28480	2100-2452
A1A1R9	0698-3444	3	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1A1R10	0698-3161	2	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A1A1R11	0698-3161		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A1A1R12	2100-3647	1	RESISTOR-VAR CONTROL CP 5K 10% LIN	28480	2100-3647
A1A1R13	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1A1R14	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1A1R15	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A1S1- A1A1S28	5060-9436	28		28480	5060-9436
A1A1U1	1820-1730	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A1A1U2	1820-1730		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A1A1U3	1810-0203	2	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R470
A1A1U4	1810-0203		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R470
A1A1XDS1- A1A1XDS15	1200-0010	16	SOCKET-TUBE 2-CONT	28480	1200-0010
A1A1XDS18	1200-0010		SOCKET-TUBE 2-CONT	28480	1200-0010

Table 8-6. A1A2 Z Axis Amplifier, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A2	85662-60100	1	BOARD ASSEMBLY, Z-AXIS AMPLIFIER	28480	85662-60054
A1A2C1	0180-0374	2	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A1A2C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A1A2C3	0160-3670	10	CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C4	0160-4084	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A2C5	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A2C6	0160-2204	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A1A2C7	0160-2308	1	CAPACITOR-FXD 36PF +-5% 300VDC MICA	28480	0160-2308
A1A2C8	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C9	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C10	0121-0474	1	CAPACITOR-V TRMR-PSTN .3-1.5PF 600V	28480	0121-0474
A1A2C11	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C12	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C13	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C14	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A2C15	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A2C16	0180-0269	1	CAPACITOR-FXD 1UF+75-10% 150VDC AL	56289	30D105G150BA2
A1A2C17	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A2C18	0160-2204		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A1A2C19	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C20	0160-2238	1	CAPACITOR-FXD 1.5PF +-.25PF 500VDC CER	28480	0160-2238
A1A2C21	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C22	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2C23	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A2CR1	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A1A2CR2	1901-0096	2	DIODE-SWITCHING 120V 50MA 100NS	28480	1901-0096
A1A2CR3	1901-0028	4	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A2CR4	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A2CR5	1901-0096		DIODE-SWITCHING 120V 50MA 100NS	28480	1901-0096
A1A2CR6	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A2CR7	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A2L1	9140-0210	3	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A2L2	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A2L3	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A2Q1	1853-0232	2	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A1A2Q2	1854-0419	2	TRANSISTOR NPN SI TO-39 PD=1W FT=200MHZ	28480	1854-0419
A1A2Q3	1853-0232		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A1A2Q4	1853-0007	4	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A2Q5	1854-0404	8	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2Q6	1854-0419		TRANSISTOR NPN SI TO-39 PD=1W FT=200MHZ	28480	1854-0419
A1A2Q7	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2Q8	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2Q9	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A2Q10	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A2Q11	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A2Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2Q13	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2Q14	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2Q15	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2Q16	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A2R1	0757-0394	8	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R2	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R3	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A2R4	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R5	2100-3351	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A1A2R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R7	0757-0200	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A1A2R8	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1A2R9*	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-4221-F
A1A2R10	0757-0441	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A1A2R11	0698-0085	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A1A2R12	0757-0443	2	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A1A2R13	0757-0280	5	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R15	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R16	0698-0084	3	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A2R17	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R18	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A2R19	0757-0421	2	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F

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Table 8-6. A1A2 Z Axis Amplifier, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A2R20	0757-0428	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1A2R21	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A1A2R22	2100-3207	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A1A2R23	0698-3152	2	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A1A2R24	0698-3416	2	RESISTOR 21.5K 1% .5W F TC=0+-100	28480	0698-3416
A1A2R25	0757-0841	2	RESISTOR 12.1K 1% .5W F TC=0+-100	28480	0757-0841
A1A2R26	0698-3151	2	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A1A2R27	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R28	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R29	0757-0819	2	RESISTOR 909 1% .5W F TC=0+-100	28480	0757-0819
A1A2R30	2100-3351		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A1A2R31	2100-3353	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-203
A1A2R32	2100-3355	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	28480	2100-3355
A1A2R33	0698-3158	1	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A1A2R34	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R35	2100-3354	2	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	28480	2100-3354
A1A2R36	2100-3354		RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	28480	2100-3354
A1A2R37	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A2R38	0698-3440	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A1A2R39	0757-0274	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1A2R40	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A1A2R41	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A1A2R42	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A1A2R43	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A2R44	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A2R45	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A1A2R46	0698-3416		RESISTOR 21.5K 1% .5W F TC=0+-100	28480	0698-3416
A1A2R47	0757-0841		RESISTOR 12.1K 1% .5W F TC=0+-100	28480	0757-0841
A1A2R48	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A1A2R49	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R50	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A2R51	0757-0819		RESISTOR 909 1% .5W F TC=0+-100	28480	0757-0819
A1A2TP1	0360-0535	3	TERMINAL TEST POINT PCB	28480	0360-0535
A1A2TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A1A2TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A1A2VR1	1902-3333	1	DIODE-ZNR 46.4V 5% DO-7 PD=.4W TC=+.081%	28480	1902-3333
A1A2VR2	1902-3357	1	DIODE-ZNR 56.2V 5% DO-7 PD=.4W TC=+.081%	28480	1902-3357
A1A2VR3	1902-0049	1	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
			A1A2 MISCELLANEOUS		
	5000-9043	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	5040-6843	1	EXTRACTOR, P.C. BOARD	28480	5040-6843

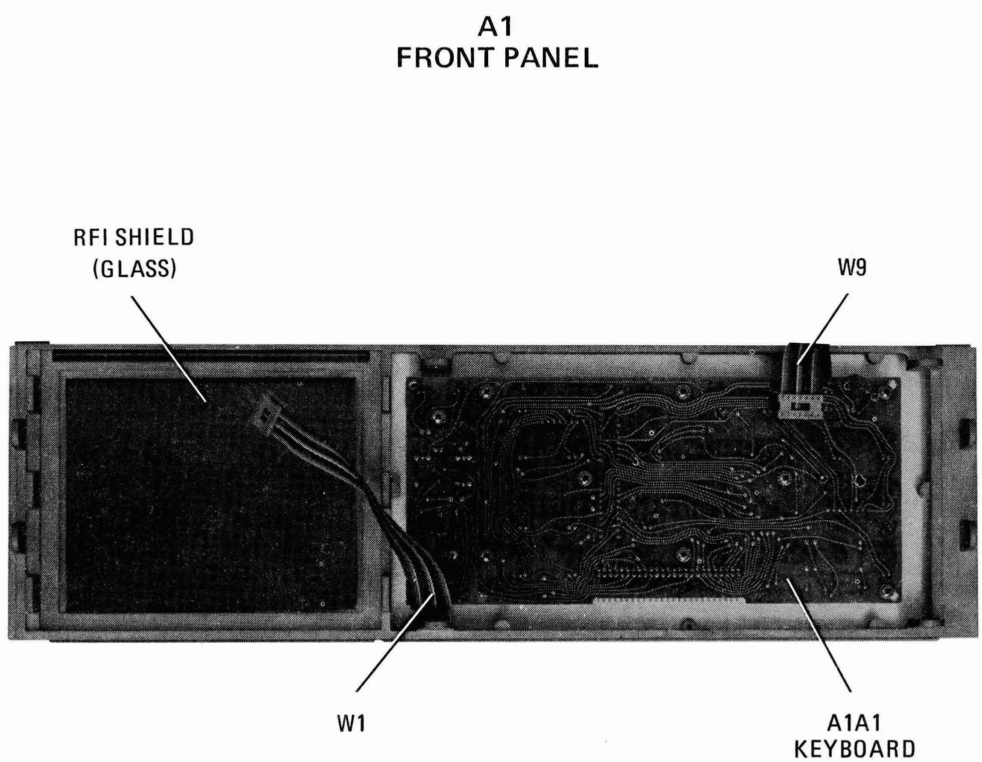

Figure 8-15. A1 Front Panel, Assembly and Component Locations

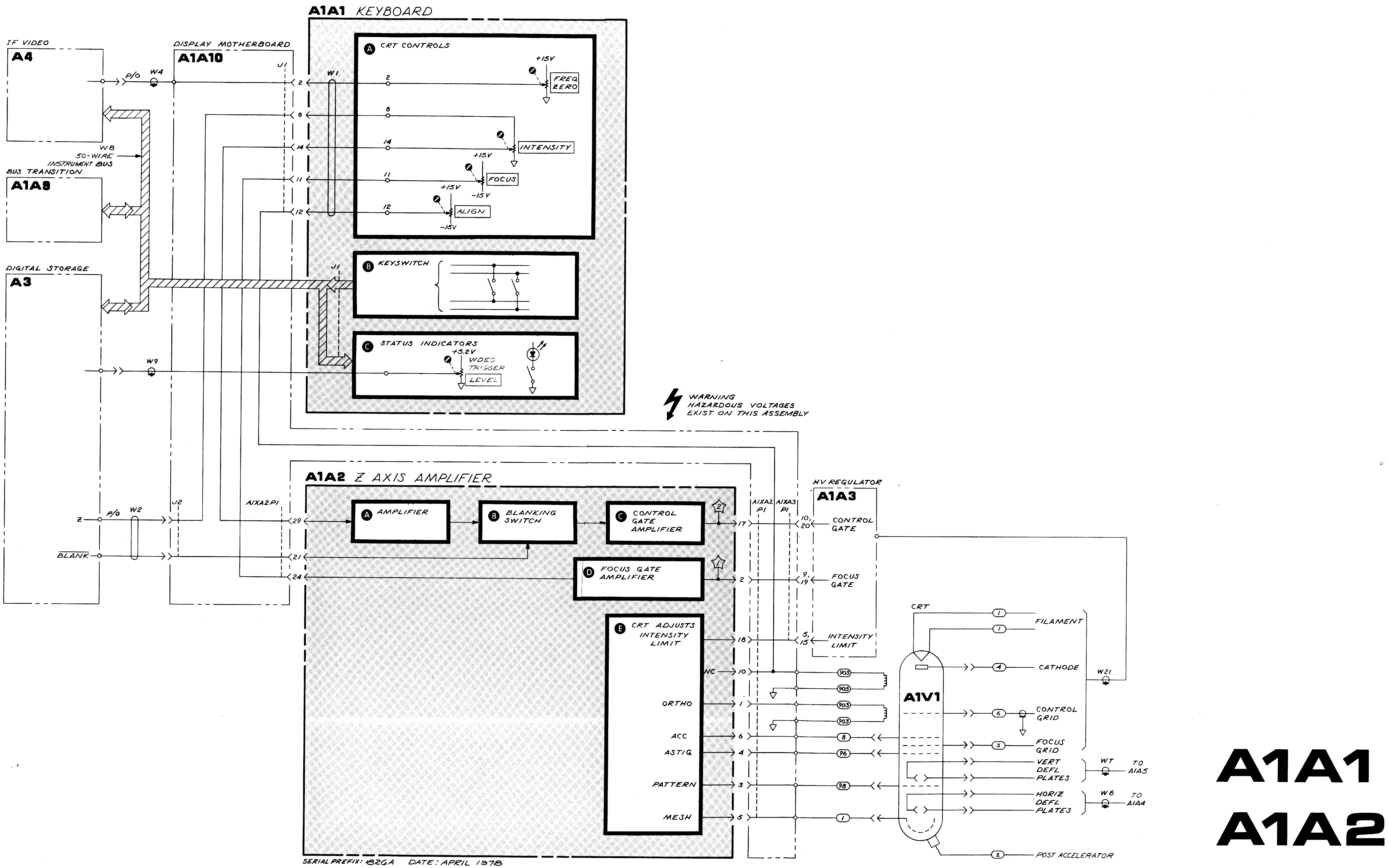

Figure 8-16. A1A1 Keyboard and A1A2 Z Axis Amplifier, Block Diagram

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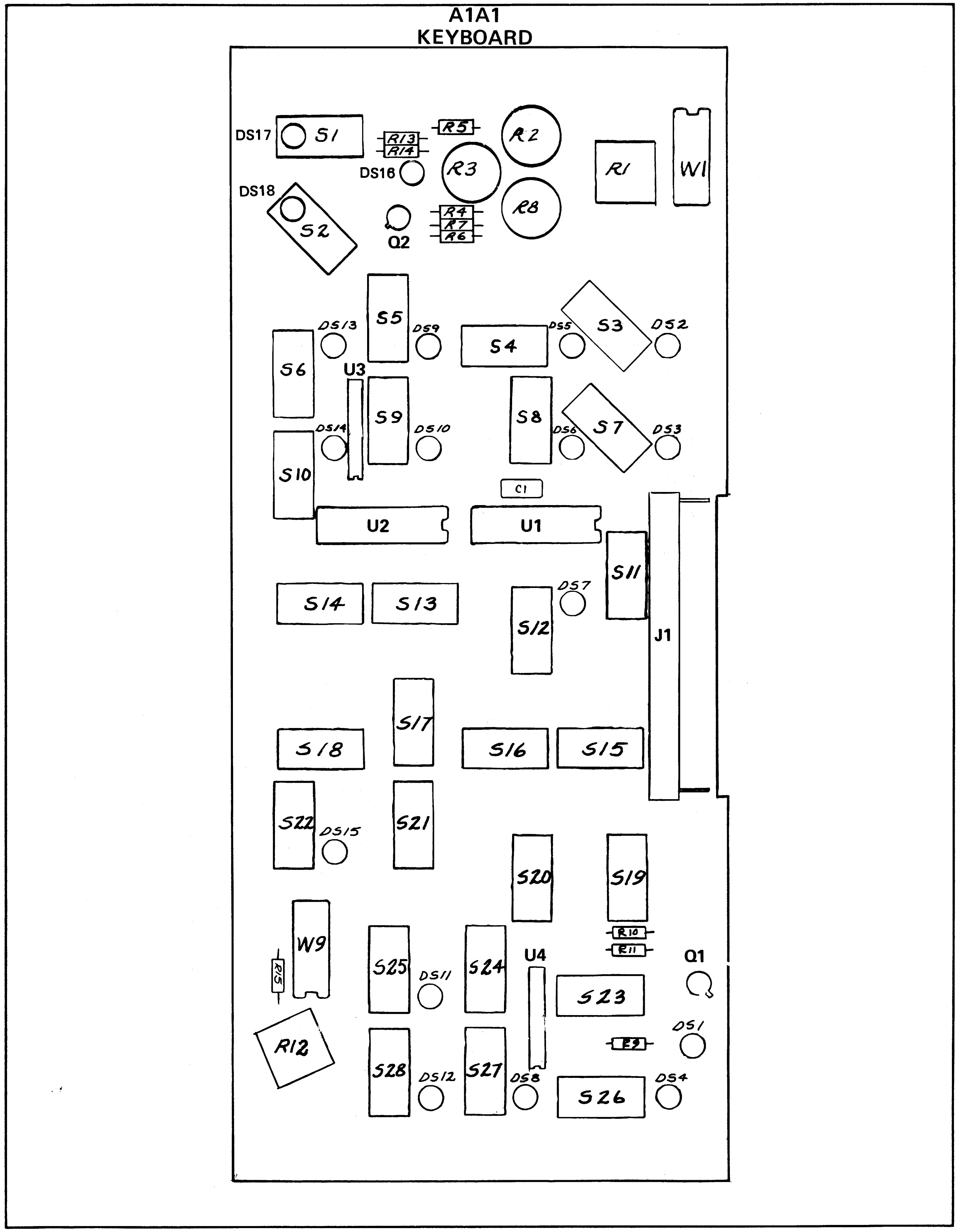


Figure 8-17. A1A1 Keyboard, Component Locations

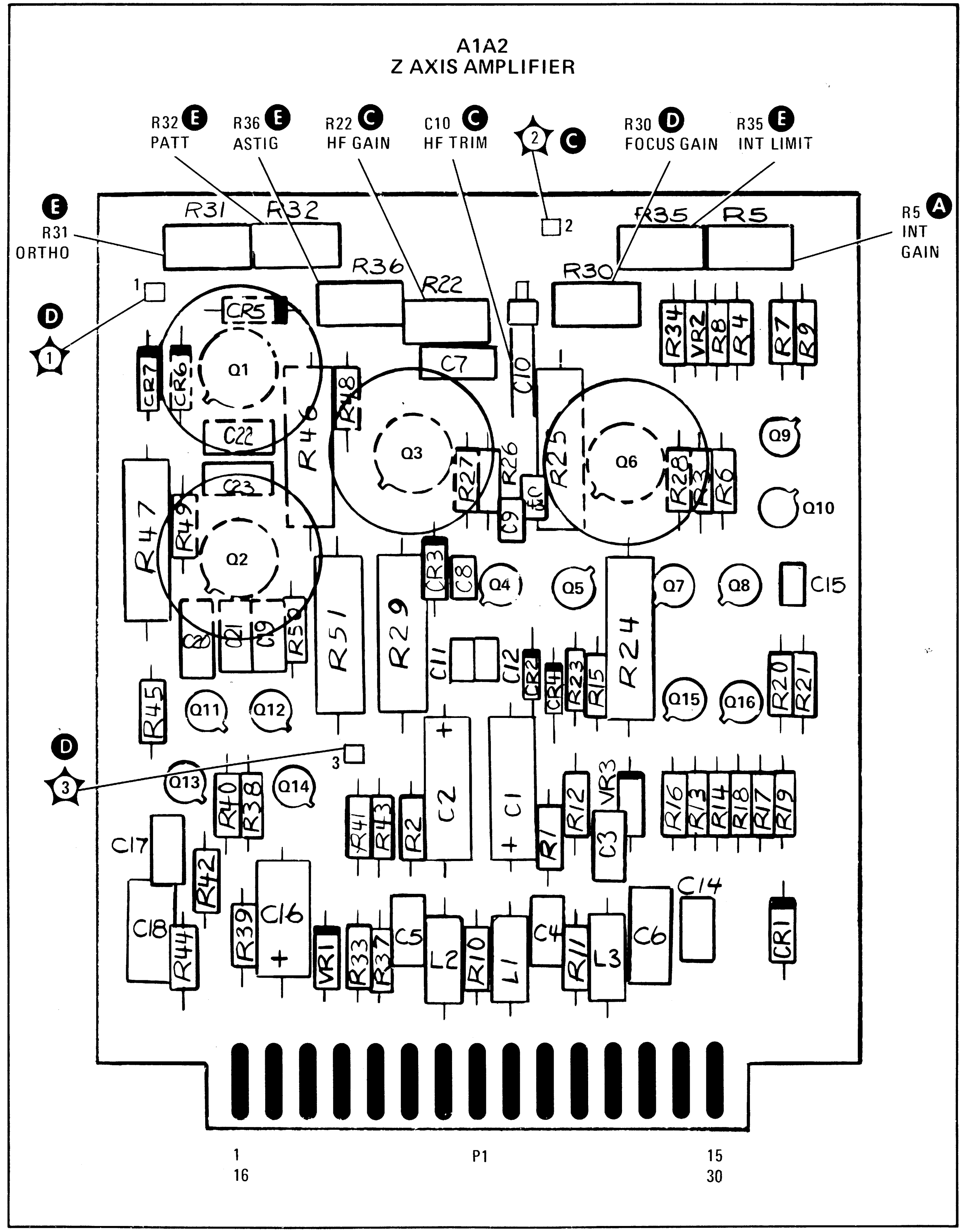
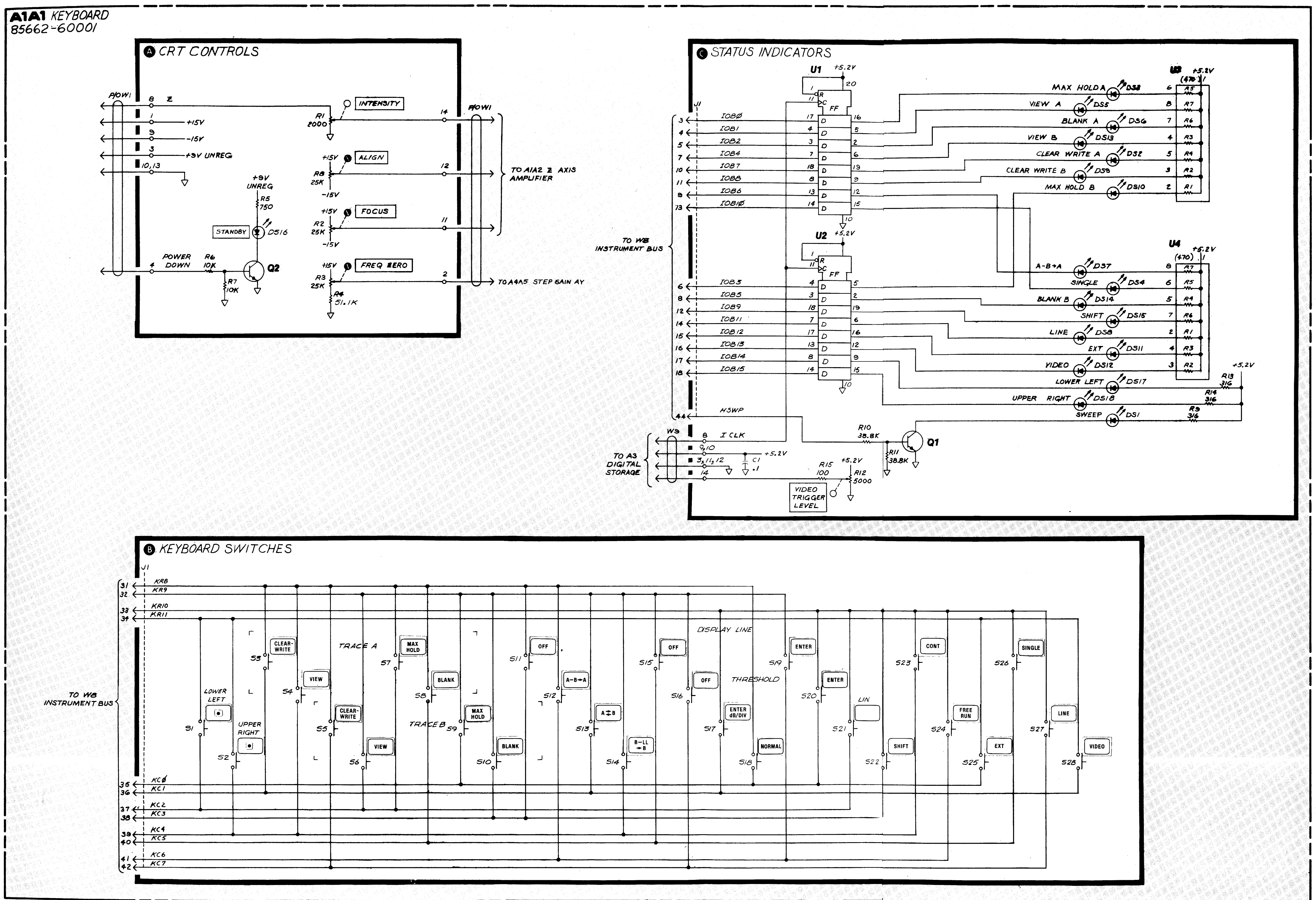


Figure 8-18. A1A2 Z Axis Amplifier, Component Locations

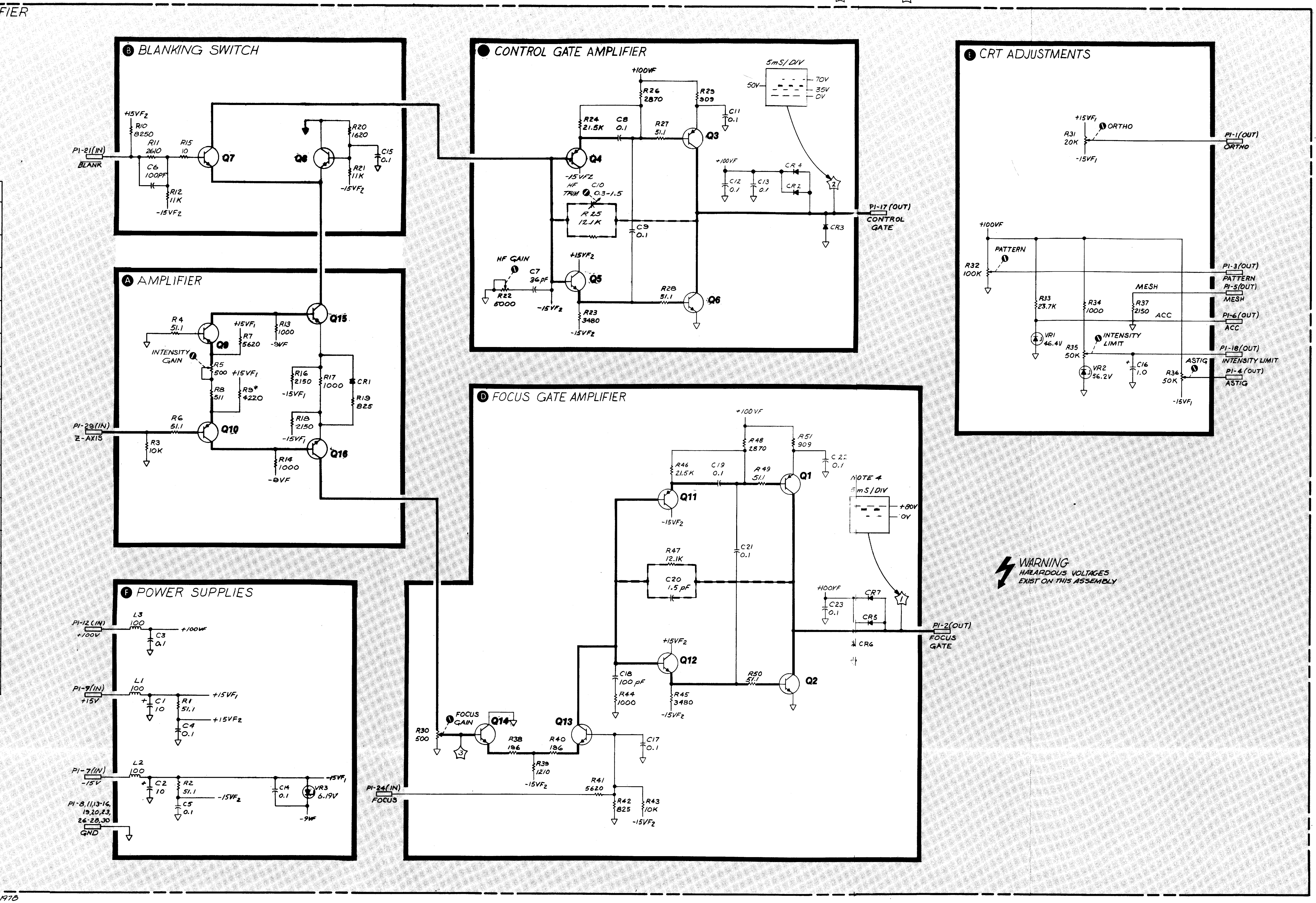


A1A2 Z AXIS AMPLIFIER
85662-60054

P1

PIN	SIGNAL	TO/ FROM	FUNCTION BLOCK
1	ORTHO	A1V1	E
16	GND		F
2	FOCUS GATE	A1A3	D
17	CONTROL GATE	A1A3	C
3	PATTERN	A1V1	E
18	INTENSITY LIMIT	A1A3	E
4	ASTIG	A1V1	E
19	GND		F
5	MESH	A1V1	E
20	GND		F
6	ACC	A1V1	E
21	$\overline{BLANK}$	A3A2	B
7	-15V		F
22	NC		
8	GND		F
23	GND		F
9	+15V		F
24	FOCUS	A1A1	D
10	TRACE ALIGN	NC	
25	NC		
11	GND		F
26	GND		F
12	+100V		F
27	GND		F
13	GND		F
28	GND		F
14	GND		F
29	Z-AXIS	A1A1	A
15	GND		F
30	GND		F

SERIAL PREFIX: 1826A 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. MNEMONICS TABLE

MNEMONIC	DESCRIPTION
ORTHO	ORTHOGONAL
ACC	ACCELERATOR
ASTIG	ASTIGMATISM
Z	AUXILIARY Z OUTPUT
BLANK	BLANKING SIGNAL
Z-AXIS	INTENSITY SIGNAL
I CLK	INDICATOR CLOCK (FRONT PANEL LEDS)

4. TEST POINT WAVEFORMS ASSUME INSTRUMENT PRESET CONDITION. ACTUAL AMPLITUDE OF SIGNALS IS DETERMINED BY SETTING OF A1A1R1 INTENSITY CONTROL.

5. 50-WIRE INSTRUMENT BUS, MNEMONIC/PIN NUMBER INDEX.

PIN	SIGNAL	DESCRIPTION
1	GND	GROUND
2	NC	NO CONNECTION
3	IOBØ	
4	IOB1	
5	IOB2	
6	IOB3	
7	IOB4	
8	IOB5	INSTRUMENT BUS
9	IOB6	DATA BITS Ø-15
10	IOB7	
11	IOB8	
12	IOB9	
13	IOB10	
14	IOB11	
15	IOB12	
16	IOB13	
17	IOB14	
18	IOB15	
19	NC	
20	NC	NO CONNECTION
21	NC	
22	HPON	HIGH = DISPLAY SECTION POWER ON
23	ADRØ	
24	ADR1	
25	ADR2	INSTRUMENT BUS
26	ADR3	ADDRESS BITS Ø-5
27	ADR4	
28	ADR5	(NOT USED)
29	NC	NO CONNECTION
30	NC	
31	KR8	
32	KR9	KEY ROWS 8-11
33	KR10	
34	KR11	
35	KCØ	
36	KC1	
37	KC2	
38	KC3	
39	KC4	KEY COLUMNS Ø-7
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 = DISPLAY SECTION I/O STROBE
50	GND	GROUND

6. * INDICATES FACTORY SELECTED COMPONENT. REFER TO SECTION V FOR RANGE OF VALUES.

A1A1
A1A2

Figure 8-19. A1A1 Keyboard and A1A2Z Axis Amplifier, Schematic Diagram

A1A3 HIGH VOLTAGE REGULATOR, CIRCUIT DESCRIPTION

WARNING

The CRT filament potential is connected to the −4000 Vdc cathode potential, which is dangerous to life.

The post-accelerator potential of approximately +18 kV is supplied by High Voltage Multiplier A1A11 (refer to block diagram).

High-Voltage Transformer A
High-Voltage Rectifier and Filter B

The cathode of CRT A1V1 operates at −4000 Vdc. This voltage is generated by rectifying an ac signal (approximately 30 kHz) on the secondary of High-Voltage Transformer T1. The primary side of T1 is an oscillator circuit located in A1A6 ±15V Regulator. The rectifier circuit consists of CR1 and filter components C1, R3, and C3. The CRT filament voltage of 4.45 Vrms is generated by another secondary winding of T1 and is held at −4000 Vdc by R1.

The cathode voltage is stabilized by a feedback control circuit consisting of R4, C4, and the amplifier circuit in A1A6 ±15V Regulator in conjunction with a primary feedback winding on T1. (Refer to the circuit description of A1A6.) The cathode voltage is set by HV ADJ potentiometer A1A6R32 in the Oscillator Level Control circuit of A1A6.

Control Grid Level Shift C

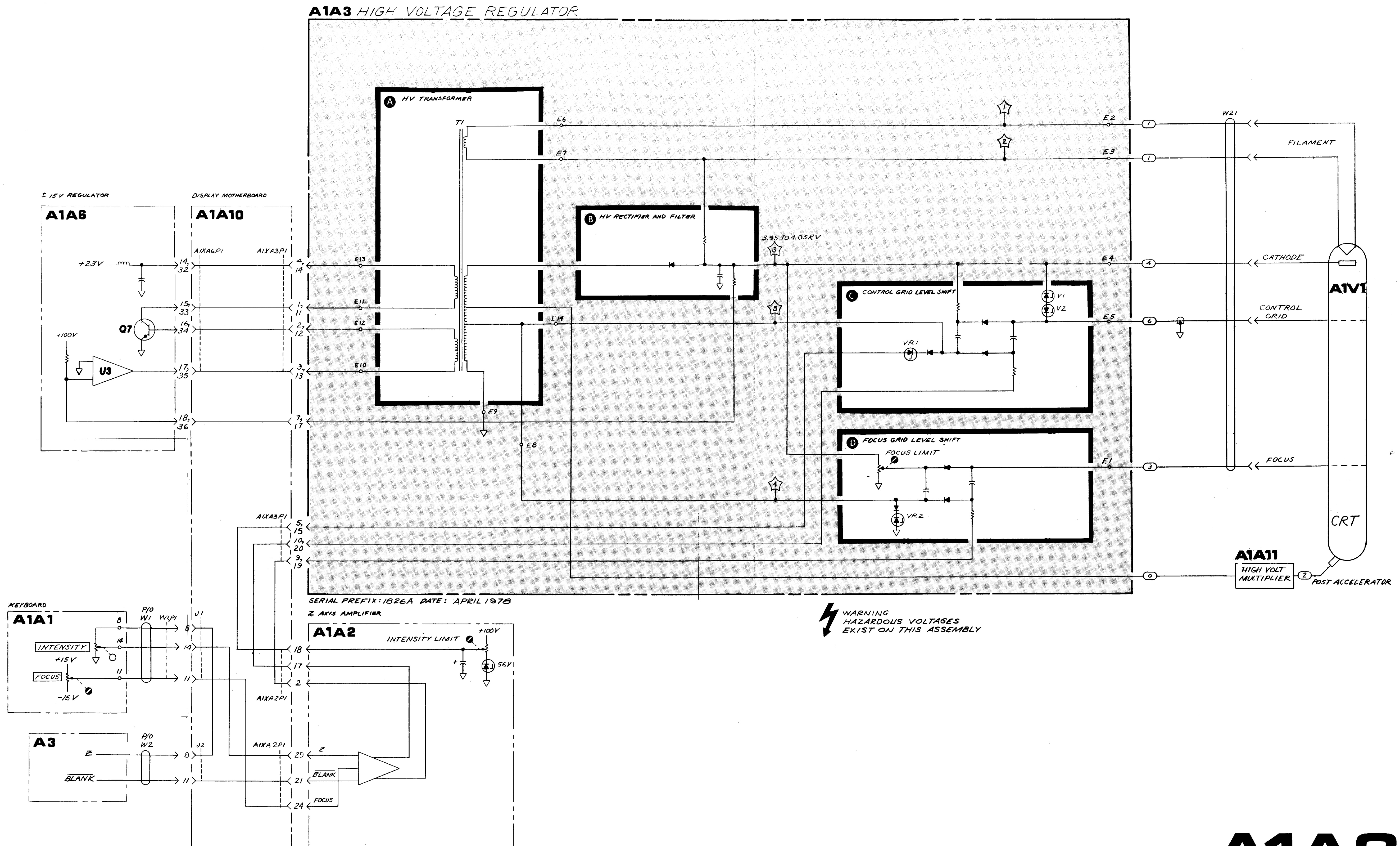
The control grid voltage is provided by generating a bias voltage with respect to the cathode voltage. This bias voltage is generated by a capacitively coupled, clipped sine-wave signal at the junction of C2 and C5. The sine wave is derived from the T1 secondary through R2. The upper clipping level is set by INTENSITY LIMIT adjustment A1A2R35 in A1A2 Z Axis Amplifier. The lower clipping level is set by the output of the Control Gate Amplifier in A1A2. The clipped sine-wave signal is coupled to the control grid circuit through C5, where it is rectified by CR3 and CR4 to generate a dc bias voltage across R7. C6, R10, and C7 are a filter to remove ripple from the bias voltage. C7 also allows fast pulse signals to be coupled directly to the the control grid, to maintain response times of 30 nsec or less.

Focus Grid Charge Level Shift D

The focus voltage is set by a resistive divider string from the cathode, with an intensity-focus correction bias developed in a manner similar to that of the control grid bias voltage described above. FOCUS LIMIT potentiometer R14 sets the focus grid to approximately −2500 Vdc, and the focus bias is generated by a clipped sine wave at the junction of C9 and C10. This upper clipping level is set by VR2 (+82.5V), and the lower clipping level is set by the FOCUS GATE voltage from A1A2.

Table 8-7. A1A3 High Voltable Regulator, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A3	85662-60059	1	BOARD ASSEMBLY, HIGH VOLTAGE REGULATOR	28480	85662-60059
A1A3C1	0160-4148		CAPACITOR-FXD .033UF +-20% 6KVDC	56289	430P333060
A1A3C2	0160-2264		CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A1A3C3	0160-4148		CAPACITOR-FXD .033UF +-20% 6KVDC	56289	430P333060
A1A3C4	0160-3960		CAPACITOR-FXD 1000PF +-20% 8KVDC	28480	0160-3960
A1A3C5	0160-3960		CAPACITOR-FXD 1000PF +-20% 8KVDC	28480	0160-3960
A1A3C6	0160-0678		CAPACITOR-FXD .01UF +-20% 6KVDC	28480	0160-0678
A1A3C7	0160-0678		CAPACITOR-FXD .01UF +-20% 6KVDC	28480	0160-0678
A1A3C8	0160-0543		CAPACITOR-FXD 4700PF +-20% 4KVDC	28480	0160-0543
A1A3C9	0160-2264		CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A1A3C10	0160-0543		CAPACITOR-FXD 4700PF +-20% 4KVDC	28480	0160-0543
A1A3C11	0160-0543		CAPACITOR-FXD 4700PF +-20% 4KVDC	28480	0160-0543
A1A3C12	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A1A3C13	0160-0543		CAPACITOR-FXD 4700PF +-20% 4KVDC	28480	0160-0543
A1A3C14	0180-0269		CAPACITOR-FXD 1UF+75-10% 150VDC AL	56289	30D105G150BA2
A1A3CR1	1901-0683	1	DIODE-HV RECT 10KV 5MA 250NS	28480	1901-0683
A1A3CR2	1901-0028	8	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3CR3	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3CR4	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3CR5	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3CR6	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3CR7	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3CR8	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3CR9	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A3R1	0684-1041	1	RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A1A3R2	0687-3941	2	RESISTOR 390K 10% .5W CC TC=0+882	01121	EB3941
A1A3R3	0687-4721	1	RESISTOR 4.7K 10% .5W CC TC=0+647	01121	EB4721
A1A3R4	0698-8018	1	RESISTOR 30M 1% 3W C TC=0+-100	03888	PVC175-3-T0-3004-F
A1A3R5	0684-1021	6	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A1A3R6	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A1A3R7	0686-1065	2	RESISTOR 10M 5% .5W CC TC=0+1059	01121	EB1065
A1A3R8	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A1A3R9	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A1A3R10	0684-1051	2	RESISTOR 1M 10% .25W FC TC=-800/+900	01121	CB1051
A1A3R11	0687-2221	1	RESISTOR 2.2K 10% .5W CC TC=0+647	01121	EB2221
A1A3R12	0687-1001	1	RESISTOR 10 10% .5W CC TC=0+412	01121	EB1001
A1A3R13	0698-8992	1	RESISTOR 8M 2% 1W C TC=0+-250	28480	0698-8992
A1A3R14	2100-3626	1	RESISTOR-TRMR 2M 20% C SIDE-ADJ 1-TRN	28480	2100-3626
A1A3R15	0698-8993	1	RESISTOR 14M 2% 1W C TC=0+-250	28480	0698-8993
A1A3R16	0684-1011	1	RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A1A3R17	0687-3941		RESISTOR 390K 10% .5W CC TC=0+882	01121	EB3941
A1A3R18	0684-1031	1	RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A1A3R19	0686-1065		RESISTOR 10M 5% .5W CC TC=0+1059	01121	EB1065
A1A3R20	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A1A3R21	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A1A3R22	0684-1051		RESISTOR 1M 10% .25W FC TC=-800/+900	01121	CB1051
A1A3R23	0687-2231	1	RESISTOR 22K 10% .5W CC TC=0+765	01121	EB2231
A1A3R24	0687-6801	1	RESISTOR 68 10% .5W CC TC=0+412	01121	EB6801
A1A3T1	01332-61103	1	TRANSFORMER ASSEMBLY, HIGH VOLTAGE	28480	01332-61103
A1A3TP1	0360-0535	5	TERMINAL TEST POINT PCB	28480	0360-0535
A1A3TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A1A3TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A1A3TP4	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A1A3TP5	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A1A3V1	2140-0018	2	LAMP-GLOW A9A-C 90/58VCD 700UA T-2-BULB	0046G	AGA-C
A1A3V2	2140-0018		LAMP-GLOW A9A-C 90/58VCD 700UA T-2-BULB	0046G	AGA-C
A1A3VR1	1902-0182	1	DIODE-ZNR 20.5V 5% DO-7 PD=.4W TC=+.072%	28480	1902-0182
A1A3VR2	1902-0197	1	DIODE-ZNR 82.5V 5% DO-15 PD=1W TC=+.082%	28480	1902-0197



A1A3

Figure 8-20. A1A3 High Voltage Regulator, Block Diagram

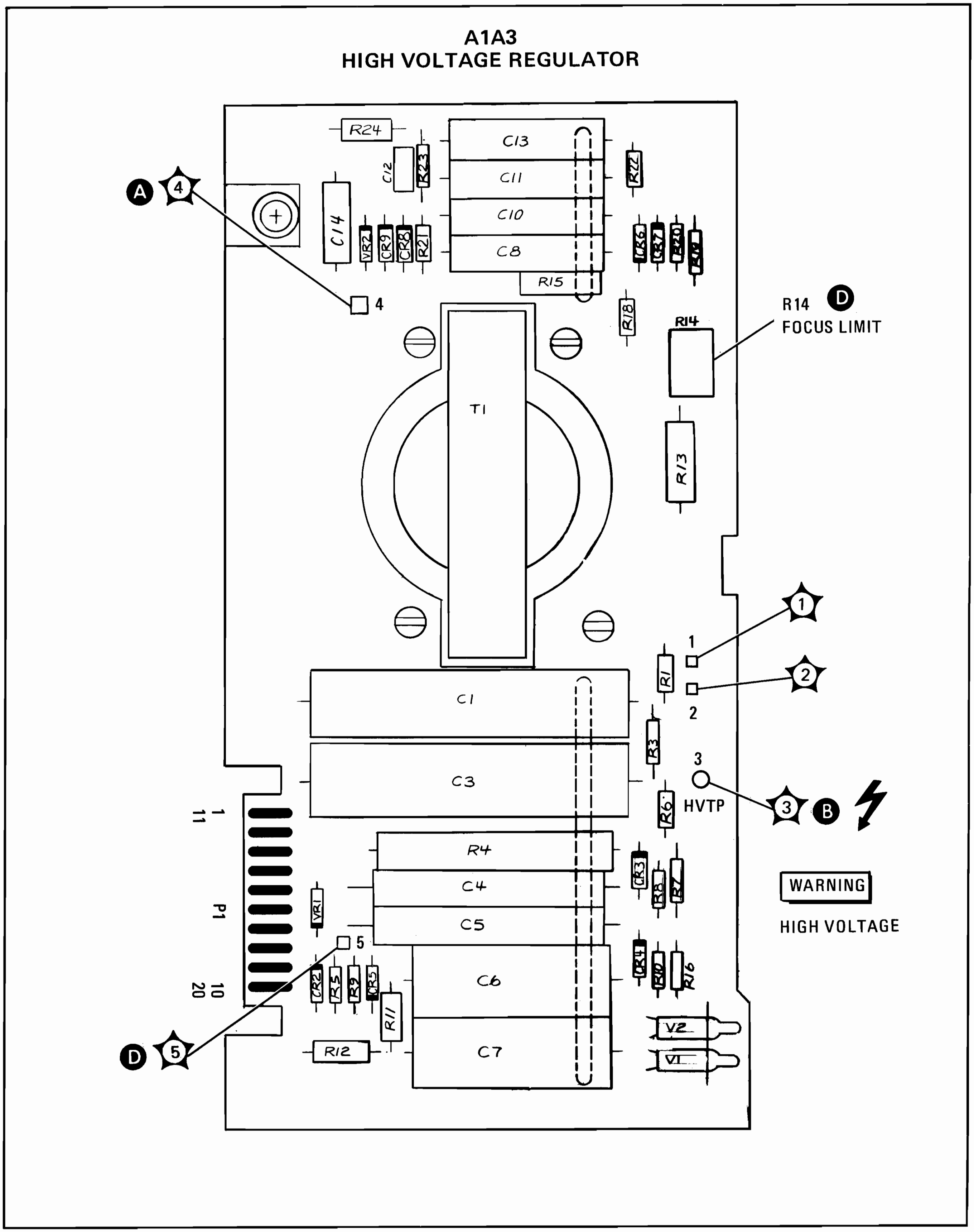
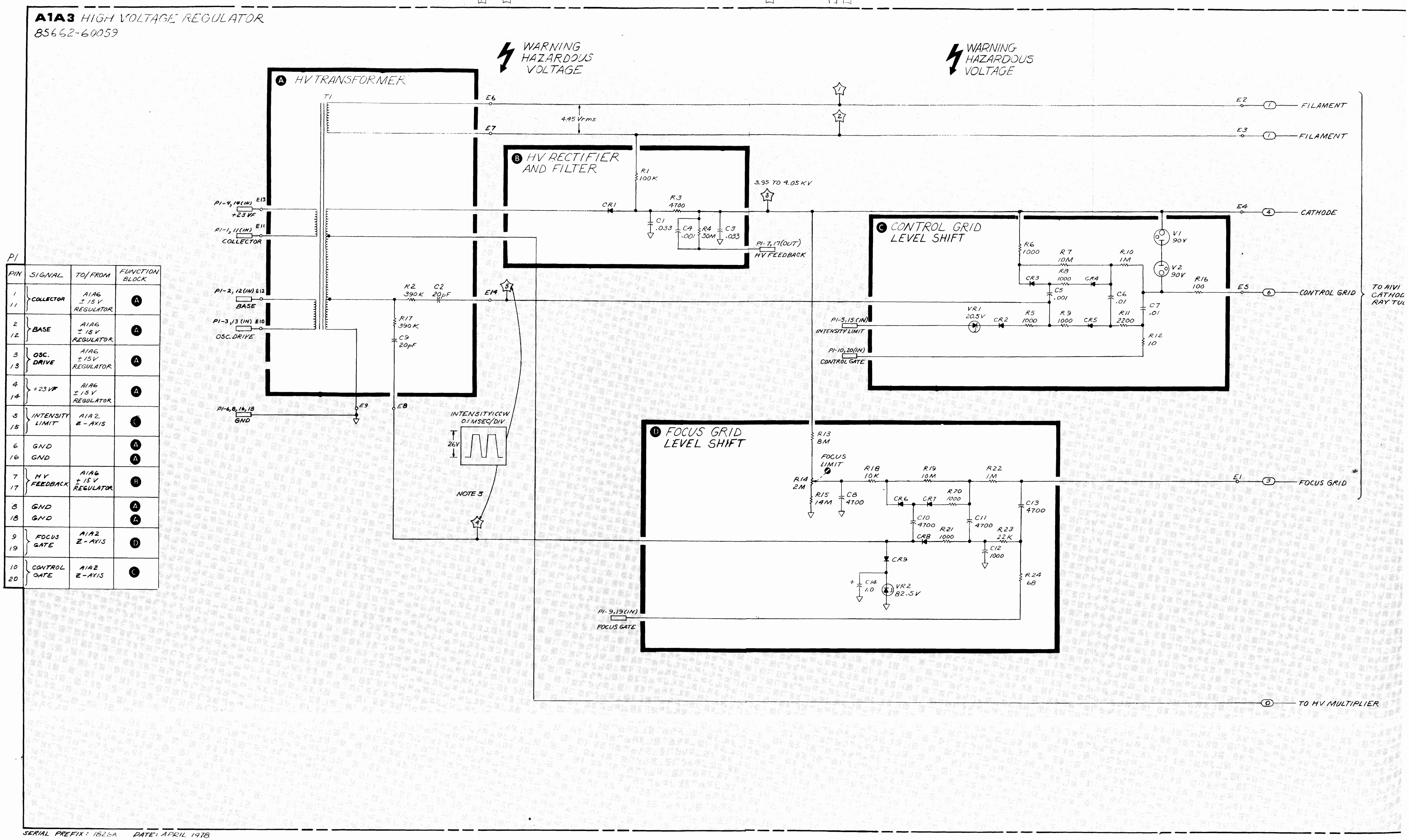


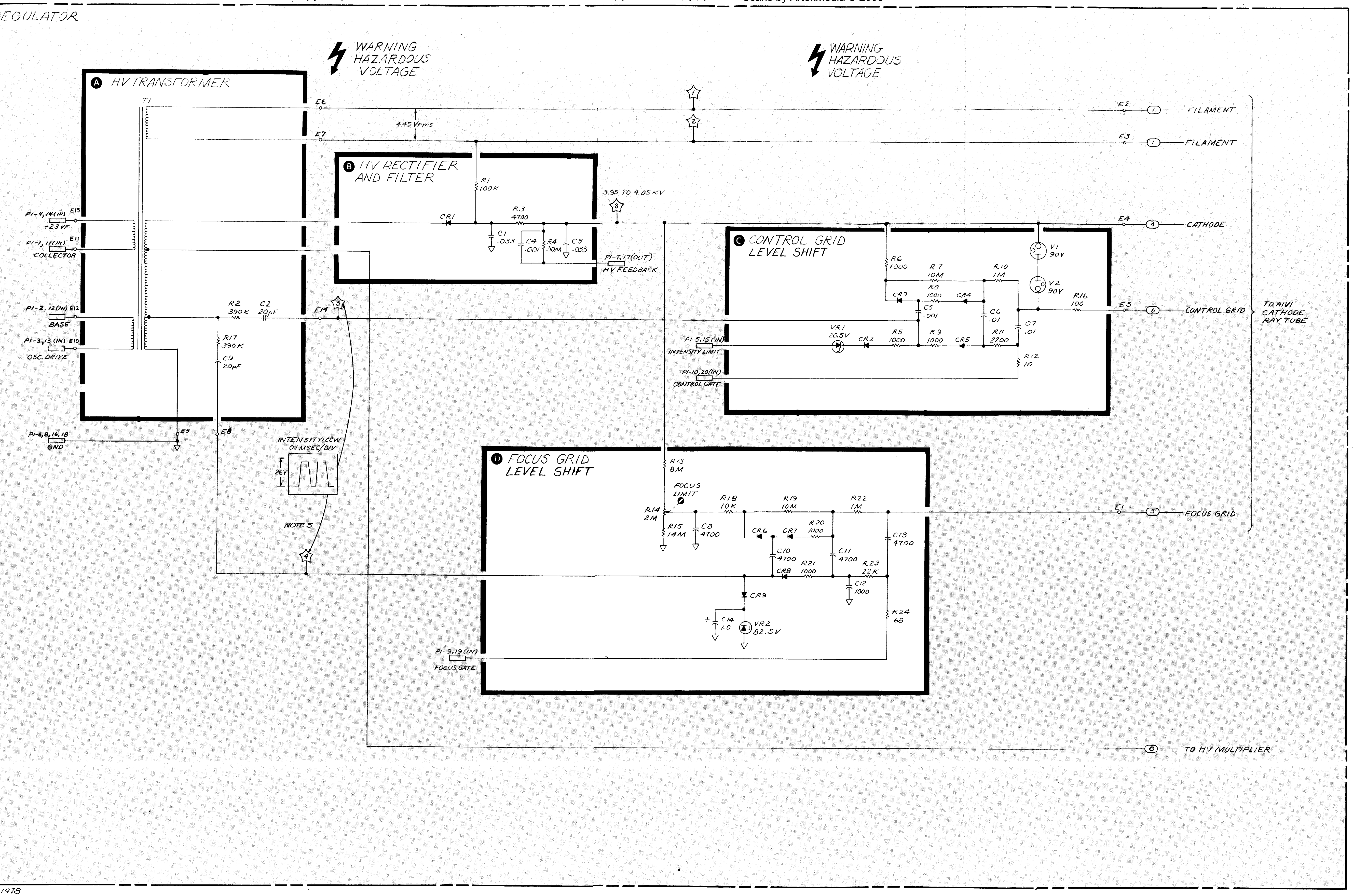
Figure 8-21. A1A3 High Voltage Regulator, Component Locations



P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 / 11	COLLECTOR	A1A6 ±15V REGULATOR	A
2 / 12	BASE	A1A6 ±15V REGULATOR	A
3 / 13	OSC. DRIVE	A1A6 ±15V REGULATOR	A
4 / 14	+23 VF	A1A6 ±15V REGULATOR	A
5 / 15	INTENSITY LIMIT	A1A2 Z-AXIS	C
6 / 16	GND / GND		A / A
7 / 17	HV FEEDBACK	A1A6 +15V REGULATOR	B
8 / 18	GND / GND		A / A
9 / 19	FOCUS GATE	A1A2 Z-AXIS	D
10 / 20	CONTROL GATE	A1A2 Z-AXIS	C

Figure 8-22. A1A



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATORS.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. TP4 AND TP5 ARE DIFFICULT TO REACH. USE CAUTION WHEN MAKING THESE MEASUREMENTS.

A1A3

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Figure 8-22. A1A3 High Voltage Regulator, Schematic Diagram

A1A4 A1A5 X AND Y DEFLECTION AMPLIFIERS, CIRCUIT DESCRIPTION

A1A4 X Deflection Amplifier and A1A5 Y Deflection Amplifier each consists of a differential input state (Q10, Q15) with current source Q11, two current gain stages (Q9, Q14 and Q8, Q13), and two output differential current-to-voltage amplifiers. A display output amplifier provides rear-panel X and Y DISPLAY OUTPUTS.

Current Amplifier B

The Current Amplifier transforms an input voltage change to a differential current change at the collectors of Q10 and Q15. This change is amplified in the following current gain stages Q9 and Q14. POSN adjust R7 sets the CRT trace position, and GAIN adjust R27 sets the CRT trace deflection limits.

The collectors of Q8 and Q13 are virtual-ground, current-summing junctions of the output amplifiers. When a signal is applied so as to increase the current in Q8 (decrease in Q13) Q5 conducts more, turning off Q2 and causing the output (collector of Q2) to rise. Current feedback through R29 supplies the increase in current required by Q8. The analogous operation, with inverted polarity, occurs in the other output amplifier.

Current to Voltage Amplifiers C D

Emitter followers Q7 and Q12 are feedforward amplifiers, coupling the drive signal directly to the bases of Q1 and Q4, thus improving the frequency response. Trimmer capacitors C10 and C11, along with HF GAIN potentiometer R28, adjust the amplifier frequency response for minimum overshoot and equal risetimes ($\approx$70 nsec).

An input signal of 0 to 2V peak will cause a beam deflection equal to the length of the graticule lines.

Display Output A

Display output amplifier U1 provides a 1-volt maximum rear-panel signal to the X and Y DISPLAY OUTPUTS.

Table 8-8. A1A4 X Deflection Amplifier, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A4	85662-60057	1	BOARD ASSEMBLY, X-DEFLECTION AMPLIFIER	28480	85662-60057
A1A4C1	0180-0374	2	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A1A4C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A1A4C3	0160-4084	6	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A4C4	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A4C5	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A4C6	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A4C7	0160-3670	3	CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A4C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A4C9	0160-3533	1	CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-3533
A1A4C10	0121-0474	2	CAPACITOR-V TRMR-PSTN .3-1.5PF 600V	28480	0121-0474
A1A4C11	0121-0474		CAPACITOR-V TRMR-PSTN .3-1.5PF 600V	28480	0121-0474
A1A4C12	0160-2055	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A4C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A4C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A4C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A4C16	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A4C17	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A4C18	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A4CR1	1901-0040	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A4CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A4E1	1251-0600	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A4E2	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A4L1	9140-0210	3	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A4L2	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A4L3	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A4Q1	1853-0232	2	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A1A4Q2	1854-0523	2	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A1A4Q3	1854-0523		TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A1A4Q4	1853-0232		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A1A4Q5	1853-0007	7	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A4Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A4Q7	1854-0404	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A4Q8	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A4Q9	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A4Q10	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A4Q11	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A4Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A4Q13	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A4Q14	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A4Q15	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A4R1	0757-0438	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A4R2	0757-0394	3	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A4R3	0698-3150	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1A4R4	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1A4R5	0698-3155	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A1A4R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A4R7	2100-3353	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-203
A1A4R8	0757-0401	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A4R9	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A4R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A4R11	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A4R12	0757-0428	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1A4R13	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1A4R14	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A1A4R15	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A1A4R16	0698-0084	4	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A4R17	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A4R18	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A4R19	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A4R20	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A1A4R21	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A1A4R22	0757-0460	2	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1A4R23	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1A4R24	0698-3153	3	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1A4R25	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1A4R26	0757-0421	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A1A4R27	2100-3273	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	28480	2100-3273
A1A4R28	2100-3352	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A1A4R29	0698-3415	2	RESISTOR 19.6K 1% .5W F TC=0+-100	28480	0698-3415
A1A4R30	0698-3415		RESISTOR 19.6K 1% .5W F TC=0+-100	28480	0698-3415

Table 8-8. A1A4 X Deflection Amplifier, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A4R31	0757-0439	2	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A1A4R32	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A1A4R33	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A4R34	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A4R35	0757-0851	2	RESISTOR 43.2K 1% .5W F TC=0+-100	28480	0757-0851
A1A4R36	0757-0851		RESISTOR 43.2K 1% .5W F TC=0+-100	28480	0757-0851
A1A4R37	0757-0346	4	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A4R38	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A4R39	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A4R40	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A4R41	0757-0873	2	RESISTOR 1.62K 1% .5W F TC=0+-100	28480	0757-0873
A1A4R42	0757-0873		RESISTOR 1.62K 1% .5W F TC=0+-100	28480	0757-0873
A1A4R43	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1A4R44	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A4TP1	0360-0535	3	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A1A4TP2	0360-0535		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A1A4TP3	0360-0535		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A1A4U1	1826-0021	1	IC OP AMP TO-99	27014	LM310H
			A1A4 MISCELLANEOUS PARTS		
	5000-9043	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	5040-6843	1	EXTRACTOR, P.C. BOARD	28480	5040-6843

Table 8-9. A1A5 Y Deflection Amplifier, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A5	85662-60057	1	BOARD ASSEMBLY, Y-DEFLECTION AMPLIFIER	28480	85662-60057
A1A5C1	0180-0374	2	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A1A5C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A1A5C3	0160-4084	6	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A5C4	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A5C5	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A5C6	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A5C7	0160-3670	3	CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A5C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A5C9	0160-3533	1	CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-3533
A1A5C10	0121-0474	2	CAPACITOR-V TRMR-PSTN .3-1.5PF 600V	28480	0121-0474
A1A5C11	0121-0474		CAPACITOR-V TRMR-PSTN .3-1.5PF 600V	28480	0121-0474
A1A5C12	0160-2055	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A5C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A5C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A5C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A5C16	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A5C17	0160-3670		CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A5C18	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A5CR1	1901-0040	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A5CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A5E1	1251-0600	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A5E2	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A5L1	9140-0210	3	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A5L2	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A5L3	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A1A5Q1	1853-0232	2	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A1A5Q2	1854-0523	2	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A1A5Q3	1854-0523		TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A1A5Q4	1853-0232		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A1A5Q5	1853-0007	7	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A5Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A5Q7	1854-0404	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A5Q8	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A5Q9	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A5Q10	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A5Q11	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A5Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A5Q13	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A5Q14	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A5Q15	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1A5R1	0757-0438	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A5R2	0757-0394	3	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A5R3	0698-3150	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1A5R4	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1A5R5	0698-3155	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A1A5R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A5R7	2100-3353	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-203
A1A5R8	0757-0401	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A5R9	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A5R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A5R11	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A5R12	0757-0428	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1A5R13	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1A5R14	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A1A5R15	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A1A5R16	0698-0084	4	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A5R17	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A5R18	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A5R19	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A1A5R20	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A1A5R21	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A1A5R22	0757-0460	2	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1A5R23	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1A5R24	0698-3153	3	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1A5R25	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1A5R26	0757-0421	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A1A5R27	2100-3273	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	28480	2100-3273
A1A5R28	2100-3352	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A1A5R29	0698-3415	2	RESISTOR 19.6K 1% .5W F TC=0+-100	28480	0698-3415
A1A5R30	0698-3415		RESISTOR 19.6K 1% .5W F TC=0+-100	28480	0698-3415

Table 8-9. A1A5 Y Deflection Amplifier, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A5R31	0757-0439	2	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A1A5R32	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A1A5R33	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A5R34	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A5R35	0757-0851	2	RESISTOR 43.2K 1% .5W F TC=0+-100	28480	0757-0851
A1A5R36	0757-0851		RESISTOR 43.2K 1% .5W F TC=0+-100	28480	0757-0851
A1A5R37	0757-0346	4	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A5R38	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A5R39	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A5R40	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A5R41	0757-0873	2	RESISTOR 1.62K 1% .5W F TC=0+-100	28480	0757-0873
A1A5R42	0757-0873		RESISTOR 1.62K 1% .5W F TC=0+-100	28480	0757-0873
A1A5R43	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1A5R44	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A5TP1	0360-0535	3	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A1A5TP2	0360-0535		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A1A5TP3	0360-0535		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A1A5U1	1826-0021	1	IC OP AMP TO-99	27014	LM310H
			A1A5 MISCELLANEOUS PARTS		
	5000-9043	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	5040-6843	1	EXTRACTOR, P.C. BOARD	28480	5040-6843

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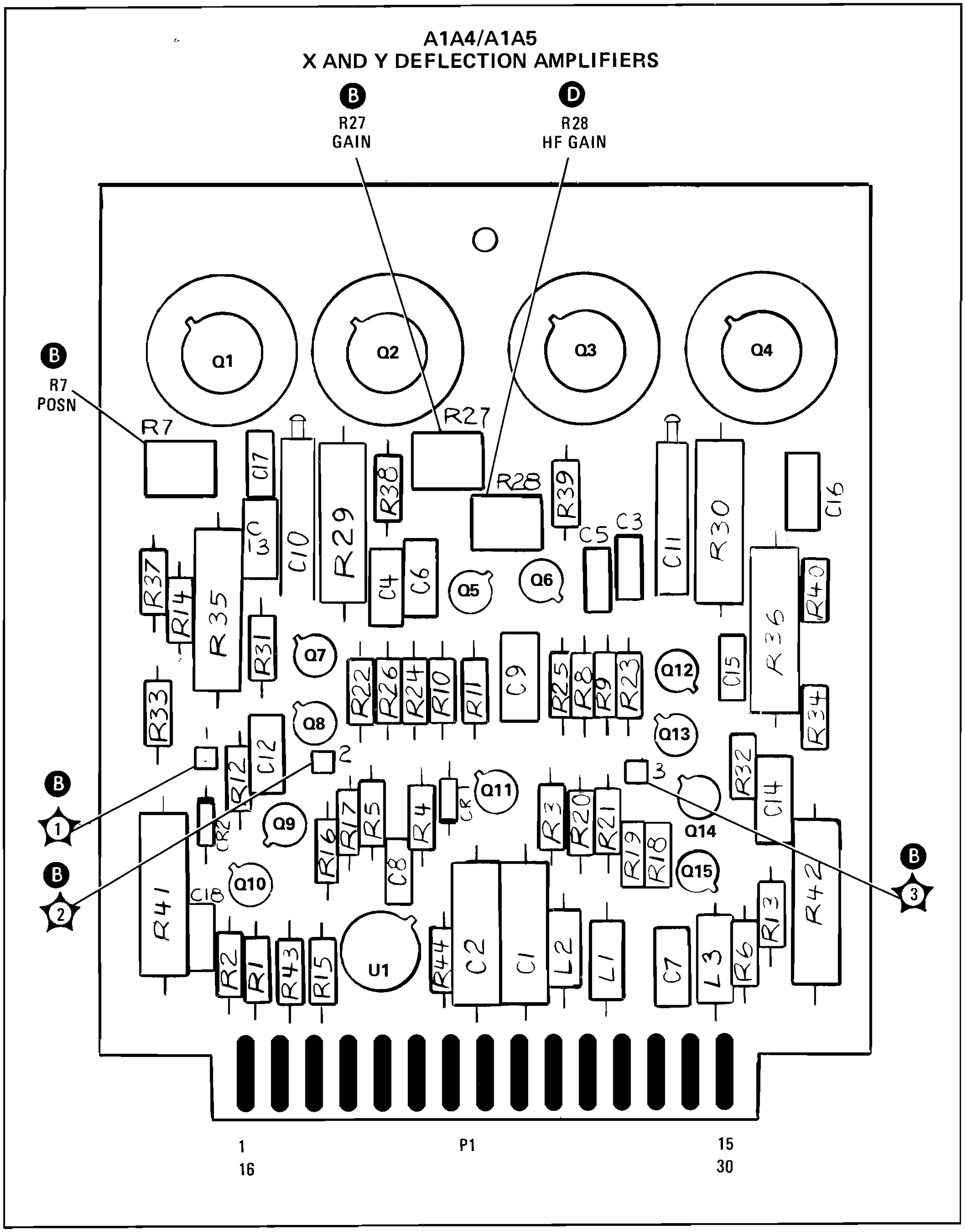


Figure 8-23. A1A4 X Deflection Amplifier and A1A5 Y Deflection Amplifier, Component Locations

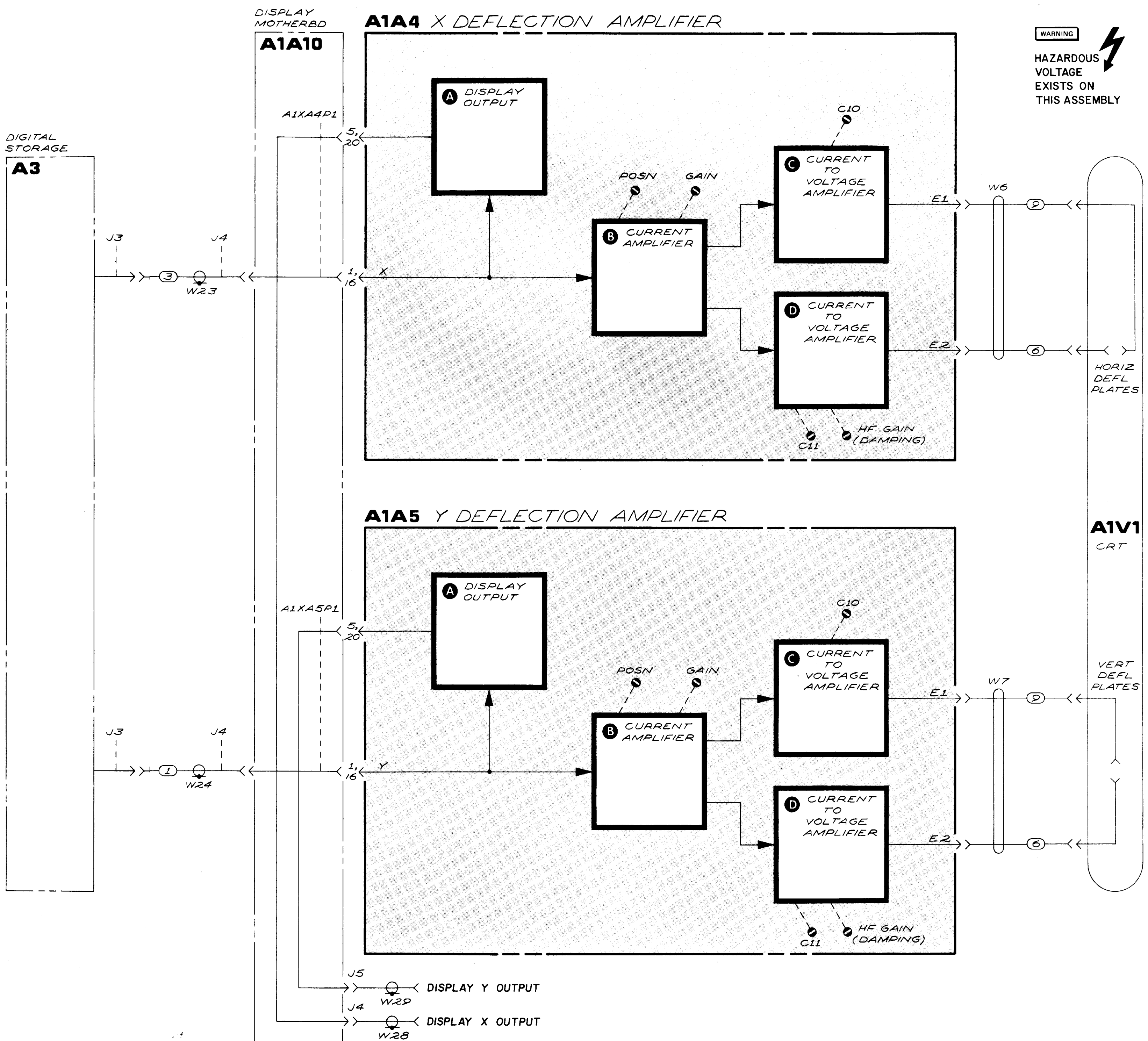
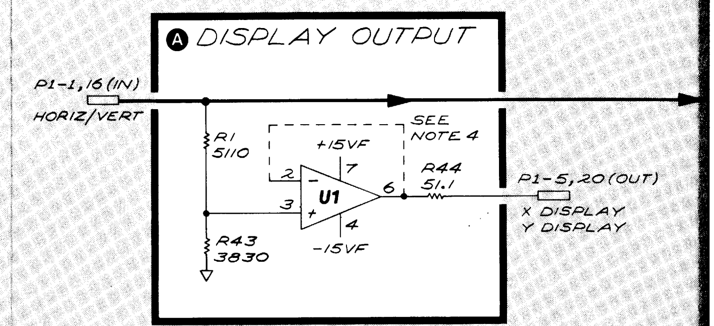


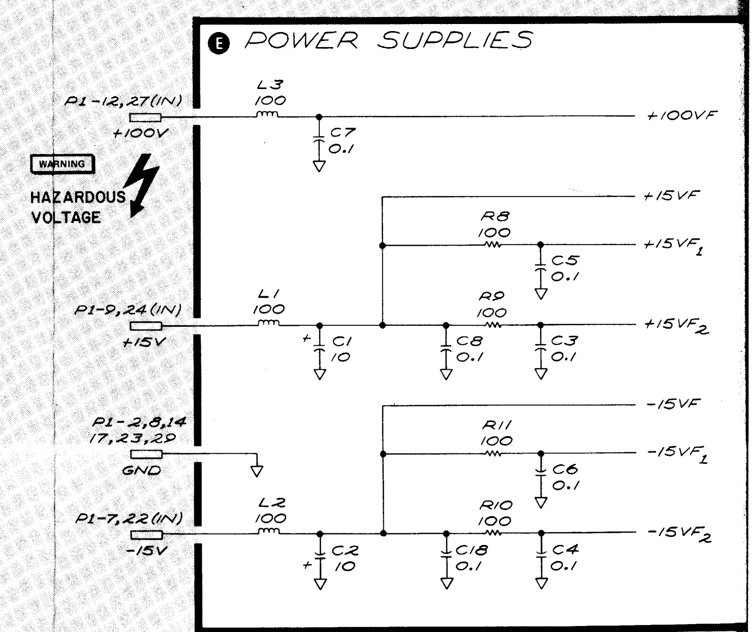
Figure 8-24. A1A4 X Deflection Amplifier and A1A5 Y Deflection Amplifier, Block Diagram

A1A4 X DEFLECTION AMPLIFIER
A1A5 Y DEFLECTION AMPLIFIER
85662-60057

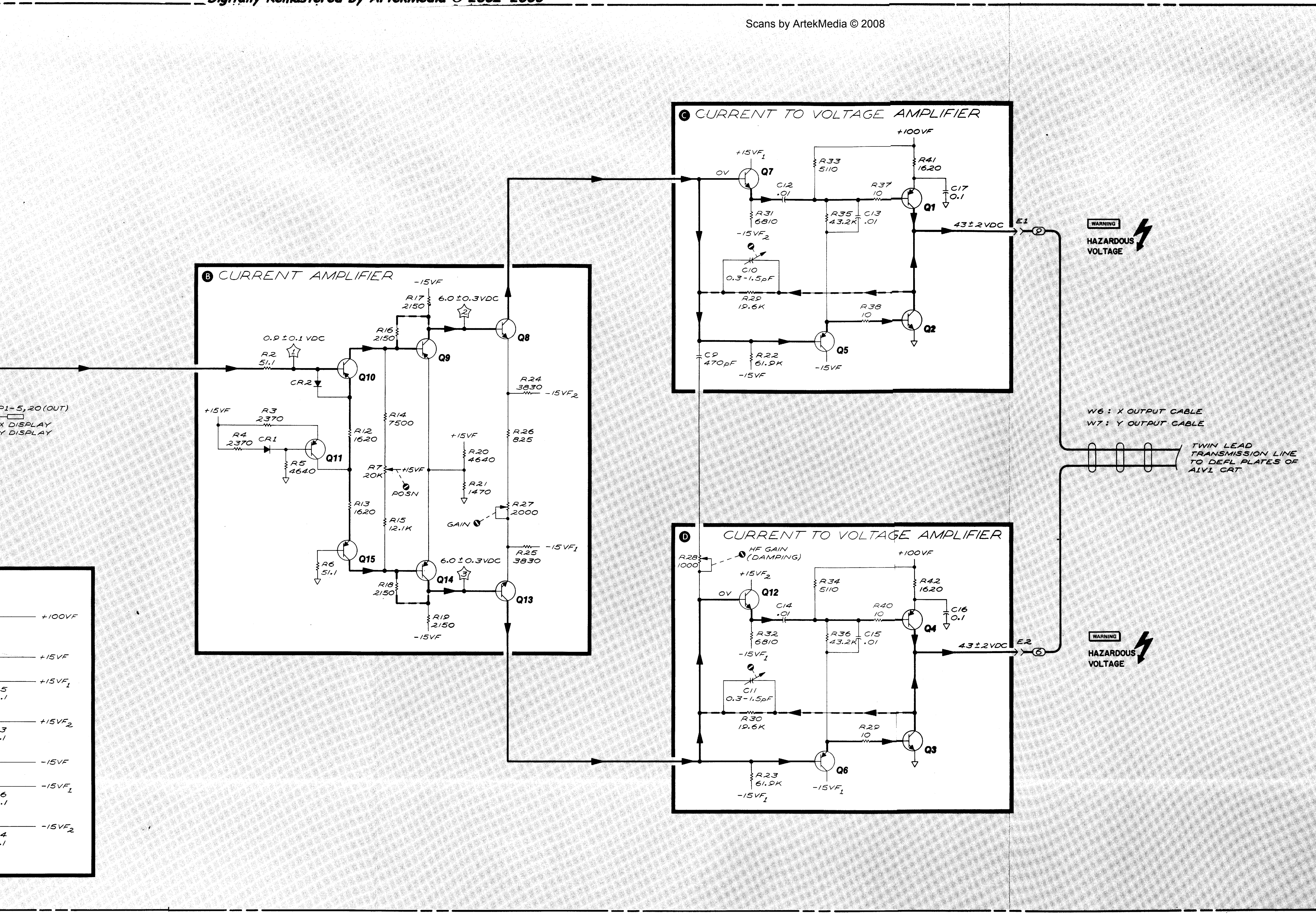
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 16	HORIZ/VERT INPUT	A3A2	A
2 17	GND GND		E
3 18	NC NC		
4 19	NC NC		
5 20	DISPLAY OUT	REAR PANEL	A
6 21	NC NC		
7 22	-15V -15V		E
8 23	GND GND		E
9 24	+15V +15V		E
10 25	NC NC		
11 26	NC NC		
12 27	+100V +100V		E
13 28	NC NC		
14 29	GND GND		E
15 30	NC NC		





SERIAL PREFIX: 1826A 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. DC TEST VOLTAGES ARE VALID WHEN THE FOLLOWING PROGRAM IS KEYED IN:
   INSTRUMENT PRESET
   BLANK TRACE A
   SHIFT LOWER LEFT 0Hz
   SHIFT UPPER RIGHT
   1090 Hz
   512 Hz
   512 Hz
   1092 Hz
4. INVERTING INPUT (PIN 2) IS INTERNALLY CONNECTED TO OUTPUT (PIN 6).

A1A4

A1A5

Figure 8-25. A1A4 Deflection Amplifier and A1A5 Deflection Amplifier, Schematic Diagram

A1A6 ± 15V REGULATOR, CIRCUIT DESCRIPTION

WARNING

Unregulated voltages as high as +150V are present in the IF-Display Section whenever the power cord is connected to a power source. This condition is annunciated by LED indicator A1A8DS1. Remove the power cord when setting up service procedures.

The IF-Display section is activated by the logic signal HPON (power on), which is connected to the RF Section via wire number 22 of the Instrument Bus. A logic "0" (< +0.8V) holds the instrument in a standby condition with all unregulated supplies active and the regulated supplies turned off. A logic "1" (> +2.0V) turns on the regulators and activates the instrument.

A1A6 ±15V Regulator contains the +15V Regulator, to which all other supplies are referenced, the −15V Regulator, a thermal shutdown circuit, and active components necessary for A1A3 High Voltage Regulator to activate the CRT.

NOTE

Reference is made in the following paragraphs to components in other assemblies: A1A3 High Voltage Regulator and A1A7 +100V, +5.2V Regulator. These components are identified by complete reference designations; for example, A1A6Q7.

+15V Regulator (A)

Q1 and Q2 form a current source from the unregulated (+23V typical) supply. Under active conditions, this current drives Darlington regulator Q5 on until amplifier U1 senses an equal-voltage condition between voltage reference CR1 (U1 pin 3) and the sense input (U1 pin 2). U1 then holds that regulated condition by shunting the drive current through R4.

Foldback current limiting is provided by Q4 and the voltage divider string on its base. This circuit senses an overcurrent condition (higher voltage across R11, R18) and limits the current to a value proportional to the supply voltage.

Overvoltage crowbar circuit CR4 and associated circuitry shorts the output when an overvoltage condition of approximately +18.5V is reached. Zener diode CR3 conducts, turning on CR4, which conducts and blows fuse F1.

The regulator circuit can be shut down by turning on Q3, which shunts the source current to ground.

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—15V Regulator B

The —15V Regulator is a tracking supply, holding the —15V supply to the same magnitude (inverted polarity) as the +15V supply, through divider resistors R19 and R20. Overvoltage and current limiting circuits are identical to those of the +15V supply.

Thermal Shutdown C

Thermistor R46 (negative temperature coefficient) is mounted to the heat sink of Q5 and Q9. As the heat sink temperature increases to approximately 85°C, the resistance decreases to less than 107Ω, and the voltage across the bridge circuit in which the thermistor is located changes polarity, causing U4 to go high. This turns on transistors Q3 and A1A7Q2, to shut down all power supplies, and transistor A1A1Q2, to light the front-panel STANDBY indicator. Current feedback though CR6 holds the bridge circuit in an unbalanced condition until the temperature drops to about 55°C, when the increased thermistor resistance again switches the bridge polarity. Q10 turns off the supplies by unbalancing the bridge when its input (HPON) is less than about +2.0V.

High-Voltage Oscillator D

The collector of A1A6Q7 is connected to the primary winding of transformer A1A3T1, and a feedback winding is connected to the base of Q7. Positive feedback from the feedback winding causes the circuit to oscillate at a frequency (approximately 25 to 30 kHz) determined primarily by the inductance and capacitance of T1. Q7 operates as a Class C amplifier, supplying a large current (approximately 2A peak) over a conduction period of less than one-half cycle.

Oscillator Level Control E

Amplifier U3 regulates the dc level of the high-voltage CRT cathode voltage by controlling the base drive to Q7 through the feedback winding. The cathode voltage is sampled via current through A1A3R4, which is compared with a reference current through A1A6R31, R32, and R50 (referenced to the +100V supply) at the input to U3. The output of U3 then holds the base drive at the level necessary to maintain about —4000 Vdc at the cathode of A1V1. Amplifier open loop gain is set by R35, with R34, R36, and C14 limiting the control loop bandwidth to approximately 7 Hz.

C15 supplies surge current for Q7, and L2 controls the conduction time of Q7. CR15 and CR16 allow U3 to generate self-bias sufficient to maintain level control if the —15V supply should fail.

Q8 disables the CRT by removing the +100V reference for the regulator circuit. Q8 is controlled from A4A9 IF Control, which may be addressed via the Instrument Bus.

A1A7 + 100V, + 5.2V REGULATOR, CIRCUIT DESCRIPTION

A1A7 +100V, +5.2V Regulator receives +118V unregulated and +9V unregulated inputs from A1A8 Rectifier to provide regulated outputs of +100V and +5.2V.

+ 100V Regulator (A)

Q6 and associated circuitry form a current source of approximately 3 mA from the unregulated +118V supply. Under active conditions, this current drives Q8 on until amplifier U2 senses an equal voltage condition between the voltage reference (divider resistors R8 and R9 from the +15V supply) and the sense input (U2 pin 2). U2 then holds the regulated condition by shunting current through Q4.

The +100V regulator circuit is shut down by PWR DWN going high, turning on Q2, which shunts the source current to ground.

+ 5.2V Regulator (B)

The +5.2V Regulator is similar to the −15V Regulator in A1A6 ±15V Regulator. It is referenced to the +15V supply and has overvoltage and current limiting circuits similar to those in the −15V Regulator.

Table 8-10. A1A6 ±15V Regulator, Replaceable Parts (1 of 2)

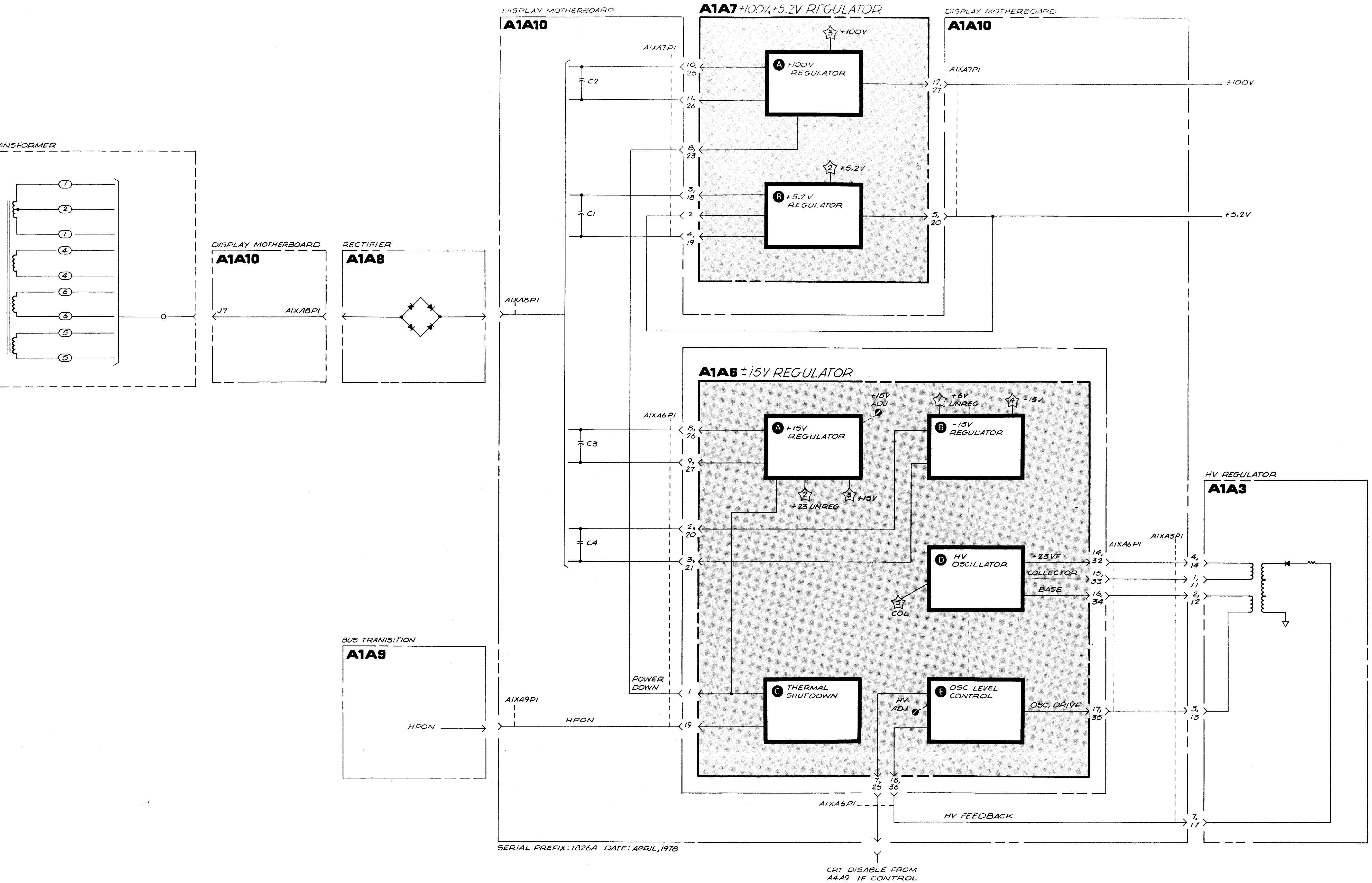
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A6	85662-60053	1	BOARD ASSEMBLY, +/-15V REGULATOR	28480	85662-60053
A1A6C1	0180-2205	1	CAPACITOR-FXD .33UF+-10% 35VDC TA	56289	150D334X9035A2
A1A6C2	0180-0116	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A1A6C3	0160-2199	2	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A1A6C4	0180-1746	3	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A1A6C5	0180-0228	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A1A6C6	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A1A6C7	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A1A6C8	0160-3456	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A1A6C9	0160-2199		CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A1A6C10	0180-0291	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A1A6C11	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A1A6C12	0180-0141	1	CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A1A6C13	0160-0164	1	CAPACITOR-FXD .039UF +-10% 200VDC POLYE	28480	0160-0164
A1A6C14	0160-4084	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A6C15	0160-0166	1	CAPACITOR-FXD .068UF +-10% 200VDC POLYE	28480	0160-0166
A1A6C16	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A6C17	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A6CR1			NOT ASSIGNED		
A1A6CR2	1901-0033	5	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A6CR3	1902-3224	2	DIODE-ZNR 17.8V 5% DO-7 PD=.4W TC=+.067%	28480	1902-3224
A1A6CR4	1884-0018	2	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A1A6CR5			NOT ASSIGNED		
A1A6CR6	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A6CR7	1902-3224		DIODE-ZNR 17.8V 5% DO-7 PD=.4W TC=+.067%	28480	1902-3224
A1A6CR8	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A6CR9	1884-0018		THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A1A6CR10	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A6CR11	1901-0200	1	DIODE-PWR RECT 100V 1.5A	28480	1901-0200
A1A6CR12			NOT ASSIGNED		
A1A6CR13	1901-0028	2	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A6CR14	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1A6CR15	1901-0040	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A6CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A6CR17	1902-0556	1	DIODE-ZNR 20V 5% DO-15 PD=1W TC=+.073%	28480	1902-0556
A1A6CR18	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A6DS1	1990-0487	2	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A1A6DS2	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A1A6F1	2110-0083	1	FUSE 2.5A 250V FAST-BLO 1.25X.25 UL IEC	28480	2110-0083
A1A6F2	2110-0002	1	FUSE 2A 250V FAST-BLO 1.25X.25 UL IEC	75915	312002
A1A6F3	2110-0007	1	FUSE 1A 250V SLO-BLO 1.25X.25 UL IEC	75915	313001
A1A6L1	9140-0171	1	COIL-MLD 40UH 10% Q=20 .296DX.968LG-NOM	28480	9140-0171
A1A6L2	9100-1641	1	COIL-MLD 240UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1641
A1A6Q1	1853-0281	3	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A6Q2	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A6Q3	1854-0477	2	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A1A6Q4	1854-0019	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1A6Q5	1854-0611	2	TRANSISTOR NPN 2N6055 SI DARL TO-3	04713	2N6055
A1A6Q6	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1A6Q7	1854-0518	1	TRANSISTOR NPN 2N5877 SI TO-3 PD=150W	04713	2N5877
A1A6Q8	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A1A6Q9	1854-0611		TRANSISTOR NPN 2N6055 SI DARL TO-3	04713	2N6055
A1A6Q10	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A6R1	0757-0442	7	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A6R2	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A1A6R3	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1A6R4	0698-3150	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1A6R5	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A1A6R6	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A1A6R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A6R8	0698-3247	1	RESISTOR 4.53K .25% .125W F TC=0+-50	28480	0698-3247
A1A6R9	2100-3095	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	02111	43P201
A1A6R10	0698-6835	1	RESISTOR 3.16K .5% .125W F TC=0+-50	24546	NC55-1/8-T2-3161-D
A1A6R11	0811-1669	2	RESISTOR 1.8 5% 2W PW TC=0+-400	75042	BWH2-1R8-J
A1A6R12	0757-0280	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A6R13	0757-0424	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A1A6R14	0683-0275	2	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A1A6R15	0698-3444	2	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F

Table 8-10. A1A6 ±15V Regulator, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A6R16	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A6R17	0757-0317	2	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A1A6R18	0811-1669		RESISTOR 1.8 5% 2W PW TC=0+-400	75042	BWH2-1R8-J
A1A6R19	0698-7794	2	RESISTOR 10K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-1002-C
A1A6R20	0698-7794		RESISTOR 10K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-1002-C
A1A6R21	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1A6R22	0757-0418	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1A6R23	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A6R24	0757-0276	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/3-TO-61R9-F
A1A6R25	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1A6R26	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A6R27	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A1A6R28	0811-1661	1	RESISTOR .39 5% 2W PW TC=0+-800	75042	BWH2-39/100-J
A1A6R29	0683-0275		RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A1A6R30	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A6R31	0698-3453	1	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A1A6R32	2100-3094	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	02111	43P104
A1A6R33	0757-0465	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A1A6R34	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A1A6R35	0683-2265	1	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A1A6R36	0698-3459	1	RESISTOR 383K 1% .125W F TC=0+-100	28480	0698-3459
A1A6R37	0757-0403	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A1A6R38	0698-3446	2	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A1A6R39	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A6R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A6R41	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A1A6R42	0757-0290	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A1A6R43	0698-4405	1	RESISTOR 107 1% .125W F TC=0+-100	24546	C4-1/8-T0-107R-F
A1A6R44	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A1A6R45	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A1A6R46	0837-0126	1	THERMISTOR DISC 1K-OHM TC=-4.4%/C-DEG	28480	0837-0126
A1A6R47			NOT ASSIGNED		
A1A6R48	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A1A6R49	0757-0816	1	RESISTOR 681 1% .5W F TC=0+-100	28480	0757-0816
A1A6R50	0757-0482	1	RESISTOR 511K 1% .125W F TC=0+-100	28480	0757-0482
A1A6R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A6R52	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A6TP1	1251-0600	7	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6TP2	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6TP3	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6TP4	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6TP5	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6TP6	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6TP7	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6U1	1820-0223	2	IC 301 OP AMP TO-99	18324	LM301A
A1A6U2	1820-0223		IC 301 OP AMP TO-99	18324	LM301A
A1A6U3	1826-0167	1	IC OP AMP TO-99	01928	CA3094AT
A1A6U4	1826-0026	1	IC 311 COMPARATOR TO-99	04713	MLM311G
A1A6VR1	1902-0686	1	DIODE-ZNR 1N825 6.2V 2% DO-7 PD=.4W	04713	1N825
A1A6VR2	1902-0554	1	DIODE-ZNR 10V 5% DO-15 PD=1W TC=+.06%	28480	1902-0554
			A1A6 MISCELLANEOUS PARTS		
	4040-0754	1	EXTRACTOR-PC BOARD BLU POLYC	28480	4040-0754
	1480-0073	1	PIN-ROLL .062-IN-DIA .25-IN-LG	28480	1480-0073

Figure 8-11. A1A7 +100V +5.2V Regulator, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A7	85662-60052	1	BOARD ASSEMBLY, +100V+5.2V REGULATOR	28480	85662-60052
A1A7C1	0180-0197	2	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A1A7C2	0160-3670	1	CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A1A7C3	0160-2199	2	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A1A7C4	0180-0228	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A1A7C5	0160-2199		CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A1A7C6	0180-0291	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A1A7C7	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A1A7C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A1A7C9	0160-3449	1	CAPACITOR-FXD 2000PF +-10% 250VDC CER	28480	0160-3449
A1A7C10	0160-4084	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A7CR1	1901-0050	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1A7CR2	1901-0050		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1A7CR3	1901-0033	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A7CR4	1902-0513	1	DIODE-ZNR 82.5V 2% DO-15 PD=1W TC=+.082%	28480	1902-0513
A1A7CR5	1902-3256	1	DIODE-ZNR 23.7V 5% DO-7 PD=.4W TC=+.076%	28480	1902-3256
A1A7CR6	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A7CR7	1902-0049	1	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A1A7CR8	1884-0018	1	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A1A7CR9	1901-0200	1	DIODE-PWR RECT 100V 1.5A	28480	1901-0200
A1A7DS1	1990-0487	2	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A1A7DS2	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A1A7F1	2110-0010	1	FUSE 5A 250V FAST-BLO 1.25X.25 UL IEC	75915	312005
A1A7F2	2110-0004	1	FUSE .25A 250V FAST-BLO 1.25X.25 UL IEC	28480	2110-0004
A1A7L1	9100-1641	1	COIL-MLD 240UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1641
A1A7Q1	1854-0404	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A7Q2	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A7Q3	1854-0019	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1A7Q4	1854-0523	1	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A1A7Q5	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1A7Q6	1854-0618	1	TRANSISTOR NPN SI DARL TO-3 PD=150W	04713	MJ3000
A1A7Q7	1853-0414	1	TRANSISTOR PNP 2N6423 SI TO-66 PD=35W	28480	1853-0414
A1A7Q8	1854-0311	1	TRANSISTOR NPN 2N4240 SI TO-66 PD=35W	01928	2N4240
A1A7R1	0757-0466	1	RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1103-F
A1A7R2	0757-0442	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A7R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A7R4	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A7R5	0698-3440	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A1A7R6	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A1A7R7	0757-0317	2	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A1A7R8	0757-0438	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A7R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A7R10	0698-7794	1	RESISTOR 10K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-1002-C
A1A7R11	0698-8417	1	RESISTOR 5.3K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-5301-C
A1A7R12	0757-0418	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1A7R13	0757-0276	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1A7R14	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A7R15	0757-0274	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1A7R16	0698-3427	2	RESISTOR 13.3 1% .125W F TC=0+-100	03888	PME55-1/8-T0-13R3-F
A1A7R17	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A7R18	0812-0066	2	RESISTOR .33 5% 2W PW TC=0+-800	75042	BWH2-33/100-J
A1A7R19	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1A7R20	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A1A7R21	0698-0085	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A1A7R22	0698-3453	1	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A1A7R23	0757-0464	1	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A1A7R24	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A7R25	0698-3427		RESISTOR 13.3 1% .125W F TC=0+-100	03888	PME55-1/8-T0-13R3-F
A1A7R26	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A1A7R27	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1A7R28	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A1A7R29	0812-0066		RESISTOR .33 5% 2W PW TC=0+-800	75042	BWH2-33/100-J
A1A7TP1	1251-0600	4	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A7TP2	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A7TP3	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A7TP4	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A7U1	1820-0223	2	IC 301 OP AMP TO-99	18324	LM301A
A1A7U2	1820-0223		IC 301 OP AMP TO-99	18324	LM301A
			A1A7 MISCELLANEOUS PARTS		
	4040-0755	1	EXTRACTOR-PC BOARD VIOLET POLYC	28480	4040-0755
	1480-0073	1	PIN-ROLL .062-IN-DIA .25-IN-LG	28480	1480-0073



A1A6

A1A7

Figure 8-26. A1A6 ±15V Regulator and A1A7 +100V, +5.2V Regulator, Block Diagram

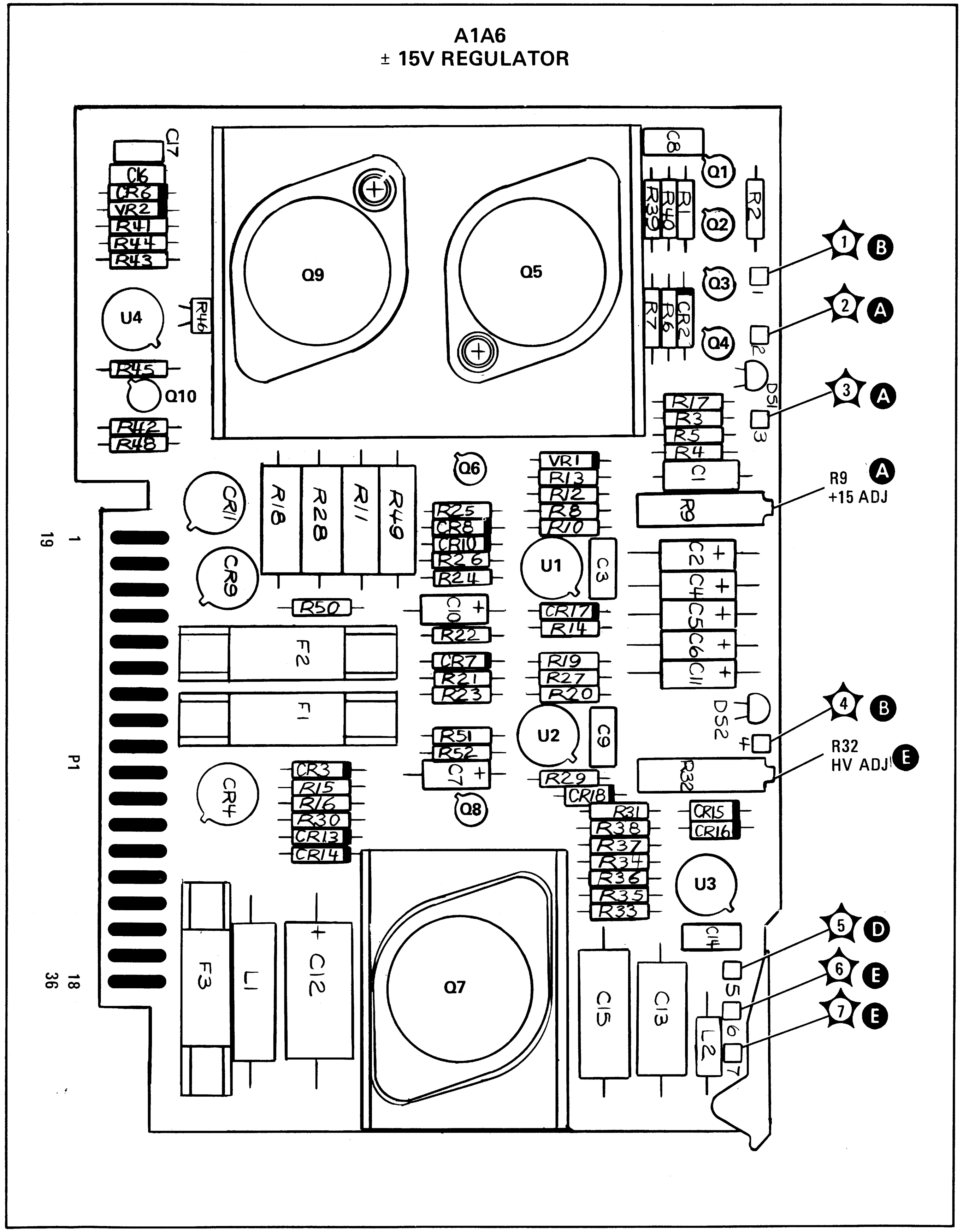


Figure 8-27. A1A6 ±15V Regulator, Component Locations

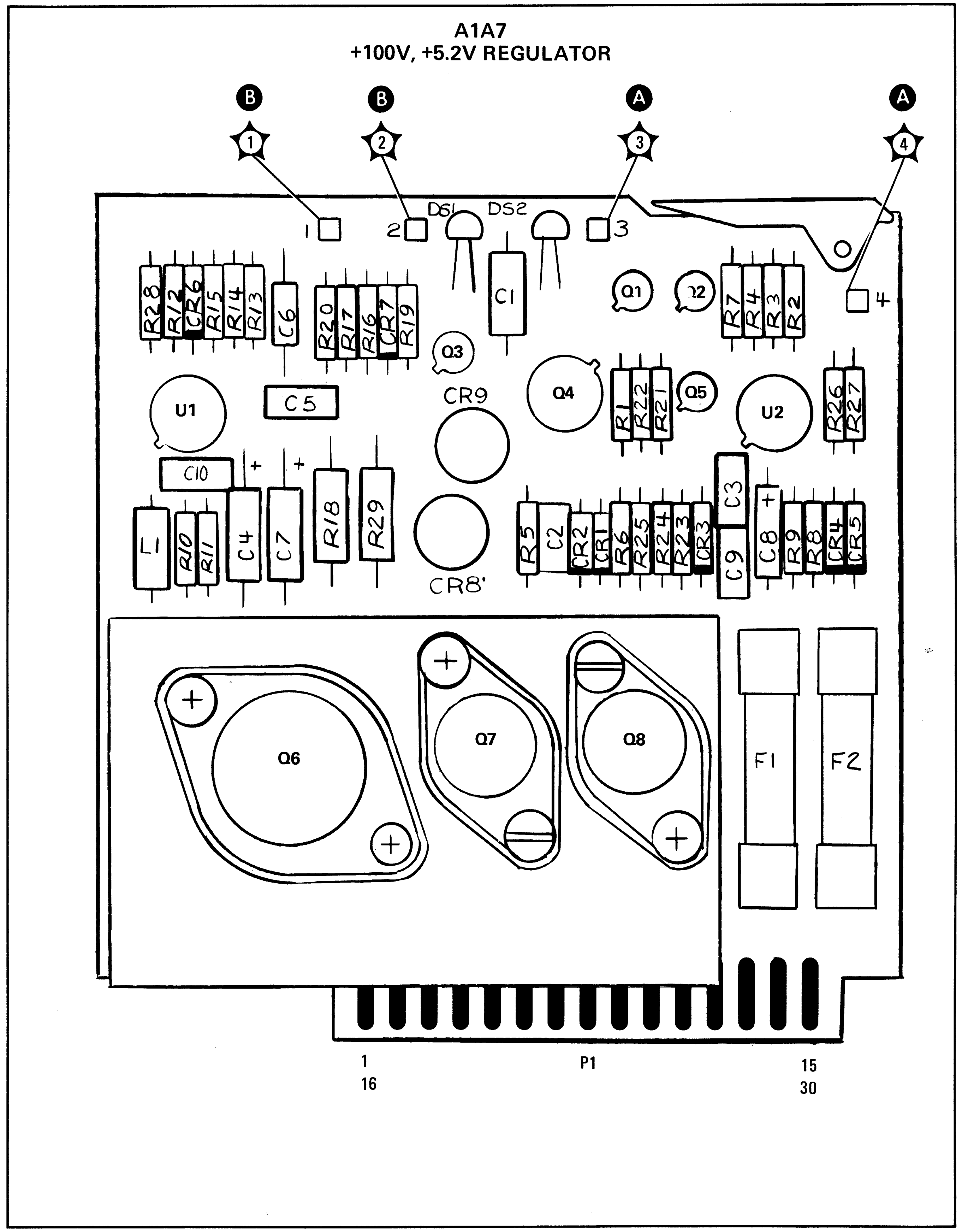
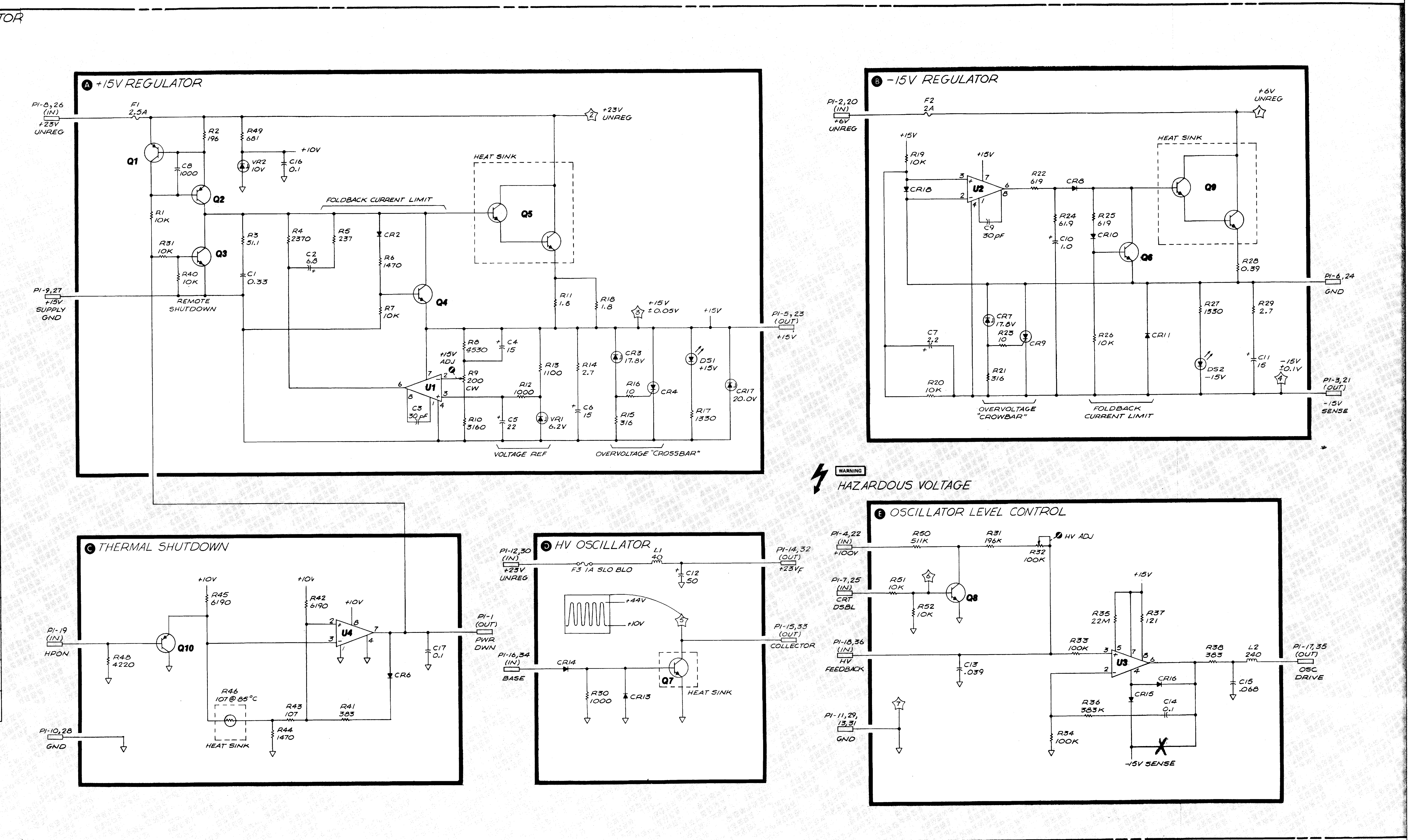


Figure 8-28. A1A7 +100V, +5.2V Regulator, Component Locations

A1A6 ±15V REGULATOR
85662-60053

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 19	PWR DWN HPON	A1A9	C
2 20	+6V UNREG	A1A10	B
3 21	-15V SENSE	A1A10	B
4 22	+100V		B
5 23	+15V		A
6 24	GND		B
7 25	CRT DSBL	A4A9	E
8 26	+23V UNREG	A1A10	A
9 27	+15V GND	A1A10	A
10 28	+15V GND		C
11 29	+15V GND		E
12 30	+23V UNREG	A1A10	A
13 31	+15V GND		E
14 32	+23V$_F$	A1A3	D
15 33	COLLECTOR	A1A3	D
16 34	BASE	A1A3	D
17 35	OSC DRIVE	A1A3	E
18 36	HV FEEDBACK	A1A3	E



SERIAL PREFIX: 1826A DATE: APRIL, 1978

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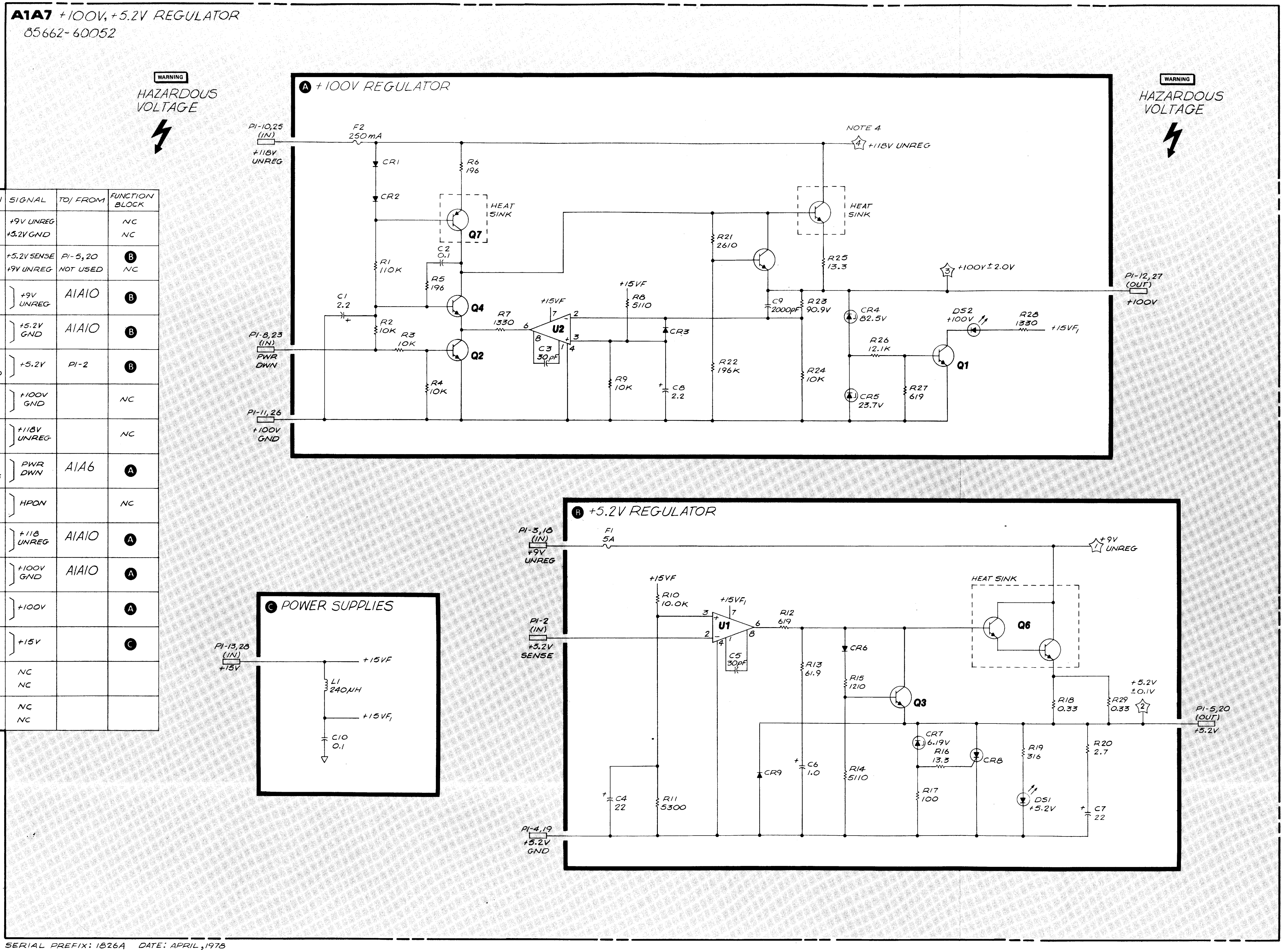


P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+9V UNREG		NC
16	+5.2V GND		NC
2	+5.2V SENSE	P1-5,20	B
17	+9V UNREG	NOT USED	NC
3, 18	+9V UNREG	A1A10	B
4, 19	+5.2V GND	A1A10	B
5, 20	+5.2V	P1-2	B
6, 21	+100V GND		NC
7, 22	+118V UNREG		NC
8, 23	PWR DWN	A1A6	A
9, 24	HPON		NC
10, 25	+118 UNREG	A1A10	A
11, 26	+100V GND	A1A10	A
12, 27	+100V		A
13, 28	+15V		C
14, 29	NC		
15, 30	NC		

NOTES:

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

WARNING

3. HAZARDOUS VOLTAGE EXISTS ON THIS BOARD
4. THE TIME CONSTANT OF THE +118V UNREGULATED CIRCUIT IS 25 SECONDS. ALLOW ADEQUATE TIME AFTER THE POWER CORD IS REMOVED FOR THE FILTER CAPACITORS TO DISCHARGE BEFORE SERVICING.

A1A6
A1A7

Figure 8-29. A1A5 ±15V Regulator and A1A7 +100V, +5.2V Regulator, Schematic Diagram

A1A8 RECTIFIER, CIRCUIT DESCRIPTION

WARNING

Because of the high voltages present in this assembly, servicing should be performed only by qualified personnel.

A1A8 Rectifier contains three bridge rectifiers and one full-wave rectifier to provide unregulated power for the IF-Display Section. External power is supplied to the instrument through Line Module FL1 and Power Transformer A1T1.

+9V UNREG

Full-wave rectifier CR7 and CR8 provides an unregulated +9V to A1A7 +100V, +5.2V Regulator. LED DS1 is lit whenever there is power to the transformer.

Test points TP1 and TP2, when jumpered together, cause HPON to go high, turning on the IF-Display Section in the absence of a signal from the RF Section when power is required for troubleshooting.

The LINE TRIGGER voltage is selected as required by A3A1 Trigger.

+118V UNREG

Bridge rectifier U1 provides an unregulated +118V to A1A7.

WARNING

The time constant of the filter capacitor circuit C2 and R6 is about 25 seconds. Before servicing, allow adequate time for discharge after line power cable is removed.

+23V UNREG

The +23V unregulated supply, bridge rectifier CR9 through CR12, includes an overvoltage protection circuit. If line power from a 220V/240V source is applied when the Line Voltage Selector is set to 100V/120V, the overvoltage causes CR6 to conduct, turning on CR5 to blow the fuse in the Line Module.

+5V UNREG

Bridge rectifier CR1 through CR4 provides unregulated +5V and −15V to A1A6 ±15V Regulator.

A1A9 BUS TRANSITION, CIRCUIT DESCRIPTION

A1A9 Bus Transistion provides jack J2 (inside front panel) for the 50-wire Instrument Bus, which is routed through the IF-Display Section through a flat ribbon cable W8.

HPON, the IF-Display Section power-on control line (W8 wire 22) is sensed by amplifier Q1 and Q2 to activate fan relay K1, which supplies line power to the cooling fan B1.

The +5.2V supply is connected to the LSTP line (W8 wire 43) through CR1 to halt operation of A15 Processor if there is a supply failure.

Table 8-12. A1A8 Rectifier, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A8	85662-60051	1	BOARD ASSEMBLY, RECTIFIER	28480	85662-60051
A1A8C1	0160-2055	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A8C2	0160-4298	1	CAPACITOR-FXD 4700PF +-20% 250VDC CER	56289	C067F251H472M822-CDH
A1A8C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A1A8C4	0160-0168	2	CAPACITOR-FXD .1UF +-10% 200VDC POLYE	28480	0160-0168
A1A8C5	0160-0168		CAPACITOR-FXD .1UF +-10% 200VDC POLYE	28480	0160-0168
A1A8C6	0160-0970	1	CAPACITOR-FXD .47UF +-10% 80VDC POLYE	28480	0160-0970
A1A8C7	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A1A8CR1	1901-0662	10	DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR2	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR3	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR4	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR5	1884-0018	1	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A1A8CR6	1902-0656	1	DIODE-ZNR 39.2V 5% DO-15 PD=1W TC=+.081%	28480	1902-0656
A1A8CR7	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR8	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR9	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR10	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR11	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8CR12	1901-0662		DIODE-PWR RECT 100V 6A	04713	MR751
A1A8DS1	1990-0486	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A1A8R1	0757-0420	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A1A8R2	0757-0442	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A8R3	0698-0085	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A1A8R4	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A1A8R5	0757-0280	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A8R6	0757-0367	1	RESISTOR 100K 1% .5W F TC=0+-100	28480	0757-0367
A1A8R7	0698-3407	1	RESISTOR 1.96K 1% .5W F TC=0+-100	28480	0698-3407
A1A8R8	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1A8TP1	0360-1788	2	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A1A8TP2	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A1A8U1	1901-0367	1	DIODE-FW BRDG 600V 1A	28480	1901-0367
			A1A8 MISCELLANEOUS PARTS		
	4040-0747	1	EXTRACTOR-PC BOARD GRAY POLYC	28480	4040-0747
	1480-0073	1	PIN-ROLL .062-IN-DIA .25-IN-LG	28480	1480-0073

Table 8-13. A1A9 Bus Transition, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A9	85662-60056	1	BOARD ASSEMBLY, BUS TRANSITION(INCL W5)	28480	85662-60056
A1A9CR1	1901-0033	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A9CR2	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A1A9E1	1251-0600	2	CONTACT-CONN U/W-POST-TYPE MALE	28480	1251-0600
A1A9E2	1251-0600		CONTACT-CONN U/W-POST-TYPE MALE	28480	1251-0600
A1A9J1	1251-4828	1	CONNECTOR 50-PIN M POST TYPE	0138J	2-87230-5
A1A9J2	1251-4432	1	CONNECTOR 50-PIN F D SUBMIN	28480	1251-4432
A1A9K1	0490-0618	1	RELAY 2C 24VDC-COIL 5A 115VAC	28480	0490-0618
A1A9Q1	1854-0477	2	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	02230	2N2222A
A1A9Q2	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	02230	2N2222A
A1A9R1	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A1A9R2	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A1A9R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F

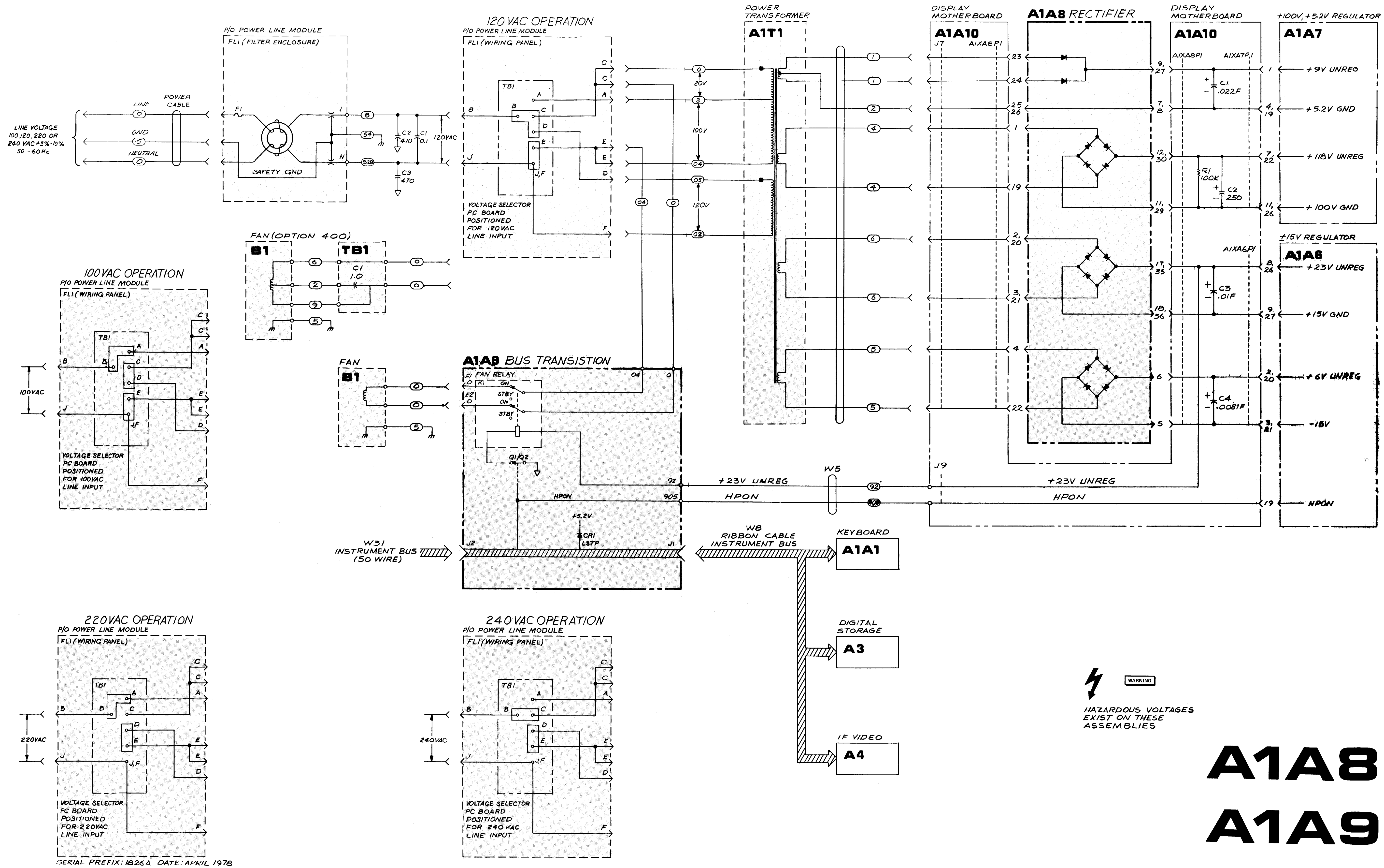


Figure 8-30. A1A8 Rectifier and A1A9 Bus Transistion, Block Diagram

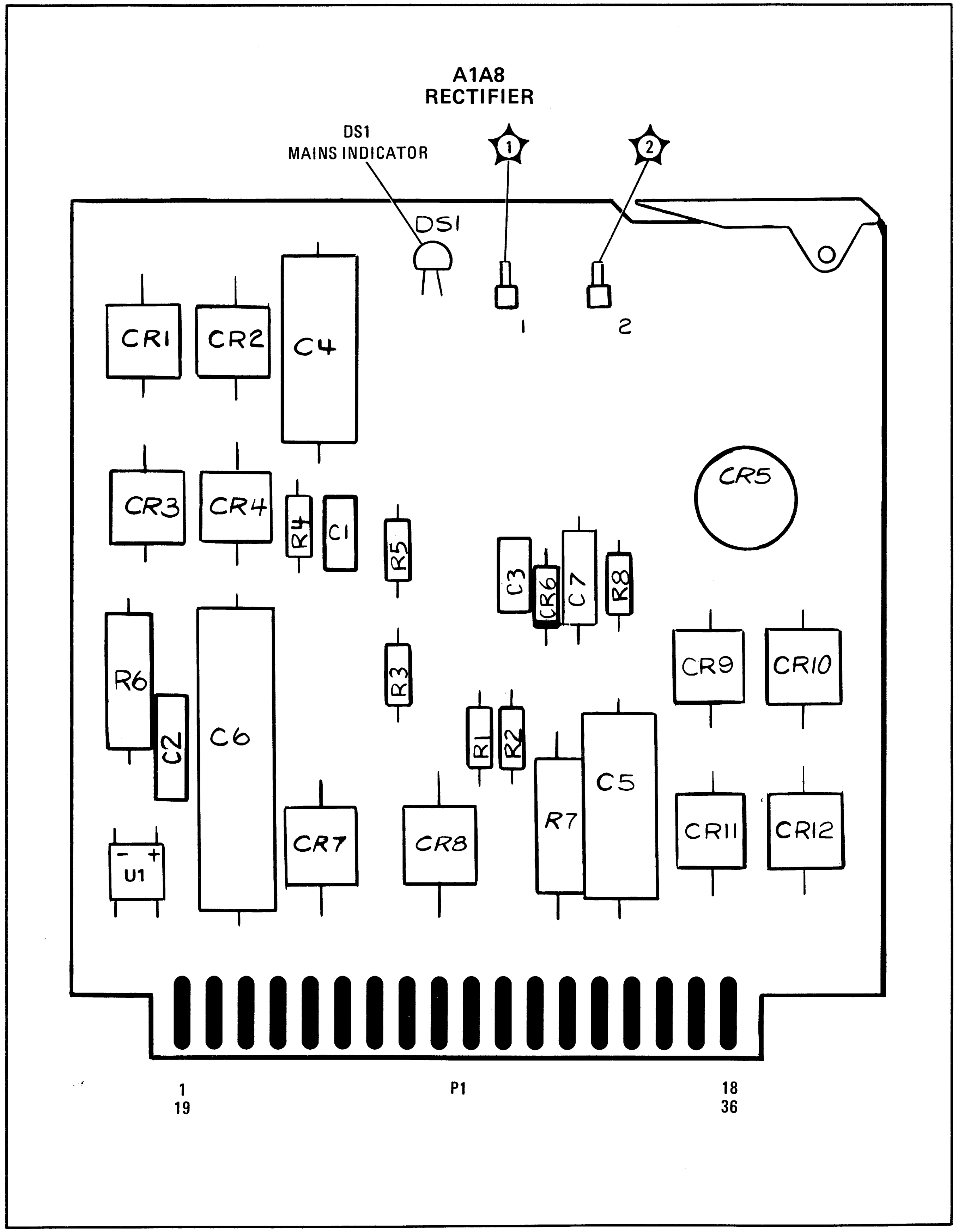


Figure 8-31. A1A8 Rectifier, Component Locations

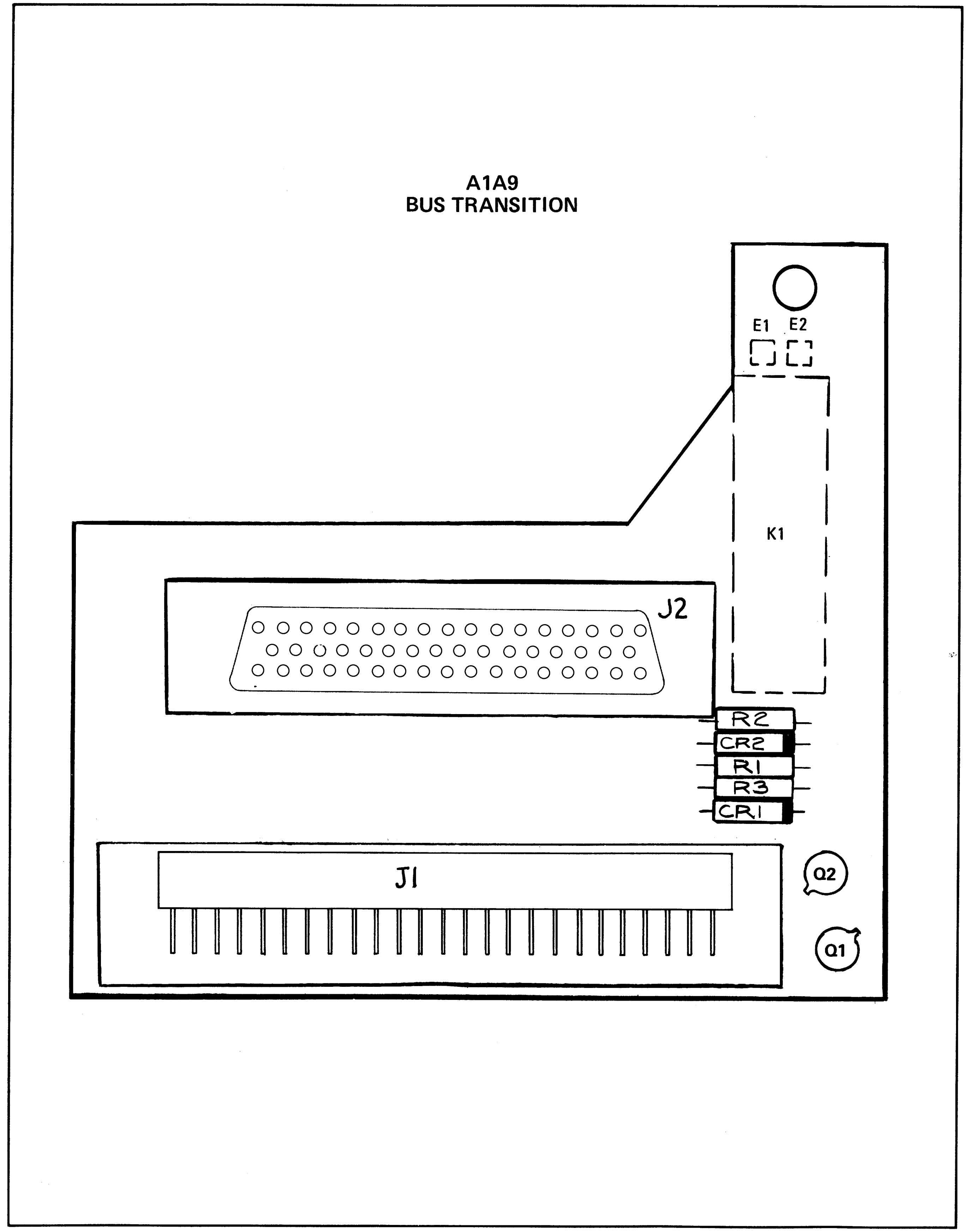
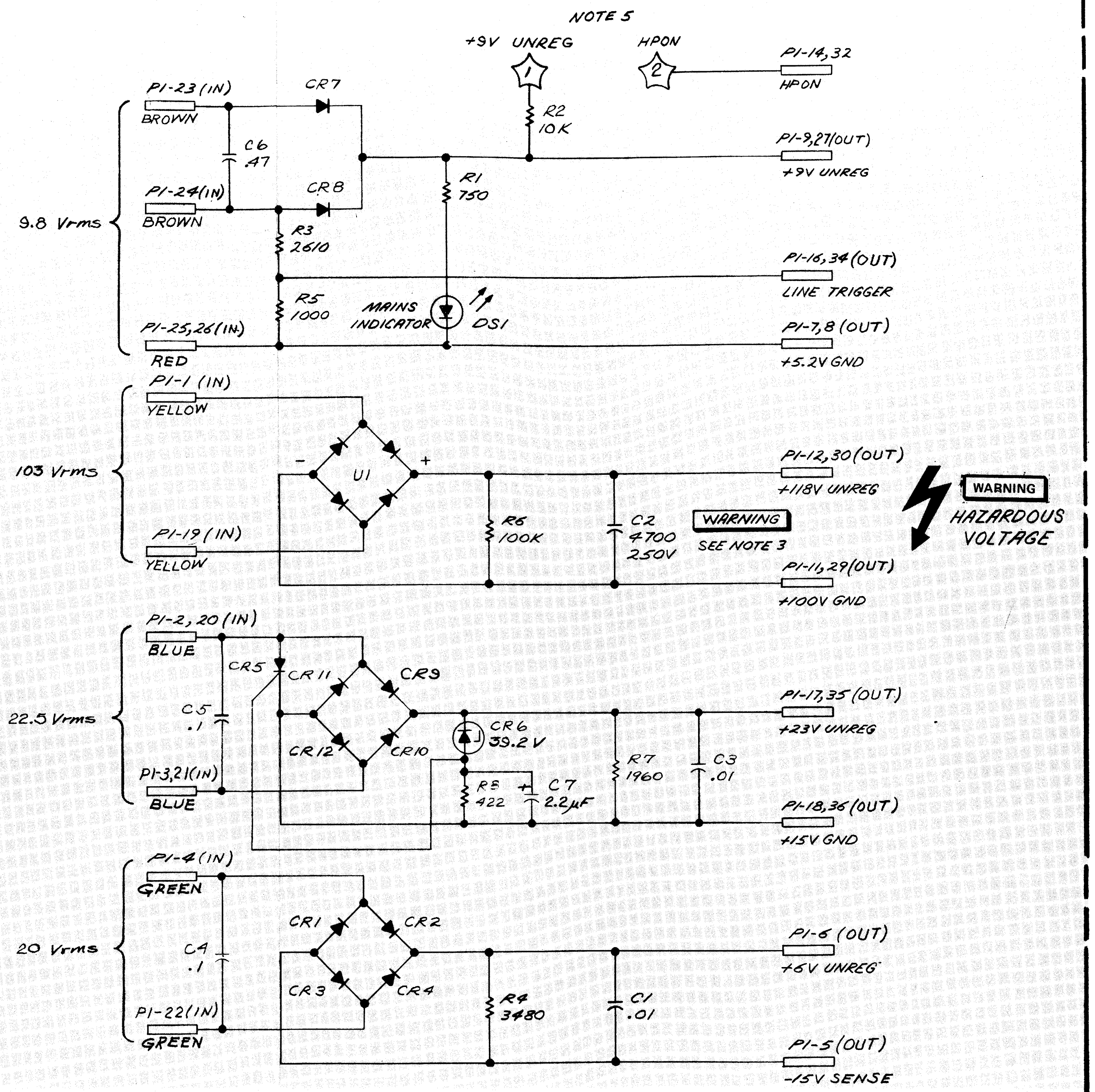


Figure 8-32. A1A9 Bus Transition, Component Locations

A1A8 RECTIFIER
85662-60051



P1

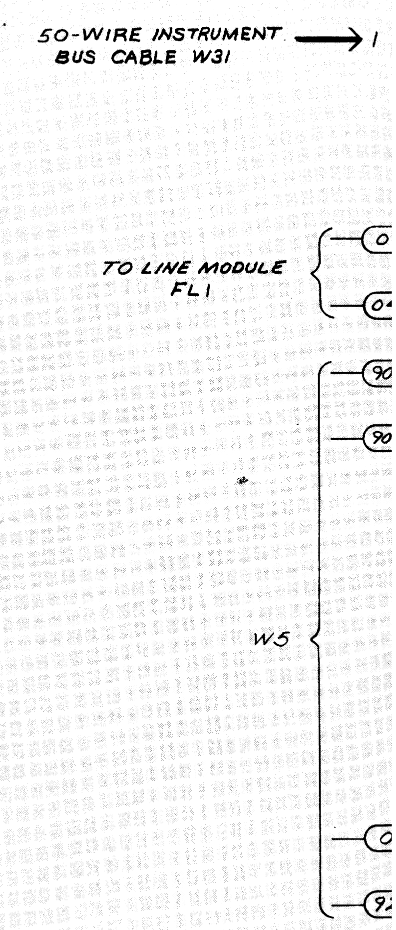
PIN	SIGNAL	TO/FROM
1 19	YELLOW	A1 T1
2 20	BLUE	A1 T1
3 21	BLUE	A1 T1
4 22	GREEN	A1 T1
5 23	-15V SENSE BROWN	A1A6 A1 T1
6 24	+6V UNREG BROWN	A1A6 A1 T1
7 25	+5.2V GND RED	A1A7 A1 T1
8 26	+5.2V GND RED	A1A7 A1 T1
9 27	+9 V UNREG	A1A7
10 28	N.C.	
11 29	+100V GND	A1A7
12 30	+118V UNREG	A1A7
13 31	N.C.	
14 32	HPON	A1A7
15 33	N.C.	
16 34	LINETRIGGER	A3
17 35	+23V UNREG	A1A6
18 36	+15VGND	A1A6

SERIAL PREFIX 1826A DATE: APRIL 1978

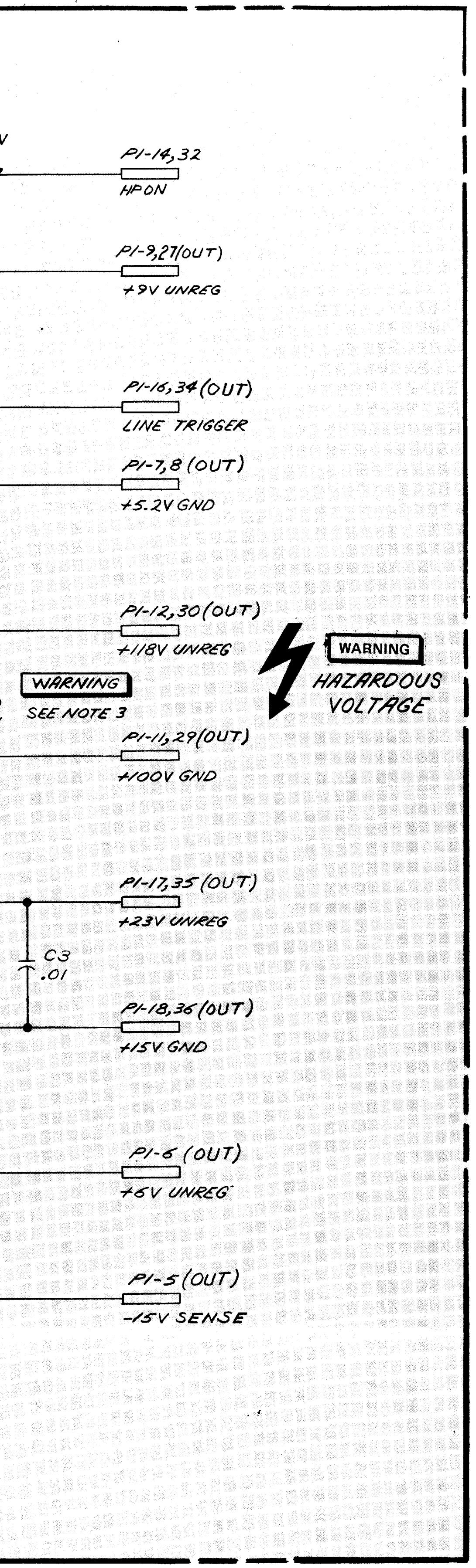
A1A8 BUS TRANSITION
85662-60056

J1 50-WIRE INSTRUMENT BUS

PIN	SIGNAL
1	GND
2	NC
3	IOBØ
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
20	NC
21	NC
22	HPON
23	ADRØ
24	ADR1
25	ADR2
26	ADR3
27	ADR4
28	ADR5 (NOT USED)
29	NC
30	NC
31	KR8
32	KR9
33	KR10
34	KR11
35	KCØ
36	KC1
37	KC2
38	KC3
39	KC4
40	KC5
41	KC6
42	KC7
43	LSTP
44	HSWP
45	LSRQ
46	LDSR
47	LBIO
48	GND
49	LTIO
50	GND



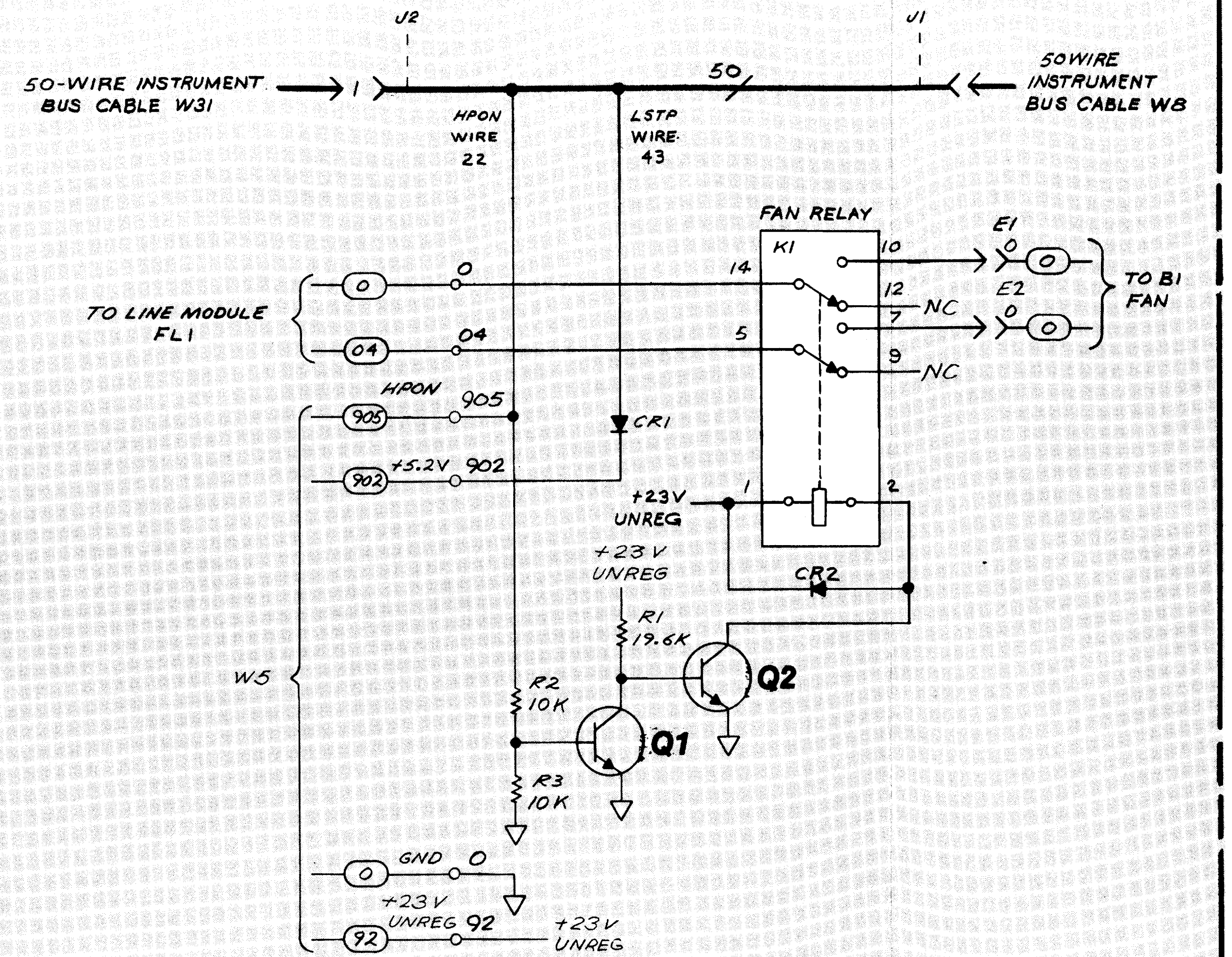
SERIAL PREFIX 1826A DATE: APRIL 1978



A1A9 BUS TRANSITION
85662-60056

J1 50-WIRE INSTRUMENT BUS

PIN	SIGNAL
1	GND
2	NC
3	IOBØ
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
20	NC
21	NC
22	HPON
23	ADRØ
24	ADR1
25	ADR2
26	ADR3
27	ADR4
28	ADR5 (NOT USED)
29	NC
30	NC
31	KR8
32	KR9
33	KR10
34	KR11
35	KCØ
36	KC1
37	KC2
38	KC3
39	KC4
40	KC5
41	KC6
42	KC7
43	LSTP
44	HSWP
45	LSRQ
46	LDSR
47	LBIO
48	GND
49	LTIO
50	GND



SERIAL PREFIX 1826A DATE: APRIL 1978

NOTES:

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

WARNING

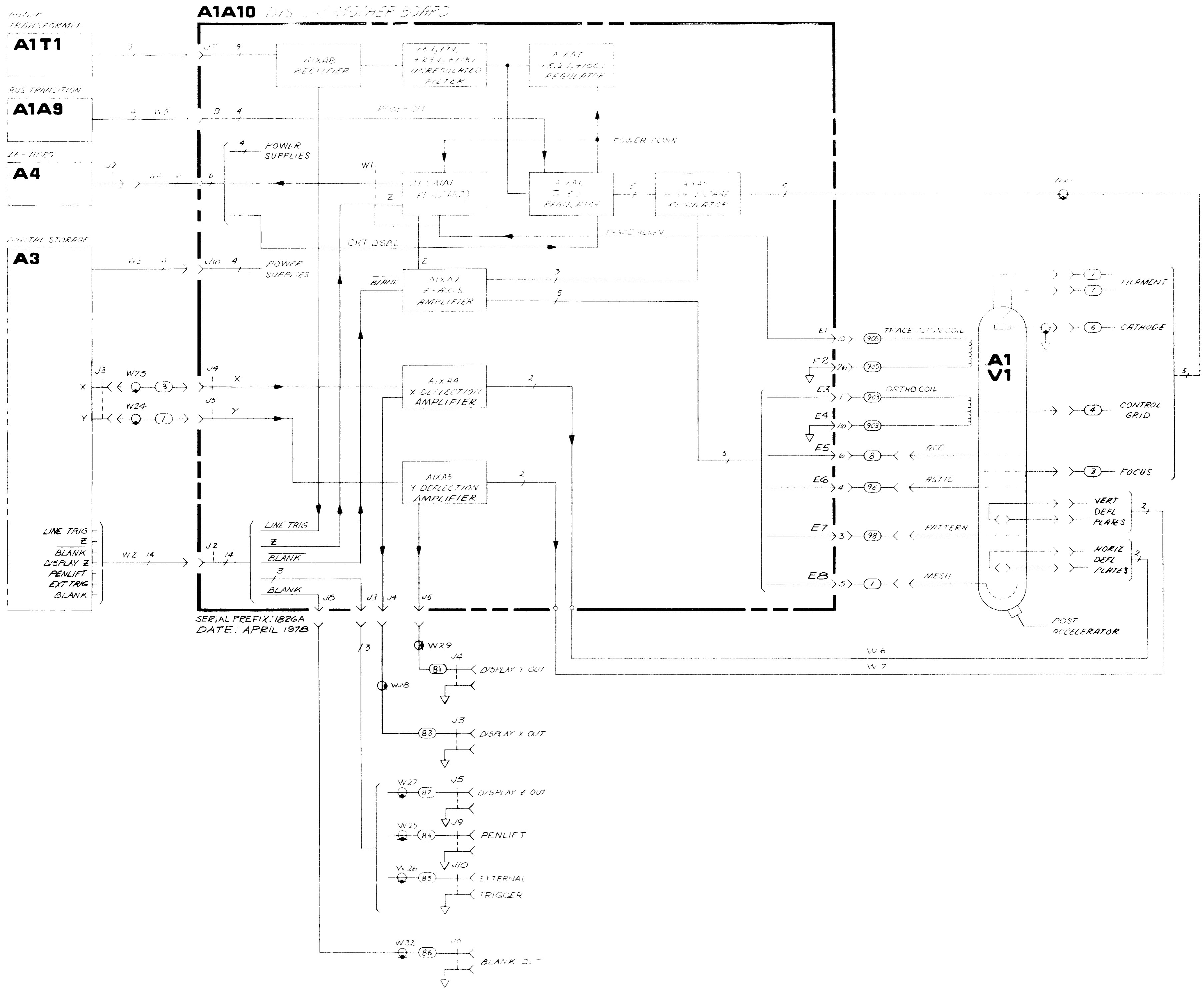
3. THE TIME CONSTANT OF THE 100V FILTER CAPACITOR CIRCUIT IS 25 SECONDS. ALLOW ADEQUATE TIME AFTER POWER CORD IS REMOVED FOR FILTER CAPACITORS TO DISCHARGE BEFORE SERVICING.
4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
HPON	HIGH = DISPLAY POWER ON
LSTP	LOW = STOP PROCESSOR
HSWP	HIGH = SWEEPING
LSRQ	LOW = SERVICE REQUEST
LDSR	LOW = DIGITAL STORAGE READY
LBIO	LOW = RF SECTION I/O STROBE
LTIO	LOW = DISPLAY SECTION I/O STROBE
ADRØ-ADR5	ADDRESS BITS Ø-5
IOBØ-IOB15	DATA BITS Ø-15
KR8-KR11	KEY ROWS 8-11
KCØ-KC7	KEY COLUMNS Ø-7

5. SHORTING TP1 TO TP2 ALLOWS SERVICING OF THE IF-DISPLAY SECTION WITHOUT THE RF SECTION BEING CONNECTED.

A1A8
A1A9

Figure 8-33. A1A8 Rectifier and A1A9 Bus Transistion, Schematic Diagram



A1A10

Figure 8-34. A1A10 Display Motherboard, Block Diagram

Table 8-14. A1A10 Display Motherboard, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A10	85662-60050	1	BOARD ASSEMBLY, DISPLAY MOTHER BOARD (INCLUDES W3)	28480 28480	85662-60050 0
A1A10C1	0180-2808	1	CAPACITOR-FXD .022F+-20% 20VDC AL	28480	0180-2808
A1A10C2	0180-2642	1	CAPACITOR-FXD 250UF+50-10% 250VDC AL	56289	36DX251F250AA2A
A1A10C3	0180-2641	1	CAPACITOR-FXD .018F+75-10% 40VDC AL	00853	500183U040EC2A
A1A10C4	0180-0453	1	CAPACITOR-FXD 8700UF+75-10% 40VDC AL	28480	0180-0453
A1A10E1-A1A10E8	0360-1788	8	TERMINAL-STUD SINGLE CONTACT	28480	0360-1788
A1A10J1	1200-0508	2	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A1A10J2	1200-0508		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A1A10J3	1251-4798	1	CONNECTOR 6-PIN M POST TYPE	28480	1251-4798
A1A10J4	1251-4804	3	CONNECTOR 4-PIN M POST TYPE	28480	1251-4804
A1A10J5	1251-4804		CONNECTOR 4-PIN M POST TYPE	28480	1251-4804
A1A10J6	1251-3195	1	CONNECTOR 4-PIN M POST TYPE	28480	1251-3195
A1A10J7	1251-4281	1	CONNECTOR 9-PIN M POST TYPE	28480	1251-4281
A1A10J8	1251-4990	1	CONNECTOR 2-PIN M POST TYPE	28480	1251-4990
A1A10J9	1251-4804		CONNECTOR 4-PIN M POST TYPE	28480	1251-4804
A1A10R1	0757-0367	1	RESISTOR-100K 1% .5W F TC=+-100	28480	0757-0367
A1A10W1	8150-2829	1.4FT	WIRE-18 GUAGE BLACK	28480	8150-2829
A1A10W2	8150-3246	1.4FT	WIRE-18 GUAGE WHITE/RED	28480	8150-3246
A1XA2	1251-2035	4	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1XA3	1251-2034	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	28480	1251-2034
A1XA4	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1XA5	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1XA6	1251-2026	2	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A1XA7	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1XA8	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A1A11	0960-0383	1	MULTIPLIER-HV 20KV	28480	0960-0383

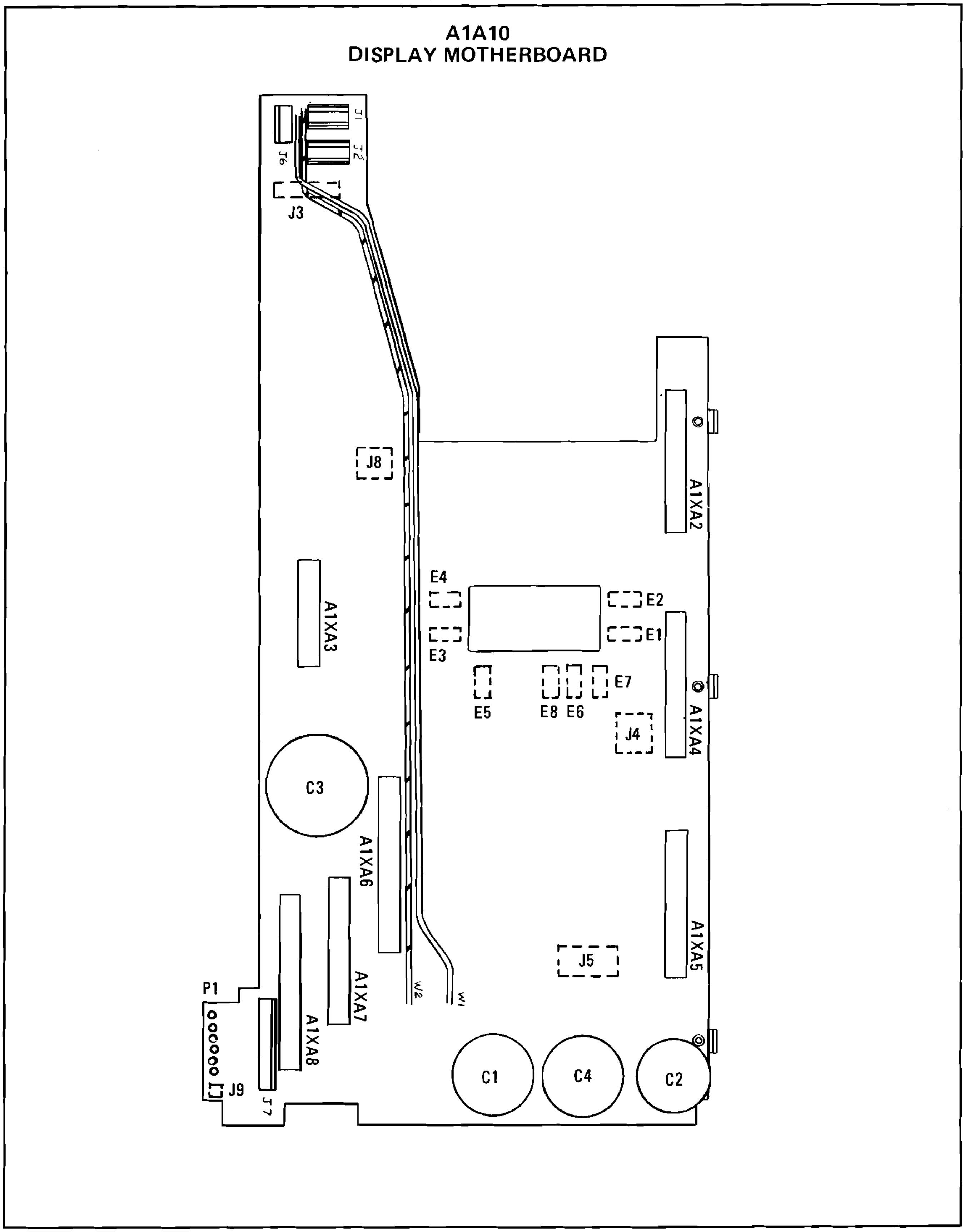
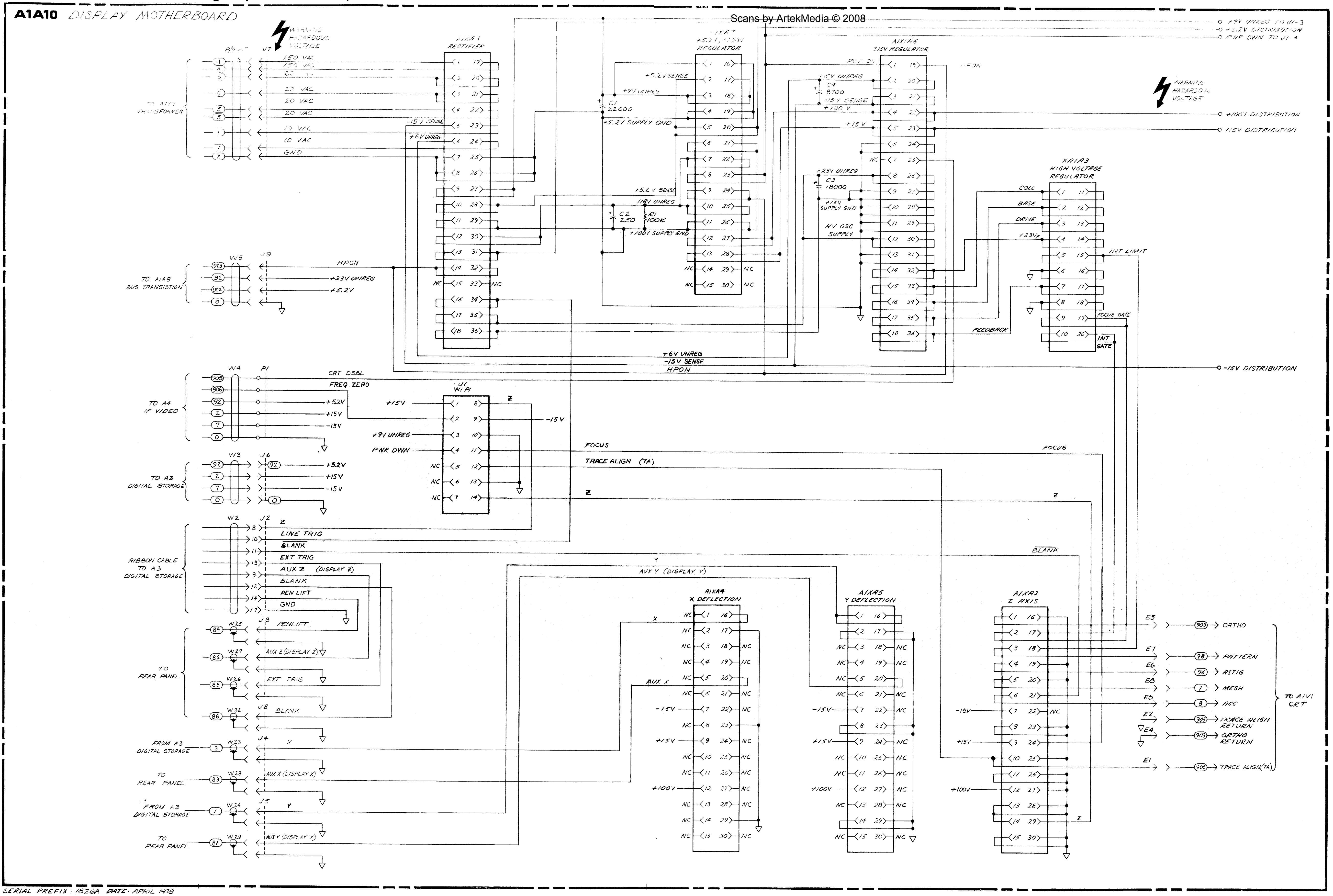


Figure 8-35. A1A10 Display Motherboard, Component Locations



SERIAL PREFIX: 1826A DATE: APRIL 1978

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

A1A10

Figure 8-36. A1A10 Display Motherboard, Schematic Diagram

A3 DIGITAL STORAGE, CIRCUIT DESCRIPTION

A3 Digital Storage consists of three sections:

- **Input Section:** A3A8 Analog-Digital Converter and A3A9 Track and Hold. This section receives the video and sweep signals, converts them to digital, and transfers the data to the Processor Section.
- **Processor Section:** A3A4 Memory, A3A5 Data Manipulator, A3A6 Main Control, and A3A7 Interface. This section handles all data transfers, data functions, and control for the data storage. The digital storage algorithm is contained in read-only memory (ROM) in A36 Main Control.
- **CRT Driver Section:** A3A1 Trigger, A3A2 Intensity Control, and A3A3 Line Generator. This section, under control of the Processor Section, generates beam control signals (X, Y, and Z) to display the memory data.

