HEWLETT PACKARD

OPERATING AND SERVICE MANUAL

CHAPTER. D

8505A
NETWORK ANALYZER
500 kHz to 1.3 GHz

SERIAL NUMBERS

Chapter A of this manual applies directly to HP Model 8505A Network Analyzers with serial number prefix 1816A. Chapters B and on apply directly to instruments with serial number prefix 1628A. For instruments with serial number lower than these, refer to the Manual Changes section of each chapter.

1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CALIFORNIA 95404 U.S.A.

MANUAL PART NO. 08505-90002
Microfiche Part No. 08505-90003

Printed: SEPTEMBER 1978

COPYRIGHT AND DISCLAIMER NOTICE

MANUAL CHANGES

MANUAL IDENTIFICATION	
Model Number:	8505A
Date Printed:	September 1978
Part Number:	08505-90002

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

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes
1628A00240 and thru 1631A prefix	1
1644A, 1653	1,2
1646A	1,3
1602A00112	4
1710A	1,2,5
1712A	1,2,5,6,7
1716A	1,2,5,6,7,8
1720A	1,2,5,6,7,8,9
1723A	1,2,5,6,7,8,9,10
1733A	1,2,5 – 11
1735A, 1739	1,2,5 – 12
1745A	1,2,5 – 13
1747A	1,2,5 – 14
1802A	1,2,5 – 15
1804A	1,2,5 – 16

Serial Prefix or Number	Make Manual Changes
1806A	1,2,5 – 17
1816A	1,2,5 – 18
1831A	1,2,5 – 19
1833A	1,2,5 – 20
1845A	1,2,5–21
► 1928A	1,2,5–22
► 1930A, 1932A	1,2,5–23

► NEW ITEM

NOTE

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

9 OCTOBER 1979

70 Pages

HEWLETT PACKARD

The following Service Notes are available from your local HP Sales and Service Office.

SERVICE NOTE	SERIAL NUMBER	DESCRIPTION
8505A-1A	1716A00380 and below	*INCREASED POWER SUPPLY RELIABILITY*
8505A-2	1602A00111 thru 1610A00140	*REDUCED 50 HZ LINE RELATED VARIATIONS ON CRT TRACE*
8505A-3	1622A00185 and below	*RECOMMENDED REPLACEMENT FOR OP AMP*
8505A-4	1606A00130 and below	*IMPROVED OPERATION OF A3A11 GROUP DELAY CIRCUIT*
8505A-5	1723A00396 and below	*AIR FILTER RETAINER*
8505A-6A	All serials	*A3A11 GROUP DELAY DETECTOR TROUBLESHOOTING*
8505A-7	All serials	*A3A4 PROCESSOR INTERFACE BOARD TROUBLESHOOTING*
8505A-8	1716A00380 and below	*ELIMINATION OF MARKER GLITCHES ON CRT WHEN 8505A IS USED WITH HP8501A STORAGE NORMALIZER*
8505A-9	1710A00350 and below	*ELIMINATION OF ERRONEOUS DATA TAKING BY HP-IB AT "TURN ON"*
8505A-10A	All serials	*A3A5 PROCESSOR D/A TROUBLESHOOTING*
8505A-12	All serials	*CRT CONTROL CIRCUITS TROUBLESHOOTING*
8505A-17	All serials	*A3A17 MARKER I ASSEMBLY TROUBLESHOOTING*
8505A-18	All serials	*A3A18 MARKER II ASSEMBLY TROUBLESHOOTING*

ERRATA

All references to "Option 001" should be deleted throughout the manual and the phrase "HP-IB" substituted in their place.

Page A4-24, Paragraph A4-18:
In step a, "On A3 Signal Processor, Channel 1", change MODE switch position to PHASE.

Page B2-8, Table B2-2:
Change A1A15J1 thru J5 to HP Part Number 1250-0691.

Page B2-10, Table B2-2:
Add another entry after A1A15A1Y1 as follows:
HP Part No. 0410-0675, Crystal, Matched Set, A1A15A1Y1 9.9 MHz Crystal and A2A12Y1 100 MHz Crystal.

Page C2-4, Table C2-2:
Add Reference Designation A2A1W3S1 to the replaceable switch (3101-2025) which is part of Line Switch Cable Assembly A2A1W3.
Change A2A1A1DS1 thru DS14 to HP Part Number 1990-0503.

Page C2-5, Table C2-2:
Change A2A1A1U2 to HP Part Number 1820-1823.
Change A2A1A1U3 to HP Part Number 1820-1823.
Change A2A1A1U5 to HP Part Number 1820-1823.

Page C2-8, Table C2-2:
Change A2A3U28 to HP Part Number 1820-1823.
Change A2A3U29 to HP Part Number 1820-1823.
Change A2A3U30 to HP Part Number 1820-1823.
Change A2A3U31 to HP Part Number 1820-1823.
Change A2A3U32 to HP Part Number 1820-1823.
Change A2A3U33 to HP Part Number 1820-1823.

Page C2-10, Table C2-2:
► Change A2A4U2 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.
► Change A2A4U5 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.
Add A2A5C35, 0160-0571, CAPACITOR-FXD 470PF +–20% 100 WVDC CER
Add A2A5C36, 0160-3879, CAPACITOR-FXD .01 UF +–20% 100 WVDC CER

Page C2-12, Table 2-2:
Change A2A5U12 to HP Part Number 1820-1823.
Change A2A5U13 to HP Part Number 1820-1823.
Change A2A5U14 to HP Part Number 1820-1823.
Change A2A5U15 to HP Part Number 1820-1823.

►Page C2-15, Table C2-2:
Change A2A7U1 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.
Change A2A7U2 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.
Change A2A7U3 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.
Change A2A7U11 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.
Change A2A7U12 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.

►Page C2-18, Table C2-2:
Change A2A8U17 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.
Change A2A8U19 to HP Part No. 1826-0229, OP AMP LOW DRIFT TO-99.

Page C2-20, Table C2-2:
Change A2A10CR4 and A2A10CR5 to HP Part Number 1901-0743, DIODE-PWR RECT IN4004 400V 1A DO-41.

Page C2-24, Table C2-2:
Add another entry after A2A12Y1 as follows:
HP Part Number 0410-0675, Crystal, Matched Set, A1A15A1Y1 9.9 MHz Crystal and A2A12Y1 100 MHz Crystal.

ERRATA (Cont'd)

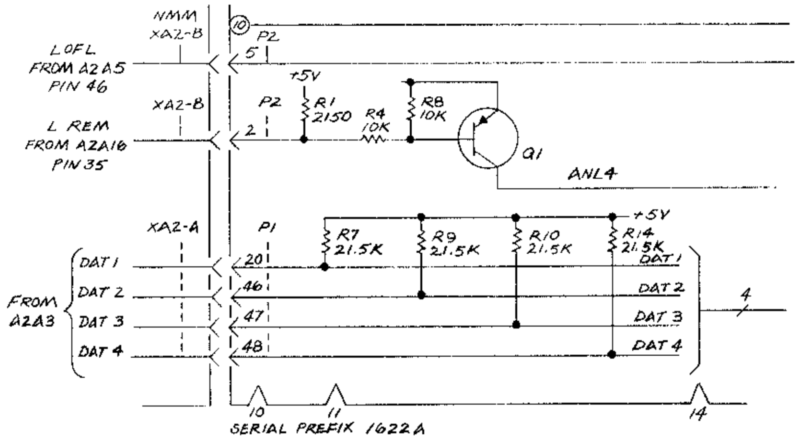
Page C2-25, Table C2-2:
Add additional entries for A2A19 as follows:
A2A19, HP Part Number 08505-60227, YIG OSCILLATOR, NEW (includes A2A11R22 and A2A11R40 Selected Value Resistors).
A2A19, HP Part Number 08505-60228, YIG OSCILLATOR, REBUILT (includes A2A11R22 and A2A11R40 Selected Value Resistors).

Page C2-27, Table C2-2:
Add A2A23, HP Part Number 5086-7005, PREAMP 0.1 - 1300 MHz.

Page C2-28, Figure C2-1:
Change Reference Designation 69 part number to 08505-00135.

►Page C3-33, Table C3-1:
In signal line "MPX H", delete entry in "LOCAL" column and add "A2A15-30" in "REMOTE" column.

Page C3-49, Figure C3-22:
Change notations on connector plugs and jacks as shown in the Partial Schematic.



P/O Figure C3-22. A2A2 Display Logic Schematic (ERRATA)

Page C3-81, Figure C3-31:
Change CR1 to CR3 and CR3 to CR1.

Page C3-81, Figure C3-32:
Change "R58" at input pin 2 of U9A to "R38."

Page C3-93, Figure C3-39:
Change R43 to R42.
Change C9 to C8.
Change R42 to R41.
Change C8 to C9.
Change R41 to R43.

Page C3-93, Figure C3-40:
Change R41 to 10K.
Change R43 to 147K.

Page C3-99, Figure C3-44:
Change "+2V SERIES REGULATORS" to "+20V SERIES REGULATOR".

ERRATA (Cont'd)

Page C3-105, Figure C3-47:
Change references to NOTE 5 on Q1, Q2 and Q3 to NOTE 3.

Page D2-4, Table D2-2:
Change A3F1 from HP Part Number 2110-0059 to HP Part Number 2110-0304, FUSE 1.5 AT 250V SLO-BLO.
Change Reference Designation "A3F2" to A3F1.
Change A3S1 to HP Part Number 3101-1235.
Change A3V1 to HP Part Number 08505-60196, CRT ASSEMBLY WITH OVERLAY TAB MOUNTS.

Page D2-5, Table D2-2:
Add HP Part Number 08505-60154 to the Overlay Kit listed in the table.
Change A3A1DS20-22, 24-26, 28 and 29 to HP Part Number 1990-0503.

Page D2-7, Table D2-2:
Change A3A3C8 to HP Part Number 0180-0116 CAPACITOR-FXD 6.8UF 35VDC.

►Page D2-14, Table D2-2:
Change A3A8VR1 to HP Part No. 1902-3082, DIODE–ZNR 4.64V 5% DO-7 PO = .2W TC = -.016%.

Page D2-30, Table D2-2:
Change A3A24CR2 to HP Part Number 1901-0743, DIODE-PWR RECT IN4004 400V 1A DO-41.

Page D2-31, Table D2-2:
Change Part Number of A3A25R1, A3A25R4, A3A25R5, and A3A25R7 to 2100-3476.
Change Part Number of A3A25R2 to 2100-3473.
Change Part Number of A3A25R3 to 2100-3475.
Change Part Number of A3A25R6 to 2100-3474.

Page D2-32, Table D2-2:
Change A3A26VR1 and A3A26VR2 to HP Part No. 2140-0015, LAMP-GLOW C2A 115/58 VDC 1.9 mA T-2-BULB (Recommended Replacement).

►Change A3A27 to HP Part No. 08505-60237. 08505-60237 is a preferred replacement for 08505-60172.

Page D2-35, Table D2-2:
Change A3A28R20 to A3A28R26, A3A28R24 to A3A28R20, and A3A28R26 toA3A28R24.
Change A3A30C1 to A3A30C2, A3A30C2 to A3A30C5, A3A30C4 to A3A30C1 and A3A30C5 to A3A30C4.

Page D2-36, Figure D2-1:
Add after Item 1 and 5 the following attaching hardware:
0570-1171, SCREW; COVER MTG; 6-32 THD; 0.460-IN LG
0510-0043, RETAINER-RING .141-DIA STL CD-PL
Change Item 16 to HP Part Number 01332-02201.
Change Item 33 to HP Part Number 1490-0968.
►Change Item 34 to HP Part No. 08505-20219, DIVIDER, FRONT FRAME, VERTICAL.
Change Item 36A to HP Part Number 5001-1043.

Page D2-37, Figure D2-1:
Add Item 111, HP Part Number 5001-0432, GUSSET-SIDE.
Change Reference Designation 101 part number to 08505-00135.

Page D3-63, Figure D3-24:
Change C8 to 6.8 UF.

ERRATA (Cont'd)

►Page D3-81, Figure D3-34:
Change the notation on VR1 to "4.64V."
Just above C8, add a notation under "–4.6V" as follows: "TYPICALLY –3.9V."

►Page D3-118, Figure D3-52B:
Change U6 to Up.

►Page D3-131/132, Figure D3-56B:
Change the resistor between C7 and Q8 on the Parts Location drawing from R24 to R26.

Page E4-4, Table E4-2:
Change A2A13U4 to HP Part Number 1820-1823.
Change A2A13U6 to HP Part Number 1820-1823.
Change A2A13U8 to HP Part Number 1820-1823.

Page E4-5, Table E4-2:
Change A2A14U6 to HP Part Number 1820-1823.
Change A2A14U10 to HP Part Number 1820-1823.
Change A2A14U14 to HP Part Number 1820-1823.
Change A2A15U14 to HP Part Number 1820-1823.

Page E4-6, Table E4-2:
Change A2A16U11 to HP Part Number 1820-1823.
Change A2A16U16 to HP Part Number 1820-1823.

Page E4-7, Table E4-2:
Change A3A19U14 to HP Part Number 1820-1823.
Change A3A19U15 to HP Part Number 1820-1823.
Change A3A20U13 to HP Part Number 1820-1823.

Page E4-8, Table E4-2:
Change A3A21U11 to HP Part Number 1820-1823.

Page F4-21/F4-22, Figure F4-15 (Option 005 Supplement):
Change A2A101L1 and A2A101L2 to 270UH.

CHANGE 1

NOTE

This change is required with divide-by-ten IC A2A5U1, Part Number 1820-1636 with "H" at the end of the Manufacturer's Part Number.

Page C2-10, Table C2-2:
Delete A2A5C3, A2A5C8, A2A5C18.

Page C2-11, Table C2-2:
Delete A2A5CR2, A2A5L2, A2A5R2, and A2A5R3.
Change A2A5R1 to HP Part Number 0698-7206, RESISTOR 56.2 OHMS 2% .05W F TC=0+–100.
Change A2A5R4 to HP Part Number 0698-7229 RESISTOR 511 OHM 2% .05W F TC=0+–100.

Page C3-70, Figure C3-27:
Change Parts Location for A2A5 in the manual for Parts Location in this change sheet.

Page C3-71, Figure C3-28:
Change A2A5U1 Circuit as shown in the partial schematic in this change sheet.

CHANGE 2

Pages C2-18, C2-19, and C2-20, Table C2-2:
Change Discriminator Board A2A9 to HP Part Number 08505-60169 and change all component parts per the A2A9 parts list contained in this change sheet.

Page C2-26, Table C2-2:
Change Transistor A2A21Q8 to HP Part Number 1854-0271, Transistor NPN.
Change Resistor A2A21R2 to HP Part Number 0698-3447, Resistor 422 OHM, 1% .125W F TC=0+–100.

CHANGE 1 (Cont'd)

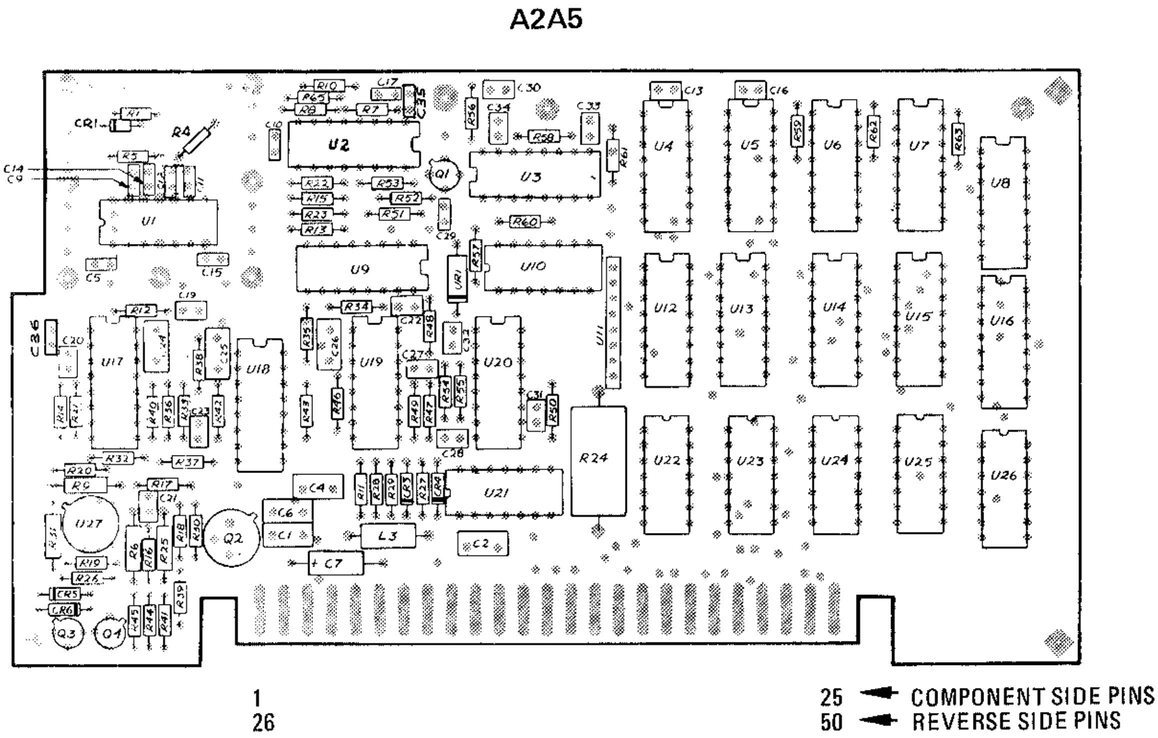
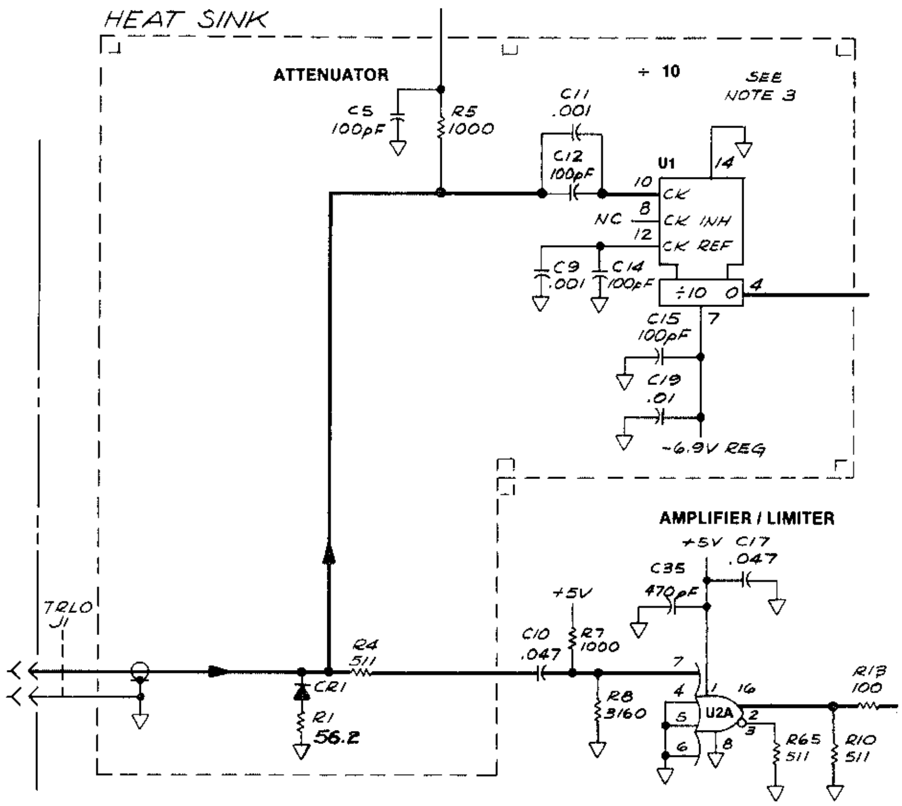


Figure C3-27. A2A5 Prescaler/Counter Parts Locations (CHANGE 1)



P/O Figure C3-28. Partial Schematic of A2A5 (CHANGE 1)

CHANGE 2 (Cont'd)

Pages C3-83 thru C3-90:
Replace pages in the manual for A2A9 Service with new pages contained in this change sheet.

Page C3-103, Figure C3-46:
Change A2A21R2 to 422 Ohms.

Page D2-6, Table D2-2:
Change A3A1S1 thru A3A1S6, A3A1S11 thru A3A1S16, and A3A1S21 thru A3A1S24 to HP Part Number 08505-40010, INCREMENT Button.
Change A3A1S9 and A3A1S19 to HP Part Number 08505-40011, MRK Button.
Change A3A1S7 and A3A1S17 to HP Part Number 08505-40012, REF Button.
Change A3A1S10, A3A1S20, and A3A1S25 to HP Part Number 08505-40013, ZRO Button.
Change A3A1S8, A3A1S18, and A3A1S26 to HP Part Number 08505-40014, CLR Button.

Page D2-36, Figure D2-1:
Delete Items 21, 22, 26, 31, and 32 in Reference Designator column and on photo.

Page F4-13, Figure F4-5:
Replace schematic of A2A9 with new one in this change sheet for Figure 3-36 (Change 2).

CHANGE 3

Page C2-7, Table C2-2:
►Delete A2A3C22 and A2A3CR12.

Page C2-8, Table C2-2:
Delete A2A3Q2 and A2A3R41.
Change A2A3Q3 to A2A3Q2, A2A3Q4 to A2A3Q3, A2A3Q5 to A2A3Q4, A2A3Q6 to A2A3Q5, A2A3Q7 to A2A3Q6, and A2A3Q8 to A2A3Q7.

Page C2-18, Table C2-2:
Delete A2A9C10.
Change A2A9C17 to HP Part Number 0180-0197, CAPACITOR-FXD 2.2UF +−10% 20 VDC TA.

Page C2-26, Table C2-2:
Change Transistors A2A21Q1 to A2A21Q6, A2A21Q2 to A2A21Q7, A2A21Q3 to A2A21Q8, A2A21Q4 to A2A21Q1, A2A21Q5 to A2A21Q2, A2A21Q6 to A2A21Q4, A2A21Q7 to A2A21Q3, and A2A21Q8 to A2A21Q5.
Change A2A21Q5 to HP Part Number 1854-0271.

Page C3-61/62, Figure C3-23:
Delete C22, CR12, Q2, and R41.
Change Q3 to Q2, Q4 to Q3, Q5 to Q4, Q6 to Q5, Q7 to Q6, and Q8 to Q7.

Page C3-61/62, Figure C3-24:
Change A2A3Q3 to Q2, Q4 to Q3, Q5 to Q4, and Q6 to Q5.

CHANGE 3 (Cont'd)

Page C3-63, Figure C3-24:
Delete C22, CR12, Q2, and R41.
Change Q7 to Q6, and Q8 to Q7.

Page C3-89, Figure C3-36:
Delete Capacitor A2A9C10.
Change Capacitor A2A9C17 to 2.2UF.

Page C3-103, Figure C3-45 and C3-46:
Change Resistor A2A21R2 to 422 Ohms.
Change Transistors Q1 to Q6, Q2 to Q7, Q3 to Q8, Q4 to Q1, Q5 to Q2, Q6 to Q4, Q7 to Q3, and Q8 to Q5.

CHANGE 4 (SERIAL NUMBER 1602A00112 ONLY)

Page C4-1, Table C4-1:
Change entry for 1602A Serial Number Prefix 1602A to: "1602A, Make Changes A, B, C,E."

Page E6-1, Table E6-1:
Add to second line entry in Table, "Serial Prefix 1602A to Make Changes A, B."
Delete Serial Prefix 1602A from fourth line entry in Table.

P/O Table C2-2. A2A9 Parts List (CHANGE 2) (1 of 4)

Reference Designator	HP Part Number	Description
A2A9	08505-60169	BOARD ASSEMBLY, DISCRIMINATOR
A2A9C1	0180-0197	CAPACITOR-FXD 2.2UF +—10% 20VDC TA
A2A9C2	0180-0197	CAPACITOR-FXD 2.2UF +—10% 20VDC TA
A2A9C3	0180-0197	CAPACITOR-FXD 2.2UF +—10% 20VDC TA
A2A9C4	0180-0116	CAPACITOR-FXD 6.8UF 35V TA
A2A9C5 thru A2A9C8		NOT ASSIGNED
A2A9C9	0160-0575	CAPACITOR-FXD .047UF +—20% 50WVDC CER
A2A9C10	0180-0116	CAPACITOR-FXD 6.8UF 35V TA
A2A9C11	0180-0116	CAPACITOR-FXD 6.8UF 35V TA
A2A9C12	0180-0116	CAPACITOR-FXD 6.8UF 35V TA
A2A9C13		NOT ASSIGNED
A2A9C14	0160-4084	CAPACITOR-FXD .1UF +—20% 50WVDC CER
A2A9C15	0180-0116	CAPACITOR-FXD 6.8UF 35V TA
A2A9C16	0160-0174	CAPACITOR-FXD .47UF +80—20% 25WVDC CER
A2A9C17	0160-0174	CAPACITOR-FXD .47UF +80—20% 25WVDC CER
A2A9C18	0160-4084	CAPACITOR-FXD .1UF +—20% 50WVDC CER
A2A9C19	0160-4084	CAPACITOR-FXD .1UF +—20% 50WVDC CER
A2A9C20	0160-0174	CAPACITOR-FXD .1UF +—20% 50WVDC CER
A2A9C21	0160-0174	CAPACITOR-FXD .1UF +—20% 50WVDC CER
A2A9C22	0160-2306	CAPACITOR-FXD 27PF +—5% 300WVDC MICA
A2A9C23	0180-0197	CAPACITOR-FXD 2.2UF +—10% 20VDC TA
A2A9C24	0160-2256	CAPACITOR-FXD 9.1PF +—.25PF 500WVDC CER
A2A9C25	0160-0168	CAPACITOR-FXD .1UF +—10% 200WVDC POLYE
A2A9C26	0160-0161	CAPACITOR-FXD .01UF +—10% 200WVDC POLYE
A2A9C27	0160-3533	CAPACITOR-FXD 470PF +—5% 100WVDC MICA
A2A9C28	0160-0945	CAPACITOR-FXD 910PF +—5% 100WVDC MICA
A2A9C29	0160-0174	CAPACITOR-FXD .1UF +—20% 50WVDC CER
A2A9C30	0160-0174	CAPACITOR-FXD .1UF +—20% 50WVDC CER
A2A9C31	0180-0116	CAPACITOR-FXD 6.8UF 35V TA
A2A9C32	0160-0174	CAPACITOR-FXD .47UF +80—20% 25WVDC CER
A2A9C33	0160-3456	CAPACITOR-FXD 1000PF +—10% 1000WVDC CER
A2A9C34	0160-0174	CAPACITOR-FXD .47UF +80—20% 25WVDC CER
A2A9C35	0160-0174	CAPACITOR-FXD .47UF +80—20% 25WVDC CER
A2A9C36	0160-0574	CAPACITOR-FXD .022UF +—20% 100WVDC CER
A2A9C37	0160-2437	CAPACITOR-FD THRU 5000PF +80—20% 200V
A2A9C38	0160-4083	CAPACITOR-FD THRU 10PF 10% 200V CERAMIC
A2A9C39	0160-0570	CAPACITOR-FXD 220PF +—20% 100WVDC CER
A2A9C40 thru A2A9C99		NOT ASSIGNED
A2A9C100	0180-0116	CAPACITOR-FXD 6.8UF 35V TA
A2A9C101	0160-0570	CAPACITOR-FXD 220PF +—20% WVDC CER
A2A9CR1	1901-0050	DIODE-SWITCHING 80V 200MA 2NS DO-7
A2A9CR2	1901-0050	DIODE-SWITCHING 80V 200MA 2NS DO-7
A2A9CR3	1901-0050	DIODE-SWITCHING 80V 200MA 2NS DO-7
A2A9CR4	1901-0050	DIODE-SWITCHING 80V 200MA 2NS DO-7
A2A9CR5	1901-0050	DIODE-SWITCHING 80V 200MA 2NS DO-7
A2A9CR6	1901-0050	DIODE-SWITCHING 80V 200MA 2NS DO-7
A2A9CR7	1901-0050	DIODE-SWITCHING 80V 200MA 2NS DO-7
A2A9CR8	1901-0539	DIODE-SCHOTTKY
A2A9DS1	1990-0404	LED-VISIBLE LUM-INT-300UCD IF=50MA-MAX
A2A9FL1	9135-0002	FILTER-LOW PASS SOLDER -TERMS
A2A9FL2	9135-0002	FILTER-LOW PASS SOLDER-TERMS
A2A9J1	08443-00041	TEST POINT CONNECTOR
A2A9J2	1250-0691	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ
A2A9L1	9100-1641	COIL-MLD 240UH 5% Q65 .155DX .375LG
A2A9L2	9100-1641	COIL-MLD 240UH 5% Q65 .155DX .375LG

P/O Table C2-2. A2A9 Parts List (CHANGE 2) (2 of 4)

Reference Designator	HP Part Number	Description
A2A9L3	9140-0114	COIL-MLD 10UH 10% Q=55 .155DX .375LG
A2A9L4	9100-2257	COIL-MLD 820NH 10% Q=32 .095DX .25LG
A2A9L5	9100-2254	COIL-MLD 390NH 10% Q=35 .095DX .25LG
A2A9L6	9100-2248	COIL-MLD 120NH 10% Q=34 .095DX .25LG
A2A9L7	9100-1641	COIL-MLD 240UH 5% Q=65 .155DX .375LG
A2A9MP1	0520-0128	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI
A2A9MP2	0520-0169	SCREW-MACH 2-56 .625-IN-LG 82 DEG
A2A9MP3	0590-0519	THREADED INSERT-NUT 4-40 .062-LG
A2A9MP4	0610-0003	NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK
A2A9MP5	2190-0014	WASHER-LK INTL T NO.2 .089-IN-ID
A2A9MP6	2190-0123	WASHER-FL MTLC NO.1 .08-IN-ID
A2A9MP7	2190-0910	WASHER-LK NO.4 .12-IN-ID .275-IN-OD STL
A2A9MP8	2200-0101	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI
A2A9MP9	2200-0105	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI
A2A9MP10	2200-0168	SCREW—MACH 4-40 .438-IN-LG 82 DEG
A2A9MP11	08505-20154	KNOB-PULL
A2A9MP12	08505-00127	TOP COVER
A2A9MP13	08505-00128	COVER
A2A9MP14	08505-20196	RF SHIELD
A2A9MP15	08505-20197	BOTTOM COVER
A2A9Q1	5081-8120	TRANSISTOR NPN SI TO-18 PD=360MW
A2A9Q2	1854-0330	TRANSISTOR NPN SI
A2A9Q3	1853-0075	TRANSISTOR-DUAL PNP PD=400MW
A2A9Q4	1854-0345	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW
A2A9Q5	1854-0345	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW
A2A9Q6	1853-0007	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW
A2A9Q7	1853-0007	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW
A2A9Q8	1853-0007	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW
A2A9Q9	1853-0007	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW
A2A9Q10	1855-0020	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI
A2A9Q11	1855-0020	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI
A2A9Q12	1855-0020	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI
A2A9Q13	1855-0020	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI
A2A9Q14	1855-0020	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI
A2A9Q15	1854-0404	TRANSISTOR NPN SI TO-18 PD=360MW
A2A9Q16	1854-0404	TRANSISTOR NPN SI TO-18 PD=360MW
A2A9Q17	1853-0007	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW
A2A9Q18	1853-0007	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW
A2A9Q19	1854-0404	TRANSISTOR NPN SI TO-18 PD=360MW
A2A9Q20	1854-0404	TRANSISTOR NPN SI TO-18 PD=360MW
A2A9Q22	1855-0020	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI
A2A9R1		NOT ASSIGNED
A2A9R2	0811-3247	RESISTOR 150 1% 7.5W PW TC=0+—20
A2A9R3	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R4	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R5 thru A2A9R11		NOT ASSIGNED
A2A9R12	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R13	0757-0458	RESISTOR 51.1K 1% .125W F TC=0+—100
A2A9R14	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R15	0757-0458	RESISTOR 51.1K 1% .125W F TC=0+—100
A2A9R16	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R17	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R18		NOT ASSIGNED
A2A9R19	0757-0458	RESISTOR 51.1K 1% .125W F TC=0+—100
A2A9R20	0757-0458	RESISTOR 51.1K 1% .125W F TC=0+—100
A2A9R21	0698-3450	RESISTOR 42.2K 1% .125W F TC=0+—100

P/O Table C2-2. A2A9 Parts List (CHANGE 2) (3 of 4)

Reference Designator	HP Part Number	Description
A2A9R22 thru A2A9R26		NOT ASSIGNED
A2A9R27	0757-0401	RESISTOR 100% .125W F TC=0+—100
A2A9R28	0757-0416	RESISTOR 511 1% .125W F TC=0+—100
A2A9R29	0757-0416	RESISTOR 511 1% .125W F TC=0+—100
A2A9R30	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R31	0757-0416	RESISTOR 511 1% .125W F TC=0+—100
A2A9R32	0698-3445	RESISTOR 348 1% .125W F TC=0+—100
A2A9R33	0698-3153	RESISTOR 3.83K 1% .125W F TC=0+—100
A2A9R34	0811-2813	RESISTOR 1 5% .75W PW TC=0+—50
A2A9R35	0757-0398	RESISTOR 75 1% .125W F TC=0+—100
A2A9R36	0698-3454	RESISTOR 215K 1% .125W F TC=0+—100
A2A9R37	0757-0416	RESISTOR 511 1% .125W F TC=0+—100
A2A9R38	0757-0416	RESISTOR 511 1% .125W F TC=0+—100
A2A9R39	0698-3454	RESISTOR 215K 1% .125W F TC-0+—100
A2A9R40	0698-3441	RESISTOR 215 1% .125W F TC=0+—100
A2A9R41	0757-0416	RESISTOR 511 1% .125W F TC=0+—100
A2A9R42	0757-0379	RESISTOR 12.1 1% .125W F TC=0+—100
A2A9R43	0757-0289	RESISTOR 13.3K 1% .125W F TC=0+—100
A2A9R44	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R45	0698-3435	RESISTOR 38.3 1% .125W F TC=0+—100
A2A9R46	0757-0405	RESISTOR 162 1% .125W
A2A9R47	0698-3438	RESISTOR 147 1% .125W F TC=0+—100
A2A9R48	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R49	0757-0280	RESISTOR 1K 1% .125W F TC=0+—100
A2A9R50	0757-0398	RESISTOR 75 1% .125W F TC=0+—100
A2A9R51	0698-8640	RESISTOR 4.734K .1% .125W F TC=0+—25
A2A9R52	0698-3454	RESISTOR 215K 1% .125W F TC=0+—100
A2A9R53	0698-3441	RESISTOR 215 1% .125W F TC=0+—100
A2A9R54	0757-0416	RESISTOR 511 1% 125W F TC=0+—100
A2A9R55	0683-5655	RESISTOR 5.6 M 5% .25W FC TC=900/+1100
A2A9R56	0698-3435	RESISTOR 38.3 1% .125W F TC=0+—100
A2A9R57	2100-3349	RESISTOR TRMR 100 10% C SIDE-ADJ 1-TURN
A2A9R58	0698-6862	RESISTOR 1.153K .25% .125W F TC=0+—50
A2A9R59	0698-6620	RESISTOR 150K .1% .125W F TC=0+—25
A2A9R60	0698-3447	RESISTOR 422 1% .125W F TC=0+—100
A2A9R61	0698-8052	RESISTOR 590 .1% .25 F TC=0+—25
A2A9R62	0698-7205	RESISTOR 51.1 1% .05W F TC=0+—100
A2A9R63	0757-0317	RESISTOR 1.33K 1% .125W F TC=0+—100
A2A9R64	0757-0278	RESISTOR 1.78K 1% .125W F TC=0+—100
A2A9R65	0757-0199	RESISTOR 21.5K 1% .125W F TC=0+—100
A2A9R66	0757-0465	RESISTOR 100K 1% .125W F TC=0+—100
A2A9R67	0757-0458	RESISTOR 51.1K 1% .125W F TC=0+—100
A2A9R68	2100-3052	RESISTOR-TRMR 50 20% C SIDE-ADJ 17-TURN
A2A9R69	0698-3442	RESISTOR 237 1% .125W F TC=0+—100
A2A9R70	0698-5552	RESISTOR 1K 1% .125W F TC=0+—100
A2A9R71	0757-0199	RESISTOR 21.5K 1% .125W F TC=0+—100
A2A9R72	0757-0458	RESISTOR 51.1K 1% .125W F TC=0+—100
A2A9R73	0757-0442	RESISTOR 10K 1% .125W F TC=0+—100
A2A9R74	0698-5552	RESISTOR 1K 1% .125W F TC-0+—25
A2A9R75	0698-3454	RESISTOR 215K 1% .125W F TC=0+—100
A2A9R76	0757-0442	RESISTOR 10K 1% .125W F TC=0+—100
A2A9R77	0698-3156	RESISTOR 14.7K 1% .125W F TC=0+—100
A2A9R78	0698-5552	RESISTOR 1K 1% .125W F TC=0+—100

P/O Table C2-2. A2A9 Parts List (CHANGE 2) (4 of 4)

Reference Designator	HP Part Number	Description
A2A9R79	0757-0199	RESISTOR 21.5K 1% .125W F TC=0+—100
A2A9R80	0698-3160	RESISTOR 31.6K 1% .125W F TC=0+—100
A2A9R81	0757-0447	RESISTOR 16.2K 1% .125W F TC=0+—100
A2A9R82	0698-0084	RESISTOR 2.15K 1% .125W F TC=0+—100
A2A9R83	0757-0443	RESISTOR 11K 1% .125W F TC=0+—100
A2A9R84	0698-3458	RESISTOR 348K 1% .125W F TC=0+—100
A2A9R85	0757-0442	RESISTOR 10K 1% .125W F TC=0+—100
A2A9R86 thru A2A9R99		NOT ASSIGNED
A2A9R100	0757-0420	RESISTOR 750 1% .125W F TC=0+—100
A2A9R101	0698-3442	RESISTOR 237 1% .125W F TC=0+—100
A2A9R102	0757-0442	RESISTOR 10K 1% .125W F TC=0+—100
A2A9R103	0698-3152	RESISTOR 3.48K 1% .125W F TC=0+—100
A2A9R104	0757-0447	RESISTOR 16.2K 1% .125W F TC=0+—100
A2A9R105	0698-3159	RESISTOR 26.1K 1% .125W F TC=0+—100
A2A9R106	0698-3158	RESISTOR 23.7K 1% .125W F TC=0+—100
A2A9R107	0757-0401	RESISTOR 100 1% .125W F TC=0+—100
A2A9TP1	1251-0600	CONTACT-CONN U/W-POST-TYPE MALE DPSLDR
A2A9U1	1826-0013	IC 741 OP AMP
A2A9U2	1820-1308	IC-DIGITAL MC10116L ECL TPL 2 LINE RCVR
A2A9U3	1826-0302	IC MC 1741SC OP AMP
▶A2A9U4	1826-0249	IC AD 504J OP AMP
A2A9U5	1826-0026	IC LM 311 COMPARATOR
▶A2A9U6	1820-1538	IC-DIGITAL MC14011UBCL CMOS QUAD 2 NAND
▶A2A9U7	1820-1531	IC-DIGITAL MC14013BCL CMOS DUAL D-TYPE
▶A2A9U8	1820-1538	IC-DIGITAL MC14011UBCL CMOS QUAD 2 NAND
A2A9VR1		NOT ASSIGNED
A2A9VR2	1902-3071	DIODE-ZNR 4.22V 2% DO-7 PD= .4W TC= .038%
▶A2A9VR3	1902-0692	DIODE-ANR 6.3V 1% PD= .4W
A2A9VR4	1902-3048	DIODE-ZNR 3.48V 5% DO-7 PD=.4W TC=.058%
A2A9VR5	1902-3048	DIODE-ZNR 3.48V 5% DO-7 PD=.4W TC=.058%
A2A9VR6 thru A2A9VR99		NOT ASSIGNED
A2A9VR100	1902-0025	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%

A2A9 DISCRIMINATOR (CHANGE 2)

General Description

The Discriminator is part of the Automatic Frequency Control (AFC) Loop, which also includes the Prescaler/Counter (A2A5) and FM Driver (A2A10). The RF output of the Source/Converter is first fed to the Prescaler/Counter, where its frequency is prescaled, and then applied to the input (PTLO) of the Discriminator. The Discriminator generates a current proportional to the frequency of the RF input and compares it with a current which is proportional to the Tuning Voltage (V TUN). The difference between these currents, a measure of the frequency error of the Source/Converter, is amplified and fed to the FM Driver (A2A10) as V FM. The FM Driver further amplifies this error signal to drive the FM coil of the YIG-tuned Oscillator (A2A19), thereby closing the AFC loop. This feedback reduces the drift and residual FM of the Source/Converter. The AFC loop operates only in the 13 MHz and 130 MHz ranges; in the 1300 MHz range the Discriminator output is disconnected from the FM Driver.

The Discriminator has five major parts: Frequency-to-Current Converter, Summing Amplifier, Frequency Range Logic and FET Drivers, Low-Frequency Clamp, and Search Control (See Figure C3-34E).

Frequency-to-Current Converter

The Frequency-to-Current Converter generates a current which is proportional to the frequency of the RF signal from the Source/Converter. There are four elements: Amplifier-Limiter, Delay Line Driver, Delay Line, and Current Switch.

Two differential amplifiers from an ECL line receiver (U2) make up the Amplifier-Limiter, which shapes the RF pulses (PTLO) from the Prescaler/Counter (A2A5). The first amplifier is connected as a single-input amplifier with a differential output. The second amplifier is a Schmitt trigger whose differential output is ac-coupled to the Delay Line Driver. The base bias supply of the differential amplifiers is tapped at U2 pin 11 to provide a stable reference voltage for the input (pin 4) of the first stage.

The Delay Line Driver consists of the differential pair Q4 and Q5 with positive feedback. Positive feedback causes the driver to act as the second Schmitt trigger in the input chain. The normal state of the driver is Q5 ON, Q4 OFF, with the base of Q4 biased near 0 volts ($V_{be}4$ = 0 volts). When the input to the driver causes Q4 to turn ON, the current flowing through Q5 is diverted to the Delay Line. This causes the voltage at the collector of Q5 to rise, which turns Q4 on harder. Because of this positive feedback, the state of the driver changes rapidly to Q4 ON, Q5 OFF. The exact inverse occurs when Q4 is turned OFF by the input. The output of the driver is thus a square wave of current into the Delay Line.

The Delay Line, consisting of L4-6, C21, C22, and C24, is a lumped approximation of a shorted transmission line with an 11 nsec delay. The current wave applied to the Delay Line by the Driver is converted to constant width voltage pulses. (See Figure C3-34A.) These pulses are then applied to the Current Switch.

The Current Switch, Q3A and Q3B, is a differential pair with emitter current fixed by VR3, CR7, R61, and R68. The emitter current is adjusted with R68 for a high frequency reading of 20.000 MHz ±0.2 MHz on the FREQ COUNTER readout . The normal state of the Current Switch is Q3A ON, Q3B OFF. When the voltage pulse from the Delay Line goes

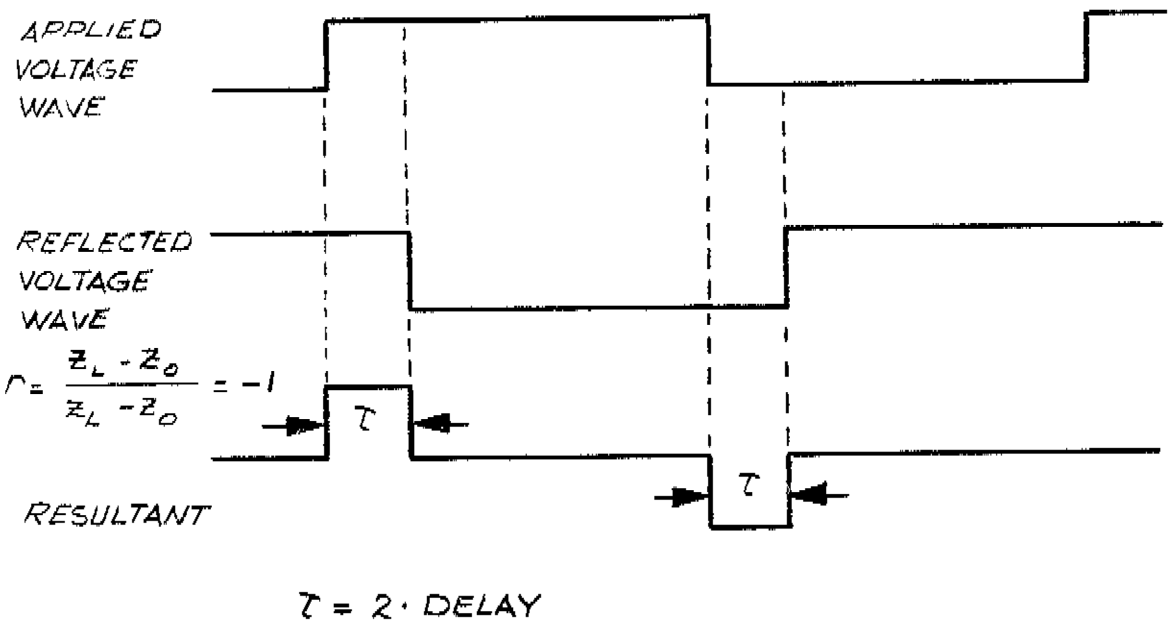


Figure C3-34A. Shorted Delay Line Principle

high, Q3A is turned OFF and Q3B is turned ON, switching the emitter current to C28, L7, and R54, the low-pass filter. The average current through the filter is proportional to the frequency of the input signal, PTLO.

Summing Amplifier

The Tuning Voltage, V TUN, is converted by R51 to a current and summed with the output of the Frequency-to-Current Converter by U4. The difference between these two currents is amplified by U4 to produce the output voltage V FM. V FM drives the FM Driver to correct any frequency errors of the YTO. Feedback capacitors C25 and C26 set the AFC loop compensation and bandwidth. The capacitors are selected by Q9, which is driven by the Frequency Range Logic. The offset voltage at U4 pin 3 is changed by FET Q10 when the frequency range of the instrument is changed; the offset is approximately +100 mV in the 13 MHz range and about +10 mV in the 130 MHz range. In the 1300 MHz (undiscriminated) range, the Frequency Range Logic turns FET Q11 on, reducing the gain of U4 to zero. R57 is used to adjust the offset for a low frequency indication of 5.000 MHz ±0.010 MHz on the FREQ COUNTER readout.*

Frequency Range Logic and FET Drivers

The Frequency Range Logic consists of CMOS NAND Gates (U6) connected as inverters driving level shifters Q6 —Q9. The level shifters turn on and off the FET's(Q10,Q11,Q12, Q13, and Q14) used as switches in the Summing Amplifier and Low-Frequency Clamp.

The Frequency Range Logic detects the frequency range of the instrument and adjusts the AFC loop compensation capacitors (C25, C26), offset voltages at U4 pin 3, and V TUN clamp voltages for proper operation of the AFC loop. The offset voltages are required because the RF input to the Discriminator, PTLO, is offset by 100 kHz from the RF output of the source. Compensation changes are needed because the source RF frequency is divided by one in the 13 MHz range and by 10 in the 130 MHz range before it reaches the Discriminator. The change in division ratio is an effective change in AFC loop gain and bandwidth which is compensated for by the change in feedback capacitance.

* See adjustment procedure, paragraph A5-21.

Low-Frequency Clamp

A Low-Frequency Clamp is used to accurately set the low frequency of the RF source and prevent the RF from going through zero frequency (where the instrument is unspecified and the Discriminator is unlocked). U3 clamps the tuning voltage, V TUN, to about −400 mV in the 13 MHz range and −40 mV in the 130 MHz range. The clamp voltage is selected by Q13, which is driven by the Frequency Range Logic. This voltage is applied to pin 3 of U3. When V TUN goes above the voltage at pin 3, the output of U3 goes low, pulling V TUN more negative. The output of U3 also drives Q15, which generates one of the blanking pulses (BP2) to the Sweep Select Board, A2A8.

When the instrument is put in the 1300 MHz range, Q7 drives FET Q14 ON, pulling U3 pin 3 up to +1.5 volts. Since V TUN cannot go this positive, the Low-Frequency Clamp is effectively removed from the circuit in the 1300 MHz range.

Search Control

A detailed block diagram of the Search Control is shown in Figure C3-34F. This block diagram will be referred to in the following description.

The function of the Search Control is to keep the Discriminator output, V FM, in the range where the AFC loop will lock. The Search Control detects when V FM goes above or below an allowable range (about −3V to +3V). If V FM goes too positive, the positive limit detector (VR4 and Q20) sets flip-flop U7A, turning Q13 ON; this injects a search current into the summing junction which causes the output of U4 to slew in the negative direction. When V FM reaches the negative limit, the negative limit detector (VR5 and Q21) sets flip-flop U7B. Since the outputs of the two flip-flops are ANDed to drive both of their reset inputs, flip-flop U7A is reset at this point; flip-flop U7B remains set since its set input is held high by the negative limit detector. The high output of U7B turns Q19 ON, injecting a search current into the summing junction which causes V FM to slew in the positive direction. As V FM goes through +1.5V, the output of the reset comparator goes high, applying a reset pulse to flip-flop U7B and turning off the search current. With V FM at this reset voltage (+1.5V) the AFC loop will lock.

The no-lock state (either flip-flop set) turns on the no-lock indicator DS1. In the 130 MHz range, FET Q12 is driven ON in the no-lock state to increase the feedback capacitance of U4 and thus decrease the slope of V FM during the search. Capacitor C9 keeps Q12 ON for a period following the search current reset (both flip-flops reset) to allow the AFC loop to stabilize before the bandwidth is increased.

Typical search waveforms and a description of Search Control operation are presented in the Troubleshooting section which follows.

A2A9 Discriminator — Troubleshooting Information

Equipment:

Oscilloscope

Frequency-to-Current Converter

The Frequency-to-Current Converter produces a current which is proportional to the frequency of the prescaled source RF signal, PTLO, in all frequency ranges.

The operation of this portion of the Discriminator may be checked by setting the front panel controls of the Frequency Control as follows:

RANGE MHz .... 0.5—1300
SCAN TIME SEC.................................. .01
MODE .... LIN FULL

Connect the oscilloscope to C38 feedthrough. Set TIME/DIV to 2 msec and VOLTS/DIV to 0.2V. The voltage should look like the waveform of Figure C3-34B.

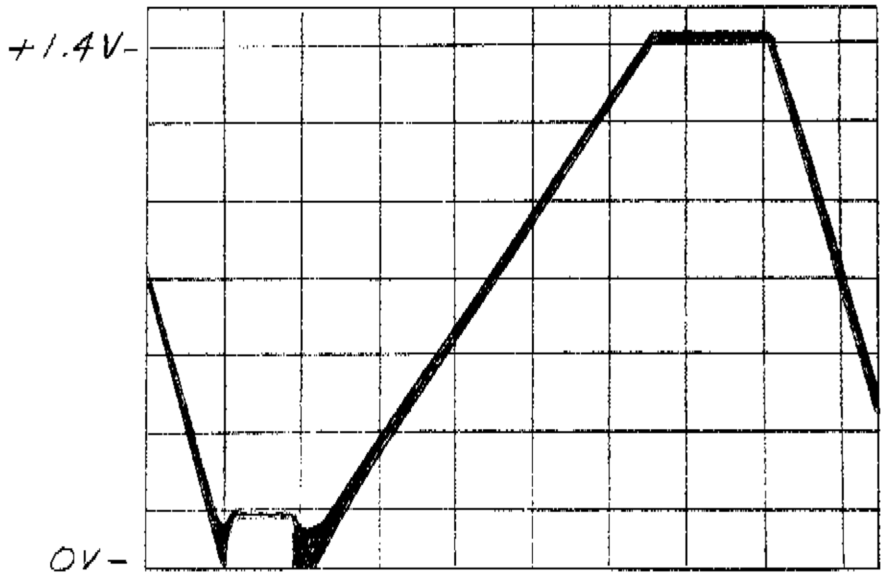


Figure C3-34B. Output of Frequency-to-Current Converter (C38 feedthrough)

The voltage at C38 is proportional to the average current output of the Current Switch and thus to the frequency of the RF input signal, PTLO, as it varies from 600 kHz to 1300.1 MHz.

If this waveform is not present, then one or more of the following components may be faulty: (1) Current Switch: Q3, (2) Delay Line Driver: Q4, Q5, or VR2, (3) Amplifier-Limiter: U2. Also, operational amplifier U4 may not be maintaining a virtual ground at U4 pin 2.

Search Control

The operation of the Search Control may be checked in the two discriminated frequency ranges as described below.

0.5 — 13 MHz Range

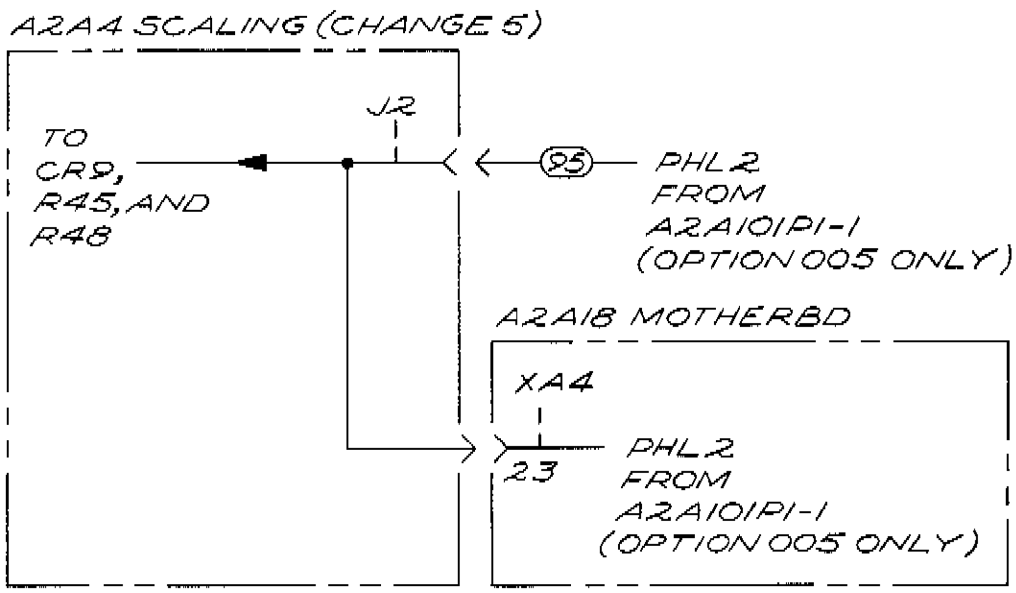
1. Set the front-panel controls as follows:

RANGE MHz .... 0.5 — 13
MODE .... LIN EXP
WIDTH.. CW±ΔF
SCAN TIME SEC................................ .01
CW FREQUENCY MHz 0
ΔF FREQUENCY MHz 0

CHANGE 17 (Cont'd)

In this Change Sheet, Table C2-2 CHANGE 5:
Change A2A4 to Part Number 08505-60212.

In this Change Sheet, Figure C3-26, A2A4 Scaling Schematic, CHANGE 5:
Change the phase lock circuit for Option 005 as shown in the partial schematic following:



CHANGE 18

Page C2-4, Table C2-2:
Change A2W107 to HP Part Number 08505-60217.
Change A2W108 to HP Part Number 08505-60218.
Change A2W8 to HP Part Number 08505-60219.
Change A2W9 to HP Part Number 08505-60220.
Change A2W10 to HP Part Number 08505-60221.
Change A2W16 to HP Part Number 08505-60216.

Page C2-5, Table C2-2:
Change A2A1A1U2, A2A1A1U3, and A2A1A1U5 to HP Part Number 1820-1823.

Page C2-7, Table C2-2:
Delete A2A3C22.

Page C2-8, Table C2-2:
Change A2A3U28, A2A3U29, and A2A3U30 to HP Part Number 1820-1823.

0.5 — 130 MHz Range

The front panel controls should be set as for the 0.5 — 13 MHz range except that the RANGE MHz control should be set to 0.5 — 130. The RF input, PTLO, should be disconnected at J2.

With these control settings, the tuning voltage (V TUN) should be clamped at −40 mV and the offset at U4 pin 3 should be +10 mV.

Connect the oscilloscope to pin 25 or 50. Set TIME/DIV to 1 msec and VOLT/DIV to 1 volt. The absence of frequency feedback should cause the Search Control and Summing Amplifier to generate the search waveform of Figure C3-34D at the Discriminator output (pin 25, 50).

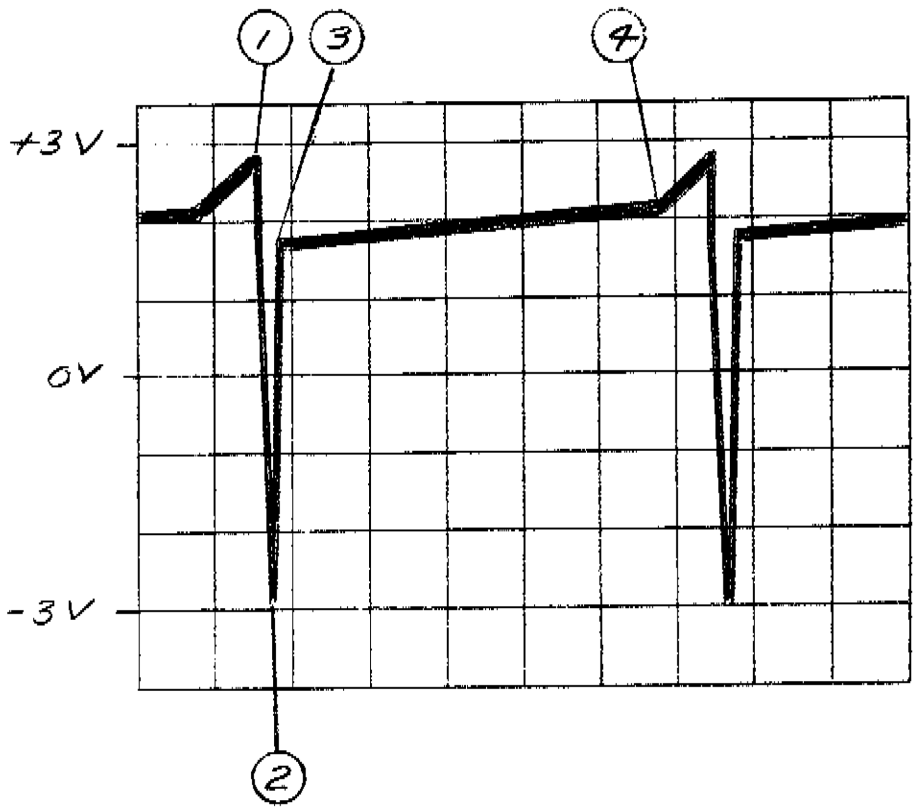


Figure C3-34D. Search Waveform, 0.5 – 130 MHz Range (Pin 25, 50)

Points 1 and 2 of the search waveform in Figure C3-34D correspond exactly to points 1 and 2 in Figure C3-34C, described above. Points 3 and 4 are described below:

Point 3: Reset comparator (U5) turns off Q19 so that no search current is injected into the summing junction. The only current flowing into the summing junction is due to the clamped Tuning Voltage. V FM slews in the positive direction with a reduced slope determined by the Tuning Voltage (clamped at −40mV), the offset voltage at U4 pin 3 (+10 mV), and the feedback capacitance on U4 (since C9 has been discharged by Q16, Q12 should be on, providing maximum capacitance.

Point 4: FETQ12 is turned off by Q9 (C9 is now charged), reducing the feedback capacitance on U4. This causes V FM to slew with an increased slope until the positive limit is reached.

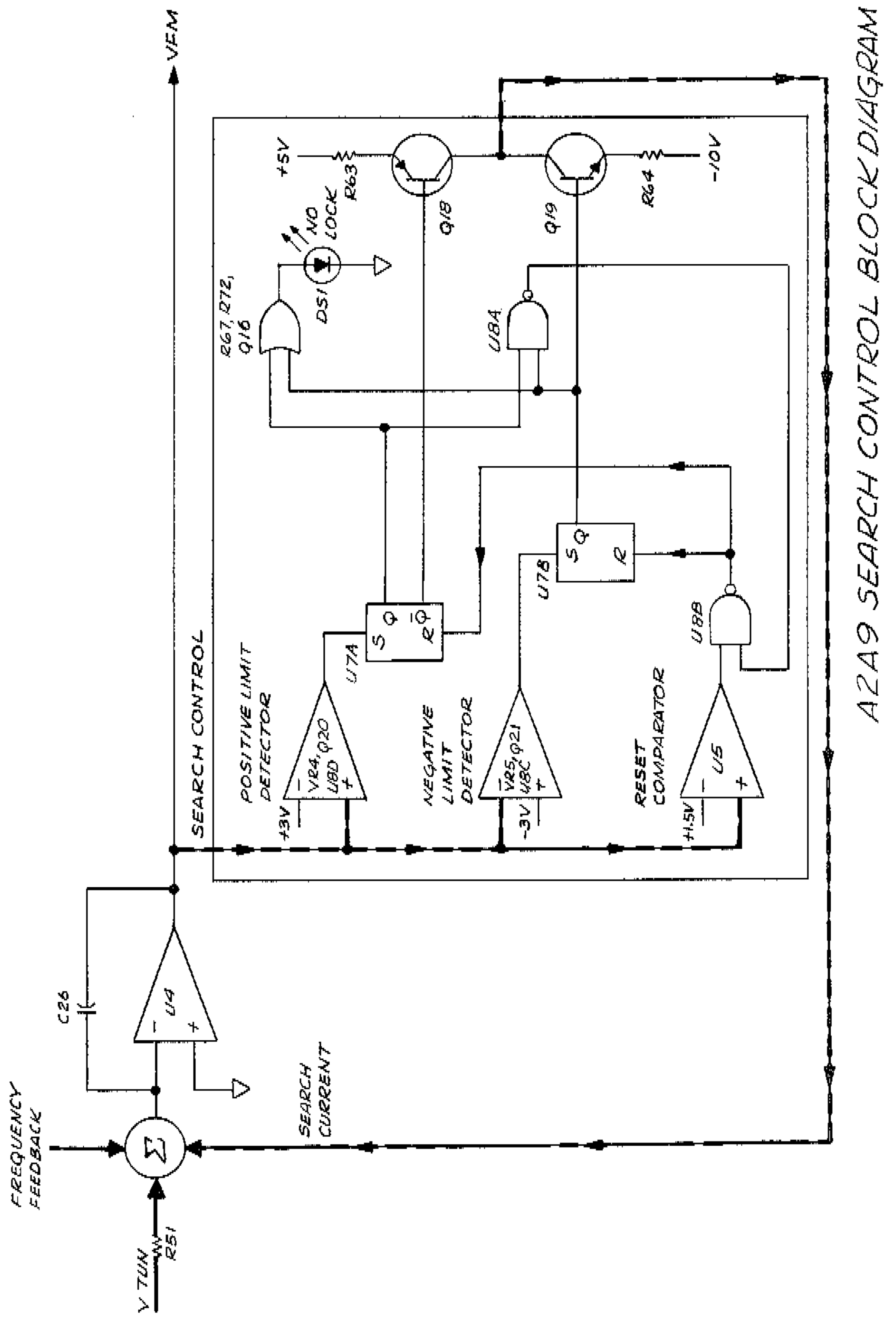
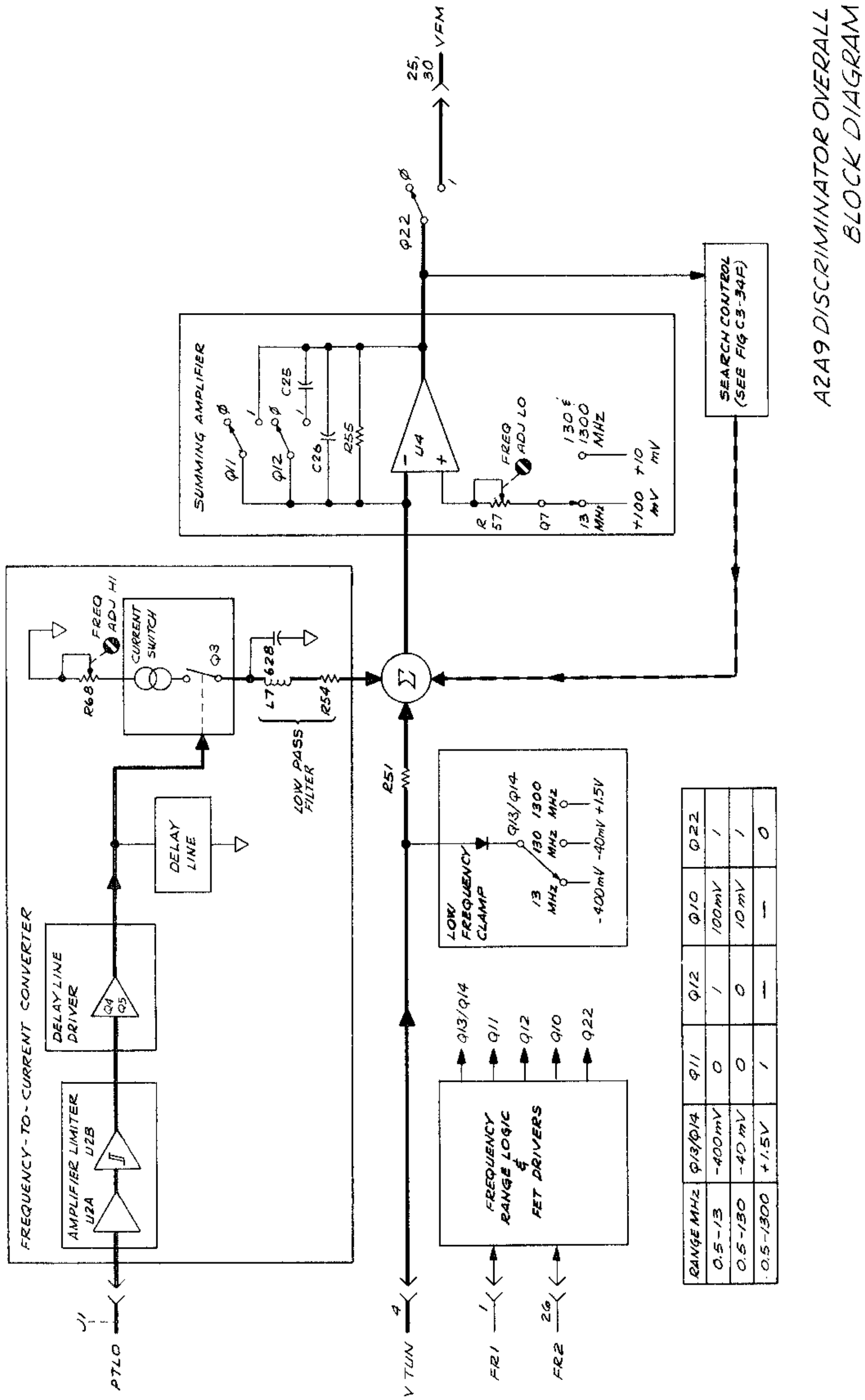


Figure C3-34E. A2A9 Discriminator, Block Diagram (Change 2)



RANGE MHz	Q13/Q14	Q11	Q12	Q10	Q22
0.5–13	-400mV	0	1	100mV	1
0.5–130	-40 mV	0	0	10 mV	1
0.5–1300	+1.5V	1	—	—	0

Figure C3-34F. A2A9 Discriminator Search Control Circuit, Block Diagram (Change 2)

A2A9

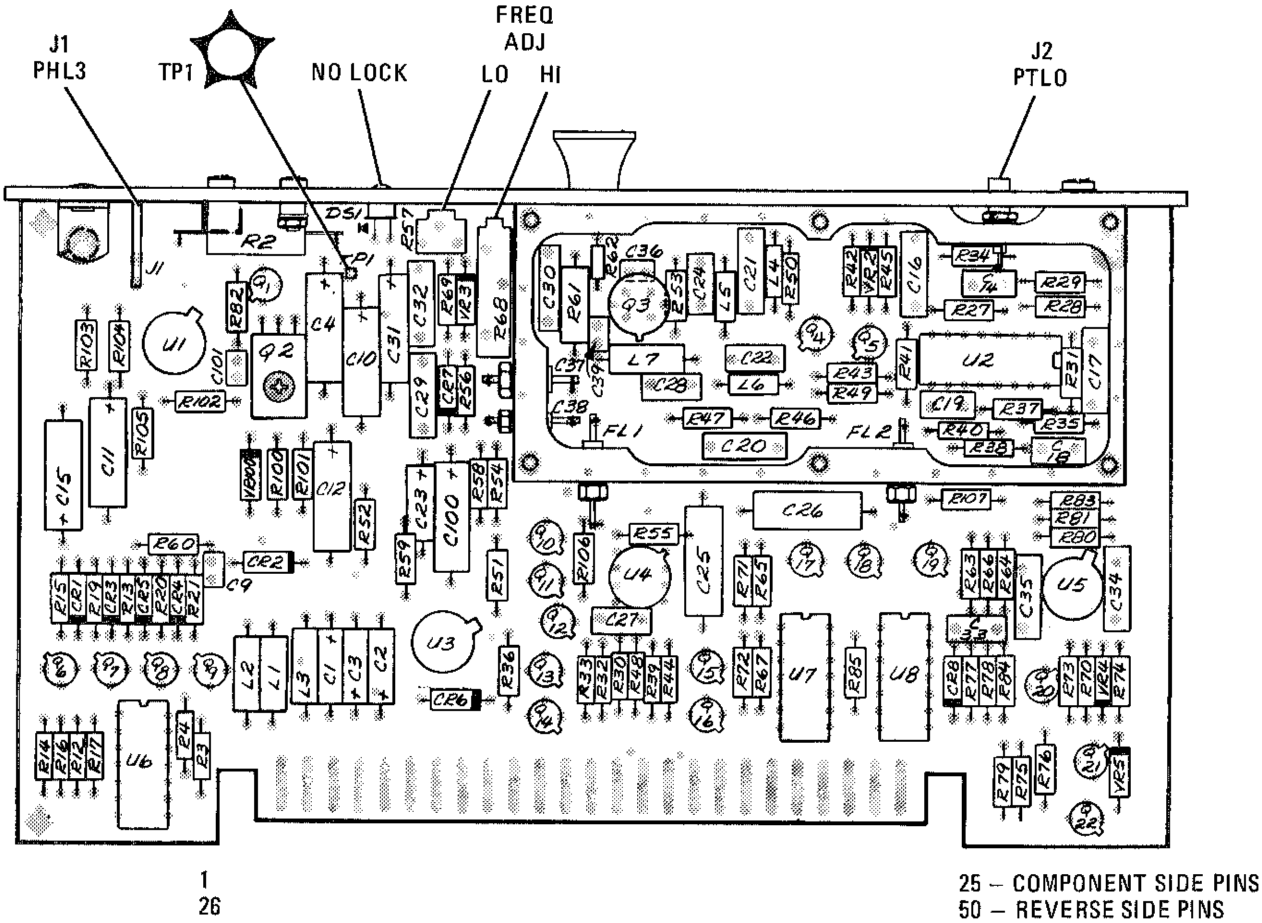
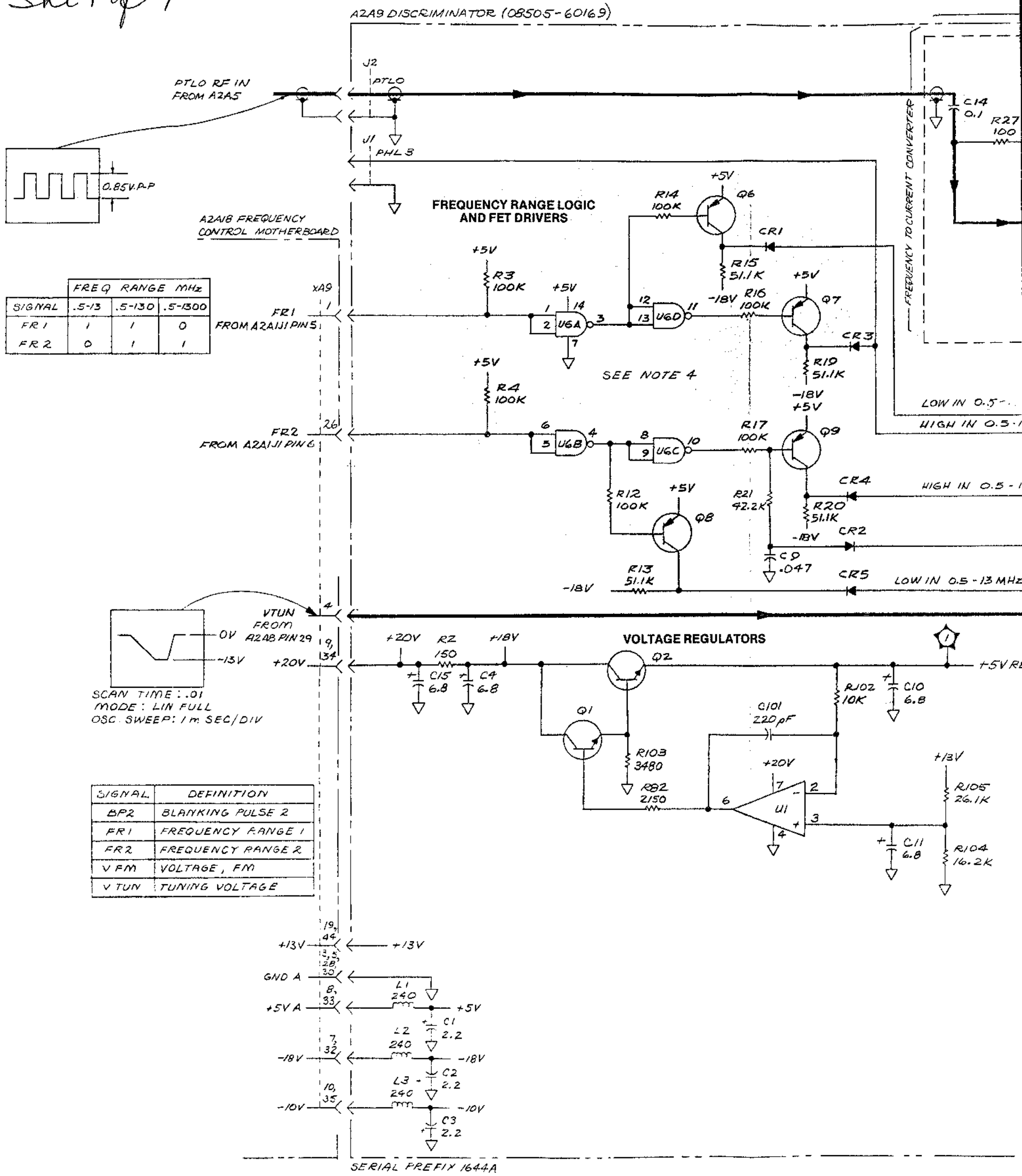


Figure C3-35. A2A9 Discriminator Parts Locations (Change 2)

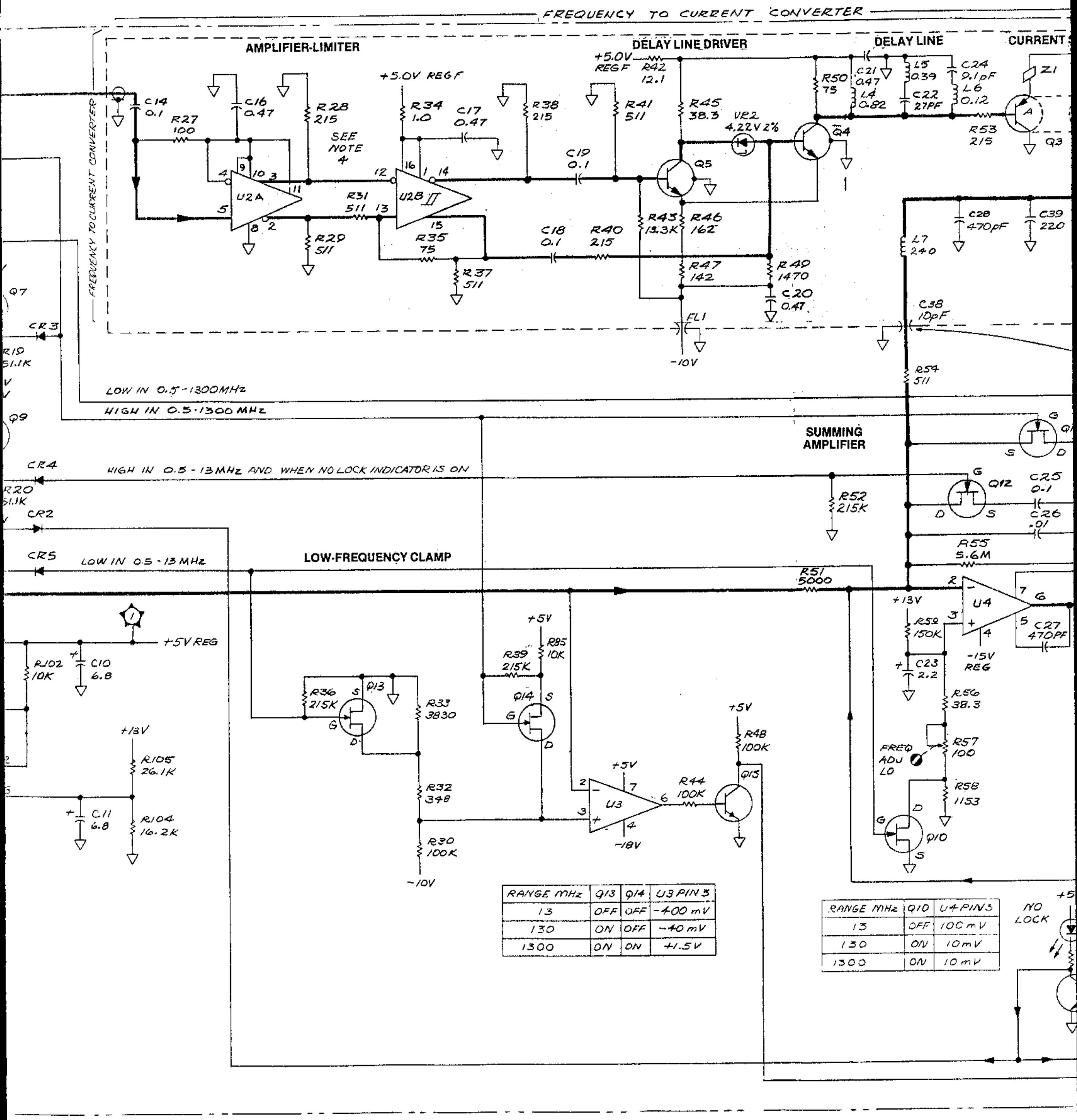
Fig. 3-36
Sht 1 of 4



	FREQ RANGE MHz		
SIGNAL	.5-13	.5-130	.5-1300
FR1	1	1	0
FR2	0	1	1

SIGNAL	DEFINITION
BP2	BLANKING PULSE 2
FR1	FREQUENCY RANGE 1
FR2	FREQUENCY RANGE 2
V FM	VOLTAGE, FM
V TUN	TUNING VOLTAGE

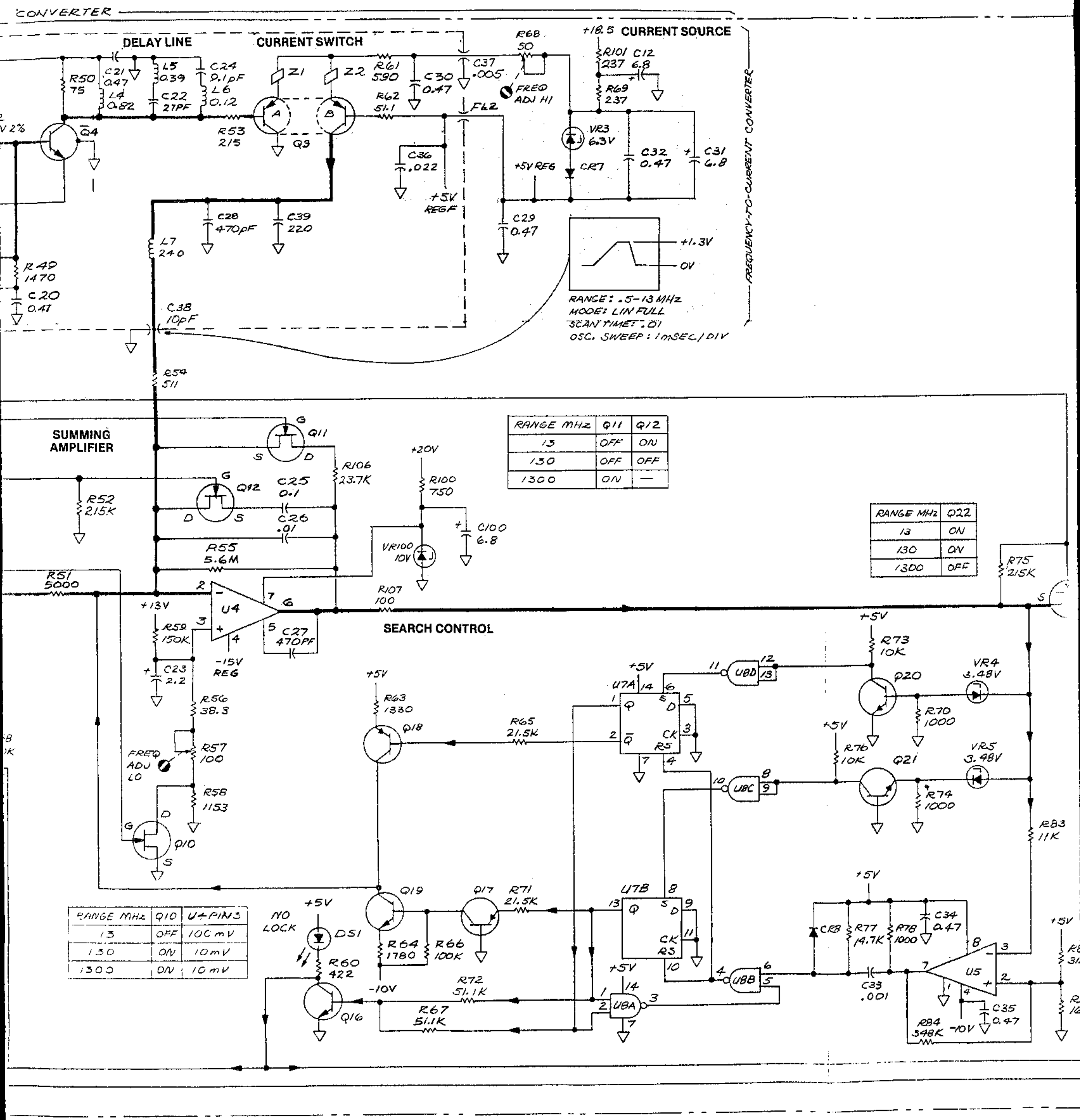
Fig. 3-36
Sht 2 of 4



RANGE MHz	Q13	Q14	U3 PIN 3
13	OFF	OFF	-400 mV
130	ON	OFF	-40 mV
1300	ON	ON	+1.5 V

RANGE MHz	Q10	U4 PIN 3
13	OFF	100 mV
130	ON	10 mV
1300	ON	10 mV

Fig 3-36
Sht 3 of 4

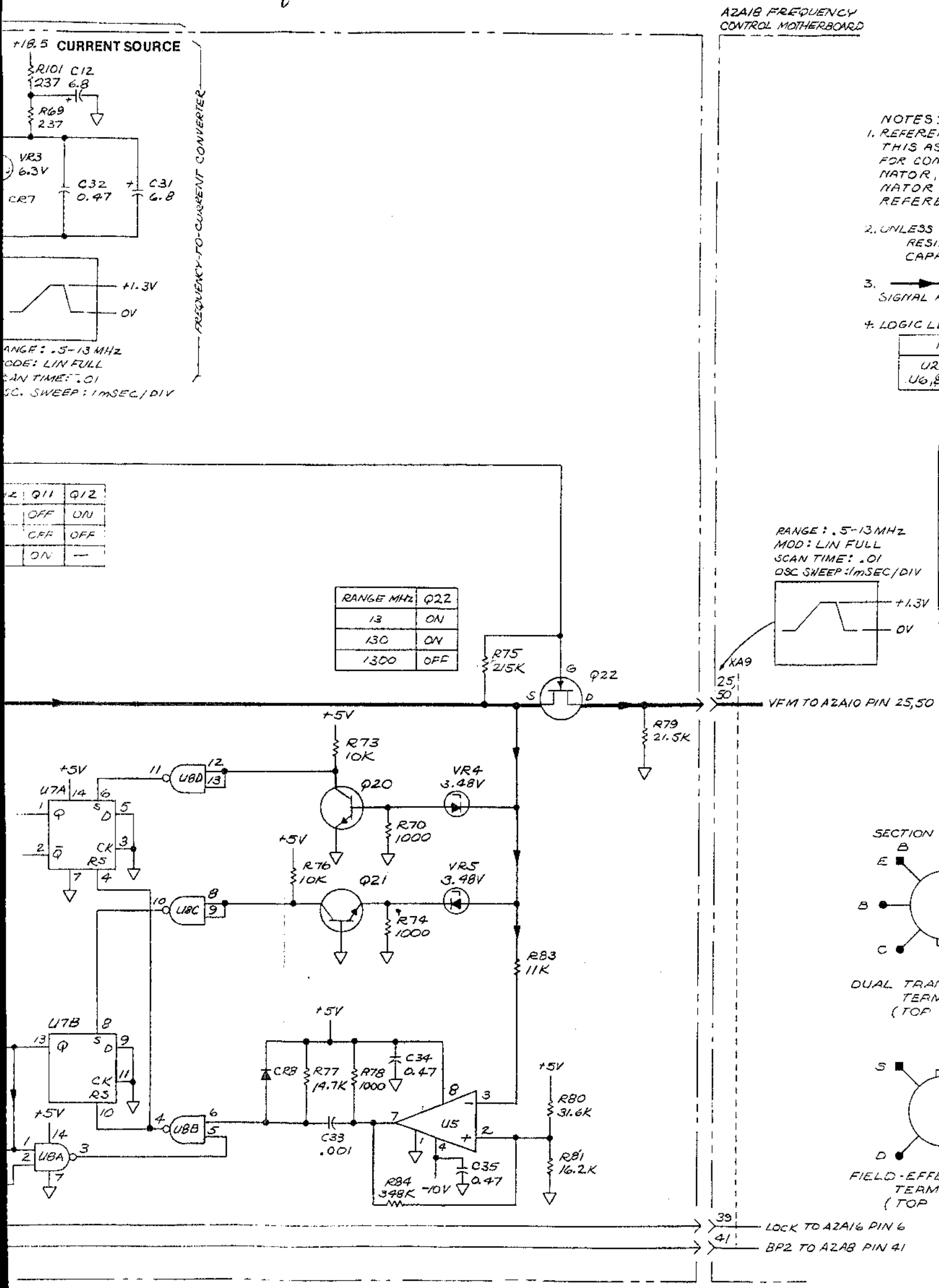


RANGE MHz	Q11	Q12
13	OFF	ON
130	OFF	OFF
1300	ON	—

RANGE MHz	Q22
13	ON
130	ON
1300	OFF

RANGE MHz	Q10	U4 PIN 3
13	OFF	10C mV
130	ON	10 mV
1300	ON	10 mV

Fig 3-36
Sht 4 of 4



NOTES:

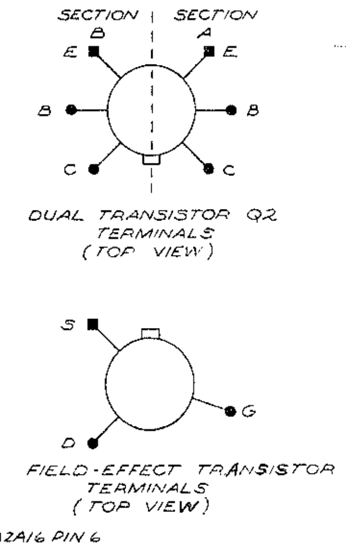
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATOR, PREFIX REFERENCE DESIGNATOR SHOWN WITH THE ASSEMBLY REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS CAPACITANCE IN MICROFARADS
3. ——▶—— INDICATES PRIMARY SIGNAL FLOW PATHS
4. LOGIC LEVELS:

IC	LOW	HIGH
U2 (ECL)	+3.4V	+4.2V
U6,9 (CMOS)	0V	+5V

REFERENCE DESIGNATIONS

A2A9	
C1-C4	Q1-Q22
C9-C12	R2-R4
C14-C39	R12-R17
C100, C101	R19-R21
CR1-CR8	R27-R85
DS1	R100-R107
FL1, FL2	TP1
U1, U2	U1-U8
L1-L7	VR2-VR5
MP1-MP15	VR100

NOT ASSIGNED:
A2A9C5-C8
A2A9C13
A2A9C40-C99
A2A9R1
A2A9R5-R11
A2A9R18
A2A9R22-R26
A2A9R86-R99
A2A9VR1
A2A9VR6-VR99



A2A9

Figure 3-36. A2A9 Discriminator, Schematic (CHANGE 2)

CHANGE 5

Page B2-9, Table B2-2:
Add A1A15A1CR4, HP Part No. 1901-0033, DIODE-GEN PRP 180V 200MA DO-7

Page B2-10, Table B2-2:
Change A1A15A1U1 to HP Part No. 1820-0681, IC GATE TTL S NAND QUAD 2-INP
Change A1A15A2U1 to HP Part No. 1820-0681, IC GATE TTL S NAND QUAD 2-INP

Page B3-45, Figure B3-40:
Add CR4 to A1A15A1 as shown in parts location drawing in this change sheet.