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.

A3 DIGITAL STORAGE TROUBLESHOOTING

Two tests can be performed to isolate failures in the Spectrum Analyzer to the Digital Storage section of the IF-Display Section.

1. INSTRUMENT CHECK LED: The left INSTR CHECK LED (CHECK LED I) remaining on after INSTR PRESET is pushed indicates a bad bit was detected when the Analyzer performed its self check routine. This check routine writes and reads to the read-write memory (RAM) in Digital Storage. See the 8568A Digital Troubleshooting to determine which bit failed. To activate this test, press INSTR PRESET .

2. DIGITAL STORAGE TEST PATTERN: The test pattern shown in Figure 8-37 can be used to verify the existence of a failure. This pattern can be generated independently of the main processor in the RF Section (A15 Processor). To enable the test pattern:

   a. Jumper A3A6TP3 and A3A6TP6. (Turns on the test ROMs.)

   b. Push A3A7S1 to initialize.

   If troubleshooting without the RF section or with the Analyzer Bus Interconnect cable W31 disconnected, A1A8TP1 and A1A8TP2 must be jumpered to turn on the power supplies.

   If the CRT remains blank, A1A6TP6 and A1A6TP7 may have to be jumpered to inhibit the CRT disable line controlled by the A15 Processor.

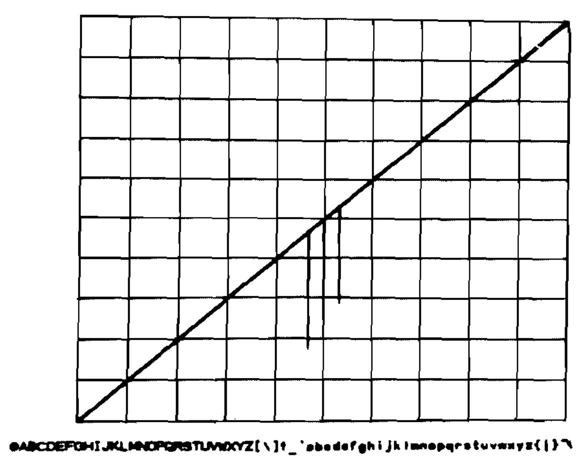


Figure 8-37. Digital Storage Test Pattern

Failure Analysis

INSTR CHECK LED I and the Digital Storage test pattern can be used together to determine in what area of the Digital Storage Section a failure exists. Refer to previous page for procedure for enabling the CHECK LED and test pattern tests. Failure symptoms (and troubleshooting information for each) are as follows:

1. If INSTR CHECK LED I remains on and no test pattern can be obtained, the Digital Storage processor must be checked starting with the A3A6 Main Control assembly. The sequence of tests, indicated on the SA diagrams, is listed below.

NOTE
For all of the following tests, except the System ROMs Check, A3A6TP3 and A3A6TP6 must be jumpered to turn on the test ROMs and disable the normal system ROMs.

Control Board Outputs and Test ROMs Check	A3A6 SHEET 1/2
System ROMs Check	A3A6 SHEET 2/2
Decoder Check	A3A7 SHEET 1/2
A3A5 (Data Manipulator) Verification	A3A5 SHEET 3/3
IOB Interface Check	A3A7 SHEET 2/2
Memory Check	A3A4
Test B Check	A3A2
Test B Check and Test A Check	A3A6 SHEET 2/2
Test A Check and ADC Check	A3A8
Line Generator	A3A3
Intensity Control	A3A2
CRT Deflection Circuitry	A1A2, A1A4, A1A5
DS Address Check	A3A7 SHEET 1/2
A15 Processor I/O	A15

2. If INSTR CHECK LED I remains on but the test pattern is correct, first check the following:

IOB Interface	A3A7 SHEET 2/2
Memory	A3A4
DS Address	A3A7 SHEET 1/2
System ROM	A3A6 SHEET 2/2
A15 Processor I/O	A15

3. If INSTR CHECK LED I is off but the test pattern is incorrect, first check the A3A3 Line Generator and A3A2 Intensity Control before checking the entire Digital Storage Processor.

4. If INSTR CHECK LED I is off and the test pattern is correct, but the CRT and characters come up incorrectly after a normal Instrument Preset, check the System ROMs first. A "long POP" check of the A15 Processor in the RF section should also be performed.

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DESCRIPTION OF DIGITAL STORAGE TEST PROGRAMS

NOTE

For all tests, unless otherwise specified: Test Point A3A6TP3 must be jumpered to A3A6TP6. This turns on the Test ROMs. After all jumpers for a test are connected, momentarily push switch A3A7S1 to initialize.

THE LEFT INSTRUMENT CHECK LED SHOULD REMAIN ON WHEN THE TEST ROMS ARE ENABLED AND INSTRUMENT PRESET IS PUSHED.

Test Pattern:

Generates a test pattern with graticule, a diagonal line, characters, and three vertical lines representing the ADC converter outputs of the negative peak, sample, and positive peak detectors.

The IOB Interface circuitry and the System ROM are not used in generating the Test Pattern.

Free Run Check:

A3A6E1 removed: disables feedback from the program ROM to the Branch Length Adder.
A3A6TP8 grounded: disables qualifier feedback.
A3A6TP5 grounded: disables interrupt and return inputs to the State Machine Controller. The BS (Block Switch) line is forced to toggle at a 4 MHz rate.

The program address decrements in a binary sequence through all possible addresses with the BS line toggling at 4 MHz, SØ at 2 MHz, S1 at 1 MHz, etc. This checks the A3A6 Main Control assembly, its ROM, Pipeline Registers, flip-flops and control pulses outputs, and the A3A7 I/O Port Decorder. To check the System ROMs, the same test setup is used but the A3A6TP3 to A3A6TP6 jumper is removed to re-enable the System ROMs outputs.

This test requires that the 8 MHz clocks, CLK and LCLK, and the initialize signal, LTON, from A3A7 be working.

This test also requires that a basic "kernel" be running. This includes part of the State Machine Control F , and the loop consisting of the Link Register, State Register, and Branch Length Adder on A3A6. See A3A6 Main Control Troubleshooting to troubleshoot this circuitry.

Test Program 1:

A3A6TP8 grounded: disables qualifier feedback.
A3A6TP7 grounded: forces state machine interrupt high.
A3A5TP2 grounded: disables the Register RAM outputs.

This program generates the pattern to test the A3A5 Data Manipulator, its Accumulator, Control Decode logic, Pipeline Registers, and parts of its ALU, Constant ROM, and Multiplexer Bus Drivers. This is the test that exercises the Digital Storage Bus with all feedback from it disabled.

Test Program 2:

A3A6TP8 grounded: disables qualifier feedback.
A3A6TP7 grounded: forces state machine interrupt high.

This program is the same as Test Program 1 except that the Register RAM outputs are enabled on the A3A5 Data Manipulator assembly. Since there is now feedback from the Accumulator through the Register RAM, a bad bit will make all higher order bits appear bad; so when probing the bus lines, the low order bits should be verified first and then higher order ones. The program generates various patterns that are written into and read from register RAM location Ø ; it also selects all the qualifier inputs on A3A7 in both a low and high state; and it exercises all the bits in the branch length word on the A3A6 Main Control assembly.

This program is used to verifiy the Branch Length Adder on A3A6 Main Control assembly when A3A6E1 jumper is replaced. On A3A5 it tests the Register RAM, ALU A inputs, and the multiplexer inputs from the RAMs. And finally, it checks the qualifier select circuitry on A3A7, so that the qualifier feedback can be used in generating the following test programs.

Test Program 3:

A3A7TP6 grounded: test qualifier bit read by program.
A3A2R12 LL FULL CW: The long line threshold on A3A2 is adjusted fully clockwise so that the normal interrupt, INTR, is always a 20 usec period, independent of the line generator.

This program uses the Register RAM location Ø and the qualifier verified in Test Program 2 to generate a complete pattern test of all the Register RAM locations and Constant ROM words on A3A5. A pattern is also output to the X and Y line generator registers on A3A3. The program does not read any input ports; Multiplexer Bus Drivers on A3A5 are the only talkers on the Digital Storage data bus. However, a hard failure on the bus will be fed back into the A3A5 Data Manipulator and appear to make all signatures incorrect. In this case, Test Program 1 must be used.

Test Program 4:

A3A7TP6 jumpered to A3A7TP3: test qualifier bit
A3A2R12 LL FULL CW

This is the overall check program used test all the Digital Storage input ports. The program generates the signals to check the memory, IOB data, IOB address, LTSTA, LTSTB, and ADC inputs on the bus. For each input, a clock is selected corresponding to each input putting data on the bus. This is done by positioning the jumper plug at the proper position in the IC socket A3A7J1. For example, to check Memory, the jumper is put at pin 3, connecting pin 3 to pin 12. The clock then appearing on A3A7TP1 is used by the Signature anaiyzer to check the data coming only from the A3A4 Memory Assembly, and is independent of data from the other input ports.

This program requires that the A3A5 Data Manipulator assembly be working and the Digital Storage bus be good. As in Test Program 3, a hard failure on the Digital Storage bus on, for example, the A3A4 Memory Asembly would make all signatures appear incorrect and require using Test Program 1 to check the bus.

Test Program 5:

A3A7TP6 jumpered to A3A7TP4: test qualifier bit
A3A2R12 LL FULL CW
A3A1 removed

This program is used to generate a simple ramp waveform for the X and Y Line Generators and to also generate simple repetitive control signals to the A3A9 Track and Hold assembly. It is also used to check the Buffer on the A3A5 Data Manipulator assembly. The X and Y ramp waveforms are 20 msec long when A3A2R12 is full CW (long line) and 5 msec long when A3A2R12 is full CCW (short line). See A3A9 Troubleshooting for a diagram of the A3A9 control signals. A3A1 is removed to let the HSWP line go high, for A3A9 troubleshooting.

Test Program 6:

A3A7TP6 jumpered to A3A6TP2: test qualifier bit
A3A2R12 LL FULL CW
A3A1 removed

This program is almost identical to Test Program 5, except that the HOLD line to A3A9 is normally high, going low to reset the hold capacitor and peak detectors only every 80 msec. This can be used to check hold times. In addition, the CRT trace will be in the blink mode, blinking once a second.

Figure B shows the CRT displays for the various Test Programs. They are not meant to verifiy that each test is running correctly, but rather to assure you that the test program is cycling. With caution, they can also be used to do some shortcutting in the overall Digital Storage troubleshooting procedure.

For example, the memory check, the IOB interface checks, the ADC check, Test A and Test B checks should not be done if the Test Program 4 trace is not on the CRT. On the other hand, if the traces for Test Programs, 3, 4, and 5 appear correct, then the Main Control and Data Manipulator checks could be temporarily bypassed and the memory or IOB interface checks performed. (If, though, these checks have bad inputs or the fault cannot be found, then the A3A6 Main Control and A3A5 Data Manipulator assemblies must be verified as shown the complete Digital Storage troubleshooting procedure.)

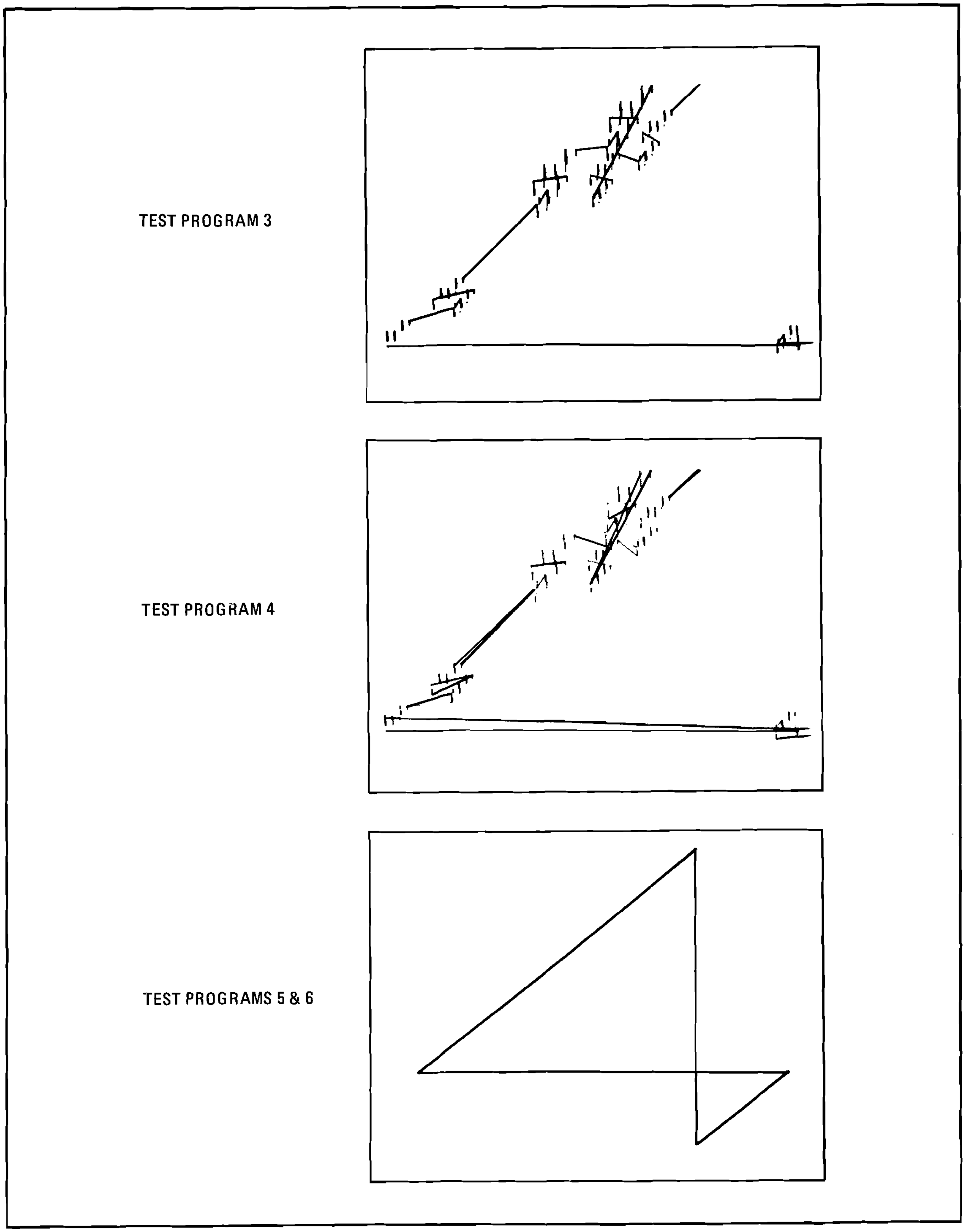

Figure 8-38. Digital Storage Test Program CRT Displays

A3A1 TRIGGER TROUBLESHOOTING

The SA diagram uses both the Digital Storage Test Program 4 and the A15 Processor IOB stimulus program. The IOB stimulus program outputs different patterns to the A3A1 Trigger assembly. The Digital Storage program generates the Reset High Sweep (RSHS) line to A3A1. Due to the interaction of the two processors and the asynchronous sweep trigger inputs, one-shots, and oscillators, some of the IC pins have unstable signatures. These are checked for activity only, highs and lows indicated by a flashing SA probe tip. The SA Diagram checks the sweep time latch and decoding logic in A, most of the logic in blocks B (except the HSWP output and the pen lift driver) and F, and the control inputs.

Some care should be taken in troubleshooting the sweep trigger/fast sweep control circuit due to the feedback on the LRTRC signal. To eliminate this, select continuous, line trigger when troubleshooting fast sweep in normal instrument operation mode. When troubleshooting with sweep times longer than 10 msec, use free run, continuous mode since this mode ignores the sweep trigger circuit. If the instrument does not work when ext, line, or video trigger modes are selected, the problem is isolated to the sweep trigger block.

Further troubleshooting information, including waveforms, is available in the troubleshooting hints and notes on A3A1 schematic.

A3A2 INTENSITY CONTROL TROUBLESHOOTING

The A3A2 Intensity Control assembly contains several different circuits. There is also feedback from A3A2 to the A3A3 Line Generator and back to A3A2. To break this loop, A3A2R12, the Long Line threshold adjustment, is turned fully clockwise (to long line position). This should force comparator U4 output high. The Long Line/Short Line timing B should then be generating 1 usec pulses with a 20 usec period. The Integrator Switch Driver E and Sample and Hold Switch Driver G can now be checked if the X and Y line generators are not operating on A3A3. Once the X and Y line generators are operating, the Z Axis Line Generator, Aux Z amplifiers, and the Digital Storage/Fast Sweep Multiplexer can be checked.

The SA Diagram is used to check the TEST B bus buffer. To check all the bits, A3A1 is removed and the DIM line is jumpered to the HSWP, LFSEN, and LRTRC lines from A3A1. The interrupt portion of the SA Diagram merely verifies that the long line/short line timing is operating. The intensity control check tests the various control inputs, Input Reg C and portions of the Blanking Logic F. The blink oscillator switches once a second so some of the signatures, marked with a 1, will appear to be unstable once a second,

A3A3 LINE GENERATOR TROUBLESHOOTING

The SA Diagram for the A3A3 Line Generator uses Test Program 3 to check the digital outputs of the X, Y, and Expand Registers. The analog portion of the board must be checked using an oscilloscope. Test Program 5 generates a simple ramp waveform which can be checked at the output test points A3A3TP9 and A3A3TP10. If a channel is not operating properly, it is often easiest to troubleshoot by first opening the feedback path (by unsoldering either R10 or R11). This permits the summing amplifier and sample and hold to be checked. The integrators, with the feedback open, will be saturated at greater than +10 volts. The A3A2R12 adjustment can be adjusted full CCW to check the short line operation (5 msec ramp) or full CW to check long line operation (20 msec ramp).

A3A4 MEMORY TROUBLESHOOTING

The overall Test Program 4 is used to write and read various patterns from the Memory E and to read the Character Stroke Memory G . This test requires that the Digital Storage input bus be good (i.e., there are no shorted Digital Storage data lines), This would show up either as an incorrect 5 VDC signature or as incorrect inputs to the Memory Address Registers U16 and U17. To isolate a hard bus bit failure, Test Program 1 on the A3A5 Data Manipulator SA Diagram 1 must be used.

The Memory Data Register D (U15 and U18) is not shown on the diagram. If its output is incorrect as seen on the RAM U1-U12 pin 6 input, then the data register is probably defective, since the only inputs to it are the bus inputs (which are verified at the address register), and the clock which is checked on A3A7 Decoder check. These inputs to the memory data register can be checked at the IC pin for activity to make certain that a PC trace is not open; otherwise, either the data register is defective or its output is being loaded.

A3A5 DATA MANIPULATOR TROUBLESHOOTING

SA Diagram 3 is used to verify proper operation of A3A5 Data Manipulator. The first check uses Test Program 2, with the qualifier feedback disabled, to verify the qualifier select circuitry on A3A7. The next check uses Test Program 3 to check the Data Manipulator Bus output at the connector and the LZERO output at U14 pin 9. (Since Test Program 3 is the first program to use the qualifier and the normal interrupt, the INTR line from A3A2 to A3A6U16 pin 10 and the buffered qualifier A3A6U27 might have to be checked, if the proper 5 VDC signature is not obtained. The INTR line should be a 50 kHz signal.) If any signatures are incorrect in these two checks on SA Diagram 3, then SA Diagrams 1 and 2 must be checked first. If tests on diagrams 1 and 2 check correctly, then the fault can be properly traced back using Diagram 3. The last check on this diagram verifies the U5 and U11 buffers. On all previous checks, they have not been enabled, so that the Source bus was always the Constant ROM output. Test Program 5, though, enables U5 and U11 so they can be checked. This also checks that the Constant ROM outputs can be disabled.

SA Diagram 1 uses Test Program 1 to check the Accumulator, Control Decode logic, Pipeline Registers, and parts of the ALU, Constant ROM, and the Multiplexer Bus Driver. The Register RAM outputs are disabled by A3A5TP2 being grounded thus should be high. This eliminates the feedback from the data bus back into the A3A5 Data Manipulator.

Troubleshooting the Digital Storage Bus

If a Multiplexer Bus Driver on A3A5 has an incorrect output but all its inputs are good, the multiplexer may be defective or there may be another bad driver/load on that data bit. To help isolate this problem, A3A2, A3A4, and A3A8 can be removed and the test program on Diagram 1 run. If neither removing the boards nor replacing the multiplexer solves the problem, additional probing with a scope, current tracer, or ohmmeter may be required to further isolate the bad node.

SA Diagram 2 uses Test Program 2, which is the same as Test Program 1 except that the Register RAMs are enabled. This feedback path means that a low order bit failure can make higher order bits appear bad. Therefore, it is best to probe beginning with bit Ø and then working up. This is the purpose of the red arrows on U2, U3, and U4. If a register RAM output appears incorrect, it may be due to either the RAM being defective, or the ALU input being faulty. To check this, the table on the diagram should be used. Grounding A3A5TP2 disables the RAM ouputs, and the ALU input is verified by manually grounding the RAM output. The signature at U9 pin 10 should change to the one shown in the table. If it does, the ALU is probably all right; the fault is in the Register RAM.

A3A6 MAIN CONTROL TROUBLESHOOTING

On SA Diagram 1, the Free Run check is used to test the outputs of the Test ROM flip-flops, pipeline registers and control pulses decoder. The INTR and LQ inputs do not have stable signatures, so a few pins, such as U16 pin 10, are checked simply for activity. The SA probe light should flash, indicating high and low activity.

The Free Run check is done with A3A6TP8 grounded. This forces U27 pin 11 high and U18 pin 6 low. To verify these components and the U1 adder input, this ground is removed. As soon as a high qualifier comes in, the state register should quit sequencing since the branch length is 0 (−1 due to all highs from J1 plus 1 due to the qualifier input). This in turn stops the gate light on the Signature Analyzer.

To verify that the branch length adder works, the E1 jumper is replaced, Test Program 2 is setup and the 5 Vdc signature is checked to see if the program is sequencing properly.

On SA Diagram 2, the Free Run check setup is used to verify the System ROM. The setup is the same as on Diagram 1 except that the Test ROMs are not enabled by the A3A6TP3 to A3A6TP6 jumper.

The LTSTA and LTSTB lines are verified, after A3A5 and A3A7 have been checked, by using Test Program 4.

5 Vdc Signature of 4596 is Not Obtained

Verify 8 MHz clocks at P2-19 and P2-20.
Verify a high (low when A3A7S1 pressed) at LTON P1-13 and U15-5.
Verify a 4 MHz waveform on BS A3A6TP9.

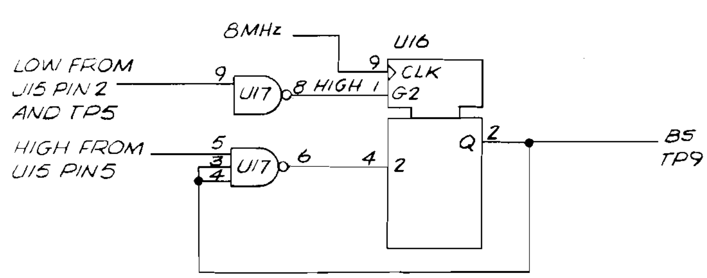

Figure 8-39. Equivalent Circuit of State Machine Control

Verify the turn-on states of the register and adder outputs.

When A3A7S1 is pressed:
LTON P1-13 goes low
U12, U15 outputs go low.
U13, U14 outputs go low.
U1, U2 outputs go high.

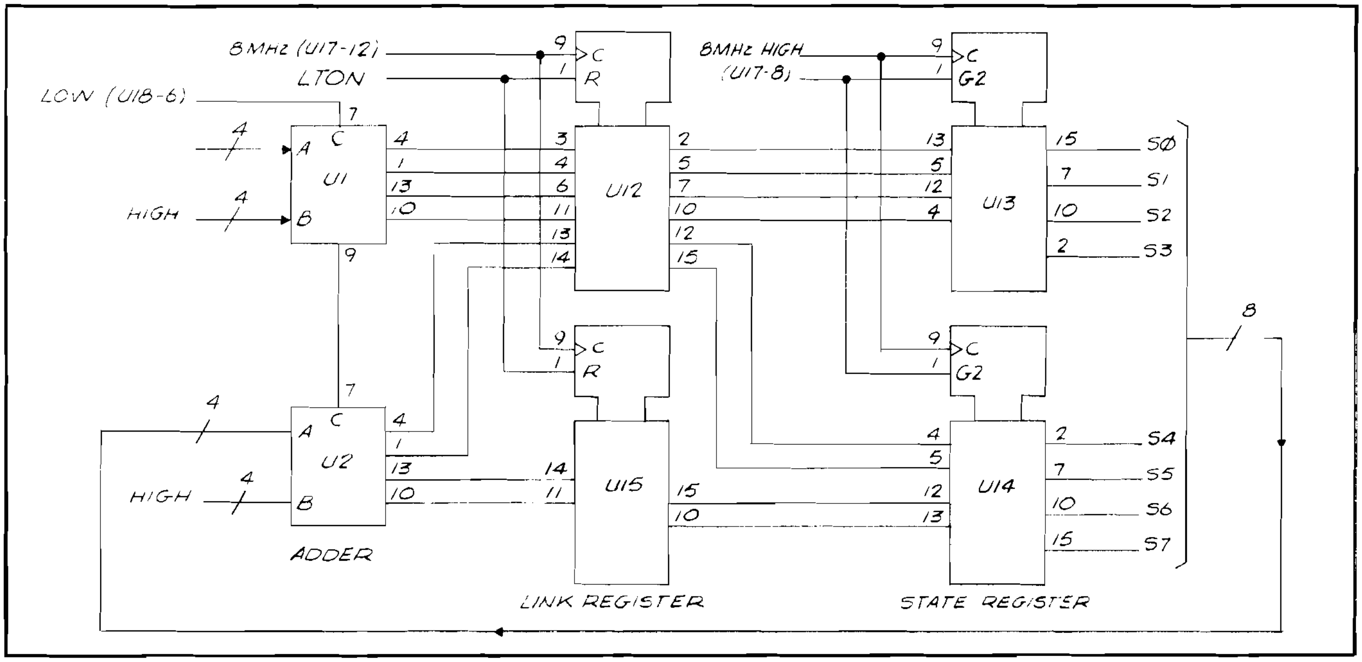

Figure 8-40. Equivalent Circuit of State Register, Adder, and Link Register

Verify binary count sequence, starting at least significant bit SØ (500 nsec square wave) to S7 (64 usec square wave). (A signature of 3951 when the Start and Stop are changed to S3 (A3A6TP10) indicates that U1, U13 and U12 pins 2, 5, 7, 10 are good.)

5 Vdc Signature of P545 Not Obtained

Verify that U18 pin 3 is always high. (A3A6TP7 grounded.)

The reason that the test is not cycling properly is probably due to either the B inputs to the Branch Length Adders U1 and U2 or to the NS (Next State) inputs to the State Register U13 and U14 or U16. To isolate, remove E1 from the IC socket again and ground A3A6TP5 and A6TP8 as at the beginning of the check. (5 Vdc 4596.)

Momentarily ground U17 pin 8 while noting the 5 Vdc signature.

If a 5 Vdc signature of CC34 is not obtained, U13 or U14 is defective. Change the Start and Stop to S3 (A3A6TP10). The 5 Vdc signature should be 3951. Momentarily ground U17 pin 8 again while noting the 5 Vdc signature. A signature of UP73 indicates that U13 is good.

If a 5 Vdc signature of CC34 was obtained, check the adder B inputs U1, U2, pins 2, 6, 15, 11 by individually grounding the inputs. Pressing A3A7S1, and observing on an oscilloscope that the period of S7 (A3A6TP11) decreases. If it doesn't, then the faulty adder has been located.

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A3A7 INTERFACE TROUBLESHOOTING

The A3A7 Interface Assembly contains several different circuits. Testing the Timing Generator and Turn-on Control is probably best done with an oscilloscope to monitor the 8 MHz, 1 MHz, and 200 kHz outputs. The I/O Port Decoder, on SA Diagram 1, is tested using the Free Run check. The Qualifier Select circuit is checked, along with the A3A5 Data Manipulator assembly, using Test Program 2. The Digital Storage address check uses the self check routine from the A15 Processor in the RF Section.

The IOB interface circuitry is checked on SA Diagram 2 using the overall Test Program 4. The 50 wire Analyzer Bus Interconnect cable W31 is removed so that the U6 and U7 Bus Drivers B can continually drive the IOB lines when A3A7TP8 is grounded. The address section of the interface is done first, with the jumper pin put in pin 6 of A3A7J1 to generate the proper clock for the Signature Analyzer. To check the data portion of the interface, the jumper is moved to pin 7. If a fault is found in verifying the data at the P2 connector, the jumper E1 is opened before probing U3 to U9. This opens the feedback from the Data Transfer Registers A through the Bus Driver B and back to the register A. If all the Bus Driver B outputs and Digital Storage Bus Driver E outputs are good when the jumper is opened, then the fault is in the register corresponding to the bad bit detected at the connector, i.e., its IOB input is defective.

If the fault appears to be a bus fight problem (i.e., the A15 Processor cannot properly drive the IOB data lines until A3A7 is removed), then the problem might be that the Bus Driver B will not go into its high impedance output state. This can be determined by checking with an oscilloscope the IOB0-11 lines with the Analyzer Bus Interconnect cable disconnected and with A3A7TP8 not grounded. The lines should be "floating," usually between 1.4 and 2 volts. With the Analyzer Bus Interconnect cable disconnected, A1A8TP1 and A1A8TP2 must be jumpered to turn on the power supplies.

A3A8 ANALOG DIGITAL CONVERTER TROUBLESHOOTING

Several checks are required on the Analog Digital Converter Assembly. The first check is the TEST A check, using Test Program 4, to check the three TEST A bits on the assembly. To do this, the sweep input cable 0 at A3A8J1 is removed and the input A3A8TP1 is grounded. The program then cycles the scan address from 0 to 1023, so the ramp comparator output on TEST A can be checked. The ADC converter is also cycled so the ADC busy output is tested. The third bit is the LTRK input from A3A9. A3A9 is removed to let LTRK go high and then it is grounded at A3A8P1 pin 21 to check this buffer bit.

The next check, labeled ADC Check on the SA Diagram, tests the successive approximation register U8 and the ADC Buffers U1 and U9. A3A9 is removed to disconnect the normal video input to the board and the video test point A3A8TP6 is jumpered to +15 volts on A3A8P1 pin 18. This forces the comparator U12 output high. The video input is then jumpered to −15 volts on A3A8P1 pin 36, which forces U12 output low and verifies U8 with a low input. This test does not check the U13 DAC linearity; so if the signatures are all correct, but the video trace is obviously nonlinear and missing bits, then suspect the DAC. DAC linearity may be verified by the following procedure. Remove A3A9. Jumper A3A8TP1 to A3A8TP6. Display should appear as in Figure 8-41.

If the ramp output in the TEST A check is incorrect or the sweep appears irregular as described in the troubleshooting hints included with the schematic, then the Ramp Converter must be checked. The signatures of the Scan Address Latches U2 and U10 outputs can be checked using Test Program 4. Note that the diode array U11 is not shown on the SA diagram. If one of the latch outputs appears to be stuck, check U11 before replacing the latch. The DAC U5 and amplifier U3 must be checked with an oscilloscope. E1, on the output of U3, is opened to disconnect the limiting diodes and the 0 to 14 volt ramp waveform can be checked. When expanded, the digital step size of approximately 10 mV will be seen every 20 usec when A3A2R12 is CW. The steps must be monotonic. For low order bit failures, it may be easier to use the procedure described in the troubleshooting notes included with the schematic.

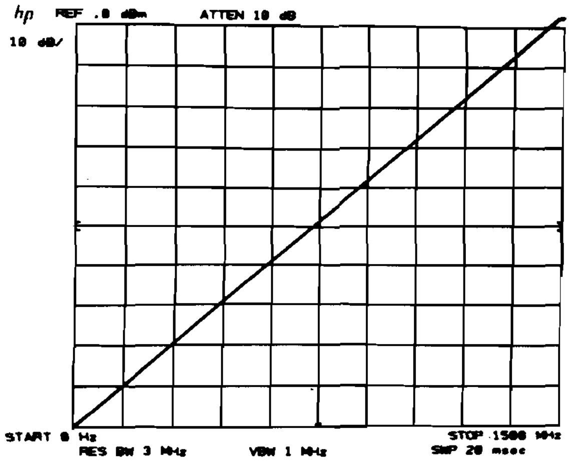
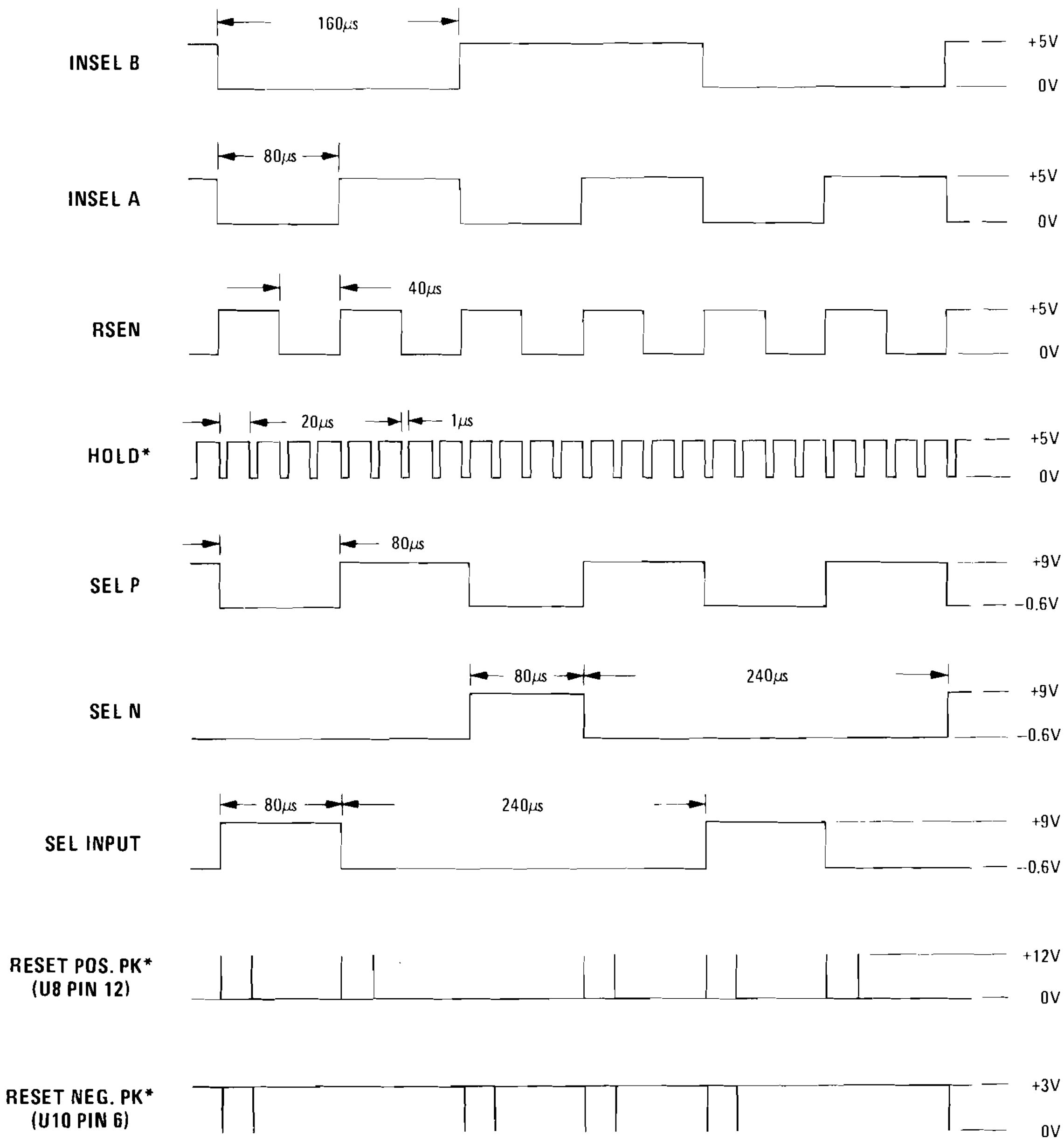


Figure 8-41. A3A8 DAC Linearity

A3A9 TRACK AND HOLD TROUBLESHOOTING

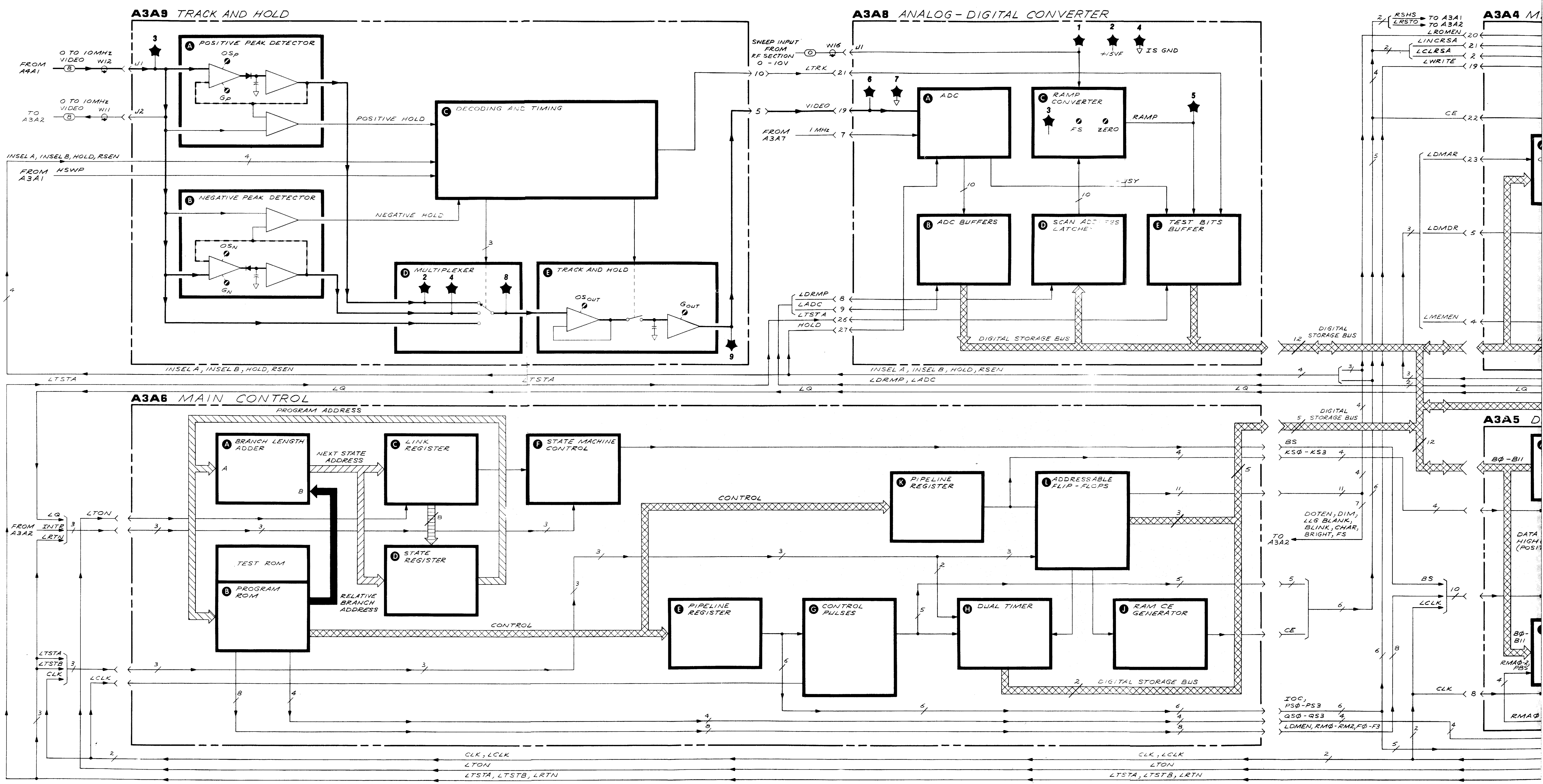


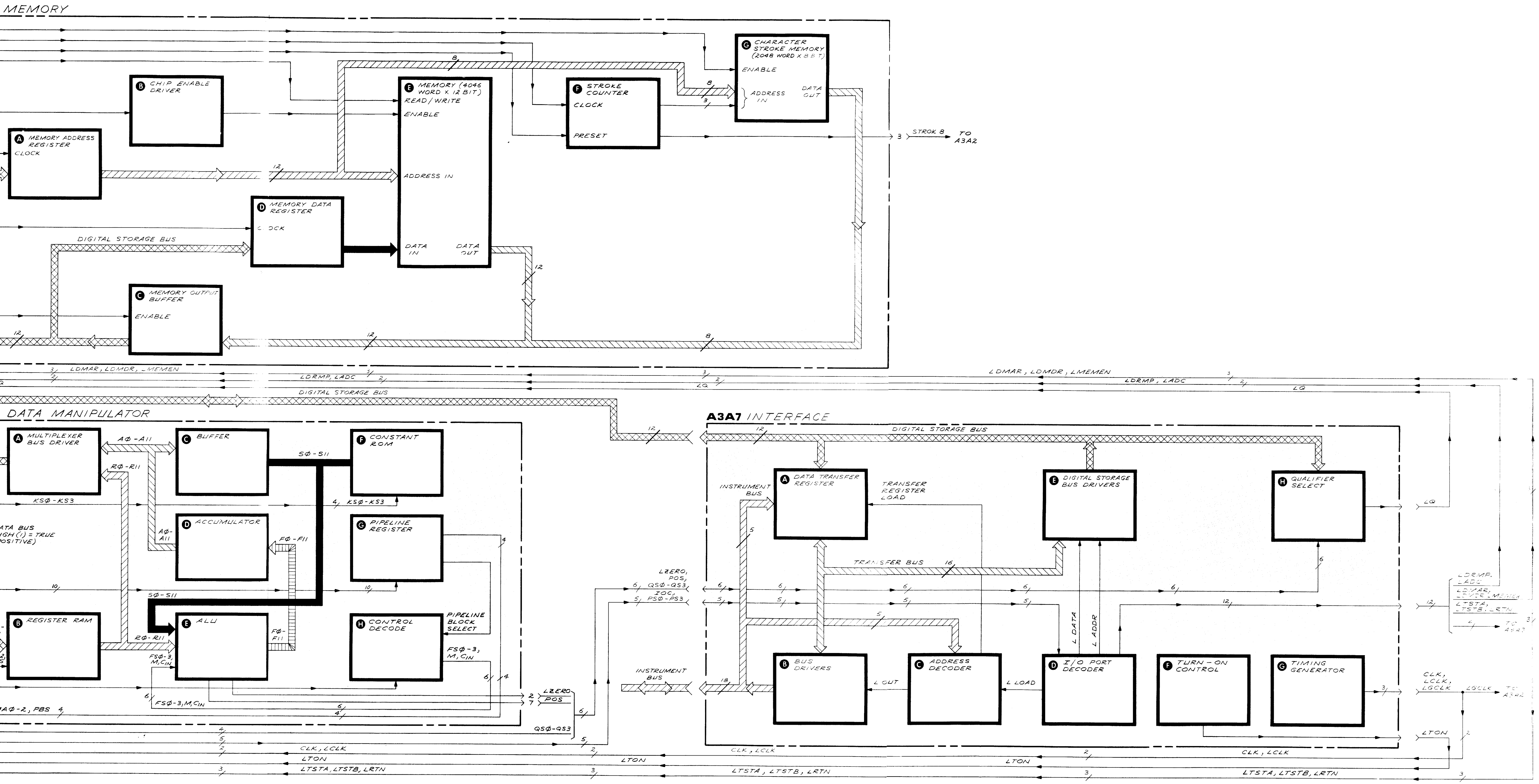
* For Test Program 6, HOLD is normally high, going low only every 80 msec which resets the peak detectors (RESET POS. PK and RESET NEG. PK). All other waveforms remain the same as for Test Program 5.

Figure 8-42. Track and Hold Troubleshooting

Table 8-15. A3 Digital Storage Mnemonic Table

Mnemonic	Description	Mnemonic	Description
IOBØ – IOB15	Instrument Bus Data Bits Ø through 15	LCLRSA	LOW=Clear Stroke Address
ADRØ – ADR3	Instrument Bus Address Bits Ø through 3	RSHS	Reset High Sweep
BØ – B11	Digital Storage Bus Data Bits Ø through 11	LINCRSA	Increment Stroke Address
FSOUT	Fast Sweep Output	LRSTO	LOW=Reset Trigger Occurred
HSWP	HIGH=Sweeping	RSEN	Reset Peak Detectors Enable
PENLIFT	Recorder PENLIFT control	CE	Memory Chip Enable
ICLK	Indicator Clock (Front-Panel LEDS)	KSØ KS3	Constant Selection Bit Ø through 3
LFSEN	LOW=Fast Sweep Enable	INTR	Interrupt Signal
LRTRC	LOW=Retrace Signal	INSELA	Input Selection Bit A
FSZ	Fast Sweep Z Axis	INSELB	Input Selection Bit B
AUX BLANK	Auxiliary Blanking Output	DOTEN	Dot Enable
$\overline{\text{BLANK}}$	LOW=Blanking Control	HOLD	Track and Hold Control
HLDX	Hold X Position (Sample and Hold Control)	BRIGHT	Bright CRT Display Control
HLDY	Hold Y Position (Sample and Hold Control)	LLGBLANK	LOW=Line Generator Blanking Control
SMPL	Sample	DIM	Dim CRT Display Control
AUX Z	Auxiliary Z Axis Output	BLINK	Blink CRT Display Control
X	Horizontal Signal to CRT	CHAR	Character Mode Display Control
Y	Vertical Signal to CRT	LROMEN	LOW=ROM Enable
Z	Intensity Signal to CRT	BS	Block Switch Control
INTG	Integrator Control	FS	Fast Sweep Mode
$\overline{\text{INTG}}$	LOW=*Integrator Control*	NSØ NS7	Next State Bus Bits Ø through 7
LL	Long Line	LØ L7	Link State Bus Bits Ø through 6
$\overline{\text{LL}}$	LOW=Long Line	SØ S7	State Bus Bits Ø through 7
LGX	Line Generator Horizontal Signal	BLØ BL6	Branch Length Bus Bits Ø through 6
LGY	Line Generator Vertical Signal	CLK	8 MHz System Clock
ΔX	Delta X Position	LCLK	Inverted CLK
ΔY	Delta Y Position	1MHZ	1 MHz ADC Clock
STROK8	Stroke 8 of Current Character	LGCLK	200 kHz Line Generator Clock
MAØ – MA11	Memory Address Bus Bits Ø through 11	LTON	LOW=Turn On
POS	Sign of ALU Results	LDX	Load X Position Register
LZERO	Output of Zero Check on ALU Result	LDCHAR	Load Character Register
RØ – R11	Ram Bus Bits Ø through 11	LDMDR	Load Memory Data Register
AØ – A11	Accumulator Bus Bits Ø through 11	LDY	Load Y Position Register
FØ – F11	Function Bus Bits Ø through 11	LDMAR	Load Memory Address Register
SO – S11	Source Bus Bits Ø through 11	LDRMP	Load Ramp Register
RMØ – RM2	Ram Register Select Bits Ø through 2	LTSTA	LOW=Input Test A Data
LDMEN	Data Manipulator Output Enable	LTSTB	LOW=Input Test B Data
FCØ FC3	Data Manipulator Function Control Bits Ø through 3	LMEMEN	LOW=Enable Memory Output
QSØ QS3	Qualifier Selection Bits Ø through 3	LADC	LOW=Enable ADC Output
PSØ PS3	I/O Port Selection Bits Ø through 3	LRTN	LOW=Enable Interrupt Return
IOC	I/O Port Input/Output Control	LDEXP	Load Expand Register
LWRITE	Memory Write Control	LQ	LOW=Selected Qualifier
		LDSR	LOW=Digital Storage Ready
		LTIO	LOW=IF-Display Section I/O Strobe


A3A9 TRACK AND HOLD
A POSITIVE PEAK DETECTOR
B NEGATIVE PEAK DETECTOR
C DECODING AND TIMING
D MULTIPLEXER
E TRACK AND HOLD
POSITIVE HOLD
NEGATIVE HOLD
FROM A4A1
TO A3A2
0 TO 10MHz VIDEO
INSEL A, INSEL B, HOLD, RSEN
FROM A3A1 HSWP
A3A8 ANALOG - DIGITAL CONVERTER
SWEEP INPUT FROM RF SECTION 0 - 10V
A ADC
B ADC BUFFERS
C RAMP CONVERTER
D SCAN ADDRESS LATCHES
E TEST BITS BUFFER
RAMP
VIDEO
FROM A3A7
1 MHz
LDRMP
LADC
LTSTA
HOLD
DIGITAL STORAGE BUS
LDRMP, LADC
LQ
A3A4
A3A6 MAIN CONTROL
PROGRAM ADDRESS
A BRANCH LENGTH ADDER
NEXT STATE ADDRESS
C LINK REGISTER
F STATE MACHINE CONTROL
TEST ROM
B PROGRAM ROM
RELATIVE BRANCH ADDRESS
D STATE REGISTER
CONTROL
E PIPELINE REGISTER
G CONTROL PULSES
K PIPELINE REGISTER
L ADDRESSABLE FLIP - FLOPS
H DUAL TIMER
J RAM CE GENERATOR
FROM A3A2
LTON
LTSTA
LTSTB
CLK
LCLK
CLK, LCLK
LTSTA, LTSTB, LRTN
A3A5
DOTEN, DIM, LLG BLANK, BLINK, CHAR, BRIGHT, FS
TO A3A2
IOC, PS0-PS3
QS0-QS3
LDMEN, RM0-RM2, F0-F3



A3

Figure 8-43. A3 Digital Storage Block Diagram

A3A1 TRIGGER, CIRCUIT DESCRIPTION

A3A1 Trigger contains circuits which generate the HSWP signal used by other assemblies in the A3 Digital Storage, A12 RF Section Interface, A15 Processor, and A22 Frequency Control. Instrument Bus commands set the HSWP line high or low, or program HSWP to go high when a sweep trigger occurs. Trigger sources that may be selected are: the AC line, the video signal, or an external trigger input to the rear panel. A3A1 contains circuits that select and process trigger signals. It also contains the Fast Sweep Generator, which produces a linear ramp voltage (0V to approximately +2.2V) used as a horizontal sweep for the CRT display. This sweep ramp is used only with FREQUENCY SPAN=0 Hz. (It is not used to sweep the RF Section frequency.)

The fast sweep ramp is applied to A1A4 X Deflection Amplifier when selected by an analog multiplexer in A3A2 Intensity Control. The fast sweep time may be varied in a 1, 2, 5 sequence from 10 msec (1 msec/div) to 1 μsec (100 nsec/div). Trigger circuitry used for the triggering of RF Section sweeps (by HSWP) is used to trigger fast sweeps.

A3A1 also contains the Recorder Penlift Driver circuit, which is part of the High Sweep Control.

High Sweep Control B

The High Sweep Control circuit generates HSWP, which is a TTL open-collector signal that is used by A3 Digital Storage to control signal tracking and conversion. HSWP is also used by A22 Frequency Control to control the Sweep Generator in that assembly. The sweep generated in A22 is in progress when HSWP is high and is stopped (at any point during the sweep) when HSWP is low. Several assemblies in the RF Section pull HSWP low to stop the RF Section sweep under certain conditions. For example, when a front-panel key is pressed, A15 Processor pulls HSWP low to immediately stop the sweep, then programs HSWP low with an Instrument Bus command before servicing the front-panel request. HSWP must be set high again for the sweep in the RF Section to resume.

HSWP Generation. For HSWP to be high, flip-flop U12A pin 6 must be low. Inverter U7A buffers U12A and provides the open collector drive for the HSWP line. U12A is set and cleared by the Instrument Bus and can be cleared by the RSHS signal from A3A6 Main Control. To set HSWP, Instrument Bus bits 14 and 15 are set high, Address 50 is selected, and address decoder U18 is enabled by LTIO, the IF-Display Section address strobe. U18, pin 13 goes low, which clocks the U4A and U4B Q outputs high. The positive-going transition at the U4B output triggers a pulse of approximately 500 μsec at U9A pin 4. At the end of this pulse, U9B generates a narrow (50-nsec) pulse that clocks U12A and U12B. This causes U12A pin 6 to go low and HSWP to go high. (Note that HSWP is set high approximately 500 μsec after occurrence of the Instrument Bus SET command. This time delay allows A15 Processor to stop running before the sweep starts.

To clear HSWP, Instrument Bus bit 13 is set high, Address 50 is selected, and (when the IF-Display Section address strobe occurs) U12A, U12B, U4A, and U4B are cleared. HSWP may also be cleared by other assemblies in the A3 Digital Storage when the RSHS line goes low.

Free Run Mode (Sweep Time ⩾20 mSec). When the RF Section is in Free Run mode with sweep time ≥20 msec, the sweep is started when the Instrument Bus sets HSWP. The sweep is stopped by the RSHS line or by a CLEAR command from the Instrument Bus. A15 Processor controls the time from the end of one sweep to the beginning of the next sweep (sweep dead time).

Line, Video, and External Triggers (Sweep Time ⩾20 mSec). The RF Section can direct A3A1 to set HSWP high when a line, video, or external trigger occurs. If Instrument Bus line 14 is high and U18 is strobed with Address 50, U18 pin 13 will go low, setting U4A pin 9 high, which triggers U9A. At the end of the pulse generated by U9B, U12B pin 9 will be clocked high, placing a high at the data input (pin 2) of U12A. The output (pin 6) of trigger multiplexer U16 in the Trigger generator will then cause U12A to be clocked on a negative-going transition of the selected trigger input. (Refer to the Trigger Generator circuit description.)

Recorder Pen Lift Driver. In sweep times ⩾20 msec, the Recorder Pen Lift Driver supplies the PEN LIFT signal to the rear-panel PENLIFT connector. PENLIFT May also be used to control blanking of an external CRT display.

PENLIFT is a 0V to 15V signal that lowers the recorder pen when an RF Section sweep is in progress (HSWP is high, PENLIFT is 0V) and lifts the pen when a sweep is not in progress (HSWP is low, PENLIFT is 15V). Decoder U3A is a non-inverting buffer that drives Q15 from the HSWP line.

Sweep Trigger F

The Sweep Trigger circuit produces triggers for all sweep times. It contains the video, external, and line trigger circuits, the fast sweep Free Run Oscillator, the trigger multiplexer, and the fast-sweep Auto Trigger circuit. A valid trigger for the Fast Sweep Generator or the High Sweep Control circuit is produced by a negative-going transition at the selected input of trigger multiplexer U16. This trigger signal will start a sweep only if the Fast Sweep Control and High Sweep Control circuits are in the proper states.

Video Trigger. Video Trigger Comparator U13 generates a negative-going transition when the VIDEO signal rises above the voltage at U13 pin 2, which depends on the position of the front-panel TRIGGER LEVEL control. R49, R50, and R51 divide the TRIG LEVEL voltage (0V to +5.1 V) to approximately −0.1V to +2.1V at U13 pin 2. The LOW FAST SWEEP line, connected to the strobe inputs (pins 5 and 6) of U13, disables the output of U13 in Fast Sweep mode when the fast sweep ramp is being generated. R52 provides hysteresis for U13, and CR1 protects U13 from excessive input voltage on the VIDEO line. The +10V and −10V supply voltages for U13 are derived through VR4 and VR5.

External and Line Triggers. The EXT TRIG input from the IF-Display Section rear panel is applied to buffer/inverter Q14 through divider R61 and R62. When EXT TRIG rises above approximately +1.4V, Q14 saturates and U15C pin 9 goes low, causing U16 pin 3 to go low, producing a trigger.

A voltage, resistively divided from a winding of the IF-Display Section line transformer, is buffered by Schmitt trigger inverter U15A, the output of which is applied to U16 pin 2, the line trigger input of the trigger multiplexer. Negative-going transitions at U16 pin 2 are valid line triggers.

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Free Run Mode (Sweep Time ⩽ 10 mSec). In Fast Sweep mode, during the fast sweep dead time, U11C pin 8 is high. This causes U15B to oscillate at a rate (determined by R59 an C11) of approximately 500 kHz. Negative-going transitions at U15B pin 6 produce triggers in Free run, Fast Sweep mode. U15B is gated off during the fast sweep ramp. Note that the Free Run Oscillator is not used to trigger sweeps in sweep times ≥20 msec. (See High Sweep Control circuit description.)

Fast Sweep Auto Trigger. When the [EXT] or [VIDEO] key is pressed and the sweep time is 10 msec or less (Fast Sweep mode), a fast sweep ramp will be started automatically about 25 msec after the start of the last fast sweep if no video or external trigger occurs first. If [SHIFT] [EXT] or [SHIFT] [VIDEO] keys are pressed, fast sweep triggering will be in Normal mode. In Normal mode, no fast sweep will be started until a trigger occurs. The CRT graticule and characters will not be refreshed until a fast sweep has occurred.

Auto Trigger Circuitry. In Auto Trigger mode, the instrument Bus sets U5 pin 12 High. U1A pin 1 goes high when the fast sweep ramp begins, triggering a 25-msec (low) pulse at U1A pin 4. If another fast sweep ramp is started within 25 msec of the beginning of the previous fast sweep ramp, U1A will be re-triggered, and U1A pin 4 will not go high for at least another 25 msec. If triggers cease to occur, U11D pin 11 will go high 25 msec after the last fast sweep. This causes trigger multiplexer U16 to select the output of the Free Run Oscillator in either Video or External mode, triggering a sweep. Auto triggering will not occur in sweep times ≥20 msec, because in this case the Auto Trigger circuitry is disabled by the FAST SWEEP ENABLE line to U11B pin 5.

If [SHIFT] [EXT] or [SHIFT] [VIDEO] keys are pressed, U5 Pin 12 will be low, preventing automatic triggering in the absence of a video or external trigger.

Fast Sweep Time Control Ⓐ

Data on Instrument Bus lines 11 through 14 specify the fast sweep generator sweep time. This data is latched into hex D flip-flop U6 when Address 51 is strobed. (Refer to the table, Note 6 on the schematic, for coding of the sweep time control lines.) Data on Instrument Bus line 15 is latched into U6 with the four sweep time bits (IOB11 – IOB14) and enables fast sweep generator operation.

Switchable Current Source. Current for the generation of the fast sweep ramp is supplied by Q13.Op amp U8 regulates (through R6 and R7) the emitter voltage of Q13 to keep it equal to the reference voltage at U8 pin 3.

Q6 controls the reference voltage by switching R2 in or out of the voltage divider circuit, which is made up of R1, R2, and R3. The voltage difference between Q13 emitter and +15 VF1 is set at 2V when Q6 is off and 4V when Q6 is on. The voltage difference is held across a switchable resistance between Q13 emitter and +15 VF1. FET switches Q7, Q8, and Q9 connect resistors in parallel with R14 to change the current supplied by the current source. When Q7, Q8, and Q9 are off, R14 sets Q13 collector current. In certain sweep times, Q9 is turned on by U2C. (Refer to the table on the schematic, Note 6.) This places R11 In parallel with R14, increasing the current by a factor of 5. Similarly, R12 or R13 may be switched in to increase current by factors of 10 and 50 respectively. Q7, Q8, and Q9 are controlled by open-collector drivers U2B, U2A, and U2C. The FET switches are on when the FET gate voltage is high (+15 V) and off when the FET gate voltage is low (approximately +0.2 V). U3B decodes the sweep rate control lines from U6 and controls U2A, U2B, and U2C.

Fast Sweep Generator C

To produce the fast sweep ramp for sweep times $\leqslant$ 100 μsec, current from Q13 charges timing capacitor C4. For sweep times of 200 μsec to 10 msec, Q11 is turned on, placing timing capacitor C5 in parallel with C4, increasing the sweep time by a factor of 100. C4 and C5 (if it is in the circuit) are discharged by Q10 and Q12 at the end of the sweep.

Discharge Switch. When no sweep is in progress, the output of open-collector inverter U7D is high (+5V), and current through R30 and R31 flow into Q10 and through CR6 into Q12. In addition, current flows from Q13 into Q12. At the start of a fast sweep ramp, U7D pin 8 goes low, and the voltage at the anode of CR6 and the emitter of Q10 is pulled slightly negative by R32. CR6 becomes reverse biased, and Q10 turns off, turning Q12 off. Current from the collector of Q13 now flows into timing capacitors C4 and C5, and the sweep ramp begins. When the end of the sweep ramp (+2.2V) is detected by the Fast Sweep Control circuit, U7D pin 8 goes high (about +5V), turning Q10 On. This turns Q12 on, and it begins to discharge C4 and C5. Q12 continues to discharge the timing capacitors until CR6 becomes forward biased. At that time, the circuit reaches equilibrium, holding the sweep ramp at near 0 V, with the offset adjusted by R34.

Fast Sweep Buffer Amplifier. Op amp U14 is connected as a unity gain buffer amplifier, which provides the low impedance fast sweep ramp output (FS OUT). FS OUT is applied to the X-axis scan multiplexer in A3A2 Intensity Control.

Fast Sweep Control D

The Fast Sweep Control contains circuitry for end of sweep detection and controls fast sweep dead time, and fast sweep triggering.

End of Sweep Detection. When the sweep ramp reaches about +2.2 V, Q5 conducts and turns Q4 on. When the collector of Q4 goes low, U1B pin 5 produces a pulse whose length is the dead time. U10A and U10B are cleared when U10B pin 5 goes low, and timing capacitors C4 and C5 are discharged by the Discharge Switch in the Fast Sweep Generator. Voltage divider R19 and R20 set the level at which Q5 senses the end of the sweep ramp.(Note that the fast sweep ramp ends beyond the right-hand edge of the CRT.) The LRTRC line from U10B pin 5, which is high during the sweep, supplies the retrace blanking signal to A3A2 Intensity Control.

Fast Sweep Dead Time. Multivibrator U1B controls the sweep dead time. U1B is triggered at the end of the fast sweep ramp and holds U10A and U10B cleared for a time that is determined by C7, R24, and R25. This prevents the triggering of further ramps for the length of the pulse from U1B pin 5. The length of the dead time is about 15 μsec for sweep times from 1 μsec through 100 msec and about 120 μsec for sweep times from 200 μsec through 10 msec. The ST 100 line (from U6 pin 12 in the Fast Sweep Time Control circuit) controls the length of the sweep dead time by switching the U1B timing resistors with transistor switch Q3. In sweep times of 10 msec through 200 μsec, Q3 is off and the dead time, set by C7 and R24, is 120 μsec. In sweep times of 100 μsec through 1 μsec, Q3 is on, placing R25 in parallel with R24 to decrease the dead time to 15 μsec. C6 and R23 supply additional base drive to Q4 at the end of the sweep to insure triggering of U1B.

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Fast Sweep Triggering. Flip-flops U10A and U10B control the state of the fast sweep generator. U10A controls the Discharge Switch through inverter/buffer U7D. At the end of a fast sweep. both U10A and U10B are held cleared by the dead time circuit (U1B and U7F). Following the dead time, a trigger from U16 pin 5 causes U10B pin 7 to go low. This causes U10A pin 5 to go high, which turns off the Discharge Switch and starts a sweep ramp. This can occur only if FS EN is high. If FS EN is low, the J and K inputs of U10B are held low and a trigger will not set U10B.

Fast Sweep Multiplexing. In Fast Sweep mode, the X ouput of A3A3 Line Generator and the fast sweep ramp must be multiplexed to A1A4 X Deflection Amplifier to produce a display consisting of the graticule and characters with the fast sweep ramp and the analog video signal. The video signal from A4A1 Video Processor is multiplexed to A1A5 Y Deflection Amplifier when the fast sweep ramp is multiplexed to A1A4. The X and Y multiplexers are located in A3A2 Intensity Control.

In Fast Sweep mode, the output from A3A3 is applied to the CRT deflection amplifiers following the completion of at least one fast sweep ramp.

Fast Sweep Intensity Control E

To provide uniform intensity between the fast sweep trace and the other information displayed on the CRT, the Fast Sweep Intensity Control circuit generates a voltage to control the CRT beam intensity (Z-axis) when the fast sweep ramp is multiplexed in.

The FSZ voltage is dependent on the duty cycle of the fast sweep ramp; that is, the ratio of time during which the ramp is in progress to the sum of dead time and sweep time. FSZ varies from about 150 mV (low beam intensity) for high duty cycle operation to about 2V (high beam intensity) for very low duty cycle operation.

The LRTRC line, high during the fast sweep ramp, provides a digital waveform which is averaged and inverted by Q2, C15, and associated circuity, providing an output voltage to Q1 that is dependent on the average value of the LRTRC signal. Q1 is an emitter follower which provides drive when the FSZ signal is above $\approx$150 mV for low duty cycle sweep operation (less than about 20 percent). When the voltage at the collector of Q2 is below +0.7 V (high duty cycle operation), the base-emitter junction of Q1 is off, and the FSZ voltage is held at about 150 mV by voltage divider R71 and R72.

A3A1 TRIGGER TROUBLESHOOTING

Much of the circuitry on the A3A1 Trigger can be tested without removing the assembly from the instrument. First key in [INSTR PRESET], [FREQUENCY SPAN] 0 Hz and [SWEEP TIME] 10 ms. Noise should be displayed at approximately 2.5 divisions up from the bottom graticule. If the display is blanked, try [LINE] and then [VIDEO] triggering.

The waveforms shown on the service sheet for TP2 and TP5 are valid only in the [FREE RUN] and Normal mode ([SHIFT] [VIDEO], [SHIFT] [EXT]). The Fast Sweep time should be equal to the time it takes the ramp at TP5 to sweep from 0V to +2V. The oversweep above 2V is determined by the Sweep Comparator and is not critical for instrument operation. The dead time when the ramp and LRTRC are low is approximately 15 μsec for sweep times less than 200 μsec, and 120 μsec for sweep times from 200 μsec to 10 ms. During the dead time the Free Run Oscillator is on. See Figure 8-44 for the relationships between the waveforms.

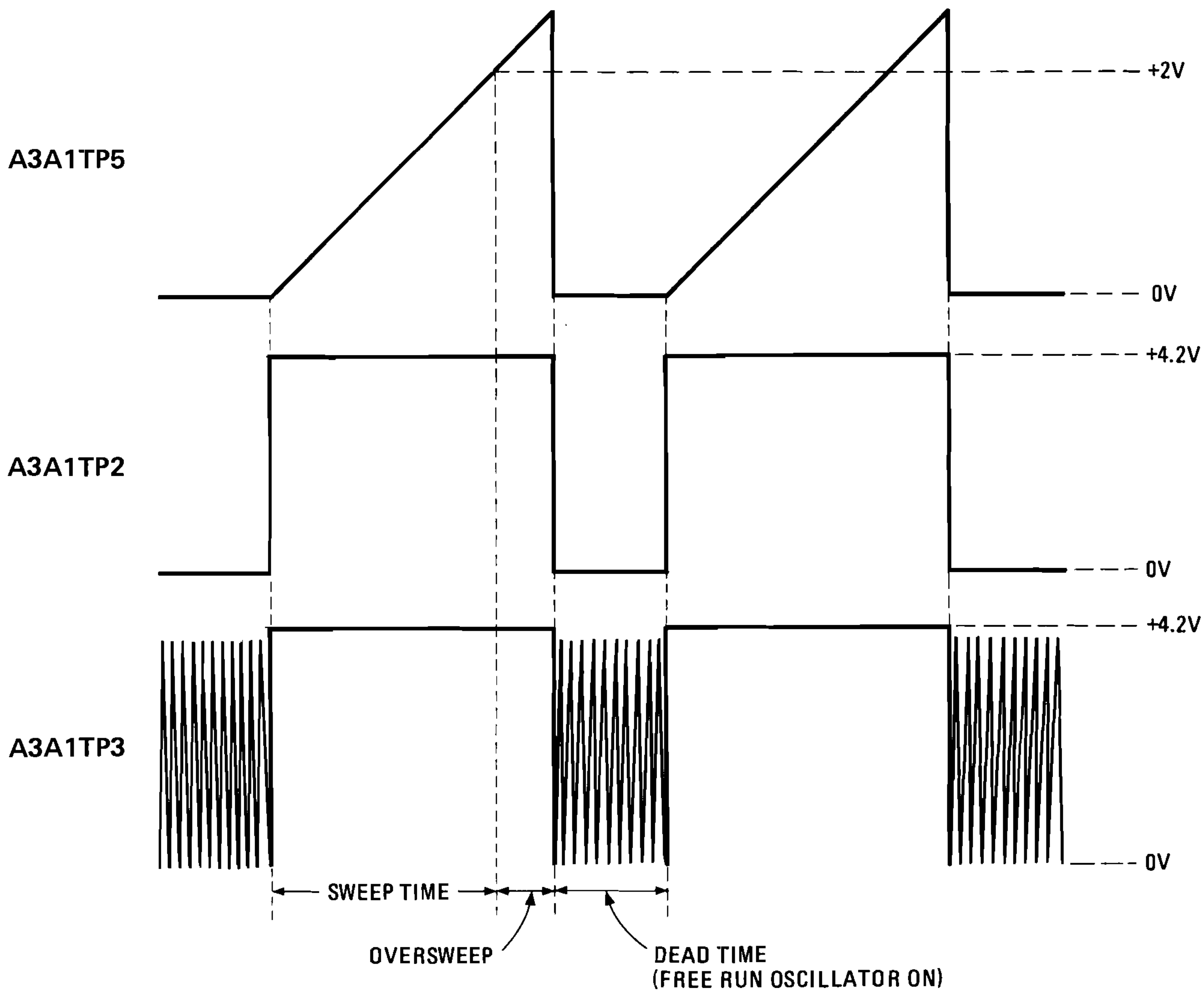

Figure 8-44. Fast Sweep Time Waveforms

When using [LINE] TRIGGER, the waveforms are similar except for the dead time. Following the minimum dead time period, whenever a negative-going transition occurs at TP3, a ramp is started. When the sweep ends, TP2 goes low and stays low until a negative going transition occurs at TP3. See Figure 8-45 for the relationships between the [LINE] TRIGGER waveforms.

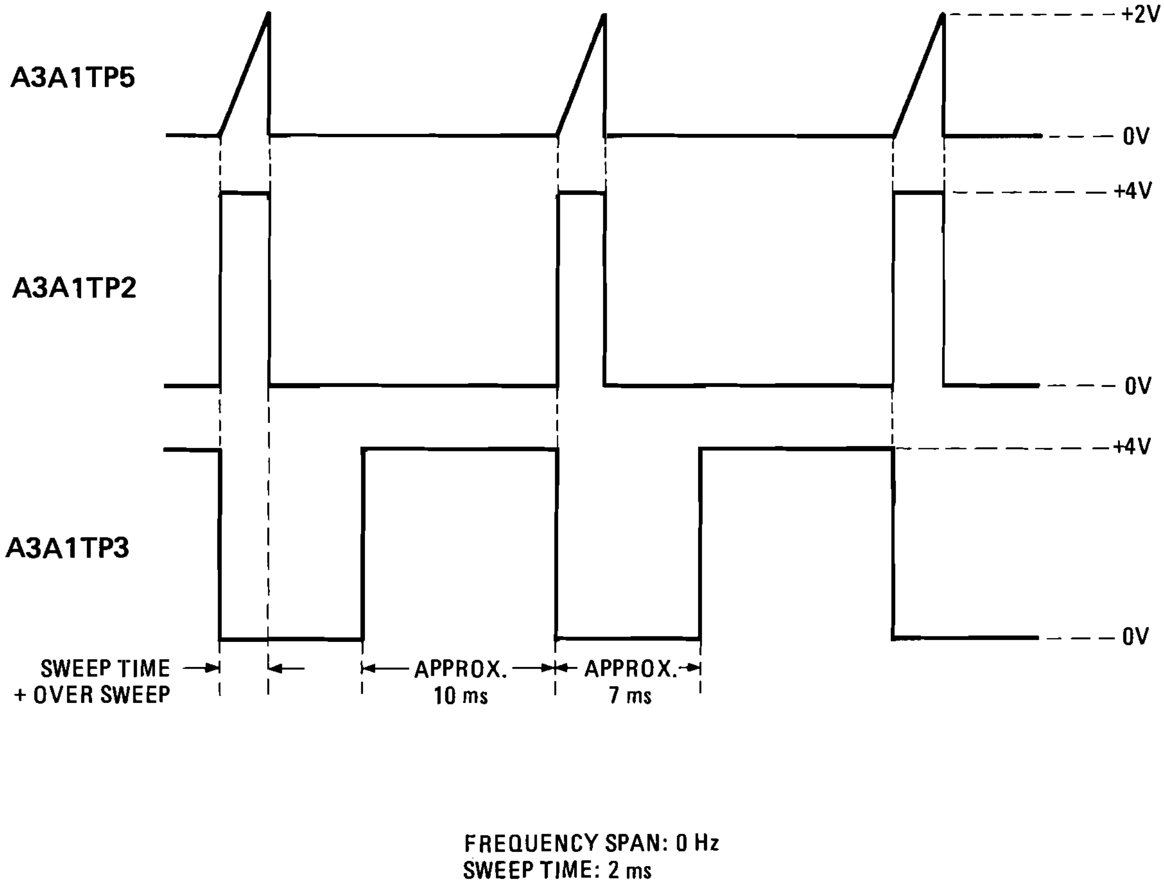

Figure 8-45. Fast Sweep Line Trigger Waveforms

If noise is used as a video trigger and the TRIGGER LEVEL control properly set, the [VIDEO] trigger waveforms at TP5 and TP2 will be the same as those in Figure 8-44 . During the minimum dead time period, the noise signal trigger will be present. If a video trigger does not occur (TRIGGER LEVEL control set fully CW or CCW), then the Auto Trigger circuitry will generate a trigger approximately every 25 ms. TP2 and TP5 will have the relationship shown in Figure 8-45 . If the voltage at U13 pin 3 is much less than U13 pin 2, then TP3 will be approximately +4V. If the opposite is true, the waveforms at TP3 and TP2 will be the same.

If no fast sweep is occurring, check TP5 first. If the voltage is greater than +2.6V, the most likely failure would be in the Fast Sweep Control circuitry. Refer to the circuit description for operation of this functional block. An open Discharge Switch would also cause TP5 to remain greater than +2.6V for all fast sweep times.

If TP5 is 0±200 mVdc and no fast sweeps occur, the Fast Sweep Control circuitry should be examined. Other defective components that would cause the same indications are Q13 and U7D. The Sweep Trigger circuit may also be defective.

The Sweep Trigger circuitry can be tested by tracing the trigger signals thru U16 to pin 13 of U10. Try [LINE] Triggering first, as this is the simplest source. A TTL signal at the power line frequency should be present at TP3. U7 pin 12 and the FAST SWP ENABLE line should both be high. Also check for proper trigger signals at TP3.

Incorrect sweep times on the fast sweep time mode are difficult to observe from the display. One quick method is to disconnect cable 9 from A3A9J1 and connect it to A3A2J2. This sends a 200 kHz test waveform to the Deflection Amplifiers. Press [VIDEO] TRIGGER and set the [SWEEP TIME] to 10 μsec. Adjust the LEVEL Control to produce a display. It should appear as in Figure 8-46 . By using fast sweep times from 10 μsec to 200 μsec, all of the Fast Sweep Time Control circuitry will be exercised. If one or more of the sweep times is incorrect, Note 6 will be helpful in determining if one of the control lines is faulty. The Switchable Current Source circuitry may also be defective.

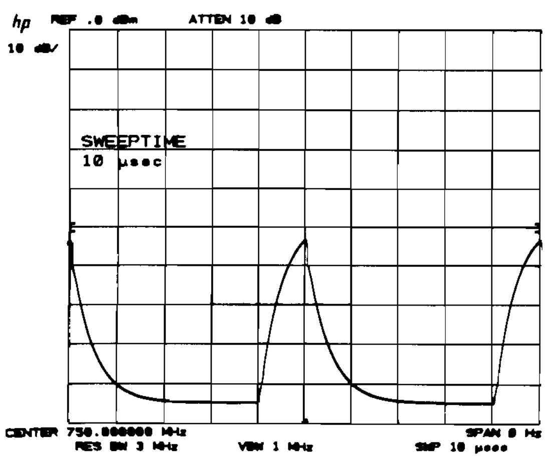

Figure 8-46. 200 kHz Test Signal Waveform

Table 8-16. A3A1 Trigger, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1	85662-60014	1	BOARD ASSEMBLY, TRIGGER	28480	85662-60014
A3A1C1	0160-0174	3	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A3A1C2	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A3A1C3	0160-2252	1	CAPACITOR-FXD 6.2PF +-.25PF 500VDC CER	28480	0160-2252
A3A1C4	0140-0233	1	CAPACITOR-FXD 480PF +-1% 300VDC MICA	72136	DM15F481F0300WV1C
A3A1C5	0160-4314	1	CAPACITOR-FXD .05UF +-1% 200VDC	28480	0160-4314
A3A1C6	0160-2307	1	CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A3A1C7	0160-0155	1	CAPACITOR-FXD 3300PF +-10% 200VDC POLYE	28480	0160-0155
A3A1C8	0160-4084	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A1C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A1C10			NOT ASSIGNED		
A3A1C11	0160-3456	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A3A1C12	0180-0197	7	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A1C13			NOT ASSIGNED		
A3A1C14	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A1C15	0180-0374	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A1C16	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A1C17	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A1C18	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A1C19	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A1C20	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A3A1C21			NOT ASSIGNED		
A3A1C22			NOT ASSIGNED		
A3A1C23	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A1C24			NOT ASSIGNED		
A3A1C25			NOT ASSIGNED		
A3A1C26			NOT ASSIGNED		
A3A1C27	0160-2055	3	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A1C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A1C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A1CR1	1901-0535	4	DIODE-SCHOTTKY	28480	1901-0535
A3A1CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A1CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A1CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A1CR5	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A1CR6	1901-0179	1	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3A1L1	9140-0114	3	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A3A1L2	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A3A1L3	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A3A1Q1	1854-0404	6	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A1Q2	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A1Q3	1853-0281	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3A1Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A1Q5	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3A1Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A1Q7	1855-0020	3	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A1Q8	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A1Q9	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A1Q10	1853-0034	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3A1Q11	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A1Q12	1854-0546	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A3A1Q13	1853-0451	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A3A1Q14	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A1Q15	1854-0039	1	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	04713	2N3053
A3A1R1	0698-6863	1	RESISTOR 1.537K .25% .125W F TC=0+-50	28480	0698-6863
A3A1R2	0698-6867	1	RESISTOR 7.35K .25% .125W F TC=0+-50	28480	0698-6867
A3A1R3	0698-7794	1	RESISTOR 10K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-1002-C
A3A1R4	0757-0279	10	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R5	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R6	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R7	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R8	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R9	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R10	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R11	0698-5573	1	RESISTOR 50K .5% .125W F TC=0+-100	24546	C4-1/8-T0-5002-D
A3A1R12	0698-8014	1	RESISTOR 22.3K .5% .125W F TC=0+-50	19701	MF4C1/8-T2-2232-D
A3A1R13	0698-6840	1	RESISTOR 4.07K .5% .125W F TC=0+-50	24546	NC55-1/8-T2-4071-D
A3A1R14	0698-6217	1	RESISTOR 200K .5% .125W F TC=0+-100	28480	0698-6217
A3A1R15	0757-0416	4	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A1R16	0757-0280	11	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R17	0698-0083	2	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A3A1R18	0698-3440	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A3A1R19	0757-0443	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3A1R20	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F

Table 8-16. A3A1 Trigger, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1R21	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R23	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R24	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A1R25	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A1R26	0698-3156	4	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A3A1R27	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R28	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A3A1R29	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R30	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R31	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A1R32	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A3A1R33	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A3A1R34	2100-1972	1	RESISTOR-TRMR 20K 10% WW SIDE-ADJ 20-TRN	02660	3810P-203
A3A1R35	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A3A1R36	0698-3441	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A3A1R37	0698-3445	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A3A1R38			NOT ASSIGNED		
A3A1R39			NOT ASSIGNED		
A3A1R40	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R41	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A3A1R42	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A1R43	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A1R44			NOT ASSIGNED		
A3A1R45	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R46	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A1R47	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A1R48	0757-0442	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A1R49	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A1R50	0683-1555	1	RESISTOR 1.5M 5% .25W FC TC=-900/+1100	01121	CB1555
A3A1R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A1R52	0698-3260	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A3A1R53	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A1R54	0757-0346	3	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A1R55	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A1R56	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A1R57			NOT ASSIGNED		
A3A1R58	0698-3160	2	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A3A1R59	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R60	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R61	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R62	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A1R63			NOT ASSIGNED		
A3A1R64			NOT ASSIGNED		
A3A1R65	0698-0085	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A3A1R66	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A3A1R67	0757-0290	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A3A1R68	0698-3160		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A3A1R69	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A1R70			NOT ASSIGNED		
A3A1R71	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A3A1R72	0698-3450	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A3A1TP1	1251-0600	5	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1TP2	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1TP3	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1TP4	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1TP5	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1U1	1820-1423	2	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A3A1U2	1820-1417	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS26N
A3A1U3	1820-1281	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2-INP	01295	SN74LS139N
A3A1U4	1820-1112	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A3A1U5	1820-1196	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A1U6	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A1U7	1820-0471	1	IC INV TTL HEX 1-INP	01295	SN7406N
A3A1U8	1826-0319	2	IC OP AMP TO-99	27014	LF356H
A3A1U9	1820-1423		IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A3A1U10	1820-1212	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112N
A3A1U11	1820-1201	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A3A1U12	1820-1112		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A3A1U13	1820-0475	1	IC COMPARATOR TO-99	27014	LM306H
A3A1U14	1826-0319		IC OP AMP TO-99	27014	LF356H
A3A1U15	1820-1425	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A3A1U16	1820-1298	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS251N
A3A1U17	1820-1197	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3A1U18	1820-1216	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N

Table 8-16. A3A1 Trigger, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1VR1	1902-3224	2	DIODE-ZNR 17.8V 5% DO-7 PD=.4W TC=+.067%	28480	1902-3224
A3A1VR2	1902-3224		DIODE-ZNR 17.8V 5% DO-7 PD=.4W TC=+.067%	28480	1902-3224
A3A1VR3	1902-3182	1	DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	28480	1902-3182
A3A1VR4	1902-0041	2	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A3A1VR5	1902-0041		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
			A3A1 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0749	2	EXTRACTOR-PC BOARD BROWN POLYC	28480	4040-0749

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A3A1
TRIGGER

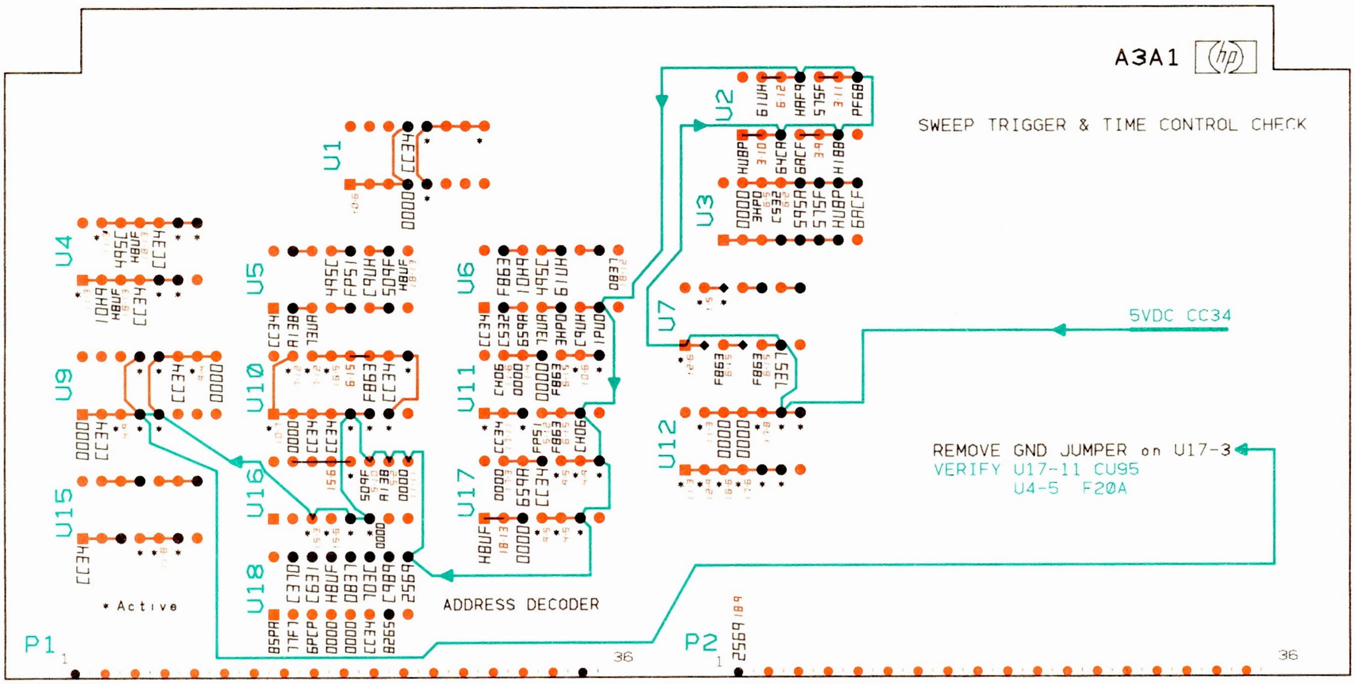

Figure 8-47. A3A1 Trigger, Signature Analysis Troubleshooting Diagram

SWEEP TRIGGER AND TIME CONTROL CHECK

Spectrum Analyzer Connections:

Jumper A14TP12 to A15TP8
Jumper A15TP3 to A15TP9 (+5V)
Jumper A3A7TP3 to A3A7TP6
Jumper A3A1U17 pin 3 to A3A1P2-16 (GND)
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⎍ to A15U2 pin 11
START ⎍ to A14TP10
STOP ⎍ to A14TP9

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

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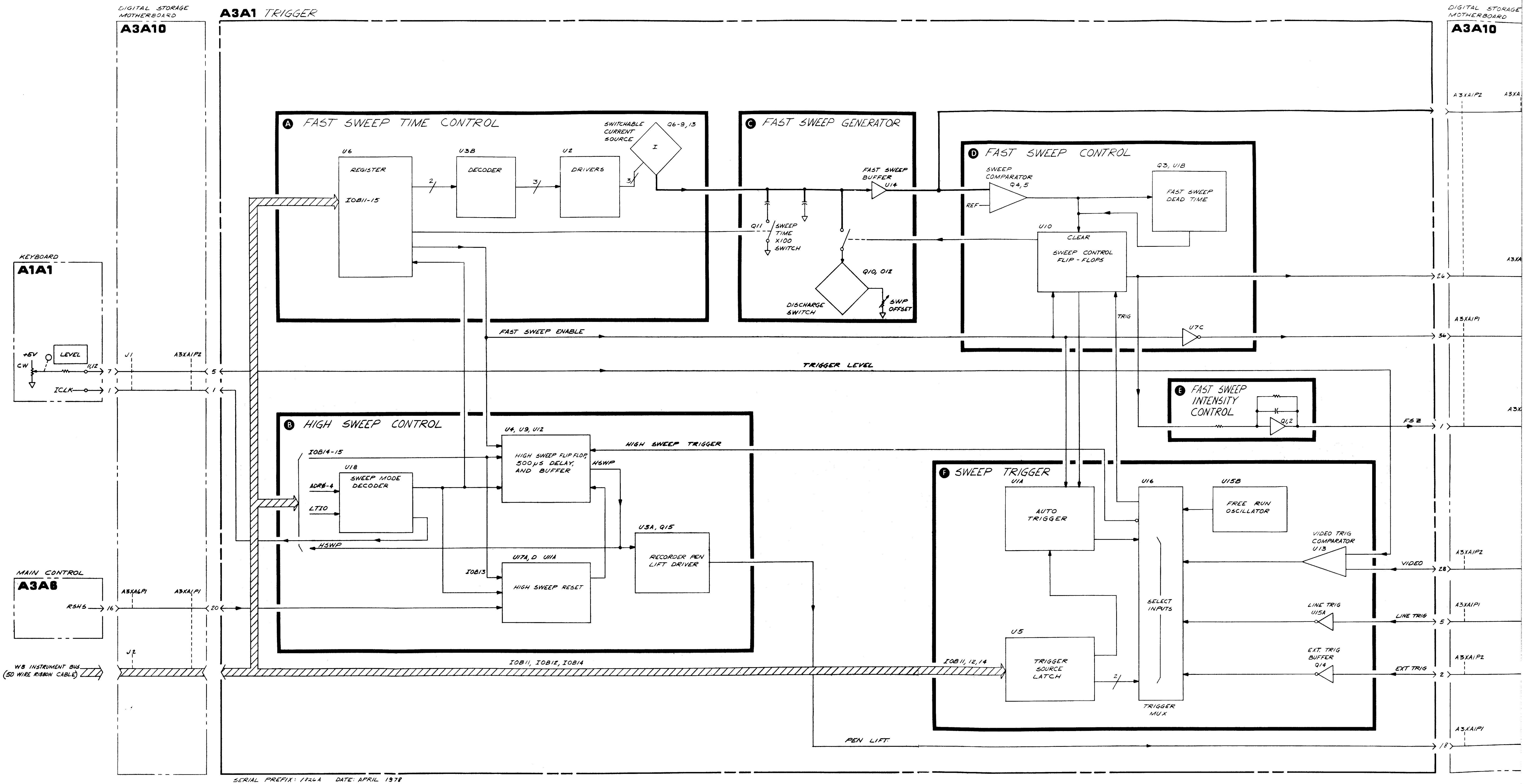

DIGITAL STORAGE MOTHERBOARD
A3A10
A3A1 TRIGGER
KEYBOARD
A1A1
LEVEL
+5V
CW
ICLK
MAIN CONTROL
A3A6
RSH6
W8 INSTRUMENT BUS (50 WIRE RIBBON CABLE)
A FAST SWEEP TIME CONTROL
U6
REGISTER
IOB11-15
U3B
DECODER
U2
DRIVERS
SWITCHABLE CURRENT SOURCE
Q6-9,13
C FAST SWEEP GENERATOR
FAST SWEEP BUFFER U14
Q11
SWEEP TIME X100 SWITCH
Q10, Q12
DISCHARGE SWITCH
SWP OFFSET
D FAST SWEEP CONTROL
SWEEP COMPARATOR Q4,5
REF
Q3, U18
FAST SWEEP DEAD TIME
U10
CLEAR
SWEEP CONTROL FLIP-FLOPS
TRIG
U7C
FAST SWEEP ENABLE
TRIGGER LEVEL
E FAST SWEEP INTENSITY CONTROL
Q1,2
FSZ
B HIGH SWEEP CONTROL
IOB14-15
U18
SWEEP MODE DECODER
ADR6-4
LTIO
U4, U9, U12
HIGH SWEEP FLIP FLOP, 500µs DELAY, AND BUFFER
HIGH SWEEP TRIGGER
HSWP
U3A, Q15
RECORDER PEN LIFT DRIVER
U17A, D U11A
IOB13
HIGH SWEEP RESET
F SWEEP TRIGGER
U1A
AUTO TRIGGER
U16
U15B
FREE RUN OSCILLATOR
VIDEO TRIG COMPARATOR U13
VIDEO
SELECT INPUTS
LINE TRIG U15A
LINE TRIG
U5
TRIGGER SOURCE LATCH
IOB11, 12, 14
EXT. TRIG BUFFER Q14
EXT TRIG
TRIGGER MUX
IOB11, IOB12, IOB14
PEN LIFT
A3XA1P1
A3XA1P2
A3XA6P1
J1
J2
SERIAL PREFIX: 1826A DATE: APRIL 1978

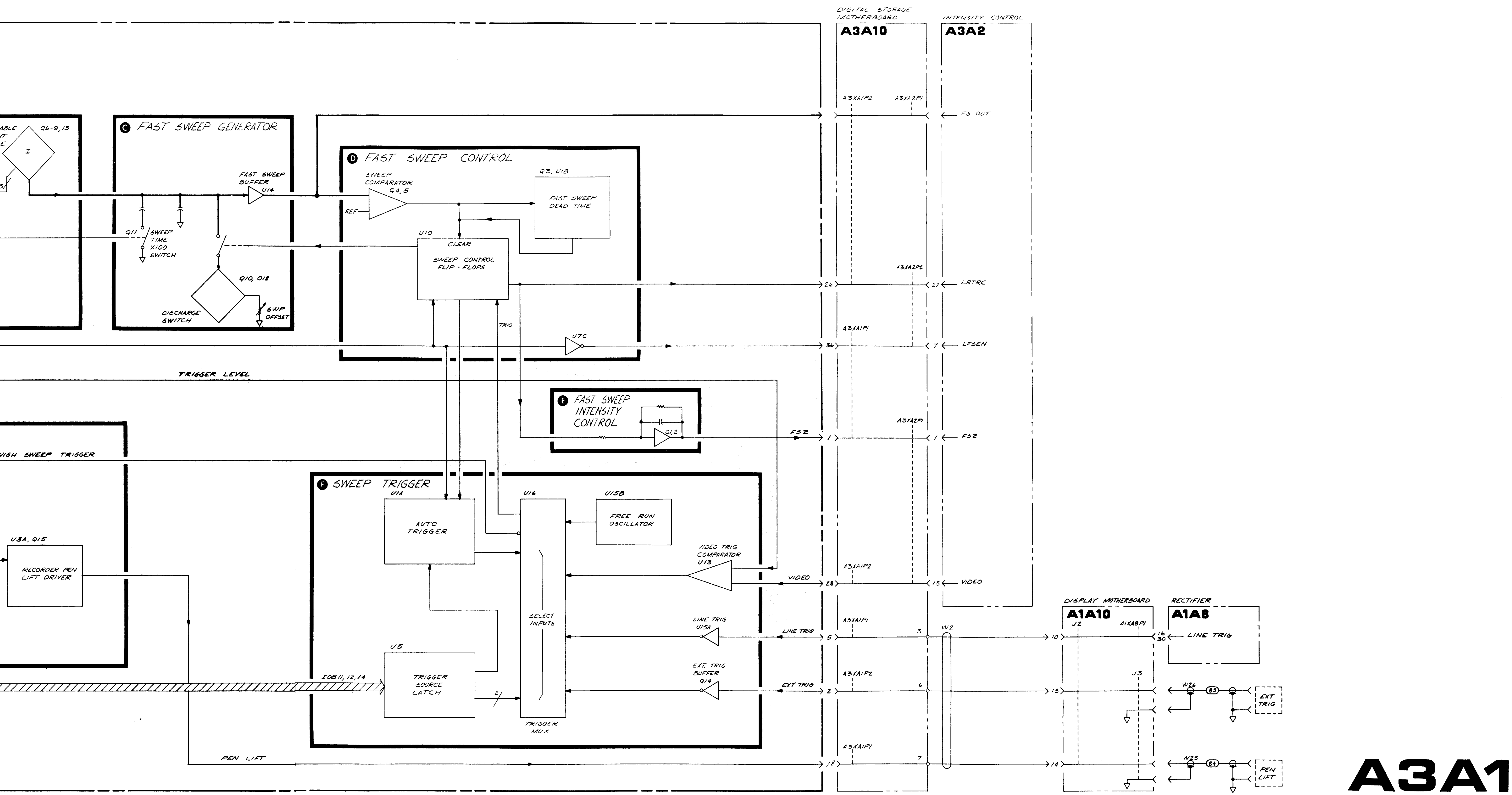


Figure 8-48. A3A1 Trigger, Block Diagram

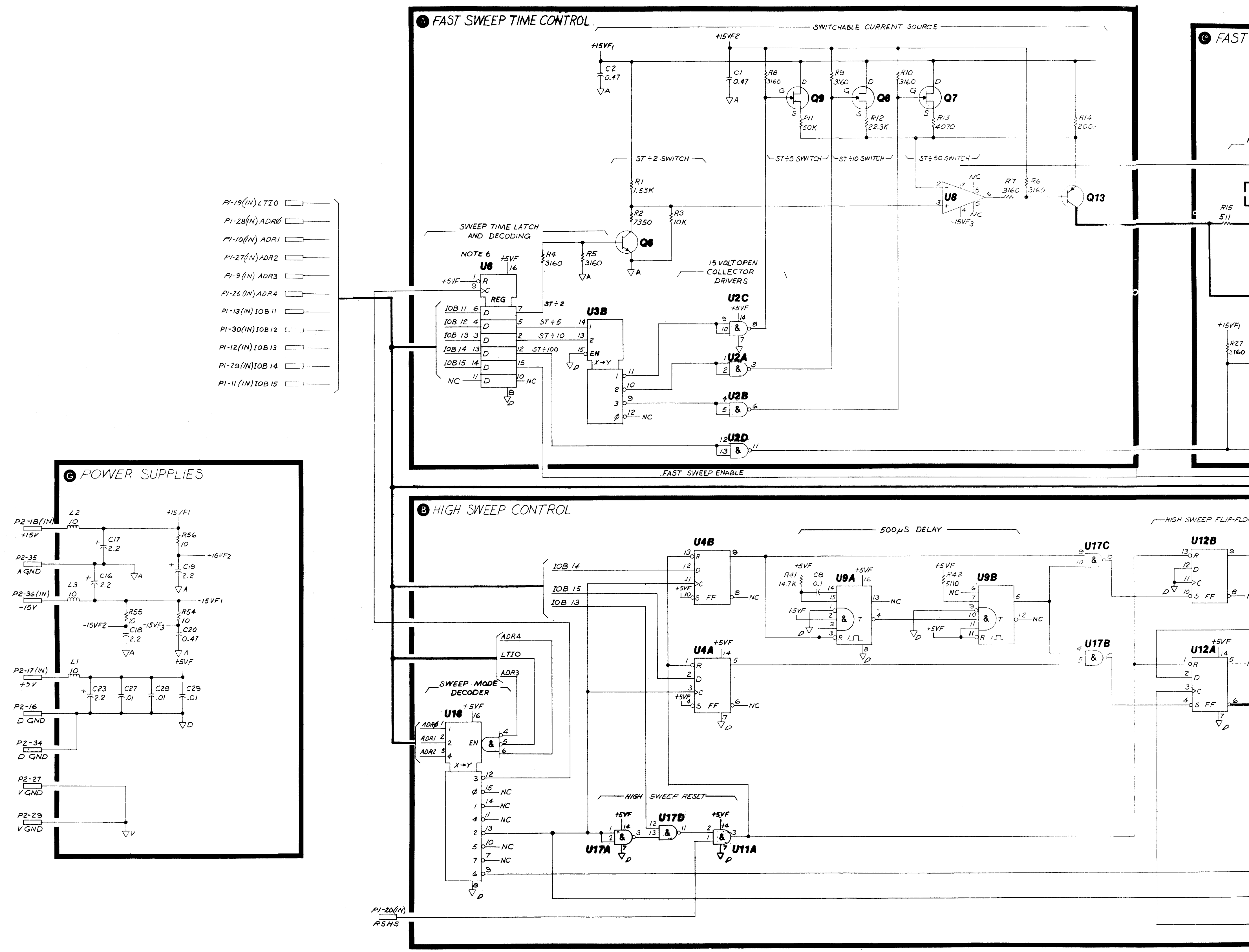
A3A1 TRIGGER
85662-20014

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	FSZ	A3A2 P1-1	E
19	LTIO	A3A10 J2-49	B
2	NC		
20	RSHS	A3A6 P1-16	B
3	NC		
21	HSWP	A3A10 J1-7	
4	NC		
22	NC		
5	LINE TRIG	A3A10 W2-10	F
23	NC		
6	NC		
24	NC		
7	NC		
25	NC		
8	NC		
26	ADR 4	A3A10 J2-27	B
9	ADR3	A3A10 J2-26	B
27	ADR 2	A3A10 J2-25	B
10	ADR 1	A3A10 J2-24	B
28	ADR Ø	A3A10 J2-23	B
11	IOB 15	A3A10 J2-18	A B
29	IOB 14	A3A10 J2-17	A B
12	IOB 13	A3A10 J2-16	A B
30	IOB 12	A3A10 J2-15	A B
13	IOB 11	A3A10 J2-14	A B
31	NC		
14	NC		
32	NC		
15	NC		
33	NC		
16	NC		
34	NC		
17	NC		
35	NC		
18	PEN LIFT	A3A10 W2-14	B
36	LFSEN	A3A2 P2-7	D

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	I CLK	A3A10 J1-8	B
19	NC		
2	EXT TRIG	A3A10 W2-13	F
20	NC		
3	NC		
21	NC		
4	NC		
22	NC		
5	TRIG LEVEL	A3A10 J1-14	F
23	NC		
6	NC		
24	NC		
7	NC		
25	NC		
8	NC		
26	LRTRC	A3A2 P2-27	
9	NC		
27	V GND	A3A2 P1-11	G
10	NC		
28	VIDEO	A3A2 P1-12	F
11	NC		
29	VGND	A3A2 P1-13	G
12	NC		
30	FS OUT	A3A2 P1-15	C
13	NC	NOTE 8	
31	NC	NOTE 8	
14	NC		
32	NC		
15	NC		
33	NC		
16	D GND		G
34	D GND		G
17	+5V		G
35	A GND		G
18	+15V		G
36	-15V		G



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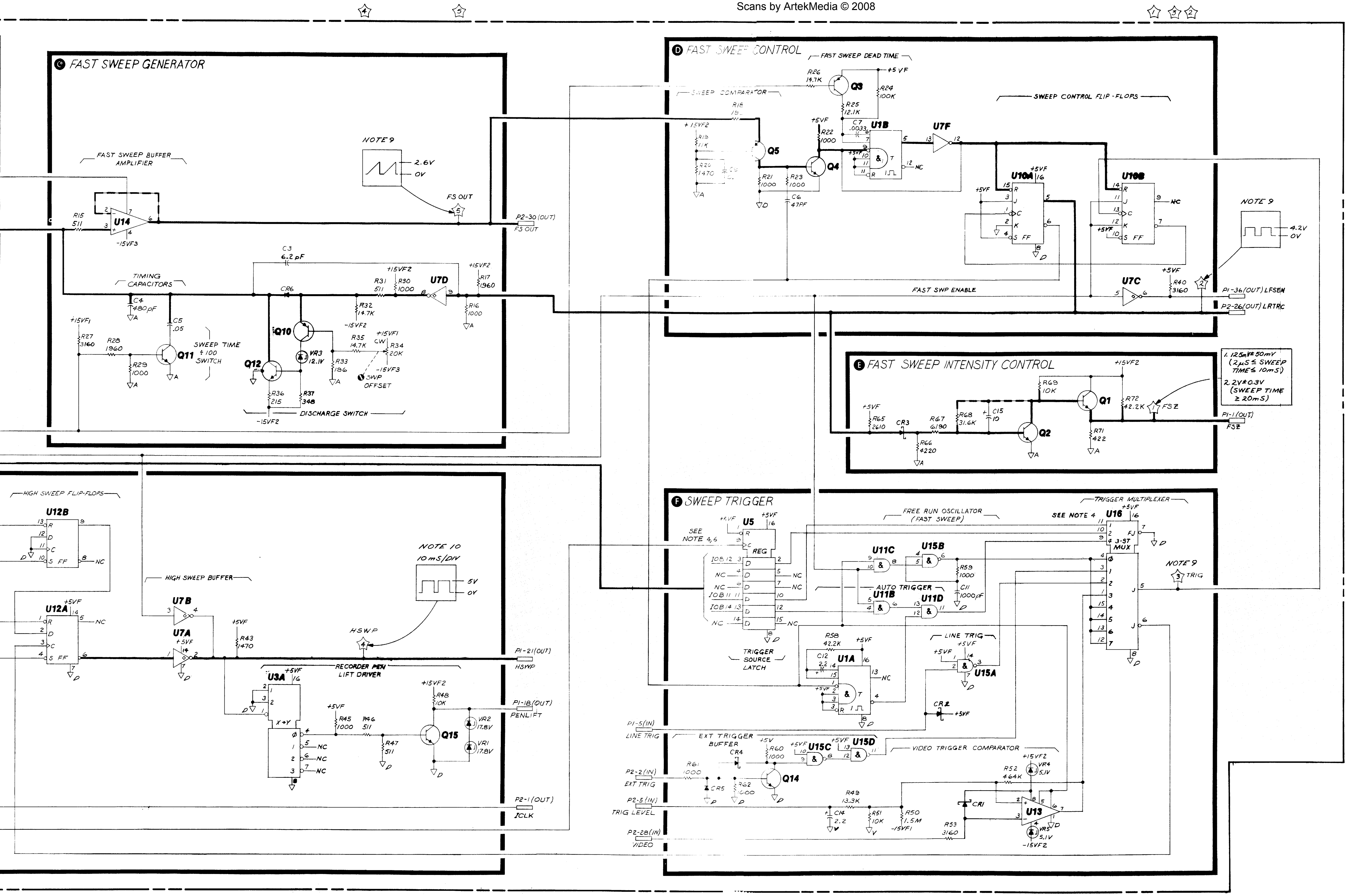

NOTES:

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. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
ADR Ø-4	INSTRUMENT BUS ADDRESS BITS Ø-4 (HIGH = TRUE)
EXT TRIG	EXTERNAL TRIGGER
LFSEN	FAST SWEEP ENABLE
FS OUT	FAST SWEEP OUT
FSZ	FAST SWEEP Z-AXIS (INTENSITY)
HSWP	HIGH SWEEP
IOB 11-15	INSTRUMENT BUS DATA BITS 11-15 (HIGH = TRUE
I CLK	INDICATOR CLOCK (FRONT PANEL LEDS)
LINE TRIG	LINE TRIGGER
LTIO	LOW = TOP BOX I/O STROBE
PEN LIFT	CHART RECORDER PEN LIFT (+15V = LIFT)
LRTRC	FAST SWEEP RETRACE (LOW = RETRACE
RSHS	RESET HIGH SWEEP
TRIG LEVEL	TRIGGER LEVEL (FROM FRONT PANEL CONTROL)
VIDEO	VIDEO SIGNAL, 0-2V

4. TRIGGER SOURCE ADDRESS:

U16 PIN 10	U16 PIN 11	TRIGGER SOURCE
0	0	FREE RUN
0	1	EXT
1	0	LINE
1	1	VIDEO

5. AUTO TRIGGERING TRUTH TABLE:

U5 PIN 12	FAST SWEEP TRIGGERING
1	AUTO TRIGGER
0	NORMAL MODE (SHIFT VIDEO, EXT)

6. FAST SWEEP TIME TRUTH TABLE:

FAST SWEEP TIME	U6 PIN 12 ÷ 100	U6 PIN 2 ÷ 10	U6 PIN 5 ÷ 5	U6 PIN 7 ÷ 2
10mS	0	0	0	0
5	0	0	0	1
2	0	0	1	0
1	0	1	0	0
500μs	0	1	0	1
200	0	1	1	0
100	1	0	0	0
50	1	0	0	1
20	1	0	1	0
10	1	1	0	0
5	1	1	0	1
2	1	1	1	0
1	1	1	1	1

7. UNLESS OTHERWISE INDICATED LOGIC LEVELS ARE TTL:

   +2.0V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW

8. P2-13,31 USED FOR SIGNAL FEEDTHROUGH ON A3A10 DIGITAL STORAGE MOTHER-BOARD.

9. SEE TROUBLE SHOOTING HINTS FOR THIS BOARD.

10. FOR SWEEP TIMES ≤ 10mS TP4 WILL BE A TTL LOW SIGNAL. TEST WAVEFORM IS OBTAINED BY SHORTING A14TP11 TO A15TP8 AND THEN PUSHING INSTRUMENT PRESET.

A3A1

Figure 8-50. A3A1 Trigger, Schematic Diagram

A3A2 INTENSITY CONTROL,CIRCUIT DESCRIPTION

A3A2 Intensity Control provides the following functions:

- It receives ΔX and ΔY signals from A3A3 Line Generator, approximates the line length, and controls the Z-axis level to the display.
- It sets and controls the duration of the Line Generator drawing period, which is either 4 μsec or 19 μsec, depending on the approximate line length.
- It provides drive signals to Line Generator switches.
- It controls all display blanking.
- It multiplexes digital storage (Line Generator) X, Y, Z,and blanking with direct display of fast sweep, video, fast sweep Z, and retrace blanking.

Intensity level is modulated as a function of ΔX and ΔY. The Line Generator Z-Axis circuit receives ΔX and ΔY from A3A3 Line Generator. The magnitudes of ΔX and ΔY are summed together to approximate line length. The output of the Line Generator Z-Axis circuit goes to the Bright circuit, which sets the Z-axis signal to maximum when bright lines are drawn. The signal from the Bright circuit is multiplexed with the FSZ signal from A3A1 Trigger and becomes the Z signal to the display. The Z signal also goes to the AUX Z circuit, where Z and AUX BLANK are combined to form the AUX Z signal.

The line length approximation from the Line Generator Z-Axis circuit goes to the Long Line Comparator, which decides whether the line should be drawn as a long line (19 μsec drawing time) or a short line (4 μsec drawing time). This decision is stored at the Input Register and sent to the Line Generator as the $\overline{\text{LL}}$ signal. It goes with LGCLK to the Long Line/Short Line Timing circuit, which generates the timing signals necessary to control the Line Generator setup and drawing periods. The signal INTR is used by A3A6 Main Control to determine when to send new X and Y values to the Line Generator. The timing signals also go to the Integrator Switch Driver and to the Sample and Hold Driver, which form the drive signals needed for the Line Generator.

Control of display blanking begins at the Input Register. Blank and blink information are held in the register during the line drawing period. The Blanking Logic circuit controls all display blanking. It unblanks, blanks, or blinks lines as required by the Input Register. It multiplexes digital storage blanking with fast-sweep retrace blanking.

Fast Scan Trigger Detect and Bus Buffer circuits are used to provide information to A3A6 Main Control to create the digital storage display.

Line Generator Z-Axis J

ΔX and ΔY are received from A3A3 Line Generator. U17 and associated circuitry is a magnitude detector. For positive ΔX, CR1 is forward biased, U17 output goes negative, and CR2 cathode is at 0V. For negative ΔX, CR1 is reverse biased, U17 output goes positive, and CR2 cathode is $-\Delta X$ volts (or $|\Delta X|$). Since R15=2R7=R1, the signal at CR5 anode due to ΔX alone is $-|\Delta X|$. When added to the output of the ΔY magnitude detector, the signal at CR5 anode is $(-|\Delta X|-|\Delta Y|)$, which is a rough approximation of line length. The signal at CR7 anode is equal to the signal at CR5 anode except when CR5 anode is more positive than -0.1V. R16 and R17 prevent CR7 anode from rising above -0.1V.

The line length signal $(-|\Delta X|-|\Delta Y|)$ is sampled by U5 during the setup period of A3A3 Line Generator. Switches Q2 and Q4 are closed during sampling. The signal is held on C3 during the drawing period. Switches Q1 and Q3 are closed during the hold mode.

For dim lines, the DIM signal is high, and switch A of analog switch U1A is closed to lower the gain of the Sample and Hold circuit.

U1A switch D is closed during long lines (19 μsec drawing period).

Bright K

For bright lines (BRIGHT signal high), switch C of U1B is closed to set the signal LGZ to +2V.

Digital Storage/Fast Scan Mux M

This circuit provides multiplexing between the digital storage display (Line Generator) and the fast scan display (video and fast sweep). For the digital storage display, LGX, LGY, and LGZ are connected to X, Y, and Z by U15 and U14. For the fast scan display, FS OUT (fast sweep output), VIDEO, and FSZ (fast sweep Z axis) are selected.

Long Line Comparator L

The Long Line Comparator receives the line length approximation from CR7 cathode and compares it with the long-line threshold (LL THRESHOLD adjustment R12). U4 pin 7 goes high when the approximation has greater magnitude than the threshold.

Input Register C

The signal from the Long Line Comparator and line intensity information are stored in the Input Register when a positive edge occurs on the INTR line. The Input Register is updated for each line drawn on the display. Signal FS is used to select the fast scan display (fast sweep and video).

Blink D

The output of U12 is a 1-Hz signal with a 90 percent duty cycle. When enabled by the BLINK command stored in the Input Register, this signal causes display blinking.

Long Line/Short Line Timing B

This circuit receives signal LGCLK from A3A7 Interface and signal LL from the Input Register. It generates signal INTR, which is a string of 1-μsec pulses. When LL is low the pulses are spaced 5 μsec apart; when LL is high the pulses are 20 μsec apart. This provides the timing signals for the 4- and 19-μsec Line Generator drawing periods and 1-μsec setup period.

Integrator Switch Driver E

This circuit provides the drive signals for the Integrator switches in A3A3 Line Generator. Q13 and Q14 form a complementary driver. When the input is low, Q13 is on and Q14 is off, setting INTG to −5V and $\overline{\text{INTG}}$ to 4.7V nominal. When the input is high, Q13 is off and 14 is on, setting INTG to +7.3V nominal and $\overline{\text{INTG}}$ to −5V.

Sample and Hold Switch Driver G

This circuit provides the drive signals for the Sample and Hold circuits of the Line Generator X, Y, and Z axes. Q10 and Q12 form a complementary driver. A −9.6V reference is provided by Q11 and associated circuitry. Q9 is a level translator. When U11 pin 11 goes low, Q9 collector goes to −10.3V, turning Q10 off and Q12 on. Signals HLDX and HLDY go to 0V, and signal SMPL goes to −7.6V nominal. When U11 pin 11 goes high, Q9 collector goes to −8.9V, turning Q10 on and Q12 off. SMPL goes to 0V and Q10 collector goes to −8.4V nominal. Potentiometers R50 (X S&H BAL) and R51 (Y S&H BAL) are used to adjust the HLDX and HLDY drive levels to A3A3 Line Generator. C18 and Q5 provide a speed-up to the rising edges of the HLDX and HLDY signals. As U11 pin 11 goes from high to low, the base of Q5 goes low, causing Q5 to turn on and the HLDX and HLDY signals to rise almost instantaneously.

Blanking Logic F

This circuit provides all display blanking. It multiplexes the retrace blanking of the fast scan display (direct video and fast sweep) with the digital storage blanking. For the digital storage display it provides blanking or unblanking as specified by signals LLGBLANK, BLINK, DOTEN, and INTR. R30, R27, C16, R28, R32, and C15 are delay circuits which match the delay of the $\overline{\text{BLANK}}$ signal to the delay of the Line Generator. R31, R29, and C14 match the retrace blanking delay to the fast sweep delay.

AUX Z N

The AUX Z circuit receives the $\overline{\text{BLANK}}$ signal from the Blanking Logic and the Z signal from the Digital Storage/Fast Scan Mux. It generates the AUX BLANK and AUX Z signals. R65 and R62 convert the 0 — 2V range of Z to the 0 — 1V range necessary for variation of AUX Z intensity. U8 is a voltage follower with Q6 providing a high current output.

Blanking causes the AUX Z signal to drop to −1V or less. When AUX BLANK goes high, Q7 turns off and Q8 turns on, causing AUX Z to go negative. When AUX BLANK is low, Q7 is on and Q8 is off.

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Fast Scan Trigger Detect (H)

This circuit is used to detect the occurrence of a fast scan trigger. When LRTRC, the retrace signal, goes high, a fast scan has been triggered. Flip-flop U18B is set by the postive edge of LRTRC. U18B is reset by LRST0.

Bus Buffer (I)

This circuit buffers status signals onto the Digital Storage Bus.

A3A2 INTENSITY CONTROL, TROUBLESHOOTING

The A3A2 Intensity Control Assembly modulates the Z-axis intensity, controls the A3A3 Line Generator drawing period, controls the display blanking and multiplexes Digital Storage with the fast sweep video for sweep times less than 20 ms.

Digital Storage Test Program 4 is used to troubleshoot this assembly. Table 8-18 lists the voltages that are present at various nodes in the Line Generator Z-Axis J. Depending on the persistence of the oscilloscope the waveforms will appear either as dots or vertical line segments. If any of the sample and hold FETs A3A2 Q1-Q4 are defective, it is easier to replace all four than to isolate the defective component.

Table 8-18. Line Generator Z-Axis Voltages

A3A2 R12	P1-36	U17 pin 6	P1-34	U16 pin 6	U9 pin 6	U5 pin 6
LL(CW)	+2V to -6V	-0.5V to +6V	+2V to -9V	-0.5V to +9V	0 to +9V	0 to +6V
SL (CCW)	+5V to -6V	-0.5V to +6V	+2V to -9V	-0.5V to +9V	0 to +9V	0 to +14V

Disabling the blanking signal can be helpful when troubleshooting labels that are shifted from their proper positions. This is done by grounding one input to U7D. This can be accomplished without removing the board by running a jumper from ground to A3A2R32, the resistor nearest to the LG/FS CAL connector, A3A2J2.

The following program draws either a horizontal or a vertical line on the CRT. It is useful for troubleshooting problems associated with dynamic operation of the Z-Axis Line Generator. A better understanding of the operation of the Z-Axis Line Generator will be gained by keying in this program and observing the waveforms while reading the circuit description.

Key in the following:

	Comments
[INSTR PRESET]	
[BLANK] TRACE A	
[BLANK] TRACE B	
[SHIFT] Recorder Upper Right	WRITE:
1056 Hz	(Skip Page)
[SHIFT] Recorder Lower Left	DSPL ADRS
0 Hz	
[SHIFT] Recorder Upper Right	WRITE:
1026 Hz	Vector Command

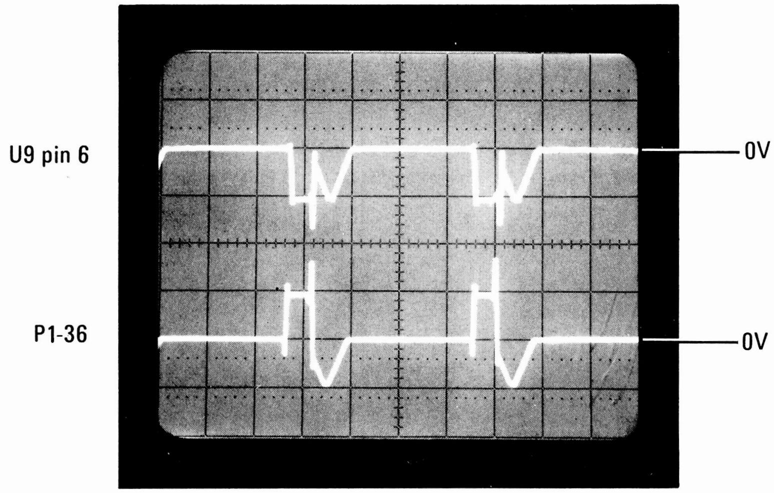
0 Hz 0 Hz	}	X,Y PAIR 1
1023 Hz 0 Hz	}	X,Y Pair 2
0 Hz 0 Hz	}	X, Y PAIR 3 (Skip Page)
1056 Hz		
SHIFT Recorder Lower Left		DSPL ADRS
2048 Hz		
SHIFT Recorder Upper Right		WRITE:
1056 Hz		(Skip Page)

To switch to a vertical line key in:

SHIFT Recorder Lower Left
3 Hz
SHIFT Recorder Upper Right
0 Hz
1023 Hz

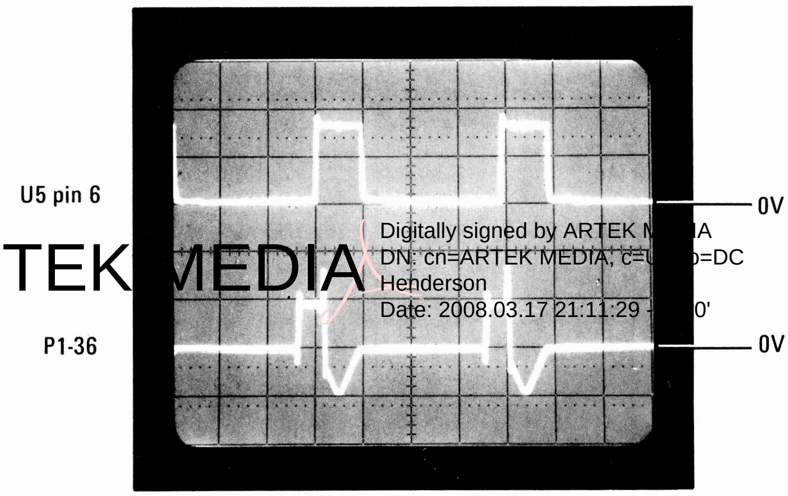
The waveforms in Figure 8-51 show the voltages for the ΔX and X components. For a vertical line the waveforms are identical at the corresponding nodes in the ΔY and Y channels.

Oscilloscope settings:
Vertical: 5V/div
Sweeptime: 10μs/div
Ext trigger: A3A2 P2-23
A3A2R12: Fully CCW



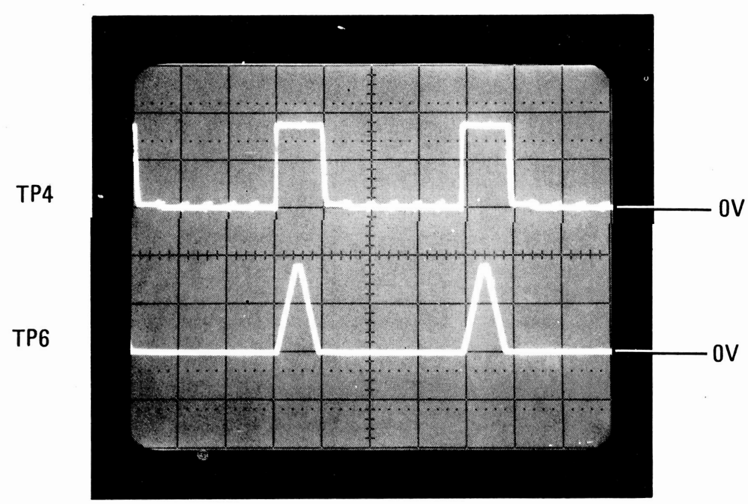
a. Magnitude Detector Output

Oscilloscope Settings:
Vertical: 5V/div
Sweeptime: 10μs/div
Ext trigger: A3A2 P2-23
A3A2R12: Fully CCW



b. Sample and Hold Output

Oscilloscope Settings:
Vertical: 1V/div
Sweeptime: 10μs/div
Ext trigger: A3A2 P2-23
A3A2R12: Fully CCW



c. Z and X Outputs

Figure 8-51. Intensity Control Waveforms

Table 8-19. A3A2 Intensity Control, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A2	85662-60025	1	BOARD ASSEMBLY, INTENSITY CONTROL	28480	85662-60025
A3A2C1	0160-2249	1	CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A3A2C2	0160-2264	2	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A3A2C3	0140-0198	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A3A2C4	0160-2202	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
A3A2C5	0160-4084	17	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C6	0180-0228	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3A2C7	0180-0374	3	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A2C8	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A2C9	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A2C10	0160-2055	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A2C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A2C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A2C13	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C14	0160-2257	1	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A3A2C15	0160-2264		CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A3A2C16	0140-0192	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A3A2C17	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C18	0160-2204	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A3A2C19	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C20	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C21	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C22	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C23	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C24	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C25	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C26	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C27	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C28	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C29	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C30	0140-0205	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A3A2C31	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C32	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C33	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A2C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A2CR1	1901-0040	12	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR5	1901-0518	5	DIODE-SCHOTTKY	28480	1901-0518
A3A2CR6	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A2CR7	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A2CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2CR15	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A2CR16	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A2CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A2J1	1250-0543	2	CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A3A2J2	1250-0543		CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A3A2L1	9140-0210	2	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A3A2L2	08558-8001	1	FILTER, COIL, BLUE	28480	08558-80011
A3A2L3	9140-0237	1	COIL-MLD 200UH 5% Q=65 .155DX.375LG-NOM	28480	9140-0237
A3A2L4			NOT ASSIGNED		
A3A2L5	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A3A2Q1	1855-0081	4	TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A2Q2	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A2Q3	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A2Q4	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A2Q5	1853-0007	6	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A2Q6	1854-0404	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A2Q7	1853-0034	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3A2Q8	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A2Q9	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A2Q10	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A2Q11	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A2Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A2Q13	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A2Q14	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251

Table 8-19. A3A2 Intensity Control, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A2R1	0757-0449	7	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A2R2	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A2R3	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A2R4	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A2R5	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A2R6	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A2R7	0757-0442	8	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R8	0698-3153	2	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A3A2R9	0698-3156	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A3A2R10	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R12	2100-3354	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	28480	2100-3354
A3A2R13	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R14	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R15	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A2R16	0757-0438	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A2R17*	0698-3455	1	RESISTOR 261K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2613-F
A3A2R18	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A2R19	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A2R20	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R21*	0757-0447	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A3A2R22	0757-0443	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3A2R23	0757-0421	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A3A2R24	0698-3157	3	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A2R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A2R26	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R27	0757-0422	3	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A3A2R28	0757-0317	3	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A3A2R29	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A3A2R30	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A3A2R31	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A3A2R32	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A3A2R33	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A2R34	0698-0084	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3A2R35	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A2R36	0698-3435	1	RESISTOR 38.3 1% .125W F TC=0+-100	24546	C4-1/8-T0-38R3-F
A3A2R37	0698-3151	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A3A2R38	0757-0398	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3A2R39	0757-0401	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A2R40	0698-3446	2	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A3A2R41	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A2R42	0757-0394	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3A2R43	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A2R44	0757-0460	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A3A2R45	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A2R46	0757-0419	2	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A2R47	0757-0278	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A3A2R48	0698-3155	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A2R49	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3A2R50	2100-3351	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A3A2R51	2100-3351		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A3A2R52	0698-3443	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A3A2R53	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A2R54	0698-0082	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A3A2R55	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A2R56	0698-3150	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A3A2R57	0757-0428	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A3A2R58	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A2R59	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A3A2R60	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A3A2R61	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A2R62	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A2R63	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A3A2R64	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A2R65	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A2R66	0757-0405	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A3A2TP1	0360-0535	13	TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP4	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP5	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP6	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP7	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP8	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP9	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP10	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535

Table 8-19. A3A2 Intensity Control, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A2TP11	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP12	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2TP13	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A2U1	1820-1548	1	IC SW CMOS BILATL QUAD	01928	CD4066AY
A3A2U2	1820-1196	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A2U3	1820-1197	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3A2U4	1826-0026	1	IC 311 COMPARATOR TO-99	04713	MLM311G
A3A2U5	1826-0081	5	IC 318 OP AMP TO-99	27014	LM318H
A3A2U6	1820-1415	1	IC SCHMITT-TRIG TTL LS NAND DUAL 4-INP	01295	SN74LS13N
A3A2U7	1820-1425	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A3A2U8	1826-0081		IC 318 OP AMP TO-99	27014	LM318H
A3A2U9	1826-0081		IC 318 OP AMP TO-99	27014	LM318H
A3A2U10	1820-1199	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A3A2U11	1820-0054	1	IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A3A2U12	1826-0180	1	IC 555 8-DIP-P	18324	NE555V
A3A2U13	1820-1432	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS163N
A3A2U14	1826-0417	2	IC SWITCH 16-DIP-C	27014	NF13333D
A3A2U15	1826-0417		IC SWITCH 16-DIP-C	27014	NF13333D
A3A2U16	1826-0081		IC 318 OP AMP TO-99	27014	LM318H
A3A2U17	1826-0081		IC 318 OP AMP TO-99	27014	LM318H
A3A2U18	1820-1112	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A3A2U19	1820-1491	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A2VR1	1902-0554	1	DIODE-ZNR 10V 5% DO-15 PD=1W TC=+.06%	28480	1902-0554
A3A2VR2	1902-0025	1	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A3A2VR3	1902-3092	1	DIODE-ZNR 4.99V 2% DO-7 PD=.4W TC=-.012%	28480	1902-3092
A3A2VR4	1902-3139	1	DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	28480	1902-3139
			A3A2 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

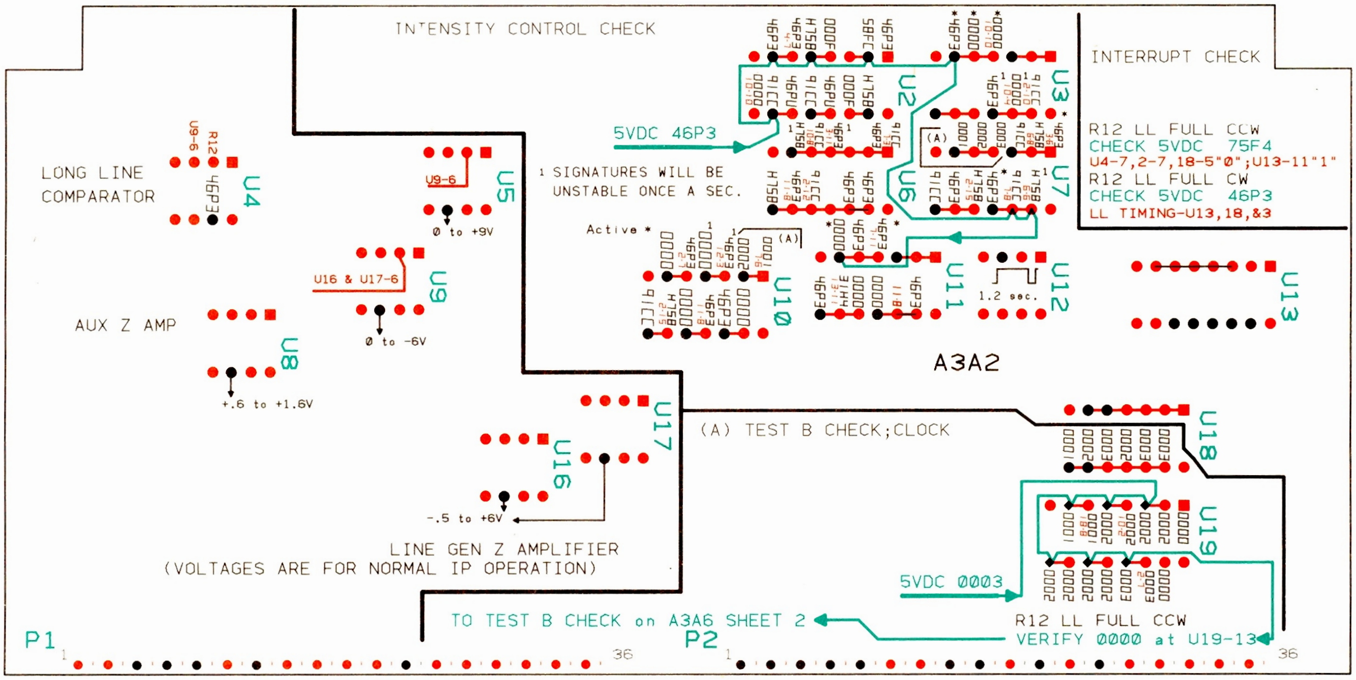


Figure 8-52. A3A2 Intensity Control, Signature Analysis Troubleshooting Diagram

INTENSITY CONTROL CHECK

Spectrum Analyzer Connections:

Remove A3A1
Adjust A3A2R12 LL fully CW
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK _/‾ to A3A2TP2
START _/‾ to A3A6TP2
STOP _/‾ to A3A6TP2

INTERRUPT CHECK

Spectrum Analyzer Connections:

Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK _/‾ A3A2TP2
START _/‾ A3A6TP2
STOP _/‾ A3A6TP2

(A) TEST B CHECK

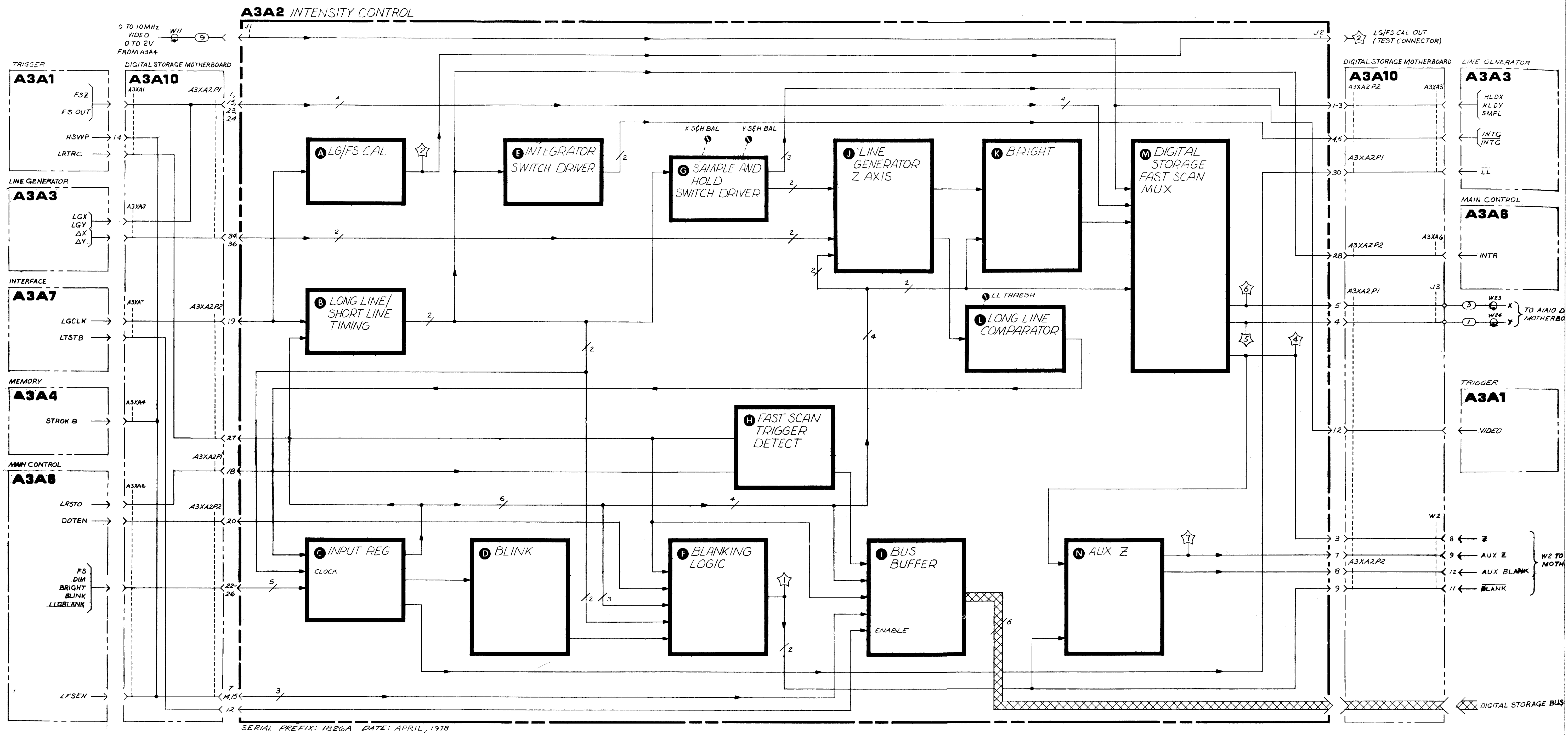
Spectrum Analyzer Connections

Disconnect rear-panel cables (To keep power on, jumper A1A8TP1 to A1A8TP2.)
Adjust A3A2R12 LL fully CW
Connect A3A7J1 Jumper to pins 4 and 11
Jumper A3A2P2-26 to P2-27, P2-14, and P2-7
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6
Remove A3A1

Signature Analyzer Connections:

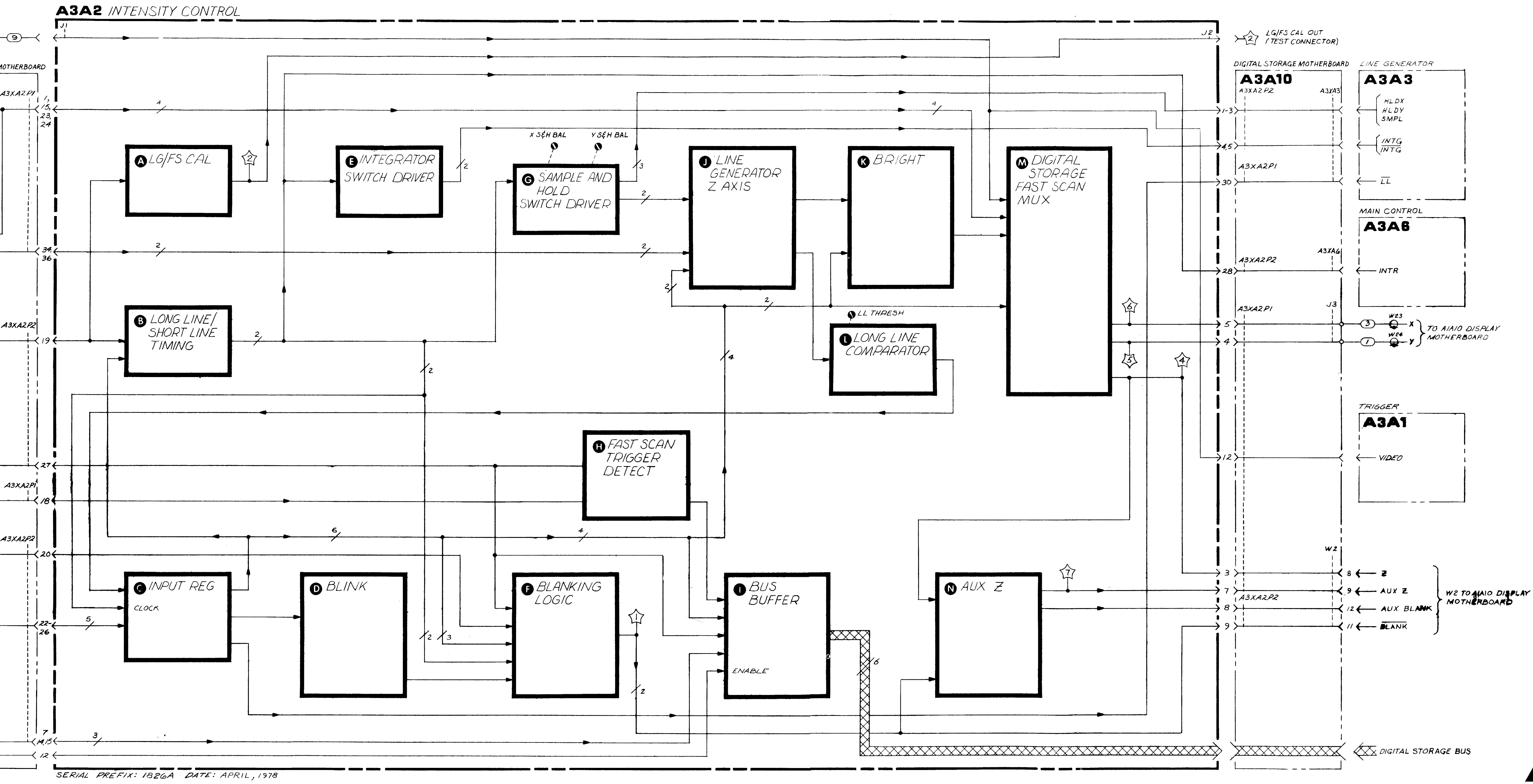
CLOCK _/‾ to A3A7TP1
START _/‾ to A3A6TP2
STOP _/‾ to A3A6TP2
Probe GND to A3A2P2-16

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.



A3A2 INTENSITY CONTROL
LG/FS CAL
LONG LINE/ SHORT LINE TIMING
INPUT REG
BLINK
INTEGRATOR SWITCH DRIVER
SAMPLE AND HOLD SWITCH DRIVER
FAST SCAN TRIGGER DETECT
BLANKING LOGIC
LINE GENERATOR Z AXIS
BRIGHT
LONG LINE COMPARATOR
DIGITAL STORAGE FAST SCAN MUX
BUS BUFFER
AUX Z
TRIGGER A3A1
LINE GENERATOR A3A3
INTERFACE A3A7
MEMORY A3A4
MAIN CONTROL A3A6
DIGITAL STORAGE MOTHERBOARD A3A10
LG/FS CAL OUT (TEST CONNECTOR)
DIGITAL STORAGE BUS
SERIAL PREFIX: 1826A DATE: APRIL, 1978

Figure 8-53. A



A3A2

Figure 8-53. A3A2 Intensity Control, Block Diagram

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Table 8-20. A3A2 Intensity Control, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C1	CR16	B2	R25	C2	TP8	B2
C2	C2	CR17	B3	R26	C2	TP9	B3
C3	C2			R27	C3	TP10	B3
C4	B2	J1	C1	R28	C4	TP11	B3
C5	C2	J2	C4	R29	C4	TP12	B3
C6	C3			R30	C4	TP13	B3
C7	B4	L1	B4	R31	C4		
C8	B4	L2	B4	R32	C4	U1	C2
C9	B4	L3	B3	R33	B2	U2	C3
C10	B3	L5	B2	R34	B2	U3	C3
C11	C3			R35	C2	U4	C1
C12	B2	Q1	C2	R36	B2	U5	C2
C13	B1	Q2	C2	R37	C2	U6	C3
C14	C4	Q3	C2	R38	B2	U7	C3
C15	C4	Q4	C2	R39	B2	U8	C1
C16	C4	Q5	C2	R40	B2	U9	C2
C17	C1	Q6	C2	R41	B1	U10	C3
C18	C2	Q7	B2	R42	B2	U11	C3
C19	B2	Q8	B2	R43	B3	U12	C3
C20	B2	Q9	B2	R44	C3	U13	C4
C21	B2	Q10	B2	R45	C3	U14	B1
C22	B2	Q11	B3	R46	B3	U15	B2
C23	C2	Q12	B3	R47	B3	U16	B2
C24	C2	Q13	B3	R48	B3	U17	B2
C25	C1	Q14	B3	R49	C2	U18	B4
C26	C1			R50	C3	U19	B4
C27	C2	R1	B2	R51	C2		
C28	C2	R2	B2	R52	B3	VR1	C2
C29	B3	R3	B2	R53	B3	VR2	B3
C30	B3	R4	B2	R54	B3	VR3	B3
C31	B3	R5	C2	R55	B3	VR4	B3
C32	B2	R6	C2	R56	B3		
C33	B3	R7	C2	R57	B3		
C34	C3	R8	C4	R58	B3		
		R9	C4	R59	B3		
CR1	B2	R10	C2	R60	B3		
CR2	C2	R11	B1	R61	B3		
CR3	B2	R12	C1	R62	B1		
CR4	C2	R13	C2	R63	C2		
CR5	C1	R14	C2	R64	C4		
CR6	C1	R15	C1	R65	B1		
CR7	C1	R16	B1	R66	C2		
CR8	C2	R17	B1				
CR9	C2	R18	C1	TP1	C3		
CR10	C2	R19	C2	TP2	B4		
CR11	B2	R20	C1	TP3	B1		
CR12	B2	R21	C1	TP4	B1		
CR13	B2	R22	C1	TP5	B1		
CR14	B3	R23	C2	TP6	B1		
CR15	B3	R24	C2	TP7	B2		

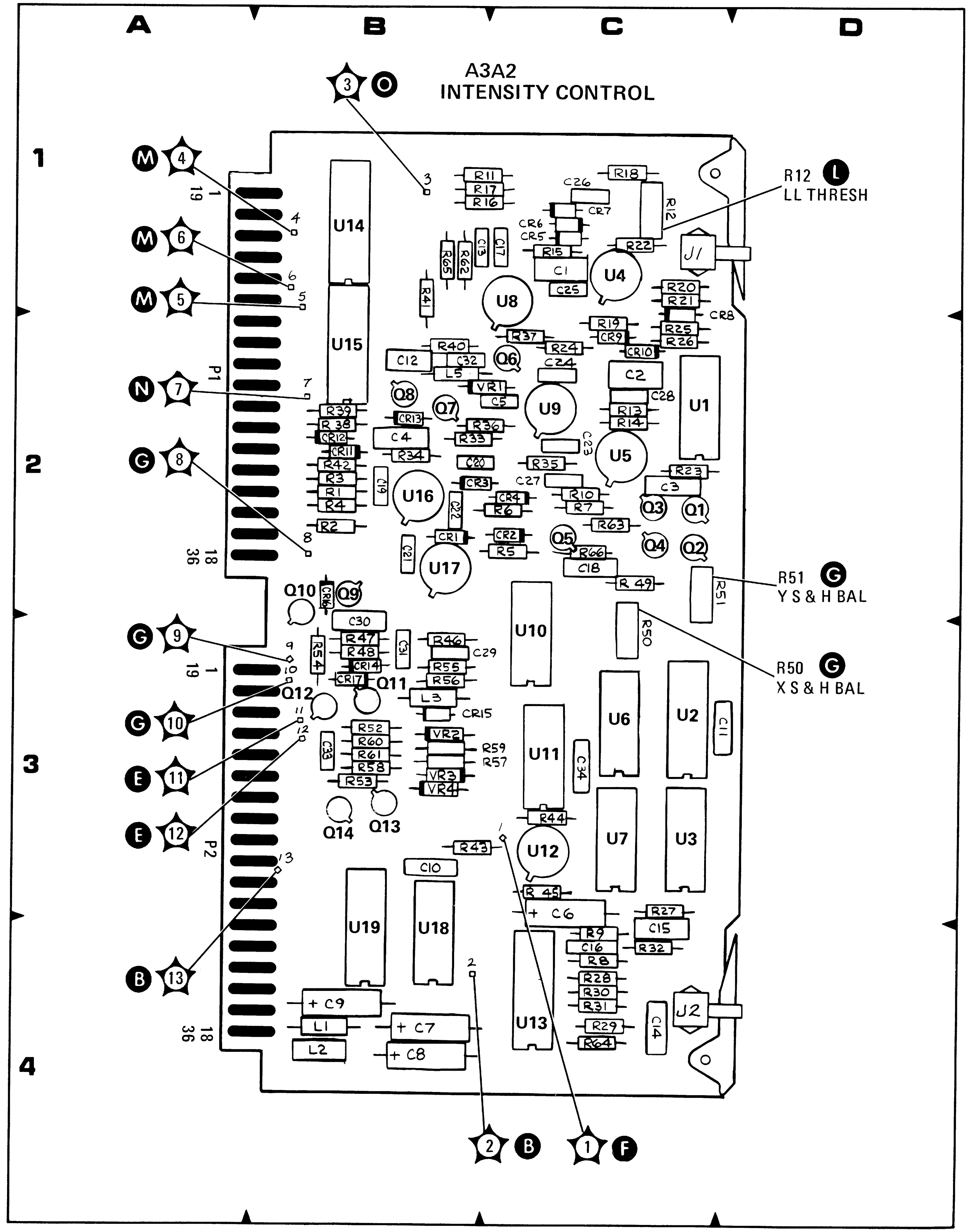


Figure 8-54. A3A2 Intensity Control, Component Locations

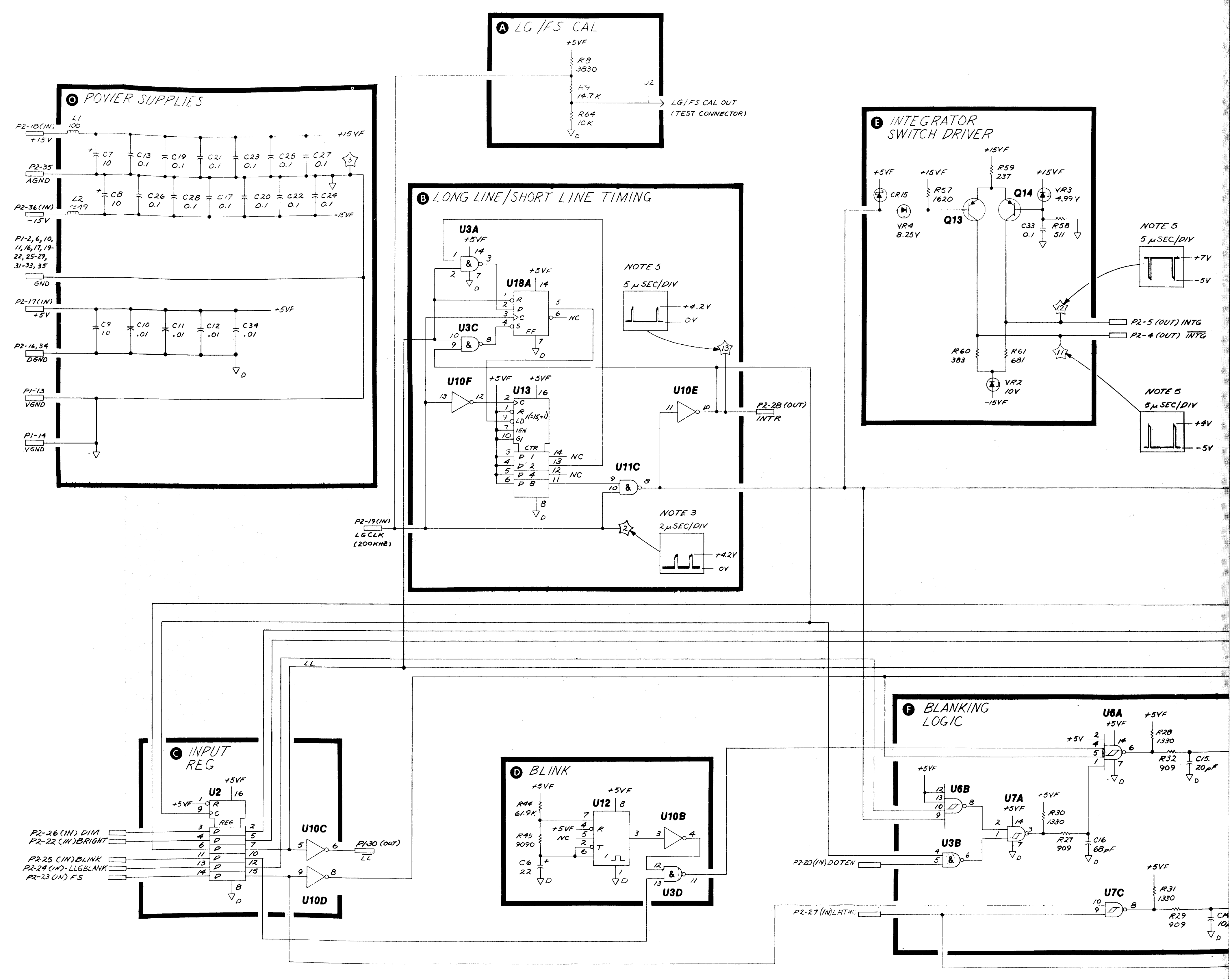
A3A2 INTENSITY CONTROL
85662-60025

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	FSZ	A3A1P1-1	M
19	GND		O
2	GND		O
20	GND		O
3	Z	A3A10W2-8	M
21	GND		O
4	Y	A3A10J3-Y	M
22	GND		O
5	X	A3A10J3-X	M
23	LGX	A3A3P1-5	N
6	GND		O
24	LGY	A3A3P1-6	M
7	AUX Z	A3A10W2-9	N
25	GND		O
8	NC		
26	GND		O
9	NC		
27	GND		O
10	GND		O
28	GND		O
11	GND		O
29	GND		O
12	VIDEO	A3A1P2-28	M
30	$\overline{LL}$	A3A3P1-30	C
13	VGND		O
31	GND		O
14	VGND		O
32	GND		O
15	F.S. OUT	A3A1P2-30	M
33	GND		O
16	GND		O
34	ΔY	A3A3P1-16	J
17	GND		O
35	GND		O
18	LRSTO	A3A6P1-18	H
36	ΔX	A3A3P1-18	J

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HLDY	A3A3P1-32	G
19	LGCLK	A3A7P2-8	B
2	HLDX	A3A3P1-33	G
20	DOTEN	A3A6P1-24	F
3	SMPL	A3A3P1-34	G
21	NC		
4	$\overline{INTG}$	A3A3P1-35	E
22	BRIGHT	A3A6P1-1	C
5	INTG	A3A3P1-36	E
23	FS	A3A6P1-19	C
6	NC		
24	LLGBLANK	A3A6P1-2	C
7	LFSEN	A3A1P2-31	I
25	BLINK	A3A6P1-20	C
8	AUX BLANK	A3A10W2-13	M
26	DIM	A3A6P1-3	C
9	$\overline{BLANK}$	A3A10W2-11	F
27	LRTRC	A3A1P2-26	F
10	NC		
28	INTR	A3A6P2-24	B
11	B2		I
29	NC		
12	LTSTB	A3A7P2-4	I
30	B5		I
13	B6	A3A7P2-13	I
31	B7		I
14	HSWP	A3A1P1-21	I
32	B9		I
15	STROK8	A3A4P1-3	I
33	B11		I
16	DGND		O
34	DGND		O
17	+5V		O
35	AGND		O
18	+15V		O
36	-15V		O



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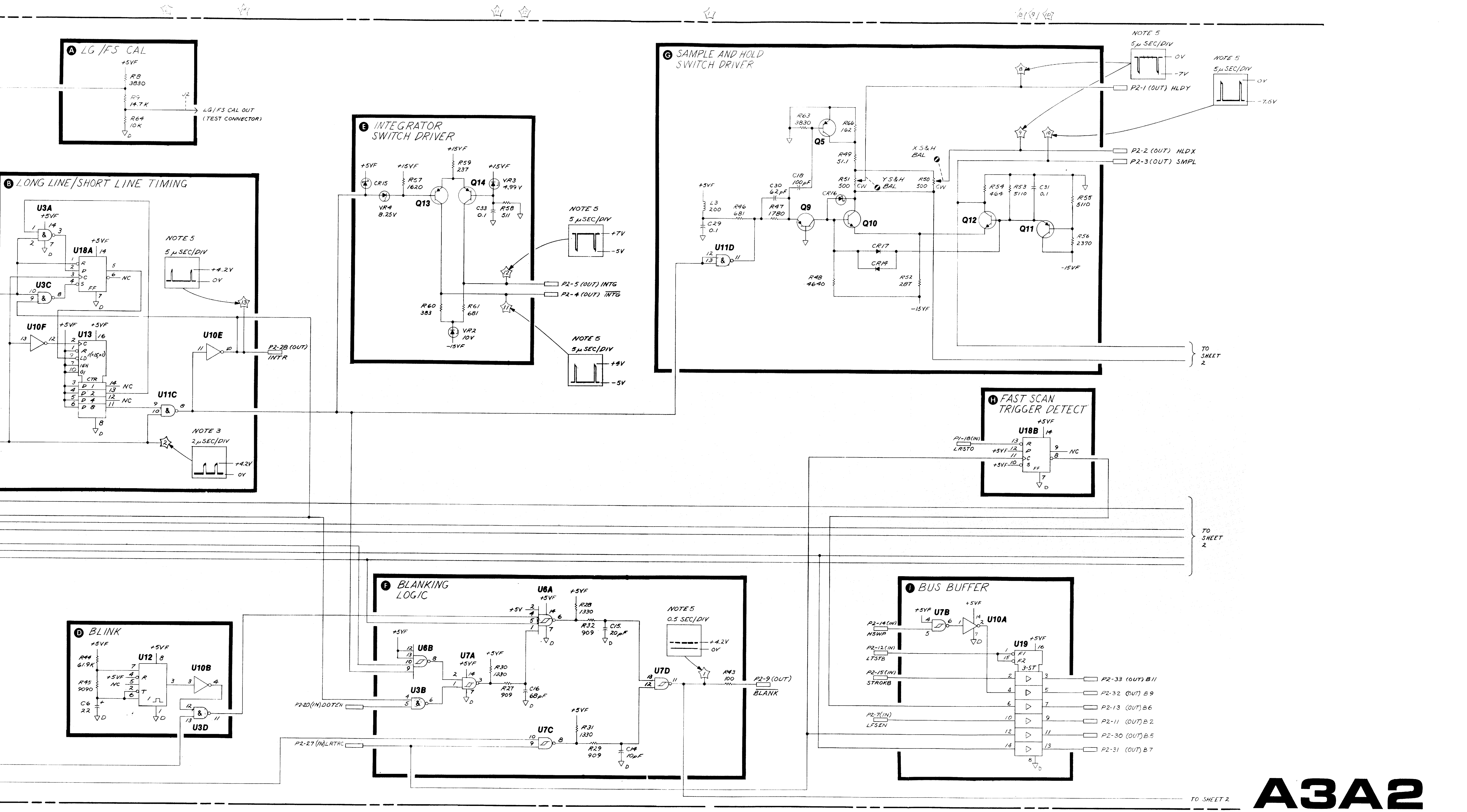
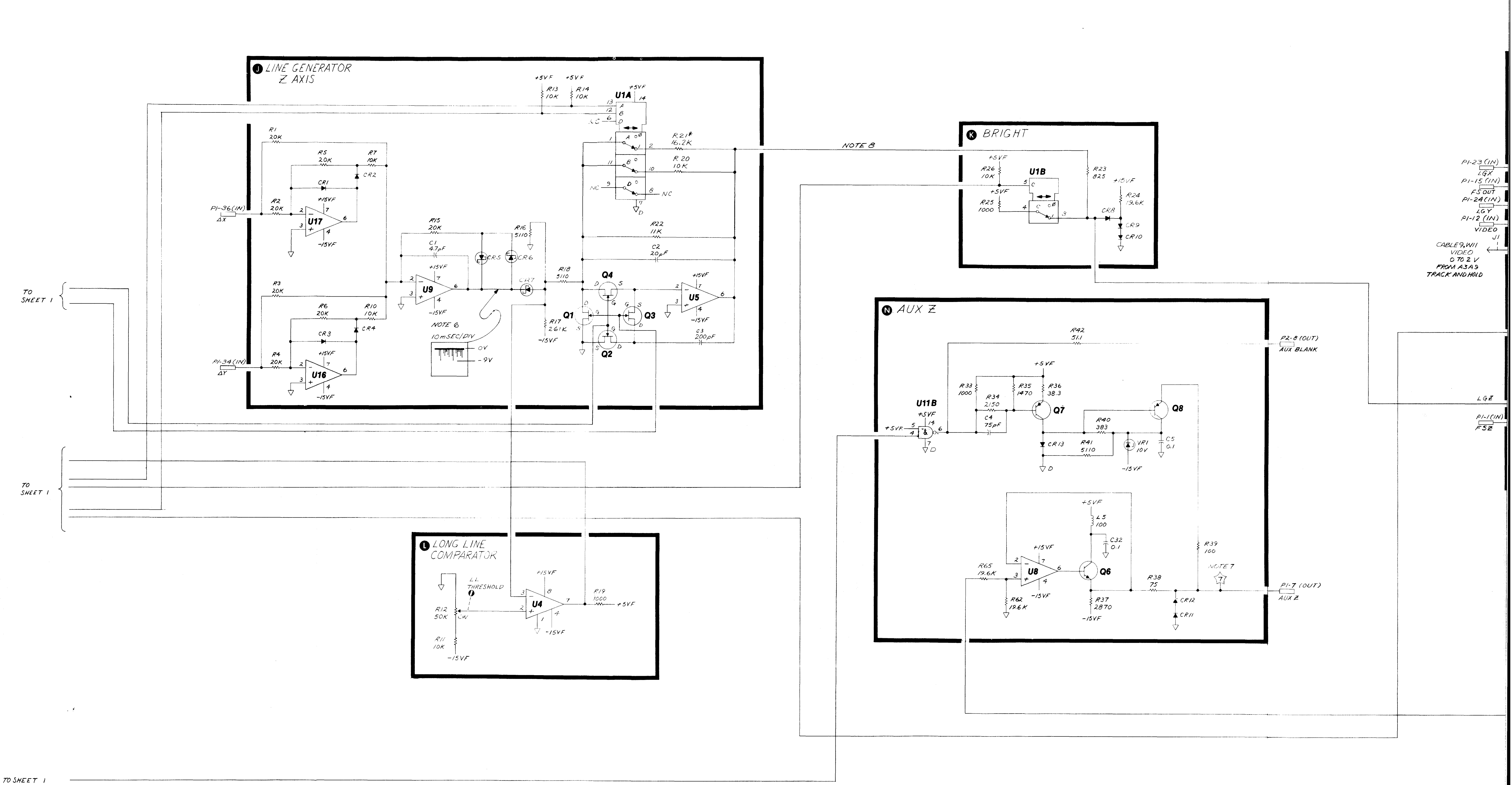


Figure 8-55. A3A2 Intensity Control, Schematic Diagram (1 of 2)

A3A2 INTENSITY CONTROL
85662-60025



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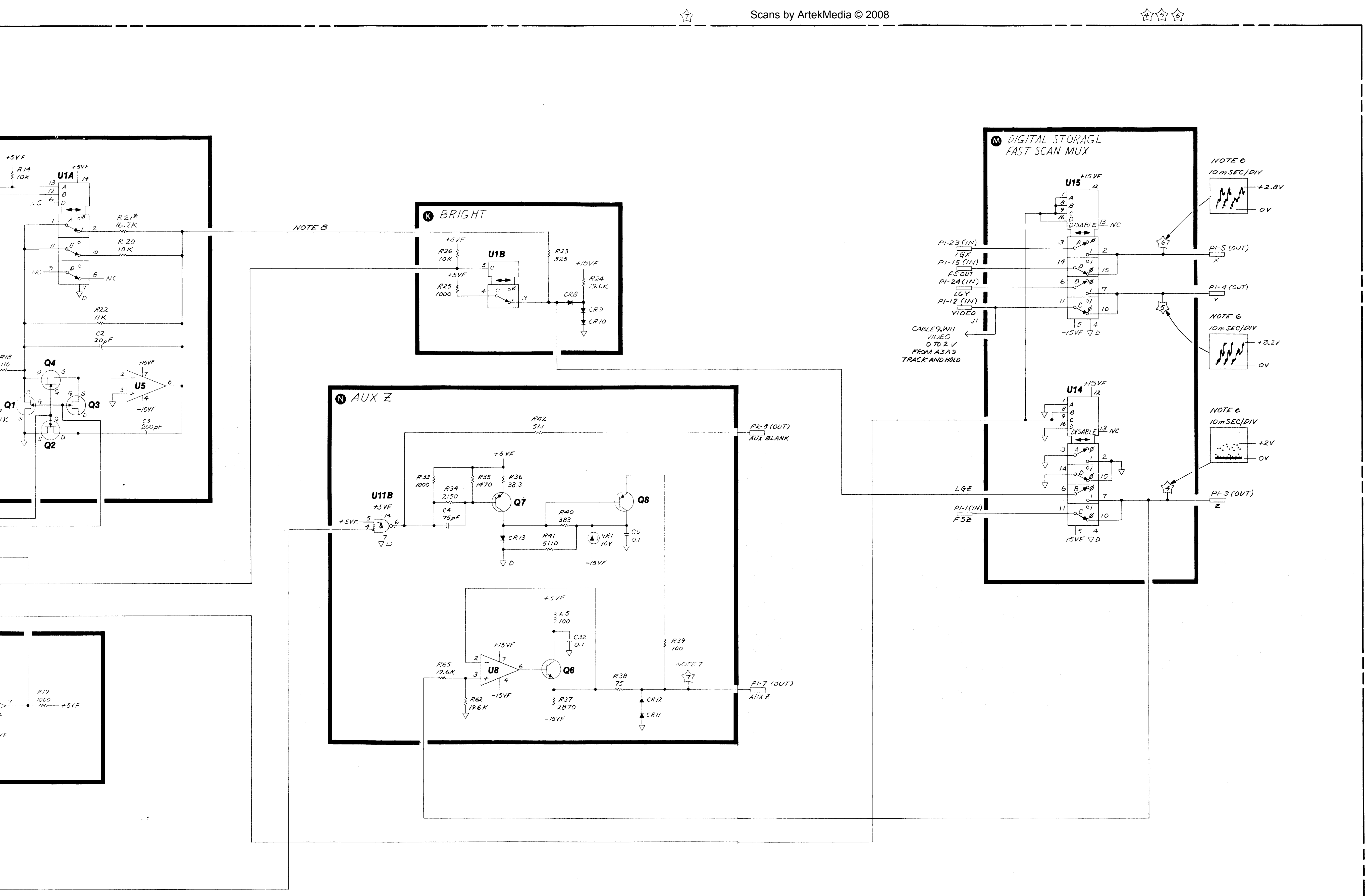

A3A2

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 +0.8 V = LOGIC "0" = LOW
4. MNEMONIC TABLE:

MNEMONIC	
FSZ	FAST SWEEP Z
LGX	LINE GENERATOR X
LGY	LINE GENERATOR Y
$\overline{LL}$	LOW = LONG LINE
HLDY	HOLD Y
LGCLK	LINE GENERATOR CLOCK
HLDX	HOLD X
DOTEN	DOT ENABLE
SMPL	SAMPLE
$\overline{INTG}$	NOT INTEGRATE
INTG	INTEGRATE
FS	FAST SCAN
LLG BLANK	LOW = LINE GENERATOR BLANK
LFSEN	LOW = FAST SCAN ENABLE
INTR	INTERRUPT
HSWP	HIGH = SWEEP
LRSTO	LOW = RESET TRIGGER OCCURRED
STROK8	EIGHTH CHARACTER STROKE
BRIGHT	BRIGHT LINE
DIM	DIM LINE
LL	LONG LINE
LRTRC	LOW = RETRACE
BLINK	BLINK LINE
ΔX	DELTA X
ΔY	DELTA Y
$\overline{BLANK}$	LOW = BLANK
LTSTB	LOW = TEST B
XS&HBAL	X SAMPLE AND HOLD BALANCE
YS&HBAL	Y SAMPLE AND HOLD BALANCE
LLTHRESH	LONG LINE THRESHOLD

5. TEST CONDITIONS FOR WAVEFORMS ARE:
   ROTATE A3A2 R12 TO FULL CW POSITION
   SHORT A3A6TP3 TO A3A6TP6
   SHORT A3A7TP3 TO A3A7TP6
   PRESS A3A7S1
6. USE TEST CONDITIONS FROM NOTE 5 AND EXTERNAL TRIGGER FROM P2-23.
7. USING TEST CONDITIONS FROM NOTE 5 AND EXTERNAL TRIGGER FROM P2-23, A WAVEFORM SIMILIAR TO TP4 WILL RESULT. MAXIMUM POSITIVE AMPLITUDE IS +1V. A -1.3V BLANKING SIGNAL IS ALSO PRESENT.
8. USING TEST CONDITIONS FROM NOTE 5 AND EXTERNAL TRIGGER FROM P2-23. A WAVEFORM SIMILIAR TO TP4 WILL RESULT. MAXIMUM POSITIVE AMPLITUDE IS +8V.

Figure 8-56. A3A2 Intensity Control, Schematic Diagram (2 of 2)

A3A3 LINE GENERATOR, CIRCUIT DESCRIPTION

A3A3 Line Generator receives a series of digital X and Y display positions, converts them to analog values, and connects them with straight lines. This process, called line generation, is similar to that of dot-to-dot drawing on paper (see Figure 8-57). Two independent line generators are required: one for the X series of values and one for the Y series. For each line there is a setup period followed by a drawing period. During the setup period the display is blanked by A3A2 Intensity Control.

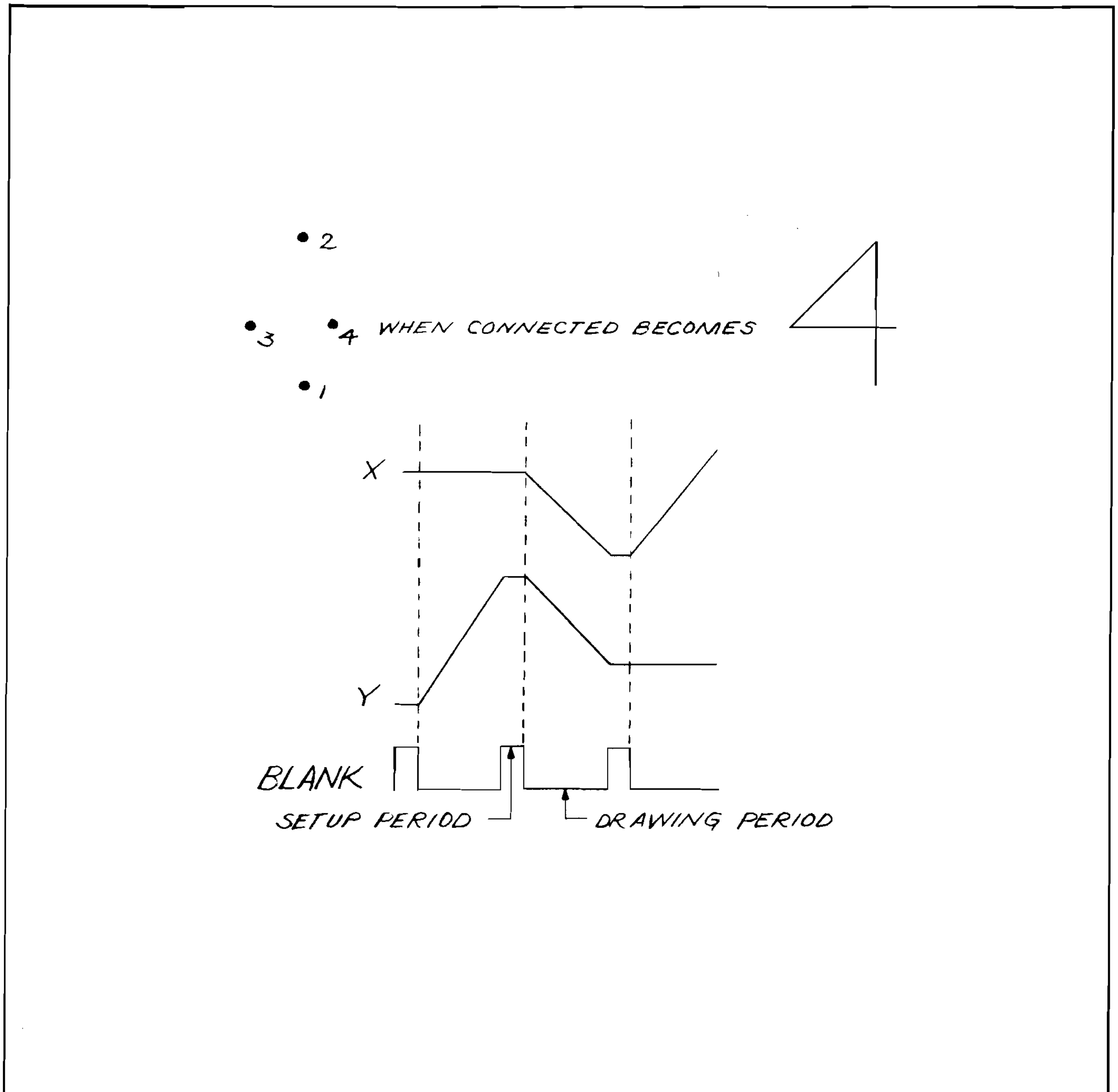

Figure 8-57. Line Generation Process

Each of the line generators consists of a register, a digital-to-analog converter (DAC), a summing amplifier, a sample and hold circuit, an integrator,and a filter. The X or Y register receives the next display point from the Digital Storage Bus. The DAC converts this number to a current. The summing amplifier then computes a position change ΔX equal to "next X" minus "present X." During the setup time for the next line, ΔX and ΔY are sampled by the Sample and Hold circuit. At the end of the setup time and during the drawing time, ΔX and ΔY are held for constant input to the Integrator. During the drawing time, the Integrator output changes linearly from X to X + ΔX and from Y to Y + ΔY. This is done by integrating ΔX and ΔY at a constant rate such that the output becomes X + ΔX and Y + ΔY; that is, "new X" and "new Y."

X Register A

U5 and U6 form a 10-bit X Position Register. When a new X position is present on lines B0-B9 of the Digital Storage Bus, the CHAR line is held low and a positive-going edge on LDX causes U5 and U6 to be loaded with the value of B0-B9. These 10 bits then become the X position input to the X DAC. Characters are drawn by changing only bits 1, 2, and 3 of the X Position Register and bits 1—4 of the Y Position Register. Strokes of a character are described by a series of X and Y values sent to the Line Generator on the Digital Storage Bus. B4-B6 of the Digital Storage Bus carry the series of X values. When the next X value is present on B4-B6, the CHAR line is held high and a positive-going edge on LDCHAR causes U5 to be loaded with the new values for bits 1—3 of the X position.

X DAC D

The output of U5 and U6 are the X position input to U4, the X DAC. U4 is a 10-bit multiplying DAC whose output current depends on the digital input code and the voltage at VREF (pin 15). This output current is the analog X position sent to the X Summing Amplifier. The inputs of U4 are clamped to a maximum of +3.6V by diodes CR1 through CR10.

X Summing Amplifier G

The X Summing Amplifier receives the next X position from the X DAC, the present X position from the X Integrator, and an X position shift from the Expand Register. The three signals are summed to give ΔX = "next X" + "X shift" − "present X." "X shift" is a binary signal of 0V or +5V, and the amount of shift is adjusted by X EXP potentiometer R1. (X and Y shift are used to move the display origin from the graticule lower left to the screen lower left.) X GAIN potentiometer R4, the X line generator gain adjustment, varies the magnitude of the X line generator output. R4 also has an effect on the accuracy of line positions. XLL potentiometer R6, the X long line ajdust, is used to adjust line position accuracy (see Integrator description).

X Sample and Hold J

The ΔX value from the Summing Amplifier is held for constant input to the Integrator by the X Sample and Hold circuit. Sampling occurs during the setup period, which lasts 1 μsec. Holding occurs during the drawing period, which lasts 4 μsec or 19 μsec. Q2 and Q3 are on during the sample mode and are driven by the SMPL line. Q1 and Q4 are on during the hold mode and are driven by the HLDX line (see Figure 8-58). Q6 is a dual FET used to provide a high-impedance input to U2. Capacitor C23 is the holding capacitor.

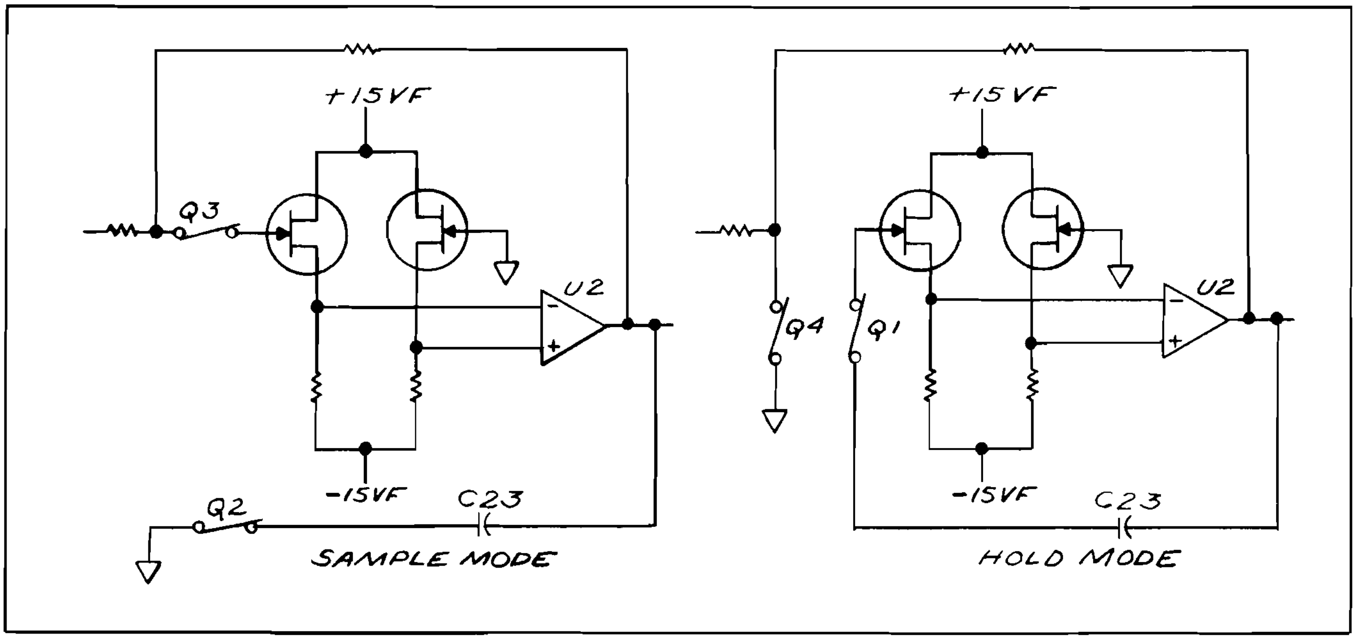

Figure 8-58. Sample and Hold Modes, Simplified Schematic

X Integrator L

U1, C26, and Q5 form an "integrate and hold" circuit whose output is the X display position. During the setup period, Q5 is open, leaving only U1 and C26 as a hold circuit holding the present value of X. During the drawing period Q5 is closed and the constant ΔX value from the Sample and Hold circuit causes a constand current (proportional to ΔX) to flow through C26. This constant current through C26 causes the output of U1 to change linearly from the value (X_i) at the last setup period toward a new value $X_{i+1} = X_i + \Delta X$. When the drawing period ends, Q5 opens and the circuit returns to the hold mode, this time with output at the new X position, X_i. The process of current flow through C26 is equivalent to integrating ΔX over the drawing period.

The drawing period may last for 4 μsec (short line) or 19 μsec (long line). The hold period lasts for 1 μsec. When the Line Generator is drawing a long line (19 μsec), switch Q8 is open and the current through C26 is determined by R15. When the Line Generator is drawing a short line (4 μsec), switch Q8 is closed and the current through C26 is determined by R15 in parallel with R7, R18. In either case, the current must be precisely set so that the X position will become $X_{i+1} = X_i + \Delta X$ at the end of the drawing period. In the long line mode, XLL potentiometer R6 of the Summing Amplifier is adjusted to get accurate line positioning. For accuracy in the short line mode, XSL potentiometer R18 must be properly adjusted.

Diodes CR22 and CR23 keep the source of Q5 within 0.7V of ground during the hold mode. Capacitors C43 and C27 and signal $\overline{\text{INTG}}$ compensate for gate feedthrough on Q5. R16, C29, and C28 provide frequency compensation for U1.

X Filter O

The X Filter is a 2.5-MHz low-pass filter which smooths out transients from the X Integrator.

Y Register C

U9 and U10 form a 10-bit Y Register. When a new Y position is present on B0-B9 of the Digital Storage Bus, the CHAR line is held low and a positive-going edge on LDY causes U9 and U10 to be loaded with the value of B0-B9. These 10 bits then become the Y position input to the Y DAC. When characters are being drawn, bits 1—4 of the Y Register are changed. B0-B3 of the Digital Storage Bus carry the series of Y values representing the Y components of the character strokes. When the next Y value is present on B0-B3, the CHAR line is held high and a positive-going edge on LDCHAR causes U9 to be loaded with the new values for bits 1 through 4 of the Y position.

Y DAC, Y Summing Amplifier, Y Sample and Hold, Y Integrator, and Y Filter F I K N P

The Y DAC, Y Summing Amplifier, Y Sample and Hold, Y Integrator, and Y Filter operate in a manner identical to that of the corresponding X Line Generator circuits.

Expand Register B

U14 is a 2-bit Expand Register which provides scale and origin-shift information to the X and Y Line Generators. When a new expand value is present on B6 and B8 of the Digital Storage Bus, a positive-going edge on LDEXP causes U14 to be loaded with the value of B6 and B8. A high on B6 will cause a scale increase of 13 percent over normal (the graticule is drawn at normal scale) and an origin shift of 13.6 percent of normal scale. A high on B8 will cause a scale increase of 55 percent over normal with no origin shift. A high on both B6 and B8 will cause a scale increase of 68 percent over normal and an origin shift of 13.6 percent of normal scale. Q16 and Q17 provide buffering from the TTL signals to the analog circuits.

Reference E

U13 provides the reference voltage to the X and Y DACs. The magnitude of the reference voltage is proportional to the scale of the Line Generator output. For normal scale the reference voltage is nominally −5.12V. For the three expanded scales, the reference may be −5.8V, −7.9V, or −8.6V.

Y Offset H

The Y Offset circuit supplies a signal to the Y Summing Amplifier such that the output of the Y Line Generator will be 0V when the Y Register contains all zeroes and no origin shift is present. YOS potentiometer R43 is used to make the adjustment.

Long Line Switch Driver M

The long Line Switch Driver provides level translation from the TTL signal $\overline{LL}$ to the gate signals for Q7 and Q8. A high on $\overline{LL}$ turns on Q7 and Q8.

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Line Generator Timing

Figure 8-59 shows the timing relationship between the X and Y Line Generator outputs and the drive signals. Changes in the X Register, Y Register, and Expand Register occur only during the drawing period; that is, when the Sample and Hold circuit is holding. Changes in the $\overline{LL}$ signal occur only during the setup period; that is, when the Integrator is holding. The length of the drawing period (either 4- or 19-μsec) is determined by A3A2 Intensity Control.

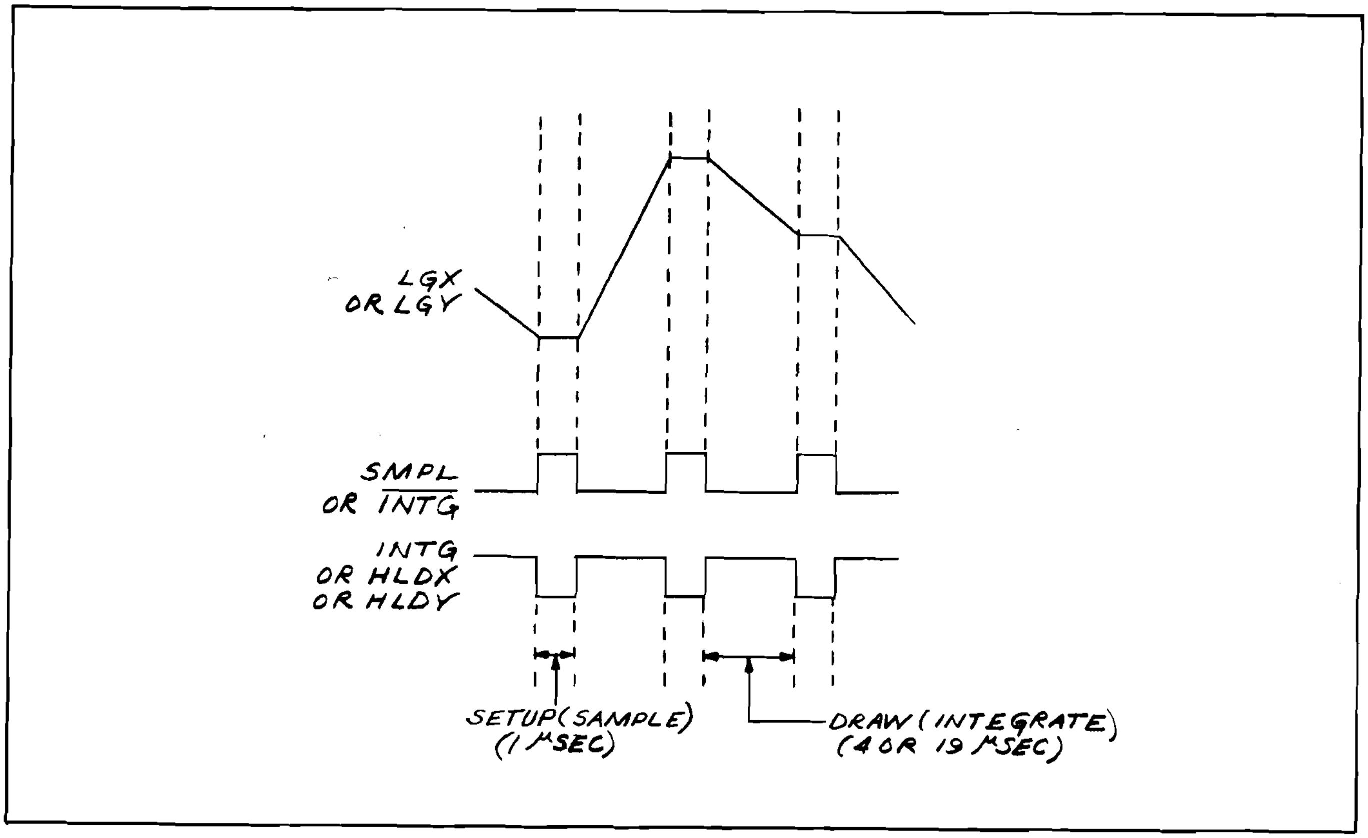


Figure 8-59. Line Generator Timing

A3A3 LINE GENERATOR, TROUBLESHOOTING

The A3A3 Line Generator Assembly converts the digital X and Y display positions from the Digital Storage processor to analog values and draws lines between them. It positions the characters with respect to the graticule and sets the size of the display and graticule.

A distorted CRT display involving both the horizontal and the vertical components is often caused by malfunctions on this assembly. If only the video information is distorted, suspect the A3A8 Analog Digital Converter. Drawing of the characters is controlled by the Character Stroke Memory on the A3A4 Memory Assembly.

If both the X and Y channels are distorted, suspect the Expand Register B, Reference E, Long Line Switch Driver M and/or the INTG or SMPL control signals, as these are common to both channels.

If the positive amplitude at A3A3TP11 is only +2V, the gate of either Q5 or Q10 has been damaged.

The Long Line switches Q7 and Q8 can be tested as follows. Set A3A2R12 in the LL position (full CW). A3A3TP6 is then a TTL low and the gates of Q7 and Q8 are approximately −15V. With A3A2R12 in the fully CCW position, A3A3TP6 is a TTL high and the gates of Q7 and Q8 are approximately −1V.

If it is determined that any of the Sample and Hold FETs Q1–Q4 or Q12–Q15 are defective, the best procedure is to replace all four since it is not easy to determine which FET is defective.

The Digital Storage Test Programs can be used to troubleshoot the analog functions on A3A3. When using these programs, the LL/SL pot A3A2R12 should be set to the full CW position (LL). The SL (full CCW) position should also be examined as it exercises the circuitry at the highest speeds.

Digital Storage Test Program 5 and the CRT display are used to verify the input Registers and the DACs. It is not necessary to remove A3A1 when testing A3A3. The display in Figure 8-60 is the result of a Y DAC or Y Register malfunction. Notice that the malfunction causes vertical jumps in the test waveform. A defective component in the X channel would cause horizontal jumps. The Signature Analyzer is necessary to determine the defective component.

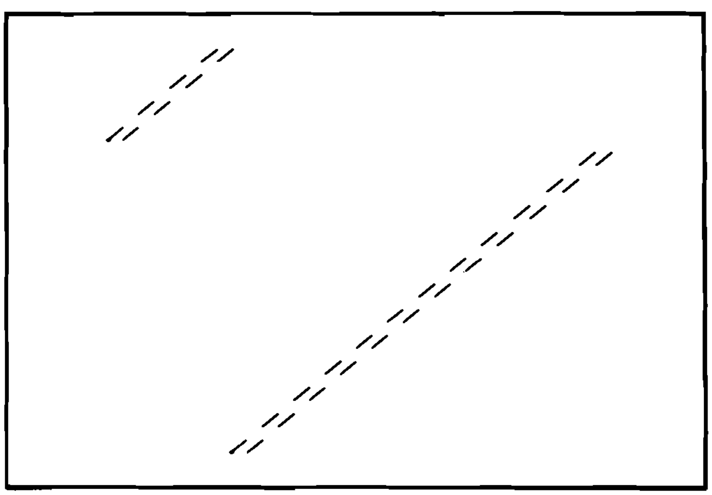


Figure 8-60. Digital Storage Test Program #5 Display with Defective Y Channel

The Expand Register B and Reference E set the V_{REF} levels for the X and Y DACs. This provides both magnification and origin shift for the display. As shown in Table 8-21, four voltage levels are generated. These levels are present when Digital Storage Test Program 3 is used. (Again it is not necessary to remove A3A1.) The reference voltage is measured at A3A3TP8. With A3A2R12 in the LL position and the oscilloscope sweep time set to 2 ms/div, the waveform shown in Figure 8-61 will result. In the SL position the waveform is identical for a sweep time of 1 ms/div.

Table 8-21. Reference Voltage Truth Table

	Reference Voltage			
	-5.1V	-5.8V	-7.9V	-8.6V
U14 pin 3	H	L	H	L
U14 pin 11	H	H	L	L

2V/DIV
2MS/DIV
A3A2R12 FULLY CW

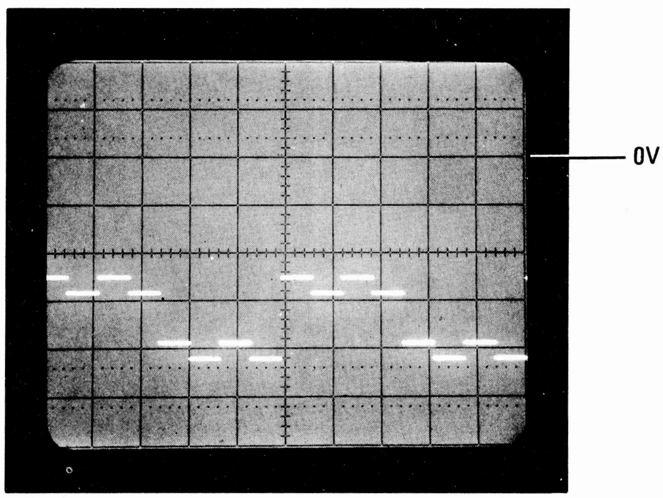


Figure 8-61. Reference Voltages

The following program is useful in troubleshooting problems related to the dynamic operation of the Summing Amplifiers, Sample and Hold, and Integrators. It draws a line from the lower left corner of the display to the upper right corner and then back to the lower left.

Key in the following:

INSTR PRESET ... Comments

BLANK TRACE A

BLANK TRACE B

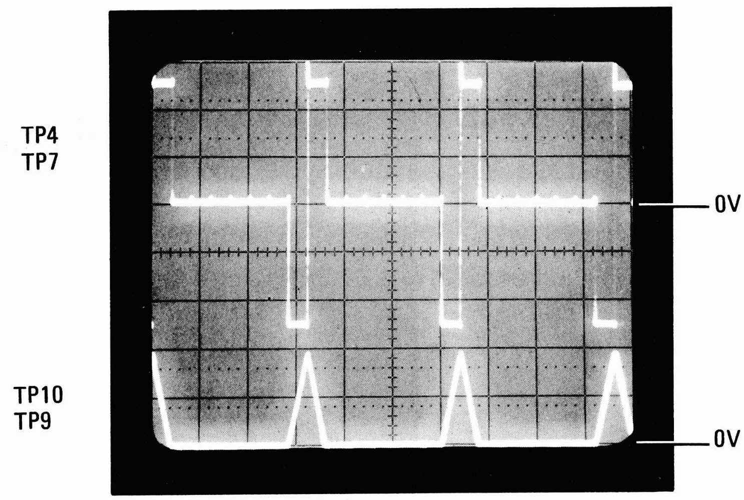
SHIFT Recorder Upper Right .... WRITE:

1056 Hz .... Skip Page

SHIFT Recorder Lower Left . . . . DSPL ADRS
0 Hz
SHIFT Recorder Upper Right . . . . WRITE:
1026 Hz . . . . Vector Command
0 Hz
0 Hz } . . . . X, Y pair 1
1023 Hz
1023 Hz } . . . . X,Y pair 2
0 Hz
0 Hz } . . . . X, Y pair 3
1056 Hz . . . . Skip Page
SHIFT Recorder Lower Left . . . . DSPL ADRS
2048 Hz
SHIFT Recorder Upper right. . . . . WRITE:
1056 Hz . . . . Skip Page

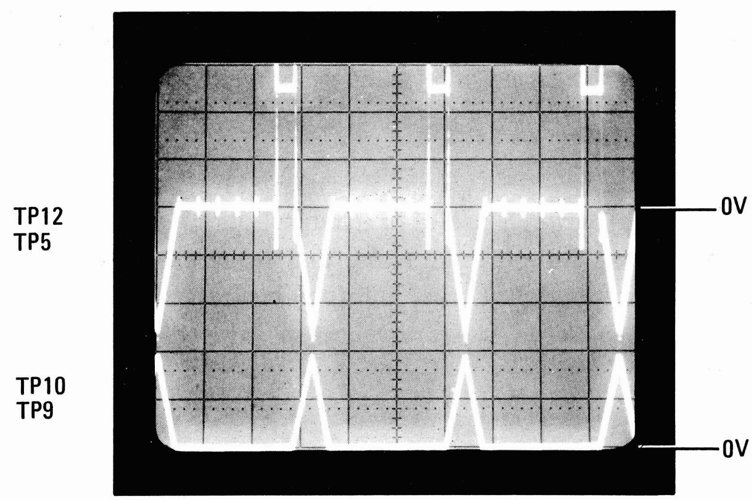
The waveforms in Figure 8-62 show the X and Y channel outputs for this program.

Oscilloscope Settings:
Sweeptime: 10 μs/div
Ext. trigger: TP10
Vertical:
Upper trace: 2V/div
Lower trace: 1V/div
A3A2R12: Fully CCW



a. Sample and Hold Output

Oscilloscope Settings:
Sweeptime: 10μs/div
Ext. trigger: TP10
Vertical:
Upper trace: 2V/div
Lower trace: 1V/div
A3A2R12: Fully CCW



b. Summing Amplifier Output

Figure 8-62. Line Generator X and Y Channel Outputs

The +5V pulse at A3A3TP12 is the "next X" data from the X DAC. In this program the "X shift" value from the Expand Register is 0V. The "present X" value is the waveform of A3A3TP10. The output at A3A3TP12 is ΔX = "next X" + "X shift" – "present X." The small spikes every 5μsec indicate the beginning and end of the 1 μsec sampling period. A3A3TP4 shows the output of the Sample and Hold circuitry. Note that the output is inverted relative to the output of the summing amplifier.

A3A3TP10 shows the result of integrating ΔX over the drawing period. See the A3A3 Line Generator Circuit Description for a more complete descripton of the operation of the Integrator circuit.

Table 8-22. A3A3 Line Generator, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A3	85662-60026	1	BOARD ASSEMBLY, LINE GENERATOR	28480	85662-60026
A3A3C1	0180-0374	3	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A3C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A3C3	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A3C4	0160-2257	2	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A3A3C5	0160-2257		CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A3A3C6	0160-4084	17	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C7	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C10	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C11	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C12	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C13	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C14	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C15	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C16	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C17	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C18	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C19	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C20	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C21	0160-2250	5	CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A3A3C22	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A3A3C23	0140-0198	2	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A3A3C24	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A3A3C25	0140-0198		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A3A3C26	0160-2675	2	CAPACITOR-FXD 3900PF +-1% 300VDC MICA	28480	0160-2675
A3A3C27*			*FACTORY SELECTED PART-NORMALLY OPEN		
A3A3C28	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A3A3C29	0160-3995	2	CAPACITOR-FXD 3900PF +-10% 250VDC CER	28480	0160-3995
A3A3C30	0160-3995		CAPACITOR-FXD 3900PF +-10% 250VDC CER	28480	0160-3995
A3A3C31	0160-2675		CAPACITOR-FXD 3900PF +-1% 300VDC MICA	28480	0160-2675
A3A3C32*			*FACTORY SELECTED PART-NORMALLY OPEN		
A3A3C33	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A3A3C34	0140-0191	2	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A3A3C35	0140-0199	2	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A3A3C36	0160-3536	2	CAPACITOR-FXD 620PF +-5% 100VDC MICA	28480	0160-3536
A3A3C37	0140-0191		CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A3A3C38	0140-0199		CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A3A3C39	0160-3536		CAPACITOR-FXD 620PF +-5% 100VDC MICA	28480	0160-3536
A3A3C40	0160-2055	3	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A3C41	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A3C42	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A3C43	0160-2241	2	CAPACITOR-FXD 2.2PF +-.25PF 500VDC CER	28480	0160-2241
A3A3C44	0160-2241		CAPACITOR-FXD 2.2PF +-.25PF 500VDC CER	28480	0160-2241
A3A3C45	0160-2264	2	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A3A3C46	0160-2264		CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A3A3C47	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A3C48	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3C49	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A3CR1	1901-0535	21	DIODE-SCHOTTKY	28480	1901-0535
A3A3CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR5	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR6	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR7	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR8	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR9	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR10	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR11	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR12	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR13	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR14	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR15	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR16	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR17	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR18	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR19	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR20	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A3CR21	1901-0040	5	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A3CR22	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A3CR23	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A3CR24	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A3CR25	1901-0535		DIODE-SCHOTTKY	28480	1901-0535

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Table 8-22. A3A3 Line Generator, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A3CR26	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A3L1	9140-0210	2	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A3A3L2	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A3A3L3	9100-1618	3	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A3A3L4	9100-1620	2	COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A3A3L5	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A3A3L6	9100-1620		COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A3A3L7	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A3A3Q1	1855-0081	8	TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q2	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q3	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q4	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q5	1855-0241	2	TRANSISTOR MOSFET N-CHAN E-MODE TO-72 SI	18324	SD215
A3A3Q6	1855-0050	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0050
A3A3Q7	1855-0020	2	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A3Q8	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A3Q9	1853-0034	3	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3A3Q10	1855-0241		TRANSISTOR MOSFET N-CHAN E-MODE TO-72 SI	18324	SD215
A3A3Q11	1855-0050		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0050
A3A3Q12	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q13	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q14	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q15	1855-0081		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A3A3Q16	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3A3Q17	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3A3R1	2100-3356	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	28480	2100-3356
A3A3R2	2100-3357	1	RESISTOR-TRMR 500K 10% C SIDE-ADJ 1-TRN	28480	2100-3357
A3A3R3	0698-3440	3	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A3A3R4	2100-3207	2	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A3A3R5	2100-3207		RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A3A3R6	2100-3274	2	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A3A3R7	2100-3351	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A3A3R8	2100-3351		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A3A3R9	2100-3274		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A3A3R10	0698-5350	8	RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R11	0698-5350		RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R12	0698-3157	6	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A3R13	0698-5350		RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R14	0698-5350		RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R15	0698-7095	2	RESISTOR 11K .25% .125W F TC=0+-50	28480	0698-7095
A3A3R16	0698-3428	2	RESISTOR 14.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-14R7-F
A3A3R17	0698-0085	2	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A3A3R18	0698-5350		RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R19	0757-0442	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A3R20	0757-0438	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A3R21	0757-0462	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A3A3R22	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A3A3R23	0698-0084	3	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3A3R24	0757-0424	2	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3A3R25	0698-3161	1	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A3A3R26	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A3R27	0698-5350		RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R28	0698-5350		RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R29	0698-5350		RESISTOR 2.613K .1% .125W F TC=0+-25	28480	0698-5350
A3A3R30	0698-7095		RESISTOR 11K .25% .125W F TC=0+-50	28480	0698-7095
A3A3R31	0698-3428		RESISTOR 14.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-14R7-F
A3A3R32	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A3R33	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A3A3R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A3R35	0698-3136	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A3A3R36	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A3R37	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A3A3R38	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3A3R39	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A3R40	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A3R41	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A3R42	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A3R43	2100-3354	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	28480	2100-3354
A3A3R44	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A3R45	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A3R46	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A3R47	0698-6963	2	RESISTOR 5.55K .1% .125W F TC=0+-25	28480	0698-6963
A3A3R48	0698-6963		RESISTOR 5.55K .1% .125W F TC=0+-25	28480	0698-6963
A3A3R49	0698-3150	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A3A3R50	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F

Table 8-22. A3A3 Line Generator, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A3R51	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3A3R52	0757-0421	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A3A3R53	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A3TP1	0360-0535	12	TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP4	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP5	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP6	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP7	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP8	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP9	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP10	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP11	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3TP12	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A3U1	1826-0079	4	IC 2625 OP AMP TO-99	29832	1321
A3A3U2	1826-0089	2	IC 2525 OP AMP TO-99	29832	1322
A3A3U3	1826-0079		IC 2625 OP AMP TO-99	29832	1321
A3A3U4	1826-0448	2	IC DIGITAL-ANALOG CONV 7520	28480	1826-0448
A3A3U5	1820-1444	2	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A3A3U6	1820-1196	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A3U7	1826-0079		IC 2625 OP AMP TO-99	29832	1321
A3A3U8	1826-0448		IC DIGITAL-ANALOG CONV 7520	28480	1826-0448
A3A3U9	1820-1444		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A3A3U10	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A3U11	1826-0079		IC 2625 OP AMP TO-99	29832	1321
A3A3U12	1826-0089		IC 2525 OP AMP TO-99	29832	1322
A3A3U13	1826-0081	1	IC 318 OP AMP TO-99	27014	LM318H
A3A3U14	1820-1195	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A3A3U15	1820-1197	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3A3VR1	1902-3036	1	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A3A3VR2	1902-0686	1	DIODE-ZNR 1N825 6.2V 2% DO-7 PD=.4W	04713	1N825
			A3A3 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0751	2	EXTRACTOR-PC BOARD ORN POLYC	28480	4040-0751

A3A3
LINE GENERATOR

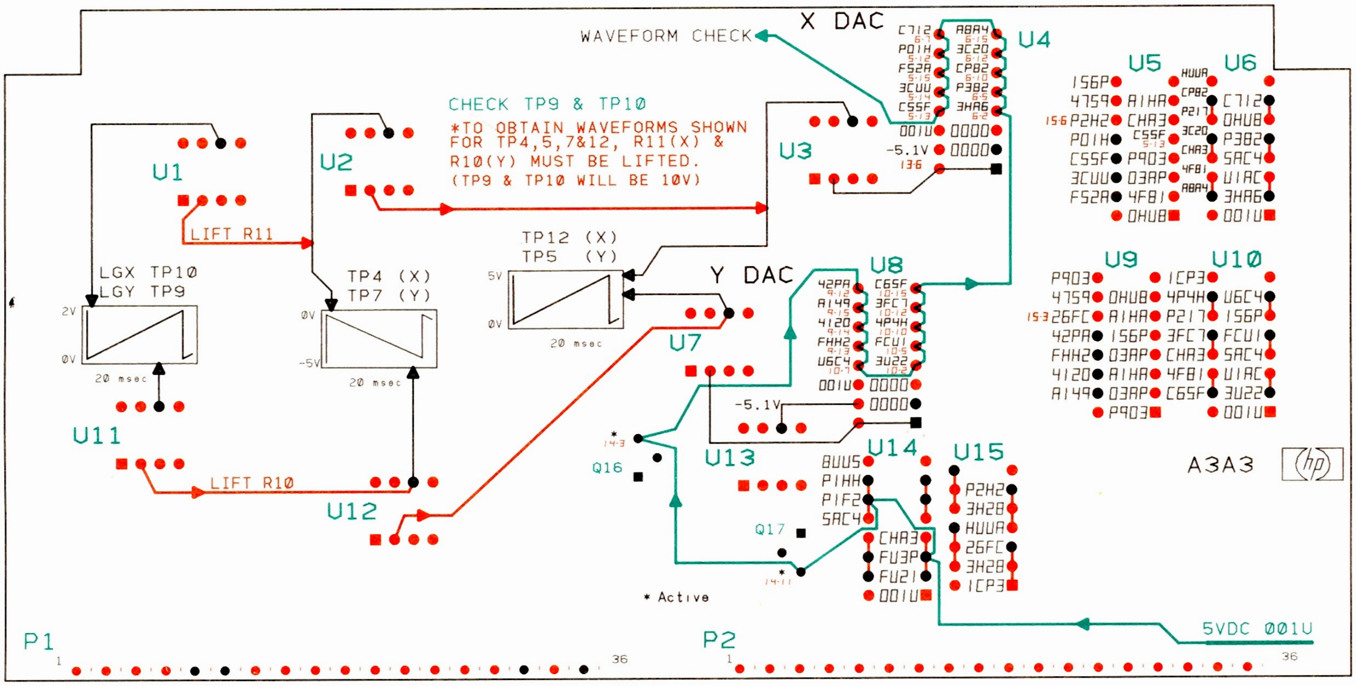


Figure 8-63. A3A3 Line Generator, Signature Analysis Troubleshooting Diagram

WAVEFORM CHECK

Spectrum Analyzer Connections:

Jumper A3A7TP6 to A3A7TP4
Jumper A3A6TP3 to A3A6TP6
Adjust A3A2R12 LL fully CW

Signature Analyzer Connections:

None; not required

A3A3 CHECK

Spectrum Analyzer Connections:

Adjust A3A2R12 LL fully CW
Ground A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⌐ to A3A6TP4
START ⌐ to A3A6TP2
STOP ⌐ to A3A6TP2
Probe GND to A3A3P2-16

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

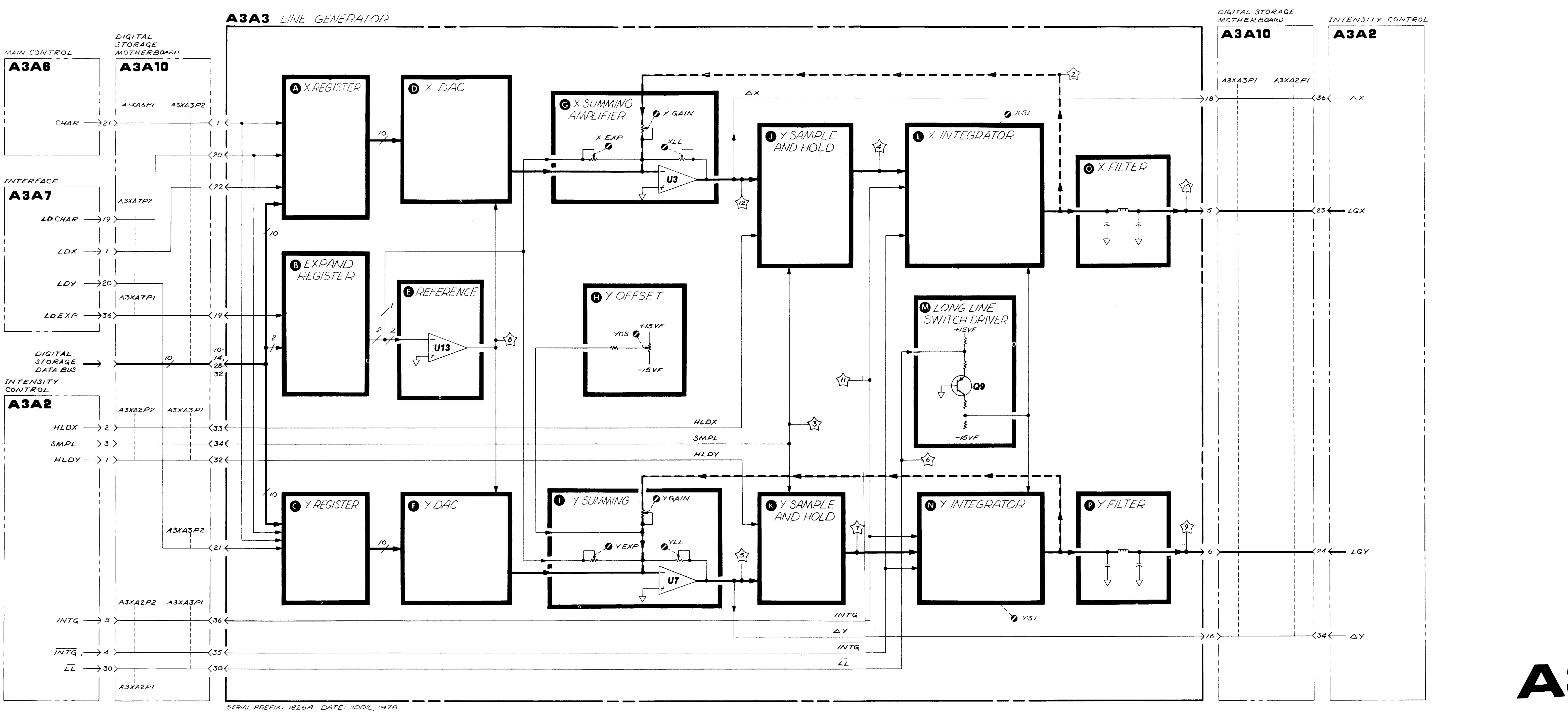
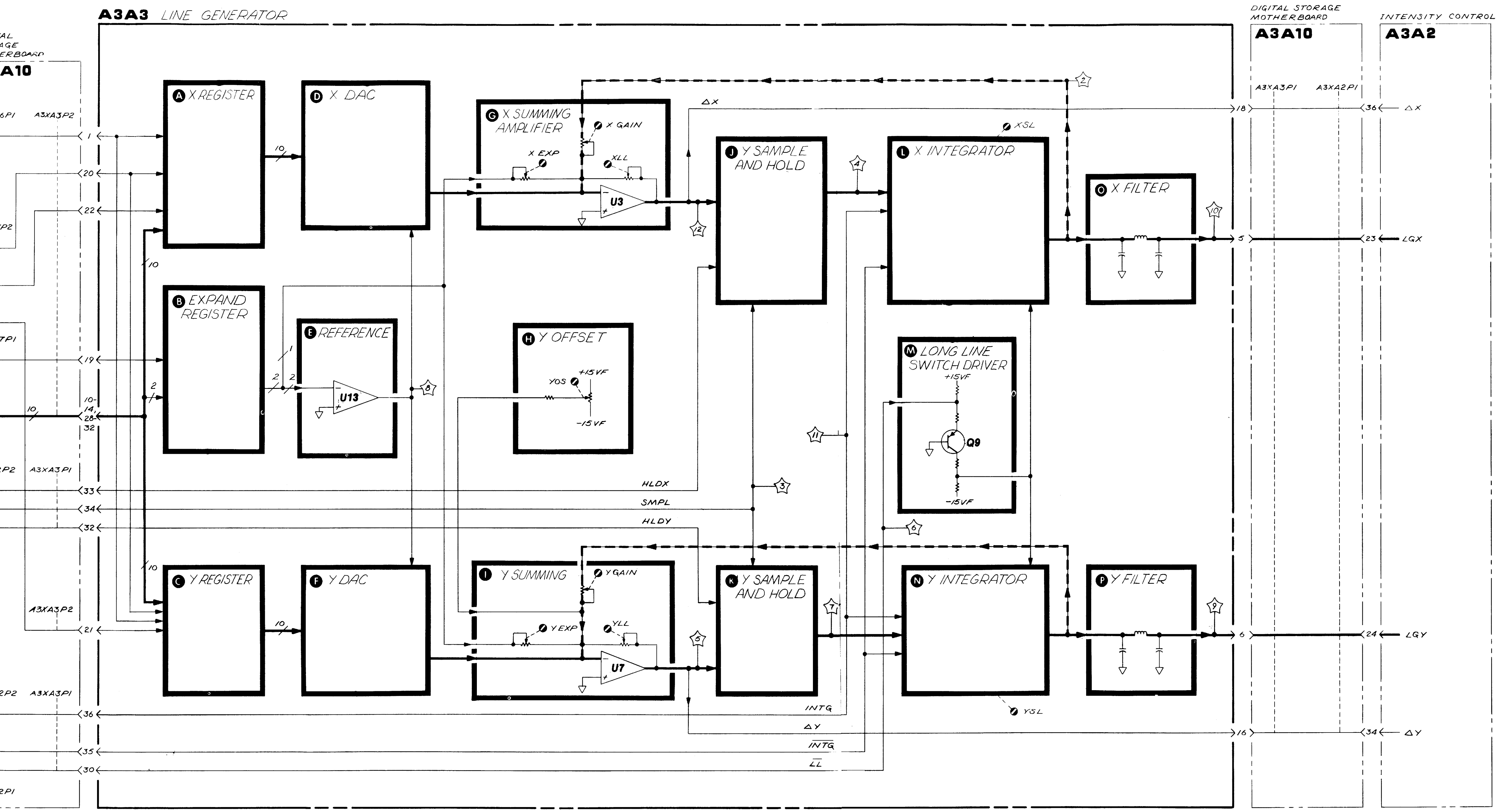


Figure 8-64. A3A3 Line Gene



A3A3

Figure 8-64. A3A3 Line Generator, Block Diagram

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Table 8-23. A3A3 Line Generator, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	B4	CR1	C4	Q16	B2	R48	B2
C2	B4	CR2	C4	Q17	B3	R49	B2
C3	B4	CR3	C4			R50	B2
C4	C3	CR4	C3	R1	C3	R51	C2
C5	C3	CR5	C4	R2	C3	R52	C2
C6	C1	CR6	C4	R3	B4	R53	C2
C7	C2	CR7	C3	R4	C3		
C8	C3	CR8	C3	R5	C3	TP1	C1
C9	B1	CR9	C3	R6	C3	TP2	D2
C10	B2	CR10	C4	R7	C2	TP3	C2
C11	C3	CR11	C3	R8	B2	TP4	C2
C12	B3	CR12	B3	R9	B2	TP5	C3
C13	C1	CR13	C3	R10	C3	TP6	B2
C14	C2	CR14	B3	R11	C3	TP7	B2
C15	B3	CR15	C3	R12	C3	TP8	B3
C16	B1	CR16	C3	R13	C2	TP9	B1
C17	B2	CR17	B3	R14	C2	TP10	A1
C18	C3	CR18	B3	R15	C2	TP11	A3
C19	B3	CR19	B3	R16	C1	TP12	A3
C20	B2	CR20	C3	R17	B2		
C21	B3	CR21	B1	R18	C2	U1	C1
C22	C1	CR22	C2	R19	B2	U2	C2
C23	C2	CR23	C2	R20	C3	U3	C3
C24	B2	CR24	B1	R21	B3	U4	C3
C25	B2	CR25	B2	R22	C1	U5	C4
C26	C1	CR26	C2	R23	C1	U6	C4
C27	C1			R24	B3	U7	C3
C28	C1	L1	B4	R25	C3	U8	B3
C29	C1	L2	B4	R26	B3	U9	C4
C30	B1	L3	C1	R27	C3	U10	C4
C31	B1	L4	C1	R28	C2	U11	B1
C32	B1	L5	B1	R29	B2	U12	B2
C33	B1	L6	B1	R30	B2	U13	B3
C34	C1	L7	B2	R31	B1	U14	B3
C35	C1			R32	B3	U15	B3
C36	C1	Q1	C2	R33	B3		
C37	C1	Q2	C2	R34	B3	VR1	B3
C38	B1	Q3	C2	R35	B3	VR2	B3
C39	B1	Q4	C2	R36	B3		
C40	C4	Q5	C1	R37	B1		
C41	C4	Q6	C2	R38	B1		
C42	B4	Q7	B2	R39	B2		
C43	C1	Q8	C2	R40	B2		
C44	B1	Q9	C2	R41	C2		
C45	C2	Q10	B1	R42	C2		
C46	C2	Q11	B2	R43	D4		
C47	C3	Q12	B2	R44	C3		
C48	C3	Q13	B2	R45	C3		
C49	C2	Q14	B2	R46	C3		
		Q15	B2	R47	C3		

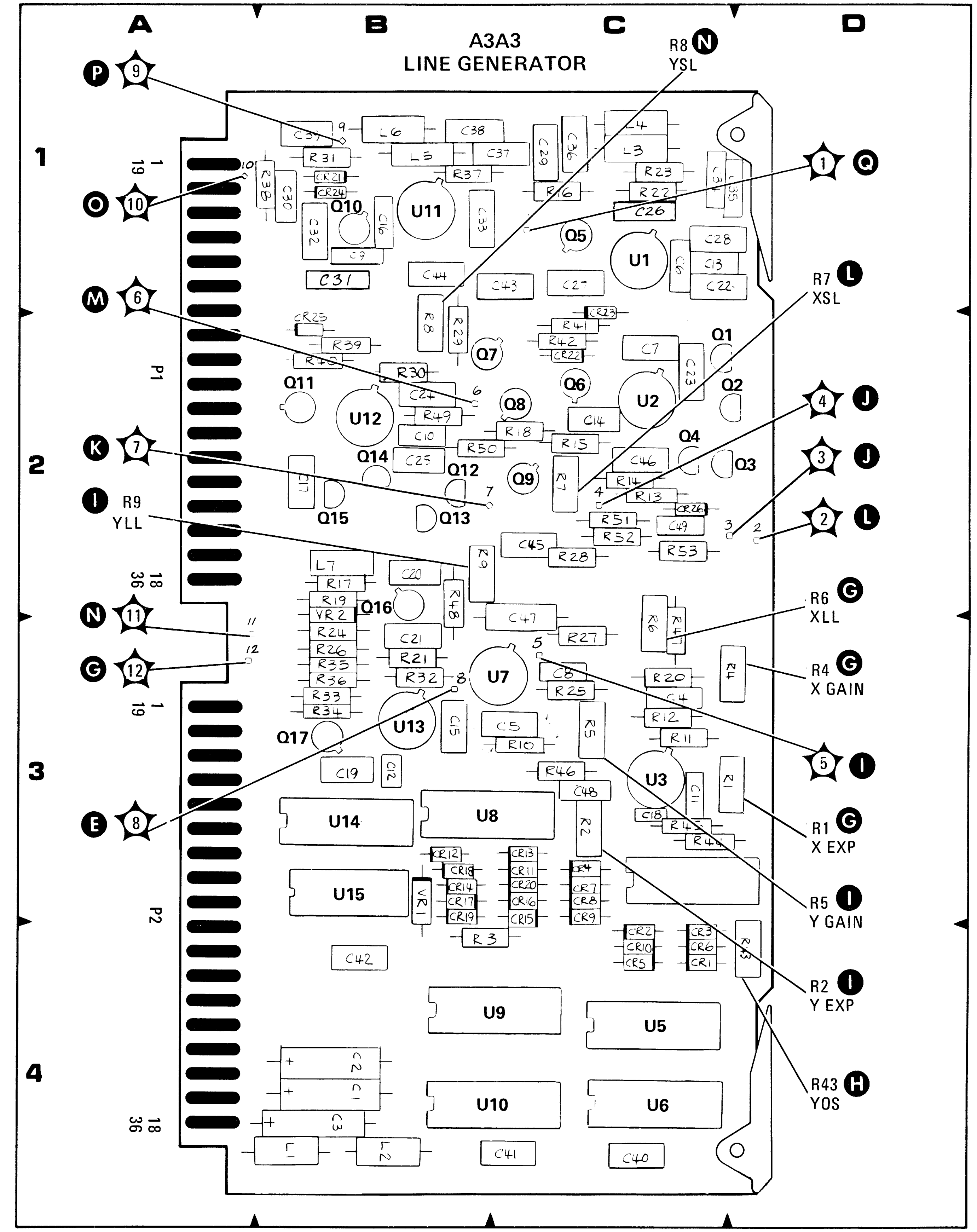


Figure 8-65. A3A3 Line Generator, Component Locations

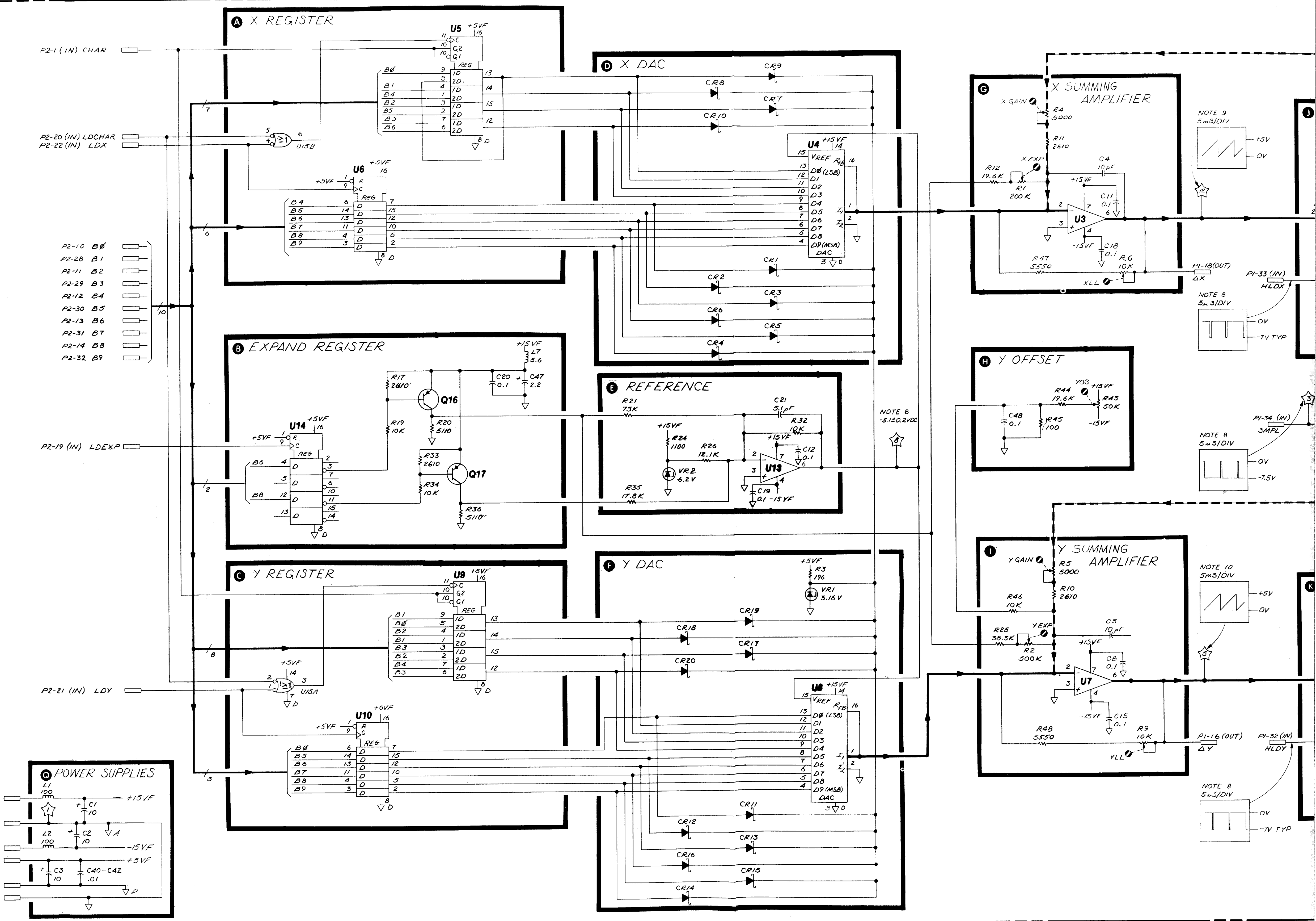
A3A3 LINE GENERATOR
85662-60026

P1

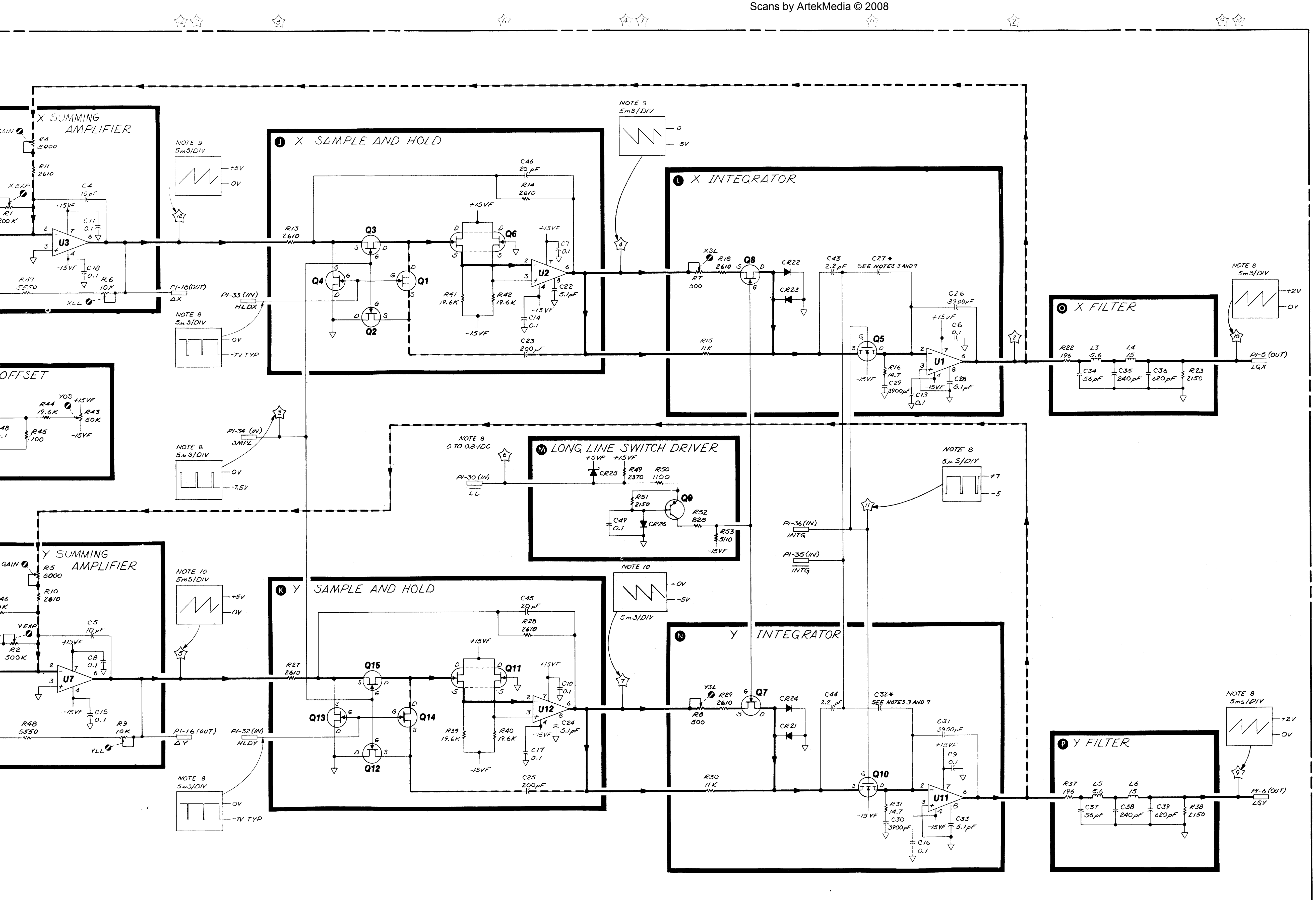
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		Q
19	GND		
2	GND		Q
20	GND		
3	GND		Q
21	GND		
4	GND		Q
22	GND		
5	LQX	A3A2 P1-23	O
23	GND		Q
6	LGY	A3A2 P1-24	P
24	GND		Q
7	GND		Q
25	GND		
8	GND		Q
26	GND		
9	GND		Q
27	GND		
10	GND		Q
28	GND		
11	GND		Q
29	GND		
12	GND		Q
30	LL	A3A2 P1-30	M
13	GND		Q
31	GND		
14	GND		Q
32	HLDY	A3A2 P2-1	K
15	GND		Q
33	HLDX	A3A2 P2-2	J
16	ΔY	A3A2 P1-34	I
34	SMPL	A3A2 P2-3	J
17	GND		Q
35	INTG	A3A2 P2-4	L N
18	ΔX	A3A2 P1-36	G
36	INTG	A3A2 P2-5	L N

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	CHAR	A3A6 P1-21	A
19	LDEXP	A3A7 P1-36	B
2	NC		
20	LDCHAR	A3A7 P2-19	A C
3	NC		
21	LDY	A3A7 P2-20	
4	NC		
22	LDX	A3A7 P2-1	A
5	NC		
23	NC		
6	NC		
24	NC		
7	NC		
25	NC		
8	NC		
26	NC		
9	NC		
27	NC		
10	BØ	DIGITAL STORAGE BUS	A
28	B1	DIGITAL STORAGE BUS	A
11	B2	DIGITAL STORAGE BUS	A
29	B3	DIGITAL STORAGE BUS	A
12	B4	DIGITAL STORAGE BUS	A
30	B5	DIGITAL STORAGE BUS	A
13	B6	DIGITAL STORAGE BUS	A
31	B7	DIGITAL STORAGE BUS	A
14	B8	DIGITAL STORAGE BUS	A
32	B9	DIGITAL STORAGE BUS	A
15	NC		
33	NC		
16	DGND		Q
34	DGND		Q
17	+5V		Q
35	AGND		Q
18	+15V		Q
36	-15V		Q



SERIAL PREFIX: 1826A DATE: APRIL 1978

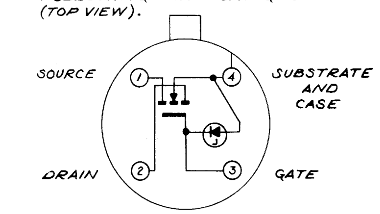


NOTES:

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. ASTERISK (*) DENOTES FACTORY SELECTED COMPONENT; TYPICAL VALUE IS SHOWN. REFER TO SECTION V FOR RANGE OF VALUES
4. MNEMONICS TABLE:

MNEMONIC	DESCIPTION
XSL	X SHORT LINE
XLL	X LONG LINE
INTG	INTEGRATE
$\overline{INTG}$	LOW= INTEGATE
YSL	Y SHORT LINE
YLL	Y LONG LINE
$\overline{LL}$	LOW= LONG LINE
HLDY	HOLD Y
LGY	LINE GEN Y POSITION
LGX	LINE GEN X POSITION
HLDX	HOLD X
SMPL	SAMPLE
Δ X	DELTA X
Δ Y	DELTA Y
LDX	LOAD X REGISTER
LDY	LOAD Y REGISTER
LD EXP	LOAD EXPAND REGISTER
CHAR	CHARACTER MODE
LD CHAR	LOAD CHARACTER REGISTER
BØ-B9	DIGITAL STORAGE BUS BITS Ø-9

5. Q5 AND Q10 ARE N-CHANNEL ENHANCEMENT MODE FETS WITH THE FOLLOWING PIN CONFIGURATION (TOP VIEW).



6. UNLESS OTHERWISE INDICATED, LOGIC LEVELS ARE TTL:
   +2.0V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW
7. C27 AND C32 ARE FACTORY SELECTED FOR OPTIMUM PERFORMANCE AND MAY NOT BE PRESENT.
8. TEST CONDITIONS TO OBTAIN THESE WAVEFORMS ARE AS FOLLOWS:
   1. ROTATE A3A2R12 TO FULL CW POSITION
   2. SHORT A3A6TP3 TO A3A6TP6
   3. SHORT A3A7TP4 TO A3A7TP6
   4. PUSH A3A7S1
9. LIFT R11 AND USE TEST CONDITIONS FROM NOTE 8.
10. LIFT R10 AND USE TEST CONDITIONS FROM NOTE 8.

A3A3

Figure 8-66. A3A3 Line Generator, Schematic Diagram

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A3A4 MEMORY, CIRCUIT DESCRIPTION

A3A4 Memory contains 4096 12-bit words of random-access memory (RAM) storage and 2048 8-bit words of read-only memory (ROM) storage.

4K x 12 MEMORY E

Each of the RAMs U1 through U12 contains 4096 bits of storage. Stored in memory are all data that may be displayed on the CRT, including display annotation data (center frequency, reference level, etc.), graticules, characters, and Trace A, Trace B, and Trace C data.

Character Stroke Memory G

U13 is a 16,384-bit ROM in which is stored the stroke description of each character: the length and direction of each stroke required to "draw" a character and blanking data.

Memory Address Register A

U16 and U17 hold the address during memory access.

Memory Data Register D

U15 and U18 hold data while it is being written into memory.

Memory Output Buffer C

U14 and U19 are buffers to output memory data onto the Digital Storage Bus.

Chip Enable Driver B

U20 provides a 12-volt clock driver for the RAMs.

Stroke Counter F

U22 is a 4-bit counter used in the character display routine.

A3A4
MEMORY

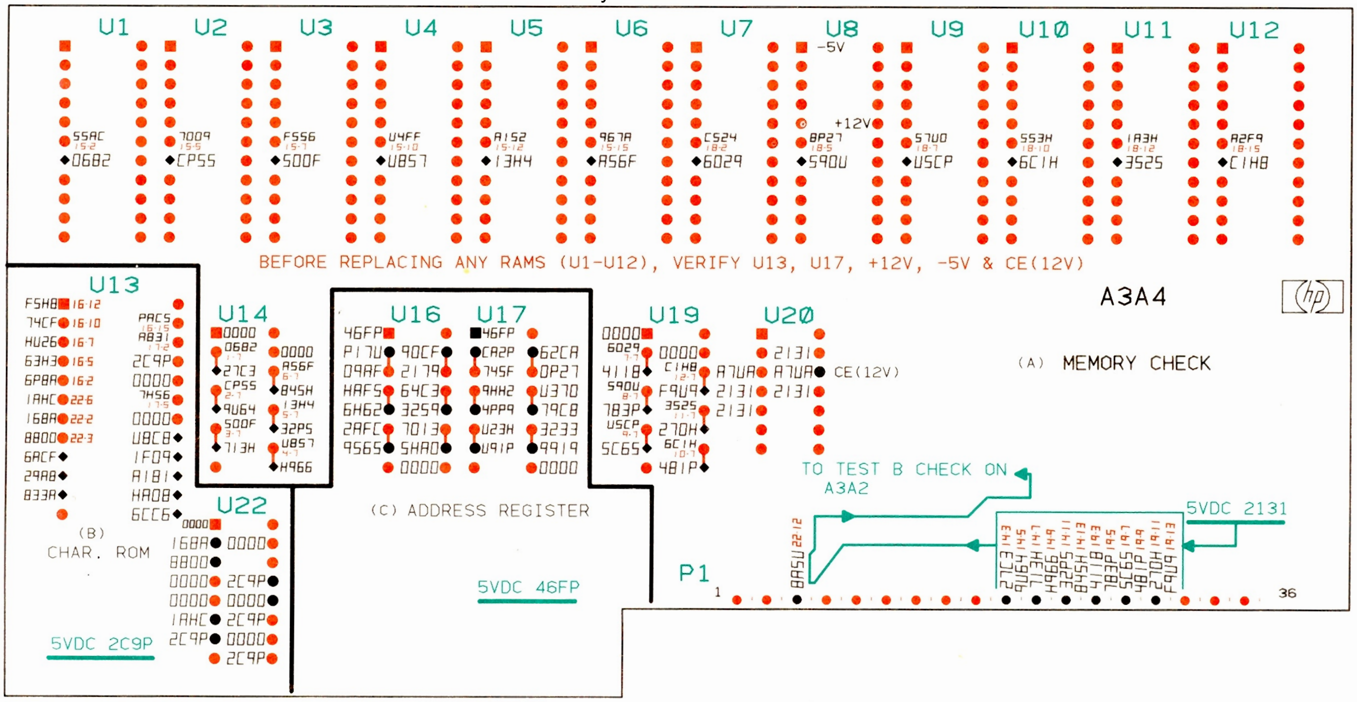

Figure 8-67. A3A4 Memory, Signature Analysis Troubleshooting Diagram

(A) MEMORY CHECK

Spectrum Analyzer Connections:

Adjust A3A2R12 LL fully CW
Connect A3A7J1 Jumper to pins 3 and 12
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⎠ to A3A7TP1
START ⎠ to A3A6TP2
STOP ⎠ to A3A6TP2
Probe GND to A3A4P1-16

(B) CHARACTER ROM

Spectrum Analyzer Connections:

Adjust A3A2R12 LL fully CW
Connect A3A7J1 Jumper to pins 3 and 12
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⎠ to A3A4P1-21
START ⎠ to A3A6TP2
STOP ⎝ to A3A6TP2
Probe GND to A3A4P1-16

(C) ADDRESS REGISTER

Spectrum Analyzer Connections:

Adjust A3A2R12 LL fully CW
Connect A3A7J1 Jumper to pins 3 and 12
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⎠ to A3A4P1-23
START ⎠ to A3A6TP2
STOP ⎠ to A3A6TP2
Probe GND to A3A4P1-16

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

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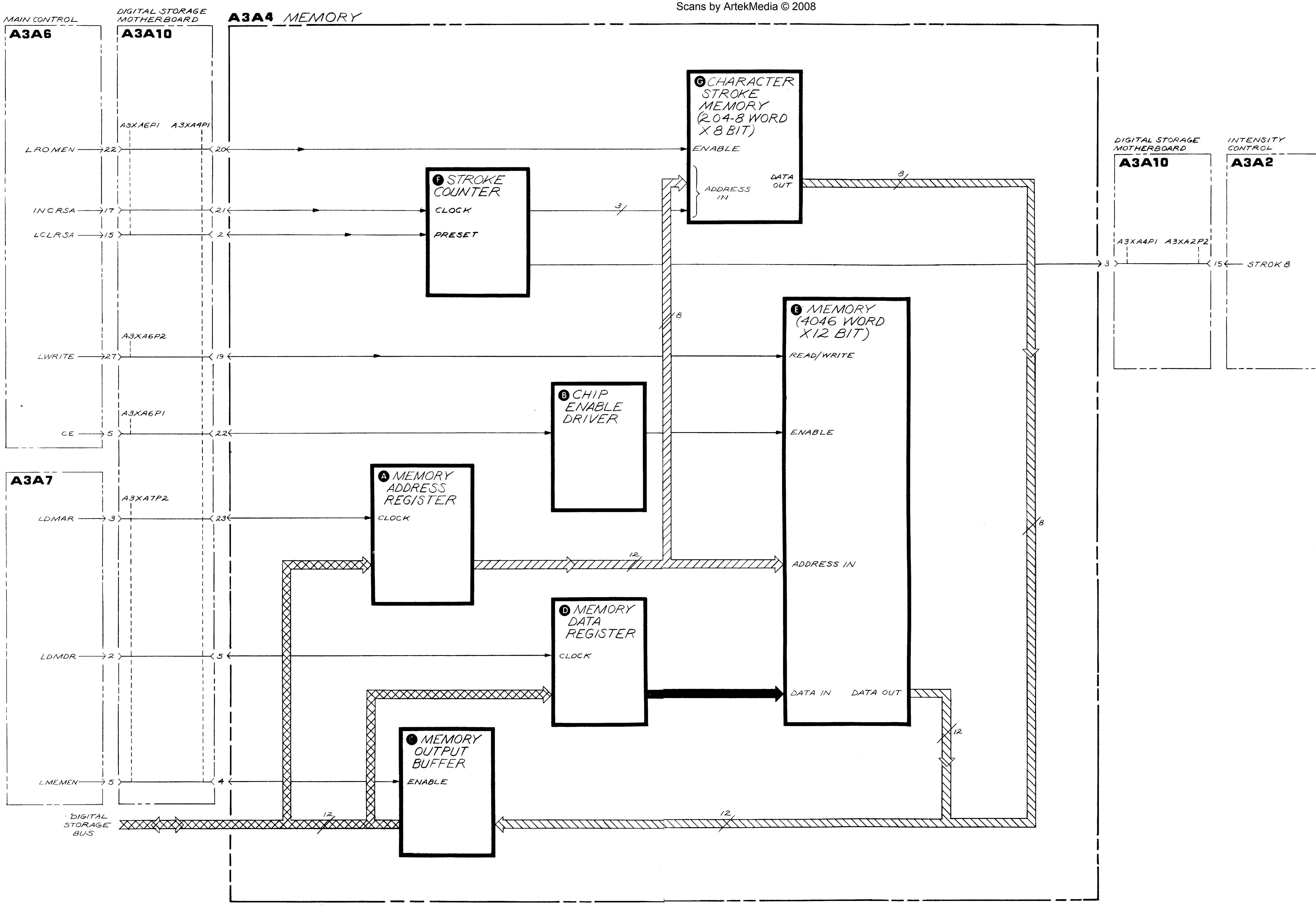


A3A4

Figure 8-68. A3A4 Memory, Block Diagram

Table 8-24. A3A4 Memory, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A4	85662-60023	1	BOARD ASSEMBLY, MEMORY	28480	85662-60023
A3A4C1	0160-4084	16	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C2	0180-2144	1	CAPACITOR-FXD 200UF+75-10% 25VDC AL	0420J	30D207G025DH9
A3A4C3	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C4	0160-0127	10	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C5	0180-1746	5	CAPACITOR-FXD 15UF+-10% 20VDC TA	0420J	150D156X9020B2
A3A4C6	0180-0374	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	0420J	150D106X9020B2
A3A4C7	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C10	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	0420J	150D156X9020B2
A3A4C11	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C12	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	0420J	150D156X9020B2
A3A4C13	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C14	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C15	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C16	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C17	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C18	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C19	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C20	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C21	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	0420J	150D156X9020B2
A3A4C22	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C23	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C24	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C25	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C26	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C27	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4C28	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	0420J	150D156X9020B2
A3A4C29	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC C[illegible]	28480	0160-0127
A3A4C30	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C31	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C32	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A4C33	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A4L1	9140-0171	1	COIL-MLD 40UH 10% Q=20 .296DX.968LG	28480	9140-0171
A3A4L2	9140-0210	1	COIL-MLD 100UH 5% Q=50 .155DX.375LG	02178	15-1315-12J
A3A4R1	0757-0280	1	RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A3A4U1	1818-0156	12	IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U2	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U3	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U4	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U5	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U6	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U7	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U8	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U9	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U10	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U11	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U12	1818-0156		IC TMS4060N 4K RAM NMOS	28480	1818-0156
A3A4U13	1818-0293	1		28480	1818-0293
A3A4U14	1820-1492	2	IC BFR TTL LS INV HEX 1-INP	0169H	SN74LS368N
A3A4U15	1820-1196	4	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	0379D	AM74LS174N
A3A4U16	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	0379D	AM74LS174N
A3A4U17	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	0379D	AM74LS174N
A3A4U18	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	0379D	AM74LS174N
A3A4U19	1820-1492		IC BFR TTL LS INV HEX 1-INP	0169H	SN74LS368N
A3A4U20	1820-1982	1	IC DRVR TTL* DUAL	0169H	SN75363N
A3A4U21	1826-0147	1	IC 7812 V RGLTR	0223G	7812UC
A3A4U22	1820-1278	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	0169H	SN74LS191N
A3A4VR1	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	0203G	SZ 10939-98
			A3A4 MISCELLANEOUS PARTS		
	1480-0073	2	PIN:DRIVE 0.250" LG .062" DIA	28480	1480-0073
	4040-0752	2	EXTRACTOR-PC BOARD YEL POLYC	28480	4040-0752

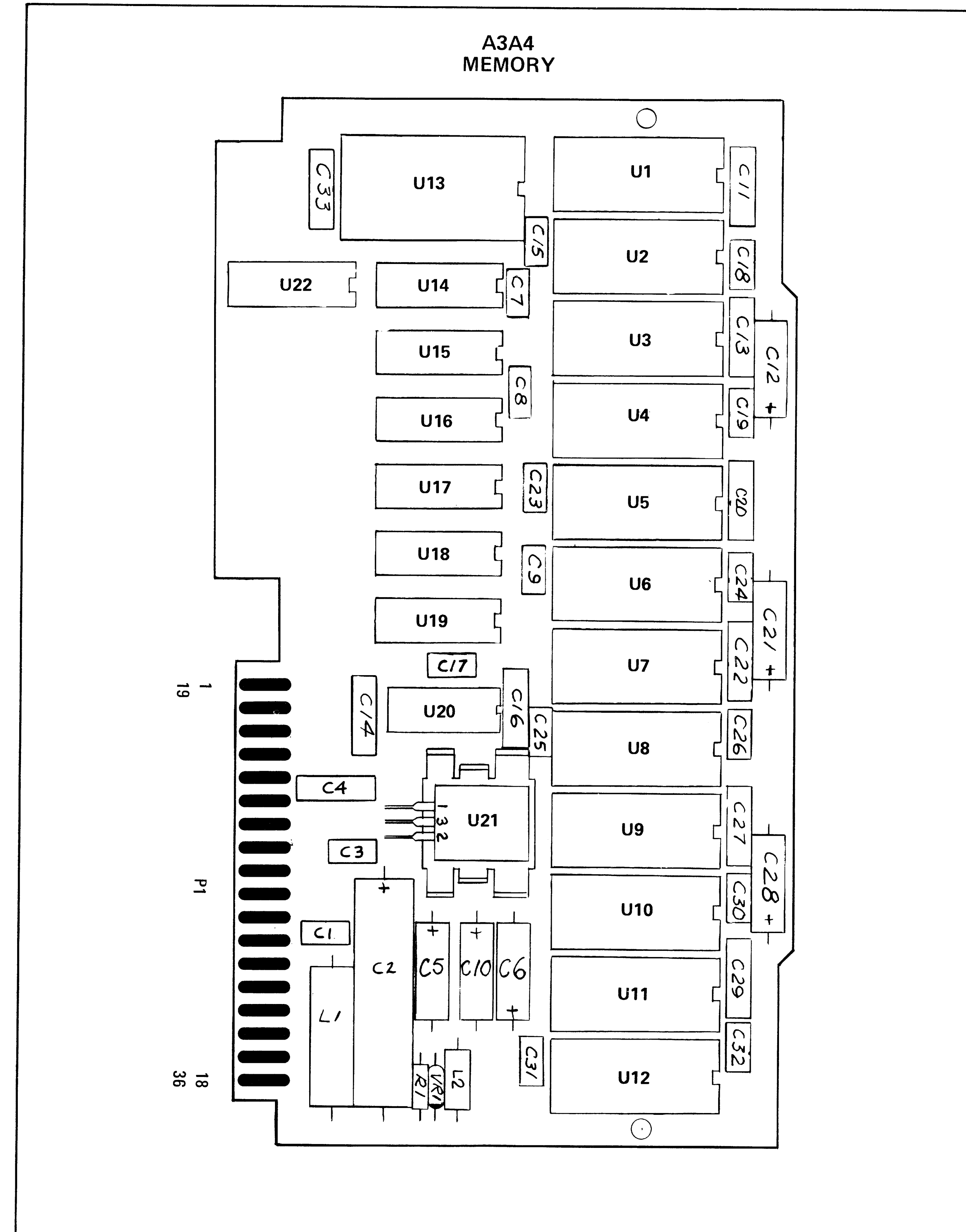
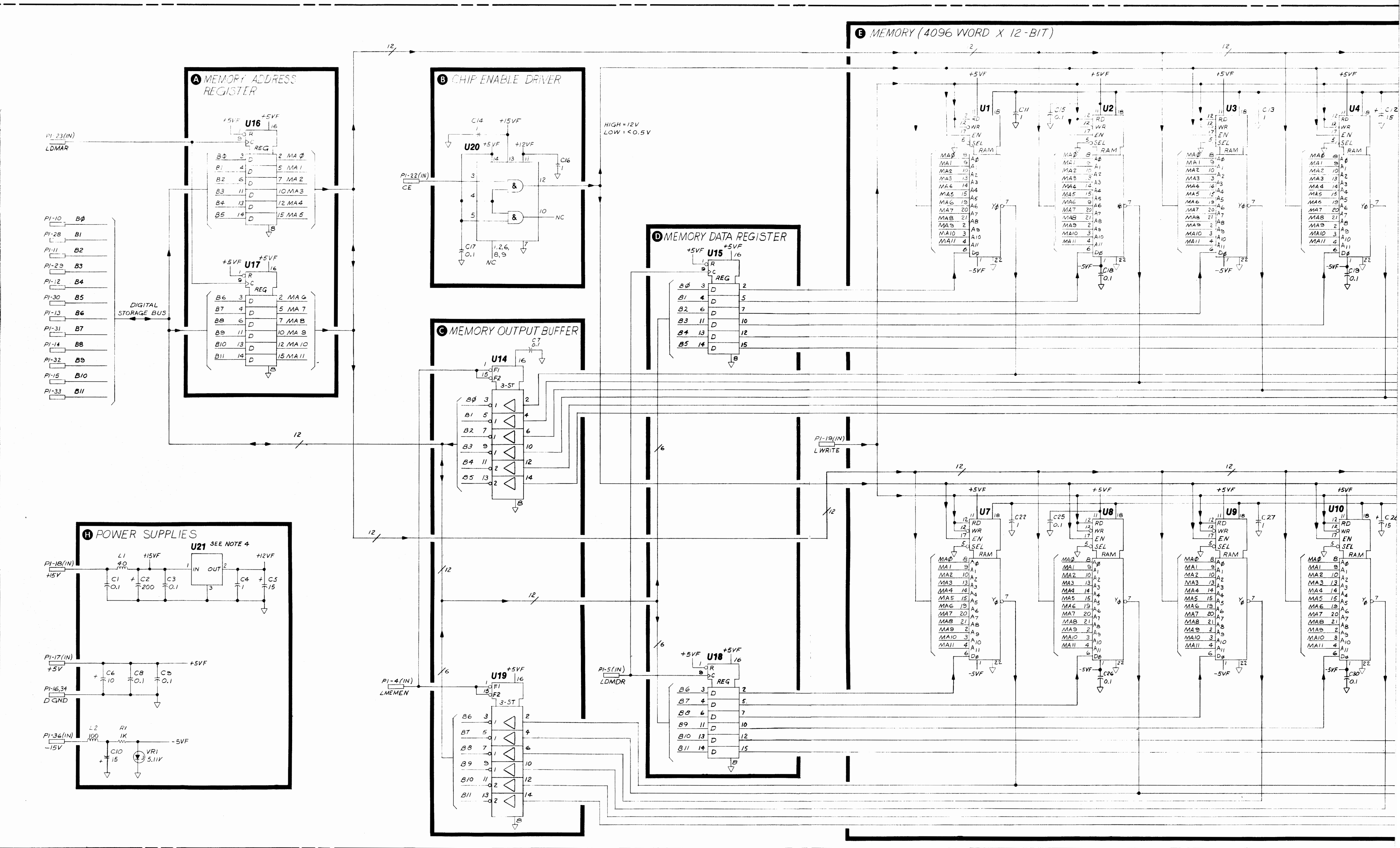


Figure 8-69. A3A4 Memory, Component Locations

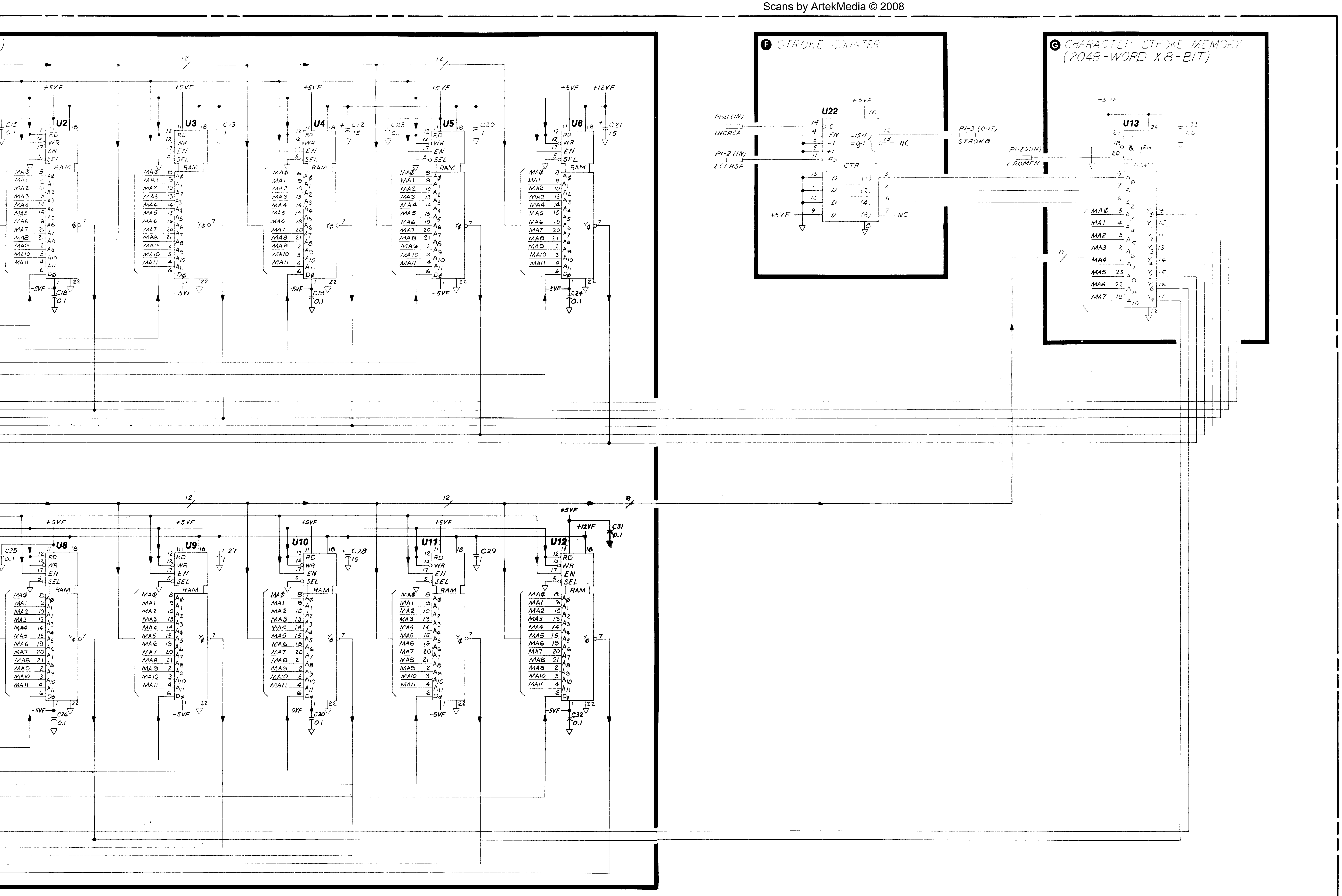
A3A4 MEMORY
85662-60023

P1

PIN	SIGNAL	TO/FROM	FUNCTIONAL BLOCK
1	NC		
19	L WRITE	A3A6, P2-22	E
2	LCLRSA	A3A6, P1-15	F
20	LROMEN	A3A6, P1-22	G
3	STROKB	A3A2, P2-15	F
21	INCRSA	A3A6, P1-17	F
4	LMEMEN	A3A7, P2-5	C
22	CE	A3A6, P1-5	B
5	LDMDR	A3A7, P2-2	D
23	LDMAR	A3A7, P2-3	A
6	NC		
24	NC		
7	NC		
25	NC		
8	NC		
26	NC		
9	NC		
27	NC		
10	B0	DIGITAL STORAGE BUS	A
28	B1	DIGITAL STORAGE BUS	A
11	B2	DIGITAL STORAGE BUS	A
29	B3	DIGITAL STORAGE BUS	A
12	B4	DIGITAL STORAGE BUS	A
30	B5	DIGITAL STORAGE BUS	A
13	B6	DIGITAL STORAGE BUS	A
31	B7	DIGITAL STORAGE BUS	A
14	B8	DIGITAL STORAGE BUS	A
32	B9	DIGITAL STORAGE BUS	A
15	B10	DIGITAL STORAGE BUS	A
33	B11	DIGITAL STORAGE BUS	A
16	D GND		H
34	D GND		H
17	+5V		H
35	NC		
18	+15V		H
36	-15V		H



SERIAL PREFIX: 1826A 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:

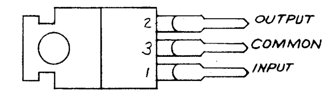
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

3. MNEMONICS TABLE

MNEMONIC	DESCRIPTION
LDMAR	LOAD MEMORY ADDRESS REG.
LMEMEN	LOW = MEMORY ENABLE
LWRITE	LOW = WRITE IN MEMORY
LDMDR	LOAD MEMORY DATA REG.
LCLRSA	LOW = CLEAR STROKE ADDRESS
INCRSA	INCREMENT STROKE ADDRESS
STROK8	EIGHTH CHARACTER STROKE
LROMEN	LOW = ROM ENABLE
DGND	DIGITAL GROUND
CE	CHIP ENABLE

4. U21 IS A 3-TERMINAL, +12V VOLTAGE REGULATOR.

TOP VIEW



5. UNLESS OTHERWISE INDICATED, LOGIC LEVELS ARE TTL:

   +2.0V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW

A3A4

Figure 8-70. A3A4 Memory, Schematic Diagram

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A3A5 DATA MANIPULATOR, CIRCUIT DESCRIPTION

A3A5 Data Manipulator contains 16 random-access memory (RAM) registers and 32 read-only memory (ROM) registers, an accumulator, and an arithmetic logic unit (ALU). This assembly provides all data functions and transfers for digital storage.

Register RAM B

U13, U15, U17 form the 16 12-bit RAM registers used for data storage during data manipulation.

Constant ROM F

U1 and U18 form the 16 12-bit ROM registers used as constants for data storage during data manipulation.

Accumulator D

U7 and U9 form the 12-bit Accumulator, which receives and holds all results of ALU operations.

Buffer C

U5 and U11 are three-state data buffers that allow the Accumulator data to be transferred to the Source Bus.

Arithmetic Logic Unit (ALU) E

U2, U3, and U4 are the main Arithmetic Logic Unit (ALU). U16 provides high-speed carry look-ahead. U14 decodes ALU outputs to determine whether a zero-value result has been generated.

Pipeline Register G

U12 and U24 form an instruction Pipeline Register for data manipulation instructions.

Control Decoder H

U19 through U23 decode data manipulation instructions into the necessary control lines.

Muliplexer/Bus Driver A

U6, U8, and U10 form a 12-bit Bus Driver with two data inputs. Data from the RAM Bus or from the Accumulator Bus may be transferred to the main Digital Storage Bus through these drivers.