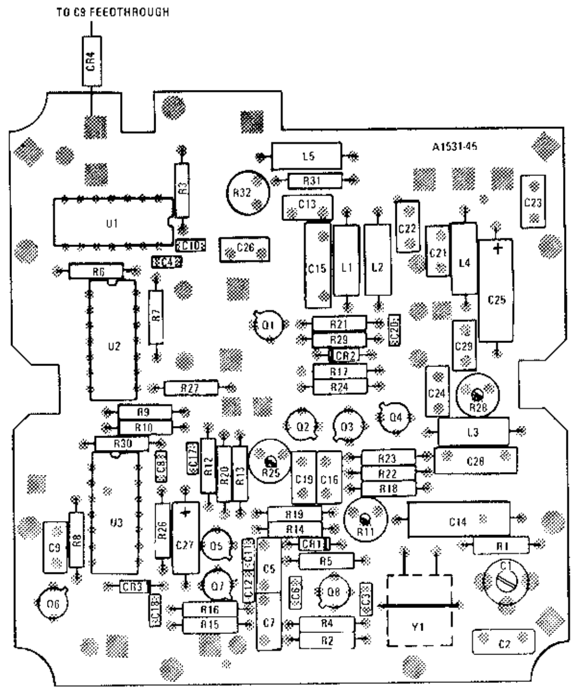
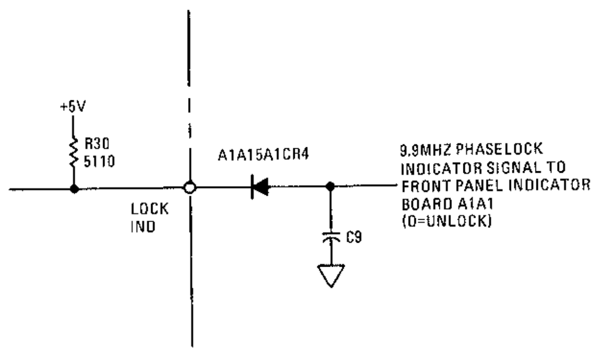


Figure B3-40. A1A15A1 9.9 MHz Phase Lock Board Assembly Parts Locations (CHANGE 5)

Page B3-45, Figure B3-41:
Add Diode A1A15A1CR4 to schematic as shown below.



CHANGE 5 (Cont'd)

Page C2-4, Table C2-2:
Delete A2W15.
Add A2W20, HP Part No. 1250-0669, BARREL MALE TO MALE.
Add A2W107, HP Part Number 08505-60193, CABLE ASSEMBLY, VTN 1, BLUE.
Add A2W108, HP Part Number 08505-60194, CABLE ASSEMBLY, VTN 2, GRAY/BLUE.

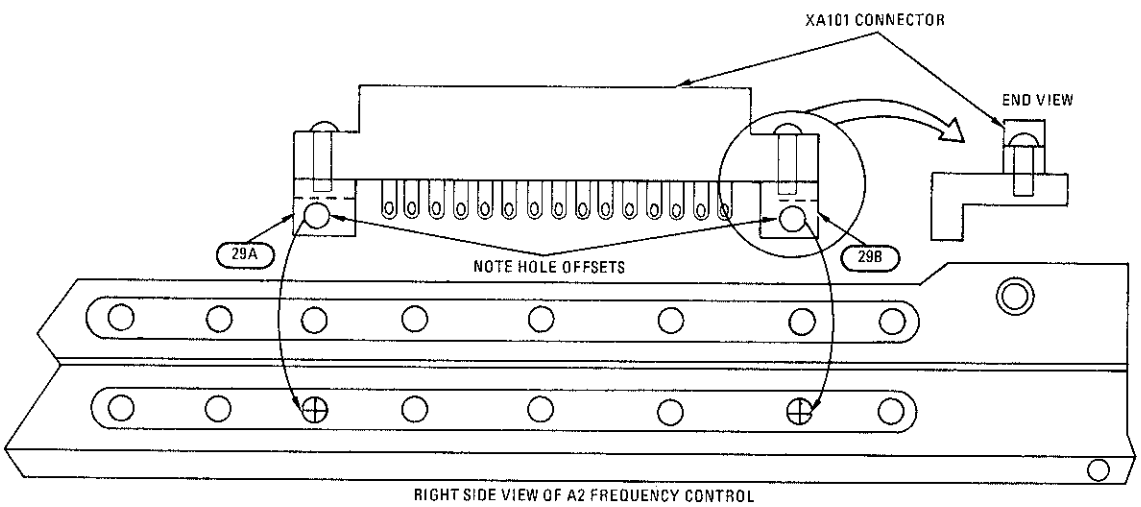
Page C2-9, Table C2-2:
Change A2A4 to HP Part Number 08505-60185 and a complete new listing of component parts for the Scaling Board in this change sheet.

Page C2-20, Table C2-2:
Change A2A10 to HP Part Number 08505-60184 and a complete new listing of component parts for the FM Driver Board in this change sheet.

Page C2-27, Table C2-2:
Add A2XA101, HP Part Number 08505-60186, Connector Assembly.

Page C2-28, Figure C2-1:
Change Item 29 to HP Part Number 08505-00126.
Add Item 29A, HP Part Number 08505-20178, Phase Lock Bracket, Right Hand.
Add Item 29B, HP Part Number 08505-20179, Phase Lock Bracket, Left Hand.
Change Item 32 to HP Part Number 08505-00130.
Change Item 36 to HP Part Number 08505-00131.
Change Item 66 to HP Part Number 08505-00129.

Page C2-30, Figure C2-1 (4 of 4):
Add drawing showing connector XA101 and mounting hardware as shown in this change sheet.



P/O Figure C2-1. A2 Frequency Control Mechanical Parts Location (4 of 4) (CHANGE 5)

P/O Table C2-2. Replaceable Parts (CHANGE 5)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			A2A4 SCALER BOARD		
A2A4	08505-60185	1	BOARD ASSEMBLY, SCALER	28480	08505-60185
A2A4C1	0180-1746	4	CAPACITOR-FXD 15UF+-10% 20VDC TA	04200	150D156X9020B2
A2A4C2	0180-2206	1	CAPACITOR-FXD 60UF+-10% 6VDC TA	04200	150D606X9006B2
A2A4C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	04200	150D156X9020B2
A2A4C4	0180-0116	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	04200	150D685X9035B2
A2A4C5	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	04200	150D225X9020A2
A2A4C6	0160-2199	1	CAPACITOR-FXD 30PF +-5% 300VDC	28480	0160-2199
A2A4C7	0140-0200	1	CAPACITOR-FXD 390PF +-5% 300VDC MICA	04522	DM15F391J0300WV1CR
A2A4C8	0140-0193	1	CAPACITOR-FXD 82PF +-5% 300VDC	04522	DM15E820J0300WV1CR
A2A4C9			DELETED		
A2A4C10			DELETED		
A2A4C11	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A2A4CR1	1901-0033	7	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2A4CR2	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2A4CR3	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2A4CR4	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2A4CR5	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2A4CR6	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2A4CR7	1901-0539	2	DIODE-SCHOTTKY	28480	1901-0539
A2A4CR8	1901-0539		DIODE-SCHOTTKY	28480	1901-0539
A2A4CR9	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2A4J1	1250-0543	2	CONNECTOR-RF SM-SNP M PC 50-OHM	05769	51-053-0000
A2A4J2	08443-00041	1	TEST POINT	28480	08443-00041
A2A4L1	9100-1623	1	COIL-MLD 27UH 5% Q=60 .155DX.375LG	02172	15-4455-2J
A2A4L2	9100-1645	3	COIL-MLD 390UH 5% Q=65 .19DX.44LG	02172	19-1331-25J
A2A4L3	9100-1645		COIL-MLD 390UH 5% Q=65 .19DX.44LG	02172	19-1331-25J
A2A4L4	9100-1645		COIL-MLD 390UH 5% Q=65 .19DX.44LG	02172	19-1331-25J
A2A4MP1	5000-9043	2	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A2A4MP2	5040-6848	1	EXTRACTOR, BOARD, YELLOW	28480	5040-6848
A2A4MP3	08505-00131	1	COVER, SCALING BOARD	28480	08505-00131
A2A4Q1	1855-0020	3	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A2A4Q2	1853-0050	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A2A4Q3	1854-0404	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A2A4Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A2A4Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A2A4Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A2A4Q7	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A2A4Q8	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A2A4Q9	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A2A4R1	0757-0465	10	RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R2	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R3	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R4	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R5	0757-0438	7	RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A4R6	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R7	0757-0458	5	RESISTOR 51.1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5112-F
A2A4R8	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R9	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R10	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5112-F
A2A4R11	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5112-F
A2A4R12	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5112-F
A2A4R13	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R14	2100-3273	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	04568	72-144-0
A2A4R15	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	03292	C4-1/8-T0-196R-F
A2A4R16	2100-3352	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	04568	72-143-0
A2A4R17	0683-1055	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01607	CB1055
A2A4R18	0698-3162	1	RESISTOR 46.4K 1% .125W F TC=0+-100	03292	C4-1/8-T0-4642-F
A2A4R19	0698-3136	1	RESISTOR 17.8K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1782-F
A2A4R20	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	03292	C4-1/8-T0-101-F
A2A4R21	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A4R22	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A4R23	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A4R24	2100-3350	2	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	04568	72-141-0
A2A4R25	2100-3350		RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	04568	72-141-0
A2A4R26	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4R27	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A4R28	0698-3457	4	RESISTOR 316K 1% .125W F TC=0+-100	02995	MF4C-1
A2A4R29	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	02995	MF4C-1
A2A4R30	0757-0346	6	RESISTOR 10 1% .125W F TC=0+-100	03292	C4-1/8-T0-10R0-F

P/O Table C2-2. Replaceable Parts (CHANGE 5)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A4R31	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03292	C4-1/8-T0-10R0-F
A2A4R32	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03292	C4-1/8-T0-10R0-F
A2A4R33	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	02995	MF4C-1
A2A4R34	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	02995	MF4C-1
A2A4R35	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03292	C4-1/8-T0-10R0-F
A2A4R36	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03292	C4-1/8-T0-10R0-F
A2A4R37	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	03292	C4-1/8-T0-10R0-F
A2A4R38	0698-3449	1	RESISTOR 28.7K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2872-F
A2A4R39	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5112-F
A2A4R40	2100-3207	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	04568	72-145-0
A2A4R41	0698-7236	1	RESISTOR 1K 1% .05W F TC=0+-100	03292	C3-1/8-T0-1001-G
A2A4R42	0757-0199	1	RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A2A4R43	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A4U1	1810-0221	2	NETWORK-RES 14-PIN-DIP .1-PIN-SPCG	28480	1810-0221
A2A4U2	1826-0249	1	IC OP AMP	03285	AD504J
A2A4U3	1820-1545	10	IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U4	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U5	1826-0229	2	IC OP AMP	02180	OP-05CJ
A2A4U6	1810-0221		NETWORK-RES 14-PIN-DIP .1-PIN-SPCG	28480	1810-0221
A2A4U7	1820-1536	2	IC GATE CMOS EXCL-OR QUAD 2-INP	01921	CD4030AF
A2A4U8	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U9	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U10	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U11	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U12	1820-1536		IC GATE CMOS EXCL-OR QUAD 2-INP	01921	CD4030AF
A2A4U13	1820-1534	3	IC GATE CMOS NOR QUAD 2-INP	01921	CD4001AF
A2A4U14	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U15	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U16	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U17	1820-1545		IC DSEL/MULTIPLXR CMOS TPL	02037	MC14053BCL
A2A4U18	1820-1534		IC GATE CMOS NOR QUAD 2-INP	01921	CD4001AF
A2A4U19	1820-1540	6	IC LCH CMOS D-TYPE QUAD	01921	CD4042AF
A2A4U20	1820-1540		IC LCH CMOS D-TYPE QUAD	01921	CD4042AF
A2A4U21	1820-1540		IC LCH CMOS D-TYPE QUAD	01921	CD4042AF
A2A4U22	1820-1538	4	IC GATE CMOS NAND QUAD 2-INP	01921	CD4011AF
A2A4U23	1820-1534		IC GATE CMOS NOR QUAD 2-INP	01921	CD4001AF
A2A4U24	1820-1531	1	IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01921	CD4013AF
A2A4U25	1820-1538		IC GATE CMOS NAND QUAD 2-INP	01921	CD4011AF
A2A4U26	1820-1538		IC GATE CMOS NAND QUAD 2-INP	01921	CD4011AF
A2A4U27	1820-1538		IC GATE CMOS NAND QUAD 2-INP	01921	CD4011AF
A2A4U28	1820-1540		IC LCH CMOS D-TYPE QUAD	01921	CD4042AF
A2A4U29	1820-1540		IC LCH CMOS D-TYPE QUAD	01921	CD4042AF
A2A4U30	1820-1540		IC LCH CMOS D-TYPE QUAD	01921	CD4042AF
			A2A10 FM DRIVER BOARD		
A2A10	08505-60184	1	BOARD ASSEMBLY, FM DRIVER	28480	08505-60184
A2A10C1	0160-2307	1	CAPACITOR-FXD 47PF +-5% 300VDC	28480	0160-2307
A2A10C2	0160-2230	3	CAPACITOR-FXD 3300PF +-5% 300VDC	28480	0160-2230
A2A10C3	0160-2230		CAPACITOR-FXD 3300PF +-5% 300VDC	28480	0160-2230
A2A10C4	0160-0945	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA0+70	28480	0160-0945
A2A10C5	0160-2209	1	CAPACITOR-FXD 360PF +-5% 300VDC MICA0+70	28480	0160-2209
A2A10C6	0160-3539	1	CAPACITOR-FXD 820PF +-5% 100VDC MICA0+70	28480	0160-3539
A2A10C7	0160-2230		CAPACITOR-FXD 3300PF +-5% 300VDC	28480	0160-2230
A2A10C8	0180-2141	1	CAPACITOR-FXD 3.3UF+-10% 50VDC TA	04200	150D335X9050B2
A2A10C9	0160-0161	3	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	04200	292P10392
A2A10C10	0160-3537	1	CAPACITOR-FXD 680PF +-5% 100VDC MICA0+70	28480	0160-3537
A2A10C11	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	04200	150D156X9020B2
A2A10C12	0160-0161		CAPACITOR-FXD .01UF +-10% 200VDC POLYE	04200	292P10392
A2A10C13	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	04200	150D156X9020B2
A2A10C14	0160-0161		CAPACITOR-FXD .01UF +-10% 200VDC POLYE	04200	292P10392
A2A10CR1	1901-0040	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2A10CR2	1901-0040	2	DIODE-SWITCHING 1N4004 30V 50MA 2NS DO-35	28480	1901-0040
A2A10CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2A10CR4	1901-0743		DIODE-PWR RECT 400V 1 AMP DO-41	01698	1N4004
A2A10CR5	1901-0743		DIODE-PWR RECT 1N4004 400V 1 AMP DO-41	01698	1N4004
A2A10J1	1250-0543		CONNECTOR-RF SM-SNP M PC 50-OHM	05769	51-053-0000
A2A10L1	9100-2585	2	COIL-MLD 10MH 10% Q=40 .156DX.375LG	02172	15S-103K
A2A10L2	9100-2585		COIL-MLD 10MH 10% Q=40 .156DX.375LG	02172	15S-103K
A2A10MP1	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A2A10MP2	5040-6843	1	EXTRACTOR, P.C. BOARD	28480	5040-6843
A2A10MP3	0340-0162	2	INSULATOR-XSTR ALUMINUM	28480	0340-0162
A2A10MP4	0340-0162		INSULATOR-XSTR ALUMINUM	28480	0340-0162
A2A10MP5	0590-0519	8	THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519
A2A10MP6	0590-0519		THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519
A2A10MP7	0590-0519		THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519
A2A10MP8	0590-0519		THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519
A2A10MP9	0590-0519		THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519
A2A10MP10	0590-0519		THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519

P/O Table C2-2. Replaceable Parts (CHANGE 5)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A10MP11	0590-0519		THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519
A2A10MP12	0590-0519		THREADED INSERT-NUT 4-40 .062-LG STL	28480	0590-0519
A2A10MP13	2200-0103	4	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
A2A10MP14	2200-0103		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
A2A10MP15	2200-0103		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
A2A10MP16	2200-0103		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
A2A10MP17	2200-0113	4	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	28480	2200-0113
A2A10MP18	2200-0113		SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	28480	2200-0113
A2A10MP19	2200-0113		SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	28480	2200-0113
A2A10MP20	2200-0113		SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	28480	2200-0113
A2A10MP21	08505-20135	1	SHIELD	28480	08505-20135
A2A10MP22	08505-20136	1	BASE, SHIELD	28480	08505-20136
A2A10MP23	1205-0012	1	HEAT SINK TO-18-PKG	28480	1205-0012
A2A10MP24	08505-00130	1	FM DRIVER COVER	28480	08505-00130
A2A10Q1	1853-0007	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	02037	2N3251
A2A10Q2	1854-0237	1	TRANSISTOR NPN SI TO-66 PD=20W FT=10MHZ	28480	1854-0237
A2A10Q3	1854-0039	1	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	02037	2N3053
A2A10Q4	1853-0052	1	TRANSISTOR PNP 2N3740 SI TO-66 PD=25W	02037	2N3740
A2A10Q5	1854-0475	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A2A10R1	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	03292	C4-1/8-T0-3162-F
A2A10R2	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1002-F
A2A10R3	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A10R4	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1002-F
A2A10R5	0698-3151	1	RESISTOR 2.87K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2871-F
A2A10R6	0698-0084	2	RESISTOR 2.15K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2151-F
A2A10R7	0757-0422	3	RESISTOR 909 1% .125W F TC=0+-100	03292	C4-1/8-T0-909R-F
A2A10R8	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A10R9	0757-0290	1	RESISTOR 6.19K 1% .125W F TC=0+-100	02995	MF4C1/8-T0-6191-F
A2A10R10	0757-0280	1	RESISTOR 1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1001-F
A2A10R11	0698-3132	1	RESISTOR 261 1% .125W F TC=0+-100	03292	C4-1/8-T0-2610-F
A2A10R12	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	03292	C4-1/8-T0-909R-F
A2A10R13	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	03292	C4-1/8-T0-909R-F
A2A10R14	0698-3631	1	RESISTOR 330 5% 2W MO TC=0+-200	03412	FP-42
A2A10R15	0698-3430	3	RESISTOR 21.5 1% .125W F TC=0+-100	01992	PME55-1/8-T0-21R5-F
A2A10R16	0757-1090	1	RESISTOR 261 1% .5W F TC=0+-100	02995	MF7C1/2-T0-261R-F
A2A10R17	0698-3430		RESISTOR 21.5 1% .125W F TC=0+-100	01992	PME55-1/8-T0-21R5-F
A2A10R18	0698-3430		RESISTOR 21.5 1% .125W F TC=0+-100	01992	PME55-1/8-T0-21R5-F
A2A10R19	0698-3607	1	RESISTOR 18 5% 2W MO TC=0+-200	03412	FP42-2-T00-18R0-J
A2A10R20	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	03292	C4-1/8-T0-51R1-F
A2A10R21	0698-3603	1	RESISTOR 12 5% 2W MO TC=0+-200	03412	FP42-2-T00-12R0-J
A2A10R22	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2151-F
A2A10U1	1826-0229		IC OP AMP	02180	OP-05CJ

CHANGE 5 (Cont'd)

Page C3-66, Figure C3-25:
Replace Figure C3-25 with new Parts Location drawing of A2A4 in this change sheet.

Page C3-67, Figure C3-26:
Replace Figure C3-26 with new Schematic of A2A4 in this change sheet.

Page C3-91, Figure C3-37:
Replace Figure C3-37 with new Parts Location drawing of A2A10 in this change sheet.

Page C3-91, Figure C3-38:
Replace Figure C3-38 with new Schematic of A2A10 in this change sheet.

Page C3-105/106:
Add new Figures C3-48 and C3-49 in this change sheet.

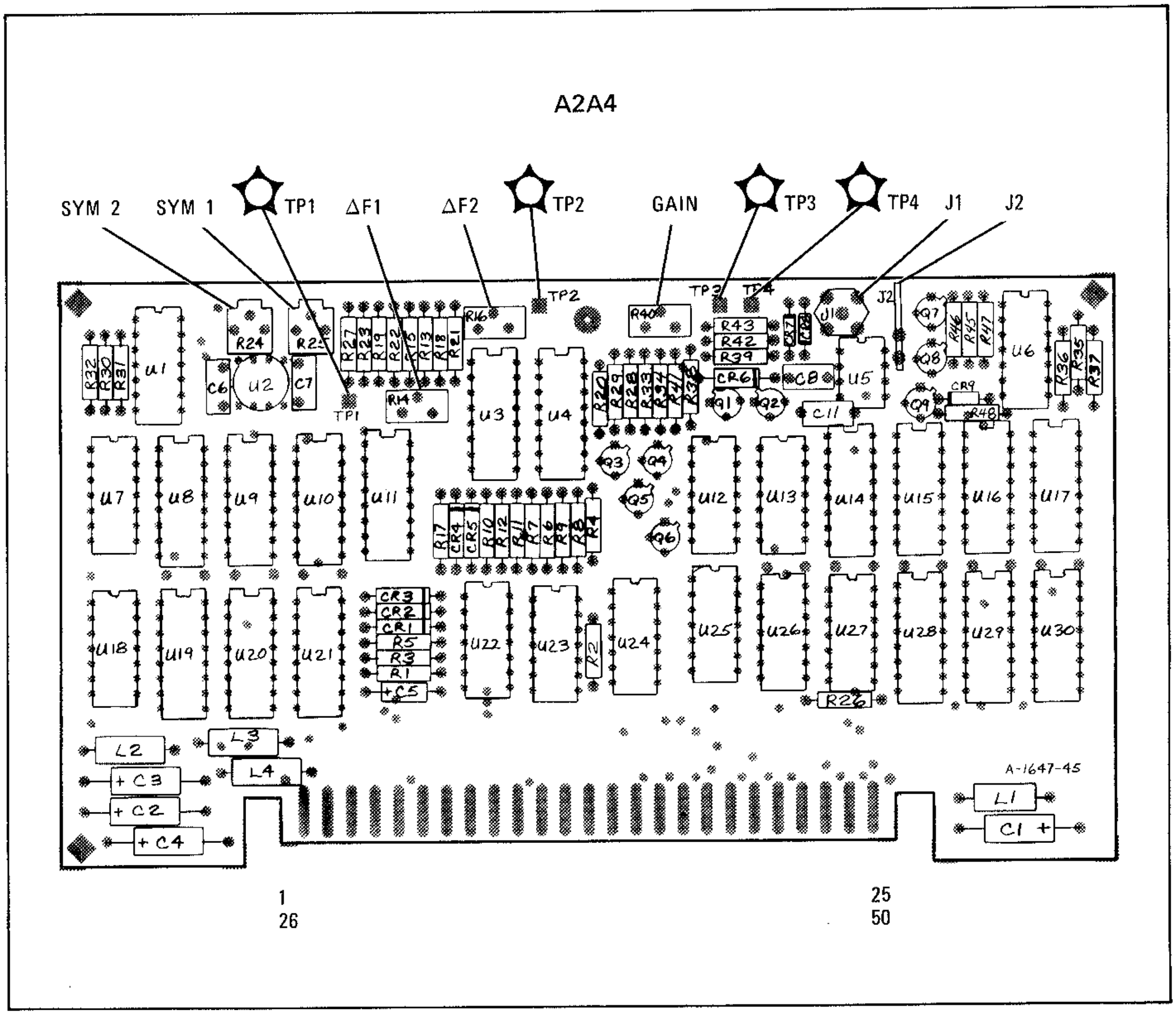


Figure C3-25. A2A4 Scaling Circuit, Parts Location (CHANGE 5)

Fig C3-26
Sht 1 of 5

SIGNAL	DEFINITION
DAT 1	DATA 1 FOR INSTRUMENT I/O
DAT 2	DATA 2 FOR INSTRUMENT I/O
DAT 3	DATA 3 FOR INSTRUMENT I/O
DAT 4	DATA 4 FOR INSTRUMENT I/O
DIG 1	DIGIT 1
DIG 2	DIGIT 2
DIG 3	DIGIT 3
DIG 4	DIGIT 4
LT EN	LATCH ENABLE
POSN 1	POSITION 1 (START/CW)
POSN 2	POSITION 2 (STOP/ΔF)
LVDIS	VERNIER DISABLE (0=NO VERNIER)
WTH 1	WIDTH 1
WTH 3	WIDTH 3
VSC	SCALING VOLTAGE

WIDTH		
	WTH1	WTH3
SS1	1	0
SS2	1	0
ALT	0	0
ΔF	0	1
CW	1	1

SWITCH CONTROL					
	U3			U4B	
	A	B	C	B	C
SS1	1	1	1	1	1
SS2	1	1	1	1	1
ALT	1	1	1	1	1
ΔF	0	1	0	0	0
CW	OPEN	———		0	1

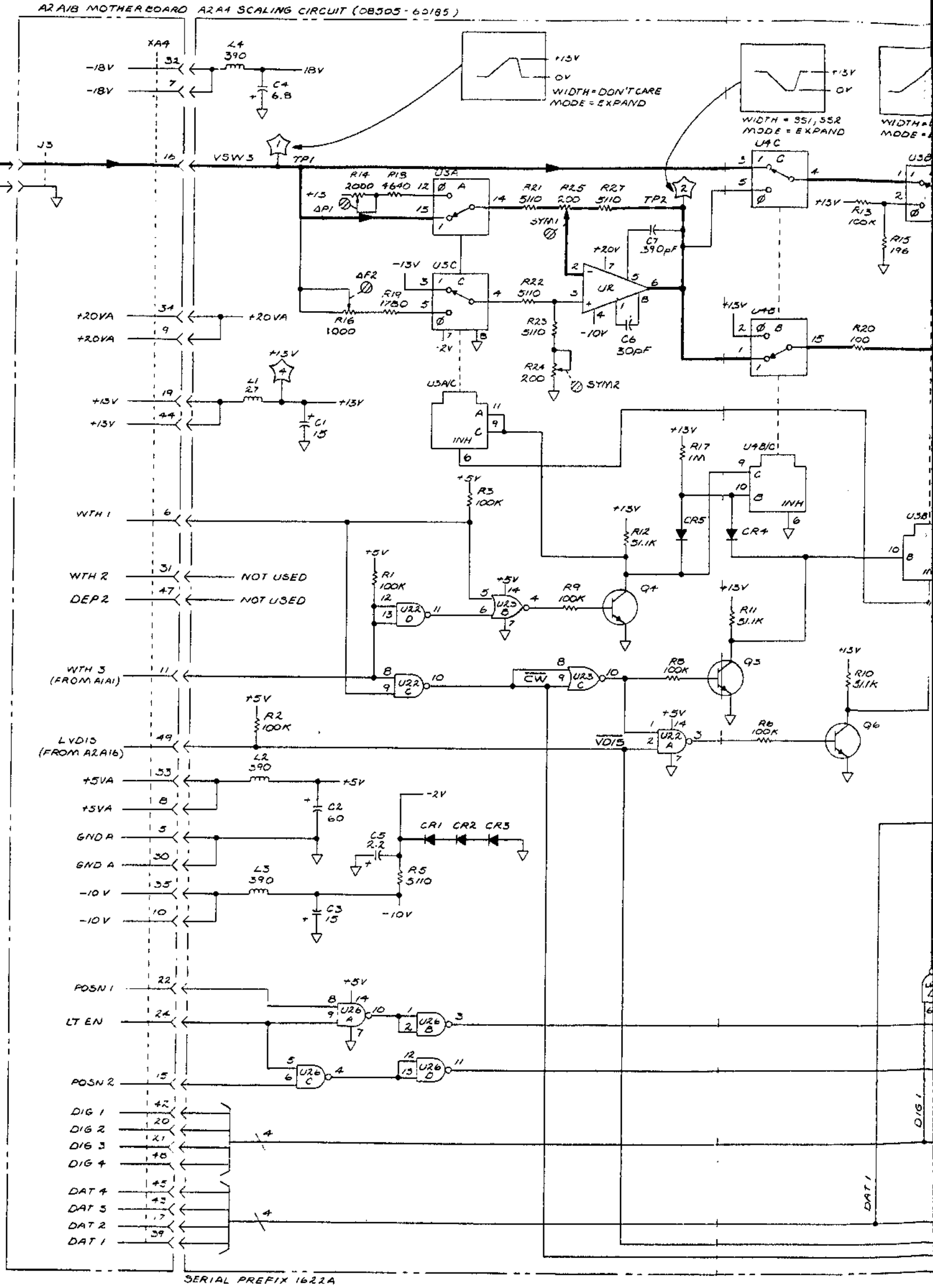


Fig. C3-26
Sht 2 of 5

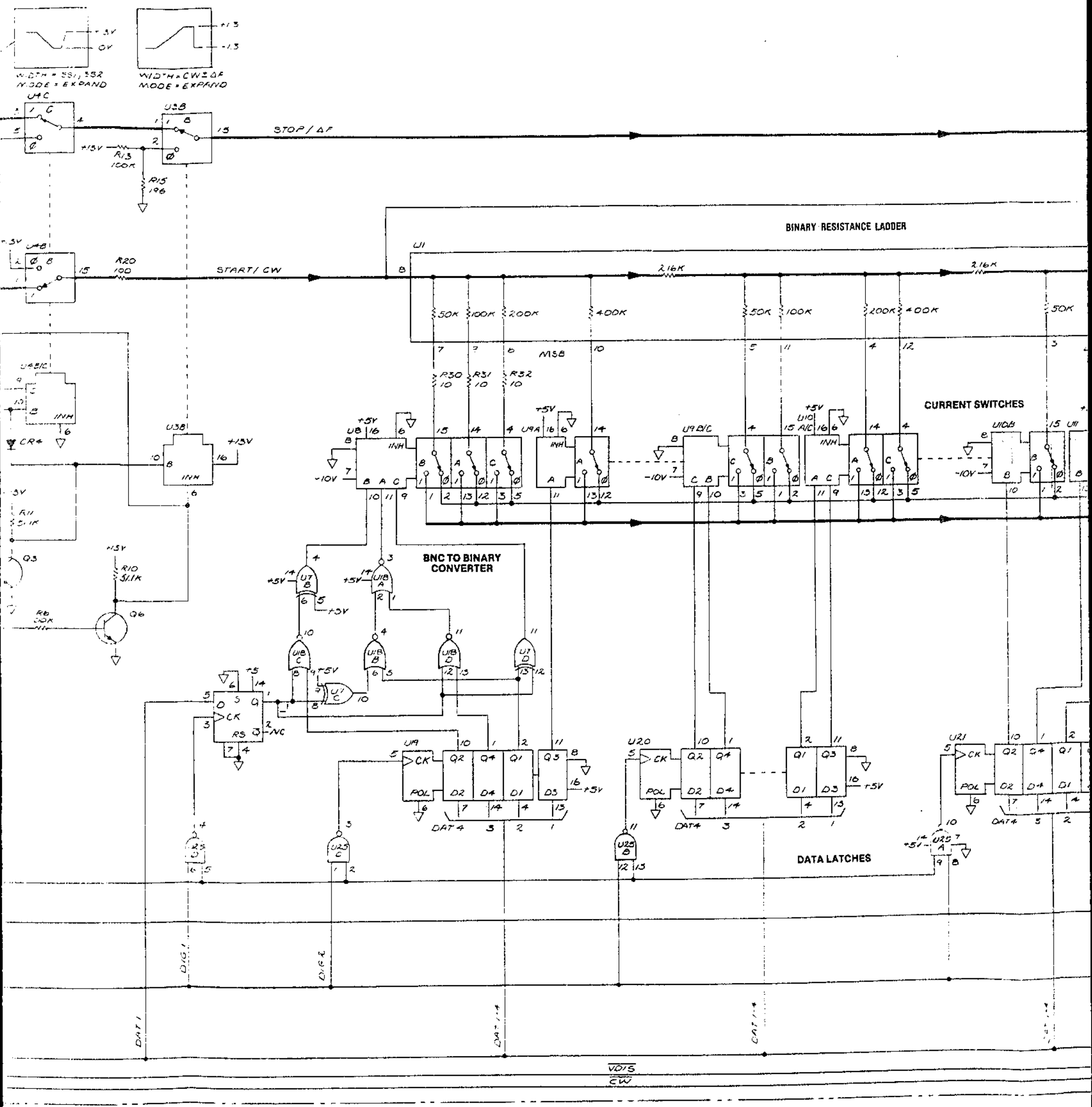


Fig. C3-26
Sht 3 of 5

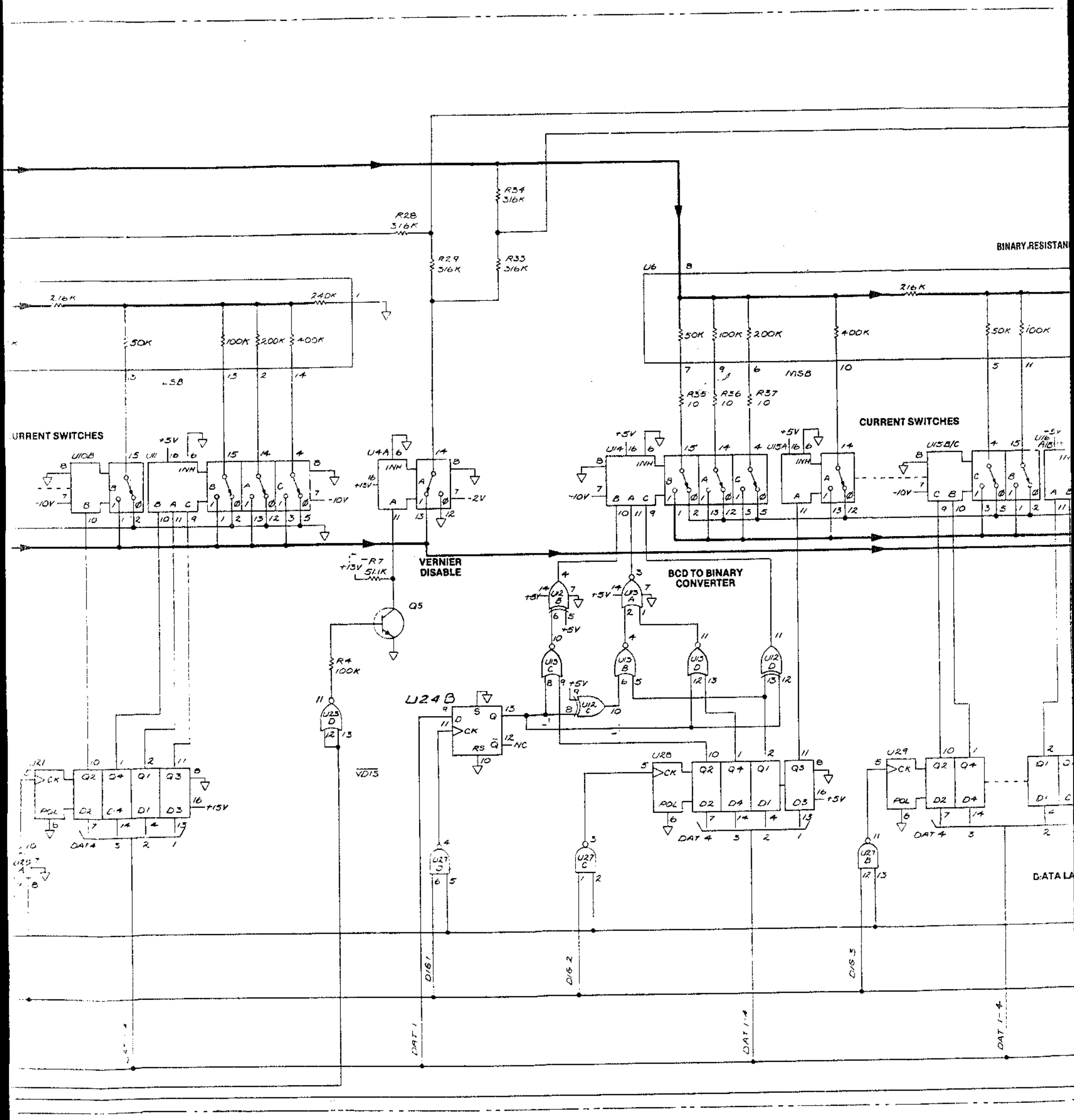


Fig C3-26
Sht 4 of 5

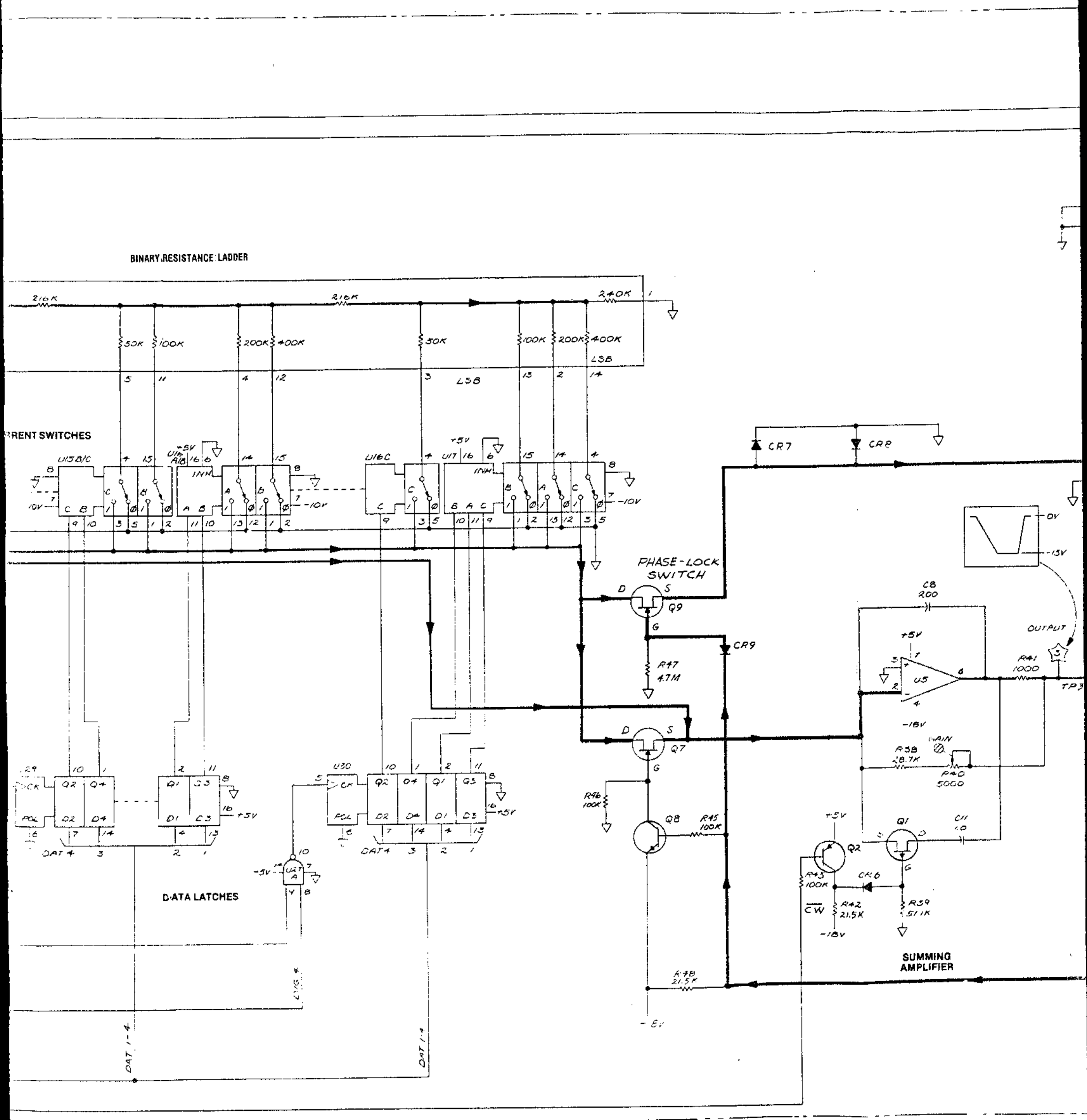
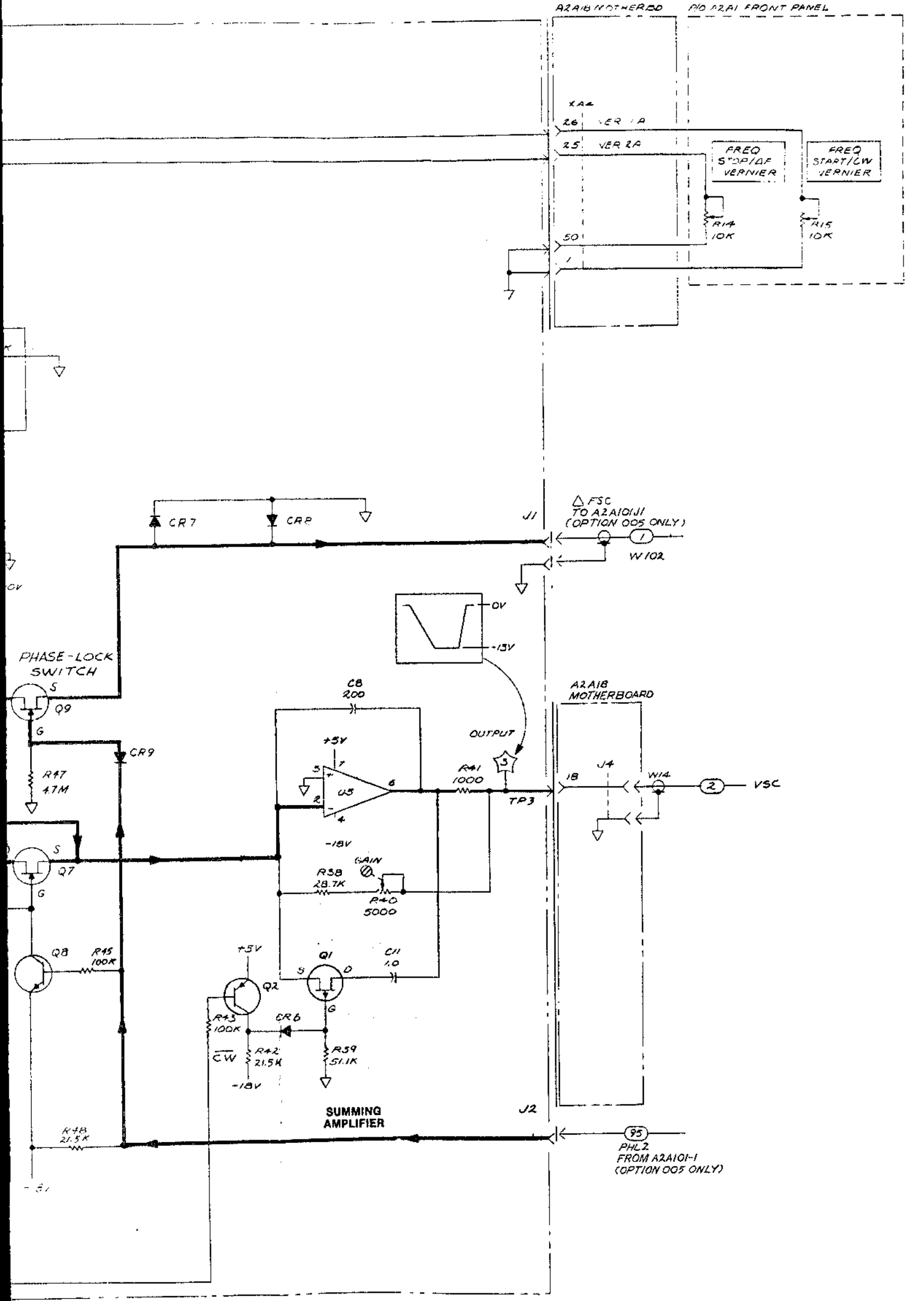


Fig. C3-26
Sht 5 of 5



NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATOR, PREFIX REFERENCE SHOW WITH THE ASSEMBLY REFENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS CAPACITANCE IN MICROFARADS
3. INTERCONNECTION SYMBOL FOR (1)
4. LOGIC LEVELS ARE:
   LOW = 0 = < 0.8V
   HIGH = 1 = > 2.2V

REFERENCE DESIGNATORS

NO PREFIX
W13, W14
A2A1
R14, R15
A2A4
C1-C8, C11 CR1-CR9 L1-L4 Q1-Q9 R1-R47 U1-U30
A2A18
XA4 J3, J4

NOT ASSIGNED
A2A4C9
A2A4C10

Figure C3-26. A2A4 Scaling, Schematic (CHANGE 5)

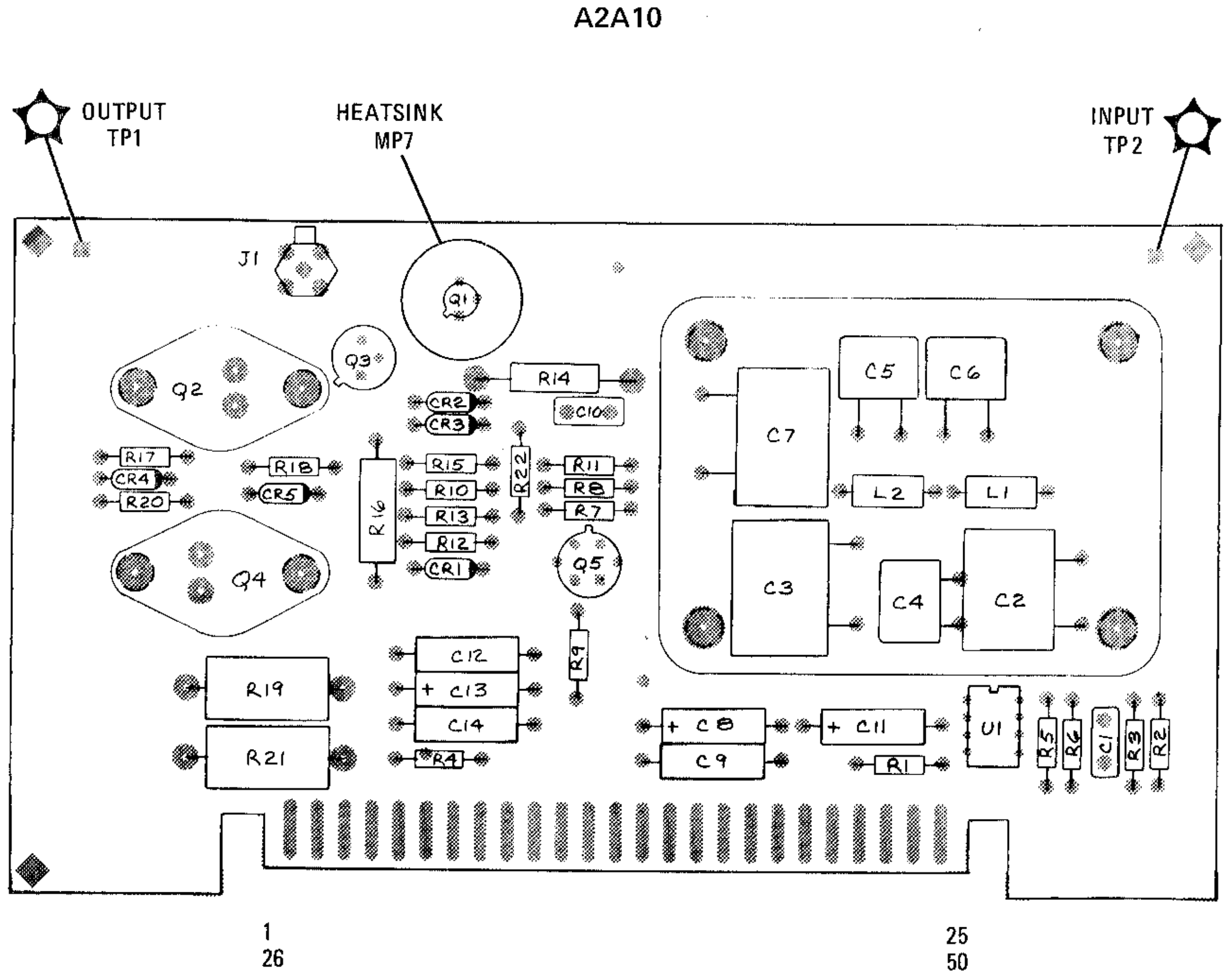


Figure C3-37. A2A10 FM Driver, Parts Location (CHANGE 5)

Fig. C3-38, Sht 1 of 4

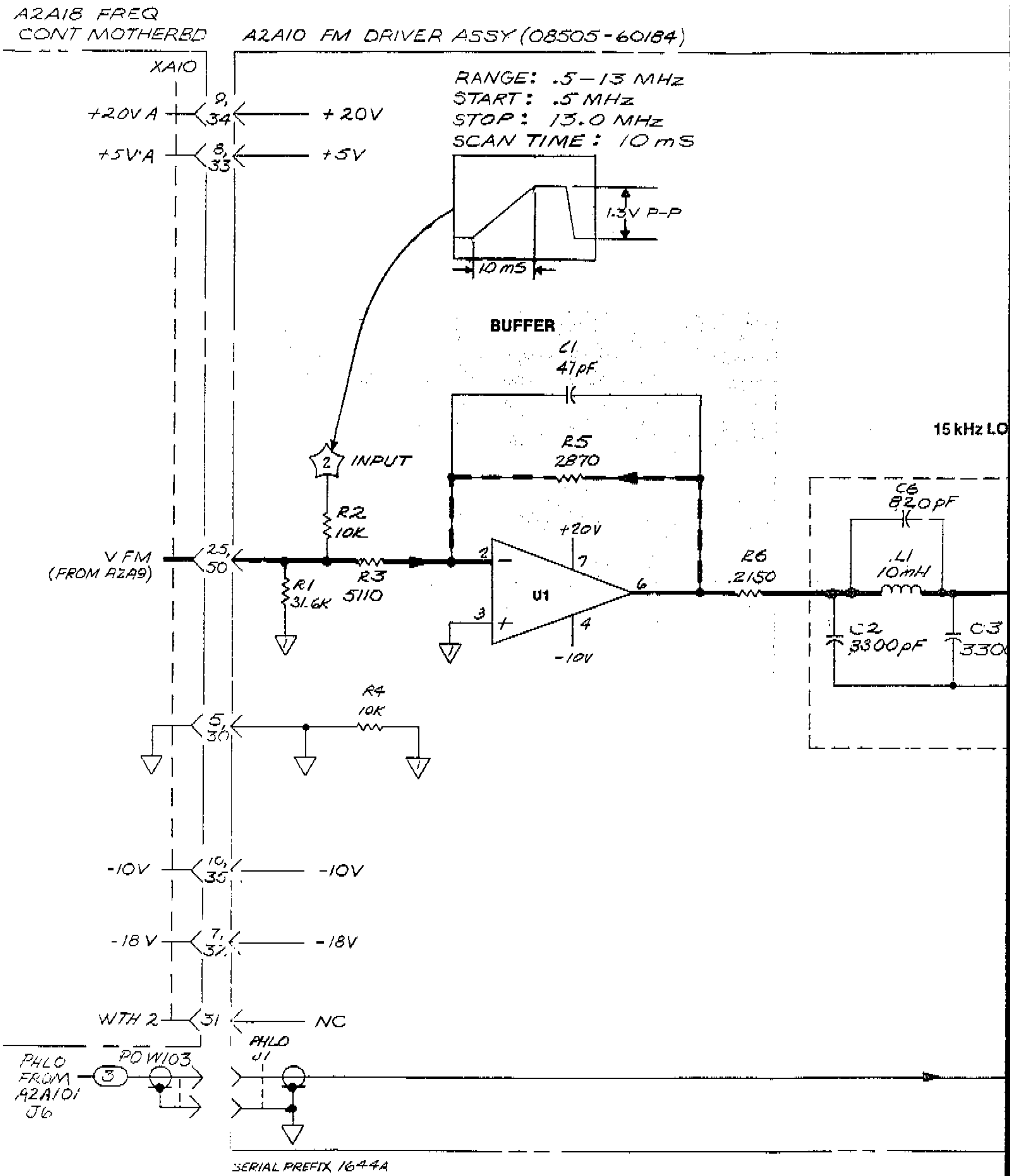


Fig C3-38
Sht 2 of 4

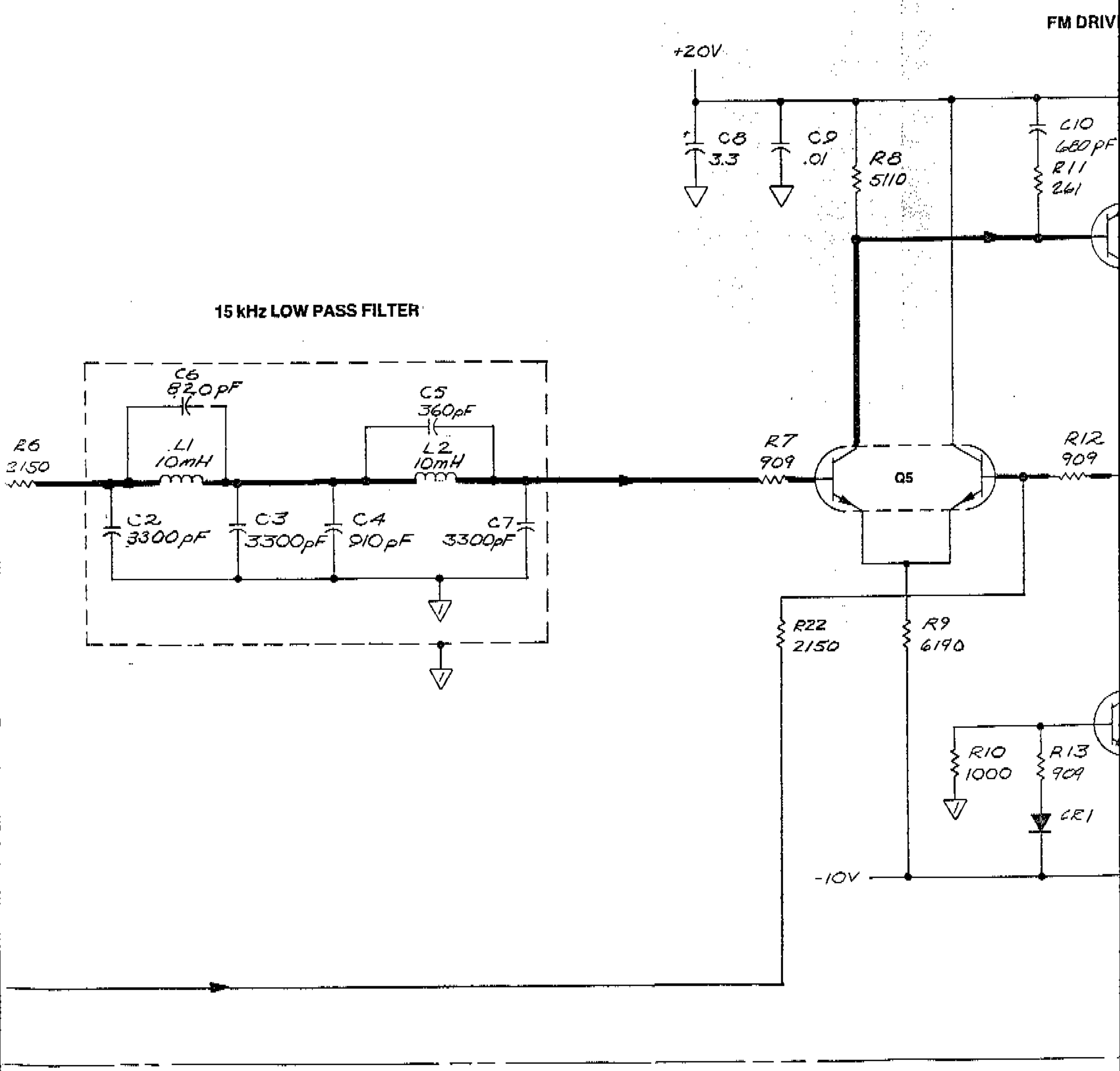


Fig C3-38
Sht 3 of 4

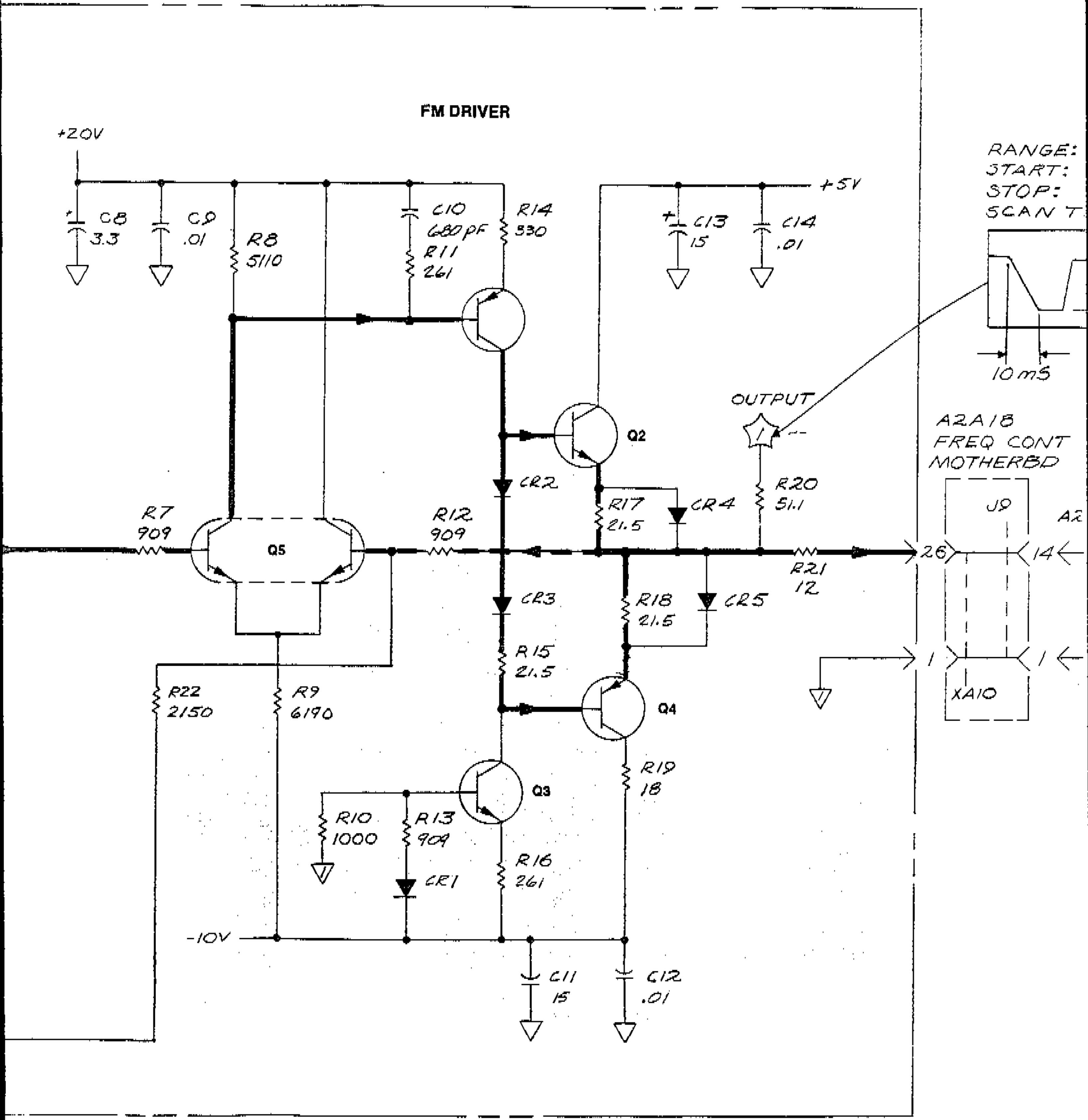
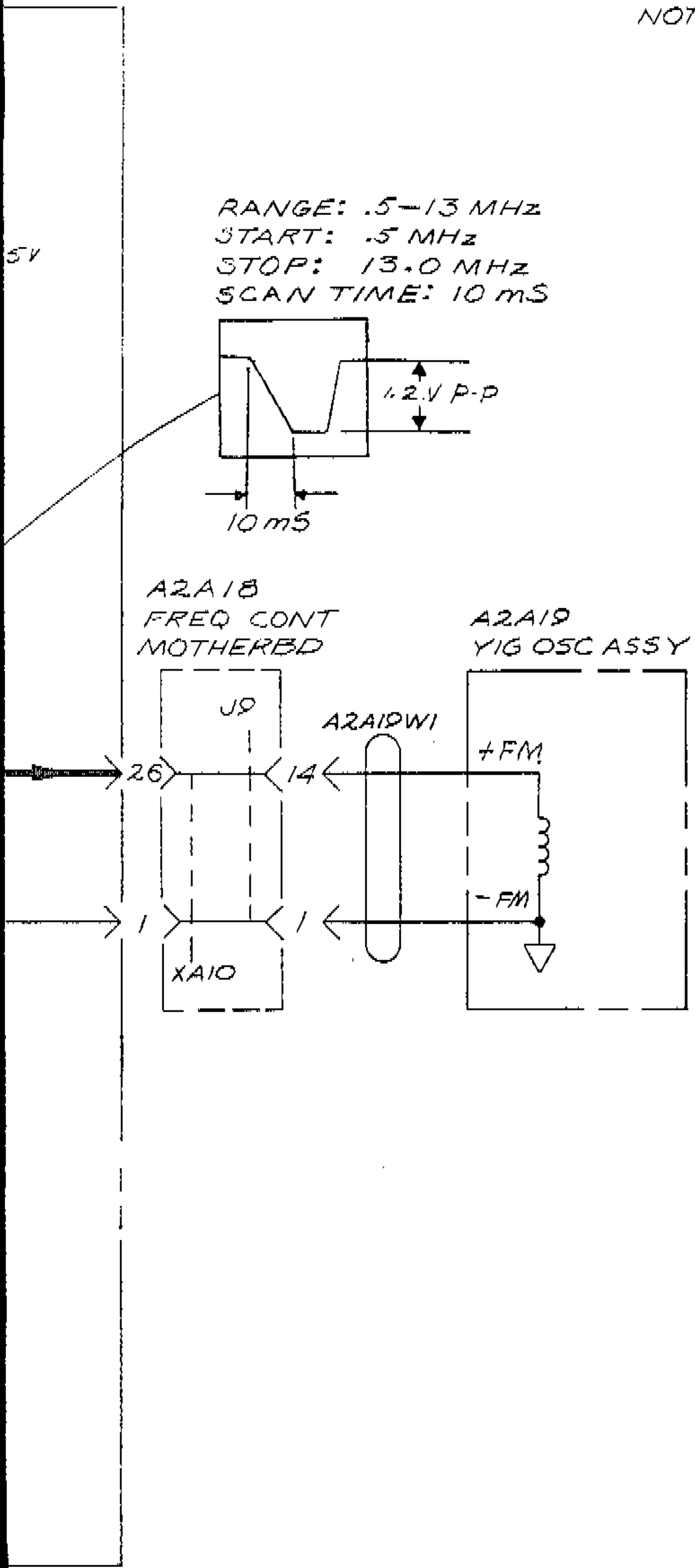


Fig. C3-38
Sht 4 of 4



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
   CAPACITANCE IN MICROFARADS

REFERENCE DESIGNATIONS

A2A10
C1-C14
CR1-CR5
L1, L2
Q1-Q5
R1-R22
U1

3. ——▶—— INDICATES PRIMARY SIGNAL FLOW PATH; — —◀— — INDICATES PRIMARY FEEDBACK PATH.

Figure C3-38. A2A10 FM Driver Schematic (CHANGE 5)

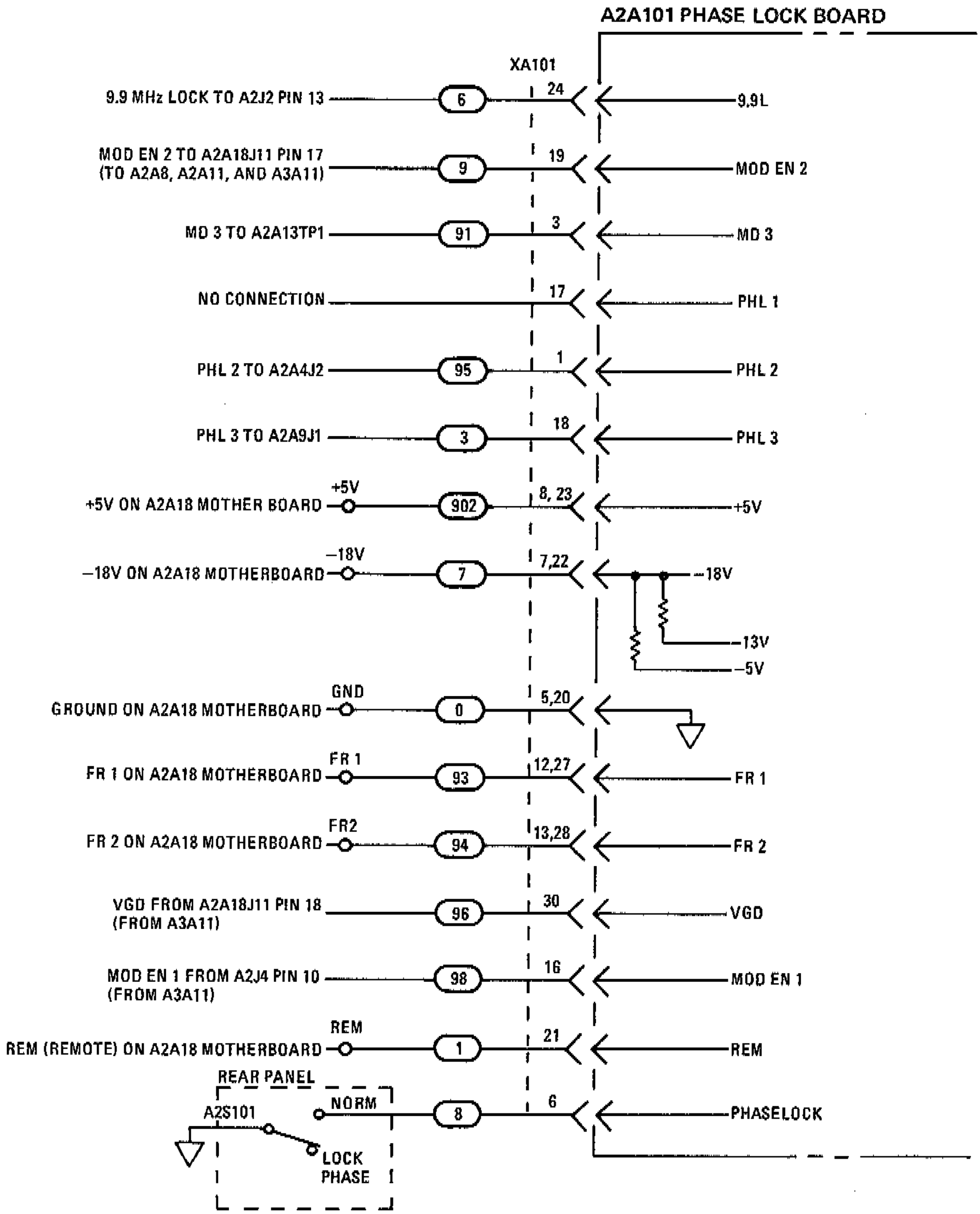


Figure C3-48. Wiring to Connector A2XA101 (CHANGE 5)

CHANGE 5 (Cont'd)

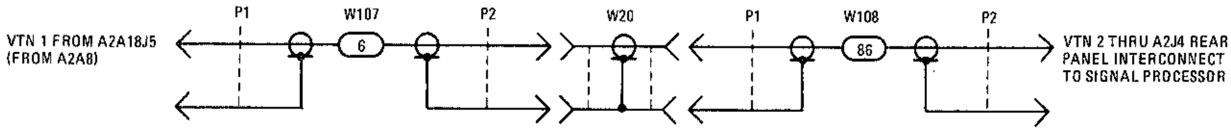


Figure C3-49. Tuning Voltage Cable Interconnect for Standard Instrument without Opt. 005 (CHANGE 5)

Page E4-4, Table E4-2:
Change A2A13 to HP Part Number 08505-60198 and a complete new listing of component parts for the Switch Register Board in this change sheet.

Page E5-5, Figure E5-1C:
Replace Figure E5-1C with new Parts Location drawing of A2A13 in this change sheet.

Page E5-5, Figure E5-2:
Replace Figure E5-2 with new schematic of A2A13 in this change sheet.

P/O Table E4-2. Replaceable Parts (CHANGE 5)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			A2A13 SWITCH REGISTER BOARD		
A2A13	08505-60198	1	SWITCH REGISTER STORAGE ASSEMBLY	28480	08505-60198
A2A13C1	0180-0197	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	04200	150D225X9020A2
A2A13C2	0160-2055	5	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2A13C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2A13C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2A13C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2A13C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2A13MP1	5000-9043	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A2A13MP2	5040-6852	1	EXTRACTOR, ORANGE	28480	5040-6852
A2A13R1	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	03292	C4-1/8-T0-511R-F
A2A13R2	0757-0199	6	RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A2A13R3	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A2A13R4	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A2A13R5	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A2A13R6	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A2A13R7	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A2A13R8	2100-3103	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	03744	3006P-1-103
A2A13R9	0757-0438	2	RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A13R10	2100-3054	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	03744	3006P-1-503
A2A13R11	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A2A13R12	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	03292	C4-1/8-T0-101-F
A2A13R13	0757-0123	1	RESISTOR 34.8K 1% .125W F TC=0+-100	02273	CEA-993
A2A13R14	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1003-F
A2A13U1	1820-1216	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01698	SN74LS138N
A2A13U2	1826-0092	1	IC OP AMP	28480	1826-0092
A2A13U3	1820-1538	1	IC GATE CMOS NAND QUAD 2-INP	01921	CD4011AF
A2A13U4	1820-1823	3	IC BFR CMOS NON-INV HEX 1-INP	03406	MM80C97N
A2A13U5	0960-0442	1		28480	0960-0442
A2A13U6	1820-1823		IC BFR CMOS NON-INV HEX 1-INP	03406	MM80C97N
A2A13U7	1820-1552	1	IC GATE CMOS NAND TPL 3-INP	01921	CD4023BF
A2A13U8	1820-1823		IC BFR CMOS NON-INV HEX 1-INP	03406	MM80C97N
A2A13U9	1820-1544	8	IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF
A2A13U10	1820-1544		IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF
A2A13U11	1820-1547	3	IC DSEL/MULTIPLXR CMOS	02037	MC14051BCL
A2A13U12	1820-1544		IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF
A2A13U13	1820-1547		IC DSEL/MULTIPLXR CMOS	02037	MC14051BCL
A2A13U14	1820-1547		IC DSEL/MULTIPLXR CMOS	02037	MC14051BCL
A2A13U15	1820-1544		IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF
A2A13U16	1820-1544		IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF
A2A13U17	1820-1544		IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF
A2A13U18	1820-1544		IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF
A2A13U19	1810-0224	4	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	02483	750-83-R33K
A2A13U20	1810-0224		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	02483	750-83-R33K
A2A13U21	1810-0224		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	02483	750-83-R33K
A2A13U22	1810-0224		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	02483	750-83-R33K
A2A13U23	1820-1544		IC FF CMOS D-TYPE POS-EDGE-TRIG COM	01921	CD4076AF

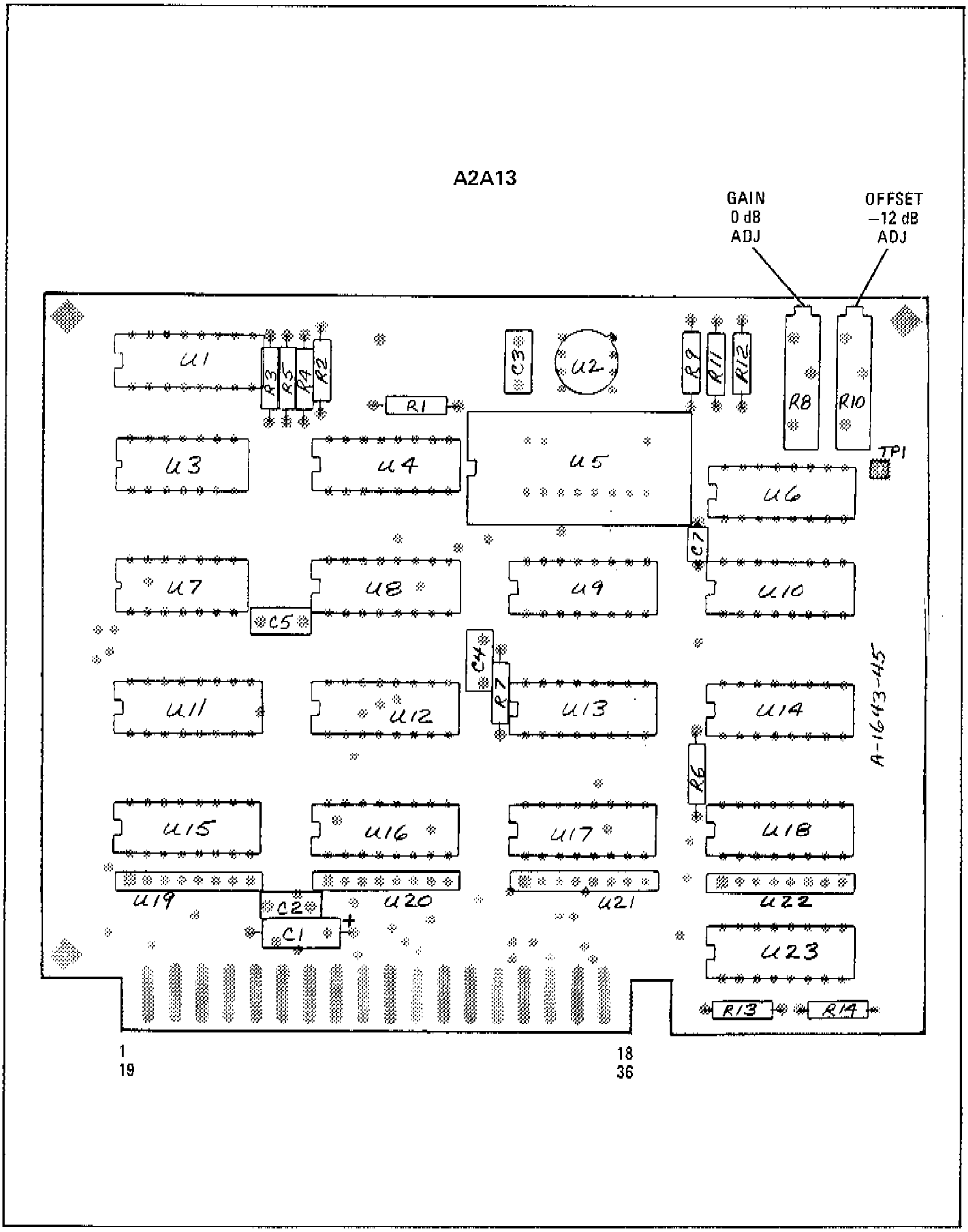


Figure E5-1C. A2A13 Frequency Control Switch Register Storage Board Parts Locations (CHANGE 5)

Fig. E5-2
Sht 1 of 4

INPUT SWITCH TRUTH TABLE

CONTROLLER CODE	I1	I2
INPUT LEVEL dBm MAX	-30dBm MAX	-10dBm MAX
IFG (IF GAIN)	0	1

RANGE SWITCH TRUTH TABLE

CONTROLLER CODE	R1	R2	R3
FREQ. RANGE MHz	.5-13	.5-130	.5-1300
FR 1	1	1	0
FR 2	0	1	1

WIDTH SWITCH TRUTH TABLE

CONTROLLER CODE	W1	W2	W3	W4	W5
WIDTH:	START/STOP			CW IF	CW
	1	2	ALT		
WTH 1	1	1	0	0	1
WTH 2	0	1	1	1	1
WTH 3	0	0	0	1	1

SCAN TIME SWITCH TRUTH TABLE

CONTROLLER CODE	S1	S2	S3	S4	S5
SCAN TIME SEC:	MAN-UAL	100-10	10-1	1-.1	.1-.01
SCT 1	1	1	0	0	1
SCT 2	0	1	1	1	1
SCT 3	0	0	0	1	1

OUTPUT LEVEL TRUTH TABLE

CONTROLLER CODE	FRONT PANEL OUTPUT LEVEL SWITCH	10dB ATTEN. (PIN 34)	20dB ATTEN. (PIN 15)	40dB ATTEN. (PIN 17)
08	+10	1	1	1
07	0	0	1	1
06	-10	1	0	1
05	-20	0	0	1
04	-30	1	1	0
03	-40	0	1	0
02	-50	1	0	0
01	-60	0	0	0

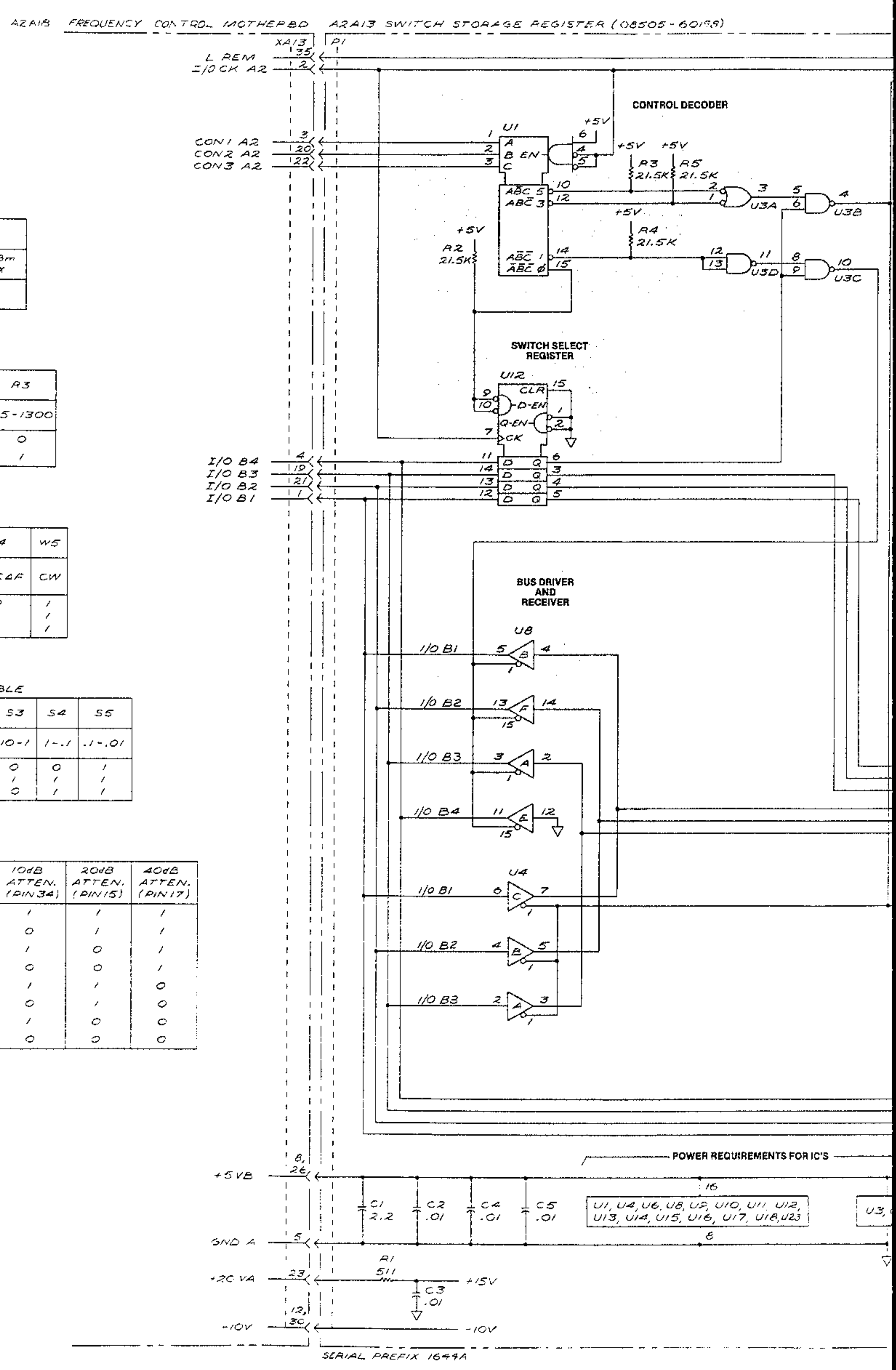


Fig E5-2, Sht 2 of 4

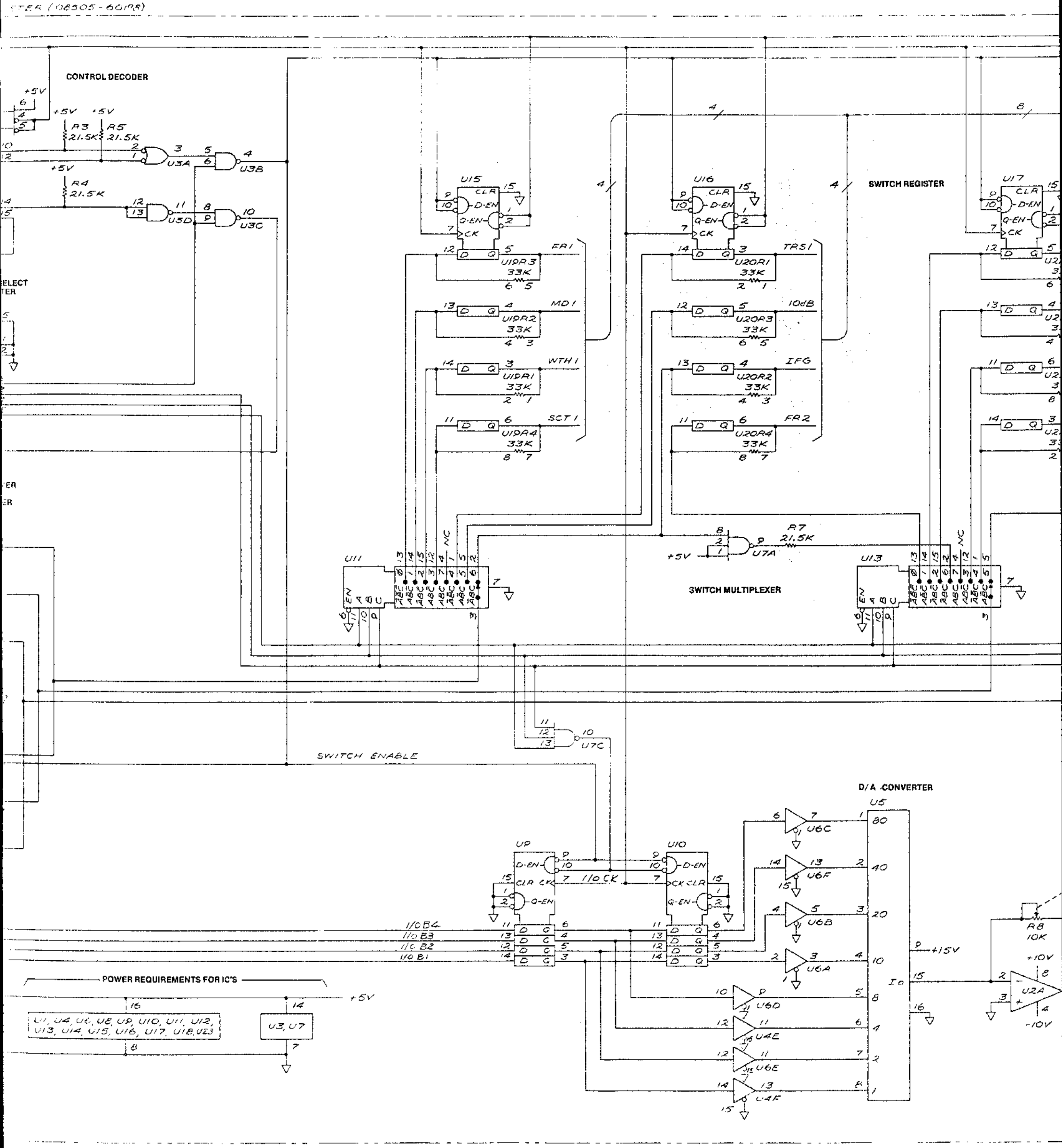


Fig. E5-2
Sht 3 of 4

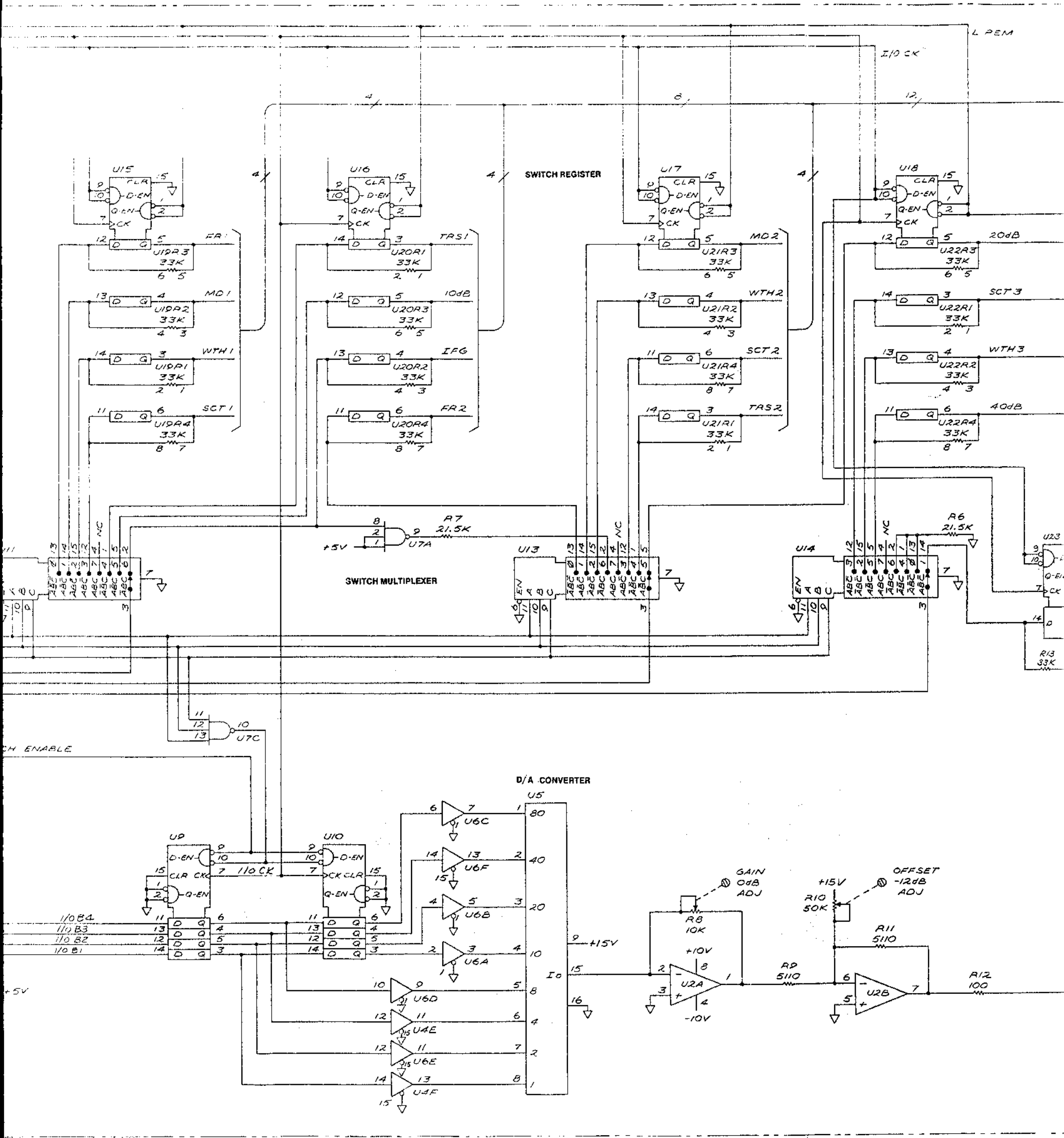
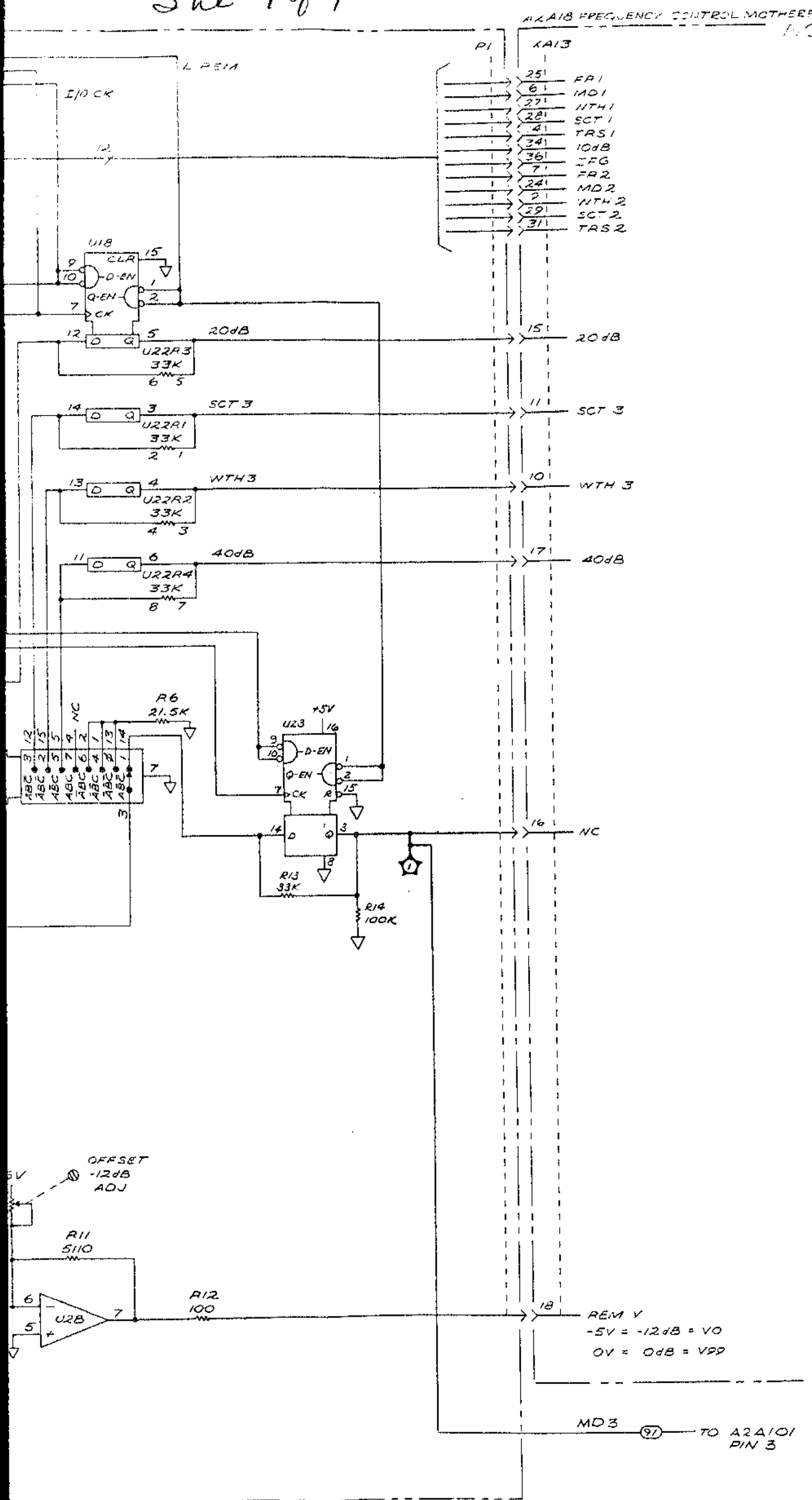


Fig E5-2
Sht 4 of 4



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
   CAPACITANCE IN MICROFARADS
3. ABBREVIATIONS:
   CK = CLOCK
   CLR = CLEAR
   EN = ENABLE
   D-EN = DATA INPUT ENABLE
   Q-EN = Q OUTPUT ENABLE
4. LOGIC LEVELS ARE:
   0 = LOW = < 0.8V
   1 = HI = > 2.2V

   EXCEPT INPUTS OF U1 (1,2,3) WHICH ARE:
   0 = LOW = < 1.5V
   1 = HI = > 3.5V

REFERENCE DESIGNATORS

A2A13
C1-7
R1-14
U1-23

MODE SWITCH TRUTH TABLE

CONTROLLER CODE	M1	M2	M3
MODE:	LOG FULL	LIN FULL	LIN EXPAND
MD 1	1	1	0
MD 2	0	1	1

TRIGGER SWITCH TRUTH TABLE

CONTROLLER CODE	T1	T2	T3	NONE
TRIGGER	AUTO	LINE	EXT	SINGLE
TRS 1	1	1	0	0
TRS 2	0	1	1	1

A2A13

Figure E5-2. A2A13 Switch Register Storage, Schematic (CHANGE 5)

CHANGE 6

Page C2-27, Table C2-2:
Delete A2A22U1.
Add the following:
A2A24, HP Part Number 08505-60199, PLUS 5 VOLT RECTIFIER BOARD ASSEMBLY
A2A24C1, HP Part Number 0160-4300, CAPACITOR-FXD .047 UF +80 –20% 100 WVDC CER.
A2A24CR1 through A2A24CR4, HP Part Number 1901-0662, DIODE PWR RECT 100V 6A
A2A24E1 and A2A24E2, HP Part Number 2110-0269, FUSEHOLDER-CLIP TYPE 0.25 FUSE
A2A24F1, HP Part Number 2110-0036, FUSE 8A 125A FAST-BLO

Page C3-97/98, Figure C3-97/98, Figure C3-42A:
Delete A2A22U1.
Replace A2A22U1 Rectifier circuit with A2A24 +5 Volt Rectifier Board as shown in the partial schematic in this change sheet.