A3A5
DATA MANIPULATOR

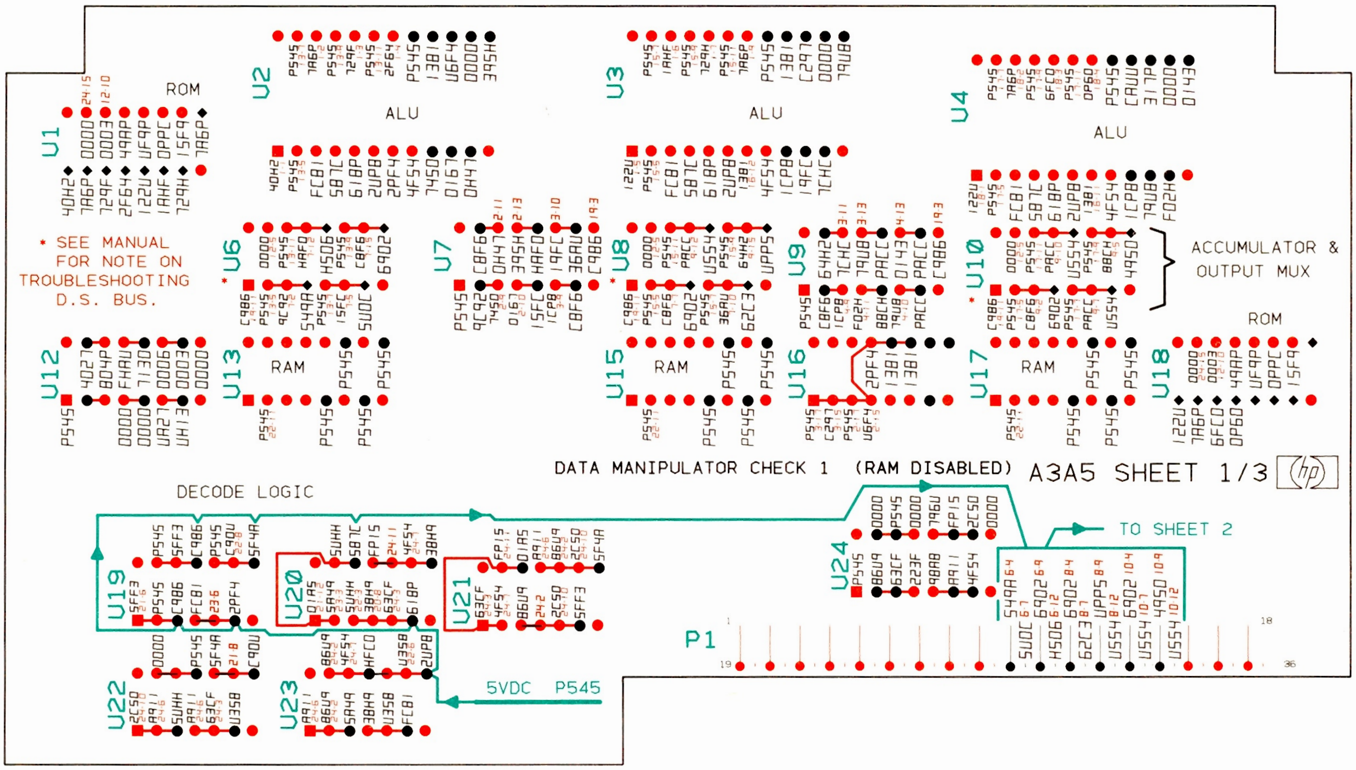

Figure 8-71. A3A5 Data Manipulator, Signature Analysis Troubleshooting Diagram (1 of 3)

DATA MANIPULATOR CHECK 1

Spectrum Analyzer Connections:

Ground A3A5TP2, A3A6TP7, and A3A6TP8
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⟋ to A3A5P1-22
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2
POD GND to A3A5TP1
Probe GND to A3A5TP1

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

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A3A5
DATA MANIPULATOR

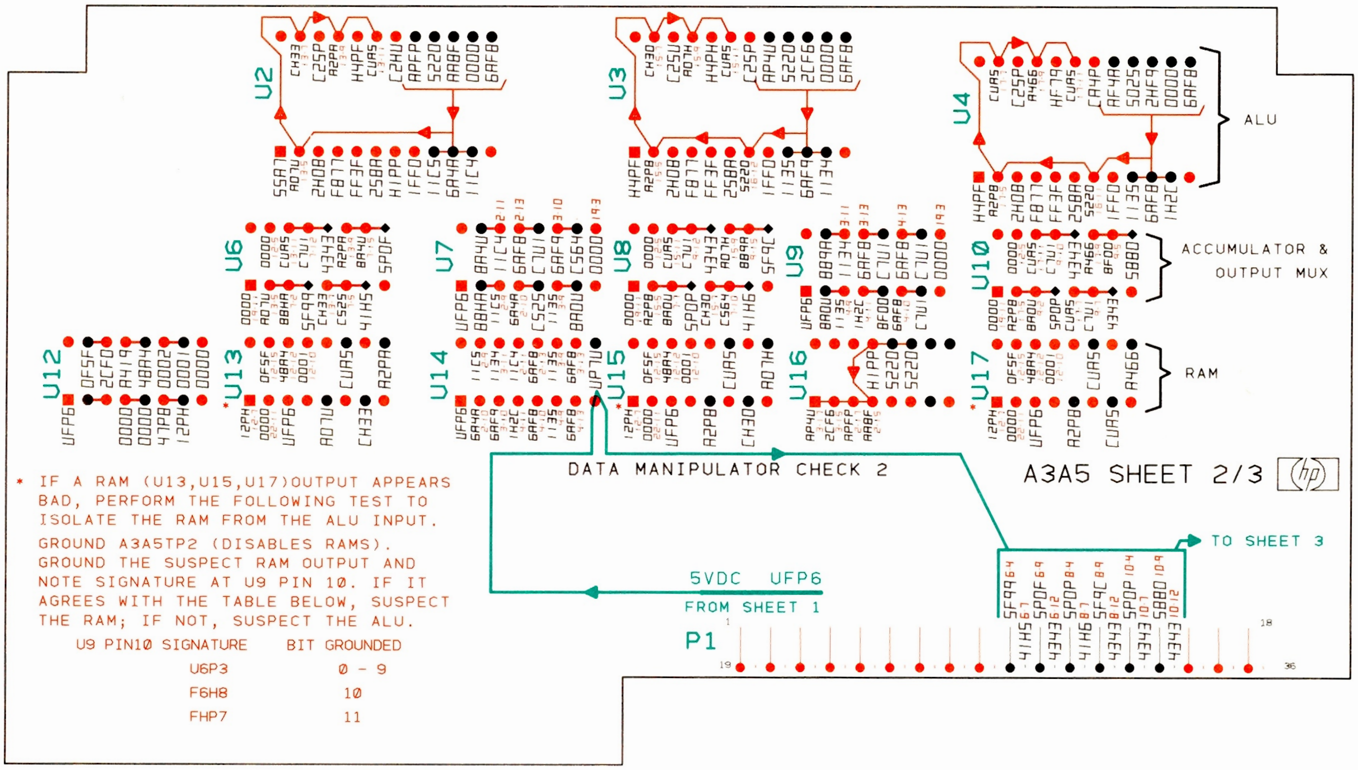

Figure 8-71. A3A5 Data Manipulator, Signature Analysis Troubleshooting Diagram (2 of 3)

DATA MANIPULATOR CHECK 2

Spectrum Analyzer Connections:

Ground A3A6TP7 and A3A6TP8
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⌠ to A3A5TP4
START ⌠ to A3A6TP2
STOP ⌠ to A3A6TP2
POD GND to A3A5TP1
Probe GND to A3A5TP1

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

A3A5
DATA MANIPULATOR

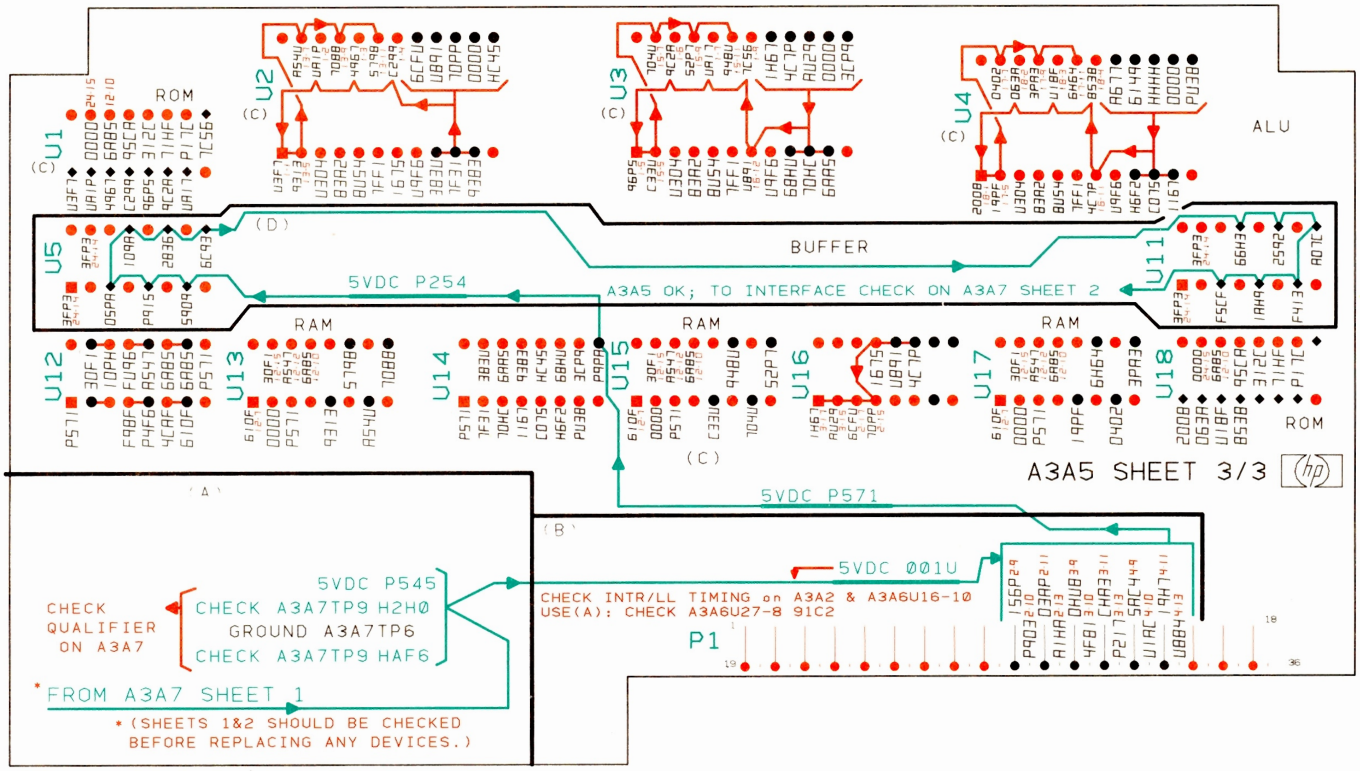

Figure 8-71. A3A5 Data Manipulator, Signature Analysis Troubleshooting Diagram (3 of 3)

(A)

Spectrum Analyzer Connections:

Jumper A3A6TP3 to A3A6TP6

Ground A3A6TP7 and A3A6TP8

Signature Analyzer Connections:

CLOCK ⟋ to A3A5P1-22
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2
POD GND to A3A5TP1
Probe GND to A3A5TP1

(B)

Spectrum Analyzer Connections:

Adjust A3A2R12 LL fully CW
Ground A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⟋ to A3A5P1-22
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2
POD GND to A3A5TP1
Probe GND to A3A5TP1

(C)

Spectrum Analyzer Connections:

Ground A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⟋ to A3A5TP4
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2
POD GND to A3A5TP1
Probe GND to A3A5TP1

(D)

Spectrum Analyzer Connections:

Adjust A3A2R12 LL fully CW
Jumper A3A7TP4 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⟋ to A3A5TP4
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2
POD GND to A3A5TP1
Probe GND to A3A5TP1

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

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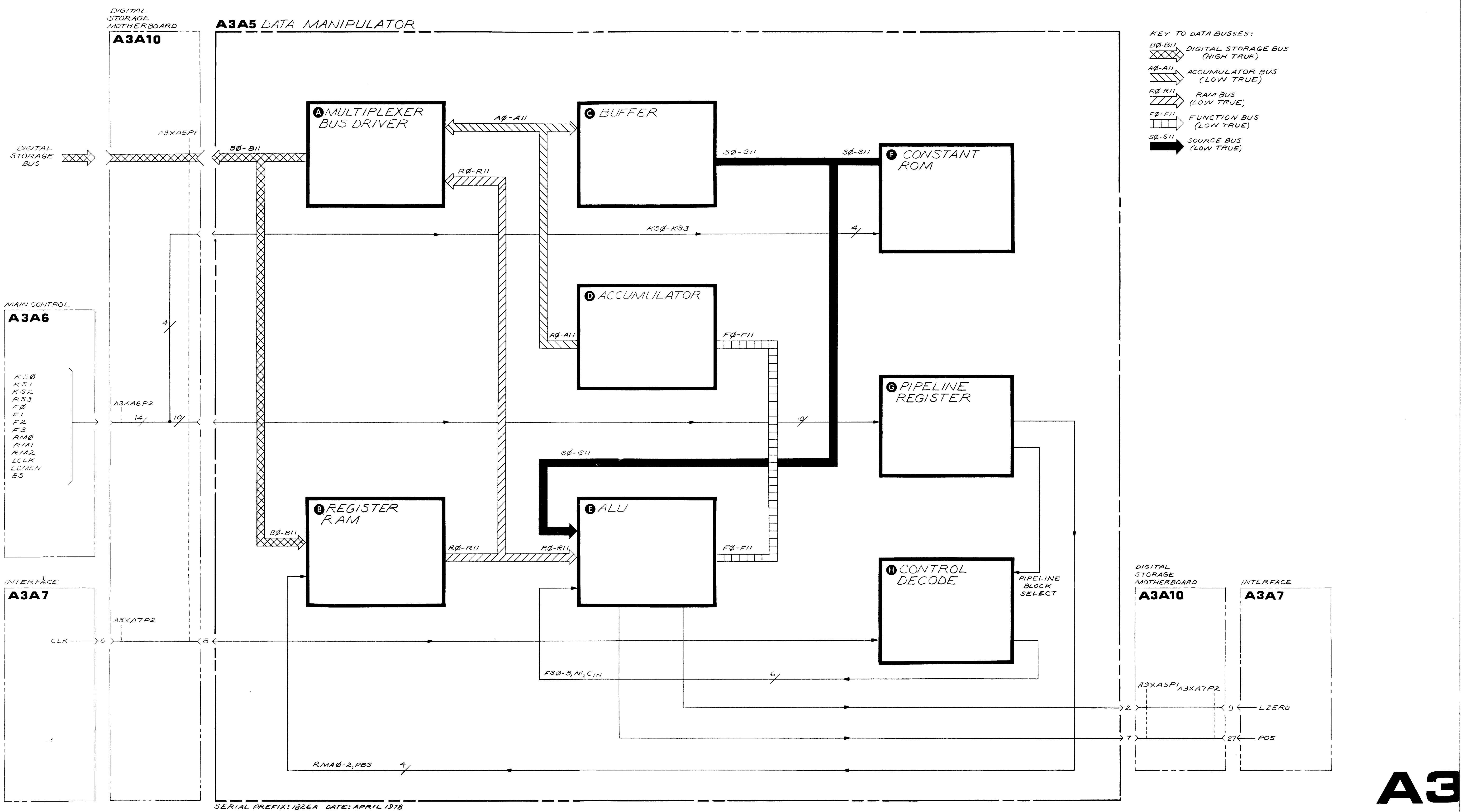
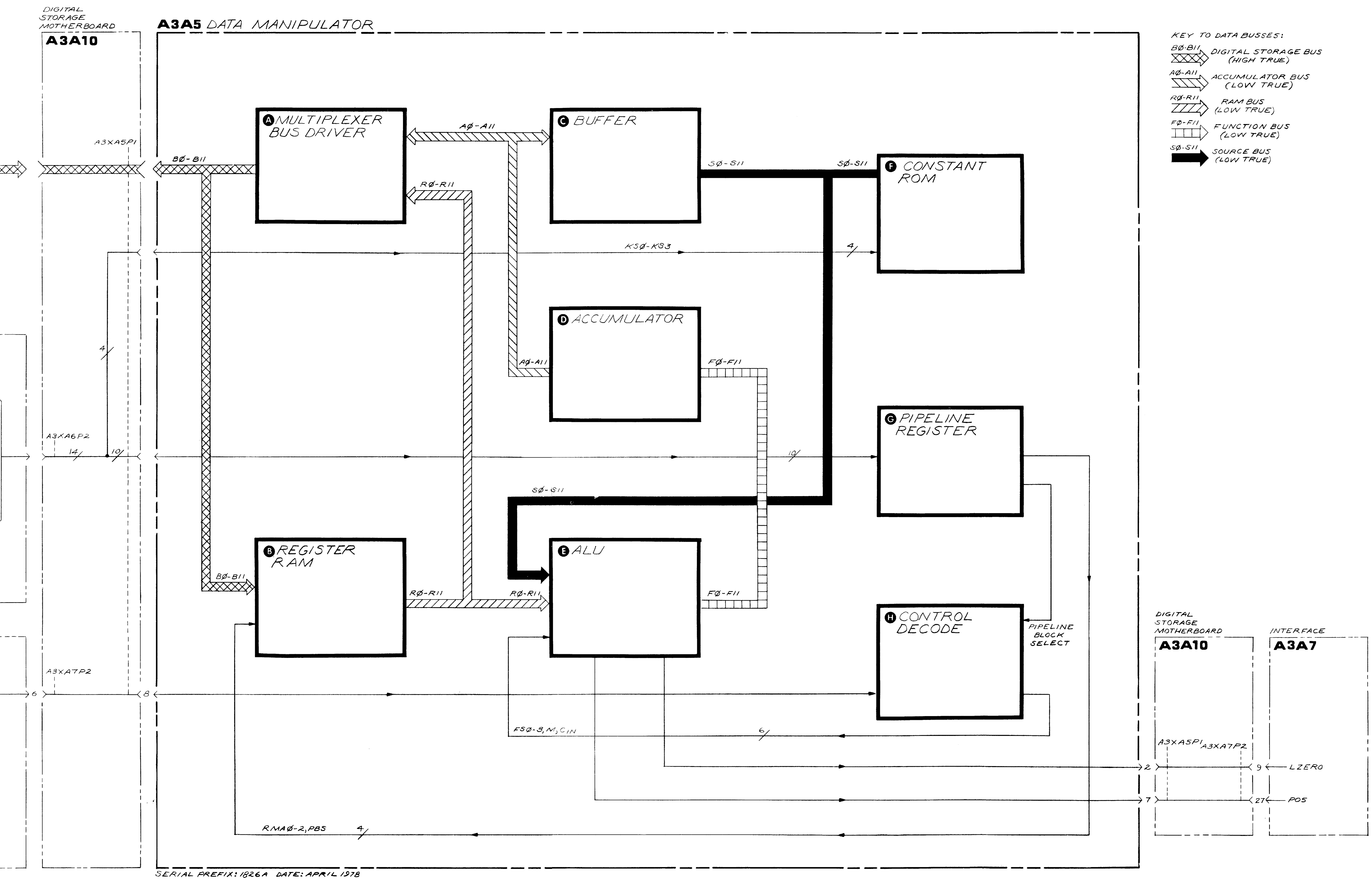


A3

Figure 8-72. A3A5 Data Manipulator,



A3A5

Figure 8-72. A3A5 Data Manipulator, Block Diagram

Table 8-25. A3A5 Data Manipulator, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A5	85662-60024	1	BOARD ASSEMBLY, DATA MANIPULATOR	28480	85662-60024
A3A5C1	0160-4084	11	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C2	0180-0228	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3A5C3	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C4	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C5	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C6	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C7	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C10	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C11	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C12	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A5C13	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3A5L1	08558-80011	1	FILTER, COIL, BLUE	28480	08558-80011
A3A5R1	0698-3155	14	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R2	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R3	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R4	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R5	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R6	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R7	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R8	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R9	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R10	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R11	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R12	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R13	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R14	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A5R15	0698-3132	2	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A3A5R16	0698-3132		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A3A5TP1	0360-0535	4	TERMINAL TEST POINT PCB	28480	0360-0535
A3A5TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A5TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A5TP4	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A5U1			NOT ASSIGNED		
A3A5U2	1820-1974	3	IC ARITH-LGC-UN TTL S	01295	SN74S181J
A3A5U3	1820-1974		IC ARITH-LGC-UN TTL S	01295	SN74S181J
A3A5U4	1820-1974		IC ARITH-LGC-UN TTL S	01295	SN74S181J
A3A5U5	1820-1491	2	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A5U6	1820-1439	3	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE	01295	SN74LS258N
A3A5U7	1820-1196	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A5U8	1820-1439		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE	01295	SN74LS258N
A3A5U9	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A5U10	1820-1439		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE	01295	SN74LS258N
A3A5U11	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A5U12	1820-1076	1	IC FF TTL S D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74S174N
A3A5U13	1816-0724	3	IC SN74S189N 64-BIT RAM TTL	01295	SN74S189N
A3A5U14	1820-1130	1	IC GATE TTL S NAND 13-INP	01295	SN74S133N
A3A5U15	1816-0724		IC SN74S189N 64-BIT RAM TTL	01295	SN74S189N
A3A5U16	1820-1305	1	IC GEN TTL S LOOK-AHD-CRY	01295	SN74S182N
A3A5U17	1816-0724		IC SN74S189N 64-BIT RAM TTL	01295	SN74S189N
A3A5U18			NOT ASSIGNED		
A3A5U19	1820-0681	1	IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
A3A5U20	1820-0685	1	IC GATE TTL S NAND TPL 3-INP	01295	SN74S10N
A3A5U21	1820-1202	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3A5U22	1820-1197	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3A5U23	1820-1287	1	IC BFR TTL LS NAND QUAD 2-INP	01295	SN74LS37N
A3A5U24	1820-1195	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
			A3A5 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0753	2	EXTRACTOR-PC BOARD GRN POLYC	28480	4040-0753

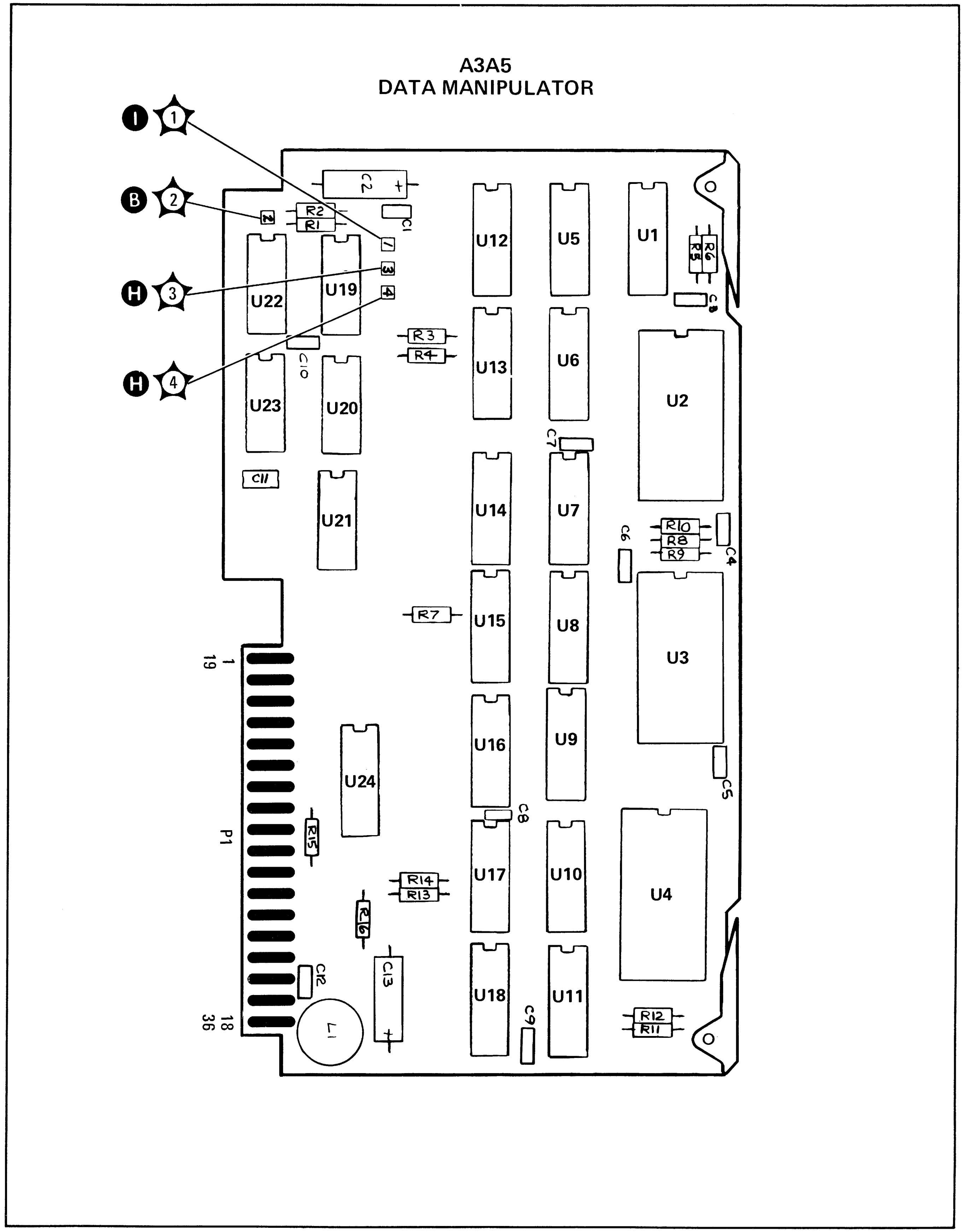
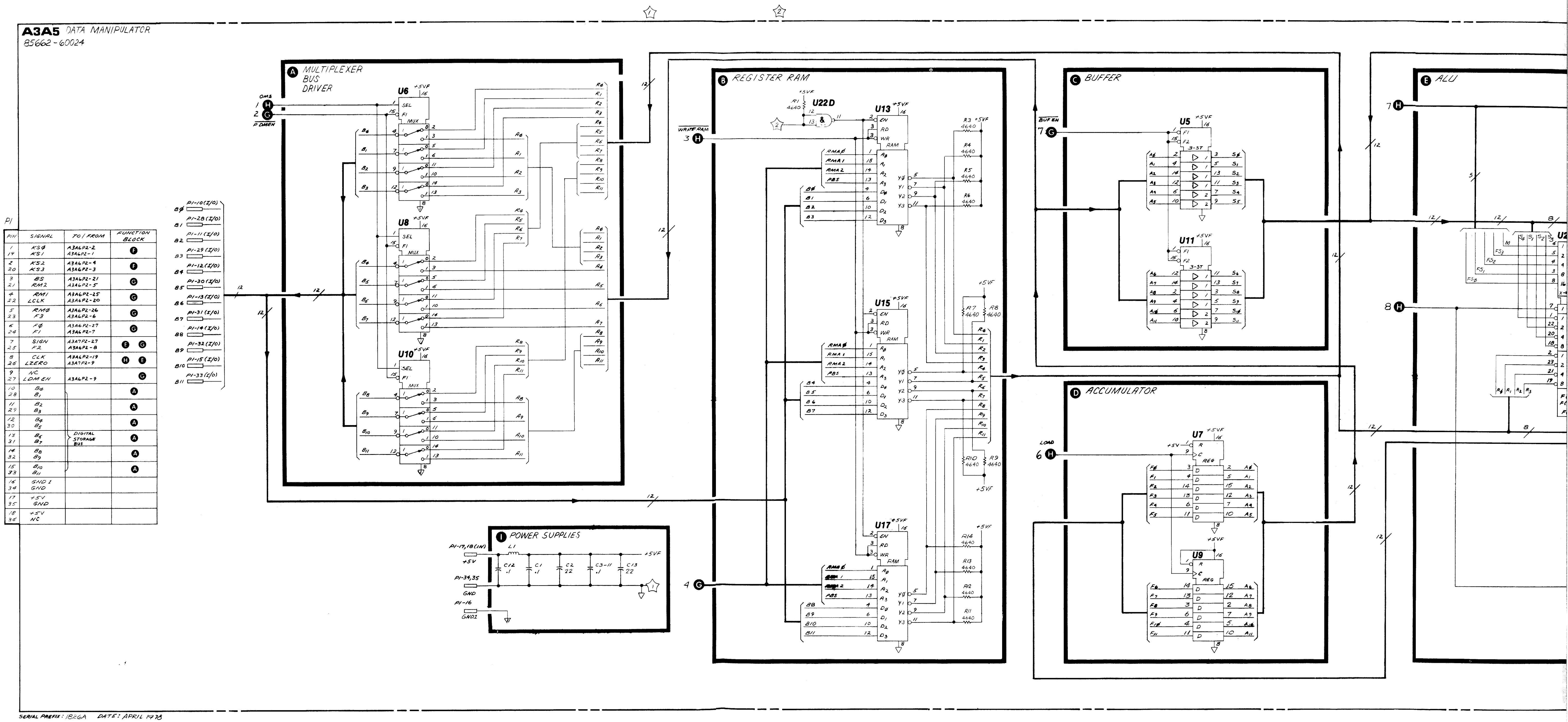
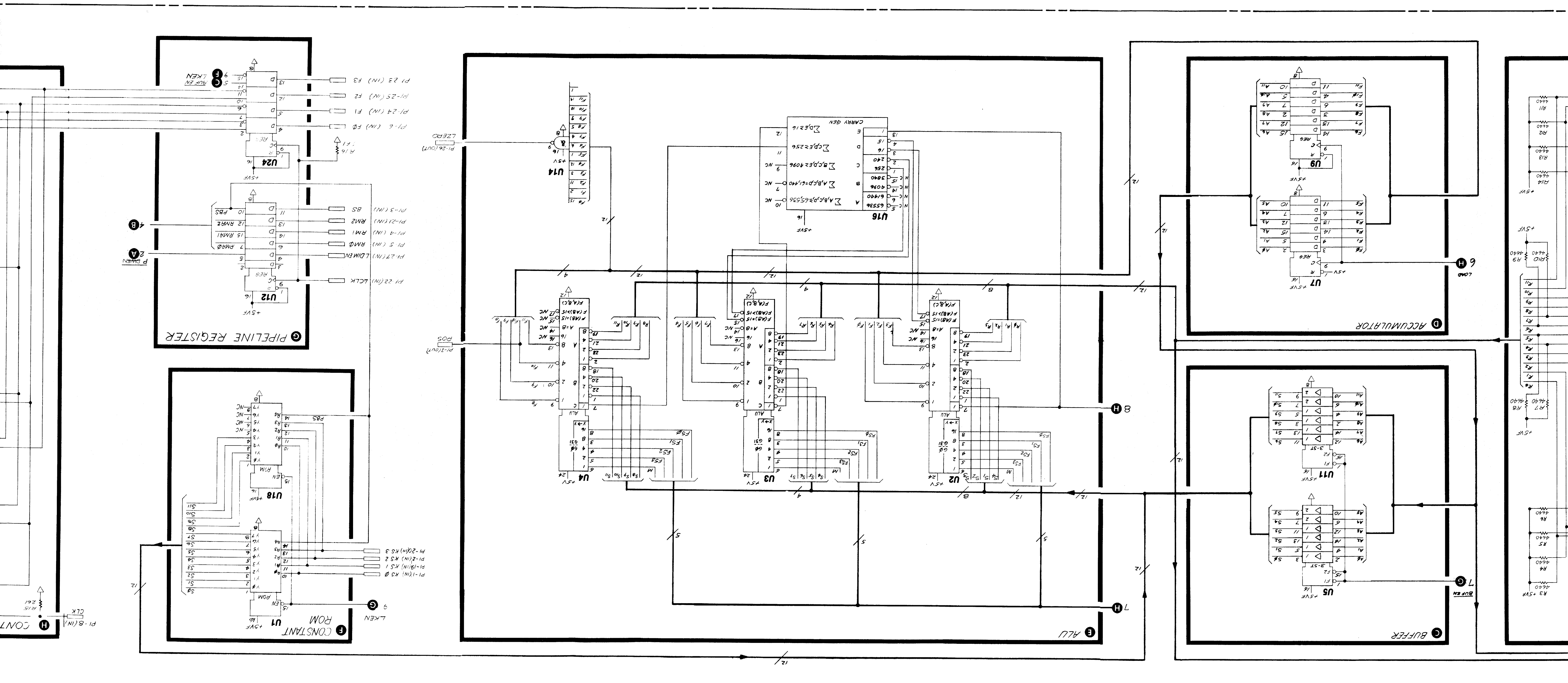


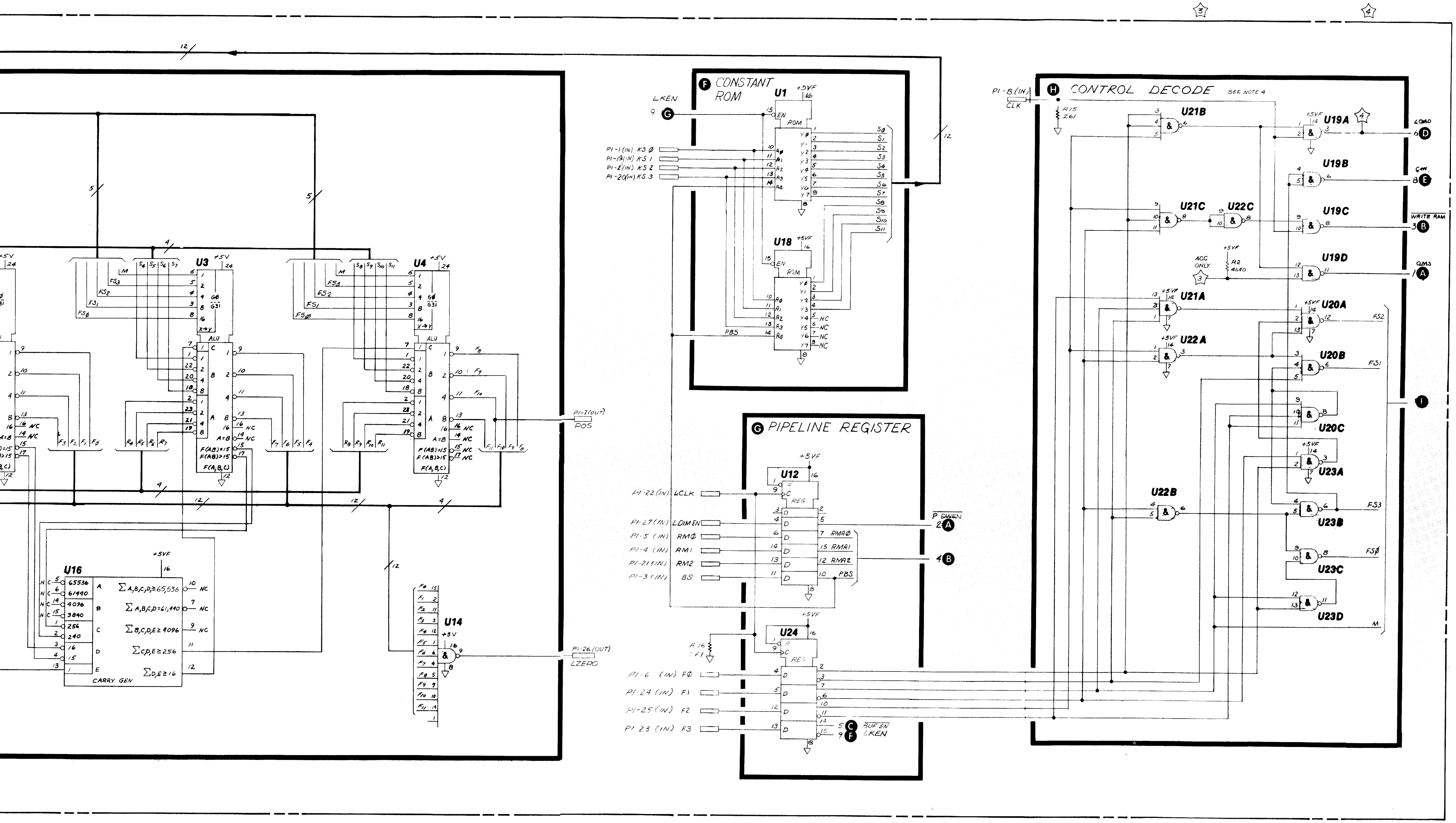
Figure 8-73. A3A5 Data Manipulator, Component Locations



P1

PIN	SIGNAL	TO / FROM	FUNCTION BLOCK
1 19	KSØ KS1	A3A6P2-2 A3A6P2-1	F
2 20	KS2 KS3	A3A6P2-4 A3A6P2-3	F
3 21	BS RM2	A3A6P2-21 A3A6P2-5	G
4 22	RM1 LCLK	A3A6P2-25 A3A6P2-20	G
5 23	RMØ F3	A3A6P2-26 A3A6P2-6	G
6 24	FØ F1	A3A6P2-27 A3A6P2-7	G
7 25	SIGN F2	A3A7P2-27 A3A6P2-8	E G
8 26	CLK LZERO	A3A6P2-19 A3A7P2-9	H E
9 27	NC LDM EN	A3A6P2-9	G
10 28	$B_Ø$ B_1	DIGITAL STORAGE BUS	A
11 29	B_2 B_3		A
12 30	B_4 B_5		A
13 31	B_6 B_7		A
14 32	B_8 B_9		A
15 33	B_{10} B_{11}		A
16 34	GND 1 GND		
17 35	+5V GND		
18 36	+5V NC		


PIPELINE REGISTER
CONSTANT ROM
ALU
CARRY GEN
ACCUMULATOR
BUFFER



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATOR, PREFIX REFERENCE DESIGNATOR SHOWN WITH THE ASSEMBLY REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. MNEMONICS TABLES:

MNEMONIC	DESCRIPTION
KSØ-KS3	CONSTANT SELECTION BITS Ø THROUGH 3
BS	BLOCK SWITCH CONTROL
RMØ-RM2	RAM REGISTER SELECT BITS Ø THROUGH 2
LCLK	INVERTED CLOCK
FØ-F3	FUNCTION BITS Ø THROUGH 3
POS	SIGN OF ALU RESULTS
LZERO	OUTPUT OF ZERO CHECK ON ALU RESULT (LOW = TRUE)
LDMEN	DATA MANIPULATOR OUTPUT ENABLE (LOW = TRUE)
CLK	8 MHz SYSTEM CLOCK
BØ-B11	DIGITAL STORAGE BUS DATA BITS Ø THROUGH 11

4. CONTROL DECODE

INPUTS				OUTPUTS								
FUNCTION	F CODE				FUNCTION SELECT							
	F2	F1	FØ	M	FS3	FS2	FS1	FSØ	CIN	$\overline{\text{WRITE RAM}}$	LOAD	OMS
A+B→ACC	0	0	0	0	1	0	0	1	0	0	1	0
A-B→ACC	0	0	1	0	0	1	1	0	1	0	1	0
A∧B→ACC	0	1	0	1	1	1	1	0	X	0	1	0
A∨B→ACC	0	1	1	X	1	0	1	1	0	0	1	0
A→ACC	1	0	0	X	1	1	1	1	0	0	1	0
BUS→ACC	1	0	1	X	X	X	X	X	X	1	0	1
$\bar{A}$→ACC	1	1	0	1	0	0	0	0	X	0	1	0
ACC→BUS	1	1	1	X	X	X	X	X	X	0	0	1

5. UNLESS OTHERWISE INDICATED:
   LOGIC LEVELS ARE TTL:
   +2.0V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW

A3A5

Figure 8-74. A3A5 Data Manipulator, Schematic Diagram

A3A6 MAIN CONTROL, CIRCUIT DESCRIPTION

The Digital Storage Processor is controlled by an algorithmic state machine, which uses relative-state addressing and interrupt linkage in performing the control algorithm. The Digital Storage Processor includes A3A4 Memory, A3A5 Data Manipulator, A3A6 Main Control, and A3A7 Interface.

State Register D

The State Register, U13 and U14, contains the present state of the algorithm. The present state data is supplied to the Program ROM (Read-Only Memory), where it is decoded into control functions.

Branch Length Adder A

The Branch Length Adder, U1 and U2, receives branch length data from the Program ROM and adds it to the present state data to generate the next state.

Link Register C

The Link Register, U12 and U15, holds the suspended state of the main program during interrupts and holds the next interrupt state during the main program.

In effect the Link Register acts as a "bookmark" for both the main program and the interrupt program, so that each program can resume at the correct state.

State Machine Control F

The State Machine Control, U16, U17, U18, U27C, and U27D, manages switching between the main and interrupt programs. In addition, it generates a signal to increment the Branch Length Adder for conditional branching.

Program ROM B

The Program ROM, U4, U6, U8, and U10, contains both the main program and the interrupt program. U5, U7, U9, and U11 are test firmware used in Signature Analysis.

Pipeline Registers E K

The Pipeline Registers, U24 and U28, hold instructions from the Program ROM for 125 nsec during execution.

Addressable Flip-Flops L

U21 and U23 contain 16 flip-flops that may be individually set and cleared. These flip-flops control signals for the Input Section and CRT Driver Section of A3 Digital Storage. The Input Section includes A3A8 Analog-Digital Converter and A3A9 Track and Hold. The CRT Driver Section includes A3A1 Trigger, A3A2 Intensity Control, and A3A3 Line Generator. The flip-flops also control flags and memory control

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lines for the Processor Section, which includes A3A4 Memory, A3A5 Data Manipulator, A3A6 Main Control, and A3A7 Interface. U19, U27A, and U27B decode instructions from Pipeline Register U28 to control the 16 flip flops. U29 contains buffers to output flag and timer signals onto the Digital Storage Bus.

Control Pulses G

U26 decodes eight control pulses based on the instruction in the Pipeline Register U24. U25A is a flip-flop that is set and cleared by the signals decoded by U26. U26 controls the reset of peak detectors in the Input Section of A3 Digital Storage.

Dual Timer H

U20 provides two timing pulses. One, about 20 msec, controls the CRT refresh rate. The other, about 20 μsec, is used in the digital peak detection algorithm.

RAM Chip Enable Generator J

U22 generates chip enable timing for A3A4 Memory. It delays execution of program instructions 1 1/2 states (182.5 nsec) to allow addresses to settle.

A3A6
MAIN CONTROL

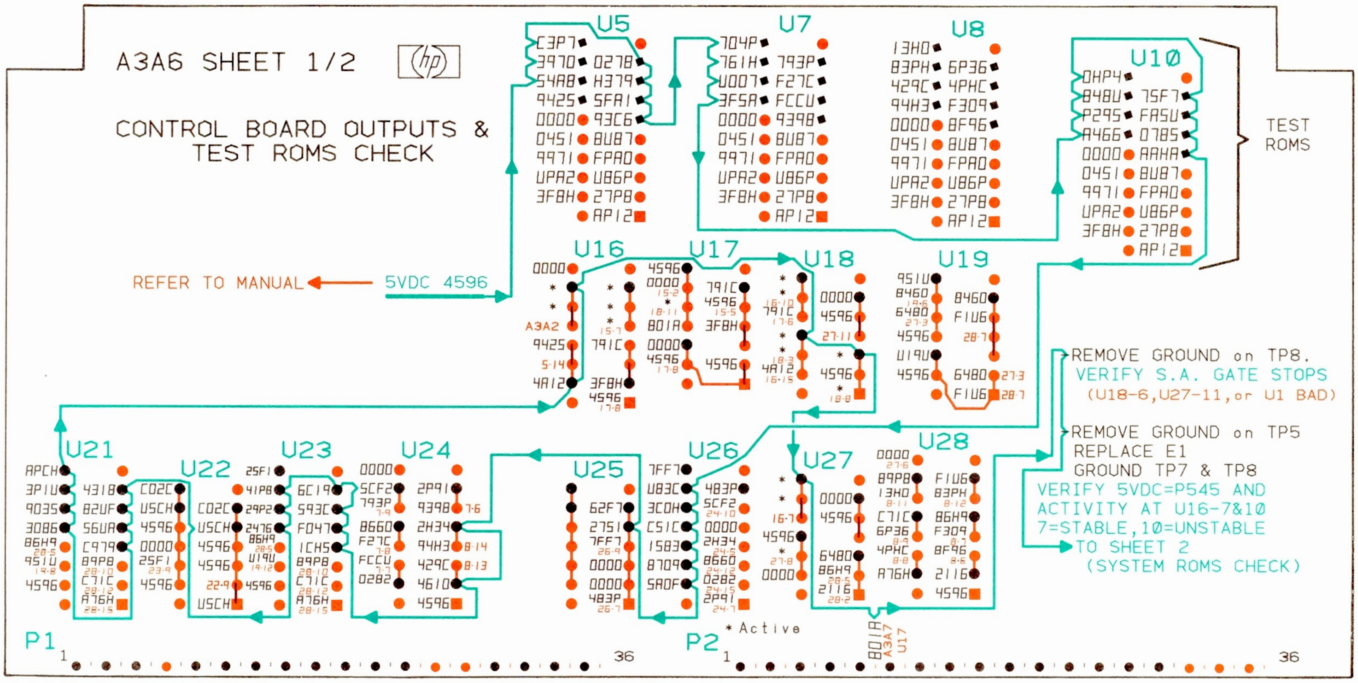


Figure 8-75. A3A6 Main Control, Signature Analysis Troubleshooting Diagram (1 of 2)

CONTROL BOARD OUTPUTS & TEST ROMS CHECK

Spectrum Analyzer Connections:

Ground A3A6TP5 and A3A6TP8
Jumper A3A6TP3 to A3A6TP6
Remove A3A6E1 from A3A6J1 socket

Signature Analyzer Connections:

CLOCK ⌐ to A3A6TP4
START ⌐ to A3A6TP11
STOP ⌐ to A3A6TP11
POD GND to A3A6TP1
Probe GND to A3A6TP1

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

A3A6
MAIN CONTROL

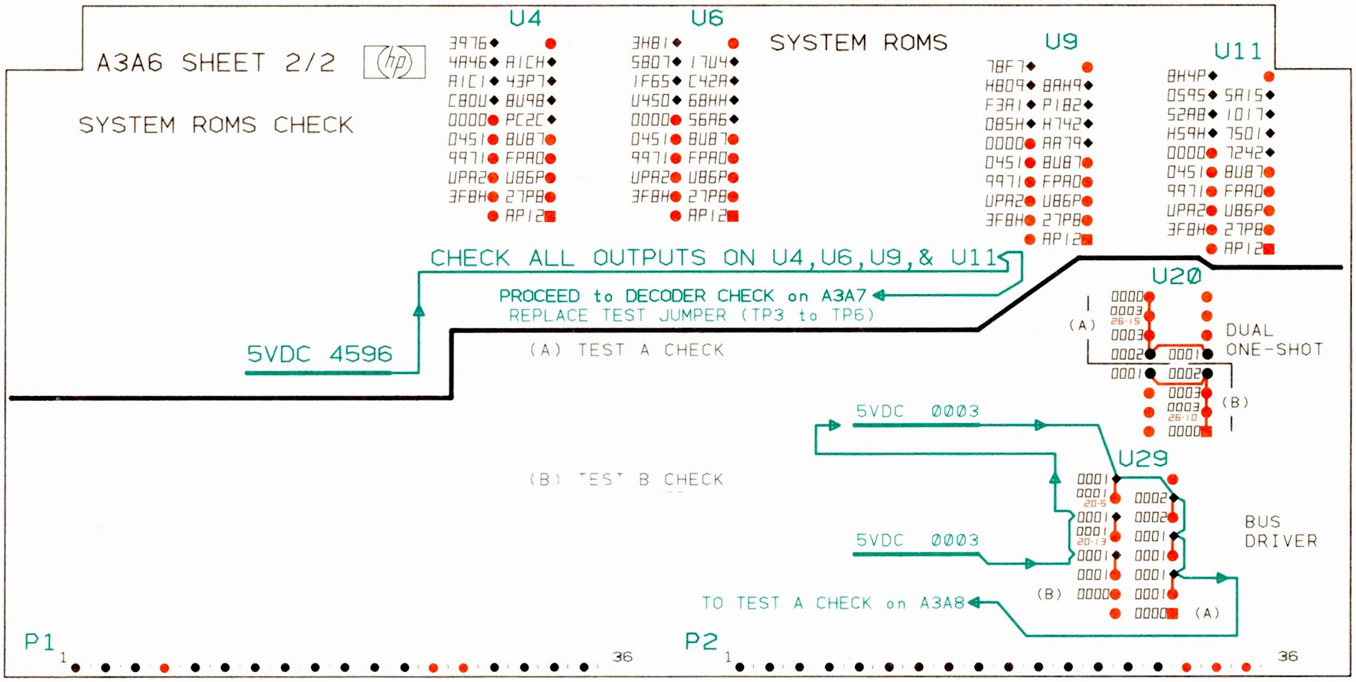


Figure 8-75. A3A6 Main Control, Signature Analysis Troubleshooting Diagram (2 of 2)

SYSTEM ROMS CHECK

Spectrum Analyzer Connections:

Remove A3A6E1 from A3A6J1 socket
Ground A3A6TP5 and A3A6TP8
Remove jumper from between A3A6TP3 and A3A6TP6 (Replace jumper after completion of test.)

Signature Analyzer Connections:

CLOCK ⎍ to A3A6TP4
START ⎍ to A3A6TP11
STOP ⎍ to A3A6TP11
POD GND to A3A6TP1
Probe GND to A3A6TP1

(A) TEST A CHECK

Spectrum Analyzer Connections:

Connect A3A7J1 Jumper to pins 5 and 10
Jumper A3A7TP3 to A3A7TP6
Adjust A3A2R12 LL fully CW
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⎍ to A3A7TP1
START ⎍ to A3A6TP2
STOP ⎍ to A3A6TP2

(B) TEST B CHECK

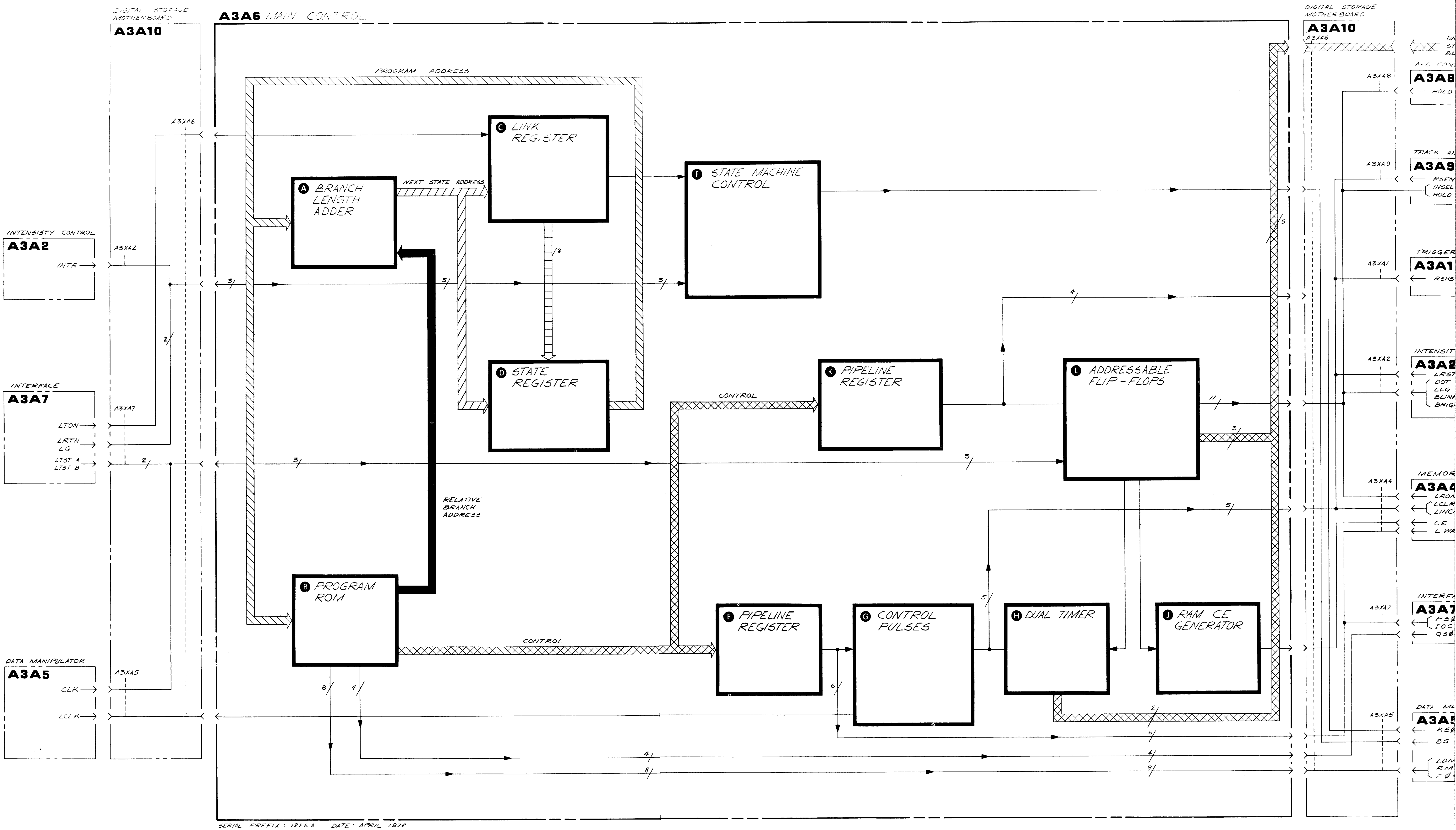
Spectrum Analyzer Connections:

Connect A3A7J1 Jumper to pins 4 and 11
Jumper A3A7TP3 to A3A7TP6
Adjust A3A2R12 LL fully CW
Jumper A3A6TP3 to A3A6TP6

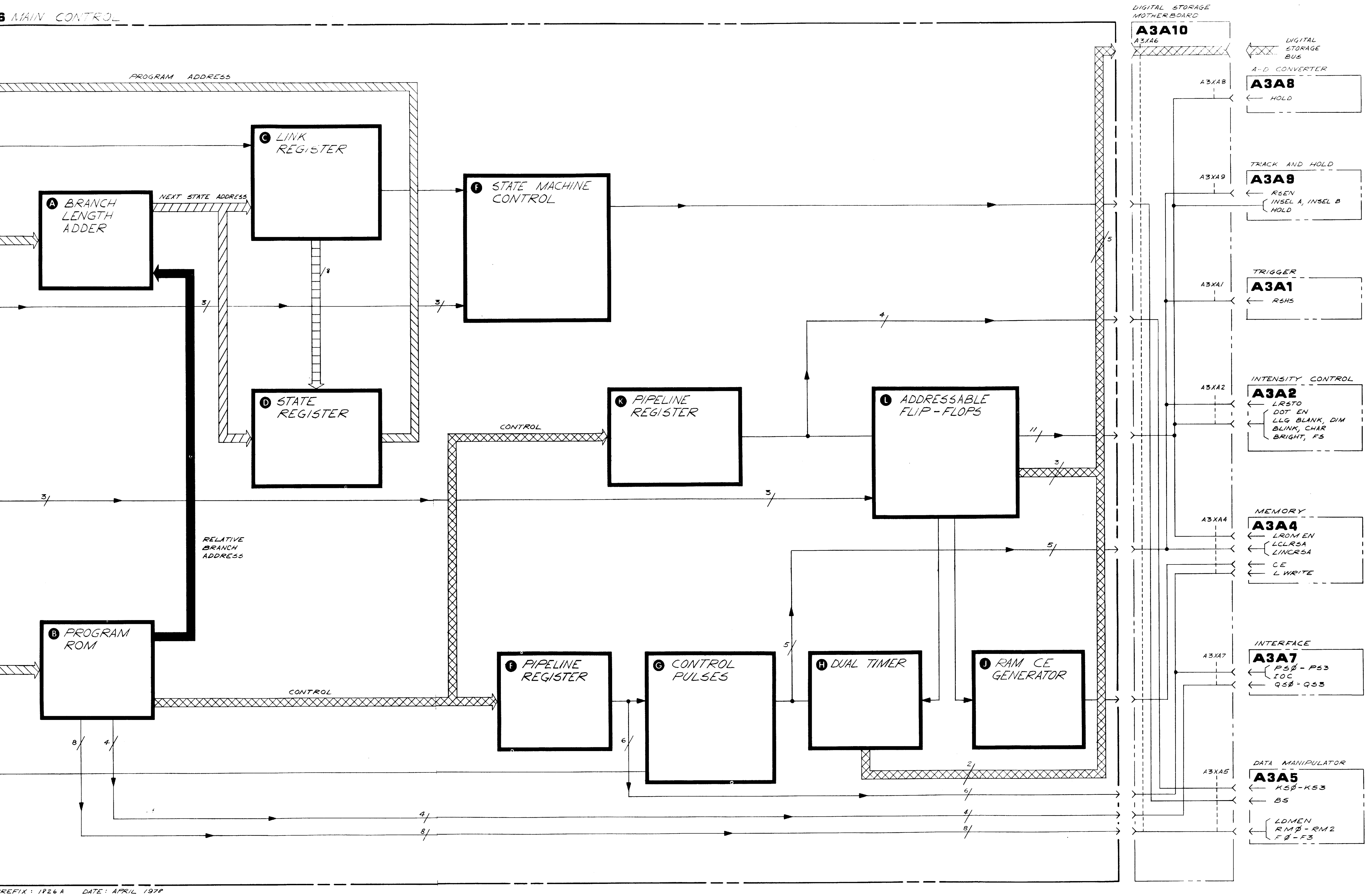
Signature Analyzer Connections:

CLOCK ⎍ to A3A7TP1
START ⎍ to A3A6TP2
STOP ⎍ to A3A6TP2

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.



A3A6 MAIN CONTROL
DIGITAL STORAGE MOTHER BOARD
A3A10
PROGRAM ADDRESS
A LINK REGISTER
A BRANCH LENGTH ADDER
NEXT STATE ADDRESS
F STATE MACHINE CONTROL
D STATE REGISTER
K PIPELINE REGISTER
L ADDRESSABLE FLIP-FLOPS
CONTROL
RELATIVE BRANCH ADDRESS
B PROGRAM ROM
F PIPELINE REGISTER
G CONTROL PULSES
H DUAL TIMER
J RAM CE GENERATOR
INTENSITY CONTROL
A3A2
INTR
INTERFACE
A3A7
LTON
LRTN
LQ
LTST A
LTST B
DATA MANIPULATOR
A3A5
CLK
LCLK
A3XA6
A3XA2
A3XA7
A3XA5
A3XA8
A3XA9
A3XA1
A3XA4
A3A8
HOLD
A3A9
RSEN
INSEL
HOLD
TRIGGER
A3A1
RSHS
A3A4
CE
L WR
BS
SERIAL PREFIX: 1926A DATE: APRIL 1978



A3A6

Figure 8-76. A3A6 Main Control, Block Diagram

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Table 8-26. A3A6 Main Control, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A6	85662-60022	1	BOARD ASSEMBLY, MAIN CONTROL	28480	85662-60022
A3A6C1	0160-4084	12	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C2	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C3	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C4	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C5	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C6	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C7	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C10	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C11	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6C12	0160-0573	1	CAPACITOR-FXD 4700PF +-20% 100VDC CER	28480	0160-0573
A3A6C13	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A6C14	0180-0228	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3A6C15	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A6E1	1251-4787	1	SHUNT-DIP 8 POSITION	28480	1251-4787
A3A6J1	1200-0507	1	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A3A6L1	08558-80011	1	FILTER COIL BLUE	28480	08558-80011
A3A6R1	0698-3155	3	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A6R2	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A6R3	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A3A6R4	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3A6R5	0757-0442	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A6R6	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A6TP1	0360-0535	11	TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP4	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP5	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP6	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP7	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP8	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP9	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP10	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6TP11	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A6U1	1820-1871	2	IC ADDR TTL S BIN FULL ADDR 4-BIT	01295	SN74S283N
A3A6U2	1820-1871		IC ADDR TTL S BIN FULL ADDR 4-BIT	01295	SN74S283N
A3A6U3	1810-0205	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R4.7K
A3A6U4	1816-1008	8	IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U5	1816-1008		IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U6	1816-1008		IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U7	1816-1008		IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U8	1816-1008		IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U9	1816-1008		IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U10	1816-1008		IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U11	1816-1008		IC TTL 4K PROM 55-NS 3-S	01295	SN74S472J
A3A6U12	1820-1076	3	IC FF TTL S D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74S174N
A3A6U13	1820-1981	3	IC RGTR TTL S QUAD 2-INP	34335	AM25S09PC
A3A6U14	1820-1981		IC RGTR TTL S QUAD 2-INP	34335	AM25S09PC
A3A6U15	1820-1076		IC FF TTL S D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74S174N
A3A6U16	1820-1981		IC RGTR TTL S QUAD 2-INP	34335	AM25S09PC
A3A6U17	1820-0685	2	IC GATE TTL S NAND TPL 3-INP	01295	SN74S10N
A3A6U18	1820-0681	2	IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
A3A6U19	1820-0685		IC GATE TTL S NAND TPL 3-INP	01295	SN74S10N
A3A6U20	1820-1423	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A3A6U21	1820-1729	2	IC LCH TTL LS COM CLEAR 8-BIT	01295	SN74LS259N
A3A6U22	1820-0693	1	IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
A3A6U23	1820-1729		IC LCH TTL LS COM CLEAR 8-BIT	01295	SN74LS259N
A3A6U24	1820-1196	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A6U25	1820-1112	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A3A6U26	1820-1216	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3A6U27	1820-0681		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
A3A6U28	1820-1076		IC FF TTL S D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74S174N
A3A6U29	1820-1491	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
			A3A6 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0754	2	EXTRACTOR-PC BOARD BLU POLYC	28480	4040-0754

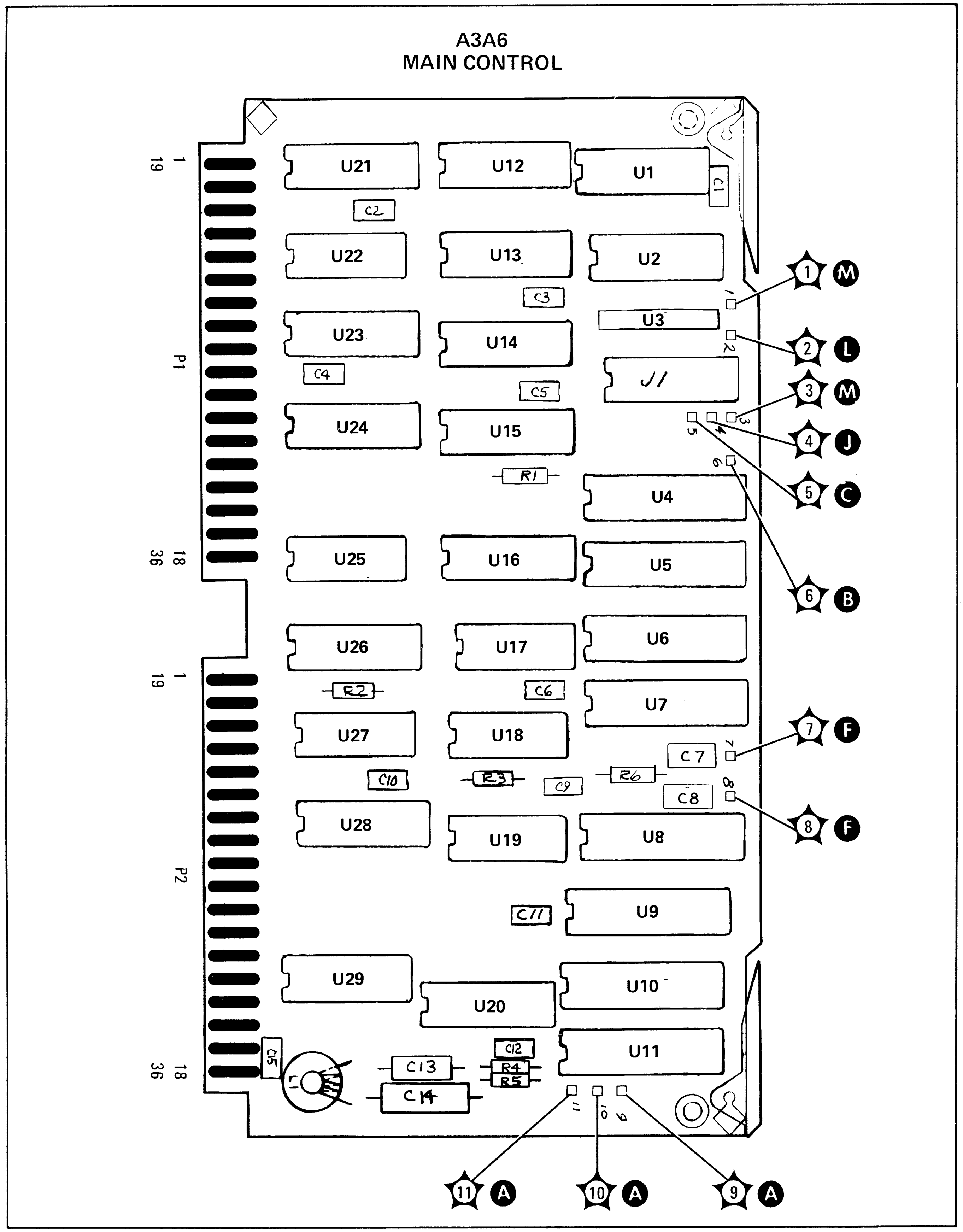

Figure 8-77. A3A6 Main Control, Component Locations

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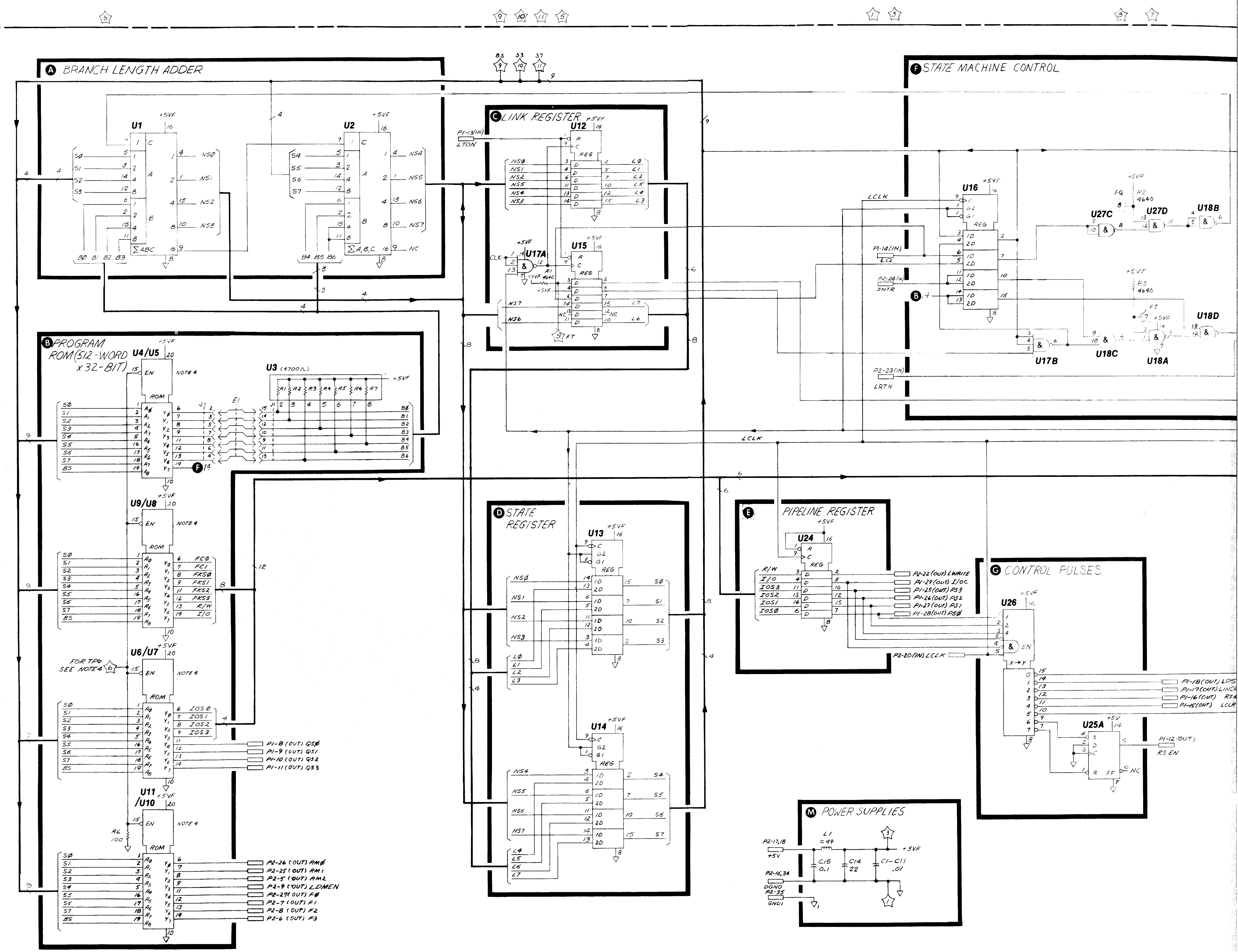
A3A6 MAIN CONTROL
85662-60022

P1

PIN	SIGNAL	TO / FROM	FUNCTION BLOCK
1	BRIGHT	A3A2P2-22	L
19	FS	A3A2P2-23	L
2	LLG BLANK	A3A2P2-24	L
20	BLINK	A3A2P2-25	L
3	DIM	A3A2P2-26	L
21	CHAR	A3A2P2-1	L
4	NC		
22	LROM EN	A3A4P1-20	L
5	CE		J
23	INSEL A	A3A4P1-22, A3A9P1-13	L
6	INSEL B	A3A9P1-12	L
24	DOT EN	A3A2P1-20	L
7	HOLD	A3A8P1-27, A3A9P1-15	L
25	PS3	A3A7P1-29	E
8	QSØ	A3A7P1-30	B
26	PS2	A3A7P1-11	E
9	QS1	A3A7P1-31	B
27	PS1	A3A7P1-12	E
10	QS2	A3A7P1-32	B
28	PSØ	A3A7P1-13	E
11	QS3	A3A7P1-33	B
29	IOC	A3A7P1-14	E
12	RS EN	A3A9P1-30	G
30	NC		
13	LTON	A3A7P1-15	C
31	NC		
14	LQ	A3A7P1-16	F
32	NC		
15	LCLRSA	A3A4P1-2	G
33	NC		
16	RSHS	A3A1P1-20	G
34	NC		
17	INCRSA	A3A4P1-21	G
35	LTST B	A3A7P2-4	L
18	LRSTO	A3A2P1-18	G
36	LTST A	A3A7P2-22	L

P2

PIN	SIGNAL	TO / FROM	FUNCTION BLOCK
1	KS1	A3A5P1-19	K
19	CLK	A3A5P1-8	L
2	KSØ	A3A5P1-1	K
20	LCLK	A3A5P1-22	G
3	KS3	A3A5P1-20	K
21	BS	A3A5P1-3	
4	KS2	A3A5P1-2	K
22	LWRITE	A3A4P1-19	E
5	RM2	A3A5P1-21	B
23	LRTN	A3A7P2-26	F
6	F3	A3A5P1-23	B
24	INTR	A3A2P2-28	F
7	F1	A3A5P1-24	B
25	RM1	A3A5P1-4	B
8	F2	A3A5P1-25	B
26	RMØ	A3A5P1-5	B
9	DM EN	A3A5P1-27	B
27	FØ	A3A5P1-6	B
10	BØ	DIGITAL STORAGE BUS	H
28	B1	DIGITAL STORAGE BUS	NC
11	B2	DIGITAL STORAGE BUS	NC
29	B3	DIGITAL STORAGE BUS	L
12	B4	DIGITAL STORAGE BUS	L
30	B5	DIGITAL STORAGE BUS	H
13	B6	DIGITAL STORAGE BUS	L
31	B7	DIGITAL STORAGE BUS	NC
14	B8	DIGITAL STORAGE BUS	NC
32	NC		
15	B10	DIGITAL STORAGE BUS	NC
33	B11	DIGITAL STORAGE BUS	NC
16	DGND		M
34	DGND		M
17	+5V		M
35	GND1		M
18	+5V		M
36	NC		



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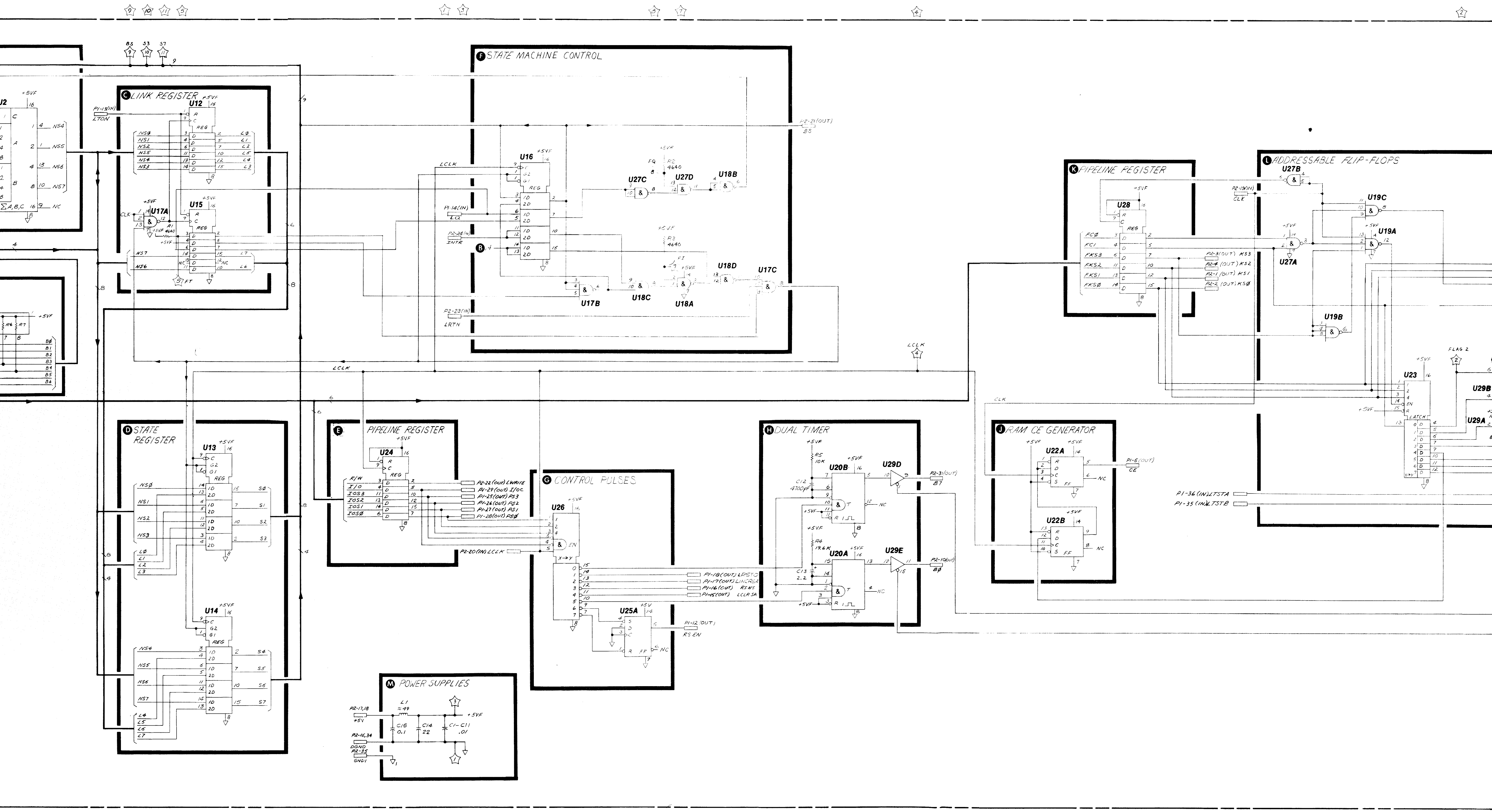
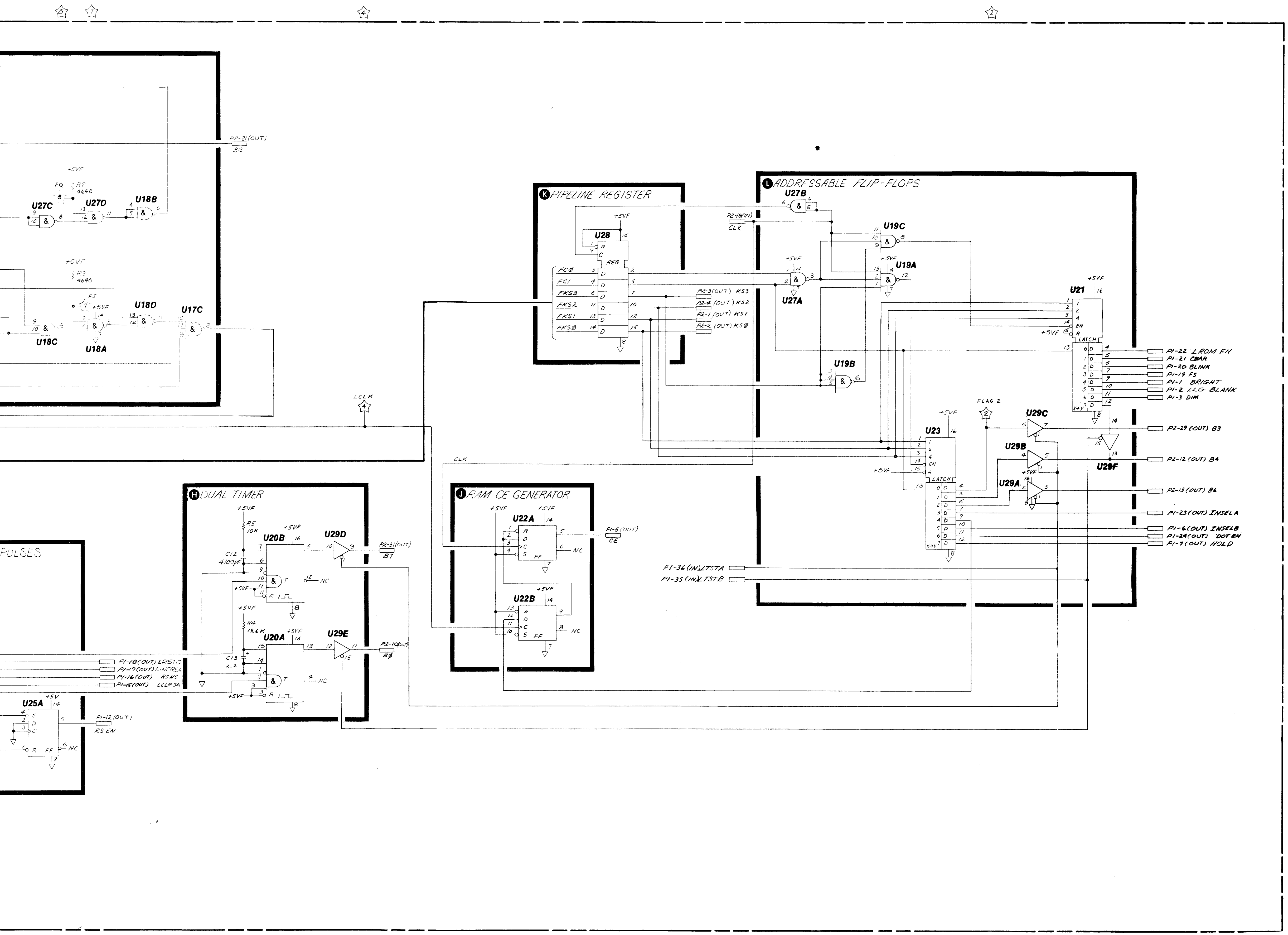

LINK REGISTER
U12
U15
U17A
STATE MACHINE CONTROL
U16
U27C
U27D
U18B
U17B
U18C
U18A
U18D
U17C
PIPELINE REGISTER
U28
ADDRESSABLE FLIP-FLOPS
U27B
U19C
U19A
U27A
U19B
U23
U29B
U29A
STATE REGISTER
U13
U14
PIPELINE REGISTER
U24
CONTROL PULSES
U26
U25A
DUAL TIMER
U20B
U29D
U20A
U29E
RAM CE GENERATOR
U22A
U22B
POWER SUPPLIES
+5VF



NOTES:

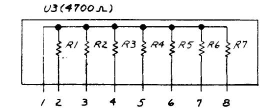
1. REFERENCE DESIGNATION WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED:
   LOGIC LEVELS ARE TTL:
   +2.0V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW
4. ROMS U4-U11 ARE USED IN PAIRS. U4, U6, U9, AND U11 ARE THE MAIN PROGRAM ROM U5, U7, U8, AND U10 ARE TEST PROGRAM ROMS. ALL CONNECTIONS TO EACH PAIR U4/U5, U6/U7, U9/U8, AND U11/U10 ARE THE SAME EXCEPT FOR PIN: 15 AND PIN 20

	PIN 15	PIN 20
U4, U6, U9, U11	TP6	+5V
U5, U7, U8, U10	GND	TP6

TO ENABLE THE TEST PROGRAM, CONNECT TP3 TO TP6.

5. U3 PIN CONFIGURATION:

U3 (4700Ω)



6. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
BRIGHT	BRIGHT CRT DISPLAY CONTROL
FS	FAST SWEEP MODE
LLG BLANK	LOW = LINE GENERATOR BLANKING CONTROL
BLINK	BLINK CRT DISPLAY CONTROL
DIM	DIM CRT DISPLAY CONTROL
CHAR	CHARACTER MODE DISPLAY CONTROL
LROM EN	LOW = ROM ENABLE
CE	MEMORY CHIP ENABLE
INSELA	INPUT SELECT BIT A
INSELB	INPUT SELECT BIT B
DOTEN	DOT ENABLE
HOLD	TRACK AND HOLD CONTROL
PSØ - PS3	I/O PORT SELECTION BITS Ø-3
QSØ - QS3	QUALIFIER SELECTION BITS Ø-3
IOC	I/O PORT INPUT/OUTPUT CONTROL
RSEN	RESET PEAK DETECTORS ENABLE
LTON	LOW = TURN ON
LQ	LOW = SELECTED QUALIFIER
LCLRSA	LOW = CLEAR STROKE ADDRESS
RSHS	RESET HIGH SWEEP
INCRSA	INCREMENT STROKE ADDRESS
LTSTA	LOW = INPUT TEST A DATA
LTSTB	LOW = INPUT TEST B DATA

MNEMONIC	DESCRIPTION
LRSTO	LOW = RESET TRIGGER OCCURRED
KSØ - KS3	CONSTANT SELECTION BITS Ø-3
CLK	8 MHZ SYSTEM CLOCK
LCLK	INVERTED CLK
BS	BLOCK SWITCH CONTROL
LDMEN	LOW = DATA MANIPULATOR OUTPUT ENABLE
LWRITE	MEMORY WRITE CONTROL
RMØ - RM2	RAM REGISTER SELECTION BITS Ø-2
LRTN	LOW = ENABLE INTERUPT RETURN
FØ - F3	PART OF FUNCTION SELECTION BITS Ø-2
INTR	INTERUPT CONTROL
BØ - B11	DIGITAL STORAGE BUS DATA BITS Ø-11

A3A6

Figure 8-78. A3A6 Main Control, Schematic Diagram

A3A7 INTERFACE, CIRCUIT DESCRIPTION

A3A7 Interface provides data transfer between A15 Processor and A3 Digital Storage. This assembly also includes qualifier selection for conditional branching, input/output (I/O) port decoding, and the main clock circuits.

Data Transfer Register A

U1, U3, U4, and U8 form a 16-bit Data Transfer Register which can be loaded or output onto either the Instrument Bus (through U6 and U7, the Instrument Bus Drivers) or the Digital Storage Bus (through U2, U5, and U9, the Digital Storage Bus Drivers).

Instrument Address Decoder C

U11, U12, and U13 control the loading and output of data betwen the Data Transfer Register and the Instrument Bus.

Qualifier Select H

U14 and U15 select one of 16 qualifiers to be used for conditional branching. Selection is controlled by A3A6 Main Control firmware.

I/O Port Decoder D

U16 and U17 decode I/O port control signals from the Pipeline Registers in A3A6 Main Control.

Timing Generator G

U10, U18, U20 and U21 generate 8-MHz, 1-MHz, and 200-kHz timing signals used by A3 Digital Storage.

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A3A7 INTERFACE

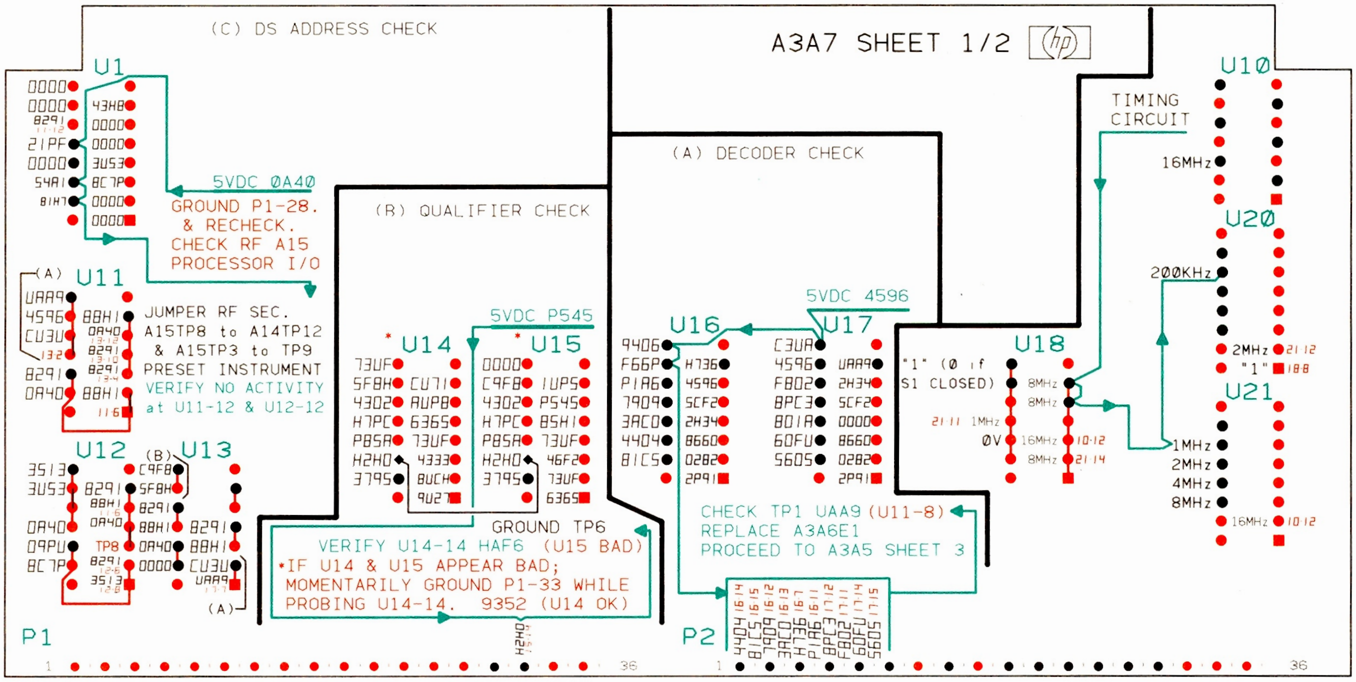

Figure 8-79. A3A7 Interface, Signature Analysis Troubleshooting Diagram (1 of 2)

(A) DECODER CHECK

Spectrum Analyzer Connections:
Remove A3A6E1 from A3A6J1 socket
Connect A3A7J1 Jumper to pins 7 and 8
Ground A3A6TP5 and A3A6TP8
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:
CLOCK ⎍ to A3A7P2-24
START ⎍ to A3A6TP11
STOP ⎍ to A3A6TP11
POD GND to A3A7P2-16
Probe GND to A3A7P2-16

(B) QUALIFIER CHECK

Spectrum Analyzer Connections:
Ground A3A6TP7 and A3A6TP8
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connection:
CLOCK ⎍ to A3A7P2-24
START ⎍ to A3A6TP2
STOP ⎍ to A3A6TP2
Probe GND to A3A7P2-16

(C) DS ADDRESS CHECK

Spectrum Analyzer Connections:
Ground A15TP8 (STATUS)
Ground A3A7TP2
Remove A3A6

Signature Analyzer Connections:
CLOCK ⎍ to A15TP2 (IOSB)
START ⎍ to A14TP10
STOP ⎍ to A14TP9

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

A3A7
INTERFACE

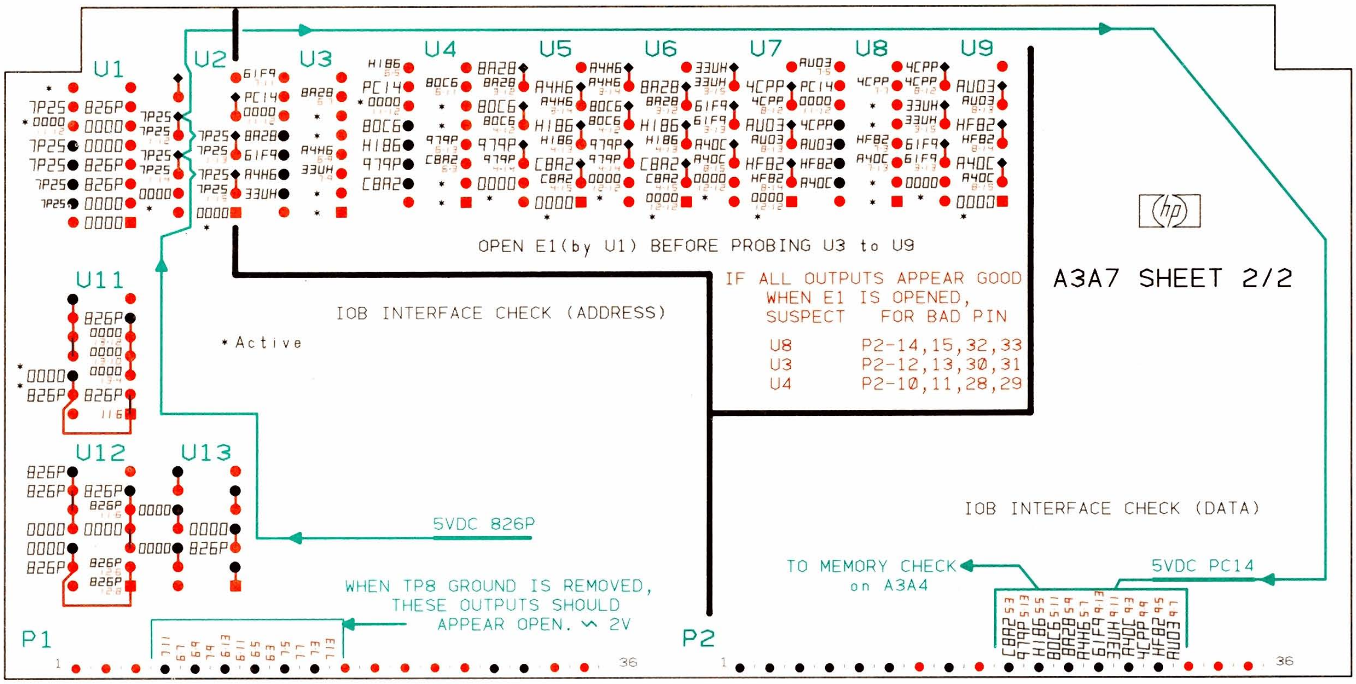

Figure 8-79. A3A7 Interface, Signature Analysis Troubleshooting Diagram (2 of 2)

IOB INTERFACE CHECK (ADDRESS)

Spectrum Analyzer Connections:

Connect A3A7J1 Jumper to pins 6 and 9
Jumper A3A7TP3 to A3A7TP2 and A3A7TP6
Ground A3A7TP8
Adjust A3A2R12 LL fully CW
Jumper A3A6TP3 to A3A6TP6
Disconnect rear-panel cables (To keep power on jumper A1A8TP1 to A1A8TP2.)

Signature Analyzer Connections:

CLOCK ⎍ to A3A7TP1
START ⎍ to A3A6TP2
STOP ⎍ to A3A6TP2
Probe GND to A3A7P2-16

IOB INTERFACE CHECK (DATA)

Spectrum Analyzer Connections:

Connect A3A7J1 Jumper to pins 7 and 8
Jumper A3A7TP3 to A3A7TP2 and A3A7TP6
Ground A3A7TP8
Adjust A3A2R12 LL fully CW
Jumper A3A6TP3 to A3A6TP6
Disconnect rear-panel cables (To keep power on, jumper A1A8TP1 to A1A8TP2.)

Signature Analyzer Connections:

CLOCK ⎍ to A3A7TP1
START ⎍ to A3A6TP2
STOP ⎍ to A3A6TP2
Probe GND to A3A7P2-16

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

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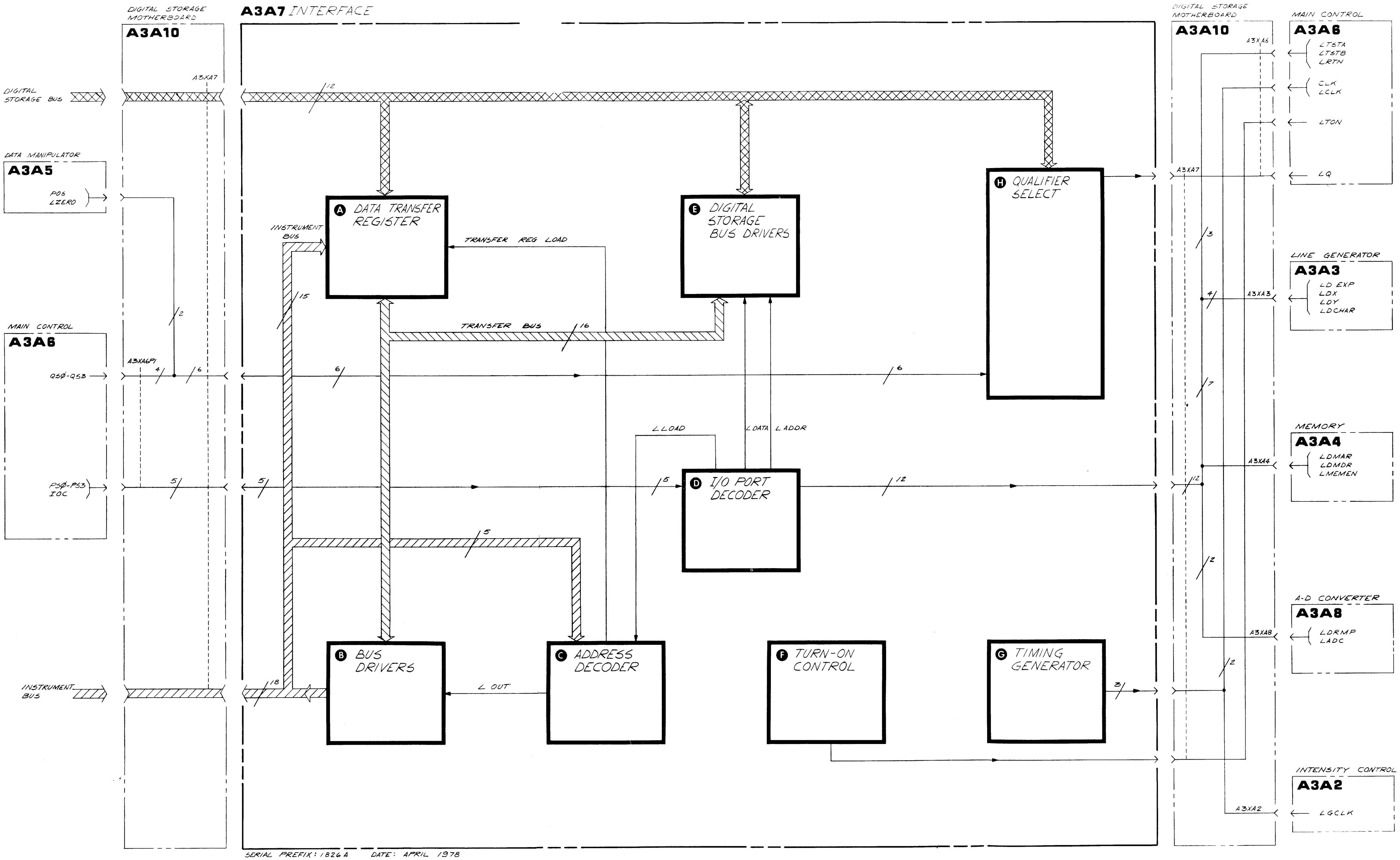


A3A7

Figure 8-80. A3A7 Interface, Block Diagram

Table 8-27. A3A7 Interface, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A7	85662-60021	1	BOARD ASSEMBLY, INTERFACE	28480	85662-60021
A3A7C1	0160-4084	12	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C2	0180-0228	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3A7C3	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C4	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C5	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C6	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C7	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C10	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C11	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C12	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C13	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3A7C14	0160-2264	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A3A7CR1	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A3A7E1	1460-1489	1	SPRING, WIREFORM (TEST JUMPER)	28480	1460-1489
A3A7E2	1258-0124	1	JUMPER-SINGLE POSITION (FOR IC SOCKET J1)	28480	1258-0124
A3A7J1	1200-0508		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A3A7L1	08558-8001	1	FILTER, COIL, BLUE	28480	08558-80011
A3A7Q1	1854-0404	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A7R1	0698-7232	2	RESISTOR 681 1% .05W F TC=0+-100	24546	C3-1/8-T0-681R-G
A3A7R2	0698-7242	6	RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-G
A3A7R3	0698-7232		RESISTOR 681 1% .05W F TC=0+-100	24546	C3-1/8-T0-681R-G
A3A7R4	0698-7242		RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-G
A3A7R5	0698-7242		RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-G
A3A7R6	0698-7242		RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-G
A3A7R7	0698-7242		RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-G
A3A7R8	0698-7228	1	RESISTOR 464 1% .05W F TC=0+-100	24546	C3-1/8-T0-464R-G
A3A7R9	0698-7242		RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-G
A3A7S1	3101-2170	1	SWITCH, PUSHBUTTON SPDT MOM	28480	3101-2170
A3A7TP1	0360-0535	10	TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP4	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP5	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP6	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP7	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP8	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP9	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7TP10	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A7U1	1820-1444	4	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A3A7U2	1820-1491	5	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A7U3	1820-1444		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A3A7U4	1820-1444		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A3A7U5	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A7U6	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A7U7	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A7U8	1820-1444		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A3A7U9	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A7U10	1820-1199	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A3A7U11	1820-1202	2	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3A7U12	1820-1202		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3A7U13	1820-1416	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3A7U14	1820-1980	2	IC MUXR/DATA-SEL TTL S 8-INP	18324	N82S31B
A3A7U15	1820-1980		IC MUXR/DATA-SEL TTL S 8-INP	18324	N82S31B
A3A7U16	1820-1240	2	IC DCDR TTL S 3-TO-8-LINE 3-INP	01295	SN74S138N
A3A7U17	1820-1240		IC DCDR TTL S 3-TO-8-LINE 3-INP	01295	SN74S138N
A3A7U18	1820-0693	1	IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
A3A7U19	1810-0206	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R10K
A3A7U20	1820-1431	1	IC CNTR TTL LS DECD SYNCHRO	01295	SN74LS162N
A3A7U21	1820-1432	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS163N
A3A7VR1	1902-3036	1	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	0203G	SZ 10939-38
A3A7Y1	0410-1034	1	CRYSTAL, 16.00 MHZ	28480	0410-1034
			A3A7 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0755	2	EXTRACTOR-PC BOARD VIO POLYC	28480	4040-0755

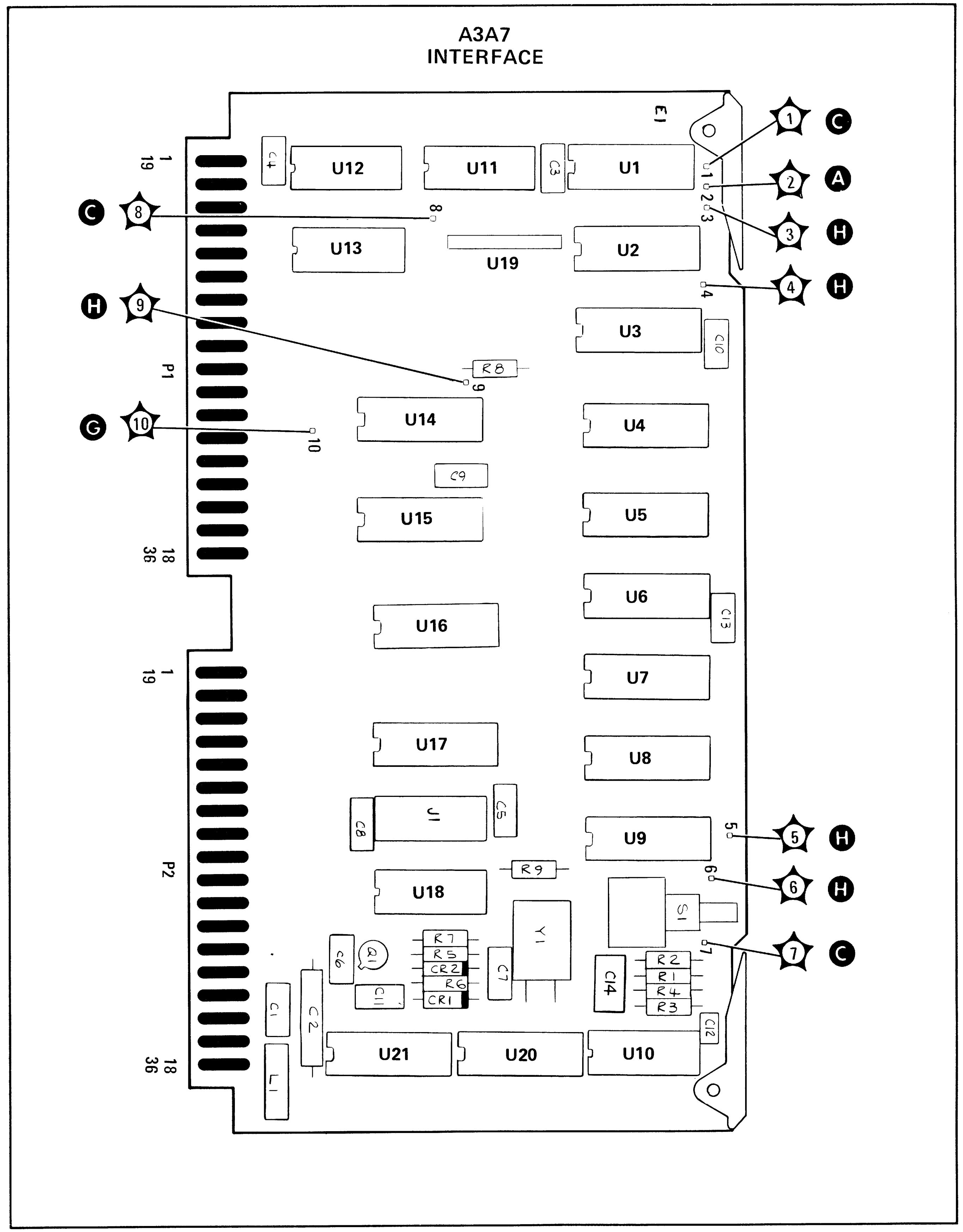


Figure 8-81. A3A7 Interface, Component Locations

A3A7 INTERFACE

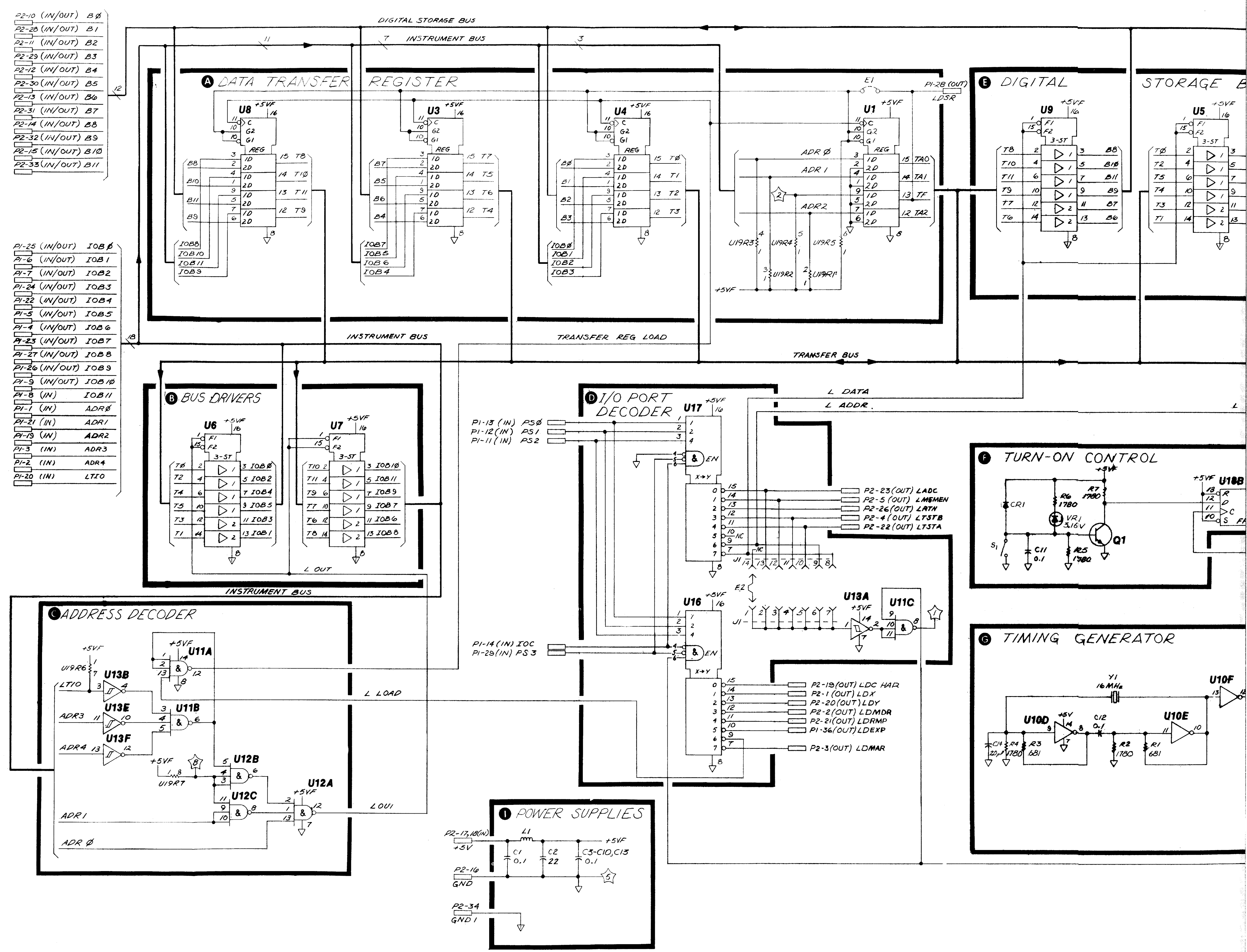
85662-60021

P1

PIN	SIGNAL	TO / FROM	FUNCTION BLOCK
1	ADR Ø		A
19	ADR 2		
2	ADR 4		
20	LTIO		
3	ADR 3		
21	ADR 1		
4	IOB 6		
22	IOB 4		
5	IOB 5	INSTRUMENT BUS	
23	IOB 7		
6	IOB 1		
24	IOB 3		
7	IOB 2		
25	IOB Ø		
8	IOB 11		
26	IOB 9		
9	IOB 10		A
27	IOB 8		
10	NC		
28	LDSR	A3A10J2-48	A
11	PS 2	A3A6P1-26	D
29	PS 3	A3A6P1-25	D
12	PS 1	A3A6P1-27	D
30	QS Ø	A3A6P1-8	H
13	PS Ø	A3A6P1-28	D
31	QS 1	A3A6P1-9	H
14	IOC	A3A6P1-29	D
32	QS 2	A3A6P1-10	H
15	LTON	A3A6P1-13	F
33	QS 3	A3A6P1-11	H
16	LQ	A3A6P1-14	H
34	NC		
17	NC		
35	NC		
18	NC		
36	LD EXP	A3A6P1-19	D

P2

PIN	SIGNAL	TO / FROM	FUNCTION BLOCK
1	LDX	A3A3P2-22	D
19	LDCHAR	A3A3P2-20	D
2	LD MDR	A3A4P1-5	D
20	LDY	A3A3P1-21	D
3	LD MAR	A3A4P1-23	D
21	LD RMP	A3A8P1-8	D
4	LTSTB	A3A6P1-35	D
22	LTST A	A3A6P1-36	D
5	LMEMEN	A3A4P1-4	D
23	LADC	A3A8P1-9	D
6	CLK	A3A6P2-19	G
24	LCLK	A3A6P2-20	G
7	NC		
25	1MHZ	A3A8P1-7	G
8	LG CLK	A3A2P2-19	G
26	L RTN	A3A6P2-23	D
9	LZERO	A3A5P1-26	H
27	POS	A3A5P1-7	H
10	B Ø		A
28	B 1		
11	B 2		
29	B 3		
12	B4	DIGITAL STORAGE BUS	
30	B5		
13	B6		
31	B7		
14	B8		
32	B9		
15	B10		A
33	B11		
16	GND		I
34	GND 1		I
17	+5V		
35	NC		
18	+5V		
36	NC		



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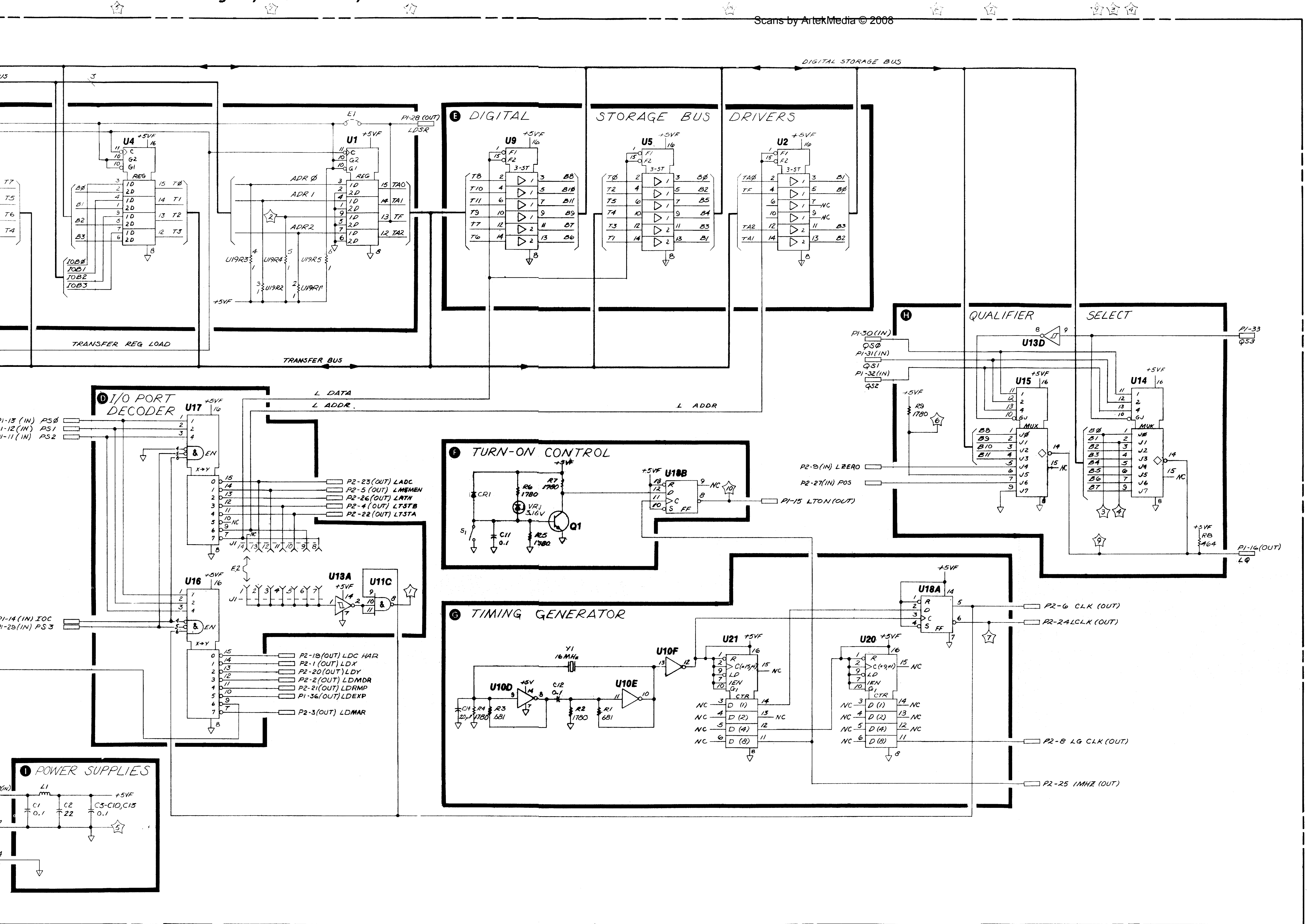


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATOR, PREFIX REFERENCE DESIGNATOR SHOWN WITH THE ASSEMBLY REFERENCE DESIGNATOR.

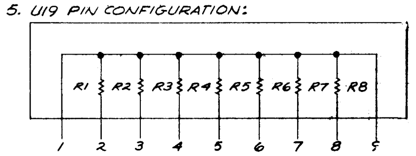
2. UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS (Ω)
CAPACITANCE IN MICROFARADS (μF)
INDUCTANCE IN MICROHENRIES (μH)

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 - ADR4	INSTRUMENT BUS ADDRESS BITS Ø-4
IOBØ - IOB11	INSTRUMENT BUS DATA BITS Ø-11
PSØ - PS3	I/O PORT SELECTION BITS
QSØ - QS3	QUALIFIER SELECTION BITS
BØ - B11	DIGITAL STORAGE DATA BITS Ø-11
DOTEN	DOT ENABLE
LDSR	LOW = DIGITAL STORAGE READY
IOC	I/O PORT INPUT/OUTPUT CONTROL
LTON	TURN ON CONTROL (LOW TRUE)
LQ	QUALIFIER SELECTED (LOW TRUE)
LD EXP	LOAD EXPAND REGISTER
LD X	LOAD X POSITION REGISTER
LD Y	LOAD Y POSITION REGISTER
LD CHAR	LOAD CHARACTER REGISTER
LD MDR	LOAD MEMORY DATA REGISTER
LD MAR	LOAD MEMORY ADDRESS REGISTER
LD RMP	LOAD RAMP REGISTER
LTSTA	LOW = INPUT TEST A DATA
LTSTB	LOW = INPUT TEST B DATA
LMEMEN	LOW = ENABLE MEMORY OUTPUT
LADC	LOW = ENABLE ADC OUTPUT
LRTN	LOW = ENABLE INTERRUPT RETURN
LZERO	ZERO CHECK ON ALU RESULT OUTPUT- (LOW TRUE)
POS	SIGN OF ALU RESULTS (HIGH = +, LOW = −)
CLK	8mHz SYSTEM CLOCK
LCLK	INVERTED CLOCK
LG CLK	200kHz LINE GENERATOR CLOCK
LTIO	LOW = IF-DISPLAY SECTION STROBE

5. U19 PIN CONFIGURATION:



U19 (10KΩ)

A3A7

Figure 8-82. A3A7 Interface, Schematic Diagram

A3A8 ANALOG-DIGITAL CONVERTER, CIRCUIT DESCRIPTION

A3A8 Analog-Digital Converter is used to produce storable graph data for A3 Digital Storage. It converts analog data from A3A9 Track and Hold and transfers this data to the Digital Storage Bus. The important data and control lines are: all Digital Storage Bus bits, B0–B11, which are used for data inputs and outputs; ADC, which loads final ADC data onto the Digial Storage Bus; HLD, which resets the ADC and initiates a conversion; LD RAMP, which updates the Ramp DAC with a new scan address; and LTSTA, which enables test bits (B0, B1, and B2), BUSY, RAMP, and LTRK onto the Digital Storage Bus.

ADC Ⓐ

The ADC (analog-to-digital) circuit converts analog (sampled video) data from A3A9 Track and Hold into 10 bits of binary code using the technique of successive approximation. A simplified schematic of the ADC circuit is shown in Figure 8-83.

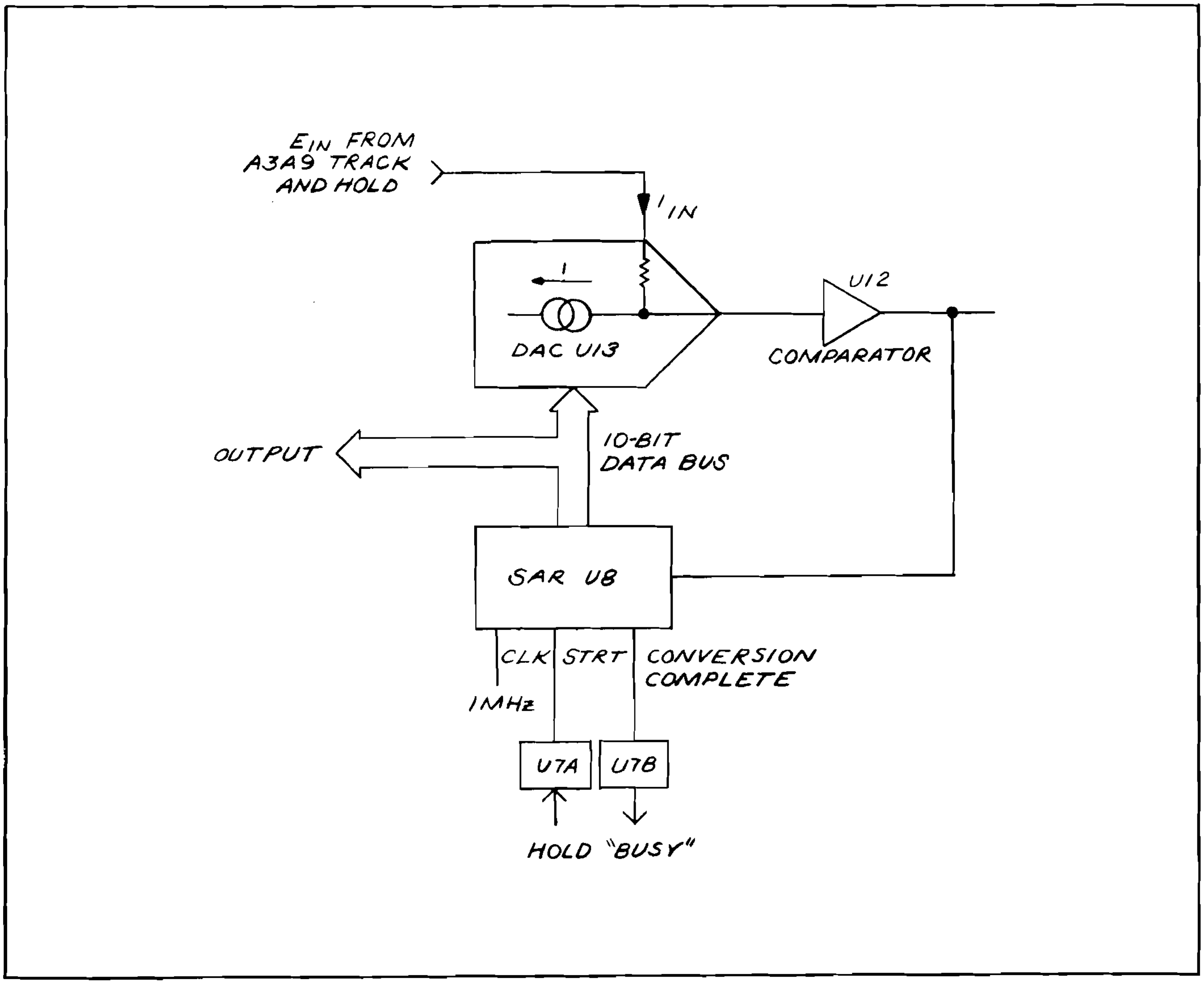


Figure 8-83. A3A8 Analog-Digital Converter, Simplified Schematic

The ADC circuit consists of digital-to-analog converter (DAC) U13, comparator U12, and successive approximation register U8. A 1-MHz clock fixes conversion time at 11 μsec. To begin a conversion, the ADC is first reset to zeroes by a low HOLD. When HOLD goes high, each bit is individually tried in a "trial" conversion, starting with the most significant bit. A decision is made to retain or drop the bit based on the comparator output. Once the decision has been made for each of the 10 bits, a "conversion-complete" signal sets the flip-flop U7A. This signal, called BUSY, can be transferred onto the Digital Storage Bus by the Test Bits Buffer U14.

Ramp Converter C

The Ramp Converter makes a comparison between the analog sweep signal and the scan address (X Axis). Comparator U4 makes this comparison and produces a signal called RAMP. RAMP high indicates that the scan address needs to be updated. When RAMP is low, no update is needed. When an update occurs, a new address is latched into the Scan Address latches U2 and U10. This results in an updated comparison between the output of DAC U5 and the Sweep input as shown in the simplified schematic (Figure 8-84). A reference voltage is created for the DAC by VR2 and U6. This voltage is adjustable by R9 to achieve SWP IN (FS +10.000V). Amplifier U3 sums the currents from the DAC, the sweep input, and the ZERO stick and drives the comparator input. ZERO is adjustable by R14.

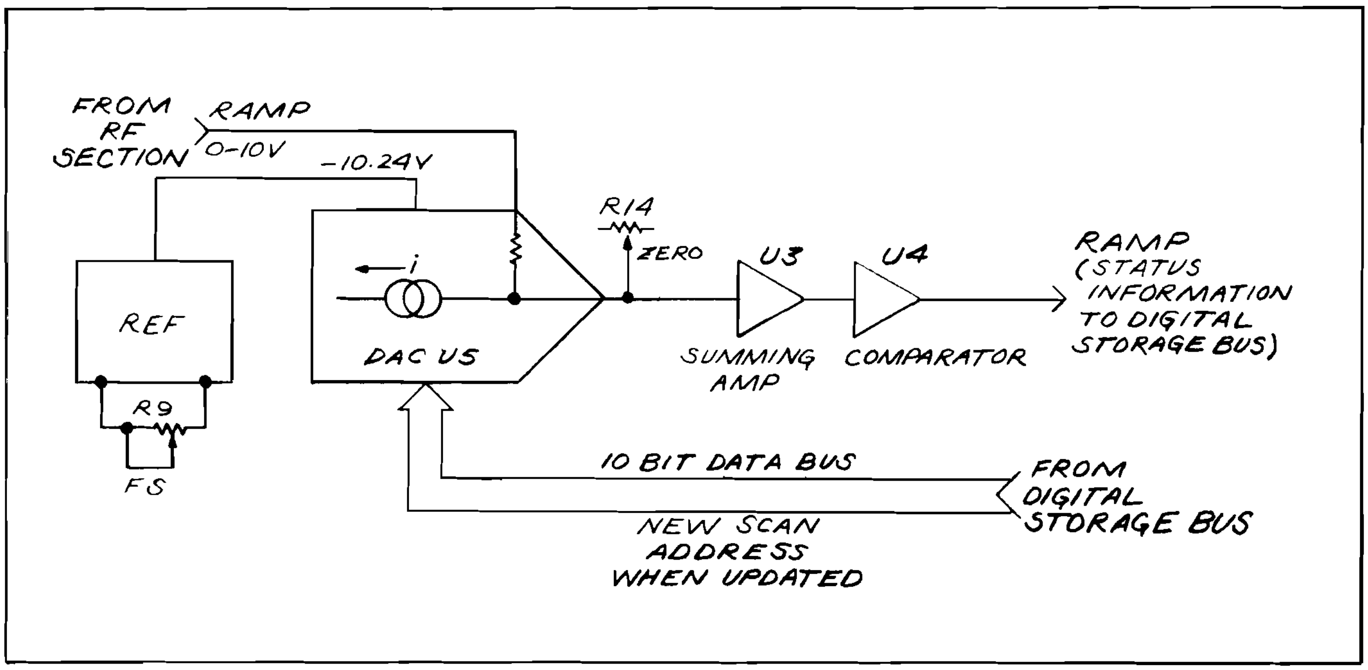


Figure 8-84. Ramp Converter, Simplified Schematic

A3A8 ANALOG-DIGITAL CONVERTER, TROUBLESHOOTING

The A3A8 Analog Digital Converter converts the analog video and sweep voltages to digital data. Consequently, a failure on this assembly will affect the display of Trace A and Trace B data character and graticule generation are not affected by A3A8.

Stuck bits in the Ramp Converter will distort the displayed signal. This is most easily observed with slow sweep times. When a bit fails, the Ramp Converter will default to a 20 ms sweep rate during the display period when that bit would normally be working. Figure 8-85 is an example of the CAL OUTPUT signal with a 3 sec sweep time when U5 pin 5 is stuck low.

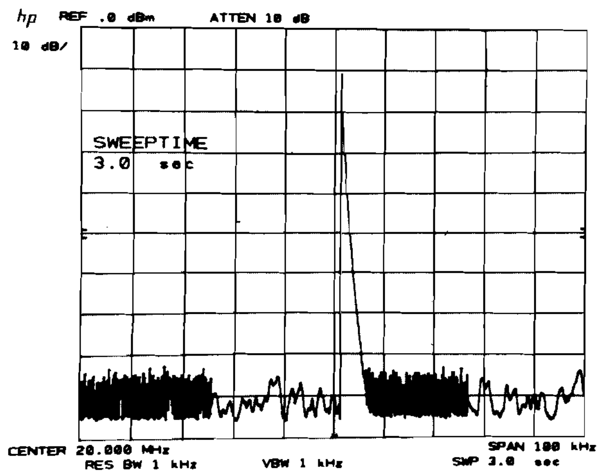


Figure 8-85. Ramp Converter Bit Failure

By looking at noise with a 3-second sweep time (push INSTR PRESET first), it is possible to determine which of the data bits are stuck by counting the discrete states displayed. For example, Figure 8-86 shows the result of a MSB failure (D9). $2^{10-9} = 2$ states are displayed. The ADC Check on the SA Diagram is then performed to isolate the failure to a single component. Low order bit (D0-D4) failures are easier to detect under the following conditions.

Center Frequency 20 MHz, Frequency Span 100 kHz, Sweep Time 3 sec. A failure will then result in slight "stair-stepping" of the displayed signal. The noise display will be missing states but this will be difficult to see.

Digital Storage Test Program 4 is used to verify the inputs to the DAC, U5. If one of the inputs appear to be stuck, be certain to check diode array U11 for defective diodes. U11 does not appear on the SA diagram.

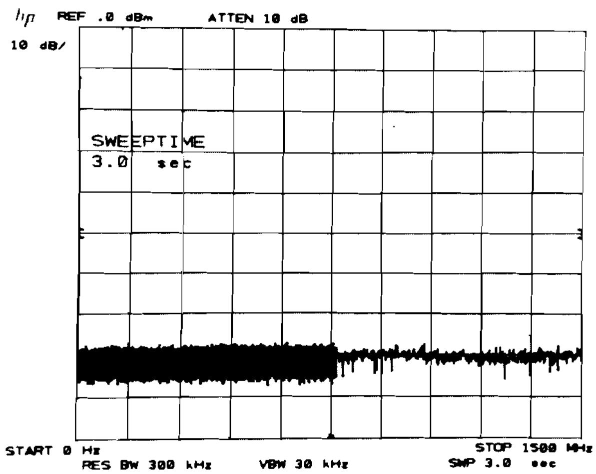


Figure 8-86. Ramp Converter MSB Failure

Failures in the video analog to digital process are characterized by "stair-stepped" signals and noise that is displayed as discrete vertical lines. Low order bit failures will cause many small steps while a high order bit failure will cause a single step that will eliminate the peak of the display. Note that only the signal will be affected and that the graticules and characters will not be affected. Front panel displays of the CAL OUTPUT signal for several bit failures are shown in Figure 8-87 and 8-88. Consult the A3A8 Analog-Digital Converter Troubleshooting information listed in the A3 Digital Storage Troubleshooting procedure on how to determine the faulty component using signature analysis.

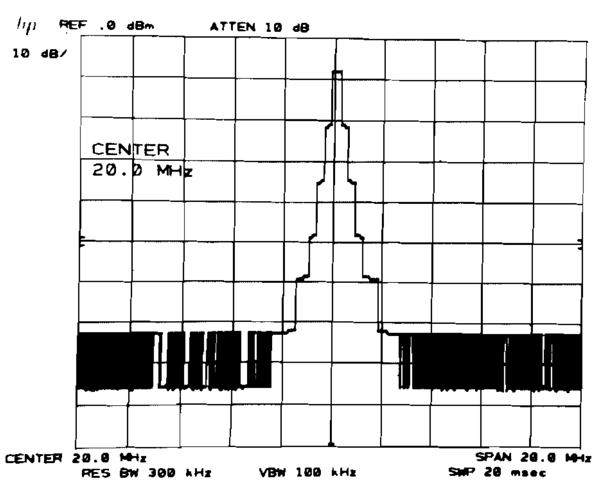


Figure 8-87. Video ADC Bit 5 Failure

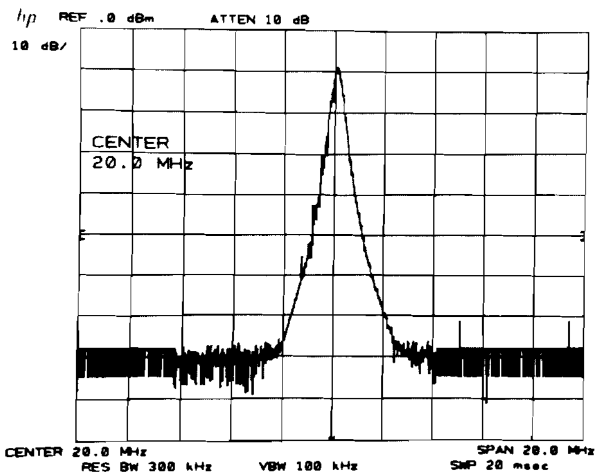


Figure 8-88. Video ADC Bit 2 Failure

If the RAMP, HOLD or BUSY lines become stuck, the display will show a sweep related problem. If the analyzer is not sweeping, the Sweep System Troubleshooting notes should be consulted to help isolate the failure to a particular assembly.

Table 8-28 contains the display symptoms that result from failures of the RAMP, HOLD or BUSY lines.

Table 8-28. A3A8 Sweep Related Failure Symptoms

Line	Failure	
	Stuck High	**Stuck Low**
BUSY	Sweep LED on Line at bottom of display CK LED I on after INSTR PRESET	Displayed signals noisy and similar to Figure 8-87
RAMP	Display jitter along x axis Frequency readout incorrect	Sweep LED on Line at bottom of display
HOLD	Line at top of display	Sweep LED on Line at bottom of display CK LED I on after INSTR PRESET

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A3A8
ANALOG-DIGITAL CONVERTER

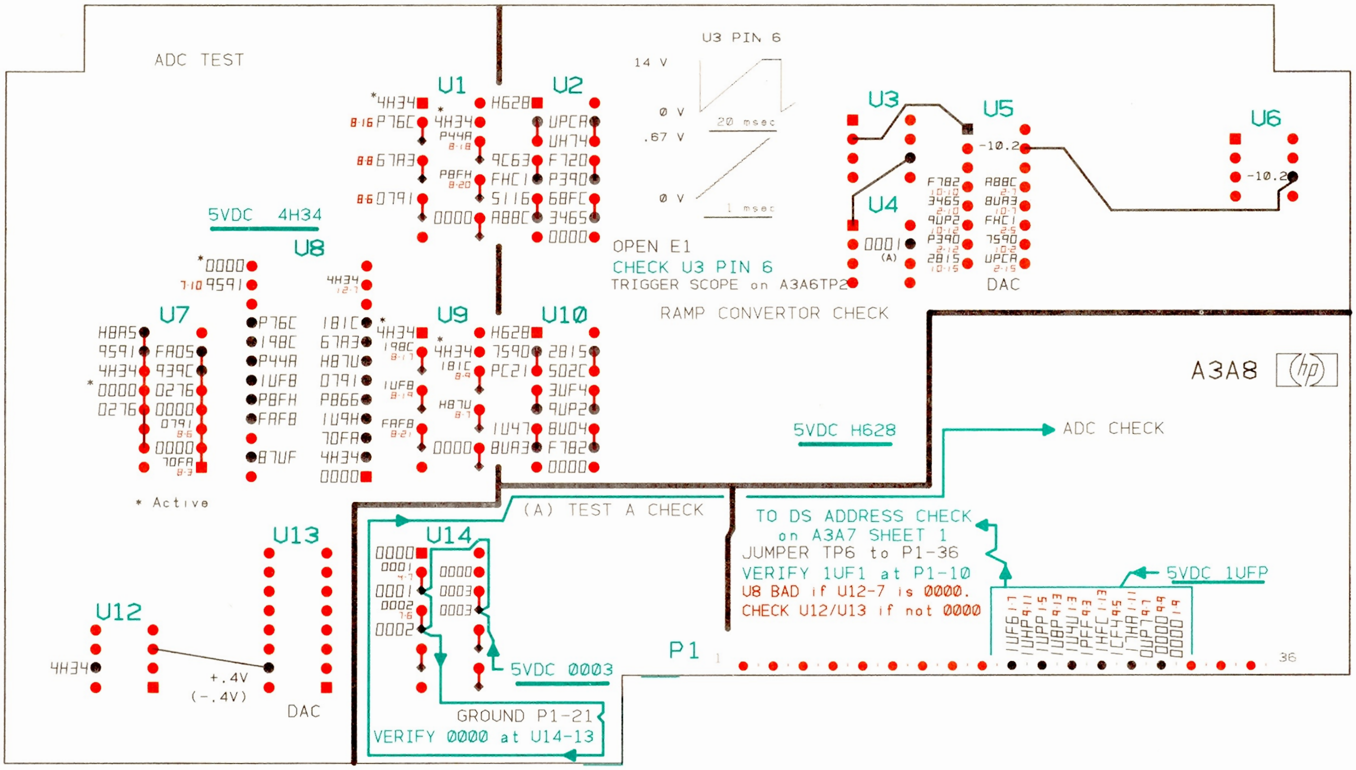

Figure 8-89. A3A8 Analog-Digital Converter, Signature Analysis Troubleshooting Diagram

ADC TEST

Spectrum Analyzer Connections:

Remove A3A9
Adjust A3A2R12 LL fully CW
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6
Jumper A3A8TP6 to A3A8P1-18

Signature Analyzer Connections:

CLOCK ⟋ to A3A8P1-7
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2

RAMP CONVERTER CHECK

Spectrum Analyzer Connections:

Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6
Ground A3A8TP1
Remove A3A8E1

Signature Analyzer Connections:

CLOCK ⟋ to A3A8P1-8
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2

(A) TEST A CHECK

Spectrum Analyzer Connections:

Connect A3A7J1 Jumper to pins 5 and 10
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6
Jumper A3A8TP1 to A3A8TP7
Remove A3A9; Remove A3A8E1

Signature Analyzer Connections:

CLOCK ⟋ to A3A7TP1
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2

ADC CHECK

Spectrum Analyzer Connections:

Connect A3A7J1 Jumper to pins 2 and 13
Jumper A3A7TP3 to A3A7TP6
Jumper A3A6TP3 to A3A6TP6
Adjust A3A2R12 LL fully CW
Jumper A3A8TP6 to A3A8P1-18
Remove A3A9

Signature Analyzer Connections:

CLOCK ⟋ to A3A7TP1
START ⟋ to A3A6TP2
STOP ⟋ to A3A6TP2

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

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Table 8-29. A3A8 Analog-Digital Converter, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A8	85662-60013	1	BOARD ASSEMBLY, ANALOG-DIGITAL CONVERTER	28480	85662-60013
A3A8C1	0180-0229	2	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A8C2	0180-1746	5	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A8C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A8C4	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A8C5	0160-2055	12	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C6	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A8C7	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A8C8	0160-2260	1	CAPACITOR-FXD 13PF +-5% 500VDC CER 0+-30	28480	0160-2260
A3A8C9	0160-2199	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A3A8C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C18	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A8C19	0160-0174	2	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A3A8C20	0160-0174		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A3A8C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C22	0160-2055		1	28480	0160-2055
A3A8C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A8C25	0160-2201	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A3A8C26	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A8CR1	1901-0535	4	DIODE-SCHOTTKY	28480	1901-0535
A3A8CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A8CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A8CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A3A8E1	1460-1489	1	WIREFORM-BE CU AG	28480	1460-1489
A3A8J1	1250-0543	1	CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A3A8L1	9140-0114	4	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A3A8L2	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A3A8L3	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A3A8L4	9140-0210	2	COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A3A8L5	9140-0210		COIL-MLD 100UH 5% Q=50 .155DX.375LG-NOM	28480	9140-0210
A3A8L6	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A3A8R1	0698-3432	1	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A3A8R2	0757-0401	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A8R3	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A3A8R4	0757-0439	3	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R5	0698-3136	2	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A3A8R6	0757-0279	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A8R7	0757-0442	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A8R8	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A3A8R9	2100-2850	1	RESISTOR-TRMR 10K 10% WW SIDE-ADJ 20-TRN	02660	3810P-103
A3A8R10	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A8R11	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R12	0698-3429	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A3A8R13	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A3A8R14	2100-3054	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A3A8R15			NOT ASSIGNED		
A3A8R16	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R17	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A8R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A8R19	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A8R20	0698-3430	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A3A8TP1	0360-0535	7	TERMINAL TEST POINT PCB	28480	0360-0535
A3A8TP2	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A8TP3	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A8TP4	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A8TP5	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A8TP6	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A8TP7	0360-0535		TERMINAL TEST POINT PCB	28480	0360-0535
A3A8U1	1820-1491	3	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A8U2	1820-1196	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A8U3	1820-0223	2	IC 301 OP AMP TO-99	18324	LM301A
A3A8U4	1820-0475	1	IC COMPARATOR TO-99	27014	LM306H
A3A8U5	1826-0448	1	IC DIGITAL-ANALOG CONV 7520	28480	1826-0448

Table 8-29. A3A8 Analog-Digital Converter, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A8U6	1820-0223		IC 301 OP AMP TO-99	18324	LM301A
A3A8U7	1820-1282	1	IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN74LS109N
A3A8U8	1820-1978	1	IC RGTR TTL L 12-BIT	34335	AM25L04PC
A3A8U9	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A8U10	1820-1196		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3A8U11	1906-0202	1	DIODE-ARRAY 40V 400MA	01295	TID130
A3A8U12	1826-0116	1	IC COMPARATOR TO-99	06665	CMP-01-CJ
A3A8U13	1820-1984	1	IC CONV TTL* D/A 10-BIT	24355	AD561KD
A3A8U14	1820-1491		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367N
A3A8U15	1902-0908	1	DIODE-ZNR 6.95V 5% TC=+.0002%	27014	LM399H
A3A8VR1	1902-3036	1	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
			A3A8 MISCELLANEOUS PARTS		
	1480-0073	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
	4040-0747	2	EXTRACTOR-PC BOARD GRA POLYC	28480	4040-0747

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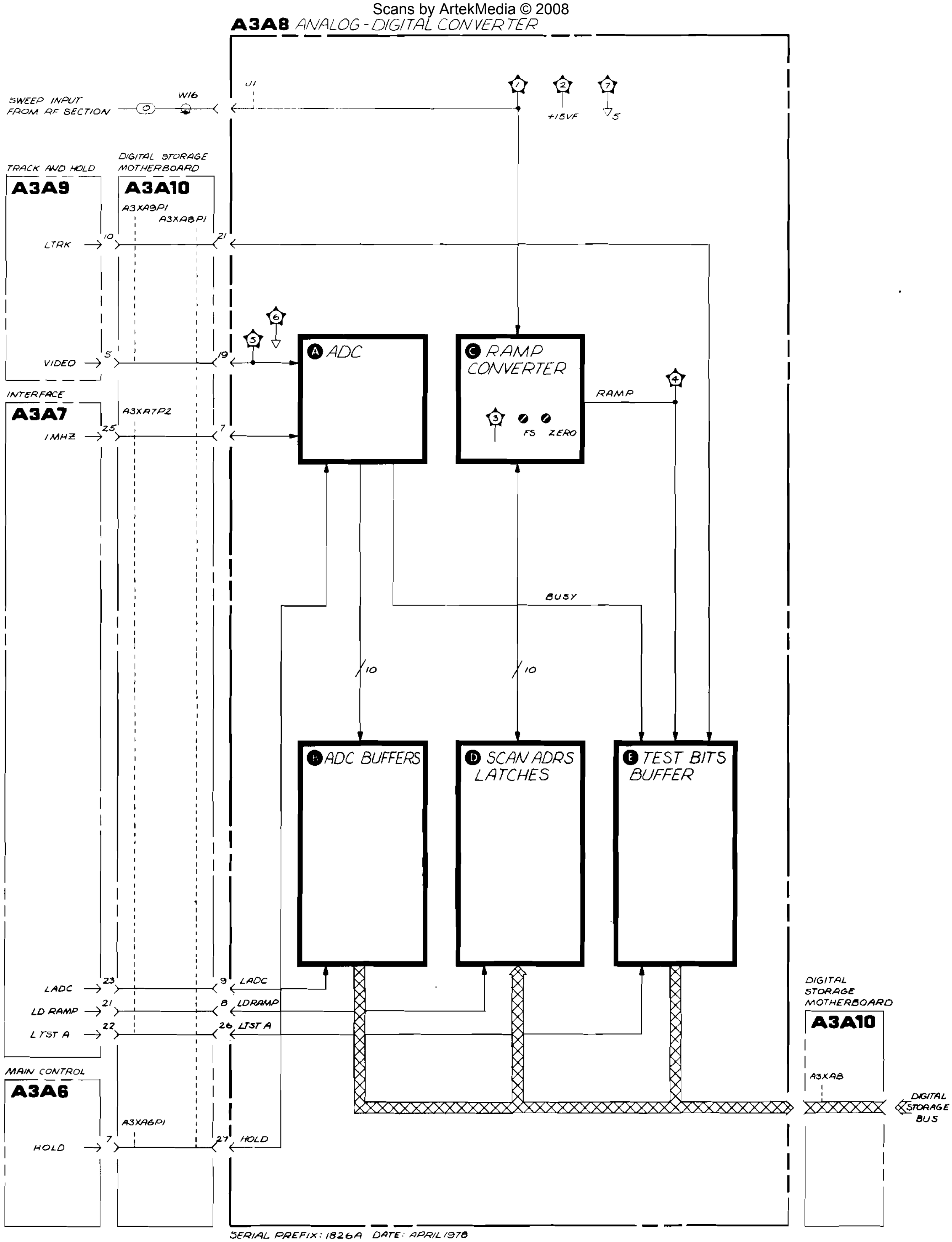


Figure 8-90. A3A8 Analog-Digital Converter, Block Diagram

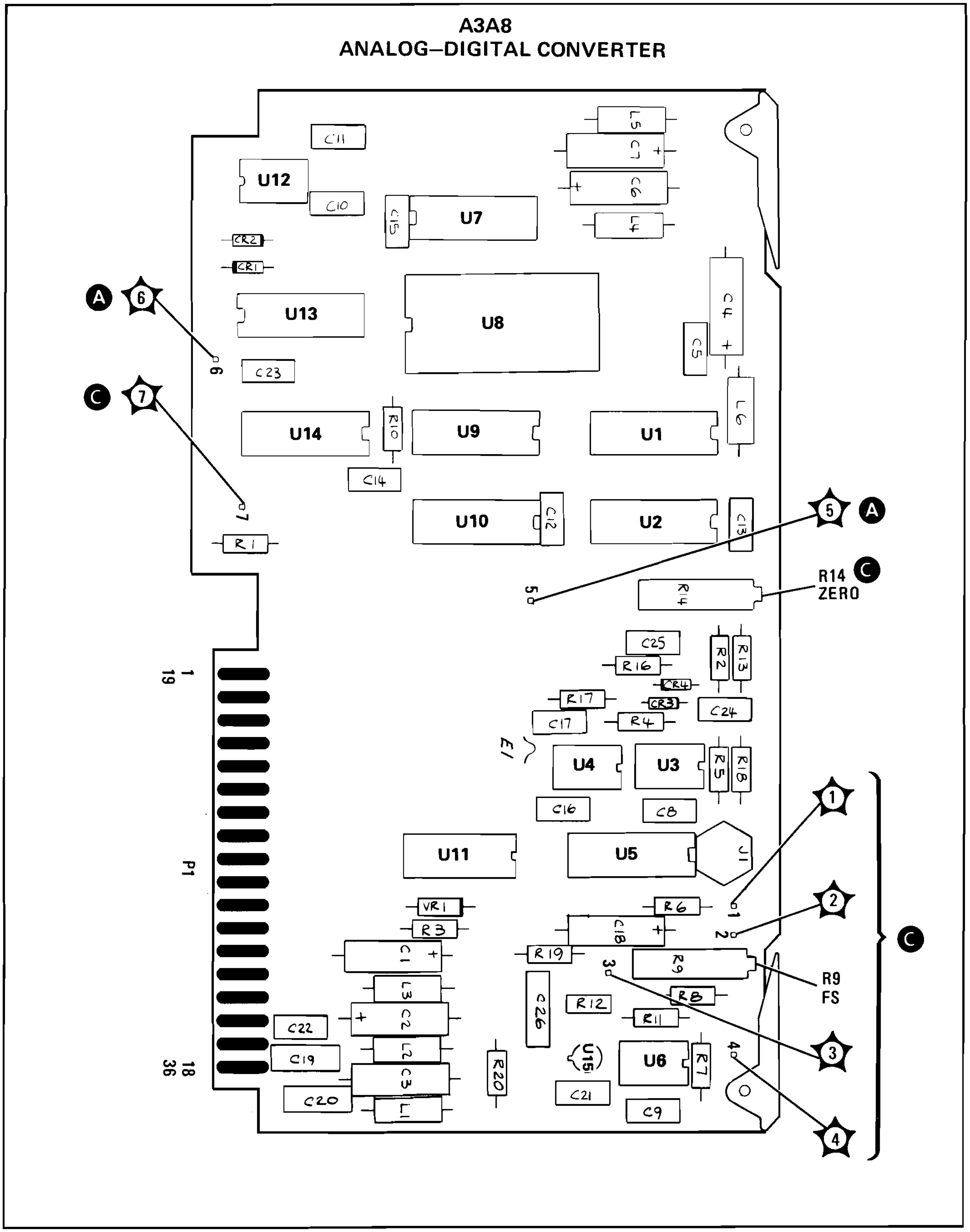
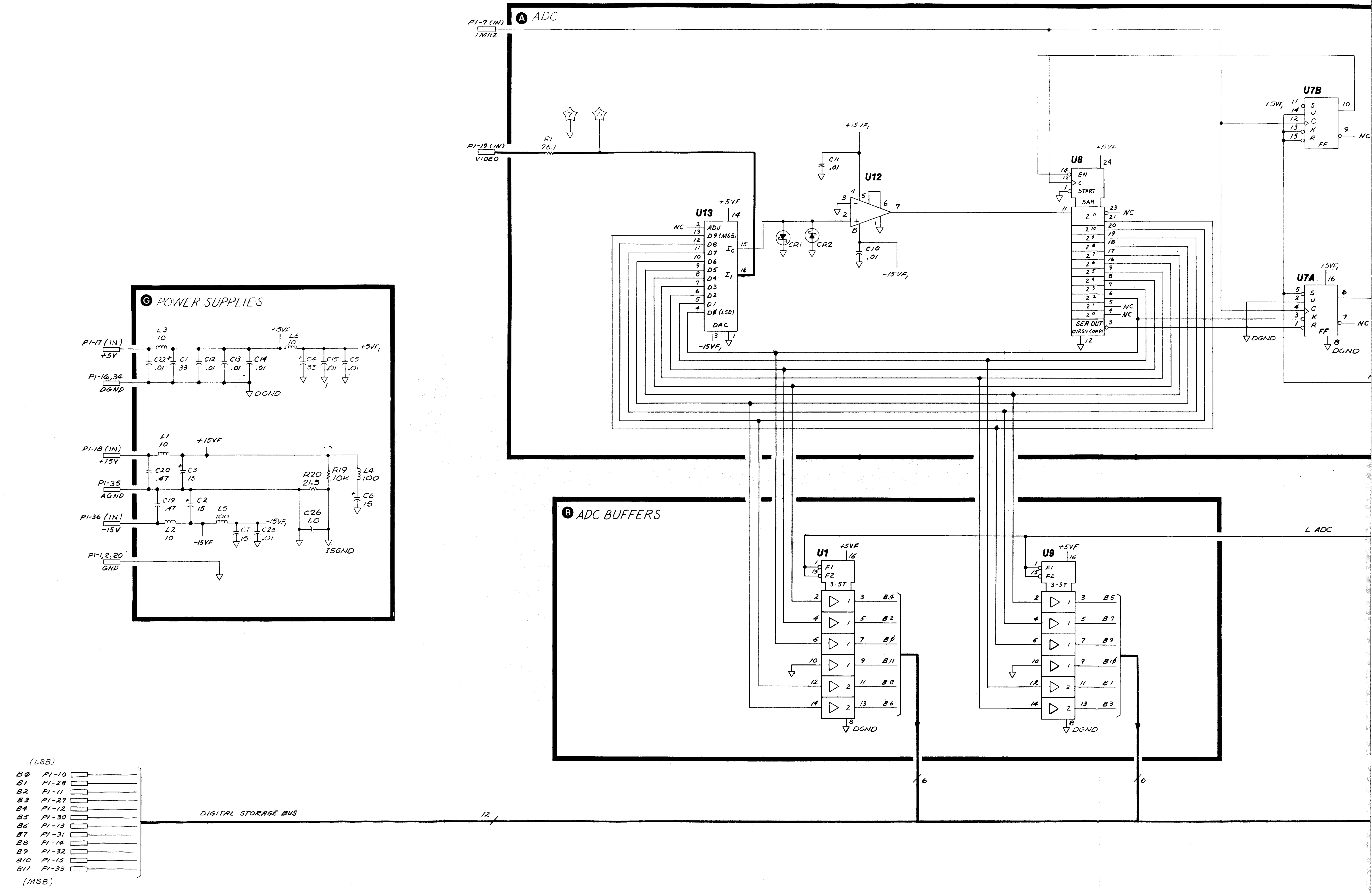


Figure 8-91. A3A8 Analog-Digital Converter, Component Locations

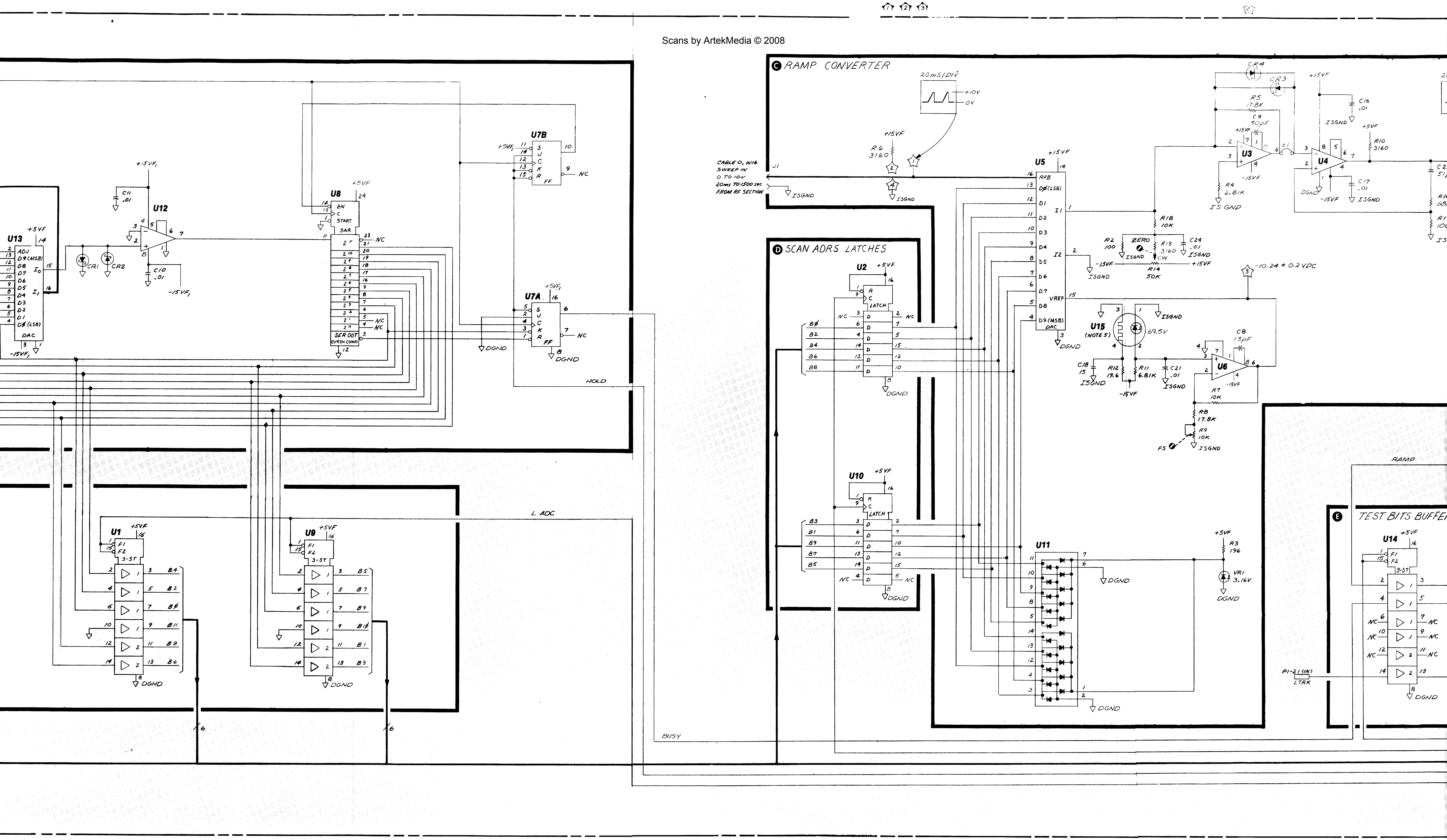
A3A8 ANALOG DIGITAL CONVERTER
85662 - 60043

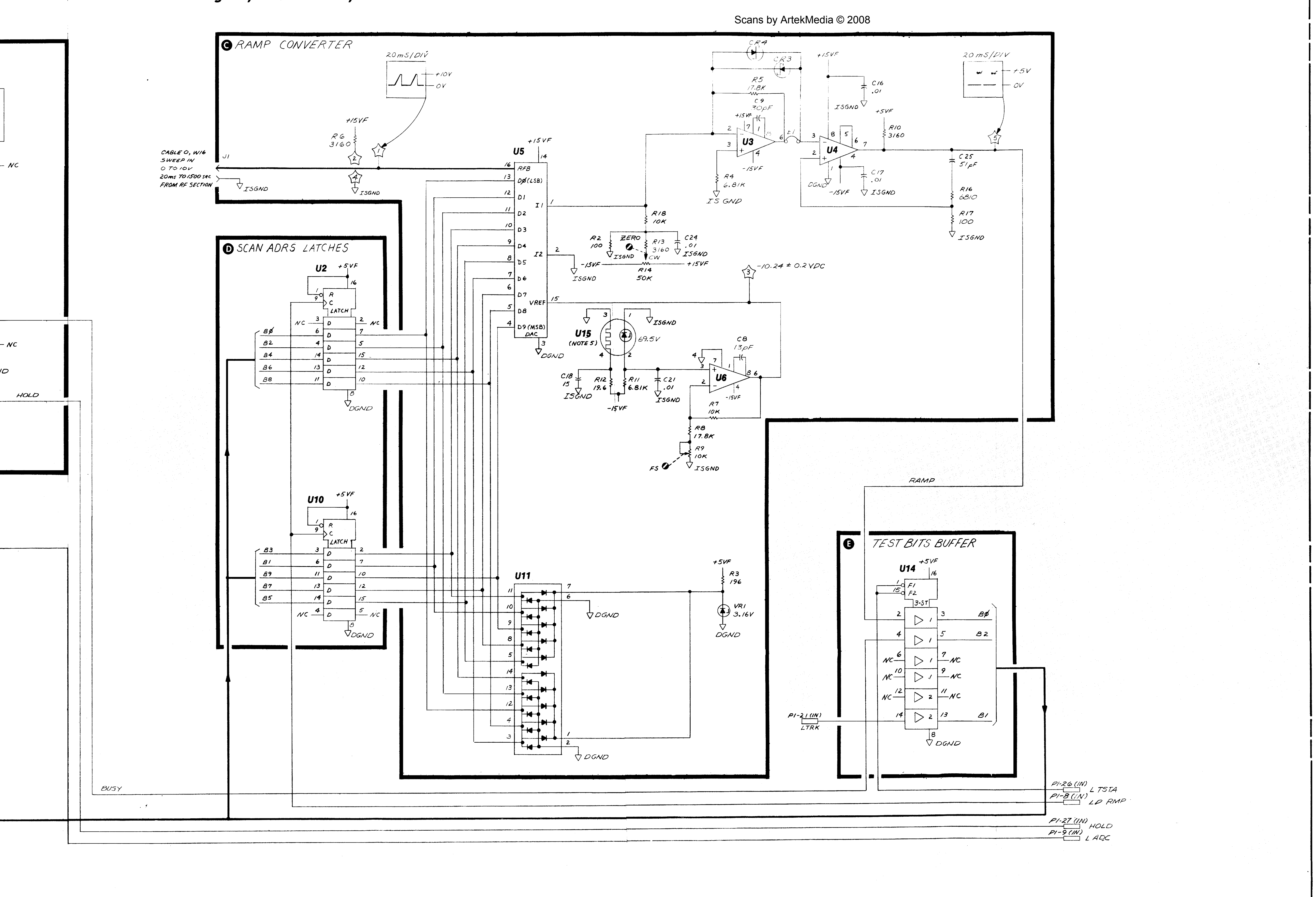
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 19	GND VIDEO	A3A9P1-5	G A
2 20	GND GND		G G
3 21	NC LTRK	A3A9P1-10	E
4 22	NC NC		
5 23	NC NC		
6 24	NC NC		
7 25	1MHZ NC	A3A7P2-25	A
8 26	LO RMP LTST A	A3A7P2-21 A3A7P2-22	D E
9 27	L ADC HOLD	A3A7P2-23 A3A6P1-7	B A
10 28	B0 B1	DIGITAL STORAGE BUS	B
11 29	B2 B3		
12 30	B4 B5		
13 31	B6 B7		
14 32	B8 B9		
15 33	B10 B11		
16 34	DGND DGND		G G
17 35	+5V AGND		G G
18 36	+15V -15V		G G



SERIAL PREFIX: 1826A DATE: APRIL 1978


C RAMP CONVERTER
20mS/DIV
+10V
0V
CABLE O, W16 SWEEP IN 0 TO 10V 20ms TO 1500 sec FROM RF SECTION
J1
ISGND
R6 3160
+15VF
U5
U3
U4
CR4
CR3
R5 17.8K
C9 30pF
R4 6.81K
IS GND
C16 .01
R10 3160
C17 .01
R18 10K
R2 100
ZERO
R13 3160
R14 50K
C24 .01
-10.24 ± 0.2VDC
U15 (NOTE 5)
6.9.5V
U6
C8 13pF
C18 15
R12 19.6
R11 6.81K
C21 .01
R7 10K
R8 17.8K
R9 10K
FS
D SCAN ADRS LATCHES
U2
U10
LATCH
U11
+5VF
R3 196
VR1 3.16V
DGND
E TEST BITS BUFFER
U14
P1-21 (IN) LTRK
RAMP
U13
DAC
U12
CR1
CR2
C11 .01
C10 .01
+15VF1
-15VF1
U8
EN
START
SAR
SER OUT
CVRSN COMPL
U7B
U7A
FF
HOLD
L ADC
BUSY
U1
U9
3-ST
B4 B2 B0 B11 B8 B6
B5 B7 B9 B10 B1 B3
NC

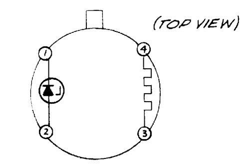


NOTES:

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
L ADC	LOADS ADC OUTPUT ONTO D.S. BUS
AGND	ANALOG GROUND
BØ-B11	DIGITAL STORAGE BUS BITS Ø-11
DGND	DIGITAL GROUND
HOLD	HOLD; CONTROLS TRACK/HOLD MODE, INITIATES DATA A/D CONVERSION
LD RMP	LOADS RAMP CONVERTER DAC
L TSTA	LOAD TEST BITS ONTO D.S. BUS
ISGND	ISOLATED SWEEP GROUND
LTRK	LO TRACKING

5. U15 IS A PRECISION VOLTAGE REFERENCE:
   PIN CONFIGURATION:



6. TEST POINT WAVEFORMS ASSUME INSTRUMENT PRESET CONDITION UNLESS NOTED.

A3A8

Figure 8-92. A3A8 Analog-Digital Converter, Schematic Diagram

Scans by ArtekMedia © 2008

A3A9 TRACK AND HOLD, CIRCUIT DESCRIPTION

A3A9 Track and Hold provides circuitry to insure that the true peak of the RF signal and a true representation of noise are displayed on the CRT. This is accomplished by positive and negative peak detection.

Positive Peak Detector A

The Positive Peak Detector acquires the most positive voltage to appear at its input and holds that voltage on holding capacitor C26 until the circuit is reset by a reset pulse from the decoding and timing circuits. FET Q6 is periodically turned on by the reset pulse, discharging C26 through R12 and Q6 to ground. Figure 8-93 shows a simplified schematic of the Positive Peak Detector.

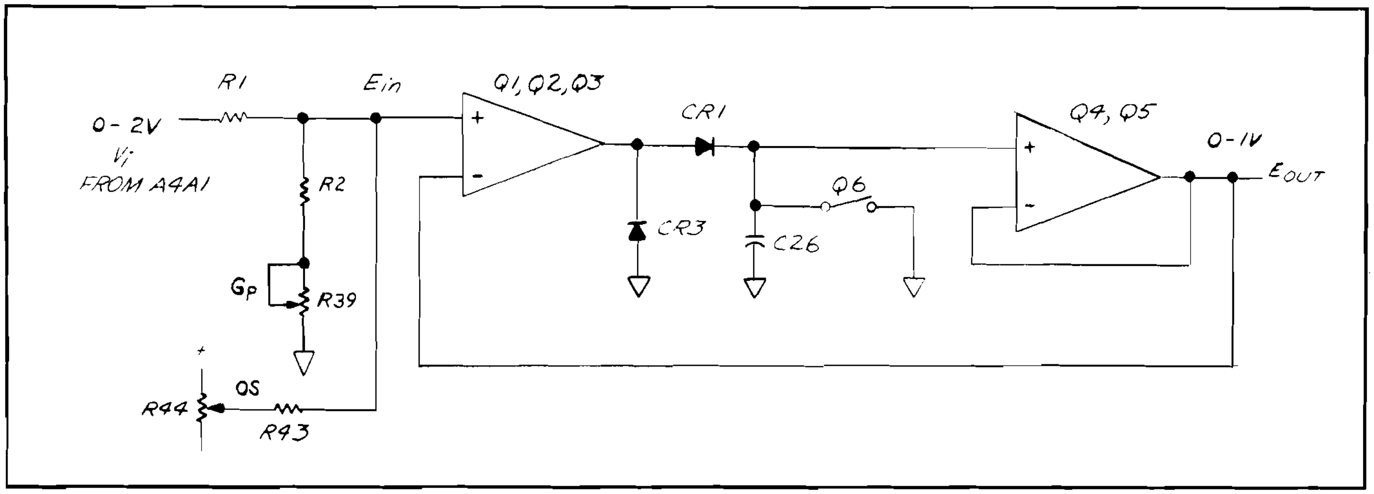


Figure 8-93. Positive Peak Detector, Simplified Schematic

The circuit consists of amplifier Q3, Q2, Q1, diode CR1, holding capacitor C26, and buffer Q4, Q3. When E_{in} is less than the feedback voltage E_{out}, CR1 is off and C26 will hold the voltage it has acquired. CR3 limits the reverse voltage across CR1 to minimize leakage current. CR1 turns on when E_{in} is greater than E_{out}, and C16 charges to equalize E_{in} and E_{out}.

A pair of matched FETs, Q4A and Q4B, and emitter follower Q5 are used in the buffer circuit. Q4A is used as a source follower and Q4B as a current source. The Q4A bias current is equal to the algebraic sum of the current from Q4B, the base current to Q3B, and the bias current through R13. This sum of currents insures a very small gate-to-source voltage and prevents gate-to-source forward biasing

Q1, Q2, and Q3 are all dual transistors. Q3 and Q2 form the input stage, with Q3 connected as emitter followers and Q2 forming a differential pair. Gain for the differential stage is set by collector resistor R7. Additional gain is provided by Q1. Q1B is connected as a transistor inverter with R19 in the emitter and R8 in the collector. Q1A is connected as a diode. Gain and offset adjustments for the positive Peak Detector are performed in the resistor divider that includes R1 and R2. Gp potentiometer R39 adjusts the attenuation so that a 2V full-scale input produces a 1V full-scale output. OSp potentiometer R44 zeroes the output with 0V input. U5 compares the input and output of the Peak Detector. A TTL high level is produced when the output is greater than the input.

Negative Peak Detector B

The Negative Peak Detector acquires the most negative voltage to appear at its input and holds that voltage on holding capacitor C38 until reset by a pulse from the decoding and timing circuits. Circuit operation is the same as that of the Positive Peak Detector except that supply polarities are reversed and PNP instead of NPN transistors are used. Figure 8-94 shows a simplified schematic of the Negative Peak Detector.

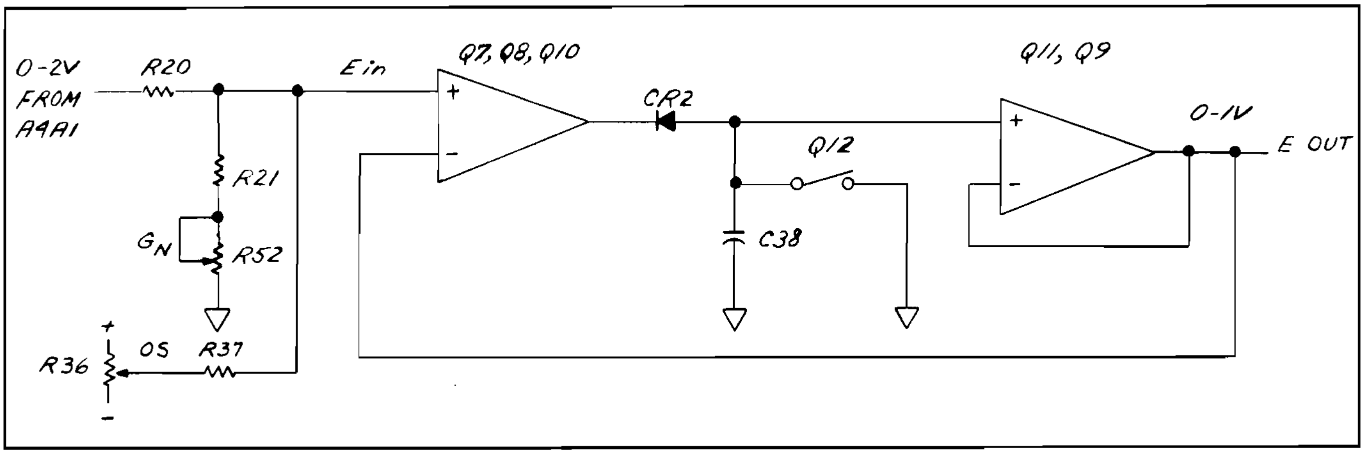


Figure 8-94. Negative Peak Detector, Simplified Schematic

The circuit consists of amplifier Q7, Q8, Q10, diode CR2, holding capacitor C38, buffer Q11,and Q9, and reset transistor Q12. R71 creates an offset between the output and the emitter of Q9. This insures that the voltage across C38 is always negative for positive outputs from 0V to + 1V. G_N potentiometer R52 sets the gain (input attenuation) so that a 2V Full-Scale input produces a 1V full-scale output. OS_N potentiometer R36 zeroes the offset. U4 compares the input to the output.

Decoding and Timing C

The Decoding and Timing circuit provides reset pulses to the Peak Detectors and control lines for Multiplexer selection, and it performs some other logic functions.

U9A decodes control lines SEL A and SEL B to produce three lines for Multiplexer selection. After inversion by U8A, U8B, and U8C, the voltage levels are shifted to −0.5V and +9V. Multivibrators U12A and U12B produce pulses (when triggered by HOLD) which reset the Peak Detectors. Latches U13A and U13B are used to provide the Peak Detector status signal LTRK.

Multiplexer D

The outputs of the Peak Detectors are multiplexed through U1 before sampling by the Track and Hold circuit. Control lines to the Multiplexer are provided by the Decoding and Timing circuit.

Track and Hold E

The Track and Hold circuit samples the signal appearing at the output of multiplexer U1 and holds the voltage on capacitor C15. The output of the Track and Hold circuit is used in A3A8 Analog-Digital Converter, where it is converted into Y-axis graph data. A simplified schematic of the Track and Hold circuit is shown in Figure 8-95.

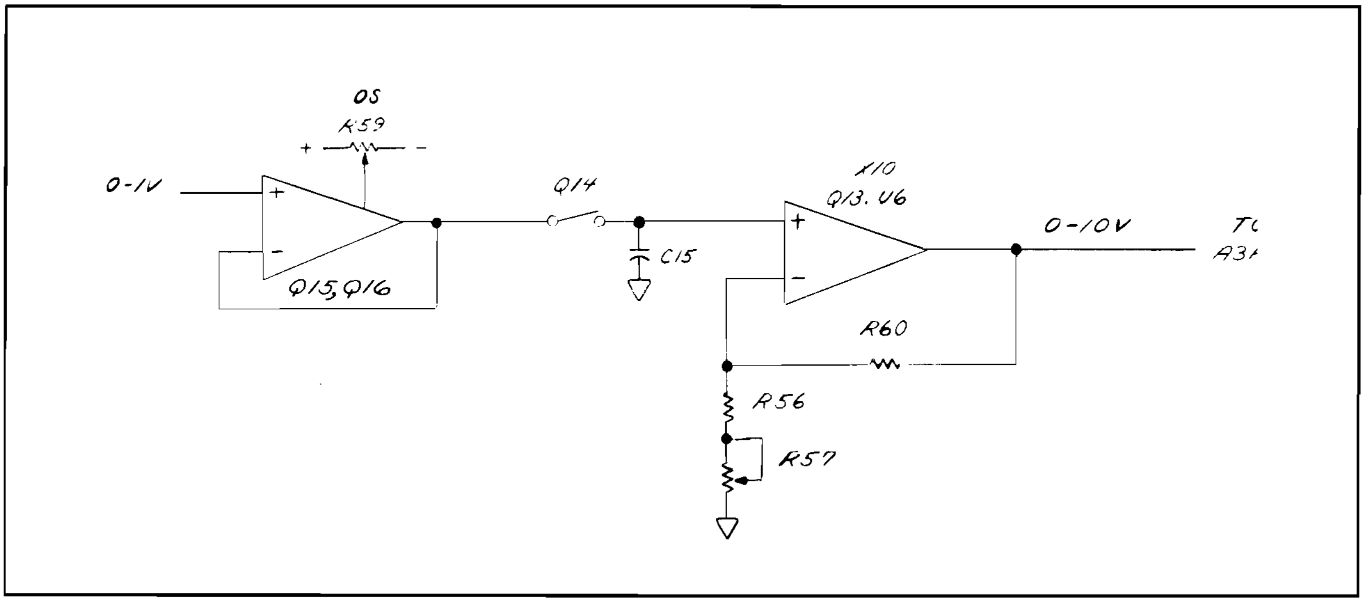


Figure 8-95. Track and Hold Circuit, Simplified Schematic

Q16 and Q15 form a buffer amplifier. Q14 switches on and off to open or close a path between the amplifier and holding capacitor C15. A FET input amplifier (Q13, U6) amplifies the capacitor voltage by a factor of 10. Gain is set by G_{OUT} potentiometer R57. Offset is adjusted by controlling the current flow through R67 with OS_{OUT} potentiometer R59.

A3A9 TRACK AND HOLD, TROUBLESHOOTING

Display problems which involve only the video are often caused by malfunctions on either A3A8 Analog-Digital Converter or the A3A9 Track and Hold. The blue [SHIFT] key functions and the Digital Storage Test Patterns can be used to isolate the failure.

Figure 8-96 shows the Digital Storage Test Pattern. The three vertical lines represent the detector outputs on A3A9. The left one is the negative peak detector, the center one is the sampling mode and the right one is the positive peak detector. These should move up and down indicating normal operation. If one is stuck, the blue [SHIFT] key can be used to verify this.

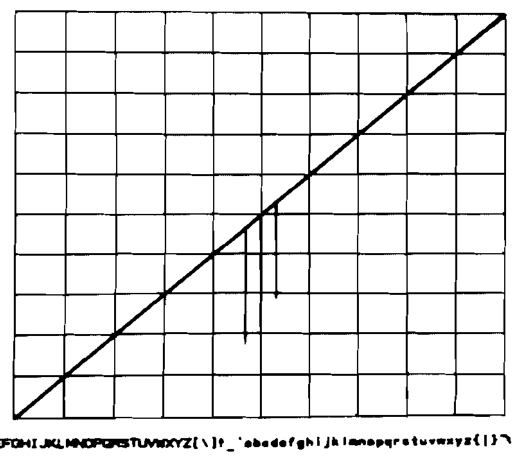


Figure 8-96. Digital Storage Test Pattern

Slight stair-stepping of the diagonal line could be caused by a low order bit failure on A3A8 or a noisy component on A3A9. To isolate the assemblies remove A3A9, jumper A3A8TP1 to A3A8TP6 and push [INSTR PRESET] . The Display is a diagonal line. If the diagonal line is not stair-stepped or noisy the problem is on A3A9.

Noise on the peaks of the displayed signals is most often caused by leakage in Q6 or Q14. This is very noticeable in 0 Hz frequency spans. To determine whether Q6 or Q14 is defective, sampling detection is used. [SHIFT] TRACE A [BLANK] (KSe) puts the instrument in the sampling mode. A noisy signal when using the sampling mode generally indicates a defective Q14. A defective Q6 produces noise in the normal detection mode and in the positive peak detection mode, [SHIFT] TRACE A [MAX HOLD] (KSb).

Proper operation of the detectors can be tested with the following sequence.

[INSTR PRESET]
[CLEAR WRITE] TRACE B [RECALL] [8]
[SHIFT] TRACE A [MAX HOLD] .... Positive Peak Detection
[VIEW] TRACE B
[SHIFT] TRACE A [VIEW] .... Negative Peak Detection (both traces coincide)
[SHIFT] TRACE A [BLANK] .... Sampling Mode (both traces coincide)

If the traces don't coincide in the above test, refer to the Trace and Hold adjustments in Section V.

If the voltage on TP8 is correct and that of TP9 is incorrect when performing the BIAS Check of Note 11 on the schematic, check to see if the drain and source voltages on Q14 are approximately +1V. If not, Q14 is most likely open.

The LTRK signal is verified using an oscilloscope. Following an [INSTR PRESET], set the Spectrum Analyzer sweeptime to 75 ms. Figure 8-97 shows the resultant waveform.

Oscilloscope settings:
Sweeptime: 50 ms/div
Analyzer Sweeptime: 75 ms

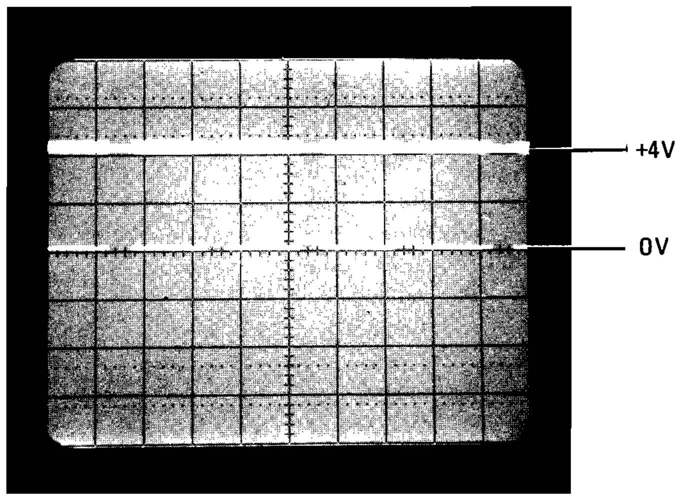
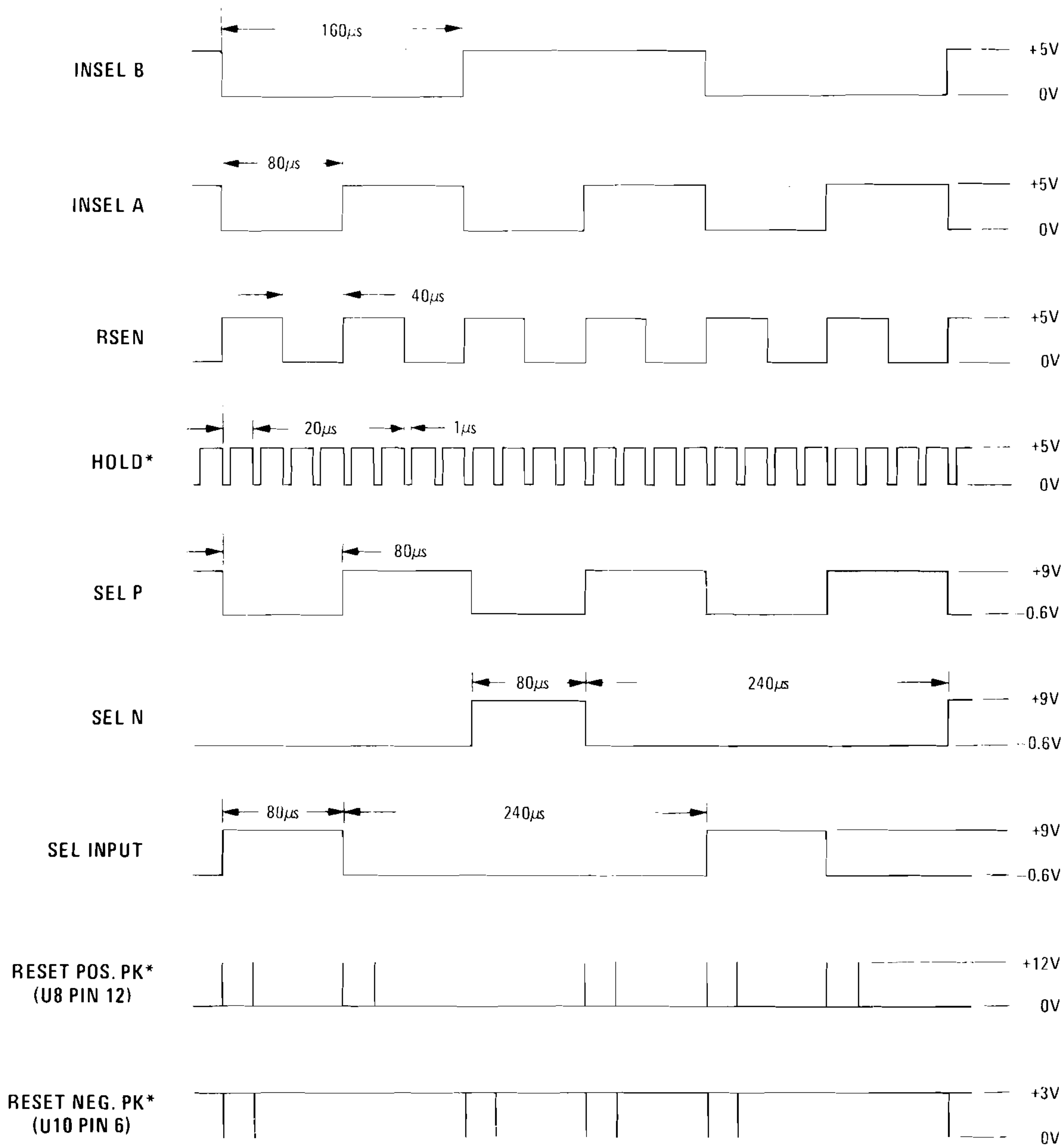


Figure 8-97. LTRK Timing Waveform

The Decoding and Timing C is checked using an oscilloscope. Figure 8-98 shows the timing waveforms when using Digital Storage Test Program 5. When Digital Storage Test Program 6 is used, HOLD is normally high. It goes low every 80 ms. The two reset lines are then active only every 80 ms. Figure 8-97 shows the LTRK line for a sweeptime of 75 ms following an [INSTR PRESET].



* For Test Program 6, HOLD is normally high, going low only every 80 msec which resets the peak detectors (RESET POS. PK and RESET NEG. PK). All other waveforms remain the same as for Test Program 5.

Figure 8-98. A3A9 Timing Waveforms Using Digital Storage Test Program 5

Table 8-30. A3A9 Track and Hold, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A9	85662-60012	1	BOARD ASSEMBLY, TRACK AND HOLD	28480	85662-60012
A3A9C1	0160-0127	4	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A9C2	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A9C3	0180-1746	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	0420J	150D156X9020B2
A3A9C4	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	0420J	150D156X9020B2
A3A9C5	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A9C6	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3A9C7	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	0420J	150D336X9010B2
A3A9C8	0160-2055	22	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C11	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	0420J	150D225X9020A2
A3A9C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C13	0160-3456	2	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A3A9C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C15	0160-0945	3	CAPACITOR-FXD 910PF +-5% 100VDC MICA0+70	28480	0160-0945
A3A9C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C18	0160-2204	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70	28480	0160-2204
A3A9C19	0160-2204		CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70	28480	0160-2204
A3A9C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C23	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A3A9C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C26	0160-0945		CAPACITOR-FXD 910PF +-5% 100VDC MICA0+70	28480	0160-0945
A3A9C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C28			NOT ASSIGNED		
A3A9C29			NOT ASSIGNED		
A3A9C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C31	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9C38	0160-0945		CAPACITOR-FXD 910PF +-5% 100VDC MICA0+70	28480	0160-0945
A3A9C39	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3A9CR1	1901-0376	2	DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A3A9CR2	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A3A9CR3	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A3A9J1	1250-0543	2	CONNECTOR-RF SM-SNP M PC 50-OHM	0576I	51-053-0000
A3A9J2	1250-0543		CONNECTOR-RF SM-SNP M PC 50-OHM	0576I	51-053-0000
A3A9L1	9140-0096	1	COIL-MLD 1UH 10% Q=50 .155DX.375LG	0217B	15-4425-6K
A3A9L2	9100-1629	2	COIL-MLD 47UH 5% Q=55 .155DX.375LG	0217B	15-1315-4J
A3A9L3	9100-1629		COIL-MLD 47UH 5% Q=55 .155DX.375LG	0217B	15-1315-4J
A3A9L4	9140-0210	1	COIL-MLD 100UH 5% Q=50 .155DX.375LG	0217B	15-1315-12J
A3A9Q1	1853-0075	2	TRANSISTOR-DUAL PNP PD=400MW	28480	1853-0075
A3A9Q2	1854-0475	4	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A3A9Q3	1854-0475		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A3A9Q4	1855-0050	3	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0050
A3A9Q5	1854-0019	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A9Q6	1855-0241	2	TRANSISTOR MOSFET N-CHAN E-MODE TO-72 SI	0291J	SD215
A3A9Q7	1853-0316	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A3A9Q8	1853-0075		TRANSISTOR-DUAL PNP PD=400MW	28480	1853-0075
A3A9Q9	1853-0034	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3A9Q10	1854-0475		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A3A9Q11	1855-0050		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0050
A3A9Q12	1853-0322	1	TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	0169H	2N2946A
A3A9Q13	1855-0050		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0050
A3A9Q14	1855-0241		TRANSISTOR MOSFET N-CHAN E-MODE TO-72 SI	0291J	SD215
A3A9Q15	1854-0404	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A9Q16	1854-0475		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A3A9R1	0698-3441	3	RESISTOR 215 1% .125W F TC=0+-100	0329B	C4-1/8-T0-215R-F
A3A9R2	0698-3440	4	RESISTOR 196 1% .125W F TC=0+-100	0329B	C4-1/8-T0-196R-F
A3A9R3	0757-0442	7	RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A3A9R4	0757-0438	4	RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A3A9R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F

Table 8-30. A3A9 Track and Hold, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A9R6	0757-0280	6	RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A3A9R7	0757-0274	2	RESISTOR 1.21K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1213-F
A3A9R8	0698-0083	1	RESISTOR 1.96K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1961-F
A3A9R9	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	03298	C4-1/8-T0-196R-F
A3A9R10	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A3A9R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A3A9R12	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-TO-10R0-F
A3A9R13	0757-0465	2	RESISTOR 100K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1003-F
A3A9R14	0757-0279	4	RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A3A9R15	0698-3157	7	RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A3A9R16	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A3A9R17	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	03298	C4-1/8-T0-178R-F
A3A9R18	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	03298	C4-1/8-T0-196R-F
A3A9R19	2100-3053	1	RESISTOR-TRMR 20 20% C SIDE-ADJ 17-TRN	73138	89PR20
A3A9R20	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	03298	C4-1/8-T0-215R-F
A3A9R21	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	03298	C4-1/8-T0-196R-F
A3A9R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A3A9R23	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5111-F
A3A9R24	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A3A9R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A3A9R26	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1213-F
A3A9R27	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5111-F
A3A9R28	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A3A9R29	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A3A9R30	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A3A9R31	0757-0401	5	RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A3A9R32	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A3A9R33	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A3A9R34	0698-0084	1	RESISTOR 2.15K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2151-F
A3A9R35	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A3A9R36	2100-3161	3	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
A3A9R37	0698-3160	2	RESISTOR 31.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3162-F
A3A9R38	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A3A9R39	2100-3052	2	RESISTOR-TRMR 50 20% C SIDE-ADJ 17-TRN	73138	89PR50
A3A9R40	0698-3136	2	RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A3A9R41	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A3A9R42	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A3A9R43	0698-3160		RESISTOR 31.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3162-F
A3A9R44	2100-3161		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
A3A9R45	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A3A9R46	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A3A9R47	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5111-F
A3A9R48	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-1332-F
A3A9R49	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	03298	C4-1/8-T0-7501-F
A3A9R50	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1471-F
A3A9R51	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A3A9R52	2100-3052		RESISTOR-TRMR 50 20% C SIDE-ADJ 17-TRN	73138	89PR50
A3A9R53	0698-0085	1	RESISTOR 2.61K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2611-F
A3A9R54	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A3A9R55	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1962-F
A3A9R56	0757-0422	1	RESISTOR 909 1% .125W F TC=0+-100	03298	C4-1/8-T0-909R-F
A3A9R57	2100-3095	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	73138	89PR200
A3A9R58	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1003-F
A3A9R59	2100-3161		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
A3A9R60	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-9091-F
A3A9R61	0757-0441	1	RESISTOR 8.25K 1% .125W F TC=0+-100	03298	C4-1/8-T0-8251-F
A3A9R62			NOT ASSIGNED		
A3A9R63			NOT ASSIGNED		
A3A9R64	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A3A9R65	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A3A9R66	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A3A9R67	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-TO-511R-F
A3A9R68	0757-0417	1	RESISTOR 562 1% .125W F TC=0+-100	03298	C4-1/8-TO-562R-F
A3A9R69	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A3A9R70	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A3A9R71	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	03298	C4-1/8-T0-215R-F
A3A9TP1	0360-0535	10	TERMINAL, TEST POINT	28480	0360-0535
A3A9TP2	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP3	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP4	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP5	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP6	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP7	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP8	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP9	0360-0535		TERMINAL, TEST POINT	28480	0360-0535
A3A9TP10	0360-0535		TERMINAL, TEST POINT	28480	0360-0535

Table 8-30. A3A9 Track and Hold, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A9U1	1826-0415	1	IC SWITCH	0291J	SD5000B
A3A9U2	1810-0207	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	0248C	750-81-R22K
A3A9U3	1810-0037	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	0248C	760 SERIES/16 PIN
A3A9U4	1826-0026	2	IC COMPARATOR	0340F	LM311H
A3A9U5	1826-0026		IC COMPARATOR	0340F	LM311H
A3A9U6	1826-0089	1	IC 2525 OP AMP	0379I	HA2-2525-5
A3A9U7	1810-0205	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	0248C	750-81-R4.7K
A3A9U8	1820-0471	1	IC INV TTL HEX 1-INP	0223G	7406PC
A3A9U9	1820-1281	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2-INP	0379D	AM74LS139
A3A9U10	1820-1202	1	IC GATE TTL LS NAND TPL 3-INP	0223G	9LS10PC
A3A9U11	1820-1197	1	IC GATE TTL LS NAND QUAD 2-INP	0169H	SN74LS00N
A3A9U12	1820-1423	1	IC MV TTL LS MONOSTBL RETRIG DUAL	0169H	SN74LS123N
A3A9U13	1820-1112	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	0169H	SN74LS74N
			A3A9 MISCELLANEOUS PARTS		
	1480-0073	2	PIN:DRIVE 0.250" LG .062" DIA	28480	1480-0073
	4040-0756	2	EXTRACTOR-PC BOARD WHT POLYC	28480	4040-0756

Table 8-31. A3A9 Track and Hold, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	B1	Q1	C1	R34	C4	U3	C3
C2	B2	Q2	C1	R35	C4	U4	C3
C3	B1	Q3	C2	R36	C3	U5	B2
C4	B1	Q4	C2	R37	C3	U6	B2
C5	B1	Q5	C2	R38	C3	U7	B3
C6	B2	Q6	C2	R39	C2	U8	B3
C7	B4	Q7	C3	R40	B1	U9	B3
C8	B4	Q8	C3	R41	B1	U10	B3
C9	B3	Q9	C3	R42	C4	U11	B3
C10	B2	Q10	C3	R43	C1	U12	B4
C11	B2	Q11	C4	R44	C2	U13	B4
C12	B2	Q12	C4	R45	C2		
C13	C2	Q13	B2	R46	C4		
C14	B2	Q14	B2	R47	B2		
C15	B2	Q15	B2	R48	B2		
C16	B2	Q16	B2	R49	B2		
C17	B2			R50	B2		
C18	B4	R1	C1	R51	B2		
C19	B4	R2	C1	R52	C3		
C20	B1	R3	C2	R53	B3		
C21	B2	R4	C2	R54	B2		
C22	C1	R5	C2	R55	B2		
C23	B2	R6	C2	R56	B2		
C24	C1	R7	C1	R57	C2		
C25	C1	R8	C1	R58	B2		
C26	C2	R9	C1	R59	C2		
C27	C1	R10	C2	R60	B2		
C30	D3	R11	C3	R61	C4		
C31	C4	R12	C2	R64	B3		
C32	C3	R13	C2	R65	C2		
C33	C4	R14	C2	R66	B2		
C34	D3	R15	B1	R67	B2		
C35	C2	R16	B1	R68	C2		
C36	C3	R17	C3	R69	B4		
C37	C4	R18	C2	R70	C2		
C38	C4	R19	C3	R71	C3		
C39	C4	R20	C3				
		R21	C3	TP1	D2		
CR1	C2	R22	C3	TP2	C2		
CR2	C4	R23	C3	TP3	D2		
CR3	C1	R24	C3	TP4	C3		
		R25	C3	TP5	B1		
J1	D2	R26	C4	TP6	B1		
J2	D2	R27	C3	TP7	B2		
		R28	C4	TP8	C2		
L1	B4	R29	C4	TP9	B2		
L2	B1	R30	C4	TP10	C3		
L3	B2	R31	C4				
L4	B3	R32	C3	U1	C2		
		R33	C4	U2	C3		

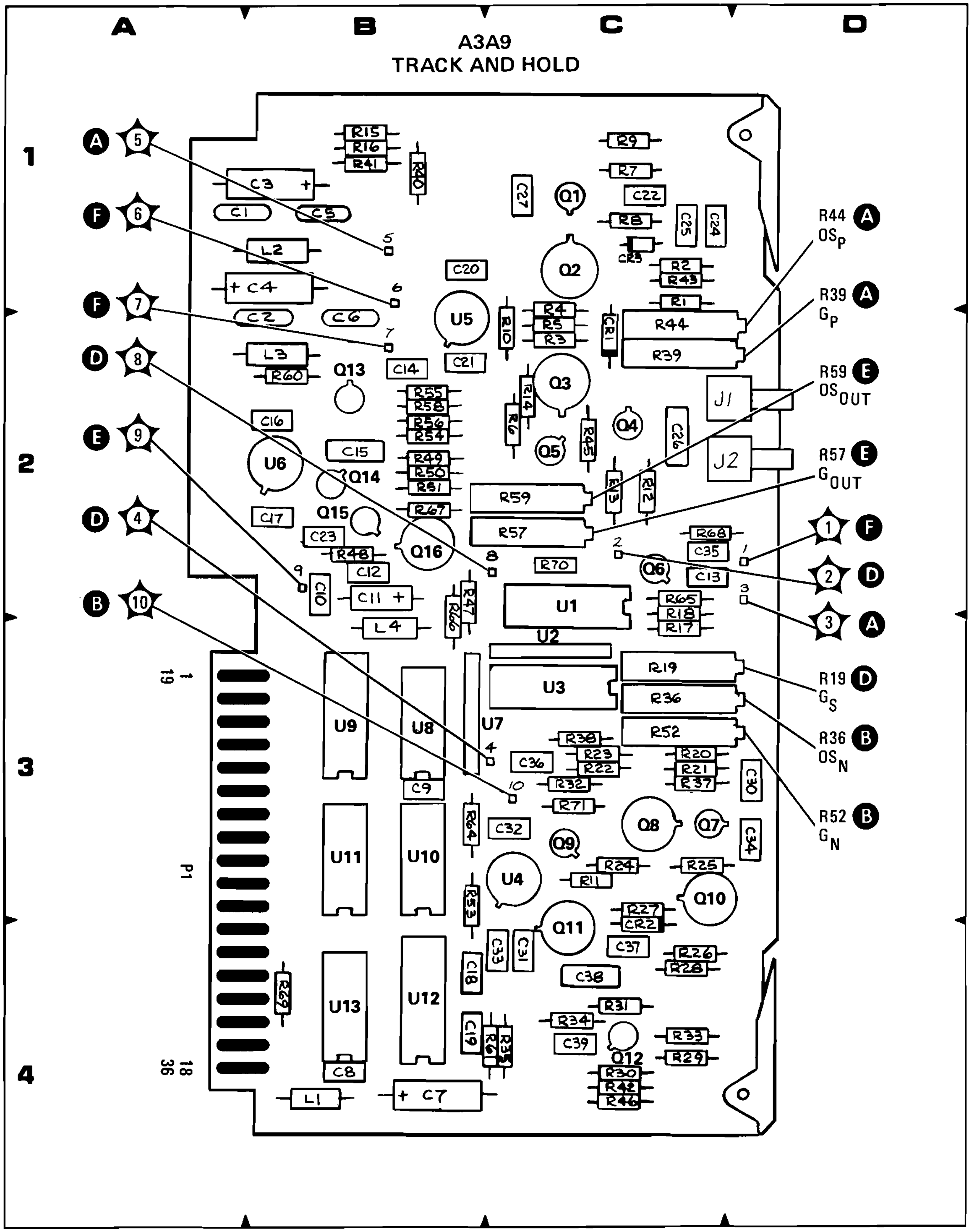


Figure 8-99. A3A9 Track and Hold, Component Locations

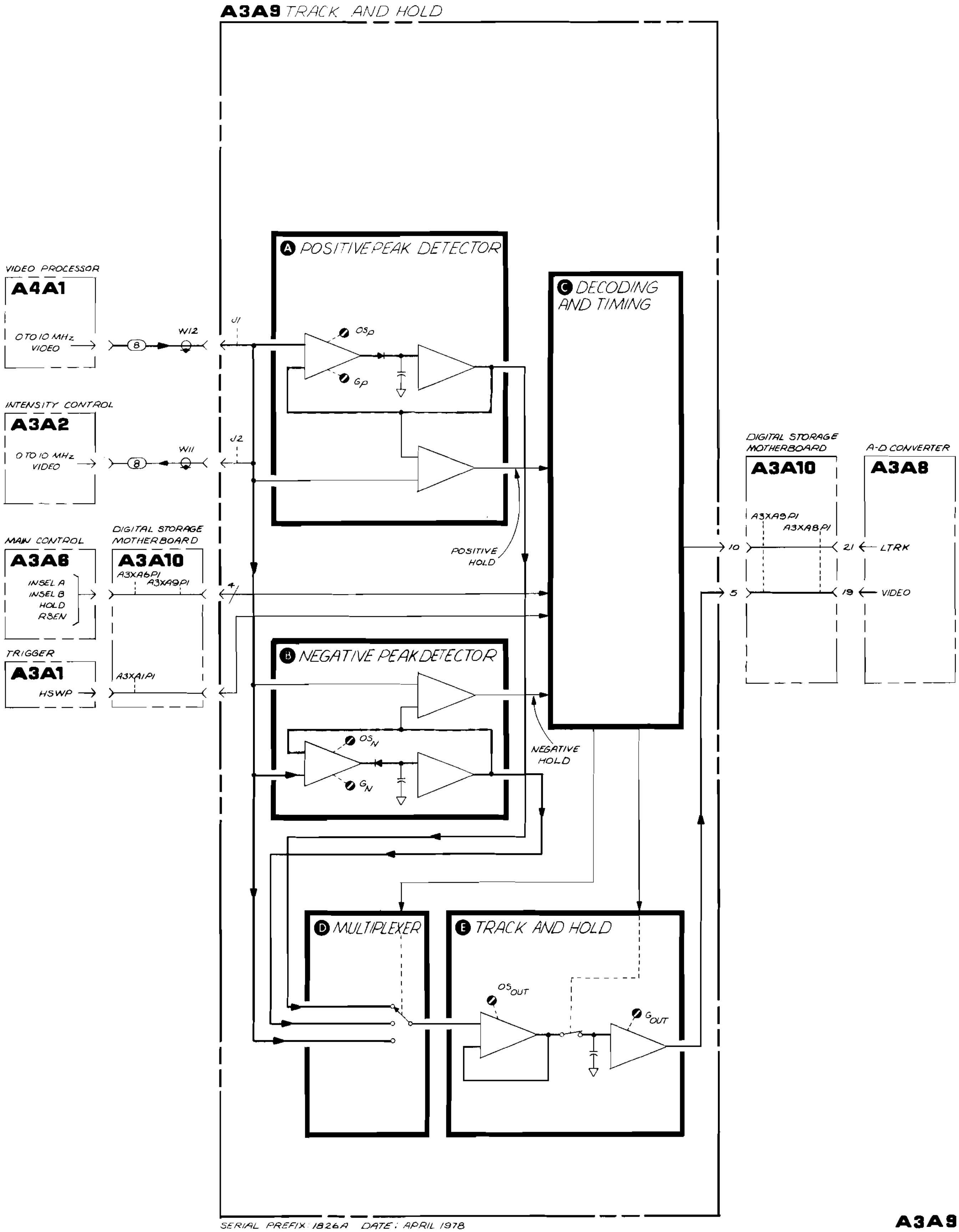
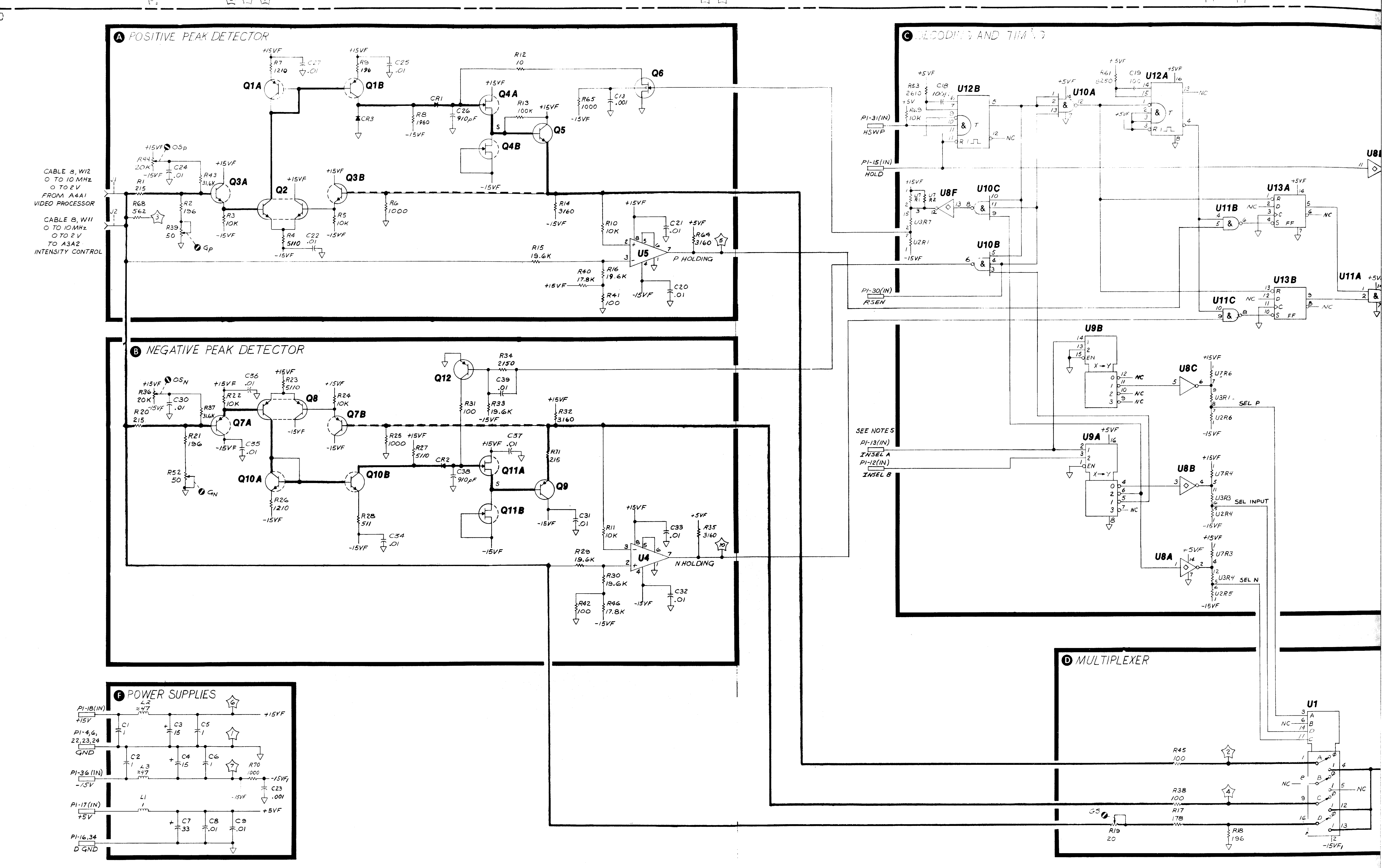


Figure 8-100. A3A9 Track and Hold, Block Diagram

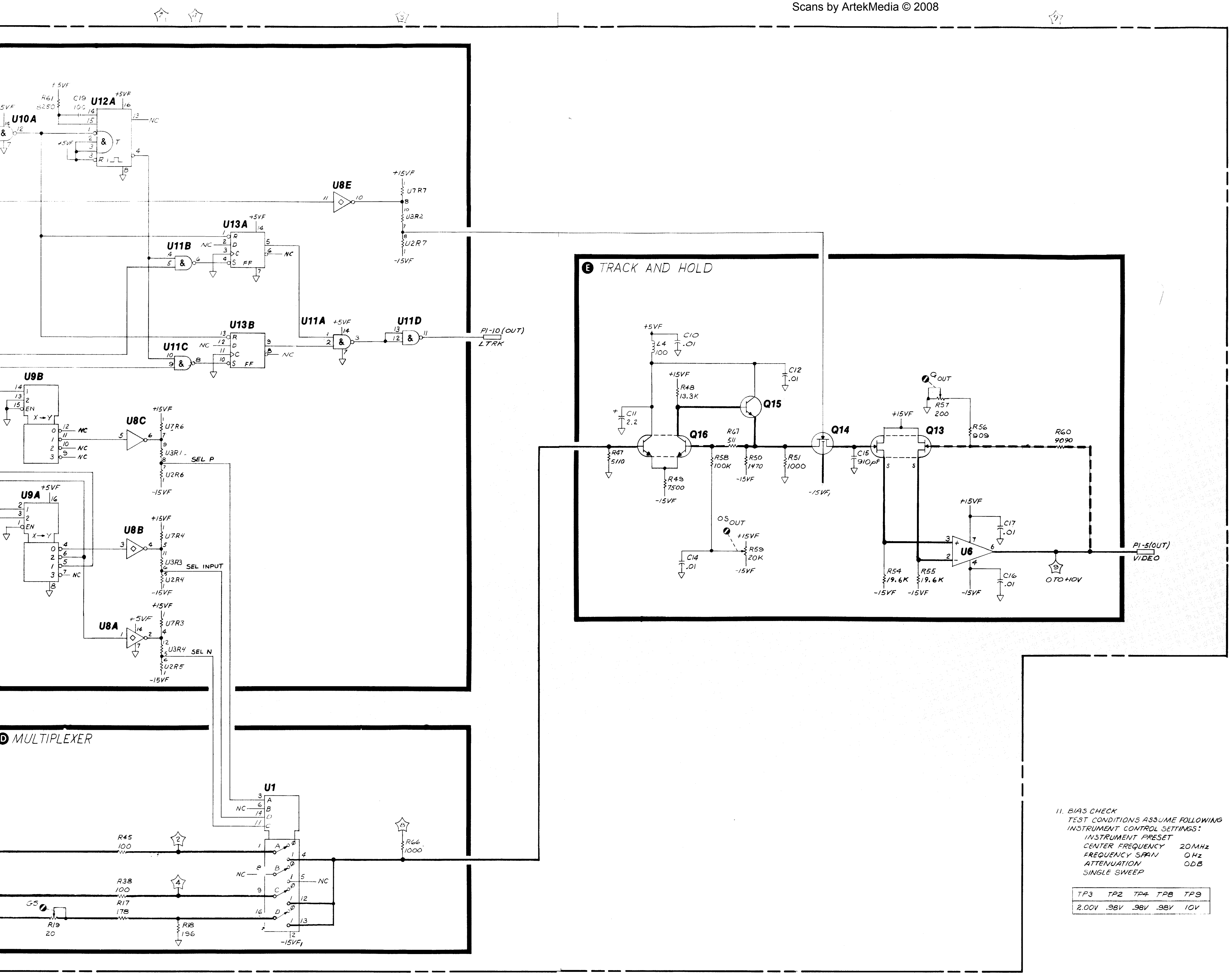
A3A9 TRACK AND HOLD
85662-60012

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
19	NC		
2	NC		
20	NC		
3	NC		
21	NC		
4	GND		F
22	GND		F
5	VIDEO	A3A8P1-19	E
23	GND		F
6	GND		F
24	GND		F
7	NC		
25	NC		
8	NC		
26	NC		
9	NC		
27	NC		
10	LTRK	A3A8 P1-21	C
28	NC		
11	NC		
29	NC		
12	INSEL B	A3A6 P1-6	C
30	RSEN	A3A6 P1-12	C
13	INSEL A	A3A6 P1-23	C
31	HSWP	A3A1 P1-21	C
14	NC		
32	NC		
15	HOLD	A3A6 P1-7	C
33	NC		
16	D GND		F
34	D GND		F
17	+5V		F
35	NC		
18	+15V		F
36	-15V		F



SERIAL PREFIX: 1826A DATE: APRIL 1978



NOTES:

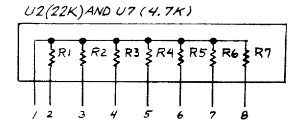
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED, LOGIC LEVELS ARE TTL:
   +2.0V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW
4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
INSEL A INSEL B	MULTIPLEX CHANNEL SELECT
RSEN	PEAK DETECTOR RESET ENABLE
HSWP	HIGH = SWEEPING
HOLD	SAMPLER ON/OFF CONTROL
G_P	POSITIVE PEAK DETECTOR GAIN
G_N	NEGATIVE PEAK DETECTOR GAIN
GS	GAIN FOR SAMPLING W/O PEAK DETECTION
G_{OUT}	FINAL OUTPUT GAIN ADJUST
OS_{OUT}	FINAL OUTPUT OFFSET ADJUST
LTRK	LOW = A PEAK DETECTOR IS TRACKING THE INPUT SIGNAL.

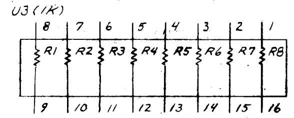
5. INPUT SELECT TABLE

INSEL A	INSEL B	FUNCTION SELECTED
0	0	SAMPLE
1	0	POS. PEAK
0	1	NEG. PEAK
1	1	POS. PEAK

6. PIN CONFIGURATION FOR U2 AND U7.
   U2(22K) AND U7 (4.7K)

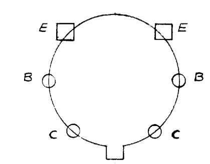


7. PIN CONFIGURATION FOR U3:
   U3 (1K)



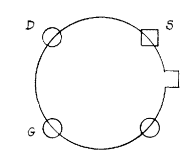
8. Q1, 2, 3, 7, 8, 10 AND 16 ARE DUAL TRANSISTORS WITH THE FOLLOWING PIN CONFIGURATION:

TOP VIEW



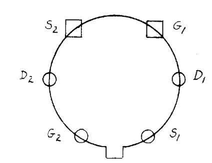
9. Q6 AND Q14 ARE MOS n-channel ENHANCEMENT MODE FETs WITH THE FOLLOWING PIN CONFIGURATION:

TOP VIEW



10. Q4, 11, AND 13 ARE DUAL FETs WITH THE FOLLOWING PIN CONFIGURATION:

TOP VIEW



11. BIAS CHECK
   TEST CONDITIONS ASSUME FOLLOWING INSTRUMENT CONTROL SETTINGS:
   INSTRUMENT PRESET
   CENTER FREQUENCY 20MHz
   FREQUENCY SPAN 0Hz
   ATTENUATION 0DB
   SINGLE SWEEP

TP3	TP2	TP4	TP8	TP9
2.00V	.98V	.98V	.98V	10V

A3A9

Figure 8-101. A3A9 Track and Hold, Schematic Diagram

Table 8-32. A3A10 Digital Storage Motherboard, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A10	85662-60015	1	BOARD ASSEMBLY,DIGITAL STORAGE MOTHER BD (INCLUDES W2 AND W3)	28480	85662-60015
A3A10J1	1200-0508	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A3A10J2	1251-4827	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A3A10J3	1251-4804	1	CONNECTOR 4-PIN M POST TYPE	28480	1251-4804
A3XA1P1	1251-2026	14	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA1P2	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA2P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA2P2	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA3P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA3P2	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA4P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA5P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA6P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA6P2	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA7P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA7P2	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA8P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3XA9P1	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026

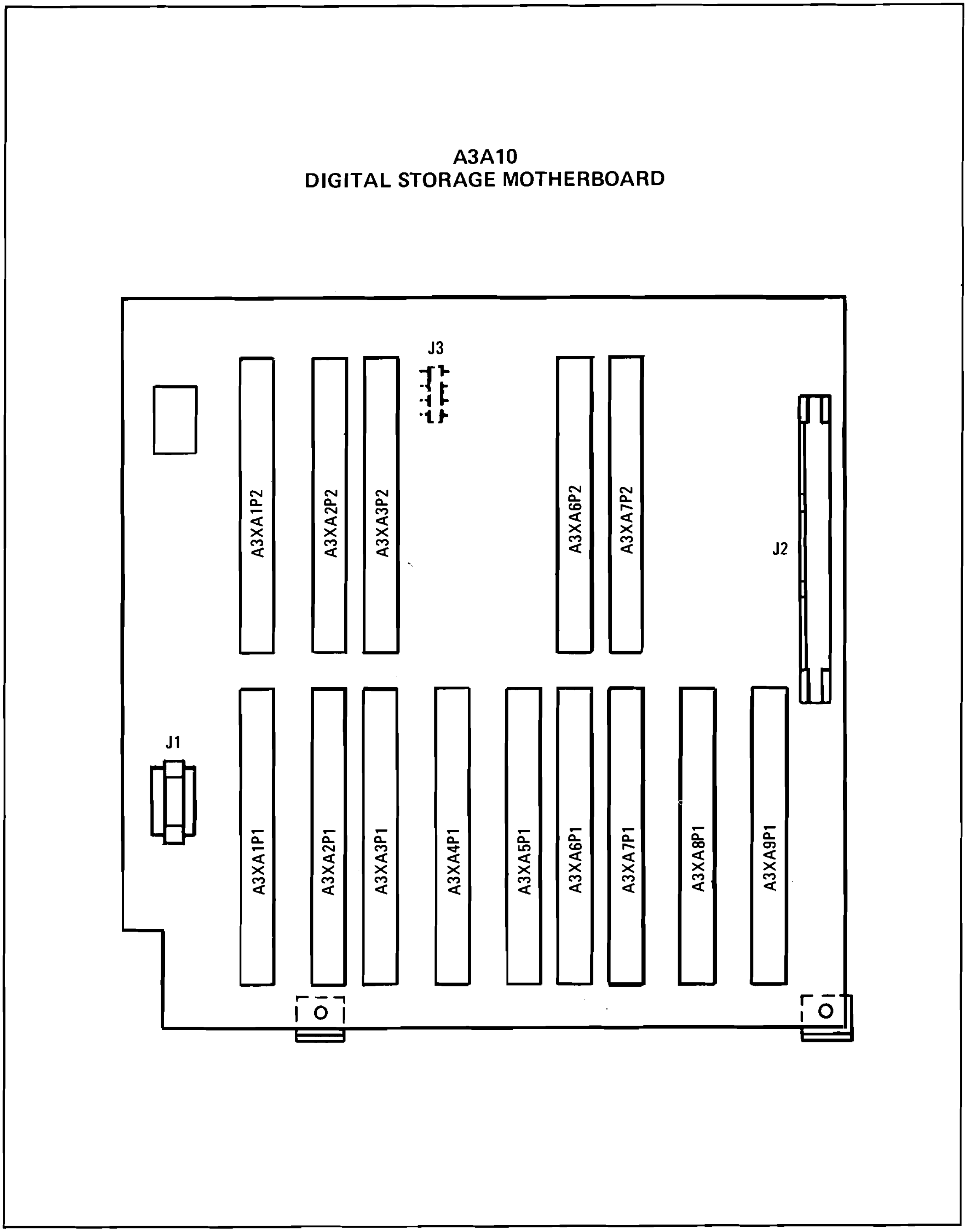
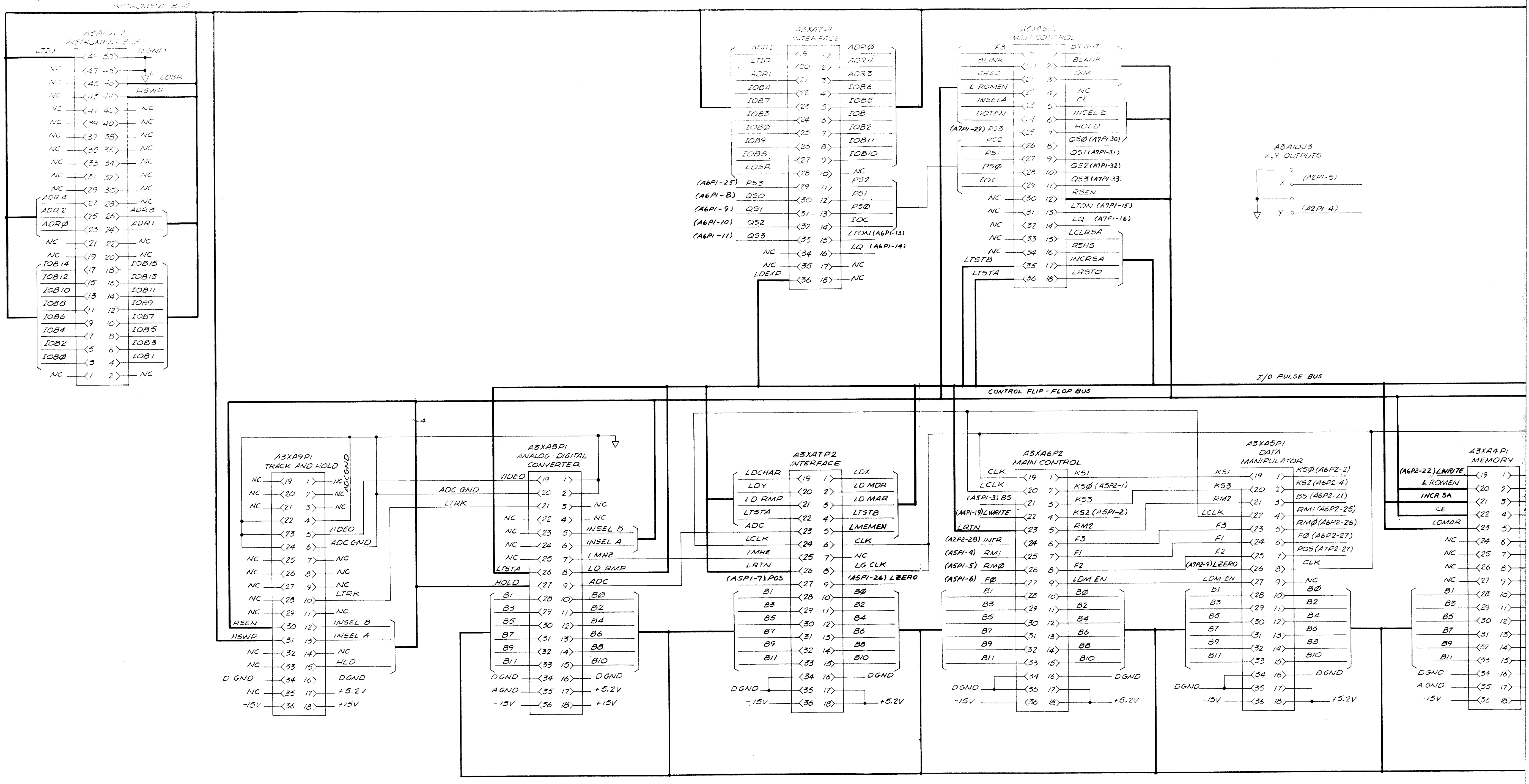


Figure 8-102. A3A10 Digital Storage Motherboard, Component Locations

A3A10
DIGITAL STORAGE MOTHERBOARD
85662-60015

A3A10J2
50-WIRE INSTRUMENT BUS

PIN	SIGNAL
1	GND (N.C.)
2	LTGR
3	IOBØ
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	N.C.
20	N.C.
21	N.C.
22	HPON (N.C.)
23	ADRØ
24	ADR1
25	ADR2
26	ADR3
27	ADR4
28	ADR5 (NOT USED)
29	N.C.
30	N.C.
31	KR8 (N.C.)
32	KR9 (N.C.)
33	KR10 (N.C.)
34	KR11 (N.C.)
35	KCØ (N.C.)
36	KC1 (N.C.)
37	KC2 (N.C.)
38	KC3 (N.C.)
39	KC4 (N.C.)
40	KC5 (N.C.)
41	KC6 (N.C.)
42	KC7 (N.C.)
43	LSTP (N.C.)
44	HSWP
45	LSRQ (N.C.)
46	LOSR
47	LBIO (N.C.)
48	GND
49	LTIO
50	DGND



SERIAL PREFIX: 1826A DATE: APRIL, 1978

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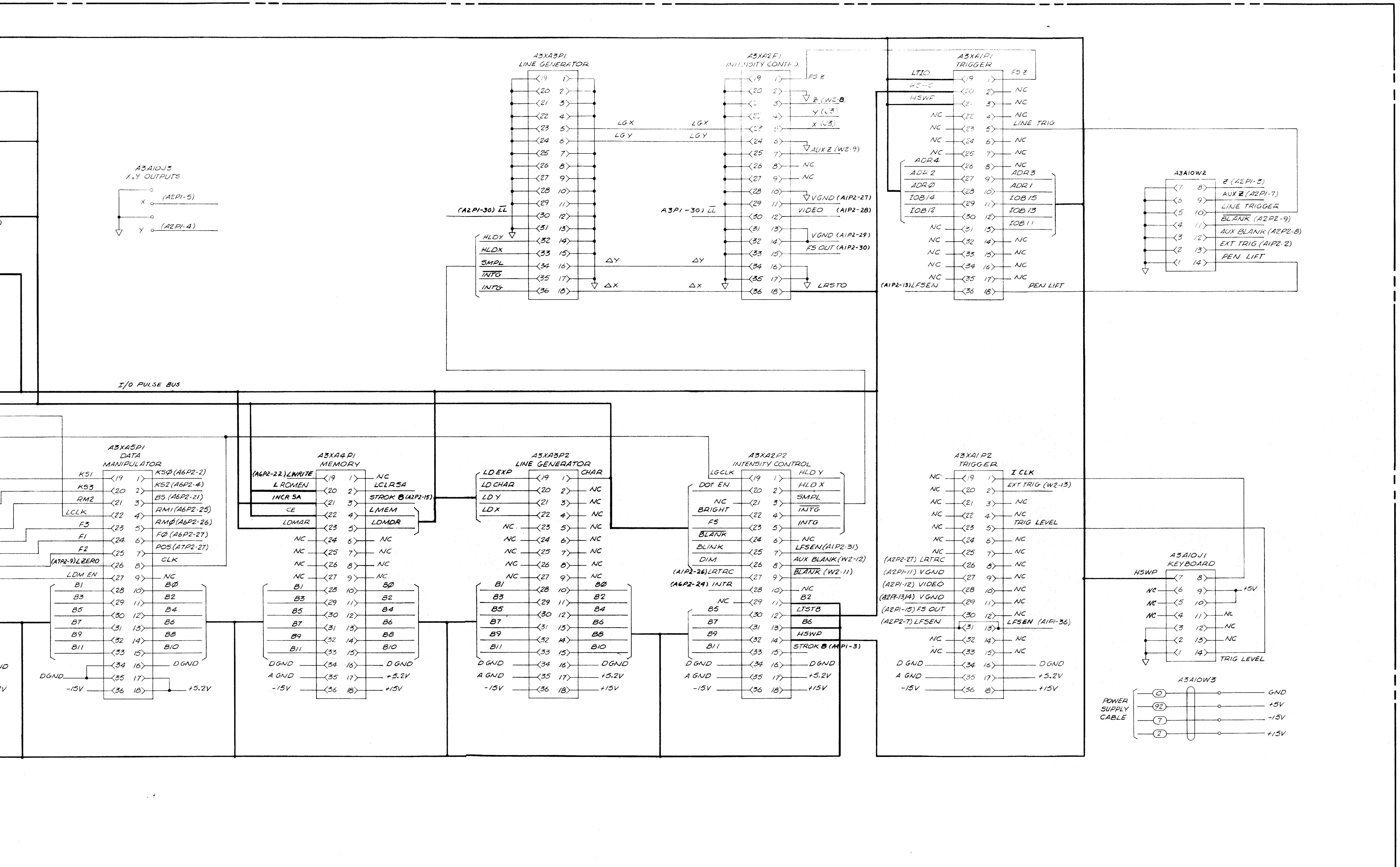
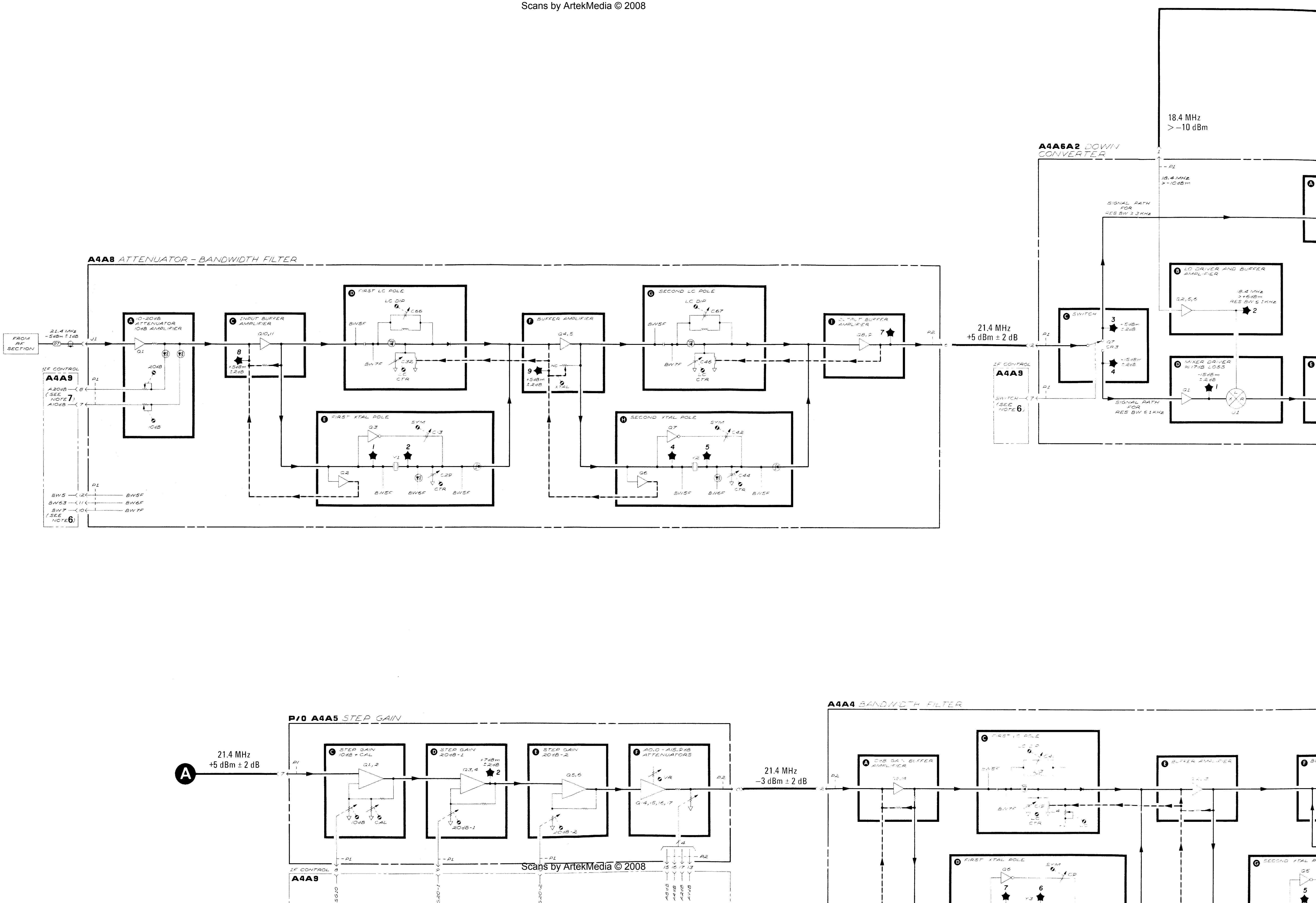


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE COMPLETE AS SHOWN.
2. MNEMONICS TABLE:

A3A10

Figure 8-103. A3A10 Digital Storage Motherboard, Interconnect Diagram



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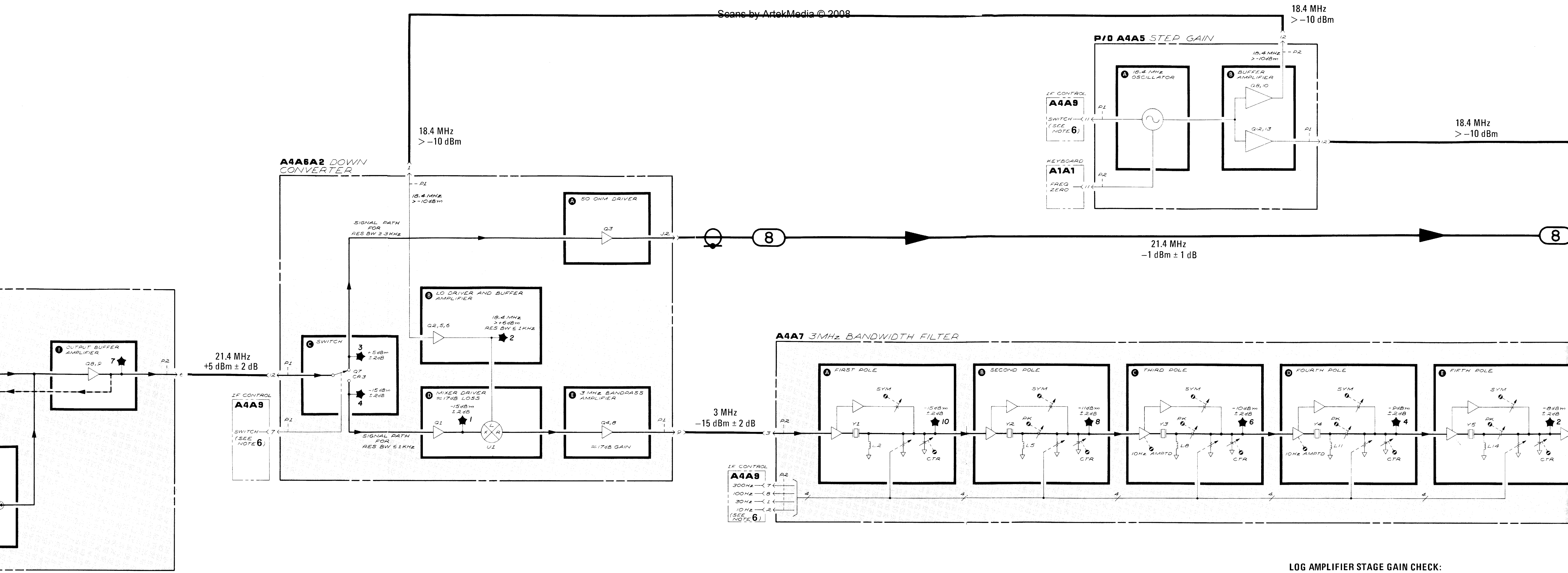
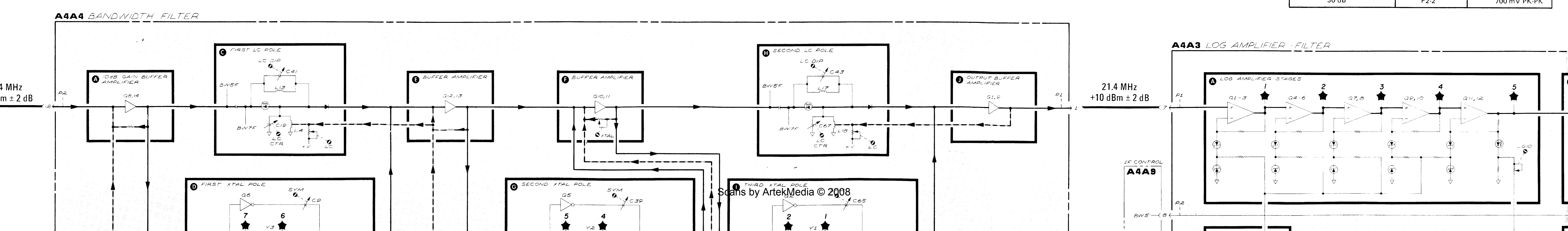


LOG AMPLIFIER STAGE GAIN CHECK:

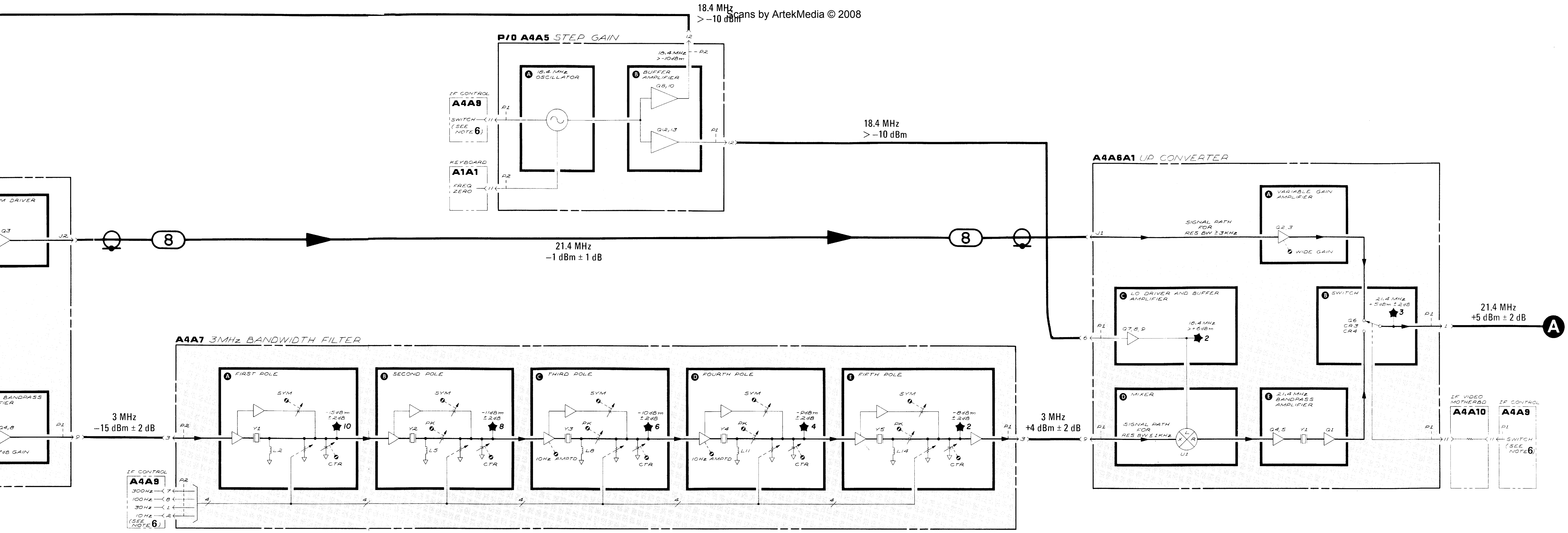
CONTROL SETTINGS: (INSTR PRESET)
- CENTER FREQUENCY . . . . 20 MHz
- FREQUENCY SPAN . . . . 0 Hz
- RES BW . . . . 100 kHz
- REFERENCE LEVEL . . . . 0 dBm
- ATTENUATION . . . . 10 dB

CONNECT HP 355D ATTENUATOR BETWEEN CAL OUTPUT AND SIGNAL INPUT 2 CONNECTORS

20 MHz CALIBRATOR ATTENUATED BY	TEST POINT	LEVELS (±25%)
0 dB	P1-7	700 mV PK-PK
0 dB	1	700 mV PK-PK
10 dB	2	700 mV PK-PK
20 dB	3	280 mV PK-PK
30 dB	4	100 mV PK-PK
30 dB	5	330 mV PK-PK
30 dB	P2-2	700 mV PK-PK



Scans by ArtekMedia © 2008



LOG AMPLIFIER STAGE GAIN CHECK:

CONTROL SETTINGS: (INSTR PRESET)

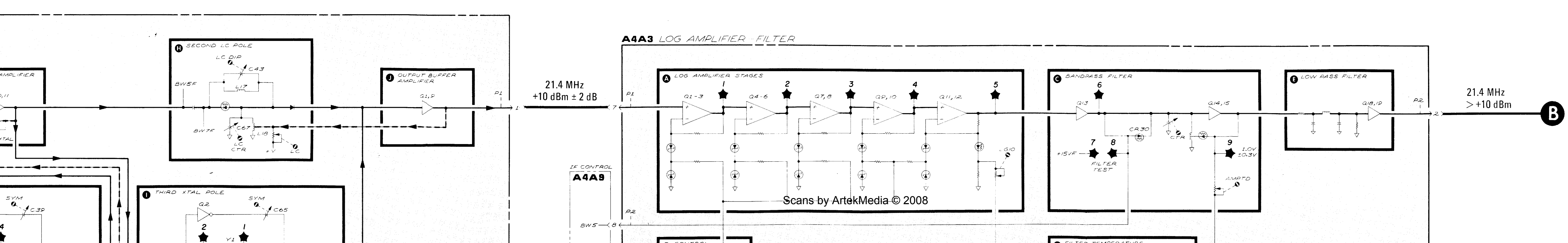
- CENTER FREQUENCY . . . . 20 MHz
- FREQUENCY SPAN . . . . 0 Hz
- RES BW . . . . 100 kHz
- REFERENCE LEVEL . . . . 0 dBm
- ATTENUATION . . . . 10 dB

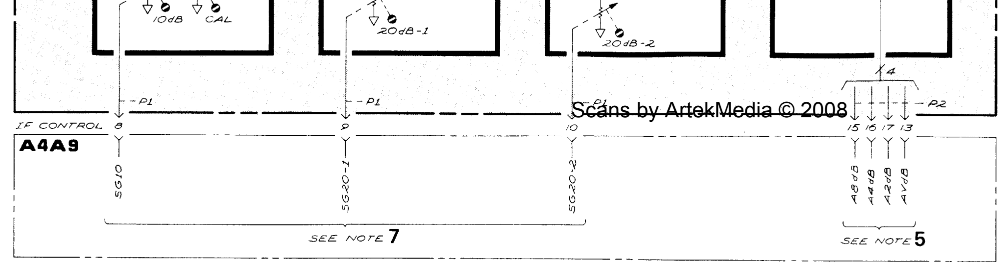
CONNECT HP 355DATTENUATOR BETWEEN CAL OUTPUT AND SIGNAL INPUT 2 CONNECTORS

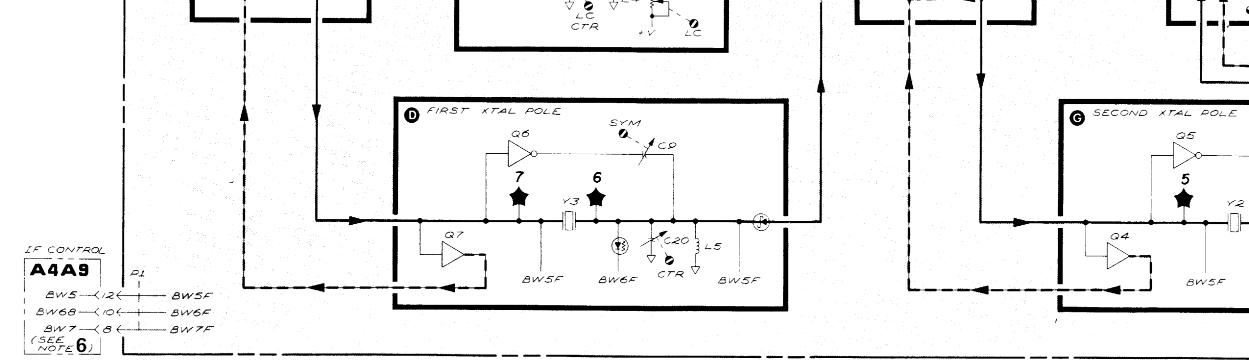
20 MHz CALIBRATOR ATTENUATED BY	TEST POINT	LEVELS (±25%)
0 dB	P1-7	700 mV PK-PK
0 dB	1	700 mV PK-PK
10 dB	2	700 mV PK-PK
20 dB	3	280 mV PK-PK
30 dB	4	100 mV PK-PK
30 dB	5	330 mV PK-PK
30 dB	P2-2	700 mV PK-PK

BANDPASS FILTER WIDE/NARROW CONDITIONS:

BW5	RESOLUTION BW	FILTER BANDWIDTH	CR30 BIAS
HI +14.8V (TYP)	100 kHz TO 3 MHz	WIDE (APPROX. 20 MHz)	FORWARD
LO −.6V (TYP)	10 Hz TO 30 kHz	NARROW (APPROX. 1 MHz)	REVERSE







LOG AMPLIFIER STAGE GAIN CHECK:

CONTROL SETTINGS: (INSTR PRESET)
CENTER FREQUENCY . . . . 20 MHz
FREQUENCY SPAN . . . . 0 Hz
RESOLUTION BANDWIDTH. . . . . 100 kHz
REFERENCE LEVEL . . . . 0 dBm
ATTENUATION . . . . 10 dB

CONNECT HP 355D ATTENUATOR BETWEEN CAL OUTPUT AND SIGNAL INPUT 2 CONNECTORS

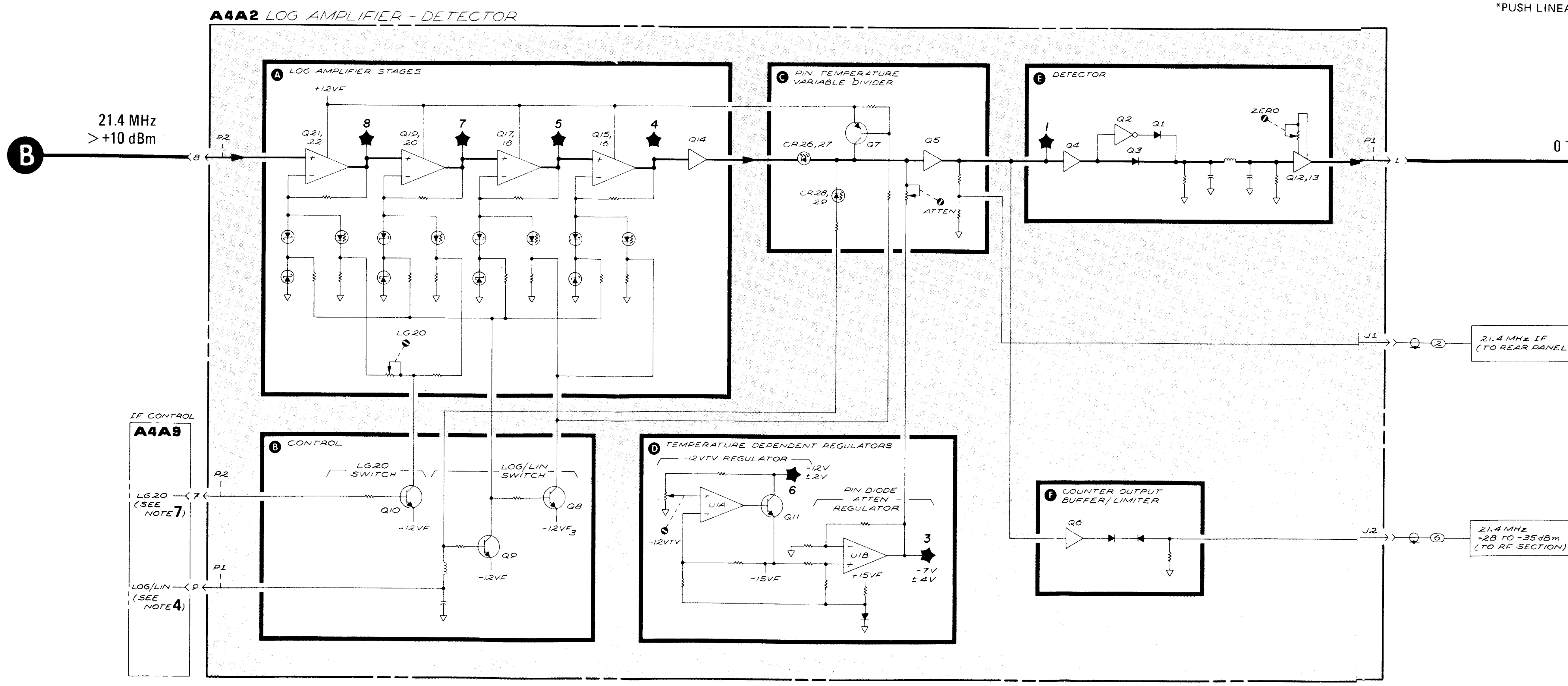
20 MHz CALIBRATOR ATTENUATED BY	TEST POINT	LEVEL (±25%)
20 dB	P2-8 TP8	1.1V PK-PK
30 dB	TP7	1.1V PK-PK
40 dB	TP5	1.2V PK-PK
50 dB	TP4	1.2V PK-PK
50 dB	TP2	1.5V PK-PK
50 dB	TP1	800 mV PK-PK
0 dB	P1-1 (TP9)	0.9±0.05 VDC

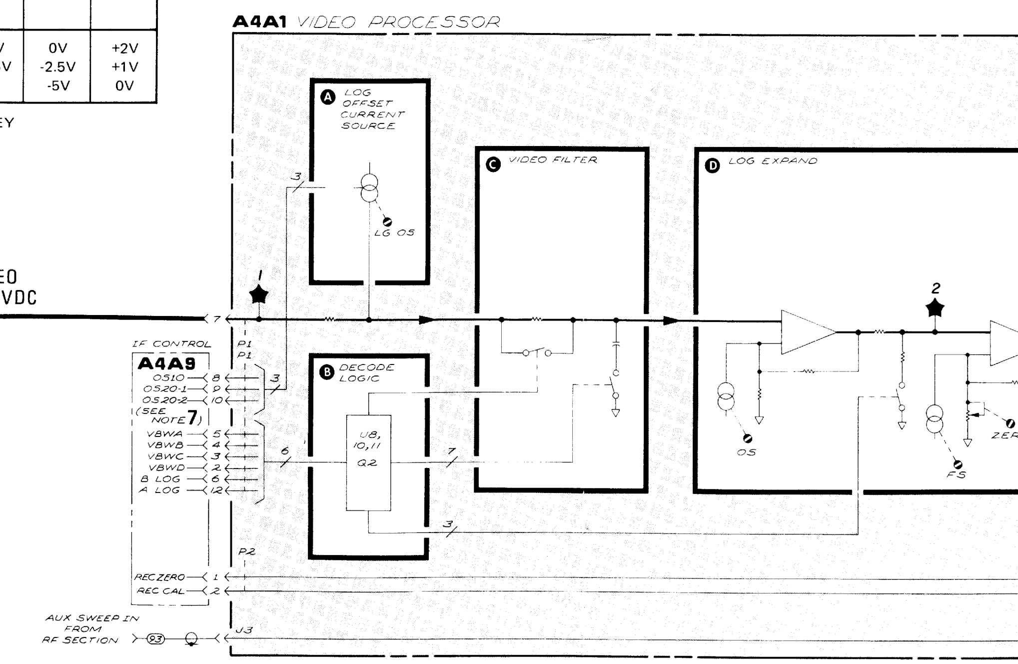
LOG EXPAND FIDELITY TABLE:

INSTRUMENT CONTROL SETTINGS ARE AS FOLLOWS:
INSTRUMENT PRESET
CENTER FREQUENCY . . . . 20 MHz
FREQUENCY SPAN . . . . 0 Hz
ATTENUATOR. . . . . 0 dB
CONNECT 355D ATTENUATOR BETWEEN CALIBRATOR OUTPUT AND SIGNAL INPUT 2

EXTERNAL ATTENUATOR (355D)	TP1	TP2	TP3
0 dB	+1V	0V	+2V
50 dB	+0.5V	-2.5V	+1V
50 dB*	0V	-5V	0V

*PUSH LINEAR KEY





VIDEO BANDWIDTH TRUTH TABLE: (TTL LEVELS)

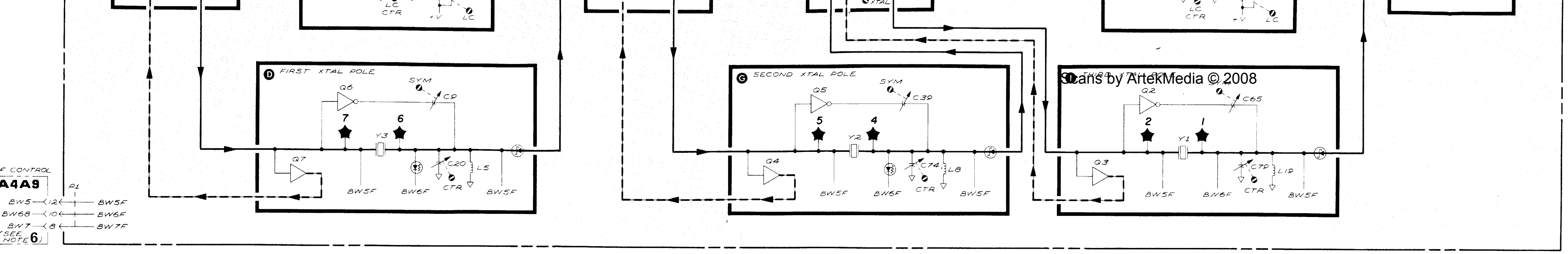
VIDEO BANDWIDTH	VBWD	VBWC	VBWB	VBWA
3 MHz	H	H	H	H
1 MHz	H	H	H	L
300 kHz	H	H	L	H
100 kHz	H	H	L	L
30 kHz	H	L	H	H
10 kHz	H	L	H	L
3 kHz	H	L	L	H

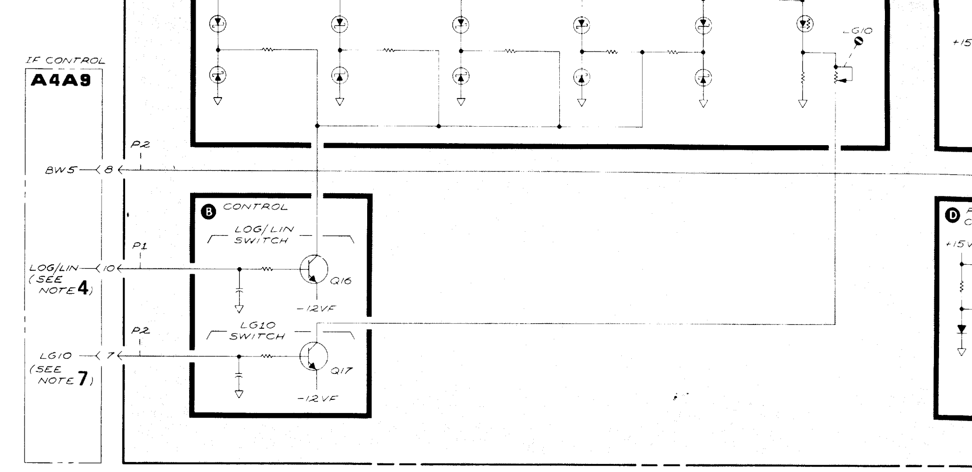
LOG EXPAND TRUTH TABLE:

dB/DIV	B LOG	A LOG
10	L	L
5	L	H
2	H	L
1	H	H

(TTL LEVELS)

SERIAL PREFIX: 1826A DATE: APRIL 1978





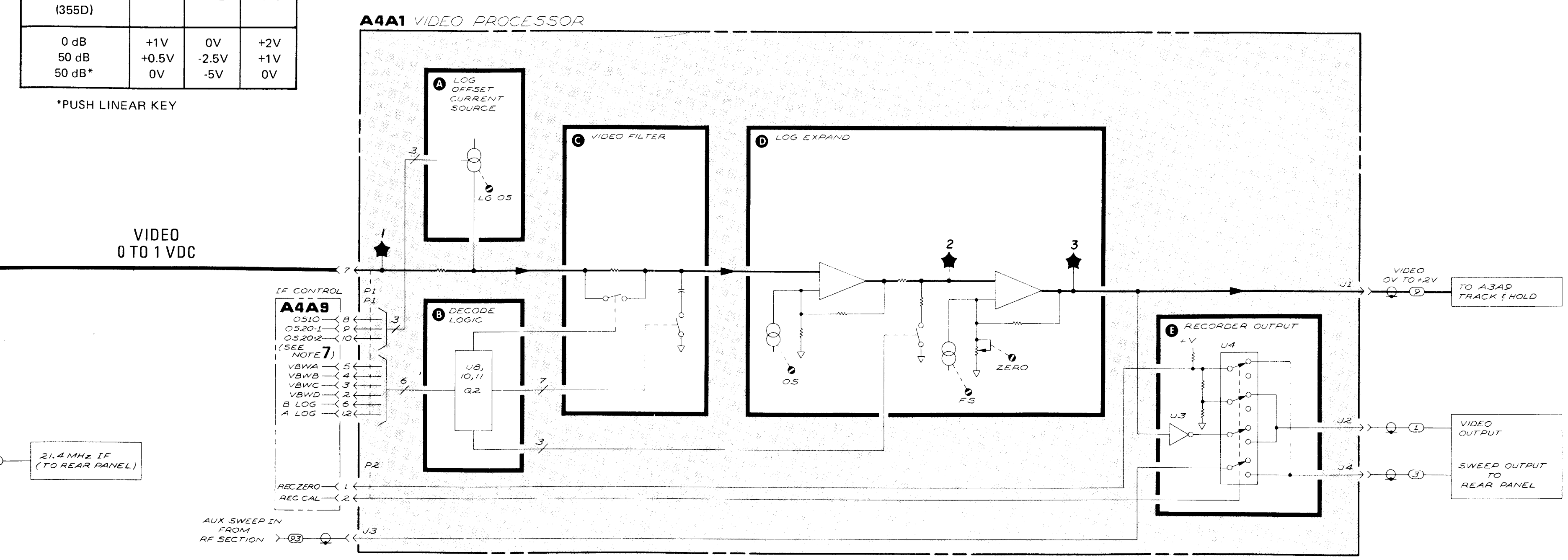
LOG EXPAND FIDELITY TABLE:

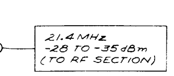
INSTRUMENT CONTROL SETTINGS ARE AS FOLLOWS:
INSTRUMENT PRESET
CENTER FREQUENCY . . . . 20 MHz
FREQUENCY SPAN . . . . 0 Hz
ATTENUATOR . . . . 0 dB
CONNECT 355D ATTENUATOR BETWEEN CALIBRATOR OUTPUT AND SIGNAL INPUT 2

EXTERNAL ATTENUATOR (355D)	TP1	TP2	TP3
0 dB	+1V	0V	+2V
50 dB	+0.5V	-2.5V	+1V
50 dB*	0V	-5V	0V

*PUSH LINEAR KEY

A4A1 VIDEO PROCESSOR





VIDEO BANDWIDTH TRUTH TABLE: (TTL LEVELS)

VIDEO BANDWIDTH	VBWD	VBWC	VBWB	VBWA	VIDEO BANDWIDTH	VBWD	VBWC	VBWB	VBWA
3 MHz	H	H	H	H	1 kHz	L	H	H	L
1 MHz	H	H	H	L	300 Hz	L	H	L	H
300 kHz	H	H	L	H	100 Hz	L	H	L	L
100 kHz	H	H	L	L	30 Hz	L	L	H	H
30 kHz	H	L	H	H	10 Hz	L	L	H	L
10 kHz	H	L	H	L	3 Hz	L	L	L	H
3 kHz	H	L	L	H	1 Hz	L	L	L	L

LOG EXPAND TRUTH TABLE:

dB/DIV	B LOG	A LOG
10	L	L
5	L	H
2	H	L
1	H	H

(TTL LEVELS)

NOTES:

1. UNLESS OTHERWISE INDICATED POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND SPECTRUM ANALYZER:
   INSTRUMENT PRESET
   CENTER FREQUENCY . . . . 20 MHz
   FREQUENCY SPAN . . . . 0 Hz
   ATTENUATION . . . . 0 dB
   RESOLUTION BANDWIDTH. . . . . . 3 kHz
2. A4A9 IF CONTROL ASSEMBLY IS NOT INCLUDED ON THE BLOCK DIAGRAM. IF A CONTROL LINE HAS AN INCORRECT VOLTAGE LEVEL REFER TO THE A4A9 SCHEMATIC FOR FURTHER TROUBLESHOOTING INFORMATION.
3. SEE SPECIAL MESSAGE AND DIAGNOSTIC FUNCTIONS FOR USE OF THE ERROR CORRECTION ROUTINE (KSW - SHIFT FREQUENCY SPAN) IN TROUBLESHOOTING.

4. LOG/LIN CONTROL LEVELS:

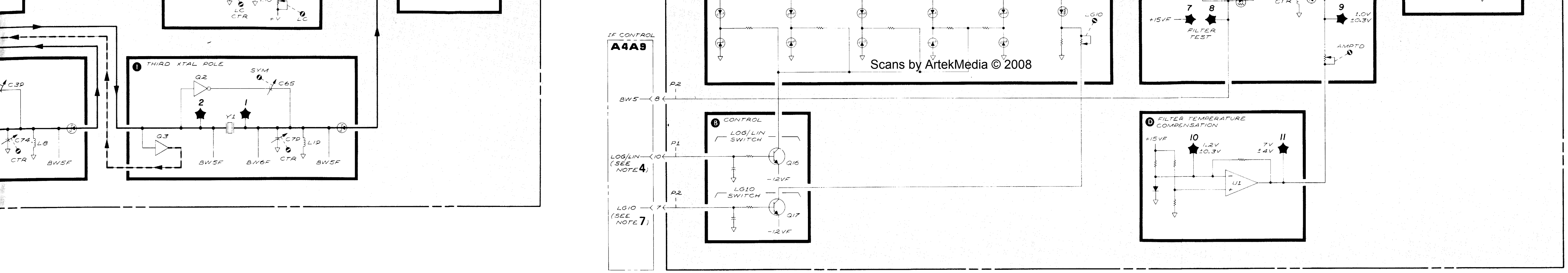
	LOG/LIN
LOG	5V TO 10V
LIN	−10V TO −14V

5. A0.0 – 15.9 dB ATTENUATOR CONTROL TABLE:

REFERENCE LEVEL dBm	CONTROL LINES A2dB	A4dB	A8dB
−10	>+13V	>+13V	0V
−11	>+13V	>+13V	0V
−12	0V	0V	>+13V
−13	0V	0V	>+13V
−14	>+13V	0V	>+13V
−15	>+13V	0V	>+13V
−16	0V	>+13V	>+13V
−17	0V	>+13V	>+13V
−18	>+13V	>+13V	>+13V
−19	>+13V	>+13V	>+13V

6. BANDWIDTH CONTROL LINES (ALL VOLTAGES APPROXIMATE)

RES BW \ CONTROL LINES	BW5	BW63	BW68	BW7	SWITCH	300 Hz	100 Hz	30 Hz
3 MHz	+14.8V	−14V	−14V	+9.7V	+14.7V	<−10V	<−10V	<−10V
1 MHz	+14.8V	−14V	−14V	+13.1V	+14.7V	<−10V	<−10V	<−10V
300 kHz	+14.8V	−14V	−14V	+14.1V	+14.7V	<−10V	<−10V	<−10V
100 kHz	+14.8V	−14V	−14V	+14.5V	+14.7V	<−10V	<−10V	<−10V
30 kHz	−.6V	+14.3V	+14.3V	+14.3V	+14.7V	<−10V	<−10V	<−10V
10 kHz	−.6V	+9.3V	+9.3V	+14.3V	+14.7V	<−10V	<−10V	<−10V
3 kHz	−.6V	+9.0V	+9.0V	+14.3V	+14.7V	<−10V	<−10V	<−10V
1 kHz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	<−10V	<−10V
500 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	>4V	<−10V	<−10V
100 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	>4V	<−10V
30 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	<−10V	>4V
10 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	<−10V	>4V



NOTES:

1. UNLESS OTHERWISE INDICATED POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND SPECTRUM ANALYZER:
INSTRUMENT PRESET
CENTER FREQUENCY . . . . 20 MHz
FREQUENCY SPAN . . . . 0 Hz
ATTENUATION . . . . 0 dB
RESOLUTION BANDWIDTH . . . . . . 3 kHz

2. A4A9 IF CONTROL ASSEMBLY IS NOT INCLUDED ON THE BLOCK DIAGRAM. IF A CONTROL LINE HAS AN INCORRECT VOLTAGE LEVEL REFER TO THE A4A9 SCHEMATIC FOR FURTHER TROUBLESHOOTING INFORMATION.

3. SEE SPECIAL MESSAGE AND DIAGNOSTIC FUNCTIONS FOR USE OF THE ERROR CORRECTION ROUTINE (KSW - SHIFT FREQUENCY SPAN) IN TROUBLESHOOTING.

4. LOG/LIN CONTROL LEVELS:

	LOG/LIN
LOG	5V TO 10V
LIN	−10V TO −14V

5. A0.0 – 15.9 dB ATTENUATOR CONTROL TABLE:

REFERENCE LEVEL dBm	CONTROL LINES		
	A2dB	A4dB	A8dB
−10	>+13V	>+13V	0V
−11	>+13V	>+13V	0V
−12	0V	0V	>+13V
−13	0V	0V	>+13V
−14	>+13V	0V	>+13V
−15	>+13V	0V	>+13V
−16	0V	>+13V	>+13V
−17	0V	>+13V	>+13V
−18	>+13V	>+13V	>+13V
−19	>+13V	>+13V	>+13V

6. BANDWIDTH CONTROL LINES (ALL VOLTAGES APPROXIMATE)

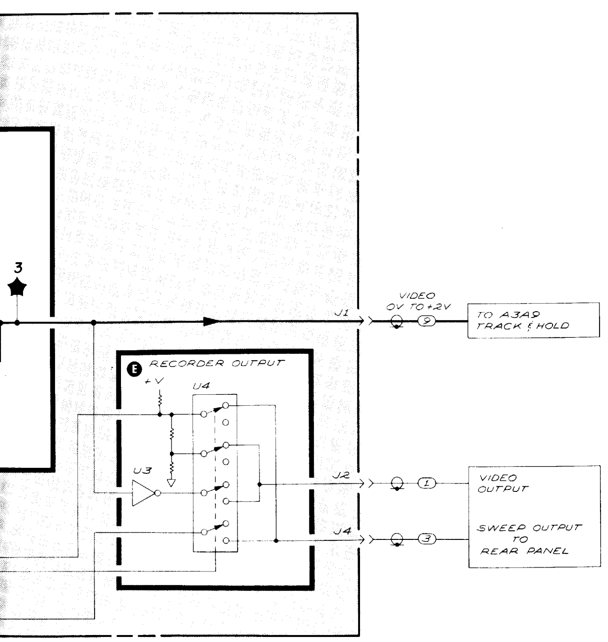
RES BW \ CONTROL LINES	BW5	BW63	BW68	BW7	SWITCH	300 Hz	100 Hz	30 Hz	10 Hz
3 MHz	+14.8V	−14V	−14V	+9.7V	+14.7V	<−10V	<−10V	<−10V	<−10V
1 MHz	+14.8V	−14V	−14V	+13.1V	+14.7V	<−10V	<−10V	<−10V	<−10V
300 kHz	+14.8V	−14V	−14V	+14.1V	+14.7V	<−10V	<−10V	<−10V	<−10V
100 kHz	+14.8V	−14V	−14V	+14.5V	+14.7V	<−10V	<−10V	<−10V	<−10V
30 kHz	−.6V	+14.3V	+14.3V	+14.3V	+14.7V	<−10V	<−10V	<−10V	<−10V
10 kHz	−.6V	+9.3V	+9.3V	+14.3V	+14.7V	<−10V	<−10V	<−10V	<−10V
3 kHz	−.6V	+9.0V	+9.0V	+14.3V	+14.7V	<−10V	<−10V	<−10V	<−10V
1 kHz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	<−10V	<−10V	<−10V
500 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	>4V	<−10V	<−10V	<−10V
100 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	>4V	<−10V	<−10V
30 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	<−10V	>4V	<−10V
10 Hz	−.6V	+14.3V	+9.2V	+14.3V	0V	<−10V	<−10V	>4V	>4V

7. 10 dB STEP GAIN TRUTH TABLE: (ALL VOLTAGES APPROXIMATE)

REFERENCE LEVEL RES BW ≥3 kHz	dBm			−10	−20	−30	−40	−50	−60	−70	−80	−90	−100	−110
REFERENCE LEVEL RES BW ≤1 kHz	dBm	−10	−20	−30	−40	−50	−60	−70	−80	−90	−100	−110	−120	−130
A10dB	LOG	9	0	9	9	9	9	9	9	9	9	9	9	9
	LIN	9	0	9	9	9	9	9	9	9	9	9		
A20dB	LOG	0	9	9	9	9	9	9	9	9	9	9	9	9
	LIN	0	9	9	9	9	9	9	9	9	9	9		
SG10	LOG	>7.5	>7.5	>7.5	0	>7.5	0	>7.5	0	0	0	0	0	0
	LIN	>7.5	>7.5	>7.5	0	>7.5	0	>7.5	0	0	0	0		
SG20−1	LOG	>8.5	>8.5	>8.5	>8.5	0	0	0	0	0	0	0	0	0
	LIN	>8.5	>8.5	>8.5	>8.5	0	0	0	0	0	0	0		
SG20−2	LOG	>8.5	>8.5	>8.5	>8.5	>8.5	>8.5	0	0	0	0	0	0	0
	LIN	>8.5	>8.5	>8.5	>8.5	>8.5	>8.5	0	0	0	0	0		
OS10	LOG	>14	>14	>14	>14	>14	>14	>14	>14	0	>14	0	>14	0
	LIN	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14		
OS20−1	LOG	>14	>14	>14	>14	>14	>14	>14	>14	>14	0	0	0	0
	LIN	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14		
OS20−2	LOG	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	0	0
	LIN	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14		
LG10	LOG	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10		
	LIN	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	>−3	<−10	>−3		
LG20	LOG	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10		
	LIN	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	<−10	>−3	>−3		

INPUT ATTENUATION SETTING AT 0 dB

SHIFT ATTEN (KSI) (FOR EXTENDED REFERENCE LEVEL RANGES)



IDEO NDWIDTH	VBWD	VBWC	VBWB	VBWA
1 kHz	L	H	H	L
300 Hz	L	H	L	H
100 Hz	L	H	L	L
30 Hz	L	L	H	H
10 Hz	L	L	H	L
3 Hz	L	L	L	H
1 Hz	L	L	L	L

A4

Figure 8-104. A4 IF Section Block Diagram

A4A1 VIDEO PROCESSOR, CIRCUIT DESCRIPTION

A4A1 Video Processor filters the detected IF signal from A4A2 Log Amplifier, it sets the dB/DIV LOG SCALE and the REFERENCE LEVEL offsets below −50 dBm or −70 dBm, and it provides the IF video output and the X and Y recorder outputs.

Video Filter C

The Video Filter is an RC low pass filter with selectable R and C. The series resistance R is one of two values controlled by switch U7. When the switch is closed (0), R17 is short circuited and the series resistance is minimum. In this state, video bandwidths from 3 kHz to 3 MHz are attainable. (The 3 MHz nominal bandwidth is attained when Q14 through Q20 are turned off.) When switch U7 is open (1), the series resistance R is high, approximately equal to R17 and video bandwidths from 1 Hz to 1 kHz are attainable. Shunt capacitors C5 through C11 are selected by switching transistors Q14 through Q20. Only one of these switching transistors can be on at any one time. Each capacitor except C11 is used with the high series resistance for the lower bandwidths and the low series resistance for the higher bandwidths.

Log Expand D

The Log Expand circuit allows four different amplitude scales: 10, 5, 2, 1 dB/DIV. Changes in the amplitude scale are accomplished by first amplifying the video signal, then attenuating it various amounts. This is accomplished by FET input amplifier U2, which offsets the input −5V and whose gain (set by R22 and R21) is 5. The offset is set by the current through Q1. This current source is adjustable using OS potentiometer R14. Switching transistors Q4, Q5, and Q6 are turned on or off to achieve voltage divider ratios of 1/10, 1/5, 1/2, and 1. Diodes CR2 and CR3 clamp this attenuated signal at about −1.2V to prevent forward biasing any switch in the off state. A final amplifier consisting of Q7, Q8 and Q9 amplifies this attenuated signal by 4 and offsets the output +2V. A +2V output corresponds to a full scale signal. This final amplifier is a two-stage amplifier. The first stage is a FET input stage made up of dual FET Q7. The first-stage output is multiplied by the transistor inverter Q8, whose output is buffered by an emitter follower Q9. This output is fed back to the inverting input through a resistor divider stick. Gain of the amplifier is adjusted by ZERO potentiometer R32, and offset for full scale is adjusted by FS potentiometer R36. Diode CR1 clamps the output at about −1.2V.

Log Offset Current Source A

The Log Offset Current Source simulates log gain for instrument reference levels below −60 dBm. This is achieved by offsetting the 0V to 1V video input signal by driving current through the source resistance R16. This current is changed by supplying different currents into the emitter of Q13, the transistor current source. Currents are controlled by switching transistors Q10, Q11, and Q12. For example, when switch Q12 is turned on, the transistor saturates and a current flows through R5 into the emitter of Q13. This emitter current (set by the voltage drop across R5) is closely equal to the collector current through Q12. The voltage drop across R5 can be changed by varying LG 0S potentiometer R2, since U6 pin 3 and the emitter of Q13 are at the same voltage. This is true because U6 is a voltage follower with unity gain. Once R2 is set, the accuracy of R5, R7, and R9 determines the relative accuracy of the offsets, 0.1V, 0.2V, 0.2V (10 dB, 20 dB, 20 dB).

Power Supplies F

In the Voltage Reference circuit, zener diode VR1 is used to provide +8.8V and −10.0V sources. Amplifier U1B inverts and amplifies +8.8V to get −10.00V, which is used in the Log Expand circuit with the FS adjustment R36. The +8.8V source is used for LG OS (log offset) adjustment R2 and OS (offset) adjustment R14.

Decode Logic B

The Decode Logic circuit performs additional decoding on output lines from IF Control A4A9. VBWA, VBWB, VBWC, and VBWD are decoded by U8, a 1-of-8 decoder, and inverted by U10 to drive one of the seven capacitors used in the Video Filter. U11 decodes A LOG and B LOG and drives the switches that vary the attenuator in the Log Expand circuit.

Recorder Output F

The Recorder Output circuit provides outputs for an X-Y plotter. Also provided are outputs for calibrating lower left (LL) and upper right (UR). Calibration outputs and signal outputs are routed through switch U4. A control line, REC CAL, from IF Control A4A9 controls the state of the U4 switches. When REC CAL is high, the video output through U3 and AUX SWEEP have closed paths through the switch to provide VIDEO and SWEEP outputs to the rear panel. When the REC CAL is high, a closed path through the switch exists between the calibration voltages and the VIDEO and SWEEP outputs. Control line REC ZERO causes the FS or ZERO voltage to appear across the R50, R55, R51 divider stick. When in LL, REC ZERO is low and the switch inputs are pulled to about 0V. When REC ZERO is high, its open collector output will be set to the voltage determined by the divider stick: +10V for X_r out, and +1V for Y_r out.

A4A1 VIDEO PROCESSOR, TROUBLESHOOTING

Proper operation of the Log Offsets, OS10, OS20-1 and OS20-2 can be determined from the display.

Connect an HP 355D Step Attenuator between CAL OUTPUT and SIGNAL INPUT 2. Set this attenuator to 110 dB. Key in the following settings:

INSTR PRESET
CENTER FREQUENCY . . . . 20 MHz
FREQUENCY SPAN . . . . 0 Hz
RES BW . . . . 3 kHz
VIDEO BW . . . . 10 Hz
ATTEN . . . . 0 dB
SHIFT ATTEN
SWEEP TIME . . . . 20 Sec
REFERENCE LEVEL . . . . −40 dBm

Press the SINGLE sweep key. Then press the DATA STEP ⇩ key repetitively. A display similar to Figure 8-105 should result. If a step is missing, one of the offsets or its control circuitry is defective. The truth table in Note 3 is an aid to determine which offset circuit isn't operating properly. 0V in the table indictes that an offset is active. Accurate determination of amplitude step size is attainable using the MARKER Δ key and the DATA knob.

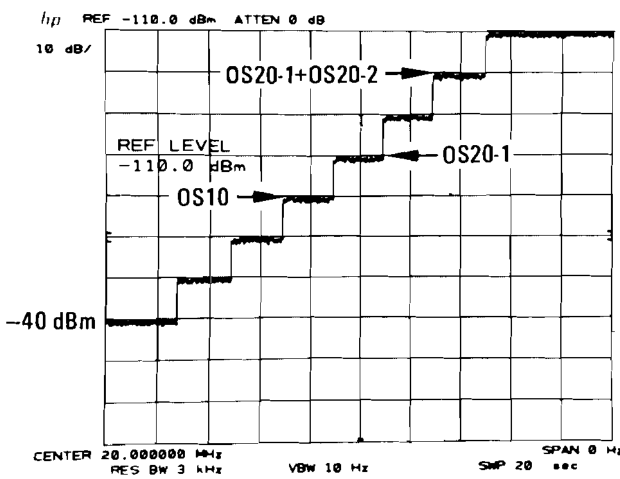


Figure 8-105. Log Offset Gain Step Display

The Video Filter circuit can be checked from the front panel. With no input signal, set the controls as follows:

[INSTR PRESET]
[CENTER FREQUENCY] .... 25 MHz
[FREQUENCY SPAN] .... 100 kHz
[SWEEP TIME] .... 20 sec
[REFERENCE LEVEL] .... −90 dBm
[VIDEO BW] .... 1 Hz

Press [SINGLE] sweep. Then press the DATA STEP [⇧] key repetitively. The display should appear as in Figure 8-106. Now key in [SHIFT] TRACE A [VIEW] . This turns only the Negative Peak Detector on. Reset [VIDEO BW] to 1 Hz. Press the [SINGLE] sweep key. Then press the DATA step [⇧] key repetitively. The display should appear as in Figure 8-107.

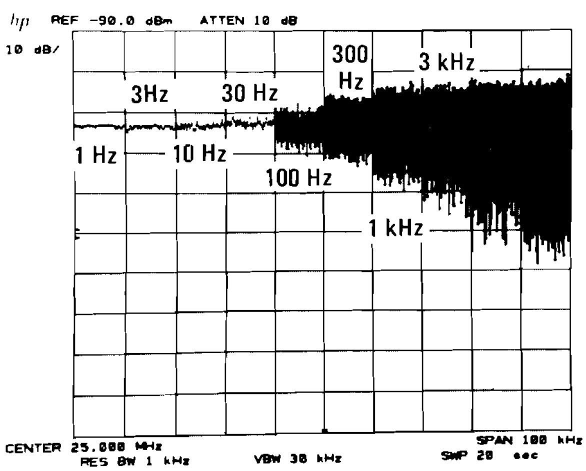


Figure 8-106. Video Bandwidth Step Display

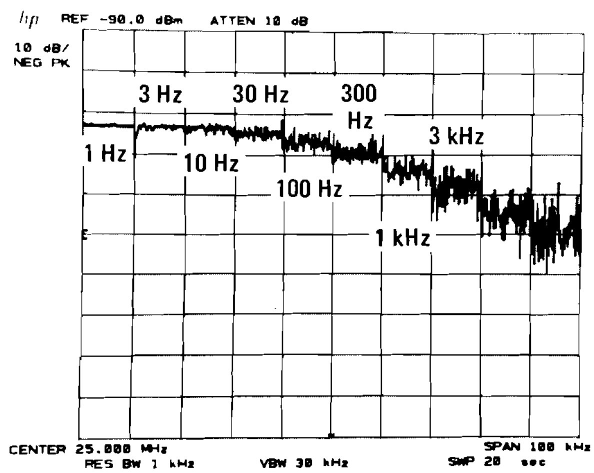


Figure 8-107. Video Bandwidth Step Display with Negative Peak Detection

If the displayed noise does not change monotonically with the step key, the indicated Video bandwidth is faulty. Refer to the service sheet to determine the defective switch, capacitor, or decoder.

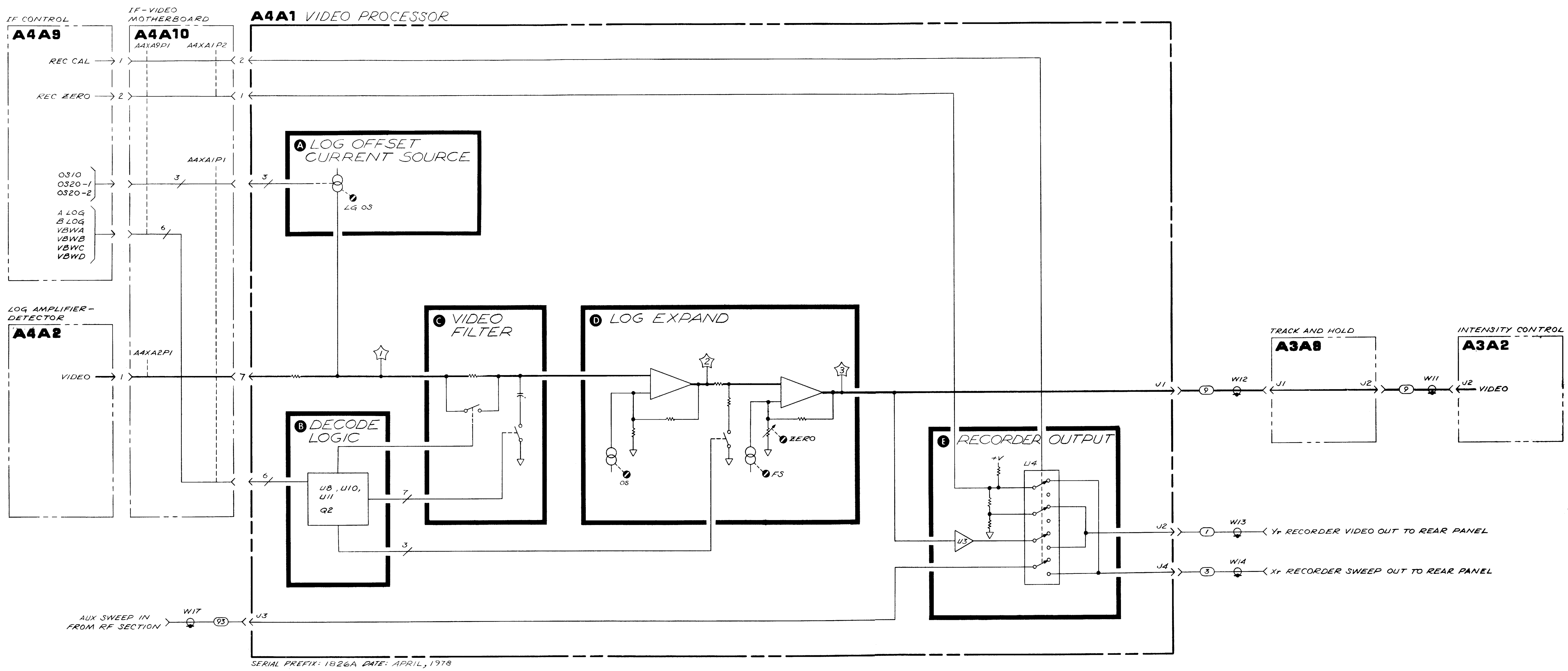
The Log Expand and Decode Logic circuitry can be accurately checked by using the Error Correction Routine. Pressing [SHIFT] [FREQUENCY SPAN] (KSW) starts this routine. The error terms are displayed by pressing [SHIFT] [LINE] (KSw). The last three lines give the offset errors from the 1 dB LOG reference for the 2 dB, 5 dB and 10 dB LOG scales, respectively. Maximum error is ±0.5 dB for proper operation.

Table 8-33. A4A1 Video Processor, Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A1	85662-60011	1	BOARD ASSEMBLY, VIDEO PROCESSOR	28480	85662-60011
A4A1C1	0180-0197	2	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4A1C2	0160-2055	9	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C3	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4A1C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C5	0160-0945	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A4A1C6	0160-0155	1	CAPACITOR-FXD 3300PF +-10% 200VDC POLYE	28480	0160-0155
A4A1C7	0160-0161	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A4A1C8	0160-0163	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A4A1C9	0160-0168	1	CAPACITOR-FXD .1UF +-10% 200VDC POLYE	28480	0160-0168
A4A1C10	0180-2205	1	CAPACITOR-FXD .33UF+-10% 35VDC TA	56289	150D334X9035A2
A4A1C11	0180-0291	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4A1C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C13			NOT ASSIGNED		
A4A1C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C16	0180-0228	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A4A1C17	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A4A1C18	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A4A1C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A1C23	0140-0195	1	CAPACITOR-FXD 130PF +-5% 300VDC MICA	72136	DM15F131J0300WV1CR
A4A1CR1	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A4A1CR2	1901-0179	2	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A4A1CR3	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A4A1J1	1250-0690	4	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A1J2	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A1J3	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A1J4	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A1L1	9140-0114	2	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A4A1L2	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A4A1L3	9100-1618	3	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A1L4	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A1L5	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A1Q1	1853-0281	5	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A4A1Q2	1854-0404	12	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q3	1855-0050	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0050
A4A1Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q7	1855-0213	1	TRANSISTOR-JFET DUAL 2N5912 N-CHAN	17856	2N5912
A4A1Q8	1853-0316	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A4A1Q9	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q10	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A4A1Q11	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A4A1Q12	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A4A1Q13	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A4A1Q14	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q15	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q16	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q17	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q18	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q19	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1Q20	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A1R1	0698-3155	9	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R2	2100-3109	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A4A1R3	0698-3151	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A4A1R4	0757-0442	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A1R5	0698-6880	1	RESISTOR 16K .5% .125W F TC=0+-50	28480	0698-6880
A4A1R6	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A1R7	0698-6755	2	RESISTOR 8K .5% .125W F TC=0+-50	24546	NC4-1/8-T2-8001-D
A4A1R8	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A1R9	0698-6755		RESISTOR 8K .5% .125W F TC=0+-50	24546	NC4-1/8-T2-8001-D
A4A1R10	0757-0290	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4A1R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A1R12	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4A1R13	0757-0280	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A1R14	2100-3123	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A4A1R15	0698-0084	7	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F

Table 8-33. A4A1 Video Processor, Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A1R16	0757-0394	3	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A1R17	0698-3452	1	RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A4A1R18	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R19	0698-3158	5	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A4A1R20	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A4A1R21	0698-3240	2	RESISTOR 500 .25% .125W F TC=0+-50	28480	0698-3240
A4A1R22	0698-7799	3	RESISTOR 2K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-2001-C
A4A1R23	0698-7799		RESISTOR 2K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-2001-C
A4A1R24	0698-7839	1	RESISTOR 222 .5% .125W F TC=0+-50	19701	MF4C1/8-T2-222R-D
A4A1R25	0698-3240		RESISTOR 500 .25% .125W F TC=0+-50	28480	0698-3240
A4A1R26	0698-7799		RESISTOR 2K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-2001-C
A4A1R27	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A1R28	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A1R29	0757-0200	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A4A1R30	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A1R31	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A1R32	2100-3122	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	02111	43P101
A4A1R33	0698-3150	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A4A1R34	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A1R35	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R36	2100-3154	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A4A1R37	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A1R38	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A1R39	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A1R40	0698-0085	2	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A4A1R41	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A4A1R42	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4A1R43	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R44	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A4A1R45	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R46	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A4A1R47	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R48	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A4A1R49	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A1R50	0698-5577	1	RESISTOR 2.5K .5% .125W F TC=0+-100	24546	C4-1/8-T0-2501-D
A4A1R51	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4A1R52	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R53	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R54	0698-3445	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A4A1R55	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A4A1R56	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A1R57	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A1R58	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A4A1TP1	1251-0600	3	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A1TP2	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A1TP3	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A1U1	1826-0092	1	IC OP AMP TO-99	28480	1826-0092
A4A1U2	1826-0089	1	IC 2525 OP AMP TO-99	29832	1322
A4A1U3	1826-0021	1	IC OP AMP TO-99	27014	LM310H
A4A1U4	1826-0417	1	IC SWITCH 16-DIP-C	27014	NF13333D
A4A1U5	1810-0215	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R75K
A4A1U6	1826-0261	1	IC 741 OP AMP TO-99	28480	1826-0261
A4A1U7	1826-0154	1	IC SW CMOS 2-CHAN ANAL	17856	DG200BA
A4A1U8	1820-1216	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A4A1U9	1810-0231	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R2.2K
A4A1U10	1820-1200	1	IC INV TTL LS HEX	01295	SN74LS05N
A4A1U11	1820-1272	1	IC BFR TTL LS NOR QUAD 2-INP	01295	SN74LS33N
A4A1VR1	1902-0686	1	DIODE-ZNR 1N825 6.2V 2% DO-7 PD=.4W	04713	1N825
			A4A1 MISCELLANEOUS PARTS		
	86701-4000(	2	EXTRACTOR, PC BOARD	28480	86701-40001



A4A1

Figure 8-108. A4A1 Video Processor, Block Diagram

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Table 8-34. A4A1 Video Processor, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C1	Q13	B2	R42	B3		
C2	B1	Q14	B2	R43	C3		
C3	C1	Q15	B2	R44	C3		
C4	C2	Q16	B2	R45	C3		
C5	B3	Q17	B3	R46	C3		
C6	B3	Q18	B3	R47	C3		
C7	B3	Q19	B3	R48	C3		
C8	B2	Q20	B3	R49	B4		
C9	B2			R50	B4		
C10	B2	R1	C1	R51	B4		
C11	B3	R2	C1	R52	B2		
C12	C2	R3	C1	R53	B2		
C14	B4	R4	B1	R54	C4		
C15	C4	R5	B1	R55	B4		
C16	B4	R6	B1	R56	B3		
C17	B4	R7	B1	R57	C3		
C18	B4	R8	B1	R58	C3		
C19	B1	R9	B1				
C20	C4	R10	C1	TP1	C2		
C21	C4	R11	C1	TP2	C2		
C22	C4	R12	C1	TP3	C3		
C23	C3	R13	C1				
		R14	C2	U1	C1		
CR1	C3	R15	C2	U2	C2		
CR2	C2	R16	B1	U3	C4		
CR3	C2	R17	B2	U4	C4		
		R18	B2	U5	B1		
J1	D4	R19	C2	U6	B1		
J2	D4	R20	C2	U7	B2		
J3	D4	R21	C2	U8	B2		
J4	D4	R22	C2	U9	B2		
		R23	C2	U10	B2		
L1	B4	R24	C2	U11	B3		
L2	B4	R25	C2				
L3	B4	R26	C2	VR1	C1		
L4	B4	R27	B3				
L5	B4	R28	B3				
		R29	B3				
Q1	C1	R30	C3				
Q2	C2	R31	C3				
Q3	C2	R32	C3				
Q4	C3	R33	C3				
Q5	C3	R34	C3				
Q6	C3	R35	C3				
Q7	C3	R36	C3				
Q8	C3	R37	C3				
Q9	C3	R38	C3				
Q10	B1	R39	C4				
Q11	B1	R40	B3				
Q12	B1	R41	B3				

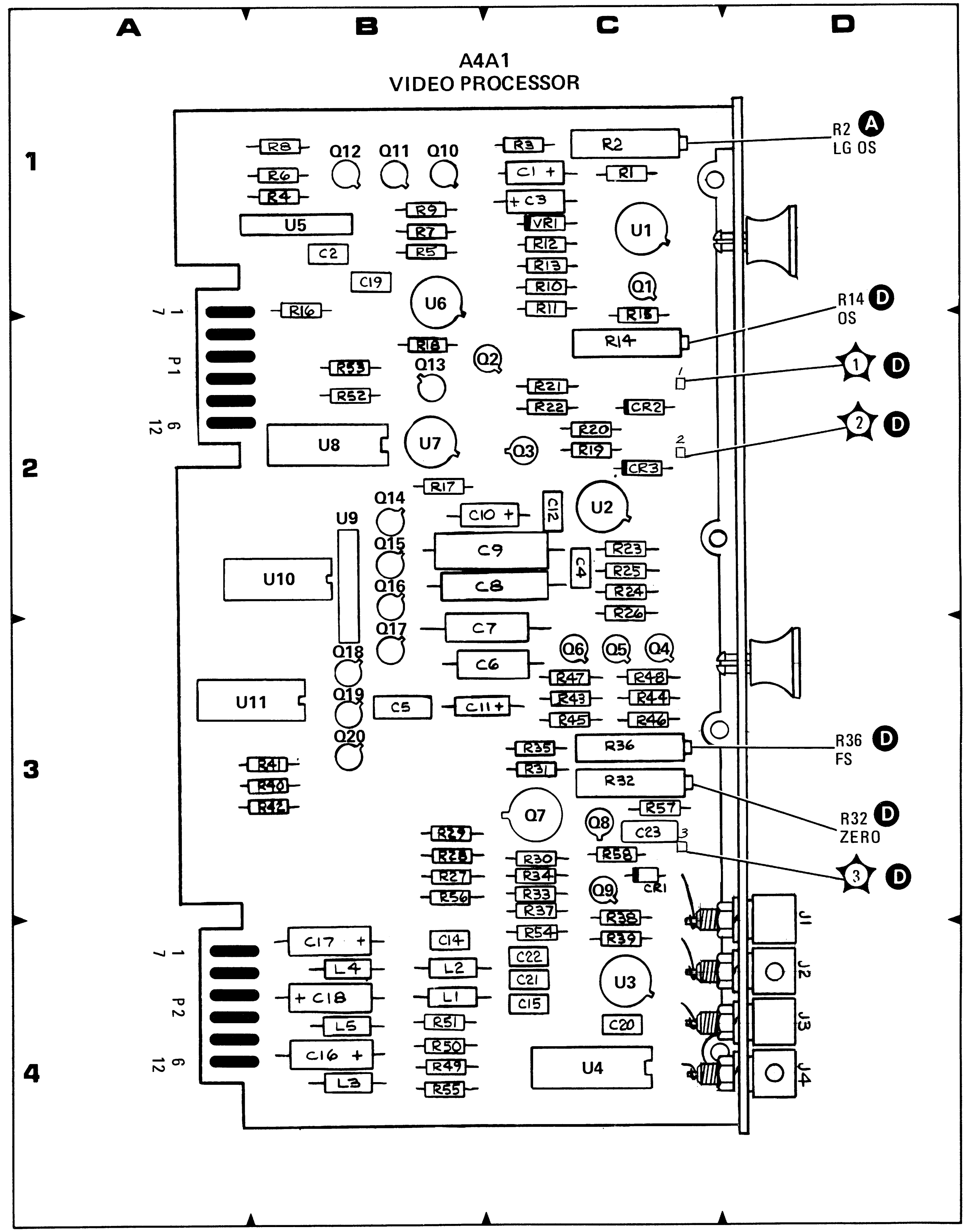
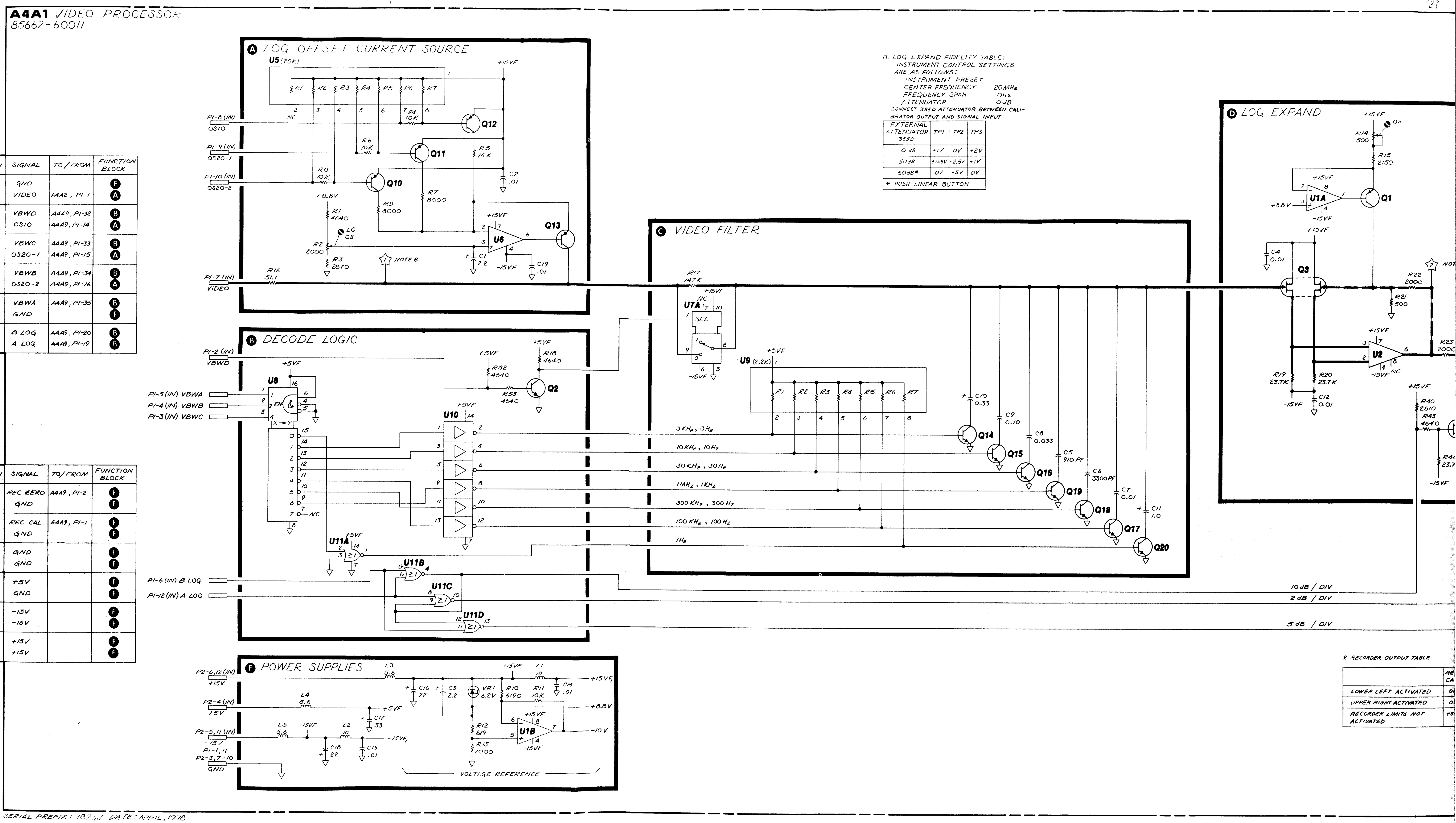


Figure 8-109. A4A1 Video Processor, Component Locations

A4A1 VIDEO PROCESSOR
85662-60011



P1

PIN	SIGNAL	TO / FROM	FUNCTION BLOCK
1	GND		F
7	VIDEO	A4A2, P1-1	A
2	VBWD	A4A9, P1-32	B
8	0S10	A4A9, P1-14	A
3	VBWC	A4A9, P1-33	B
9	0S20-1	A4A9, P1-15	A
4	VBWB	A4A9, P1-34	B
10	0S20-2	A4A9, P1-16	A
5	VBWA	A4A9, P1-35	B
11	GND		F
6	B LOG	A4A9, P1-20	B
12	A LOG	A4A9, P1-19	B

P2

PIN	SIGNAL	TO / FROM	FUNCTION BLOCK
1	REC ZERO	A4A9, P1-2	E
7	GND		F
2	REC CAL	A4A9, P1-1	E
8	GND		F
3	GND		F
9	GND		F
4	+5V		F
10	GND		F
5	-15V		F
11	-15V		F
6	+15V		F
12	+15V		F

8. LOG EXPAND FIDELITY TABLE:
INSTRUMENT CONTROL SETTINGS ARE AS FOLLOWS:
INSTRUMENT PRESET
CENTER FREQUENCY 20MHz
FREQUENCY SPAN 0Hz
ATTENUATOR 0dB
CONNECT 355D ATTENUATOR BETWEEN CALIBRATOR OUTPUT AND SIGNAL INPUT

EXTERNAL ATTENUATOR 355D	TP1	TP2	TP3
0 dB	+1V	0V	+2V
50dB	+0.5V	-2.5V	+1V
50dB*	0V	-5V	0V

* PUSH LINEAR BUTTON

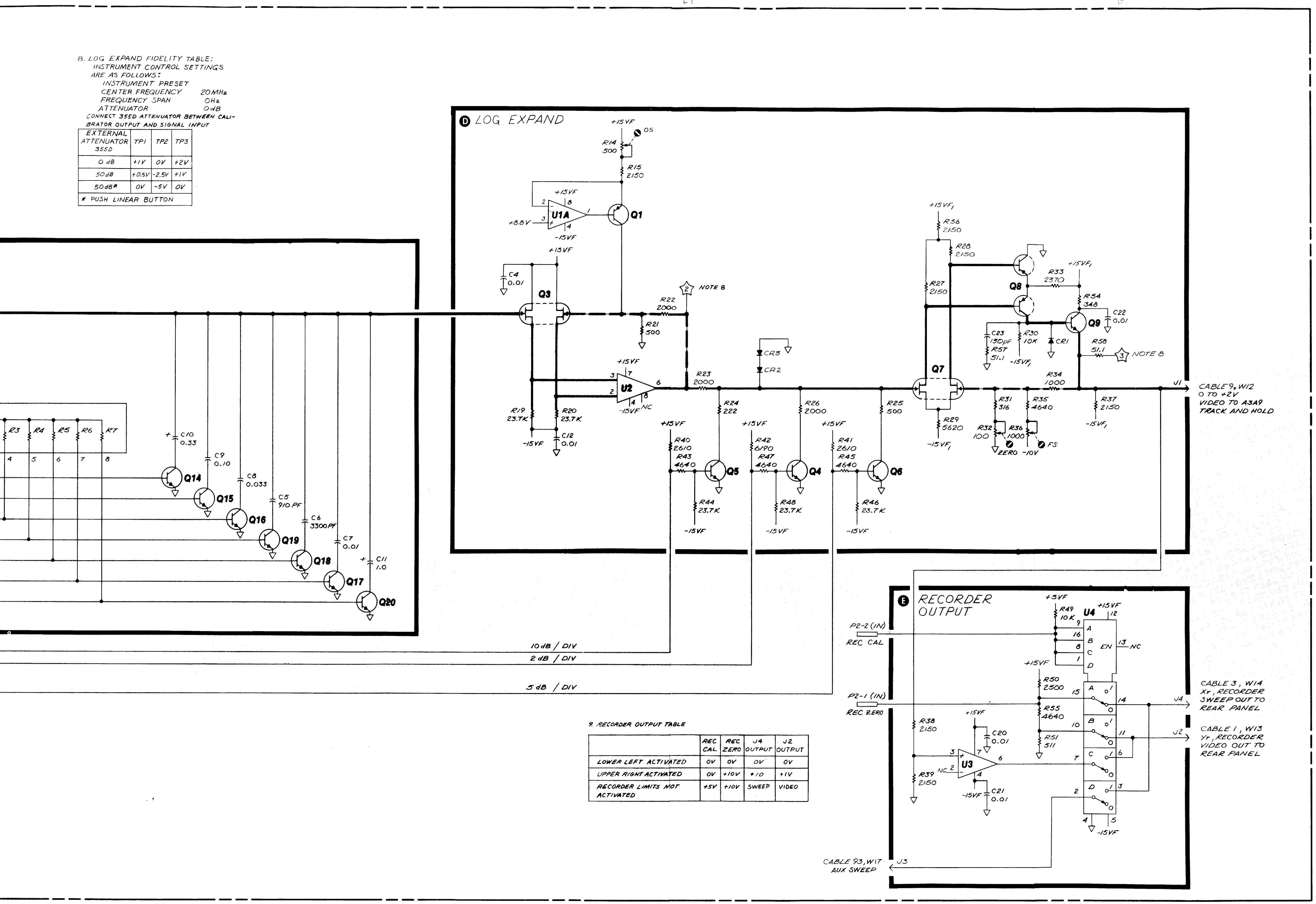
9. RECORDER OUTPUT TABLE

	RE CA
LOWER LEFT ACTIVATED	0
UPPER RIGHT ACTIVATED	0
RECORDER LIMITS NOT ACTIVATED	+5

SERIAL PREFIX: 1826A DATE: APRIL, 1978

8. LOG EXPAND FIDELITY TABLE:
INSTRUMENT CONTROL SETTINGS ARE AS FOLLOWS:
INSTRUMENT PRESET
CENTER FREQUENCY 20MHz
FREQUENCY SPAN 0Hz
ATTENUATOR 0dB
CONNECT 355D ATTENUATOR BETWEEN CALIBRATOR OUTPUT AND SIGNAL INPUT

EXTERNAL ATTENUATOR 355D	TP1	TP2	TP3
0 dB	+1V	0V	+2V
50dB	+0.5V	-2.5V	+1V
50dB*	0V	-5V	0V
* PUSH LINEAR BUTTON			



9. RECORDER OUTPUT TABLE

	REC CAL	REC ZERO	J4 OUTPUT	J2 OUTPUT
LOWER LEFT ACTIVATED	0V	0V	0V	0V
UPPER RIGHT ACTIVATED	0V	+10V	+10	+1V
RECORDER LIMITS NOT ACTIVATED	+5V	+10V	SWEEP	VIDEO

NOTES:

1. REFERENCE DESIGNATIONS 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. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
VBWA	VIDEO BANDWIDTH (LSB)
VBWB	VIDEO BANDWIDTH
VBWC	VIDEO BANDWIDTH
VBWD	VIDEO BANDWIDTH (MSB)
A LOG	LOG SCALE (LSB)
B LOG	LOG SCALE (MSB)
OS10	LOG OFFSET 10dB
OS20-1	LOG OFFSET 20dB-1
OS20-2	LOG OFFSET 20dB-2
REC ZERO	RECORDER LOWER LEFT
REC CAL	RECORDER LOWER LEFT OR UPPER RIGHT
VIDEO	DETECTED IF SIGNAL

4. UNLESS OTHERWISE INDICATED, LOGIC LEVELS ARE TTL:
   +3.6V TO +5.0V = LOGIC "1" = HIGH
   0V TO +0.8V = LOGIC "0" = LOW
5. OFFSET GAIN STEPS TRUTH TABLE:

LOG REF LEVEL		OS10	OS20-1	OS20-2
RES BW ≥ 3KHz	RES BW < 3KHz			
-70 TO -79.9 dBM	-90 TO -99.9	0V	>+14V	>+14V
-80 TO -89.9 dBM	-100 TO -109.9	>+14V	0V	>+14V
-90 TO -99.9 dBM	-110 TO -119.9	0V	0V	>+14V
-100 TO -109.9 dBM	-120 TO -129.9	>+14V	0V	0V
-110 TO -119.9 dBM	-130 TO -139.9	0V	0V	0V
INPUT ATTENUATOR 0dB SHIFT ATTENUATOR (FOR EXTENDED RANGES)				

6. VIDEO BANDWIDTH TRUTH TABLE:

VIDEO BANDWIDTH	VBWD	VBWC	VBWB	VBWA
3 MHz	H	H	H	H
1 MHz	H	H	H	L
300 KHz	H	H	L	H
100 KHz	H	H	L	L
30 KHz	H	L	H	H
10 KHz	H	L	H	L
3 KHz	H	L	L	H
1 KHz	L	H	H	L
300 Hz	L	H	L	H
100 Hz	L	H	L	L
30 Hz	L	L	H	H
10 Hz	L	L	H	L
3 Hz	L	L	L	H
1 Hz	L	L	L	L

7. LOG EXPAND TRUTH TABLE

LOG SCALE	B LOG	A LOG
10 dB / DIV	L	L
.5 dB / DIV	L	H
2 dB / DIV	H	L
1 dB / DIV	H	H

A4A1

Figure 8-110. A4A1 Video Processor, Schematic Diagram

A4A2 LOG AMPLIFIER—DETECTOR, CIRCUIT DESCRIPTION

A4A2 Log Amplifier-Detector Assembly contains the last four of the nine log amplifier stages. (The first five stages are in A4A3 Log Amplifier—Filter.) The first two stages in this assembly (Stage 6 and Stage 7) are also used in linear mode as a switchable 20 dB gain step. Following the last log stage, the 21.4 MHz IF signal is applied to a PIN diode attenuator. In log mode, this attenuation is varied with temperature to compensate for bias variations in the log stages. After passing through the PIN attenuator, the IF signal is detected to produce the vertical (video) signal which is applied to A4A1 Video Processor. The 21.4 MHz signal is attenuated and sent to the 21.4 MHz IF OUTPUT connector on the rear panel.