Page C3-99/100, Figure C3-44:
Delete A2A22U1.
Replace A2A22U1 Rectifier circuit with A2A24 +5 Volt Rectifier Board as shown in the partial schematic in this change sheet.

Page C3-105/106:
Add Figure C3-46A, A2A24 Parts Location, as shown in this change sheet.

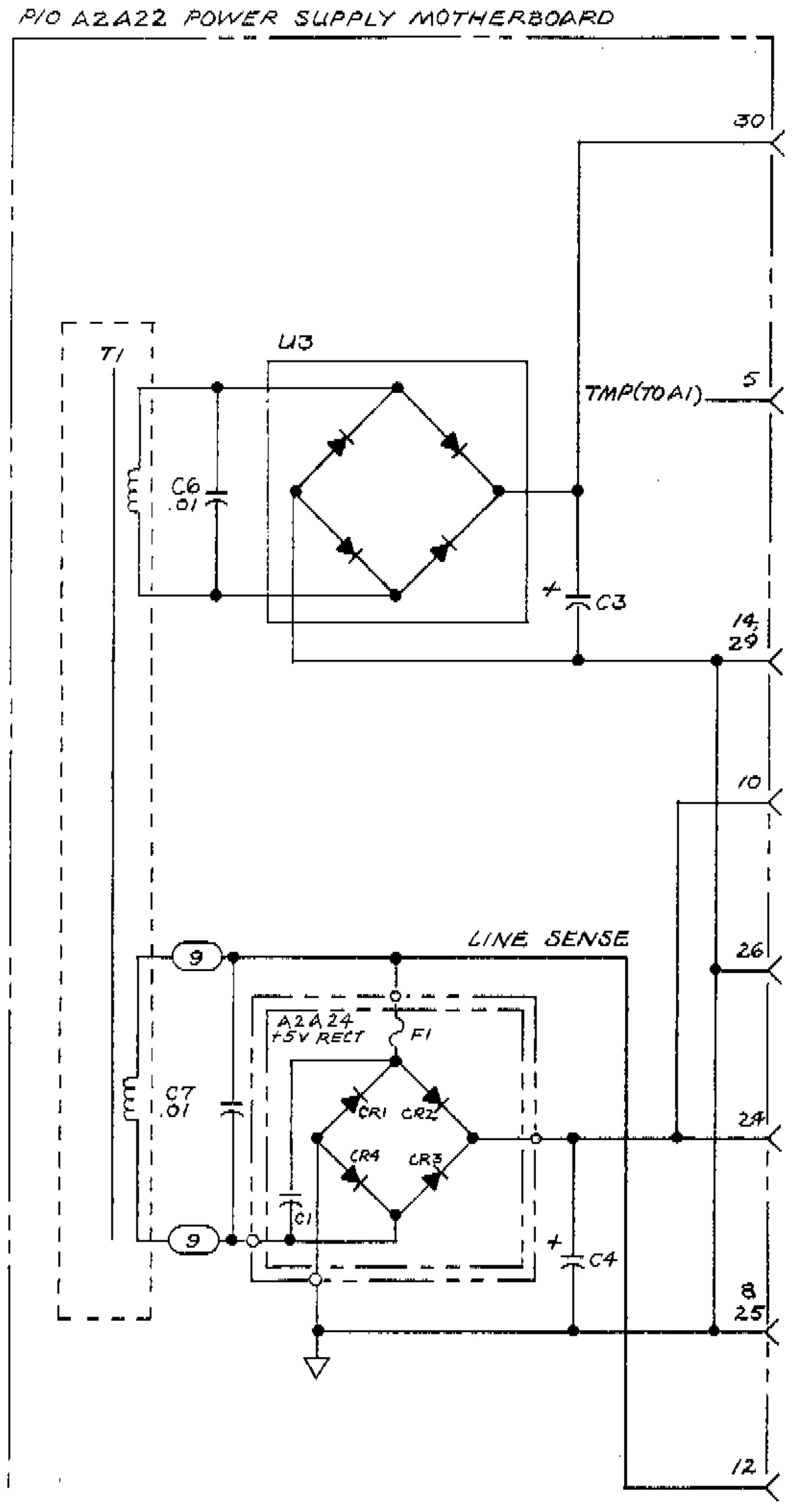
Page C3-105/106, Figure C3-47:
Delete A2A22U1.
Replace A2A22U1 Rectifier circuit with A2A24 +5 Volt Rectifier Board as shown in the partial schematic in this change sheet.

Page E4-6, Table E4-2:
Change A3A19C11 to HP Part Number 0180-0106, CAPACITOR-FXD, 60UF +–20% 6VDC TA.

Page E4-7, Table E4-2:
Change A3A19R8 to HP Part Number, 0698-3157, RESISTOR 19.6K 1% .125W F TC=0+–100.

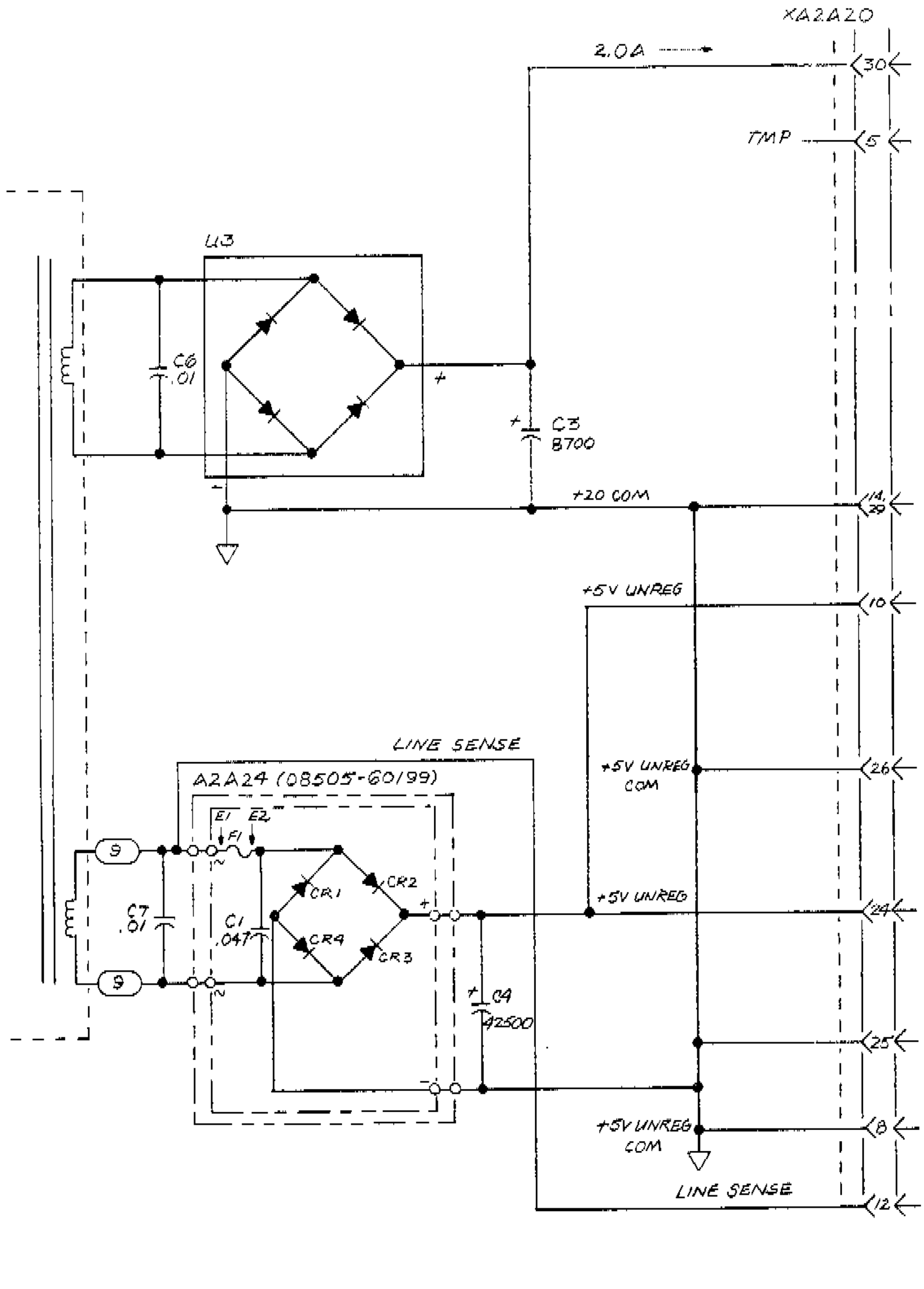
Page E5-33, Figure E5-10:
Change A3A19R8 to 19.6KΩ.
Change A3A19C11 to 60μF.

CHANGE 6 (Cont'd)



P/O Figure C3-42A. A2A20 Positive Voltage Regulator Block Diagram (CHANGE 6)

CHANGE 6 (Cont'd)



P/O Figure C3-44. A2A20 Positive Voltage Regulator, Schematic (CHANGE 6)

CHANGE 6 (Cont'd)

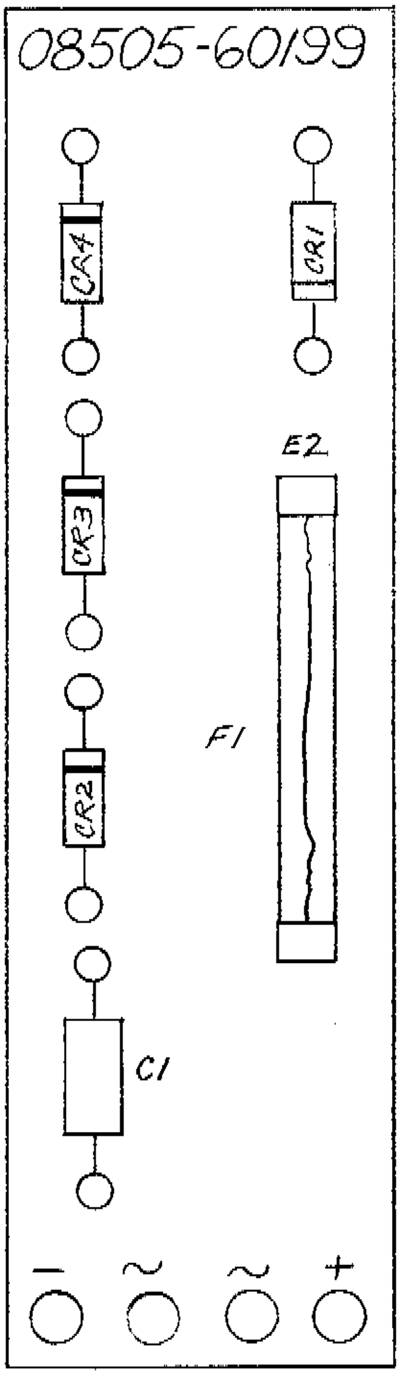
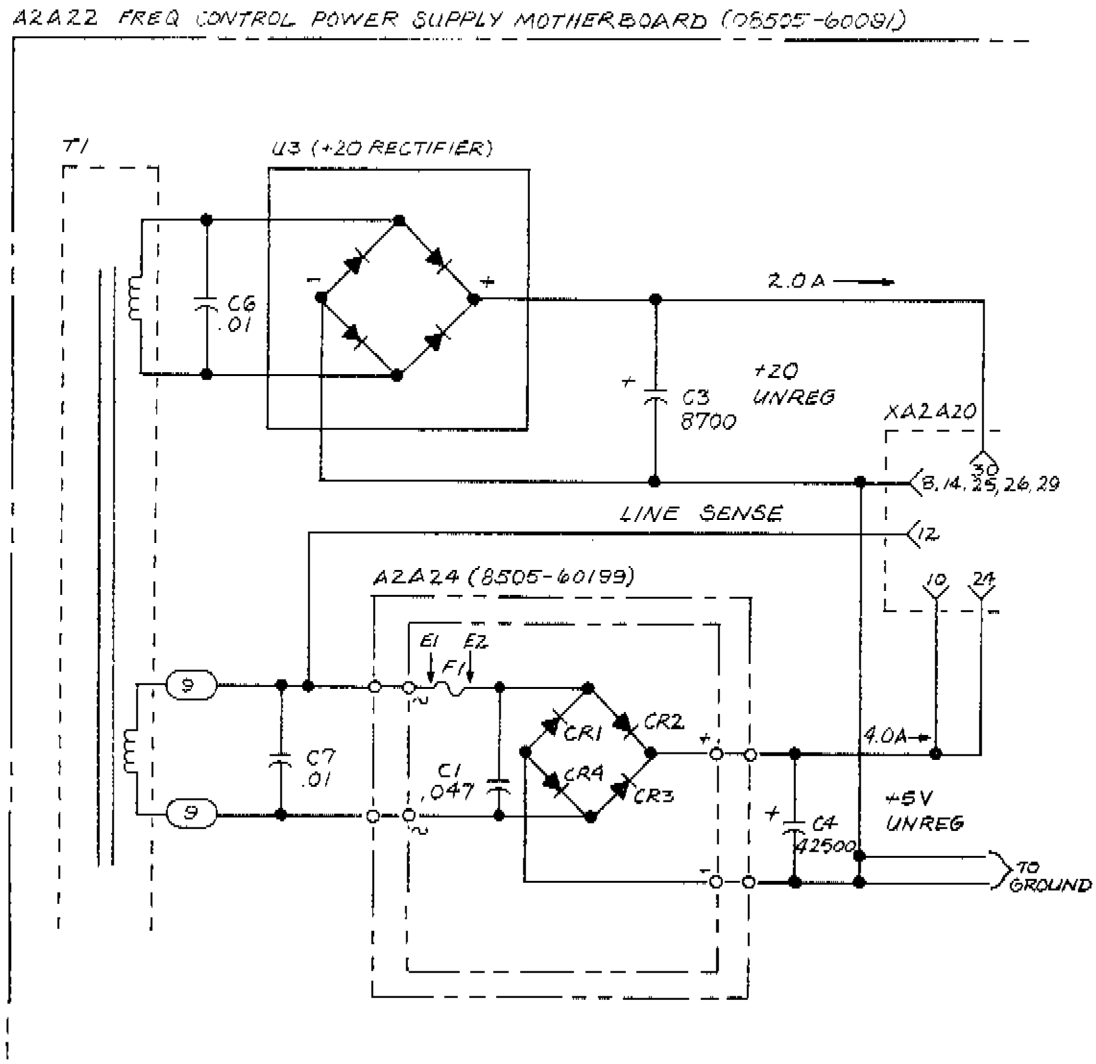


Figure C3-46A. A2A24 Plus 5 Volt Rectifier Board Parts Location (CHANGE 6)

CHANGE 6 (Cont'd)



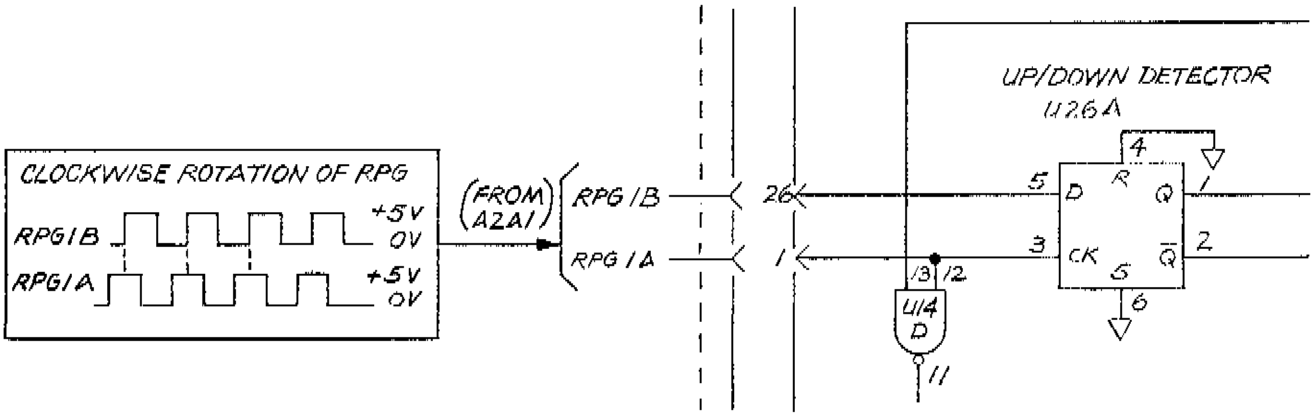
P/O Figure C3-47. A2A22 Frequency Control Power Supply, Schematic (CHANGE 6)

CHANGE 7

Page C2-5, Table C2-2:
Change A2A1A2 to HP Part Number 08505-60203 and delete all components listed for A2A1A2.
Change A2A1A3 to HP Part Number 08505-60203.

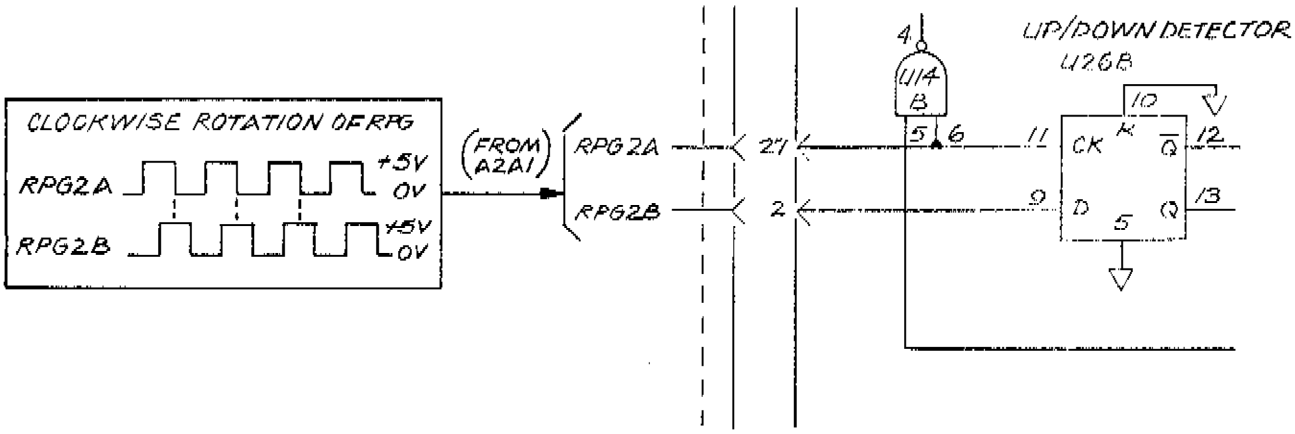
Page C3-43, Figure C3-20A:
Delete Figure C3-20A, A2A1A2/A3 Schematic.

Page C3-61, Figure C3-24:
Change A2A3U26A Circuit as shown in the partial schematic in this change sheet.



P/O Figure C3-24. Partial Schematic of A2A3 (CHANGE 7)

Change A2A3U26B Circuit as shown in the partial schematic in this change sheet.



P/O Figure C3-24. Partial Schematic of A2A3 (CHANGE 7)

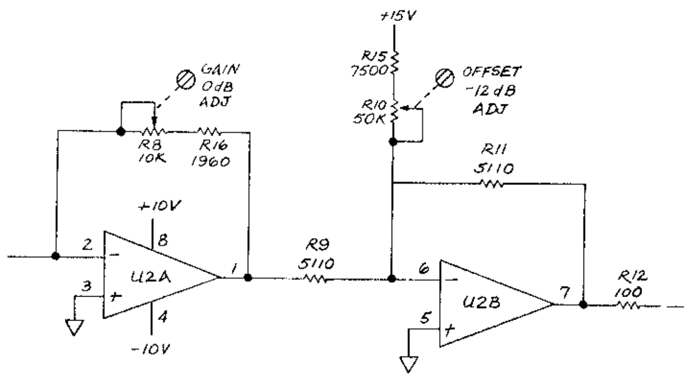
CHANGE 8

Page C2-25, Table C2-2:
Change A2A20 R2 to HP Part Number 0757-0447, RESISTOR 16.2K 1% .125W F TC=0+–100.

►Page C3-99/100:
Change Resistor A2A20R2 to 16.2K Ohm.

Page E4-4, Table E4-2:
Add A2A13R15, 0757-0440, RESISTOR 7.5K 1% .125W TC=0+–100.
Add A2A13R16, 0698-0083, RESISTOR 1.96K 1% .125W TC=0+–100.

Page E5-5, Figure E5-2:
Change A2A13U2 circuit as shown in the partial schematic in this change sheet.



P/O Figure E5-2. Partial Schematic of A2A13 (CHANGE 8)

CHANGE 9

Page C2-25, Table C2-2:
Change A2A20R15 to HP Part Number 0698-0082, RESISTOR 464 1% .125W F TC=0+–100

►Page C3-99/100, Figure C3-44:
Change A2A20R15 to 464 Ohms.

CHANGE 9 (Cont'd)

Page D2-5, Table D2-2:
Change A3W18 to HP Part Number 08505-60176.
Change A3W19 to HP Part Number 08505-60177.
Change A3W20 to HP Part Number 08505-60179.
Change A3W21 to HP Part Number 08505-60180.
Change A3W22 to HP Part Number 08505-60181.

Page D2-11, Table D2-2:
Add A3A7C21 and A3A7C22, HP Part Number 0160-3451, CAPACITOR-FXD .01UF +80-20% 100Vdc CER.

Page D2-12, Table D2-2:
Change A3A8 to HP Part number 08505-60205.

Page D2-14, Table D2-2:
Add A3A8R93 and A3A8R95, HP Part Number 2100-2031, RESISTOR-TRMR 50K 10% C TOP-ADJ 1 TRN.
Add A3A8R94 and A3A8R96, HP Part Number 0683-6845, RESISTOR 680K 5% .25W FC TC=-800/+900.

Page D2-30, Table D2-2:
Change A3A24 to HP Part Number 08505-60175.
Change A3A24MP1 to HP Part Number 08505-00115.

Page D2-31, Table D2-2:
Change A3A25R1, A3A25R4, A3A25R5, and A3A25R7 to HP Part Number 2100-3476.
Change A3A25R2 to HP Part Number 2100-3473.
Change A3A25R3 to HP Part Number 2100-3475.
Change A3A25R6 to HP Part Number 2100-3474.
Change A3A25S1 to HP Part number 08505-80006.
Change A3A25S2 to HP Part Number 3101-1982.

Page D2-32, Table D2-2:
Change A3A27 to HP Part Number 08505-60172.
Add A3A27E5, 0340-0614, INSULATOR-XSTR.

Page D2-34, Table D2-2:
Change A3A28 to HP Part Number 08505-60173.

Page D2-35, Table D2-2:
Change A3A29 to HP Part Number 08505-60173.
Change A3A30 to HP Part Number 08505-60174.
Add A3A30E29--A3A30E35, 1251-2039, CONNECTOR-SGL CONT SKT .041-IN-BSC-SZ.

Page D2-36, Figure D2-1:
Change 15 to HP Part Number 08505-00108.
Change 18 to HP Part Number 08505-00112.
Change 19 to HP Part Number 08505-00111.
Change 37 to HP Part Number 08505-00109.
Change 39 to HP Part Number 08505-00122.
Change 42 to HP Part Number 1220-0203.
Change 44 to HP Part Number 08505-00119.
Change 52 to HP Part Number 08505-00123.
Change 53 to HP Part Number 08505-00124.
Change 61 to HP Part Number 08505-00121.
Change 66 to HP Part Number 08505-00118.
Change 67 to HP Part Number 08505-00117.
Change 68 to HP Part Number 08505-00116.

CHANGE 9 (Cont'd)

Page D2-37, Figure D2-1:
Change 86 to HP Part Number 08505-00120.
Change 87 to HP Part Number 08505-00113.
Change 88 to HP Part Number 08505-00107.
Change 95 to HP Part Number 08505-00106.
Change 108 to HP Part Number 08505-00110.
Change 117 to HP Part Number 08505-00114.
Add the following hardware after item 117:

HP PART NUMBER	DESCRIPTION
0510-0062	RETAINER-PUSH ON RECT EXT .125-DIA STL
0520-0164	SCREW-MACH 2-56 .25-IN-LG-82 DEG
1251-2942	LOCK-SUBMIN D CONN
1400-0082	CLAMP-CABLE .125-DIA .375 WD NYL
2190-0004	WASHER-LK INTL T NO. 6 .115-IN-ID
2190-0017	WASHER-LK HLCL NO. 8 .168-IN-ID
2190-0045	WASHER-LK HLCL NO. 2 .088-IN-ID
2190-0047	WASHER LK 82 CTSK EXT T NO. 6 .142-IN-ID
2190-0067	WASHER-LK INTL T 1/4 IN .256-IN-ID
2200-0139	SCREW-MACH 4-40 .250-IN-LG PAN-HDPOZI
2360-0116	SCREW-MACH 6-32 .312-IN-LG 82 DEG
2360-0181	SCREW-MACH 6-32 .25-IN-LG 82 DEG
2360-0194	SCREW-MACH 6-32 .312-IN-LG 100 DEG
2360-0201	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI
2360-0331	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI
2510-0137	SCREW-MACH 8-32 2.75-IN-LG PAN-HD-POZI
2580-0003	NUT-HEX-W/LKWR 8-32-THD .125-IN THK
2950-0072	NUT-HEX-DBL-CHAM 1/4-32-THD .062-IN-THK
2950-0153	NUT-HEX-DBL-CHAM 1/4-32-THD .29-IN-THK
3030-0083	SCREW-SET 2-56 .188-IN-LG SMALL CUP-PT
3050-0001	WASHER-FL MTLC NO. 8 .172-IN-ID
3050-0010	WASHER-FL MTL NO. 6 .147-IN-ID
3050-0105	WASHER-FL MTLC NO. 4 .125-IN-ID
3050-0152	WASHER-SHLDR NM NO. 8 .172-IN-ID
3050-0226	WASHER-FL MTLC NO. 10 .203-IN-ID
7120-3812	LABEL-WARNING
7120-4192	LABEL-INFO
7120-4829	LABEL-INFO

Page D3-77, Figure D3-32:
Add C21, .01 UF, from pin 14 of U1A Signal Multiplexer to ground.
Add C22, .01 UF, from pin 14 of U11A Signal Multiplexer to ground.

Page D3-80, Figure D3-33:
Replace Figure D3-33 with new Parts Location drawing of A3A8 in this change sheet.

A3A8

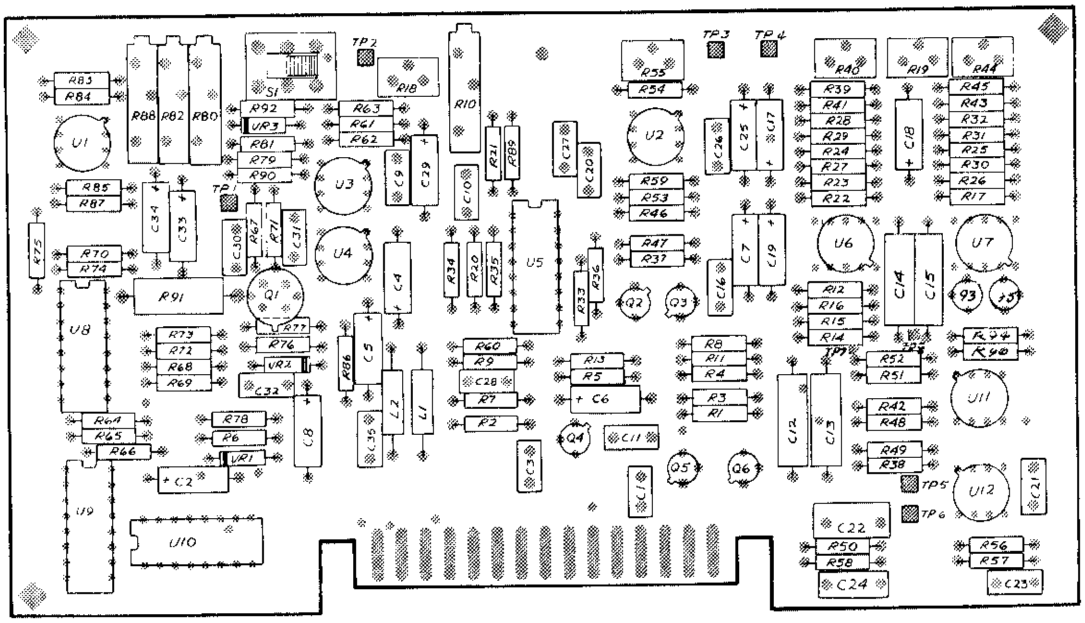


Figure D3-33. A3A8 Polar Converter Parts Locations (Change 9)

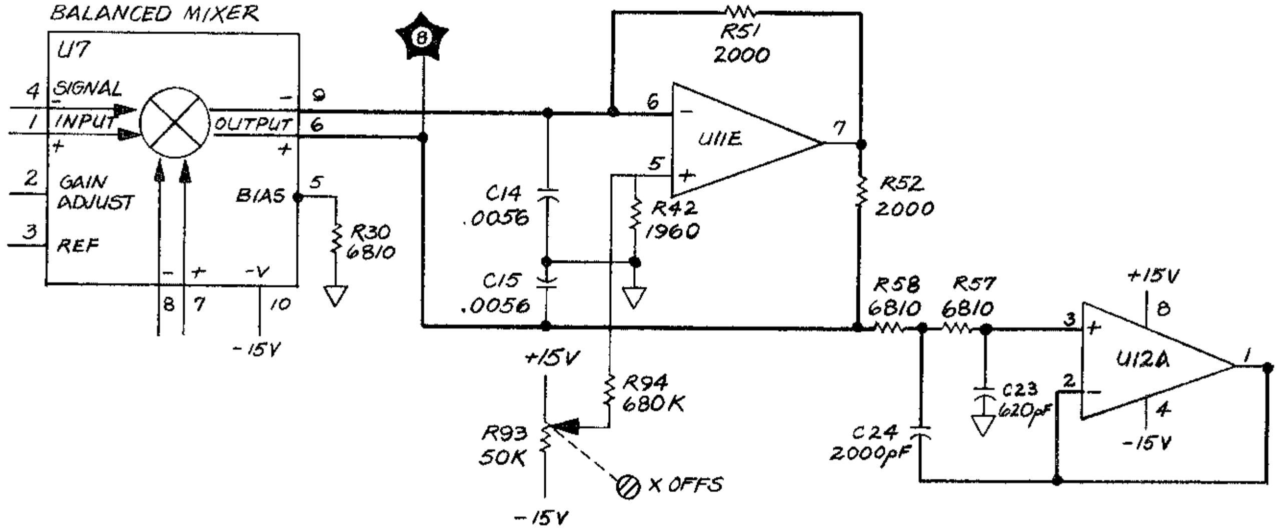
CHANGE 9 (Cont'd)

Page D3-81, Figure D3-34:

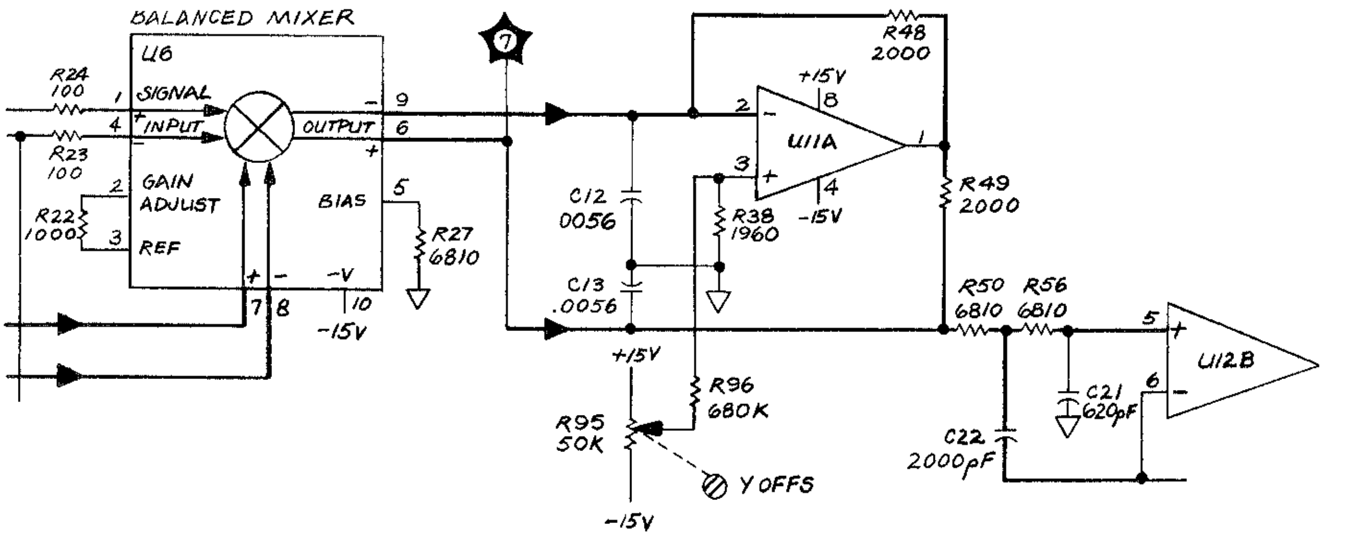
Change the circuit for U11A and U11B as shown in the partial schematic in this change sheet.

Change the HP Part Number for A3A8 at the top of schematic to 08505-60205.

X AXIS OUTPUT MIXER AND FILTER



Y AXIS OUTPUT MIXER AND FILTER



P/O Figure D3-34. Partial Schematic of A3A8 (CHANGE 9)

CHANGE 9 (Cont'd)

Page E4-7, Table E4-2:
Change "A3A20C10" to A3A20C10* HP Part Number 0160-0571, CAPACITOR-FXD 470PF (FACTORY SELECTED VALUE).
Change "A3A20R11" to A3A20R11* HP Part Number 0698-0083, RESISTOR 1.96K 1% .125W (FACTORY SELECTED VALUE).

Page E5-45, Figure E5-12:
Change "A3A20R11" to A3A20R11* 1.96K and change "A3A20C10" to A3A20C10* 470 pf.

CHANGE 10

Page D2-4, Table D2-2:
Change A3FL1 to HP Part Number 9135-0052, Filter RFI.

Page D2-36, Figure D2-1:
Change Item 36A to HP Part Number 9135-0052, Filter RFI.

Page D2-23, Table D2-2:
Change A3A13C44 and A3A13C45 to HP Part Number 0160-3459. CAPACITOR-FXD .02μF, +–10%, 250 WVDC, CER.

Page D3-99, Figure D3-44:
Change value of C44 and C45 to .02μF.

CHANGE 11

Page C2-25, Table C2-2:
Add at end of description for A2A19 the statement, "Alternate replacement for 5086-7268".
Add prior to the existing entry for A2A19, a listing for A2A19, HP Part Number 5086-7268, YIG OSCILLATOR 4.2 – 5.5 GHz.

Page D2-15, Table D2-2:
Add A3A9C32, HP Part Number 0170-0066, CAPACITOR-FXD .027UF+–10% 200VDC POLYE.

Page D2-31, Table D2-2:
Change A3A25R2 to HP Part Number 2100-3684, RESISTOR-VARIABLE CONTROL CC 50 10% LIN.

Page D3-85, Figure D3-36:
Add A3A9C32, 0.027UF Capacitor, between U5 pin 6 and ground.

Page D3-121, Figure D3-54:
Change A3A25R2 to 50 Ohm.

CHANGE 12

Page D2-14, Table D2-2:
Change A3A8R82 to HP Part Number 2100-3161, RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TURN

Page D2-19, Table D2-2:
Change A3A11R12* to HP Part Number 0757-0199, RESISTOR 21.5K 1% .125W F TC=0+–100 (*FACTORY SELECTED PART, TYPICAL VALUE GIVEN.)

Page D3-81, Figure D3-34:
Change A3A8R82 to 20K.

CHANGE 12 (Cont'd)

Page D3-91, Figure D3-40:
Change A3A11R12 to 21.5K.

CHANGE 13

Page C2-21, Table C2-2:
Add A2A11C11, HP Part Number 0160-4256, CAPACITOR-FXD .047UF 200 WVDC MICA.

Page C3-93, Figure C3-39:
Add C11 between the left end of R42 and the bottom end of R30 (but not connected to R30).

Page C3-93, Figure C3-40:
Add C11, a .047UF capacitor between pins 1 and 28 of A2A11 board.

CHANGE 14

P/O Table C2-2, A2A9 Parts List, CHANGE 2 of this Change Sheet:
Change the entry for A2A9R65 to HP Part Number 0757-0280, RESISTOR 1K 1% .125W F TC=0+–100.

Page C2-27, Table C2-2:
Change A2A22 to HP Part Number 08505-60209.
Delete A2A22C6 thru C10.
Add A2A22T1P1, HP Part Number 1251-3389, Connector-Receptacle 10 contact.
Delete A2A22U1 thru U5.
Add A2A22XA25, HP Part Number 1251-2035, CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS.
Add A2A25, HP Part Number 08505-60210, Rectifier Board Assembly.
Add Component Parts of A2A25 as follows:
A2A25C1 thru C5, HP Part Number 0170-0060, CAPACITOR-FXD .047UF 400V.
A2A25CR1 thru CR12, HP Part Number 1902-0662, DIODE-POWER RECT 100V 6A.
A2A25F1, HP Part Number 2110-0036, FUSE 8A 125V F.
A2A25J1, HP Part Number 1251-3750, CONNECTOR-POST 10 CONTACT.
A2A25U1 and U2, HP Part Number 1906-0094, DIODE-FW BRIDGE 400V 1.5A.
A2A25XF1, HP Part Number 2110-0269, FUSE HOLDER CLAMP (2 REQUIRED).

Page C2-28, Figure C2-1:
Change Reference Designator 27 Quantity to 6.

►Page C3-105/106, Figure C3-47:
Change schematic as shown in Partial Schematic contained in this change sheet.
►Add Figure C3-46A contained in this change sheet.

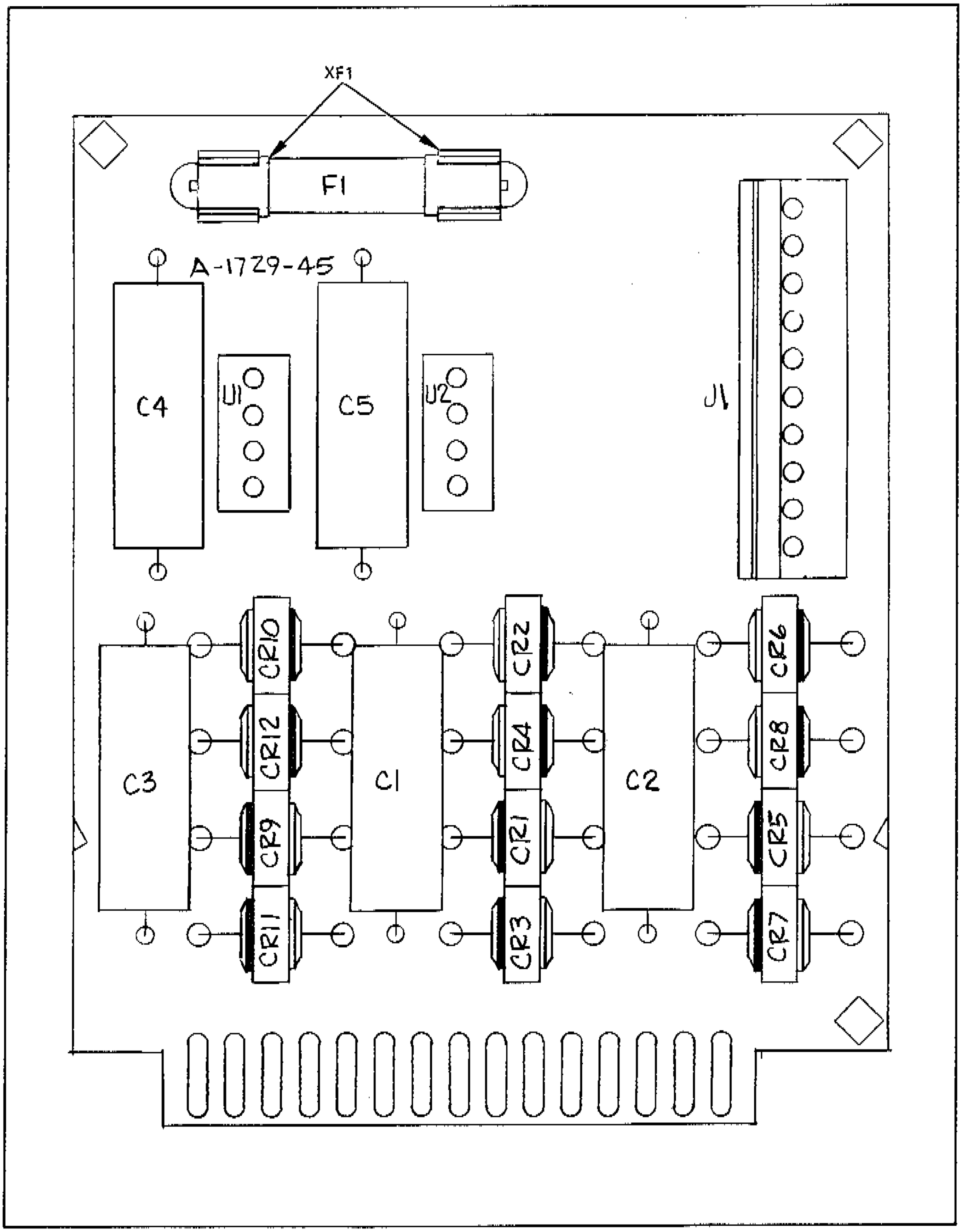
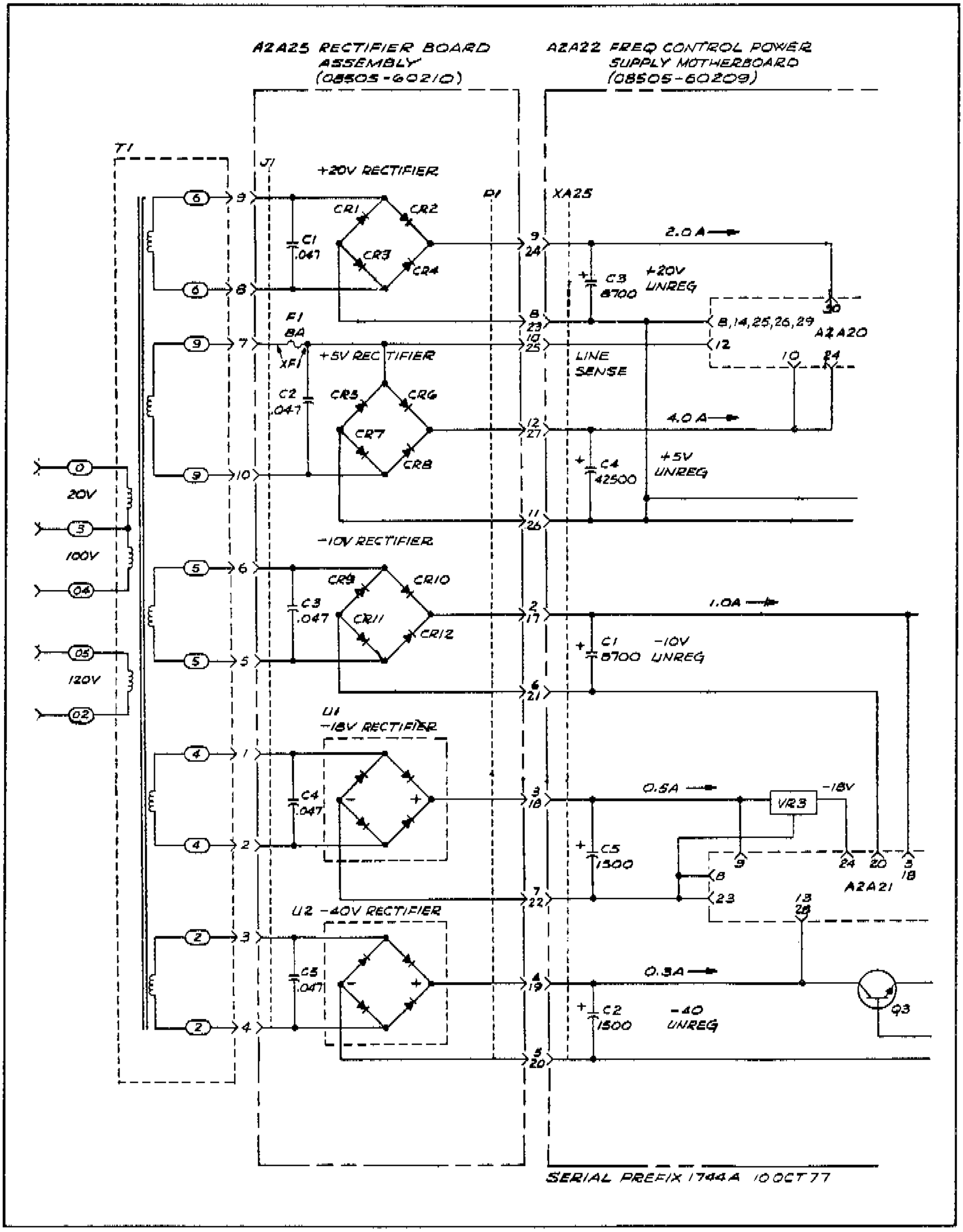


Figure C3-46A. A2A25 Rectifier Board Assembly, Parts Location (CHANGE 14)



P/O Figure C3-47. A2A22 Frequency Control Power Supply, Schematic (CHANGE 14)

CHANGE 15

Page D2-29, Table D2-2:
Change A3A18C1 to HP Part Number 0140-0198, CAPACITOR-FXD 200pF +-5% 300 WVDC MICA.
Change A3A18C2 to HP Part Number 0160-2203, CAPACITOR-FXD 91pF +-5% 300 WVDC MICA.

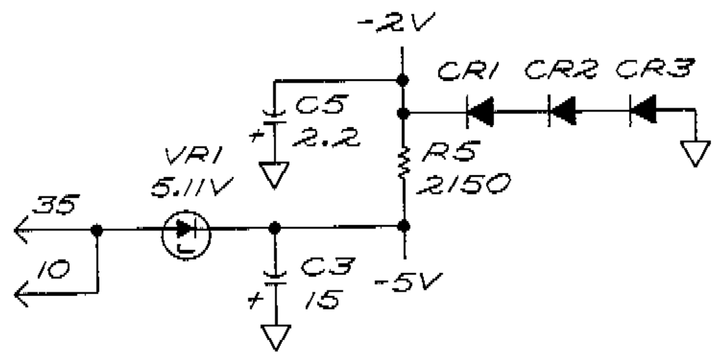
Page D3-115/116, Figure D3-52:
Change A3A18C1 to 200pF.
Change A3A18C2 to 91pF.

CHANGE 16

In this Change Sheet, Table C2-2, CHANGE 5:
Change the Parts List in Change 5 of this change sheet as follows:
Delete A2A4L3.
Add A2A4MP4 through MP13, HP Part Number 1200-0507, IC SOCKET 16 CONTACT.
Change A2A4R5 to HP PART NUMBER 0698-0084, RESISTOR 2.15K 1% .125W F TC=0+–100.
Add A2A4VR1, HP PART NUMBER 1902-0041, DIODE-ZNR 5.11V 5% DO-7 PD= .4W TC= –.009%.

In this Change Sheet, Figure C3-25, CHANGE 5:
Change L3 to VR1.

In this Change Sheet, Figure C3-26, CHANGE 5:
Delete L3 and add VR1 in its place, change the value of R5, and change –10V to –5V as shown in the partial schematic below.



Change the "–10V" notation to "–5V" on U2, U8 through U11, and U14 through U17.

Page C2-23, Table C2-2:
Change A2A11VR1 to HP Part Number 1902-1336.

Page D2-30, Table D2-2:
Add A3A24CR3 through CR6, HP Part Number 1901-0662, DIODE PWR RECT 100V 6A.

Page D2-31, Table D2-2:
Change A3A24U5 through U8 to HP Part Number 1906-0094, DIODE-MULT FULL WAVE BRIDGE 400V 1.5A.
Delete A3A24U9.

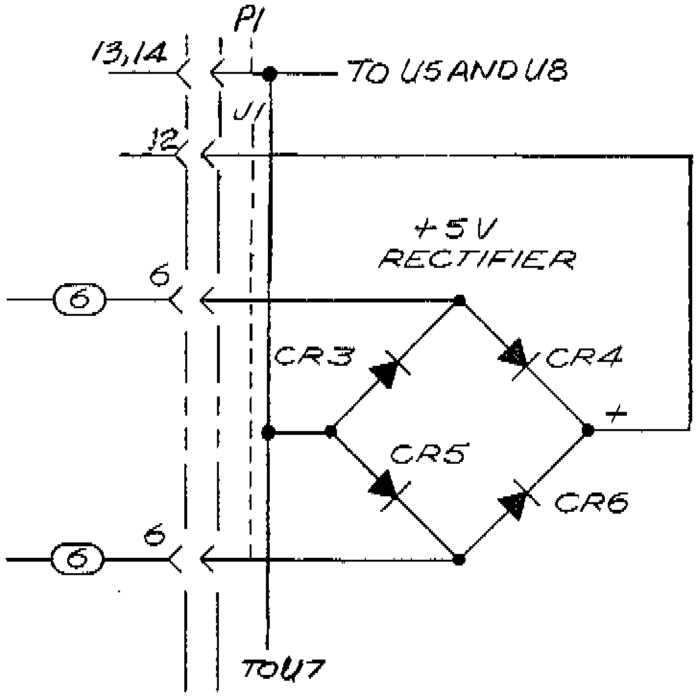
►CHANGE 16 (Cont'd)

Page D3-118, Figure D3-52B:

Replace Figure D3-52B with new Parts Location Drawing of A3A24 in this change sheet.

►Page D3-119/120, Figure D3-53:

Delete A3A24U6 and add in its place A3A24CR3 through CR6 as shown in the partial schematic below:



A3A24

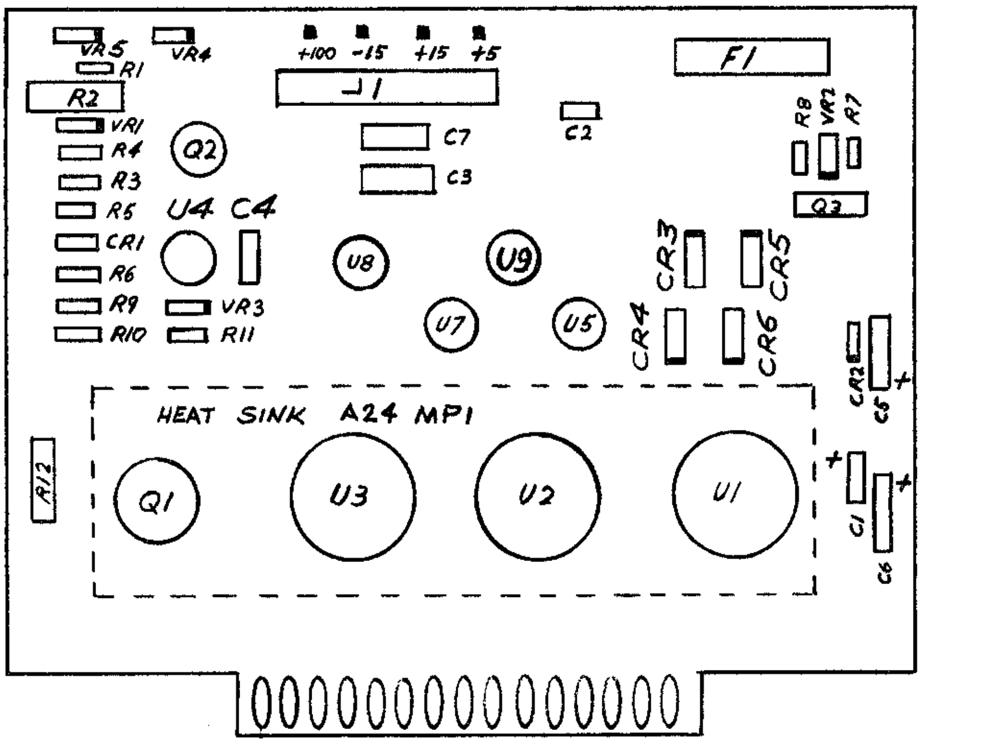


Figure D3-52B. A3A24 Voltage Regulator Board Parts Locations (Change 16)

CHANGE 17

Page C2-4, Table C2-2:
Change A2A1A1DS1 through DS14 to MFR PART NUMBER 1990-0503.

Page D2-25, Table D2-2:
Change A3A13R83 to HP Part Number 0757-0442, RESISTOR 10K 1% .125W F TC=0+–100.
Change A3A13R91 to HP Part Number 2100-3154, RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TURN.

Page D2-28, Table D2-2:
Delete A3A17C19.

Page D2-29, Table D2-2:
Change A3A17U5 to HP Part Number 1826-0371, IC OP AMP TO-99.

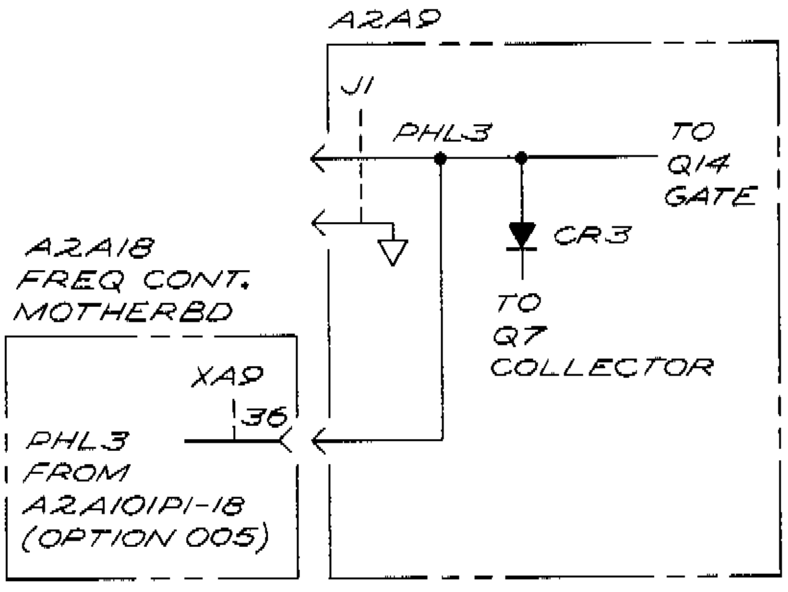
Page D2-36, Figure D2-1:
Change Reference Designator 66 to HP Part Number 08505-00136.

Page D2-37, Figure D2-1:
Change Reference Designator 95 to HP Part Number 08505-00137.
Change Machine Screw, HP Part Number 2510-0137, to 2510-0136.

Page D3-99, Figure D3-44:
Change R83 to 10K.
Change R91 to 1000.

In this Change Sheet, Table C2-2, A2A9 Part List, CHANGE 2:
Change A2A9 to HP Part Number 08505-60211.

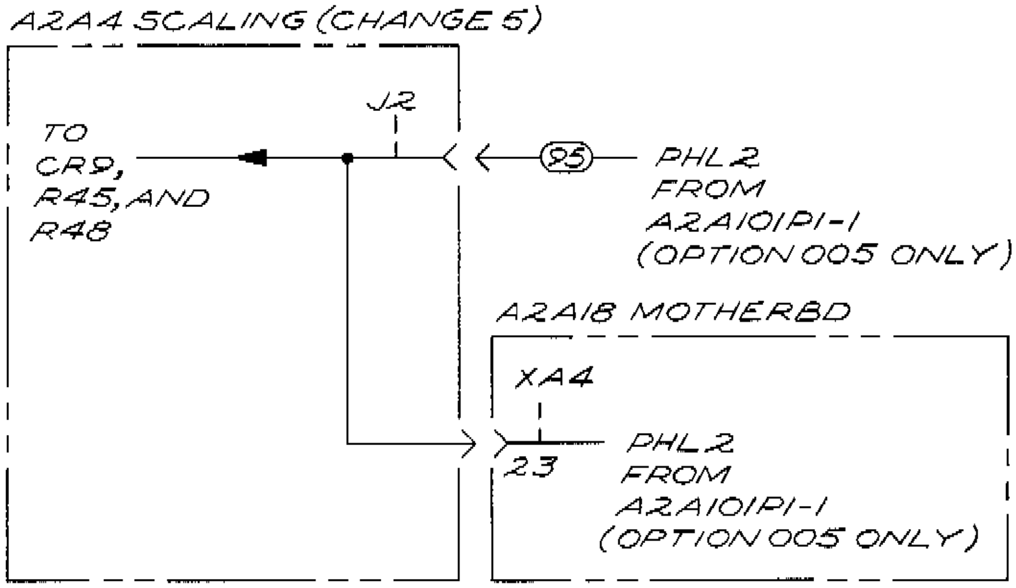
In this Change Sheet Figure C3-36, A2A9 Discriminator Schematic CHANGE 2; and Figure F4-5, in Option 005 Supplement:
Change Part Number of A2A9 in upper left hand corner to 08505-60211.
►Change the phase lock circuit for Option 005 as shown in the partial schematic following:



CHANGE 17 (Cont'd)

In this Change Sheet, Table C2-2 CHANGE 5:
Change A2A4 to Part Number 08505-60212.

In this Change Sheet, Figure C3-26, A2A4 Scaling Schematic, CHANGE 5:
Change the phase lock circuit for Option 005 as shown in the partial schematic following:



CHANGE 18

Page C2-4, Table C2-2:
Change A2W107 to HP Part Number 08505-60217.
Change A2W108 to HP Part Number 08505-60218.
Change A2W8 to HP Part Number 08505-60219.
Change A2W9 to HP Part Number 08505-60220.
Change A2W10 to HP Part Number 08505-60221.
Change A2W16 to HP Part Number 08505-60216.

Page C2-5, Table C2-2:
Change A2A1A1U2, A2A1A1U3, and A2A1A1U5 to HP Part Number 1820-1823.

Page C2-7, Table C2-2:
Delete A2A3C22.

Page C2-8, Table C2-2:
Change A2A3U28, A2A3U29, and A2A3U30 to HP Part Number 1820-1823.

CHANGE 18 (Cont'd)

Page C2-9, Table C2-2:
Change A2A3U31, A2A3U32, and A2A3U33 to HP Part Number 1820-1823.

Page C2-12, Table C2-2:
Change A2A5U12 thru A2A5U15 to HP Part Number 1820-1823.

Page C2-24, Table C2-2:
Change A2A18 to HP Part Number 08505-60214.

Page C2-28, Figure C2-1:
Change Item 29 to HP Part Number 08505-00141.
Delete Items 29A and 29B.
Change Item 30 to HP Part Number 08505-20216.
Change Item 33 to HP Part Number 08505-20217.

Page C3-63, Figure C3-24:
Delete A2A3C22.

Page D2-11, Table D2-2:
Change A3A7C21 and A3A7C22 to HP Part Number 0160-2055.

Page E4-4, Table E4-2:
Change A2A13U4, A2A13U6, and A2A13U8 to HP Part Number 1820-1823.

Page E4-5, Table E4-2:
Change A2A14U6, A2A14U10, A2A14U14, and A2A15U14 to HP Part Number 1820-1823.

Page E4-6, Table E4-2:
Change A2A16C3 to HP Part Number 0180-0116, CAPACITOR-FXD 6.8 UF +−10% 35VDC TA.
Change A2A16U11 and A2A16U16 to HP Part Number 1820-1823.

Page E4-7, Table E4-2:
Change A3A19U14, A3A19U15, and A3A20U13 to HP Part Number 1820-1823.

Page E4-8, Table E4-2:
Change A3A21U11 and A3A21U17 to HP Part Number 1820-1823.

Page E5-29, Figure E5-8:
Change A2A16C3 to 6.8 UF.

CHANGE 19

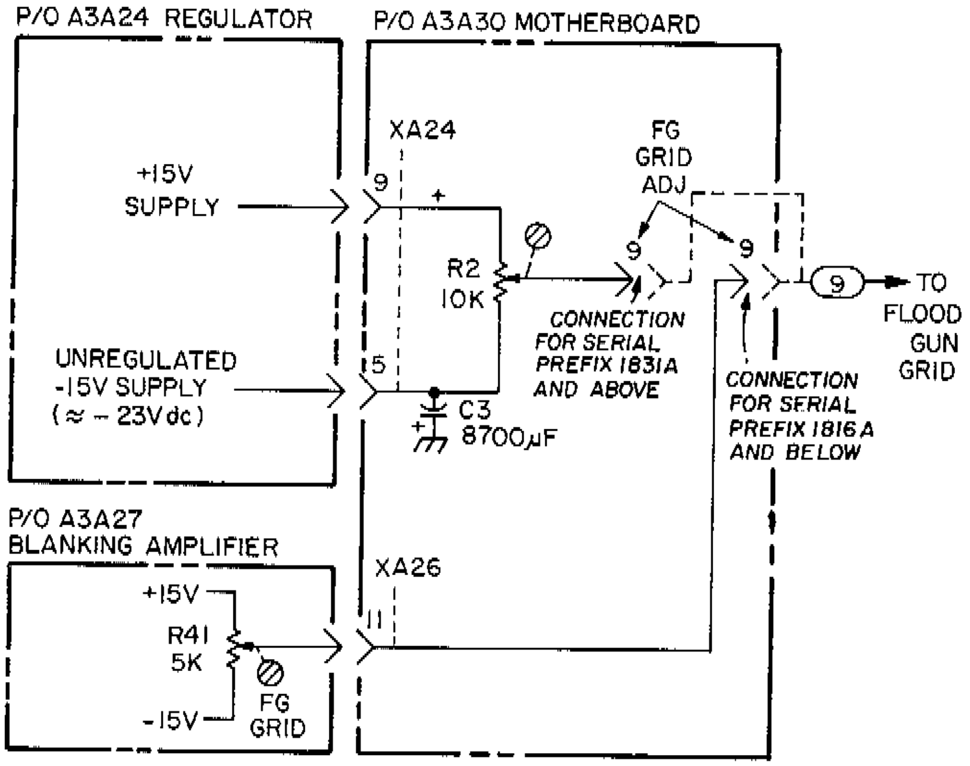
Page A5-67, Paragraph A5-36:
Add the following Flood Gun adjustment:
Flood Gun
ac-1. Set front-panel SCALE control fully clockwise to turn on flood gun. For instruments with serial prefix 1831A and above, adjust FG GRID ADJ control A3A30R2 on the bottom center of Display Motherboard A3A30 for the most uniform illumination on the screen. For instruments with serial prefix 1816A and below, adjust "FG GRID" control A3A27R41 for the most uniform illumination on the screen.
ac-2. If illumination is too bright, increase resistance of A3A30R1 (½ watt resistor). If illumination is too dark, decrease value of A3A30R1. Do not make any smaller value than 6.8 ohms ½ watt or damage to filament may occur.

CHANGE 19 (Cont'd)

Page D2-4, Table D2-2:
Change A3V1 to HP Part Number 08505-60232, CRT ASSEMBLY WITH OVERLAY TAB MOUNTS.

Page D2-35, Table D2-2:
Change A3A30 to HP Part Number 08505-60230.

Page D3-127, Figure D3-56:
Add Partial Schematic of flood gun grid circuit shown in this change sheet.



P/O Figure D3-56. A3A27 Blanking Amplifier, Schematic (CHANGE 19)

In Chapters A and E, delete all references to "Option 001" and substitute "HP-IB" as appropriate. Option 001 HP-IB is now a standard part of the 8505A and is included with all instruments starting at Prefix 1831A.

CHANGE 20

Page C2-5A, Table C2-2:
Change A2A1A2 to HP Part Number 5060-9444.
Change A2A1A3 to HP Part Number 5060-9444.

NOTE

Part Number 5060-9444 is the recommended replacement for A2A1A2 and A2A1A3 in all instruments.

CHANGE 21

Page A1-0, Figure A1-1:
Change part number under Interconnect Cable to 08505-60231.

Page A1-4, Paragraph A1-41:
Change the part number of "Interconnect Cable" to 08505-60231.

Page B2-13, Figure B2-1:
Change item 14 to HP Part Number 08505-00139.
Change item 33 to HP Part Number 08505-00140.

CHANGE 21 (Cont'd)

Page D2-31, Table D2-2:
Add A3A25R10 through A3A25R14, HP Part Number 0757-0280, RESISTOR 1K 1% .125W TC=0+–100.
Change the HP Part Number of A3A26 to 08505-60215.

Page D2-32, Table D2-2:
Add A3A26MP8, HP Part Number 85662-20042, GUIDE-HIGH VOLTAGE BD.
Change A3A26R13 to HP Part Number 0698-8992, RESISTOR 8M 2% 1W C TC=0+–250.
Change A3A26R14 to HP Part Number 2100-3626.
Change A3A26R15 to HP Part Number 0698-8993, RESISTOR 14M 2% 1W C TC=0+–250.
Change A3A26VR1 and A3A26VR2 to HP Part Number 2140-0015, LAMP-GLOW C2A 115/58 VDC 1.9 mA BULB (Recommended Replacement).

Page D2-36, Figure D2-1:
Change item 52 to HP Part Number 08505-00144, COVER-HIGH VOLTAGE.
Change item 67 to HP Part Number 08505-00138.

Page D2-37, Figure D2-1:
Change item 88 to HP Part Number 08505-00145.

► Page D3-121, Figure D3-54:
Add A3A25R10, 1K RESISTOR, in the "3" line between W22 and the wiper of R1.
Add A3A25R11, 1K RESISTOR, in the "5" line between W22 and the wiper of R4.
Add A3A25R12, 1K RESISTOR, in the "9" line between W22 and the wiper of R5.
Add A3A25R13, 1K RESISTOR, in the "1" line between W22 and the wiper of R7.
Add A3A25R14, 1K RESISTOR, in the "7" line between W22 and the wiper of R8.

Page D3-123, Figure D3-55:
Change the Part Number of A3A26 at top of schematic to 08505-60215.
Change the value of VR1 and VR2 to 115V.
Change the value of R13 to 8M.
Change the value of R15 to 14M.

Page E4-8, Table E4-2:
Change A3A21C7 to HP Part Number 0180-0116, CAPACITOR-FXD 6.8UF +–10% 35VDC TA.

Page E5-49, Figure E5-14:
Change A3A21C7 (located in parallel with R2 in POWER-ON RESET circuit) to 6.8UF.

►CHANGE 22

Page C2-9, Table C2-2:
Change A2A4R16 to HP Part No. 2100-3273, RESISTOR-TRMR 2K 10% C Side-Adj 1-Trn, Mfr Part No. 3386-Y46-202.
Change A2A4R24 to HP Part No. 2100-3351, RESISTOR-TRMR 500 10% C Side-Adj 1-Trn, Mfr Part No. 3386-Y46-501.

Page C2-26, Table C2-2:
Change A2A21 to HP Part No. 08505-60235, Mfr Part No. 08505-60235.
Change A2A21Q3 to HP Part No. 1884-0261, THYRISTOR-SCR TO-220AB Mfr Code 01698, Mfr Part No. S2060A.
Change A2A21Q7 to HP Part No. 1854-0271, TRANSISTOR NPN SI TO-39 PD = 1W FT 150MHZ, Mfr Code 02037, Mfr Part No. SS92.

Page C3-67, Figure C3-26:
Change the value of R16 to 2000 ohms.
Change the value of R24 to 500 ohms.

Page C3-103/104, Figure C3-46:
Change A2A21 to HP Part No. 08505-60235.

Page D2-9, Table D2-2:
Change A3A5R42 to HP Part No. 0698-3444, RESISTOR 316 10% .125W, Mfr Part No. C4-1/8-TO-316R-F.
Change A3A5R45 to HP Part No. 2100-3351, RESISTOR-TRMR 500 10% C Side-Adj 1-Trn, Mfr Part No. 3386-Y46-501.

Page D2-31, Table D2-2:
Delete A3A25R10 thru A3A25R14.

Page D2-35, Table D2-2:
Change A3A30 to HP Part No. 08505-60236.
Add A3A30R2 thru A3A30R6, HP Part No. 0757-0280, RESISTOR, 1K 1% .125W TC = 0+-100.

Page D3-71, Figure D3-28:
Change the value of R42 to 316 ohms.
Change the value of R45 to 500 ohms.

Page D3-121, Figure D3-54:
Change the position of the 1K RESISTORS A3A25R10 thru A3A25R14 to the A3A30 Mother Board. Change the reference designators as follows:

Old Reference Designator	New Reference Designator	Move From A3A25	To New Location on A3A30
A3A25R10	A3A30R2	In "3" line from wiper of R1	In line to pin J1FP-7
A3A25R11	A3A30R3	In "5" line from wiper of R4	In line to pin J1FP-8
A3A25R12	A3A30R4	In "9" line from wiper of R5	In line to pin J1FP-5
A3A25R13	A3A30R5	In "1" line from wiper of R7	In line to pin J1FP-6
A3A25R14	A3A30R6	In "7" line from wiper of R8	In line to pin J1FP-4

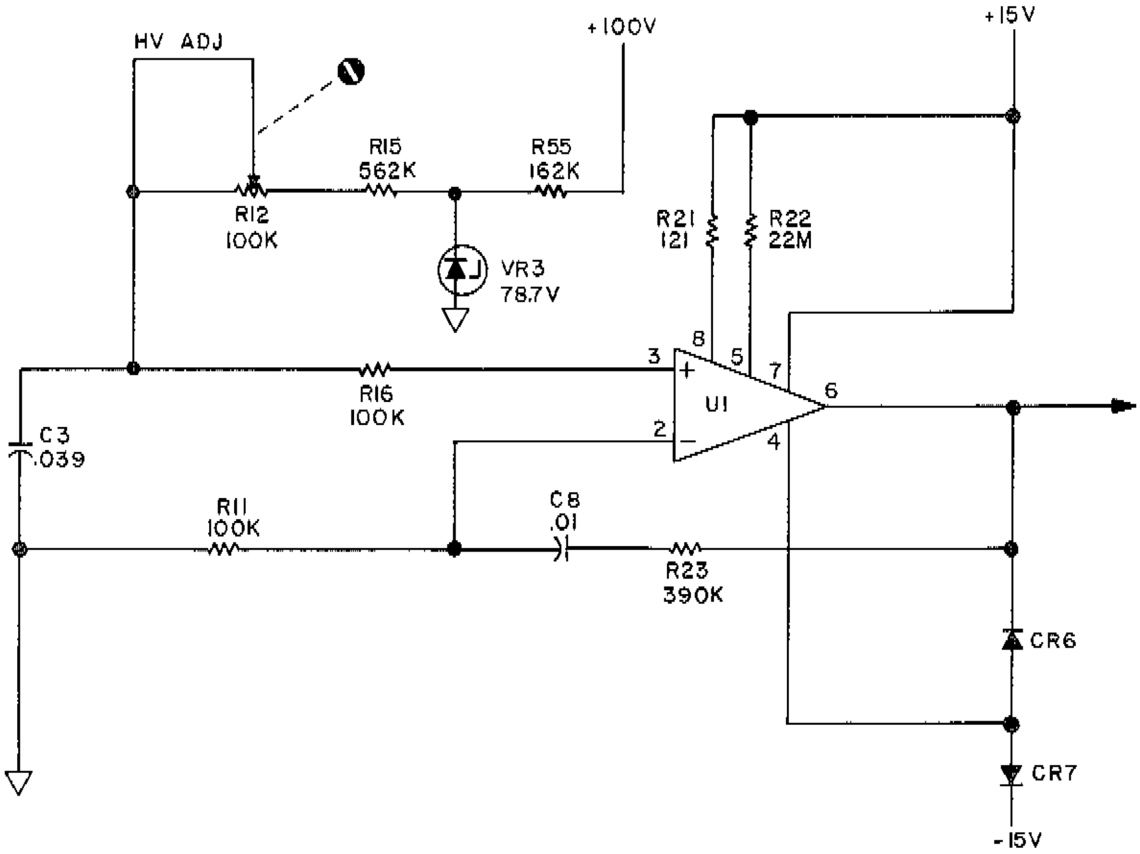
►CHANGE 23

Page D2-32, Table D2-2:
Change A3A27 to HP Part No. 08505-60237.
Change A3A27R12 to HP Part No. 2100-2655, RESISTOR-TRMR, 100K 10% TOP-ADJ, 1-TRN.
Change A3A27R15 to HP Part No. 0698-8824, RESISTOR, 562K 1% .125W F TC = 0+-100.
Add A3A27R55, HP Part No. 0757-0470, RESISTOR, 162K 1% .125W F TC = 0+-100.
Add A3A27VR3, HP Part No. 1902-3400, DIODE-ZNR 78.7V 2% DO-7 PD = .4W TC = +.08%.

Page D3-127, Figure D3-55B:
Replace Figure D3-55B with Figure D3-55B (Change 23) of this Manual Change.

Page D3-127, Figure D3-56:
Change FEEDBACK AMPLIFIER, A3A27 Circuit as shown in the partial schematic following:

FEEDBACK AMPLIFIER



A3A27

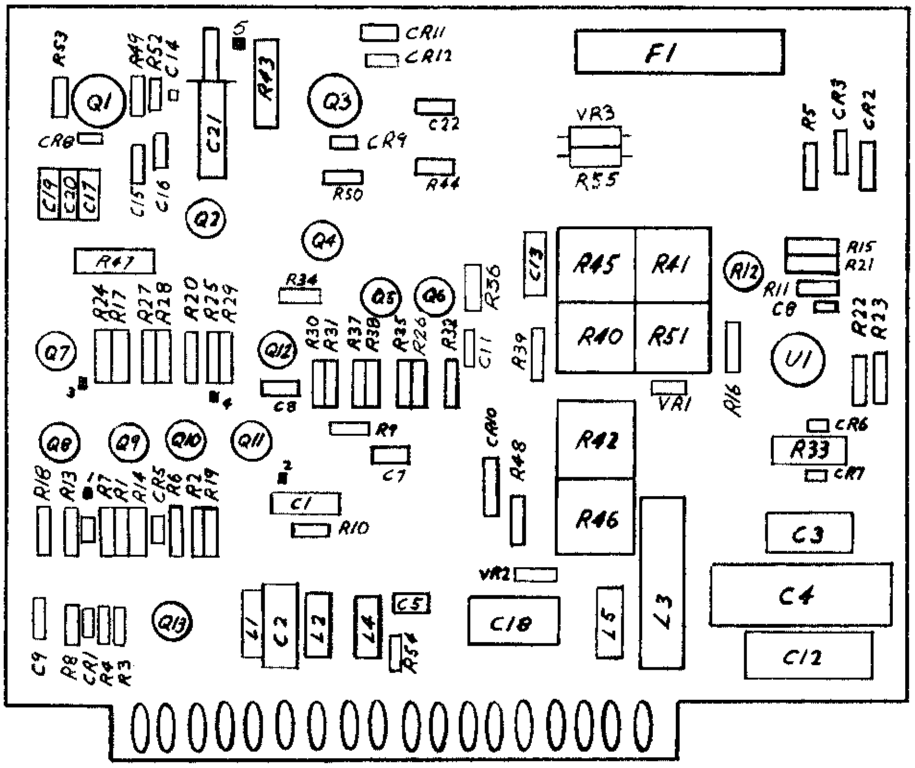


Figure D3-55B. A3A27 Blanking Amplifier Parts Locations (CHANGE 23)

CONTENTS

CHAPTER A
MODEL 8505A NETWORK ANALYZER

CONTENTS (Cont'd)

CHAPTER B
RF SOURCE/CONVERTER

CONTENTS (Cont'd)

CHAPTER C
FREQUENCY CONTROL

CHAPTER D
SIGNAL PROCESSOR

ILLUSTRATIONS

CHAPTER A
MODEL 8505A NETWORK ANALYZER

ILLUSTRATIONS (Cont'd)

ILLUSTRATIONS (Cont'd)

CHAPTER B
RF SOURCE/CONVERTER

ILLUSTRATIONS (Cont'd)

CHAPTER C
FREQUENCY CONTROL

ILLUSTRATIONS (Cont'd)

CHAPTER D
SIGNAL PROCESSOR

ILLUSTRATIONS (Cont'd)

CHANGE A

TABLES

CHAPTER A
MODEL 8505A NETWORK ANALYZER

CHAPTER B
RF SOURCE/CONVERTER

CHAPTER C
FREQUENCY CONTROL

CHAPTER D
SIGNAL PROCESSOR

CHAPTER D
SIGNAL PROCESSOR

D-1. INTRODUCTION

D-2. This chapter of the manual contains the information you will need to service the Signal Processor Assembly. The chapter is divided into three sections: Section I contains general information about the Signal Processor Assembly; Section II contains a list of the assembly's replaceable parts; Section III provides troubleshooting information, the assembly schematic diagrams, and parts location illustrations; Section IV contains changes you must make to this chapter to adapt (backdate) it to instruments having serial number prefixes below those indicated on the manual's title page.

SECTION I
GENERAL INFORMATION

CHAPTER D
SIGNAL PROCESSOR

SECTION II
SIGNAL PROCESSOR ASSEMBLY A3 REPLACEABLE PARTS

D2-1. INTRODUCTION

D2-2. This section contains information for ordering parts for the Signal Processor Assembly. Table D2-1 is a list of abbreviations used in the parts list and throughout the manual. Table D2-2 lists all the replaceable parts in the Signal Processor Assembly in reference designator order. Table D2-3 lists the manufacturers codes used in the Replaceable Parts List and the names of the corresponding manufacturers. Miscellaneous mechanical parts are identified in Figure D2-1.

D2-3. PARTS LIST ARRANGEMENT

D2-4. In Table D2-2, the Replaceable Parts List, electrical assemblies and their components are listed in alpha-numerical order by reference designator. Chassis-mounted parts are listed first followed by subassemblies A3A1 through A3A18 and A3A23 through A3A30 and their components. (Reference designators A3A19 through A3A22 are reserved for Option 001, HP Interface Bus, subassemblies.) Miscellaneous mechanical parts are listed at the end of the table.

D2-5. ORDERING INFORMATION

D2-6. To order a part listed in Table D2-2, address the order to the nearest Hewlett-Packard office, stating the Hewlett-Packard part number and quantity required.

D2-7. To order a part that is not listed in the Replaceable Parts List, include the instrument serial number, the description and function of the part, and the number of parts required.