The control circuit of A4A2 contains log/linear switching circuitry and 20 dB linear gain step switching circuitry. Also contained in A4A2 is a temperature-dependent power supply which biases the log stages in A4A2 and A4A3. A similar temperature-dependent bias supply controls the attenuation of the PIN Diode Attenuator.

Log Amplifier Stages A

A4A2 contains the last four of the nine log amplifier stages. (Refer to A4A3 Log Amplifier–Filter for a description of log amplifier stages.) The operation of each stage is essentially identical to that of the log stages in A4A3.

LOG Mode. In LOG mode, the LOG/LIN control line from A4A9 IF Control is high (about +7V). Q9 is turned on, connecting the log diode bias resistor of each stage to the −12 VTV supply through CR16 and CR18. Q8 is off and PIN diodes CR12 and CR15 are reverse biased through R50. The LG20 control line from A4A9 IF Control Assembly is low in LOG mode, so Q10 is off and CR6 and CR9 are reversed biased. Thus all log diodes are on, and linear gain PIN diodes are off. The logged IF signal is applied through Q14 to the PIN Diode Attenuator, the Detector, and the Counter Output Limiter.

LINEAR Mode. Each of the log stages in this assembly provides linear gain through the use of a switchable PIN diode signal path. In LINEAR mode, the LOG/LIN control line is pulled to the −12 VTV supply through R101. This turns off Q9, removing the bias current from all log diodes. As the Q9 collector is pulled high through R46, the Q8 collector saturates to the −12 VTV supply, forward biasing PIN diodes CR2 and CR15 through CR21 in Log Amplifier Stages 8 and 9. Since PIN diode resistance is not affected by signal level, Stages 8 and 9 become non-limiting amplifiers with combined gain of approximately 15 dB. R36 is factory selected to adjust the gain of Stage 9 in LINEAR mode. This gain is necessary to obtain a 1V (full screen) video output in linear mode at approximately the same input level to the IF module that causes a 1V (full screen) output in LOG mode.

20 dB Linear Gain Step. Stages 6 and 7 are used as a switchable 20 dB gain step in LINEAR mode at low reference levels. When the LG20 control line is high (more positive than −5V), The Q10 collector saturates to the −12 VTV supply, turning on PIN diodes CR6 and CR9 in Log Amplifier Stages 6 and 7. Stage 6 and 7 each provide approximately 10 dB of non-limiting gain when LG20 is high. The combined gain of stages 6 and 7 is adjusted to 20 dB by varying the resistance of CR6. R14 sets the bias current and thus the resistance of CR6.

Pin Diode Attenuator C

In LOG mode, attenuation of the PIN Diode Attenuator is varied with temperature to compensate for bias variations with temperature in the Log Amplifier Stages. The attenuation is removed in the LINEAR mode.

LOG Mode. In LOG mode, Q7 is turned off because Q8 is off. CR30 is forward biased by the LOG/LIN control line through R63. PIN diodes CR28 and CR29 are forward biased by U1B through R62 and R61. PIN diodes CR26 and CR27 operate with fixed bias current through R56 and R57. CR26 through CR29 form a resistive voltage divider with CR28 and CR29 operating as a variable resistance. Op amp U1, which biases CR28 and CR29, is a temperature dependent voltage source. The voltage at U1 pin 7 becomes more negative as temperature increases, causing the attenuation to increase. The attenuation of the PIN Diode Attenuator is set by R61. (Refer to ATTEN and —12 VTV Adjustments.)

LINEAR Mode. In LINEAR mode, Q9 is off and Q8 and Q7 are on. Q7 supplies additional drive for CR26 and CR27 through R58. This biases CR26 and CR27 so that their resistance is small (<50Ω total). CR28 and CR29 are reverse biased through R63, since LOG/LIN is pulled to −12 VTV in linear mode. There is no attenuation, and the signal from Q14 is coupled directly to emitter follower Q5.

Detector Driver. The signal output from the PIN Diode attenuator is applied to emitter follower Q5, which provides low-impedance drive for the Detector. Bias for Q5 is supplied by R65, which with R64 forms a voltage divider for the signal from the Q5 emitter. The signal at J1 is linearly related to the displayed vertical signal in both LINEAR and LOG modes. The signal is sent by coax cable to the 21.4 MHz IF OUTPUT connector on the rear panel.

Temperature-Dependent Regulators D

The −12 VTV and PIN Diode Regulators provide temperature compensation for the Log Amplifier Stages. CR37 and CR38 operate as the temperature sensing elements to control the two voltages. U1A controls Q11 to regulate the −12 VTV supply, which provides a nominal −12V to a filter network for distribution throughout the Log Amplifier assemblies. The −12 VTV voltage is adjusted to provide proper log fidelity; it becomes more negative as temperature increases to correct for variations in log diode resistance. U1B produces a nominal −7V and forms the current source for CR28 and CR29 in the PIN Diode Attenuator. The voltage of U1B pin 7 becomes more negative as temperature increases to control the attenuation of the PIN Diode Attenuator.

ATTEN and —12 VTV Adjustments C D

The PIN Diode Attenuator adjustment (ATTEN potentiometer R61) is essentially a gain adjustment that varies the slope of the log curve. The −12 VTV adjustment (—12 VTV potentiometer R91 in the Temperature-Dependent Regulators circuit) varies the offset and slope of the log curve. These two adjustments (which interact) are used to set the output versus input curve in log mode. The IF input signal level, which causes a 1V (full screen) output in LINEAR mode, is used as a reference for full-scale deflection in LOG mode. The ATTEN and −12 VTV adjustments are made to give a 1V video output in both LOG and LINEAR modes for the same IF input signal level, and a 100 mV video output change for a 10 dB IF signal change in LOG mode.

Detector (E)

Q1 through Q4 and associated circuitry form a full wave rectifier to convert the IF signal to a video signal. Q4 is the current driver for the detector and converts voltage variations at the Q5 emitter to current variations which drive Q2 and Q3. Q3 is a half wave rectifier and conducts when the signal at the Q5 emitter is positive. The Q3 collector current is applied to the low-pass filter consisting of R75, R76, L12 through L14 and C51 through C54. When the signal at the Q5 collector goes negative, current generated in the Q4 collector is pulled out of the Q2 emitter. Q1 forms a current mirror, which drives current into the low pass filter when Q2 collector current flows. Thus current flows into the low-pass filter on both positive and negative halves of the IF signal at the Q5 emitter. CR31, CR32, CR33 and R72 keep Q2 and Q3 biased slightly below cutoff. When current flows into the low-pass filter from Q1 or Q3, a positive voltage is developed across R75 and R76. The voltage developed is proportional to the IF signal level at the Q5 emitter. The low-pass filter has a bandwidth of about 7 MHz to remove IF frequencies from the detected video output signal. The detected voltage is applied to unity gain buffer amplifier Q12 and Q13 to drive A4A1 Video Processor. The offset of differential pair Q12 is removed by ZERO adjustment R79.

Counter Output Limiter (F)

The Counter Output Limiter provides an amplitude-limited signal at the IF frequency used for frequency counting. The IF signal from detector driver Q5 is buffered by Q6. CR35 and CR36 are biased to cutoff for signal levels above that corresponding to greater than a one-division display. In LOG or LINEAR mode, the counter output remains at approximately −30 dBm for signal levels displayed in the top nine divisions of the display.

A4A2 LOG AMPLIFIER—DETECTOR, TROUBLESHOOTING

If the amplitude of the displayed signals is approximately 10 dB low (i.e., CAL OUTPUT appears to be −20 dBm) in the log mode but correct in the linear display mode, then one of the log amplifier stages in the A4A3 Log Amplifier–Filter board or the A4A2 Log Amplifier–Detector board is defective. Connect a 10 dB step attenuator between the CAL OUTPUT and SIGNAL INPUT 2 connectors. Refer to the Log Amplifier Stage Gain Check note on the service sheets for the necessary front panel control settings. When forward biased in log mode, the Schottky diodes should have voltage drops of 200 to 400 mV.

The following procedure will determine if the Linear Gain Steps, LG10 and LG20, are operating properly. The LG10 circuitry is located on the A4A3 Log Amplifier–Filter board while the LG20 circuitry is located on the A4A2 Log Amplifier–Detector board. Connect a 10 dB step attenuator set to 0 dB between the CAL OUTPUT and SIGNAL INPUT 2 connectors. Key in the following settings:

[INSTR PRESET]
[CENTER FREQUENCY] .... 20 MHz
[FREQUENCY SPAN] .... 10 kHz
[RES BW] .... 3 kHz
[ATTEN] .... 0 dB
[SHIFT] LOG SCALE [ENTER dB/DIV] (Turns off IF Step Gains)
[REFERENCE LEVEL] .... −60 dBm
SCALE LIN

The peak of the displayed signal should be on the top graticule. Adjust the front panel AMPTD CAL control to place the peak of the signal one division below the top graticule. If the signal limits at the top of the display, one of the Linear Gain Steps is stuck in the on state.

Set the 10 dB step attenuator to 10 dB and key in [REFERENCE LEVEL] −70 dBm. The peak of the displayed signal should be one division below the top graticule. If signal limits at the top of the display, the LG20 circuitry is defective. A signal approximately 3 divisions high indicates the LG10 circuitry is defective.

Set the 10 dB step attenuator to 20 dB and key in [REFERENCE LEVEL] −80 dBm. The peak of the displayed signal should be one division below the top graticule. The LG10 circuitry is defective if the signal limits at the top of the display. The LG20 circuitry is faulty if the displayed signal is approximately 3 divisions high.

The detector circuit on the A4A2 Log Amplifier-Detector board is most easily checked with DC voltages. These are derived using 0 Hz [FREQUENCY SPAN] and attenuating the CAL OUTPUT signal. The easiest point to check the detector output without removing boards is A4A1TP1. Connect a DVM to this test point. The voltage at A4A1TP2 should be +1V for a signal displayed on the top graticule. The output will be 0.1V less for each division down from the top in either the linear or the 10 dB/Div log modes when the detector is operating properly.

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Table 8-35. A4A2 Log Amplifier-Detector, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A2	85662-60096	1	LOG AMPLIFIER (INCLUDES A4A2 AND A4A3)	28480	85662-60096
A4A2	85662-60097		RESTORED 85662-60096	28480	85662-60097
A4A2	85662-60010	1	BOARD ASSEMBLY, LOG AMPLIFIER-DETECTOR	28480	85662-60010
A4A2C1			NOT ASSIGNED		
A4A2C2			NOT ASSIGNED		
A4A2C3	0160-2055	50	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C31			NOT ASSIGNED		
A4A2C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C35			NOT ASSIGNED		
A4A2C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C39	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C40	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C41	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C42	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C43	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C44	0160-4084	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A2C45			NOT ASSIGNED		
A4A2C46	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C47			NOT ASSIGNED		
A4A2C48	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C49	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C50	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C51	0160-2262	1	CAPACITOR-FXD 16PF +-5% 500VDC CER0+-30	28480	0160-2262
A4A2C52	0160-2200	1	CAPACITOR-FXD 43PF +-5% 300VDC	28480	0160-2200
A4A2C53	0160-2307	1	CAPACITOR-FXD 47PF +-5% 300VDC	28480	0160-2307
A4A2C54	0160-2205	1	CAPACITOR-FXD 120PF +-5% 300VDC MICA0+70	28480	0160-2205
A4A2C55	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C56			NOT ASSIGNED		
A4A2C57			NOT ASSIGNED		
A4A2C58			NOT ASSIGNED		
A4A2C59	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C60			NOT ASSIGNED		
A4A2C61			NOT ASSIGNED		
A4A2C62	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C63	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C64	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C65	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C66	0180-0228	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	0420J	150D226X9015B2
A4A2C67			NOT ASSIGNED		
A4A2C68	0160-4297	7	CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A2C69	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A2C70	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A2C71	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH

Table 8-35. A4A2 Log Amplifier-Detector, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A2C72	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A2C73	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A2C74	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C75	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A2CR1			NOT ASSIGNED		
A4A2CR2			NOT ASSIGNED		
A4A2CR3			NOT ASSIGNED		
A4A2CR4	1901-1085	8	DIODE-SCHOTTKY	28480	1901-1085
A4A2CR5	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A2CR6	1901-1070	8	DIODE-PIN	28480	1901-1070
A4A2CR7	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A2CR8	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A2CR9	1901-1070		DIODE-PIN	28480	1901-1070
A4A2CR10	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A2CR11	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A2CR12	1901-1070		DIODE-PIN	28480	1901-1070
A4A2CR13	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A2CR14	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A2CR15	1901-1070		DIODE-PIN	28480	1901-1070
A4A2CR16	1901-0047	11	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2CR17	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2CR18	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2CR19	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2CR20	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2CR21	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2CR22			NOT ASSIGNED		
A4A2CR23			NOT ASSIGNED		
A4A2CR24			NOT ASSIGNED		
A4A2CR25			NOT ASSIGNED		
A4A2CR26	1901-1070		DIODE-PIN	28480	1901-1070
A4A2CR27	1901-1070		DIODE-PIN	28480	1901-1070
A4A2CR28	1901-1070		DIODE-PIN	28480	1901-1070
A4A2CR29	1901-1070		DIODE-PIN	28480	1901-1070
A4A2CR30	1901-0047		DIODE-SWITCHING 20V 75MA IONS	28480	1901-0047
A4A2CR31	1910-0016	3	DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A4A2CR32	1910-0016		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A4A2CR33	1910-0016		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A4A2CR34			NOT ASSIGNED		
A4A2CR35	1901-0047		DIODE-SWITCHING 20V 75MA IONS	28480	1901-0047
A4A2CR36	1901-0047		DIODE-SWITCHING 20V 75MA IONS	28480	1901-0047
A4A2CR37	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2CR38	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A2E1	9170-0029	8	CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2E2	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2E3	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2E4	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2E5	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2E6	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2E7	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2E8	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A2J1	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A2J2	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A2L1	9100-1618	4	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A2L2	9140-0105	5	COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	28480	9140-0105
A4A2L3	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	28480	9140-0105
A4A2L4	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	28480	9140-0105
A4A2L5	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	28480	9140-0105
A4A2L6	9100-1623	2	COIL-MLD 27UH 5% Q=60 .155DX.375LG	0217B	15-4455-2J
A4A2L7	9100-1623		COIL-MLD 27UH 5% Q=60 .155DX.375LG	0217B	15-4455-2J
A4A2L8	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A2L9	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A2L10	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A2L11			NOT ASSIGNED		
A4A2L12	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	28480	9140-0105
A4A2L13	9140-0114	1	COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A2L14	9140-0178	1	COIL-MLD 12UH 10% Q=65 .155DX.375LG	0217B	15-4445-3K
A4A2Q1	1853-0075	1	TRANSISTOR-DUAL PNP PD=400MW	28480	1853-0075
A4A2Q2	1854-0345	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	0203G	2N5179
A4A2Q3	1853-0015	1	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A4A2Q4	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	0203G	2N5179
A4A2Q5	1853-0405	1	TRANSISTOR PNP 2N4209 SI TO-18 PD=300MW	28480	1853-0405
A4A2Q6	1854-0019	10	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q7	1853-0281	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	0203G	2N2907A
A4A2Q8	1854-0404	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A2Q9	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A2Q10	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404

Table 8-35. A4A2 Log Amplifier-Detector, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A2Q11	1854-0637	1	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	28480	1854-0637
A4A2Q12	1854-0475	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A4A2Q13	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A2Q14	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q15	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q16	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q17	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q18	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q19	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q20	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q21	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q22	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2R1	0757-0346	9	RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R2	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R3	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R4	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R5	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R6	0757-0279	14	RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R7	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	03298	C4-1/8-T0-111-F
A4A2R8	0698-3136	8	RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R9	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R10	0698-3444	5	RESISTOR 316 1% .125W F TC=0+-100	03298	C4-1/8-T0-316R-F
A4A2R11	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R12	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R13	0757-0280	6	RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A4A2R14	2100-3161	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
A4A2R15	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R16	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R17	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	03298	C4-1/8-T0-316R-F
A4A2R18*	0757-0402	2	RESISTOR 110 1% .125W F TC=0+-100	03298	C4-1/8-T0-111-F
A4A2R19	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R20	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R21	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R22	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R23	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R24	0757-0439	11	RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R25	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R26	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	03298	C4-1/8-T0-147R-F
A4A2R27	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R28	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R29	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	03298	C4-1/8-T0-316R-F
A4A2R30	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R31	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R32	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R33			NOT ASSIGNED		
A4A2R34	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R35	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1471-F
A4A2R36*	0757-0405	1	RESISTOR 162 1% .125W F TC=0+-100	03298	C4-1/8-T0-162R-F
A4A2R37	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R38	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R39	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1782-F
A4A2R40	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R41	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	03298	C4-1/8-T0-316R-F
A4A2R42	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R43	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R44	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	03298	C4-1/8-T0-316R-F
A4A2R45	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A4A2R46	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R47	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R48	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R49	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R50	0757-0442	14	RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R51			NOT ASSIGNED		
A4A2R52			NOT ASSIGNED		
A4A2R53			NOT ASSIGNED		
A4A2R54			NOT ASSIGNED		
A4A2R55			NOT ASSIGNED		
A4A2R56	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5111-F
A4A2R57	0757-0458	2	RESISTOR 51.1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5112-F
A4A2R58	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R59	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R60	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R61	2100-1972	1	RESISTOR-TRMR 20K 10% WW SIDE-ADJ 20-TRN	0374D	3005P-1-203
A4A2R62*	0698-3449	1	RESISTOR 28.7K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2872-F
A4A2R63	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R64	0757-0394	2	RESISTOR 51.1 1% .125W F TC=0+-100	03298	C4-1/8-T0-51R1-F
A4A2R65	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F

Table 8-35. A4A2 Log Amplifier-Detector, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A2R66	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R67	0757-0416	3	RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A2R68			NOT ASSIGNED		
A4A2R69	0698-3437	1	RESISTOR 133 1% .125W F TC=0+-100	03298	C4-1/8-T0-133R-F
A4A2R70	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A4A2R71	0698-3446	1	RESISTOR 383 1% .125W F TC=0+-100	03298	C4-1/8-T0-383R-F
A4A2R72	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R73	0757-0401	4	RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A4A2R74	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A4A2R75	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A2R76	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A2R77	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R78	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1212-F
A4A2R79	2100-3103	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	73138	89PR10K
A4A2R80	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	03298	C4-1/8-T0-7501-F
A4A2R81	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R82	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	03298	C4-1/8-T0-237R-F
A4A2R83	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A4A2R84	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	03298	C4-1/8-T0-6811-F
A4A2R85	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R86*	0698-3155	1	RESISTOR 4.64K 1% .125W F TC=0+-100	03298	C4-1/8-T0-4641-F
A4A2R87	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3481-F
A4A2R88*	0698-3158	1	RESISTOR 23.7K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2372-F
A4A2R89*	0698-3454	1	RESISTOR 215K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2153-F
A4A2R90	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-5112-F
A4A2R91	2100-2852	1	RESISTOR-TRMR 1K 10% WW SIDE-ADJ 20-TRN	0374D	3005P-1-102
A4A2R92	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	03298	C4-1/8-T0-4221-F
A4A2R93	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A4A2R94	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	28480	0683-0275
A4A2R95	0698-3153	2	RESISTOR 3.83K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3831-F
A4A2R96*	0698-3161	1	RESISTOR 38.3K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3832-F
A4A2R97*	0698-3260	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A2R98	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3831-F
A4A2R99*	0757-0462	1	RESISTOR 75K 1% .125W F TC=0+-100	03298	C4-1/8-T0-7502-F
A4A2R100	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R101	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-F
A4A2R102	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R103	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1003-F
A4A2R104	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R105	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2R106	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	03298	C4-1/8-T0-51R1-F
A4A2R107	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R108	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R109	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R110	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1002-F
A4A2R111	0757-0123	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A4A2R112	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	03298	C4-1/8-T0-56R2-F
A4A2R113	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-F
A4A2R114	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03298	C4-1/8-T0-10R0-F
A4A2R115	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3161-F
A4A2TP1	1251-0600	8	CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2TP2	1251-0600		CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2TP3	1251-0600		CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2TP4	1251-0600		CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2TP5	1251-0600		CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2TP6	1251-0600		CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2TP7	1251-0600		CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2TP8	1251-0600		CONTACT-CONV V/W-POST-TYPE MALE DPSLDR	28480	1251-0600
A4A2U1	1826-0092	1	IC OP AMP	28480	1826-0092
A4A2VR1	1902-0126	2	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.073%	0203G	SZ 10939-14
A4A2VR2	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	0203G	SZ 10939-98
A4A2VR3	1902-0126		DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.073%	0203G	SZ 10939-14
			A4A2 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR-PC BOARD	28480	86701-40001

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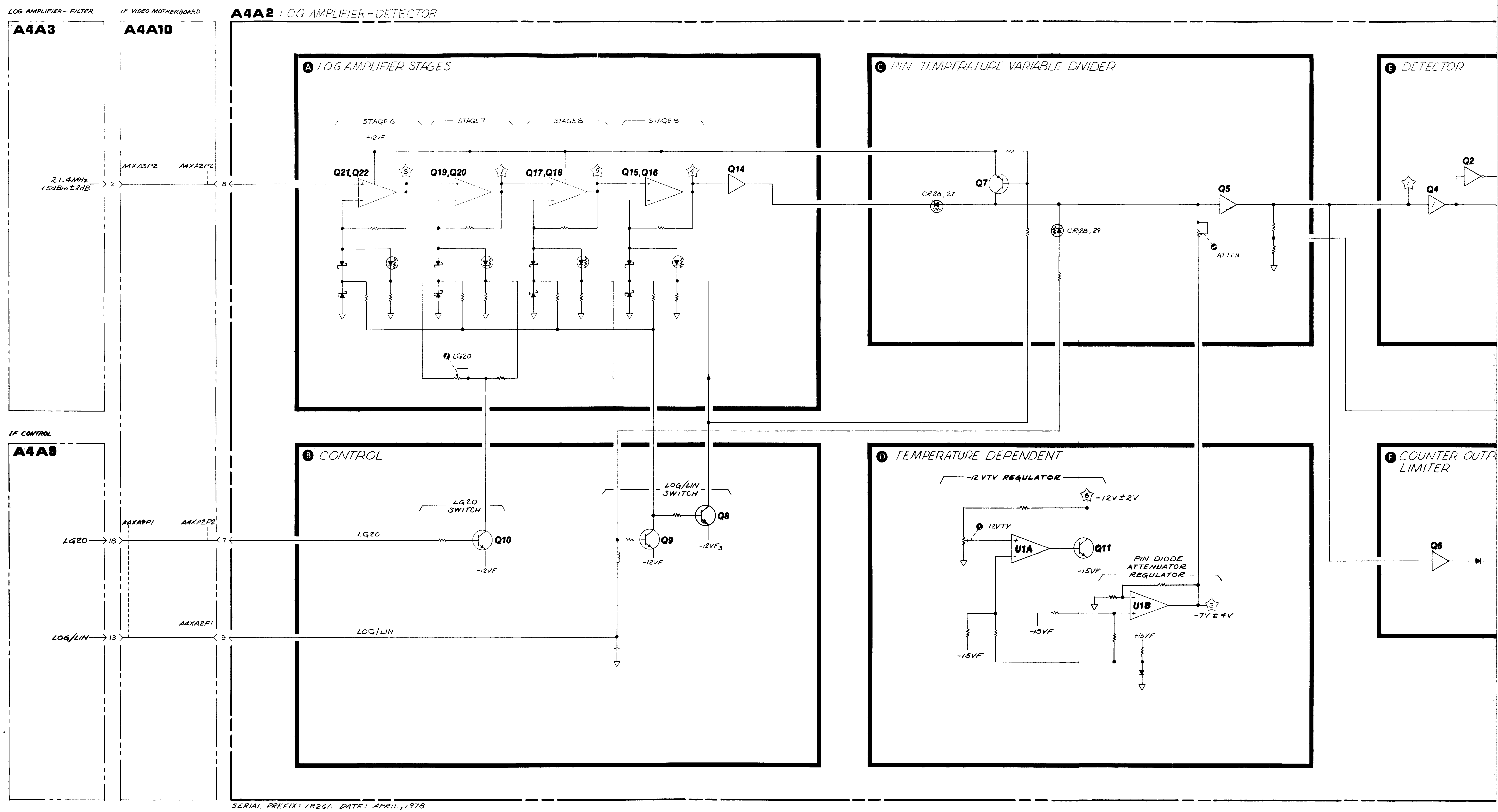

LOG AMPLIFIER – FILTER
A4A3
IF VIDEO MOTHERBOARD
A4A10
A4A2 LOG AMPLIFIER-DETECTOR
A LOG AMPLIFIER STAGES
STAGE 6
STAGE 7
STAGE 8
STAGE 9
+12VF
Q21,Q22
Q19,Q20
Q17,Q18
Q15,Q16
Q14
21.4MHz
+5dBm ±2dB
A4XA3P2
A4XA2P2
LG20
C PIN TEMPERATURE VARIABLE DIVIDER
Q7
CR26, 27
CR28, 29
Q5
ATTEN
E DETECTOR
Q2
Q4
IF CONTROL
A4A8
B CONTROL
LG20 SWITCH
LOG/LIN SWITCH
Q10
Q9
Q8
-12VF
-12VF3
LG20
LOG/LIN
A4XA9P1
A4XA2P2
A4XA2P1
D TEMPERATURE DEPENDENT
-12 VTV REGULATOR
-12V ± 2V
-12VTV
U1A
Q11
-15VF
PIN DIODE ATTENUATOR REGULATOR
U1B
-7V ± 4V
+15VF
F COUNTER OUTPUT LIMITER
Q6
SERIAL PREFIX: 1826A DATE: APRIL, 1978

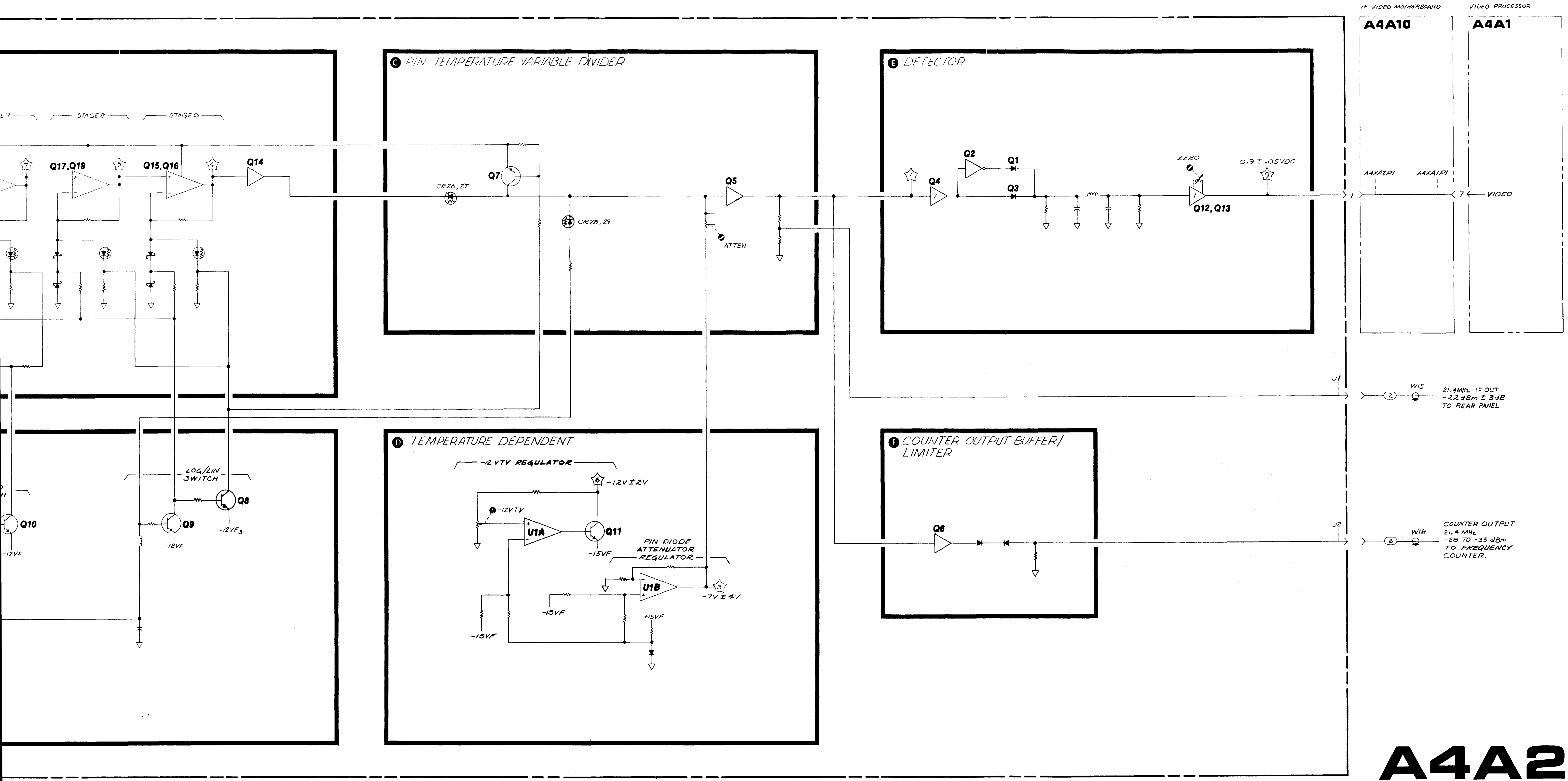

Figure 8-111. A4A2 Log Amplifier-Detector, Block Diagram

Table 8-50. A4A2 Log Amplifier Filter, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C3	B4	C62	C2	E6	C2	R7	C4	R63	B2	R114	B2
C4	B4	C63	C2	E7	C1	R8	C4	R64	C1	R115	C2
C5	C4	C64	C2	E8	C2	R9	C4	R65	C1		
C6	C4	C65	C3			R10	B4	R66	C2	TP1	C1
C7	C4	C66	C3	J1	D1	R11	B4	R67	B2	TP2	B2
C8	B4	C68	A3	J2	D2	R12	B4	R69	C1	TP3	C3
C9	B4	C69	B2			R13	C4	R70	C1	TP4	B3
C10	B3	C70	A2	L1	B4	R14	C4	R71	C1	TP5	B3
C11	B3	C71	B4	L2	B4	R15	B4	R72	B1	TP6	C3
C12	B3	C72	B3	L3	B3	R16	B4	R72	C1	TP7	B4
C13	B3	C73	B4	L4	B3	R17	B3	R74	C1	TP8	B4
C14	B3	C74	B4	L5	B2	R18	B3	R75	B1		
C15	B3	C75	A2	L6	B2	R19	C3	R76	B1	U1	C3
C16	B3			L7	A2	R20	C3	R77	B2		
C17	B3	CR4	C4	L8	B4	R21	C3	R78	B2	VR1	A3
C18	B3	CR5	C4	L9	A2	R22	B3	R79	C2	VR2	C4
C19	C3	CR6	B4	L10	B1	R23	B3	R80	B1	VR3	C2
C20	B3	CR7	B3	L12	B1	R24	B3	R81	B2		
C21	B3	CR8	B3	L13	B1	R25	B3	R82	B2		
C22	B3	CR9	B3	L14	A1	R26	B3	R83	B1		
C23	B2	CR10	B3			R27	C3	R84	C3		
C24	B2	CR11	B3	Q1	B1	R28	C3	R85	B4		
C25	B2	CR12	B3	Q2	C1	R29	B3	R86	C3		
C26	B2	CR13	B3	Q3	B1	R30	B3	R87	C3		
C27	B2	CR14	B2	Q4	C1	R31	B3	R88	C3		
C28	C4	CR15	B2	Q5	C2	R32	C3	R89	C3		
C29	C3	CR16	C4	Q6	C2	R34	B3	R90	C3		
C30	C3	CR17	C4	Q7	C2	R35	B3	R91	C2		
C32	C3	CR18	C3	Q8	C2	R36	B3	R92	C4		
C33	C2	CR19	C3	Q9	C3	R37	C2	R93	C4		
C34	B2	CR20	C2	Q10	C3	R38	C2	R94	C4		
C36	B2	CR21	C2	Q11	C4	R39	C2	R95	C3		
C37	B2	CR26	B2	Q12	B1	R40	B2	R96	C3		
C38	B2	CR27	B2	Q13	B1	R41	B3	R97	C3		
C39	C2	CR28	B2	Q14	B2	R42	B2	R98	C3		
C40	B2	CR29	B2	Q15	B2	R43	B2	R99	C3		
C41	C2	CR30	B2	Q16	B3	R44	B2	R100	C3		
C42	C1	CR31	C1	Q17	B3	R45	B2	R101	C3		
C43	C2	CR32	C1	Q18	B3	R46	C2	R102	C2		
C44	C3	CR33	B1	Q19	B3	R47	C3	R103	C3		
C46	C1	CR35	C2	Q20	B4	R48	C3	R104	C3		
C48	C1	CR36	C2	Q21	B4	R49	B2	R105	C3		
C49	C1	CR37	C3	Q22	B4	R50	C2	R106	C2		
C50	B1	CR38	B3			R56	B2	R107	C2		
C51	B1			R1	A3	R57	B2	R108	C2		
C52	B1	E1	B4	R2	A3	R58	C2	R109	C2		
C53	B1	E2	B4	R3	A3	R59	C2	R110	C2		
C54	A1	E3	B3	R4	B2	R60	C2	R111	C2		
C55	B2	E4	B3	R5	B4	R61	C2	R112	C2		
C59	C2	E5	B2	R6	C4	R62	C2	R113	C1		

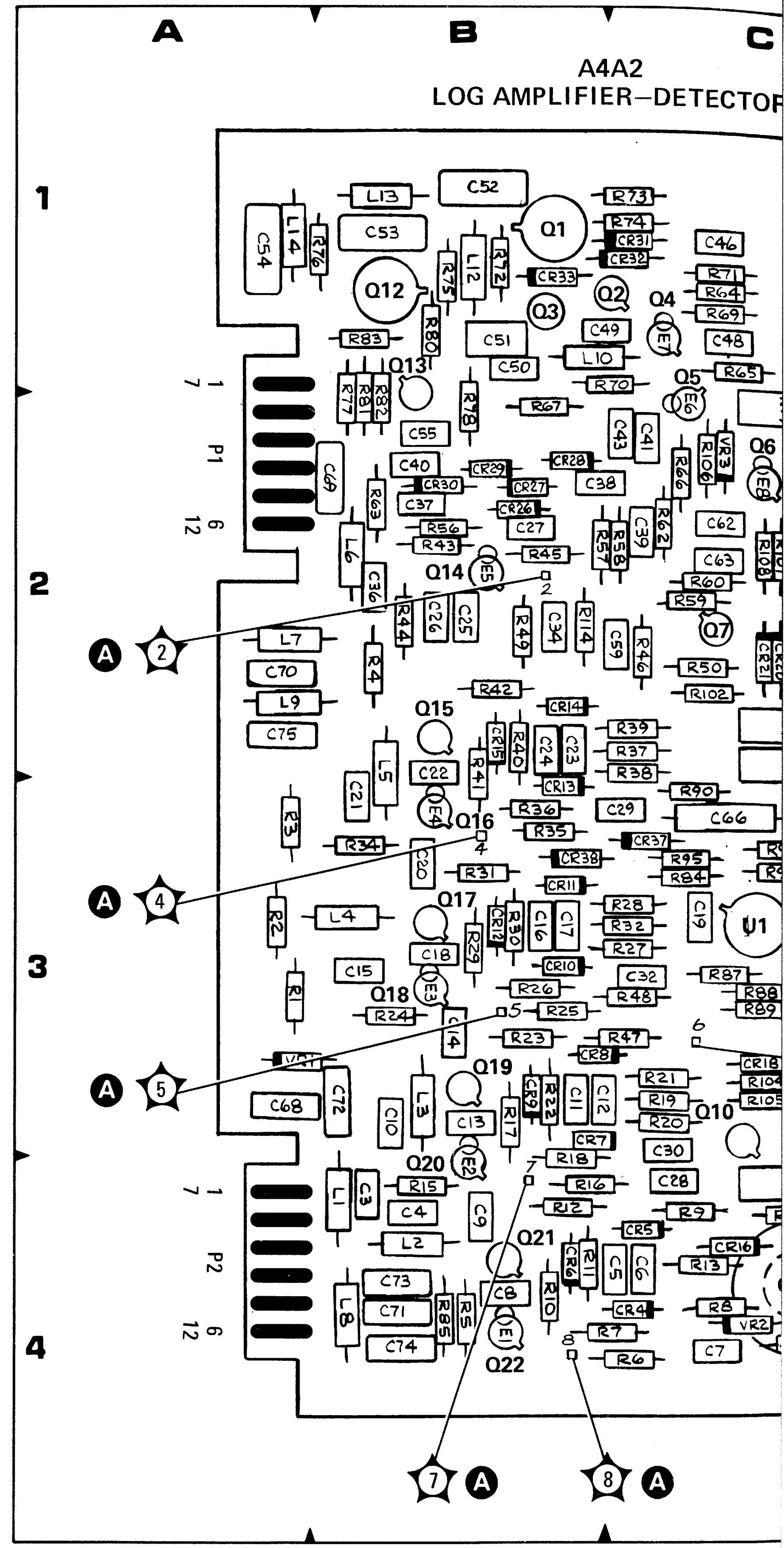

Figure 8-112. A4A2 Log Amplifier–Detector, Com

Table 8-36. A4A2 Log Amplifier Filter, Component Locator Table

...nce ...tor	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
	C2	E6	C2	R7	C4	R63	B2	R114	B2
	C2	E7	C1	R8	C4	R64	C1	R115	C2
	C2	E8	C2	R9	C4	R65	C1		
	C3			R10	B4	R66	C2	TP1	C1
	C3	J1	D1	R11	B4	R67	B2	TP2	B2
	A3	J2	D2	R12	B4	R69	C1	TP3	C3
	B2			R13	C4	R70	C1	TP4	B3
	A2	L1	B4	R14	C4	R71	C1	TP5	B3
	B4	L2	B4	R15	B4	R72	B1	TP6	C3
	B3	L3	B3	R16	B4	R72	C1	TP7	B4
	B4	L4	B3	R17	B3	R74	C1	TP8	B4
	B4	L5	B2	R18	B3	R75	B1		
	A2	L6	B2	R19	C3	R76	B1	U1	C3
		L7	A2	R20	C3	R77	B2		
	C4	L8	B4	R21	C3	R78	B2	VR1	A3
	C4	L9	A2	R22	B3	R79	C2	VR2	C4
	B4	L10	B1	R23	B3	R80	B1	VR3	C2
	B3	L12	B1	R24	B3	R81	B2		
	B3	L13	B1	R25	B3	R82	B2		
	B3	L14	A1	R26	B3	R83	B1		
0	B3			R27	C3	R84	C3		
1	B3	Q1	B1	R28	C3	R85	B4		
2	B3	Q2	C1	R29	B3	R86	C3		
3	B3	Q3	B1	R30	B3	R87	C3		
4	B2	Q4	C1	R31	B3	R88	C3		
5	B2	Q5	C2	R32	C3	R89	C3		
6	C4	Q6	C2	R34	B3	R90	C3		
7	C4	Q7	C2	R35	B3	R91	C2		
8	C3	Q8	C2	R36	B3	R92	C4		
9	C3	Q9	C3	R37	C2	R93	C4		
0	C2	Q10	C3	R38	C2	R94	C4		
1	C2	Q11	C4	R39	C2	R95	C3		
6	B2	Q12	B1	R40	B2	R96	C3		
7	B2	Q13	B1	R41	B3	R97	C3		
8	B2	Q14	B2	R42	B2	R98	C3		
9	B2	Q15	B2	R43	B2	R99	C3		
0	B2	Q16	B3	R44	B2	R100	C3		
1	C1	Q17	B3	R45	B2	R101	C3		
2	C1	Q18	B3	R46	C2	R102	C2		
3	B1	Q19	B3	R47	C3	R103	C3		
5	C2	Q20	B4	R48	C3	R104	C3		
6	C2	Q21	B4	R49	B2	R105	C3		
7	C3	Q22	B4	R50	C2	R106	C2		
8	B3			R56	B2	R107	C2		
		R1	A3	R57	B2	R108	C2		
	B4	R2	A3	R58	C2	R109	C2		
	B4	R3	A3	R59	C2	R110	C2		
	B3	R4	B2	R60	C2	R111	C2		
	B3	R5	B4	R61	C2	R112	C2		
	B2	R6	C4	R62	C2	R113	C1		

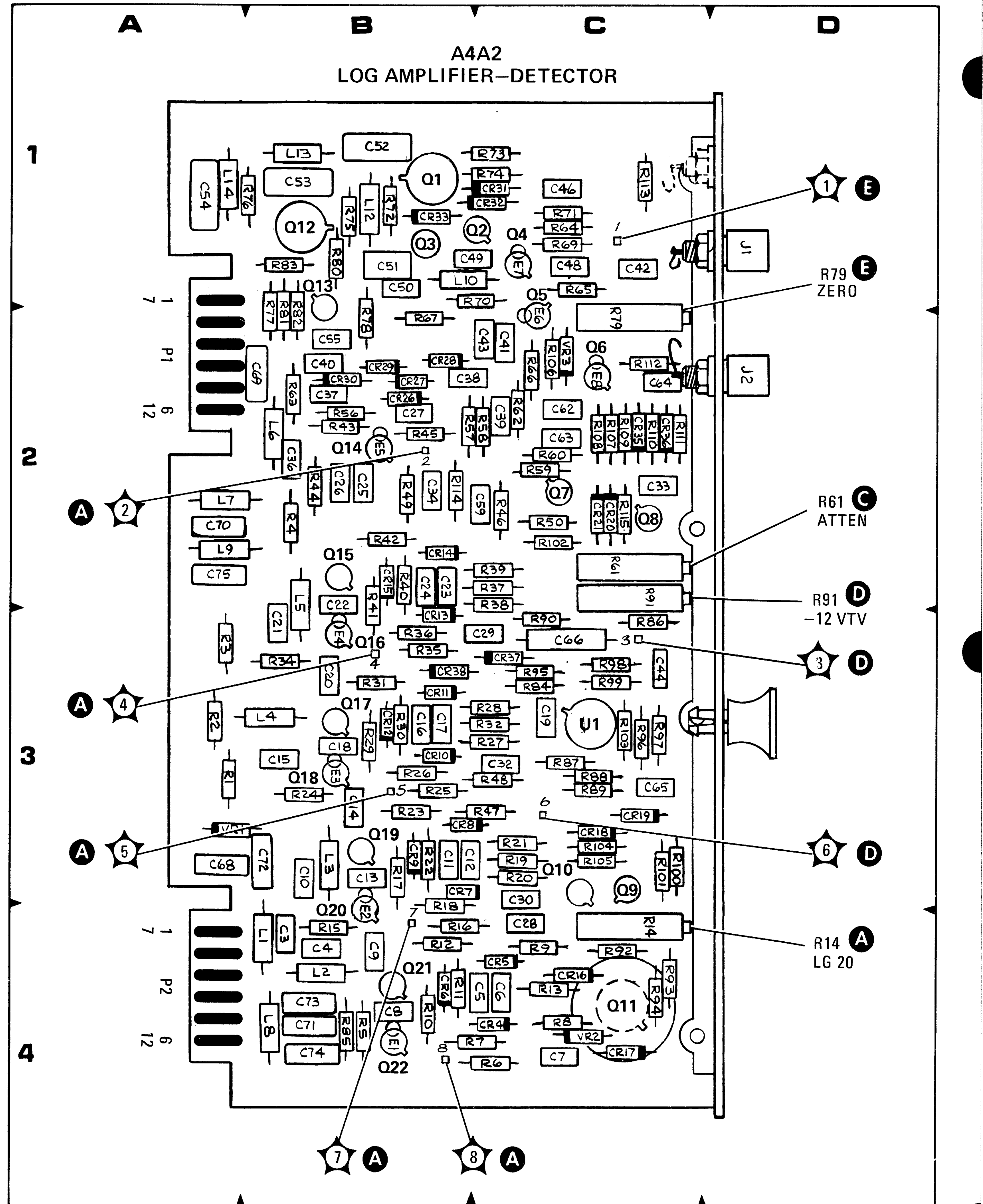

Figure 8-112. A4A2 Log Amplifier–Detector, Component Locations

A4A3 LOG AMPLIFIER—FILTER, CIRCUIT DESCRIPTION

A4A3 Log Amplifier—Filter, with A4A2 Log Amplifier—Detector, provides the ability to display signals in either a linear or log mode. In log mode the calibrated display range is 90 dB. A4A3 contains the first five of nine log stages, and A4A2 contains the last four. A4A3 also contains circuitry for using one of the log stages as a switchable 10 dB gain step. This is used only in linear mode.

After being processed by the first five log amplifier stages, the 21.4 MHz IF signal is applied to the log amplifier filter, the bandwidth of which is either narrow (approximately 1 MHz) or wide (>20 MHz). The filter is in narrow mode for resolution bandwidths of ≤30 kHz to reduce noise generated in the log amplifier stages.

Control lines from A4A9 IF Control drive circuits of A4A3 which control the log amplifier filter, log/linear switching, and 10 dB linear gain step.

Log Amplifier Stages Ⓐ

In LOG mode, the five log amplifier stages in A4A3 and the four log amplifier stages in A4A2 limit their gain in sequence with increasing signal level to provide 90 dB of log display range. In LINEAR mode, signal-level-dependent components are switched out of the signal path, and a linear display is provided.

LOG Mode. A simplified schematic of a log amplifier stage is shown in Figure 8-114. In LOG mode, the LOG/LIN control line is high (about +7V), Q16 is on, forward biasing log diodes CR25, CR26, and all other log diodes in this assembly. CR25 and CR26 are Schottky diodes with a forward bias voltage of approximatey +0.4V. Q11 is an emitter follower used as a voltage source which drives Q12 through the resistance of CR25 and CR26. Q12 forms a common-base amplifier tuned to approximately 21.4 MHz. The gain of the amplifier is set by the ratio of R48 to the total resistance R_T between the emitters of Q11 and Q12 (primarily the resistance of CR25 and CR26). The formula for computing gain is:

$$G = 1 + \frac{316}{R_T}$$

R_T is at a minimum (approximately 150Ω) for small signals. The small-signal gain of the stage (about 10 dB) is set by the dc bias current through the log diodes. As the signal level at the Q11 emitter increases, signal current cancels bias current in the log diodes, increasing R_T The gain of the stage for large signals is reduced to nearly unity (0 dB) because R_T becomes very large. Signal current flow through R41 keeps the stage gain slightly above unity to compensate for the input loading of the following stage.

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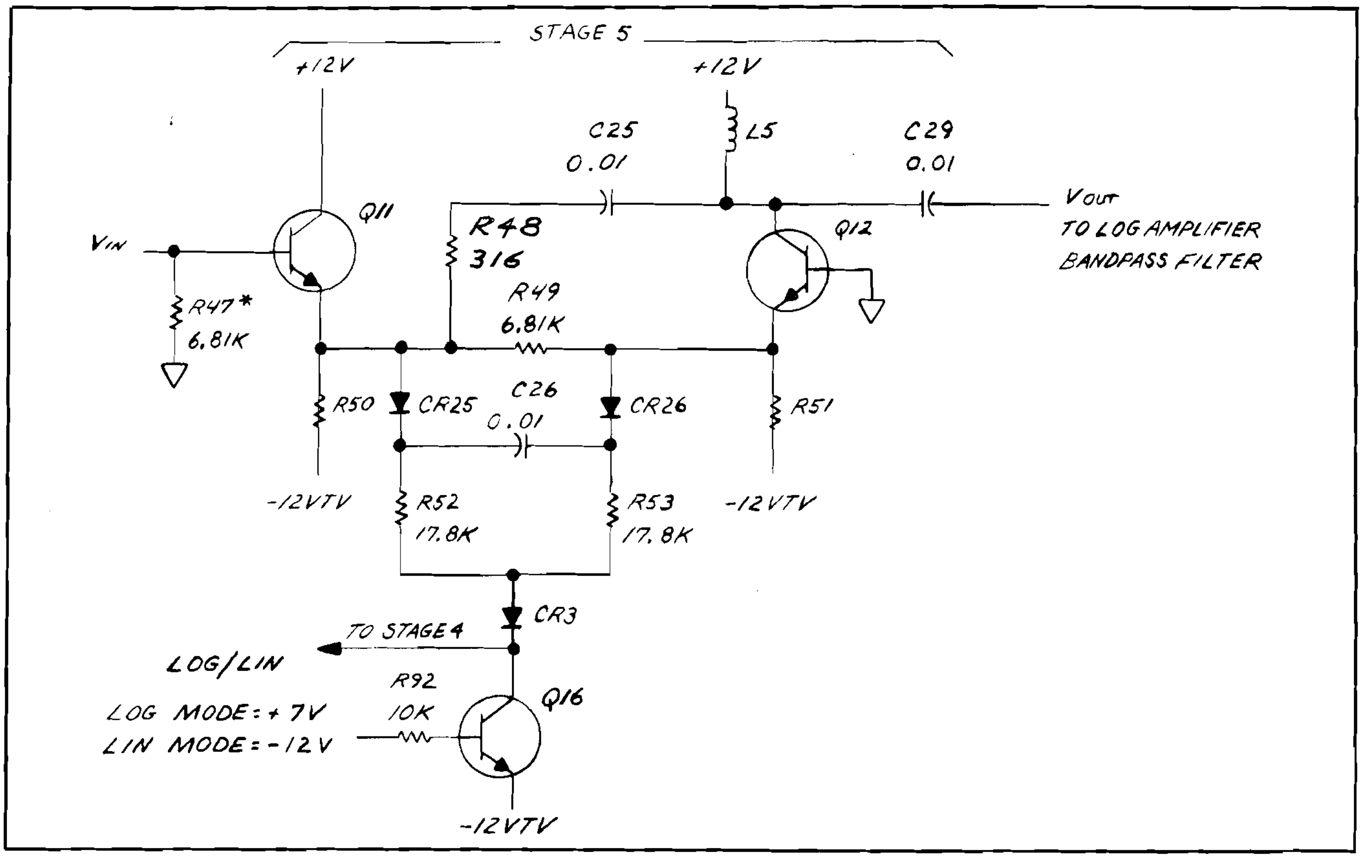

Figure 8-114. Log Amplifier Stage, Simplified Schematic

Bias Supplies

The −12 VTV is supplied to A4A3 from A4A2. This voltage determines log diode bias current and becomes more negative as temperature increases to compensate for the increased resistance of the log diodes. The same supply is used to compensate the log diodes of the four log stages in A4A2.

LINEAR Mode (See Figure 8-114.) In LINEAR Mode, log diodes CR15 and CR16 are zero biased, and the limiting action is removed from the stage. R_T is large, and stage gain is nearly unity. Signal flow is through emitter follower Q11 and R48 to Q13.

Log Stages. All nine of the log amplifier stages in A4A2 and A4A3 are similar in operation, although there are variations in certain stages. While all stages except the first three contain two log diodes each, the first two stages contain six diodes each, and the third contains four diodes. More diodes are used in Stages 1 through 3 because these stages have their logging action at higher signal levels than the other log stages. Log diodes of Stages 1 and 2 are biased so that the logging action occurs at signal levels of approximately 0 dBm to +10 dBm, whereas the remaining stages log at lower signal levels. To provide proper log fidelity (log amplifier output versus input), attenuation is required between the output of a higher level log stage and the input of a lower level log stage. Resistive divider R20, R29, and R30 attenuates the output of Stage 2, and a similar attenuator is used between Stages 3 and 4. Resistors in series with the log diodes of Stage 1 through 3 are factory-selected to compensate for variations in log diode resistance. Correct stage gain is required for proper log fidelity. Refer to the A4A3 schematic note for the method of checking the gain of Stages 1 through 5 in log mode.

10 dB Linear Gain Step. Stage 5 is used as a switchable 10 dB gain step in linear mode at low reference levels. When control line LG10 is low (−12V typical), Q17 is off and CR27 is reverse biased, preventing CR27 from being a signal path. When control line LG10 is high (more positive than −3V), the Q17 collector is saturated to the −12VTV supply, and PIN diode CR27 is forward biased. LG10 adjustment R83 sets the bias current (and thus resistance) of PIN diode CR27. The resistance of CR27 plus R54 is set so that the gain of Stage 5 will increase by 10 dB when CR27 is turned on (refer to the foregoing gain formula). Since PIN diode resistance is unaffected by signal level, Stage 5 operates as a non-limiting amplifier. This 10 dB gain step, in conjunction with a similar 20 dB gain step in A4A2, is used for the last 30 dB of step gain (lowest 30 dB of reference level) in linear mode. See the schematic note for the reference levels at which this gain step is checked.

Bandpass Filters C

In narrow resolution bandwidths, noise generated in the log amplifiers is reduced by the Bandpass Filter following Log Amplifier Stage 5. The bandwidth of this filter is switchable between wide (>20 MHz) and narrow (about 1 MHz). In resolution bandwidths of 30 kHz or less, the filter bandwidth is narrow. This reduces the log amplifier noise contribution 90 dB down from the reference level. In resolution bandwidths of 100 kHz and greater, the bandwidth of the filter is wide enough so as not to affect the shape of the wide resolution bandwidth filters. (See Figure 8-115.)

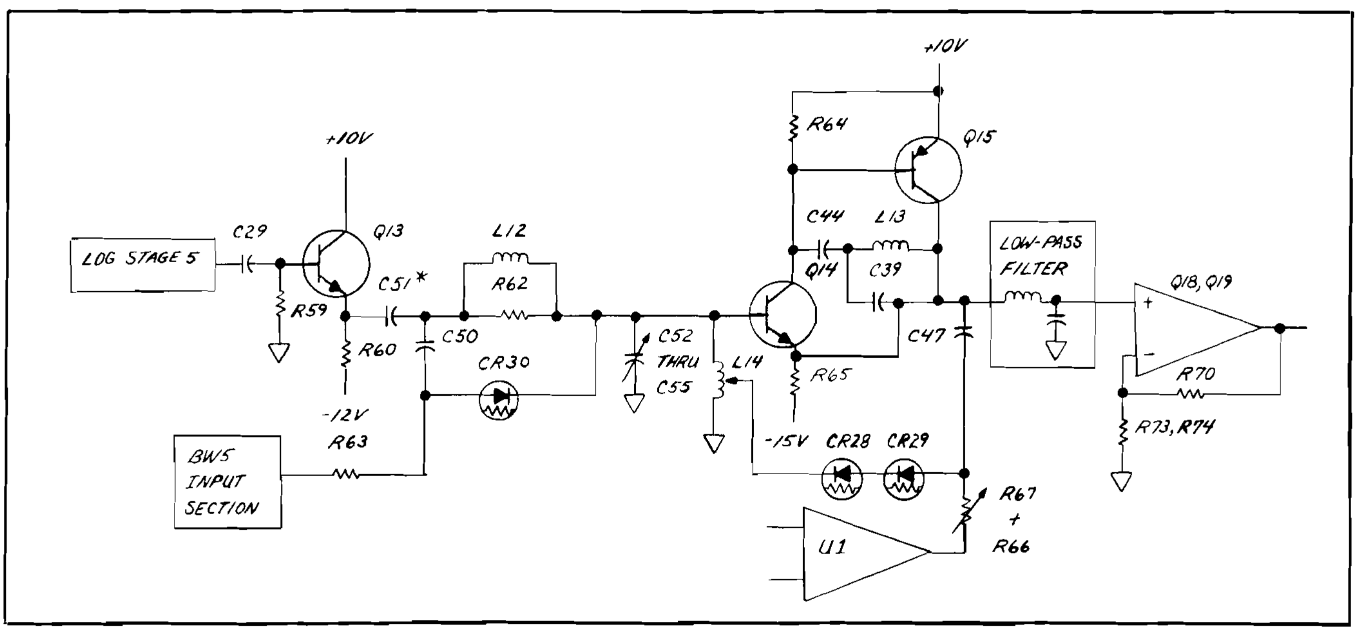

Figure 8-115. Bandpass Filter, Simplified Schematic

Bandpass Filter Switching. Emitter follower Q13 buffers the output of Log Amplifier Stage 5 and drives the Bandpass Filter. The filter bandwidth is determined by the resistance through which the LC tank network (L14 and C52 through C55) is driven. In resolution bandwidths of 3 MHz to 100 kHz, bandwidth control line BW5 is high (+15V) and CR30 is forward biased through R63, resulting in a low filter drive impedance and wide bandwidth. When the analyzer resolution bandwidth is less than 100 kHz, BW5 is low (about −0.6V). CR30 is reverse biased, and the LC shunt network is driven through R62, setting the filter bandwidth at about 1 MHz. The signal is buffered by Q14 and Q15. The output of buffer amplifier Q14/Q15 provides a low impedance drive for the Low-Pass Filter. The Buffer Amplifier Q14/Q15 also drives the center tap of L14 through the resistance of PIN diodes CR28 and CR29. This feedback results in an apparent negative input resistance in parallel with L14. The negative input resistance compensates for the parallel resistance present in the tank circuit because of the Q of L14. The gain of the filter in narrow mode is set equal to that in wide mode by setting the resistance CR28 and CR29. The resistance of CR28 and CR29 is set by adjusting the diode bias current with FILTER AMPTD adjustment R67. L13 and C39 are frequency compensation for Q14 and Q15.

BW5 Input Section. TP7 and TP8 provide a means to adjust the bandpass filter for equal gain in wide and narrow modes. This can be done without changing IF bandwidth, which might in itself introduce an amplitude change. With the analyzer in narrow resolution bandwidths (30 kHz through 10 Hz), BW5 is approximately −0.6V, which reverse biases CR30. This places the Bandpass Filter in narrow mode. The center frequency of the bandpass filter can be adjusted with CRT adjusment C55. To place the Bandpass Filter in wide mode, TP7 and TP8 are shorted together with a jumper wire. This forward biases CR30 through R89 and R63. Filter amplitude can then be set with FILTER AMPTD adjustment R67 so that amplitudes are equal in wide (test points jumpered) and narrow (jumper removed) modes.

Filter Temperature Compensation D

The Filter Temperature Compensation circuit stabilizes the gain of the bandpass filter with temperature changes.

Op Amp U1 and associated circuitry provide temperature dependent bias for CR28 and CR29 to compensate for temperature-dependent changes in the Q of L14 and the resistance of CR28 and CR29. As temperature increases, diode bias current increases as the voltage at U1 pin 6 increases. CR5 and CR6 operate as temperature-sensing elements to control the voltage at U1 pin 6.

Low-Pass Filter

The Low-Pass Filter consists of L15, L16, C56 through C59, R67, and R68. It has a bandwidth of about 30 MHz, which removes harmonics of the 21.4 MHz IF signal to reduce log fidelity variations between wide and narrow settings of the Bandpass Filter. The Low-Pass Filter has a loss of 6 dB, which is compensated for by buffer amplifier Q18/Q19, which has a gain of 6 dB. R74* is factory-selected to adjust the gain of Q18/Q19 for proper log fidelity.

A4A3 LOG AMPLIFIER—FILTER, TROUBLESHOOTING

If the amplitude of the displayed signals is approximately 10 dB low (i.e., CAL OUTPUT appears to be −20 dBm) in the log mode but correct in the linear display mode, then one of the log amplifier stages in the A4A3 Log Amplifier-Filter board or the A4A2 Log Amplifier-Detector board is defective. Connect a 10 dB step attenuator between the CAL OUTPUT and SIGNAL INPUT 2 connectors. Refer to the Log Amplifier Stage Gain Check note on the service sheets for the necessary front panel control settings. When forward biased in log mode the Schottky diodes should have voltage drops of 200–400 mV.

The following procedure will determine if the Linear Gain Steps, LG10 and LG20, are operating properly. The LG10 circuitry is located on the A4A3 Log Amplifier-Filter Board while the LG20 circuitry is located on the A4A2 Log Amplifier-Detector Board. Connect a 10 dB step attenuator set to 0 dB between the CAL OUTPUT and SIGNAL INPUT 2 connectors. Key in the following settings:

[INSTR PRESET]
[CENTER FREQUENCY] .... 20 MHz
[FREQUENCY SPAN] .... 10 kHz
[RES BW] .... 3 kHz
[ATTEN] .... 0 dB
[SHIFT] LOG SCALE [ENTER dB/DIV] (Turns off IF Step Gains)
[REFERENCE LEVEL] .... −60 dBm
SCALE LIN

The peak of the displayed signal should be on the top graticule. Adjust the front panel AMPTD CAL control to place the peak of the signal one division below the top graticule. If the signal limits at the top of the display, one of the Linear Gain Steps is stuck in the on state.

Set the 10 dB step attenuator to 10 dB and key in [REFERENCE LEVEL] −70 dBm. The peak of the displayed signal should be one division below the top graticule. If signal limits at the top of the display, the LG20 circuitry is defective. A signal approximately 3 divisions high indicates the LG10 circuitry is defective.

Set the 10 dB step attenuator to 20 dB and key in [REFERENCE LEVEL] −80dBm. The peak of the displayed signal should be one division below the top graticule. The LG10 circuitry is defective if the signal limits at the top of the display. The LG20 circuitry is faulty if the displayed signal is approximately 3 divisions high.

The Detector circuit on the A4A2 Log Amplifier-Detector board is most easily checked with DC voltages. These are derived using 0 Hz [FREQUENCY SPAN] and attenuating the CAL OUTPUT signal. The easiest point to check the Detector output without removing boards is A4A1TP1. Connect a DVM to this test point. The voltage at A4A1TP1 should be +1V for a signal displayed on the top graticule. The output will be 0.1V less for each division down from the top in either the linear or the 10 dB/Div log modes when the detector is operating properly.

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Table 8-37. A4A3 Log Amplifier-Filter, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A3	85662-60096		LOG AMPLIFIER (INCLUDES A4A2 AND A4A3)	28480	85662-60096
A4A3	85662-60097	1	RESTORED 85662-60096	28480	85662-60097
A4A3C1	0160-2055	46	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C7	0160-2244	1	CAPACITOR-FXD 3PF +-.25PF 500VDC CER	28480	0160-2244
A4A3C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C9	0160-2236	2	CAPACITOR-FXD 1PF +-.25PF 500VDC CER	28480	0160-2236
A4A3C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C21			NOT ASSIGNED		
A4A3C22			NOT ASSIGNED		
A4A3C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C30			NOT ASSIGNED		
A4A3C31	0160-4297	6	CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A3C32	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A3C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C35			NOT ASSIGNED		
A4A3C36			NOT ASSIGNED		
A4A3C37	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A3C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C39	0160-2255	1	CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A4A3C40	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C41	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A3C42	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C43	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C44	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C45	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C46	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C47	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C48	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C49	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C50	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C51*	0160-3534	1	CAPACITOR-FXD 510PF +-5% 100VDC MICA	28480	0160-3534
A4A3C52*			FACTORY SELECTED PART-NORMALLY OPEN		
A4A3C53*	0160-0839	1	CAPACITOR FXD 110PF +-1% 300VDC MICA	28480	0160-0839
A4A3C54	0160-0455	1	CAPACITOR-FXD 18PF +-2% 600VDC CER	28480	0160-0455
A4A3C55	0121-0493	1	CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A4A3C56	0160-2251	1	CAPACITOR-FXD 5.6PF +-.25PF 500VDC CER	28480	0160-2251
A4A3C57	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500VDC CER	28480	0160-2236
A4A3C58	0160-2262	1	CAPACITOR-FXD 16PF +-5% 500VDC CER 0+-30	28480	0160-2262
A4A3C59	0160-2252	1	CAPACITOR-FXD 6.2PF +-.25PF 500VDC CER	28480	0160-2252
A4A3C60			NOT ASSIGNED		
A4A3C61	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C62	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C63	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C64			NOT ASSIGNED		
A4A3C65	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C66	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A3C67	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C68	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C69	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C70	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C71	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH

Table 8-37. A4A3 Log Amplifier-Filter, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A3CR1	1901-0047	7	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A3CR2	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A3CR3	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A3CR4	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A3CR5	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A3CR6	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A3CR7	1901-1085	20	DIODE-SCHOTTKY	28480	1901-1085
A4A3CR8	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR9	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR10	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR11	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR12	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR13	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR14	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR15	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR16	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR17	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR18	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR19	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR20	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR21	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR22	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR23	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR24	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR25	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR26	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A4A3CR27	1901-1070	4	DIODE;PIN	28480	1901-1070
A4A3CR28	1901-1070		DIODE;PIN	28480	1901-1070
A4A3CR29	1901-1070		DIODE;PIN	28480	1901-1070
A4A3CR30	1901-1070		DIODE;PIN	28480	1901-1070
A4A3CR31	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A3E1	9170-0029	12	CORE-SHIELDING BEAD	28480	9170-0029
A4A3E2	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E3	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E4	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E5	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E6	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E7	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E8	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E9	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E10	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E11	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3E12	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A3L1	9140-0105	6	COIL-MLD 8.2UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0105
A4A3L2	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0105
A4A3L3	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0105
A4A3L4	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0105
A4A3L5	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0105
A4A3L6	9100-1618	6	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A3L7	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A3L8	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A3L9	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A3L10	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A3L11	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A3L12	9100-1623	1	COIL-MLD 27UH 5% Q=60 .155DX.375LG-NOM	28480	9100-1623
A4A3L13	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0105
A4A3L14	9100-3854	1	COIL 400NH 5% Q=150 .3DX1.016LG-NOM	28480	9100-3854
A4A3L15	9140-0111	1	COIL-MLD 3.3UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0111
A4A3L16	9140-0098	1	COIL-MLD 2.2UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0098
A4A3Q1	1854-0345	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A3Q2	1853-0007	3	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4A3Q3	1854-0019	11	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q4	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q5	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4A3Q6	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q7	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q8	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q9	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q10	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q11	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q12	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q13	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q14	1854-0546	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A4A3Q15	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251

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Table 8-37. A4A3 Log Amplifier-Filter, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A3Q16	1854-0404	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A3Q17	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A3Q18	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q19	1853-0405	1	TRANSISTOR PNP 2N4209 SI TO-18 PD=300MW	28480	1853-0405
A4A3R1			NOT ASSIGNED		
A4A3R2	0757-0346	6	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A3R3			NOT ASSIGNED		
A4A3R4	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A3R5	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A3R6	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A3R7	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A3R8	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A3R9	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R10	0698-3444	7	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A3R11	0698-3439	3	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A4A3R12	0698-3429	2	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A4A3R13	0757-0279	11	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R14	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R15*	0757-0316	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A4A3R16	0698-0084	3	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A3R17	0698-3151	2	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A4A3R18			NOT ASSIGNED		
A4A3R19	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R20	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A3R21	0698-3429		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A4A3R22	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A4A3R23	0757-0274	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A4A3R24	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R25*	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A3R26	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A4A3R27	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A3R28			NOT ASSIGNED		
A4A3R29	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4A3R30	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A3R31	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A3R32	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R33	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R34	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R35*	0757-0180	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A3R36	0757-0441	2	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A4A3R37	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A4A3R38	0698-3443	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A4A3R39	0698-3446	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A4A3R40	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A3R41	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R42	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R43	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R44	0698-3136	4	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A3R45	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A3R46			NOT ASSIGNED		
A4A3R47*	0757-0439	8	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R48	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A3R49	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R50	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R51	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R52	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A3R53	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A4A3R54*	0757-0399	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A4A3R55			NOT ASSIGNED		
A4A3R56			NOT ASSIGNED		
A4A3R57	0757-0442	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A3R58			NOT ASSIGNED		
A4A3R59	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R60	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A3R61	0698-0082	2	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A4A3R62	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A4A3R63	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R64	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A4A3R65	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A4A3R66*	0757-0462	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A4A3R67	2100-3054	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A4A3R68	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A4A3R69	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A3R70	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F

Table 8-37. A4A3 Log Amplifier-Filter, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A3R71	0757-0394		RESISTOR-51.1 1% .125W F TC=0+-100	0329B	C4-1/8-TO-51R1-F
A4A3R72	0757-0280	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A3R73	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4A3R74*	0757-0290	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4A3R75			NOT ASSIGNED		
A4A3R76	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A3R77	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A3R78	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A3R79*	0698-3450	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A4A3R80*	0757-0278	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4A3R81*			FACTORY SELECTED PART-NORMALLY OPEN		
A4A3R82	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R83	2100-3161	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A4A3R84	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A3R85	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A3R86			NOT ASSIGNED		
A4A3R87	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A3R88	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A4A3R89	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A3R90	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4A3R91			NOT ASSIGNED		
A4A3R92	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A3R93	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A3TP1	1251-0600	11	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP2	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP3	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP4	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP5	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP6	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP7	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP8	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP9	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP10	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3TP11	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A3U1	1826-0261	1	IC 741 OP AMP TO-99	28480	1826-0261
A4A3VR1	1902-0126	1	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	28480	1902-0126
A4A3VR2	1902-0579	1	DIODE-ZNR 5.11V 5% DO-15 PD=1W TC=-.009%	28480	1902-0579
A4A3VR3	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
			A4A3 MISCELLANEOUS PARTS		
	6960-0016	1	PLUG-HOLE .125" DIA	28480	6960-0016

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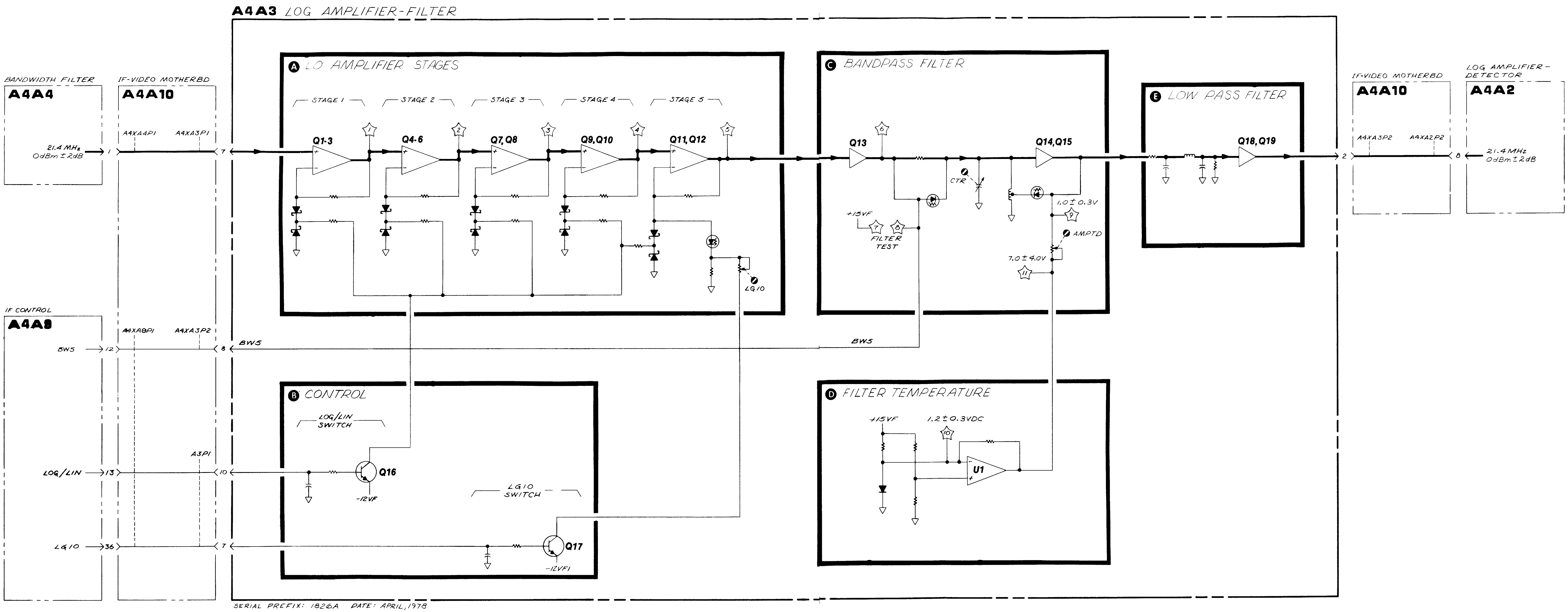


A4A3

Figure 8-116. A4A3 Log Amplifier-Filter, Component Locations

Table 8-38. A4A3 Log Amplifier-Detector, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C1	C56	B3	E4	C1	R6	C2	R62	C3
C2	B1	C57	B3	E5	C2	R7	C3	R63	C3
C3	C1	C58	B3	E6	C2	R8	C1	R64	C3
C4	B1	C59	B3	E7	C2	R9	B1	R65	C3
C5	B1	C61	B3	E8	C3	R10	C1	R66	C4
C6	C1	C62	B4	E9	C3	R11	C1	R67	C4
C7	C1	C63	B3	E10	C3	R12	C1	R68	B3
C8	C1	C65	B4	E11	C3	R13	B1	R69	B3
C9	C1	C66	B4	E12	B3	R14	B1	R70	B3
C10	C1	C67	B4			R15	B1	R71	B3
C11	B1	C68	B4	L1	C1	R16	B1	R72	B3
C12	B2	C69	C4	L2	C1	R17	B1	R73	B3
C13	C2	C70	B3	L3	C2	R19	C1	R74	A3
C14	C2	C71	B4	L4	C2	R20	C1	R76	B4
C15	B2			L5	C3	R21	C1	R77	C4
C16	C2	CR1	B1	L6	B4	R22	C1	R78	B4
C17	C2	CR2	B1	L7	B2	R23	C1	R79	B4
C18	C2	CR3	B2	L8	B2	R24	B2	R80	B4
C19	C2	CR4	B2	L9	B4	R25	B1	R81	B4
C20	C2	CR5	C4	L10	B4	R26	B1	R82	C3
C23	C2	CR6	C4	L11	B2	R27	B2	R83	C2
C24	C2	CR7	C1	L12	C3	R29	C2	R84	B3
C25	C3	CR8	B1	L13	C3	R30	C2	R85	B3
C26	C3	CR9	B1	L14	C4	R31	C2	R87	C4
C27	B2	CR10	B1	L15	B3	R32	C2	R88	C4
C28	B3	CR11	B1	L16	B3	R33	C2	R89	C4
C29	C3	CR12	B1			R34	C2	R90	C3
C31	B2	CR13	C1	Q1	C1	R35	B2	R92	A1
C32	B2	CR14	B1	Q2	C1	R36	B2	R93	B1
C33	B2	CR15	B1	Q3	C1	R37	B2		
C34	B3	CR16	B1	Q4	C1	R38	C2	TP1	C1
C37	B3	CR17	B1	Q5	C1	R39	C2	TP2	C1
C38	C3	CR18	B2	Q6	C1	R40	C2	TP3	C2
C39	C3	CR19	C2	Q7	C2	R41	C2	TP4	C2
C40	B2	CR20	B2	Q8	C2	R42	C2	TP5	C3
C41	B2	CR21	C2	Q9	C2	R43	C2	TP6	C3
C42	C3	CR22	B2	Q10	C2	R44	B2	TP7	C4
C43	B3	CR23	C2	Q11	C2	R45	B2	TP8	C4
C44	C3	CR24	C2	Q12	C3	R47	C2	TP9	C4
C45	C3	CR25	C2	Q13	C3	R48	C3	TP10	C3
C46	C4	CR26	C3	Q14	C3	R49	C3	TP11	C4
C47	C3	CR27	C3	Q15	C3	R50	C2		
C48	C3	CR28	C4	Q16	B1	R51	C3	U1	B4
C49	D3	CR29	C4	Q17	B3	R52	B3		
C50	C3	CR30	C3	Q18	B3	R53	B3	VR1	C3
C51	C3	CR31	C4	Q19	B3	R54	C2	VR2	B4
C52	C3					R57	C1	VR3	B2
C53	C3	E1	C1	R2	C1	R59	C3		
C54	C4	E2	C1	R4	C1	R60	C3		
C55	C3	E3	C1	R5	C2	R61	B3		

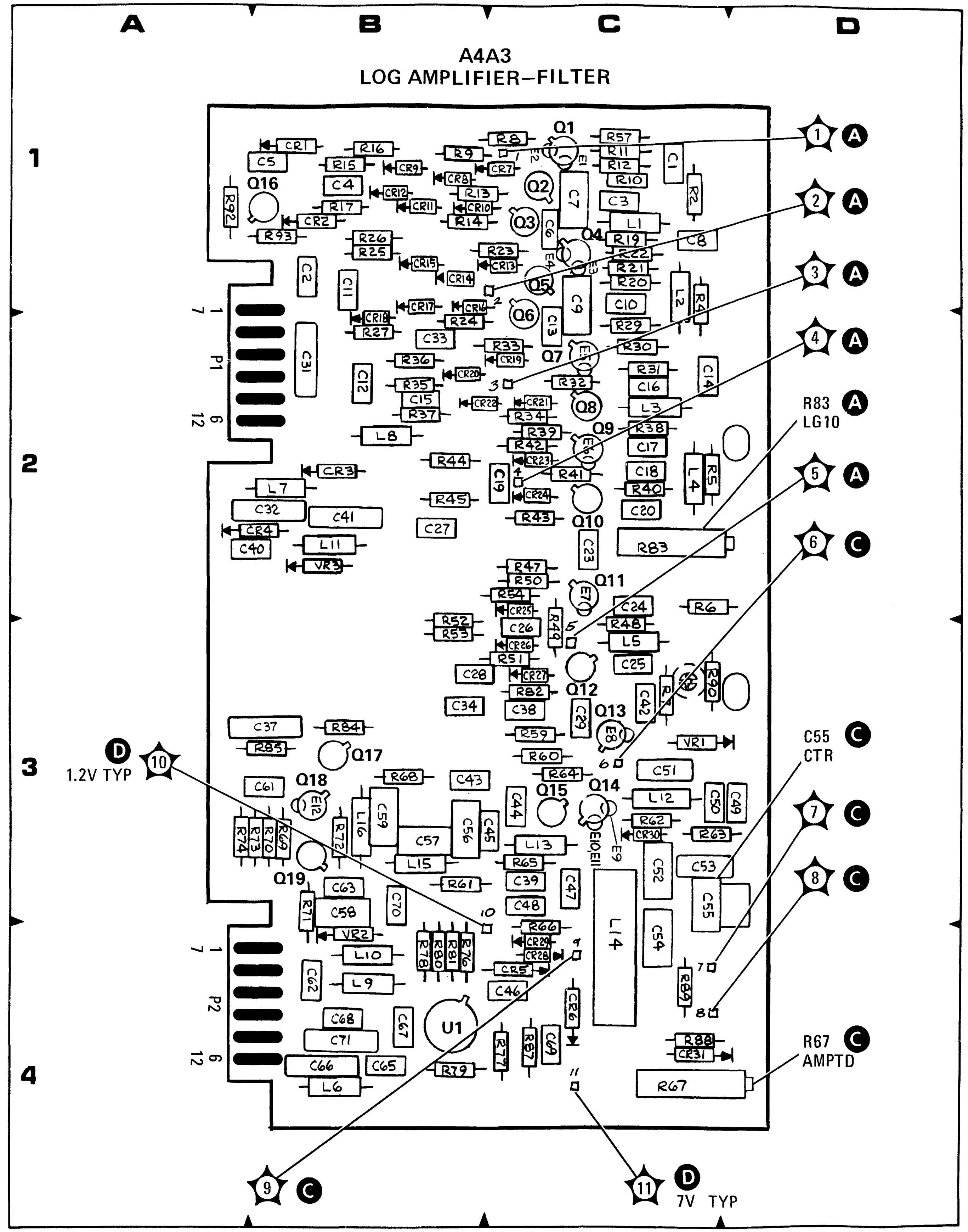


Figure 8-117. A4A3 Log Amplifier—Filter, Component Locations

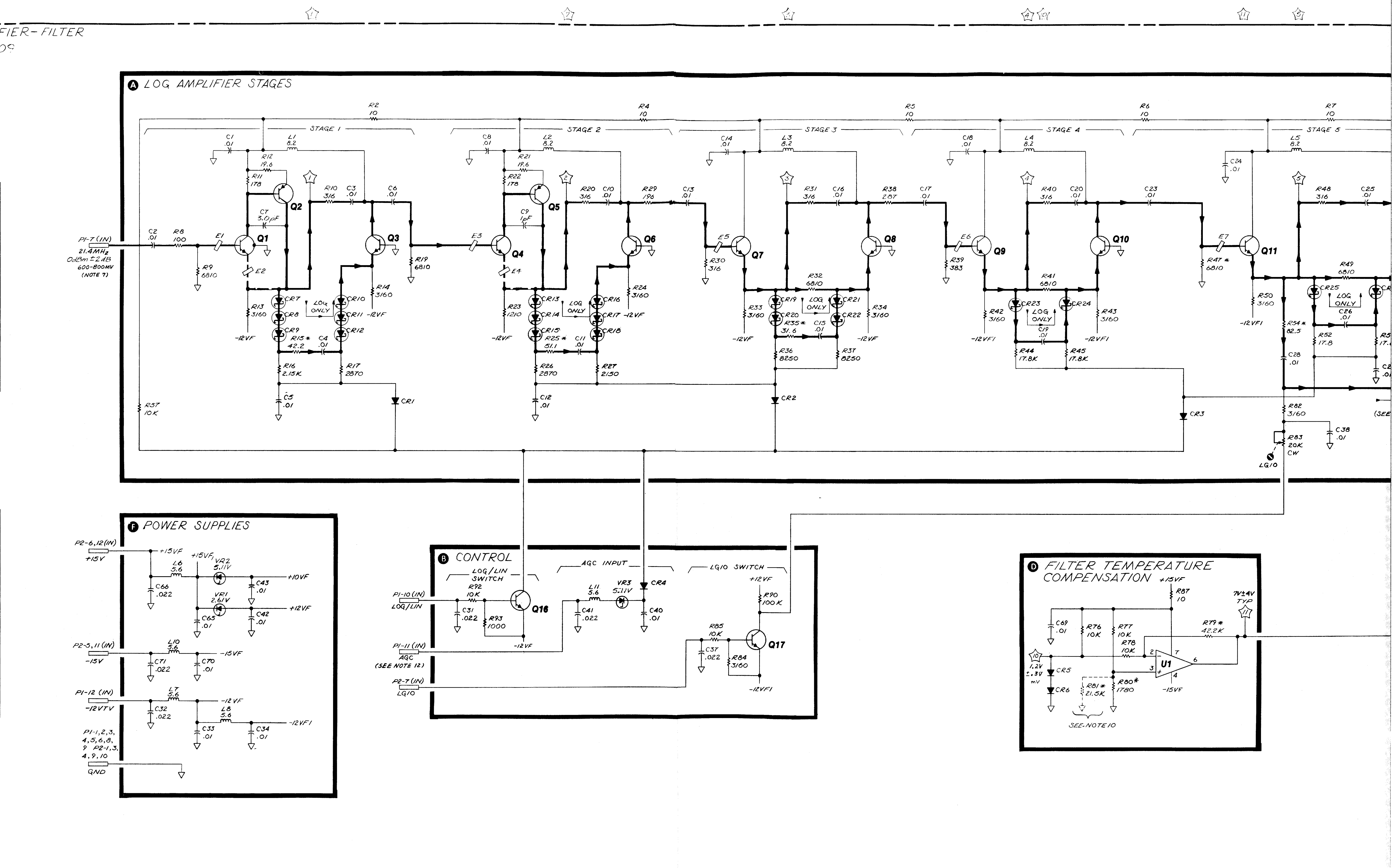
A4A3 LOG AMPLIFIER-FILTER
85662-60009

P1

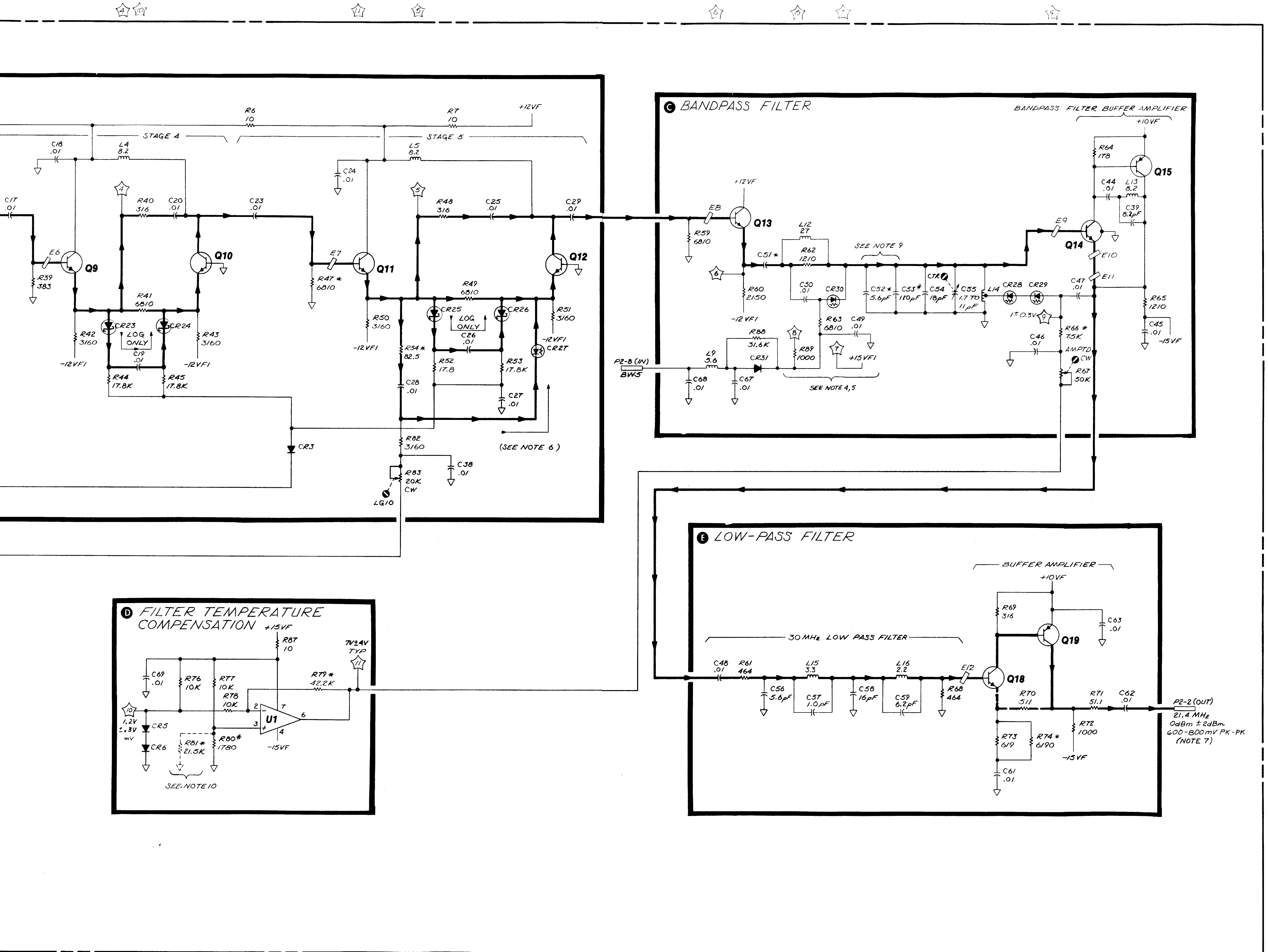
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		F
7	21.4MHz	A4A4 P1-1	A
2	GND		F
8	GND		F
3	GND		F
9	GND		F
4	GND		F
10	LOG/LIN	A4A9 P1-13	B
5	GND		F
11	AGC	A4A2 P1-10	B
6	GND		F
12	-12VTV	A4A2 P1-12	F

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		F
7	LG/0	A4A9 P1-36	B
2	21.4 MHz	A4A2 P2-5	E
8	BWS	A4A9 P1-12	C
3	GND		F
9	GND		F
4	GND		F
10	GND		F
5	-15V		F
11	-15V		F
6	+15V		F
12	+15V		F



SERIAL PREFIX: 1826A 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. * INDICATES FACTORY SELECTED COMPONENT: TYPICAL VALUE SHOWN. REFER TO SECTION V FOR RANGE OF VALUES.

4. BANDPASS FILTER WIDE/NARROW CONDITIONS:

BW5	RESOLUTION BW	FILTER BANDWIDTH	CR30 BIAS
HI +14.8V (TYP)	100 KHz TO 3 MHz	WIDE (APPROX. 20 MHz)	FORWARD
LO -.6V (TYP)	10 Hz TO 30 KHz	NARROW (APPROX. 1 MHz)	REVERSE

5. FOR ADJUSTMENT OF BANDPASS FILTER, TP8 IS JUMPERED (SHORTED) TO TP7 WHICH FORWARD BIASES CR30 TO PLACE FILTER IN "WIDE" MODE (APPROX. 20 MHz).

6. LG 10 OPERATION:
   CONTROL SETTINGS: (INSTR PRESET)
   ATTENUATION 0dB
   FREQUENCY SPAN 0Hz
   LINEAR
   RESOLUTION BANDWIDTH 3 kHz

REFERENCE LEVEL	LG10	CR27 BIAS
50 μV 50 mV	Hi (-3V TO +1V) Lo (-14V TO -10V)	FORWARD REVERSE

7. LOG AMPLIFIER STAGE GAIN CHECK:
   CONTROL SETTINGS: (INSTR PRESET)
   CENTER FREQUENCY ... 20 MHz
   FREQUENCY SPAN ...... 0 Hz
   RES BW .... 100 KHz
   REFERENCE LEVEL 0dBm
   ATTENUATION 10dB
   CONNECT HP355D ATTENUATOR BETWEEN CAL OUTPUT AND SIGNAL INPUT 2 CONNECTOR

20 MHz CALIBRATOR ATTENUATED BY	TEST POINT	LEVELS ±25%
0dB	P1-7	700 mV PK-PK
0dB	1	700 mV PK-PK
10dB	2	700 mV PK-PK
20dB	3	280 mV PK-PK
30dB	4	100 mV PK-PK
30dB	5	330 mV PK-PK
30dB	P2-2	700 mV PK-PK

8. MNEMONICS TABLE:

MNEMONICS	DESCRIPTION
LG10	LINEAR GAIN STEP (10dB)
LOG/LIN	LOG-LINEAR CONTROL
AGC	AUTOMATIC GAIN CONTROL VOLTAGE INPUT
BW5	BANDWIDTH CONTROL LINE 5

9. C52 IS FACTORY SELECTED IF REQUIRED TO ADJUST FILTER CENTER FREQUENCY.

10. R81 IS FACTORY SELECTED FOR TEMPERATURE COMENSATION AND MAY NOT BE PRESENT.

11. LOG/LIN CONTROL LEVELS:

	LOG/LIN
LOG	3V TO 10V
LIN	-10V TO -14V

12. REFER TO NOTE 9 ON A4A2 LOG AMPLIFIER DETECTOR SCHEMATIC.

A4A3

Figure 8-118. A4A3 Log Amplifier-Filter, Schematic Diagram

A4A4 BANDWIDTH FILTER, CIRCUIT DESCRIPTION

A4A4 Bandwidth Filter determines the bandwidth of the 21.4 MHz IF in conjunction with A4A8 Attenuator — Bandwidth Filter. A4A4 is very similar to A4A8 except that it does not have a switchable gain input amplifier, and it has an extra stage of crystal filtering. Only the 10 dB Gain Input Buffer Amplifier will be described here. For descriptions of the other circuits in A4A4, refer to descriptions of the corresponding circuits in A4A8.

Input Buffer Amplifier A

The 10 dB Input Buffer Amplifier (Figure 8-116) functions as a non-inverting op amp.

In the crystal mode (30 kHz, 10 kHz, and 3 kHz bandwidths), the amplifier includes Q7. The biasing of the amplifier is independent of its RF (21.4 MHz) operation but is very critical for its proper functioning. If a malfunction occurs, the dc bias should be checked first.

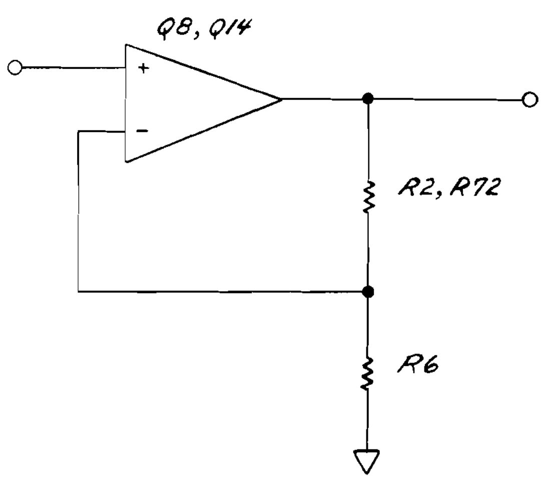


Figure 8-119. A4A4 Input Buffer Amplifier, Equivalent Circuit

The current through Q14 is determined by the difference between two current sources, one involving Q7 and the other involving Q8 (See Figure 8-117). The most convenient way to find the current from each source is to measure the voltage across each emitter resistor. (A 1 kΩ resistor should be used in series with the voltmeter probe tip to prevent the circuit from oscillating and giving an erroneous reading.) For Q7, the current through R90 must be included. If results are inconsistent, the emitter resistor should be checked also. Check to see that the BW5 line is at the voltage specified on the schematic.

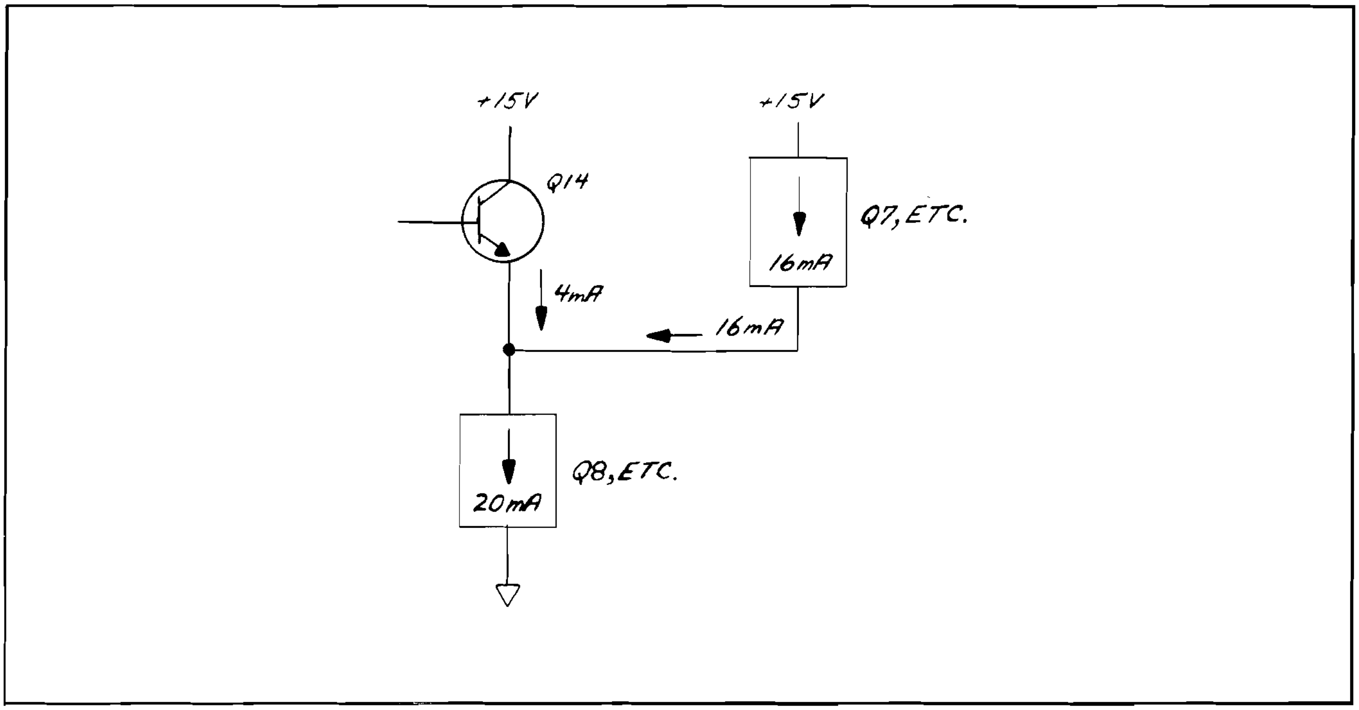


Figure 8-120. A4A4 Input Buffer Amplifier, Current Sinks

In the LC mode (the four wider bandwidths), the BW5 line goes to approximately +14.8V and turns off the current source Q7. The current supplied by Q7 in the crystal mode is now supplied through CR1 and R12 from the BW5 line. In the LC mode, the current through Q14 can be found by subtracting the current through R12 from the current through R4.

Table 8-39. A4A4 Bandwidth Filter, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A4	85662-60008	1	BOARD ASSEMBLY, BANDWIDTH FILTER	28480	85662-60008
A4A4C1	0160-2055	48	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C3	0160-2254	1	CAPACITOR-FXD 7.5PF +-.25PF 500VDC CER	28480	0160-2254
A4A4C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C6	0160-4297	3	CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A4C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C8	0160-2257	3	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A4A4C9	0121-0059	3	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A4A4C10*	0160-2249	3	CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A4A4C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C15	0160-3456	2	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4A4C16	0160-3431	2	CAPACITOR-FXD 6.8PF +-.5PF 500VDC CER	28480	0160-3431
A4A4C17*	0140-0194	3	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A4A4C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C19	0121-0036	2	CAPACITOR-V TRMR-CER 5.5-18PF 350V	52763	304324 5.5/18PF NPO
A4A4C20	0121-0446	3	CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0446
A4A4C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C28	0140-0194		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A4A4C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C31	0160-2207	3	CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A4A4C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C33	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A4C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C37	0160-2257		CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A4A4C38*	0160-2249		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A4A4C39	0121-0059		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A4A4C40	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C41	0121-0452	2	CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0103-005
A4A4C42			NOT ASSIGNED		
A4A4C43	0121-0452		CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0103-005
A4A4C44			NOT ASSIGNED		
A4A4C45			NOT ASSIGNED		
A4A4C46	0160-4084	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A4C47	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C48	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C49	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C50	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C51			NOT ASSIGNED		
A4A4C52	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C53	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C54	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C55	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A4C56	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C57	0160-2207		CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A4A4C58	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C59	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C60	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C61	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C62	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4A4C63	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C64	0160-2257		CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A4A4C65	0121-0059		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A4A4C66*	0160-2249		CAPACITOR-FXD 4.7PF +-.25PF 500VDC CER	28480	0160-2249
A4A4C67	0121-0036		CAPACITOR-V TRMR-CER 5.5-18PF 350V	52763	304324 5.5/18PF NPO
A4A4C68	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C69	0160-3431		CAPACITOR-FXD 6.8PF +-.5PF 500VDC CER	28480	0160-3431
A4A4C70*	0140-0194		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR

Table 8-39. A4A4 Bandwidth Filter, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A4C71	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C72	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C73	0121-0446		CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0446
A4A4C74	0121-0446		CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0446
A4A4C75			NOT ASSIGNED		
A4A4C76	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C77	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C78	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C79	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C80	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C81	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C82			NOT ASSIGNED		
A4A4C83			NOT ASSIGNED		
A4A4C84	0160-2207		CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A4A4C85			NOT ASSIGNED		
A4A4C86	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C87	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A4C88	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A4C89	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4CR1	1901-0047	11	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR2			NOT ASSIGNED		
A4A4CR3	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR4	1901-1070	6	DIODE:PIN	28480	1901-1070
A4A4CR5	1901-1070		DIODE:PIN	28480	1901-1070
A4A4CR6	1901-0535	8	DIODE-SCHOTTKY	28480	1901-0535
A4A4CR7	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR8	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A4CR9			NOT ASSIGNED		
A4A4CR10	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR11			NOT ASSIGNED		
A4A4CR12	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR13	1901-1070		DIODE:PIN	28480	1901-1070
A4A4CR14	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A4CR15	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR16	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A4CR17			NOT ASSIGNED		
A4A4CR18	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR19	1901-1070		DIODE:PIN	28480	1901-1070
A4A4CR20	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR21	1901-1070		DIODE:PIN	28480	1901-1070
A4A4CR22	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A4CR23	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR24	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A4CR25	1901-1070		DIODE:PIN	28480	1901-1070
A4A4CR26			NOT ASSIGNED		
A4A4CR27	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A4CR28	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A4CR29	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4CR30	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A4E1	9170-0029	15	CORE-SHIELDING BEAD	28480	9170-0029
A4A4E2	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E3	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E4	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E5	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E6	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E7	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E8	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E9	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E10	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E11	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E12	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E13	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E14	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4E15	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A4L1	9100-1641	3	COIL-MLD 240UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1641
A4A4L2	9140-0114	4	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A4A4L3	9100-1620	4	COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A4A4L4	9100-3854	2	COIL 400NH 5% Q=150 .3DX1.016LG-NOM	28480	9100-3854
A4A4L5	9140-0098	3	COIL-MLD 2.2UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0098
A4A4L6	9100-1620		COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A4A4L7	9100-1641		COIL-MLD 240UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1641
A4A4L8	9140-0098		COIL-MLD 2.2UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0098
A4A4L9	9100-1618	7	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A4L10	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618

Table 8-39. A4A4 Bandwidth Filter, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A4L11			NOT ASSIGNED		
A4A4L12	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	02178	15-4435-1K
A4A4L13	9100-1620		COIL-MLD 15UH 10% Q=65 .155DX.375LG	02178	15-4445-4K
A4A4L14	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	02178	15-4435-1K
A4A4L15	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	02178	15-4445-2K
A4A4L16	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	02178	15-4445-2K
A4A4L17	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	02178	15-4445-2K
A4A4L18	9100-3854		COIL 400NH 5% Q=150 .3DX1.016LG	28480	9100-3854
A4A4L19	9140-0098		COIL-MLD 2.2UH 10% Q=33 .155DX.375LG	02178	15-4425-10K
A4A4L20	9100-1641		COIL-MLD 240UH 10% Q=50 .155DX.375LG	02178	15-1315-21J
A4A4L21			NOT ASSIGNED		
A4A4L22	9100-1620		COIL-MLD 15UH 10% Q=65 .155DX.375LG	02178	15-4445-4K
A4A4L23			NOT ASSIGNED		
A4A4L24	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	02178	15-4435-1K
A4A4L25	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	02178	15-4435-1K
A4A4L26	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	02178	15-4435-1K
A4A4Q1	1855-0267		TRANSISTOR J-FET N-CHAN D-MODE SI	0169H	SKA 3807
A4A4Q2	1853-0007	7	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A4Q3	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A4Q4	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A4Q5	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A4Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A4Q7	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A4Q8	1854-0404	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A4Q9	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A4Q10	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A4Q11	1855-0267		TRANSISTOR J-FET N-CHAN D-MODE SI	0169H	SKA 3807
A4A4Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A4Q13	1855-0267		TRANSISTOR J-FET N-CHAN D-MODE SI	0169H	SKA 3807
A4A4Q14	1854-0345	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	0203G	2N5179
A4A4R1	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A4A4R2	0698-3431	2	RESISTOR 23.7 1% .125W F TC=0+-100	03888	PME55-1/8-TO-23R7-F
A4A4R3*	0698-8819	1	RESISTOR 3.83 1% .125W F TC=0+-100	28480	0698-8819
A4A4R4	0757-0401	4	RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A4R5	0757-0442	4	RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A4R6	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-68R1-F
A4A4R7	0698-3155	3	RESISTOR 4.64K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4641-F
A4A4R8	0757-0280	8	RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A4R9	0757-0438	6	RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A4R10	0698-3441	3	RESISTOR 215 1% .125W F TC=0+-100	0329B	C4-1/8-T0-215R-F
A4A4R11	0757-0443	3	RESISTOR 11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1102-F
A4A4R12	0698-0082	4	RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A4R13	0698-3444	3	RESISTOR 316 1% .125W F TC=0+-100	0329B	C4-1/8-T0-316R-F
A4A4R14	0698-3442	3	RESISTOR 237 1% .125W F TC=0+-100	0329B	C4-1/8-T0-237R-F
A4A4R15	0757-0279	3	RESISTOR 3.16K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-3161-F
A4A4R16*	0757-0290	8	RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R17	0698-3156	4	RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A4R18	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A4R19	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A4R20*	0757-0441	4	RESISTOR 8.25K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-8251-F
A4A4R21	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R22	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R23			NOT ASSIGNED		
A4A4R24	0698-3431		RESISTOR 23.7 1% .125 F TC=0+-100	03888	PME55-1/8-TO-23R7-F
A4A4R25	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A4R26	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A4R27	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4641-F
A4A4R28	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A4R29	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1102-F
A4A4R30	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A4R31	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	0329B	C4-1/8-T0-215R-F
A4A4R32	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	0329B	C4-1/8-T0-316R-F
A4A4R33	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	0329B	C4-1/8-T0-237R-F
A4A4R34	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-3161-F
A4A4R35*	0698-3132	1	RESISTOR 261 1% .125W F TC=0+-100	0329B	C4-1/8-T0-2610-F
A4A4R36			NOT ASSIGNED		
A4A4R37	0757-0458	1	RESISTOR 51.1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5112-F
A4A4R38			NOT ASSIGNED		
A4A4R39	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A4R40*	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-8251-F
A4A4R41	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R42*			FACTORY SELECTED PART-NORMALLY OPEN		
A4A4R43	2100-3165	1	RESISTOR-TRMR 2M 20% C SIDE-ADJ 17-TRN	02111	43P205
A4A4R44*			FACTORY SELECTED PART-NORMALLY OPEN		
A4A4R45*	0757-0346		RESISTOR 10 1% .125W F TC=0± 100	24546	C4-1/8-TO-10R0-F
A4A4R46	0757-0280		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1001-F

Table 8-39. A4A4 Bandwidth Filter, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A4R47			NOT ASSIGNED		
A4A4R48	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R49	2100-3052	1	RESISTOR-TRMR 50 20% C SIDE-ADJ 17-TRN	73138	89PR50
A4A4R50	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A4R51	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A4R52	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4641-F
A4A4R53	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A4R54	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1102-F
A4A4R55	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A4R56	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	0329B	C4-1/8-T0-215R-F
A4A4R57	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	0329B	C4-1/8-T0-316R-F
A4A4R58	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	0329B	C4-1/8-T0-237R-F
A4A4R59	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-3161-F
A4A4R60*	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R61	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A4R62	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A4R63	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A4R64*	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-8251-F
A4A4R65*	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1471-F
A4A4R66	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R67	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A4R68	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A4R69			NOT ASSIGNED		
A4A4R70	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	0329B	C4-1/8-T0-196R-F
A4A4R71			NOT ASSIGNED		
A4A4R72	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	0329B	C4-1/8-T0-147R-F
A4A4R73	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A4R74	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A4R75	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A4R76	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A4R77- A4A4R81			NOT ASSIGNED		
A4A4R82	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A4R83	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A4R84	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A4R85	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A4R86			NOT ASSIGNED		
A4A4R87			NOT ASSIGNED		
A4A4R88	0698-3154	3	RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A4R89	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A4R90	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A4R91	0757-0180	3	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A4R92	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A4R93	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A4R94	0757-0465	1	RESISTOR 100K 1%.125W F TC=0± 100	0329B	C4-1/8-TO-1003-F
A4A4TP1	0360-1788	6	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A4TP2	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A4TP3	0360-1514	2	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A4A4TP4	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A4TP5	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A4TP6	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A4TP7	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A4TP8	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A4A4VR1	1902-0048	1	DIODE-ZNR 6.81V 5% DO-7 PD=.4W TC=+.043%	0223G	FZ7244
A4A4Y1- A4A4Y3	0410-1029	3	CRYSTAL, 21.4 MHZ (SET OF SIX) (INCLUDES A4A8Y1-2, A4A6A1Y1)	28480	0410-1029
			A4A4 MISCELLANEOUS PARTS		
	6960-0016	1	PLUG-HOLE .125" DIA	28480	6960-0016

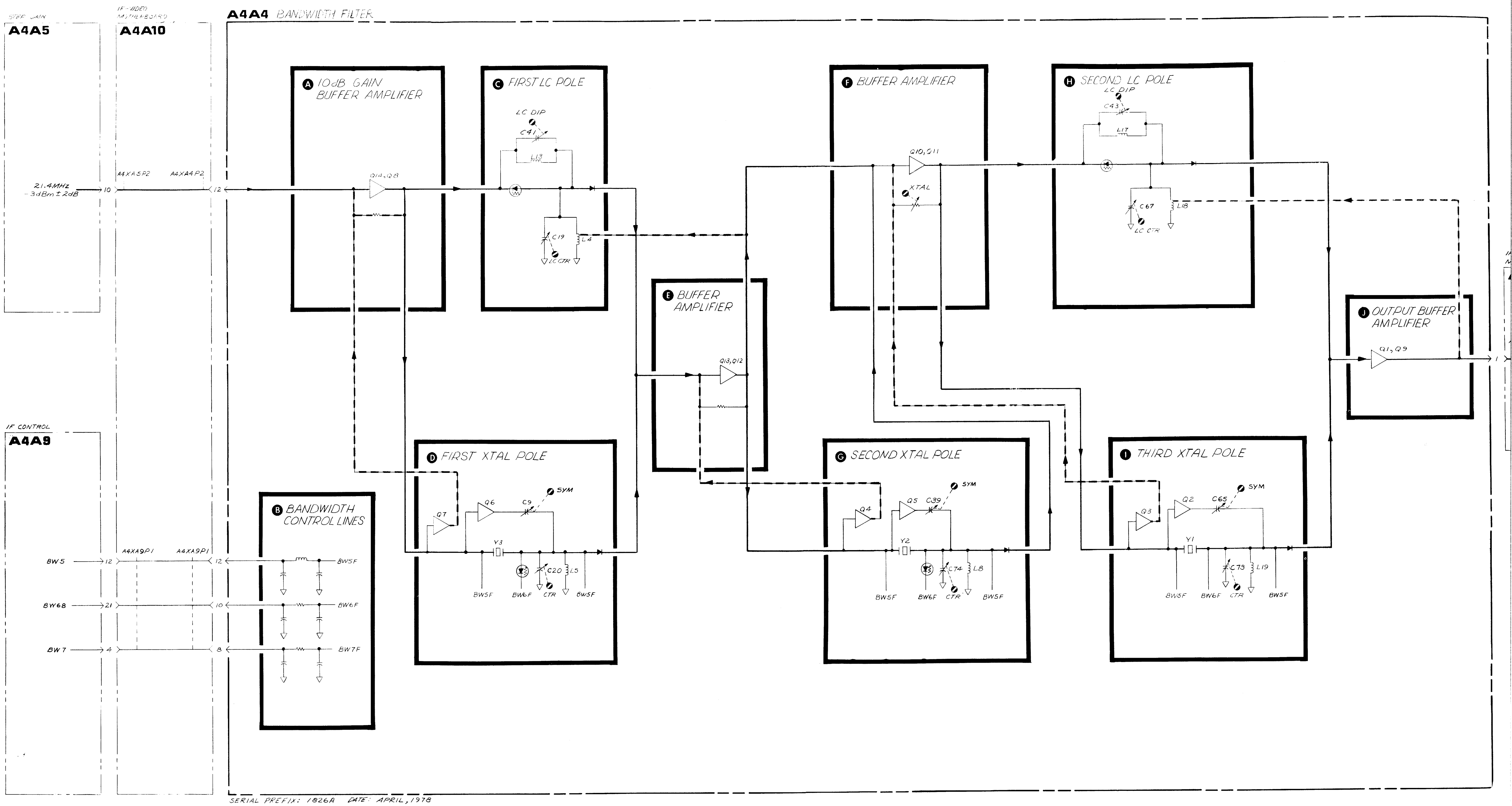
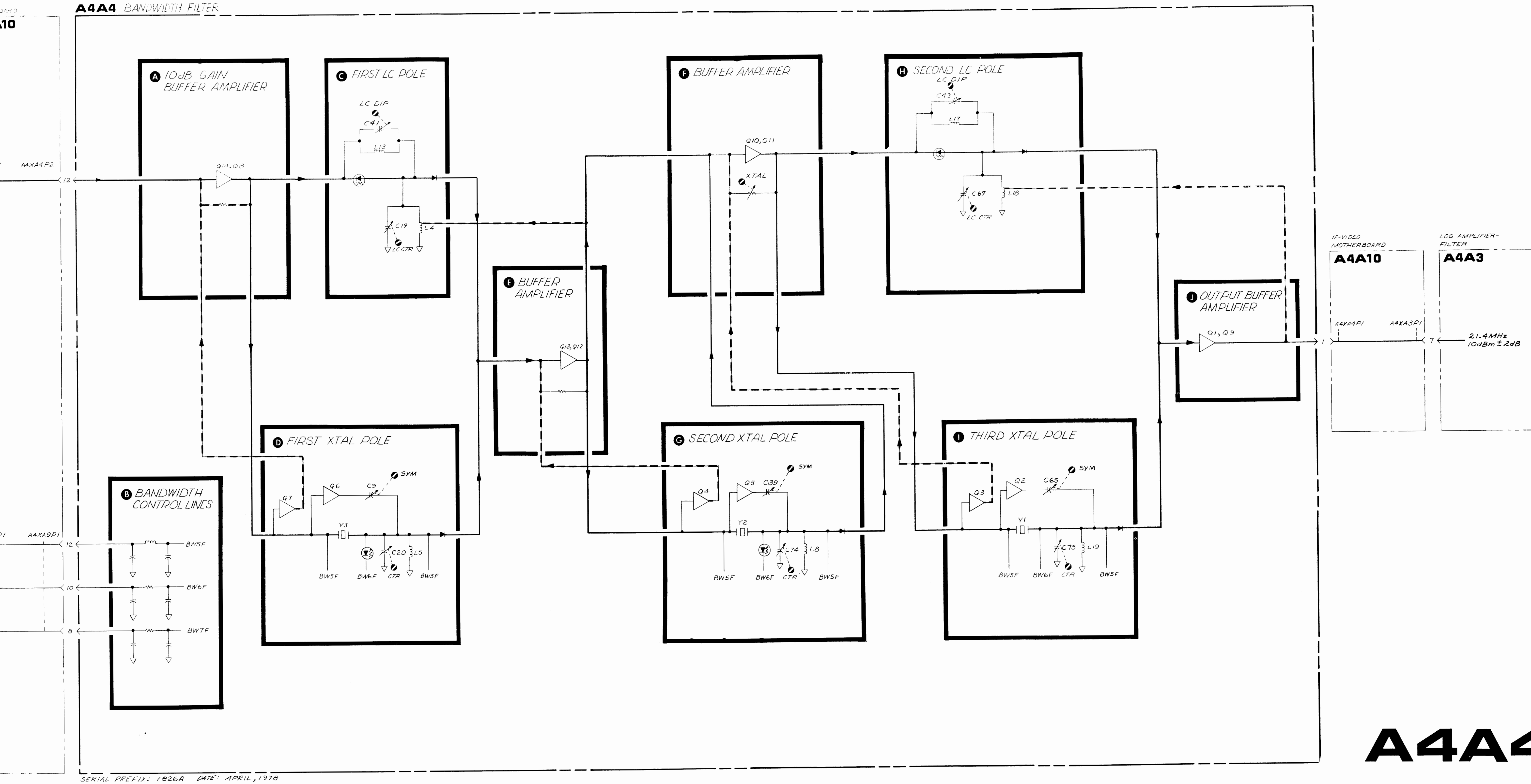


Figure 8-121. A4A·



A4A4

Figure 8-121. A4A4 Bandwidth Filter, Block Diagram

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Table 8-40. A4A4 Bandwidth Filter, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	D3	C55	B2	CR23	C1	Q3	C2	R42	B2	TP8	D4
C2	B4	C56	B2	CR24	C1	Q4	C2	R43	C3		
C3	B4	C57	B2	CR25	B3	Q5	C3	R44	B2	VR1	C3
C4	C4	C58	C2	CR27	C3	Q6	C4	R45	B2		
C5	B4	C59	C1	CR28	C2	Q7	C4	R46	C3	Y1	C1
C6	C4	C60	B1	CR29	B4	Q8	C4	R48	B2	Y2	C2
C7	B4	C61	B1	CR30	B4	Q9	B1	R49	C2	Y3	C3
C8	C4	C62	B1			Q10	B2	R50	B2		
C9	D4	C63	C2	E1	B4	Q11	B2	R51	B2		
C10	C3	C64	C2	E2	C4	Q12	B3	R52	B2		
C11	C4	C65	C2	E3	C4	Q13	B3	R53	B2		
C12	B4	C66	C1	E4	C4	Q14	B4	R54	B1		
C13	B4	C67	D1	E5	B3			R55	C2		
C14	B4	C68	C1	E6	B2	R1	B4	R56	C2		
C15	B3	C69	B1	E7	C3	R2	B4	R57	C2		
C16	B3	C70	B1	E8	C2	R4	C4	R58	C2		
C17	B3	C71	C2	E9	C2	R5	B4	R59	C2		
C18	B3	C72	C1	E10	C2	R6	B4	R60	B1		
C19	C3	C73	D1	E11	C2	R7	B4	R61	B1		
C20	D3	C74	C2	E12	C2	R8	C4	R62	B1		
C21	C3	C76	C1	E13	C1	R9	C4	R63	C1		
C22	B3	C77	C1	E14	B3	R10	C4	R64	C1		
C23	C3	C78	C1	E15	B2	R11	C4	R65	B1		
C24	C3	C79	C2			R12	C4	R66	C1		
C25	B3	C80	B4	L1	B4	R13	C4	R67	C1		
C26	C3	C81	B1	L2	C4	R14	C4	R68	B1		
C27	C3	C84	C4	L3	B4	R15	C4	R70	B1		
C28	B3	C86	C1	L4	B3	R16	B3	R72	B4		
C29	C3	C87	D1	L5	C3	R17	B3	R73	B2		
C30	B3	C88	C3	L6	C3	R18	B3	R74	C3		
C31	B3	C89	B2	L7	C3	R19	B3	R75	C2		
C32	B3			L8	C2	R20	C4	R76	C1		
C33	B3	CR1	C4	L9	B2	R21	C3	R82	B1		
C34	B2	CR3	B4	L10	B2	R22	C3	R83	C3		
C35	B2	CR4	C3	L12	B4	R24	B3	R84	C2		
C36	B2	CR5	B3	L13	C2	R25	B3	R85	C1		
C37	C3	CR6	C3	L14	C1	R26	B3	R88	C3		
C38	C2	CR7	C3	L15	C2	R27	B3	R89	C2		
C39	C3	CR8	C3	L16	C2	R28	B2	R90	C4		
C40	C2	CR10	B2	L17	B1	R29	B2	R91	C3		
C41	B3	CR12	C2	L18	B1	R30	C3	R92	C4		
C43	C1	CR13	C2	L19	C1	R31	C3	R93	B2		
C46	C2	CR14	C2	L20	B2	R32	C3				
C47	B2	CR15	B2	L22	C1	R33	C3	TP1	D1		
C48	B2	CR16	B2	L24	B4	R34	C2	TP2	D2		
C49	C2	CR18	B1	L25	C2	R35	B2	TP3	D2		
C50	B2	CR19	B1	L26	C3	R37	C3	TP4	D2		
C52	B2	CR20				R39	B2	TP5	D2		
C53	B2	CR21		Q1	C1	R40	C2	TP5	D3		
C54	C3	CR22		Q2	C2	R41	C3	TP7	D3		

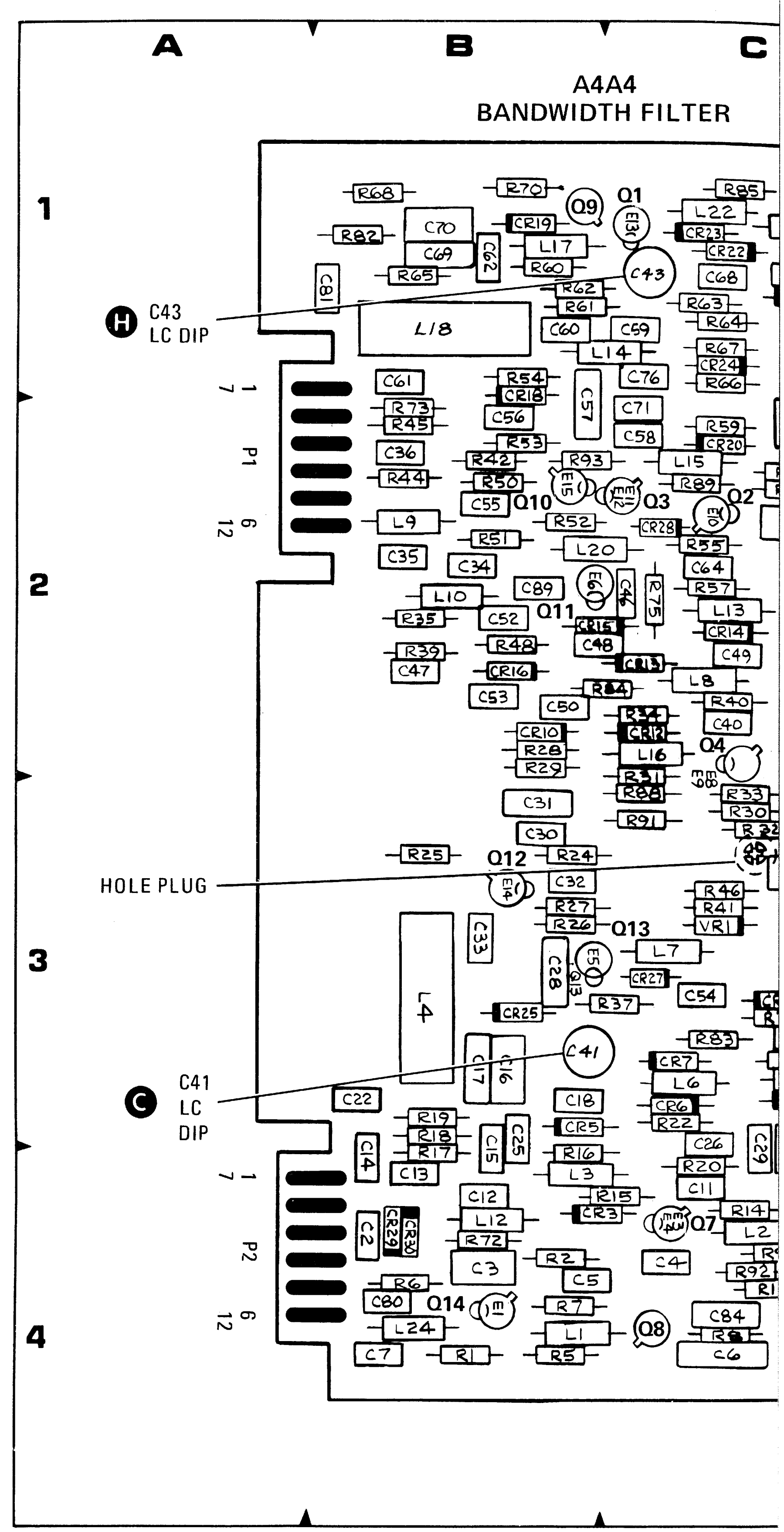


Figure 8-122. A4A4 Bandwidth Filter, Compon

Table 8-40. A4A4 Bandwidth Filter, Component Locator Table

ence nator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
5	B2	CR23	C1	Q3	C2	R42	B2	TP8	D4
6	B2	CR24	C1	Q4	C2	R43	C3		
7	B2	CR25	B3	Q5	C3	R44	B2	VR1	C3
8	C2	CR27	C3	Q6	C4	R45	B2		
9	C1	CR28	C2	Q7	C4	R46	C3	Y1	C1
0	B1	CR29	B4	Q8	C4	R48	B2	Y2	C2
1	B1	CR30	B4	Q9	B1	R49	C2	Y3	C3
2	B1			Q10	B2	R50	B2		
3	C2	E1	B4	Q11	B2	R51	B2		
4	C2	E2	C4	Q12	B3	R52	B2		
5	C2	E3	C4	Q13	B3	R53	B2		
6	C1	E4	C4	Q14	B4	R54	B1		
7	D1	E5	B3			R55	C2		
8	C1	E6	B2	R1	B4	R56	C2		
9	B1	E7	C3	R2	B4	R57	C2		
0	B1	E8	C2	R4	C4	R58	C2		
1	C2	E9	C2	R5	B4	R59	C2		
2	C1	E10	C2	R6	B4	R60	B1		
3	D1	E11	C2	R7	B4	R61	B1		
4	C2	E12	C2	R8	C4	R62	B1		
5	C1	E13	C1	R9	C4	R63	C1		
7	C1	E14	B3	R10	C4	R64	C1		
8	C1	E15	B2	R11	C4	R65	B1		
9	C2			R12	C4	R66	C1		
0	B4	L1	B4	R13	C4	R67	C1		
	B1	L2	C4	R14	C4	R68	B1		
	C4	L3	B4	R15	C4	R70	B1		
	C1	L4	B3	R16	B3	R72	B4		
	D1	L5	C3	R17	B3	R73	B2		
	C3	L6	C3	R18	B3	R74	C3		
	B2	L7	C3	R19	B3	R75	C2		
		L8	C2	R20	C4	R76	C1		
	C4	L9	B2	R21	C3	R82	B1		
3	B4	L10	B2	R22	C3	R83	C3		
	C3	L12	B4	R24	B3	R84	C2		
	B3	L13	C2	R25	B3	R85	C1		
	C3	L14	C1	R26	B3	R88	C3		
	C3	L15	C2	R27	B3	R89	C2		
	C3	L16	C2	R28	B2	R90	C4		
0	B2	L17	B1	R29	B2	R91	C3		
2	C2	L18	B1	R30	C3	R92	C4		
3	C2	L19	C1	R31	C3	R93	B2		
4	C2	L20	B2	R32	C3				
5	B2	L22	C1	R33	C3	TP1	D1		
6	B2	L24	B4	R34	C2	TP2	D2		
8	B1	L25	C2	R35	B2	TP3	D2		
9	B1	L26	C3	R37	C3	TP4	D2		
20				R39	B2	TP5	D2		
21		Q1	C1	R40	C2	TP5	D3		
22		Q2	C2	R41	C3	TP7	D3		

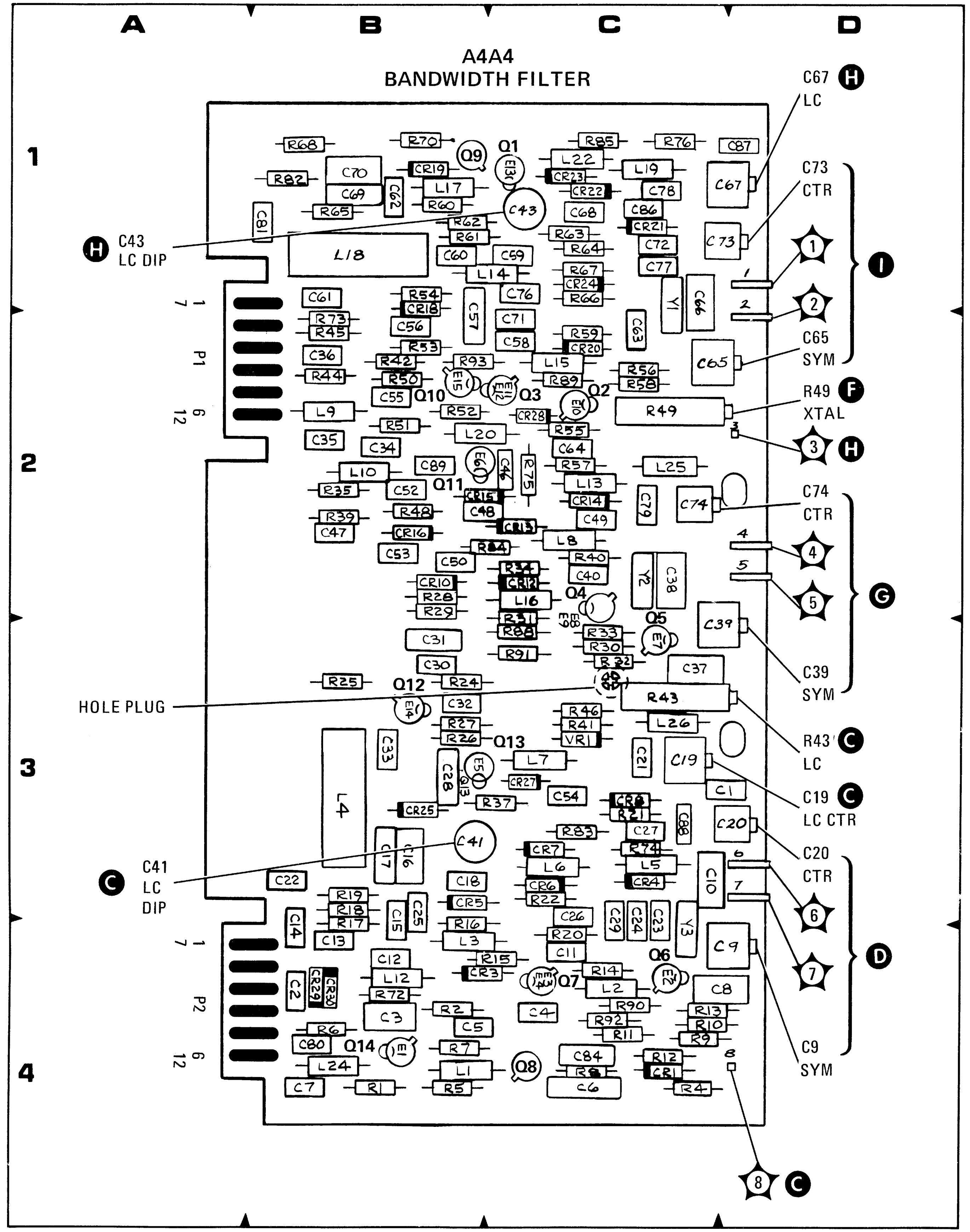


Figure 8-122. A4A4 Bandwidth Filter, Component Locations

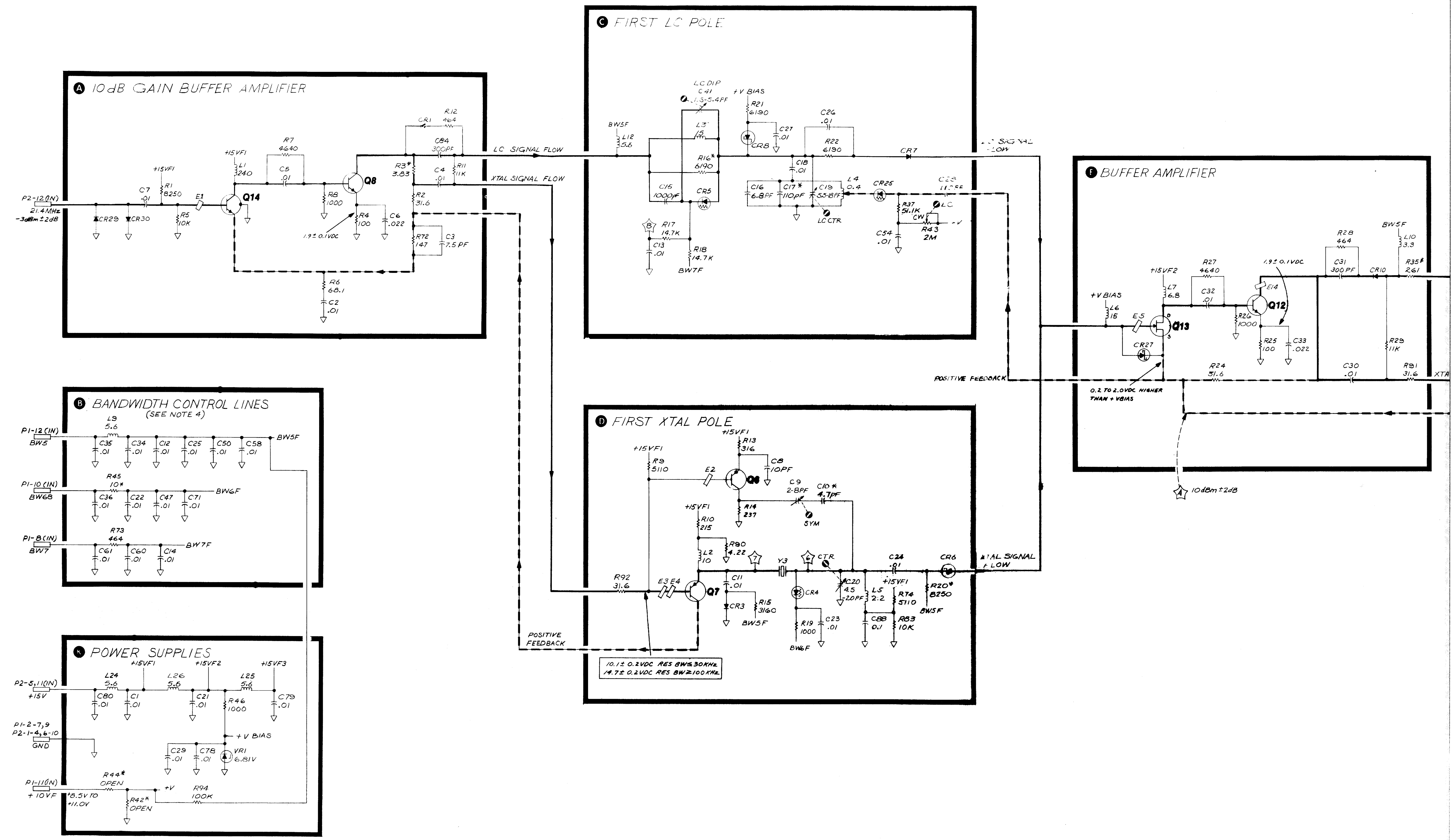
A4A4 BANDWIDTH FILTER
85662-60008

P1

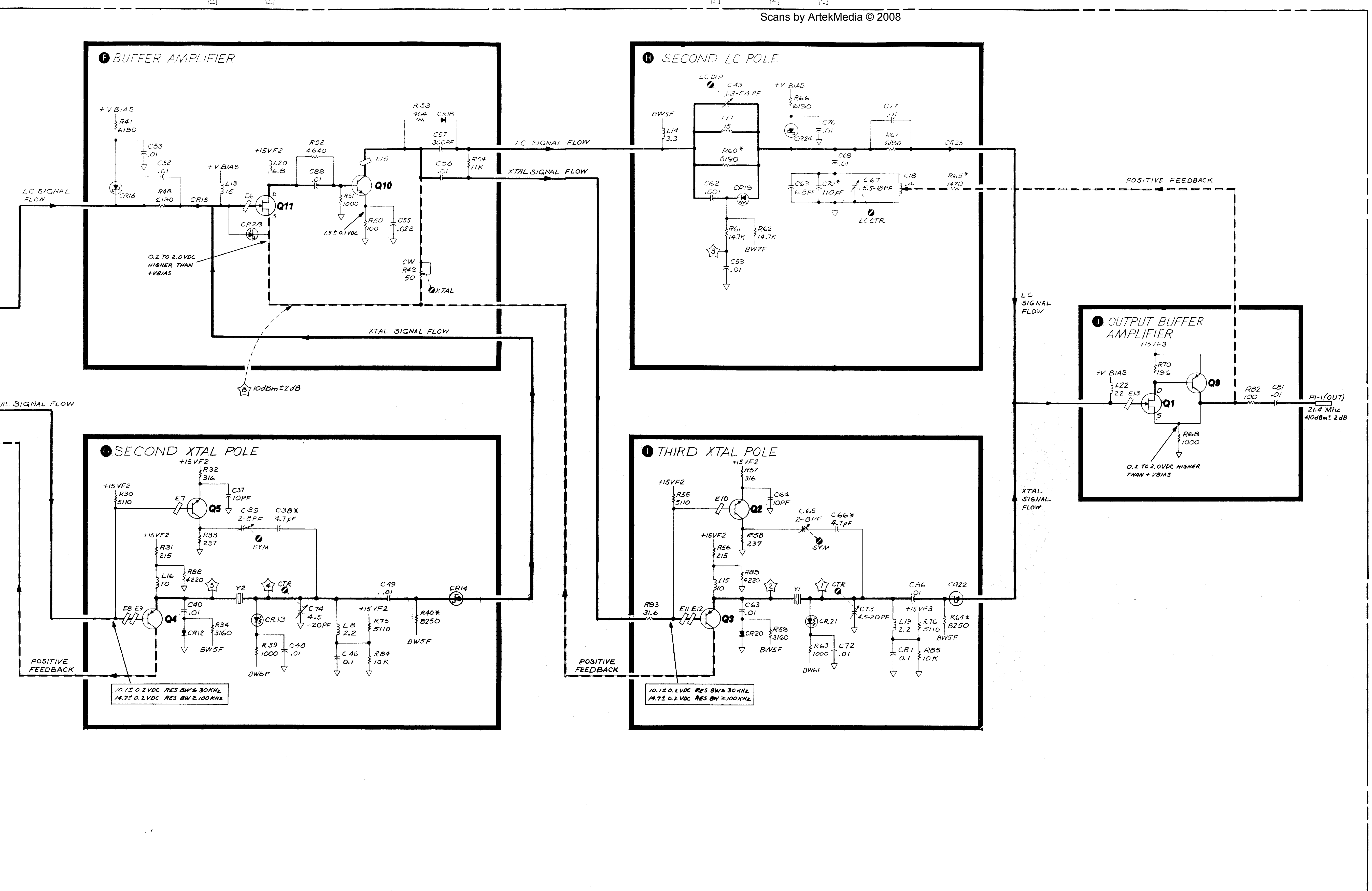
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	21.4 MHz	A4A3,P1-7	J
7	GND		K
2	GND		K
8	BW7	A4A9,P1-4	B
3	GND		K
9	GND		K
4	GND		K
10	BW68	A4A9,P1-21	B
5	GND		K
11	+10VF	A4A5,P1-5	K
6	GND		K
12	BW5	A4A9,P1-12	B

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		K
7	GND		K
2	GND		K
8	GND		K
3	GND		K
9	GND		K
4	GND		K
10	GND		K
5	+15V		K
11	+15V		K
6	GND		K
12	21.4 MHz	A4A5,P2-10	A



SERIAL PREFIX: 1826A 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:
   RESISTENCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

3. ASTERISK (*) DENOTES A FACTORY SELECTED COMPONENT; TYPICAL VALUE IS SHOWN. REFER TO SECTION V FOR RANGE OF VALUES.

4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
BW5	BANDWIDTH 5
BW7	BANDWIDTH 7 (LC MODE)
BW68	BANDWIDTH 68 (XTAL MODE)

5. UNLESS OTHERWISE NOTED, INSTRUMENT SETTINGS ARE AS FOLLOWS:

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

6. TABLE OF RESOLUTION BANDWIDTH CONTROL LINE VOLTAGES.

RESOLUTION BANDWIDTH	TYPICAL VALUES		
	BW5	BW68	BW7
3 MHz	+14.8	+4.1	+9.7
1 MHz	+14.8	+4.1	+13.1
300 KHz	+14.8	+4.1	+14.1
100 KHz	+14.8	+4.1	+14.5
30 KHz	−.6	+14.3	+14.3
10 KHz	−.6	+9.3	+14.3
3 KHz	−.6	+9.0	+14.3
1 KHz AND NARROWER	−.6	+9.2	+14.3

A4A4

Figure 8-123. A4A4 Bandwidth Filter, Schematic Diagram

A4A5 STEP GAIN, CIRCUIT DESCRIPTION

A4A5 Step Gain has three functions. It provides 65.9 dB of gain in discrete 0.1 dB steps (from −15.9 dB to +50 dB); it develops a nominal +10V bias supply and it provides the 18.4 MHz LO frequency to A4A6A1 Up Converter and A4A6A2 Down Converter.

Step Gain 10 dB + Calibration C

This circuit is configured as a non-inverting operational amplifier. It provides a minimum of about 2 dB gain (adjustable by CAL potentiometer R33) and a maximum of about 12 dB (adjustable by 10 dB potentiometer R32.) (See Figure 8-124.) The PIN diode CR5 functions as a variable resistor that has about 1K resistance at minimum and 70Ω of resistance at maximum gain. When the SG10 line is not sinking current (SG10 is off), the PIN resistance is controlled only by R33. When the SG10 line is grounded (SG10 is on), the gain is controlled primarily by R32. If the CAL potentiometer is adjusted, R32 must be adjusted also.

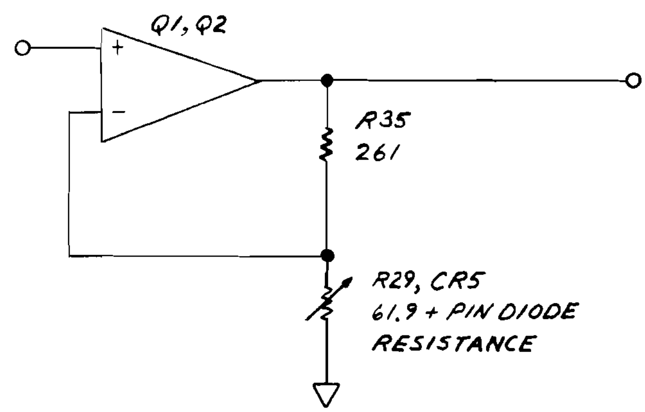


Figure 8-124. Step Gain 10 dB + Calibration, Equivalent Circuit

Step Gain 20 dB-1 D
Step Gain 20 dB-2 E

This circuit is similar to the Step Gain 10 dB + Calibration circuit, except that the gain range is from 0 dB to 20 dB. PIN diode CR6 functions as both a switch and as a variable resistor. When the SG20-1 line is low, CR6 is turned on by current adjustable by 20 dB-1 potentiometer R44. More current through the PIN causes the PIN to have a lower reistance and the amplifier to have more gain. The Step Gain 20 dB-2 circuit is identical in operation to the Step Gain 20 dB-1 circuit.

A0.0 — A15.9 dB Attenuators F

These attenuators normally operate over the range of 0.0 dB to 9.9 dB except in the Error Correction function [SHIFT] [FREQUENCY SPAN] when they operate over the whole range of 0.0 dB to 15.9 dB. The first three attenuation stages, A8dB, A4dB and A2dB, are emitter followers with a resistor divider on the output of each one. The dividers are switched in and out with diodes CR8, CR9, and CR10 to yield discrete steps of attenuation. The last attenuator is variable. Its range is adjusted by VR potentiometer R51. R51 sets the emitter voltage of Q16, which in turn determines how much current is sunk through PIN diode CR11 when resistors are switched in A4A9 IF Control. (See Figure 8-125.)

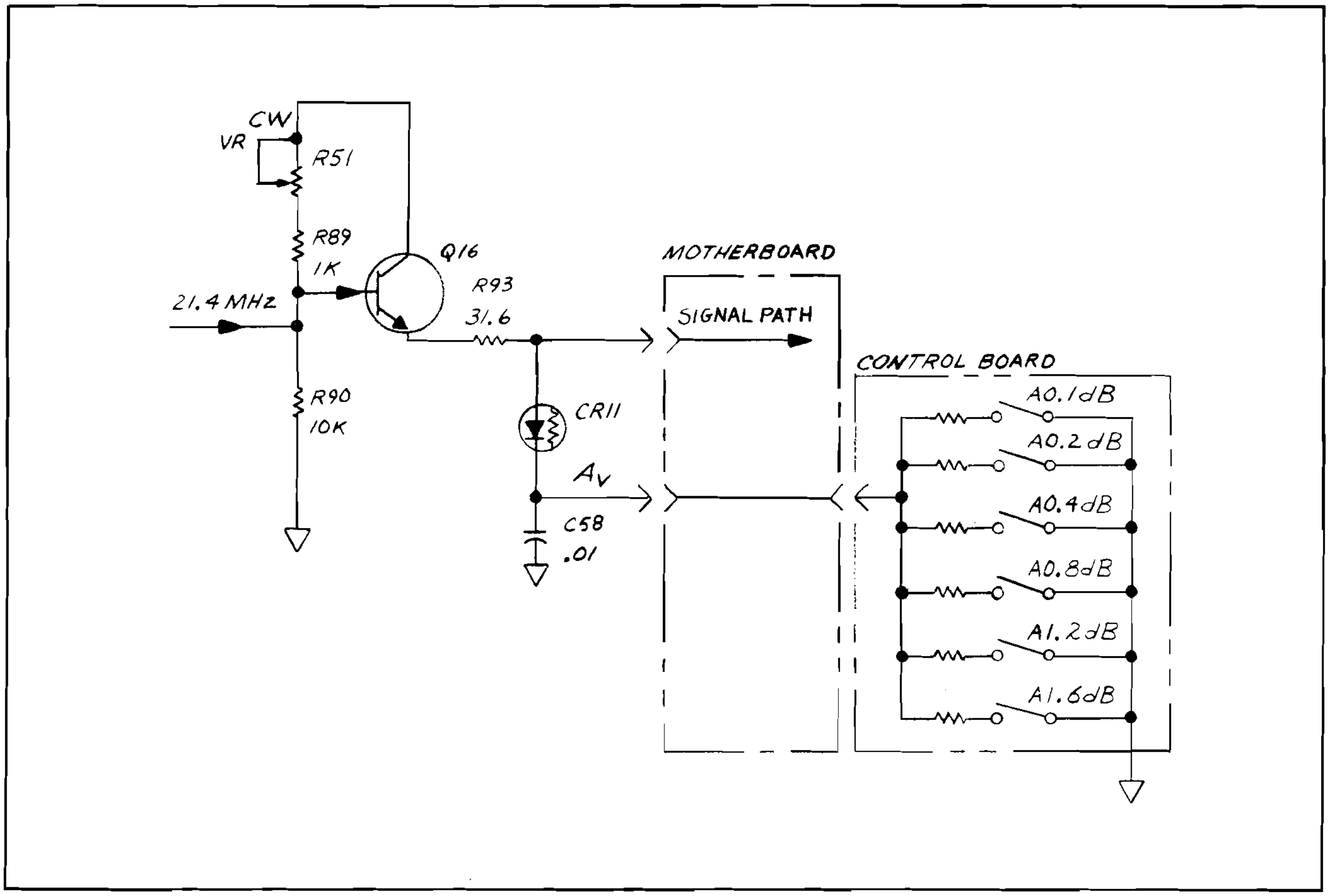


Figure 8-125. A0.0–A15.9 dB Attenuators, Simplified Schematic

+ 10V Temperature Compensating Power Supply G

This supply (see Figure 8-126) is used through the IF-Display Section to compensate for the effect of temperature on PIN diodes. Its nominal voltage is +10V and its nominal temperature coefficient is +35 mV/°C. The output voltage is equal to the voltage at pin 3 minus the voltage difference on the cathode of CR2 times the gain of the op amp:

$$V_O = [3V - (3V - 1.8V)] \left[-\frac{51.1K}{9.09K}\right] \cong 10V \text{ (at room temperature)}$$

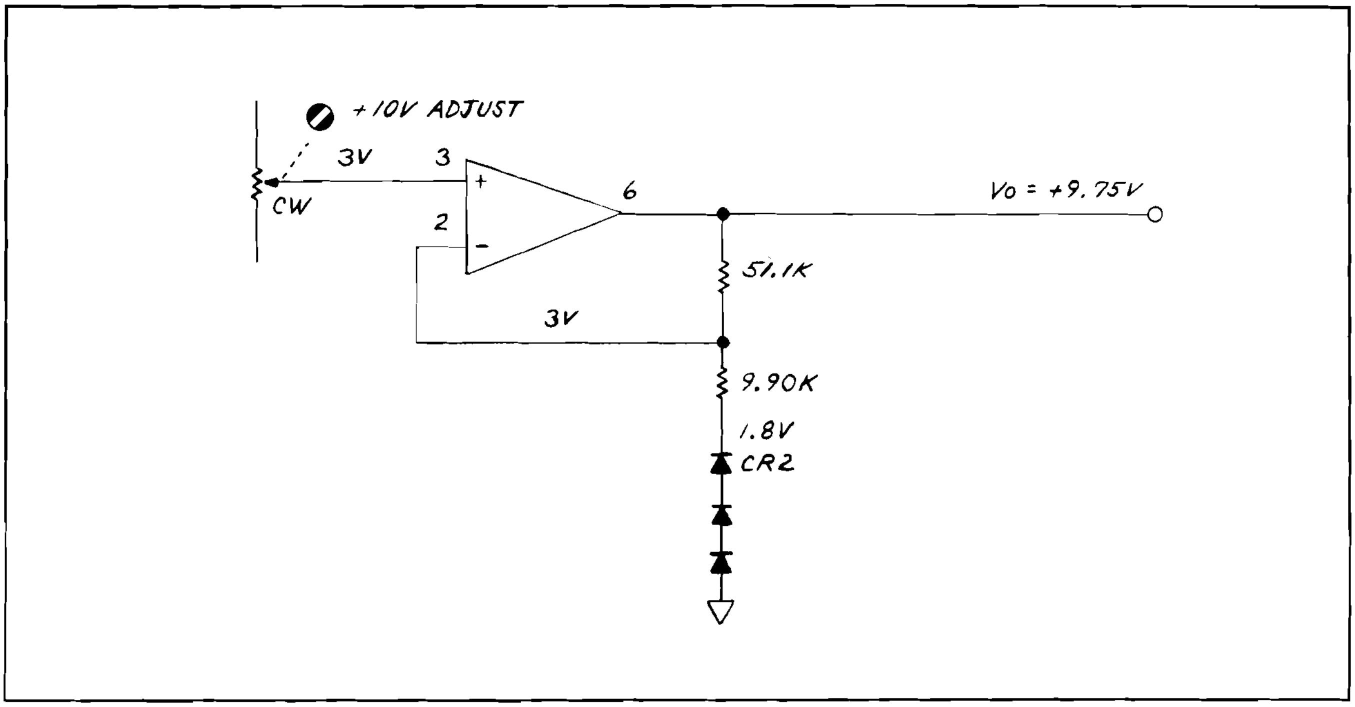


Figure 8-126. +10V Temperature-Compensating Power Supply, Simplified Schematic

18.4 MHz Oscillator (A)

The 18.4 MHz Oscillator is basically a Colpitts oscillator with a crystal Y1 in the feedback path. A simplified schematic is shown in Figure 8-127.

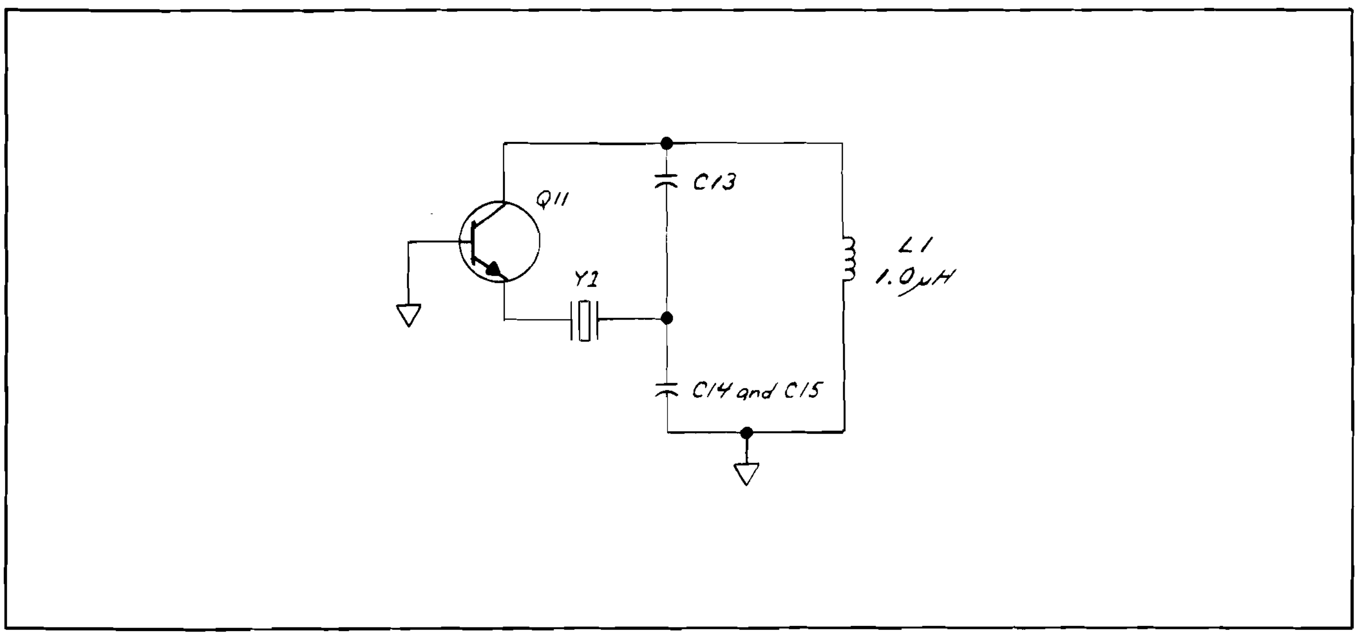


Figure 8-127. 18.4 MHz Oscillator, Equivalent Circuit

If the crystal were replaced with a large capacitor, the circuit would oscillate at the resonant frequency of the parallel resonant circuit made up of L1, C13, C14, and C15. When the crystal is inserted, the feedback path is broken except at the series resonance of the crystal (18.4 MHz). The parallel combination of varactor CR1, temperature-compensating capacitor C7, and FREQ ZERO COARSE air-variable capacitor C10 are in series with the crystal and can pull it several kHz either side of 18.4 MHz.

The voltage output is determined by the current through R10* times the collector load. If the output is too low, R10* can be decreased in size.

The collector voltage is divided by C13, C14, and C15 and goes to the Buffer Amplifiers. The division ratio is:

$$\frac{\frac{1}{390}}{\frac{1}{390}+\frac{1}{82}} \cong 0.2$$

Buffer Amplifiers C

The Buffer Amplifiers are two almost identical amplifier circuits. The top amplifier on the schematic (Q10, Q8) provides the 18.4 MHz LO signal to A4A6A1 Up Converter, while the bottom amplifier (Q12, Q13) provides the signal to A4A6A2 Down Converter.

A4A5 STEP GAIN, TROUBLESHOOTING

Operation of the Step Gains and A0.0 to A15.9 Attenuator can be determined from the display by several easy tests.

The Step Gains are checked in the following way. Connect a 10 dB step attenuator between CAL OUTPUT and SIGNAL INPUT 2. Set this attenuator to 90 dB, and key in the following:

[INSTR PRESET]
[CENTER FREQUENCY] . . . . 20 MHz
[FREQUENCY SPAN] . . . . 0 Hz
[RES BW] 1kHz
[ATTEN] . . . . 0 dB
[VIDEO BW] . . . . 10 Hz
[SWEEP TIME] . . . . 20 Sec
[REFERENCE LEVEL] . . . . −10 dBm

Press the [SINGLE] sweep key and then repetitively press the DATA SWEEP [⇩] key. Figure 8-128 should be displayed. If one or more of the steps is missing refer to NOTE 8 for the Step Gain truth table to determine which stage is faulty. 0V in the table indicates that a control line as active.

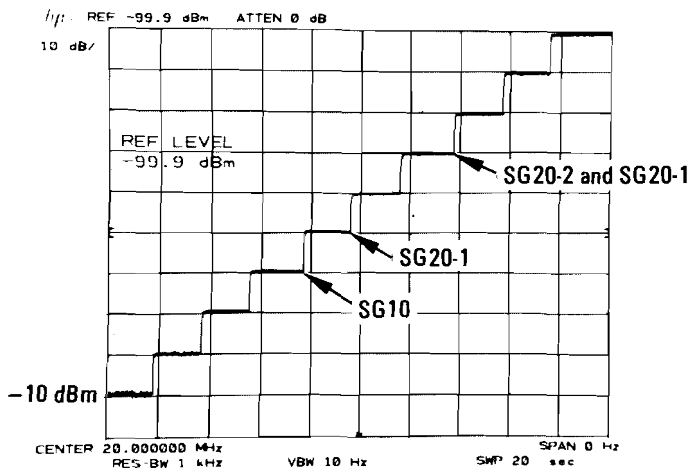


Figure 8-128. 10 dB Step Gain Test

If a component has been replaced, a simple calibration/diagnostic program exists. The calibration routine is started by connecting a cable from CAL OUTPUT to SIGNAL INPUT 2 and then pressing [SHIFT] [FREQUENCY SPAN]. When this program has finished, press [SHIFT] [LINE] TRIGGER which will list the calibration data. (Refer to Figure 8-129.) Lines 19 through 26 give the step gain errors. Acceptable error is ±1 dB. Locations of the correction data is given in Table 8-41.

Table 8-41. Locations of Step Gain Calibration Data

Reference Level (dBm)	−10	−20	−30	−40	−50	−60	−70	≤−80
Step Gain Control Line	A20 dB	A10 dB		SG10	SG20-1	SG10 SG20-1	SG20-1 SG20-2	SG10 SG20-1 SG20-2
Calibration Data Line	26	25	24	23	22	21	20	19

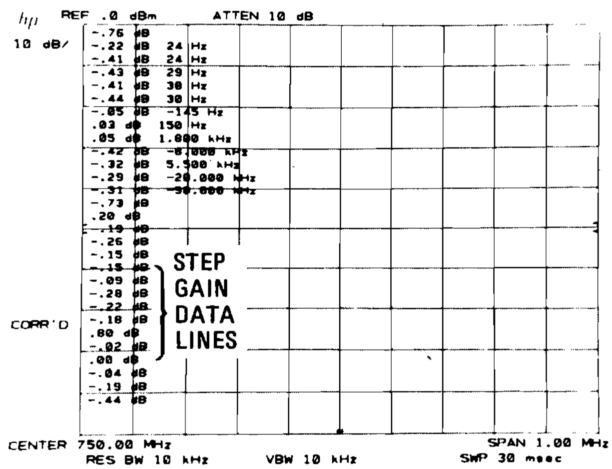


Figure 8-129. Error Correction Routine Data

The A2dB, A4dB, and A8dB circuitry of the A0.0 to A15.9 Attenuator is activated by the following routine. First, connect a 1 dB step attenuator between CAL OUTPUT and SIGNAL INPUT 2. Set this attenuator to 10 dB and key in the following:

[INSTR PRESET]

[CENTER FREQUENCY] . . . . 20 MHz

[FREQUENCY SPAN] . . . . 0 Hz

LOG SCALE [ENTER dB/DIV] . . . . 1 dB

[SWEEP TIME] . . . . 20 sec

[REFERENCE LEVEL] . . . . −10 dBm

Scans by ArtekMedia © 2008

Press [SINGLE] sweep and repetitively press the DATA STEP [⇩] key. The display should appear as in Figure 8-130. If every other step is missing, the AVdB control line is faulty. Check the A1dB circuitry on the A4A9 IF Control board to find the defective component. If only a few steps are missing, refer to the truth table in Note 9 to determine which function is not operating properly. 0V in the table indicates that a line is active.

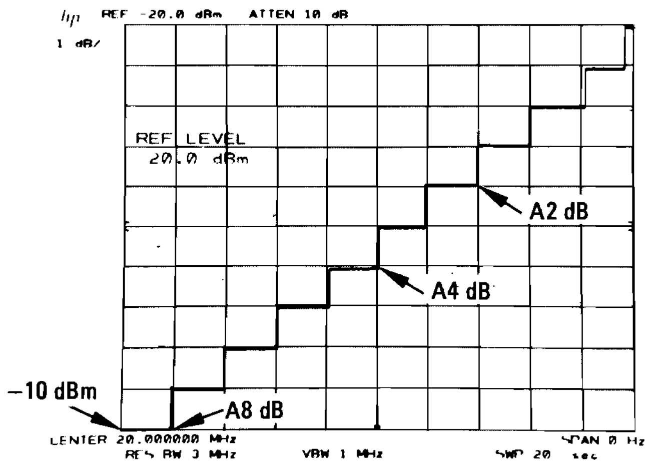


Figure 8-130. 1 dB Step Gain Test

Often several steps will appear to be slightly in error. Analysis of the truth table in Note 9 will indicate that no single stage could be faulty. This is caused by log fidelity error in the log amplifier circuitry. If accurate determination of the step size is necessary, IF substitution using a calibrated 1 dB step attenuator will be required.

Operation of the AVdB control line and the 0.1−1.9 dB section of the A0.0−A15dB Attenuator on A4A9 IF Control can be tested with the following method.

[INSTR PRESET]
[CENTER FREQUENCY] . . . . 20 MHz
[FREQUENCY SPAN] . . . . 0 Hz
LIN [.]
[SHIFT] RES BW [AUTO] (KSA)
[SWEEP TIME] . . . . 20 sec
[VIDEO BW] . . . . 3 kHz
[REFERENCE LEVEL] . . . . −8 dBm

Press the [SINGLE] sweep key and rotate the DATA control knob in a counterclockwise direction. A stepped display similar to Figure 8-131 should result. If the steps are not monotonic, the circuitry is faulty. The AVdB control line voltage for a −10 dBm Reference Level will vary widely among instruments although the ratio between the voltage for −11.9 dBm and −10 dBm will remain constant. During the above test the voltage should vary approximately 8.5% from −10 dBm to −11.9 dBm.

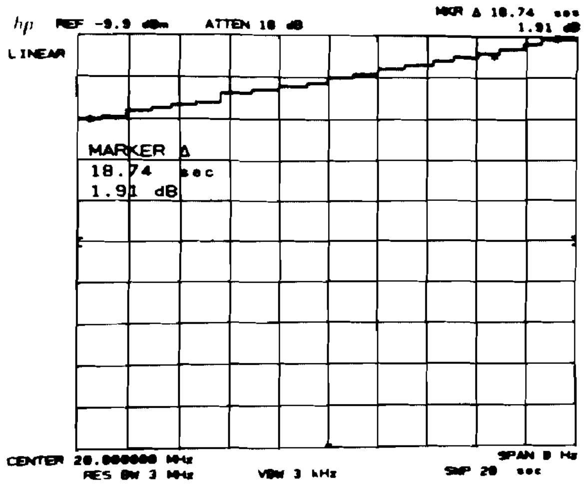


Figure 8-131. 0.1 dB Step Gain Test

The absolute step amplitudes can be determined with the MARKER Δ function. The reference steps are 0.00dB, 0.90dB and 1.90dB. In the Linear mode, the error should be less than ±0.12dB. If these steps are not correct or the display is not monotonic, refer to A4A9 IF Control Service Sheet for more trouble-shooting information.

Table 8-42. A4A5 Step Gain, Replaceable Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A5	85662-60007	1	BOARD ASSEMBLY, STEP GAIN	28480	85662-60007
A4A5C1	0160-4297	3	CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223Z822-CDH
A4A5C2			NOT ASSIGNED		
A4A5C3	0160-2055	41	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C4	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4A5C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C6			NOT ASSIGNED		
A4A5C7*			FACTORY SELECTED PART-NORMALLY OPEN		
A4A5C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C10	0121-0451	1	CAPACITOR-V TRMR-AIR 1.7-11PF 250V	74970	187-0106-005
A4A5C11	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4A5C9	0160-4633		CAPACITOR-FXD 12PF 500V	28480	0160-4633
A4A5C12			NOT ASSIGNED		
A4A5C13	0140-0193	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A4A5C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C15	0140-0200	1	CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
A4A5C16			NOT ASSIGNED		
A4A5C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C24	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223Z822-CDH
A4A5C25	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223Z822-CDH
A4A5C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C30			NOT ASSIGNED		
A4A5C31	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C32	0160-2250	1	CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A4A5C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C37	0160-2244	2	CAPACITOR-FXD 3PF +-.25PF 500VDC CER	28480	0160-2244
A4A5C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C39	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C40	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C41	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C42	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C43			NOT ASSIGNED		
A4A5C44	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C45	0160-2244		CAPACITOR-FXD 3PF +-.25PF 500VDC CER	28480	0160-2244
A4A5C46	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C47	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C48	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C49	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C50	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C51	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C52	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C53	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C54	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C55	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C56	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C57	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C58	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C59	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C60			NOT ASSIGNED		
A4A5C61			NOT ASSIGNED		
A4A5C62			NOT ASSIGNED		
A4A5C63	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A5C64	0180-2216	1	CAPACITOR-FXD 350UF+75-10% 16VDC AL	56289	30D357G016DH2
A4A5CR1	0122-0255	1	DIODE-VVC 1N5144 22PF 10% C4/C60-MIN=3.2	04713	1N5144
A4A5CR2	1901-0040	8	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A5CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A5CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A5CR5	1901-1070	4	DIODE:PIN	28480	1901-1070
A4A5CR6	1901-1070		DIODE:PIN	28480	1901-1070
A4A5CR7	1901-1070		DIODE:PIN	28480	1901-1070
A4A5CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A5CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A5CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

Table 8-42. A4A5 Step Gain, Replaceable Parts (2 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A5CR11	1901-1070		DIODE:PIN	28480	1901-1070
A4A5CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A5CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A5E1	9170-0029	13	CORE-SHIELDING BEAD	28480	9170-0029
A4A5E2	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E3	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E4	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E5	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E6	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E7	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E8	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E9	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E10	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E11	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E12	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5E13	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A5L1	9140-0096	1	COIL-MLD 1UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0096
A4A5L2			NOT ASSIGNED		
A4A5L3	9100-1618	3	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A5L4	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A5L5	9100-1624	6	COIL-MLD 30UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1624
A4A5L6	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A5L7			NOT ASSIGNED		
A4A5L8			NOT ASSIGNED		
A4A5L9			NOT ASSIGNED		
A4A5L10	9100-1624		COIL-MLD 30UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1624
A4A5L11	9100-1624		COIL-MLD 30UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1624
A4A5L12	9100-1624		COIL-MLD 30UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1624
A4A5L13	9100-1624		COIL-MLD 30UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1624
A4A5L14	9100-1624		COIL-MLD 30UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1624
A4A5Q1	1854-0345	3	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A5Q2	1853-0015	3	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A4A5Q3	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A5Q4	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A4A5Q5	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A5Q6	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A4A5Q7	1854-0404	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A5Q8	1854-0019	9	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q9	1853-0281	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A4A5Q10	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q11	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q12	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q13	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q14	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q15	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q16	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5Q17	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A5R1	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A5R2	2100-3103	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A4A5R3	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A4A5R4	0757-0458	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A4A5R5	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A4A5R6	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A5R7	0757-0465	3	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4A5R8	0698-3156	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A4A5R9	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4A5R10*	0698-3153	2	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4A5R11	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A4A5R12	0698-3260	8	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A5R13	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A5R14	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A5R15	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A5R16	0757-0403	2	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A4A5R17	0757-0346	3	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A5R18	0698-3444	5	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A5R19	0757-0399	2	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A4A5R20	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A5R21	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A5R22	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A5R23	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A4A5R24	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A5R25	0757-0279	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A5R26	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A5R27	0757-0290	3	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4A5R28	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A5R29	0757-0276	3	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A4A5R30	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260

Table 8-42. A4A5 Step Gain, Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A5R31	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R32	2100-3056	3	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A4A5R33	2100-3163	1	RESISTOR-TRMR 1M 20% C SIDE-ADJ 17-TRN	02111	43P105
A4A5R34	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4A5R35	0698-3132	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A4A5R36	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R37	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A4A5R38	0757-0401	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A5R39	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4A5R40	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A5R41	0757-0394	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A5R42	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A5R43	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R44	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A4A5R45	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R46	0757-0420	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A5R47	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A4A5R48	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A5R49	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4A5R50	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A5R51	2100-3161	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A4A5R52	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A5R53	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R54	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A4A5R55	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4A5R56	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R57	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4A5R58	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A5R59	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A5R60	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A5R61	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A4A5R62*	0698-0084	7	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A5R63	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A4A5R64	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R65	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A5R66	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A5R67	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A5R68	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A5R69	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A4A5R70*	0757-0280	11	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R71	0757-0400	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-TO-90R9-F
A4A5R72-A4A5R79			NOT ASSIGNED		
A4A5R80	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A4A5R81	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A4A5R82	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A4A5R83	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2151-F
A4A5R84	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A5R85	0757-0316	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A4A5R86*			*FACTORY SELECTED PART-NORMALLY OPEN		
A4A5R87	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A4A5R88	0757-0317	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A4A5R89	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R90	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A5R91	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A5R92	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4A5R93	0757-0180	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A5R94			NOT ASSIGNED		
A4A5R95			NOT ASSIGNED		
A4A5R96	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A5R97	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A5TP1	1251-0600	3	TERMINAL-TEST POINT	28480	1251-0600
A4A5TP2	1251-0600		TERMINAL-TEST POINT	28480	1251-0600
A4A5TP3	1251-0600		TERMINAL-TEST POINT	28480	1251-0600
A4A5U1	1826-0261	1	IC 741 OP AMP TO-99	28480	1826-0261
A4A5VR1	1902-3104	1	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	28480	1902-3104
A4A5Y1	0410-0671	1	CRYSTAL, 1,.4MHZ	28480	0410-0671
			A4A5 MISCELLANEOUS PARTS		
	86701-40001		EXTRACTOR, PC BOARD	28480	86701-40001
	6960-0016		PLUG-HOLE .125" DIA	28480	6960-0016

See introduction to this section for ordering information

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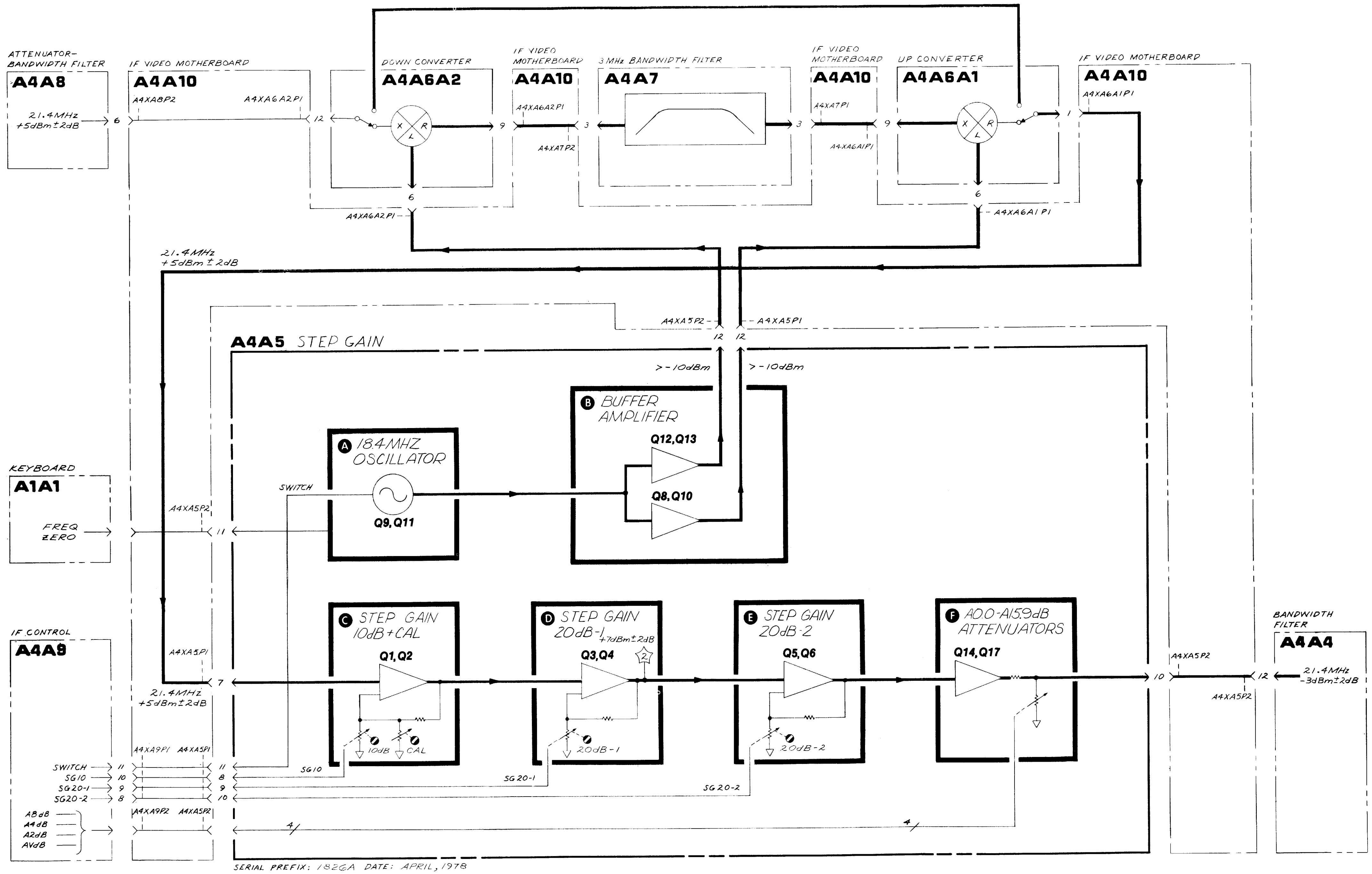


A4A5

Figure 8-132. A4A5 Step Gain, Block Diagram

Table 8-43. A4A5 Step Gain, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	A2	C57	B3	Q6	C4	R38	B2	TP1	C1
C3	A1	C58	B4	Q7	B1	R39	C2	TP2	C3
C4	B1	C59	B4	Q8	B2	R40	C3	TP3	B2
C5	A3	C63	B4	Q9	A2	R41	C3		
C7	B2	C64	B2	Q10	B3	R42	C3	U1	A1
C8	B3			Q11	B3	R43	C3		
C9	B2	CR1	B3	Q12	B3	R44	C2	VR1	B1
C10	B2	CR2	B1	Q13	B3	R45	C3		
C11	A3	CR3	B1	Q14	B4	R46	C3	Y1	B3
C13	B3	CR4	B1	Q15	B4	R47	C3		
C14	B3	CR5	C2	Q16	B4	R48	C4		
C15	B2	CR6	C3	Q17	B4	R49	C4		
C17	B3	CR7	C4			R50	C4		
C18	B3	CR8	C3	R1	B1	R51	C4		
C19	B3	CR9	B3	R2	C1	R52	C4		
C20	B3	CR10	B3	R3	C1	R53	C4		
C21	B3	CR11	B4	R4	B1	R54	C3		
C22	B2	CR12	A3	R5	B1	R55	C4		
C23	B2	CR13	B3	R6	A2	R56	C4		
C24	B4			R7	A2	R57	C4		
C25	B2	E1	B3	R8	A3	R58	C4		
C26	C2	E2	B3	R9	A3	R59	C4		
C27	B2	E3	B2	R10	B3	R60	C3		
C28	C2	E4	B3	R11	A3	R61	B4		
C29	C2	E5	B3	R12	A3	R62	B4		
C31	B2	E6	C1	R13	A3	R63	C4		
C32	C2	E7	C3	R14	B2	R64	B3		
C33	C2	E8	C4	R15	B3	R65	B4		
C34	C3	E9	C4	R16	B2	R66	B4		
C35	B2	E10	B4	R17	B2	R67	B4		
C36	C3	E11	B4	R18	B3	R68	C4		
C37	C3	E12	B4	R19	B3	R69	B4		
C38	C3	E13	B4	R20	B3	R70	B4		
C39	C3			R21	B3	R71	B4		
C40	C4	L1	A3	R22	B3	R80	B3		
C41	C4	L3	C1	R23	B3	R81	B4		
C42	B2	L4	B4	R24	B3	R82	B4		
C44	C4	L5	B3	R25	B2	R83	B4		
C45	C4	L6	B1	R26	B3	R84	C3		
C46	C4	L10	C2	R27	C1	R85	B4		
C47	B4	L11	C3	R28	C2	R86	B4		
C48	B3	L12	C2	R29	C2	R87	B4		
C49	B4	L13	C3	R30	A3	R88	B3		
C50	B3	L14	C4	R31	C2	R89	B4		
C51	B4			R32	C1	R90	B4		
C52	B4	Q1	C1	R33	C1	R91	B4		
C53	C4	Q2	C2	R34	C2	R92	B2		
C54	B3	Q3	C3	R35	C2	R93	B4		
C55	B4	Q4	C3	R36	C2	R96	B3		
C56	B4	Q5	C4	R37	C2	R97	B2		

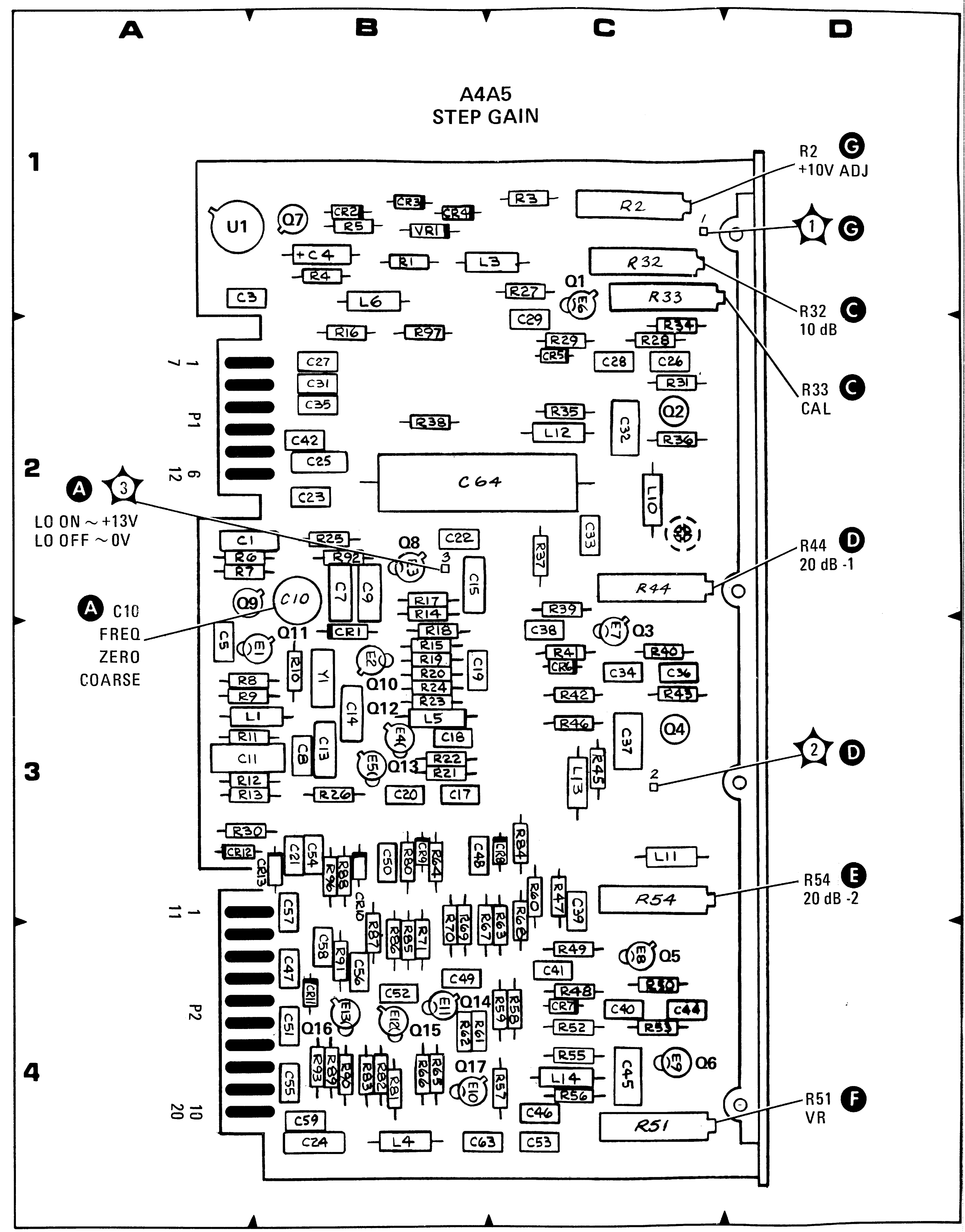


Figure 8-133. A4A5 Step Gain, Component Locations

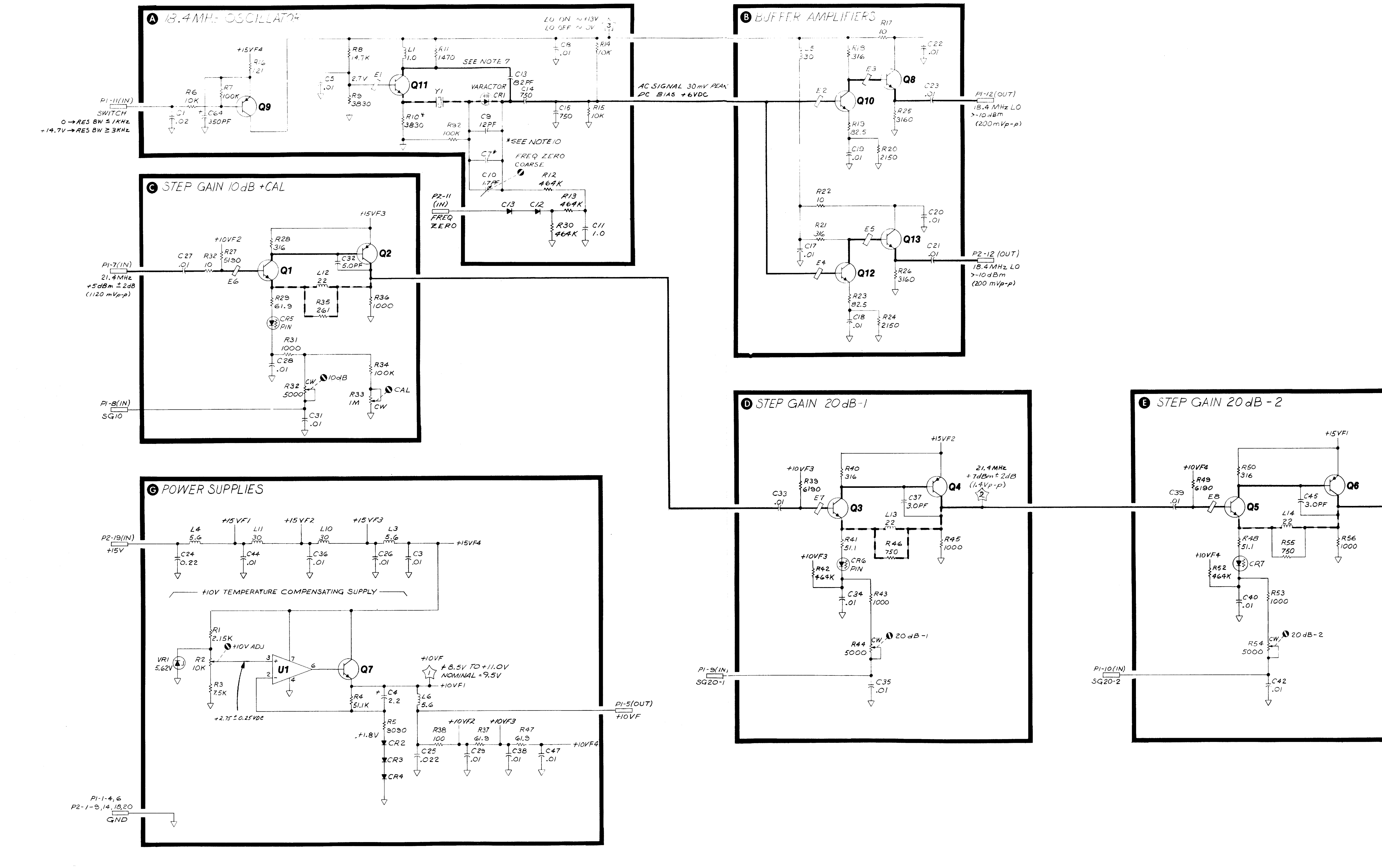
A4A5 STEP GAIN
85662-60007

P1

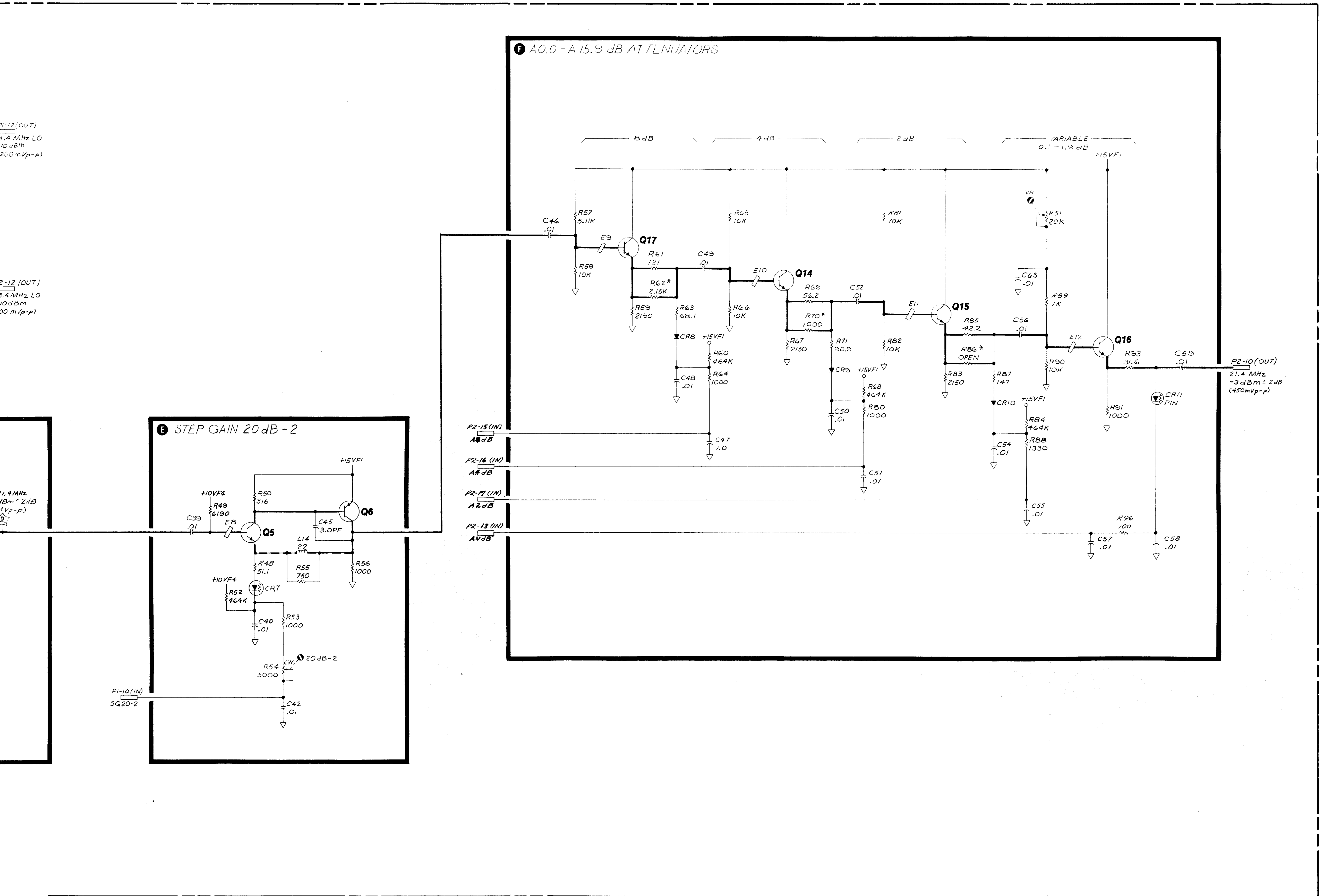
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		G
7	21.4MHz	A4A6 A1P1-1	C
2	GND		G
8	SG10	A4A9 P1-10	C
3	GND		G
9	SG20-1	A4A9 P1-9	D
4	GND		G
10	SG20-2	A4A9 P1-8	E
5	+10VF	A4A4 P1-11, A4A8 P1-6	G
11	SWITCH	A4A9 P1-11	A
6	GND		G
12	18.4MHz LO	A4A6 A1P1-6	B

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		G
11	FREQ ZERO	A1A1	A
2	GND		G
12	18.4MHz LO	A4A6 A2P1-1	B
3	GND		G
13	AV dB	A4A9 P2-7	F
4	GND		G
14	GND		G
5	GND		G
15	A8 dB	A4A9 P2-5	F
6	GND		G
16	A4 dB	A4A9 P2-4	F
7	GND		G
17	A2 dB	A4A9 P2-22	F
8	GND		G
18	GND		G
9	GND		G
19	+15V		G
10	21.4MHz	A4A4 P2-12	F
20	GND		G



SERIAL PREFIX: 1826A 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. ASTERISK (*) DENOTES FACTORY SELECTED COMPONENT; TYPICAL VALUE IS SHOWN. REFER TO SECTION V FOR RANGE OF VALUES.
4. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
A2 dB	ATTENUATION 2dB
A4 dB	ATTENUATION 4dB
A8 dB	ATTENUATION 8 dB
AV dB	ATTENUATION VARIABLE
FREQ ZERO	FREQUENCY ZERO FROM FRONT PANEL CONTROL
SG10	STEP GAIN 10 dB
SG20-1	STEP GAIN 20 dB -1
SG20-2	STEP GAIN 20 dB -2
SWITCH	LOW = DOWN CONVERTING (3 MHz IF)

5. RF PERFORMANCE OF THIS BOARD IS ADVERSELY AFFECTED BY USE OF EXTENDERS. SEE TROUBLE-SHOOTING HINTS FOR INFORMATION ON REPAIR OF THIS BOARD.
6. INSTRUMENT CONTROL SETTINGS FOR ALL MEASUREMENTS ON THIS BOARD ARE AS FOLLOWS:
   INSTRUMENT PRESET ...
   CENTER FREQUENCY.... 20 MHz
   FREQUENCY SPAN....... 0 Hz
   ATTENUATION.......... 0 dB
7. 300 mV PEAK (SCOPE PROBE MAY LOAD THE CIRCUIT, MAKING ACCURATE MEASUREMENT DIFFICULT.)
8. STEP GAIN TRUTH TABLE:

REFERENCE LEVEL RES BW ≤ 1 KHz	dBM	-10	-20	-30	-40	-50	-60	-70	≤-80
SG10	LOG	>7.5V	>7.5V	>7.5V	0V	>7.5V	0V	>7.5V	0V
SG20-1	LOG	>8.5V	>8.5V	>8.5V	>8.5V	0V	0V	0V	0V
SG20-2	LOG	>8.5V	>8.5V	>8.5V	>8.5V	>8.5V	>8.5V	0V	0V

9. A0.0 - 15.9dB ATTENUATOR CONTROL TABLE:

REFERENCE LEVEL dBM	CONTROL LINES		
	A2dB	A4dB	A8dB
-10	>+13V	>+13V	0V
-11	>+13V	>+13V	0V
-12	0V	0V	>+13V
-13	0V	0V	>+13V
-14	>+13V	0V	>+13V
-15	>+13V	0V	>+13V
-16	0V	>+13V	>+13V
-17	0V	>+13V	>+13V
-18	>+13V	>+13V	>+13V
-19	>+13V	>+13V	>+13V

10. NORMALLY OPEN

A4A5

Figure 8-134. A4A5 Step Gain, Schematic Diagram

A4A6A1 UP CONVERTER, CIRCUIT DESCRIPTION

For narrow (⩽1 kHz) bandwidths, A4A6A1 Up Converter Assembly converts the 3 MHz IF signal from A4A7 3 MHz Filter to a 21.4 MHz IF signal and sends it to A4A5 Step Gain. For wide (⩾3 kHz) bandwidths, the 21.4 MHz from A4A6A2 Down Converter is amplified and sent to A4A5.

Variable Gain Amplifier A

The Variable Gain Amplifier has about 6 dB of gain to compensate for the loss incurred by the 50-Ohm Driver in A4A6A2, which converts the 21.4 MHz IF signal into a 50Ω system.

21.4 MHz IF Switch B

For wide (⩾3 kHz) bandwidths, the SWITCH line goes to +15V, which turns Q6 off. This forward biases CR3 (the current is sunk through the LO Driver and Buffer Amplifier) and reverse biases CR2, allowing the 21.4 MHz IF signal to pass through CR3 and then to A4A5.

For narrow (⩽1 kHz) bandwidths, the SWITCH line goes to 1V, turning Q6 on. The collector of Q6 goes to about +15V, which turns the LO Driver on, forward biases CR2, and reverse biases CR3, breaking the path from the Variable Gain Amplifier.

LO Driver and Buffer Amplifer A

This circuit is only on for bandwidths ⩽1 kHz. It consists of an emitter follower (Q7) driving a common base stage (Q8) which in turn drives a common emitter stage (Q9). The Voltages and signal levels are indicated on the schematic.

Mixer D

The Mixer is double balanced and has about 6 dB conversion loss. It mixes the 3 MHz IF signal from A4A7 with the 18.4 MHz LO signal from the LO Driver and Buffer Amplifier to produce a 21.4 MHz signal through the 21.4 MHz Bandpass Amplifier to A4A5.

21.4 MHz Bandpass Amplifier E

This is a common emitter amplifier with about 7 dB of gain. It is preceded by a wide (BW ≈ 5 MHz) bandpass filter (R61, C32 and L2) and followed by a narrow (BW ≈ 10 kHz) bandpass (T1, Y1, L8, and R60). The wide filter attenuates harmonics of the 18.4 MHz LO, and the narrow filter attenuates the fundamental of the 18.4 MHz LO. 18.4 MHz NULL adjustment C31 compensates for the case capacitance of the crystal. The crystal Y1 and inverting transformer T1 are driven by an emitter follower Q4. The output emitter follower is turned on and off by the SWITCH line.

A4A6A2 DOWN CONVERTER, CIRCUIT DESCRIPTION

For resolution bandwidths ⩽1 kHz, A4A6A2 Down Converter converts the 21.4 MHz IF signal from A20 Third Converter down to a 3 MHz IF signal. For resolution bandwidths ⩾3 kHz, the 21.4 MHz is not converted but is sent through A4A6A1 Up Converter to A4A5 Step Gain.

Switch Ⓒ and 50 Ohm Driver Ⓐ

For bandwidths ≥3 kHz, the SWITCH line is +15V and Q7 is off. R38 in the LO Driver and Buffer Amplifier pulls the collector of Q7 to less than 0V. This forward biases CR3 and reverse biases CR5, passing the 21.4 MHz IF signal to the 50 Ohm Driver, where it is converted to a 50Ω system (6 dB loss) and sent to A4A6A1.

For bandwidths ≤1 kHz, the SWITCH line is 0V, turning Q7 on. The collector Q7 goes to almost +15V, which turns CR5 on (shorting any signal that might pass through CR3) and CR3 off. Q7 also turns the LO on.

LO Driver and Buffer Amplifier Ⓑ

This circuit is only on for bandwidths ⩽1 kHz. It consists of an emitter follower Q6 driving a common base stage Q5, which in turn drives a common emitter stage Q2. The proper bias voltages and signal levels are shown on the schematic.

Mixer and Driver Ⓓ

Q1 is an emitter follower driving a step-down transformer. The turns ratio is about 4 1/2 to 1, which yields a 12 dB loss and drives the Mixer from a low impedance. The Mixer has an additional 5 dB loss.

3 MHz Bandpass Amplifier Ⓔ

This amplifier compensates for the losses of the transformer T1 and the mixer M1. The filter at the output, consisting of L5, C22, and R52, has less than 1 dB of loss at 3 MHz.

A4A6 DOWN/UP CONVERTER, TROUBLESHOOTING

If the resolution bandwidths less than 3 kHz are not working properly, the fault is most likely on the Down/Up Converter or the 3 MHz Bandwidth Filter boards.

If only noise is displayed, check the voltage on the SWITCH control lines. If the SWITCH line is working, the 18.4 MHz LO signal levels should be tested. The 18.4 MHz Oscillator is located on the A4A5 Step Gain board.

A4A6A2R33* may have to be changed if mixer A4A6A2U1 is replaced. See Section V for the correct procedure for selecting this value.

Note that the SWITCH control line voltage is different on the A4A6A1 Up Converter board. This is due to a 100Ω resistor, R4, on the A4A10 IF Video Motherboard.

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Table 8-44. A4A6 Down/Up Converter, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A6	85662-60018	1	DOWN/UP CONVERTER ASSEMBLY (INCLUDES A4A6A1 UP CONVERTER & A4A6A2 DOWN CONVERTER)	28480	85662-60018
A4A6J1	1250-0690	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A6J2	1250-0690		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
			A4A6 MISCELLANEOUS PARTS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001
A4A6A1			BOARD ASSY, UP CONVERTER (P/O A4A6)		
A4A6A1C1			NOT ASSIGNED		
A4A6A1C2	0160-2055	18	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C3			NOT ASSIGNED		
A4A6A1C4	0160-4084	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A6A1C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C7			NOT ASSIGNED		
A4A6A1C8			NOT ASSIGNED		
A4A6A1C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A6A1C10			NOT ASSIGNED		
A4A6A1C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C14			NOT ASSIGNED		
A4A6A1C15			NOT ASSIGNED		
A4A6A1C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C27	0160-2244	1	CAPACITOR-FXD 3PF +-.25PF 500VDC CER	28480	0160-2244
A4A6A1C28			NOT ASSIGNED		
A4A6A1C29			NOT ASSIGNED		
A4A6A1C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A1C31	0121-0453	1	CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0103-195
A4A6A1C32	0140-0199	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A4A6A1CR1			NOT ASSIGNED		
A4A6A1CR2	1901-0047	3	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A6A1CR3	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A6A1CR4	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A6A1E1	9170-0029	7	CORE-SHIELDING BEAD	28480	9170-0029
A4A6A1E2	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A1E3	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A1E4	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A1E5	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A1E6	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A1E7	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A1L1	9140-0112	2	COIL-MLD 4.7UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0112
A4A6A1L2	9100-1611	1	COIL-MLD 220NH 20% Q=50 .155DX.375LG-NOM	28480	9100-1611
A4A6A1L3			NOT ASSIGNED		
A4A6A1L4	9100-1624	1	COIL-MLD 30UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1624
A4A6A1L5	9100-1620	1	COIL-MLD 15UH 10% Q=65 .155DX.375LG-NOM	28480	9100-1620
A4A6A1L6			NOT ASSIGNED		
A4A6A1L7	9140-0112		COIL-MLD 4.7UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0112
A4A6A1L8	9100-1618	1	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A6A1Q1	1854-0019	5	TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A1Q2	1853-0007	2	TRANSISTOR-PNP SI TO-18 PD=360MW	0203G	2N3251
A4A6A1Q3	1854-0345	1	TRANSISTOR-NPN SI TO-72 PD=200MW	0203G	2N5179
A4A6A1Q4	1854-0019		TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A1Q5	1854-0247	1	TRANSISTOR-NPN SI TO-39 PD=1W	28480	1854-0247
A4A6A1Q6	1853-0007		TRANSISTOR-PNP SI TO-18 PD=360MW	0203G	2N3251
A4A6A1Q7	1854-0019		TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A1Q8	1854-0019		TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A1Q9	1854-0019		TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019

Table 8-44. A4A6 Down/Up Converter, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A6A1R1	0757-0401	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A6A1R2			NOT ASSIGNED		
A4A6A1R3			NOT ASSIGNED		
A4A6A1R4	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A4A6A1R5	0757-0465	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4A6A1R6	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4A6A1R7			NOT ASSIGNED		
A4A6A1R8			NOT ASSIGNED		
A4A6A1R9	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A4A6A1R10	0757-0400	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A4A6A1R11			NOT ASSIGNED		
A4A6A1R12	0757-0279	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A6A1R13	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A6A1R14	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4A6A1R15	0757-0280	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A6A1R16	0757-0317	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A4A6A1R17	0757-0442	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A1R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A1R19	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A6A1R20	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A6A1R21	0757-0180	2	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A6A1R22	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A6A1R23	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A6A1R24	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4A6A1R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A6A1R26	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A6A1R27	0757-0439	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A6A1R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A1R29	2100-3154	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A4A6A1R30	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A4A6A1R31			NOT ASSIGNED		
A4A6A1R32	0757-0419	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A4A6A1R33	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A6A1R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A1R35	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4A6A1R36- A4A6A1R49			NOT ASSIGNED		
A4A6A1R50	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A1R51	0757-0447	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A4A6A1R52- A4A6A1R59			NOT ASSIGNED		
A4A6A1R60	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4A6A1R61	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A6A1T1	85662-8000C	1	COIL ASSEMBLY, TRANSFORMER	28480	85662-80002
A4A6A1TP1			NOT ASSIGNED		
A4A6A1TP2	1251-0600	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A6A1TP3	1251-0600		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4A6A1U1	0955-0084	1	MIXER, DOUBLE-BALANCED, 200MW	28480	0955-0084
A4A6A1Y1	0410-1029	1	CRYSTAL, 21.4 MHZ (SET OF SIX) (INCLUDES A4A8Y1-Y2, A4A4Y1-Y3)	28480	0410-1029
			A4A6A1 MISCELLANEOUS PARTS		
	6960-0016	1	PLUG-HOLE .125" DIA	28480	6960-0016

Table 8-44. A4A6 Down/Up Converter, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A6A2			BOARD ASSY, DOWN CONVERTER (P/O A4A6)		
A4A6A2C1			NOT ASSIGNED		
A4A6A2C2	0160-2055	19	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C3			NOT ASSIGNED		
A4A6A2C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C5			NOT ASSIGNED		
A4A6A2C6			NOT ASSIGNED		
A4A6A2C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C14	0140-0196	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	28480	0140-0196
A4A6A2C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C18	0160-4084	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A6A2C19	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A6A2C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C21	0160-2207	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A4A6A2C22	0140-0193	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A4A6A2C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C25			NOT ASSIGNED		
A4A6A2C26			NOT ASSIGNED		
A4A6A2C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6A2C30	0140-0210		CAPACITOR-FXD 270PF +-5% 300VDC MICA	28480	0140-0210
A4A6A2CR1	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A6A2CR2			NOT ASSIGNED		
A4A6A2CR3	1901-0047	2	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A6A2CR4			NOT ASSIGNED		
A4A6A2CR5	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A6A2E1	9170-0029	4	CORE-SHIELDING BEAD	28480	9170-0029
A4A6A2E2	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A2E3	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A2E4	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
A4A6A2L1	9140-0111	1	COIL-MLD 3.3UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0111
A4A6A2L2			NOT ASSIGNED		
A4A6A2L3			NOT ASSIGNED		
A4A6A2L4	9140-0112	3	COIL-MLD 4.7UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0112
A4A6A2L5	9100-1625	1	COIL-MLD 33UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1625
A4A6A2L6			NOT ASSIGNED		
A4A6A2L7			NOT ASSIGNED		
A4A6A2L8	9140-0112		COIL-MLD 4.7UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0112
A4A6A2L9	9140-0112		COIL-MLD 4.7UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0112
A4A6A2L10	9140-0114	1	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A4A6A2L11	9100-1611	1	COIL-MLD 220UH 20% Q=50 .155DX.375LG-NOM	28480	9100-1611
A4A6A2L12	9100-2232	1	COIL-MLD 560NH 10% Q=50 .156DX.375LG-NOM	28480	9100-2232
A4A6A2Q1	1854-0019	4	TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A2Q2	1853-0034	2	TRANSISTOR-PNP SI TO-18 PD=360MW	28480	1853-0034
A4A6A2Q3	1854-0019		TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A2Q4	1854-0345	1	TRANSISTOR-NPN SI TO-72 PD=200MW	0203G	2N5179
A4A6A2Q5	1854-0019		TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A2Q6	1854-0019		TRANSISTOR-NPN SI TO-18 PD=360MW	28480	1854-0019
A4A6A2Q7	1853-0007	1	TRANSISTOR-PNP SI TO-18 PD=360MW	0203G	2N3251
A4A6A2Q8	1853-0034		TRANSISTOR-PNP SI TO-18 PD=360MW	28480	1853-0034
A4A6A2R1- A4A6A2R3			NOT ASSIGNED		
A4A6A2R4	0698-0083	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A4A6A2R5- A4A6A2R10			NOT ASSIGNED		
A4A6A2R11	0757-0346	4	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A6A2R12	0757-0279	5	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A6A2R13	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A6A2R14	0757-0394	5	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A6A2R15	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4A6A2R16	0757-0442	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A2R17	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A6A2R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A2R19	0757-0418	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4A6A2R20	0698-0084	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A6A2R21			NOT ASSIGNED		

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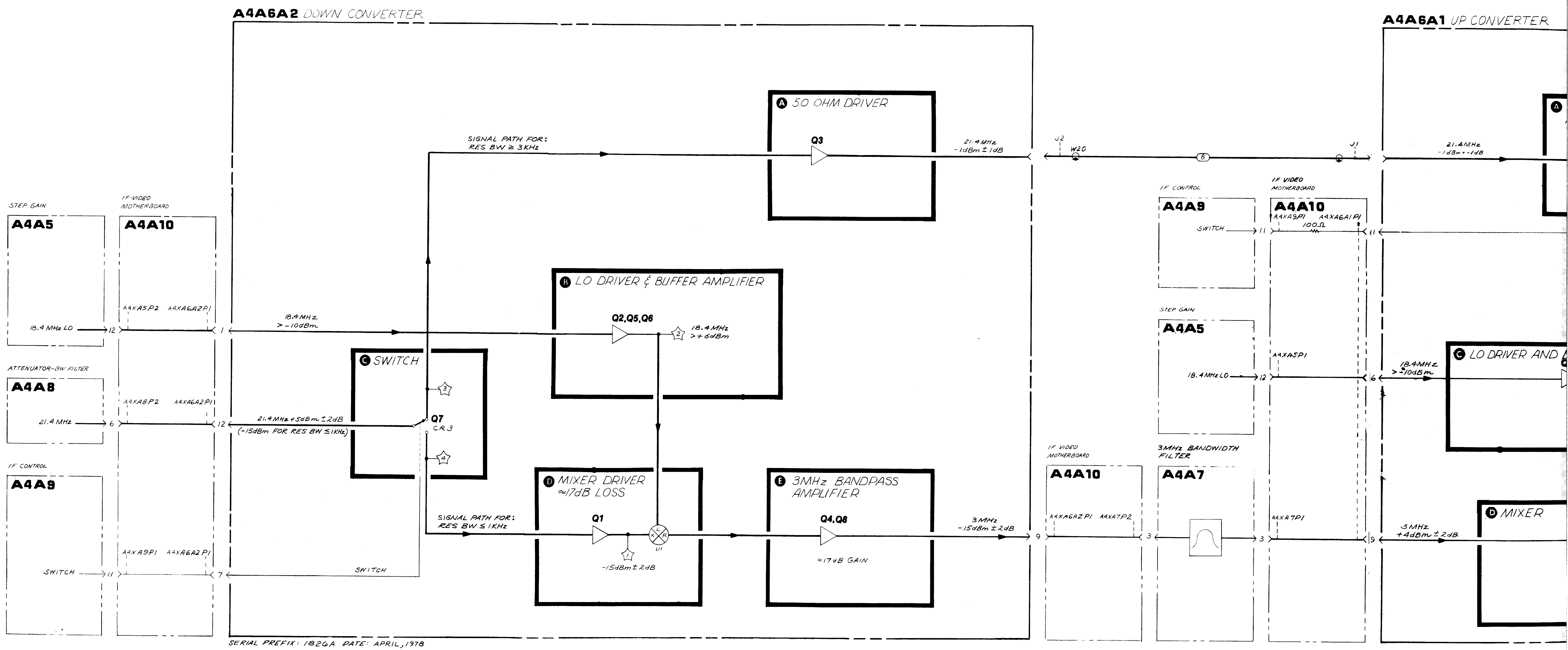
Table 8-44. A4A6 Down/Up Converter, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A6A2R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A2R23	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A6A2R24	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A6A2R25	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4A6A2R26	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A6A2R27	0698-0082	2	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A4A6A2R28	0757-0180	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4A6A2R29	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A4A6A2R30	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A6A2R31	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A6A2R32	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A4A6A2R33*	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A4A6A2R34			NOT ASSIGNED		
A4A6A2R35	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A6A2R36			NOT ASSIGNED		
A4A6A2R37			NOT ASSIGNED		
A4A6A2R38	0757-0438	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4A6A2R39	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4A6A2R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4A6A2R41	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4A6A2R42	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4A6A2R43- A4A6A2R49			NOT ASSIGNED		
A4A6A2R50	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4A6A2R51			NOT ASSIGNED		
A4A6A2R52	0757-0280	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4A6A2T1	85662-80001	1	COIL ASSEMBLY, TRANSFORMER	28480	85662-80001
A4A6A2U1	0955-0084	1	MIXER, DOUBLE-BALANCED, 200MW	28480	0955-0084
A4A6A2VR1	1902-0049	1	DIODE, ZNR 6.19V 5% DO-7 PD=.4W	0223G	FZ7240
			A4A6A2 MISCELLANEOUS PARTS		
	6960-0016		PLUG-HOLE .125" DIA	28480	6960-0016



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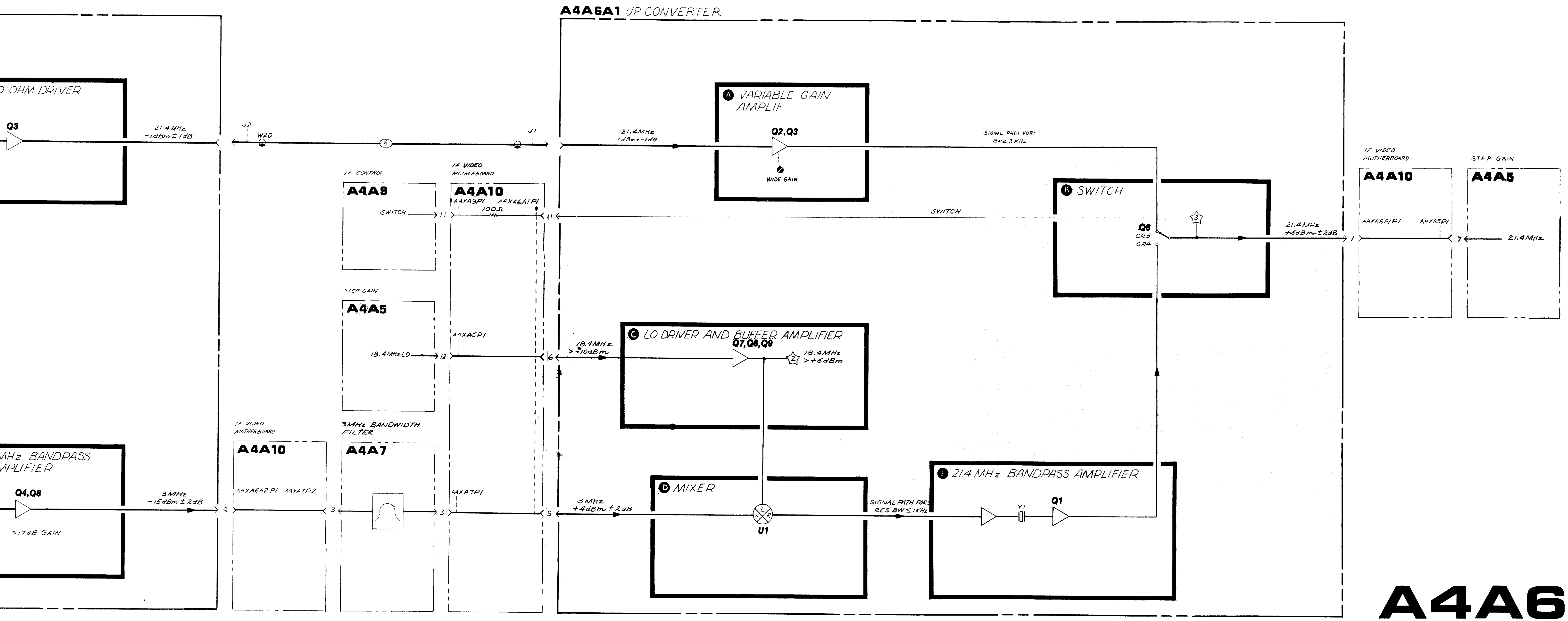


Figure 8-135. A4A6A2 Down Converter and A4A6A1 Up Converter, Block Diagram

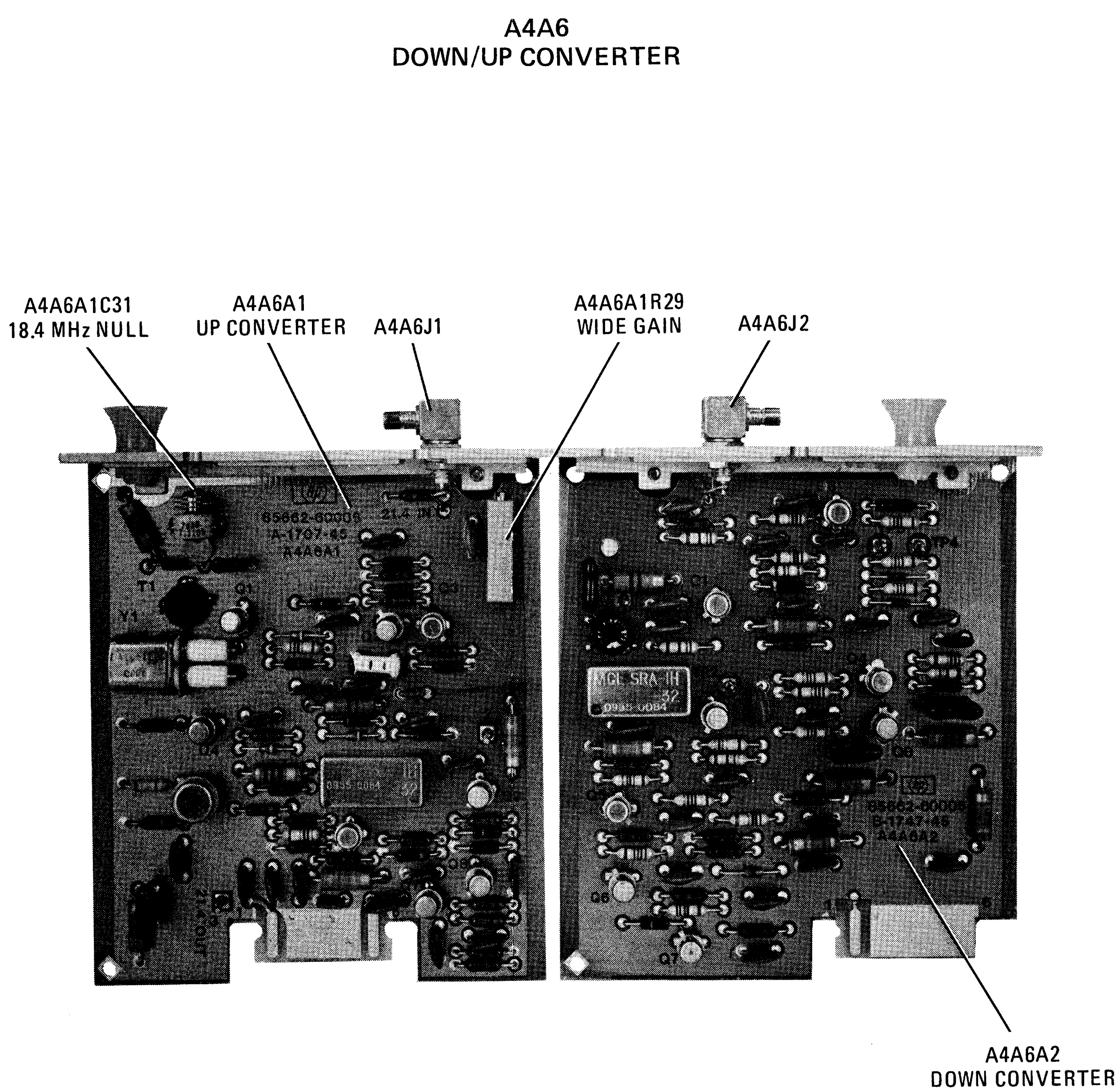


Figure 8-136. A4A6 Down/Up Converter, Assembly and Component Locations

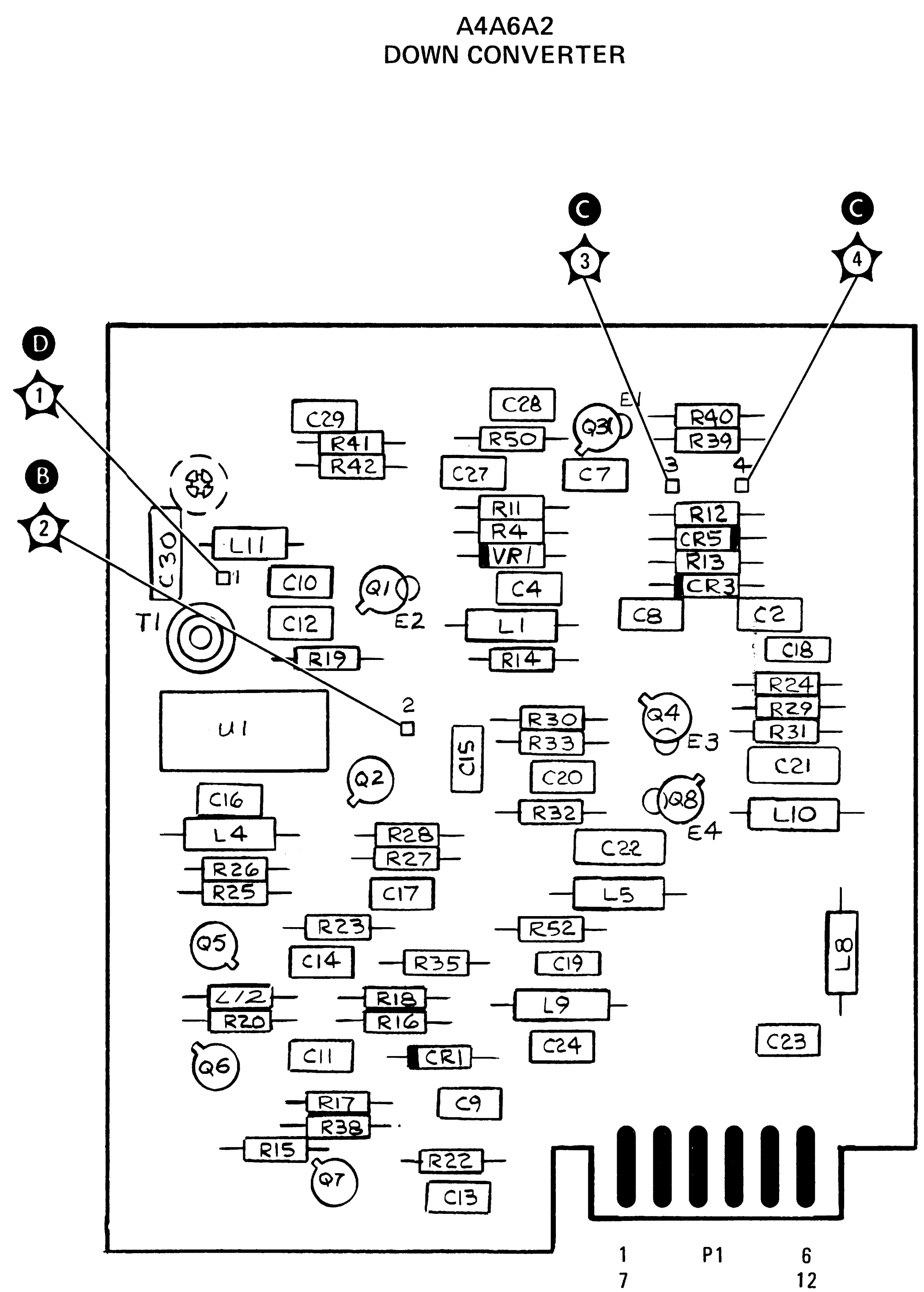


Figure 8-137. A4A6A2 Down Converter, Component Locations

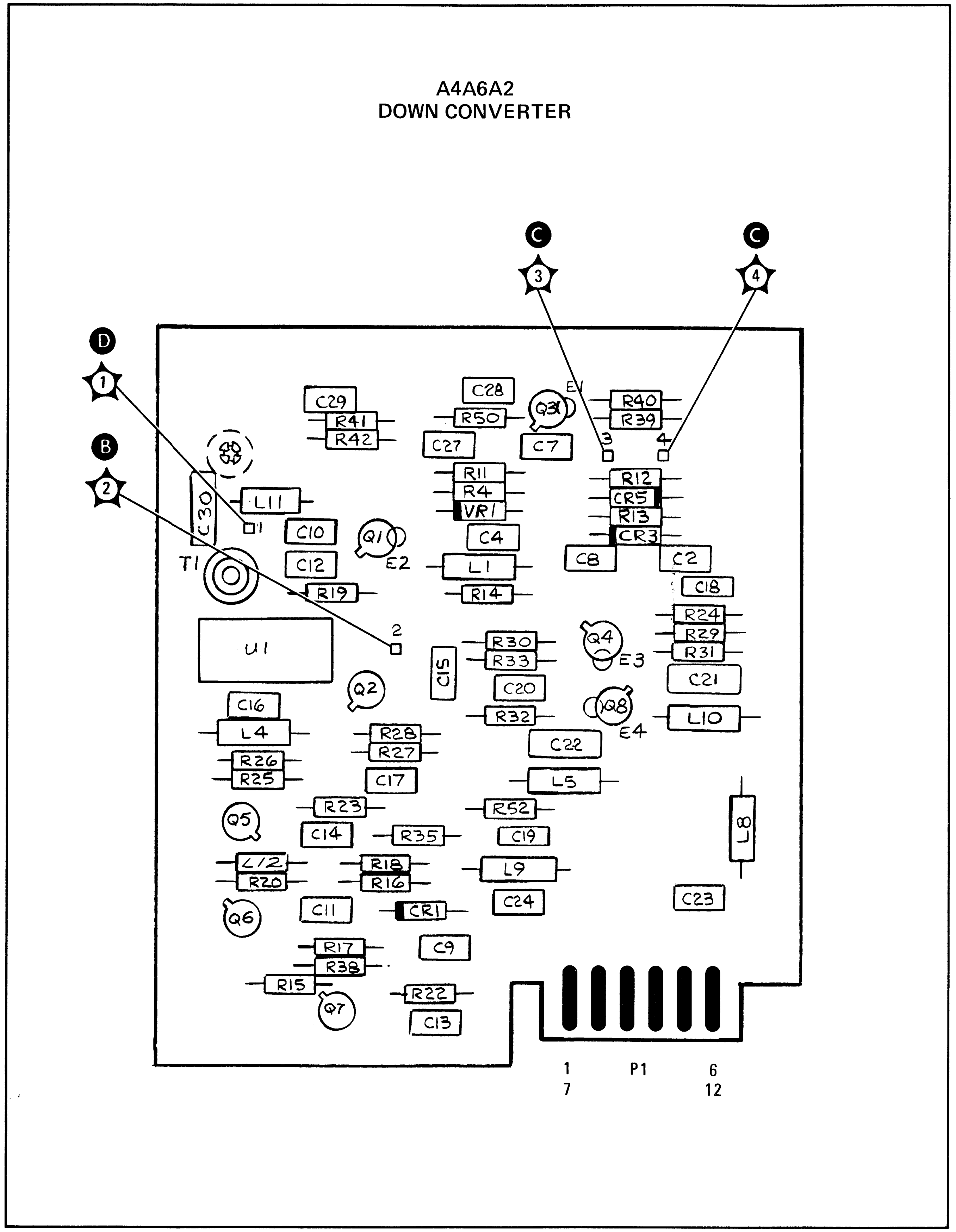


Figure 8-137. A4A6A2 Down Converter, Component Locations

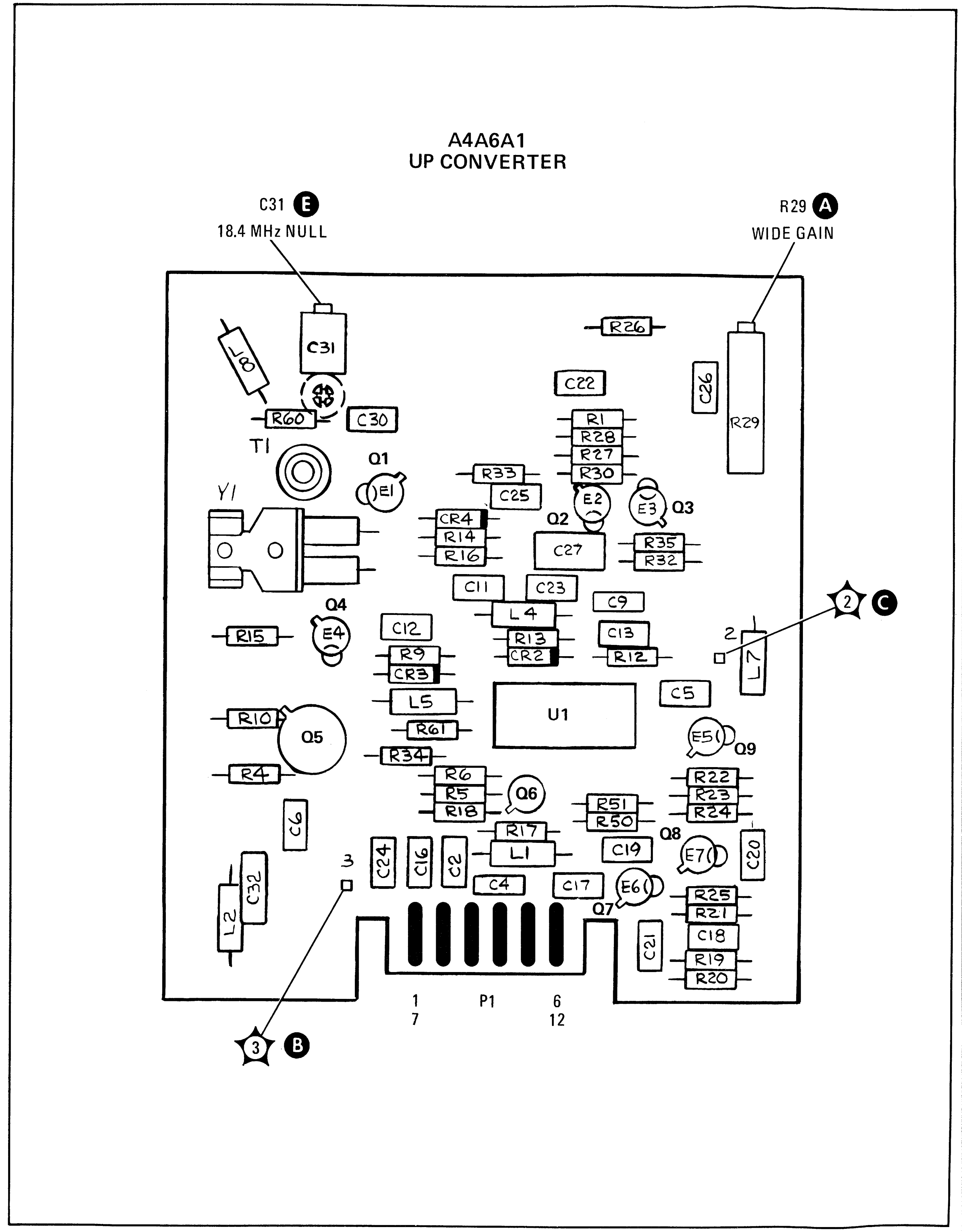
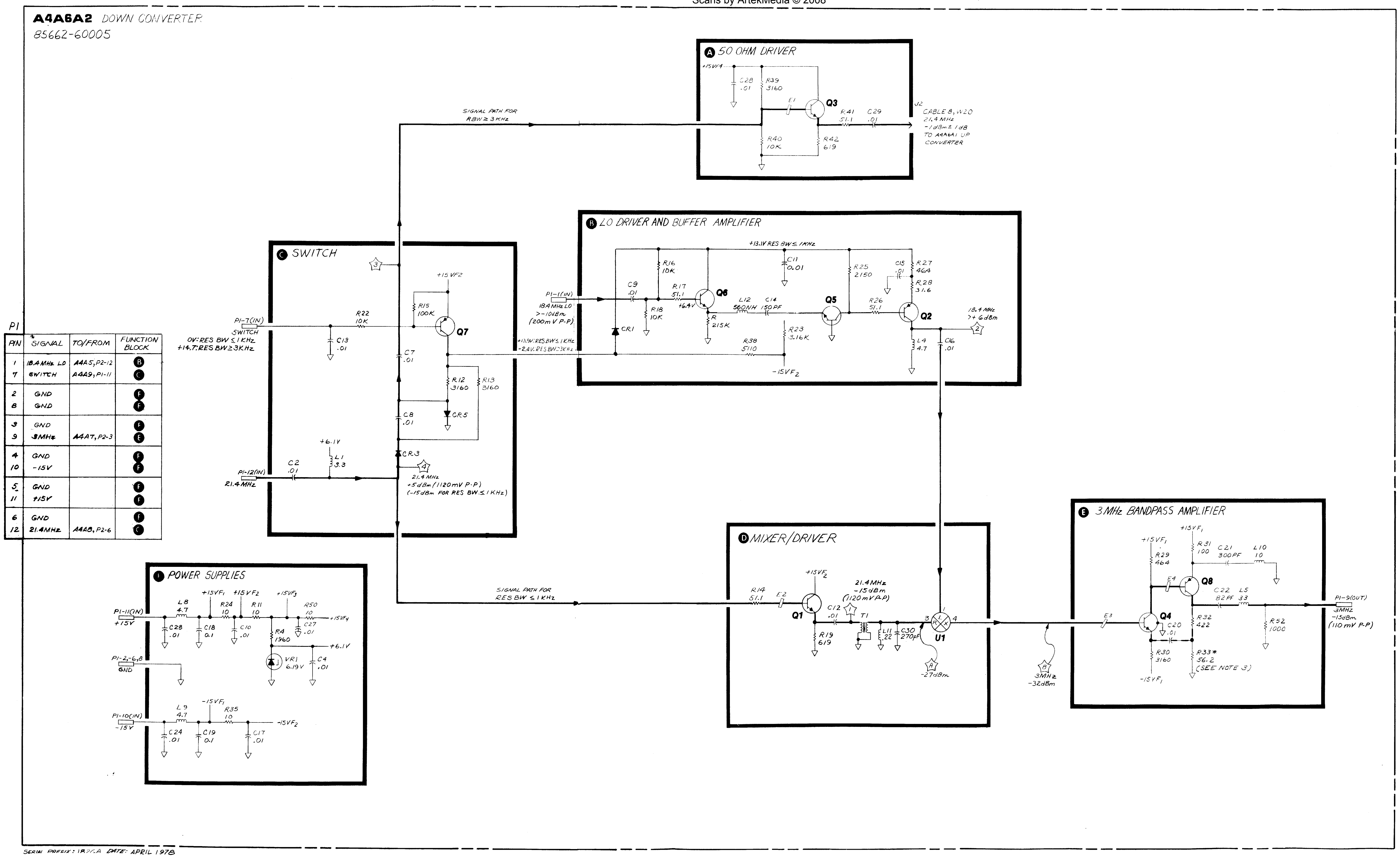
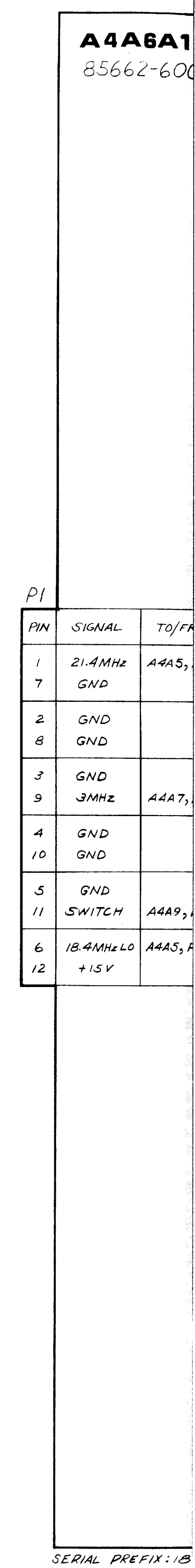
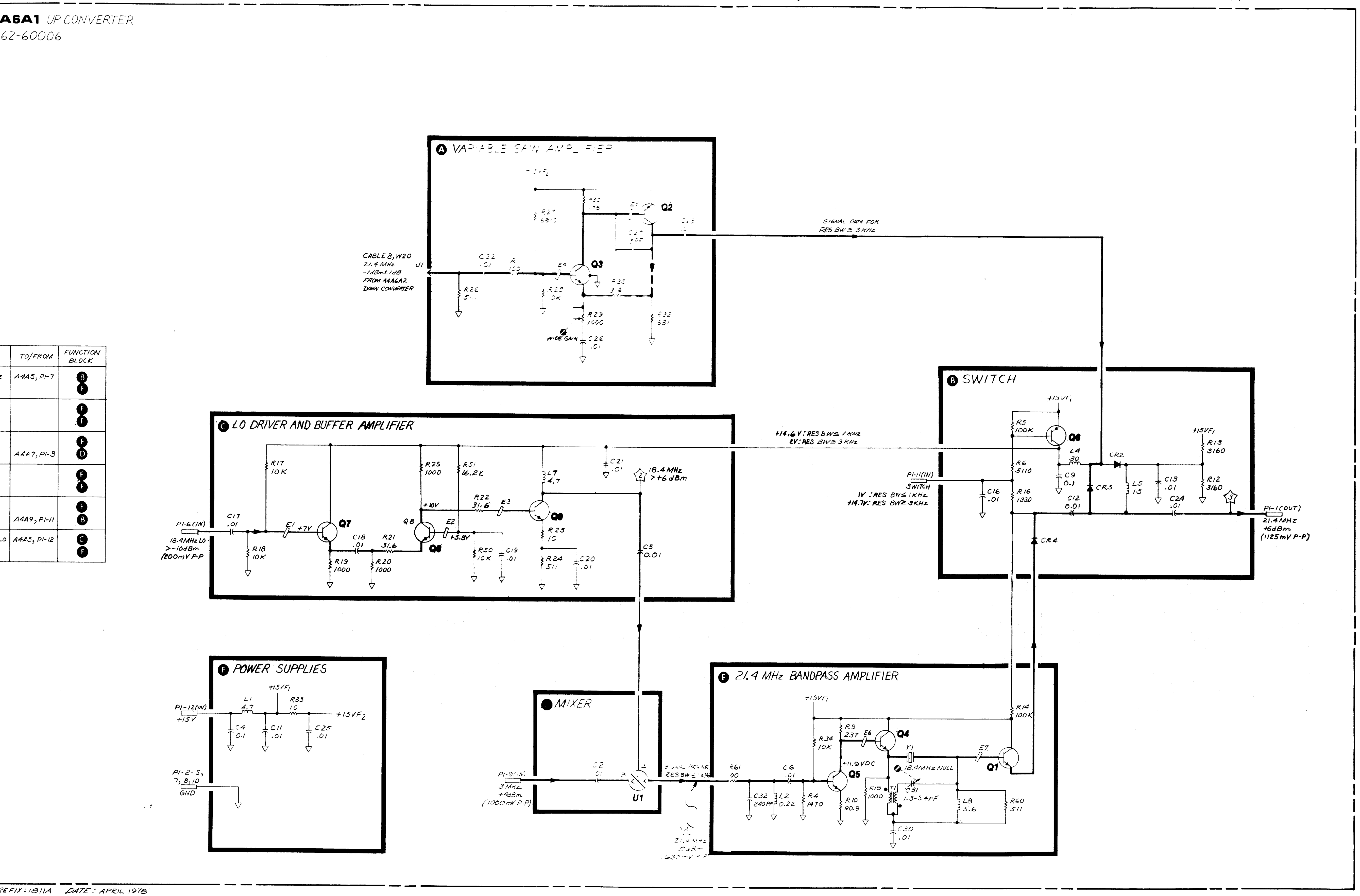


Figure 8-138. A4A6A1 Up Converter, Component Locations

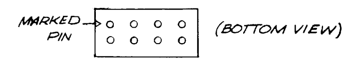

A4A6A2 DOWN CONVERTER
85662-60005
A 50 OHM DRIVER
B LO DRIVER AND BUFFER AMPLIFIER
C SWITCH
D MIXER/DRIVER
E 3MHz BANDPASS AMPLIFIER
F POWER SUPPLIES
SIGNAL PATH FOR RBW ≥ 3KHz
SIGNAL PATH FOR RES BW ≤ 1KHz
CABLE 8, W20 21.4 MHz -1dBm ± 1dB TO A4A6A1 UP CONVERTER
P1-7(IN) SWITCH
0V: RES BW ≤ 1KHz
+14.7: RES BW ≥ 3KHz
P1-1(IN) 18.4MHz LO >-10dBm (200mV P-P)
P1-12(IN) 21.4MHz
21.4 MHz +5dBm (1120mV P-P) (-15dBm FOR RES BW ≤ 1KHz)
18.4 MHz >+6dBm
21.4MHz -15dBm (1120mV P-P)
-27dBm
3MHz -32dBm
P1-9(OUT) 3MHz -15dBm (110mV P-P)
R33* 56.2 (SEE NOTE 3)
P1-11(IN) +15V
P1-2-6,8 GND
P1-10(IN) -15V
P1
PIN | SIGNAL | TO/FROM | FUNCTION BLOCK
1 | 18.4MHz LO | A4A5, P2-12 | B
7 | SWITCH | A4A9, P1-11 | C
2 | GND | | F
8 | GND | | F
3 | GND | | F
9 | 3MHz | A4A7, P2-3 | E
4 | GND | | F
10 | -15V | | F
5 | GND | | F
11 | +15V | | F
6 | GND | | F
12 | 21.4MHz | A4A8, P2-6 | C
SERIAL PREFIX: 1820A DATE: APRIL 1978


A4A6A1
P1
PIN | SIGNAL
1 | 21.4MHz
7 | GND
2 | GND
8 | GND
3 | GND
9 | 3MHz
4 | GND
10 | GND
5 | GND
11 | SWITCH
6 | 18.4MHz LO
12 | +15V



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. ASTERICK (*) INDICATES FACTORY SELECTED COMPONENT; TYPICAL VALUE IS SHOWN. REFER TO SECTION V FOR RANGE OF VALUES.
4. UNLESS OTHERWISE NOTED INSTRUMENT SETTINGS ARE AS FOLLOWS:
   INSTRUMENT PRESET-
   CENTER FREQUENCY ... 20MHz
   FREQUENCY SPAN 0Hz
   ATTENUATION 0dB
5. ALL MEASUREMENTS ARE WITH BOARDS ON EXTENDERS. POWER LEVELS MAY VARY ±2dB UNLESS OTHERWISE INDICATED. RF VOLTAGES MAY VARY ±25%.
6. A4A6A1 U1 AND A4A6A2U1 PIN CONFIGURATION



A4A6

Figure 8-139. A4A6A2 Down Converter and A4A6A1 Up Converter, Schematic Diagram

A4A7 3 MHz BANDWIDTH FILTER, CIRCUIT DESCRIPTION

A4A7 3 MHz Filter is a variable bandwidth filter centered at 3 MHz. The bandwidths are controlled from 10 Hz to 300 Hz in a 1, 3, 10 sequence by lines that have the same name as the bandwidth they activate. When none of the lines is activated, the filter has a 1 kHz bandwidth.

The filter has five poles which are almost identical. Only one is described in detail. Each pole has a negative output impedance to compensate for the series resistance of the crystal, but it is adjustable in only two poles.

4th Pole D

The basis of the buffer amplifier is a complementary feedback pair including Q9 and Q10 (see Figure 8-140).

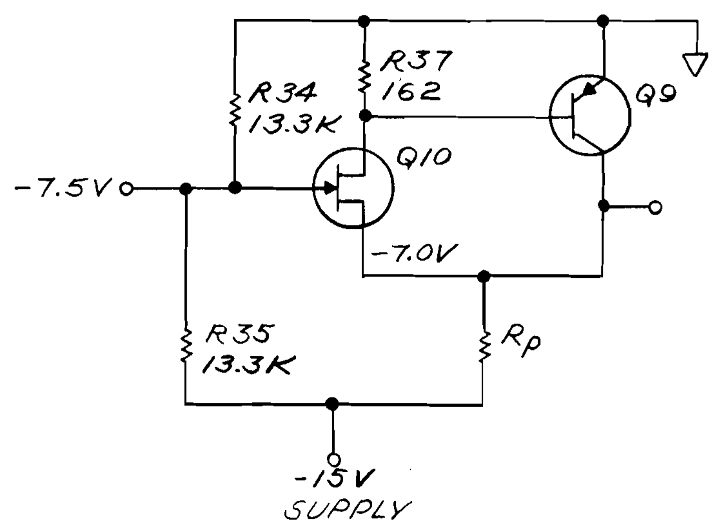


Figure 8-140. Complementary Feedback Pair, Simplified Schematic

The bias current through Q10 is $\frac{0.7\text{V}}{162\Omega} \cong 4$ mA, and the total current through Q10 plus Q9 is set by Rp to be about 20 mA. The source voltage of Q10 should always be higher than the gate voltage.

The circuit as shown in Figure 8-140 has no gain. R39, R36, and C26 are added (see schematic) so this stage has a gain of:

$$G = 1 + \frac{R38}{R36} \cong 1 \text{ dB}$$

R_P is replaced by a 20 mA current sink (see Figure 8-141).

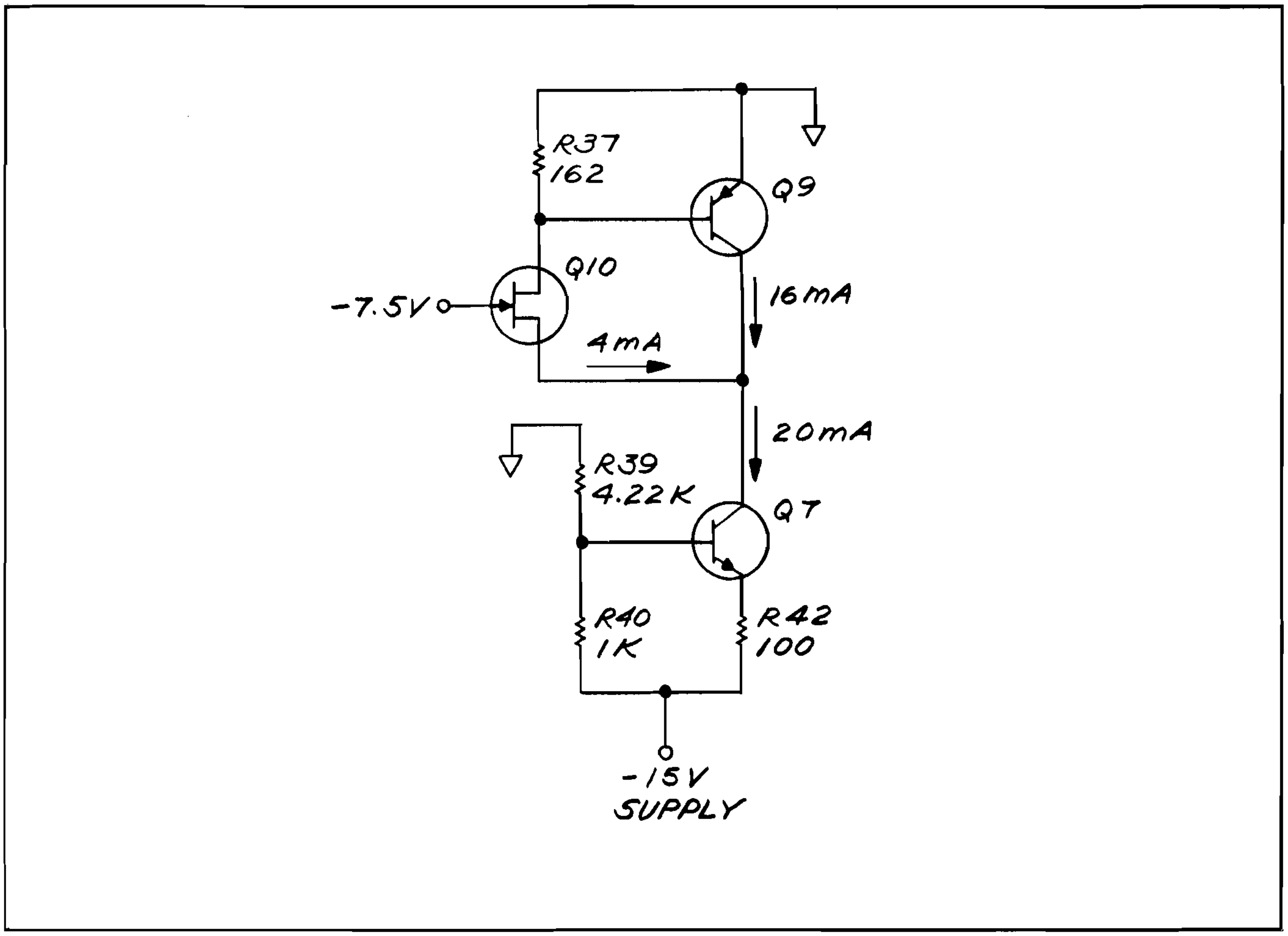


Figure 8-141: Complementary Pair with Current Sink

The description to this point is sufficient to understand how the circuit is biased. The 3 MHz operation is described in the following paragraphs.

Potentiometer R41 is added and the signal from the collector of Q9 is fed into the base of Q7 by C28 (see Figure 8-142.

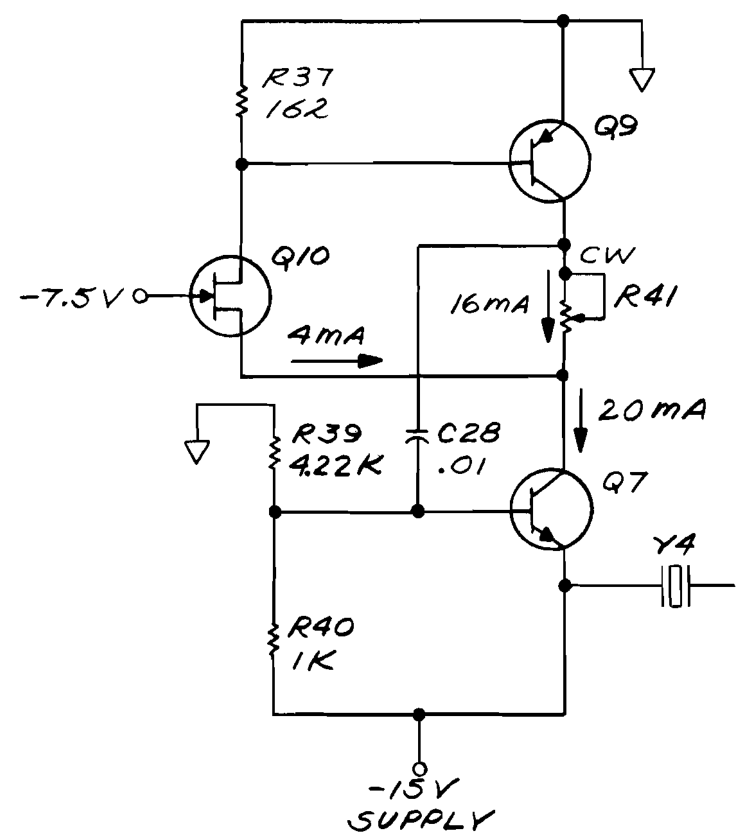


Figure 8-142. Buffer Amplifier with Negative Output Impedance

The circuit still operates the same because there is no load on the emitter of Q7 and hence no collector current. (Remember, this is 3 MHz AC operation.) If a load (Y4) is added to the emitter of Q7, collector current is developed and this current is fed back into the complementary pair Q9, Q10. The sense of this current is such that the feedback is positive. The more load – the more positive feedback is developed. The more positive feedback – the more gain the amplifier has. This implies negative output impedance. The magnitude of the negative output impedance is the reistance to which R41 is set.

Now the circuit can be completed.

Q8 and the SYM cap (Figure 8-143) are added to cancel the effect of the case (parallel) capacitance of the crystal. R94, R96 and other resistors are switched in to change bandwidths. C31 and C62 (not shown) are in series with the crystal to tune the center frequency to precisely 3 MHz. The negative output impedances of the amplifier is set to compensate for the series resistance of the crystal so that as different bandwidths are selected, the amplitude (overall gain) does not change. If the relative gain of the filter assembly is too low in the 10 Hz BW, and cannot be corrected by R41 and R30, three common problems are:

- All five crystals are not tuned close enough to the same center frequency.
- The series resistance of one or more of the crystals is too high.
- The output impedance of one or more of the buffer amplifiers is not negative enough.

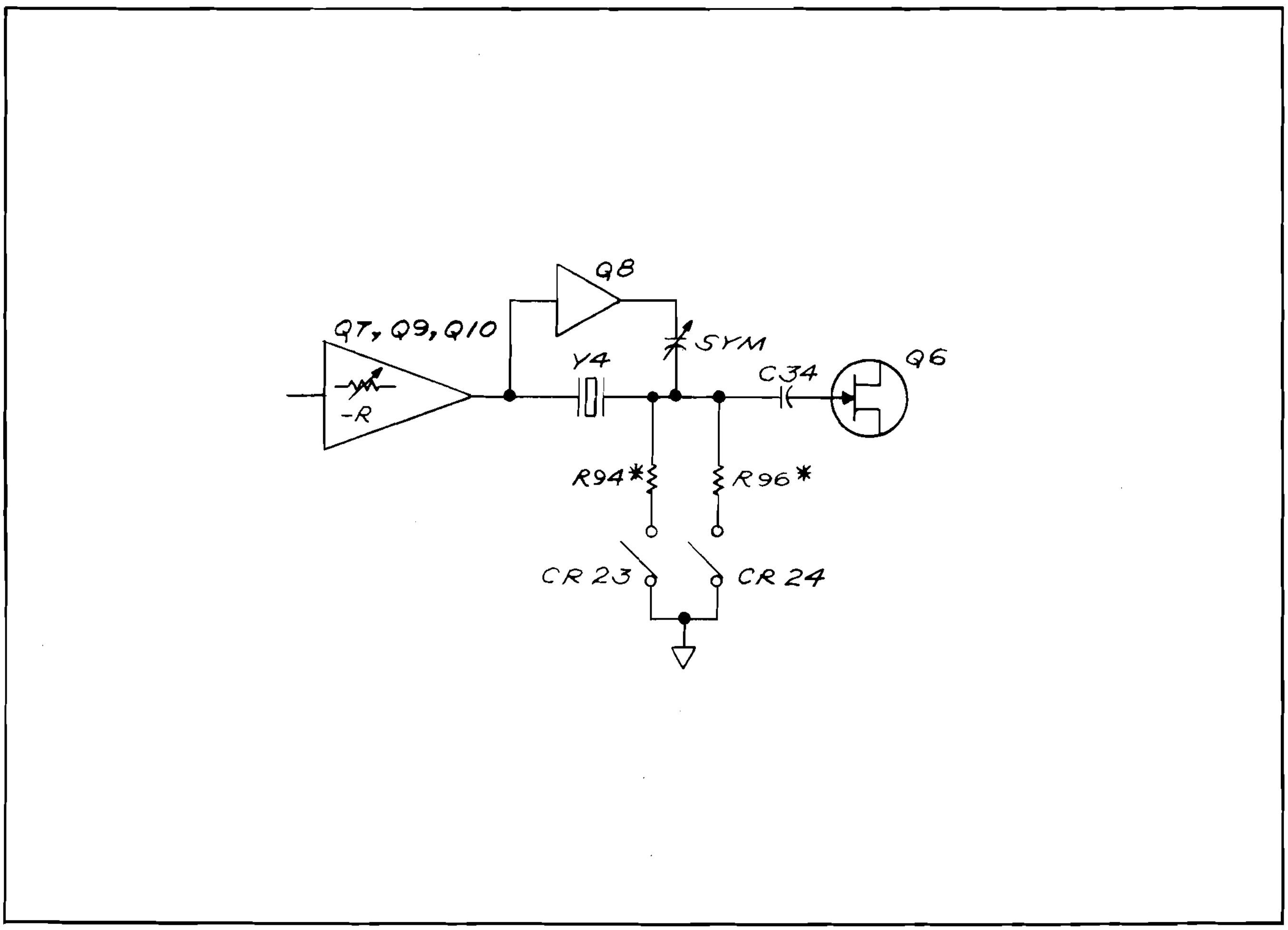


Figure 8-143. Fourth Pole, Equivalent Circuit

Table 8-45. A4A7 MHz Bandwidth Filter, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A7	85662-60004	1	BOARD ASSEMBLY, 3 MHZ BANDWIDTH FILTER	28480	85662-60004
A4A7C1	0160-2055	37	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C2	0160-2261	1	CAPACITOR-FXD 15PF +-5% 500VDC CER0+-30	28480	0160-2261
A4A7C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C4	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C5*	0160-4611	5	CAPACITOR-FXD 68 PF 300VDC	28480	0160-4611
A4A7C6	0121-0444	5	CAPACITOR-V TRMR-CER 3-9PF 160V PC-MTG	0146H	78-TRIKO-19 3-9 PF, N075
A4A7C7	0121-0105	5	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	73899	DV11PR35D
A4A7C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C11	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C12*	0160-4611		CAPACITOR-FXD 68 PF 300VDC	28480	0160-4611
A4A7C13	0121-0493	4	CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A4A7C14	0121-0444		CAPACITOR-V TRMR-CER 3-9PF 160V PC-MTG	0146H	78-TRIKO-19 3-9 PF, N075
A4A7C15	0121-0105		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	73899	DV11PR35D
A4A7C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C18	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C19	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C21*	0160-4611		CAPACITOR-FXD 68 PF 300VDC	28480	0160-4611
A4A7C22	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A4A7C23	0121-0444		CAPACITOR-V TRMR-CER 3-9PF 160V PC-MTG	0146H	78-TRIKO-19 3-9 PF, N075
A4A7C24	0121-0105		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	73899	DV11PR35D
A4A7C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C27	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C29	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C30*	0160-4611		CAPACITOR-FXD 68 PF 300VDC	28480	0160-4611
A4A7C31	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A4A7C32	0121-0444		CAPACITOR-V TRMR-CER 3-9PF 160V PC-MTG	0146H	78-TRIKO-19 3-9 PF, N075
A4A7C33	0121-0105		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	73899	DV11PR35D
A4A7C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C36	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C38	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7C39*	0160-4611		CAPACITOR-FXD 68 PF 300VDC	28480	0160-4611
A4A7C40	0121-0493		CAPACITOR-V AIR DIEL 1.7-11PF 250V	74970	187-0306-105
A4A7C41	0121-0444		CAPACITOR-V TRMR-CER 3-9PF 160V PC-MTG	0146H	78-TRIKO-19 3-9 PF, N075
A4A7C42	0121-0105		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	73899	DV11PR35D
A4A7C43	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C44	0160-2244	2	CAPACITOR-FXD 3PF +-.25PF 500VDC	28480	0160-2244
A4A7C45	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C46	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C47	0160-2244		CAPACITOR-FXD 3PF +-.25PF 500VDC	28480	0160-2244
A4A7C48	0160-4300	14	CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C49	0180-0197	6	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	0420J	150D225X9020A2
A4A7C50	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	0420J	150D225X9020A2
A4A7C51	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	0420J	150D225X9020A2
A4A7C52	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	0420J	150D225X9020A2
A4A7C53	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	0420J	150D225X9020A2
A4A7C54	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	0420J	150D225X9020A2
A4A7C55	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C56	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C57	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C58	0160-4297	5	CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A7C59	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C60	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C61	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C62	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C63	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C64	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A7C65	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C66	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C67	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C68	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C69	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C70	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH

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Table 8-45. A4A7 MHz Bandwidth Filter, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A7C71	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C72	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C73	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C74	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C75	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C76	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A7C77	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C78	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C79	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C80	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C81	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C82	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z822-CDH
A4A7C83	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C84	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A7C85	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C86	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C87	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C88	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C89	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C90	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C91	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C92	0160-4300		CAPACITOR-FXD .047UF +80-20% 100VDC CER	0420J	C023F101L473Z822-CDH
A4A7C93*	0160-2250	9	CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A4A7CR1- A4A7CR30	1901-0040	30	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A7E1- A4A7E17	9170-0029	17	CORE-SHIELDING BEAD	01880	56-590-65A2/4A
A4A7L1	9100-1643	6	COIL-MLD 300UH 5% Q=65 .19DX.44LG	0327C	19/303
A4A7L2	9100-1648	5	COIL-MLD 560UH 5% Q=65 .19DX.44LG	0217B	19-1331-29J
A4A7L3	9100-1629	5	COIL-MLD 47UH 5% Q=55 .155DX.375LG	0217B	15-1315-4J
A4A7L4	9100-1643		COIL-MLD 300UH 5% Q=65 .19DX.44LG	0327C	19/303
A4A7L5	9100-1648		COIL-MLD 560UH 5% Q=65 .19DX.44LG	0217B	19-1331-29J
A4A7L6	9100-1629		COIL-MLD 47UH 5% Q=55 .155DX.375LG	0217B	15-1315-4J
A4A7L7	9100-1643		COIL-MLD 300UH 5% Q=65 .19DX.44LG	0327C	19/303
A4A7L8	9100-1648		COIL-MLD 560UH 5% Q=65 .19DX.44LG	0217B	19-1331-29J
A4A7L9	9100-1629		COIL-MLD 47UH 5% Q=55 .155DX.375LG	0217B	15-1315-4J
A4A7L10	9100-1643		COIL-MLD 300UH 5% Q=65 .19DX.44LG	0327C	19/303
A4A7L11	9100-1648		COIL-MLD 560UH 5% Q=65 .19DX.44LG	0217B	19-1331-29J
A4A7L12	9100-1629		COIL-MLD 47UH 5% Q=55 .155DX.375LG	0217B	15-1315-4J
A4A7L13	9100-1643		COIL-MLD 300UH 5% Q=65 .19DX.44LG	0327C	19/303
A4A7L14	9100-1648		COIL-MLD 560UH 5% Q=65 .19DX.44LG	0217B	19-1331-29J
A4A7L15	9100-1629		COIL-MLD 47UH 5% Q=55 .155DX.375LG	0217B	15-1315-4J
A4A7L16	9100-1643		COIL-MLD 300UH 5% Q=65 .19DX.44LG	0327C	19/303
A4A7L17	9140-0114	6	COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A7L18	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A7L19	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A7L20	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A7L21	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A7L22	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A7Q1	1853-0034	6	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4A7Q2	1855-0081	5	TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	0169H	2N5245
A4A7Q3	1854-0404	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A7Q4	1854-0023	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4A7Q5	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4A7Q6	1855-0081		TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	0169H	2N5245
A4A7Q7	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A7Q8	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4A7Q9	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4A7Q10	1855-0081		TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	0169H	2N5245
A4A7Q11	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A7Q12	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4A7Q13	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4A7Q14	1855-0081		TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	0169H	2N5245
A4A7Q15	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A7Q16	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4A7Q17	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4A7Q18	1855-0081		TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	0169H	2N5245
A4A7Q19	1854-0023		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4A7Q20	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A7Q21	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4A7Q22	1854-0345	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	0203G	2N5179
A4A7R1	0757-0441	1	RESISTOR 8.25K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-8251-F
A4A7R2	0757-0442	1	RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A7R3	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	0329B	C4-1/8-T0-10R0-F
A4A7R4	0757-0401	9	RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A7R5	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F

Table 8-45. A4A7 MHz Bandwidth Filter, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A7R6	0698-3154	5	RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A7R7	0757-0280	5	RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A7R8	0757-0379	3	RESISTOR 12.1 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-12R1-F
A4A7R9	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-68R1-F
A4A7R10	0698-3447	6	RESISTOR 422 1% .125W F TC=0+-100	0329B	C4-1/8-T0-422R-F
A4A7R11	0757-0420	5	RESISTOR 750 1% .125W F TC=0+-100	0329B	C4-1/8-T0-751-F
A4A7R12*	0757-0444	4	RESISTOR 12.1K 1% .125W F TC=0+-100	0299E	MF 4C1/8-TO-1212-F
A4A7R13*	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	0299E	MF 4C1/8-TO-1212-F
A4A7R14	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A7R15	0757-0405	5	RESISTOR 162 1% .125W F TC=0+-100	0329B	C4-1/8-T0-162R-F
A4A7R16	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F
A4A7R17	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A7R18	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A7R19	0757-0379		RESISTOR 12.1 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-12R1-F
A4A7R20	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A7R21	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	0329B	C4-1/8-T0-422R-F
A4A7R22	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	0329B	C4-1/8-T0-751-F
A4A7R23*	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	0299E	MF 4C1/8-TO-1212-F
A4A7R24*	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	0299E	MF 4C1/8-TO-1212-F
A4A7R25	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R26	0757-0405		RESISTOR 162 1% .125W F TC=0+-100	0329B	C4-1/8-T0-162R-F
A4A7R27	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F
A4A7R28	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A7R29	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A7R30	2100-3426		RESISTOR TRMR 20 10% C SIDE-ADJ 1-TRN	04568	72-1380
A4A7R31	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-TO-10
A4A7R32	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	0329B	C4-1/8-T0-422R-F
A4A7R33	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	0329B	C4-1/8-T0-751-F
A4A7R34*	0757-0289	6	RESISTOR 13.3K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-1332-F
A4A7R35*	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-1332-F
A4A7R36	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R37	0757-0405		RESISTOR 162 1% .125W F TC=0+-100	0329B	C4-1/8-T0-162R-F
A4A7R38	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F
A4A7R39	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A7R40	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A7R41	2100-3426		RESISTOR TRMR 20 10% C SIDE-ADJ 1-TRN	04568	72-138-0
A4A7R42	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-TO-101-F
A4A7R43	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	0329B	C4-1/8-T0-422R-F
A4A7R44	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	0329B	C4-1/8-T0-751-F
A4A7R45*	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-1332-F
A4A7R46*	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-1332-F
A4A7R47	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R48	0757-0405		RESISTOR 162 1% .125W F TC=0+-100	0329B	C4-1/8-T0-162R-F
A4A7R49	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F
A4A7R50	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A7R51	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A7R52	0757-0379		RESISTOR 12.1 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-12R1-F
A4A7R53	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A7R54	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	0329B	C4-1/8-T0-422R-F
A4A7R55	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	0329B	C4-1/8-T0-751-F
A4A7R56*	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-1332-F
A4A7R57*	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-1332-F
A4A7R58	0757-0405		RESISTOR 162 1% .125W F TC=0+-100	0329B	C4-1/8-T0-162R-F
A4A7R59	0698-3438	1	RESISTOR 147 1% .125W F TC=0+-100	0329B	C4-1/8-T0-147R-F
A4A7R60*	0757-0276	1	RESISTOR 61.9 1% .125W F TC=0+-100	0329B	C4-1/8-TO-61R9-F
A4A7R61	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	0329B	C4-1/8-T0-422R-F
A4A7R62	0698-3435	1	RESISTOR 38.3 1% .125W F TC=0+-100	0329B	C4-1/8-T0-38R3-F
A4A7R63	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A7R64	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A7R65	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A7R66*	0757-0394	11	RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F
A4A7R67	0698-3443	5	RESISTOR 287 1% .125W F TC=0+-100	0329B	C4-1/8-T0-287R-F
A4A7R68*	0698-3437	5	RESISTOR 133 1% .125W F TC=0+-100	0329B	C4-1/8-T0-133R-F
A4A7R69	0698-0082	5	RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A7R70*	0757-0416	18	RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R71	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R72*	0698-0083	5	RESISTOR 1.96K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1961-F
A4A7R73	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R74*	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F
A4A7R75	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	0329B	C4-1/8-T0-287R-F
A4A7R76*	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	0329B	C4-1/8-T0-133R-F
A4A7R77	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A7R78*	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R79	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R80*	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1961-F
A4A7R81	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A7R82*	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	0329B	C4-1/8-T0-51R1-F

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Table 8-45. A4A7 MHz Bandwidth Filter, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A7R83	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	03298	C4-1/8-T0-287R-F
A4A7R84*	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	03298	C4-1/8-T0-133R-F
A4A7R85	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	03298	C4-1/8-T0-4640-F
A4A7R86*	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R87	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R88*	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1961-F
A4A7R89	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R90*	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	03298	C4-1/8-T0-51R1-F
A4A7R91	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	03298	C4-1/8-T0-287R-F
A4A7R92*	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	03298	C4-1/8-T0-133R-F
A4A7R93	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	03298	C4-1/8-T0-4640-F
A4A7R94*	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R95	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R96*	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1961-F
A4A7R97	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R98*	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	03298	C4-1/8-T0-51R1-F
A4A7R99	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	03298	C4-1/8-T0-287R-F
A4A7R100*	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	03298	C4-1/8-T0-133R-F
A4A7R101	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	03298	C4-1/8-T0-4640-F
A4A7R102*	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R103	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R104*	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1961-F
A4A7R105	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03298	C4-1/8-T0-511R-F
A4A7R106	0757-0465	4	RESISTOR 100K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1003-F
A4A7R107	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1003-F
A4A7R108	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1003-F
A4A7R109	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1003-F
A4A7TP1	0360-1788	10	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP2	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP3	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP4	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP5	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP6	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP7	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP8	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP9	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7TP10	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A7Y1- A4A7Y5	0410-0404	1	CRYSTAL:QUARTZ,MATCHED SET OF FIVE	0013F	0410-0404
			A4A7 MISCELLANEOUS PARTS		
	6960-0016	1	PLUG-HOLE .125" DIA	28480	6960-0016

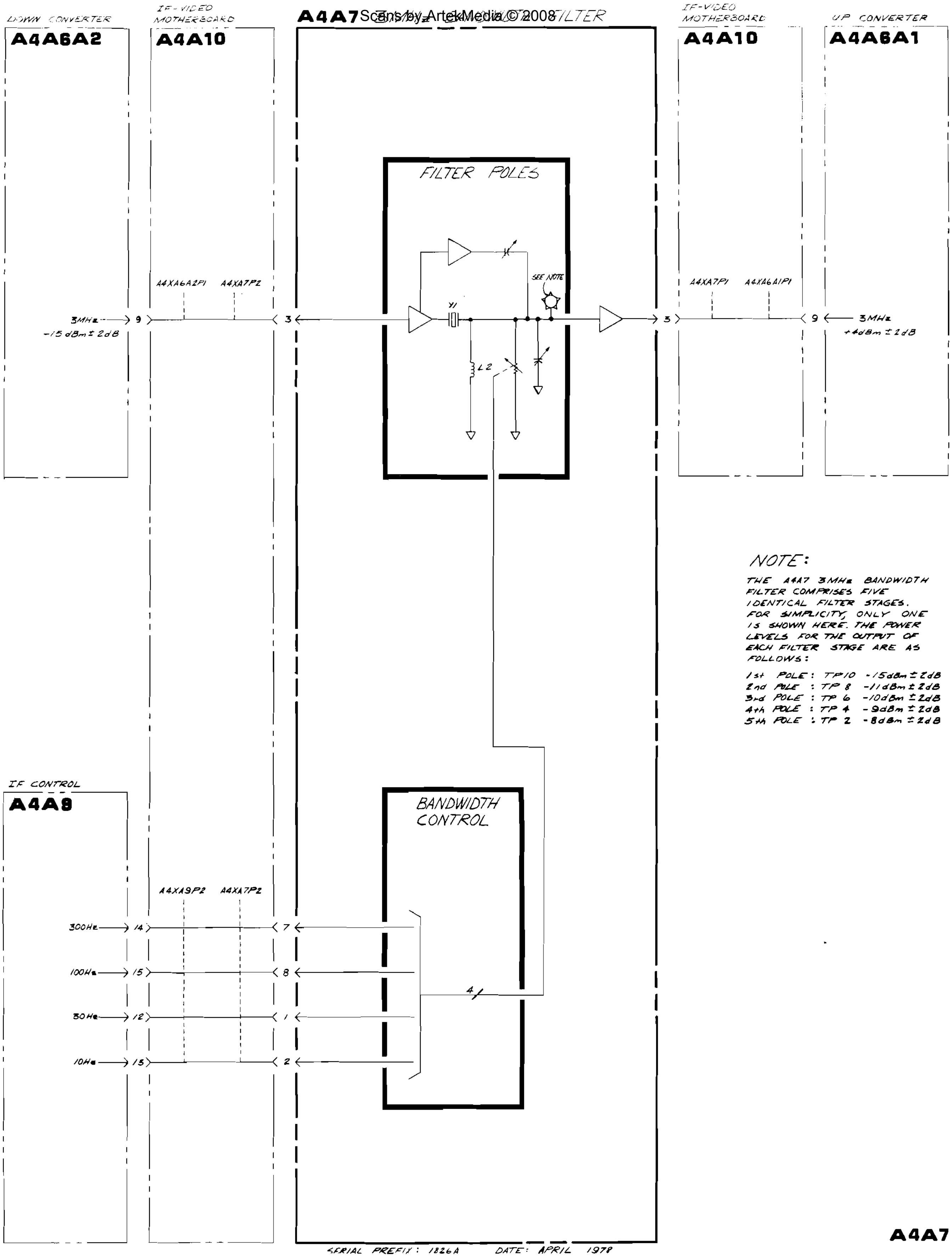

Figure 8-144. A4A7 3 MHz Bandwidth Filter, Block Diagram

Table 8-46. A4A7 3 MHz Bandwidth Filter, Component Locator Table (1 of 2)

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	B4	C51	B3	CR7	B3	L8	B3
C2	C4	C52	B2	CR8	B3	L9	C3
C3	C4	C53	B1	CR9	B3	L10	C2
C4	C4	C54	B1	CR10	B3	L11	B2
C5	C4	C55	C4	CR11	C3	L12	C2
C6	C4	C56	C4	CR12	C3	L13	C2
C7	D4	C57	B4	CR13	B3	L14	B1
C8	C3	C58	B4	CR14	B3	L15	C1
C9	B3	C59	B4	CR15	B2	L16	C1
C10	C3	C60	B3	CR16	B2	L17	B4
C11	C3	C61	C3	CR17	C2	L18	B4
C12	C3	C62	C3	CR18	C2	L19	B3
C13	D3	C63	B3	CR19	B2	L20	B2
C14	C3	C64	B3	CR20	B2	L21	B2
C15	D3	C65	B3	CR21	B2	L22	A1
C16	C3	C66	B3	CR22	B2		
C17	B3	C67	C2	CR23	C2	Q1	C1
C18	C3	C68	C2	CR24	C2	Q2	C1
C19	C2	C69	B3	CR25	B1	Q3	C1
C20	C3	C70	B2	CR26	B1	Q4	C1
C21	C2	C71	B2	CR27	B1	Q5	C1
C22	D2	C72	B2	CR28	B1	Q6	C2
C23	C2	C73	C2	CR29	C1	Q7	C2
C24	C3	C74	C2	CR30	C1	Q8	C2
C25	C2	C75	B2			Q9	C2
C26	B2	C76	B2	E1	C4	Q10	C2
C27	C2	C77	B2	E2	C4	Q11	C3
C28	C2	C78	B2	E3	C4	Q12	C3
C29	C2	C79	C1	E4	C3	Q13	C3
C30	C2	C80	C1	E5	C3	Q14	C3
C31	D2	C81	B1	E6	C3	Q15	C3
C32	C2	C82	B1	E7	C3	Q16	C3
C33	D2	C83	B1	E8	C3	Q17	C3
C34	C2	C84	B1	E9	C3	Q18	C3
C35	B1	C85	A3	E10	C2	Q19	C4
C36	C1	C86	A3	E11	C2	Q20	C4
C37	C1	C87	B3	E12	C2	Q21	C4
C38	C1	C88	B3	E13	C2	Q22	C4
C39	C1	C89	B3	E14	C1		
C40	D1	C90	B3	E15	C1	R1	C4
C41	C1	C91	B3	E16	C1	R2	B4
C42	D1	C92	B3	E17	C1	R3	B4
C43	C1	C93	C4			R4	C4
C44	C1			L1	C4	R5	C4
C45	B1	CR1	B4	L2	B4	R6	C4
C46	B1	CR2	B4	L3	C4	R7	C4
C47	C3	CR3	B4	L4	C3	R8	C4
C48	B4	CR4	B4	L5	B3	R9	B4
C49	B4	CR5	C4	L6	C3	R10	C4
C50	B3	CR6	C4	L7	C3	R11	C4

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Table 8-46. A4A7 3 MHz Bandwidth Filter, Component Locator Table (2 of 2)

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
R12	C3	R62	B3	TP2	D1		
R13	B3	R63	B3	TP3	D2		
R14	C3	R64	A3	TP4	D2		
R15	C3	R65	A3	TP5	D2		
R16	C3	R66	C4	TP6	D3		
R17	B3	R67	B3	TP7	D3		
R18	C3	R68	C4	TP8	D3		
R19	C3	R69	B3	TP9	D4		
R20	B3	R70	B4	TP10	D4		
R21	C3	R71	B3				
R22	C3	R72	B4	Y1	C4		
R23	C3	R73	B3	Y2	C3		
R24	B3	R73	C3	Y3	C2		
R25	C3	R75	B3	Y4	C2		
R26	C3	R76	C3	Y5	C1		
R27	C3	R77	B3				
R28	B3	R78	B3				
R29	C3	R79	B3				
R30	C3	R80	B3				
R31	B3	R81	B3				
R32	C3	R82	B3				
R33	C3	R83	B3				
R34	C2	R84	B2				
R35	B2	R85	B2				
R36	C2	R86	B2				
R37	C2	R87	B2				
R38	C2	R88	B2				
R39	B2	R89	B2				
R40	C2	R90	B2				
R41	C2	R91	B2				
R42	B2	R92	B2				
R43	C2	R93	B2				
R44	C2	R94	B2				
R45	C2	R95	B2				
R46	B2	R96	B2				
R47	C1	R97	B2				
R48	C2	R98	B1				
R49	C1	R99	B2				
R50	B1	R100	B1				
R51	C1	R101	B2				
R52	C1	R102	B1				
R53	B1	R103	B1				
R54	C1	R104	B1				
R55	C1	R105	B1				
R56	B1	R106	B3				
R57	B1	R107	B3				
R58	C1	R108	B4				
R59	B1	R109	B4				
R60	B1						
R61	B1	TP1	D1				

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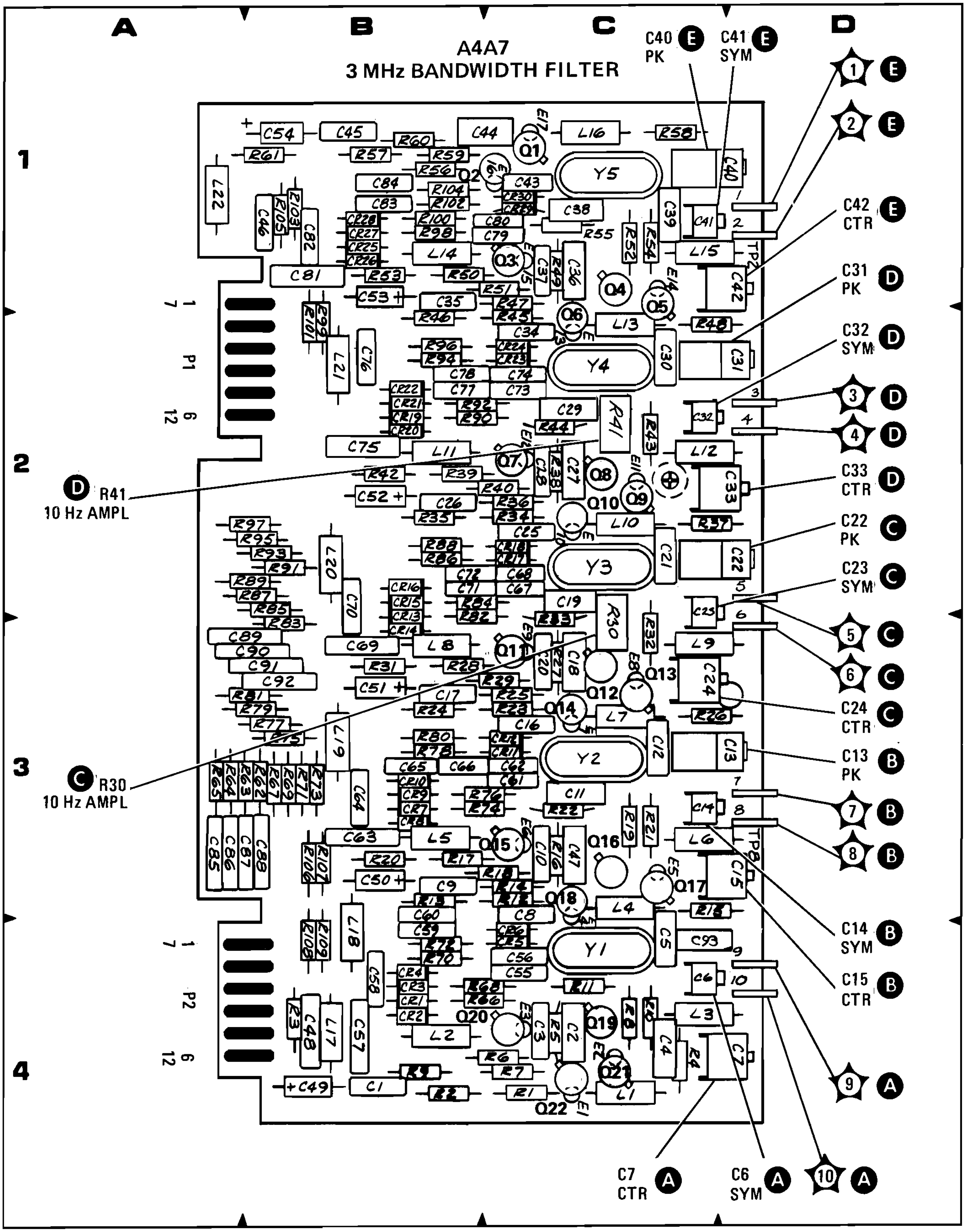
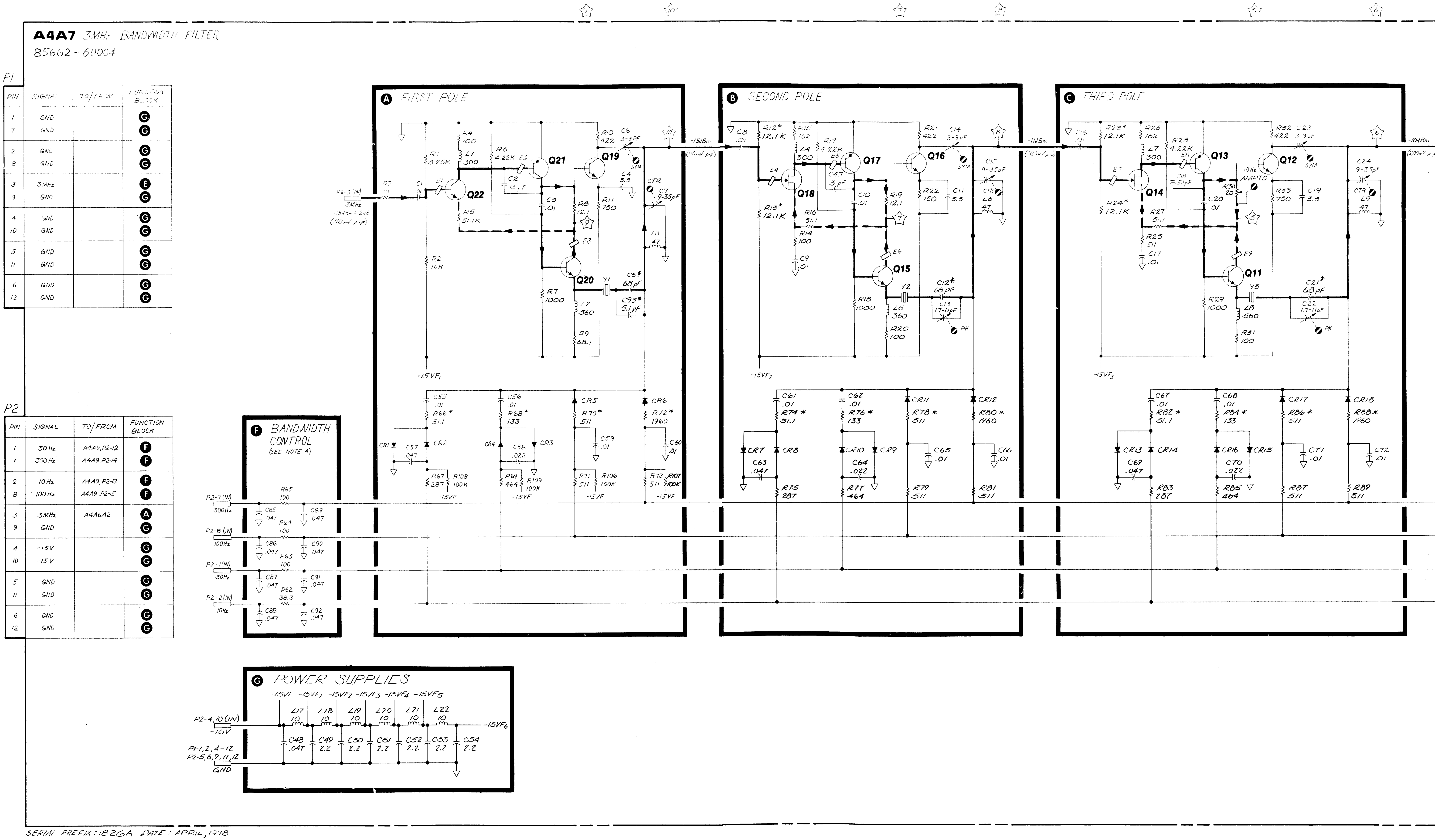


Figure 8-145. A4A7 3 MHz Bandwidth Filter, Component Locations

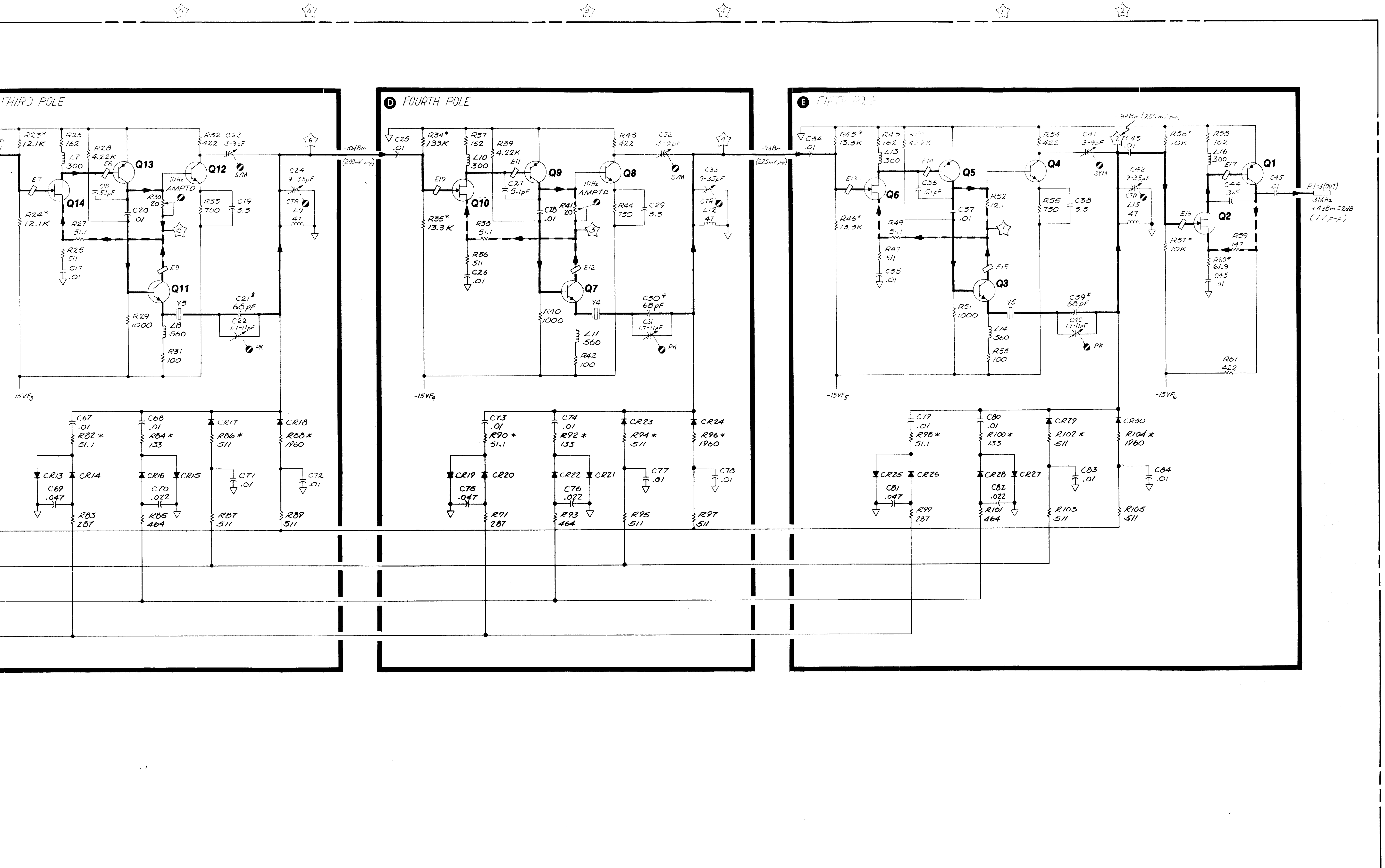


P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		G
7	GND		G
2	GND		G
8	GND		G
3	3MHz		E
9	GND		G
4	GND		G
10	GND		G
5	GND		G
11	GND		G
6	GND		G
12	GND		G

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	30 Hz	A4A9, P2-12	F
7	300 Hz	A4A9, P2-14	F
2	10 Hz	A4A9, P2-13	F
8	100 Hz	A4A9, P2-15	F
3	3MHz	A4A6A2	A
9	GND		G
4	-15V		G
10	-15V		G
5	GND		G
11	GND		G
6	GND		G
12	GND		G



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. ASTERISK (*) DENOTES FACTORY SELECTED COMPONENT; TYPICAL VALUE IS SHOWN. REFER TO SECTION V FOR RANGE OF VALUES.
4. TRUTH TABLES FOR BANDWIDTH CONTROL LINES.