Table D2-1. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

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

NOTE

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

Table D2-1. Reference Designations and Abbreviations (2 of 2)

MOD . . . . modulator
MOM . . . . . . momentary
MOS . . . . metal-oxide semiconductor
ms . . . . millisecond
MTG . . . . mounting
MTR . . . meter (indicating device)
mV . . . . millivolt
mVac . . . . . . millivolt, ac
mVdc . . . . . . millivolt, dc
mVpk . . . . millivolt, peak
mVp-p . . . millivolt, peak-to-peak
mVrms . . . . millivolt, rms
mW . . . . milliwatt
MUX . . . . multiplex
MY . . . . mylar
μA . . . . microampere
μF . . . . microfarad
μH . . . . microhenry
μmho . . . . micromho
μs . . . . microsecond
μV . . . . microvolt
μVac . . . . . . microvolt, ac
μVdc . . . . . microvolt, dc
μVpk . . . microvolt, peak
μVp-p . . . microvolt, peak-to-peak
μVrms . . . microvolt, rms
μW . . . . microwatt
nA . . . . . . nanoampere
NC . . . . . no connection
N/C . . . normally closed
NE . . . . neon
NEG . . . . negative
nF . . . . nanofarad
NI PL . . . nickel plate
N/O . . . normally open
NOM . . . . nominal
NORM . . . . normal
NPN . . . negative-positive-negative
NPO . . . negative-positive zero (zero temperature coefficient)
NRFR . . . not recommended for field replacement
NSR . . . not separately replaceable
ns . . . . nanosecond
nW . . . . nanowatt
OBD . . . order by description

OD . . . . . outside diameter
OH . . . . oval head
OP AMPL . . . operational amplifier
OPT . . . . option
OSC . . . . oscillator
OX . . . . oxide
oz . . . . ounce
Ω . . . . ohm
P . . . . peak (used in parts list)
PAM . . . . pulse-amplitude modulation
PC . . . . . . printed circuit
PCM . . pulse-code modulation; pulse-count modulation
PDM . . . . . pulse-duration modulation
pF . . . . picofarad
PH BRZ phosphor bronze
PHL . . . . Phillips
PIN . . . positive-intrinsic-negative
PIV . . . . peak inverse voltage
pk . . . . peak
PL . . . . phase lock
PLO . . . . phase lock oscillator
PM . . . . phase modulation
PNP . . . positive-negative-positive
P/O . . . . part of
POLY . . . . . . polystyrene
PORC . . . . porcelain
POS . . positive; position(s) (used in parts list)
POSN . . . . position
POT . . . . . potentiometer
p-p . . . . peak-to-peak
PP . . . peak-to-peak (used in parts list)
PPM . . . . . pulse-position modulation
PREAMPL . . . preamplifier
PRF . . . . pulse-repetition frequency
PRR . . . . pulse repetition rate
ps . . . . picosecond
PT . . . . point
PTM . . . . pulse-time modulation
PWM . . . . pulse-width modulation

PWV . . . . . . peak working voltage
RC . . . . resistance-capacitance
RECT . . . . rectifier
REF . . . . reference
REG . . . . regulated
REPL . . . . . . replaceable
RF . . . . . radio frequency
RFI . . . . radio frequency interference
RH . . . . round head; right hand
RLC . . . . resistance-inductance-capacitance
RMO . . . rack mount only
rms . . . . root-mean-square
RND . . . . round
ROM . . read-only memory
R&P . . . . . rack and panel
RWV . . . reverse working voltage
S . . . scattering parameter
s . . . . second (time)
. . ." . second (plane angle)
S-B . . . . . slow-blow (fuse) (used in parts list)
SCR . . . silicon controlled rectifier; screw
SE . . . . selenium
SECT . . . . sections
SEMICON . . . . . semiconductor
SHF . . . . . . superhigh frequency
SI . . . . silicon
SIL . . . . silver
SL . . . . slide
SNR . . signal-to-noise ratio
SPDT . . . . . . single-pole, double-throw
SPG . . . . spring
SR . . . . split ring
SPST . . . . . . single-pole, single-throw
SSB . . . . . single sideband
SST . . . . . . stainless steel
STL . . . . steel
SQ . . . . square
SWR . . standing-wave ratio
SYNC . . . . . . synchronize
T . timed (slow-blow fuse)
TA . . . . tantalum
TC . . . . temperature compensating

TD . . . . time delay
TERM . . . . terminal
TFT . . thin-film transistor
TGL . . . . toggle
THD . . . . thread
THRU . . . . through
TI . . . . titanium
TOL . . . . tolerance
TRIM . . . . trimmer
TSTR . . . . transistor
TTL . . transistor-transistor logic
TV . . . . television
TVI television interference
TWT . . traveling wave tube
U . . . . . micro (10^{-6}) (used in parts list)
UF . . . microfarad (used in parts list)
UHF . . ultrahigh frequency
UNREG . . . . unregulated
V . . . . volt
VA . . . . voltampere
Vac . . . . volts, ac
VAR . . . . variable
VCO . . . voltage-controlled oscillator
Vdc . . . . volts, dc
VDCW . . volts, dc, working (used in parts list)
V(F) . . . . . volts, filtered
VFO . . variable-frequency oscillator
VHF . . . . . . very-high frequency
Vpk . . . . volts, peak
Vp-p . . volts, peak-to-peak
Vrms . . . . volts, rms
VSWR . . . voltage standing wave ratio
VTO . . . . . . voltage-tuned oscillator
VTVM . . . . vacuum-tube voltmeter
V(X) . . . . . volts, switched
W . . . . watt
W/ . . . . with
WIV . . . . working inverse voltage
WW . . . . wirewound
W/O . . . . without
YIG . . yttrium-iron-garnet
Z_o . . . . characteristic impedance

NOTE

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

MULTIPLIERS

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

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1/A3A2	08505-60023	1	PANEL, FRONT ASSEMBLY (INCLUDES A3A1 AND A3A2)	28480	08505-60023
A3B1	3160-0273	1	FAN-TBAX 34-CFM 115V 50/60-HZ 1.496-THK	28480	3160-0273
A3E1	08505-20032	1	SPRING, CONTACT, SHORT(P/O S21-S26)	28480	08505-20032
A3E2	08505-20030	2	SPRING, CONTACT, LONG (P/O S1-S20)	28480	08505-20030
A3E3	08505-20030		SPRING, CONTACT, LONG (P/O S1-S20)	28480	08505-20030
A3F1	2110-0059	1	FUSE 1.5AT 125V SLO BLO	28480	2110-0059
A3F2	2110-0063	1	FUSE .8AT 250V SLO BLO	28480	2110-0336
A3FL1	5001-1043	1	FILTER, RFI	28480	5001-1043
	01332-02707	1	SAFETY SHIELD	28480	01332-02707
A3FL2	0960-0443	1	POWER MODULE	28480	0960-0443
A3J1	1251-2197	2	CONNECTOR 24-PIN F D SERIES	27264	08-50-0108
A3J2	1251-2197		CONNECTOR 24-PIN F D SERIES	27264	08-50-0108
A3J4	1250-0083	7	CONNECTOR-RF BNC FEM SGL HOLE FR	24931	28JR-130-1
A3J5	1250-0083		CONNECTOR-RF BNC FEM SGL HOLE FR	24931	28JR-130-1
A3J6	1250-0083		CONNECTOR-RF BNC FEM SGL HOLE FR	24931	28JR-130-1
A3J7	1250-0083		CONNECTOR-RF BNC FEM SGL HOLE FR	24931	28JR-130-1
A3J8	1250-0083		CONNECTOR-RF BNC FEM SGL HOLE FR	24931	28JR-130-1
A3J9	1250-0083		CONNECTOR-RF BNC FEM SGL HOLE FR	24931	28JR-130-1
A3J10	1250-0083		CONNECTOR-RF BNC FEM SGL HOLE FR	24931	28JR-130-1
A3K1	0490-0623	1	RELAY 6VDC CCNT 5A 115VAC FORM 2C	09023	683-6V
A3L1	01332-66001	1	COIL TRACE ALIGN	28480	01332-66001
A3L2	01701-66001	1	COIL ASSEMBLY, ALIGN	28480	01701-66001
A3S1	01334-81901	1	SWITCH DPDT 3	28480	01334-81901
A3T1	9100-0696	1	POWER TRANSFORMER	28480	9100-0696
A3U2	0960-0383	1	HV MULT ASSY	28480	0960-0383
A3V1	5083-4178	1	CRT, P39 ALIGN	28480	5083-4178
A3W1	08505-60043	1	CABLE ASSEMBLY, RIBBON PROC MB TO AUX FP	28480	08505-60043
A3W2	08505-60024	1	CABLE ASSEMBLY, RIBBON; AUX FP TO FP (2 INCH)	28480	08505-60024
A3W3	08505-60026	1	CABLE ASSEMBLY, RIBBON; AUX FP TO FP (6 INCH)	28480	08505-60026
A3W4	08505-60025	1	CABLE ASSEMBLY, RIBBON; PROC MB TO DISP MB	28480	08505-60025
A3W5	08505-60027	1	CABLE ASSEMBLY, COAX; GRAY/BRN	28480	08505-60027

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3W6	08505-60028	1	CABLE ASSEMBLY, COAX; GRAY/RED	28480	08505-60028
A3W7	08505-60029	1	CABLE ASSEMBLY, COAX; GRAY/ORN	28480	08505-60029
A3W8	08505-60030	1	CABLE ASSEMBLY, COAX; GRAY/GREEN	28480	08505-60030
A3W9	08505-60031	1	CABLE ASSEMBLY, COAX; GRAY/BLUE	28480	08505-60031
A3W10	08505-60032	1	CABLE ASSEMBLY, COAX; YELLOW	28480	08505-60032
A3W11	08505-60033	1	CABLE ASSEMBLY, COAX; GREEN	28480	08505-60033
A3W12	08505-60034	1	CABLE ASSEMBLY, COAX; ORANGE	28480	08505-60034
A3W13	08505-60036	1	CABLE ASSEMBLY, COAX; BROWN	28480	08505-60036
A3W14	08505-60037	1	CABLE ASSEMBLY, COAX; RED	28480	08505-60037
A3W15	08505-60038	1	CABLE ASSEMBLY, COAX; VIOLET	28480	08505-60038
A3W16	8120-2177	1	CABLE ASSEMBLY	28480	8120-2177
A3W17	01332-61602	1	CABLE ASSEMBLY, Y OUT	28480	01332-61602
A3W18	01334-61601	1	CABLE ASSEMBLY, CRT SOCKET	28480	01334-61601
A3W19	01334-61602	1	CABLE ASSEMBLY, POWER SUPPLY	28480	01334-61602
A3W20	01334-61604	1	CABLE ASSEBMLY, X OUT	28480	01334-61604
A3W21	01334-61605	1	CABLE, TRANSISTOR CONNECTION TO A3A27	28480	01334-61605
A3W22	01334-61606	1	CABLE ASSY, RIBBON; DISP MB TO DISP FP	28480	01334-61606
			MISCELLANEOUS		
	08505-00080	1	SMITH CHART, REGULAR (PHOTO)	28480	08505-00080
	08505-00081	1	SMITH CHART, COMPRESSED 3.16 (PHOTO)	28480	08505-00081
	08505-00082	1	SMITH CHART, 0.1 EXPANDED (PHOTO)	28480	08505-00082
	08505-00083	1	SMITH CHART, 0.2 EXPANDED (PHOTO)	28480	08505-00083
	08505-00084	1	SMITH CHART, 0.5 EXPANDED (PHOTO)	28480	08505-00084
	08505-00085	1	LOG CHART, 10 MHZ (PHOTO)	28480	08505-00085
	08505-00086	1	LOG CHART, 100 MHZ (PHOTO)	28480	08505-00086
	08505-00087	1	LOG CHART, 1000 MHZ (PHOTO)	28480	08505-00087
	08505-00096	1	SMITH CHART, REGULAR (VIEWING)	28480	08505-00096
	08505-00097	1	SMITH CHART, COMPRESSED 3.16 (VIEWING)	28480	08505-00097
	08505-00098	1	SMITH CHART, 0.1 EXPANDED (VIEWING)	28480	08505-00098
	08505-00099	1	SMITH CHART, 0.2 EXPANDED (VIEWING)	28480	08505-00099
	08505-00100	1	SMITH CHART, 0.5 EXPANDED (VIEWING)	28480	08505-00100
	08505-00101	1	LOG CHART, 10 MHZ (VIEWING)	28480	08505-00101
	08505-00102	1	LOG CHART, 100 MHZ (VIEWING)	28480	08505-00102
	08505-00103	1	LOG CHART, 1000 MHZ (VIEWING)	28480	08505-00103
		1	OVERLAY KIT	28480	08505-60154
A3A1	08505-60001	1	BOARD ASSEMBLY, FRONT PANEL	28480	08505-60001
A3A1DS1	1990-0487	18	LED-VISIBLE	28480	1990-0487
A3A1DS2	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS3	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS4	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS5	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS6	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS7	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS8	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS9	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS10	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS11	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS12	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS13	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS14	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS15	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS16	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS17	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS18	1990-0487		LED-VISIBLE	28480	1990-0487
A3A1DS19	1990-0399	3	DISPLAY AN DOT MAT 1 CHAR .135 IN HIGH	28480	1990-0399
A3A1DS20	1990-0503	8	DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1DS21	1990-0503		DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1DS22	1990-0503		DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1DS23	1990-0503		DISPLAY AN DOT MAT 1 CHAR .135 IN HIGH	28480	1990-0399
A3A1DS24	1990-0503		DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1DS25	1990-0503		DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1DS26	1990-0503		DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1DS27	1990-0503		DISPLAY AN DOT MAT 1 CHAR .135 IN HIGH	28480	1990-0399
A3A1DS28	1990-0503		DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1DS29	1990-0503		DISPLAY NUM DOT MAT 1 CHAR .29 IN HIGH	28480	1990-0330
A3A1J1	1251-3906	1	CONNECTOR 50-PIN M RECTANGULAR	76381	3433-2003
A3A1MP1	08505-20031	1	SWITCH, HOUSING BASE, SHORT	28480	08505-20031
A3A1MP2	08505-40004	4	BASE, SWITCH, LONG (P/O S1-S20)	28480	08505-40004
A3A1MP3	08505-40004		BASE, SWITCH, LONG (P/O S1-S20)	28480	08505-40004
A3A1MP4	08505-20033	1	BASE, SWITCH, SHORT (P/O S21-S26)	28480	08505-20033
A3A1MP5	08505-40004		PROTECTIVE STRIP,SHORT (P/O S21-S26)	28480	08505-40004
A3A1MP6	08505-40004		PROTECTIVE STRIP,SHORT (P/O S21-S26)	28480	08505-40004
A3A1MP7	08505-20034	1	CONTACT, SPACER, SHORT (P/O S21-S26)	28480	08505-20034
A3A1MP8	08505-20035	2	CONTACT, SPACER, LONG (P/O S1-S20)	28480	08505-20035
A3A1MP9	08505-20035		CONTACT, SPACER, LONG (P/O S1-S20)	28480	08505-20035
A3A1MP10	08505-20045	1	PROTECTIVE STRIP, SHORT (P/O S21-S26)	28480	08505-20045
A3A1MP11	08505-20044	2	PROTECTIVE STRIP, LONG (P/O S1-S20)	28480	08505-20044
A3A1MP12	08505-20044	1	PROTECTIVE STRIP, LONG (P/O S1-S20)	28480	08505-20044

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1R1	2100-2274	2	RESISTOR-VAR CONTROL CC 10K 10% LIN	12697	382
A3A1R2	2100-2274		RESISTOR-VAR CONTROL CC 10K 10% LIN	12697	382
A3A1S1	08505-40001	26	PUSHBUTTON	28480	08505-40001
	08505-40002	26	PLUNGER FOR S1 THRU S26	28480	08505-40002
A3A1S2	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S3	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S4	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S5	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S6	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S7	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S8	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S9	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S10	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S11	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S12	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S13	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S14	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S15	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S16	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S17	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S18	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S19	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S20	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S21	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S22	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S23	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S24	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S25	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S26	08505-40001		PUSHBUTTON	28480	08505-40001
A3A1S27	08505-20084	3	SLIDE SWITCH ASSEMBLY	28480	08505-20084
	5020-3440	8	SPRING:DETENT	28480	5020-3440
A3A1S28	08505-20084		SLIDE SWITCH ASSEMBLY	28480	08505-20084
	5020-3440		SPRING:DETENT	28480	5020-3440
A3A1S29	08505-20084		SLIDE SWITCH ASSEMBLY	28480	08505-20084
	5020-3440		SPRING:DETENT	28480	5020-3440
A3A1S30	08505-20047	5	SLIDE SWITCH ASSEMBLY	28480	08505-20047
	5020-3440		SPRING:DETENT	28480	5020-3440
A3A1S31	08505-20047		SLIDE SWITCH ASSEMBLY	28480	08505-20047
	5020-3440		SPRING:DETENT	28480	5020-3440
A3A1S32	08505-20047		SLIDE SWITCH ASSEMBLY	28480	08505-20047
	5020-3440		SPRING:DETENT	28480	5020-3440
A3A1S33	08505-20047		SLIDE SWITCH ASSEMBLY	28480	08505-20047
	5020-3440		SPRING:DETENT	28480	5020-3440
A3A1S34	08505-20047		SLIDE SWITCH ASSEMBLY	28480	08505-20047
	5020-3440		SPRING:DETENT	28480	5020-3440
A3A1XDS19	1200-0576	2	SOCKET-IC	28480	1200-0576
A3A1XDS23	1200-0576		SOCKET-IC	28480	1200-0576
A3A1XDS27	1200-0565	1	SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A3A2	08505-60002	1	BOARD ASSEMBLY, AUX. PANEL	28480	08505-60002
A3A2C1	0160-2055	55	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A2C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A2C3	0180-0229	14	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A2C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A2C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A2J1	1251-3141	1	CONNECTOR 50-PIN M RECTANGULAR	76381	3433-1002
A3A2R1	0757-0199	7	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A3A2R2	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A3A2R3	0757-0444	22	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A2R4	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A2R5	0757-0417	4	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3A2R6	0757-0401	55	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A2R7	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A2R8	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3A2R9	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3A2R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A2U1	1810-0219	6	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-83-R220
A3A2U2	1810-0219		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-83-R220
A3A2U3	1810-0219		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-83-R220
A3A2U4	1810-0219		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-83-R220
A3A2U5	1810-0207	5	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R22K
A3A2U6	1820-1203	1	IC SN74LS 11 N GATE	01295	SN74LS11N
A3A2U7	1810-0207		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R22K
A3A2U8	1810-0207		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R22K
A3A2U9	1810-0207		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R22K
A3A2U10	1820-1201	3	IC SN74LS 08 N GATE	01295	SN74LS08N
A3A2U11	1820-1201		IC SN74LS 08 N GATE	01295	SN74LS08N
A3A2U12	1810-0207		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R22K
A3A2U13	1820-0577	2	IC SN74 16 N INV	01295	SN7416N
A3A2U14	1820-1281	3	IC SN74LS139 N DECODER	01295	SN74LS139N
A3A2U15	1810-0219		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-83-R220
A3A2U16	1810-0219		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-83-R220
A3A2U17	1820-0577		IC SN74 16 N INV	01295	SN7416N
A3A2U18	1820-1298	3	IC SN74LS251 N DATA SEL	01295	SN74LS251N
A3A2U19	1820-1298		IC SN74LS251 N DATA SEL	01295	SN74LS251N
A3A2U20	1820-1298		IC SN74LS251 N DATA SEL	01295	SN74LS251N
A3A2U21	1820-1300	10	IC SN74LS195 N RGTR	01295	SN74LS195N
A3A2U22	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A2U23	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A2U24	1820-1216	6	IC SN74LS138 N DECODER	01295	SN74LS138N
A3A2U25	1820-1216		IC SN74LS138 N DECODER	01295	SN74LS138N
A3A2U26	1820-0661	1	IC SN74 32 N GATE	01295	SN7432N
A3A2U27	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A2U28	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A2U29	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A2U30	1820-1216		IC SN74LS138 N DECODER	01295	SN74LS138N
A3A3	08505-60003	1	BOARD ASSEMBLY, PROC. CONTROL	28480	08505-60003
A3A3C1	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X .0B2
A3A3C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-205
A3A3C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A3C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A3C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A3C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A3C7			NOT ASSIGNED		
A3A3C8	0180-0291	1	CAPACITOR-FXD 1UF +-10% 35VDC	28480	0180-0291
A3A3MP1	5040-6852	3	EXTRACTOR, ORANGE	28480	5040-6852
A3A3MP2	5000-9043	19	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A3Q1	1854-0404	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A3Q2	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A3R1	0757-0442	43	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A3R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A3R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A3R4	0698-3450	19	RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4222-F
A3A3R5	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4222-F
A3A3R6	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4222-F
A3A3R7	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4222-F
A3A3R8	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A3R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A3U1	1820-1144	3	IC SN74LS 02 N GATE	01295	SN74LS02N
A3A3U2	1820-1281		IC SN74LS139 N DECODER	01295	SN74LS139N
A3A3U3	1820-1197	4	IC SN74LS 00 N GATE	01295	SN74LS00N
A3A3U4	1820-1204	1	IC SN74LS 20 N GATE	01295	SN74LS20N
A3A3U5	1820-1199	3	IC SN74LS 04 N INV	01295	SN74LS04N
A3A3U6	1818-0166	1		28480	1818-0166
A3A3U7	1820-1212	4	IC SN74LS112 N FLIP-FLOP	01295	SN74LS112N
A3A3U8	1820-1212		IC SN74LS112 N FLIP-FLOP	01295	SN74LS112N
A3A3U9	1820-1199		IC SN74LS 04 N INV	01295	SN74LS04N
A3A3U10	1820-1216		IC SN74LS138 N DECODER	01295	SN74LS138N
A3A3U11	1820-0846	1	IC DM80 94N BUFFER	27014	DM8094N
A3A3U12	1820-0778	3	IC COUNTER	07263	93L16DC
A3A3U13	1820-1144		IC SN74LS 02 N GATE	01295	SN74LS02N
A3A3U14	1820-1199		IC SN74LS 04 N INV	01295	SN74LS04N
A3A3U15	1820-1280	1	IC SN74LS181 N ARITH LGC UN	01295	SN74LS181N
A3A3U16	1820-1296	3	IC SN74LS295 N RGTR	01295	SN74LS295N
A3A3U17	1818-0140	1	IC 2112 1K RAM NMOS	34649	2112
A3A3U18	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A3U19	1820-0778		IC COUNTER	07263	93L16DC
A3A3U20	1820-1212		IC SN74LS112 N FLIP-FLOP	01295	SN74LS112N
A3A3U21	1820-1296		IC SN74LS295 N RGTR	01295	SN74LS295N
A3A3U22	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A3U23	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N
A3A3U24	1820-1196	1	IC SN74LS174 N FLIP-FLOP	01295	SN74LS174N
A3A3U25	1820-1300		IC SN74LS195 N RGTR	01295	SN74LS195N

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A3U26	1820-0778		IC COUNTER	07263	93L16DC
A3A3VR1	1902-3070		DIODE-BRKDN 4.22V +-5% DO-7 PD=4W	28480	1902-3070
A3A4	08505-60004	1	BOARD ASSEMBLY, PROC. INTER	28480	08505-60004
A3A4C1	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A4C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A4C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A4C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A4C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A4C6	0160-2265	1	CAPACITOR-FXD 22PF +-.25PF 500WVDC CER	28480	0160-2265
A3A4C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A4C8	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A4C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A4E1	08505-20138	1	SHIELD, COIL	28480	08505-20138
A3A4L1	9100-2551	1	INDUCTOR 12UH	28480	9100-2551
A3A4L2	9140-0210	31	COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A4MP1	5040-6848	1	EXTRACTOR, YELLOW	28480	5040-6848
A3A4MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A4R1	0757-0280	65	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A4R2	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A4R3	0757-0438	58	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A4R4	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A4R5	0698-0084	42	RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A4R6	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A4R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A4U1	1820-1251	6	IC SN74LS196 N COUNTER	01295	SN74LS196N
A3A4U2	1820-1197		IC SN74LS 00 N GATE	01295	SN74LS00N
A3A4U3	1820-1201		IC SN74LS 08 N GATE	01295	SN74LS08N
A3A4U4	1820-1212		IC SN74LS112 N FLIP-FLOP	01295	SN74LS112N
A3A4U5	1820-1251		IC SN74LS196 N COUNTER	01295	SN74LS196N
A3A4U6	1820-1251		IC SN74LS196 N COUNTER	01295	SN74LS196N
A3A4U7	1820-1251		IC SN74LS196 N COUNTER	01295	SN74LS196N
A3A4U8	1820-1251		IC SN74LS196 N COUNTER	01295	SN74LS196N
A3A4U9	1820-1251		IC SN74LS196 N COUNTER	01295	SN74LS196N
A3A4U10	1820-1197		IC SN74LS 00 N GATE	01295	SN74LS00N
A3A4U11	1820-1207	1	IC SN74LS 30 N GATE	01295	SN74LS30N
A3A4U12	1820-1216		IC SN74LS138 N DECODER	01295	SN74LS138N
A3A4U13	1820-1216		IC SN74LS138 N DECODER	01295	SN74LS138N
A3A4U14	1820-1144		IC SN74LS 02 N GATE	01295	SN74LS02N
A3A4U15	1810-0206	3	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R10K
A3A4U16	1820-1281		IC SN74LS139 N DECODER	01295	SN74LS139N
A3A4U17	1820-1211	1	IC SN74LS 86 N GATE	01295	SN74LS86N
A3A4U18	1820-1296		IC SN74LS295 N RGTR	01295	SN74LS295N
A3A4U19	1820-1238	4	IC SN74LS253 N DATA SEL	01295	SN74LS253N
A3A4U20	1820-1238		IC SN74LS253 N DATA SEL	01295	SN74LS253N
A3A4U21	1810-0205	2	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R4.7K
A3A4U22	1810-0206		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R10K
A3A5	08505-60005	1	BOARD ASSEMBLY, PROC. D/A	28480	08505-60005
A3A5C1	0180-1746	22	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A5C2	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A5C3	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A5C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A5C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A5C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A5C7	0160-0127	19	CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C8	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C9	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C10	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C11	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C12	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C13	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C14	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A5C15	0160-2606	5	CAPACITOR-FXD .47UF +-20% 25WVDC CER	28480	0160-2606
A3A5C16	0160-2606		CAPACITOR-FXD .47UF +-20% 25WVDC CER	28480	0160-2606
A3A5C17	0160-2606		CAPACITOR-FXD .47UF +-20% 25WVDC CER	28480	0160-2606
A3A5C18	0160-2606		CAPACITOR-FXD .47UF +-20% 25WVDC CER	28480	0160-2606
A3A5C19	0160-2671	5	CAPACITOR-FXD .1UF +-5% 80WVDC POLYE	56289	292P1045R8
A3A5C20	0160-2671		CAPACITOR-FXD .1UF +-5% 80WVDC POLYE	56289	292P1045R8
A3A5C21	0160-2671		CAPACITOR-FXD .1UF +-5% 80WVDC POLYE	56289	292P1045R8
A3A5C22	0160-2671		CAPACITOR-FXD .1UF +-5% 80WVDC POLYE	56289	292P1045R8
A3A5C23	0160-4333	4	CAPACITOR-FXD .47UF +-5% 80WVDC POLYE	28480	0160-4333
A3A5C24	0160-4333		CAPACITOR-FXD .47UF +-5% 80WVDC POLYE	28480	0160-4333
A3A5C25	0160-4333		CAPACITOR-FXD .47UF +-5% 80WVDC POLYE	28480	0160-4333

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A5C26	0160-4333		CAPACITOR-FXD .47UF +-5% 80WVDC POLYE	28480	0160-4333
A3A5C27	0160-0574	6	CAPACITOR-FXD .022UF +-20% 100WVDC CER	28480	0160-0574
A3A5C28	0160-0574		CAPACITOR-FXD .022UF +-20% 100WVDC CER	28480	0160-0574
A3A5C29	0160-0574		CAPACITOR-FXD .022UF +-20% 100WVDC CER	28480	0160-0574
A3A5C30	0160-0574		CAPACITOR-FXD .022UF +-20% 100WVDC CER	28480	0160-0574
A3A5C31	0160-2199	5	CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-2199
A3A5C32	0180-0197	84	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A5C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A5C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A5C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A5C36	0160-4299	7	CAPACITOR-FXD 2200 +20% 250WVDC CER	28480	0160-4299
A3A5C37	0160-3456	5	CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3A5CR1	1901-0518	51	DIODE-SCHOTTKY	28480	1901-0518
A3A5CR2	1901-0040	71	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A5CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A5CR4	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A5CR5	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A5L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A5L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A5L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A5MP1	5040-6851	2	EXTRACTOR, GREEN	28480	5040-6851
A3A5MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A5Q1	1853-0007	37	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A5R1	0757-0444	28	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A5R2	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A5R3	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A5R4	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A5R5	0698-3159	8	RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A5R6	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A5R7	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A5R8	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A5R9	0757-0123	5	RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A3A5R10	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A3A5R11	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A3A5R12	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A3A5R13	0757-0463	4	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A3A5R14	0757-0463		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A3A5R15	0757-0463		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A3A5R16	0757-0463		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A3A5R17	0757-0467	8	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A5R18	0698-8046	12	RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R19	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A5R20	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R21	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A5R22	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R23	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A5R24	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R25	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A5R26	0757-0440	31	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A5R27	2100-3094	5	RESISTOR-TRMR 100K 10% C SIDE-ADJ	32997	3006P-1-104
A3A5R28	2100-3094		RESISTOR-TRMR 100K 10% C SIDE-ADJ	32997	3006P-1-104
A3A5R29	2100-3094		RESISTOR-TRMR 100K 10% C SIDE-ADJ	32997	3006P-1-104
A3A5R30	0757-0288	19	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A5R31	0698-8053	6	RESISTOR 128K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1283-B
A3A5R32	0698-8053		RESISTOR 128K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1283-B
A3A5R33	0698-8053		RESISTOR 128K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1283-B
A3A5R34	0698-8053		RESISTOR 128K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1283-B
A3A5R35	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R36	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R37	0757-0279	24	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A5R38	0698-3193	6	RESISTOR 10K .25% .125W F TC=0+-50	24546	NC55
A3A5R39	0698-3453	6	RESISTOR 196K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1963-F
A3A5R40	0698-3157	11	RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A5R41	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A5R42	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A5R43	0698-3193		RESISTOR 10K .25% .125W F TC=0+-50	24546	NC55
A3A5R44	0698-3193		RESISTOR 10K .25% .125W F TC=0+-50	24546	NC55
A3A5R45	2100-3350	3	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-201
A3A5R46	0698-3453		RESISTOR 196K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1963-F
A3A5R47	0698-3446	2	RESISTOR 383 1% .125W F TC=0+-100	16299	C4-1/8-T0-383R-F
A3A5R48	2100-3095	5	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006P-1-201
A3A5R49	0757-0317	2	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A3A5R50	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A5R51	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A5R52	0698-3460	5	RESISTOR 422K 1% .125W F TC=0+-100	03888	PME55S
A3A5R53	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A5R54	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A5R55	0757-0470	2	RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A3A5R56	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A5R57	0698-6363	14	RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A5R58	0698-3201	2	RESISTOR 80K 1% .125W F TC=0+-100	16299	C4-1/8-T0-8002-F
A3A5R59	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A3A5R60	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A5R61	0757-0464	2	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A3A5R62	0698-3193		RESISTOR 10K .25% .125W F TC=0+-50	24546	NC55
A3A5R63	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R64	0698-6630	11	RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A5R65	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A5R66	0698-3201		RESISTOR 80K 1% .125W F TC=0+-100	16299	C4-1/8-T0-8002-F
A3A5R67	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A5R68	0698-3260		RESISTOR 464K 1 .125W F TC=0+-100	03888	PME55S
A3A5R69	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A5R70	2100-3274	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ	32997	3386X-Y46-103
A3A5R71	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R72	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A5R73	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A5R74	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A3A5R75	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A3A5R76	0683-2255		RESISTOR 2.2MEG 5% .25W FC TC=900/+1100	01121	CB2255
A3A5U1	1826-0102	11	IC LM 312 OP AMP	27014	LM312H
A3A5U2	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A5U3	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A5U4	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A5U5	1826-0261	8	IC UA 741 OP AMP	28480	1826-0261
A3A5U6	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A3A5U7	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A3A5U8	1820-1546	5	IC CD4052AY MUXR	02735	CD4052AY
A3A5U9	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A3A5U10	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A3A5U11	1820-1545	18	IC CD4053AY MUXR	02735	CD4053AY
A3A5U12	1820-0223	9	IC LM 301A OP AMP	27014	LM301AH
A3A5U13	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A5U14	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A5U15	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A5U16	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A5U17	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A5U18	1820-1540	3	IC CD4042AY LATCH	02735	CD4042AY
A3A5U19	1820-1540		IC CD4042AY LATCH	02735	CD4042AY
A3A5U20	1820-1540		IC CD4042AY LATCH	02735	CD4042AY
A3A5VR1	1902-0680	10	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A6	08505-60006	1	BOARD ASSEMBLY, INPUT MULTIPLEX	28480	08505-60006
A3A6C1	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A6C2	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A6C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A6C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A6C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A6C6	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A6C7	0160-3456		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3A6C8	0160-3456		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3A6CR1	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR2	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR3	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR4	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR5	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR6	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR7	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR8	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR9	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR10	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR11	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR12	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR13	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR14	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR15	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR16	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR17	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR18	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR19	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR20	1901-0518		DIODE-SCHOTTKY	28480	1901-0518

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A6CR21	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6CR22	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A6L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A6L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A6L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A6MP1	5040-6849	2	EXTRACTOR, P.C. BOARD, BLUE	28480	5040-6849
A3A6MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A6R1	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A6R2	0698-3152	6	RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A3A6R3	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A6R4	0698-6360	7	RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A3A6R5	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A3A6R6	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A3A6R7	2100-3355	5	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-104
A3A6R8	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A3A6R9	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A6R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A6R11	0757-0289	13	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A6R12	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A6R13	2100-3355		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-104
A3A6R14	2100-3355		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-104
A3A6U1	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A6U2	1820-1541	4	IC CD4015AY RGTR	02735	CD4015AY
A3A6U3	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A6U4	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A6U5	1820-1547	5	IC CD4051AY MUXR	02735	CD4051AY
A3A6U6	1820-1547		IC CD4051AY MUXR	02735	CD4051AY
A3A6VR1	1902-0064	4	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	04713	SZ 10939 146
A3A7	08505-60007	1	BOARD ASSEMBLY, RESOLUTION	28480	08505-60007
A3A7C1	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A3A7C2	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X901082
A3A7C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A3A7C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A7C5	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A7C6	0160-0298	4	CAPACITOR-FXD 1500PF +-10% 200WVDC POLYE	56289	292P15292
A3A7C7	0160-0298		CAPACITOR-FXD 1500PF +-10% 200WVDC POLYE	56289	292P15292
A3A7C8	0160-0194	4	CAPACITOR-FXD .015UF +-10% 200WVDC POLYE	56289	292P15392
A3A7C9	0160-0194		CAPACITOR-FXD .015UF +-10% 200WVDC POLYE	56289	292P15392
A3A7C10	0160-0970	2	CAPACITOR-FXD .47UF +-10% 80WVDC POLYE	28480	0160-0970
A3A7C11	0160-0970		CAPACITOR-FXD .47UF +-10% 80WVDC POLYE	28480	0160-0970
A3A7C12	0160-0301	2	CAPACITOR-FXD .012UF +-10% 200WVDC POLYE	56289	292P12392
A3A7C13	0160-0301		CAPACITOR-FXD .012UF +-10% 200WVDC POLYE	56289	292P12392
A3A7C14	0160-3387	2	CAPACITOR-FXD .39UF +-10% 80WVDC POLYE	56289	292P3949R8
A3A7C15	0160-3387		CAPACITOR-FXD .39UF +-10% 80WVDC POLYE	56289	292P3949R8
A3A7C16	0160-0297	2	CAPACITOR-FXD 1200PF +-10% 200WVDC POLYE	56289	292P12292
A3A7C17	0160-0297		CAPACITOR-FXD 1200PF +-10% 200WVDC POLYE	56289	292P12292
A3A7C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A7C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A7C20	0160-0575		CAPACITOR-FXD .047UF ±20% 50WVDC	28480	0160-0575
A3A7CR1			DELETED		
A3A7CR2			DELETED		
A3A7CR3			DELETED		
A3A7CR4			DELETED		
A3A7CR5	1901-0450		DIODE, SWITCHING, 50V 100MA 10NS DO-7	28480	1901-0450
A3A7CR6	1901-0450		DIODE, SWITCHING 50V 100MA 10NS DO-7	28480	1901-0450
A3A7CR7	1901-0450		DIODE, SWITCHING 50V 100MA 10NS DO-7	28480	1901-0450
A3A7CR8	1901-0450		DIODE, SWITCHING 50V 100MA 10NS DO-7	28480	1901-0450
A3A7L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A7L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A7L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A7MP1	5040-6850	2	EXTRACTOR, CLEAR	28480	5040-6850
A3A7MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A7R1	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A3A7R2	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A7R3	0698-3458	2	RESISTOR 348K 1% .125W F TC=0+-100	03888	PME55S
A3A7R4	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A7R5	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A7R6	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A7R7	0698-3458		RESISTOR 348K 1% .125W F TC=0+-100	03888	PME55S
A3A7R8	2100-3355		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-104
A3A7R9	2100-3355		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-104
A3A7R10	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A7R11	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A7R12	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A7R13	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A7R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A7R15	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A7R16	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A7R17	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A7R18	0698-7332	6	RESISTOR 1M 1% .125W F TC=0+-100	19701	MF5C1/8-T0-1004-F
A3A7R19	0698-7332		RESISTOR 1M 1% .125W F TC=0+-100	19701	MF5C1/8-T0-1004-F
A3A7R20	0698-7332		RESISTOR 1M 1% .125W F TC=0+-100	19701	MF5C1/8-T0-1004-F
A3A7R21	0698-7332		RESISTOR 1M 1% .125W F TC=0+-100	19701	MF5C1/8-T0-1004-F
A3A7R22	0698-7332		RESISTOR 1M 1% .125W F TC=0+-100	19701	MF5C1/8-T0-1004-F
A3A7R23	0698-7332		RESISTOR 1M 1% .125W F TC=0+-100	19701	MF5C1/8-T0-1004-F
A3A7R24	0698-6248	2	RESISTOR 400K 1% .125W F TC=0+-100	03888	PME55S
A3A7R25	0698-6248		RESISTOR 400K 1% .125W F TC=0+-100	03888	PME55S
A3A7R26	0757-0472	2	RESISTOR 200K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2003-F
A3A7R27	0757-0472		RESISTOR 200K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2003-F
A3A7R28	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A7R29	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A7R30	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A7R31	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A7R32	0757-0449	2	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A7R33	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A7R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A7R35	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A3A7R36	0757-0458	2	RESISTOR 51.1K 1% .125W TC=0±100	28480	0757-0458
A3A7R37	0757-0458		RESISTOR 51.1K 1% .125W TC=-±100	28480	0757-0458
A3A7R38	0757-0439	21	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A7R39	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A7R40	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A7R41	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A7R42	0698-3449		RESISTOR 28.7K 1% .125W TC=0±100	28480	0698-3449
A3A7U1	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A7U2	1820-1546		IC CD4052AY MUXR	02735	CD4052AY
A3A7U3	1826-0021	4	IC LM 310 OP AMP	27014	LM310H
A3A7U4	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A7U5	1820-1547		IC CD4051AY MUXR	02735	CD4051AY
A3A7U6	1820-1541		IC CD4015AY RGTR	02735	CD4015AY
A3A7U7	1820-1546		IC CD4052AY MUXR	02735	CD4052AY
A3A7U8	1820-1541		IC CD4015AY RGTR	02735	CD4015AY
A3A7U9	1820-1547		IC CD4051AY MUXR	02735	CD4051AY
A3A7U10	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A7U11	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A7U12	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A7U13	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A7U14	1826-0021		IC LM 310 OP AMP	27014	LM310H
A3A7VR1	1902-0064		DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	04713	SZ 10939-146
A3A8	08505-60008	1	BOARD ASSEMBLY, POLAR CONVERTER	28480	08505-60008
A3A8C1	0160-4084	51	CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A8C2	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C3	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A8C4	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C5	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C6	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C7	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A8C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A8C11	0160-2257	2	CAPACITOR-FXD 10PF +-5% 500WVDC CER	28480	0160-2257
A3A8C12	0160-0158	4	CAPACITOR-FXD 5600PF +-10% 200WVDC POLYE	56289	292P56292
A3A8C13	0160-0158		CAPACITOR-FXD 5600PF +-10% 200WVDC POLYE	56289	292P56292
A3A8C14	0160-0158		CAPACITOR-FXD 5600PF +-10% 200WVDC POLYE	56289	292P56292
A3A8C15	0160-0158		CAPACITOR-FXD 5600PF +-10% 200WVDC POLYE	56289	292P56292
A3A8C16	0160-2249	1	CAPACITOR-FXD 4.7PF +-.25PF 500WVDC CER	28480	0160-2249
A3A8C17	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C18	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C19	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C20	0160-3534	4	CAPACITOR-FXD 510PF +-5% 100WVDC MICA	28480	0160-3534
A3A8C21	0160-3536	2	CAPACITOR-FXD 620PF +-5% 100WVDC MICA	28480	0160-3536
A3A8C22	0160-2225	4	CAPACITOR-FXD 2000PF +-5% 300WVDC MICA	28480	0160-2225
A3A8C23	0160-3536		CAPACITOR-FXD 620PF +-5% 100WVDC MICA	28480	0160-3536
A3A8C24	0160-2225		CAPACITOR-FXD 2000PF +-5% 300WVDC MICA	28480	0160-2225
A3A8C25	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A8C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A8C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A8C28	0160-2257		CAPACITOR-FXD 10PF +-5% 500WVDC CER	28480	0160-2257
A3A8C29	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A8C31	0160-2264	2	CAPACITOR-FXD 20PF +-5% 500WVDC CER	28480	0160-2264
A3A8C32	0160-2204	4	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A3A8C33	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C34	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A8C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A8L1	9100-1641	26	COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A8L2	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A8MP1	5040-6846	2	P.C. BOARD EXTRACTOR, GRAY	28480	5040-6846
A3A8MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A8Q1	1854-0295	3	TRANSISTOR DUAL NPN PD=400MW	28480	1854-0295
A3A8Q2	1854-0404	58	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A8Q3	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A8Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A8Q5	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A8Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A8R1	0698-0083	12	RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A3A8R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A8R3	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A3A8R4	0757-0394	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A3A8R5	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A3A8R6	0698-3154	9	RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A3A8R7	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A3A8R8	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A3A8R9	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3A8R10	2100-3109	5	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-202
A3A8R11	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A3A8R12	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R13	0757-0416	18	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A3A8R14	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R15	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R16	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R17	0757-0420	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-TO-751-F
A3A8R18	2100-3273	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-202
A3A8R19	2100-3351	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-501
A3A8R20	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A3A8R21	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A3A8R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3A8R23	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R24	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R25	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R26	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A3A8R27	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A3A8R28	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A3A8R29	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A3A8R30	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A3A8R31	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A3A8R32	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A3A8R33	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1962-F
A3A8R34	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A3A8R35	0757-0447	3	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1622-F
A3A8R36	0757-0274	13	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A3A8R37	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A3A8R38	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A3A8R39	0757-0290	8	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A3A8R40	2100-3350		RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-201
A3A8R41	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A3A8R42	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A3A8R43	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A3A8R44	2100-3350		RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-201
A3A8R45	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A3A8R46	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A8R47	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A3A8R48	0698-6624	5	RESISTOR 2K .1% .125W F TC=0+-25	24546	NE55
A3A8R49	0698-6624		RESISTOR 2K .1% .125W F TC=0+-25	24546	NE55
A3A8R50	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A3A8R51	0698-6624		RESISTOR 2K .1% .125W F TC=0+-25	24546	NE55
A3A8R52	0698-6624		RESISTOR 2K .1% .125W F TC=0+-25	24546	NE55
A3A8R53	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A3A8R54	0698-3151	6	RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2871-F
A3A8R55	2100-3351		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-501

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A8R56	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R57	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R58	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R59	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A3A8R60	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A8R61	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A8R62	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A8R63	0757-0464		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A3A8R64	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A3A8R65	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A8R66	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A8R67	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A8R68	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A8R69	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A8R70	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A8R71	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A3A8R72	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R73	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A3A8R74	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A3A8R75	0698-3243	1	RESISTOR 178K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1783-F
A3A8R76	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A8R77	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A8R78	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A8R79	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A8R80	2100-3154	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-102
A3A8R81	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A3A8R82	2100-3103	3	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-103
A3A8R83	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A8R84	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A8R85	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A8R86	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A8R87	0698-3151	13	RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A3A8R88	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-202
A3A8R89	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A8R90	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A8R91	0811-3403	3	RESISTOR 1K 5% .25W PW TC=+3400+-300	28480	0811-3403
A3A8R92	0757-0424	4	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3A8S1	3101-0973	2	SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC PC	79727	GF126-0018
A3A8U1	1826-0092	5	IC MC 1458 OP AMP	28480	1826-0092
A3A8U2	1826-0081	3	IC LM 318 OP AMP	27014	LM318H
A3A8U3	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A8U4	1826-0102		IC LM 312 OP AMP	27014	LM312H
A3A8U5	1826-0036	1	IC MC 1494 MULTIPLIER	04713	MC1494L
A3A8U6	1820-0427	4	IC MC 1496 MODULATOR	04713	MC1496G
A3A8U7	1820-0427		IC MC 1496 MODULATOR	04713	MC1496G
A3A8U8	1820-1547		IC CD4051AY MUXR	02735	CD4051AY
A3A8U9	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A8U10	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A8U11	1826-0092		IC MC 1458 OP AMP	28480	1826-0092
A3A8U12	1826-0092		IC MC 1458 OP AMP	28480	1826-0092
A3A8VR1	1902-3104	2	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=-.016%	04713	SZ 10939-110
A3A8VR2	1902-3104	2	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A3A8VR3	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A9	08505-60009	1	BOARD ASSEMBLY, OFFSET 2	28480	08505-60009
A3A9C1	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X901082
A3A9C2	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A9C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A9C4	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A3A9C5	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A3A9C6	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X901082
A3A9C7	0160-2199		CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-2199
A3A9C8	0180-2206	4	CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A3A9C9	0160-0134	3	CAPACITOR-FXD 220PF +-5% 300WVDC MICA	28480	0160-0134
A3A9C10	0160-3537	1	CAPACITOR-FXD 680PF +-5% 100WVDC MICA	28480	0160-3537
A3A9C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A9C12	0160-0194		CAPACITOR-FXD .015UF +-10% 200WVDC POLYE	56289	292P15392
A3A9C13	0160-2230	1	CAPACITOR-FXD 3300PF +-5% 300WVDC MICA	28480	0160-2230
A3A9C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A9C15	0160-0194		CAPACITOR-FXD .015UF +-10% 200WVDC POLYE	56289	292P15392
A3A9C16	0160-0159	1	CAPACITOR-FXD 6800PF +-10% 200WVDC POLYE	56289	292P68292
A3A9C17	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A9C18	0160-2229	2	CAPACITOR-FXD 3000PF +-5% 300WVDC MICA	28480	0160-2229
A3A9C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A9C20	0180-2206		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A9C21	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A9C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A9C23	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A9C24	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A9C25	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A9C26	0160-0161	5	CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A3A9C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A9C28	0160-2222	3	CAPACITOR-FXD 1500PF +-5% 300WVDC MICA	28480	0160-2222
A3A9C29	0140-0193	1	CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A3A9C30	0180-2206		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A3A9C31	0160-4084		CAPACITOR-FXD .1UF+-20%, 50WVDC CER	28480	0160-4084
A3A9CR1	1901-0050	2	DIODE-SWITCHING 80V 200MA 2NS DO-7	28480	1901-0050
A3A9CR2	1901-0050		DIODE-SWITCHING 80V 200MA 2NS DO-7	28480	1901-0050
A3A9CR3	1901-0539		DIODE-HOT CARRY	28480	1901-0539
A3A9L1	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A9L2	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A9L3	9100-2573	5	COIL-FXD MOLDED RF CHOKE 1MH 10%	24226	16/104
A3A9L4	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A9L5	9100-2573		COIL-FXD MOLDED RF CHOKE 1MH 10%	24226	16/104
A3A9L6	9100-2551	1	COIL-FXD MOLDED RF CHOKE 12UH 10%	06560	15S-120K
A3A9L7	9100-2573		COIL-FXD MOLDED RF CHOKE 1MH 10%	24226	16/104
A3A9L8	9100-1650	1	COIL-FXD MOLDED RF CHOKE 680UH 5%	24226	19/683
A3A9L9	9100-1639	1	COIL-FXD MOLDED RF CHOKE 150UH 5%	24226	15/153
A3A9L10	9100-3591	7	COIL-VAR 900UH/1.1MH Q=40 PC MTG	28480	9100-3591
A3A9MP1	5040-6845	1	PC BOARD EXTRACTOR, WHITE	28480	5040-6845
A3A9MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A9Q1	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A9Q2	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A9Q3	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A9Q4	1855-0020	15	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A9Q5	1853-0316	2	TRANSISTOR-DUAL PNPPD=500MW	28480	1853-0316
A3A9Q6	1853-0050	10	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A9Q7	1853-0050		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A9Q8	1853-0050		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A9R1	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3A9R2	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A9R3	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A9R4	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A9R5	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A9R6	0811-3113	1	RESISTOR 900 1% .125W PWW TC=0+-5	14140	1350-1/8-901-F
A3A9R7	0698-3440	4	RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A3A9R8	0698-0085	7	RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A3A9R9	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A9R10	0757-0278	2	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A3A9R11	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A9R12	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A3A9R13	0757-0290	2	RESISTOR 6.19K 1% .125W F TC=0 +-100	24546	C4-1/8-T0-6191-F
A3A9R14	0811-1198	9	RESISTOR 3K 1% .125W PWW TC = 0+-100	16299	0811-1198
A3A9R15	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A9R16	2100-3054	6	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-503
A3A9R17	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A3A9R18	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A9R19	0698-3442	2	RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A3A9R20	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A3A9R21	0757-1094	12	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A9R22	0811-1197	1	RESISTOR 1.78K 1% .125W PWW TC=0+-10	20940	114-1/8-1781-F
A3A9R23	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A9R24	0811-1177	3	RESISTOR 5.11K 1% .125W PWW TC=0+-10	07088	KP61-5111-1
A3A9R25	0811-1177		RESISTOR 5.11K 1% .125W PWW TC=0+-10	07088	KP61-5111-1
A3A9R26	2100-3161	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-203
A3A9R27	2100-3161		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-203
A3A9R28	0811-1177		RESISTOR 5.11K 1% .125W PWW TC=0+-10	07088	KP61-5111-1
A3A9R29	2100-3154		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-102
A3A9R30	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A9R31	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A9R32	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A9R33	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A9R34	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3A9R35	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A9R36	0698-3447	2	RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422R-F
A3A9R37	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A3A9R38	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A9R39	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A9R40	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A9R41	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A3A9R42	2100-3122	3	RESISTOR-TRMR 100 10% C TOP-ADJ 15-TURN	32997	3006P-1-101
A3A9R43	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	16299	C4-1/8-T0-383R-F
A3A9R44	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A3A9R45	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422R-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A9R46	0757-0290		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A9R47	0757-0199		RESISTOR 21.5K .125W FTC-0+-100	24546	C4-1/8-TO-2152-F
A3A9S1	3101-0973		SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC PC	79727	GF126-0018
A3A9U1	1820-1112	1	IC SN74LS 74 N FLIP-FLOP	01295	SN74LS74N
A3A9U2	1820-1277	2	IC SN74LS192 N COUNTER	01295	SN74LS192N
A3A9U3	1820-0630	1	IC MC 4044P DIGITAL	04713	MC4044P
A3A9U4	1820-1277		IC SN74LS192 N COUNTER	01295	SN74LS192N
A3A9U5	1826-0092		IC MC 1458 OP AMP	28480	1826-0092
A3A9U6	1826-0043	4	IC LM 307 OP AMP	27014	LM307H
A3A9U7	1826-0043		IC LM 307 OP AMP	27014	LM307H
A3A9VR1	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A9VR2	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A9VR3	1902-3104		DIODE-ZNR 5.62V	28480	1902-3104
A3A9XY1	1200-0770	1	SOCKET-XTAL 2-CONT HC-6/U-PKG	28480	1200-0770
A3A9Y1	0410-0186	1	XTAL, QUARTZ	28480	0410-0186
A3A10	08505-60010	1	BOARD ASSEMBLY, OFFSET 1	28480	08505-60010
A3A10C1	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A10C2	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A10C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A10C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A10C5	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A10C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A10C7	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A10C8	0160-2055		CAPACITOR-FXD .01UF +80 20% 100WVDC CER	28480	0160-2055
A3A10C9	0160-2675	2	CAPACITOR-FXD 3900PF +-1% 300WVDC MICA	28480	0160-2675
A3A10C10	0160-2229		CAPACITOR-FXD 3000PF +-5% 300WVDC MICA	28480	0160-2229
A3A10C11	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A3A10C12	0160-2207		CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207
A3A10C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A10C14	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A10C15	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A10C16	0160-4420	1	CAPACITOR-FXD 100PF	28480	0160-4420
A3A10C17	0160-2202	1	CAPACITOR-FXD 75PF +-5% 300WVDC MICA	28480	0160-2202
A3A10C18	0160-2675		CAPACITOR-FXD 3900PF +-1% 300WVDC MICA	28480	0160-2675
A3A10C19	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A10C20	0160-4089	1	CAPACITOR-FXD 2200PF +-1% 500WVDC MICA	28480	0160-4089
A3A10C21	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A10C22	0160-3534		CAPACITOR-FXD 510PF +-5% 100WVDC MICA	28480	0160-3534
A3A10C23	0160-3534		CAPACITOR-FXD 510PF +-5% 100WVDC MICA	28480	0160-3534
A3A10C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A10C25	0160-2308	1	CAPACITOR-FXD 36PF +-5% 300WVDC MICA	28480	0160-2308
A3A10C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A10C27	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A10C28	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A10C29	0160-2207		CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207
A3A10C30	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A10C31	0160-2222		CAPACITOR-FXD 1500PF +-5% 300WVDC MICA	28480	0160-2222
A3A10C32	0160-2222		CAPACITOR-FXD 1500PF +-5% 300WVDC MICA	28480	0160-2222
A3A10C33	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A3A10C34	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A10C35	0160-0153	3	CAPACITOR-FXD 1000PF +-10% 200WVDC POLYE	56289	292P10292
A3A10L1	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A10L2	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A10L3	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A10L4	9100-3591		COIL-VAR 900UH/1.1MH Q=40 PC MTG	28480	9100-3591
A3A10L5	08505-80001	1	COIL ASSEMBLY, 30-TURN	28480	08505-80001
A3A10L6	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A10L7	9100-2573		COIL-FXD MOLDED RF CHOKE 1MH 10%	24226	16/104
A3A10L8	9100-1660	1	COIL-FXD MOLDED RF CHOKE 2MH 5%	24226	22/204
A3A10MP1	5040-6843	4	EXTRACTOR, P.C. BOARD	28480	5040-6843
A3A10MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A10Q1	1855-0062	1	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0062
A3A10Q2	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A10Q3	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A10Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A10Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A10Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A10R1	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A10R2	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R3	0698-3443	5	RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A3A10R4	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A10R5	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A10R6	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A10R8	2100-3354	1	RESISTOR-VAR TRMR 50KOHM 10% C SIDE ADJ	73138	72XR50K
A3A10R9	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A10R10	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A10R11	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A10R12	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R13	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R14	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A10R15	0698-3431	1	RESISTOR 23.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-23R7-F
A3A10R16	0757-0421	4	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A3A10R17	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A10R18	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R19	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R20	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A10R21	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A10R22	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A3A10R23	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A10R24	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A10R25	0698-3260	3	RESISTOR 464K 1% .125W F TC=0+-100	03888	PME55S
A3A10R26	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A10R27	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A10R28	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A10R29	0757-0441	3	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A3A10R30	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A10R31	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A10R32	0757-0418	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A3A10R33	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A10R34	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A10R35	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A3A10R36	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R37	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R38	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A3A10R39	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A3A10R40	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R41	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A10R42	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A3A10R43	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A3A10R44	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A10R45	2100-3054		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-503
A3A10R46	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A10R47	0698-3452	2	RESISTOR 147K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1473-F
A3A10R48	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A3A10R49	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A10R50	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A10R51	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A10R52	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A10R53	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A10R54	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A10R55	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A10R56	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R57	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10R58	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A10R59	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A3A10R60	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A10R61	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A10R62	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A10U1	1826-0081		IC LM 318 OP AMP	27014	LM318H
A3A10U2	1858-0032	1	IC CA3146E XSTR ARRAY	02735	CA3146E
A3A10U3	1820-0427		IC MC 1496 MODULATOR	04713	MC1496G
A3A10U4	1820-0306	1	IC CA 3028A DIFF AMPL	02735	CA3028A
A3A10U5	1820-0427		IC MC 1496 MODULATOR	04713	MC1496G
A3A11	08505-60012	1	BOARD ASSEMBLY, DELAY DETECTOR	28480	08505-60012
A3A11C1	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C2	0160-3879	16	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C3	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C4	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C5	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C6	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A11C8	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A11C9	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C10	0160-2207		CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A11C11	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C12	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C13	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A3A11C14	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C15	0160-2207		CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207
A3A11C16	0160-3878	3	CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A3A11C17	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A3A11C18	0160-0339	2	CAPACITOR-FXD 534PF +-1% 300WVDC MICA	28480	0160-0339
A3A11C19	0160-0339		CAPACITOR-FXD 534PF +-1% 300WVDC MICA	28480	0160-0339
A3A11C20	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C21	0180-2206		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X900682
A3A11C22	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C23	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C24	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C25	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A11C26	0160-0575	1	CAPACITOR-FXD .047UF +-20% 50WVDC CER	28480	0160-0575
A3A11C27	0160-0162	2	CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A3A11C28	0160-0162		CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A3A11C29	0160-0945	1	CAPACITOR-FXD 910PF +-5% 100WVDC MICA	28480	0160-0945
A3A11C30	0160-2671		CAPACITOR-FXD .1UF +-5% 80WVDC POLYE	56289	292P1045R8
A3A11C31	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C32	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A11C33	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A3A11C34	0140-0196	5	CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A3A11C35	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A11C36	0160-2207		CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207
A3A11C37	0140-0196		CAPACITOR-FXD 150PF + 5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A3A11C38	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C39	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C40	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C41	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C42	0160-2606		CAPACITOR-FXD .47UF +-20% 25WVDC CER	28480	0160-2606
A3A11C43	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A11C44	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A11C45	0160-2202		CAPACITOR-FXD 75PF +-5% 300WVDC MICA	28480	0160-2202
A3A11C46	0160-2202		CAPACITOR-FXD 75PF +-5% 300WVDC MICA	28480	0160-2202
A3A11C47	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A3A11C48	0160-0298		CAPACITOR-FXD 1500PF +-10% 200WVDC POLYE	56289	292P15292
A3A11C49	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A11C50	0160-0298		CAPACITOR-FXD 1500PF +-10% 200WVDC POLYE	56289	292P15292
A3A11C51	0160-0570	3	CAPACITOR-FXD 220PF +-20% 100WVDC CER	28480	0160-0570
A3A11C52	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A11C53	0160-3874	1	CAPACITOR-FXD 10PF +-.5PF 200WVDC CER	28480	0160-3874
A3A11C54	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A11C55	0160-0570		CAPACITOR-FXD 220PF +-20% 100WVDC CER	28480	0160-0570
A3A11C56	0160-0570		CAPACITOR-FXD 220PF +-20% 100WVDC CER	28480	0160-0570
A3A11CR1	1901-0179	5	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3A11CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR3	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3A11CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR8	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3A11CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR13	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A11CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR18	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11CR19	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A11CR20	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A11CR21	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A11L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A11L2	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A11L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A11L4	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A11L5	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A11L6	9100-1629	2	COIL-FXD MOLDED RF CHOKE 47UH 5%	24226	15/472
A3A11L7	9100-1629		COIL-FXD MOLDED RF CHOKE 47UH 5%	24226	15/472
A3A11L8	9100-2585	4	COIL-FXD MOLDED RF CHOKE 10MH 10%	06560	15S-103K
A3A11L9	9100-2585		COIL-FXD MOLDED RF CHOKE 10MH 10%	06560	15S-103K
A3A11L10	9100-1663	1	COIL-FXD MOLDED RF CHOKE 2.7MH 5%	06560	22-1312-29J

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A11MP1	5040-6853	1	EXTRACTOR, BROWN	28480	5040-6853
A3A11MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A11Q1	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A11Q2	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A11Q3	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A11Q4	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A11Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A11Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A11Q7	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A11Q8	1854-0712	2	TRANSISTOR-DUAL NPN PD=1.8W	28480	1854-0712
A3A11Q9	1854-0712		TRANSISTOR-DUAL NPN PD=1.8W	28480	1854-0712
A3A11Q10	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A11Q11	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A11Q12	1854-0019	8	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A11Q13	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A11Q14	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A11Q15	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A11Q16	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A11Q17	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A11Q18	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A11R1	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A11R2	0698-3437	5	RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A3A11R3	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A11R4	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A11R5	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A3A11R6	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R7	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R8	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A11R9	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A11R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R11	0698-3158	7	RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3A11R12	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3A11R13	2100-2497	1	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TURN	19701	ET50W202
A3A11R14	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A11R15	0698-3136	10	RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A11R16	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A11R17	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A11R18	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A11R19	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R20	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A11R21	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A11R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R23	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A11R24	0757-0346	13	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A11R25	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A11R26	2100-3095		RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006P-1-201
A3A11R27	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A11R28	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R29	0698-3441	1	RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
A3A11R30	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A11R31	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A11R32	0698-3444	10	RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A3A11R33	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A11R34	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A11R35	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A11R36	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A11R37	0698-7265		RESISTOR 16.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1622-F
A3A11R38	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R39	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R40	0757-0462	5	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A3A11R41	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A11R42	0757-0462		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A3A11R43	2100-3056	9	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A3A11R44	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R45	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R46	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A11R47	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A11R48	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R49	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A11R50	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A11R51	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A11R52	0698-8053		RESISTOR 128K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1283-B
A3A11R53	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A11R54	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A11R55	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A11R56	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A11R57	0698-8053		RESISTOR 128K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1283-B
A3A11R58	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A11R59	0698-3460		RESISTOR 422K 1% .125W F TC=0+-100	03888	PME55S
A3A11R60	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A11R61	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A11R62	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A11R63	0698-3460		RESISTOR 422K 1% .125W F TC=0+-100	03888	PME55S
A3A11R64	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R65	0698-3460		RESISTOR 422K 1% .125W F TC=0+-100	03888	PME55S
A3A11R66	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R67	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R68	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A11R69	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A11R70	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A11R71	0698-3156	12	RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A11R72	0698-3266	2	RESISTOR 237K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2373-F
A3A11R73	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A11R74	2100-3054		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-503
A3A11R75	2100-3054		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-503
A3A11R76	0698-3457	2	RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A3A11R77	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A11R78	0698-3452		RESISTOR 147K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1473-F
A3A11R79	2100-3054		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-503
A3A11R80	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A11R81	0811-2813	1	RESISTOR 1 5% .75W PW TC=0+-50	91637	RS1/2-T2 1R0-J
A3A11R82	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A11R83	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A11R84	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A3A11R85	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A11R86	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A11R87	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A11R88	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A11R89	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A11R90	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A11R91	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A11R92	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A11R93	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A11R94	0698-6630		RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A3A11R95	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A11R96	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A3A11R97	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A3A11R98	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A11R99	0683-4755	2	RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A3A11R100	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A11R101	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A3A11R102	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A11R103	0683-2265	2	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A3A11R104	0683-1065	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A3A11R105	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A11R106	0683-4755		RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A3A11U1	1820-0261	2	IC SN74 121 N MV	01295	SN74121N
A3A11U2	1813-0041	5	IC LH 0042C OP AMP	27014	LH0042CH
A3A11U3	1820-0223		IC LM 301A OP AMP	27014	LM301AH
A3A11U4	1820-1545		IC CD4053AY MUXP	02735	CD4053AY
A3A11U5	1826-0261	5	IC OP AMP	28480	1826-0261
A3A11U6	1826-0021		IC LM 310 OP AMP	27014	LM310H
A3A11U7	1826-0261		IC OP AMP	28480	1826-0261
A3A11U8	1826-0261		IC OP AMP	28480	1826-0261
A3A11U9	1813-0041		IC LH 0042C OP AMP	27014	LH0042CH
A3A11U10	1820-0223		IC LM 301A OP AMP	27014	LM301AH
A3A11U11	1826-0138	1	IC LM 339 COMPARATOR	27014	LM339N
A3A11U12	1820-0223		IC LM 301A OP AMP	27014	LM301AH
A3A11U13	1820-0223		IC LM 301A OP AMP	27014	LM301AH
A3A11U14	1820-1538	4	IC CD4011AY GATE	02735	CD4011AY
A3A11U15	1820-0261		IC SN74 121 N MV	01295	SN74121N
A3A11U16	1820-1542	3	IC CD4049AY BUFFER	02735	CD4049AY
A3A11U17	1820-1552	2	IC CD4023AY GATE	02735	CD4023AY
A3A11VR1	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A11VR2	1902-3104		DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A3A12	08505-60011	1	BOARD ASSEMBLY, PHASE DETECTOR	28480	08505-60011
A3A12C1	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A12C2	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A12C3	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A12C4	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A12C5	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A12C6	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C7	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C9	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C10	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C11	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C12	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C13	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C14	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C15	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C16	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C17	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C18	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C19	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C20	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C21	0160-0218	5	CAPACITOR-FXD 2400PF +-1% 300WVDC MICA	28480	0160-0218
A3A12C22	0160-0218		CAPACITOR-FXD 2400PF +-1% 300WVDC MICA	28480	0160-0218
A3A12C23	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C24	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C25	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C26	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C27	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C28	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C29	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C30	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C31	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C32	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C33	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C34	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C35	0160-0218		CAPACITOR-FXD 2400PF +-1% 300WVDC MICA	28480	0160-0218
A3A12C36	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C37	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C38	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C39	0160-0134		CAPACITOR-FXD 220PF +-5% 300WVDC MICA	28480	0160-0134
A3A12C40	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C41	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C42	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C43	0160-0134		CAPACITOR-FXD 220PF +-5% 300WVDC MICA	28480	0160-0134
A3A12C44	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C45	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A12C46	0160-0574		CAPACITOR-FXD .022UF +-20% 100WVDC CER	28480	0160-0574
A3A12C47	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C48	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A12C49	0160-3458	13	CAPACITOR-FXD 5000PF +-10% 250WVDC CER	28480	0160-3458
A3A12C50	0140-0200	1	CAPACITOR-FXD 390PF +-5% 300WVDC MICA	72136	DM15F391J0300WV1CR
A3A12C51	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A3A12C52	0160-0574		CAPACITOR-FXD .022UF +-20% 100WVDC CER	28480	0160-0574
A3A12C53	0160-3535	1	CAPACITOR-FXD 560PF +-5% 100WVDC MICA	28480	0160-3535
A3A12L1	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L2	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L3	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L4	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L5	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L6	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L7	9100-3591		COIL-VAR 900UH/1.1MH Q=40 PC MTG	28480	9100-3591
A3A12L8	9100-3591		COIL-VAR 900UH/1.1MH Q=40 PC MTG	28480	9100-3591
A3A12L9	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L10	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L11	9100-3591		COIL-VAR 900UH/1.1MH Q=40 PC MTG	28480	9100-3591
A3A12L12	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L13	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L14	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A12L15	9100-2573		COIL-FXD MOLDED RF CHOKE 1MH 10%	24226	16/104
A3A12MP1	5040-6847	1	EXTRACTOR, RED	28480	5040-6847
A3A12MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A12Q1	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A12Q2	1853-0050		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A12Q3	1853-0050		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A12Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A12Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A12Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A12Q7	1854-0475	2	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A3A12Q8	1853-0316		TRANSISTOR-DUAL PNPPD=500MW	28480	1853-0316
A3A12Q9	1853-0050		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A12Q10	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A12Q11	1854-0475		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A3A12R1	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A12R2	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A12R3	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R4	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A12R5	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R6	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A12R7	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A12R8	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A12R9	0757-0419	9	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A12R10	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A12R11	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R12	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R13	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R14	0757-0200	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A3A12R15	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A3A12R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A12R17	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A12R18	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A12R19	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A3A12R20	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A3A12R21	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A12R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A12R23	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A12R24	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A12R25	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R26	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A3A12R27	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R28	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A3A12R29	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A12R30	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A12R31	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A3A12R32	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A3A12R33	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R34	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A12R35	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R36	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R37	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A12R38	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R39	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A3A12R40	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A12R41	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A12R42	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A12R43	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A3A12R44	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A12R45	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A3A12R46	0757-0278		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A3A12R47	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A3A12R48	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A12R49	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A3A12R50	2100-3095		RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006P-1-201
A3A12R51	0811-0599	1	RESISTOR 1.6K .05% .5W PWW TC=0+-5	07088	2798-P
A3A12R52	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A3A12R53	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A12R54	2100-3095		RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006P-1-201
A3A12R55	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A12R56	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A12R57	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A3A12R58	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A12R59	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A12R60	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A12R61	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A12R62	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A3A12R63	0698-3161	1	RESISTOR 38.3K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3832-F
A3A12U1	1820-0253	6	IC MC 1035P SCHMITT	04713	MC1035P
A3A12U2	1820-0253		IC MC 1035P SCHMITT	04713	MC1035P
A3A12U3	1820-0581	1	IC MC 1032P FLIP-FLOP	04713	MC1032P
A3A12U4	1820-0253		IC MC 1035P SCHMITT	04713	MC1035P
A3A12U5	1820-0253		IC MC 1035P SCHMITT	04713	MC1035P
A3A12U6	1820-0253		IC MC 1035P SCHMITT	04713	MC1035P
A3A12U7	1826-0091		IC LM 318 OP AMP	27014	LM318H
A3A12U8	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A3A12U9	1820-0253		IC MC 1035P SCHMITT	04713	MC1035P

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A12VR1	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A12VR2	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A12Z1	9170-0847	4	CORE-SHIELDING BEAD	02114	56-590-65/38 PARYLENE COATED
A3A12Z2	9170-0847		CORE-SHIELDING BEAD	02114	56-590-65/38 PARYLENE COATED
A3A12Z3	9170-0847		CORE-SHIELDING BEAD	02114	56-590-65/38 PARYLENE COATED
A3A12Z4	9170-0847		CORE-SHIELDING BEAD	02114	56-590-65/38 PARYLENE COATED
A3A13	08505-60013	2	BOARD ASSEMBLY, R MAGNITUDE DETECTOR		
A3A13C1	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C2	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A13C4	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A13C5	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C6	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C7	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C8	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C9	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C10	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C11	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C12	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C13	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C14	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C15	0140-0191	2	CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A3A13C16	0160-2255	2	CAPACITOR-FXD 8.2PF +-.25PF 500WVDC CER	28480	0160-2255
A3A13C17	0160-3455	4	CAPACITOR-FXD 470PF +-10% 1000WVDC CER	28480	0160-3455
A3A13C18	0160-3455		CAPACITOR-FXD 470PF +-10% 1000WVDC CER	28480	0160-3455
A3A13C19	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C20	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C21	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C22	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C23	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A13C24	0160-4137	2	CAPACITOR-FXD .01UF +-1% 100WVDC POLYSTY	84411	863UW
A3A13C25	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C26	0121-0105	2	CAPACITOR-V TRMR-CER 9/35PF 200V PC-MTG	00865	304324 9/35PF N650
A3A13C27	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C28	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A13C29	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C30	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A3A13C31	0160-2225		CAPACITOR-FXD 2000PF +-5% 300WVDC MICA	28480	0160-2225
A3A13C32	0160-2261	4	CAPACITOR-FXD 15PF +-5% 500WVDC CER	28480	0160-2261
A3A13C33	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C34	0160-0218		CAPACITOR-FXD 2400PF +-1% 300WVDC MICA	28480	0160-0218
A3A13C35	0160-2261		CAPACITOR-FXD 15PF +-5% 500WVDC CER	28480	0160-2261
A3A13C36	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A3A13C37	0160-3456		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3A13C38	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A13C39	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A3A13C40	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C41	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A13C42	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C43	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A3A13C44	0160-3458		CAPACITOR-FXD 5000PF +-10% 250WVDC CER	28480	0160-3459
A3A13C45	0160-3458		CAPACITOR-FXD 5000PF +-10% 250WVDC CER	28480	0160-3458
A3A13C46	0160-3458		CAPACITOR-FXD 5000PF +-10% 250WVDC CER	28480	0160-3458
A3A13C47	0160-3458		CAPACITOR-FXD 5000PF +-10% 250WVDC CER	28480	0160-3458
A3A13C48	0160-3458		CAPACITOR-FXD 5000PF +-10% 250WVDC CER	28480	0160-3458
A3A13C49	0160-3458		CAPACITOR-FXD 5000PF +-10% 250WVDC CER	28480	0160-3458
A3A13CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR10	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3A13CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13CR12	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A13CR13	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A13CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A13L1	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A13L2	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A13L3	08505-80002	2	COIL, VAR 250 UH	28480	08505-80002
A3A13L4	9100-3591		COIL-VAR 900UH/1.1MH Q=40 PC MTG	28480	9100-3591
A3A13L5	9100-2585		COIL-FXD MOLDED RF CHOKE 10MH 10%	06560	15S-103K

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A13MP1	5040-6852		EXTRACTOR, ORANGE	28480	5040-6852
A3A13MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A13Q1	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A13Q2	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q3	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q7	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q8	1853-0050		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A13Q9	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q10	1853-0050		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A13Q11	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q13	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q14	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q15	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q16	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q17	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A13Q18	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q19	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q20	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A13Q21	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A13Q22	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q23	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q24	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A13Q25	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A13Q26	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q27	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q28	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q29	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A13Q30	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A13Q31	1854-0295		TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A3A13R1	0698-7212	8	RESISTOR 100 2% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A3A13R2	0698-7212		RESISTOR 100 2% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A3A13R3	0698-7212		RESISTOR 100 2% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A3A13R4	0698-7212		RESISTOR 100 2% .05W F TC=0+-100	24546	C3-1/8-T0-100R-G
A3A13R5	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A13R6	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A13R7	0698-3453		RESISTOR 196K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1963-F
A3A13R8	0698-3449	4	RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A3A13R9	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A13R10	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A3A13R11	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A13R12	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A13R13	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A13R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A13R15	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A13R16	0757-0458	22	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R17	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A3A13R18	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A3A13R19	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R20	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R21	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R22	0698-3451	8	RESISTOR 133K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1333-F
A3A13R23	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A13R24	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A13R25	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A13R26	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A13R27	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R28	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A13R29	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A13R30	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A3A13R31	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A13R32	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A3A13R33	0698-3451		RESISTOR 133K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1333-F
A3A13R34	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A13R35	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R36	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A13R37	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A13R38	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A13R39	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A13R40	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A13R41	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A13R42	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R43	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R44	0698-3451		RESISTOR 133K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1333-F
A3A13R45	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R46	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A13R47	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A13R48	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A13R49	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A13R50	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A3A13R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A13R52	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100		
A3A13R53	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	CR-1/8-T0-1002-F
A3A13R54	2100-3094		RESISTOR-TRMR 100K 10% C SIDE ADJ	32997	3006P-1-104
A3A13R55	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100		
A3A13R56	0757-0458	3	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R57	0698-3445		RESISTOR 348 1% .125W F TC=0+-100	16299	C4-1/8-T0-348R-F
A3A13R58	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A13R59	0757-0462		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A3A13R60	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A13R61	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R62	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R63	0698-3453		RESISTOR 196K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1963-F
A3A13R64	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A13R65	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A3A13R66	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A13R67	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A3A13R68	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R69	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R70	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A13R71	2100-3122		RESISTOR-TRMR 100 10% C TOP-ADJ 15-TURN	32997	3006P-1-101
A3A13R72	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3A13R73	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A13R74	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A13R75	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A13R76	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A13R77	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A3A13R78	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A13R79	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A13R80	0811-3403		RESISTOR 1K 5% .25W PW TC=+3400+-300	28480	0811-3403
A3A13R81	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A13R82	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R83	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A13R84	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A13R85	0757-0136	4	RESISTOR 619K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-6193-F
A3A13R86	0757-0136		RESISTOR 619K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-6193-F
A3A13R87	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R88	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R89	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3A13R90	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A13R91	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A3A13R92	0757-0398	4	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3A13R93	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3A13R94	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A13R95	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3A13R96	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A3A13R97	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A13R98	0757-0460	6	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A3A13R99	2100-3103		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-103
A3A13R100	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A13R101	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A13R102	0698-3451		RESISTOR 133K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1333-F
A3A13R103	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A13R104	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A13R105	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A13R106	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A13R107	0683-0275		RESISTOR 2.7 5% .25W FC TC=400/+500	28480	0683-0275
A3A13U1	1820-0223		IC LM 301A OP AMP	27014	LM301AH
A3A13U2	1813-0041		IC LH 0042C OP AMP	27014	LH0042CH
A3A13U3	1826-0261		IC UA 741 OP AMP	28480	1826-0261
A3A13VR1	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A13W1	08505-20145	2	CABLE, COAXIAL	28480	08505-20145
A3A14	08505-60013		BOARD ASSEMBLY, A,B MAGNITUDE DETECTOR SAME AS A3A13, USE A3A14 PREFIX	28480	08505-60013

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A15	08505 60014	1	BOARD ASSEMBLY, DISPLAY MULTIPLEX	28480	08505-60014
A3A15C1	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D155X9020B2
A3A15C2	0180-0197		CAPACITOR FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A15C3	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A15C4	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A15C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160 2055
A3A15C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A15CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A15CR2	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A15CR3	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A15CR4	1901 0518		DIODE-SCHOTTKY	28480	1901-0518
A3A15CR5	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A15CR6	1901 0518		DIODE-SCHOTTKY	28480	1901-0518
A3A15CR7	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A15CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A15CR9	1901 0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A15CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A15CR11	1901 0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A15CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A15CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A15L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A15L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A15L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A15MP1	5040-6851		EXTRACTOR, GREEN	28480	5040 6851
A3A15MP2	5000 9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A15Q1	1853 0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A15R1	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	28480	2100-3056
A3A15R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3A15R3	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	03888	PME55
A3A15R4	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+ 100	16299	C4-1/8-TO-2611-F
A3A15R5	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1962-F
A3A15R6	0698 3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A3A15R7	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3A15R8	2100-3273		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-202
A3A15R9	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A3A15R10	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2371-F
A3A15R11	0757 0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5112-F
A3A15R12	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5112-F
A3A15R13	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A3A15R14	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A3A15R15	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+ 100	16299	C4-1/8-TO-2611-F
A3A15R16	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+ 100	24546	C4-1/8-TO-5111-F
A3A15R17	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A3A15R18	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2152-F
A3A15R19	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+ 100	16299	C4-1/8-TO-4222-F
A3A15R20	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A3A15R21	0757 0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A3A15R22	0757-0462		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7502-F
A3A15R23	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A3A15R24	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A3A15R25	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55
A3A15R26	0757 0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A3A15R27	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A3A15R28	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A3A15R29	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+ 100	16299	C4-1/8-TO-1961-F
A3A15R30	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A3A15R31	2100 3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-202
A3A15R32	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A3A15R33	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-202
A3A15R34	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A3A15R35	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3A15R36	0757 0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3A15R37	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3A15R38	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A3A15R39	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A3A15R40	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+ 100	24546	C4-1/8-TO-1212-F
A3A15R41	0757 0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3A15R42	0757-0280		RESISTOR 1K 1% .125W F TC=0+ 100	24546	C4-1/8-TO-1001-F
A3A15R43	0757-0280		RESISTOR 1K 1% .125W F TC=0+ 100	24546	C4-1/8-TO-1001-F
A3A15R44	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A3A15R45	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A15R46	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A15R47	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A15R48	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A15R49	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A15U1	1826-0261		IC OP AMP	28480	1826-0261
A3A15U2	1826-0043		IC LM 307 OP AMP	27014	LM307H
A3A15U3	1826-0043		IC LM 307 OP AMP	27014	LM307H
A3A15U4	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A15U5	1826-0261		IC OP AMP	28480	1826-0261
A3A15U6	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A15VR1	1902-3082		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	04713	SZ 10939-86
A3A15VR2	1902-3036	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	04713	SZ 10939-38
A3A15VR3	1902-3036		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	04713	SZ 10939-38
A3A16	08505-60022	1	BOARD ASSEMBLY, BLANK LOGIC	28480	08505-60022
A3A16C1	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A16C2	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A16C3	0160-3466	3	CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3A16C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A16C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A16C6	0160-3466		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3A16C7	0160-3466		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3A16C8	0160-2200	1	CAPACITOR-FXD 43PF +-5% 300WVDC MICA	28480	0160-2200
A3A16C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A16CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A16CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A16CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A16CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A16CR5	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A16CR6	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A16CR7	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A16CR8	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A16CR9	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A16CR10	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A16L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A16MP1	5040-6849		EXTRACTOR, P.C. BOARD, BLUE	28480	5040-6849
A3A16MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A16Q1	1854-0039	1	TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A3A16Q2	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A16R1	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A16R2	0757-0466	2	RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1103-F
A3A16R3	0698-3445		RESISTOR 348 1% .125W F TC=0+-100	16299	C4-1/8-T0-348R-F
A3A16R4	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A16R5	0757-0459	3	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A3A16R6	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3A16R7	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	03888	PME55S
A3A16R8	0757-0466		RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1103-F
A3A16R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A16R10	0757-0459		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A3A16R11	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A16R12	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A3A16R13	0757-0459		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A3A16U1	1820-1530	3	IC CD4027AY FLIP-FLOP	02735	CD4027AY
A3A16U2	1820-1538		IC CD4011AY GATE	02735	CD4011AY
A3A16U3	1820-1542		IC CD4049AY BUFFER	02735	CD4049AY
A3A16U4	1820-1197		IC SN74LS 00 N GATE	01295	SN74LS00N
A3A16U5	1810-0205		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R4.7K
A3A16U6	1820-1552		IC CD4023AY GATE	02735	CD4023AY
A3A16U7	1820-1541		IC CD4015AY RGTR	02735	CD4015AY
A3A16U8	1820-1674	1		28480	1820-1674
A3A16U9	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A16VR1	1902-0064		DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	04713	SZ 10939-146
A3A16VR2	1902-0176	1	DIODE-ZNR 47.5V 5% DO-15 PD=1W TC=+.081%	04713	SZ-11213-335
A3A17	08505-60015	1	BOARD ASSEMBLY, MARKER 1	28480	08505-60015
A3A17C1	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A17C2	0160-2207		CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207
A3A17C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A17C4	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A17C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A17C6	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A3A17C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A17C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3A17C9	0160-0163	1	CAPACITOR-FXD .033UF +-10% 200WVDC POLYE	56289	292P33392
A3A17C10	0160-0153		CAPACITOR-FXD 1000PF +-10% 200WVDC POLYE	56289	292P10292

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A17C11	0160-0889	1	CAPACITOR-FXD .33UF +-10% 80WVDC POLYE	28480	0160-0889
A3A17C12	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A3A17C13	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A3A17C14	0160-2199		CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-2199
A3A17C15	0160-0153		CAPACITOR-FXD 1000PF +-10% 200WVDC POLYE	56289	292P10292
A3A17C16	0160-0168	3	CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A3A17C17	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A3A17C18	0160-3534		CAPACITOR-FXD 510PF +-5% 100WVDC MICA	28480	0160-3534
A3A17C19	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A3A17C20	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A3A17CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17CR2	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A17CR3	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A17CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17CR6	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A3A17CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A17L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A17L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A17L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A17MP1	5040-6850		EXTRACTOR, P.C. BOARD, CLEAR	28480	5040-6850
A3A17MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A17Q1	1854-0210	6	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A3A17Q2	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A17Q3	1855-0020		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A3A17Q4	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A17Q5	1854-0210		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A3A17Q6	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A17Q7	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A17Q8	1854-0210		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A3A17Q9	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A17Q10	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A17Q11	1853-0007		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A17Q12	1854-0210		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A3A17Q13	1854-0210		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A3A17Q14	1853-0322	1	TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	01295	2N2946A
A3A17Q15	1854-0210		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A3A17R1	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A17R2	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A17R3	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A17R4	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A17R5	0698-6363		RESISTOR 40K .1% .125W F TC=0+-25	24546	NE55
A3A17R6	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A17R7	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A17R8	0698-3266		RESISTOR 237K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2373-F
A3A17R9	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A17R10	2100-3054		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-503
A3A17R11	0698-6624		RESISTOR 2K .1% .125W F TC=0+-25	24546	NE55
A3A17R12	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A17R14	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A3A17R15	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3A17R16	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A3A17R17	0698-8046		RESISTOR 16K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1602-B
A3A17R18	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A3A17R19	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A17R20	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A17R21	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A3A17R22	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A17R23	0757-0402	2	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3A17R24	0698-3193		RESISTOR 10K .25% .125W F TC=0+-50	24546	NC55
A3A17R25	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A17R26	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A17R27	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A17R28	0757-0405	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A3A17R29	0698-3155	11	RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A17R30	2100-3352	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-102
A3A17R31	2100-3349	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-101
A3A17R32	0698-3193		RESISTOR 10K .25% .125W F TC=0+-50	24546	NC55
A3A17R33	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A17R34	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A17R35	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A17R36	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A17R37	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A17R38	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3A17R39	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A3A17R40	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A17R41	2100-3095		RESISTOR-TRMR 200 10% C SIDE-ADJ 17 TURN	32997	3006P-1-201
A3A17R42	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A3A17R43	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A17R44	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A17R45	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A17R46	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A17R47	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A17R48	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A17R49	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3A17R50	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A17R51	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A17R52	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A17R53	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A17R54	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A17R55	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A17R56	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A17R57	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A17R58	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3A17R59	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A17R60	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A17R61	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A17R62	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A17R63	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3A17R64	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A17R65	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A17R66	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A3A17U1	1820-1546		IC CD4052AY MUXR	02735	CD4052AY
A3A17U2	1826-0021		IC LM 310 OP AMP	27014	LM310H
A3A17U3	1826-0092		IC MC 1458 OP AMP	28480	1826-0092
A3A17U4	1826-0026	1	IC LM 311 COMPARATOR	27014	LM311H
A3A17U5	1820-0223		IC LM 301A OP AMP	27014	LM301AH
A3A17U6	1820-0223		IC LM 301A OP AMP	27014	LM301AH
A3A17U7	1820-1546		IC CD4052AY MUXR	02735	CD4052AY
A3A17U8	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A17U9	1820-1545		IC CD4053AY MUXR	02735	CD4053AY
A3A17U10	1820-1534	3	IC CD4001AY GATE	02735	CD4001AY
A3A17U11	1820-1535	1	IC CD4025AY GATE	02735	CD4025AY
A3A17U12	1813-0041		IC LH 0042C OP AMP	27014	LH0042CH
A3A17VR1	1902-0064		DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	04713	SZ 10939-146
A3A17VR2	1902-0680		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3A18	08505-60016	1	BOARD ASSEMBLY, MARKER 2	28480	08505-60016
A3A18C1	0140-0195	2	CAPACITOR-FXD 130PF +-5% 300WVDC MICA	72136	DM15F131J0300WV1CR
A3A18C2	0140-0195		CAPACITOR-FXD 130PF +-5% 300WVDC MICA	72136	DM15F131J0300WV1CR
A3A18C3	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3A18C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3A18L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A18MP1	5040-6846		P.C. BOARD EXTRACTOR, GRAY	28480	5040-6846
A3A18MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A18Q1	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A18Q2	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A18Q3	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A18R1	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A3A18R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A18R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A18R4	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A3A18R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A18U1	1820-1542		IC CD4049AY BUFFER	02735	CD4049AY
A3A18U2	1820-1534		IC CD4001AY GATE	02735	CD4001AY
A3A18U3	1820-1530		IC CD4027AY FLIP-FLOP	02735	CD4027AY
A3A18U4	1820-1538		IC CD4011AY GATE	02735	CD4011AY
A3A18U5	1820-1534		IC CD4001AY GATE	02735	CD4001AY
A3A18U6	1820-1390	3	IC MM74C160N	27014	MM74C160N
A3A18U7	1820-1390		IC MM74C160N	27014	MM74C160N
A3A18U8	1820-1390		IC MM74C160N	27014	MM74C160N
A3A18U9	1820-1538		IC CD4011AY GATE	02735	CD4011AY
A3A18U10	1820-1531	1	IC CD4013AY FLIP-FLOP	02735	CD4013AY
A3A18U11	1820-1536	1	IC CD4030AY GATE	02735	CD4030AY
A3A18U12	1820-1530		IC CD4027AY FLIP-FLOP	02735	CD4027AY
A3A18U13	1820-1539	1	IC CD4012AY GATE	02735	CD4012AY
A3A18U14	1820-1238		IC SN74LS253 N DATA SEL	01295	SN74LS253N
A3A18U15	1820-1238		IC SN74LS253 N DATA SEL	01295	SN74LS253N

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A18U16	1810-0206		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	11236	750-81-R10K
A3A23	08505-60020	1	BOARD ASSEMBLY, MOTHER	28480	08505-60020
A3A23J1	1200-0507	2	SOCKET-IC 16-CONT DIP-SLDR-TERMS	06776	ICN-163-S3W
A3A23J2	1250-0543	9	CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J3	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J4	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J5	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J6	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J7	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J8	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J9	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J10	1250-0543		CONNECTOR-RF SM SNP M PC	98291	51-053-0000
A3A23J11	1200-0507		SOCKET-IC 16-CONT DIP-SLDR-TERMS	06776	ICN-163-S3W
A3A23MP1	08505-00068	10	BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP2	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP3	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP4	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP5	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP6	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP7	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP8	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP9	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23MP10	08505-00068		BRACKET, P.C. SUPPORT	28480	08505-00068
A3A23XA3	1251-2026	13	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA4A	1251-2035	11	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA4B	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA5	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA6	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA7	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA8	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA9	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA10	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA11	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA12	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA13	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA14	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A23XA15	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA16	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA17	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA18	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA19	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA20	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA21	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A23XA22	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A24	01334-66506	1	BOARD ASSEMBLY, REGULATOR	28480	01334-66506
A3A24C1	0180-0291	2	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A3A24C2	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A3A24C3	0180-0161	1	CAPACITOR-FXD 3.3UF+-20% 35VDC TA	56289	150D335X0035B2
A3A24C4	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A3A24C5	0180-0116	3	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A3A24C6	0180-0116		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A3A24C7	0180-0116		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A3A24CR1	1901-0033	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3A24CR2	1901-0159	1	DIODE-PWR RECT 400V 750MA DO-41	04713	SR1358-4
A3A24F1	2110-0003	1	FUSE 3A 250V 1.25X.25 UL IEC	71400	AGC-3
A3A24J1	1251-3904	1	CONNECTOR PCST TYPE	28480	1251-3904
A3A24MP1	01334-01101	1	HEAT SINK	28480	01334-01101
A3A24MP2	2360-0121	16	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP3	2360-0121		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP4	2360-0121		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP5	2360-0121		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP6	2360-0121		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP7	2360-0121		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP8	2360-0121		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP9	2360-0121		SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0121
A3A24MP10	2420-0001	8	NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001
A3A24MP11	2420-0001		NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001
A3A24MP12	2420-0001		NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001
A3A24MP13	2420-0001		NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001
A3A24MP14	2420-0001		NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001
A3A24MP15	2420-0001		NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A24MP16	2420-0001		NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001
A3A24MP17	2420-0001		NUT-HEX-W/LKWR 6-32-THD .109-THK	28480	2420-0001
A3A24MP18	2110-0269	6	FUSEHOLDER-CLIP TYPE .25 FUSE	91506	6008-32CN
A3A24MP19	2110-0269		FUSEHOLDER-CLIP TYPE .25 FUSE	91506	6008-32CN
A3A24MP20	1200-0043	6	INSULATOR-XSTR TO-3 .02-THK	76530	322047
A3A24MP21	1200-0043		INSULATOR-XSTR TO-3 .02-THK	76530	322047
A3A24MP22	1200-0043		INSULATOR-XSTR TO-3 .02-THK	76530	322047
A3A24MP23	0340-0162	1	INSULATOR-XSTR TO-66 .02-THK	28480	0340-0162
A3A24MP24	2190-0006	8	WASHER-LK HLCL NO.-6 .141-IN-ID	28480	2190-0006
A3A24MP25	2190-0006		WASHER-LK HLCL NO.-6 .141-IN-ID	28480	2190-0006
A3A24MP26	2190-0006		WASHER-LK HLCL NO.-6 .141-IN-ID	28480	2190-0006
A3A24MP27	2190-0006		WASHER-LK HLCL NO.-6 .141-IN-ID	28480	2190-0006
A3A24MP28	3050-0005	8	WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24MP29	3050-0005		WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24MP30	3050-0005		WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24MP31	3050-0005		WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24MP32	3050-0005		WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24MP33	3050-0005		WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24MP34	3050-0005		WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24MP35	3050-0005		WASHER-SHLDR NO. 6 .14 IN ID .375 IN OD	73734	1461
A3A24Q1	1854-0237	1	TRANSISTOR NPN SI TO-66 PD=20W FT=10MHZ	04713	2N3738
A3A24Q2	1854-0232	1	TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A3A24Q3	1884-0082	1	THYRISTOR-SCR JEDEC 2N4441	04713	2N4441
A3A24R1	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A24R2	0761-0006	1	RESISTOR 10K 5% 1W MO TC=0+-200	24546	FP32-1-1002-J
A3A24R3	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A3A24R4	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A24R5	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A24R6	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A24R7	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A24R8	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A24R9	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A3A24R10	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A24R11	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A24R12	0698-3394	1	RESISTOR 31.6 1% .5W F TC=0+-100	GM005	CEC, T-0
A3A24U1	1826-0181	1	IC LM 323 V RGLTR	27014	LM323K
A3A24U2	1826-0203	1	IC V RGLTR	07263	7815KC
A3A24U3	1826-0169	1	IC LM 320 V RGLTR	27014	LM320K-15
A3A24U4	1820-0196	1	IC UA 723C V RGLTR	07263	723HC
A3A24U5	1906-0021	3	DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1906-0021
A3A24U6	1901-0638	1	DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1901-0638
A3A24U7	1906-0021		DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1906-0021
A3A24U8	1906-0006	1	DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1906-0006
A3A24U9	1906-0021		DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1906-0021
A3A24VR1	1902-3193	1	DIODE-ZNR 13.3V 5% DO-7 PD=.4W TC=+.059%	04713	SZ 10939-218
A3A24VR2	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A3A24VR3	1902-0049	1	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	04713	SZ 10939-122
A3A24VR4	1902-3357	2	DIODE-ZNR 56.2V 5% DO-7 PD=.4W TC=+.081%	04713	SZ 10939-398
A3A24VR5	1902-3354	1	DIODE-ZNR 54.9V 5% DO-7 PD=.4W TC=+.081%	04713	SZ 10939-395
A3A25	85055-60037		CRT CONTROL PANEL	28480	85055-60037
A3A25R1	2100-3506	4	RESISTOR-VAR CONTROL CC 10K 10% LIN	01121	WA4N120S103UZ
A3A25R2	2100-3503	1	RESISTOR-VAR CONTROL CC 200 10% LIN	01121	WA4N120S201UZ
A3A25R3	2100-3505	1	RESISTOR-VAR CONTROL CC 2M 10% LIN	01121	WA4N131S205UZ
A3A25R4	2100-3506		RESISTOR-VAR CONTROL CC 10K 10% LIN	01121	WA4N120S103UZ
A3A25R5	2100-3506		RESISTOR-VAR CONTROL CC 10K 10% LIN	01121	WA4N120S103UZ
A3A25R6	2100-3504	3	RESISTOR-VAR CONTROL CC 20K 10% LIN	01121	WA4N120S203UZ
A3A25R7	2100-3506		RESISTOR-VAR CONTROL CC 10K 10% LIN	01121	WA4N120S103UZ
A3A25R8	2100-3504		RESISTOR-VAR CONTROL CC 20K 10% LIN	01121	WA4N120S203UZ
A3A25R9	2100-3504		RESISTOR-VAR CONTROL CC 20K 10% LIN	01121	WA4N120S203UZ
A3A25S1	01334-81901	1	SWITCH DPDT 3	28480	01334-81901
A3A25S2	01334-81902	1	SWITCH DPDT 2	28480	01334-81902
A3A26	01332-66508	1	BOARD ASSEMBLY, HIGH VOLTAGE	28480	01332-66508
A3A26C1	0160-4148	2	CAPACITOR-FXD .033UF +-20% 6000WVDC MET	56289	430P333060
A3A26C2	0160-2264		CAPACITOR-FXD 20PF +-5% 500WVDC CER	28480	0160-2264
A3A26C3	0160-3960	2	CAPACITOR-FXD 1000PF +-20% 8000WVDC MET	84411	HEW337
A3A26C4	0160-4148		CAPACITOR-FXD .033UF +-20% 6000WVDC MET	56289	430P333060
A3A26C5	0160-3960		CAPACITOR-FXD 1000PF +-20% 8000WVDC MET	84411	HEW337
A3A26C6	0160-0678	2	CAPACITOR-FXD .01UF +-20% 6000WVDC MET	84411	HEW-337
A3A26C7	0160-0678		CAPACITOR-FXD .01UF +-20% 6000WVDC MET	84411	HEW-337
A3A26C8	0160-0543	1	CAPACITOR-FXD 4700PF +-20% 4000WVDC MET	84411	HEW-337

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A26CR1	1901-0683	1	DIODE-HV RECT 10KV 5MA 250NS	28480	1901-0683
A3A26CR2	1901-0028	7	DIODE-PRW RECT 400V 750MA DO-29	04713	SR1358-9
A3A26CR3	1901-0028		DIODE-PRW RECT 400V 750MA DO-29	04713	SR1358-9
A3A26CR4	1901-0028		DIODE-PRW RECT 400V 750MA DO-29	04713	SR1358-9
A3A26CR5	1901-0028		DIODE-PRW RECT 400V 750MA DO-29	04713	SR1358-9
A3A26J1	1251-0206	1	CONNECTOR-SGL CONT SKT .04-DIA WHT TFE	98291	SKT-400
A3A26MP1	2360-0275	4	SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	73734	102222
A3A26MP2	2360-0275		SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	73734	102222
A3A26MP3	2360-0275		SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	73734	102222
A3A26MP4	2360-0275		SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	73734	102222
A3A26MP5	0340-0007	2	STANDOFF-RND .5LG 6-32THD .500 CER GLZ	28480	0340-0007
A3A26MP6	0340-0007		STANDOFF-RND .5LG 6-32THD .500 CER GLZ	28480	0340-0007
A3A26MP7	01332-01201	1	BRACKET, HIGH VOLTAGE BOARD	28480	01332-01201
A3A26R1	0687-3941	1	RESISTOR 390K 10% .5W CC TC=0+882	01121	EB3941
A3A26R2	0684-1041	1	RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A3A26R3	0698-8018	1	RESISTOR 30M 1% 3W CP TC=0+-100	03888	PVC175-3-TO-3004-F
A3A26R4	0757-4701	1	RESISTOR 4.7K 1% .25W F TC=0+-100	24546	C5-1/4-T0-4701-F
A3A26R5	0684-1021	4	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A3A26R6	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A3A26R7	0687-1061	1	RESISTOR 10M 10% .5W CC TC=0+1059	01121	EB1061
A3A26R8	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A3A26R9	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A3A26R10	0687-1051	1	RESISTOR 1M 10% .5W CC TC=0+1000	01121	EB1051
A3A26R11	0687-2221	1	RESISTOR 2.2K 10% .5W CC TC=0+647	01121	EB2221
A3A26R12	0687-1001	1	RESISTOR 10 10% .5W CC TC=0+412	01121	EB1001
A3A26R13	0698-5353	1	RESISTOR 8.25M 5% 1W CF TC=0-2000	14298	HVX-1/2
A3A26R14	2100-3148	1	RESISTOR-TRMR 2M 20% MG TOP-ADJ 1-TURN	84048	150-4
A3A26R15	0698-6442	1	RESISTOR 13M 5% 1W CF TC=0-3500	14298	HVX-1/2
A3A26R16	0687-1011	1	RESISTOR 100 10% .5W CC TC=0+529	01121	EB1011
A3A26T1	01332-61103	1	TRANSFORMER	28480	01332-61103
A3A26VR1	2140-0018	2	LAMP-GLOW T-2 BULB 58V	74276	A9A-C
A3A26VR2	2140-0018		LAMP-GLOW T-2 BULB 58V	74276	A9A-C
A3A26VR3	1902-0182		DIODE-ZNR 20.5V 5% DO-7 PD=.4W	28480	1902-0182
A3A27	01334-66503	1	BOARD ASSEMBLY, BLANK AMPLIFIER	28480	01334-66503
A3A27C1	0180-0374	6	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A27C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A3A27C3	0160-0164	1	CAPACITOR-FXD .039UF +-10% 200WVDC POLYE	56289	292P39392
A3A27C4	0180-0141	1	CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A3A27C5	0160-3670	11	CAPACITOR-FXD .1UF +-20% 200WVDC CER	28480	0160-3670
A3A27C6	0160-3443	16	CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A27C7	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A27C8	0160-3558	1	CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-3558
A3A27C9	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A27C10	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A27C11	0160-3451	11	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	56289	B101F103ZS25-CDH
A3A27C12	0160-0166	1	CAPACITOR-FXD .068UF +-10% 200WVDC POLYE	56289	292P68392
A3A27C13	0140-0207	1	CAPACITOR-FXD 330PF +-5% 500WVDC MICA	72136	DM15F331J0500WV1CR
A3A27C14	0160-3592	1	CAPACITOR-FXD 2.4PF +-.5PF 200WVDC CER	28480	0160-3592
A3A27C15	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	56289	B101F103ZS25-CDH
A3A27C16	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	56289	B101F103ZS25-CDH
A3A27C17	0160-3670		CAPACITOR-FXD .1UF +-20% 200WVDC CER	28480	0160-3670
A3A27C18	0180-0269	1	CAPACITOR-FXD 1UF+75-10% 150VDC AL	56289	30D105G150BA2
A3A27C19	0160-3670		CAPACITOR-FXD .1UF +-20% 200WVDC CER	28480	0160-3670
A3A27C20	0160-3670		CAPACITOR-FXD .1UF +-20% 200WVDC CER	28480	0160-3670
A3A27C21	0132-0003	1	CAPACITOR-V TRMR-PSTN .7/3PF 350V	72982	535-016-4R
A3A27CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A27CR2	1901-0045	1		28480	1901-0045
A3A27CR3	1901-0028		DIODE-PRW RECT 400V 750MA DO-29	04713	SR1358-9
A3A27CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A27CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A27CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A27CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A27CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A27CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A27CR10	1901-0028		DIODE-PRW RECT 400V 750MA DO-29	04713	SR1358-9
A3A27CR11	1901-0028		DIODE-PRW RECT 400V 750MA DO-29	04713	SR1358-9
A3A27CR12	1901-0096	1	DIODE-SWITCHING 120V 50MA 100NS	28480	1901-0096
A3A27E1	1200-0185	20	INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A27E2	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A27E3	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A27E4	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A27F1	2110-0007	1	FUSE,1A 250V SLO-BLO 1.25X.25 IEC	08806	A1
A3A27L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A27L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A27L3	9140-0171	1	COIL-FXD MOLDED RF CHOKE 40UH 10%	06560	10608-1
A3A27L4	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A27L5	9100-1641		COIL-FXD MOLDED RF CHOKE 240UH 5%	24226	15/243
A3A27MP1	5040-6843		EXTRACTOR, P.C. BOARD, BLACK	28480	5040-6843
A3A27MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28430	5000-9043
A3A27MP3	2110-0269		FUSEHOLDER-CLIP TYPE .25 FUSE	91506	6008-32CN
A3A27MP4	2110-0269		FUSEHOLDER-CLIP TYPE .25 FUSE	91506	6008-32CN
A3A27MP5	1205-0050	10	HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0050
A3A27MP6	1205-0050		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0050
A3A27Q1	1853-0038	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A3A27Q2	1853-0010	20	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A27Q3	1854-0419	1	TRANSISTOR NPN SI TO-39 PD=1W FT=200MHZ	28480	1854-0419
A3A27Q4	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A27Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A27Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A27Q7	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A27Q8	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A27Q9	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A27Q10	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A27Q11	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A27Q12	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A27Q13	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A27Q14	1854-0433	1	TRANSISTOR NPN SI PD=90W FT=2MHZ	28480	1854-0433
A3A27R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A27R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A27R3	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A27R4	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A27R5	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A27R6	0757-0180	2	RESISTOR 31.6 1% .125W F TC=0+-100	24546	C5-1/4-T0-31R6-F
A3A27R7	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	24546	C5-1/4-T0-31R6-F
A3A27R8	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A27R9	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A27R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A27R11	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A27R12	2100-2650	1	RESISTOR-TRMR 200K 10% C TOP-ADJ 1-TURN	30983	ET50W204
A3A27R13	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A27R14	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3A27R15	0757-0485	1	RESISTOR 681K 1% .125W F TC=0+-100	24546	NA4
A3A27R16	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3A27R17	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A27R18	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A27R19	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3A27R2(	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A27R20	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A27R21	0757-0403	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A3A27R22	0683-2265		RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A3A27R23	0684-3941	1	RESISTOR 390K 10% .25W FC TC=-800/+900	01121	CB3941
A3A27R24	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A27R25	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A27R26	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A3A27R28	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A27R29	0698-3162	1	RESISTOR 46.4K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4642-F
A3A27R30	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A3A27R31	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A3A27R32	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3A27R33	0687-3911	1	RESISTOR 390 10% .5W CC TC=0+529	01121	EB3911
A3A27R34	0757-0412	1	RESISTOR 365 1% .125W F TC=0+-100	24546	C4-1/8-T0-365R-F
A3A27R35	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A3A27R36	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A27R37	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3A27R38	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3A27R39	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A27R40	2100-3253	2	RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-503
A3A27R41	2100-3252	1	RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-502
A3A27R42	2100-3253		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-503
A3A27R43	0757-0839	1	RESISTOR 10K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1002-F
A3A27R44	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A3A27R45	2100-3211	3	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-102
A3A27R46	2100-0558	3	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-203
A3A27R47	0698-3416	1	RESISTOR 21.5K 1% .5W F TC=0+-100	24546	NA6
A3A27R48	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3A27R49	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A27R50	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A27R51	2100-3214	1	RESISTOR-TRMR 100K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-104
A3A27R52	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A3A27R53	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3A27R54	0698-0094		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A27U1	1826-0167	1	IC CA3094AT SWITCH	02735	CA3094AT
A3A27VR1	1902-3357		DIODE-ZNR 56.2V 5% DO-7 PD=.4W TC=+.081%	04713	SZ 10939-398
A3A27VR2	1902-3333	1	DIODE-ZNR 46.4V 5% DO-7 PD=.4W TC=+.081%	04713	SZ 10939-374
A3A28	01334-66504	2	BOARD ASSEMBLY, DEFLECTOR AMPLIFIER	28480	01334-66504
A3A28C1	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A3A28C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A3A28C3	0160-3670		CAPACITOR-FXD .1UF +-20% 200WVDC CER	28480	0160-3670
A3A28C4	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A28C5	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A28C6	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A28C7	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A28C8	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A28C9	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3A28C10	0160-3447	2	CAPACITOR-FXD 470PF +-10% 1000WVDC CER	56289	C016B102F471KS25-CDH
A3A28C11	0160-2236	4	CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A3A28C12	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A3A28C13	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	56289	8101F103ZS25-CDH
A3A28C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	56289	8101F103ZS25-CDH
A3A28C15	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	56289	8101F103ZS25-CDH
A3A28C16	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	56289	8101F103ZS25-CDH
A3A28C17	0160-3670		CAPACITOR-FXD .1UF +-20% 200WVDC CER	28480	0160-3670
A3A28C18	0160-3670		CAPACITOR-FXD .1UF +-20% 200WVDC CER	28480	0160-3670
A3A28CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A28CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A28CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3A28E1	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28E2	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28E3	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28E4	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28E5	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28E6	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28E7	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28E8	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A3A28L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A28L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A28L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A3A28MP1	5040-6843		EXTRACTOR, P.C. BOARD, BLACK	28480	5040-6843
A3A28MP2	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A3A28MP3	1205-0050		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0050
A3A28MP4	1205-0050		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0050
A3A28MP5	1205-0050		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0050
A3A28MP6	1205-0050		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0050
A3A28Q1	1853-0232	4	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A3A28Q2	1854-0523	4	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A3A28Q3	1854-0523		TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A3A28Q4	1853-0232		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A3A28Q5	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A28Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A28Q7	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A28Q8	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A28Q9	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A28Q10	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A28Q11	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A28Q12	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A28Q13	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A28Q14	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A28Q15	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3A28R1	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A28R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A28R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A28R4	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A28R5	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A3A28R6	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A28R7	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A28R8	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A28R9	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A28R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A28R11	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3A28R12	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A3A28R13	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A3A28R14	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A28R15	2100-0558		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-203

Table D2-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A28R16	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3A28R17	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A28R18	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A28R19	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A28R20	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A3A28R21	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A3A28R22	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3A28R23	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A3A28R24	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A3A28R25	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A3A28R26	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A3A28R27	2100-0567	2	RESISTOR-TRMR 2K 10% C TOP-ADJ	32997	3386P-Y46-202
A3A28R28	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A3A28R29	2100-3211		RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-102
A3A28R30	0698-3415	4	RESISTOR 19.6K 1% .5W F TC=0+-100	24546	NA6
A3A28R31	0698-3415		RESISTOR 19.6K 1% .5W F TC=0+-100	24546	NA6
A3A28R32	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A28R33	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3A28R34	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A28R35	0757-0851	4	RESISTOR 43.2K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-4322-F
A3A28R36	0757-0851		RESISTOR 43.2K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-4322-F
A3A28R37	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3A28R38	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A28R39	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A28R40	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A28R41	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3A28R42	0757-0873	4	RESISTOR 1.62K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1624-F
A3A28R43	0757-0873		RESISTOR 1.62K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1624-F
A3A29	01334-66504	2	BOARD ASSEMBLY, DEFLECTOR AMPLIFIER SAME AS A3A28, USE PREFIX A3A29	28480	01334-66504
A3A30	01334-66505	1	BOARD ASSEMBLY, MOTHER	28480	01334-66505
A3A30C1	0180-1807	1	CAPACITOR-FXD 290UF+50-10% 200VDC AL	56289	32D291F200AB2A
A3A30C2	0180-0455	1	CAPACITOR-FXD .0425F+100-10% 15VDC AL	28480	0180-0455
A3A30C3	0180-2495		CAPACITOR-FXD 8700UF+75-10% 40 VDC AL	56289	36D872G040AC2A
A3A30C4	0180-2181	1	CAPACITOR-FXD 1300UF+75-10% 50 VDC AL	56289	36D132G050AA2A
A3A30C5	0180-2495	2	CAPACITOR-FXD 8700UF+75-10% 40VDC AL	56289	36D872G040AC2A
A3A30E1	0360-1788	14	TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E2	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E3	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E4	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E5	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E6	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E7	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E8	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E9	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E10	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E11	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E12	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E13	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E14	0360-1788		TERMINAL-STUD SGL-PIN WELDED-MTG	28480	0360-1788
A3A30E15	0380-0383	14	STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E16	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E17	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E18	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E19	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E20	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E21	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E22	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E23	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E24	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E25	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E26	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E27	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30E28	0380-0383		STANDOFF-RVT-ON .125LG 6-32THD .2500 BRS	28480	0380-0383
A3A30J1	1200-0473	2	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0473
A3A30J2	1200-0473		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0473
A3A30J3	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A3A30R1	0699-0002	1	RESISTOR 6.8 10% .5W CC TC=0+412	01121	EB68G1
A3A30XA27	1251-2034	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	71785	252-10-30-300
A3A30XA28	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300
A3A30XA29	1251-2035		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	252-15-30-300

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
1	5060-9835	1	TOP COVER, STANDARD	28480	5060-9835
2	5060-9899	2	FRONT HANDLE ASSY	28480	5060-9899
3	5020-8896	2	TRIM,FRONT HANDLE	28480	5020-8896
4	5020-8874	2	RACK MOUNT FLANGE (WITH FRONT HANDLES)	28480	5020-8874
5	5060-9847	1	BOTTOM COVER, STANDARD	28480	5060-9847
6	5061-1908	2	COVER, SIDE	28480	5061-1908
7	5060-9804	2	STRAP HANDLE ASSY, 18 INCH	28480	5060-9804
8	08505-20155	1	UPPER LEFT CABINET BRACKET	28480	08505-20155
9	2360-0196	2	SCREW-MACH 6-32 .375-IN-LG 100 DEG	28480	2360-0196
10	08505-20157	1	UPPER RIGHT CABINET BRACKET	28480	08505-20157
11	5040-7207	2	REAR CAP, STRAP HANDLE	28480	5040-7207
12	0570-1170	4	SCREW-STRAP, HANDLE	28480	0570-1170
13	5040-7206	2	FRONT CAP, STRAP HANDLE	28480	5040-7206
14	5040-7221	4	FOOT, REAR STAND-OFF	28480	5040-7221
15	01334-00202	1	PANEL, LEFT FRONT	28480	01334-00202
16	01332-61602	1	BEZEL, CRT	28480	01332-61602
17	0370-0607	4	BEZEL, BLACK SQUARE	28480	0370-0607
18	01334-00203	1	PANEL, DRESS	28480	01334-00203
19	01334-00201	1	PANEL, SUB-FRONT	28480	01334-00201
20	5040-8807	7	KNOB, DISPLAY FRONT PANEL	28480	5040-8807
21	7120-4712	16	LABEL-PB .234-LG .133-WD .003-THK	28480	7120-4712
22	7120-4716	2	LABEL-PB LEG=REF .234-LG .133-WD	28480	7120-4716
23	2200-0116	1	SCREW-MACH 4-40 .75-IN-LG 82 DEG	28480	2200-0116
24	08505-20029	1	WINDOW	28480	08505-20029
25	5040-6937	2	WINDOW CLIP	28480	5040-6937
26	7120-4715	2	LABEL-PB LEG=MKR .234-LG .133-WD	28480	7120-4715
27	5040-6927	1		28480	5040-6927
28	08505-00001	1	PANEL, FRONT	28480	08505-00001
29	08505-00002	1	PANEL, SUB	28480	08505-00002
30	5040-8805	2		28480	5040-8805
31	7120-4713	3	LABEL-PB LEG=2RD .234-LG .133-WD	28480	7120-4713
32	7120-4714	3	LABEL-PB LEG=CLR .234-LG .133-WD	28480	7120-4714
33	1410-0571	2	BUSHING-PNL .136-ID .25-LG 1/4-32-THD	28480	1410-0571
34	86701-20001	1	DIVIDER, FRONT FRAME	28480	86701-20001
35	0370-0683	4	PUSHBUTTON, CLIVE BLACK	28480	0370-0683
36	0380-0623	2	SPACER-HEX .75LG 1/4-32THD .312A/F BRS	28480	0380-0623
36A	5001-1041	1	FILTER, RFI	28480	5001-1041
36B	01332-02707	1	SAFETY SHIELD	28480	01332-02707
37	01334-00204	1	PANEL, FRONT, MAIN	28480	01334-00204
38	5020-8804	1	REAR FRAME	28480	5020-8804
39	01334-01207	1	BRACKET, RELAY	28480	01334-01207
40	2360-0115	15	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0115
41	08505-00059	1	BRACKET, P.C. GUIDE	28480	08505-00059
42	01334-00604	1	SHIELD, CRT	28480	01334-00604
43	0380-0745	5	STANDOFF-RVT-ON .187LG 6-32THD .250D BRS	06540	95328-8-0632-3A
44	01334-01204	1	BRACKET, I/O	28480	01334-01204
45	2360-0113	39	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	28480	2360-0113
46	08505-00071	1	COVER ASSY, RF	28480	08505-00071
47	08505-00005	1	COVER, SHIELD ASSY, EXTRUSION	28480	08505-00005
48	0624-0349	61	SCREW-TPG 4-20 .375-IN-LG HEX WSHR-HD	93907	224-07850-012
49	08505-00004	1	BRACKET, P.C. GUIDE	28480	08505-00004
50	5020-8803	1	FRONT FRAME	28480	5020-8803
51	5040-7202	1		28480	5040-7202
52	01334-04101		TOP TRIM, FRONT FRAME	28480	01334-04101
53	01334-04102	1	GUARD, H.V.	28480	01334-04102
54		2	NOT ASSIGNED		
55	0362-0227	13	TERMINAL-CRP QDISC FEM 30-24AWG	28480	0362-0227
56	2360-0197	4	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	28480	2360-0197
57	3050-0066	9	WASHER-FL MTLC NO.-6 .147-IN-ID	28480	3050-0066
58	2190-0018	4	WASHER-LK HLCL NO.-6 .141-IN-ID	28480	2190-0018
59	1400-0023	2	CLAMP-CA .5-IN-WD NYL	28520	3329
60	5040-7783	1	SUPPORT, CRT SHIELD	28480	5040-7783
61	01334-01206	1	CLAMP, CRT SHIELD	28480	01334-01206
62	2360-0139	2	SCREW-MACH 6-32 2-IN-LG PAN-HD-POZI	28480	2360-0139
63	3050-0105		WASHER-FL MTLC NO.-4 .125-IN-ID	28480	3050-0105
64	2190-0019	2	WASHER-LK HLCL NO.-4 .115-IN-ID	28480	2190-0019
65	0362-0265	2	TERMINAL-CRP QDISC FEM 0.075-TAB	28480	0362-0265
66	01334-01203	1	BRACKET, TRANSFORMER, BOTTOM	28480	01334-01203
67	01334-01202	1	BRACKET, TRANSFORMER, RIGHT	28480	01334-01202
68	01334-01201	1	BRACKET, TRANSFORMER, LEFT	28480	01334-01201
69	0390-0006	4	INSULATOR-BSHG-FLG .173-ID	73734	103304
70	08505-20132	1	END PLATE	28480	08505-20132
71	08505-20133	7	CKT ENCLOSURE	28480	08505-20133
72	2510-0192	27	SCREW-MACH 8-32 100 DEG FL HD POZI REC	04866	YELLOW PATCH
73	08505-00003	2	SLIDE, FRONT PANEL	28480	08505-00003
74	2200-0101	4	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	28480	2200-0101
	08505-00041	2	BOARD ASSEMBLY,15 POSITION EXTENDER	28480	08505-00041
	3050-0105	8	WASHER-FL MTLC NO.-4 .125-IN-ID	28480	3050-0105

Figure D2-1. A3 Signal Processor Mechanical Parts Location (1 of 4)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
76	08505-20021	1	HEAT SINK	28480	08505-20021
	08505-60042	22	CARD ASSEMBLY, 18 POSITION EXTENDER	28480	08505-60042
77	4040-1001	18		28480	4040-1001
78	08505-40006	18	REFLECTOR-S91	28480	08505-40006
79	08505-00062	1	BRACKET	28480	08505-00062
80	08505-00073	1	LOCK BRACKET	28480	08505-00073
81	0380-0003	3	STANDOFF-RND .125LG .181D .250C BRS NI	28480	0380-0003
82	2360-0192	8	SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0192
83	1400-0017	1	CLAMP-CA .375-IN-WD NYL	28520	3305,
84	2360-0195	1	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0195
85	2200-0103	15	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
86	01334 01205	1	SHIELD, X-Y-Z- BRACKET	28480	01334-01205
87	01334-006C1	2	SHIELD, X-Y-Z- SEPARATOR	28480	01334-00601
88	01334-00103	1	DIVIDER, CENTER	28480	01334-00103
89	2420-0003	1	NUT-HEX-DBL-CHAM 6-32-THD .094-THK	28480	2420-0003
90	0510-0558	2	RETAINER-PUSH ON RND .125-DIA PSVT SST	28480	0510-0558
91	2680-0128	2	SCREW-MACH 10-32 .25-IN-LG PAN-HD-POZI	28480	2680-0128
92	3050-0002	10	WASHER-FL MTLC NO.-10 .203-IN-ID	28480	3050-0002
93	3050-0676	2	WASHER-SPCLY NO. 5/16 .325 IN ID .562 IN	28480	3050-0676
94	1400-0774	1	CLAMP-CA .75-IN-WD PVC	06915	KKU-6
95	01334-00101	1	DECK, MAIN	28480	01334-00101
96	2360-0119	3	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	28480	2360-0119
97	0360-0353	10	TERMINAL-LUG-SLDR 6 SCR .144/.144 ID	79963	176
98	0361-0008	10	RIVET:SEMITUBULAR, OVAL HEAD	00000	OBD
99	0360-0001	1	TERMINAL-LUG-SLDR 6 SCR .141/.086 ID	78452	920
100	08505-00039	1	COVER, PLATE, REAR PANEL	28480	08505-00039
101	08505-00043	1	FILTER, HOUSING	28480	08505-00043
102	5060-9421	1	ASSY:POWER MODULE	28480	5060-9421
103	2190-0016	7	WASHER-LK INTL T NO.-3/8 .377-IN-ID	78189	1920-02
104	2950-0001	7	NUT-HEX-DBL-CHAM 3/8-32-THD .094-THK	12697	20/4-13
105	1251-2992	2	CONTACT-CONN FEM CRP .045-CONT-SZ	27264	08-50-0108
107	0610-0001	2	NUT-HEX-DBL-CHAM 2-56-THD .062-THK	28480	0610-0001
108	01334-00205	1	PANEL, REAR	28480	01334-00205
109	1251 0218	4	LOCK-SUBMIN D CONN	71785	D-53018
110	2200-0105	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	28480	2200-0105
112	5020-8837	4	CORNER STRUT W/O TAPPED HOLES	28480	5020-8837
113	08505-20038	4	PIN, SLIDE	28480	08505-20038
114	3050-0692	4	WASHER-FL MTLC NO.-10 .202-IN-ID	28480	3050-0692
115	3050-0253	4	WASHER-SPR CRVD NO.-10 .195-IN-ID	78189	3502-10-25-0541
116	0510-0045	4	RETAINER-RING .188-DIA CD PL STL	0018A	1500-18-CD
117	01334-00602	1	SHIELD, X-Y-Z- BASE	28480	01334-00602

Figure D2-1. A3 Signal Processor Mechanical Parts Location (2 of 4)

FIG. P2-1 (3 OF 4)
SHT. 1 OF 3

A3 FRONT VIEWS

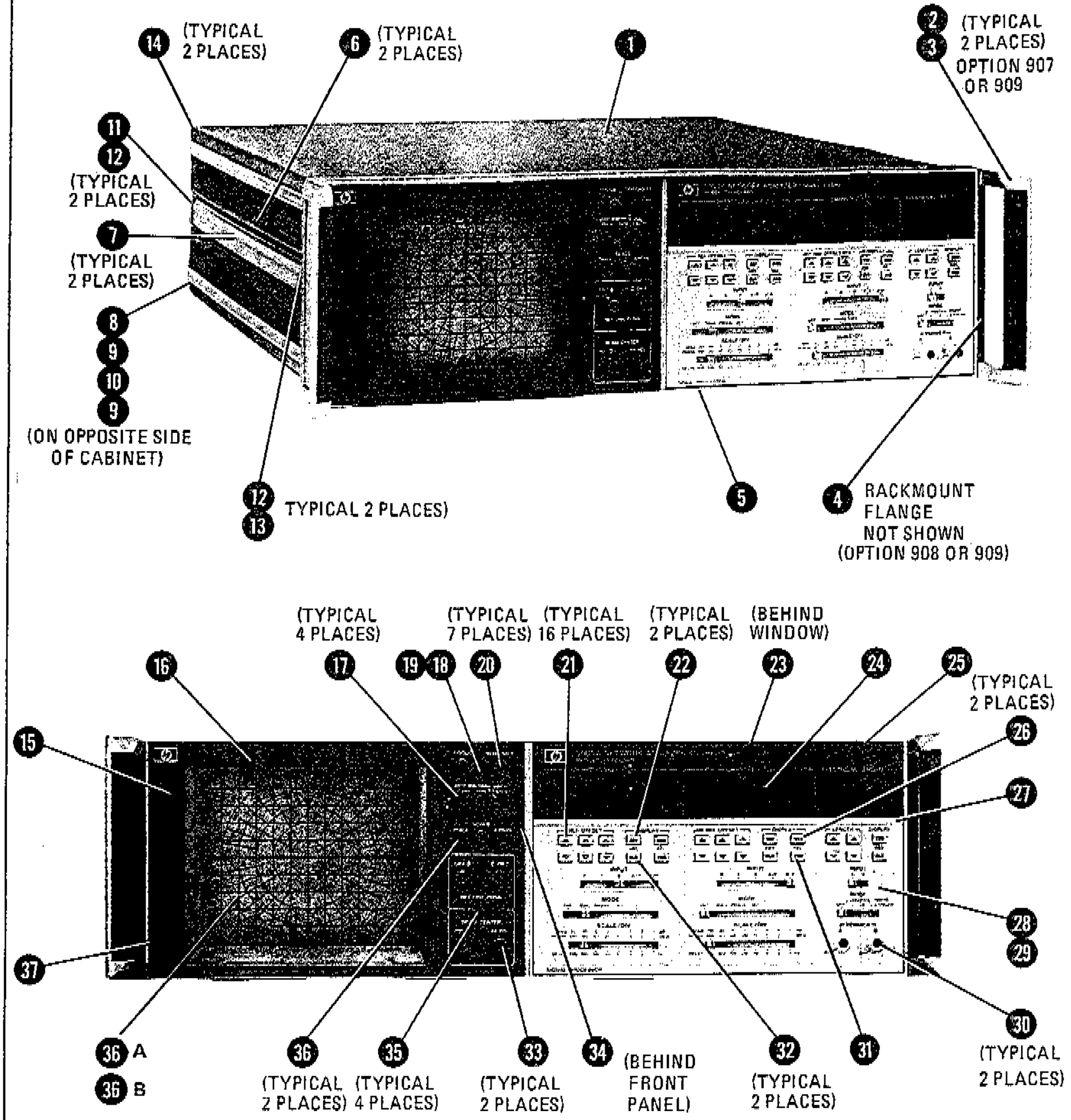


FIG. D2-1 (3 OF 4)
SHT. 2 OF 3

A3 TOP VIEW WITH TOP COVER REMOVED

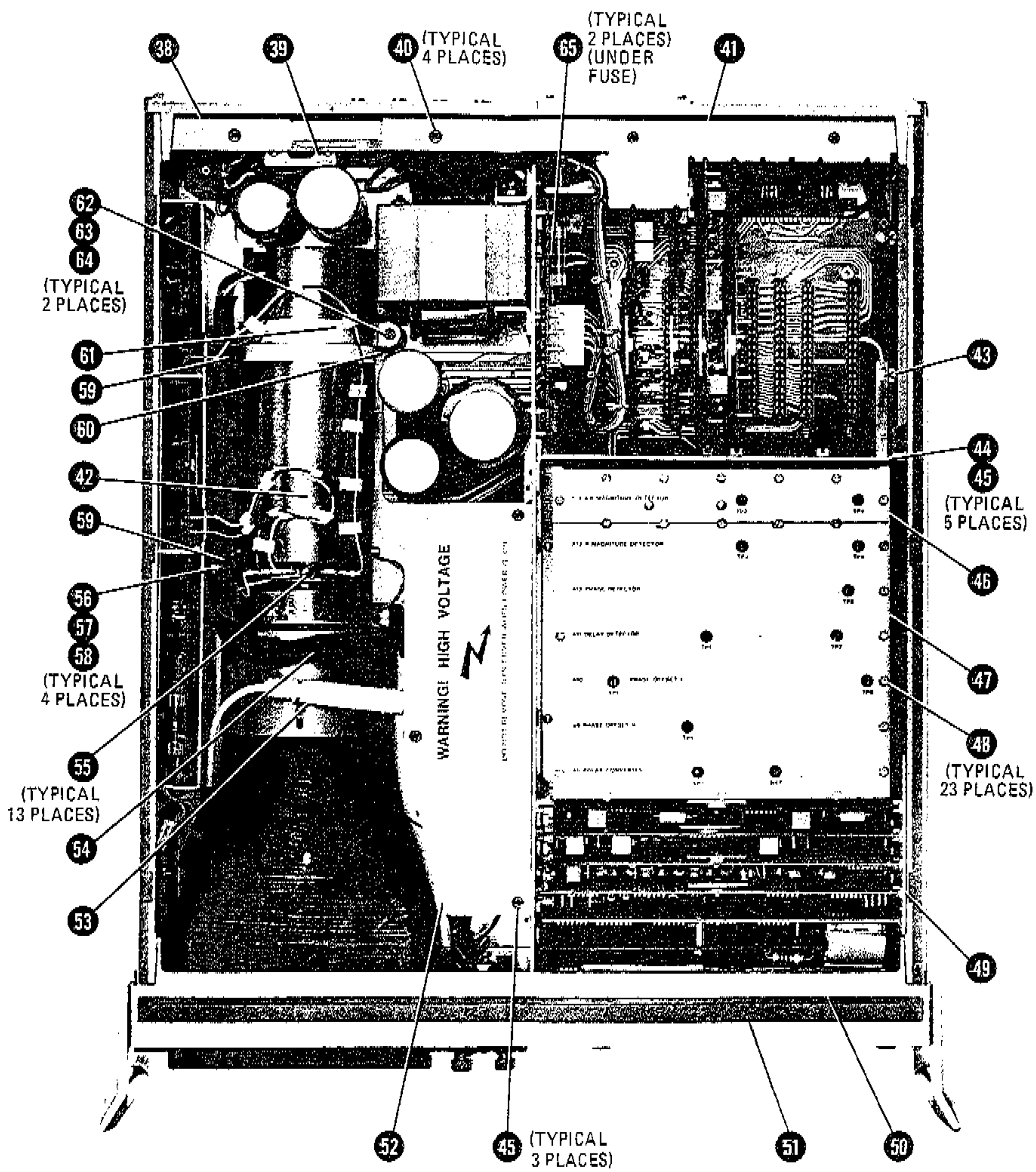


FIG. D2-1 (3 OF 4)
SHT. 3 OF 3

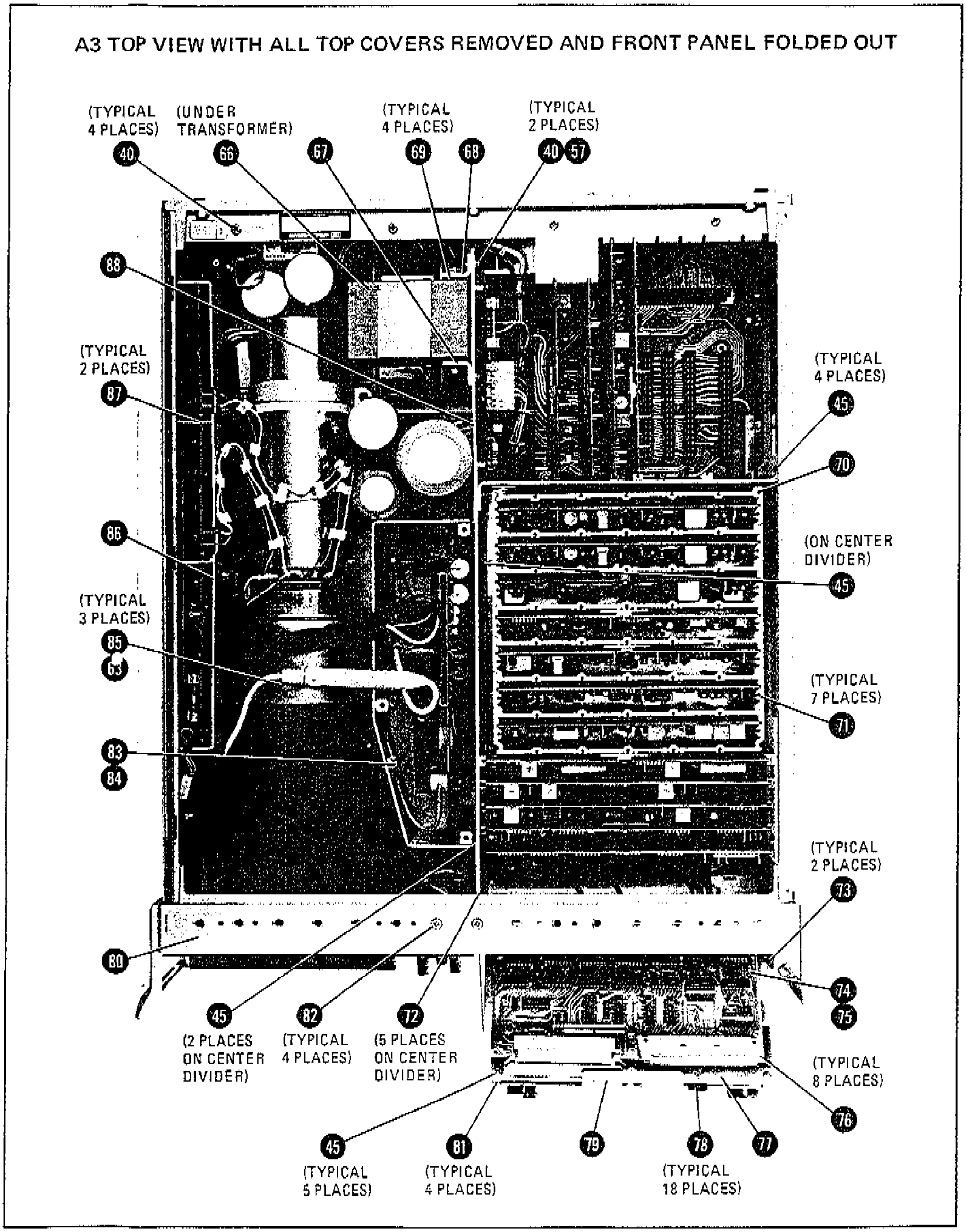


Figure D2-1. A3 Signal Processor Mechanical Parts Location (3 of 4)

FIG. D2-1 (4 OF 4)
SHT. 1 OF 3

A3 BOTTOM VIEW WITH BOTTOM COVER REMOVED

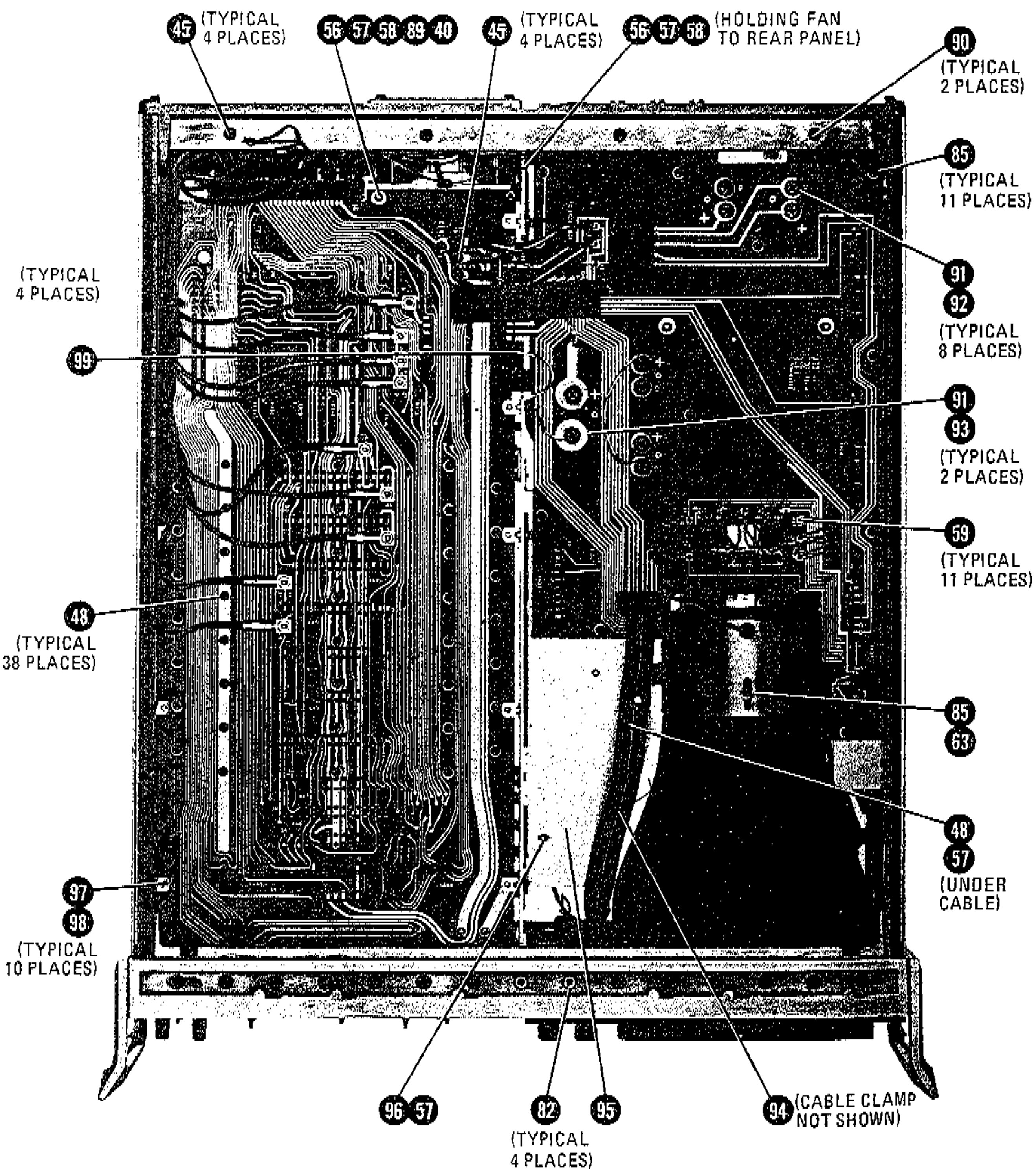


FIG. D2-1 (4 OF 4)
SHT. 2 OF 3

A3 REAR VIEW

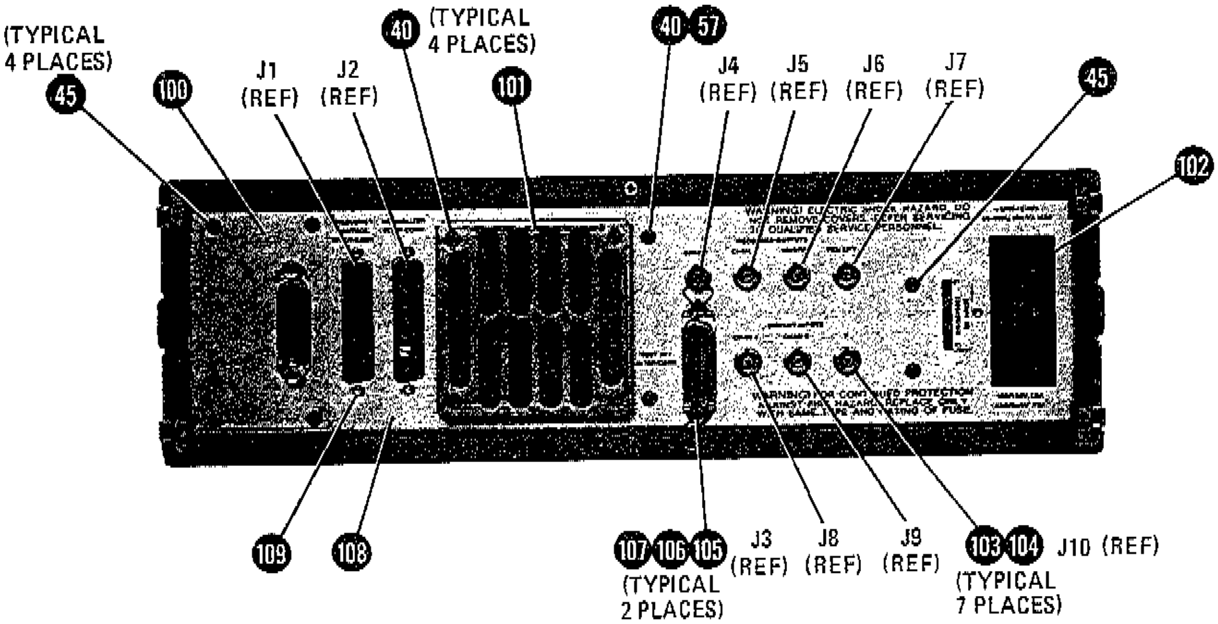
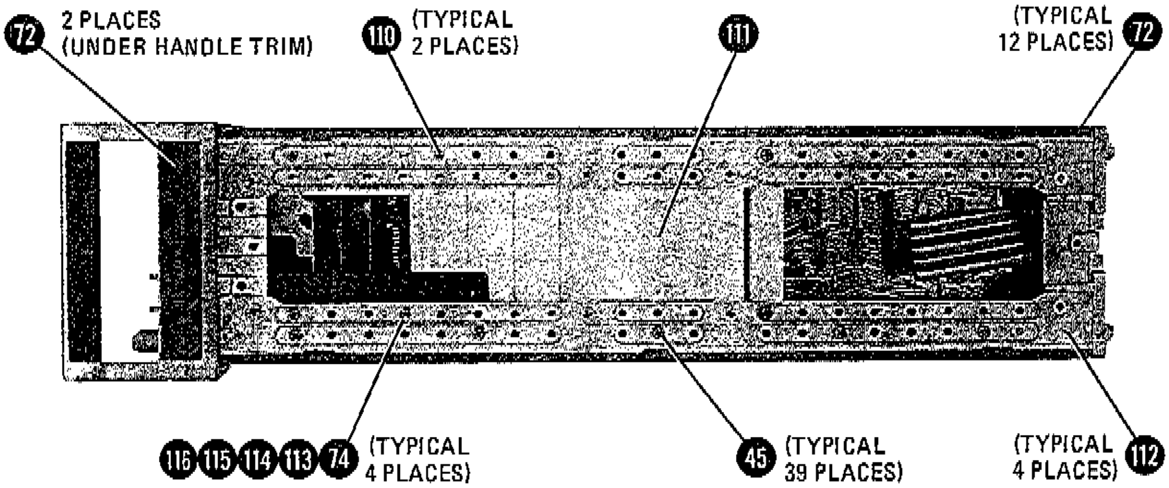


FIG. D2-1 (4 OF 4)
SHT. 3 OF 3

A3 RIGHT SIDE VIEW WITH SIDE COVER REMOVED



A3 LEFT SIDE VIEW WITH SIDE COVER REMOVED

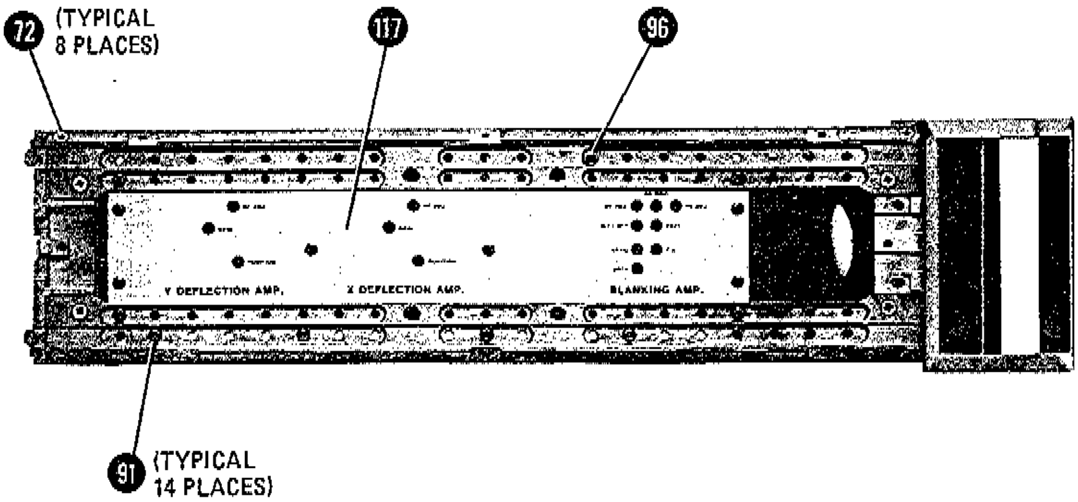


Figure D2-1. A3 Signal Processor Mechanical Parts Locations (4 of 4)

Table D2-3. Code List of Manufacturers

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
GM005	DEUTSCHE VITROHM GMBH AND CO.	GERMANY	
00000	U.S.A. COMMON	ANY SUPPLIER OF THE U.S.A.	
0018A	AR TECH PACKAGING CORP	LOWELL MA	01854
00779	AMP INC	HARRISBURG PA	17105
00865	STETTNER-TRUSH INC	CAZENOVIA NY	13035
01121	ALLEN-BRADLEY CO	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02114	FERROXCUBE CORP	SAUGERTIES NY	12477
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03877	TRANSITRON ELECTRONIC CORP	WAKEFIELD MA	01880
03888	KDI PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
04866	NYLOK-DETROIT CORP	TROY MI	48084
06540	AMATOM ELEK HARDWARE DIV OF MITE	NEW ROCHELLE NY	10802
06560	AIRCO SPEER ELEK DIV AIR RDCN CO	NOGALES AZ	85621
06776	ROBINSON NUGENT INC	NEW ALBANY IN	47150
06915	RICHCO PLASTIC CO	CHICAGO IL	60646
07088	KELVIN ELECTRIC CO	VAN NUYS CA	91401
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
08806	GE CO MINIATURE LAMP PROD DEPT	CLEVELAND OH	44112
09023	CORNELL-DUBILIER ELEK DIV FED PAC	SANFORD NC	27330
11236	CTS OF BERNE INC	BERNE IN	46711
12697	CLAROSTAT MFG CO INC	DOVER NH	03820
13103	THERMALLOY CO	DALLAS TX	75247
14140	EDISON ELEK DIV MCGRAW-EDISON	MANCHESTER NH	03130
14298	AMERICAN COMPONENTS INC SUB INSILCO	CONSHOHOCKEN PA	19428
16299	CORNING GL WK ELEC CMPNT DIV	RALEIGH NC	27604
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
20940	MICRO-OHM CORP	EL MONTE CA	91731
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS IN	46227
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
27264	MOLEX PRODUCTS CO	DOWNERS GROVE IL	60515
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
28520	HEYMAN MFG CO	KENILWORTH NJ	07033
30983	MEPCO/ELECTRA CORP	SAN DIEGO CA	92121
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
34649	INTEL CORP	MOUNTAIN VIEW CA	94040
4G819	OVERLAND PRODUCTS CO	FREMONT NE	68025
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
71400	BUSSMAN MFG DIV OF MCGRAW-EDISON CO	ST LOUIS MO	63017
71785	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VILLAGE IL	60007
72136	ELECTRO MOTIVE MFG CO INC	WILLIMANTIC CT	06226
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE PA	16512
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON CA	92634
73734	FEDERAL SCREW PRODUCTS CO	CHICAGO IL	60618
74276	SIGNALITE INC	NEPTUNE NJ	07753
76381	3M COMPANY	ST PAUL MN	55101
76530	TRW ELEK CMPNT CINCH-MONADNOCK DIV	CITY OF INDUSTRY CA	91747
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN IL	60126
78452	EVERLOCK CHICAGO INC	CHICAGO IL	60622
79727	C-W INDUSTRIES	WARMINSTER PA	18974
79963	ZIERICK MFG CO	MT KISCO NY	10549
84048	TRW INC ST PETERSBURG DIV	ST PETERSBURG FL	33702
84411	TRW CAPACITOR DIV	OGALLALA NE	69153
91506	AUGAT INC	ATTLEBORO MA	02703
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601
93907	CAMCAR SCREW & MFG CO	ROCKFORD IL	61101
98291	SEALECTRO CORP	MAMARONECK NY	10544

CHAPTER D
SIGNAL PROCESSOR

SECTION III
SERVICE

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE

DESCRIPTION:

This troubleshooting procedure checks the overall operation of Signal Processor Assembly A3. Initial "turn-on" indications are checked and the CRT display is calibrated. The CRT display is checked for correct Marker display and correct operation of the front-panel annunciator lights is verified. Magnitude, phase, and group delay measurements are then made and the front-panel controls are exercised for each mode of operation. When an incorrect indication occurs, the problem is identified and the troubleshooting procedure for isolation of the trouble to the subassembly level is indicated.

TEST SETUP:

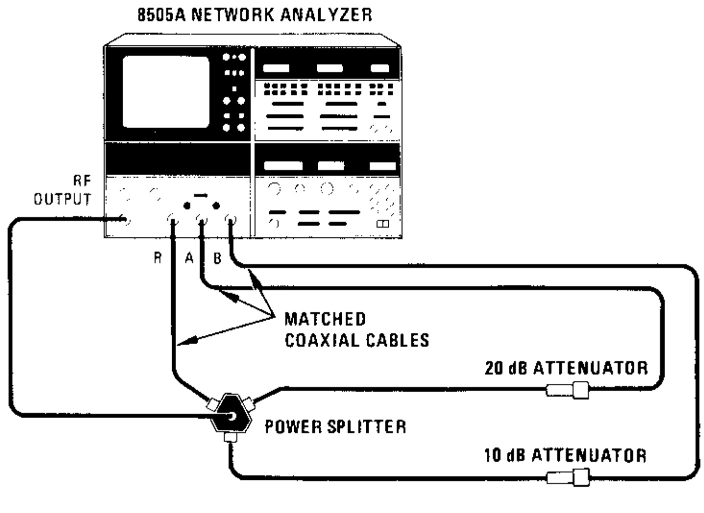


Figure D3-1. Signal Processor Troubleshooting Test Setup (Magnitude)

EQUIPMENT:

Power Splitter	HP 11850A
Matched Cable Kit	HP 11851A
20 dB Attenuator	HP 8491B Option 020
10 dB Attenuator	HP 8491B Option 010
20 cm Air Line	HP 11567A
10 cm Air Line	HP 11566A
15.24 plus Meters (50 plus feet) of Coaxial Cable	

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

CRITICAL 8505A SWITCH SETTINGS:

A1 Source/Converter:

OUTPUT LEVEL	–10 dBm
INPUT LEVEL	–10 dBm

A2 Frequency Controller:

RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	800 MHz
ΔF Frequency	100 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Clockwise
TRIGGER	AUTO
MARKERS select	1
MARKER 1 position	Centered on CRT trace

A3 Signal Processor:

Channel 1:

INPUT	R
MODE	MAG
SCALE/DIV	10 dB

Channel 2:

INPUT	R
MODE	MAG
SCALE/DIV	10 dB

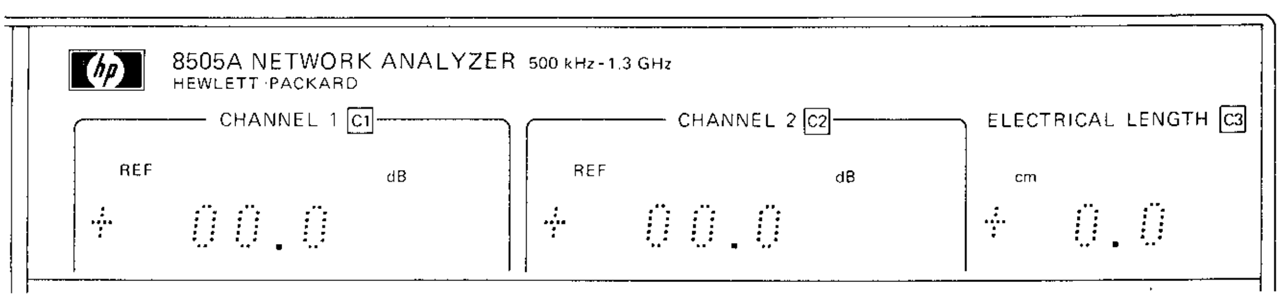
Electrical Length:

INPUT	A
MODE	LENGTH x
A and B verniers	Fully Counterclockwise

PROCEDURE:

Initial Turn-on Check

a. Connect equipment as shown in Figure D3-2 and set 8505A LINE switch to ON. Check front-panel indicators for the following indications:



D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

Possible troubles and their causes:

1. All the front-panel indicators are blanked. This is probably a power supply problem; refer to Figure D3-53 and check A3A24 Regulator Assembly outputs (+5V, +15V, −15V, +100V).

2. One or more of the digital readouts do not indicate zero. Depress DISPLAY REF and CLR pushbuttons to zero incorrect display. If digital readout still does not indicate zero, there is a problem with the digital logic.

3. Minor problems such as an LED being blanked or partially blanked, decimal point incorrectly placed or an annunciator light indication being incorrect are probably caused by the respective LED or its driver circuitry.

CRT Display Check

b. Check the operation of the CRT Display section as follows:

1. A swept trace, 12 divisions wide, should be displayed on the CRT for both Channel 1 and 2 (Adjustment of INTENsity or CH 1 and CH 2 vertical position controls may be necessary). If neither channel is displayed, the trouble is probably in the blanking or high voltage supply circuitry. Refer to Paragraph D3-2 for further troubleshooting. If only one of the channels is displayed, perform the troubleshooting procedure in Paragraph D3-2 for the channel not displayed.

2. The CRT trace should be displayed when the REF LINE POSN pushbutton is depressed and the retrace should be blanked when the REF LINE POSN pushbutton is released. If the blanking is incorrect, refer to Paragraph D3-2 for further troubleshooting.

3. CH 1 and CH 2 vertical position controls should be able to adjust the respective reference line (retrace) over the full ten vertical divisions of the graticule display. If not, refer to Paragraph D3-2 for further troubleshooting.

4. A clockwise rotation of the SCALE control should illuminate the CRT graticule display. If not, the trouble is in A3V1 CRT Assembly or its control inputs. Check that the voltage on A3A25 pin 11 can be varied with the SCALE control.

CRT Marker Display

c. Check for the correct CRT Marker display as follows:

1. The number of markers displayed on each channel should agree with the MARKERS select switch position. If not, the trouble is probably in A3A17 Marker I Assembly or the A2 Frequency Controller.

2. Markers should be diamond shaped with the marker selected extending above the CRT trace and the remaining markers displayed below the CRT trace. If not, the trouble is probably in the A3A17 Marker I Assembly or the A2 Frequency Controller.

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

Annunciator Light Check

d. Check Channel 1 and 2 front panel annunciator lights for each MODE switch position as shown below.

MODE	OFF	MAG	PHASE	DLY	POLAR MAG	POLAR PHASE
Annunciator Indication	Blanked	REF dB	REF DEG	REF ns	REF dB	REF DEG

NOTE

The digital readout is blanked and the CRT display is invalid for PHASE, DLY and POLAR MODE switch positions when the INPUT switch is in R, A or B position.

Rectangular Magnitude Check

e. Set Channel 1 and 2 reference lines on the center horizontal graticule line, then press and release the REF LINE POSN pushbutton to release the switch and blank the reference line. Set Channel 1 and 2 MODE switches to the MAG position and depress DISPLAY MKR CLR pushbuttons for both channels. Check that Channel 1 and 2 annunciator lights indicate MKR dB.

f. Check Channel 1 and 2 CRT displays and digital readouts for each INPUT switch position as shown below.

NOTE

If the absolute values of R, A or B vary greater than 5 dB from those given, and the A/R and B/R indications are correct, the RF OUTPUT LEVEL is probably incorrect. Refer to Paragraph B3-1 for further troubleshooting.

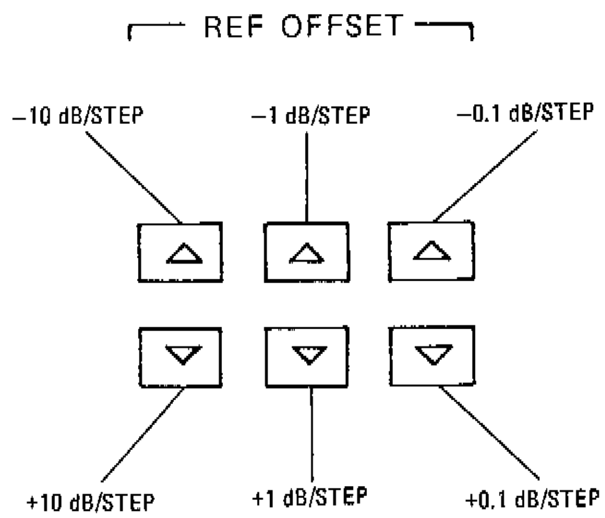
DISPLAY	INPUT				
	R	A	B	A/R	B/R
CRT (Divisions from Center Reference)	–2	–4	–3	–2	–1
Digital Readout dB	–20	–40	–30	–20	–10

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

g. Check that Channel 1 and 2 REF OFFSET pushbuttons step the CRT displays and digital readouts as shown below. If the offsets step incorrectly, refer to Paragraph D3-3 for further troubleshooting.

NOTE

If a REF OFFSET pushbutton is held depressed, the CRT display and digital readout should continue stepping until the pushbutton is released.



h. Depress Channel 1 and 2 DISPLAY CLR pushbuttons and ensure the CRT display and digital readouts return to the indications obtained in step f. If the stored offsets do not clear, refer to Paragraph D3-3 for further troubleshooting.

i. Depress Channel 1 and 2 DISPLAY ZRO pushbuttons and ensure the CRT display moves to the center horizontal graticule line (reference) and the digital readouts indicate 00.0 dB REL. If not, refer to Paragraph D3-3 and check that the corresponding V OFFSET voltage is of correct polarity and magnitude to cancel out the reading obtained in step f.

j. Check Channel 1 and 2 resolution control by using the REF OFFSET pushbuttons to set the marker base on the CRT bottom horizontal graticule line for each SCALE/DIV switch position and checking for the correct digital readout as shown below. If the digital readout is incorrect, the trouble is probably in A3A7 Resolution Control Assembly or its control inputs. Refer to Paragraph D3-3 to verify operation of the Resolution Control Assembly.

SCALE/DIV MAG	20	10	5	2	1	.5	.2	.1
Digital Readout dB	−100	−50.0	−25.0	−10.0	−5.00	−2.50	1.00	0.50

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

PHASE TEST SETUP:

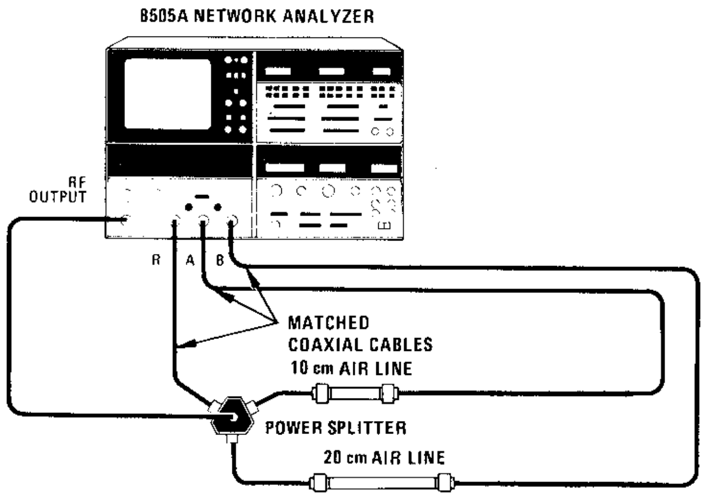


Figure D3-1A. A3 Signal Processor Troubleshooting Test Setup (Phase)

k. Connect equipment as shown in Figure D3-1A and set the 8505A controls as follows:

A1 Source Converter:

OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm

A2 Frequency Controller:

RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	1000 MHz
ΔF Frequency	0 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Counterclockwise
TRIGGER	AUTO
MARKERS Select	1
MARKER 1 position	Centered on CRT trace

A3 Signal Processor:

Channel 1:

INPUT	A/R
MODE	PHASE
SCALE/DIV	90 degrees

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

Channel 2:
- INPUT . . . . A/R
- MODE . . . . PHASE
- SCALE/DIV . . . . 90 degrees

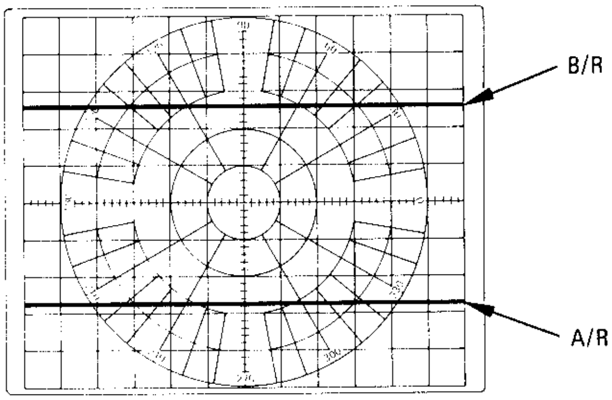
Electrical Length:
- INPUT . . . . As Required
- MODE . . . . Length x
- A and B Verniers . . . . Fully Counterclockwise

Rectangular Phase Check

1. Set Channel 1 and 2 reference lines on the center horizontal graticule line. Depress Channel 1 and 2 DISPLAY MKR and CLR pushbuttons. Check Channel 1 and 2 CRT display and digital readouts for both of the ratio INPUT switch positions shown below. If only the CRT display, or both the CRT display and digital readouts, are incorrect, refer to Paragraph D3-4 for further troubleshooting. If only the digital readout is incorrect, refer to Paragraph D3-7 and check the marker operation.

	A/R	B/R
Digital Readout	–124 DEG ±15 DEG	+116 DEG ±15 DEG

CRT DISPLAY

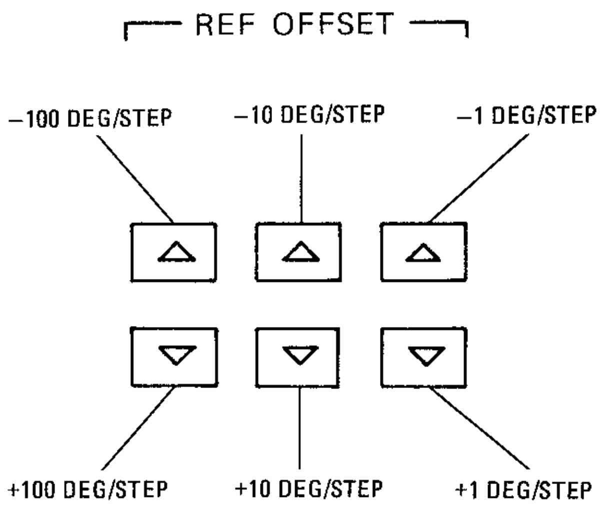


D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

m. Check that Channel 1 and 2 REF OFFSET pushbuttons step the respective digital readout and CRT display as shown below. If the offsets step incorrectly, refer to Paragraph D3-4 for further troubleshooting.

NOTE

If a REF OFFSET pushbutton is held depressed, the CRT display and digital readout should continue stepping until the pushbutton is released.



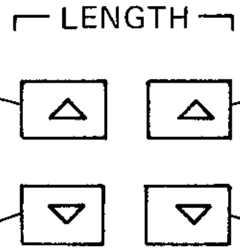
n. Check operation of the Electrical Length section for a CW frequency of 1000 MHz according to the procedure below. If a problem occurs, the trouble is probably in the A3A5 Processor Assembly or its control inputs. Refer to Paragraph D3-7 for further troubleshooting.

1. Check that the LENGTH pushbuttons step the Electrical Length digital readout as shown below.

NOTE

If a LENGTH pushbutton is held depressed, the Electrical Length digital readout should continue stepping until the pushbutton is released.

MODE	CHANGE/STEP
LENGTH x1	–1 cm
LENGTH X10	–10 cm
PHASE	–10



MODE	CHANGE/STEP
LENGTH x1	–0.1 cm
LENGTH X10	–1 cm
PHASE	–1

MODE	CHANGE/STEP
LENGTH x 1	+1 cm
LENGTH X10	+10 cm
PHASE	+10

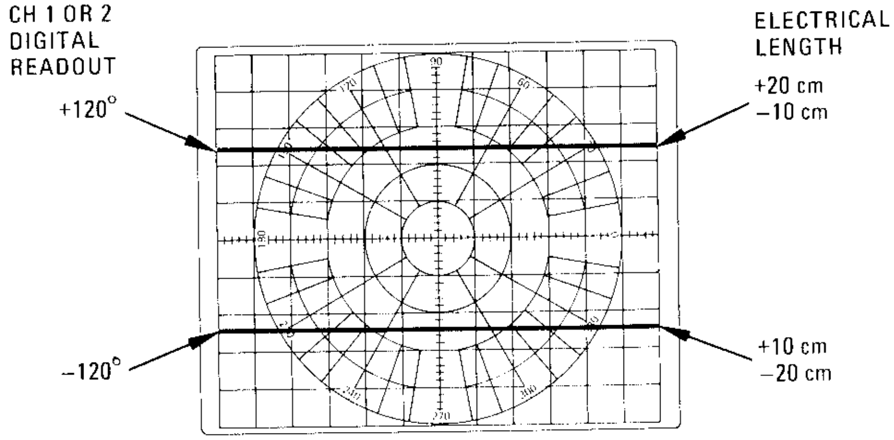
MODE	CHANGE/STEP
LENGTH x1	+0.1 cm
LENGTH X10	+1 cm
PHASE	+1

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

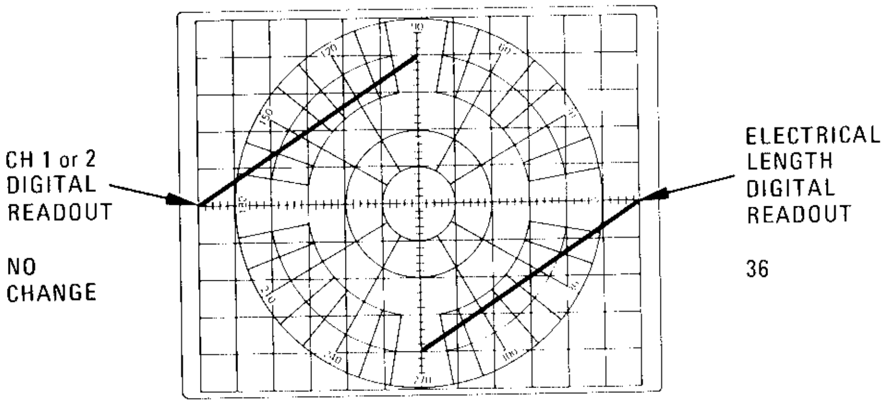
2. Depress Electrical Length CLR pushbutton for both Electrical Length A and B INPUT switch positions. Any Channel 1 or 2 phase offsets due to Electrical Length should be removed and the Electrical Length digital readout should indicate zero for both A and B INPUT switch positions.

3. Depress Channel 1 and 2 DISPLAY MKR ZRO pushbuttons to set a zero reference without any Electrical Length offsets. Check that for each Electrical Length INPUT switch position (A or B) and operating MODE (LENGTH or PHASE), an Electrical Length offset affects the respective A/R (Channel 1) or B/R (Channel 2) digital readout and CRT display as shown below.

CRT DISPLAY
FOR LENGTH (CW FREQUENCY = 1000 MHz)



CRT DISPLAY FOR PHASE



4. Depress Electrical Length ZRO pushbutton for both A and B INPUT switch positions and check that the Electrical Length digital readout changes to zero and Channel 1 and 2 digital readouts do not change. If the readouts are incorrect, refer to Figure D3-18 and associated text for further troubleshooting.

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

5. Depress Electrical Length CLR pushbutton for both A and B INPUT switch positions and check that the Electrical Length digital readout remains at zero and Channel 1 and 2 digital readouts change to zero reference set in step n3.

6. Check that rotation of Electrical Length A VERNIER control affects Channel 1 (A/R) digital readout and rotation of B VERNIER affects Channel 2 (B/R) digital readout. With PHASE MODE and X10 Electrical Length mode selected, adjusting either VERNIER control over its full range should result in greater than a 12 degree phase shift for the respective A/R or B/R input. The Electrical Length digital readout should not change with a change in either VERNIER control setting.

POLAR MAGNITUDE AND PHASE TEST SETUP:

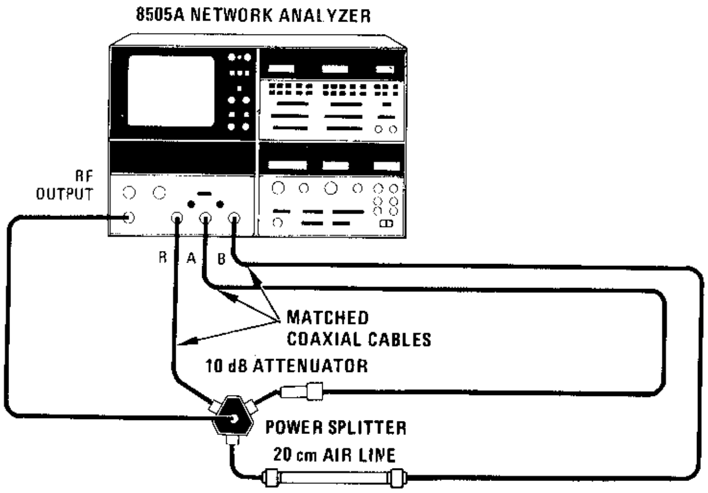


Figure D3-1B. A3 Signal Processor Troubleshooting Test Setup (Polar)

o. Connect equipment as shown in Figure D3-1B and set 8505A controls as follows:

A1 Source/Converter:

OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm

A2 Frequency Controller:

RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	1000 MHz
ΔF Frequency	0 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Counterclockwise
TRIGGER	AUTO
MARKERS Select	1
MARKER 1 position	Centered on CRT trace

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

A3 Signal Processor:
Channel 1:
INPUT . . . . A/R
MODE . . . . POLAR MAG
SCALE/DIV 1

Channel 2:
INPUT . . . . B/R
MODE . . . . POLAR PHASE
SCALE/DIV 1

Electrical Length:
MODE . . . . OFF

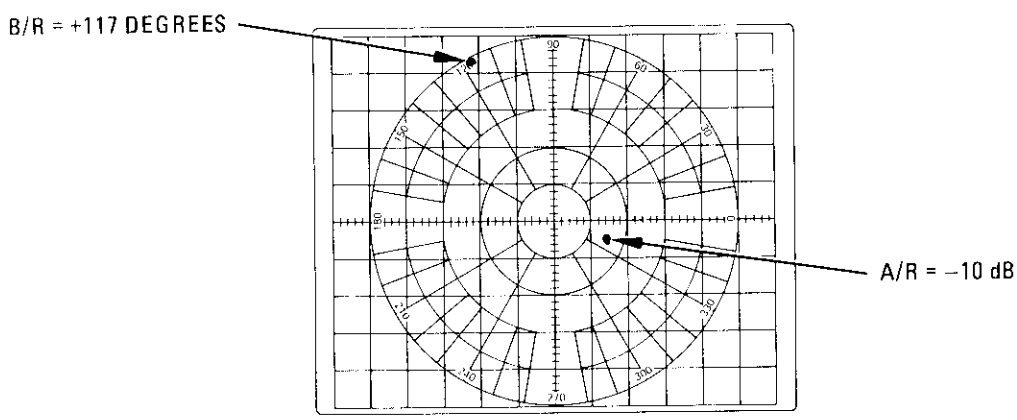
Polar Mode Check

p. Depress the REF LINE POSN pushbutton and adjust BEAM CENTER controls to set the reference display at the intersection of the horizontal and vertical axis. Depress the REF LINE POSN pushbutton again to release the switch. If the reference display will not adjust properly, the trouble is in A3A15 Analog Display Multiplex I or its control inputs. Refer to Figure D3-46 for further troubleshooting.

q. Depress Channel 1 DISPLAY MKR and ZRO pushbuttons. Use the Electrical Length LENGTH pushbuttons to input a 360 degree phase shift per scan and check that the CRT trace displayed is a circle that is the same diameter and concentric with the outer polar graticule circle. If not, refer to Paragraph D3-5 for further troubleshooting.

r. Set the Electrical Length MODE switch to OFF. Depress Channel 1 and 2 DISPLAY MKR and CLR pushbuttons. Check that Channel 1 (A/R) digital readout indicates −10 dB ±0.4 dB and Channel 2 (B/R) digital readout indicates +124 degrees ±15 degrees. The CRT display should be as shown below. If CRT display is incorrect, the trouble is in A3 Polar Converter Assembly or its control inputs. Refer to Figure D3-34 for further troubleshooting.

POLAR DISPLAY



D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

GROUP DELAY TEST SETUP:

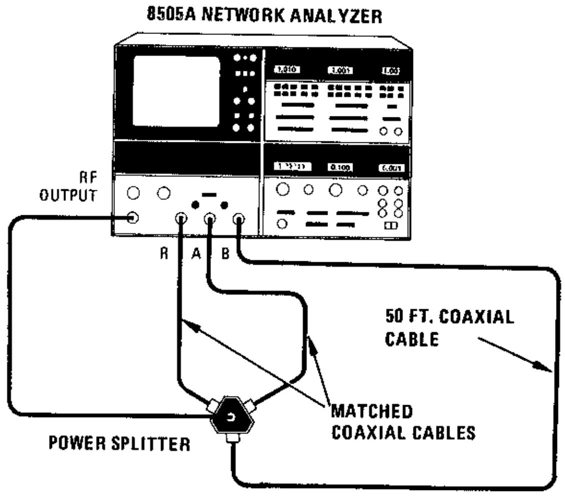


Figure D3-1C. A3 Signal Processor Troubleshooting Test Setup (Group Delay)

s. Connect equipment as shown in Figure D3-1C and set the 8505A controls as follows:

A1 Source/Converter:

OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm

A2 Frequency Controller:

RANGE	.5 − 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	700 MHz
ΔF Frequency	130 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 − .01
SCAN TIME SEC Vernier	Fully Clockwise
TRIGGER	AUTO
MARKERS Select	1
MARKER 1 position	Centered on CRT trace

A3 Signal Processor:

Channel 1:

INPUT	A/R
MODE	PHASE
SCALE/DIV	90 degrees

D3-1. A3 SIGNAL PROCESSOR OVERALL TROUBLESHOOTING PROCEDURE (Cont'd)

Channel 2:
INPUT . . . . A/R
MODE . . . . PHASE
SCALE/DIV . . . . 90 degrees

Electrical Length:
MODE . . . . OFF

Group Delay Check

t. Depress Channel 1 DISPLAY MKR and CLR pushbuttons to zero the digital readout. Adjust the CW CW FREQUENCY up in frequency until the digital readout again indicates zero degrees (this is equivalent to a 360 degree phase shift). Calculate Group Delay using the change in frequency required for a 360 degree phase shift in the formula below.

$$\text{Group Delay} = \frac{1}{F\ (\text{Hz})}$$

u. Set Channel 1 MODE switch to DLY and reset the CW FREQUENCY to 700 MHz. Depress Channel 1 DISPLAY MKR and CLR pushbuttons. Channel 1 digital readout and CRT display should indicate same as the group delay calculated in step t (±4 ns). If not, refer to Paragraph D3-6 for further troubleshooting.

v. Set the SCAN TIME SEC switch to 1 – .1 position and check that the digital readout does not change from indication in step u. If the digital readout changes, refer to Paragraph D3-6 for further troubleshooting.

D3-2. CRT DISPLAY TROUBLESHOOTING PROCEDURE

DESCRIPTION:

This troubleshooting procedure checks the basic operation of the CRT display. The CRT display is checked for the correct presentation of the CRT trace for both Channel 1 and 2 for rectagular and polar modes of operation. The ability to set a reference line or point for rectangular and polar operation is also checked.