RESOLUTION	CONTROL LINES			
BANDWIDTH	300Hz	100Hz	30Hz	10Hz
1KHz	<-10V	<-10V	<-10V	<-10V
300Hz	>+4V	<-10V	<-10V	<-10V
100Hz	<-10V	>+4V	<-10V	<-10V
30Hz	<-10V	<-10V	>+4V	<-10V
10Hz	<-10V	<-10V	>+4V	>+4V

5. INSTRUMENT SETTINGS FOR ALL MEASUREMENTS ON THIS BOARD:
   INSTRUMENT PRESET
   CENTER FREQUENCY ··· 20MHz
   FREQUENCY SPAN ··· 0 Hz
   ATTENUATION ··········· 0DB
   RESOLUTION BANDWIDTH ·· 1KHz
6. ALL MEASUREMENTS ARE WITH BOARD ON EXTENDERS. POWER LEVELS MAY VARY ± 2dB. RF VOLTAGES MAY VARY ± 25 %.
7. SOURCE VOLTAGE SHOULD BE 0.2 TO 2.0 V GREATER THAN GATE VOLTAGE ON Q2, Q6, Q10, Q14 AND Q18. ON THIS BOARD ONLY THE SOURCE IS INDICATED WITH A SQUARE PAD.

A4A7

Figure 8-146. A4A7 3 MHz Bandwidth Filter, Schematic Diagram

A4A8 ATTENUATOR—BANDWIDTH FILTER, CIRCUIT DESCRIPTION

A4A8 Attenuator–Bandwidth Filter and A4A4 Bandwidth Filter operate at 21.4 MHz and are variable in bandwidth from 3 kHz to 3 MHz. The narrower bandwidths (3 kHz through 30 kHz) are obtained from five synchronously tuned crystal filters; the wider bandwidths (100 kHz through 3 MHz), from four synchronously tuned LC tank circuits. (The bandwidths 10 Hz through 1 kHz are obtained from A4A7 3 MHz Filter.) The Bandwidth Filter assemblies are on similar printed-circuit boards. A4A8 has two LC filters and two crystal filters, and A4A4 has two LC filters and three crystal filters. (A4A6A1 Up Converter has a single 21.4 MHz crystal that is used only for bandwidths $\leqslant 1$ kHz.) These six crystals comprise a matched set and must be replaced as such. The replacement assemblies are shipped without crystals, so the crystals from the replaced boards must be used again.

10 — 20 dB Attenuator, 10 dB Amplifier Ⓐ

The 10 dB Amplifier is a common emitter amplifier with a gain of ≈ 10 dB.

$$G = \frac{R63}{R3 \| R62} = \frac{287}{90.91} = 3.16 \qquad G_{dB} = 20 \log G = 20 \log 3.16 \cong 10$$

For the lower gain settings of 0 dB and −10 dB (activated by A10dB and A20dB respectively), additional collector resistance is switched in by CR3 or CR2, thereby lowering the gain.

Input Buffer Amplifier Ⓒ

The unity gain Input Buffer Amplifier functions as a non-inverting op amp (see Figure 8-147).

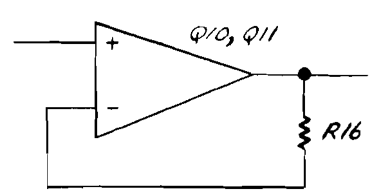


Figure 8-147. A4A8 Input Buffer Amplifier, Equivalent Circuit

In the crystal mode (3 kHz, 10 kHz, and 30 kHz bandwidths), the amplifier includes Q2. The biasing of the amplifier is independent of its ac (21.4 MHz) operation but is very critical for its proper functioning. If a malfunction occurs, the dc bias should be checked first.

The current through Q10 is determined by the difference between two current sources, one involving Q2 and the other involving Q11 (see Figure 8-148). The most convenient way to find the current from each source is to measure the voltage across each emitter resistor. (A 1 kΩ resistor should be used in series with the voltmeter probe tip to prevent the circuit from oscillating and giving an erroneous reading.) For Q2, the current through R60 must be included. If results are inconsistent, the emitter resistor should be checked also. Check to see that the BW5 line is at approximately −0.5 volts for bandwidths ≤30 kHz.

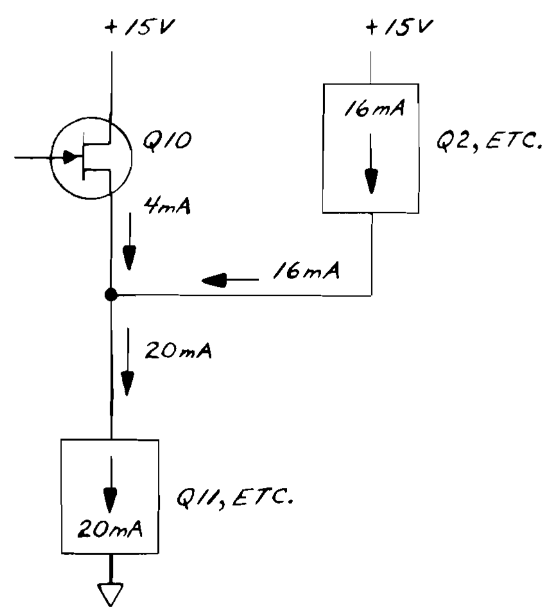


Figure 8-148. A4A8 Input Buffer Amplifier, Current Sinks

In the LC mode (the four wider bandwidths), the BW5 line goes to approximately +14.8V and turns off the current source Q2. The current supplied by Q2 in the crystal mode is now supplied through CR5 and R15 from the BW5 line. In the LC mode, the current thorugh Q10 can be found by subtracting the current through R5 from the current through R12.

Buffer Amplifier F

The Buffer Amplifier is similar to the Input Buffer Amplifier. The input is selected by the BW5 line from CR9 in the LC mode or from CR8 in the crystal mode.

In the crystal mode, the current through Q4 is determined by the difference between the current sourced by Q6 and that sunk by Q5 (about 4 mA). A significant deviation from this current should be reflected by the gate-to-source voltage of Q4. The source should be at least 0.4V more positive than the gate, but not more than 2.0V more positive. If the difference is less than 0.4V, the FET current is too high; if the difference is greater than 2.0V, the FET current may be too low. In either case the FET could also be defective. To determine precisely the current through Q4, the difference between the current through R47 and that through R61 should be subtracted from the current through R41. If the results are inconsistent, check the above-mentioned resistors.

In LC mode of operation, current is supplied through R44 and CR11 from the BW5 line instead of through Q6. The difference between the current through R44 and that through R41 yields the FET current.

Output Buffer Amplifier I

The Output Buffer Amplifier is a complementary pair of transistors in which Q8 acts as a source follower boosted by Q9. The current through FET Q8 is set by R58:

$$I_{FET} = \frac{V_{be}\,(Q9)}{196\Omega} \cong \frac{0.7V}{196\Omega} \cong 3.5 \text{ mA}$$

The total current through Q8 and Q9 is set by R59. The input is selected by the BW5 line from either CR15 in the LC mode or CR14 in the crystal mode.

Crystal Filtering Circuits F I

The bandwidths 3 kHz, 10 kHz, and 30 kHz are obtained by crystal filtering in the First Crystal Pole and Second Crystal Pole circuits. The crystals are used in series resonant mode and can be modeled as a series resonant circuit with a parallel capacitance (see Figure 8-149).

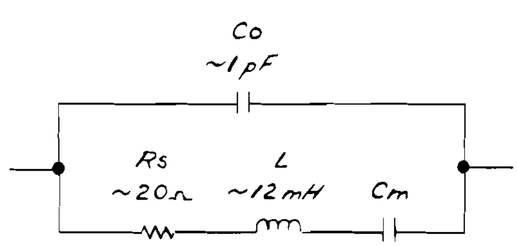


Figure 8-149. Quartz Crystal, Simplified Schematic

The parallel capacitance (C_O) and series resistance (R_S) are not desired and are compensated for in the circuit, as shown in the equivalent circuit of a single pole of crystal filtering (see Figure 8-150).

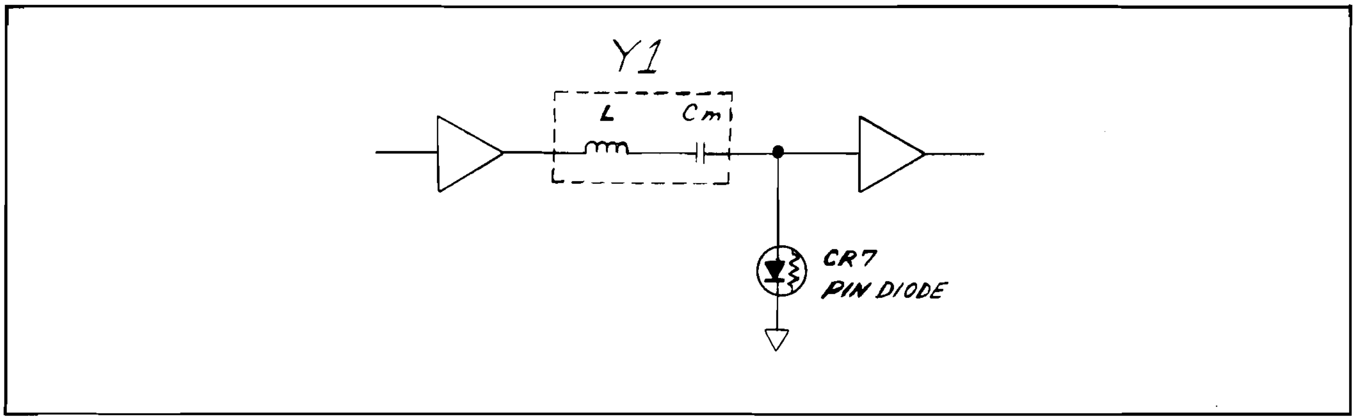


Figure 8-150. Crystal Filtering Pole, Equivalent Circuit

Since the two crystal filtering circuits are almost identical, the following description is for the First Crystal Pole circuit only.

The PIN diode CR7 functions as a variable resistor at 21.4 MHz. As the resistance is lowered by increasing the current in the BW63 line, the bandshape becomes narrower. The bandwidth of one pole widens to approximately 80 kHz when CR7 is turned off completely at the 30 kHz BW setting. (For a five-pole filter, the bandwidth of each pole is about 2.6 times the bandwidth of all five poles taken together. The bandwidth of two poles is about 1.5 times the bandwidth of all five poles taken together).

A simplified schematic of a crystal pole, including compensation for R_S and C_O in the crystal and input capacitance of the buffer amplifier, is shown in Figure 8-151.

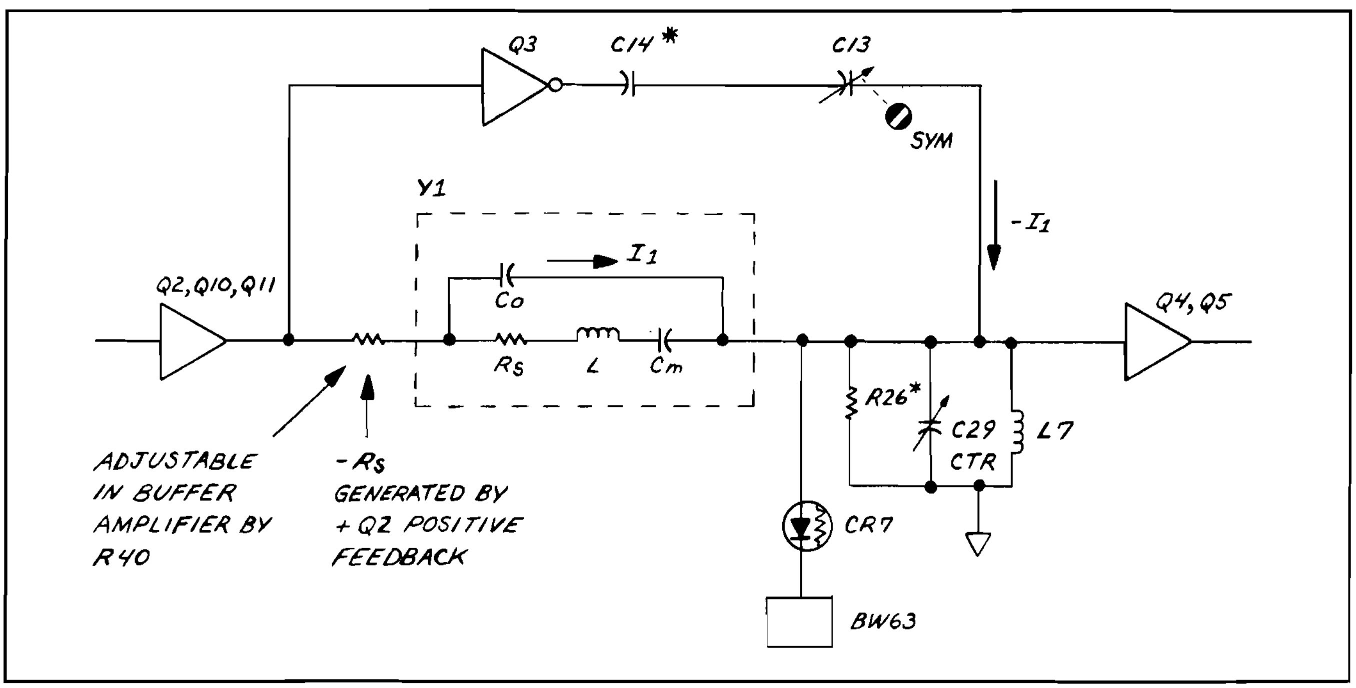


Figure 8-151. Crystal Pole, Simplified Schematic

The SYM adjustment C13 compensates for C_0 by producing a current $(-I_1)$ that is equal to the current (I_1) through C_0 of the crystal but opposite in phase. These currents cancel, nullifying the effect of C_0. The positive feedback from the collector of Q2 generates a negative output resistance that cancels R_S of the crystal. This is approximated by resistor R16 in the Input Buffer Amplifier and XTL adjustment R40 in the Buffer Amplifier.

The input capacitance of the Buffer Amplifier, printed circuit board capacitance, PIN diode capacitance, and the centering (CTR) capacitor C29 are in parallel resonance with L8. These components have negligible effect on the band shape. As long as C29 has sufficient range to "dip" the band shape, they can be ignored in analyzing the remainder of the circuit.

The PIN diode CR7 controls bandwidths from 3 kHz to 10 kHz. For the 30 kHz bandwidth, CR7 is back biased, and R26 sets that bandwidth. If the 30 kHz bandwidth is much too narrow, even with CR7 back biased, the circuit might be loaded by a bad buffer amplifier (Q4, Q5). If the bandwidth is only slightly narrow, it may be widened by selecting a new value for R26*. If the narrowest bandwidth (3 kHz) has too little gain, and it cannot be increased enough by XTL adjustment R40, then the crystals may have too high a series resistance (defective crystal), the output resistance may not be negative enough (defective Buffer Amplifier or Q3), or the crystals may have drifted too far apart in frequency.

LC Filters E H

The two LC filtering circuits are used for the wider bandwidths (100 kHz through 3 MHz). They are similar in function; the Second LC Pole circuit is described. A schematic of the simplified equivalent circuit is shown in Figure 8-152.

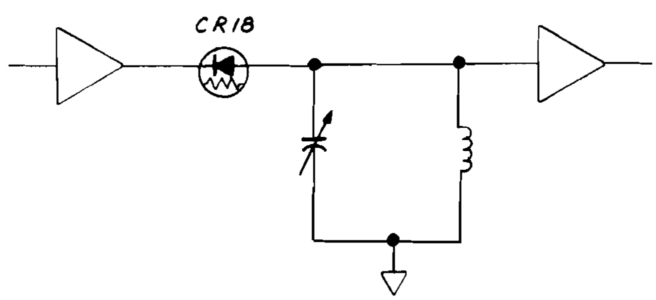


Figure 8-152. LC Pole, Equivalent Circuit

The Q (bandwidth) is set by the resistance of the PIN diode CR18. A more detailed schematic of the Second LC Pole circuit is shown in Figure 8-153.

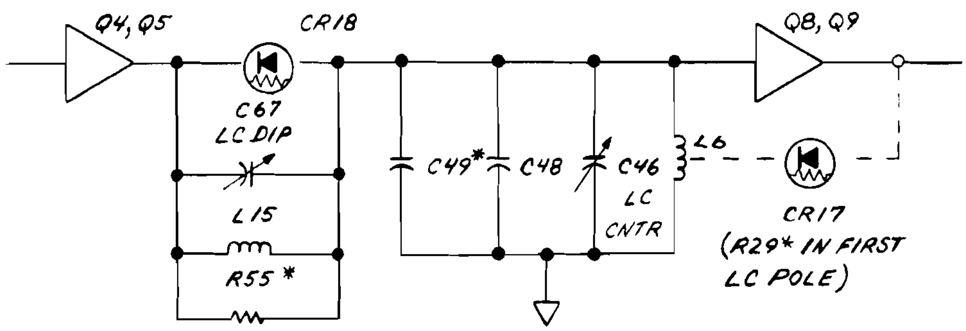


Figure 8-153. Second LC Pole Circuit, Simplified Schematic

The LC filter utilizes a metallized inductor L6 in parallel with three capacitors: C46 (LC CTR) for centering, C48 for temperature compensation, and C49*. The parallel circuit is driven through PIN diode CR18, which functions as a variable resistor. The BW7 line sets the current through CR18. Higher resistance results in narrower bandwidth.

C67 and L15 tune out the case capacitance of CR18. R55* sets the 100 kHz bandwidth when CR18 is back biased (i.e., highest resistance). CR17 is controlled by the LC adjustment R35 and compensates for losses in the parallel resonant circuit. (In the first LC Pole circuit, fixed resistor R29* replaces CR17.)

Low gain in one of the poles in the 100 kHz bandwidth is caused by:

1. Broken or cracked metalized-glass inductor (often intermittent).
2. The pole being centered at some frequency other than 21.4 MHz.
3. Insufficient feedback from the buffer amplifier.
4. Defective buffer amplifier that is loading the circuit.

If the 10 kHz bandwidth amplitude is correct, but that of the 300 kHz bandwidth is too low, either C66 or C67 are not properly adjusted. If the 300 kHz amplitude is too high, the four LC poles are not tuned close enough to the same frequency. In either case, refer to Section V, Adjustments.

A4A8 ATTENUATOR— BANDWIDTH FILTER, TROUBLESHOOTING

As an aid in troubleshooting, critical DC voltages for proper operation are indicated at several nodes on the accompanying schematic.

If the resolution bandwidths from 3 kHz to 3 MHz have low gain and/or incorrect bandwidth, either this board or the A4A4 Bandwidth Filter board may be defective. To determine which board is faulty, disconnect the 97 cable from A4A8J1 and connect it to A4A6J1. If the signal is then 3 to 5 dB lower than expected, (i.e., CAL OUTPUT is −13 to −15 dBm) and/or the bandwidth is 30 to 60% wider than expected (i.e., 1 MHz [RES BW] is 1.3 to 1.5 MHz), then A4A8 is suspect.

Control line BW5 determines whether the LC filters or the crystal filters are selected. If this line does not switch, A4A9Q3 on the IF control board should be checked. BW63 controls the crystal mode resolution bandwidths from 3 kHz to 30 kHz. The LC resolution bandwidths from 100 kHz to 3 MHz are controlled by BW7. If any of the control line voltages in Note 5 are incorrect, signals from A4A9 IF Control should be checked.

Operation of the A10dB and A20dB circuitry can be determined by the following method. Connect a 355D attenuator between the CAL OUTPUT and SIGNAL INPUT 2. Set this attenuator to 90 dB and key in the following:

[INSTR PRESET]
[CENTER FREQUENCY] . . . . 20 MHz
[FREQUENCY SPAN] . . . . 0 Hz
[RES BW] . . . . 1 kHz
[ATTEN] . . . . 0 dB
[VIDEO BW] . . . . 10 Hz
[SWEEP TIME] . . . . 20 sec
[REFERENCE LEVEL] . . . . −10 dBm

Press the SINGLE sweep key and then repetitively press the DATA STEP ⇩ key. Figure 8-154 shows the display of a properly working instrument. If either of the first two steps is missing, the A10 dB or A20 dB circuitry is faulty. Note 6 indicates the correct control line voltages from the A4A9 IF Control board.

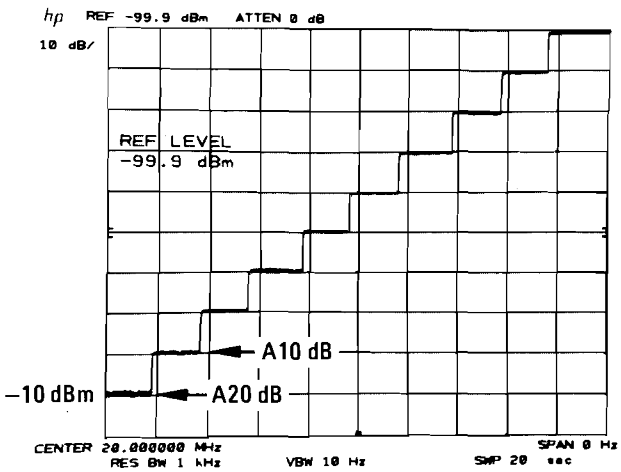


Figure 8-154. A10 dB/A20 dB Step Display

Table 8-47. A4A8 Attenuator-Bandwidth Filter, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A8	85662-60003	1	BOARD ASSEMBLY, ATTENUATOR-BANDWIDTH FLT	28480	85662-60003
A4A8C1	0140-0200	1	CAPACITOR-FXD 390PF +-5% 300VDC MICA0+70	72136	DM15F391J0300WV1CR
A4A8C2	0160-2055	46	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C10			NOT ASSIGNED		
A4A8C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C12	0160-2257	2	CAPACITOR-FXD 10PF +-5% 500VDC CER0+-60	28480	0160-2257
A4A8C13	0121-0059	2	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	73899	DV11PR8A
A4A8C14*	0160-2249	2	CAPACITOR-FXD 4.7PF +-.25PF 500VDC	28480	0160-2249
A4A8C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C17	0160-2207	2	CAPACITOR-FXD 300PF +-5% 300VDC MICA0+70	28480	0160-2207
A4A8C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C19	0160-4297	4	CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223ZS22-CDH
A4A8C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C21	0160-3456	2	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4A8C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C26	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223ZS22-CDH
A4A8C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C29	0121-0446	2	CAPACITOR-V TRMR-CER 4.5-20PF 160V	0146H	7S-TRIKO-19 4.5-20 PF, N750
A4A8C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C31	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C32	0121-0036	2	CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A4A8C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C34	0160-3431	2	CAPACITOR-FXD 6.8PF +-.5PF 500VDC	28480	0160-3431
A4A8C35*	0140-0194	4	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A4A8C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C39	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223ZS22-CDH
A4A8C40	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C41	0160-2257		CAPACITOR-FXD 10PF +-5% 500VDC CER0+-60	28480	0160-2257
A4A8C42	0121-0059		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	73899	DV11PR8A
A4A8C43*	0160-2249		CAPACITOR-FXD 4.7PF +-.25PF 500VDC	28480	0160-2249
A4A8C44	0121-0446		CAPACITOR-V TRMR-CER 4.5-20PF 160V	0146H	7S-TRIKO-19 4.5-20 PF, N750
A4A8C45	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C46	0121-0036		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A4A8C47	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C48	0160-3431		CAPACITOR-FXD 6.8PF +-.5PF 500VDC	28480	0160-3431
A4A8C49*	0140-0194		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A4A8C50	0160-3456		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4A8C51	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C52	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C53	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C54	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C55	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C56	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C57	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C58	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C59	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C60	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	0420J	C023F101H223Z522-CHD
A4A8C61	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C62	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C63*	0140-0194		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A4A8C64	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C65	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C66	0121-0452	2	CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0103-005
A4A8C67	0121-0452		CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0103-005
A4A8C68	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C69	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055

Table 8-47. A4A8 Attenuator-Bandwidth Filter, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A8C70	0160-2207		CAPACITOR-FXD 300PF +-5% 300VDC MICA0+70	28480	0160-2207
A4A8C71	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C72	0160-4084	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A8C73	0160-4084		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4A8C74	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8C75	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A8CR1			NOT ASSIGNED		
A4A8CR2	1901-0050	2	DIODE-SWITCHING 80V 200MA 2NS DO-7	28480	1901-0050
A4A8CR3	1901-0050		DIODE-SWITCHING 80V 200MA 2NS DO-7	28480	1901-0050
A4A8CR4	1901-0047	10	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A8CR5	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A8CR6	1901-1070	5	DIODE:PIN	28480	1901-1070
A4A8CR7	1901-1070		DIODE:PIN	28480	1901-1070
A4A8CR8	1901-0535	5	DIODE-SCHOTTKY	28480	1901-0535
A4A8CR9	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A8CR10	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A8CR11	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A8CR12	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A8CR13	1901-1070		DIODE:PIN	28480	1901-1070
A4A8CR14	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A8CR15	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A4A8CR16	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A8CR17	1901-1070		DIODE:PIN	28480	1901-1070
A4A8CR18	1901-1070		DIODE:PIN	28480	1901-1070
A4A8CR19	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A4A8E1	9170-0029	12	CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E2	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E3	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E4	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E5	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E6	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E7	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E8	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E9	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E10	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E11	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8E12	9170-0029		CORE-SHIELDING BEAD	0188G	56-590-65A2/4A
A4A8J1	1250-0690	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A4A8L1	9100-1610	1	COIL-MLD 150NH 20% Q=50 .155DX.375LG	0217B	15-4415-1M
A4A8L2	9140-0179	2	COIL-MLD 22UH 10% Q=75 .155DX.375LG	0217B	15-4445-7J
A4A8L3	9100-1641	2	COIL-MLD 240UH 5% Q=65 .155DX.375LG	0217B	15-1315-21J
A4A8L4	9100-1618	4	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A8L5	9140-0114	3	COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A8L6	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A8L7	9100-3854	2	COIL 400NH 5% Q=150 .3DX1.016LG	28480	9100-3854
A4A8L8	9140-0098	2	COIL-MLD 2.2UH 10% Q=33 .155DX.375LG	0217B	15-4425-10K
A4A8L9	9100-1620	3	COIL-MLD 15UH 10% Q=65 .155DX.375LG	0217B	15-4445-4K
A4A8L10	9100-1641		COIL-MLD 240UH 5% Q=65 .155DX.375LG	0217B	15-1315-21J
A4A8L11	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A8L12	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A8L13	9140-0114		COIL-MLD 10UH 10% Q=55 .155DX.375LG	0217B	15-4445-2K
A4A8L14	9100-3854		COIL 400NH 5% Q=150 .3DX1.016LG	28480	9100-3854
A4A8L15	9100-1620		COIL-MLD 15UH 10% Q=65 .155DX.375LG	0217B	15-4445-4K
A4A8L16	9100-1620		COIL-MLD 15UH 10% Q=65 .155DX.375LG	0217B	15-4445-4K
A4A8L17	9140-0098		COIL-MLD 2.2UH 10% Q=33 .155DX.375LG	0217B	15-4425-10K
A4A8L18			NOT ASSIGNED		
A4A8L19	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG	0217B	15-4435-1K
A4A8L20	9140-0179		COIL-MLD 22UH 10% Q=75 .155DX.375LG	0217B	15-4445-7J
A4A8L21-					
A4A8L32			NOT ASSIGNED		
A4A8L33	9140-0158	1	COIL-MLD 1UH 10% Q=32 .095DX.25LG	0217B	09-4426-6K
A4A8Q1	1854-0345	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	0203G	2N5179
A4A8Q2	1853-0007	5	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A8Q3	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A8Q4	1855-0267		TRANSISTOR J-FET N-CHAN D-MODE SI	0169H	SKA 3807
A4A8Q5	1854-0404	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A8Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A8Q7	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A8Q8	1855-0267		TRANSISTOR J-FET N-CHAN D-MODE SI	0169H	SKA 3807
A4A8Q9	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	0203G	2N3251
A4A8Q10	1855-0267		TRANSISTOR J-FET N-CHAN D-MODE SI	0169H	SKA 3807
A4A8Q11	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A8R1	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	0329B	C4-1/8-T0-56R2-F
A4A8R2	0698-0083	1	RESISTOR 1.96K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1961-F
A4A8R3	0757-0401	5	RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A8R4	0757-0294	1	RESISTOR 17.8 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-17R8-F
A4A8R5	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F

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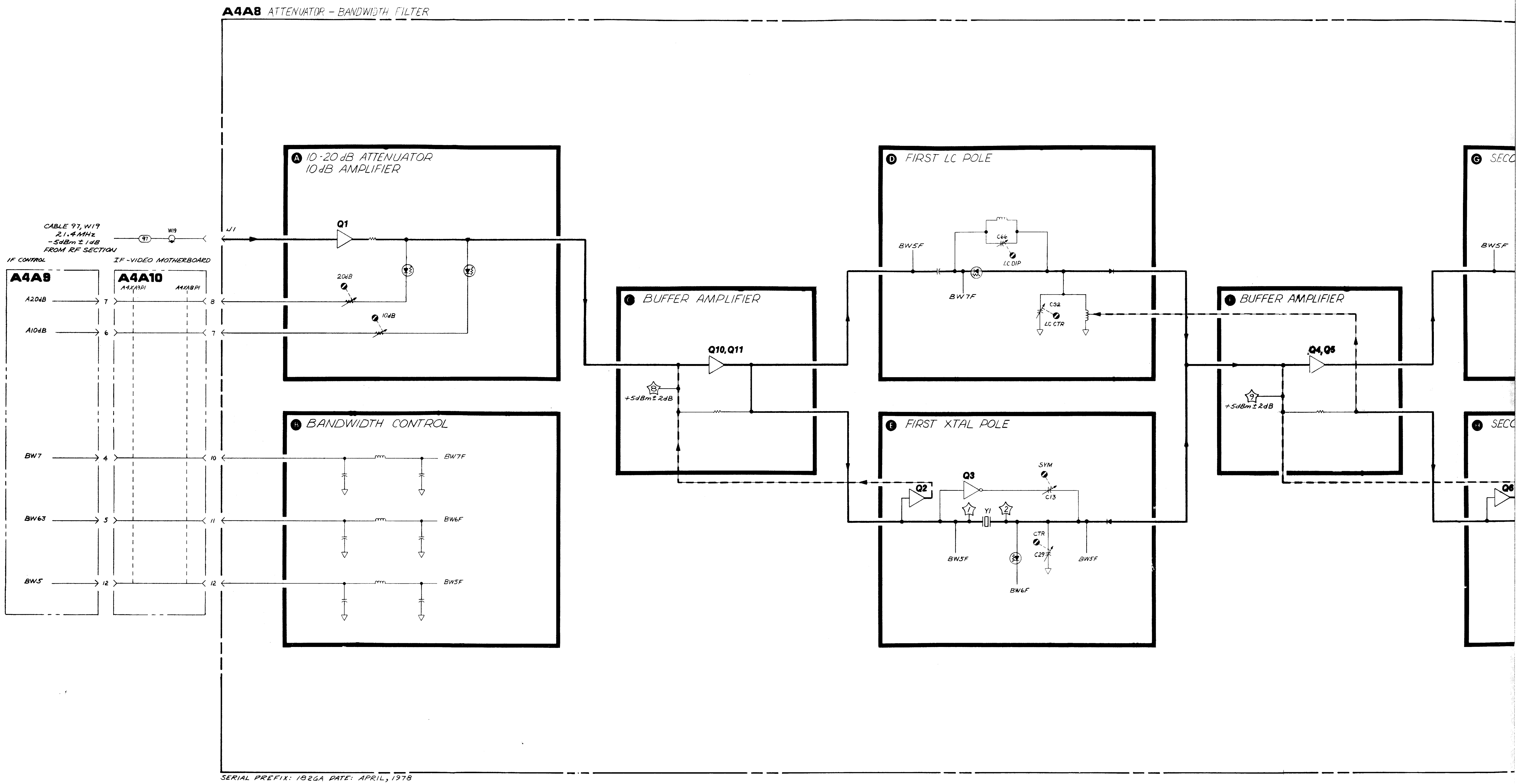
Table 8-47. A4A8 Attenuator-Bandwidth Filter, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A8R6	2100-3053	1	RESISTOR-TRMR 20 20% C SIDE-ADJ 17-TRN	73138	89PR20
A4A8R7	2100-3052	2	RESISTOR-TRMR 50 20% C SIDE-ADJ 17-TRN	73138	89PR50
A4A8R8	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	0329B	C4-1/8-T0-511R-F
A4A8R9	0698-3260	2	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A8R10	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A8R11	0757-0280	8	RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R12	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A8R13	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R14	0698-3155	2	RESISTOR 4.64K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4641-F
A4A8R15	0698-0082	3	RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A8R16	0698-3429	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A4A8R17	0757-0443	2	RESISTOR 11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1102-F
A4A8R18	0757-0438	4	RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A8R19	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	0329B	C4-1/8-TO-1003-F
A4A8R20	0698-3441	2	RESISTOR 215 1% .125W F TC=0+-100	0329B	C4-1/8-T0-215R-F
A4A8R21	0698-3444	2	RESISTOR 316 1% .125W F TC=0+-100	0329B	C4-1/8-T0-316R-F
A4A8R22	0698-3442	2	RESISTOR 237 1% .125W F TC=0+-100	0329B	C4-1/8-T0-237R-F
A4A8R23	0757-0279	2	RESISTOR 3.16K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-3161-F
A4A8R24*	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	0329B	C4-1/8-T0-10R0-F
A4A8R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R26*	0757-0440	3	RESISTOR 7.5K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-7501-F
A4A8R27	0757-0290	4	RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A8R28	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A8R29*	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1471-F
A4A8R30*	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-3481-F
A4A8R31	0698-3156	4	RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A8R32	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A8R33	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R34¤			FACTORY SELECTED PART-NORMALLY OPEN		
A4A8R35	2100-3165	1	RESISTOR-TRMR 2M 10% C SIDE-ADJ 17-TRN	01885	43P205
A4A8R36¤			FACTORY SELECTED PART NORMALLY OPEN		
A4A8R37			NOT ASSIGNED		
A4A8R38	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1471-F
A4A8R39	0757-0442	3	RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A8R40	2100-3052		RESISTOR-TRMR 50 20% C SIDE-ADJ 17-TRN	73138	89PR50
A4A8R41	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A8R42	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R43	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4641-F
A4A8R44	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A8R45	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1102-F
A4A8R46	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A8R47	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	0329B	C4-1/8-T0-215R-F
A4A8R48	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	0329B	C4-1/8-T0-316R-F
A4A8R49	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	0329B	C4-1/8-T0-237R-F
A4A8R50	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R51	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-3161-F
A4A8R52*	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-7501-F
A4A8R53	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A8R54	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	0299E	MF4C1/8-T0-6191-F
A4A8R55*	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-7501-F
A4A8R56	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A8R57	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1472-F
A4A8R58	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	0329B	C4-1/8-T0-196R-F
A4A8R59	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4640-F
A4A8R60	0698-3154	2	RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A8R61	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-4221-F
A4A8R62	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R63	0698-3443	1	RESISTOR 287 1% .125W F TC=0+-100	0329B	C4-1/8-T0-287R-F
A4A8R64	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	0329B	C4-1/8-T0-101-F
A4A8R65			NOT ASSIGNED		
A4A8R66	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A8R67	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-5111-F
A4A8R68	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1001-F
A4A8R69	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A8R70	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	0329B	C4-1/8-T0-1002-F
A4A8TP1	0360-1788	4	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A8TP2	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A8TP3	1251-0600	5	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	1251-0600
A4A8TP4	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A8TP5	0360-1788		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A4A8TP6	1251-0600		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	1251-0600
A4A8TP7	1251-0600		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	1251-0600
A4A8TP8	1251-0600		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	1251-0600
A4A8TP9	1251-0600		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	1251-0600

Table 8-47. A4A8 Attenuator-Bandwidth Filter, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A8VR1	1902-3139	1	DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	02238	FZ7252
A4A8Y1-Y2	0410-1026	1	CRYSTAL, 21.4 MHZ, SET OF SIX INCLUDES A4A4Y1-Y3, A4A6A1Y1)	28480	0410-1026
			A4A8 MISCELLANEOUS		
	86701-40001	1	EXTRACTOR, PC BOARD	28480	86701-40001
	6960-0016	1	PLUG-HOLE .125" DIA	28480	6960-0016


A4A8 ATTENUATOR - BANDWIDTH FILTER
CABLE 97, W19
21.4MHz
-5dBm ± 1dB
FROM RF SECTION
IF CONTROL
IF-VIDEO MOTHERBOARD
A4A9
A4A10
J1
A20dB
A10dB
BW7
BW63
BW5
A 10-20 dB ATTENUATOR
10 dB AMPLIFIER
Q1
20dB
10dB
B BANDWIDTH CONTROL
BW7F
BW6F
BW5F
C BUFFER AMPLIFIER
Q10,Q11
+5dBm ± 2dB
D FIRST LC POLE
C66
LC DIP
C32
LC CTR
BW7F
E FIRST XTAL POLE
Q2
Q3
SYM
C13
Y1
CTR
C29
BW6F
F BUFFER AMPLIFIER
Q4,Q5
G SECO
H SECO
Q6
SERIAL PREFIX: 1826A DATE: APRIL, 1978

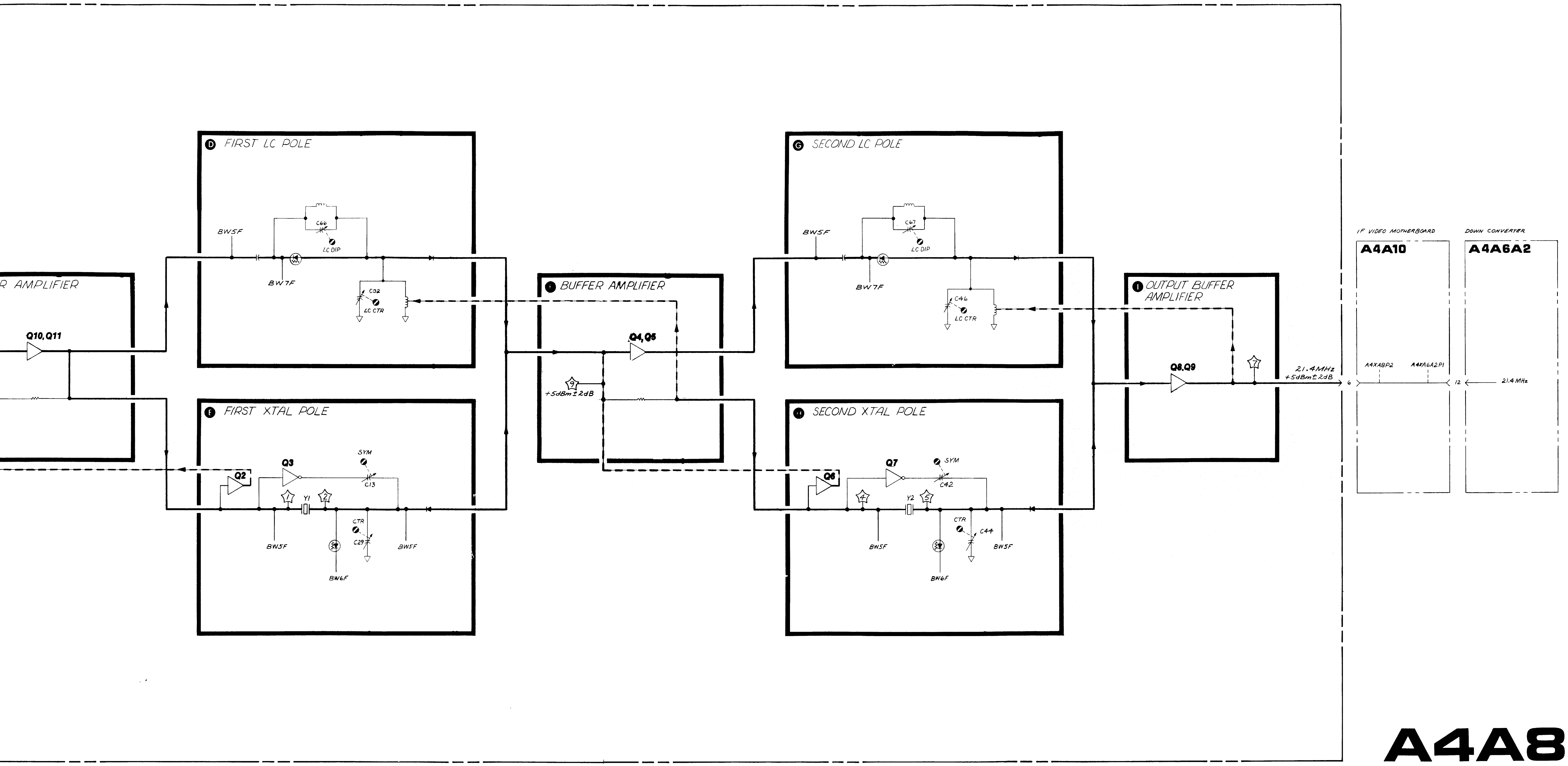


Figure 8-155. A4A8 Attenuator-Bandwidth Filter, Block Diagram

Table 8-48. A4A8 Attenuator-Bandwidth Filter, Component Locator Table

Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location	Reference Designator	Location
C1	C1	C52	B3	E9	C3	R11	B1	R63	C1
C2	C2	C53	B4	E10	C3	R12	A1	R64	B1
C3	C1	C54	B2	E11	C4	R13	B1	R66	C2
C4	C1	C55	B4	E12	C4	R14	B1	R67	C3
C5	C1	C56	C3			R15	B2	R68	C4
C6	C1	C57	C4	J1	D1	R16	B1	R69	C2
C7	C1	C58	C3			R17	B2	R70	C3
C8	B2	C59	C4	L1	C1	R18	C1		
C9	B2	C60	C4	L2	C1	R20	C2	TP1	C2
C11	C1	C61	B4	L3	C1	R21	C2	TP2	C2
C12	C2	C62	B4	L4	C3	R22	C2	TP3	C2
C13	C2	C63	B4	L5	C2	R23	B2	TP4	C4
C14	C2	C64	C4	L6	B2	R24	B2	TP5	C4
C15	C2	C65	C2	L7	C2	R25	C2	TP6	C4
C16	B2	C66	B2	L8	C2	R26	C2	TP7	C4
C17	B2	C67	B3	L9	C3	R27	B2	TP8	B1
C18	B1	C68	C3	L10	C3	R28	C3	TP9	B3
C19	B1	C69	C3	L11	B2	R29	B2		
C20	B2	C70	B3	L12	B3	R30	B2	VR1	C1
C21	B2	C71	C3	L13	C3	R31	B2		
C22	B2	C72	C3	L14	B4	R32	B2	Y1	C2
C23	C2	C73	C2	L15	B3	R33	C1	Y2	C4
C24	B2			L16	C4	R34	A2		
C25	B2	CR2	C1	L17	C4	R35	C4		
C26	C3	CR3	C1	L19	B4	R36	A2		
C27	C2	CR4	C2	L20	B1	R38	B2		
C28	C2	CR5	B2	L33	B2	R39	B4		
C29	C2	CR6	B2			R40	C3		
C30	C2	CR7	C2	Q1	C1	R41	B3		
C31	B2	CR8	C2	Q2	B2	R42	B3		
C32	C2	CR9	C2	Q3	C2	R43	C3		
C33	B2	CR10	C3	Q4	C3	R44	B3		
C34	C2	CR11	B3	Q5	C3	R45	C3		
C35	C2	CR12	C3	Q6	C3	R46	C3		
C36	B2	CR13	C3	Q7	C3	R47	C3		
C37	B3	CR14	C4	Q8	C4	R48	C3		
C38	B3	CR15	C4	Q9	C4	R49	C3		
C39	B3	CR16	C3	Q10	B1	R50	C3		
C40	C3	CR17	B4	Q11	B1	R51	C3		
C41	C3	CR18	B3			R52	C4		
C42	C3	CR19	C3	R1	C1	R53	C4		
C43	C3			R2	C1	R54	C3		
C44	C3	E1	C1	R3	B1	R55	B3		
C45	C3	E2	B1	R4	C1	R56	B3		
C46	C4	E3	C2	R5	C1	R57	B4		
C47	B3	E4	B2	R6	C2	R58	C4		
C48	B4	E5	B2	R7	C1	R59	B4		
C49	B4	E6	C3	R8	B1	R60	C2		
C50	B3	E7	C3	R9	A1	R61	C3		
C51	B3	E8	C3	R10	A1	R62	C1		

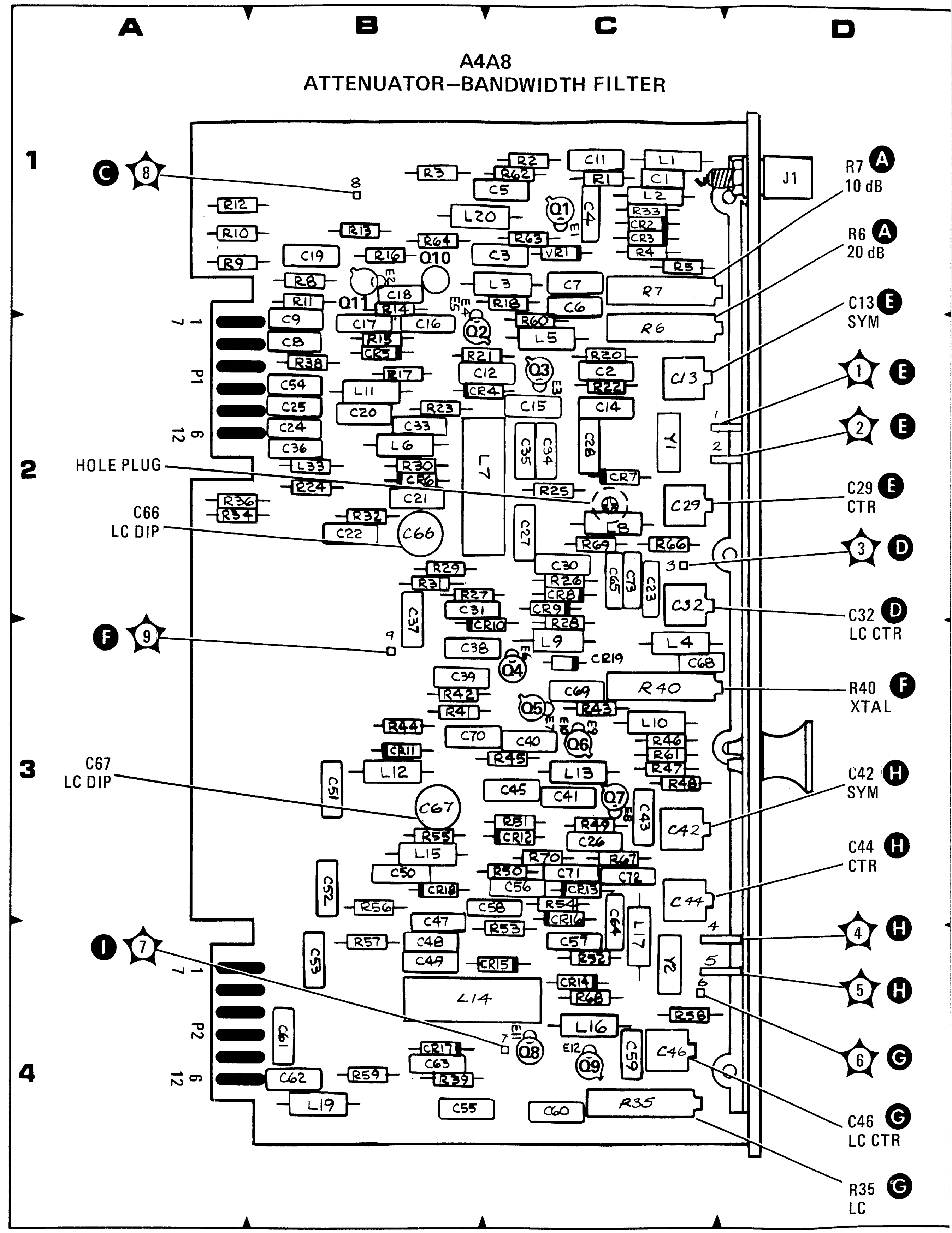


Figure 8-156. A4A8 Attenuator–Bandwidth Filter, Component Locations

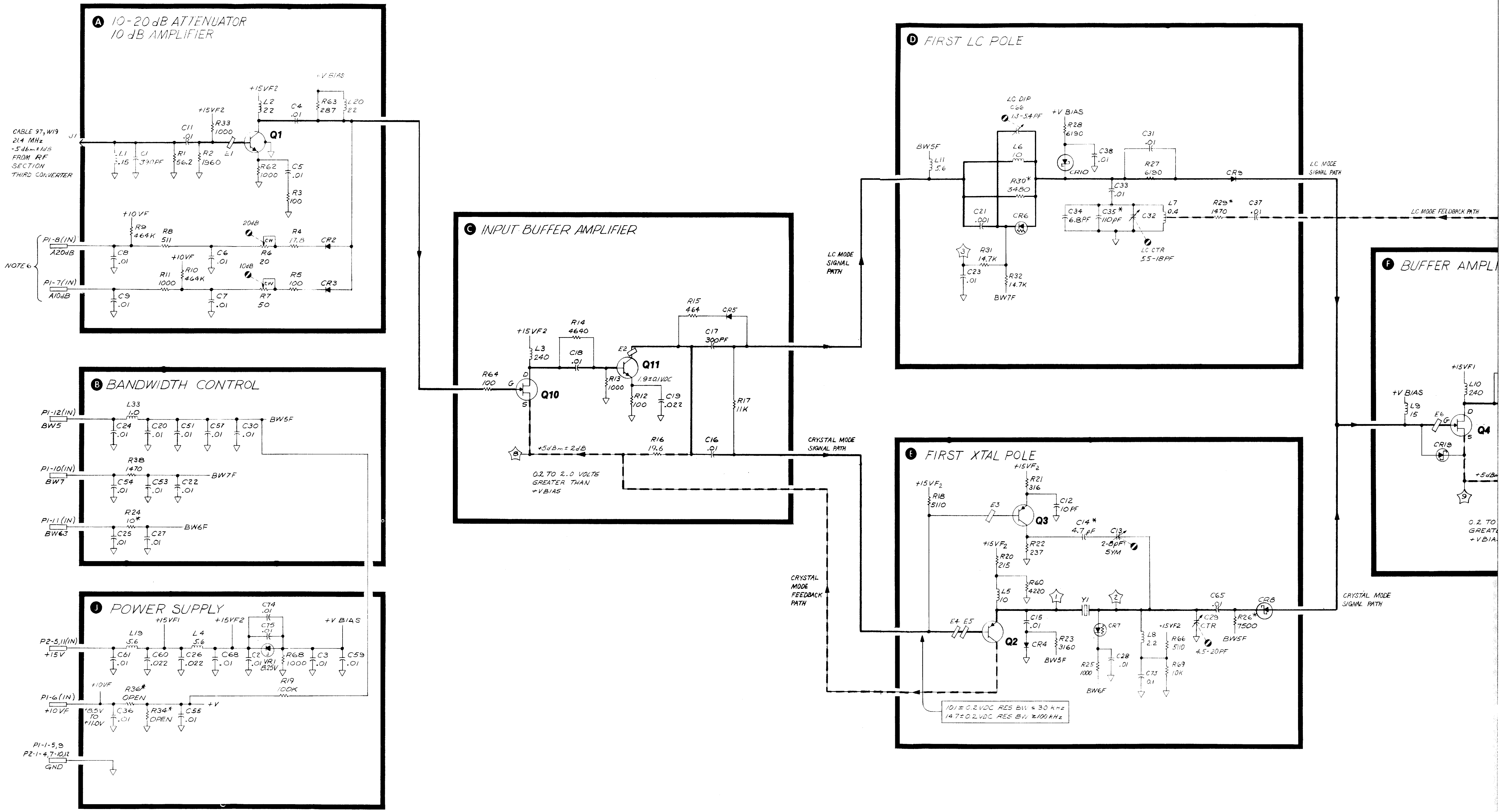
A4A8 ATTENUATOR-BANDWIDTH FILTER
85662-60003

P1

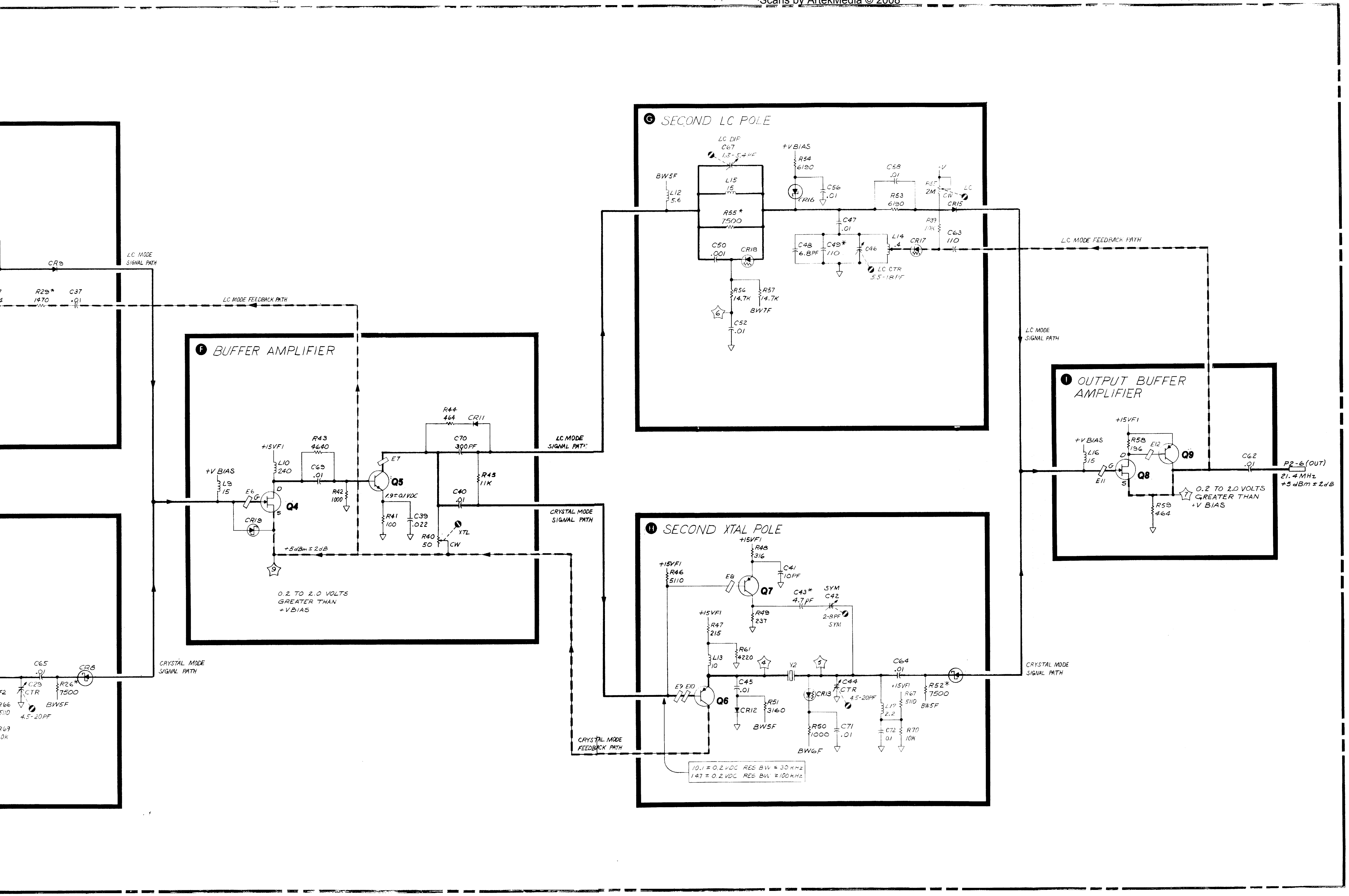
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
7	A10dB	A4A9, P1-6	A
2	GND		
8	A20dB	A4A9, P1-7	A
3	GND		J
9	GND		J
4	GND		J
10	BW7	A4A9, P14	B
5	GND		J
11	BW63	A4A9, P1-5	B
6	+10VF	A4A5, P1-5	J
12	BW5	A4A9, P1-12	B

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
7	GND		J
2	GND		J
8	GND		J
3	GND		J
9	GND		J
4	GND		J
10	GND		J
5	+15V		J
11	+15V		J
6	21.4 MHz	A4A6A2, P1-12	I
12	GND		J



SERIAL PREFIX: 1826A 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:
   RESISTANE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)
3. ASTERISK (*) DENOTES A FACTORY SELECTED COMPONENT; TYPICAL VALUE IS SHOWN. REFER TO SECTION V FOR RANGE OF VALUES.
4. MNEMONICS TABLE

MNEMONIC	DESCRIPTION
A20dB	ATTENUATION 20dB
A10dB	ATTENUATION 10dB
BW5	BANDWIDTH 5
BW7	BANDWIDTH 7 (LC MODE)
BW63	BANDWIDTH 63 (XTAL MODE)

5. TABLE OF RESOLUTION BANDWIDTH CONTROL LINE VOLTAGES.

RESOLUTION BANDWIDTH	TYPICAL VALUES		
	BW5	BW63	BW7
3 MHz	+14.8	+4.1	+9.7
1 MHz	+14.8	+4.1	+13.1
300 KHz	+14.8	+4.1	+14.1
100 KHz	+14.8	+4.1	+14.5
30 KHz	-.6	+14.3	+14.3
10 KHz	-.6	+9.3	+14.3
3 KHz	-.6	+9.0	+14.3
1 KHz AND NARROWER	-.6	+9.2	+14.3

6.

REFERENCE LEVEL RES BW ≥ 3KHz	dBm			≤+10
REFERENCE LEVEL RES BW ≥ 1 KHz	dBm	-10	-20	≤30
A 20dB	LOG	0V	+9V	+9V
	LIN	0V	+9V	+9V
A 10dB	LOG	+9V	0V	+9V
	LIN	+9V	0V	+9V
INPUT ATTENUATION .... 0 dB				

7. POWER LEVELS MEASURED UNDER THE FOLLOWING CONDITIONS:
   INSTRUMENT PRESET
   CENTER FREQUENCY 20 MHz
   FREQUENCY SPAN 0 Hz
   ATTENUATION 0 dB
   RESOLUTION BANDWIDTH 3KHz
8. SOURCE PIN ON Q8, Q4, AND Q10 IS INDICATED BY A SQUARE PAD ON THIS BOARD.

A4A8

Figure 8-157. A4A8 Attenuator-Bandwidth Filter, Schematic Diagram

A4A9 IF CONTROL, CIRCUIT DESCRIPTION

Control information for A4 IF-Video assembly is transmitted over the Instrument Bus from the A15 Processor and decoded by A4A9 IF Control.

Address Decoder B

The Address Decoder monitors ADR Ø-4 and activates the input latches for addresses 20 and 21 when LTIO goes low. Address 20 activates U6, U8, and U9. Address 21 activates U3, U10, and U12:

	ADR 4 (16)	ADR 3 (8)	ADR 2 (4)	ADR 1 (2)	ADR 0 (1)
Address 20	H	L	H	L	L
Address 21	H	L	H	L	H

Input Latches A

The input latches hold whatever was present at their inputs when LTIO goes low. The output goes high to activate the function. For example, when U8 pin 5 is high, SG10 (step gain 10) is activated.

A0.0 to A15.9 dB Control C

Fourteen dB (A8dB, A4dB, and A2dB) of attenuation is accomplished by switching in discrete steps of attenuation in A4A5 Step Gain. The smaller steps (0.1 dB through 1.9 dB) are accomplished by sinking discrete amounts of current through a PIN diode attenuator in A4A5. The output of U13 goes low when a particular step of attenuation is required. The fixed resistors tied to edge-connector pin P2-7 determine the amount of current sunk (and hence the attenuation) of the PIN diode attenuator. The operation of the attenuator is described in A4A5.

IF Gain Control D

The IF Gain Conrol interfaces with A4A5 Step Gain, the Log Amplifiers in A4A2 and A4A3, and A4A1 Video Processor. A table on the A4A9 schematic describes the conditions under which the steps are used.

Bandwidth Control E

Bandwidths from 3 MHz to 100 kHz (BW5 ⩾ + 14.8V). These bandwidths are produced in the 21.4 MHz IF by four parallel tank circuits (two in A4A4 Bandwidth Filter and two on A4A8 Attenuator—Bandwidth Filter). Their Q (which determines bandwidth) is controlled by PIN diodes used as variable resistors. The resistance of these PIN diodes is determined by the average current through them, which is generated by Q9. Either R60, R61, or R62 is switched in by U2, depending on which bandwidth had been selected. These potentiometers (3 MHz, 1 MHz, and 300 kHz) determine the amount of current sunk by Q9, which in turn determines the bandwidth. If no current is sunk by Q9, the filters go to their highest Q (determined by factory-selected resistors), which yields the 100 kHz bandwidth.

Bandwidths from 30 kHz to 3 kHz (BW7= —0.6V). These bandwidths are produced in the 21.4 Mhz IF by five crystal filters (two in A4A8 and three in A4A4). Their Q (which determines bandwidth) is controlled by PIN diodes, the same as for the wider bandwidths. (Refer to the preceding discussion of the wider bandwidths.) Q10 is the current sink for bandwidths from 30 kHz to 3 kHz. The amount of current it sinks is selected by U2 and adjusted by potentiometers R65 and R66 (10 kHz and 3 kHz), depending on which bandwidth is selected. If no current is sunk by Q10, the filters go to their lowest Q (determined by factory-selected resistors), which yields the 30 kHz bandwidth. Q1 should be off except for the 3 MHz to 100 kHz bandwidths.

Bandwidths from 1 kHz to 10 Hz (SWITCH = 0V). These bandwidths are produced in the 3 MHz IF (A4A7) by five crystal filters. The Q of these filters is controlled by resistors which are switched in by diodes. These, in turn, are controlled by Q25, Q26, Q28, and Q29. The transistors switch lines which are named after the bandwidths they produce. Q27 is on (saturated) only for bandwidths 1 kHz through 10 Hz.

A4A9 IF CONTROL, TROUBLESHOOTING

If the BW5 control line is not switching, Q3 is most likely defective. If Q3 is found to be defective, check Q6 to determine if it has failed also.

Figure 8-158 is reproduced from the troubleshooting for the A4A5 Step Gain. It shows the results of a quick test to determine proper operation of the 0.0 to 1.9 dB attenuator section of the A0.0 to A15.9 dB control. As the figure shows, the steps are not exactly 0.1 dB. If the steps are not monotonic, either a control line isn't switching or a switching diode is defective. Note 10 will be useful in determining when a control line is active.

The absolute step amplitudes can be determined with the MARKER Δ function. The reference steps are 0.0 dB and 0.90 dB. In the Linear mode the error should be less than ±0.12 dB.

The 1 dB, 1.4 dB and 1.8 dB steps are controlled by factory selected resistors. If one of these steps is in error by more than ±0.12 dB in the Linear mode, refer to Section V for the procedure to determine the correct value. The other steps should be ±0.2 dB in the Linear mode.

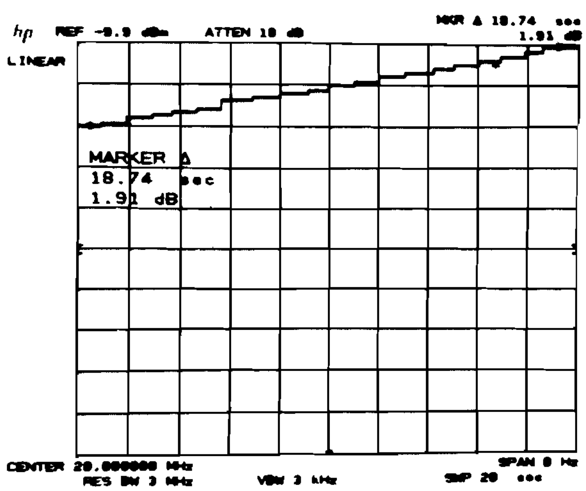


Figure 8-158. 0.1 dB Step Gain Display

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A4A9
IF CONTROL

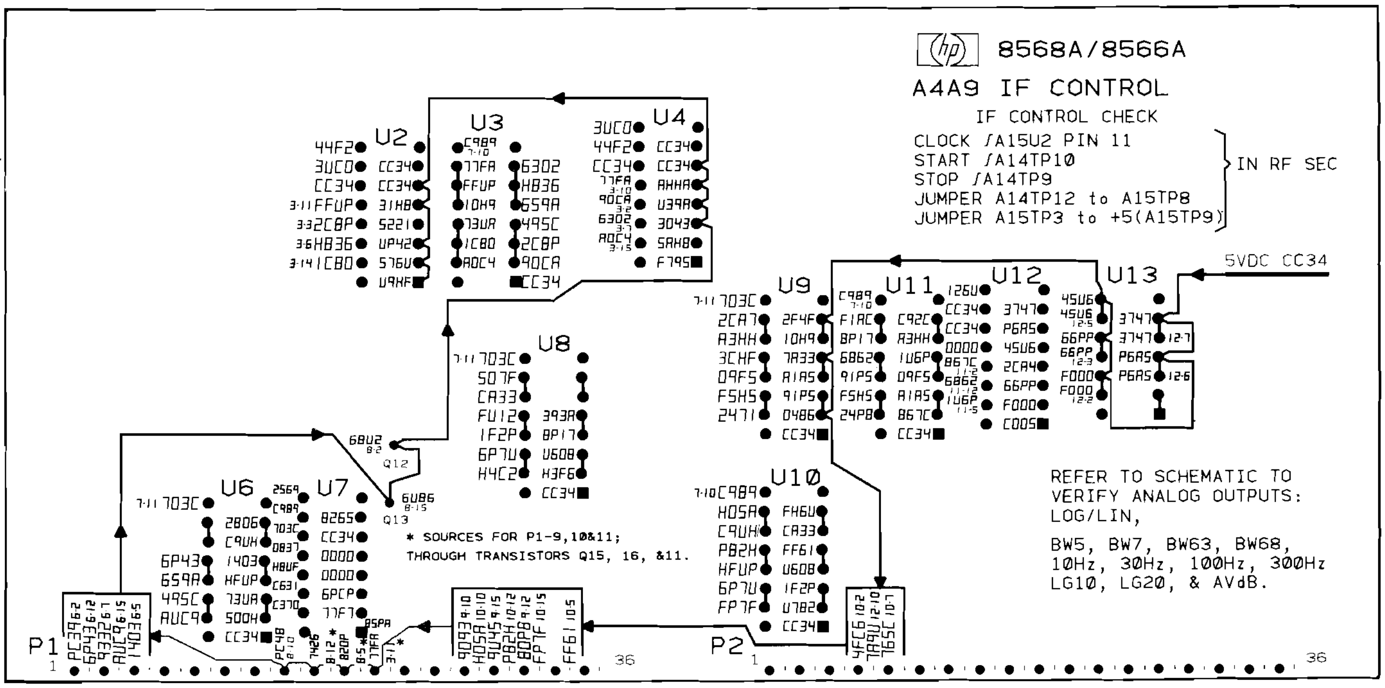

Figure 8-159. A4A9 IF Control, Signature Analysis Troubleshooting Diagram

IF CONTROL CHECK

Spectrum Analyzer Connections

Jumper A14TP12 to A15TP8
Jumper A15TP3 to A15TP9 (+5V)
Jumper A3A6TP3 to A3A6TP6

Signature Analyzer Connections:

CLOCK ⎍ to A15U2 pin 11
START ⎍ to A14TP10
STOP ⎍ to A14TP9

- 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.
- Press A3A7S1 after completing connections for each test or check.
- Refer to Figure 8-1 for explanation and instructions for use of signature analysis diagrams.
- Refer to A3 Digital Storage Block Diagram for further troubleshooting information.

Table 8-49. A4A9 IF Control, Replaceable Parts (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A9	85662-60089	1	BOARD ASSY: IF CONTROL	28480	85662-60089
A4A9C1	0180-0197	5	CAPACITOR:FXD 2.2 UF ±10% 20VDC	04200	150D225X9020A2
A4A9C2	0180-0197		CAPACITOR:FXD 2.2 UF ±10% 20VDC	04200	150D225X9020A2
A4A9C3	0180-0197		CAPACITOR:FXD 2.2 UF ±10% 20VDC	04200	150D225X9020A2
A4A9C4	0180-0197		CAPACITOR:FXD 2.2 UF ±10% 20VDC	04200	150D225X9020A2
A4A9C5	0180-0197		CAPACITOR:FXD 2.2 UF ±10% 20VDC	04200	150D225X9020A2
A4A9C6	0160-2055	1	CAPACITOR:FXD .01UF +80 −20% 100VDC	28480	0160-2055
A4A9C7	0160-3878	4	CAPACITOR:FXD 1000PF ±20% 100VDC	28480	0160-3878
A4A9C8	0160-3878		CAPACITOR:FXD 1000PF ±20% 100VDC	28480	0160-3878
A4A9C9	0160-3878		CAPACITOR:FXD 1000PF ±20% 100VDC	28480	0160-3878
A4A9C10	0160-3878		CAPACITOR:FXD 1000PF ±20% 100VDC	28480	0160-3878
A4A9CR1	1901-0040	12	DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR2	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR3			NOT ASSIGNED		
A4A9CR4	1901-0050	6	DIODE:SWITCHING 80V 200MA 2NS	28480	1901-0050
A4A9CR5	1901-0050		DIODE:SWITCHING 80V 200MA 2NS	28480	1901-0050
A4A9CR6	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR7	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR8	1901-0050		DIODE:SWITCHING 80V 200MA 2NS	28480	1901-0050
A4A9CR9	1901-0050		DIODE:SWITCHING 80V 200MA 2NS	28480	1901-0050
A4A9CR10	1901-0050		DIODE:SWITCHING 80V 200MA 2NS	28480	1901-0050
A4A9CR11	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR12	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR13	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR14	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR15	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR16	1910-0016	2	DIODE:GE 60V 60MA 1US	28480	1910-0016
A4A9CR17	1910-0016		DIODE:GE 60V 60MA 1US	28480	1910-0016
A4A9CR18	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR19	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR20	1901-0040		DIODE:SWITCHING 30V 50MA 2NS	28480	1901-0040
A4A9CR21	1901-0050		DIODE:SWITCHING 80V 200MA 2NS	28480	1901-0050
A4A9L1	9100-1618	1	COIL:MOLDED 5.6UH 10% Q=45	02172	15-4435-1K
A4A9Q1	1854-0477	1	TRANSISTOR:NPN SI PD=500MW	02237	2N2222A
A4A9Q2	1853-0281	9	TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q3	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q4	1854-0404	19	TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q5	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q6	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q7	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q8	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404

Table 8-49. A4A9 IF Control, Replaceable Parts (2 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A9Q9	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q10	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q11	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q12	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q13	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q14	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q15	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q16	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q17	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q18	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q19	1954-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q20	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q21	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q22	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q23	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q24	1854-0404		TRANSISTOR:NPN SI PD=360MW	28480	1854-0404
A4A9Q25	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q26	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q27	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q28	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9Q29	1853-0281		TRANSISTOR:PNP SI PD=400MW	02037	2N2907A
A4A9R1	0698-0085	17	RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R2	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R3	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R4	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R5	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R6	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R7	0698-0085		RESISTOR:2.16K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R8	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R9	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R10	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R11	0698-0085		RESISTOR:2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R12	0757-0442	10	RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R13	0757-0280	2	RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1001-F
A4A9R14	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R15	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R16	0757-0317	1	RESISTOR:1.33K 1% .125W	03292	C4-1/8-TO-1331-F
A4A9R17	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R18	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R19	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R20	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R21	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R22	0698-3160	1	RESISTOR:31.6K 1% .125W	03292	C4-1/8-TO-3162-F
A4A9R23	0757-0467	1	RESISTOR:121K 1% .125W	03292	C4-1/8-TO-1213-F
A4A9R24	0698-3158	1	RESISTOR:23.7K 1% .125W	03292	C4-1/8-TO-2372-F
A4A9R25	0757-0459	1	RESISTOR:56.2K 1% .125W	03292	C4-1/8-TO-5622-F
A4A9R26	0757-0458	2	RESISTOR:51.1K 1% .125W	03292	C4-1/8-TO-5112-F
A4A9R27	0757-0442		RESISTOR:10K 1% .125W	03292	C4-1/8-TO-1002-F

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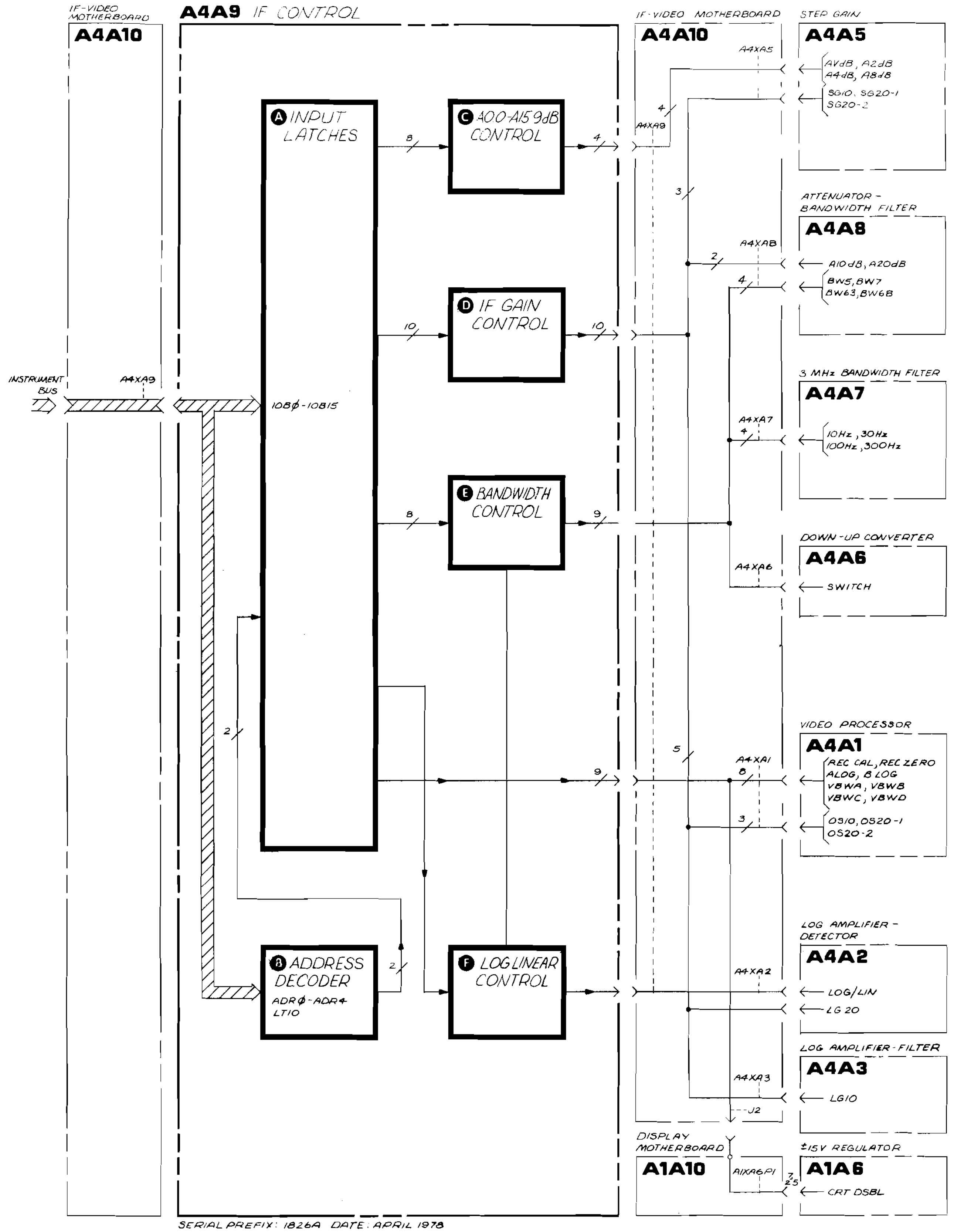
Table 8-49. A4A9 IF Control, Replaceable Parts (3 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A9R28	0757-0458		RESISTOR: 51.1K 1% .125W	03292	C4-1/8-TO-5112-F
A4A9R29	0757-0420	1	RESISTOR: 750 1% .125W	03292	C4-1/8-TO-751-F
A4A9R30	0757-0438	9	RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R31	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R31	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R32	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R33	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R34	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R35	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R36	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R37	0698-0085		RESISTOR: 2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R38	0698-0085		RESISTOR: 2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R39	0698-0085		RESISTOR: 2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R40			NOT ASSIGNED		
A4A9R41	0698-8824	1	RESISTOR: 562K 1% .125W	02995	MF4C
A4A9R42	0698-3455	2	RESISTOR: 261K 1% .125W	03282	C4-1/8-TO-2613-F
A4A9R43	0698-0085		RESISTOR: 2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R44	0757-0428	1	RESISTOR: 1.62K 1% .125W	03292	C4-1/8-TO-1621-F
A4A9R45	0757-0280		RESISTOR: 1K 1% .125W	03292	C4-1/8-TO-1001-F
A4A9R46	0757-0419	2	RESISTOR: 681 1% .125W	03292	C4-1/8-TO-681R-F
A4A9R47	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R48	0698-0083	2	RESISTOR: 1.96K 1% .125W	03292	C4-1/8-TO-1961-F
A4A9R49	0698-3260	3	RESISTOR: 464K 1% .125W	02995	MF4C-1
A4A9R50	0698-3260		RESISTOR: 464K 1% .125W	02995	MF4C-1
A4A9R51	0698-0083		RESISTOR: 1.96K 1% .125W	03292	C4-1/8-TO-1961-F
A4A9R52	0698-3150	1	RESISTOR: 2.37K 1% .125W	03292	C4-1/8-TO-2371-F
A4A9R53	0698-3158		RESISTOR: 23.7K 1% .125W	03292	C4-1/8-TO-2372-F
A4A9R54	0698-3260		RESISTOR: 464K 1% .125W	02995	MF4C-1
A4A9R55	0757-0442		RESISTOR: 10K 1% .125W	03292	C4-1/8-TO-1002-F
A4A9R56	0757-0279	2	RESISTOR: 3.16K 1% .125W	03292	C4-1/8-TO-3161-F
A4A9R57	0698-3153	1	RESISTOR: 3.83K 1% .125W	03292	C4-1/8-TO-3831-F
A4A9R58	0698-0085		RESISTOR: 2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R59	0698-0085		RESISTOR: 2.61K 1% .125W	03292	C4-1/8-TO-2611-F
A4A9R60	2100-3109	1	RESISTOR: TRMR 2K 10% 17-TRN	03744	3006P-1-202
A4A9R61	2100-3103	1	RESISTOR: TRMR 10K 10% 17-TRN	03744	3006P-1-103
A4A9R62	2100-3054	1	RESISTOR: TRMR 50K 10% 17-TRN	03744	3006P-1-503
A4A9R63	0757-0419		RESISTOR: 681 1% .125W	03292	C4-1/8-TO-681R-F
A4A9R64	0757-0438		RESISTOR: 5.11K 1% .125W	03292	C4-1/8-TO-5111-F
A4A9R65	2100-3094	1	RESISTOR: TRMR 100K 10% 17-TRN	03744	3006P-1-104
A4A9R66	2100-3161	1	RESISTOR: TRMR 20K 10% 17-TRN	03744	3006P-1-203
A4A9R67	0757-0465	1	RESISTOR: 100K 1% .125W	03292	C4-1/8-TO-1003-F
A4A9R68	0757-0279		RESISTOR: 3.16K 1% .125W	03292	C4-1/8-TO-3161-F
A4A9R69	0698-3455		RESISTOR: 261K 1% .125W	03292	C4-1/8-TO-2613-F
A4A9R70	0698-3456	1	RESISTOR: 287K 1% .125W	03292	C4-1/8-2873-F
A4A9R71	0698-3453	1	RESISTOR: 196K 1% .125W	03292	C4-1/8-TO-1963-F
A4A9TP1	1251-0600	2	CONTACT: CONNECTOR POST MALE	28480	1251-0600
A4A9TP2	1251-0600		CONTACT: CONNECTOR POST MALE	28480	1251-0600
A4A9U1	1826-0092	1	IC: OP AMP	28480	1826-0092

Table 8-49. A4A9 IF Control, Replaceable Parts (4 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A9U2	1820-1418	3	IC: 4-TO-10 LINE DECODER	01698	SN74LS42N
A4A9U3	1820-1195	1	IC: TTL D-TYPE FF	01698	SN74LS175N
A4A9U4	8120-1418		IC: 4-TO-10 LINE DECOEER	01698	SN74LS42N
A4A9U5	1810-0206	1	NETWORK: RESISTOR 8-PIN-SIP 10K	02483	750-81-R10K
A4A9U6	1820-1196	5	IC: TTL D-TYPE FF	01698	SN74LS174N
A4A9U7	1820-1216	1	IC: TTL 3-TO-8 LINE DECODER	01698	SN74LS138N
A4A9U8	1820-1196		IC: TTL D-TYPE FF	01698	SN74LS174N
A4A9U9	1820-1196		IC: TTL D-TYPE FF	01698	SN74LS174N
A4A9U10	1820-1196		IC: TTL D-TYPE FF	01698	SN74LS174N
A4A9U11	1820-1196		IC: TTL D-TYPE FF	01698	SN74LS174N
A4A9U12	1820-1418		IC: 4-TO-10 LINE DECODER	01698	SN74LS42N
A4A9U13	1820-0668	1	IC: TTL NON-INV HEX BFR	01698	SN7407N
A4A9VR1	1902-0041	1	DIODE: ZENER 5.11V 5% PD=.4W	02763	CD 35622
A4A9VR2	1902-3203	1	DIODE: ZENER 14.7V 5% PD=.4W	02237	FZ7206



A4A9

Figure 8-160. A4A9 IF Control, Block Diagram

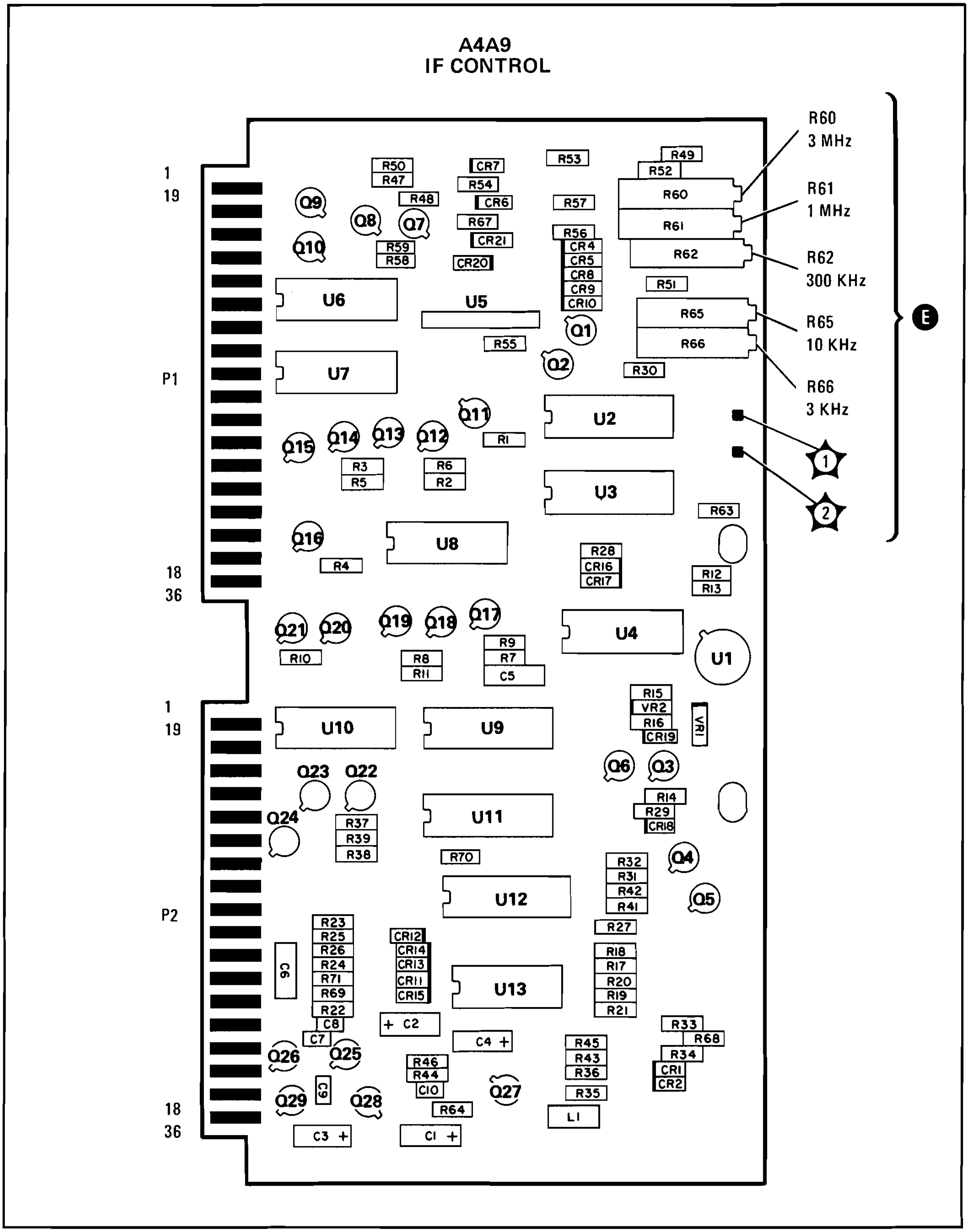


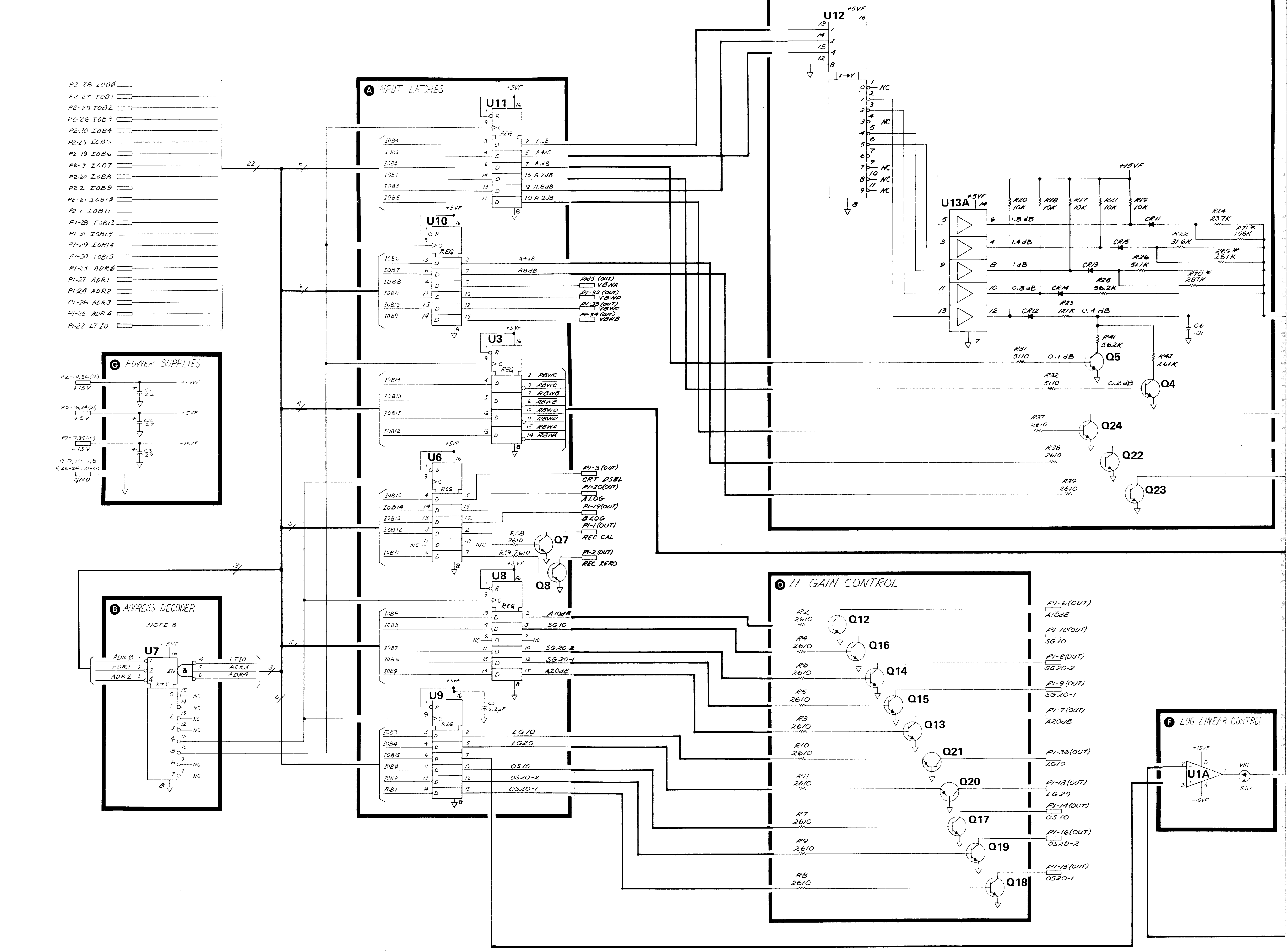
Figure 8-161. A4A9 IF Control, Component Locations

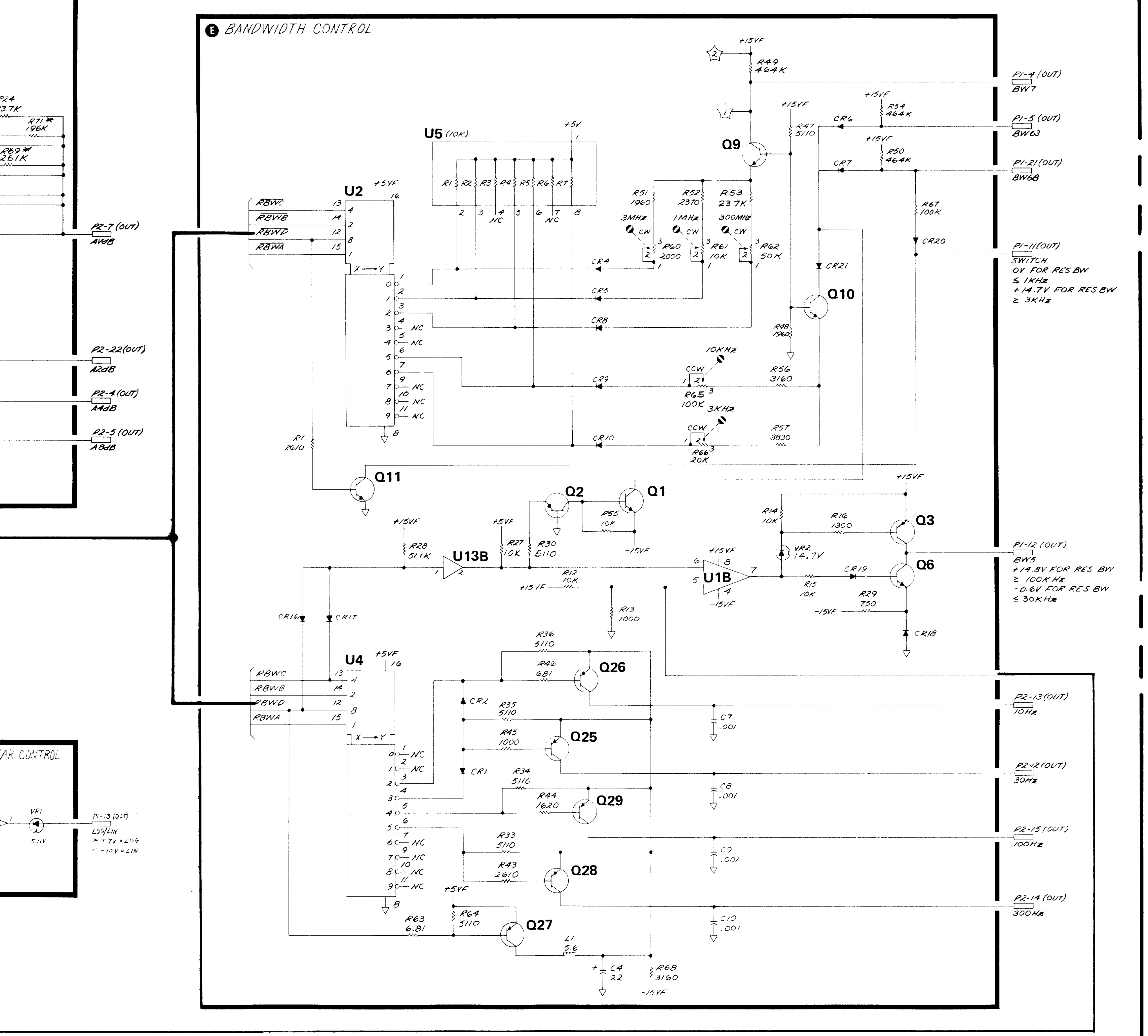
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	REC CAL	A4A1, P2-2	A
19	BLOG	A4A1, P1-12	A
2	REC ZERO	A4A1, P2-1	A
20	ALOG	A4A1, P1-6	A
3	CRT DSBL	A1A6, P1-7,25	A
21	BW6F	A4A4, P1-10	E
4	BW7	A4A8, P1-10	E
22	LT10	A4A10, J1-49	B
5	BW63	A4A8, P1-11	E
23	ADRØ	A4A10, J1-23	B
6	A10dB	A4A8, P1-7	D
24	ADR2	A4A10, J1-25	B
7	A20dB	A4A8, P1-8	D
25	ADR4	A4A10, J1-27	B
8	SG20-2	A4A5, P1-10	D
26	ADR3	A4A10, J1-26	B
9	SG20-1	A4A5, P1-9	D
27	ADR1	A4A10, J1-24	B
10	SG10	A4A5, P1-8	D
28	IOB12	A4A10, J1-15	A
11	SWITCH	A4A6	E
29	IOB14	A4A10, J1-17	A
12	BW5	A4A8,A3,A4	E
30	IOB15	A4A10, J1-18	A
13	LOG/LIN	A4A2, A3	F
31	IOB13	A4A10, J1-16	A
14	OS10	A4A1, P1-8	D
32	VBWD	A4A1, P1-2	A
15	OS20-1	A4A1, P1-9	D
33	VBWC	A4A1, P1-3	A
16	OS20-2	A4A1, P1-10	D
34	VBWB	A4A1, P1-4	A
17	GND		G
35	VBWA	A4A1, P1-5	A
18	LG20	A4A2, P2-7	D
36	LG10	A4A3, P2-7	D

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	IOB11	A4A10, J1-14	A
19	IOB6	A4A10, J1-9	A
2	IOB9	A4A10, J1-12	A
20	IOB8	A4A10, J1-11	A
3	IOB7	A4A10, J1-10	A
21	IOB1Ø	A4A10, J1-13	A
4	A4dB	A4A5, P2-16	C
22	A2dB	A4A5, P2-17	C
5	A8dB	A4A5, P2-15	C
23	GND		G
6	GND		G
24	GND		G
7	AVdB	A4A5, P2-13	C
25	IOB5	A4A10, J1-8	A
8	GND		G
26	IOB3	A4A10, J1-6	A
9	GND		G
27	IOB1	A4A10, J1-4	A
10	GND		G
28	IOBØ	A4A10, J1-3	A
11	GND		G
29	IOB2	A4A10, J1-5	A
12	30Hz	A4A7, P2-1	E
30	IOB4	A4A10, J1-7	A
13	10Hz	A4A7, P2-2	E
31	GND		G
14	300Hz	A4A7, P2-7	E
32	GND		G
15	100Hz	A4A7, P2-8	E
33	GND		G
16	+5V		G
34	+5V		G
17	-15V		G
35	-15V		G
18	+15V		G
36	+15V		G





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. MNEMONICS TABLE:

MNEMONIC	DESCRIPTION
A.1dB	ATTENUATOR STEPS FOR A4A5 STEP GAIN
A.2dB	
A.4dB	
A.8dB	
A1dB	ATTENUATOR STEPS FOR A4A8 ATTEN-BW FILTER
A2dB	
A4dB	
A8dB	
A10dB	
A20dB	
A[illegible]	
ADR0-4	INSTRUMENT BUS ADDRESS BITS
A LOG	LOG EXPAND CONTROLS FOR A4A1 VIDEO PROCESSOR
B LOG	
BW5	BANDWIDTH CONTROL LINES
BW7	
BW63	
BW68	
IB0-15	INSTRUMENT BUS DATA BITS
LG10	LINEAR GAIN STEPS AND CONTROL FOR LOG AMPLIFIERS
LG20	
LOG/LIN	
LT10	LOW = DISPLAY SECTION I/O STROBE
OS10	OFFSET GAIN STEPS FOR A4A1 VIDEO PROCESSOR
OS20-1	
OS20-2	
REC CAL	RECORDER CALIBRATE
REC ZERO	RECORDER ZERO
SG10	STEP GAIN 10dB
SG20-1	STEP GAIN 20dB #1
SG20-2	STEP GAIN 20dB #2
VBWA	VIDEO BANDWIDTH CONTROL LINES
VBWB	
VBWC	
VBWD	

4. UNLESS OTHERWISE INDICATED LOGIC LEVELS ARE:
+2.0V TO +6.0V = LOGIC "1" HIGH = H
0V TO +0.8V = LOGIC "0" LOW = BLANK

5. BANDWIDTH CONTROL LINES (ALL VOLTAGES APPROXIMATE)

RES BW \ CONTROL LINES	BW5	BW63	BW68	BW7	SWITCH	300Hz	100Hz	30Hz	10Hz
3MHz	+14.8V	-14V	-14V	+9.7V	+14.7V	<-10V	<-10V	<-10V	<-10V
1MHz	+14.8V	-14V	-14V	+13.1V	+14.7V	<-10V	<-10V	<-10V	<-10V
300KHz	+14.8V	-14V	-14V	+14.1V	+14.7V	<-10V	<-10V	<-10V	<-10V
100KHz	+14.8V	-14V	-14V	+14.5V	+14.7V	<-10V	<-10V	<-10V	<-10V
30KHz	-.6V	+14.3V	+14.3V	+14.3V	+14.7V	<-10V	<-10V	<-10V	<-10V
10KHz	-.6V	+9.3V	+9.3V	+14.3V	+14.7V	<-10V	<-10V	<-10V	<-10V
3KHz	-.6V	+9.0V	+9.0V	+14.3V	+14.7V	<-10V	<-10V	<-10V	<-10V
1KHz	-.6V	+14.3	+9.2V	+14.3V	0V	<-10V	<-10V	<-10V	<-10V
300Hz	-.6V	+14.3	+9.2V	+14.3V	0V	>4V	<-10V	<-10V	<-10V
100Hz	-.6V	+14.3	+9.2V	+14.3V	0V	<-10V	>4V	<-10V	<-10V
30Hz	-.6V	+14.3	+9.2V	+14.3V	0V	<-10V	<-10V	>4V	<-10V
10Hz	-.6V	+14.3	+9.2V	+14.3V	0V	<-10V	<-10V	>4V	>4V

6. LOG EXPAND TRUTH TABLE:

dB/DIV	B LOG	A LOG
10		
5		H
2	H	
1	H	H

7. RESOLUTION BANDWIDTH TRUTH TABLE:

RESOLUTION BANDWIDTH	RBWD	RBWC	RBWB	RBWA
3MHz	H	H	H	H
1MHz	H	H	H	
300 KHz	H	H		H
100 KHz	H	H		
30 KHz	H		H	H
10 KHz	H		H	
3 KHz	H			H
1 KHz		H	H	
300 Hz		H		H
100 Hz		H		
30 Hz			H	H
10 Hz			H	

VIDEO BANDWIDTH TRUTH TABLE:

VIDEO BANDWIDTH	VBWD	VBWC	VBWB	VBWA
3MHz	H	H	H	H
1MHz	H	H	H	
300KHz	H	H		H
100 KHz	H	H		
30 KHz	H		H	H
10 KHz	H		H	
3 KHz	H			H
1 KHz		H	H	
300 Hz		H		H
100 Hz		H		
30 Hz			H	H
10 Hz			H	
3 Hz				H
1 Hz				

8. ADDRESS LINE TRUTH TABLE:

ADR4	ADR3	ADR2	ADR1	ADR0	ADDRESS
H		H			ADDRESS 20
H		H		H	ADDRESS 21

9. 10dB GAIN STEP TRUTH TABLE: (LEVELS AT OUTPUT OF LATCHES U8 AND U9)

REFERENCE LEVEL RES BW ≥ 3 KHz		dBM			-10	-20	-30	-40	-50	-60	-70	-80	-90	-100	-110
REFERENCE LEVEL RES BW ≤ 1KHz		dBM	-10	-20	-30	-40	-50	-60	-70	-80	-90	-100	-110	-120	-130
A10dB	LOG		H											
	LIN		H											
A20dB	LOG	H												
	LIN	H												
SG10	LOG				H		H		H	H	H	H	H	H
	LIN				H		H		H	H	H	H	H	H
SG20-1	LOG					H	H	H	H	H	H	H	H	H
	LIN					H	H	H	H	H	H	H	H	H
SG20-2	LOG							H	H	H	H	H	H	H
	LIN							H	H	H	H	H	H	H
OS10	LOG									H		H		H
	LIN													
OS20-1	LOG										H	H	H	H
	LIN													
OS20-2	LOG												H	H
	LIN													
LG10	LOG													
	LIN									H		H		
LG20	LOG													
	LIN										H	H		

INPUT ATTENUATION SETTING AT 0dB
SHIFT ATTENUATOR (FOR EXTENDED RANGES)

10. 0.0-15.9 dB CONTROL TRUTH TABLE
(LEVELS AT OUTPUT OF LATCHES U10 AND U11)

CONTROL LINE \ REF LEVEL (dBm)	0	-.1	-.2	-.3	-.4	-.5	-.6	-.7	-.8	-.9	-1.0	-1.1	-1.2	-1.3	-1.4	-1.5	-1.6	-1.7	-1.8	-1.9
A.1dB	H		H		H		H		H		H		H		H		H		H	
A.2dB			H	H			H	H					H	H			H	H		
A.4dB			H	H	H	H							H	H	H	H				
A.8dB	H	H									H	H								
A1dB	H	H	H	H	H	H	H	H	H	H										

REFERENCE LEVEL (dBm)	A2dB	A4dB	A8dB
-10			H
-11			H
-12	H	H	
-13	H	H	
-14		H	
-15		H	
-16	H		
-17	H		
-18			
-19			

11. ASTERISK (*) DENOTES FACTORY SELECTED COMPONENT; TYPICAL VALUE IS SHOWN.

A4A9

Figure 8-162. A4A9 IF Control, Schematic Diagram

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Table 8-50. A4A10 IF-Video Motherboard, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A10	85662-60020	1	BOARD ASSEMBLY, IF-VIDEO MOTHER BOARD	28480	85662-60020
A4A10C1	0180-1746	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A4A10C2	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A4A10C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A4A10C4	0160-4297	13	CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C5	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C6	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C7	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C8	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C9	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C10	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C11	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C12	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C13	0160-2055	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A10C14	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A10C16	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C17	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C18	0160-4297		CAPACITOR-FXD .022UF +80-20% 100VDC CER	56289	C023F101H223ZS22-CDH
A4A10C19	0160-3878	4	CAPACITOR-FXD 1000PF 100V CER	28480	0160-3878
A4A10C20	0160-3878		CAPACITOR-FXD 1000PF 100V CER	28480	0160-3878
A4A10C21	0160-3878		CAPACITOR-FXD 1000PF 100V CER	28480	0160-3878
A4A10C22	0160-3878		CAPACITOR-FXD 1000PF 100V CER	28480	0160-3878
A4A10C23	0160-3879	1	CAPACITOR-FXD .01UF ± 20% 100VDC CER	28480	0160-3879
A4A10J1	1251-4828	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-4828
A4A10J2	1251-3276	1	CONNECTOR 6-PIN M POST TYPE	28480	1251-3276
A4A10L1	9100-1618	11	COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L2	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L3	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L4	08558-8001	3	FILTER, COIL, BLUE	28480	08558-80011
A4A10L5	08558-8001		FILTER, COIL, BLUE	28480	08558-80011
A4A10L6	08558-8001		FILTER, COIL, BLUE	28480	08558-80011
A4A10L7	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L8	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L9	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L10	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L11	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L12	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L13	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10L14	9100-1618		COIL-MLD 5.6UH 10% Q=45 .155DX.375LG-NOM	28480	9100-1618
A4A10R1	0757-0401	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A10R2	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A10R3	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4A10R4	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4XA1P1	1251-0472	15	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA1P2	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA2P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA2P2	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA3P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA3P2	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA5P2	1251-2034	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	28480	1251-2034
A4XA9P1	1251-2026	2	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A4XA9P2	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A4XA4P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA4P2	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA5P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA6A1P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA6A2P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA7P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA7P2	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA8P1	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A4XA8P2	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472

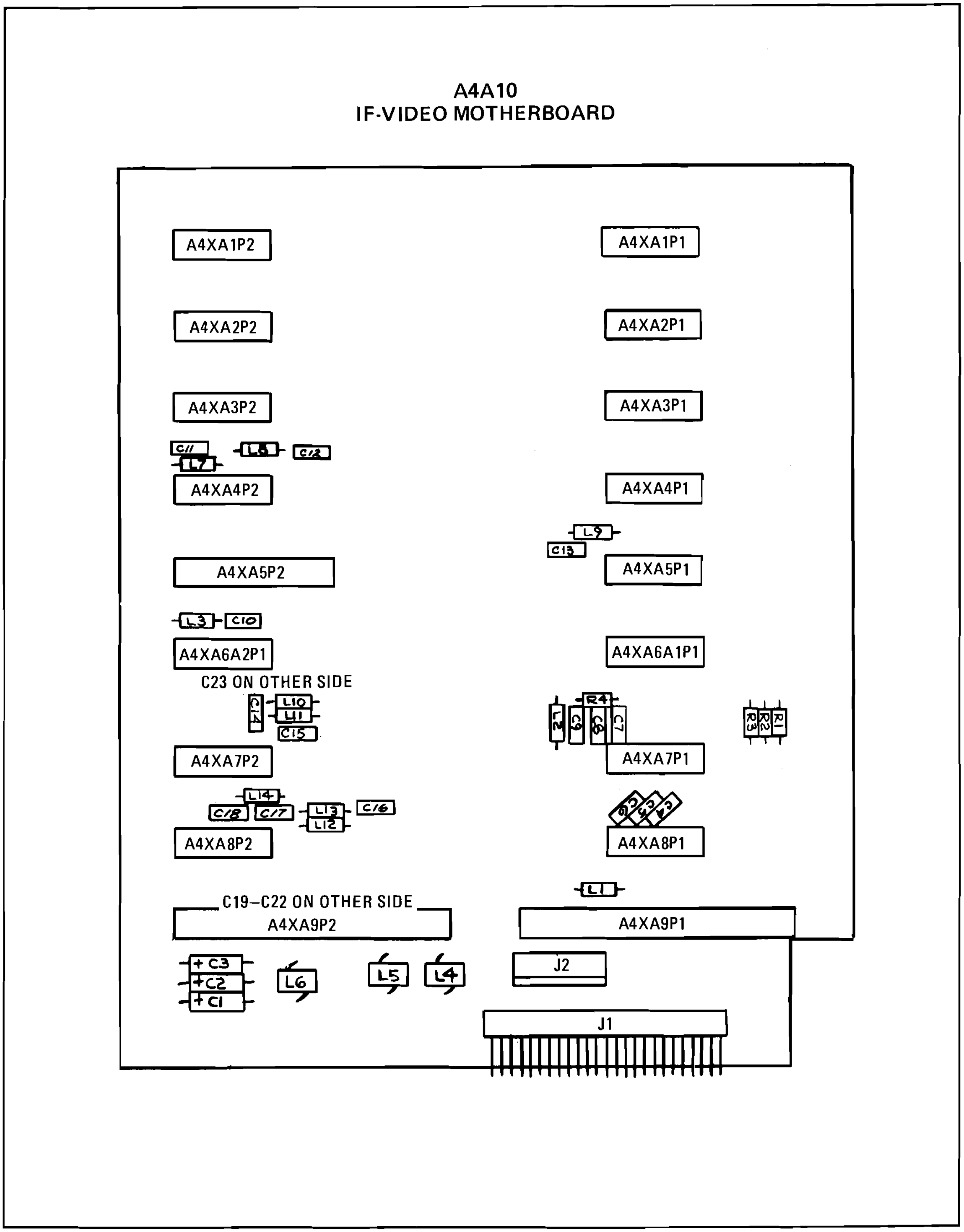
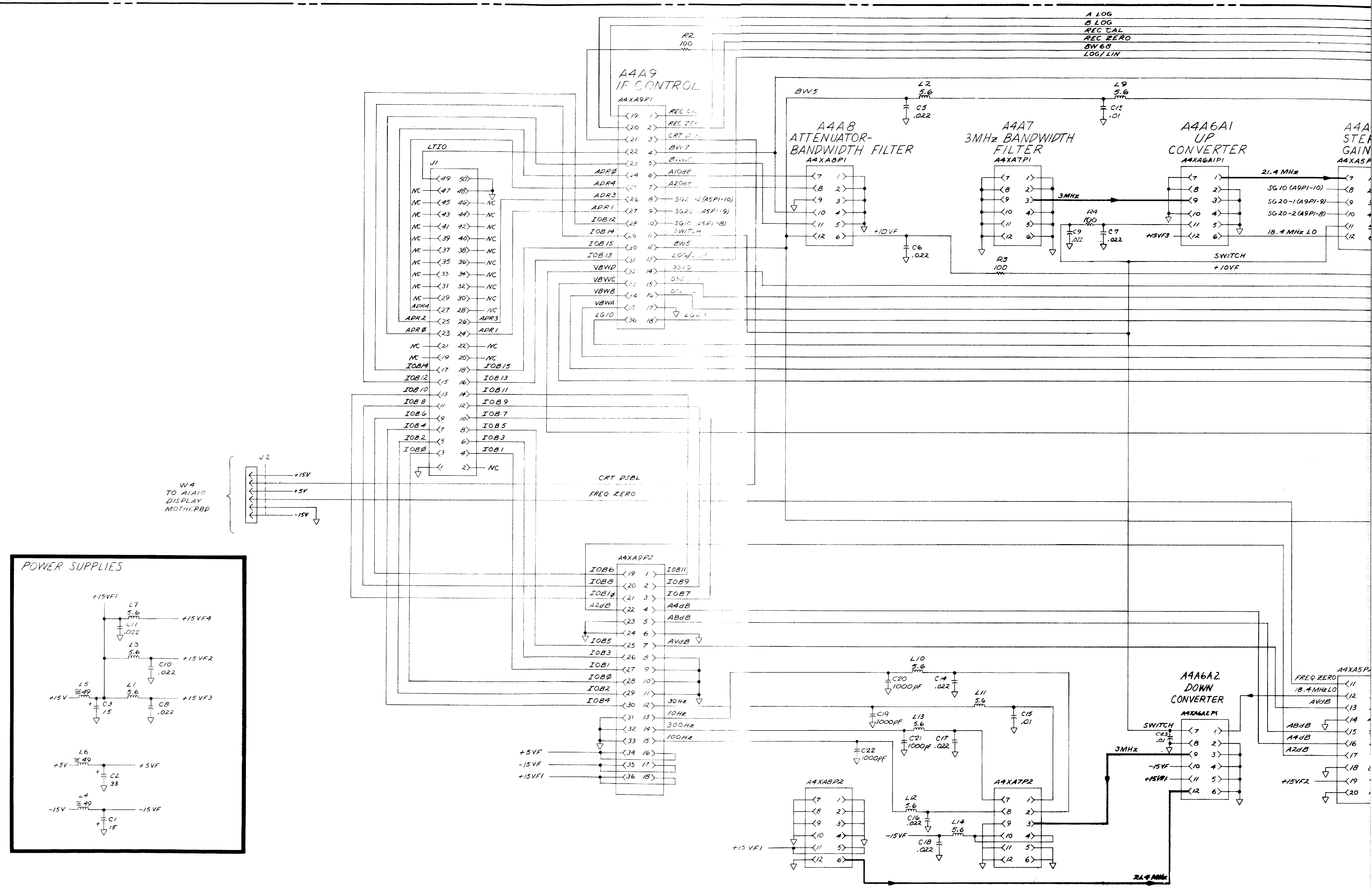


Figure 8-163. A4A10 IF-Video Motherboard, Component Locations

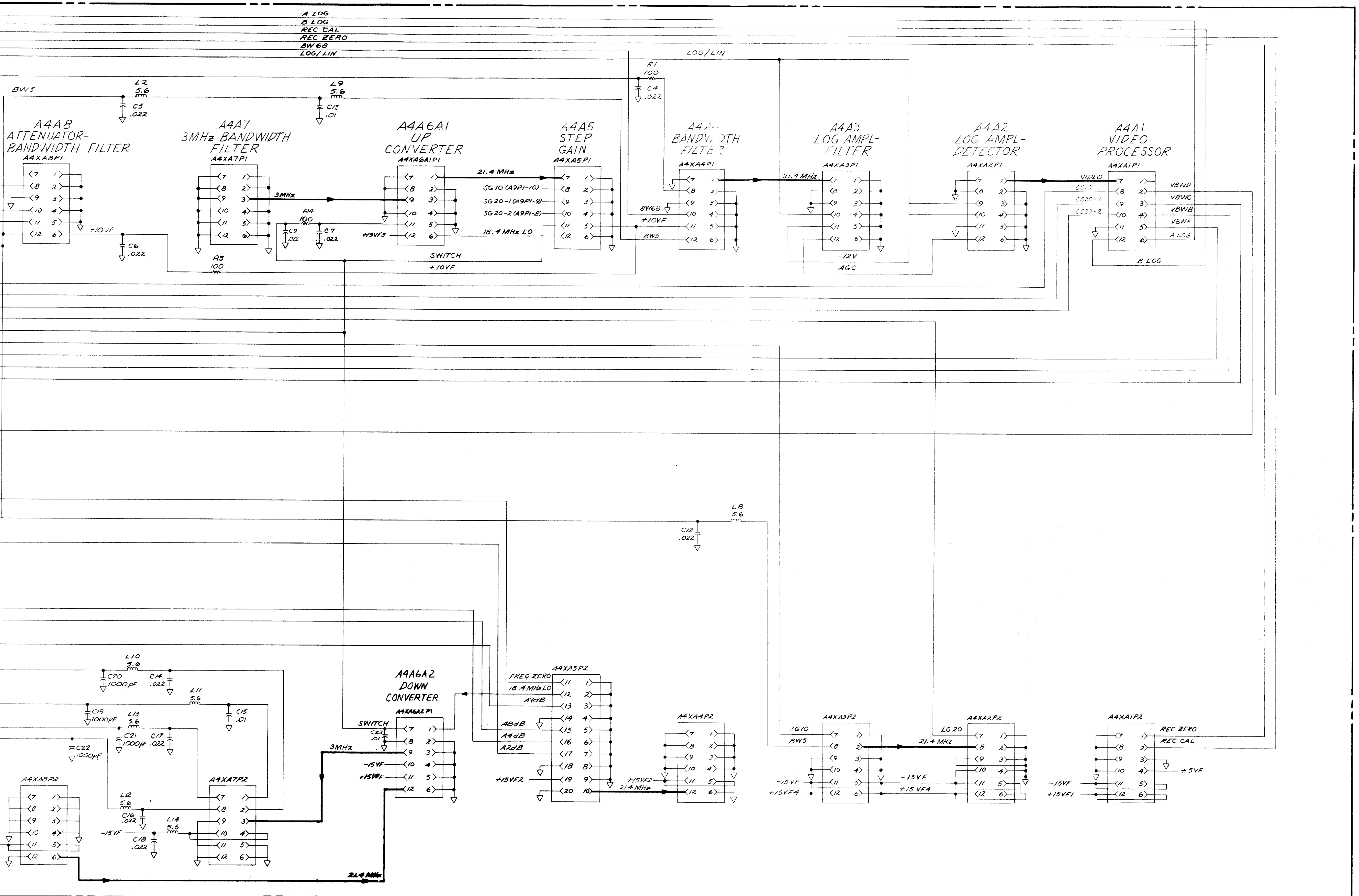
A4A10 IF-VIDEO MOTHERBOARD
85662-60020

J1 50-WIRE INSTRUMENT BUS

PIN	SIGNAL
1	GND
2	NC
3	IOBØ
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
20	NC
21	NC
22	HPON (NC)
23	ADR Ø
24	ADR 1
25	ADR 2
26	ADR 3
27	ADR4
28	ADR5 (NOT USED)
29	NC
30	NC
31	KR8 (NC)
32	KR9 (NC)
33	KR10 (NC)
34	KR11 (NC)
35	KCØ (NC)
36	KC1 (NC)
37	KC2 (NC)
38	KC3 (NC)
39	KC4 (NC)
40	KC5 (NC)
41	KC6 (NC)
42	KC7 (NC)
43	LSTP (NC)
44	HSWP (NC)
45	LSRQ (NC)
46	LDSR (NC)
47	LB10 (NC)
48	GND
49	LT10
50	GND



SERIAL PREFIX: 1826A DATE: APRIL, 1978



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR EXCEPT PC BOARD CONNECTORS WHICH ARE COMPLETE AS SHOWN.

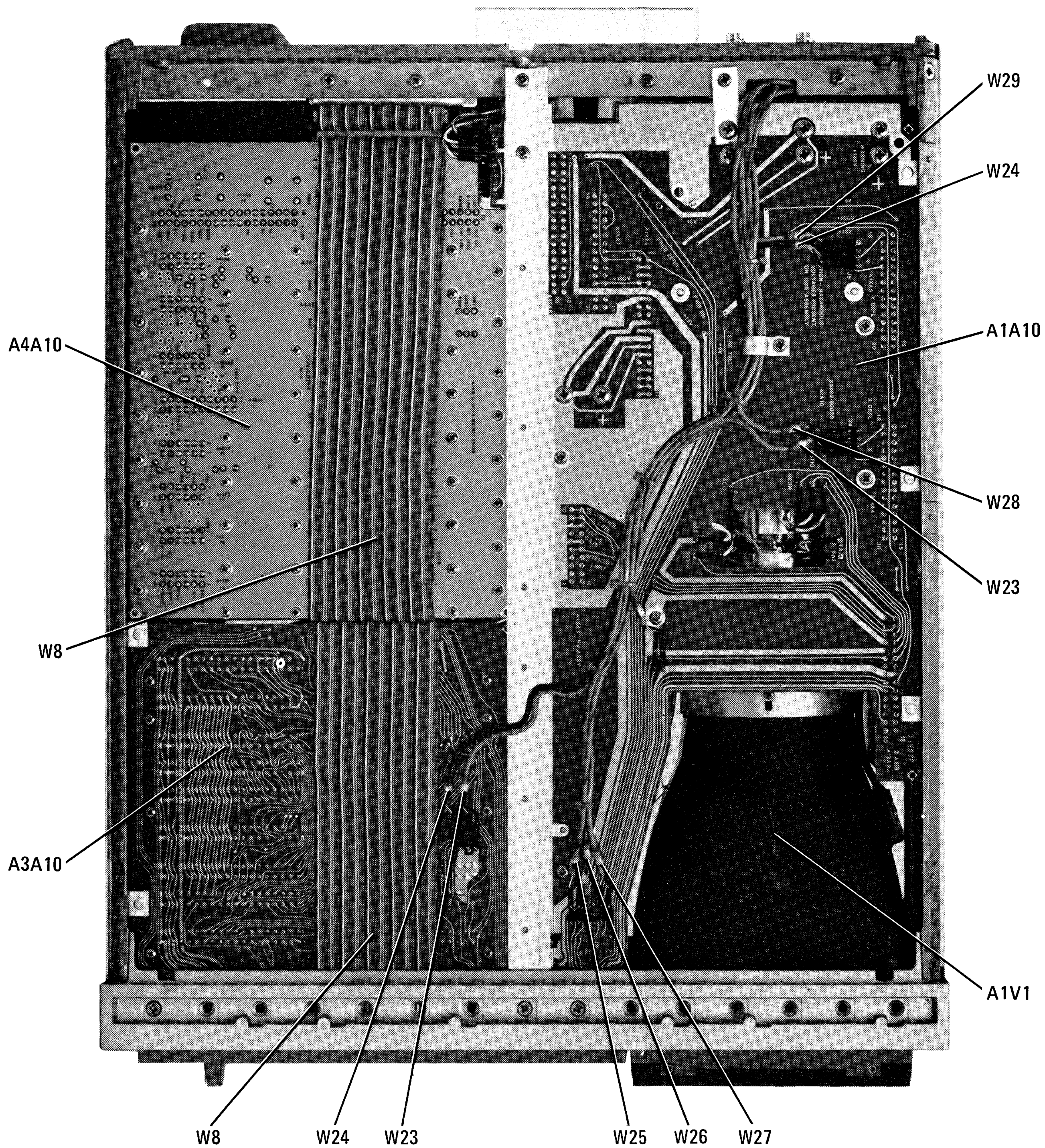
2. UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS (Ω)
CAPACITANCE IN MICROFARADS (μF)
INDUCTANCE IN MICROHENRIES (μH)

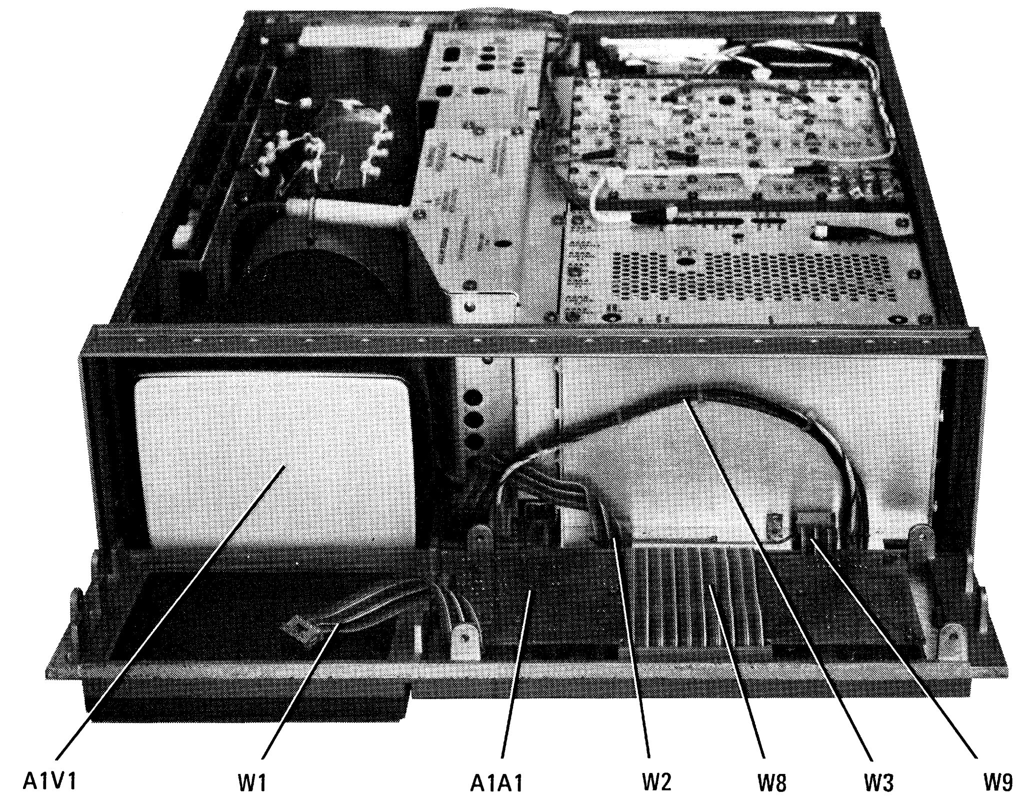
3. MNEMONICS TABLE:

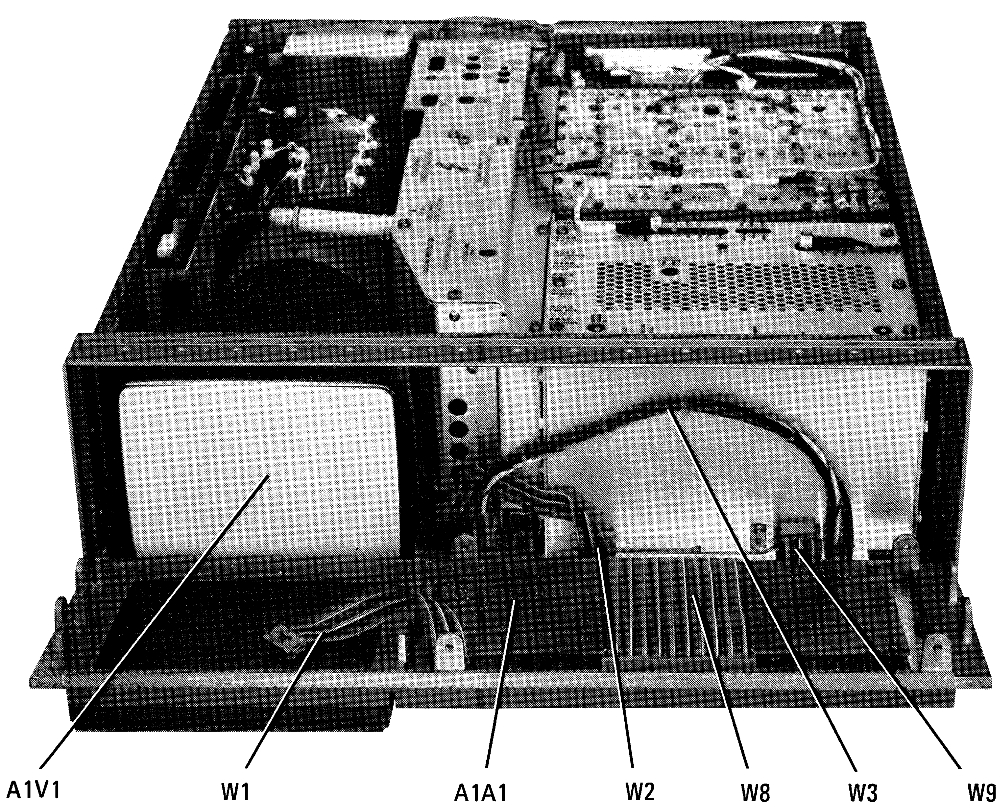
MNEMONIC	DESCRIPTION
SG10 SG20-1 SG20-2	STEP GAIN CONTROLS
OS10 OS20-1 OS20-2	OFFSET GAIN CONTROLS
LG10 LG20	LINEAR GAIN CONTROLS
VBWA VBWB VBWC VBWD	VIDEO BANDWIDTH CONTROLS
RBWA RBWB RBWC RBWD	RESOLUTION BANDWIDTH CONTROLS
VIDEO	VIDEO SIGNAL
SWITCH	UP/DOWN CONVERTER
18.4MHz LO	LOCAL OSC SIGNAL
21.4 MHz	21.4 MHz IF SIGNAL
3MHz	3 MHz IF SIGNAL
BW5 BW7 BW63 BW68	BANDWIDTH CONTROL
FREQ ZERO	FREQ ZERO [illegible]
CRT DSBL	CRT DSBL CONTROL
REC CAL	RECORDER CAL
REC ZERO	RECORDER ZERO
A LOG B LOG	LOG EXPAND CONTROL
LOG/LIN	LOG/LINEAR CONTROL
A2dB A4dB A8dB A10dB A20dB AVdB	ATTENUATOR CONTROLS
IOBØ-IOB15	INSTRUMENT BUS DATA BITS Ø-15
ADRØ-ADR4	INSTRUMENT BUS ADDRESS BITS
LTIO	LOW = DISPLAY SECTION I/O STROBE

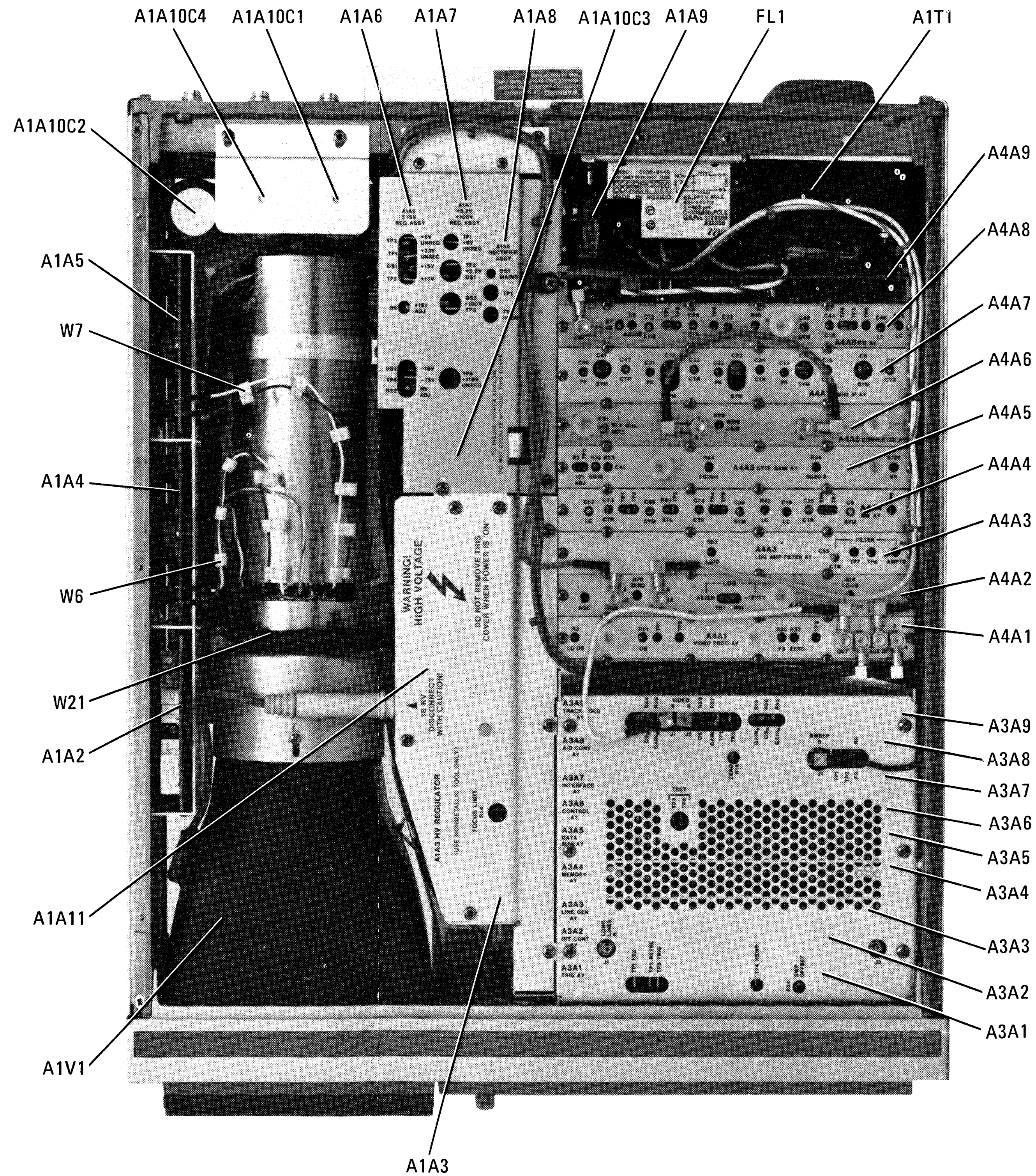
A4A10

Figure 8-164. A4A10 IF-Video Motherboard, Interconnect Diagram


W29
W24
A1A10
A4A10
W28
W23
W8
A3A10
A1V1
W8
W24
W23
W25
W26
W27


A1V1
W1
A1A1
W2
W8
W3
W9





NOTE: REFER ALSO TO FIGURE 6-1 THROUGH 6-10.

Figure 8-165. Major Assembly and Component Locations