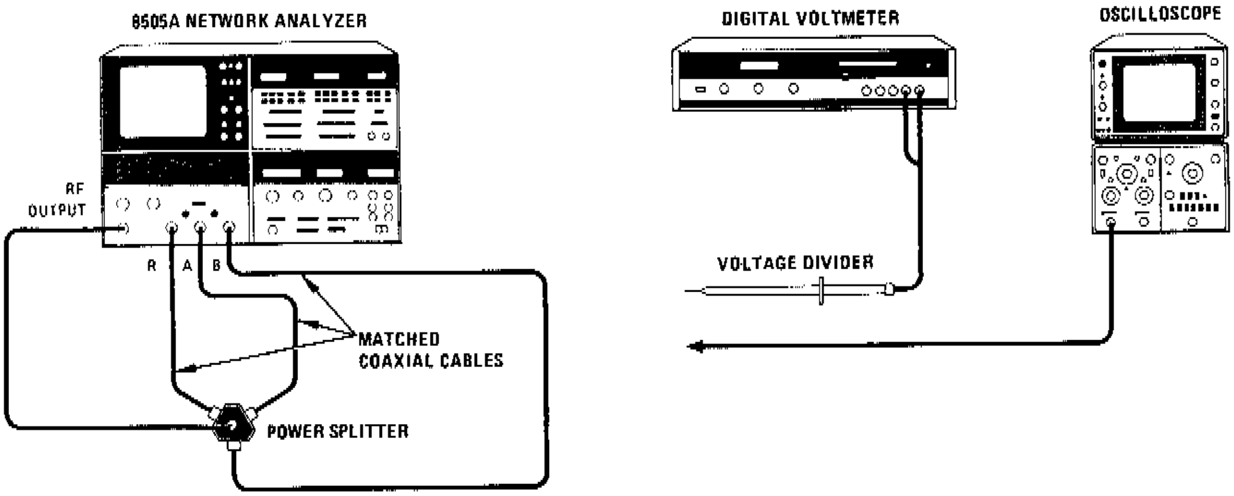


Figure D3-1D. CRT Display Troubleshooting Test Setup

D3-2. CRT DISPLAY TROUBLESHOOTING PROCEDURE (Cont'd)

CRITICAL 8505A SWITCH SETTINGS

A1 Source/Converter:

OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm

A2 Frequency Controller:

RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	800 MHz
ΔF Frequency	100 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Clockwise
TRIGGER	AUTO

A3 Signal Processor:

Channel 1 and 2:

INPUT	A/R
MODE	MAG
SCALE/DIV	20 dB

Electrical Length:

MODE	OFF

FIG. D3-1E
SHT. 1 OF 3

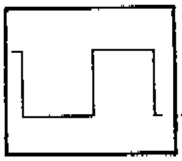
CRT DISPLAY

Connect equipment as shown in Figure D3-1D.

Check the CRT display for two horizontal traces (Channel 1 and 2) that are swept to cover the full 12 divisions of the graticule and are blanked on retrace. It may be necessary to adjust CH 1 and CH2 vertical position controls to obtain a CRT display.

NO →

SIGNAL	TEST POINT
GATE OUT	A3A27TP5



— +40V

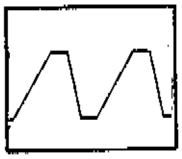
— 0V

NO →

YES ↓

SIGNAL	TEST POINT
Y DISPLAY	A3A16 pin 24
X DISPLAY	A3A16 pin 22

Switch channel not being checked to OFF and check that the Y DISPLAY voltage can be adjusted for zero volts with the vertical position control for the channel being used. Check that the X DISPLAY voltage is a ramp as shown below.



— +1.5V

— −1.5V

NO →

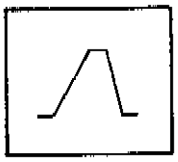
YES ↓

Y Deflection Amplifier check:

Center CH 1 and CH2 vertical position controls and check A3A28 pin 9 and A3A28 pin 6 for +45 volts ±25 volts.

X Deflection Amplifier check:

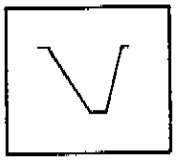
A3A29 pin 9



— +70V

— +18V

A3A29 pin 6



— +70V

— +18V

NO →

YES

YES ↓

Depress REF LINE POSN pushbutton. Check that the Channel 1 and 2 CRT traces are no longer blanked on retrace. Use CH 1 and CH 2 vertical position controls to set the reference line (retrace) for each channel on the center horizontal graticule line.

NO →

YES ↓

Switch Channel 1 and 2 MODE switches to POLAR MAG position. Use horizontal and vertical POL position controls to center the reference display on the polar display. Depress and release the REF LINE POSN (BEAM CENTER) pushbutton and check that the reference display is blanked.

NO →

Trouble is in A3A15 Analog Display Multiplex I Assembly or its control inputs. Refer to Figure D3-46 for further troubleshooting.

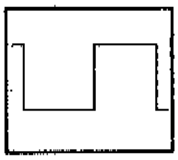
FIG. D3-1E
SHT. 2 OF 3

	TEST POINT
	A3A27TP5

S

NO

SIGNAL	TEST PO
TTL DISP	A3A16



YES

Trouble is in A3A27 Blanking Amplifier or its con input. Refer to Figure D3-56 for further trou shooting.

	TEST POINT
	A3A16 pin 24
	A3A16 pin 22

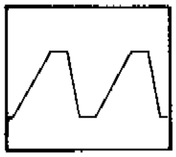
ked to OFF and check
an be adjusted for zero
control for the channel
DISPLAY voltage is a

S

NO

SIGNAL	TEST POINT
Y CH 1	A3A15TP2
Y CH 2	A3A15TP3
PROC X	A3A15TP1

Switch channel not being checked to OFF and check that each Y CH (1 and 2) voltage can be adjusted for zero volts with the vertical position control for the channel being used. Check that the PROC X voltage is a ramp as shown below.



INCORRECT
Y Channel

Trouble is in A3A15 Analog Display Multiplex Assembly or its control inputs. Refer to Figure D3- for further troubleshooting.

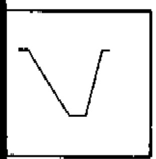
INCORRECT
PROC X

YES

Trouble is in A3A16 Blanking Logic Assembly or its control inputs. Refer to Figure D3-48 for further troubleshooting.

position controls and
8 pin 6 for +45 volts

A3A29 pin 6

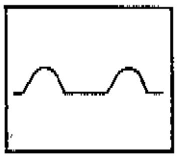


NO

Trouble is in respective Deflection Amplifier (A3A28 or A3A29). Refer to Figure D3-57 for further trouble-shooting.

Check that a clockwise rotation of the SCALE cont will illuminate the CRT display graticules.

Check for the waveform shown below at the juncti of A3A27F1 and the emitter of A3A27Q14.



YES

Trouble is probably V1 CRT Assembly.

Display Multiplex
Refer to Figure D3-46

FIG. D3-1E
SHT. 3 OF 3

TEST POINT
A3A16TP3

— +4V
— 0V

NO

SIGNAL	TEST POINT
BP 3	A3A16TP2
DBP	A3A16 pin 18

Check that BP 3 and DBP signals are 0 to +5 volt pulses.

NO

Trouble is in A2 Frequency Controller or the interconnect cables to the A3 Signal Processor. Check BP 3 (A2A8 pin 50) and DBP (A2A8 pin 47) outputs from A2A8 Sweep Select Assembly. See Figure C3-34 for further troubleshooting.

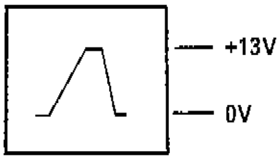
YES

Trouble is in A3A16 Blanking Logic Assembly or its control inputs. Refer to Figure D3-48 for further troubleshooting.

mplifier or its control for further trouble-

Display Multiplex I Refer to Figure D3-46

SIGNAL	TEST POINT
VSW 2	A3A15 pin 35



NO

Trouble is in A2 Frequency Controller or the interconnect cables to the A3 Signal Processor. Check VSW 2 (A2A8TP4) output from the A2A8 Sweep Select Assembly. See Figure C3-34 for further troubleshooting.

YES

Trouble is in A3A15 Analog Display Multiplex I Assembly or its control inputs. Refer to Figure D3-46 for further troubleshooting.

of the SCALE control raticules.

below at the junction A3A27Q14.

— +0.4V
— 0V

NO

WARNING

This check probes 4000 volts. Use 11044A Voltage Divider probe when making measurement.

TEST POINT	VOLTAGE
A3A26 HV TP	4 KV ±.05 KV

NO

Trouble is in A3A26 High Voltage Assembly. Refer to Figure D3-55 for further troubleshooting.

YES

Trouble is in A3A27 Blanking Amplifier Assembly or its control inputs. Refer to Figure D3-56 for further troubleshooting.

RT Assembly.

Figure D3-1E. CRT Display Troubleshooting Procedure

D3-3. RECTANGULAR MAGNITUDE TROUBLESHOOTING PROCEDURE

DESCRIPTION:

The 8505A is set up for an absolute magnitude measurement and the CRT display and digital readouts checked. If there is a problem with both the CRT display and digital readouts, the troubleshooting procedure for the CRT display should be followed first. Usually this will result in correcting the problem for both the CRT display and digital readout. The ability of the 8505A to accurately input and delete magnitude offsets is then checked. This involves checking operation of Channel 1 and 2 REF OFFSET pushbuttons along with DISPLAY ZRO and CLR pushbuttons.

TEST SETUP:

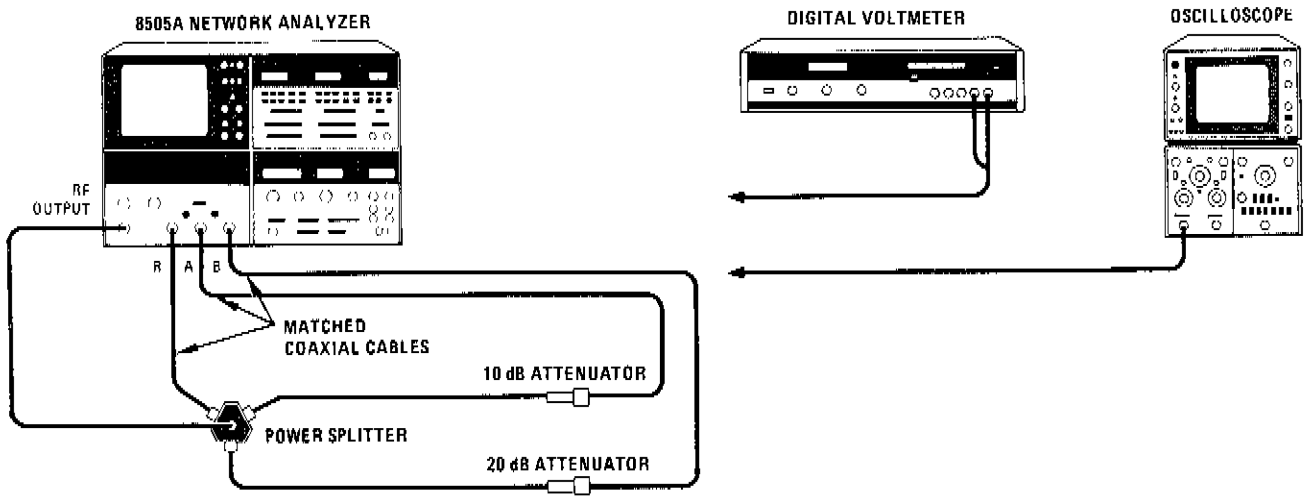


Figure D3-1F. Magnitude Troubleshooting Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
Oscilloscope	HP 180C/1801A/1820A
Power Splitter	HP 11850A
20 dB Attenuator	HP 8491B Option 020
10 dB Attenuator	HP 8491B Option 010
Matched Cable Kit	HP 11851A

D3-3. RECTANGULAR MAGNITUDE TROUBLESHOOTING PROCEDURE (Cont'd)

CRITICAL 8505A SWITCH SETTINGS:

A1 Source/Converter:

OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm

A2 Frequency Controller:

RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	1000 MHz
ΔF Frequency	0 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Counterclockwise
TRIGGER	AUTO
MARKERS Select	1
MARKER 1 Position	Centered on CRT trace

A3 Signal Processor:

Channel 1 and 2:

INPUT	R
MODE	MAG
SCALE/DIV	10 dB

Electrical Length:

INPUT	A
MODE	LENGTH x
A and B Verniers	Fully Counterclockwise

FIG. D3-1G
SHT. 1 OF 5

MAGNITUDE

Connect equipment as shown in Figure D3-1F. Set Reference Line position on the center horizontal graticule line. Depress Channel 1 and 2 MKR, then CLR pushbuttons.

Check Channel 1 and 2 digital readouts and CRT display for each INPUT switch position as shown below.

NOTE

If both the digital readout and CRT display are incorrect, follow the procedure for the incorrect CRT display first.

INPUT	R	A	B	A/R	B/R
Digital Display	−20 dB	−30 dB	−40 dB	−10 dB	−20 dB
CRT Display	−2 DIV	−3 DIV	−4 DIV	−1 DIV	−2 DIV

DIGITAL DISPLAY INCORRECT

CRT DISPLAY INCORRECT

YES

Check that Channel 1 and 2 REF OFFSET pushbuttons step the respective digital readout and CRT display as shown below.

+10 dB/STEP　+1 dB/STEP　+0.1 dB/STEP

△　△　△

▽　▽　▽

−1 dB/STEP　−0.1 dB/STEP　−10 dB/STEP

NO

SIGNAL	TEST POINT	C
V OFFSET 1	A3A5TP4	CH
V OFFSET 2	A3A5TP2	CH

Voltage changes as follows:
For △ offset – +0.5V/10 d
For ▽ offset – −0.5V/−10

YES

Trouble is in A3A7 Resolution C
Refer to Figure D3-32 for further

YES

Check Channel 1 and 2 resolution control by using the REF OFFSET pushbuttons to set the marker base on the CRT bottom horizontal graticule line for each SCALE/DIV switch position and checking for the correct digital readout as shown below.

SCALE/DIV MAG	20	10	5	2	1	.5	.2	.1
Digital Readout dB	−100	−50.0	−25.0	−10.0	−5.00	−2.50	−1.00	−0.50

NO

SCALE/DIV MAG dB	CHANNEL 1/C TEST PO A1/A2 A3A7 pin 22/31	B1/B A3A pin 23/
20	+5 Vdc	+5 V
10	0 Vdc	+5 V
5	+5 Vdc	0 V
2	0 Vdc	0 V
1	+5 Vdc	+5 V
.5	0 Vdc	+5 V
.2	+5 Vdc	0 V
.1	0 Vdc	0 V

YES

Trouble is in A3A7 Resolution C
or its control inputs. Refer to F
further troubleshooting.

FIG. D3-16
SHT. 2 OF 5

Digital logic is incorrect. Refer to Paragraph D3-7 for further troubleshooting.

SIGNAL	TEST POINT	INPUT A/R	INPUT B/R
CH 1 FILT	A3A7TP1	+0.25V	+0.5V
CH 2 FILT	A3A7TP2	+0.25V	+0.5V

Actual voltage will change with SCALE/DIV switch, but voltage remains scaled for +0.25V/DIV deflection below reference line (minus voltage for deflection above the reference line).

YES

SIGNAL	TEST POINT	INPUT A/R	INPUT B/R
Y DISP	A3A16 pin 24	−0.25V	−0.5V

Actual voltage will change with SCALE/DIV switch, but voltage remains scaled for −0.25V/DIV deflection below reference line (positive voltage for deflection above the reference line).

YES

OINT	CONTROLLING SWITCHES
TP4	CH 1 REF OFFSET
TP2	CH 2 REF OFFSET

ws:
+0.5V/10 dB
0.5V/−10 dB

NO

Digital logic is incorrect. Refer to Paragraph D3-7 for further troubleshooting

YES

solution Control Assembly.
for further troubleshooting.

Use the REF OFFSET pushbuttons to place the CRT trace on the top, center and bottom horizontal graticule lines and check for the correct Y OUT voltages.

TEST POINT	GRATICULE LINE TOP	CENTER	BOTTOM
A3A28 pin 9	+70V	+44V	+18V
A3A28 pin 6	+18V	+44V	+70V

YES

NNEL 1/CHANNEL 2 TEST POINTS

	B1/B2 A3A7 pin 23/32	C1/C2 A3A7 pin 24/33
	+5 Vdc	+5 Vdc
	+5 Vdc	+5 Vdc
	0 Vdc	+5 Vdc
	0 Vdc	+5 Vdc
	+5 Vdc	0 Vdc
	+5 Vdc	0 Vdc
	0 Vdc	0 Vdc
	0 Vdc	0 Vdc

NO

Digital logic is incorrect. Refer to Paragraph D3-7 for further troubleshooting.

WARNING

This check probes 4000 volts. Use 11044A Voltage Divider probe when making measurement.

TEST POINT	VOLTAGE
A3A26 HV TP	4 KV ± .05 KV

YES

YES

olution Control Assembly
efer to Figure D3-32 for

Trouble is probably in A3A27 Blanking Amplifier Assembly. Refer to Figure D3-56 for further troubleshooting.

FIG. D3-1G
SHT. 3 OF 5

	INPUT	
T POINT	A/R	B/R
A7TP1	+0.25V	+0.5V
A7TP2	+0.25V	+0.5V

hange with SCALE/DIV switch, scaled for +0.25V/DIV deflection (minus voltage for deflection ne).

NO

YES

	INPUT	
POINT	A/R	B/R
6 pin 24	−0.25V	−0.5V

hange with SCALE/DIV switch, scaled for −0.25V/DIV deflection (positive voltage for deflection ne).

NO

		INPUT	
SIGNAL	TEST POINT	A/R	B/R
Y CH 1	A3A15TP2	−0.25V	−0.5V
Y CH 2	A3A15TP3	−0.25V	−0.5V

Actual voltage will change with SCALE/DIV switch, but voltage remains scaled for −0.25 V/DIV deflection below reference line (positive voltage for deflection above the reference line).

NO

Trouble is in A3A15 Analog Display Multiple Assembly or its control inputs. Refer to Figure D3 for further troubleshooting.

YES

Trouble is in A3A16 Blanking Logic Assembly or its control inputs. Refer to Figure D3-48 for further troubleshooting.

YES

T pushbuttons to place the CRT ter and bottom horizontal grati- for the correct Y OUT voltages.

GRATICULE LINE		
P	CENTER	BOTTOM
0V	+44V	+18V
3V	+44V	+70V

NO

Trouble is in A3A28 Deflection Amplifier Assembly. Refer to Figure D3-57 for further troubleshooting.

YES

ARNING

robes 4000 volts. Use ge Divider probe when ement.

	VOLTAGE
	4 KV ± .05 KV

NO

Trouble is in A3A26 High Voltage Assembly. Refer to Figure D3-55 for further troubleshooting.

YES

in A3A27 Blanking Amplifier Figure D3-56 for further

FIG D3-1G
SHT. 4 OF 5

SIGNAL	TEST POINT	INPUT	
		A/R	B/R
LOG R	A3A13TP4	≈ −1V	≈ −1V
LOG AB	A3A14TP4	≈ −1.5V	≈ −2V

Voltage is scaled for 50 mV/dB (−50mV/−dB)

NO →

Use OUTPUT LEVEL control to set RF OUT to −10 dBm. Connect RF OUT directly to each of the Source/Converter INPUT connectors (R, A and B) and check the amplitude of the 100 kHz IF at the input of the respective Magnitude Detector (A13 or A14) as shown below.

INPUT	TEST POINT	OUTPUT LEVEL	AMPLITUDE (peak-to-peak)
R	A3A13 pin 1	−10 dBm	1 Volt
A	A3A14 pin 1	−10 dBm	1 Volt
B	A3A14 pin 4	−10 dBm	1 Volt

NO

YES ↓

Trouble is in respective A13/A14 Magnitude Detector. Refer to Figure D3-44 for further troubleshooting.

Display Multiplex I
Refer to Figure D3-46

YES ↓

SIGNAL	TEST POINT	INPUT	
		A/R	B/R
CH 1 MPX	A3A6TP1	−0.5V	−1.0V
CH 2 MPX	A3A6TP3	−0.5V	−1.0V

Voltage is scaled for 50 mV/dB (−50 mV/−dB)

NO →

Trouble is in A3A6 Input Multiplex Assembly or its control inputs. Refer to Figure D3-30 for further troubleshooting.

YES ↓

Trouble is in A3A7 Resolution Control Assembly. Refer to Figure D3-32 for further troubleshooting.

Figur

FIG. D3-1G
SHT. 5 OF 5

INPUT	
	B/R
V	≈ −1V
5V	≈ −2V
(mV/−dB)	

NO

Use OUTPUT LEVEL control to set RF OUT to −10 dBm. Connect RF OUT directly to each of the Source/Converter INPUT connectors (R, A and B) and check the amplitude of the 100 kHz IF at the input of the respective Magnitude Detector (A13 or A14) as shown below.

INPUT	TEST POINT	OUTPUT LEVEL	AMPLITUDE (peak-to-peak)
R	A3A13 pin 1	−10 dBm	1 Volt
A	A3A14 pin 1	−10 dBm	1 Volt
B	A3A14 pin 4	−10 dBm	1 Volt

NO

Trouble is in A1 Source/Converter. Refer to Troubleshooting Procedure in Secion B3.

YES

Trouble is in respective A13/A14 Magnitude Detector. Refer to Figure D3-44 for further troubleshooting.

INPUT	
	B/R
V	−1.0V
V	−1.0V
0 mV/−dB)	

NO

Trouble is in A3A6 Input Multiplex Assembly or its control inputs. Refer to Figure D3-30 for further troubleshooting.

trol Assembly.
roubleshooting.

Figure D3-1G. Magnitude Troubleshooting Procedure

D3-4. RECTANGULAR PHASE TROUBLESHOOTING PROCEDURE

DESCRIPTION:

The 8505A is set up for an absolute phase measurement and the CRT display and digital readouts checked. If there is a problem with both the CRT display and digital readouts, the troubleshooting procedure for the CRT display should be followed first. Usually this will result in correcting the problem for both the CRT display and digital readout. The ability of the 8505A to accurately input and delete phase offsets is then checked. This involves checking the Electrical Length section and operation of Channel 1 and 2 DISPLAY ZRO and CLR pushbuttons.

TEST SETUP:

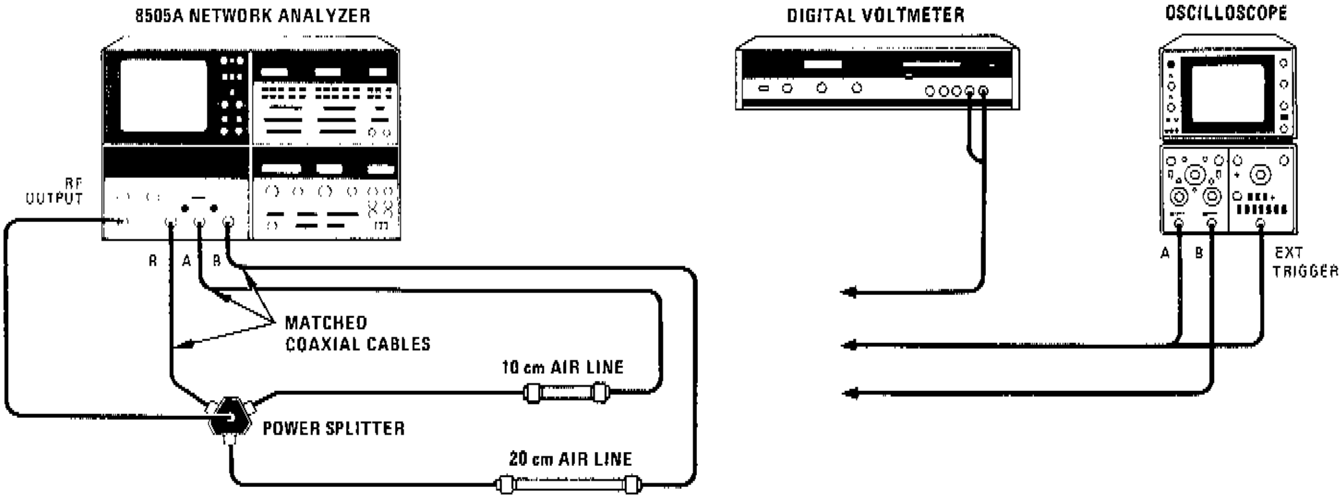


Figure D3-1H. Phase Troubleshooting Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
Oscilloscope	HP 180C/1801A/1820A
Power Splitter	HP 11850A
10 cm Air Line	HP 11566A
20 cm Air Line	HP 11567A
Matched Cable Kit	HP 11851A

D3-4. RECTANGULAR PHASE TROUBLESHOOTING PROCEDURE (Cont'd)

CRITICAL 8505A SWITCH SETTINGS:

A1 Source Converter:

OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm

A2 Frequency Controller:

RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	1000 MHz
ΔF Frequency	0 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Counterclockwise
TRIGGER	AUTO
MARKERS Select	1
MARKERS 1 Position	Centered on CRT trace

A3 Signal Processor:

Channel 1:

INPUT	A/R
MODE	PHASE
SCALE/DIV	90 degrees

Channel 2:

INPUT	A/R
MODE	PHASE
SCALE/DIV	90 degrees

Electrical Length:

INPUT	As Required
MODE	Length x
A and B Verniers	Fully Counterclockwise

FIG. D3-1I
SHT. 1 OF 4

PHASE

Connect equipment as shown in Figure D3-1H. Set Reference Line position on the center horizontal graticule line. Depress Channel 1 and 2 DISPLAY MKR and CLR pushbuttons.

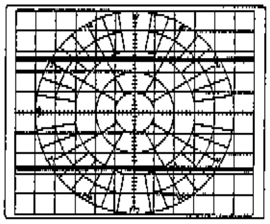
Check Channel 1 and 2 digital readouts and CRT displays for each INPUT switch position as shown below.

NOTE

The phase indications given assume a CW frequency of 1000 MHz and an electrical length for the air lines used of 20.21 cm (20 cm air line) and 10.21 cm (10 cm air line).

DISPLAY	INPUT	
	A/R	B/R
Digital	−124 deg. ±3 deg.	+116 deg. ±3 deg.

CRT DISPLAY



B/R

A/R

CRT DISPLAY INCORRECT

SIGNAL	TEST POINT	VOLTAGE
		A/R
PHASE	A3A12TP9	−0.62V

YES

Trouble is in A3A6 Input Multiplex As[...] control inputs. Refer to Figure D3-30[...] troubleshooting.

DIGITAL DISPLAY INCORRECT

Digital logic is incorrect. Refer to Para[...] for further troubleshooting.

YES

Check that Channel 1 and 2 REF OFFSET pushbuttons step the respective digtal readout and CRT display as shown below.

100 DEG/STEP 10 DEG/STEP 1 DEG/STEP

100 DEG/STEP 10 DEG/STEP 1 DEG/STEP

NO

YES

Check that the Electrical Length LENGTH[...]
Electrical Length digital readout as shown [...]
and 2 digital readouts and CRT displays c[...]
electrical length change for a CW frequency [...]

MODE	CHANGE/ STEP
LENGTH x	−1 cm
LENGTH X	−10 cm
PHASE	−10

LENGTH

MODE	CHANGE/ STEP
LENGTH x	+1 cm
LENGTH X	+10 cm
PHASE	+10

FIG. D3-1I
SHT. 2 OF 4

SIGNAL	TEST POINT	OSCILLOSCOPE CONNECTION
IF REF	A3A12 pin 1	Channel A EXT INPUT
IF TEST	A3A12 pin 15	Channel B

Connect oscilloscope as shown in Figure D3-1H. Set 8505A Channel 1 INPUT switch for signal being checked (A/R or B/R) and set Channel 2 MODE switch to OFF. Depress Channel 1 DISPLAY MKR, then CLR pushbuttons to clear any stored offsets. Adjust CW frequency control for a minimum peak-to-peak signal on the oscilloscope display. Channel 1 CRT display and digital readout should indicate ±180 degrees ±2 degrees. Set oscilloscope Channel B POLARITY switch to – position. Adjust CW frequency control for a minimum peak-to-peak signal on the oscilloscope display. Channel 1 CRT display and digital readout should indicate 0 degrees ± 2 degrees.

OLTAGE (5 mV/DEG)	
A/R	B/R
-0.62V	+0.58V

NO

ES

ltiplex Assembly or its
ure D3-30 for further

er to Paragraph D3-7

NO

Trouble is in respective A13/A14
or its control inputs. Refer to Figu
troubleshooting.

YES

SIGNAL	TEST POINT
PH OFFSET	A3A5TP5

Check that the PH OFFSET voltage responds with a scale of 5 mV/Degree offset for each of the following pushbuttons.

NOTE

To obtain an accurate voltage indication, turn the channel not being checked to OFF. This eliminates multiplexing on the line, and allows use of a digital voltmeter for the measurement.

DISPLAY CLR	Clears any stored offset: 0 Volts
DISPLAY ZRO	Offset equal and opposite to MKR CLR digital readout.
REF OFFSET	5 mV/Degree
LENGTH (MODE: LENGTH)	5 mV/Degree (For 1 GHz 12 Degrees/cm)
LENGTH (MODE: PHASE)	Ramp Voltage: Amplitude is 50 mV/10 degrees

YES

NO

Digital logic is incorrect. Refer to
further troubleshooting.

LENGTH pushbuttons change the
as shown below and the Channel 1
displays change 12 degrees/cm of
frequency of 1000 MHz.

GTH

△

MODE	CHANGE/STEP
LENGTH x	–0.1 cm
LENGTH X	–1 cm
PHASE	–1

▽

MODE	CHANGE/STEP
LENGTH x	+0.1 cm
LENGTH X	+1 cm
PHASE	+1

NO

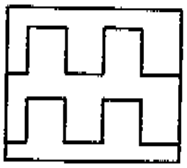
FIG. D3-1I
SHT. 3 OF 4

in respective A13/A14 Magnitude Detector
ol inputs. Refer to Figure D3-44 for further
oting.

is incorrect. Refer to Paragraph D3-7 for
bleshooting.

SIGNAL	TEST POINT	OSCILLOSCOPE CONNECTION
LIM IF REF	A3A12TP1	Channel A EXT INPUT
IF LS RET	A3A10TP4	Channel B

Connect oscilloscope as shown in Figure D3-1H. Switch Channel not being checked off. Depress DISPLAY REF CLR pushbuttons. Check that waveforms on the oscilloscope display are in phase. Use REF OFFSET pushbuttons to input a 360 degree offset as indicated on the channel digital readout. The waveforms on the oscilloscope display should again be in phase.



YES

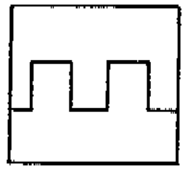
Trouble is in A3A12 Phase Detector Assembly. Refer to Figure D3-42 for further troubleshooting.

NO

SIGNAL	TE
Ø DET OUTPUT	A

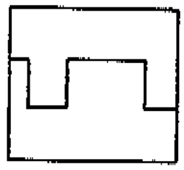
Connect oscilloscope as shown in
Switch channel not being checke
DISPLAY REF CLR pushbuttons.
oscilloscope display is a symmetri
Use REF OFFSET pushbuttons to set
below and check for correct symmetr
wave.

0° Phase Offset



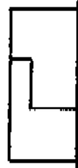
50/50 Symmetry

+600° Phase Offset



33/67 Symmetry

−600° P



67/33

YES

Trouble is in A3A10 Phase Offset I A
to Figure D3-38 for further troublesho

FIG. D3-1I
SHT. 4 OF 4

OSCILLOSCOPE CONNECTION
Channel A EXT INPUT
Channel B

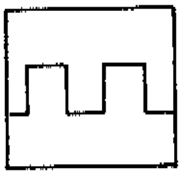
Figure D3-1H.
d off. Depress
heck that wave-
re in phase. Use
t a 360 degree
digital readout.
display should

NO

SIGNAL	TEST POINT
Ø DET OUTPUT	A3A9TP1

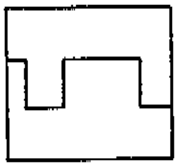
Connect oscilloscope as shown in Figure D3-1H. Switch channel not being checked off. Depress DISPLAY REF CLR pushbuttons. Check that the oscilloscope display is a symmetrical squarewave. Use REF OFFSET pushbuttons to set in offsets shown below and check for correct symmetry of the squarewave.

0° Phase Offset



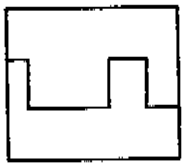
50/50 Symmetry

+600° Phase Offset



33/67 Symmetry

–600° Phase Offset



67/33 Symmetry

NO

Trouble is in A3A9 Phase Offset II Assembly. Refer to Figure D3-36 for further troubleshooting.

YES

Trouble is in A3A10 Phase Offset I Assembly. Refer to Figure D3-38 for further troubleshooting.

Assembly. Refer
ooting.

Figure D3-1I. Phase Troubleshooting Procedure

FIG. D3-1K
SHT. 1 OF 3

POLAR MODE

Connect equipment as shown in Figure D3-1J. Depress REF LINE POSN pushbutton and adjust BEAM CENTER controls to set the CRT display at the intersection of the horizontal and vertical axis. Depress REF LINE POSN pushbutton again to release the switch.

Depress Channel 1 DISPLAY MKR and ZRO pushbuttons. Use Electrical Length LENGTH pushbuttons to input a 360 degree phase shift per scan and check that the CRT trace displayed is a circle that is concentric with the outer polar graticule circle and that they are both of equal magnitude.

NOT EQUAL MAGNITUDE

SIGNAL	TEST POINT	VOLTAGE
V OFFSET 1	A3A5TP4	+0.5V

YES

SIGNAL	TEST POINT	VOLTAGE
LOG AB/R	A3A6 pin 4	−0.5V

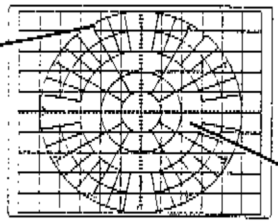
YES

Trouble is in A3A8 Polar Converter Assembly or i control inputs. Refer to Figure D3-34 for furthe troubleshooting.

NOT CONCENTRIC

YES

Set Electrical Length MODE switch to OFF. Depress Channel 1 and 2 DISPLAY MKR and CLR pushbuttons. Check that Channel 1 (A/R) digital readout indicates −10 dB ±2 dB and Channel 2 (B/R) digital readout indicates +120 degrees ±5 degrees. The CRT display should be as shown below.



NO

Trouble is in A3A8 Polar Converter Assembly or its control inputs. Refer to Figure D3-34 for further troubleshooting.

FIG. D3-1K
SHT. 2 OF 3

...OINT	VOLTAGE
...TP4	+0.5V

NO → Digital logic is incorrect. Refer to Paragraph D3-7 for further troubleshooting.

YES

...OINT	VOLTAGE
...in 4	−0.5V

NO → Trouble is in A3A6 Input Multiplex Assembly or its control inputs. Refer to Figure D3-30 for further troubleshooting.

YES

...Converter Assembly or its ...Figure D3-34 for further ...

SIGNAL	TEST POINT	OSCILLOSCOPE CONNECTIONS
		EXT INPUT
POLAR X	A3A8TP6	Channel A
POLAR Y	A3A8TP5	Channel B

90° PHASE DIFFERENCE

X Y

2.5V P-P

NO →

SIGNAL	TEST ...
PH OFFSET	A3A...

+1.4V

−1.4V

YES

SIGNAL	TEST ...
IF LS POLAR	A3A10...
BP IF TEST	A3A12...

Check that IF LS POLAR signal is a 1.3... (peak-to-peak) sinewave and that the BP IF ... signal is a 0.4 volt (peak-to-peak) sinewave.

YES

Trouble is in A3A8 Polar Converter Assembly ... control inputs. Refer to Figure D3-34 for f... troubleshooting.

YES

SIGNAL	TEST POINT	OSCILLOSCOPE CONNECTIONS
		EXT INPUT
PROC X	A3A15TP1	Channel A
Y CH 1	A3A15TP2	Channel B

90° PHASE DIFFERENCE

X Y

2.5V P-P

YES

Trouble is in A3A16 Blanking Logic Assembly or its control inputs. Refer to Figure D3-48 for further troubleshooting.

NO →

SIGNAL	TEST POINT	OSCILLOSC... CONNECTI...
		EXT INPU...
CH 2 FILT	A3A7TP2	Channel A
CH 1 FILT	A3A7TP1	Channel B

90° PHASE DIFFERENCE

2 1

2.5V P-P

YES

Trouble is in A3A15 Analog Display Multip... Assembly or its control inputs. Refer to Figure D... for further troubleshooting.

FIG. D3-1K
SHT. 3 OF 3

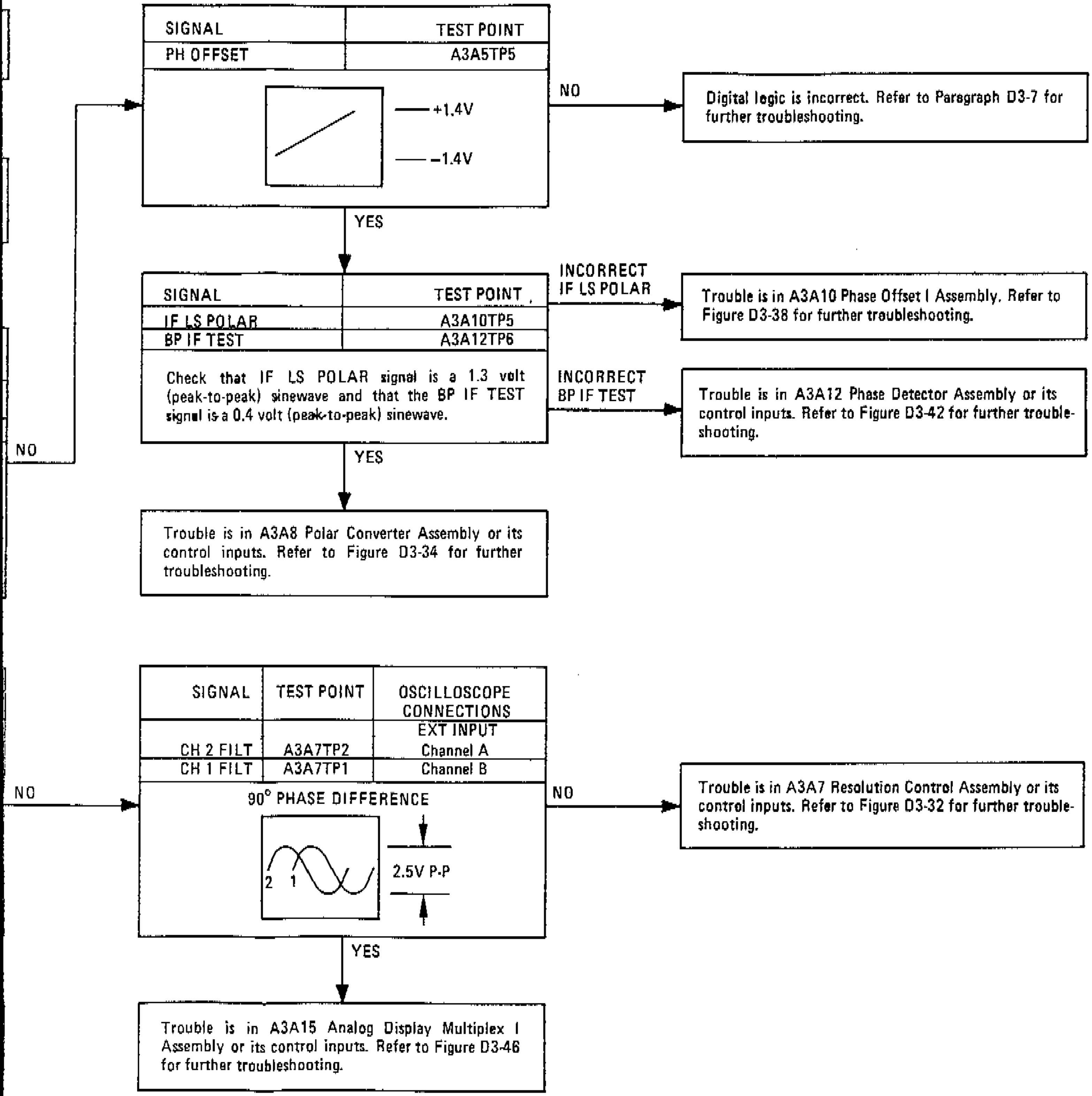


Figure D3-1K. Polar Troubleshooting Procedure

D3-6. GROUP DELAY TROUBLESHOOTING PROCEDURE

DESCRIPTION:

The 8505A is setup for a relative phase measurement and the change in frequency required for a 360 degree phase shift is determined. This change in frequency is used to calculate group delay. Group delay is then measured and compared with the calculated group delay. Because 1 kHz modulation is used to aid the 8505A measure group delay when operating in slow scan times, the group delay measurement is checked for both slow and fast scan times.

TEST SETUP:

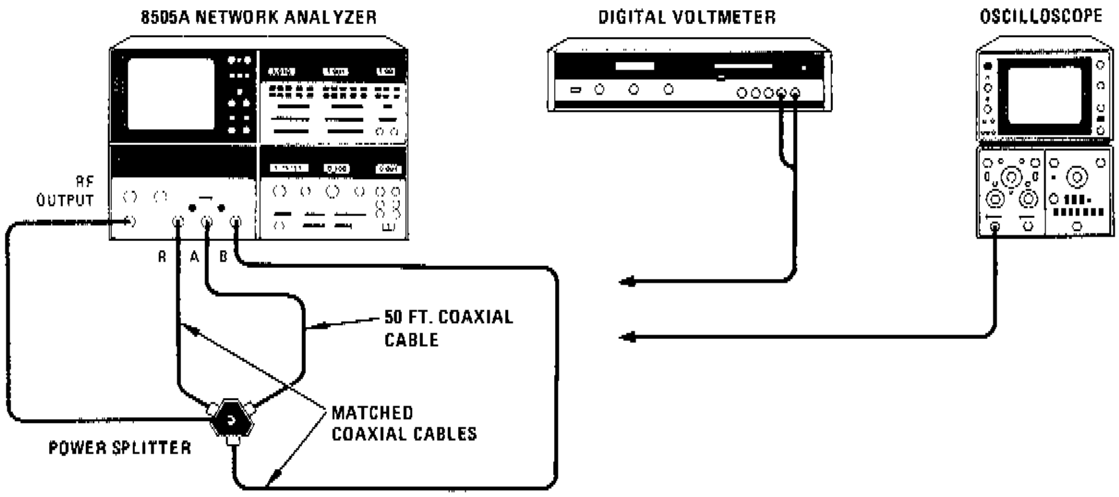


Figure D3-1L. Group Delay Troubleshooting Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
Oscilloscope	HP 180C/1801A/1820A
Power Splitter	HP 11850A
Matched Cable Kit	HP 11851A

15.24 plus Meter (50 plus feet) of Coaxial Cable

D3-6. GROUP DELAY TROUBLESHOOTING PROCEDURE (Cont'd)

CRITICAL 8505A SWITCH SETTINGS:

A1 Source/Converter:

OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm

A2 Frequency Controller:

RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW±ΔF
CW Frequency	700 MHz
ΔF Frequency	130 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Clockwise
TRIGGER	AUTO
MARKERS Select	1
MARKER 1 Position	Centered on CRT Trace

A3 Signal Processor:

Channel 1:

INPUT	A/R
MODE	PHASE
SCALE/DIV	90 degrees

Channel 2:

INPUT	A/R
MODE	PHASE
SCALE/DIV	90 degrees

Electrical Length:

MODE	OFF

D3-5. POLAR MAGNITUDE AND PHASE TROUBLESHOOTING PROCEDURE

DESCRIPTION:

This troubleshooting procedure checks the operation of the A3 Signal Processor when operating in the POLAR mode. The Electrical Length section is used to input a 360 degree/scan phase shift which results in a circle being displayed on the CRT. The circle displayed is checked for correct magnitude and concentricity with the outer polar graticule circle. The 360 degree/scan phase shift is then removed and the CRT display and digital readouts are checked for accuracy.

TEST SETUP:

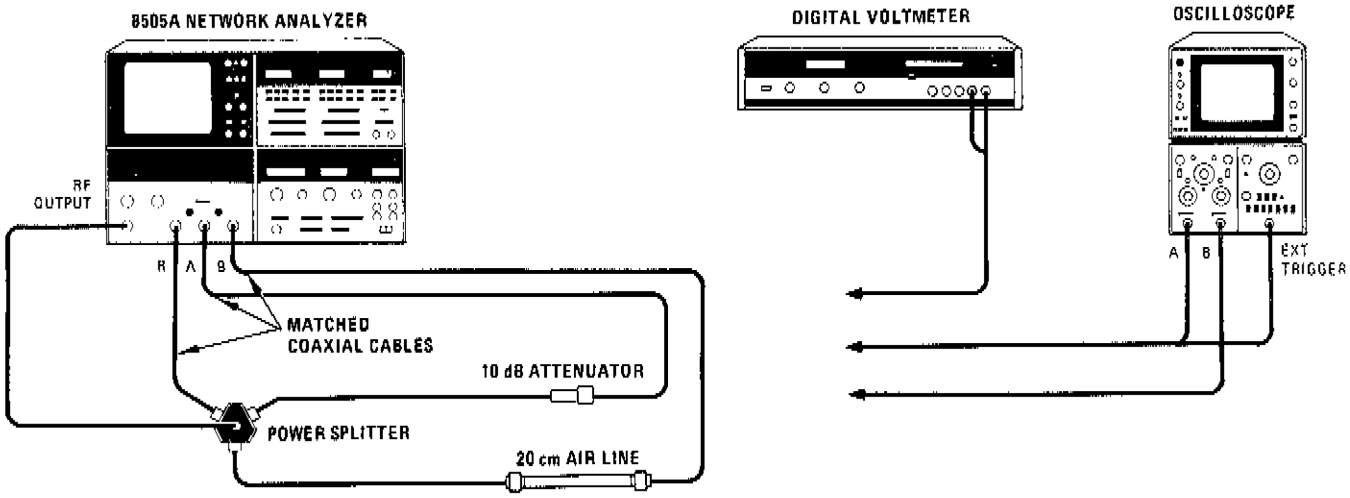


Figure D3-1J. Polar Troubleshooting Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
Oscilloscope	HP 180C/1801A/1820A
Power Splitter	HP 11850A
Matched Cable Kit	HP 11851A
10 dB Attenuator	HP 8491B Option 010
20 cm Air Line	HP 11567A

D3-5. POLAR MAGNITUDE AND PHASE TROUBLESHOOTING PROCEDURE (Cont'd)

CRITICAL 8505A SWITCH SETTINGS

A1 Source/Converter:	
OUTPUT LEVEL	−10 dBm
INPUT LEVEL	−10 dBm
A2 Frequency Controller:	
RANGE	.5 – 1300 MHz
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW Frequency	100 MHz
ΔF Frequency	0 MHz
CW Vernier	Fully Counterclockwise
ΔF Vernier	Fully Counterclockwise
SCAN TIME SEC	.1 – .01
SCAN TIME SEC Vernier	Fully Counterclockwise
TRIGGER	AUTO
MARKERS Select	1
MARKER 1 Position	Centered on CRT Trace
A3 Signal Processor:	
Channel 1:	
INPUT	A/R
MODE	POLAR MAG
SCALE/DIV	1
Channel 2:	
INPUT	B/R
MODE	POLAR PHASE
SCALE/DIV	1
Electrical Length:	
MODE	OFF

FIG. D3-1M
SHT. 1 OF 3

GROUP DELAY

Connect equipment as shown in Figure D3-1L. Depress DISPLAY MKR, then ZRO pushbuttons to zero digital readout. Adjust CW FREQUENCY up in frequency until digital readout again indicates zero degrees. (This is equivalent to 360 degrees phase shift.) Calculate Group Delay using the change in frequency required for 360 degree phase shift in formula below.

$$\text{Group Delay} = \frac{1}{\Delta F\,(\text{Hz})}$$

Set MODE switch to DLY and reset CW FREQUENCY to 700 MHz. Depress DISPLAY MKR, then CLR pushbuttons. Group Delay digital readout should indicate same as Group Delay calculated above.

NO

SIGNAL	TEST POINT
DELAY	A3A11 pin 27

Check that the voltage present corresponds to a 5 mV/ns scale.

NO

YES

Trouble is in A3A6 Input Multiplex Assembly or its control inputs. Refer to Figure D3-30 for further troubleshooting.

YES

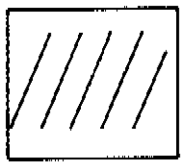
Set SCAN TIME SEC switch to 1 — .1 position. Group Delay digital readout should indicate same as above.

NO

SIGNAL	TEST POINT
V GD	A3A11 pin 15

Check that a 1 kHz sawtooth wave is present when operating in a CW frequency or the SCAN TIME SEC selected is 1 — .1 or greater.

NO

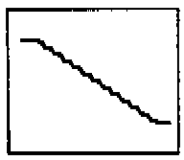


YES

SIGNAL	TEST POINT
VTN	A3A11 pin 14

Check that 1 kHz modulation is present on VTN ramp while operating in a CW frequency or the SCAN TIME SEC selected is 1 — .1 or greater.

NO



YES

Trouble is in A3A11 Delay Detector Assembly or its control inputs. Refer to Figure D3-40 for further troubleshooting.

FIG. D3-1M
SHT. 2 OF 3

	TEST POINT
	A3A11 pin 27

corresponds to a

NO

plex Assembly or
D3-30 for further

	TEST POINT
	A3A11 pin 15

is present when
SCAN TIME SEC

NO

SIGNAL	TEST POINT
GD EN	A3A11 pin 6

Check that +5 Volts is present when operating in a CW frequency or the SCAN TIME SEC switch position is 1 — .1 or greater.

NO

Trouble is in A3A7 Resolution Control Assembly or its control inputs. Refer to Figure D3-32 for further troubleshooting.

YES

Trouble is in A3A11 Delay Detector Assembly. Refer to Figure D3-40 for further troubleshooting.

	TEST POINT
	A3A11 pin 14

ent on VTN ramp
y or the SCAN
r.

— −0V

— −13V

NO

SIGNAL	TEST POINT
MOD EN	A3A11 pin 21

Check that +5 Volts is present when operating in a CW frequency or the SCAN TIME SEC switch position is 1 — .1 or greater.

NO

Trouble is in A3A11 Delay Detector Assembly or its control inputs. Refer to Figure D3-40 for further troubleshooting.

YES

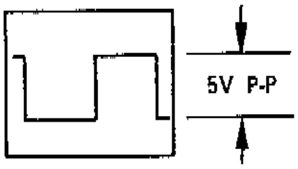
Trouble is in A2 Frequency Controller or interconnect cables. Refer to Figure C3-34 to check operation of A2A8 Sweep Select Assembly.

or Assembly or
3-40 for further

FIG D3-1M
SHT. 3 OF 3

SIGNAL	TEST POINT
LIM IF REF	A3A11 pin 4
LIM IF TEST	A3A11 pin 11

Check for the presence of a 5 Volt peak-to-peak squarewave that is varying in frequency at each test point.



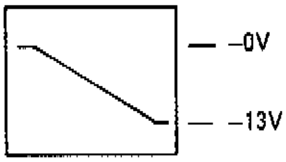
NO → Trouble is in A3A12 Phase Detector Assembly. Refer to Figure D3-42 for further troubleshooting.

YES ↓

SIGNAL	TEST POINT
VTN	A3A11 pin 14

NOTE

The VTN ramp may contain 1 kHz modulation if the 8505A is operated in a narrow ΔF frequency or a slower scan time.



NO → Trouble is in A2 Frequency Controller or interconnect cable. Refer to Figure C3-34 A2A8 Sweep Select VTN output.

YES ↓

Trouble is in A3A11 Delay Detector Assembly or its control inputs. Refer to Figure D3-40 for further troubleshooting.

ontrol Assembly
igure D3-32 for

tor Assembly or
D3-40 for further

Figure D3-1M. Group Delay Troubleshooting Procedure

TAB. D3-1 (1 OF 3)
SHT. 1 OF 2

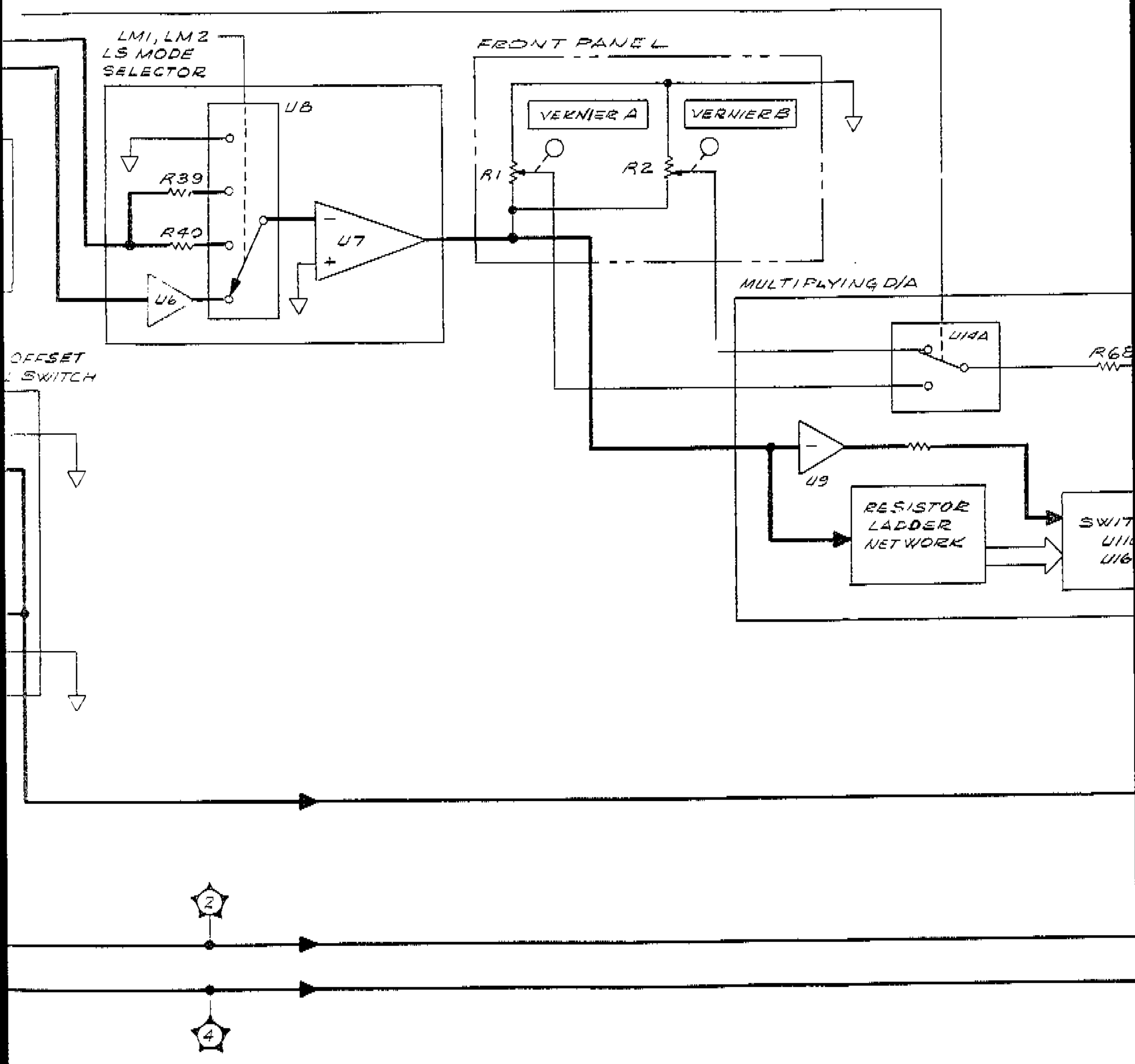
SIGNAL	SOURCE	DESCRIPTION	A3A2P1/A3A23J1	A3A3 PROCESSOR CONTROL	A3A4A PROCESSOR INTERFACE	A3A4B PROCESSOR INTERFACE	A3A5 PROCESSOR D/A	A3A6 INPUT MULTIPLEX	A3A7 RESOLUTION CONTROL	A3A8 POLAR CONVERTER	A3A9 PHASE OFFSET II	A3A10 PHASE OFFSET I	A3A11 DELAY DETECTOR	A3A12 PHASE DETECTOR	A3A13 R MAGNITUDE DETECTOR	A3A14 A,B MAGNITUDE DETECTOR	A3A15 ANALOG DISPLAY MULTIPLE…	A3A16 BLANKING LOGIC	A3A17 MARKE…
+5V (E2)	A3A4-TP4	Digital +5V Supply to Front Panel.	8,26	15,30															
+5V (E3)	A3A24-TP4	Analog +5V Supply.				8,26	8,26	8,26	5,20	5,20	5,20	5,20	5,20	6,20	5,20	8,26	8,25	8,26	8,26
+15V (E5)	A3A24-TP3	+15V Supply	12,30		20	12,30	12,30	12,30	9,24	9,24	9,24	9,24	9,24	9,24	9,24	12,30	12,30	12,30	
−15V (E4)	A3A24-TP2	−15V Supply	10,28			10,28	10,28	10,28	7,22	7,22	7,22	7,22	7,22	7,22	7,22	10,28	10,28	10,28	
+25V	A3A24-6,21	+25V Supply																	
+25V FILT	A3A27-33	+25V Filtered from Blanking Amplifier A27 to H.V. A26.																	
+25V RET	A3A27-35	+25V Return (ground).																	
+100V	A3A24-TP1	+100V Supply to Blanking Amplifier A27.																	
AB0	A3A3-1	A Bus 0 instruction decoder.	1	7															
AB1	A3A3-2	A Bus 1 instruction decoder.	2	6															
AB2	A3A3-3	A Bus 2 instruction decoder.	3	5															
AB3	A3A3-4	A Bus 3 instruction decoder.	4	4															
ACC	A3A27-28	Voltage to CRT Accelerator.																	
A/D POL	A3A17-6	Analog-to-Digital Polarity. (See Timing Diagram in Troubleshooting).																6	24
A/D REF 1	A3A18-21	Analog-to-Digital Reference 1. (See Timing Diagram in Troubleshooting).																3	21
A/D REF 2	A3A18-22	Analog-to-Digital Reference 2. (See Timing Diagram in Troubleshooting).																4	22
A/D RESET	A3A18-23	Analog-to-Digital Reset. (See Timing Diagram in Troubleshooting).																5	23
AF2 A3	A3A20-21	Algorithmic Flip-Flop 2 A3. Controls ASM2 Flags for A3.																	
ASTIG	A3A27-12	Astigmatism control to CRT.																	
AVA	A3A19,20,21	Available. Ready for update.																	
BB3	A3A3-36	B Bus 3. Bit 3 of Register B output.	36		7														
BEAM CTR X	A3A23J11-11	Beam Center X. Display Offset X Axis for Polar.														20			
BEAM CTR Y	A3A23J11-10	Beam Center Y. Display Offset Y Axis for Polar.														34			
BP 3	A2A8-50	Blanking Pulse 3. Retrace Blanking.										28					14		
BPF IF TEST	A3A12-12,27	Band Pass Filter, IF Test. 100 kHz limited IF signal.							12				12,27						
CH 1 FILT	A3A7-20	Channel 1 Filter. ±2.5V Scaled and LPF output.						20								32			
CH1 MPX	A3A6-1,19	Channel 1 Multiplex. ±5V Detector output.					1,19	1										24	
CH 2 FILT	A3A7-34	Channel 2 Filter. ±2.5V Scaled and LPF output.						34								3			
CH 2 MPX	A3A6-18,36	Channel 2 Multiplex. ±5V Detector output.					18,36	18										22	
CH 2 UD	A3A19,20	Channel 2 update. Updating Channel 2.																	
CKP	A3A4-27	Timing Clock P to Processor ≅ 800 kHz.	5	27															
CKS	A3A4-14	Timing Clock S to Processor ≅ 800 kHz.	25	14															
CON 1 A3	A3A19,20,21	ASM Control Line 1 for A3 Processor.																	
CON 2 A3	A3A19,20,21	ASM Control Line 2 for A3 Processor.																	
CON 3 A3	A3A19,20,21	ASM Control Line 3 for A3 Processor.																	
DIA X	A3A17-36	Diamond X. Deflection voltage for marker diamond.														18		36	
DIA Y	A3A17-34	Diamond Y. Deflection voltage for marker diamond.														16		34	
DBP	A2A8-47	Display Blanking Pulse from Frequency Control. DBP = 1 for blanking.															18		
DELAY	A3A11-27	Delay. ± 4V → ±800 units group delay detector output.					26					27							
DM	A2A6-22	Data Marker from Frequency Control.										25						16	19
DRIVE	A3A27-17	Drive for high voltage transformer A3A26T1.																	
DRIVE FB	A3A27-18,36	Drive Feedback to high voltage transformer.																	
EXT CH 1	A3J8	External Channel 1 input.					2,20	19											
EXT CH 2	A3J9	External Channel 2 input.					15,33	17											
EXT Z	A3J10	External Z Summing input.														24			
FG GRID	A3A27-11	Flood Gun Grid bias (to CRT).																	
FR1	A2A1A1-U3A	Frequency Range 1. FR1 = 0 when freq. range is .5 – 1300 MHz.			24							12							
FR2	A2A1A1-U3B	Frequency Range 2. FR2 = 0 when freq. range is .5 – 13 MHz.			23														
GD EN	A3A7-21	Group Delay Enable. 1 = Group Delay enabled.						21				6		11,26	11,26				
GND	A3 Ground Plane	Ground (Common), A3 Ground plane.				11,22, 29,32	11,29	11,29	8,23	2,8,14, 17,23,29	2,3,8,11, 13,14,17, 18,23,26, 28,29	1,2,3,8, 16,17, 18,23	3,8, 13,18, 23,28	8,23	8,23	11,29	11,29	11,29	11,29
GND (E1)	A3A1A1	Ground (E1) bus to front panel.	11,29		1,16														
H MOD	A3A11-13	High Modulation. 1 = Group Delay in Sample Mode.										13							
H ST 2	A3A3-19	Pulse to instruction decoder. Low enables.	19	8															
H.V. FB	A3A26-7,17	High Voltage Feedback to Blanking Amplifier.																	
IFG	A2A1J2-13	IF GAIN. 0 = IF max. input −30 dBm; 1 = max. input −10 dBm.												12,27	12,27				
IF LS POLAR	A3A10-10,25	IF Line Stretcher, Polar. 100 kHz output from Line Stretcher to Polar Converter.							6		10,25								
IF LS RET	A3A10-6,21	IF Line Stretcher Return. Limited 100 kHz output from Line Stretcher to Phase detector.									6,21		6,21						
IF PORT A	A1A5-9	100 kHz IF input to Port A.													1,16				
IF PORT B	A1A6-9	100 kHz IF input to Port B.													4,19				
IF PORT R	A1A4-9	100 kHz IF input to Port R.												1,16					
IF REF	A3A13-13,28	Band Pass 100 kHz IF reference signal.											1,16	13,28					
IF REF RET	A3A13-14,29	IF reference return.											2,17	14,29					
IF SEL	A3A7-25	IF Select 0 = Port A and 1 = Port B.				14		25							6,21				
IF TEST	A3A14-13,28	Band Pass 100 kHz IF Signal Selected for Port A or Port B.											15,30		13,28				
IF TEST RET	A3A14-14,29	IF Test Return.											14,29		14,29				
INT A3	A3A20-21	Interrupt A3.ASM Restart A3. 0 = TRUE.																	
INTENS LIM	A3A27-10	Intensity Limit to High Voltage Assembly.																	
I/O 1	A3A19,20,21	Input/Output 1. ASM Data Bus.																	
I/O 2	A3A19,20,21	Input/Output 2. ASM Data Bus.																	
I/O 3	A3A19,20,21	Input/Output 3. ASM Data Bus.																	
I/O 4	A3A19,20,21	Input/Output 4. ASM Data Bus.																	
I/O 5	Not Used.	Spare.																	
I/O A	Not Used.	Spare.																	
I/O CK A3	A3A19,20,21	Clocks ASM Data Bus in Processor Assembly.																	
I/O INH	A3A19-12	Inhibits I/O write updates.																	
L 1 kHz	A3A7-15	Low 1 kHz. 0 = 1 kHz.						15						10,25	10,25			13	
L A/D EXP	A3A3-20	Low Analog-to-Digital Expand. 0 = X10 Expand.	20															20	

TAB. D3-1 (1 OF 3) SHT. 2 OF 2

A3A11 DELAY DETECTOR	A3A12 PHASE DETECTOR	A3A13 R MAGNITUDE DETECTOR	A3A14 A-B MAGNITUDE DETECTOR	A3A15 ANALOG DISPLAY MULTIPLEX I	A3A16 BLANKING LOGIC	A3A17 MARKER I	A3A18 MARKER II	A3A19 I/O STORAGE	A3A20 I/O CONTROL	A3A21 HP INTERFACE BUS BUFFER	A3A22 CHARACTER GENERATOR	A3A23J11/A3A30J2	A3A23J12	COAX CABLE CONNECTORS	A3A30J2 FP (TO CRT CONTROL PANEL A3A25) PIN	WIRE COLOR	A3A26 HIGH VOLTAGE	A3A27 BLANKING AMPLIFIER	A3A28 HORIZ. DEFLECTION AMP	A3A29 VERT. DEFLECTION AMP	A3J1 NORMALIZER INTER-CONN PIN	WIRE COLOR	A3J2 FREQ CONTROL INTER-CONN PIN	WIRE COLOR	A3J3 TEST SET INTER-CONN PIN	WIRE COLOR
5,20	5,20	5,20	5,20	8,26	8,26	8,26	8,26	8,26	8,26	8,26	8,26				12	Blk										
9,24	9,24	9,24	9,24	12,30	12,30	12,30			35		1,19				13	Gray		7,25	9,24	9,24						
7,22	7,22	7,22	7,22	10,28	10,28	10,28			28		10,28				14	Blu		5,23	7,22	7,22						
																		16								
																	P1-4,14	33								
																		35								
																		9,27	12,27	12,27						
																		28								
						6	24																			
						3	21																			
						4	22																			
						5	23																			
									14	32																
																		12								
								19	19	19																
				20								11	25		5	Wht					3	W/Blk/Y				
				34								10	24		6	Brn					4	W/Blk/Gn				
28					14								14,25								8	W/R/Y	5	Blu		
	12,27																									
				32									23								A1	Brn				
						24																				
				3									44								A2	Red				
						22																				
								10	10																	
								7	7	7																
								6	6	6																
								5	5	5																
				18		36																				
				16		34																				
					18								7,35								9	W/Orn/Y	9	Vio		
27																										
25						16	19						8,36								14	Wht/R/Gray	14	Wht/Orn		
																	3,13	17								
																	2,12	18,36								
													52													
													53													
				24									54													
																		11								
12											23		31										2	Red		
											24		32										1	Brn		
6		11,26	11,26																							
1,2,3,8, 16,17, 18,23	3,8, 13,18, 23,28	8,23	8,23	11,29	11,29	11,29	11,29	11,29	11,29	11,29	11,29	2,6	28,56		15	Yel		2,6, 24	2,8, 14,15	2, 14,15						
13										27																
																	7,17	14,32								
		12,27	12,27										33										3	Orn		
	6,21																									
			1,16											A3A23J5									A2	Gray/Red		
			4,19											A3A23J6									A3	Gray/Orn		
		1,16												A3A23J4									A1	Gray/Brn		
	1,16	13,28																								
	2,17	14,29																								
			6,21																							
	15,30		13,28																							
	14,29		14,29																							
									15	33																
																	5,15	10								
								25	25	25																
								24	24	24																
								23	23	23																
								22	22	22																
								20	20	20																
									30	12																
								4	4	4																
								12					4													
		10,25	10,25			13																				
						20																				

Table D3-1. A3 Mnemonic Source Interconnections (1 of 3)

FIG. D3-26A
SHT. 2 OF 3



TAB. D3-1 (2 OF 3) SHT. 2 OF 2

A3A11 DELAY DETECTOR	A3A12 PHASE DETECTOR	A3A13 R MAGNITUDE DETECTOR	A3A14 A,B MAGNITUDE DETECTOR	A3A15 ANALOG DISPLAY MULTIPLEX I	A3A16 BLANKING LOGIC	A3A17 MARKER I	A3A18 MARKER II	A3A19 I/O STORAGE	A3A20 I/O CONTROL	A3A21 HP INTERFACE BUS BUFFER	A3A22 CHARACTER GENERATOR	A3A23J11/A3A30J2	A3A23J12	COAX CABLE CONNECTORS	A3A30J2 FP (TO CRT CONTROL PANEL A3A25) PIN	WIRE COLOR	A3A26 HIGH VOLTAGE	A3A27 BLANKING AMPLIFIER	A3A28 HORIZ. DEFLECTION AMP	A3A29 VERT. DEFLECTION AMP	A3J1 NORMALIZER INTER-CONN PIN	WIRE COLOR	A3J2 FREQ CONTROL INTER-CONN PIN	WIRE COLOR	A3J3 TEST SET INTER-CONN PIN	WIRE COLOR
								30			30															
							14	32			32															
				36									21												4	W/O/Grey
					17								19												2	Wht/Gray
					4								20												3	W/O/Vio
												13	55												8	W/Y/Gray
					13	31																				
												15			1	Brn										
												16			16	Red										
												14			2	Orn										
4,19	4,19																									
11,26	11,76																									
													51												9	Wht/Grn/ Blu
							10	28	27																	
				15		33																				
				13	31								49								7	Wht/ Red/ O				
					5								5,41								5	Wht/ Blk/ Blu	4	Wht/ Blu		
					7								42								6	Wht/ Blk/Vio				
			15,30																							
		15,30											1													
					32																					
				1	19								43								12	Wht/ R/Blu				
								3	3	3	12															
										36			6,9, 37										16	Wht/ Grn	7	Wht/ Y/Vio
							13	31			31															
								9	9																	
										2																
										1																
																		29								
21													34										10	Gray		
						18							11,39								13	W/R/ Vio	13	W/Red		
					9									A3A23 J9							A7	Brn				
					21									A3A23 J7							A4	Orn				
					6									A3A23 J8							A5	Yel				
														A3A23 J10							A6	Grn				
																		13								
							31	13			13															
							32	14			14															
							33	15			15															
							34	16			16															
							35	17			17															
							36	18			18															
																		30								
							15	33			33															
							16	34			34															
							17	35			35															
							18	36			36															
					1	19																				
	10,25																									
19					35	32					9		17,47								17	Wht/Blu Vio	12	Wht/ Blk		

Table D3-1. A3 Mnemonic Source Interconnections (2 of 3)

TAB. D3-1 (3 OF 3)
SHT. 1 OF 2

SIGNAL	SOURCE	DESCRIPTION	A3A2P1/A3A23J1	A3A3 PROCESSOR CONTROL	A3A4A (PROCESSOR INTERFACE)	A3A4B (PROCESSOR INTERFACE)	A3A5 PROCESSOR D/A	A3A6 INPUT MULTIPLEX	A3A7 RESOLUTION CONTROL	A3A8 POLAR CONVERTER	A3A9 PHASE OFFSET II	A3A10 PHASE OFFSET I	A3A11 DELAY DETECTOR	A3A12 PHASE DETECTOR	A3A13 R MAGNITUDE DETECTOR	A3A14 A,B MAGNITUDE DETECTOR	A3A15 ANALOG DISPLAY MULTIPLEX I	A3A16 BLANKING LOGIC	A3A17 MARKER 1	A3A18 MARK	
PLOT X	A3A15-23	Plot X recorder output.															23				
PLOT Y1	A3A15-6	CH 1 Y axis recorder output.															6				
PLOT Y2	A3A15-4	CH 2 Y axis recorder output.															4				
PL-RP	A3A16-34	Pen Lift drive voltage to Rear Panel.																34			
POLAR X	A3A8-15,30	Polar detector output X axis.						16,34	36	15,30											
POLAR Y	A3A8-14,29	Polar detector output Y axis.						17,35	35	14,28											
POSN SEL	A3A16-2	Position Select. 1 = Reference line selected during retrace.							6	10											
PRIMARY	A3A27-16,34	To Primary of A3A26T1.																2			
PROC X	A3A15-2	Processor X axis deflection voltage.															2	20			
PWM 1	A3A4A-23	Pulse Width Modulator 1. CH 1 magnitude or group delay.			23		1														
PWM 2	A3A4A-24	Pulse Width Modulator 2. CH 2 magnitude or group delay.			24		2														
PWM 3	A3A4A-25	Pulse Width Modulator 3. CH 1 phase input to D/A LPF.			25		20														
PWM 4	A3A4A-26	Pulse Width Modulator 4. CH 2 phase input to D/A LPF.			26		21														
PWM POL	A3A4A-22	Pulse Width Modulator Polarity. Multiplexed polarity. 1 = negative number.			22		19														
PWR RST	A3A3-27	Power Reset. Used on A3A3 only.		27																	
QAL 1 A3	A3A20,21	ASM Qualifier Input 1 for Processor Assembly.																			
QAL 2 A3	A3A20,21	ASM Qualifier Input 2 for Processor Assembly.																			
QAL 3 A3	A3A20,21	ASM Qualifier Input 3 for Processor Assembly.																			
RECT POSN 1	A3A25R1	Rectangular Position 1. Offset voltage from REF LINE POSN CH1 Control.															33				
RECT POSN 2	A3A25R4	Rectangular Position 2. Offset voltage from REF LINE POSN CH2 Control.															21				
RECT X POSN	A3A25R8	Rectangular X Position. Offset voltage from front panel pot for x deflection.															19				
REF UD A3	A3A19,20,21	Reference update A3. Update Reference Offset Flag.																			21
RES A1	A3A7-22	Resolution control (scale) least significant bit, CH 1.							22	16											
RES A2	A3A7-31	Resolution control (scale) least significant bit, CH 2.							31	1											
RES B1	A3A7-23	Resolution control (scale) next significant bit, CH 1.							23	17											
RES B2	A3A7-32	Resolution control (scale) next significant bit, CH 2.							32	2											
RES C1	A3A7-24	Resolution control (scale) most significant bit, CH 1.							24	18											
RES C2	A3A7-33	Resolution control (scale) most significant bit, CH 2.							33	3											
S/S UD	A2A18,20	START or STOP Update.				22			25												2
SW ALT	A3A16-3	Sweep Alternate. Controls alternating mode. 1 = CH 1; ∅ CH 2.																3	2	20	
T.A.	A3A25R9	Trace Alignment to CRT.																			
TB ∅	A3A3-32	Internal T Bus ∅ to digital processor.		32		3															
TB 1	A3A3-33	Internal T Bus 1 to digital processor.		33		4															
TB 2	A3A3-34	Internal T Bus 2 to digital processor.		34		5															
TB 3	A3A3-35	Internal T Bus 3 to digital processor.		35		6															
TEST SET	A3J3-6	Input from test set (8503). Selects forward or reverse calibration offsets.				21															
TTL DISP	A3A16-27	TTL Display. Blanking for CRT display.																27			
V GD	A3A11-15,30	Voltage, Group Delay. −6V → −3 MHz at 1300 MHz range.											15,30								
V OFFSET 1	A3A5-23	D/A offset voltage for CH 1.					23		5	19											
V OFFSET 2	A3A5-24	D/A offset voltage for CH 2.					24		7	4									23		
V SW 2	A2A8-48	Sweep voltage from Frequency Control.					25												21		
VTN	A2A8-23,37	Tuning Voltage. Sweep Select to Signal processor. 0 to −13V.					31						14,29				35		17		
WRT UD	A3A19,20	Write Update.																			1
WTH 1	A2A13-27	Width 1. State determined by controller (HP-IB).				23															
WTH 3	A2A13-10	Width 3. State determined by Controller (HP-IB).				25															
X DISP	A3A16-22	X axis deflection voltage to CRT.																22			
Y CH 1	A3A15-5	Y axis deflection voltage to CH 1.															5	23			
Y CH 2	A3A15-7	Y axis deflection voltage to CH 2.															7	25			
Y DISP	A3A16-24	Selected Y axis deflection voltage.																24			
Z DISP	A3A15-31	Z axis intensity.															31				
Z OUT	A3A27-8,26	Z axis blanking signal to High Voltage Assembly.																			

TAB. D3-1 (3 OF 3)
SHT. 2 OF 2

A3A10 PHASE OFFSET I	A3A11 DELAY DETECTOR	A3A12 PHASE DETECTOR	A3A13 R MAGNITUDE DETECTOR	A3A14 A,B MAGNITUDE DETECTOR	A3A15 ANALOG DISPLAY MULTIPLEX I	A3A16 BLANKING LOGIC	A3A17 MARKER I	A3A18 MARKER II	A3A19 I/O STORAGE	A3A20 I/O CONTROL	A3A21 HP INTERFACE BUS BUFFER	A3A22 CHARACTER GENERATOR	A3A23J11/A3A30J2	A3A23J12	COAX CABLE CONNECTORS	A3A30J2 FP (TO CRT CONTROL PANEL A3A25) PIN	A3A30J2 FP WIRE COLOR	A3A26 HIGH VOLTAGE	A3A27 BLANKING AMPLIFIER	A3A28 HORIZ. DEFLECTION AMP	A3A29 VERT. DEFLECTION AMP	A3J1 NORMALIZER INTER-CONN PIN	A3J1 WIRE COLOR	A3J2 FREQ. CONTROL INTER-CONN PIN	A3J2 WIRE COLOR	A3J3 TEST SET INTER-CONN PIN	A3J3 WIRE COLOR
					23									50													
					6									45													
					4									48													
						34								46													
						2																					
																		1,11	16,34								
					2	20																					
										16																	
										33	15																
										32	14																
										31	13																
					33								9	22		7	Orn					1	Wht/Blk Red				
					21								7	27		8	Grn					2	Wht/Blk Orn				
					19								12	16		4	Vio					10	Wht/Grn Gray				
									21	21	21																
									2	2																	
						3	2	20						10,38								15	Wht/Orn Yel	15	Wht/ Yel		
																3	Grn		31								
												22		18												6	Wht/Yel Blu
						27							1						4,22								
	15,30														A3A23 J3									A5	Gray/ Grn		
							23																				
							21																				
					35		17							12,13, 40								11	Wht/R/ Grn	11	Wht	1	Wht/ Vio
	14,29														A3A23 J2									A6	Gray/ Blu		
									1	1																	
														30										6	Yel		
														29										7	Grn		
						22							4							1,16							
					5	23																					
					7	25																					
						24							5								1,16						
					31								3						19								
																		10,20	8,26								

Table D3-1. A3 Mnemonic Source Interconnections (3 of 3)

Table D3-2. A3 Signal Processor Coax Cables (1 of 2)

Reference Designation	HP Part No.	Description	Mnemonic	Remarks
W1	08505-60043	CABLE ASSY, RIBBON; DISP MB to AUX FP A3A23J1 to A3A2P1		
W2	08505-60024	CABLE ASSY, RIBBON; AUX FP to FP A3A2P2 to A3A1J1		
W3	08505-60026	CABLE ASSY, RIBBON; AUX FP to FP A3A2J1 to A3A1P1		
W4	08505-60025	CABLE ASSY, RIBBON; PROG MB TO DISP MB A3A23J11 to A3A30J2		
W5	08505-60027	CABLE ASSY, COAX; GRAY/BRN A3J2-A1 to A3A23J4	IF PORT R	
W6	08505-60028	CABLE ASSY, COAX; GRAY/RED A3J2-A2 to A3A23J5	IF PORT A	
W7	08505-60029	CABLE ASSY, COAX; GRAY/ORN A3J2-A3 to A3A23J6	IF PORT B	
W8	08505-60030	CABLE ASSY, COAX; GRAY/GRN A3A23J3 to A3J2-A5	V GD	
W9	08505-60031	CABLE ASSY, COAS; GRAY/BLUE A3J2-A6 to A3A23J2	VTN	
W10	08505-60032	CABLE ASSY, COAX; YELLOW A3J1-A5 to A3A23J7	NORN Y	
W11	08505-60033	CABLE ASSY, COAS; GREEN A3J1-A6 to A3A23J10	NORM Z	
W12	08505-60034	CABLE ASSY, COAX; ORANGE A3J1-A4 to A3A23J7	NORM X	
W13	08505-60036	CABLE ASSY, COAX, BROWN A3A23J12-23 to A3J1-A1	CH 1 FILT	
W14	08505-60037	CABLE ASSY, COAX; RED A3A23J12-44 to A3J1-A2	CH 2 FILT	
W15	08505-60038	CABLE ASSY, COAX; VIOLET A3J1-A7 to A3A23J9	NORM TTL	

Table D3-2. A3 Signal Processor Coax Cables (2 of 2)

Reference Designation	HP Part No.	Description	Mnemonic	Remarks
W16	8120-2177	CABLE ASSY		
W17	01332-61602	CABLE ASSY, Y OUT		
W18	01332-61601	CABLE ASSY, CRT SOCKET		
W19	01334-61602	CABLE ASSY, POWER SUPPLY		
W20	01334-61604	CABLE ASSY, X OUT		
W21	01334-61605	CABLE ASSY, TRANSISTOR CONNECTION to A3A27		
W22	01334-61606	CABLE ASSY, RIBBON; DISP MB TO DISP FP		

FUNCTIONAL DESCRIPTION
8505A NETWORK ANALYZER SIGNAL PROCESSOR A3

The following descriptions are based on the block diagram of Signal Processor A3, drawing number 8505-60055.

MAGNITUDE DETECTORS A13 AND A14

The A, B, and R IF signal inputs to the Signal Processor come from the Source/Converter. The R, A, and B inputs are fed to two identical Magnitude Detector Boards, A13 and A14. A13 receives only the R input and provides a signal analogous to the magnitude of R. Another signal, taken from a point immediately after the bandpass filter and called "reference channel phase," goes to Phase Detector A12.

Magnitude Detector A14 selects either the A input or the B input with the IF switch for processing through the instrument. In both A13 and A14, following the IF switch, there is a times 1 or times 10 gain amplifier controlled by the maximum input level switch on the Source Converter. With the maximum level at -10 dBm, the gain of the amplifier is unity; when it is switched to -30 dBm, the gain is at 10. Along with the gain change, the summing junction after the logger is offset such that the level displayed on the CRT remains the same, and the level of the detector, which is picked up by the marker measurement, reads the correct value when the extra 20 dB gain is added.

The bandpass of the bandpass filter following the gain amplifier is either 10 kHz or 1 kHz wide. The band width is selected with the BANDWIDTH kHz switch on the CRT display panel. In the 10 Hz position, the band widths of both the IF bandpass filter on the Magnitude Detector and the low pass display smoothing filter on Resolution Board A7 are 10 kHz. In the 1 kHz position, both the IF bandwidth and the smoothing bandwidth are 1 kHz. In the 100 kHz position, the IF bandwidth stays at 1 kHz, but the display smoothing, or lowpass filtering, goes to 100 kHz.

The output from the bandpass filter is ac rectified to obtain a dc signal. It is then logged and buffered and fed to the Input Multiplexer, A6. Also, just as in A13, a 100 kHz sine wave signal is tapped off between the bandpass filter and the rectifier. This signal, called "Channel A or B phase," is fed, along with the reference channel phase, signal from A13 to the Phase Detector Board, A12.

PHASE DETECTOR A12

The Phase Detector input circuitry comprises two identical chains of three limiting amplifiers each. The test channel input (the Channel A or B phase signal from A14) feeds through its amplifier chain and out to the line stretcher (Phase Offset I) through pin 4. The signal is returned with some phase delay added to pin 6 and is again limited.

The Phase Detector reference channel is similar to the test channel except that it uses a bandpass filter in place of the line stretcher to simulate the Q of the line stretcher. The reference signal is limited and the two limited signals (test and reference) then drive a phase detector, providing a dc output which is applied to the Input Multiplexer, A6.

The signal in the test channel of Phase Detector A12, which is fed to the line stretcher, is also fed to the group Delay Detector Board, A11. It enters the Group Delay Detector as the IF test signal. From the reference channel of the Phase Detector, another signal is tapped off just before the bandpass filter and fed out pin 11 to Group Delay Detector A11. This signal is input to the Group Delay Detector as the IF reference signal.

GROUP DELAY DETECTOR A11

The Group Delay Detector consists of two frequency discriminators: one in the IF reference channel and one in the IF test channel. Each discriminator consists of a one-shot (monostable) multivibrator driving a current source which is followed by a low-pass filter. The signals out of the two channels enter a summing junction which derives the difference between them. The signal out of the summing junction represents the instantaneous ΔF (or frequency difference) between the two IF channels, which, in turn, corresponds to any frequency difference or delay existing in the RF channels.

Also entering the Group Delay Detector board is a tuning voltage which is differentiated to give a dc signal proportional to the frequency change rate. This signal, along with the signal out of the summing junction, is applied to a divider. The divider output is a signal that is proportional to the group delay between the two channels (R and A or B). There is also a sample and hold circuit in the group delay detector. As long as the fruency change or the amount of sweep (scan width) is great enough to maintain the output of the differentiator at more than 1/10 of a volt (normal operation), the sample/hold is inoperative. However, as the sweep rate or sweep bandwidth is decreased, the voltage out of the differentiator also decreases. If this voltage decreases to a threshold of approximately 1/10 of a volt, a sawtooth waveform is switched on which is fed back to drie the YIG oscillator and sweep it over a very small amount of its range. At the peak of the sawtooth waveform, the output of the divider is sampled and measured. Thus, the Group Delay Detector operates in two distinct modes: One, is a continuous $\Delta 0/\Delta t$ divided by the sweep rate $\Delta w/\Delta t$. The other is an artificially generated sawtooth which, by sweeping the YIG oscillator in very narrow increments, increases signal/noise ratio at slow sweeps where the ratio would ordinarily be excessively low.

POLAR CONVERTER A8

A 100 kHz signal taken from the output of the bandpass filter in the phase detector reference channel, and the output of the line stretcher (phase offset I board), are fed back into the Polar Converter Board, A8. The Polar Converter also receives the log ratio of log A/R or log B/R from Input Multiplexer Board A6 which derives this ratio from the log A or B and log R outputs of the Magnitude Detectors, A13 and A14. The log ratio is a dc level which is summed with either the magnitude offset I or magnitude offset II. The summed signal is then exponentiated and applied to one side of a multiplier. The other side of the multiplier receives the 100 kHz sine wave line-stretcher signal. These two signals are multiplied together such that the output of the multiplier is a 100 kHz sine wave with linear amplitude information on it. (In other words, a signal that is proportional to A/R or B/R and the cosine of 100 kHz). This signal is split, one side going directly to a mizer and the other through a 90-degree phase shifter to a second mixer. Both mixers are driven by the reference channel signal from the Phase Detector, A12. The signals are mixed together so that the sine of the phase difference between the signals is on the Y channel, and the cosine of their phase difference is on the X channel. The amplitude information passes through directly so there are two signals scaled by the factor A/R or B/R. These two signals form the two component parts of the polar display. When the BEAM CENTER button is pressed, a large negative voltage is summed in ahead of the exponentiator causing its output to go to zero. This enables the center of the circle to be positioned at center screen and expanded from there.

INPUT MULTIPLEXER A6

The input multiplexer receives four signals: (1) Log A or Log B; (2) Log R; (3) Group Delay Signal; and (4) Phase Detector Signal. The difference between the two log signals is taken to generate the log ratio signal. This signal goes into the Input Multiplexer besides going out to the Polar Converter. The multiplexer then selects one of these five signals for further processing in each channel to produce the Channel 1 and Channel 2 multiplex signals. Each signal can be Log A, Log B, Log R, Log (A/R), Log (B/R), Group Delay, or Phase. Each signal out of the Input Multiplexer then goes to the Resolution Control Board and the Marker I boards.

RESOLUTION CONTROL A7

In the Resolution Control Board, each channel multiplex signal is summed with the channel offset, using the front-panel OFFSET pushbutton. Once it is offset to the reference line, the trace can be expanded about that point with the SCALE/DIVISION switch on the front panel. The channel display can be either polar or rectangular, depending on which signal is selected. For example, in channel 1, selecting polar Y provides a polar display, while selecting the amplified channel 1 multiplex signal provides a rectangular display. In either case, the signal passes through the display smoothing, or video low pass filter that is controlled by the buttons on the CRT panel. The Resolution Control output is the channel 1 and channel 2 filtered signals. These signals are fed to the Display Multiplexer for further offsetting and chopping or alternating for the CRT display. They are also fed out rear-panel connector J2 as inputs to the Normalizer (a separate accessory).

DISPLAY MULTIPLEXERS I AND II, A15 AND A16

In Display Multiplexer I, the channel I or II filtered signal is summed with the channel I or II rectangular position signal from the CRT panel. Also summed in at this point are the marker diamond signals from the Marker I Board, A17. The signals are then buffered and fed to the Display Multiplex II Board, A16. In A16, two selections are made: one between the Channel I signal and the Channel II signal; and the other between the Channel I or II signal and the normalized signal (available only when a Normalizer is used). The selected signal is fed through the display interconnect receptacle J11, to the CRT.

MARKER I AND MARKER II BOARDS, A17 AND A18

The Marker Boards have two primary functions. The first is to measure the dc detector outputs by sampling the Channel I and Channel II multiplex signals and to send the measured vaues to the LED display. The second function is to generate the marker diamond information which is applied to the Display Multiplexer I Board, A15.

DIGITAL CONTROL

The instrument is controlled through two circuit board assemblies, Processor Control A3 and Processor Interface A4. These two assemblies operate through a 13-line bus which "talks" with the instrument's internal bus and communicates with the front panel. Processor Control A3 drives the Front Panel Auxiliary Board A1, which contains the digital circuitry for the LED's and annunciators. Also on the Auxiliary Front Panel Board is a multiplex scheme for scanning the state of the front panel. All the controls are scanned one channel at a time in parallel to determine what state the instrument is in. Only one-third of the front panel is operative at any one instant in time; however, the scanning is done very fast, so that it appears that the entire panel is operative. The state-of-the-instrument infromation is multiplexed back through the Processor Control.

The Processor Interface board does two things. Its output decoder sends all the information over to the Processor D/A Board A5, and controls the four pulse width modulators for generating the offsets for Channel, Channel 2, and the Phase Offset. It also communicates with all the data lines in the instrument and the I/O data registers, and they, in turn, make sure the appropriate information is going to the right place at the right time.

LINE STRETCHER OPERATION

On Phase Offset II Board A9, there are two oscillators that are phase locked together and oscillate at approximately 893 kHz. One is a crystal oscillator used as a reference. The other is a voltage-controlled oscillator (VCO) locked to the reference oscillator through a phase lock loop.

The phase offset signal (dc plus a ramp) out of the Processor DA, A5, is used to offset the phase of the VCO relative to the crystal oscillation by nearly ±1800 degrees. In Phase Offset I Board A10, these two offset 893 kHz signals are mixed with a 100 kHz signal, and the 893 kHz phase difference is applied to the 100 kHz.

The crystal oscillator in A9 drives the first mixer in A10, generating upper and lower sidebands, but only the upper sideband is selected. The signal is mixed again twith the phase locked 893 kHz from the A9 VCO and the lower sideband is taken. Now, the 100 kHz component of the signal out of the second mixer reflects the same phase difference as the incoming 893 kHz signals from the Offset II Board. This signal is fed through a low pass filter to get rid of the upper sideband and the lower sideband, which is 100 kHz, now offset in phase, is fed through pin 6 of the Phase Detector Board A12 where it is limited and used as the phase detector drive.

FIG. D3-18
SHT. 1 OF 3

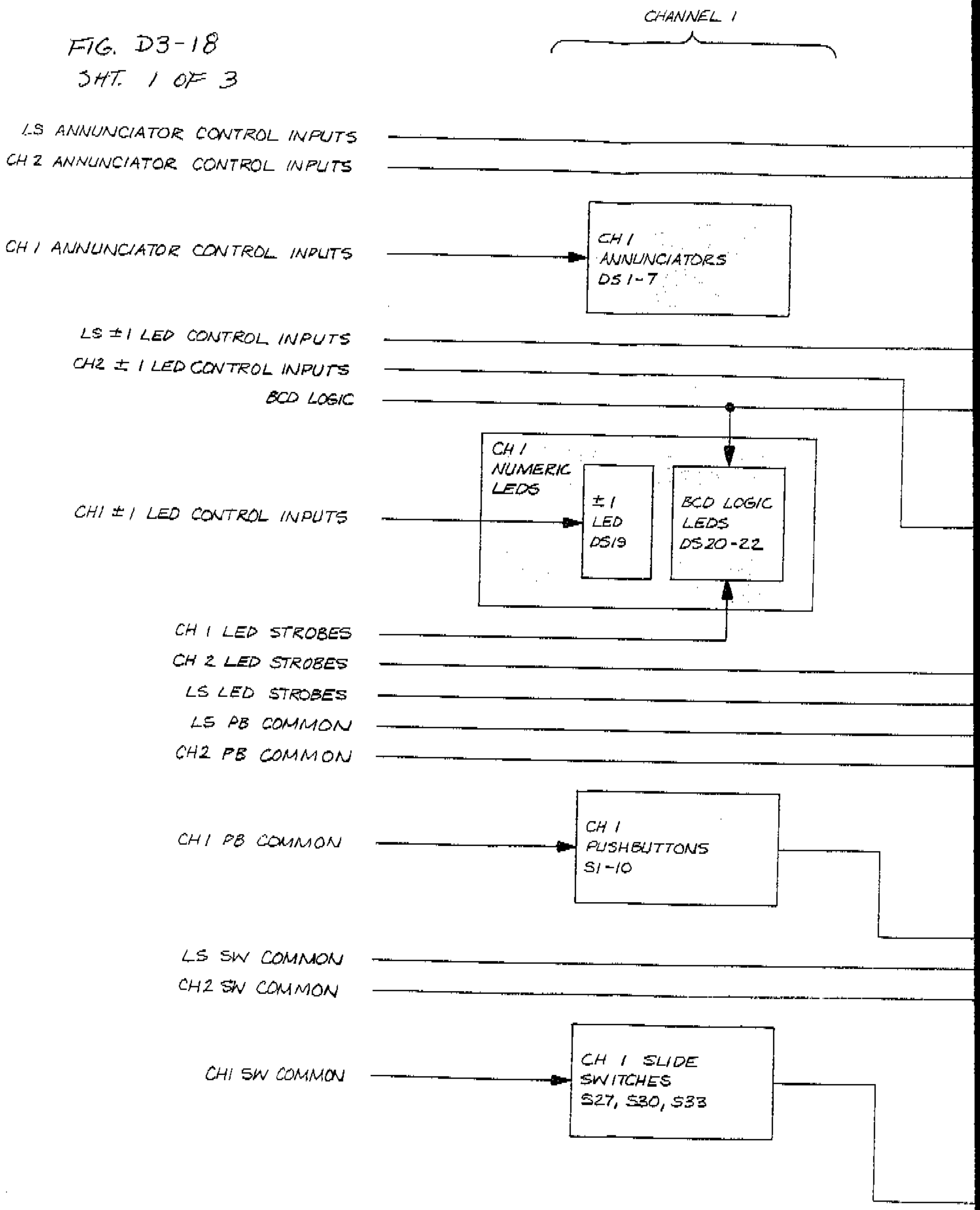


FIG. D3-18
SHT. 2 OF 3

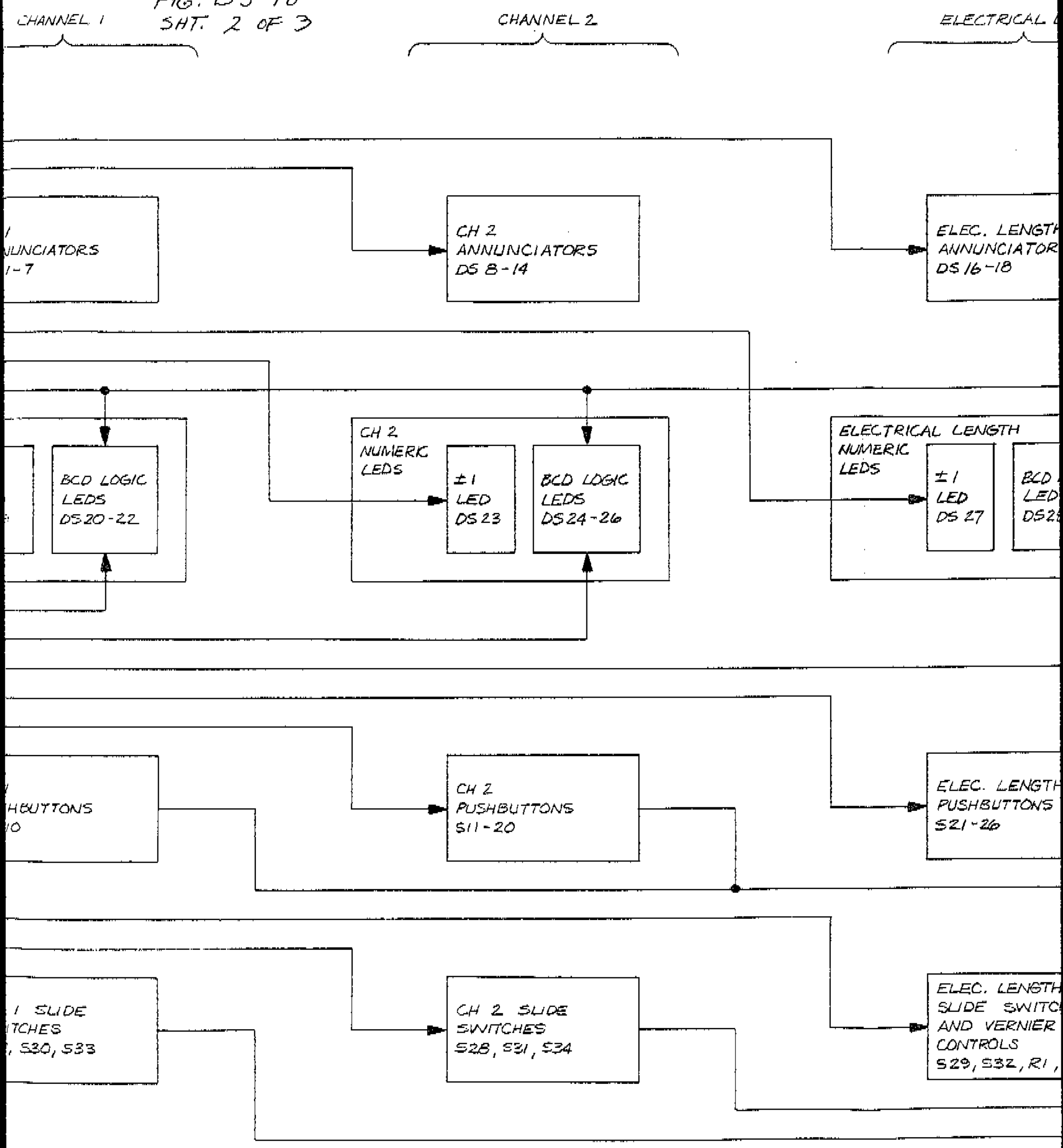


FIG. D3-18
SHT 3 OF 3

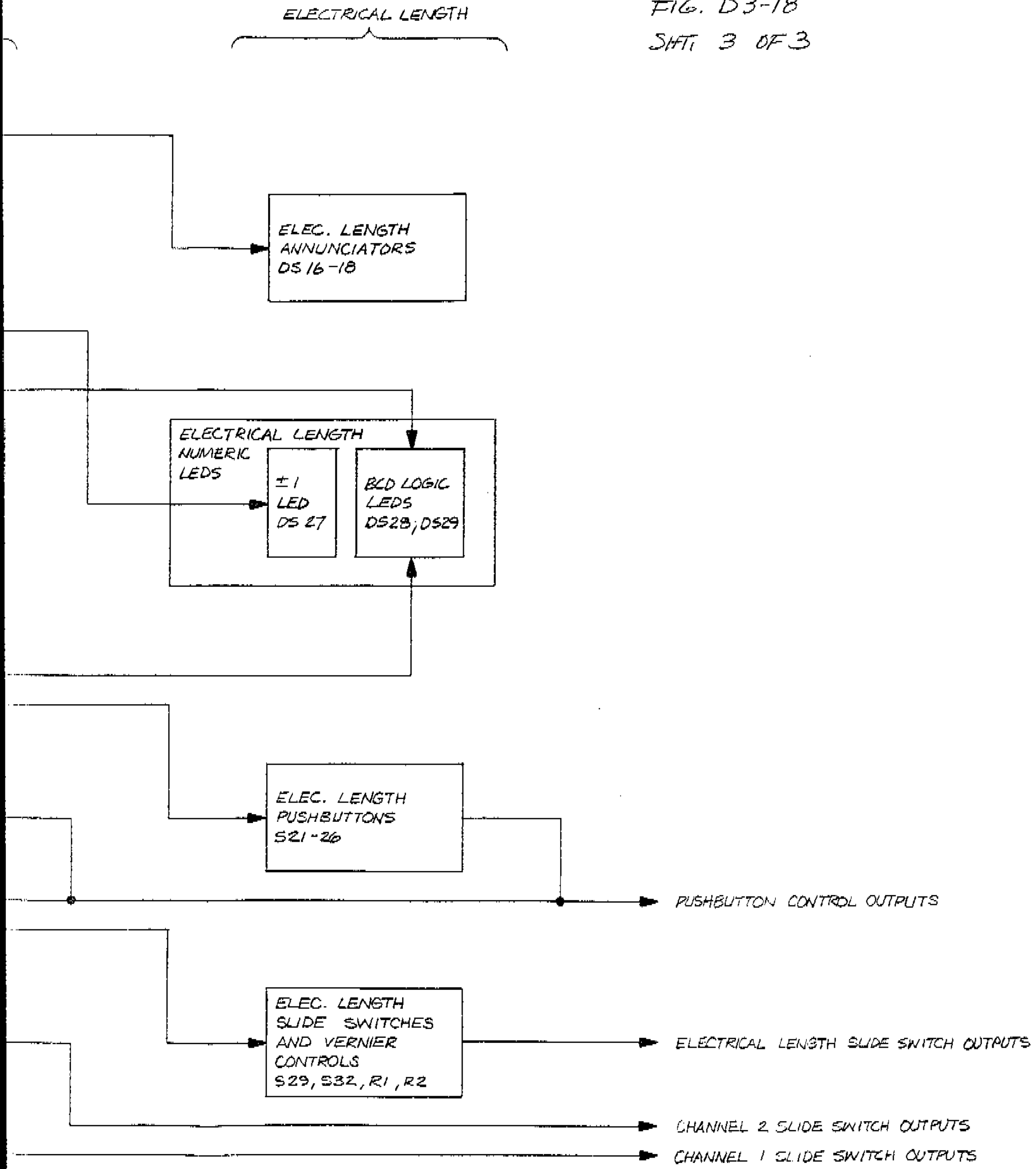


Figure D3-18. A3A1 Front Panel, Block Diagram

FIG. D3-17
SHT. 1 OF 5

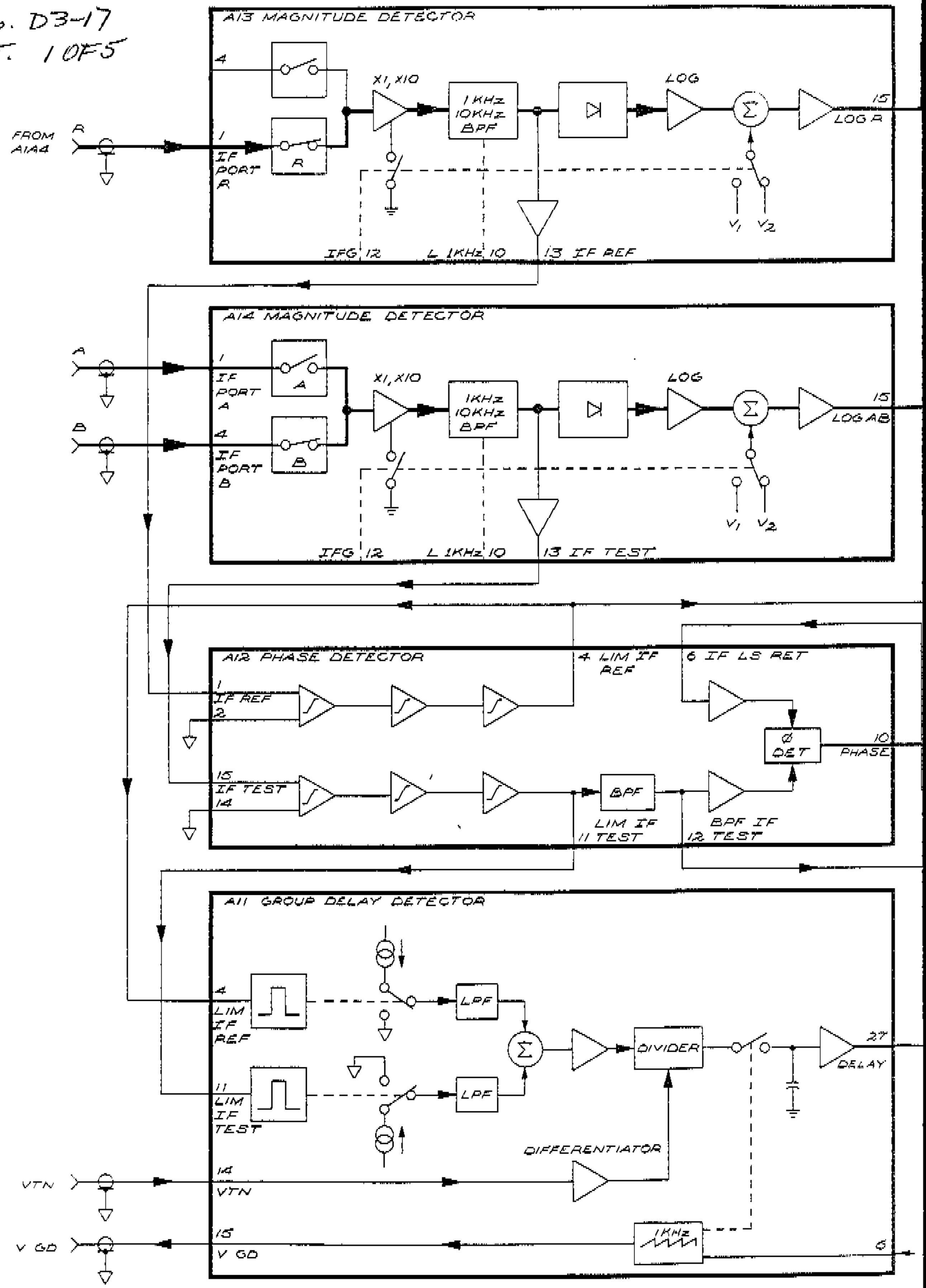


FIG. D3-17
SHT. 2 OF 5

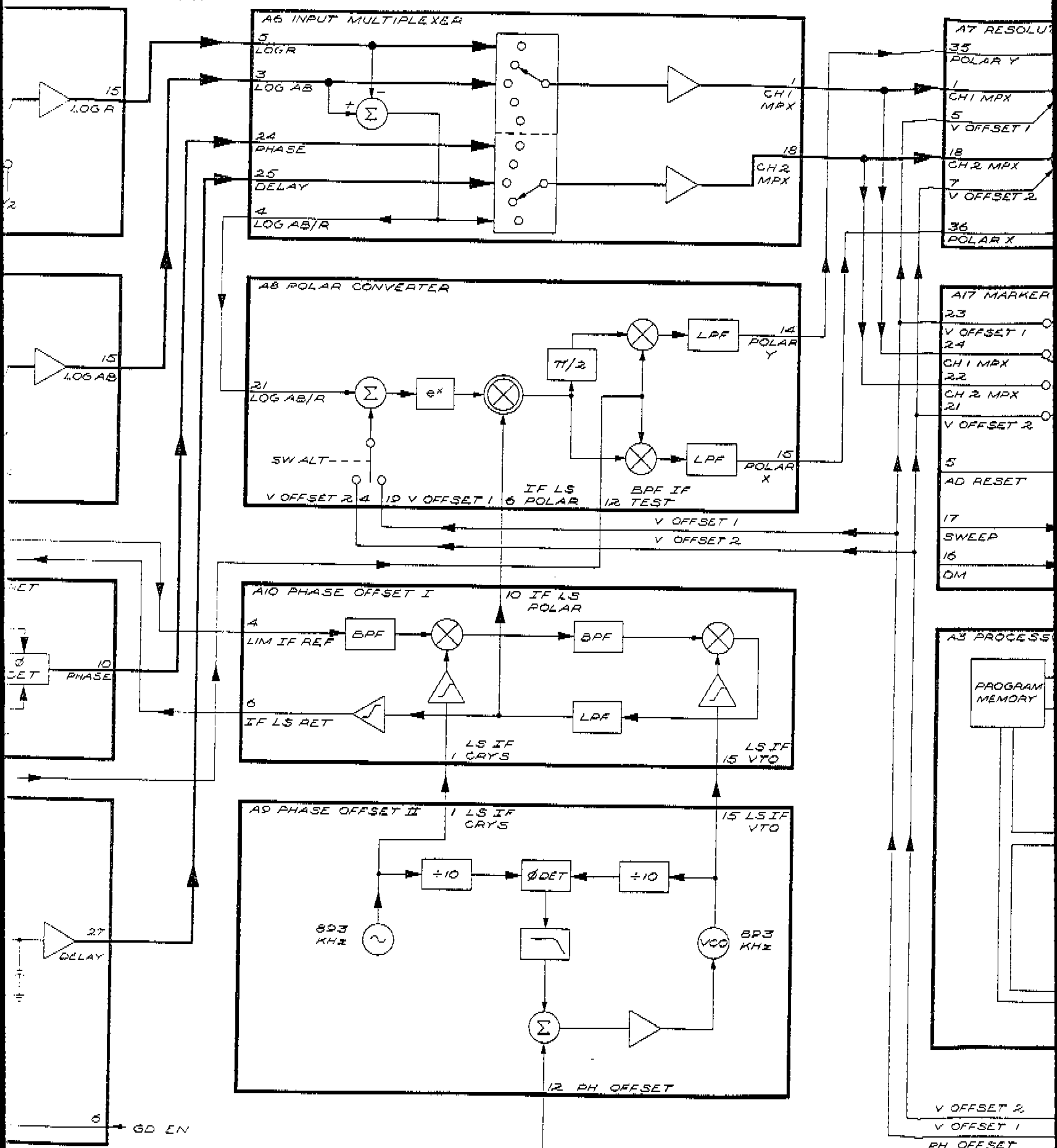


FIG. D3-17
SHT. 3 OF 5

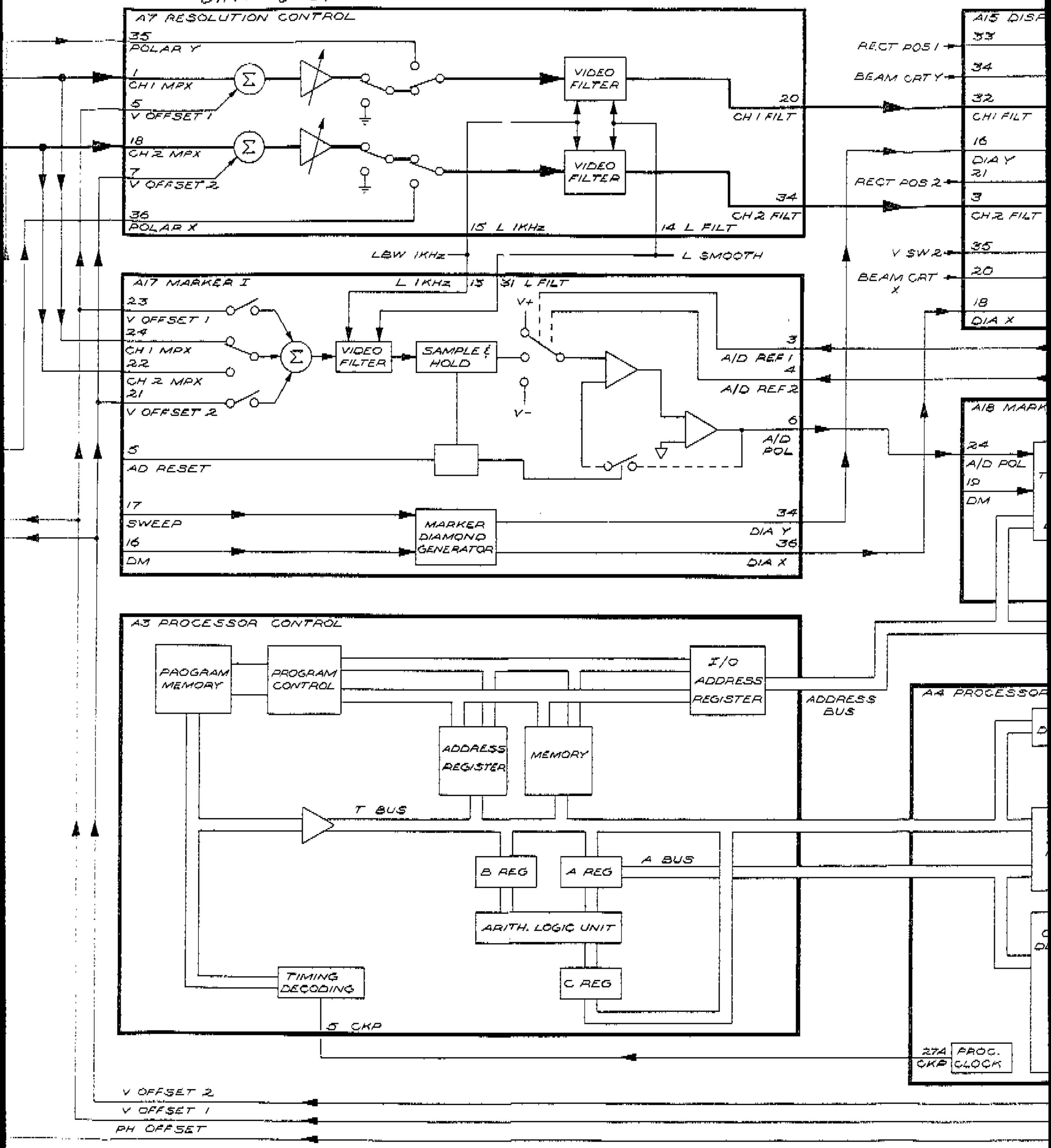


FIG. D3-17
SHT. 4 OF 5

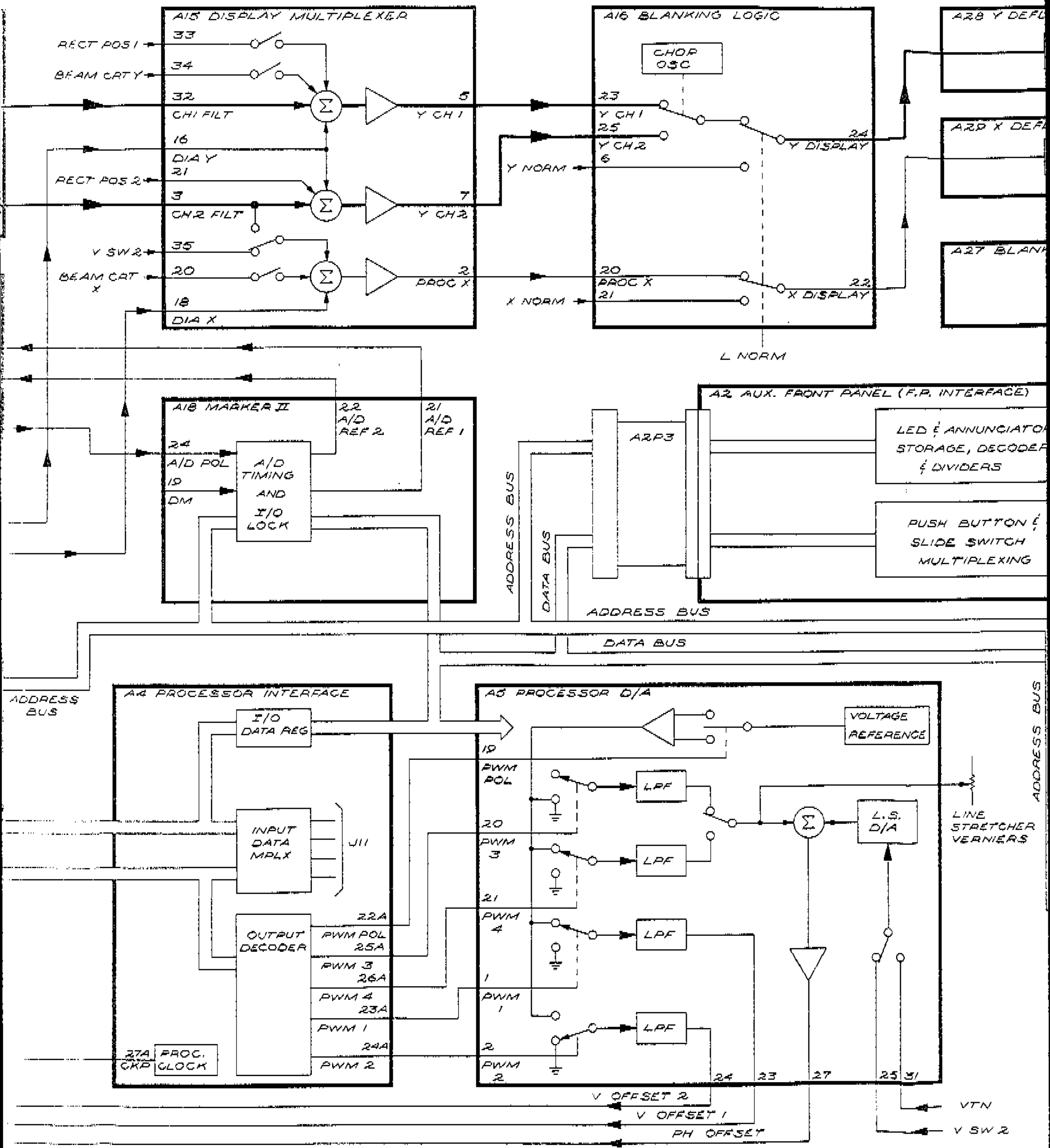
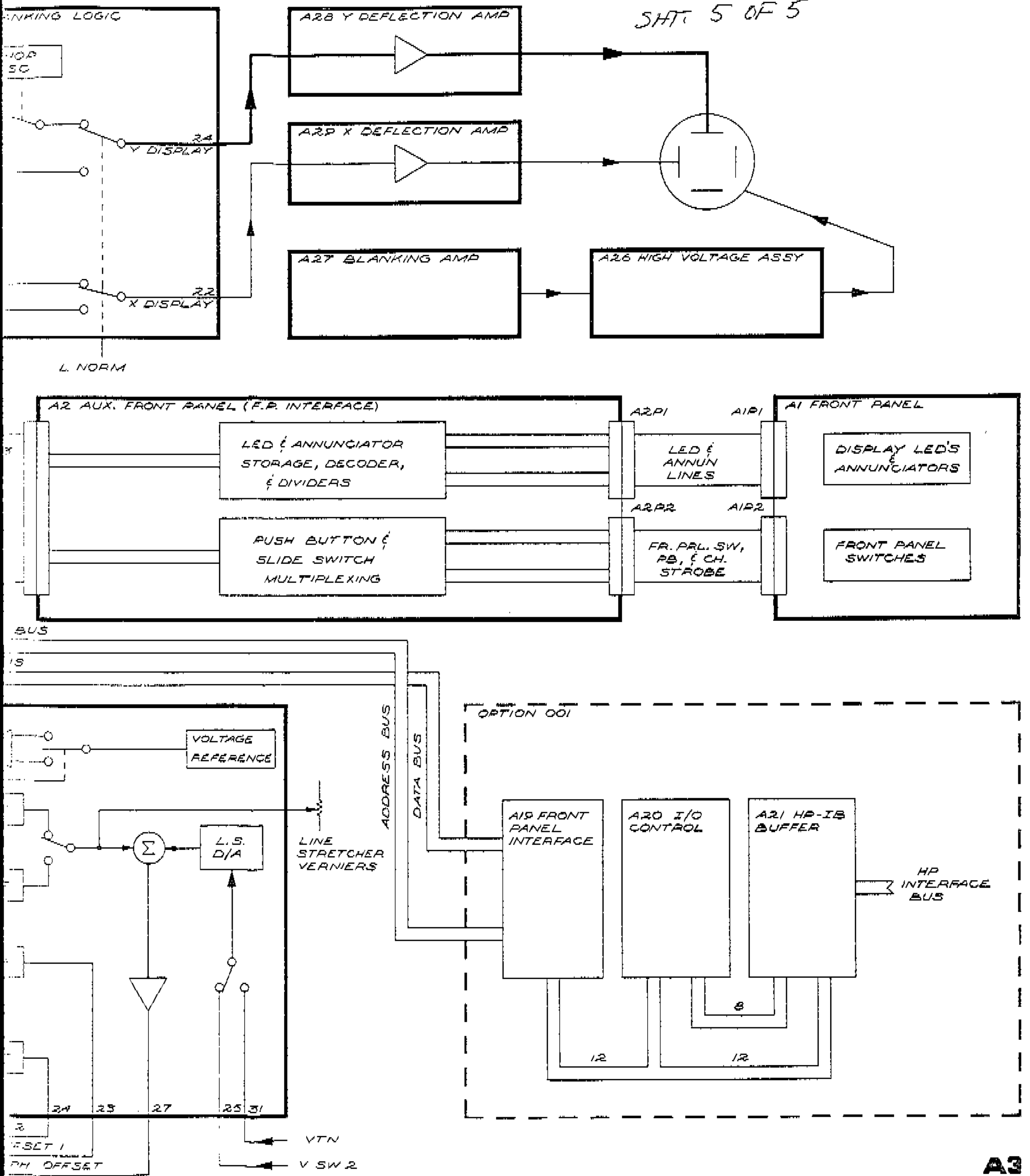


FIG. D3-17
SHT 5 OF 5



A3

Figure D3-17. A3 Signal Processor, Block Diagram

A3A1 FRONT PANEL

General Description

The A3A1 Front Panel Board is divided into three channels; Channel 1, Channel 2, and Electrical Length. Each channel has its own set of annunciators, numeric LEDs, pushbutton switches, and slide switches. The Electrical Length channel also has two vernier controls (potentiometers) for continuous fine adjustment of the Electrical Length line stretcher.

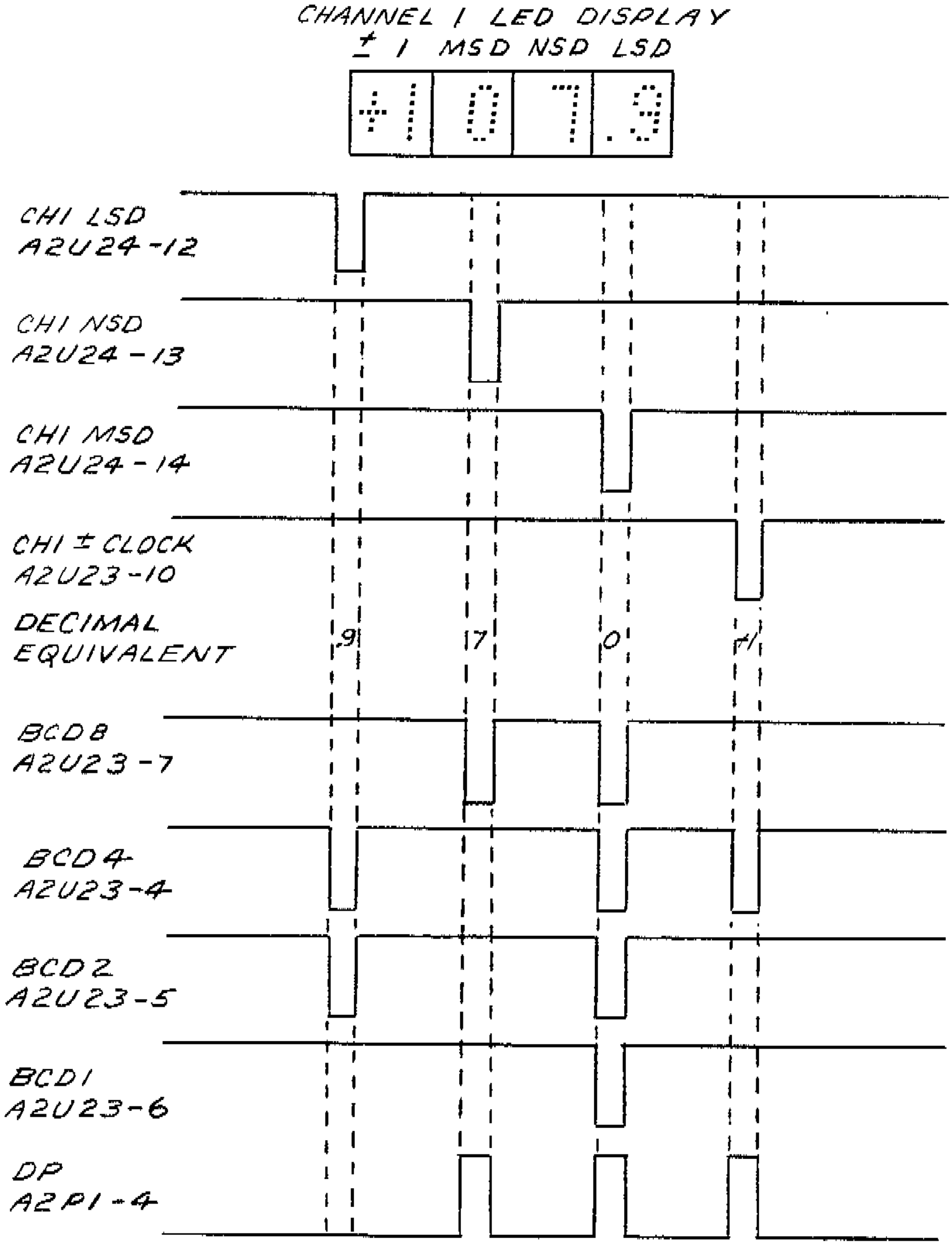
Annunciators

The annunciator LEDs are controlled by inputs from A3A2 Auxiliary Front Panel Board. Each annunciator LED is activated by a separate line. The schematic shows these individual lines at a bus for simplification and to reduce the number of signal lines on the schematic. A ground through a current-limiting resistor on the activating line from A3A2 turns an annunciator on. For example, if a ground is placed on A3A2U1R1 pin 1, the Channel 1 REF annunciator will be turned on. The Front Panel pushbuttons and slide switches, the A3A3 Processor Control and the A3A2 Auxiliary Front Panel Board actually determine which annunciator LEDs should be on.

Numeric LEDs

The digital displays for each channel contain two different types of LED readouts. Channel 1 and Channel 2 each have three LED readouts that will display a number (0 through 9) for a given BCD input, and one LED readout that will display only the "±" and "1". The Electrical Length channel has two LED readouts that will display a number (0 through 9) for a given BCD input, and one LED readout that will display only the "±" and "1". The BCD input LED readouts will also display a decimal point. The BCD lines and decimal point (DP) line are bussed to all of the LED readouts except the "±1" displays. Each LED readout is strobed in a particular time sequence to enter the data into the latches of the LED readouts.

Referring to Figure D3-18A, Channel 1 LED display is indicating +107.9. The four digits are strobed in, beginning with the least significant digit. When CH1 LSD (least significant digit) is enabled by the low-going strobe, BCD 8 and BCD 1 are high so a "9" is indicated. When CH1 NSD (next significant digit) is enabled, BCD 4, BCD 2 and BCD 1 are high so a 7 is indicated. When CH1 MSD (most significant digit) is enabled, all BCD lines are low so zero is indicated. When CH1 ±1 clock signal appears, BCD 8 line places a high on A2U23-7 which results in a low output from Q_D and turns on the vertical portion of the plus (+) sign. BCD 4 places a low on A2U23-4 which results in a low output from Q_A and turns on CH 1 "REF" (if MKR mode was selected the BCD 4 line would be high). BCD 2 places a high on A2U23-5 and turns on the horizontal portion of the plus (+) sign. And BCD 1 places a high on A2U23-6 which results in a high output from Q_C. The high output from Q_C is inverted and turns on the CH1 "1". The decimal point requires a low input at A1J1-29 (from A2P1-4). Observing the DP line output in Figure D3-18A, the only position where DP is low is when CH1 LSD is strobed so a decimal point is indicated in front of the 9 (LSD).



D3-46 b

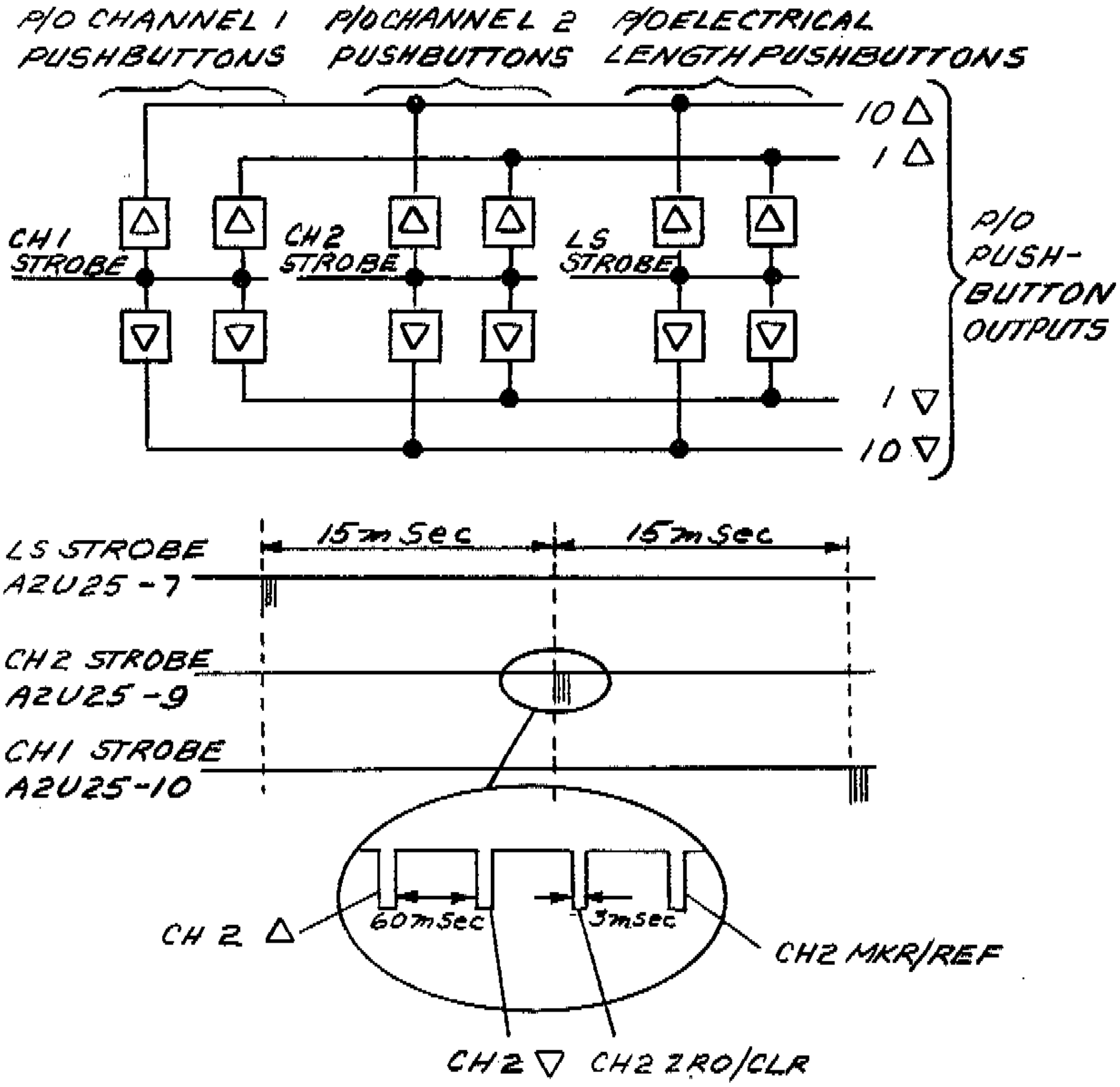
Figure D3-18A. Channel 1 LED Display

Pushbutton Switches

The pushbutton switches are grouped into three sets: Channel 1 pushbuttons, Channel 2 pushbuttons, and Electrical Length pushbuttons. Each group is strobed at a different point in time to permit the switches to be read without ambiguity. Figure D3-18B shows the strobe pulses for Channel 1 (CH1), Channel 2 (CH2), and Electrical Length (LS). Electrical Length pushbutton switches are read first, then Channel 2 pushbutton switches, and then Channel 1 pushbutton switches. The low stobe for each channel actually consists of four three-microsecond pulses approximately sixty microseconds apart. The first pulse in this series of four permits the multiplexer in A3A2 to read the "up" pushbuttons (Δ). The second pulse permits the "down" pushbuttons (∇) to be read. The third pulse permits the ZRO and CLR pushbuttons to be read. And the fourth pulse permits the MKR and REF pushbuttons to be read.

Slide Switches

The Slide Switches are read in the same manner as the pushbutton switches. The slide switches for each of the three different channels are sequentially strobed and the switch position for each channel is placed on the Processor Data Bus (PDB) by circuitry in A3A2 Auxiliary Front Panel Board.



Signal	Test Point	Signal	Test Point
10 △	A3A2U20 pin 15	MARK OFF	A3A2U19 pin 12
10 ▽	A3A2U20 pin 14	MARK ON	A3A2U20 pin 12
1 △	A3A2U19 pin 15	CLR	A3A2U19 pin 13
1 ▽	A3A2U19 pin 14	ZERO	A3A2U20 pin 13
.1 △	A3A2U18 pin 15		
.1 ▽	A3A2U18 pin 14		

Figure D3-18B. A3A1 Front Panel Pushbutton Logic

NOTE

0 = Strobed 0 Volt Signal
1 = +5 Volt

CHANNEL 1 INPUT

Signal	Test Point	R	A	B	A/R	B/R
L PORT B1	A2U6-3	1	1	0	1	0
L PORT R1	A2U10-10	0	1	1	1	1
L RATIO 1	A2U10-12	1	1	1	0	0

CHANNEL 1 MODE

Signal	Test Point	OFF	MAG	PHASE	DLY	Polar MAG	Polar PHASE
MAG 1	A2U6-1	1	1	0	0	1	0
PH 1	A2U6-10	1	0	1	0	0	1
RECT 1	A2U10-4	1	1	1	1	0	0

CHANNEL 1 SCALE/DIV

Signal	Test Point	20	10	5	2	1	.5	.2	.1
RES A1	A2U10-2	1	0	1	0	1	0	1	0
RES B1	A2U11-12	1	1	0	0	1	1	0	0
RES C1	A2U11-2	1	1	1	1	0	0	0	0

CHANNEL 2 INPUT

Signal	Test Point	R	A	B	A/R	B/R
L PORT B2	A2U6-5	1	1	0	1	0
L PORT R2	A2U10-9	0	1	1	1	1
L RATIO 2	A2U10-13	1	1	1	0	0

CHANNEL 2 MODE

Signal	Test Point	OFF	MAG	PHASE	DLY	Polar MAG	Polar PHASE
MAG 2	A2U6-2	1	1	0	0	1	0
PH 2	A2U6-11	1	0	1	0	0	1
RECT 2	A2U10-5	1	1	1	1	0	0

CHANNEL 2 SCALE/DIV

Signal	Test Point	20	10	5	2	1	.5	.2	.1
RES A2	A2U10-1	1	0	1	0	1	0	1	0
RES B2	A2U11-13	1	1	0	0	1	1	0	0
RES C2	A2U11-1	1	1	1	1	0	0	0	0

ELECTRICAL LENGTH INPUT

Signal	Test Point	A	B
L PORT B LS	A2U6-4	1	0

ELECTRICAL LENGTH MODE

Signal	Test Point	OFF	Length X	Length X	PHASE
RNG 1 LS	A2U6-9	1	0	1	0
RNG 2 LS	A2U6-13	1	1	0	0

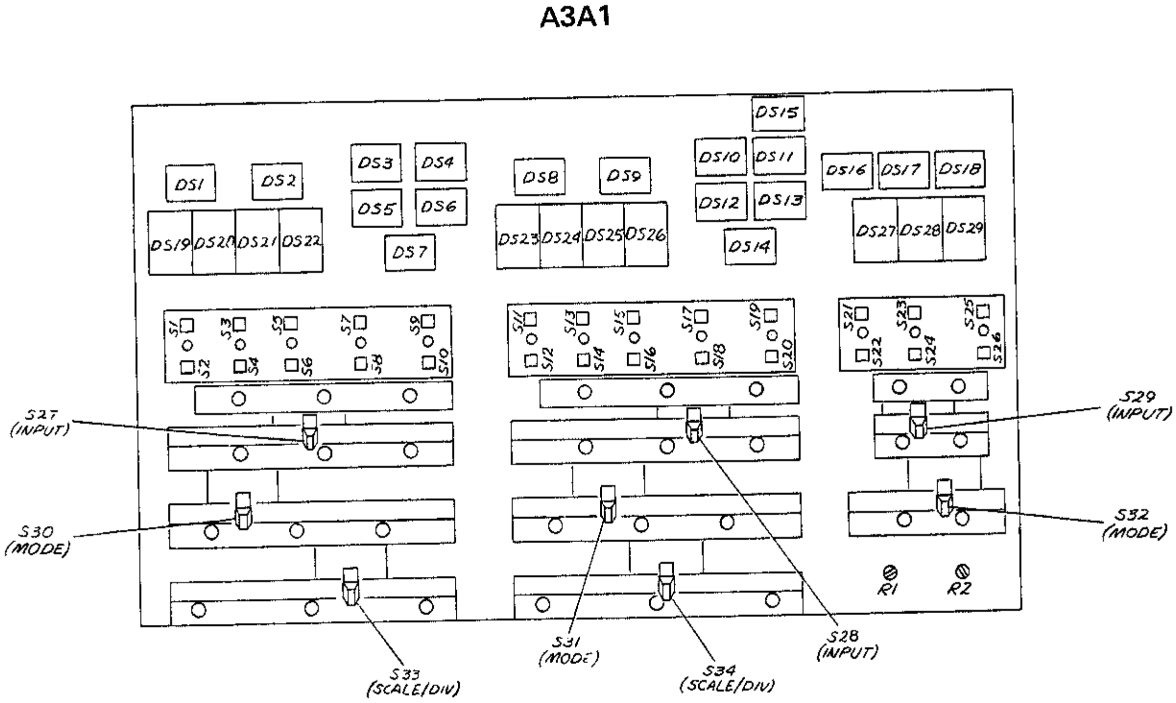


Figure D3-19. A3A1 Front Panel Parts Location

FIG. D3-20
SHT. 1 OF 4

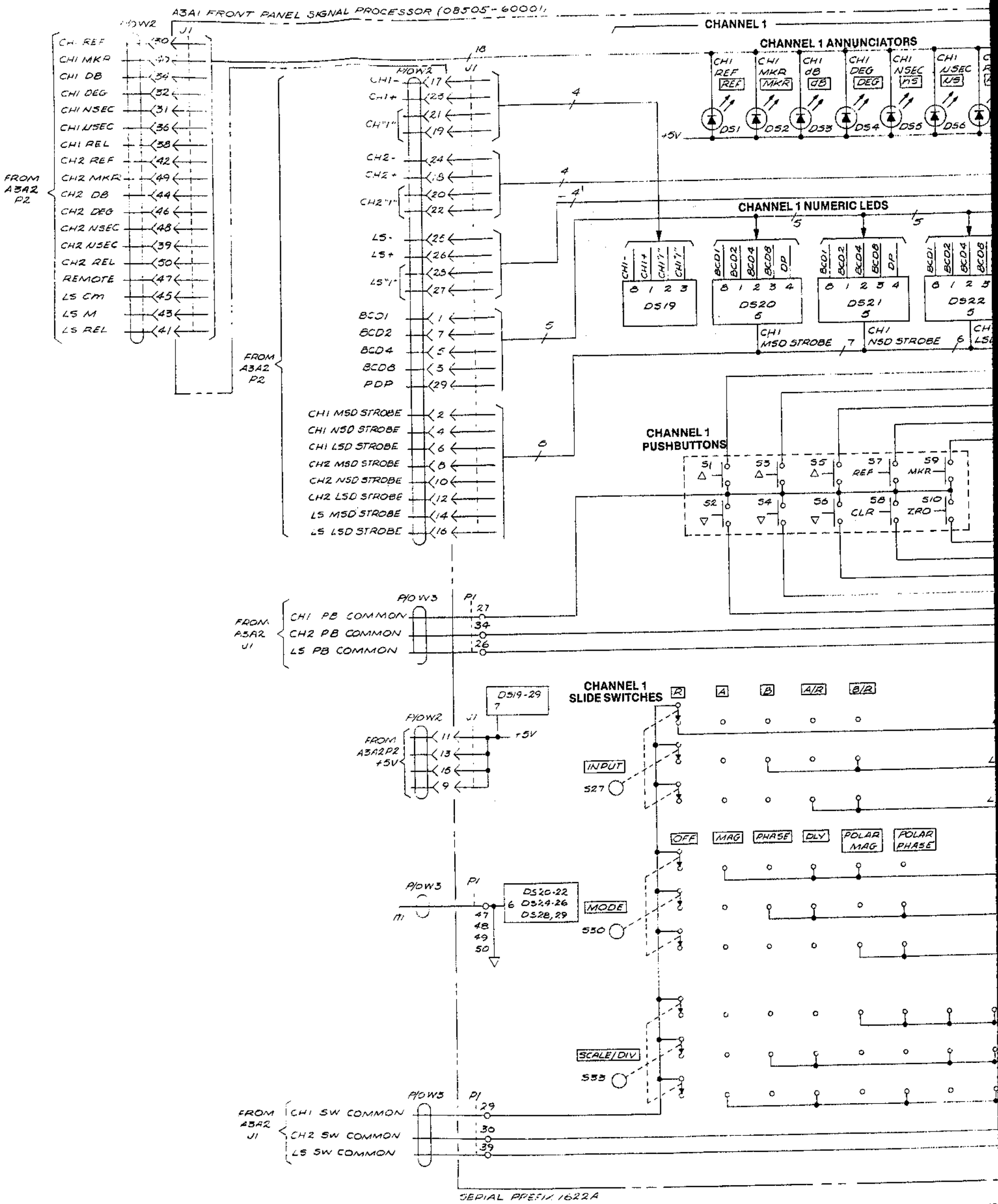
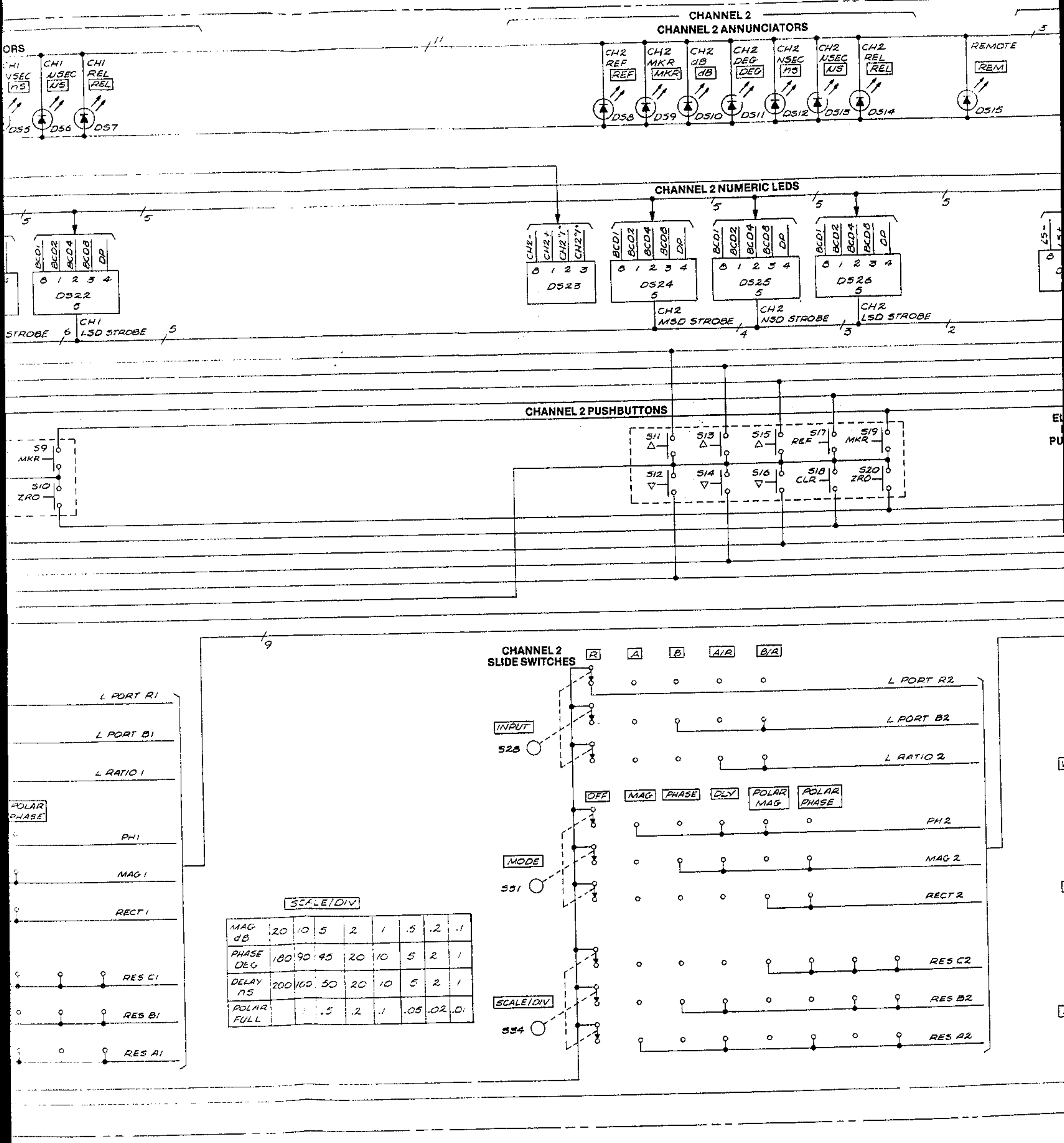


FIG. D3-20
SHT. 2 OF 4



MAG dB	20	10	5	2	1	.5	.2	.1
PHASE DEG	180	90	45	20	10	5	2	1
DELAY ns	200	100	50	20	10	5	2	1
POLAR FULL		1	.5	.2	.1	.05	.02	.01

FIG. D3-20
SHT. 3 OF 4

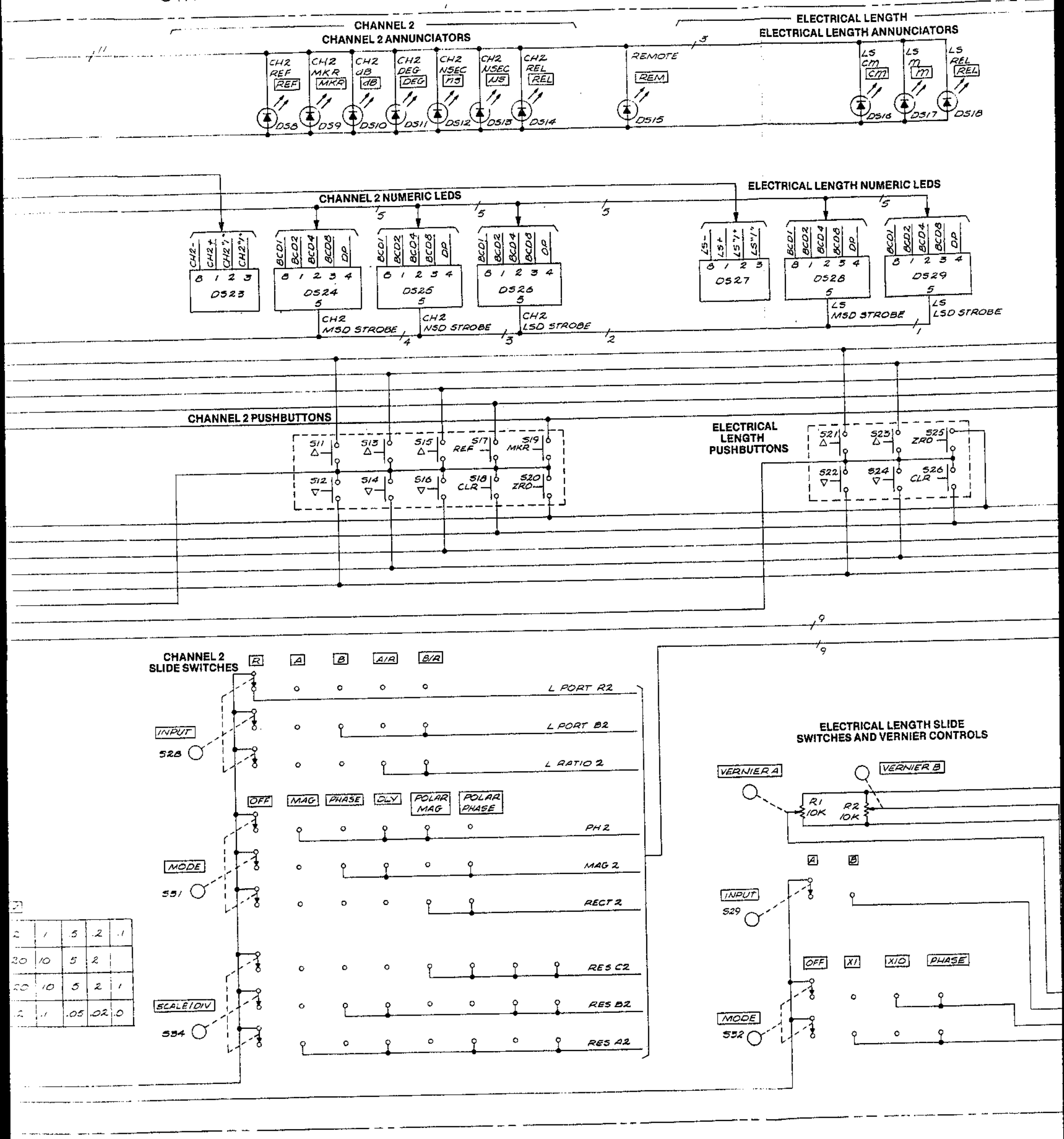


FIG. D3-20
SHT. 4 OF 4

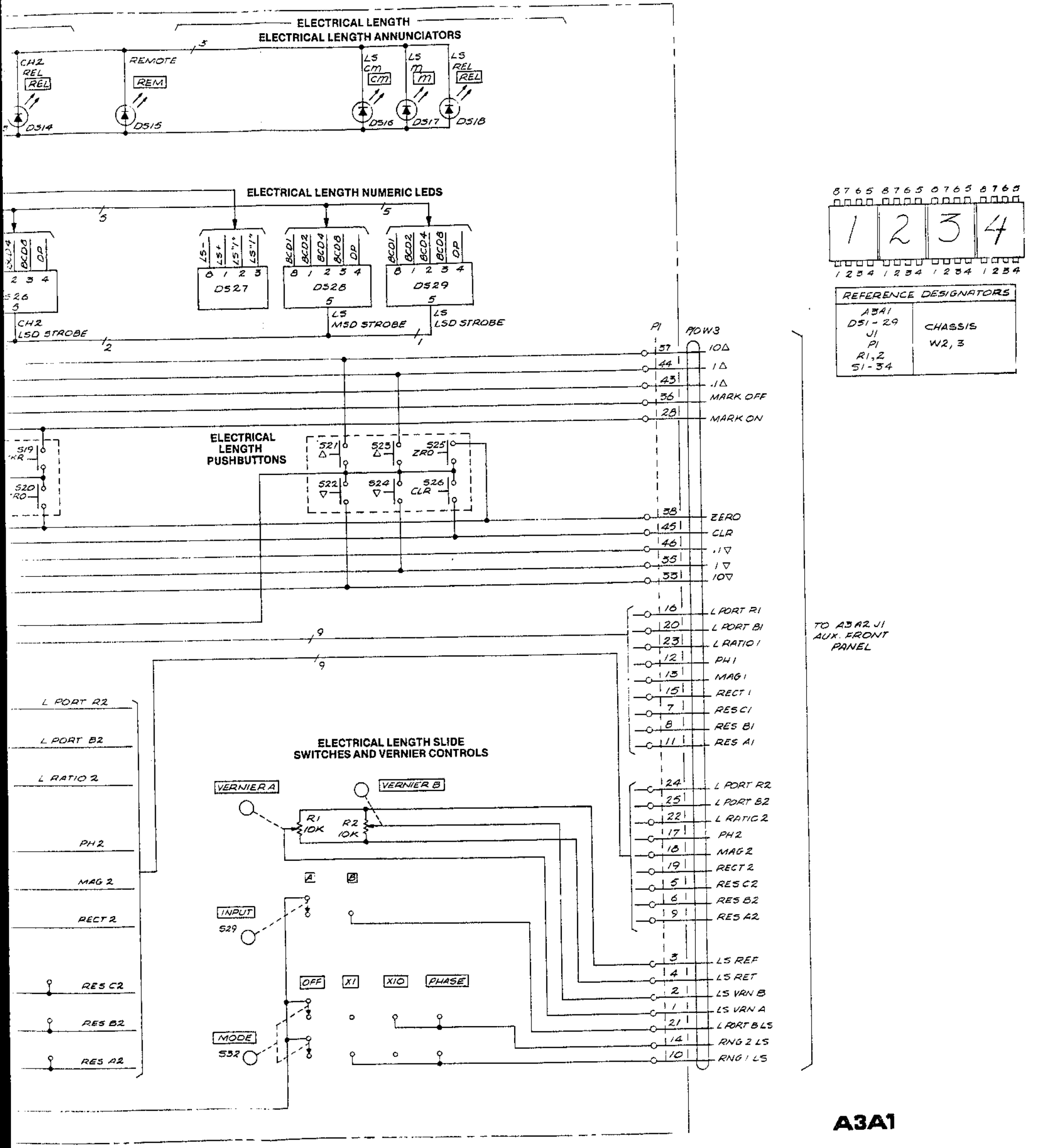


Figure D3-20. A3A1 Front Panel, Schematic

A3A2 AUXILIARY FRONT PANEL

General Description

The Auxiliary Front Panel Board serves as the interface between the Processor Control Assembly, A3A3, and the switches and indicators on the Front Panel Board, A3A1. Communication between the Auxiliary Front Panel and the Processor Control is done with a four-bit three-state data bus (PDB Ø through 3), five address lines (PAD Ø through 4), and two timing signals. The two timing signals are Low Clock Front Panel (L CK FP) and Low Enable Front Panel (L EN FP).

The Auxiliary Front Panel Board contains the switch strobe decoding and selection logic which multiplexes all of the front-panel switch lines down to three of the data bus lines (PAD Ø through 2). This board also contains the buffers, storage, and drivers to drive all of the numeric and annunciator LEDs on the Front Panel Board. By setting up the proper address on the address bus and then initiating a clock or enable pulse, the Processor Control can turn any annunciator LED on or off, display numbers on the numeric displays, or read the present state of any front-panel switch. A more detailed discussion of the address/data bus structure is presented in the A3A3 Processor Control circuit description.

Reading Front-Panel Switches

The front-panel switches are read continually at a 20 Hz rate. A front-panel switch is read by the Processor Control by first putting the appropriate address on the PAD lines. When the L EN FP pulse is then generated, one of the six switch common lines from Switch Strobe Decoder U25 goes low, corresponding to the addressed switch set. If the particular switch contacts are closed (connected to the common) then a low will appear on that switch line, coming back from the front panel into the Data Selectors U18, U19, and U20.That signal is selected by the address lines on the 8:1 selectors and is enabled onto one of the three-state data bus lines (PDB Ø, 1, or 2) to be read by the Processor Control.

Pushbutton Switches. As an example, to read the Channel 1 ZRO pushbutton switch, the Processor Control places an address of 11001 on the PAD 4 through Ø lines, respectively. When the L EN FP pulse is generated, the CH1 PB Common (U25-10) that connects to the common side of the Channel 1 momentary-contact pushbuttons, goes low. The ZRO (zero) signal from the three front-panel ZRO pushbuttons then goes low if the Channel 1 ZRO pushbutton is depressed. This zero-going pulse appears on the input (pin 13) of Data Selector U20. This input (#6) is selected by the 110 addresses (from PAD 4, 3, and 2) on U20 control inputs CBA and enabled onto the PDB 2 line by the L EN FP signal.

Slide Switches.The slide switches are read in a similar manner, except that the lines cannot be wire-ORed together since they are not momentary single contacts. the inputs from the slide switches are ORed together by the "AND" gates of U6, U10, and U11. The "AND" gates are functioning as OR gates due to negative logic. the inputs of the "AND" gates are pulled up to +5 volts. When one of the inputs is strobed low, the output of that "AND" gate goes low.

For example, the two resolution A lines, RES A1 for Channel 1 and RES A2 for Channel 2, are ORed together by "AND" gate U10A before going to the actual Data Selector U18-1. Since the Channel 1 and Channel 2 slide switches have separate commons, there is no ambiguity regarding which RES A line is being read.

Updating Front-Panel Displays

The A3A2 AuxiliaryFront Panel Board also contains circuitry which is involved in updating the numeric and annunciator LED displays on the front panel of the Signal Processor. The fourteen four-bit words required by the Front Panel Board A3A1 are updated at a continual 20 Hz rate. Eight of the words are stored in the internal latches in the eight BCD-input numeric LED displays on A3A1 Front Panel Board. Three registers, U23, U28, and U29, store the words to drive the Channel 1 (CH1), Channel 2 (CH2), and Electrical Length (LS) ± 1 LED display. The remaining three words, which contain the data for the annunciator LEDs, are stored in registers U21, U22, and U27. The clocks and strobes for these registers and latches are obtained from LED Strobe Decoders U24 and U30 by decoding the four least significant bits of the address (PAD 3, 2, 1, and Ø).

Numeric LED Readouts. The L CK FP signal clocks low to indicate valid data on the Processor Data Bus (PDB) lines and enables the LED Strobe Decoder to generate the appropriate output clock, a low-going pulse of approximately 1.4 microseconds pulse width. Eight of the lines from the LED Strobe Decoder go to the Front Panel Board A3A1 to strobe the numeric LED readouts, the other six lines clock the Storage/Drivers and Storage/Decoder Drivers on the Auxiliary Front Panel Board.

The Processor Data Bus is buffered by the OR gates of Data Bus Buffer U26, which are only enabled during the clock time when the L CK FP signal, through U13D/E, places a low on pins 2, 5, 9, and 12 of U26. The four outputs of the Data Bus Buffer drive the numeric display and the storage register inputs. A fifth input to the numeric display, Processor Decimal Point (PDP) from the Processor Interface, is also strobed in and is used to turn the decimal point on or off. See Figure D3-18A for timing diagram example for a given numeric display.

Registers U23, U28, and U29 store the words from the ± 1 LED displays. The Q_C (pin 13) output, updated PDB Ø signal, is the "1" bit. It is buffered by an open collector inverter (U17C, U17E, or U17F) to drive two inputs to the "1" segment. Two resistors, a 562 ohm and a 100 ohm, determine the drive current to the LED readout. The PDB 3 line updates the D section of registers U23, U28, and U29 with a sign bit. A "1" input at pin 7 results in a low Q_D output at pin 11, turning the minus (–) sign into a plus (+) sign. The minus sign is driven by Q_B output (pin 14) through an inverter, and is always on whenever the numeric LED display is on.

Annunciator LED Display. The fourth bit, Q_A, is used only on U23 and U29, the Channel 1 and Channel 2 registers. When the Q_A output (pin 15) of U23 is low, the output of inverter U13A places a high on pin 10 of U11C which is ANDed with the high on pin 9 of U11C. The high output at pin 8 of U11C is inverted by U13B and turns on CH1 "REF" annunciator. When the Q_A output of U23 is high, the output of inverter U13A is low, which results in a low output from U11C (pin 8). This low is inverted by U13B turning the CH1 "REF" annunciator off. The low output at pin 7 of U13A also turns on the CH1 "MARK" (MKR) annunciator. The Q_A output of U29 determines which annunciator (REF or MKR) is on for Channel 2 in the same manner as discussed for U23 Q_A output.

When the display is blanked, all of the outputs of U23, U28, and U29 are cleared (go low). Since Q_B output goes low when cleared, the outputs of U11B and U11C go low, sending a high to CH1 "REF" and CH2 "REF", blanking these two annunciators. CH1 "MARK" and CH2 "MARK" are blanked by the high outputs from inverters U13A and U13F. The Q_B line also clears the annunciator storage register and inhibits the decoder driver outputs of U21 and U22.

The QD outputs (pin 11) of U21 and U22 annunciator storage registers contain the "REL" bit for Channel 2 and Channel 1. The other two outputs of these two registers drive two-to-four-line decoders, U14A and U14B, to turn on one of the four unit annunciators (NSEC, DB, DEG, μSEC) for Channel 2 or Channel 1. The LS annunciator register, U27, contains the "REL" bit, the "M" and "CM" bits, and the "REM" bit for Electrical Length. The "REM" bit signifies that the 8505A is under remote operation and the front-panel switches are not active.

Troubleshooting Hints

A convenient check of the BCD lines can be done by using a 16-pin IC Clip Extender (HP Part Number 1400-0734) on U23 (CH1), U29 (CH2), or U28 (LS) to monitor numeric LED display waveforms shown in Figure D3-18A. Also refer to switch logic description for A3A1 Front Panel and pushbutton logic in Figure D3-18B.

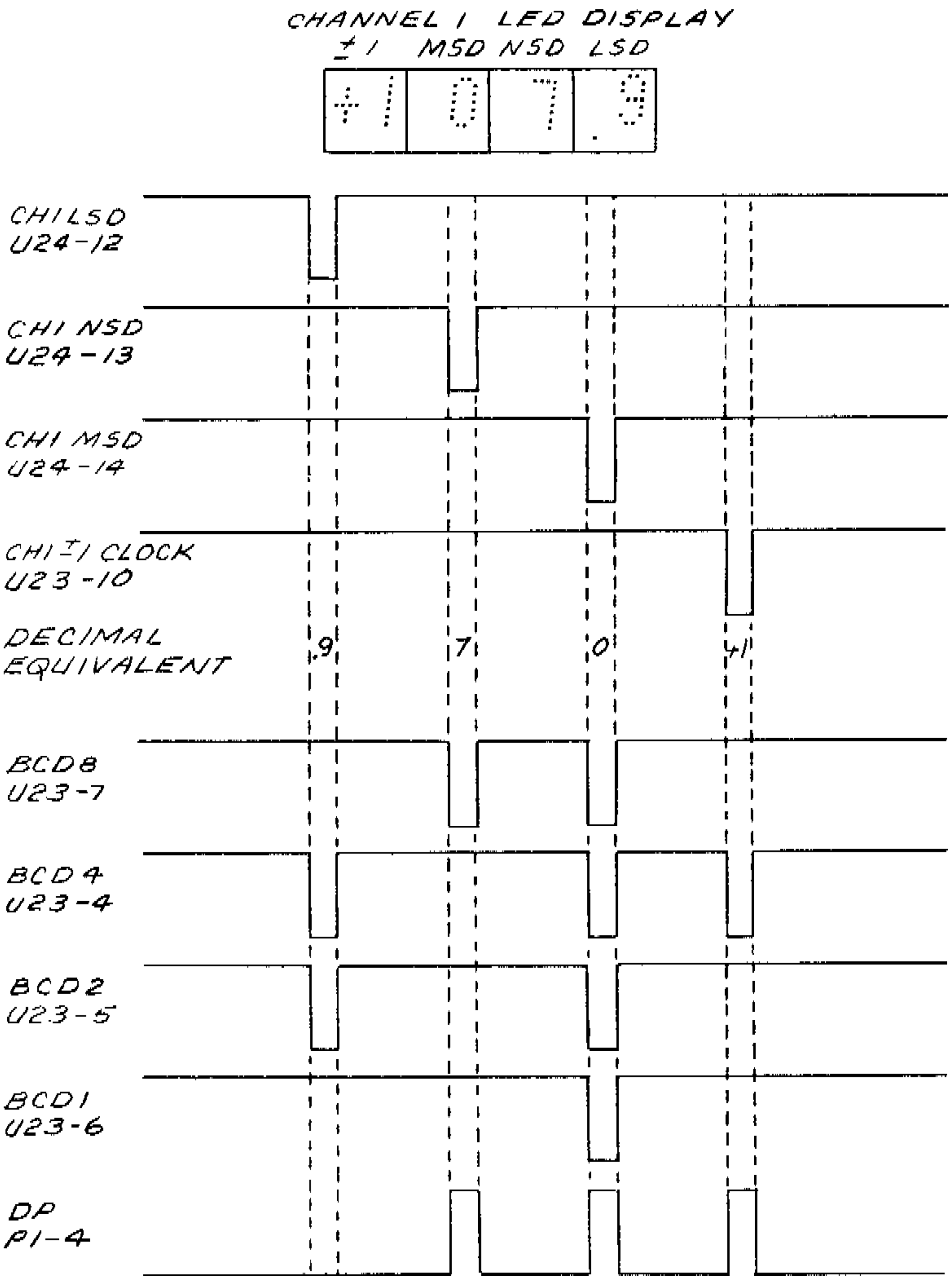
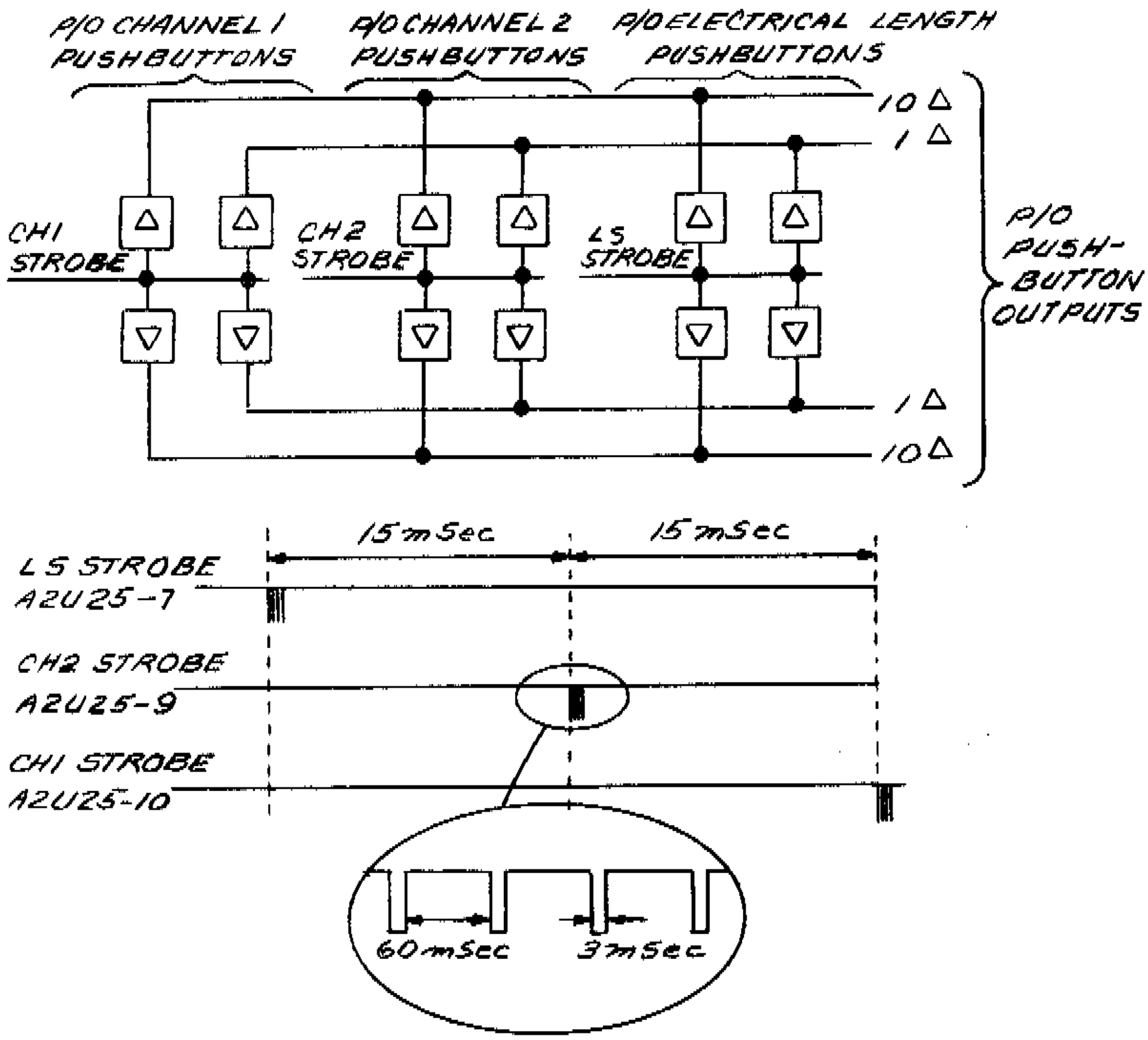


Figure D3-20A. Channel 1 Numeric LED Display Timing Diagram



Signal	Test Point	Signal	Test Point
10 △	A3A2U20 pin 15	MARK OFF	A3A2U19 pin 12
10 ▽	A3A2U20 pin 14	MARK ON	A3A2U20 pin 12
1 △	A3A2U19 pin 15	CLR	A3A2U19 pin 13
1 ▽	A3A2U19 pin 14	ZERO	A3A2U20 pin 13
.1 △	A3A2U18 pin 15		
.1 ▽	A3A2U18 pin 14		

Figure D3-20B. Front Panel Pushbutton Logic

NOTE

0 = Strobed 0 Volt Signal
1 = +5 Volt

CHANNEL 1 INPUT

Signal	Test Point	R	A	B	A/R	B/R
L PORT B1	A2U6-3	1	1	0	1	0
L PORT R1	A2U10-10	0	1	1	1	1
L RATIO 1	A2U10-12	1	1	1	0	0

CHANNEL 1 MODE

Signal	Test Point	OFF	MAG	PHASE	DLY	Polar MAG	Polar PHASE
MAG 1	A2U6-1	1	1	0	0	1	0
PH 1	A2U6-10	1	0	1	0	0	1
RECT 1	A2U10-4	1	1	1	1	0	0

CHANNEL 1 SCALE/DIV

Signal	Test Point	MAG: 20 PHASE: 180 DELAY: 200 POLAR FULL:	10 90 100 1	5 45 50 .5	2 20 20 .2	1 10 10 .1	.5 5 5 .05	.2 2 2 .02	.1 1 1 .01
RES A1	A2U10-2	1	0	1	0	1	0	1	0
RES B1	A2U11-12	1	1	0	0	1	1	0	0
RES C1	A2U11-2	1	1	1	1	0	0	0	0

CHANNEL 2 INPUT

Signal	Test Point	R	A	B	A/R	B/R
L PORT B2	A2U6-5	1	1	0	1	0
L PORT R2	A2U10-9	0	1	1	1	1
L RATIO 2	A2U10-13	1	1	1	0	0

CHANNEL 2 MODE

Signal	Test Point	OFF	MAG	PHASE	DLY	Polar MAG	Polar PHASE
MAG 2	A2U6-2	1	1	0	0	1	0
PH 2	A2U6-11	1	0	1	0	0	1
RECT 2	A2U10-5	1	1	1	1	0	0

CHANNEL 2 SCALE/DIV

Signal	Test Point	MAG: 20 PHASE: 180 DELAY: 200 POLAR FULL:	10 90 100 1	5 45 50 .5	2 20 20 .2	1 10 10 .1	.5 5 5 .05	.2 2 2 .02	.1 1 1 .01
RES A2	A2U10-1	1	0	1	0	1	0	1	0
RES B2	A2U11-13	1	1	0	0	1	1	0	0
RES C2	A2U11-1	1	1	1	1	0	0	0	0

ELECTRICAL LENGTH INPUT

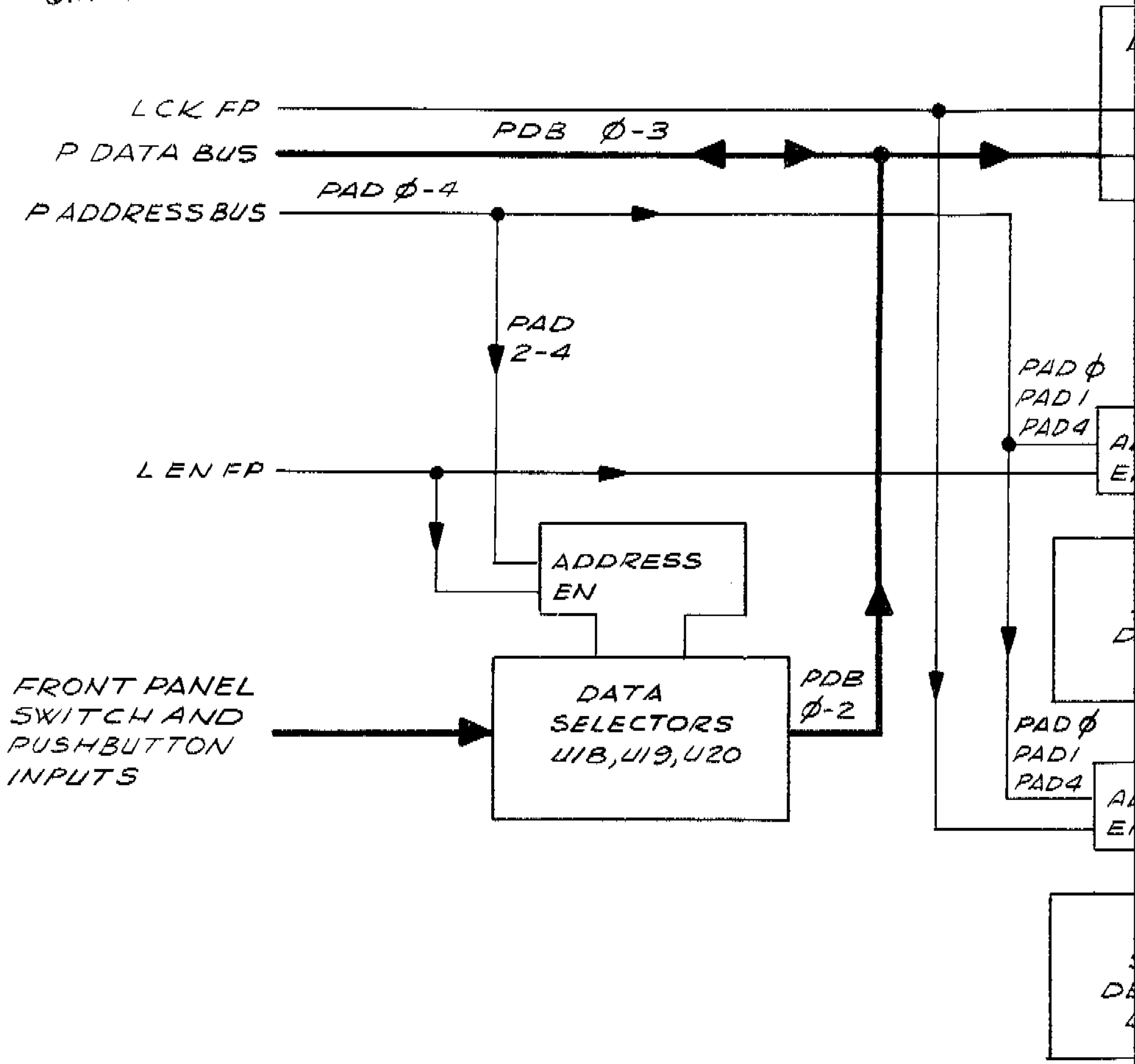
Signal	Test Point	A	B
L PORT B LS	A2U6-4	1	0

ELECTRICAL LENGTH MODE

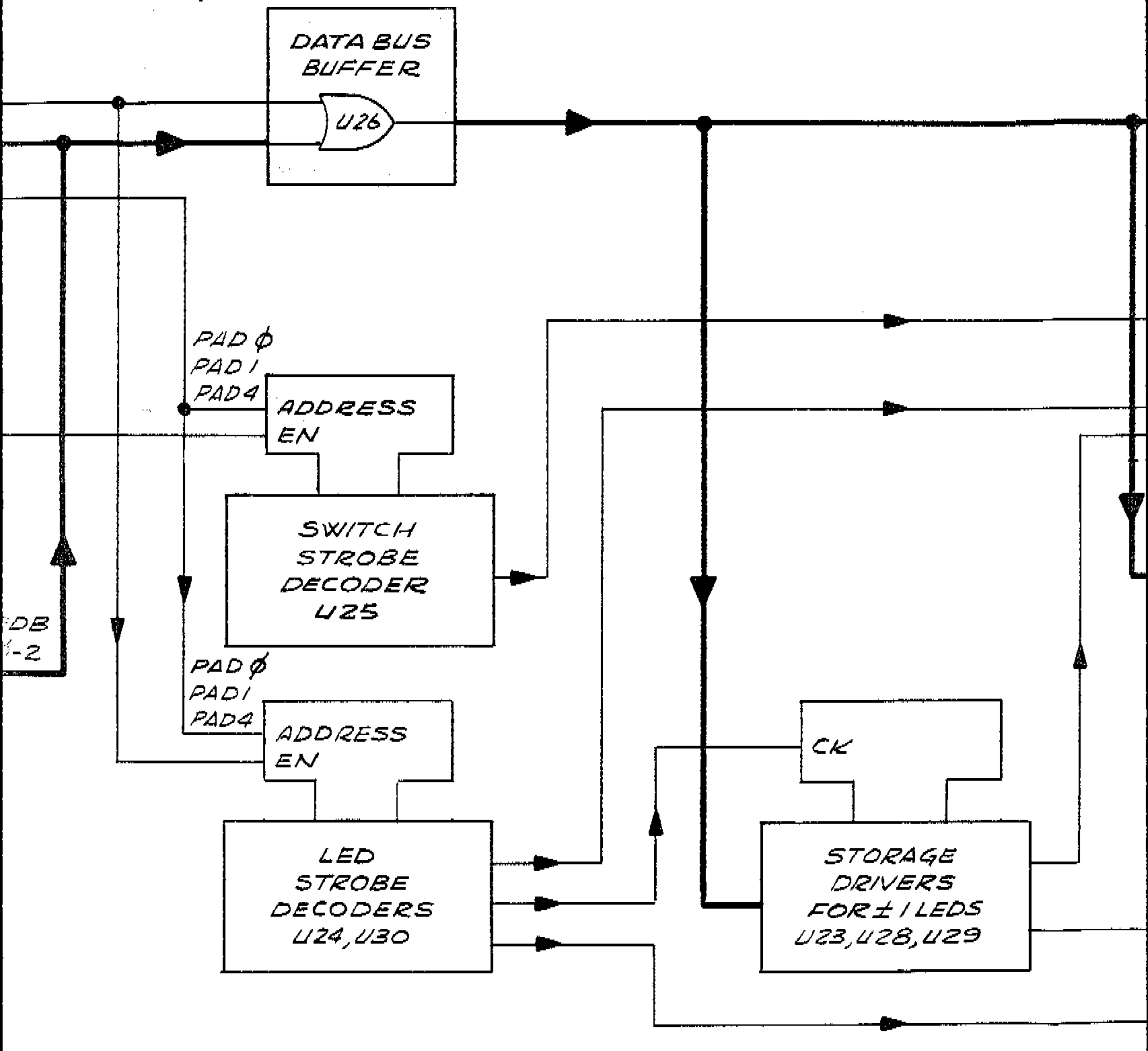
Signal	Test Point	OFF	Length X1	Length X10	PHASE
RNG 1 LS	A2U6-9	1	0	1	0
RNG 2 LS	A2U6-13	1	1	0	0

Figure D3-20C. Front Panel Slide Switch Logic Outputs

D3-20D
SHT. 1 OF 3



D3-20D
SHT. 2 OF 3



D3-20D
SHT. 3 OF 3

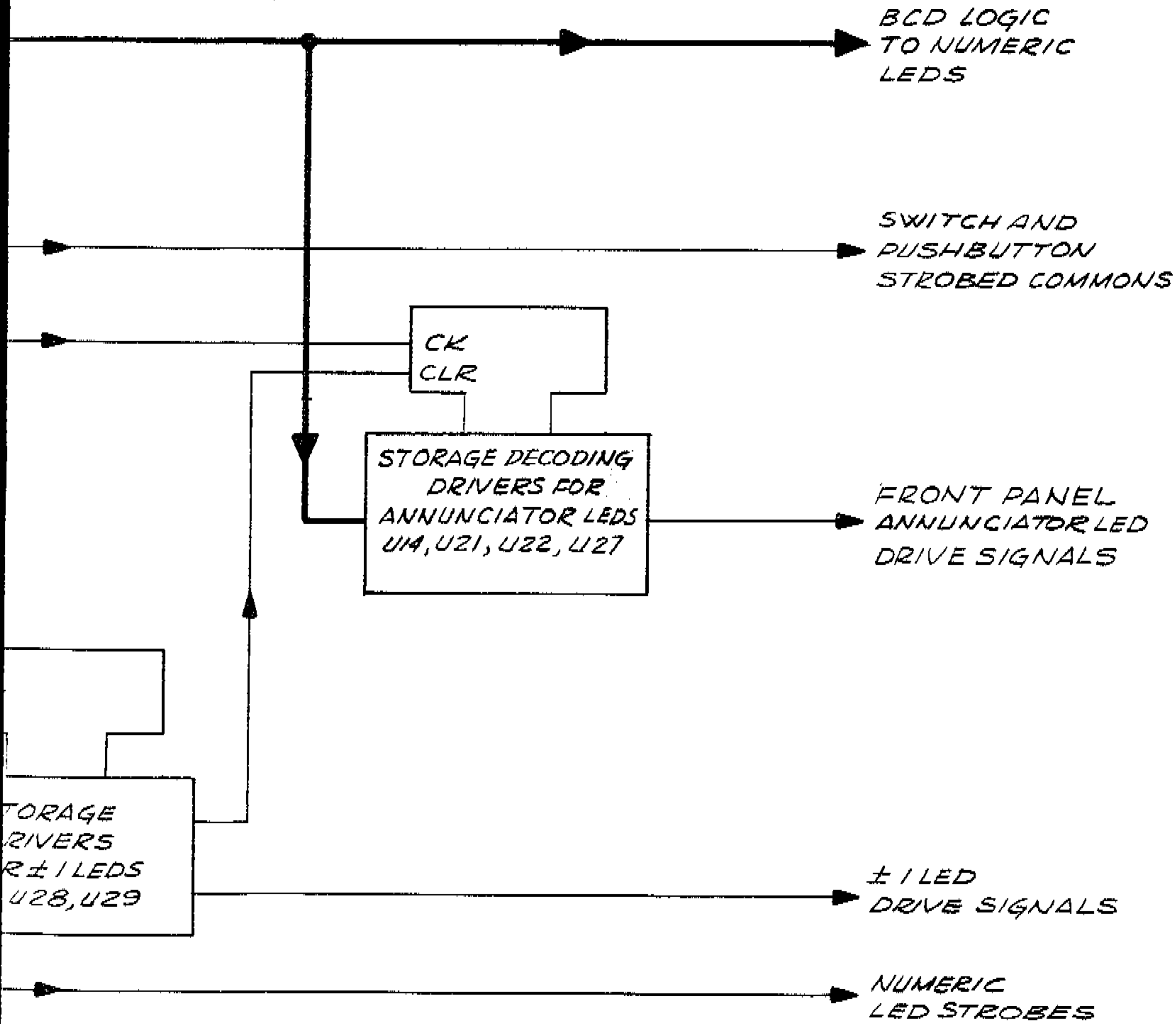


Figure D3-20D. A3A2 Auxiliary Front Panel, Block Diagram

A3A2

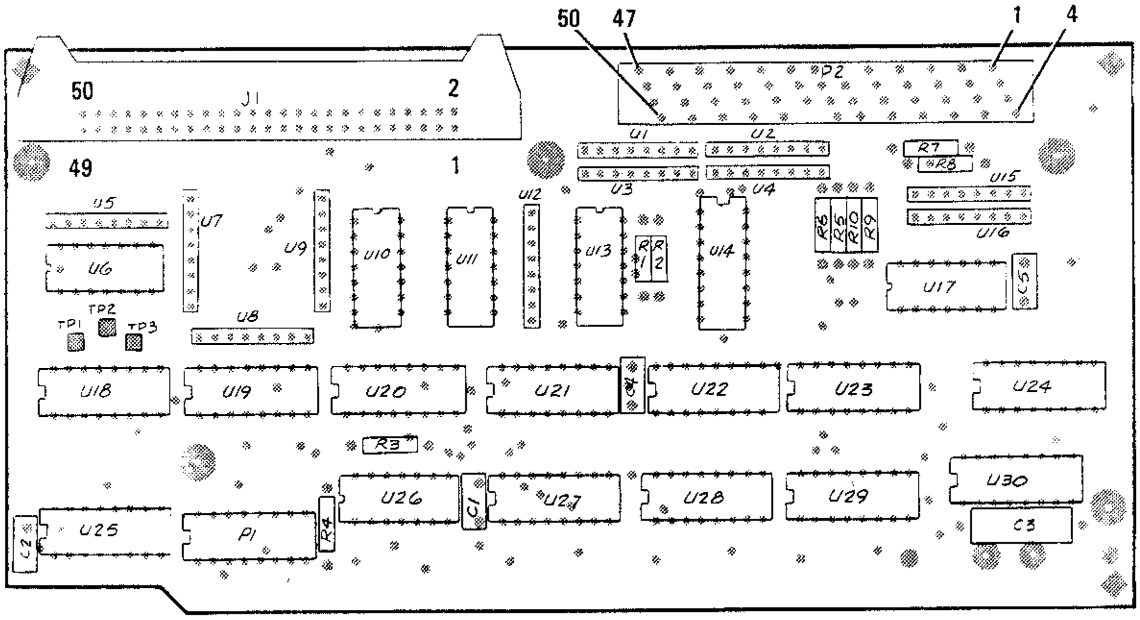


Figure D3-21. A3A2 Auxiliary Front Panel Parts Locations

FIG. D3-22
SHT. 1 OF 5

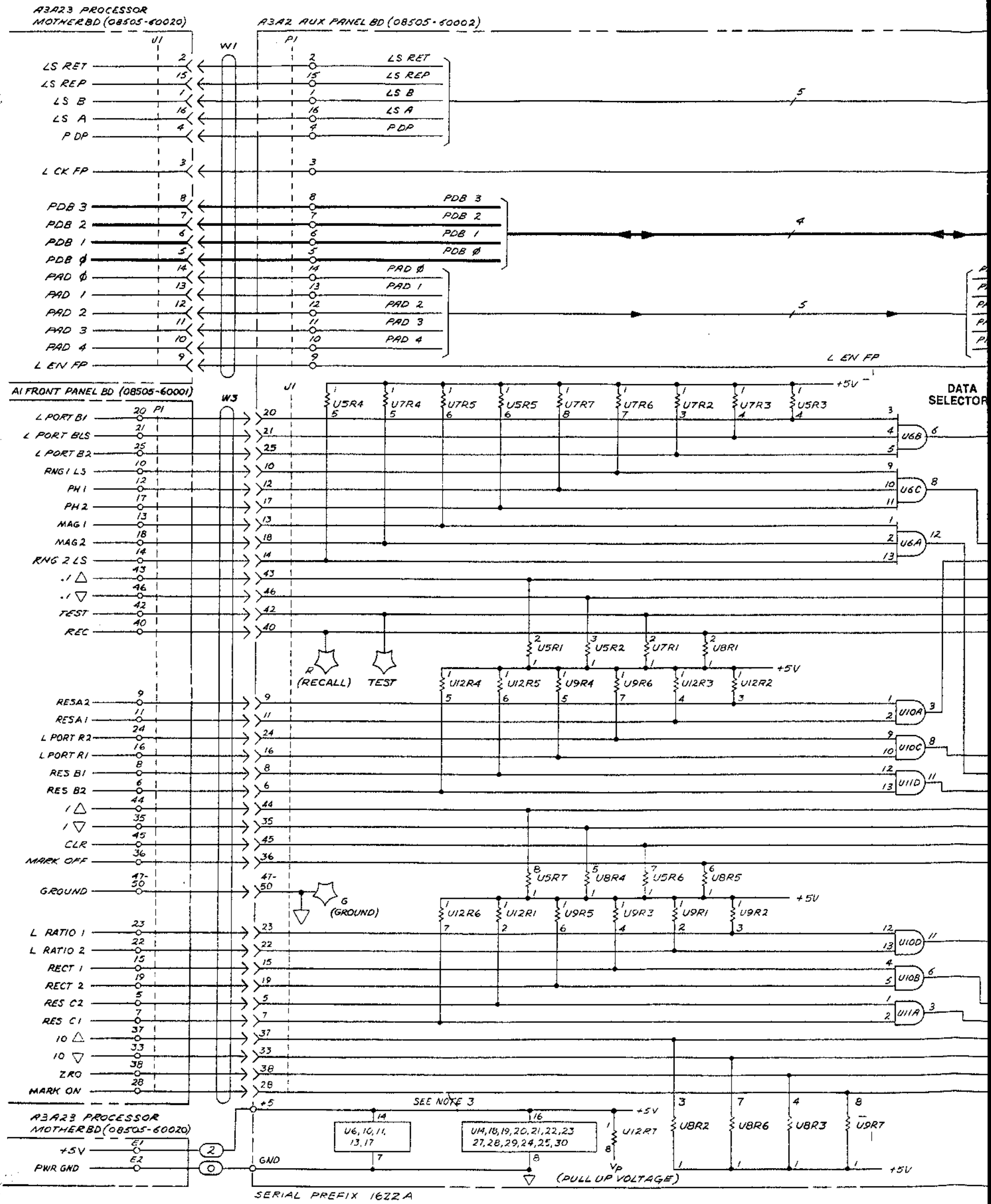


FIG. D3-22
SHT. 2 OF 5

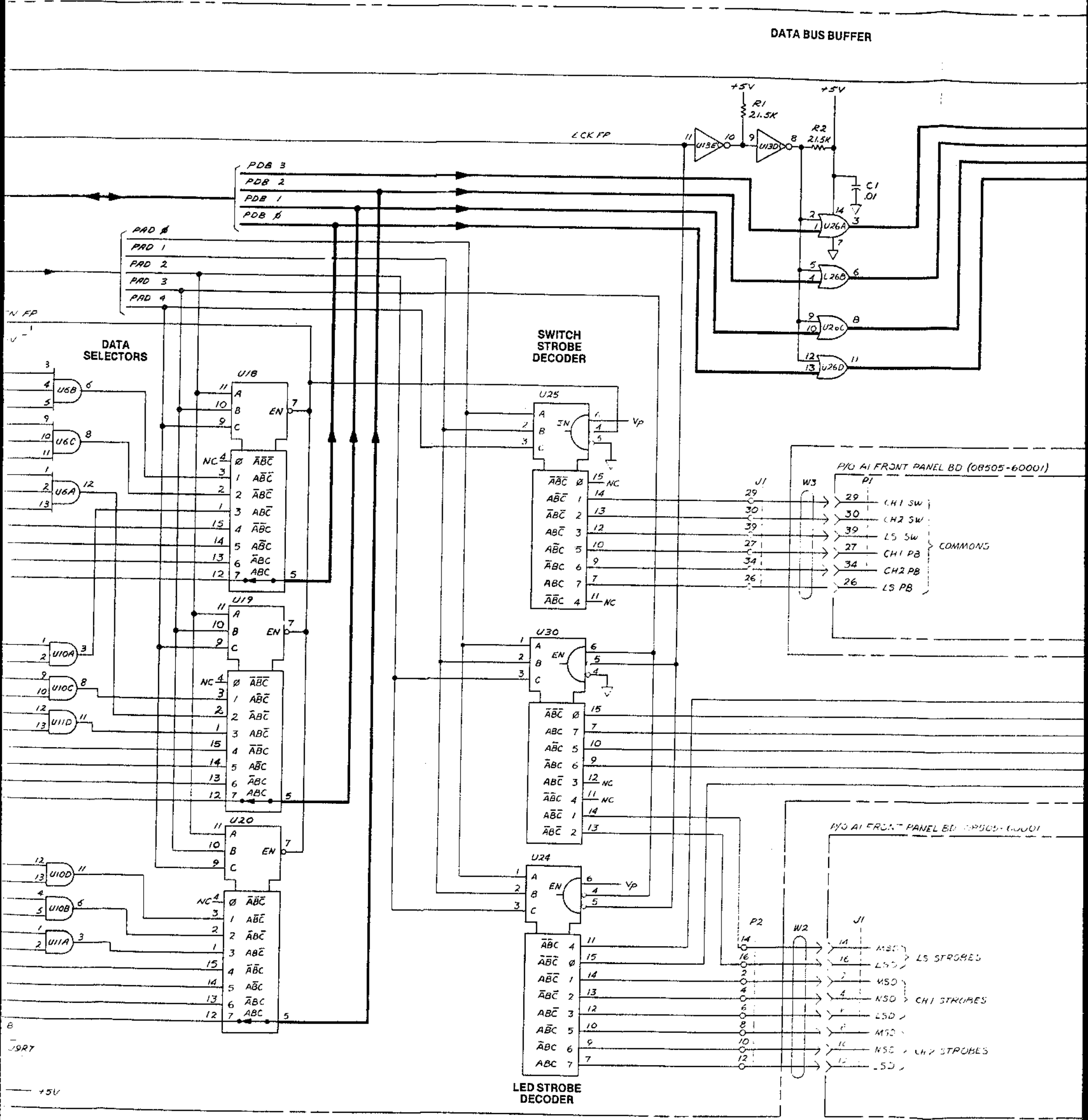


FIG. D3-22
SHT. 3 OF 5

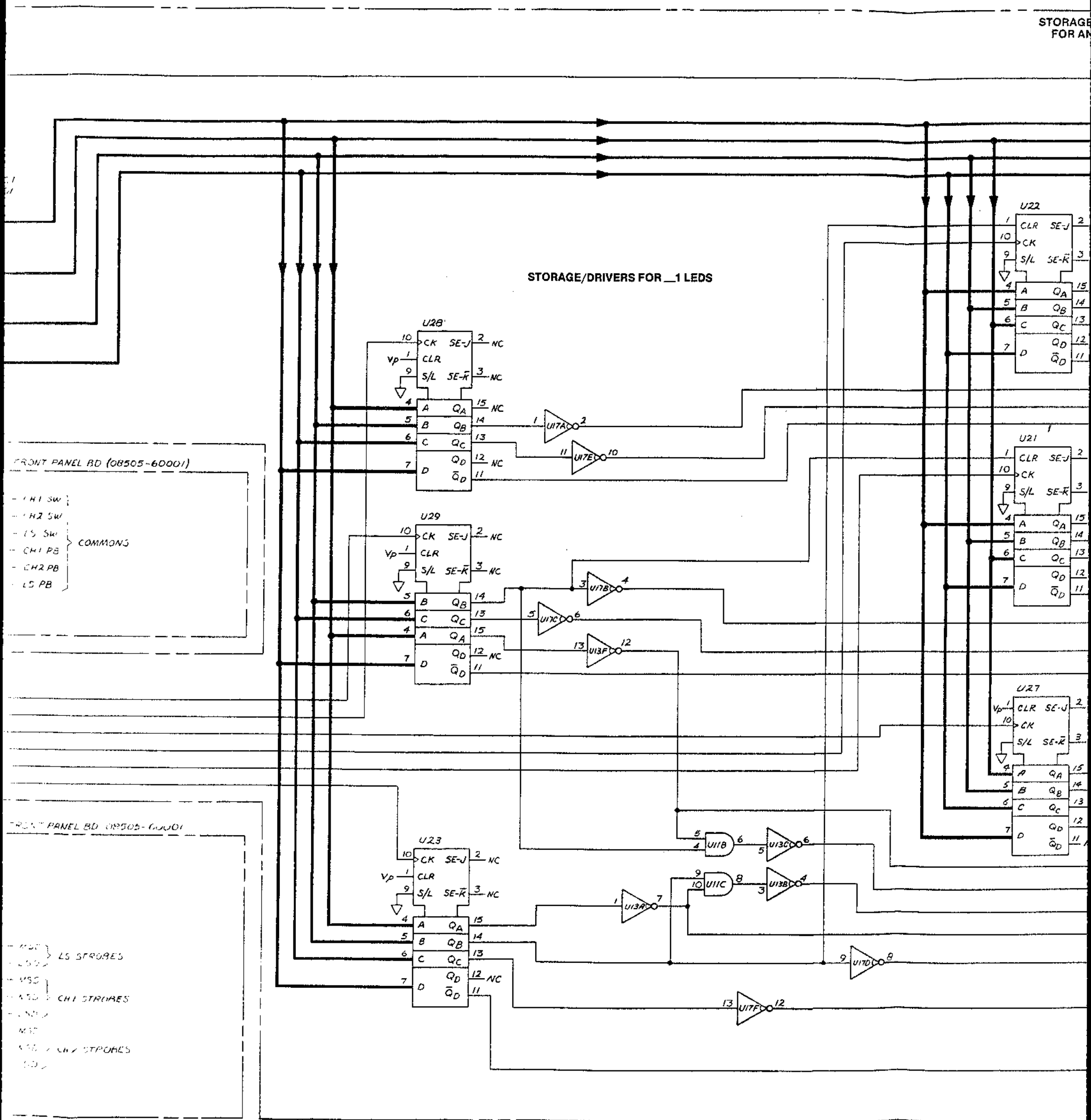


FIG. D3-22
SHT. 4 OF 5

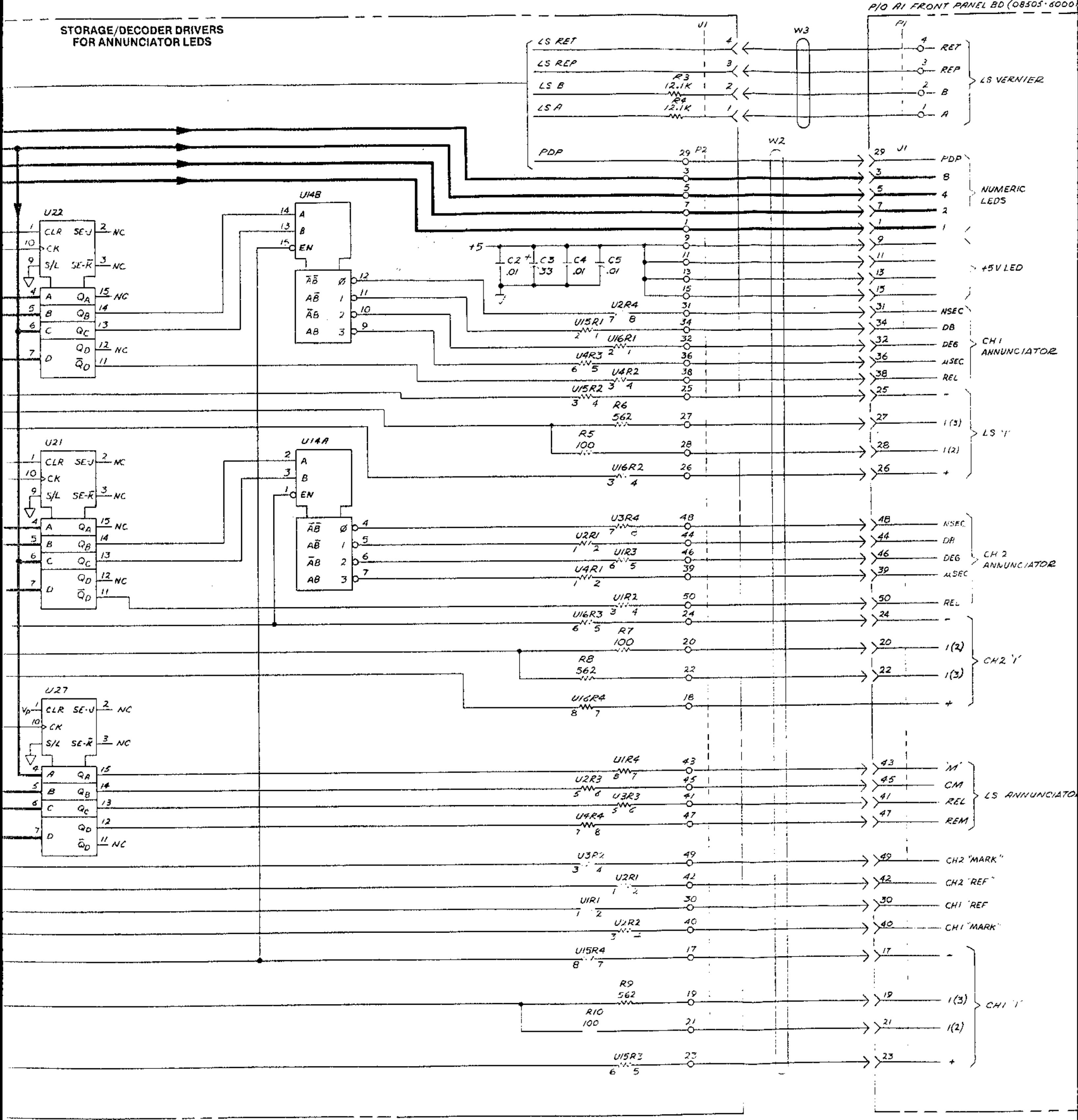
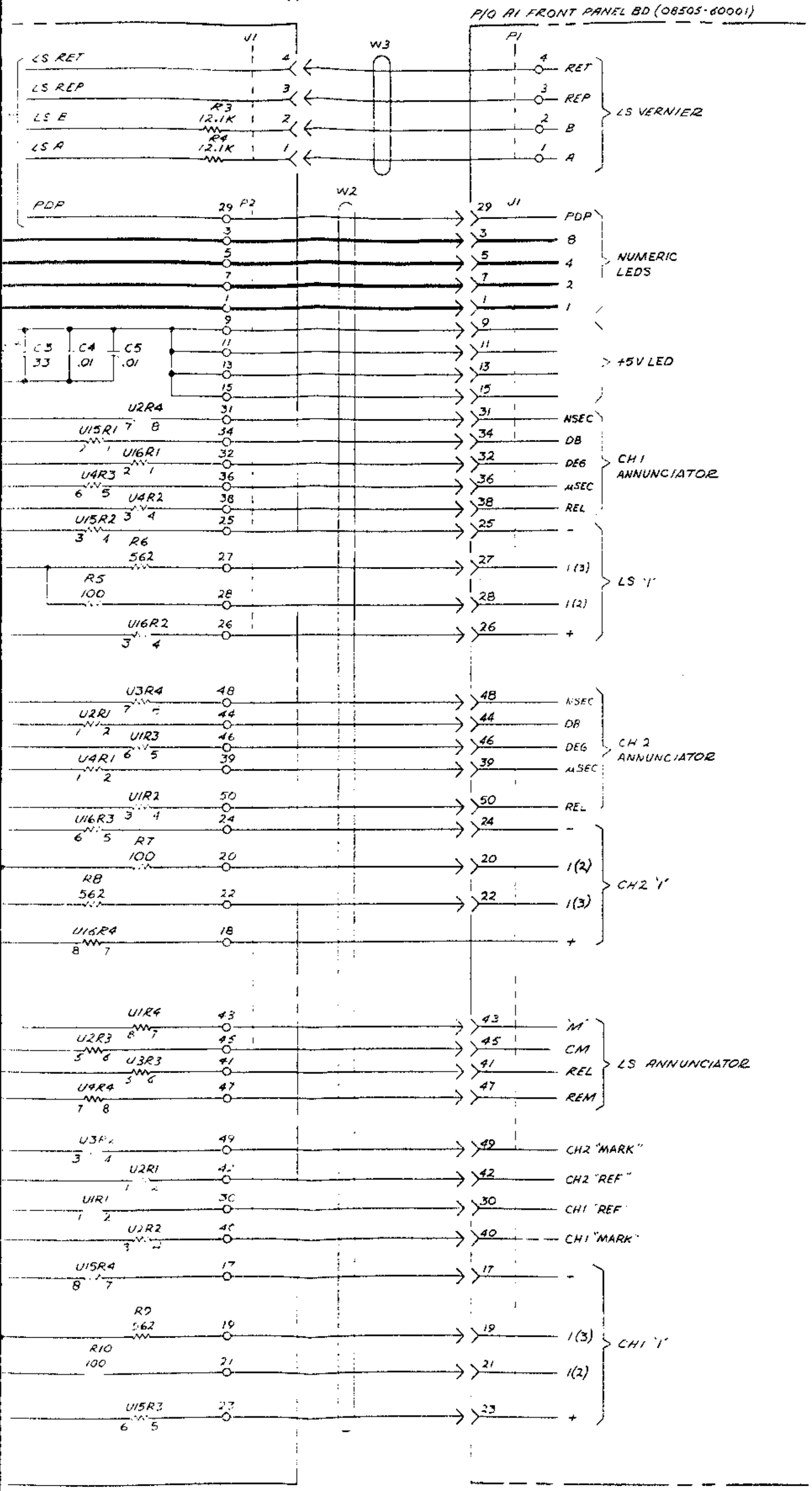


FIG. D3-22
SHT. 5 OF 5



NOTES:

1. REFERENCE DESIGNATIONS 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 CAPACITANCE IN MICROFARADS INDUCTANCE IN MICROHENRIES
3. THE +5V POWER INPUT AND POWER GROUND DO NOT FEED IN THROUGH P1, P2, OR P3. THESE INPUTS ARE WIRED DIRECTLY TO THE PC BOARD.
4. U13 AND U17 HAVE OPEN COLLECTOR OUTPUTS WITH AN OUTPUT CURRENT FLOW ONLY WHEN THE OUTPUT VOLTAGE IS LOW (0 VOLTS).

REFERENCE DESIGNATIONS

A3A2	CHASSIS
C1-C5 J1 P1-P2 R1-R10 U1-U30	W1-W3

A3A2

Figure D3-22. A3A2 Auxiliary Front Panel, Schematic

A3A3 PROCESSOR CONTROL THEORY OF OPERATION

Description

The purpose of the Control Processor A3A3 in the 8505A A3 Signal Processor is to perform the logic, arithmetic calculations, and control functions required in the Signal Processor. This includes: (1) reading the front-panel switches and generating from these the proper control signals for the analog sections of the signal processor, (2) performing the arithmetic calculations to implement the increment/decrement zero and clear pushbutton logic, (3) providing the four Pulse Width Modulator (PWM) D/A's and the Line Stretcher (LS) D/A with the correct input data, (4) reading and processing the output of the marker Analog to Digital (A/D) converter, (5) displaying the proper words on the front-panel LEDs, and (6) interfacing with the Input/Output (I/O) boards in remote operation.

The control processor is a Read Only Memory (ROM) controlled, sequential machine, using standard low-power Schottky Medium Scale Integration (MSI) devices. The hardware architecture, as shown in the block diagram, consists of an 11-bit program counter. The counter output is the address to a 2048 x 8-bit ROM that contains the system program. The program consists of a sequence of instructions to be performed by the control processor. The arithmetic and logic operations are performed by a 4-bit Arithmetic Logic Unit (ALU) U15. Registers A and B provide the two input operands to the ALU; the output of the ALU is stored in REG C. The ALU instruction to add or subtract is determined by the ROM outputs. A 256 x 4 bit read/write memory called Random Access Memory (RAM) U17 provides the storage required by the processor to store switch settings, display offsets, and calibrate offsets. The 8-bit ROM address is provided by two address registers, REG D and REG E. This address is also used to update the PAD address bus used for I/O operations. This 8-bit address, along with the four-bit T BUS, generates the jump address. The jump address is used to load the counter when a jump command is executed, instead of the normal increment of +1. Index REG G, U16, provides a general purpose, temporary storage register for the control processor. The communication between the different registers is done with the three-State T BUS. The RAM, ROM, REG C, REG B, and I REG can put data onto the T BUS, and the data inputs to REG A, REG B, REG G, REG D, REG E, RAM, and PDB I REG all come directly from the T BUS. The timing and control needed for the T BUS come from the instruction decoders that generate the proper enable line and clock line for each instruction. The carry bit from the ALU output is also utilized to perform different control functions within the control processor. It can either be used to generate a carry-back into the ALU for future calculations, or it can set the flag that is used to control transfers between registers.

The Control Processor interfaces with the front panel, marker A/D, Converter, four-bit data bus, P Data Bus (PDB Ø-3), six-bit address bus,and P Address Bus (PAB Ø-5). The control signals for the bus are a Front Panel (FP) clock, an enable pulse Low Clock Front Panel (L CK FP), Low Enable Front Panel (L EN FP), and a clock and enable pair for the I/O: Low Clock Input/Output (L CK I/O) and Low Enable Input/Output (L EN I/O). For example, updating an FP LED requires putting out the address on the PAD BUS, putting the data on PDB lines and then generating a clock L CK FP to transfer the data into the proper FP latch. An additional line, L STORE, is used by the I/O and marker. This is a common wire ORed signal into the control processor to signifiy that the I/O or A/D converter wants to input data for the present PAD address word. The processor, when it recognizes this request, will send out the enable signal L EN I/O that will enable the data from the I/O or A/D Converter onto the PDB bus to be read by the Control Processor. The final line that completes the communication bus between control processor and I/O is the L REM line. When this line is pulled low, the processor will not read the FP switches and will retain the switch settings stored in memory until updated by new data from the I/O. Figure D3-22C gives the listing of the I/O addresses with its corresponding data words; so, if necessary, the data bus can be monitored at particular addresses during either a clock or enable pulse.

The data for PWM and Line Stretcher Digital-to-Analog Converters also are transmitted over the PDB data bus. Instead of decoding the address PAD lines, they receive specially decoded load pulses directly from the control processor output instruction decoders. Some additional inputs are read by the control processor directly through its input data selector, instead of the PDB data bus. These include the CRT controls (Bandwidth BW, REF POSN), the frequency range lines from the frequency controller, and the TEST SET and EXTERNAL input enable signals. The control lines for the analog section of the signal processor are transmitted in a serial 32-bit data stream. Four 8-bit shift registers are used to store these control lines. The parallel outputs are then used to switch the multiplexers and filters. The control lines depend on the front panel (or I/O if remote) inputs and the state of the SW ALT timing signal. Whenever a FP switch is changed or SW ALT changes, the proper control lines for the next sweep are calculated and output on the serial data line LP-SD. The LPCP clock line contains the 32 clock pulses for the data stream. The shift register and output definitions are shown in Figure D3-22D.

Except for the PAD register, the input/output hardware for the control processor is contained on the A4 board. This consists of the PDB I REG that stores a 4-bit word from the T BUS and drives, if enabled, the PDB bus. A 4-line to 16-line instruction decoder (U12, U13) takes the strobe line from the control processor and the four-bit A REG outputs and generates one of sixteen possible output commands. These include the FP and I/O clocks and enables, load lines for the Digital-to-Analog Converters, and a clock line for the PAD address register. A four-to-one data selector, addressed by the two MSB of REG A, selects one of four possible input words to the control processor. These words include the PDB word, the CRT control lines, Frequency Control information, the external control inputs, L REM, L STORE request and the SW ALT timing signal. This selected word is enabled onto the T BUS by the L EN IR timing control line.

The instructions to drive the control processor can be broken down into four basic types as shown in Figure D3-22E. The first instruction takes 4 bits of data from ROM, puts it on the T BUS through U11, a 3-state buffer, and clocks it into either registers A, D, E or RAM. The next instruction takes the data from either registers C, G, IR or RAM, and transfers it to any of the eight possible destinations: Registers A, B, D, E, G, IREG, RAM, or F which is the jump instruction. The transfer instructions can be either done always, or if the conditional bit of the instruction word is set, the actual transfer only takes place if the FLAG is set. The third instruction set is the ALU operation instruction. This takes the ALU output as determined by the REG A and D inputs and the instruction code, and clocks it into REG C along with the output carry. This carry output can then be used by the fourth instruction set which can set either the flag or carry input bit if the carry out is set. Reset commands are also included. A strobe pulse can be generated, one clock period wide ($\approx 1.4\ \mu$sec), to enable the output instruction decoder.

The two clocks for the control processor come from a divide by 10 circuit on the A4 board that divides down the PWM 7.5 MHz clock. The two clock inputs are shown. Normally CKP is simply inverted to form CK1. When a RAM instruction is decoded, the J input to U20B goes high and the clock is divided by two to accommodate the RAM timing.

CK1 then clocks the 3 stages of the program counter, U12, U26, and U19 so that, except for a jump command, when the PE input to the counters goes low, the counter normally increments +1 each clock period. The clock is also one input to the U10 decoder which generates the eight possible clock load pulses for the eight registers on the T BUS. Decoder

U2A decodes from the two most significant ROM bits the 1 or 4 possible instruction sets. The pin 7 output, low for the ROM transfer command, enables 3-State U11. The pin 6 output, low during the register transfer instruction, enables decoder U2B which generates 1 of 4, three-state enable lines. The U2A pin 5 decoder output, low during an ALU instruction, clocks the ALU output register C. The U2A decoder output, pin 4, is used to clock the flag and carry-in flip-flops U7A and U7B, enable the strobe flip-flop U8B and to clock the U8A flip-flop which supplies the auto range signal to the MARKER L A/D EXP. The ROM U6 outputs are buffered by inverters U5 and U9 to drive the required loads, which include the decoders, the 3-State buffer U11, and the ALU inputs. The FLAG line, from U7B, is fed back to U13A where it is ORed with the conditional ROM bit. If both are low during a REG transfer command, then the output of U3D is forced low and the clock decoder, U10, is disabled.

A general flow chart of the overall program is shown in Figure D3-22F. All the operations that must be done relatively rapidly are included in a master subroutine. This includes loading the pulse width modulator, reading the marker ADC, updating the processor controls and loading the Line Stretcher Digital-to-Analog Converters. This routine is performed approximately every 2.7 msec. The other operations are included in the main program block that is looped through continually three times in about 50 msec; once for CH1, once for CH2 and once for the Line Stretcher (LS), included in this program flow as reading the FP switches, performing the zero clear, increment and decrement operations. Other sections take care of outputting or inputting the offset word (either to reference offset or calibration offset if recall was activated) to the I/O, update the FP LED displays, and integrate the marker readings. The power ON clear (POC) that is generated from Q1 and Q2 at power on initiates a start-up routine that clears out all offsets and starts the processor off in the correct mode.

A3A3 Control Processor — Troubleshooting

Any failure in the Control Processor will result in what appears to be a totally dead Front Panel. If a portion of the Front Panel works, CH 1 and LS, for example, but not CH 2, then the probability is that the failure is in the interface section, PAD address register, or Auxiliary Front Panel, and not in the Control Processor.

To isolate the failure of a dead Front Panel that will not respond even to manual power-on clear (POC) (momentarily grounding A3TP2), remove assemblies A3A19, A3A21, and Auxiliary Front Panel connector W1P2. Do a POC again. Check Processor by checking for a pulse waveform of about 17 mSec width on A3TP4, PAD 5. If this is present, the Control Processor is probably alright and the trouble is in one of the removed assemblies. If waveform at TP4 is incorrect, troubleshoot A3A3 and A3A4 assemblies as follows:

1. Check power supply and clock waveforms.

2. Inhibit the jump command by placing a jumper from U19 — 9 to +5 volts. Check the 11 program counter output lines, AØ — A10 for a normal binary count sequence. Also verify that grounding TP2 forces the counter outputs to Low State.

NOTE

> Except for ROM U6 outputs and the T BUS lines, all other lines are driven by regulator Low power Schottky devices. Low levels should be typically .4 volts, (0.8 volts at room temperature would mean a very marginal device and should probably be replaced). High levels should be greater than 3 volts. Rise and fall times should be less than 10 nanoseconds. The T BUS line, due to its three-state design will appear different. A typical case is shown below, where it exhibits a relatively slow rise time since no active device is driving it, except while CH 1 is low.

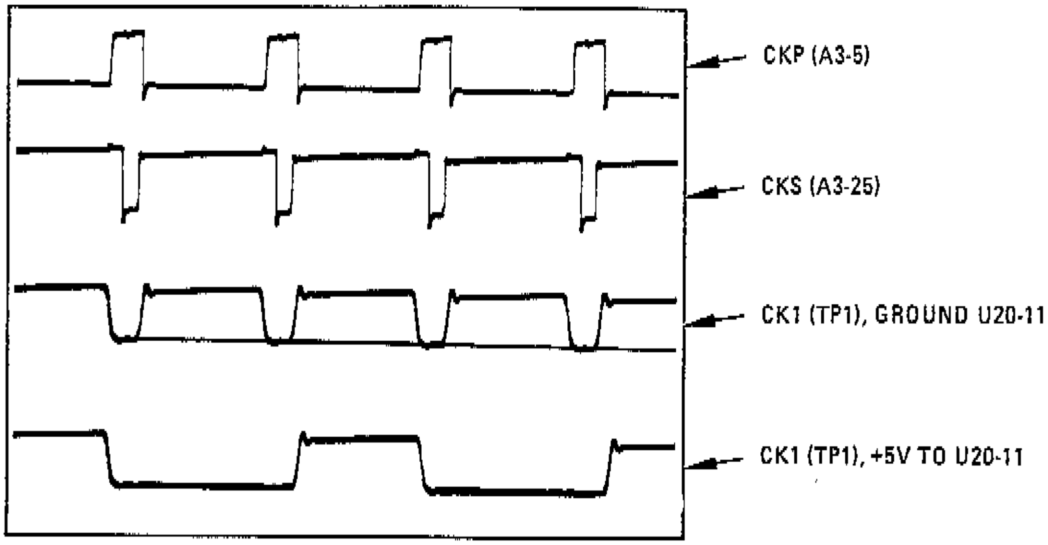


Figure D3-22A. A3A3 Processor Control Clock Timing

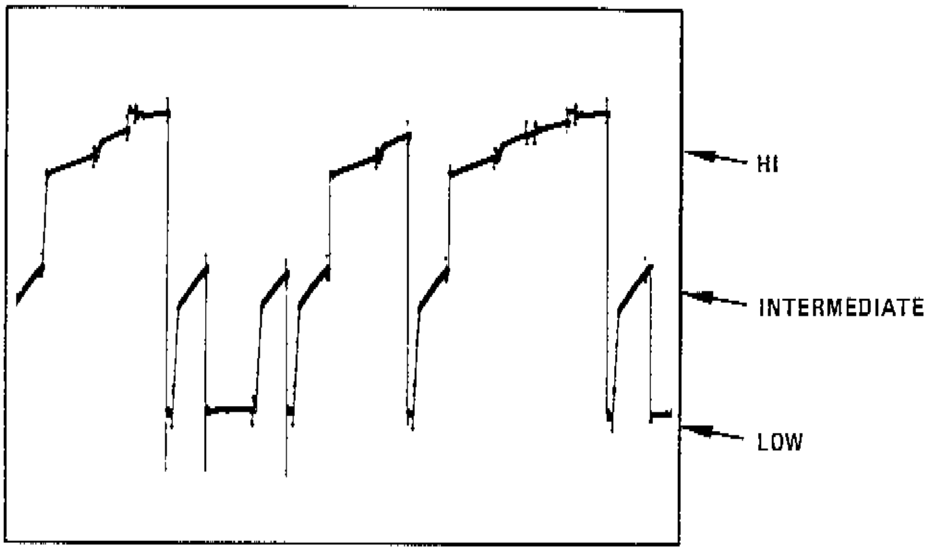


Figure D3-22B. A3A3 Processor Control T BUS 3-State Levels

3. The next step in troubleshooting the Control Processor is to check the signal flow from the ROM through the different paths. U19 — 12, the most significant ROM address bit, can be used to externally trigger an oscilloscope. The signal paths can now be checked for good high/low level logic signals. Except for the few special cases mentioned below, if the output is stuck high or low, but inputs are changing, or if the output doesn't correspond to inputs, then the device can be assumed to be bad.

   a. ROM outputs DØ-7, U5, and U9 inverter buffers (should appear fairly uniform).

   b. Decoders U2A, U2B, U13, U3, U4, U1 (Except U1-10), U7, U8B and U10 (U10-9 = +15 volt) decoder outputs

   c. T BUS; REG A, REG D, REG E, PAD REGISTER outputs.

   d. ALU OUTPUTS, U20A; (Check PDB lines / U12, U13, U17B, U3A, decoder outputs on A4.)

I/O ADDRESS/DATA DEFINITION

PAD 5	4	3	2	1	Ø	Description (B3 = 1 or don't care)	B2	B1	BØ
(Input from Data Selector instead of PDB)									
0	0	0	0	0	1	BANDWIDTH	LEXT2	LEXT1	(LREM)
0	0	0	0	1	0	EXT	LFP POSN	LFPFILT	LFP1kHz
0	0	0	1	0	1	CH1 PORT	LRATIO	LPORT R	LPORT B
0	0	0	1	1	0	CH2 PORT	LRATIO	LPORT R	LPORT B
0	0	0	1	1	1	LS PORT	1	1	LPORT B
0	0	1	0	0	1	CH1 MODE	HRECT	HMAG	HPH
0	0	1	0	1	0	CH2 MODE	HRECT	HMAG	HPH
0	0	1	0	1	1	LS MODE	1	HRNG 2	HRNG 1
0	0	1	1	0	1	CH1 RESOLUTION	RES C	RES B	RES A
0	0	1	1	1	0	CH2 RESOLUTION	RES C	RES B	RES A
0	1	0	0	0	1	CH1 UP SWITCH	10△	1△	.1△
0	1	0	0	1	0	CH2 UP SWITCH	10△	1△	.1△
0	1	0	0	1	1	LS UP SWITCH	10△	1△	.1△
0	1	0	1	0	1	CH1 DOWN SWITCH	10▽	1▽	.1▽
0	1	0	1	1	0	CH2 DOWN SWITCH	10▽	1▽	.1▽
0	1	0	1	1	1	LS DOWN SWITCH	10▽	1▽	.1▽
0	1	1	0	0	1	CH1 ZSW	LZER	LCLR	1
0	1	1	0	1	0	CH2 ZSW	LZER	LCLR	1
0	1	1	0	1	1	LS ZSW	LZER	LCLR	1
0	1	1	1	0	1	CH1 MSW	LMKON	LREFON	LRECALL
0	1	1	1	1	0	CH2 MSW	LMKON	LREFON	LRECALL
0	1	1	1	1	1	LS MSW	1	1	LRECALL

PAD 5	4	3	2	1	Ø	Description		B3	B2	B1	BØ
1	1	0	0	0	0	CH1 LED	ONE	SIGN	"MARKER"	ON	ONE*
1	1	0	0	0	1		MSD	——— BCD ———			
1	1	0	0	1	0		NSD	——— BCD ———			
1	1	0	0	1	1		LSD	——— BCD ———			
1	0	0	0	0	0		LLSD	——— BCD ———			
1	1	0	1	0	0	CH2 LED	ONE	SIGN	"MARKER"	ON	ONE*
1	1	0	1	0	1		MSD	——— BCD ———			
1	1	0	1	1	0		NSD	——— BCD ———			
1	1	0	1	1	1		LSD	——— BCD ———			
1	0	0	0	0	1		LLSD	——— BCD ———			
1	1	1	0	0	0	LS LED	ONE	SIGN	0	ON	ONE*
1	1	1	0	0	1		MSD	——— BCD ———			
1	1	1	0	1	0		LSD	——— BCD ———			

Figure D3-22C. A3A3 Processor Control I/O Address/Data Definition (1 of 2)

I/O ADDRESS/DATA DEFINITION (Cont'd)

PAD 5	4	3	2	1	∅	Description		B3	B2	B1	B∅
(FP Only)											
1	1	1	1	0	1	CH1 ANNUNCIATOR		∅	AN2	AN1**	"REL"
1	1	1	1	1	0	CH2 ANNUNCIATOR		∅	AN2	AN1	"REL"
1	1	1	1	1	1	LS ANNUNCIATOR		"REMOTE"	"M"	"CM"	"REL"
(I/O Only)											
1	1	1	1	0	1	CH1 DECIMAL POINT		LSD	NSD	MSD	(LLSD)
1	1	1	1	1	0	CH2 DECIMAL POINT		LSD	NSD	MSD	(LLSD)
1	1	1	1	1	1	LS DECIMAL POINT		∅	LSD	MSD	∅
1	0	1	0	0	0	CH1 MARKER	ONE	SIGN	0	0	ONE
1	0	1	0	0	1		MSD		BCD		
1	0	1	0	1	0		NSD		BCD		
1	0	1	0	1	1		LSD				
1	0	1	1	0	0	CH2 MARKER	ONE	SIGN	0	0	ONE
1	0	1	1	0	1		MSD		BCD		
1	0	1	1	1	0		NSD		BCD		
1	0	1	1	1	1		LSD		BCD		

* For I/O, Data is changed to SIGN 0 0 ONE

**	AN2	AN1	
	0	0	"NSEC"
	0	1	"D3"
	1	0	"DEG"
	1	1	"USEC"

D3-59a

Figure D3-22C. A3A3 Processor Control I/O Address/Data Definition (2 of 2)

e. Trigger Scope on U2B-12 (L EN REG C). Verify high and low levels on T BUS Ø-3 when L EN REG C is low. (REG C check) — check for activity on REG B outputs. Check PDB lines / U12, U13, U17B, U3A, decoder outputs on A4.

f. Trigger Scope on U2B-11 (L EN REG G). Check T BUS as above (REG G check).

g. Trigger Scope on U2B-9 (L EN RAM). Check T BUS as above (RAM check).

h. Trigger scope on U2B-90 (L EN IR). Check T BUS as above (A4 Data Selector Check).

If unable to find fault in steps 3a-h above, suspect device has not yet been found; a counter is used next.

i. Jumper U2-9, 10, 11, 12 to +5 volts; jumper U7-9 to ground, U19-9 to TP2. Measure the frequency of the AB 0-3 lines relative to clock CK1 (TP1). This can be done by using CK 1 as external standard or measuring both separately, 1 sec gate, and then divide the two. The following measurements should be obtained (± couple counts in Least Significant Digit (LSD) can be expected.)

U12—14 .5000 (Check counter setup)

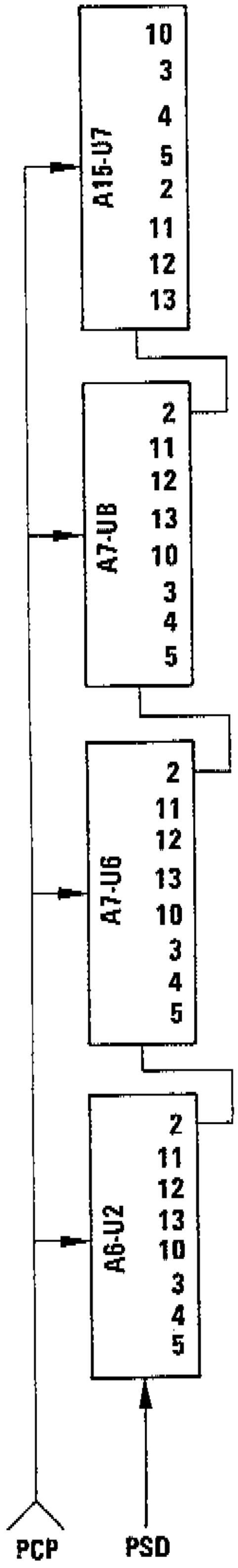
ABØ (Pin 1)	.04247	
AB1 (Pin 2)	.04199	
AB2 (Pin 3)	.04297	Suspect ROM if bad
AB3 (Pin 4)	.04346	

U20-5 .03467 Suspect ALU if bad

Remove jumper from +5V to U2-12;
Remove jumper from U7-9 to ground.

ABØ (Pin 1)	.04297	
AB1 (Pin 2)	.04150	
AB2 (Pin 3)	.04199	Suspect ALU if bad
AB3 (Pin 4)	.04297	

k. Remove all jumpers. Check L CK FP (U10-9) for activity. If still failing, suspect RAM or preset inputs on program counter (U12, U19, U26).



A15-U7

Pin	Signal	Definition
10	OFF2	= CH2 OFF
3	POSN	= POSITION SELECTED
4	OFF1	= CH1 OFF
5	L ALT	= 0 if system is in ALTERNATE SWEEP mode
2	L OFF	= CH1 OFF and CH2 OFF
11	ALT	= SWALT (POLAR 1) + SWALT (POLAR 2)
12	SEL	= $\overline{\text{SWALT} \cdot \text{ALTEN}}$ - Selects display channel in alternating mode
13	PHALT	= SWALT (PH 1) + $\overline{\text{SWALT}}$ (PH 2)

A7-U8

Pin	Signal	Definition
2	L FILT	= 0 if smoothing selected
11	L 1kHz	= 0 if 1 kHz IF Bandwidth selected
12	(NU)	
13	PH 2	= Phase selected on CH2
10	PH 2 EXP	= PH 2 · (RES 2 = 45, 90 or 180)
3	RESC2	RESOLUTION SETTING FOR CH2
4	RESB2	
5	RESA2	

A7-U6

Pin	Signal	Definition
2	GDEN	= SWALT (GD on CH1) + $\overline{\text{SWALT}}$ (GD on CH2)
11	IF SEL	= SWALT (PORT B1) + $\overline{\text{SWALT}}$ (PORT B2)
12	(NU)	
13	PH 1	= Phase selected on CH1
10	PH 1 EXP	= PH1 · (RES1 = 45, 90 or 180)
3	RESC1	MSB
4	RESB1	RESOLUTION setting for CH1 — 000 = .1 dB/DIV; 111 = 20 dB/DIV
5	RESA1	LSB

A6-U2

Pin	Signal	Definition
2	PH12	= SWALT (PH1 + POLAR 1) + SWALT · $\overline{\text{(PH2 + POLAR 2)}}$
11	(NU)	
12	MPX C2	= RATIO 2
13	MPX C1	= RATIO 1
10	MPX B2	= RATIO 2 · MAG 2 + $\overline{\text{RATIO 2}}$ · PORT R1
3	MPX A2	= RATIO 2 · PH 2 + $\overline{\text{RATIO 2}}$ · PORT B2
4	MPX B1	= RATIO 1 · MAG 1 + $\overline{\text{RATIO 1}}$ · PORT R1
5	MPX A1	= RATIO 1 · PH 1 + $\overline{\text{RATIO 1}}$ · PORT B1

(INPUT MXPX CODE)

C	B	A	
0	0	0	A } MAG
0	0	1	B } MAG
0	1	0	R MAG
0	1	1	EXT (1 or 2)
1	0	0	GD
1	0	1	PH
1	1	0	MAG
1	1	1	POLAR (X or Y)

Figure D3-22D. A3A3 Processor Control Shift Register Output Definitions

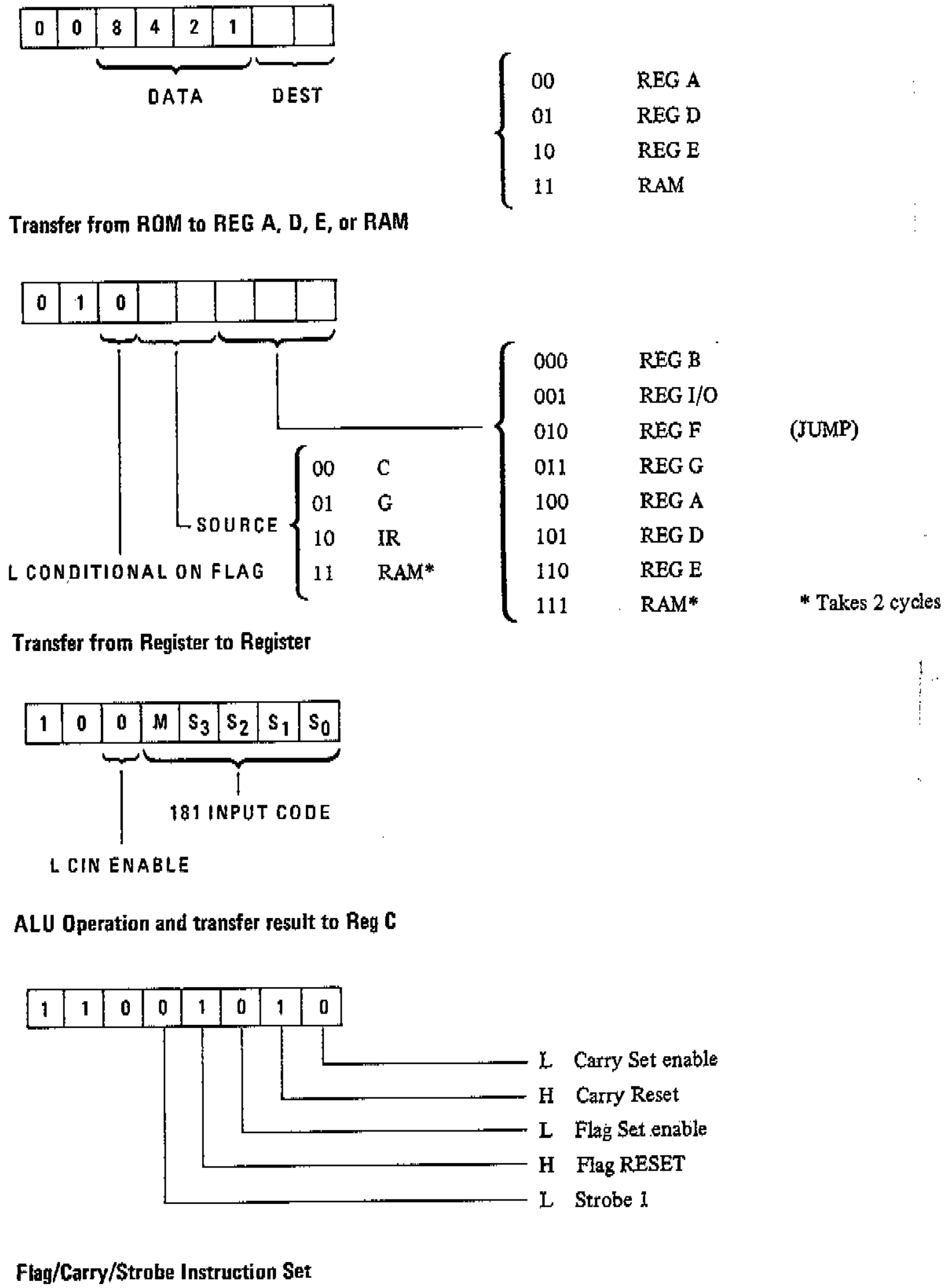


Figure D3-22E. A3A3 Processor Control Instructions

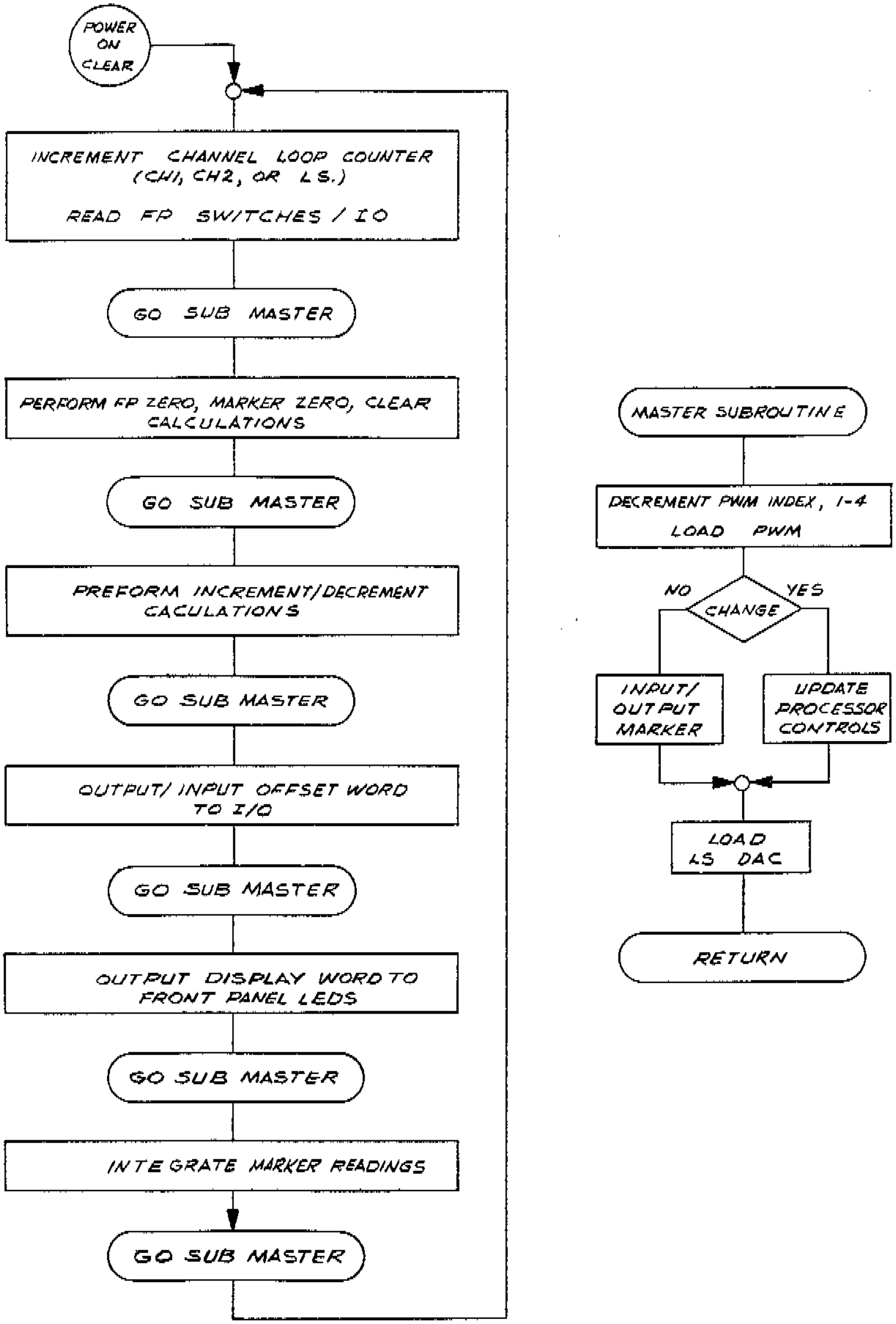


Figure D3-22F. A3A3 Processor Control Program Flow Chart

FIG. D3-22G
SHT. 1 OF 3

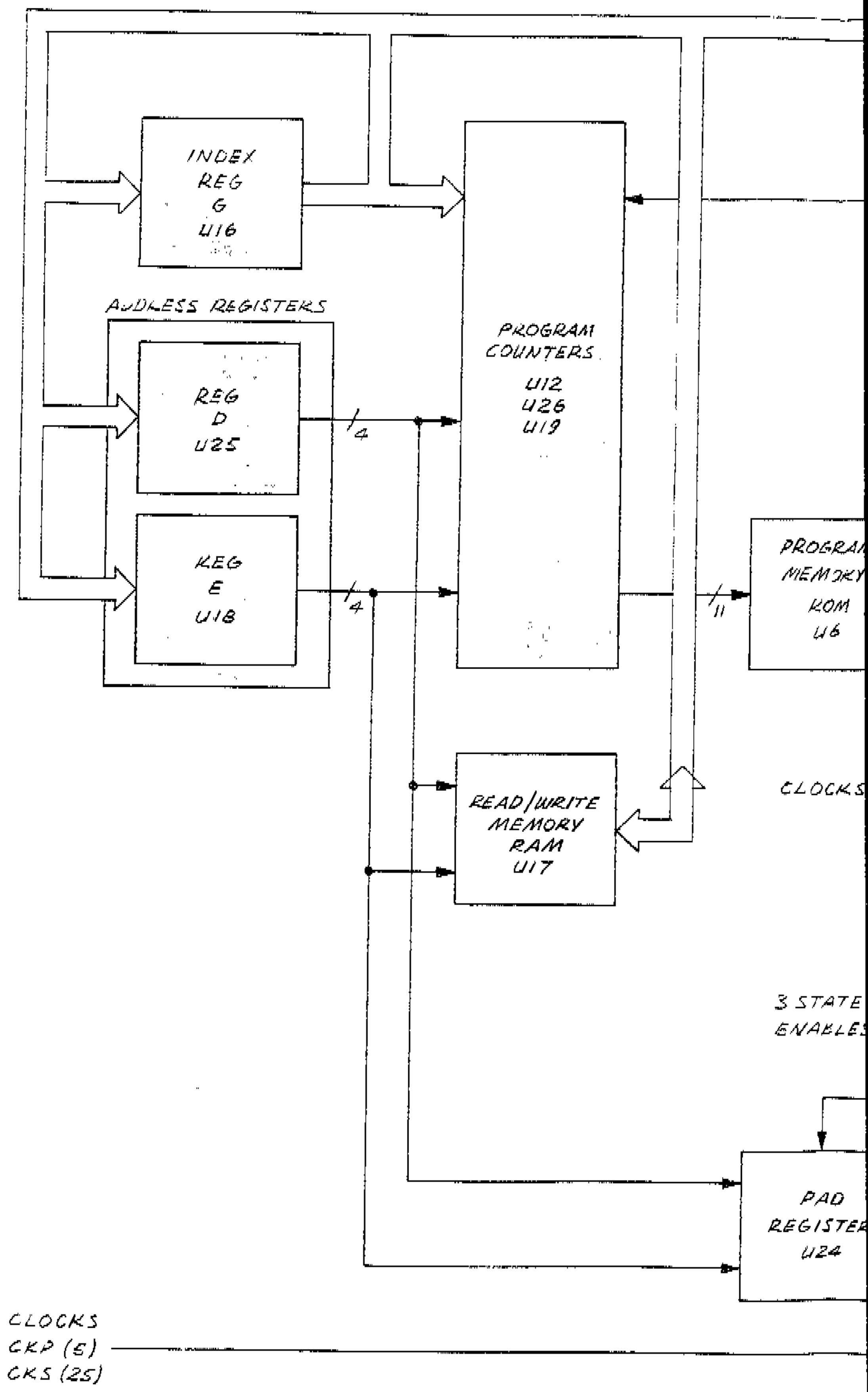


FIG. D3-22G
SHT. 2 OF 3

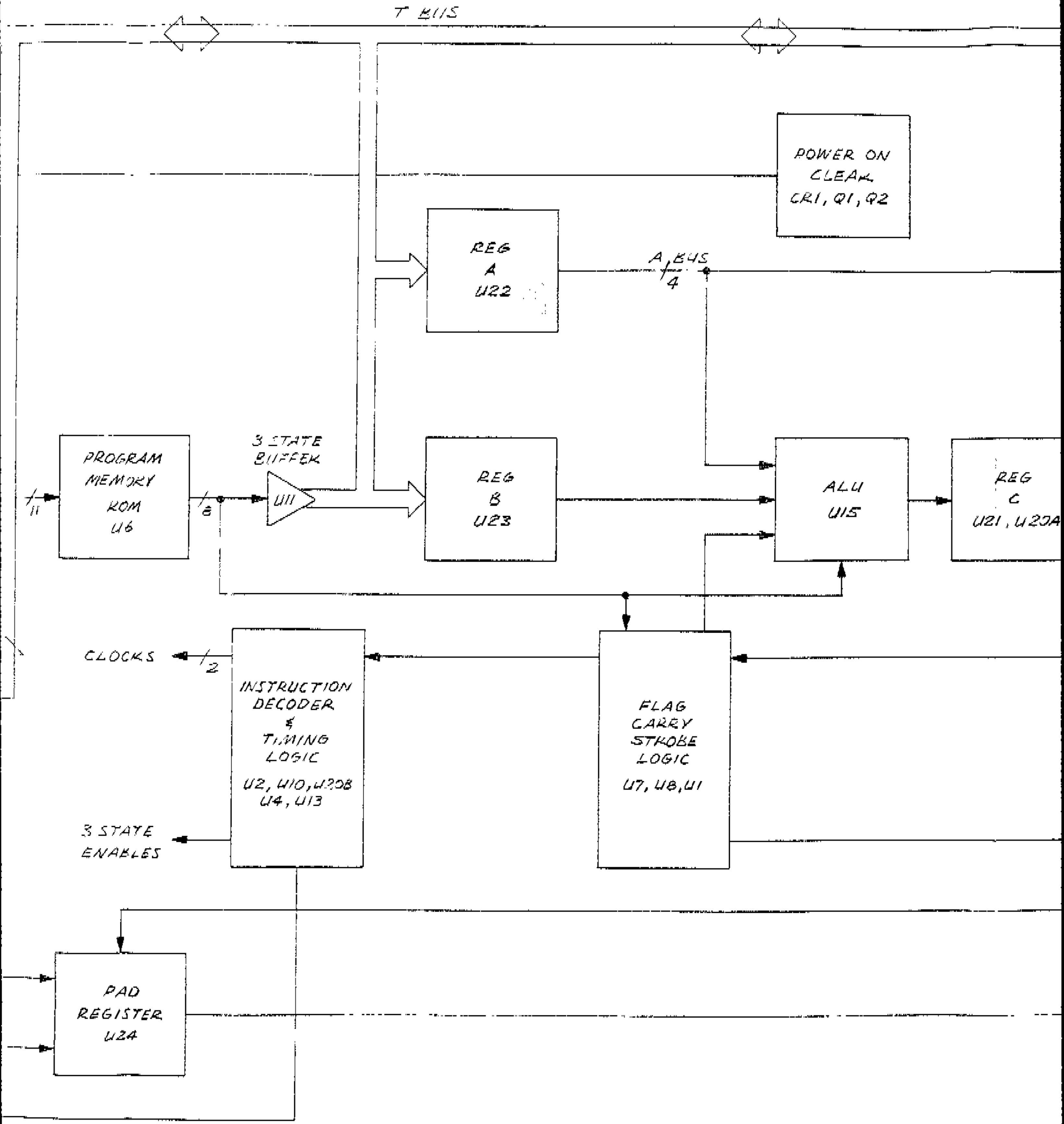


FIG. D3-22G.
SHT. 3 OF 3

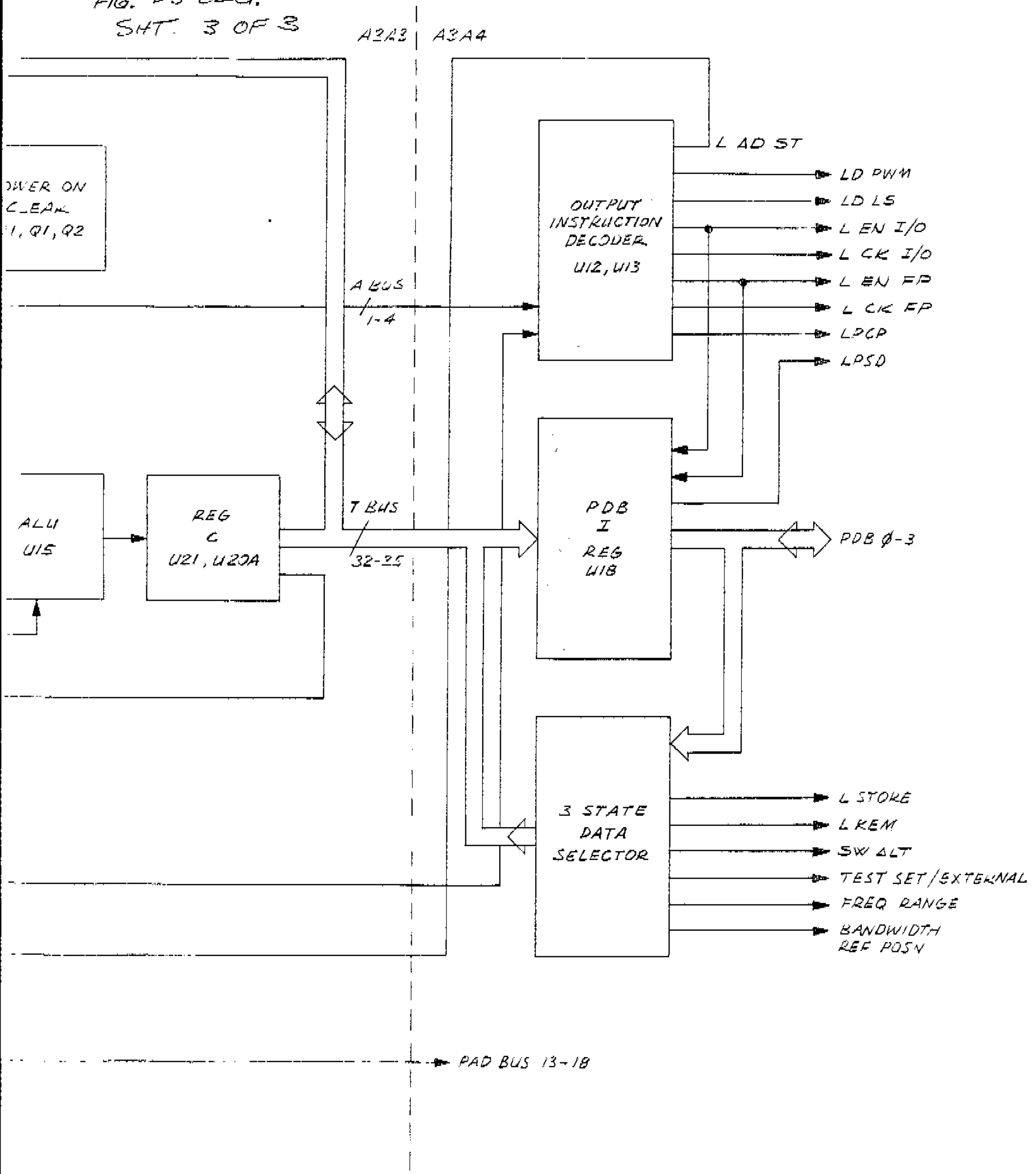
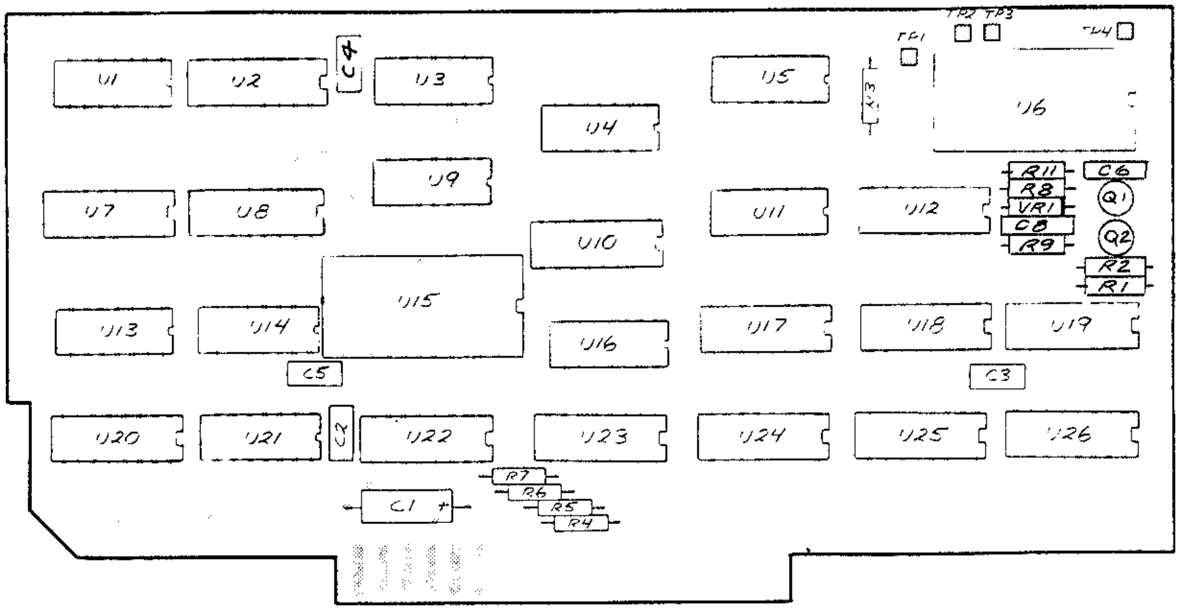


Figure D3-22G. A3A3 Processor Control, Block Diagram

A3A3



1
19

18 ◄ COMPONENT SIDE PINS
36 ◄ REVERSE SIDE PINS

Figure D3-23. A3A3 Processor Control Parts Locations

FIG. D3-24
SHT. 1 OF 4

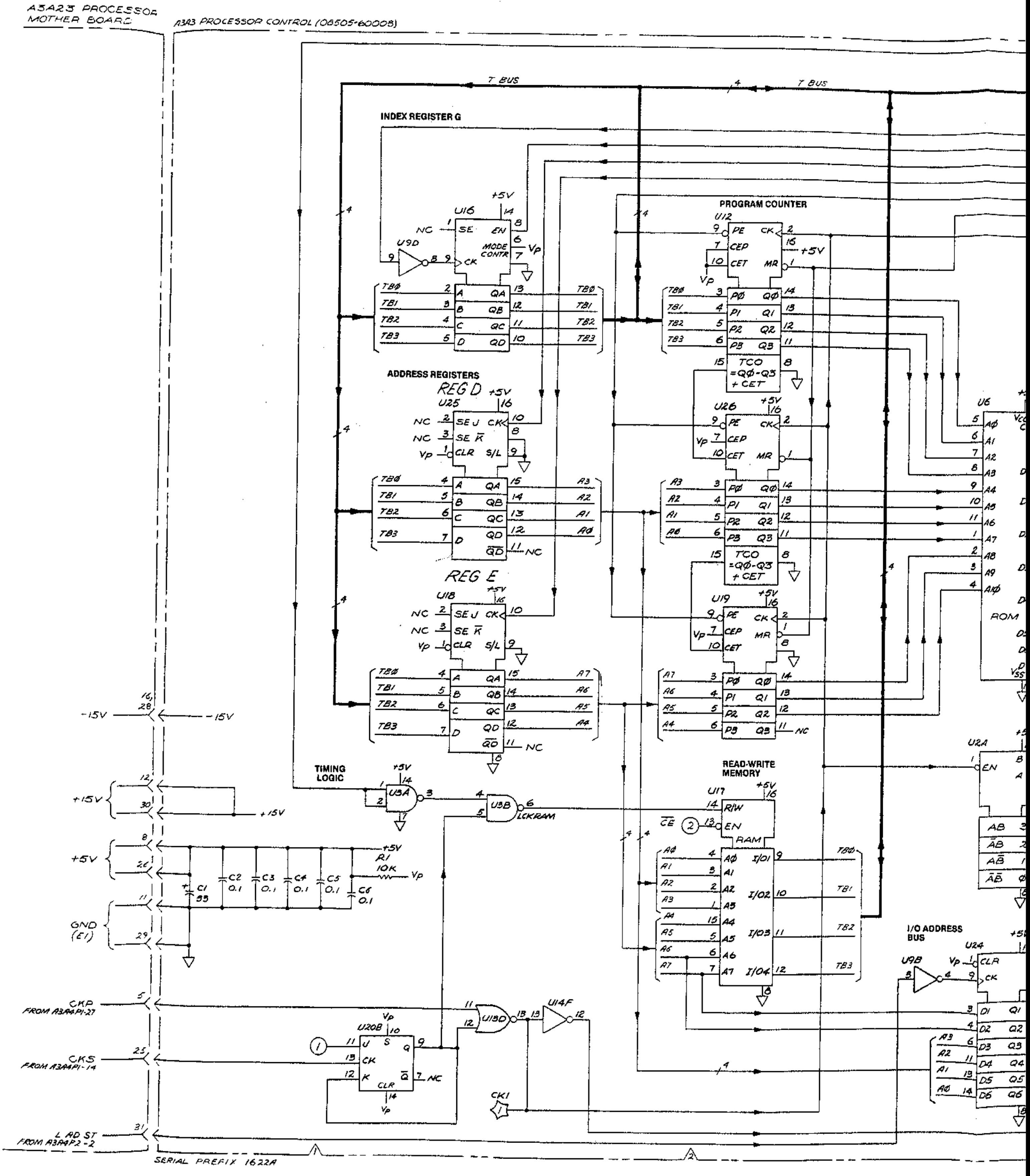


FIG. D3-24
SHT. 2 OF 4

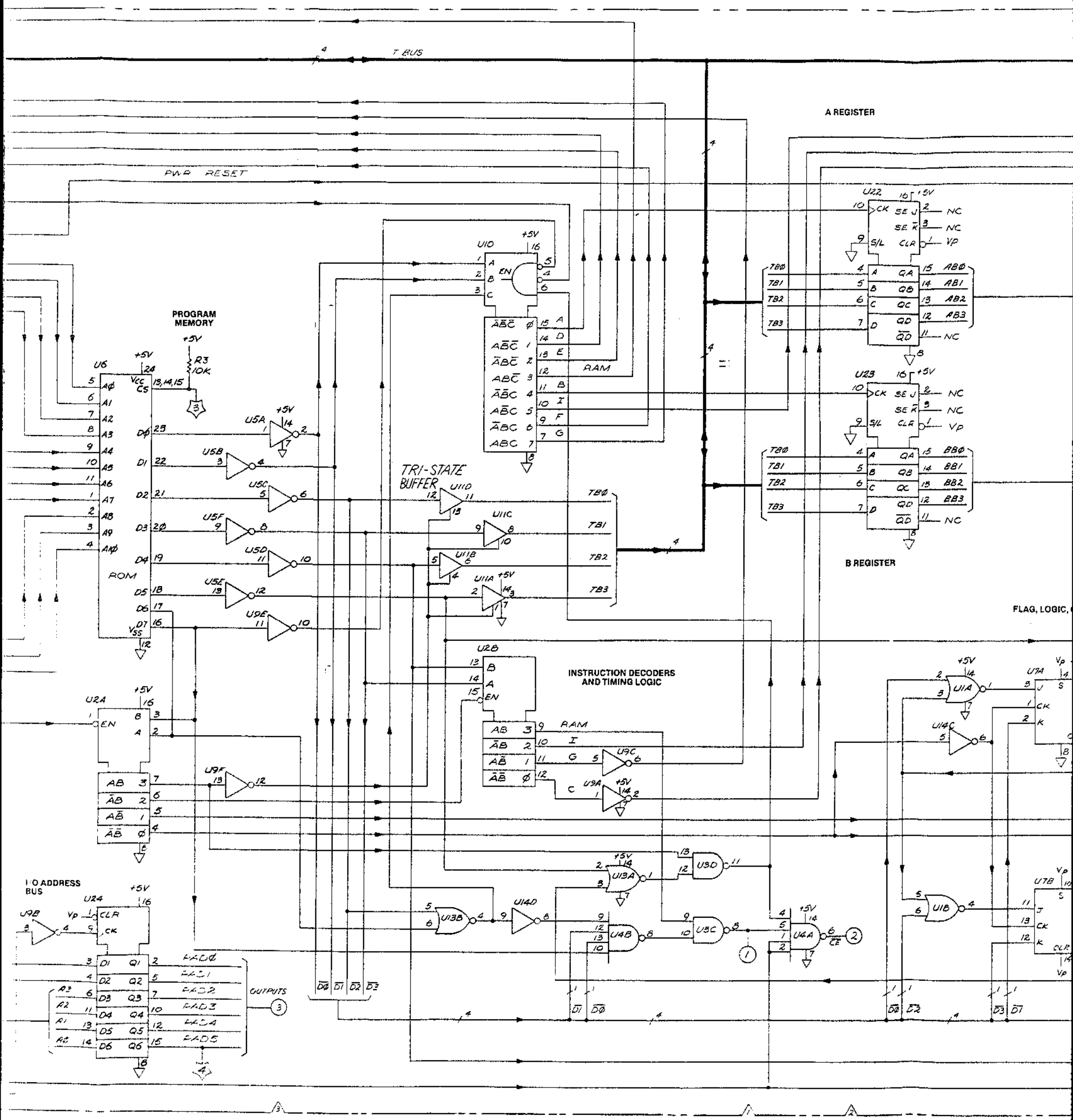
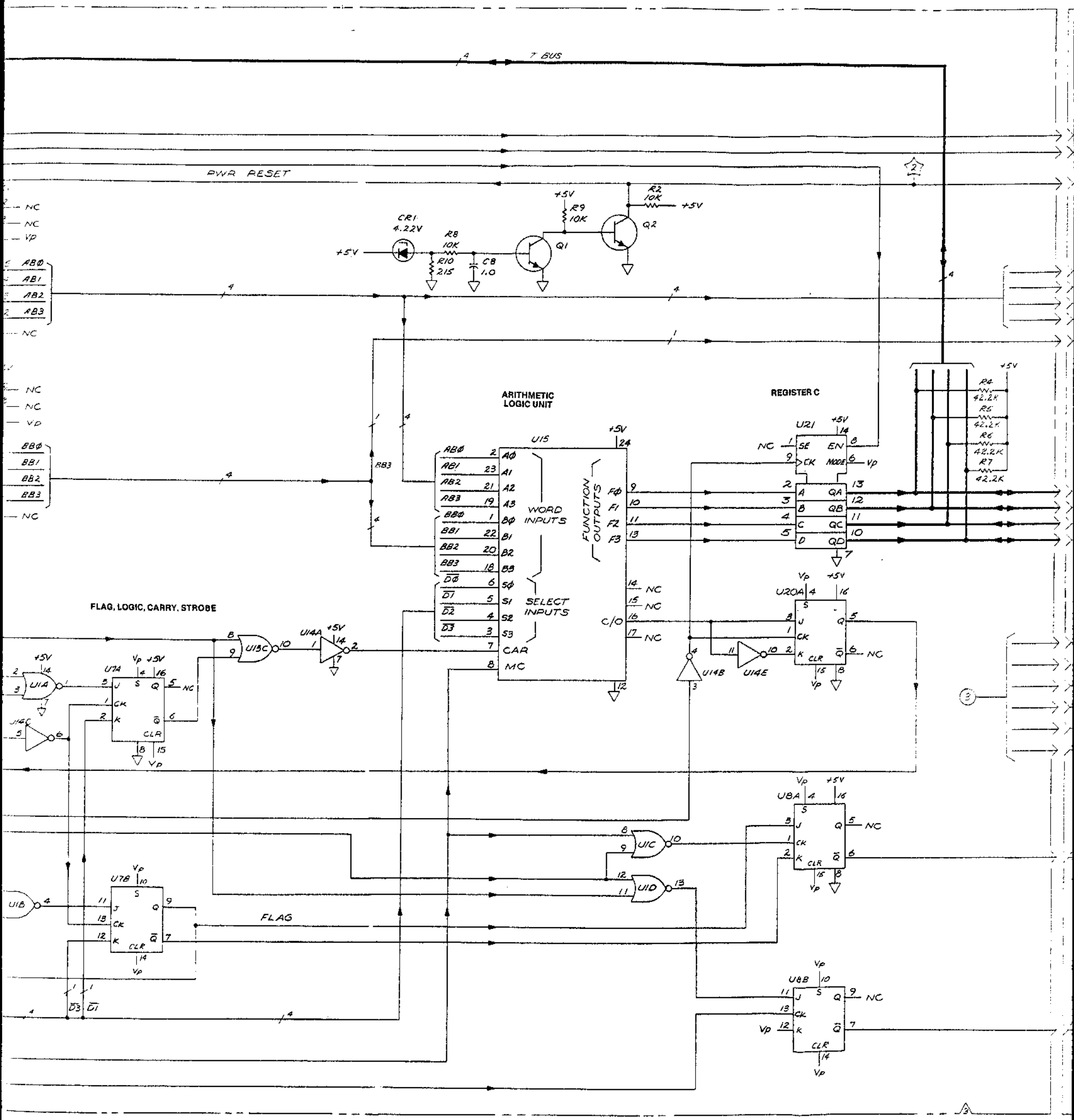


FIG. D3-24
SHT. 3 OF 4



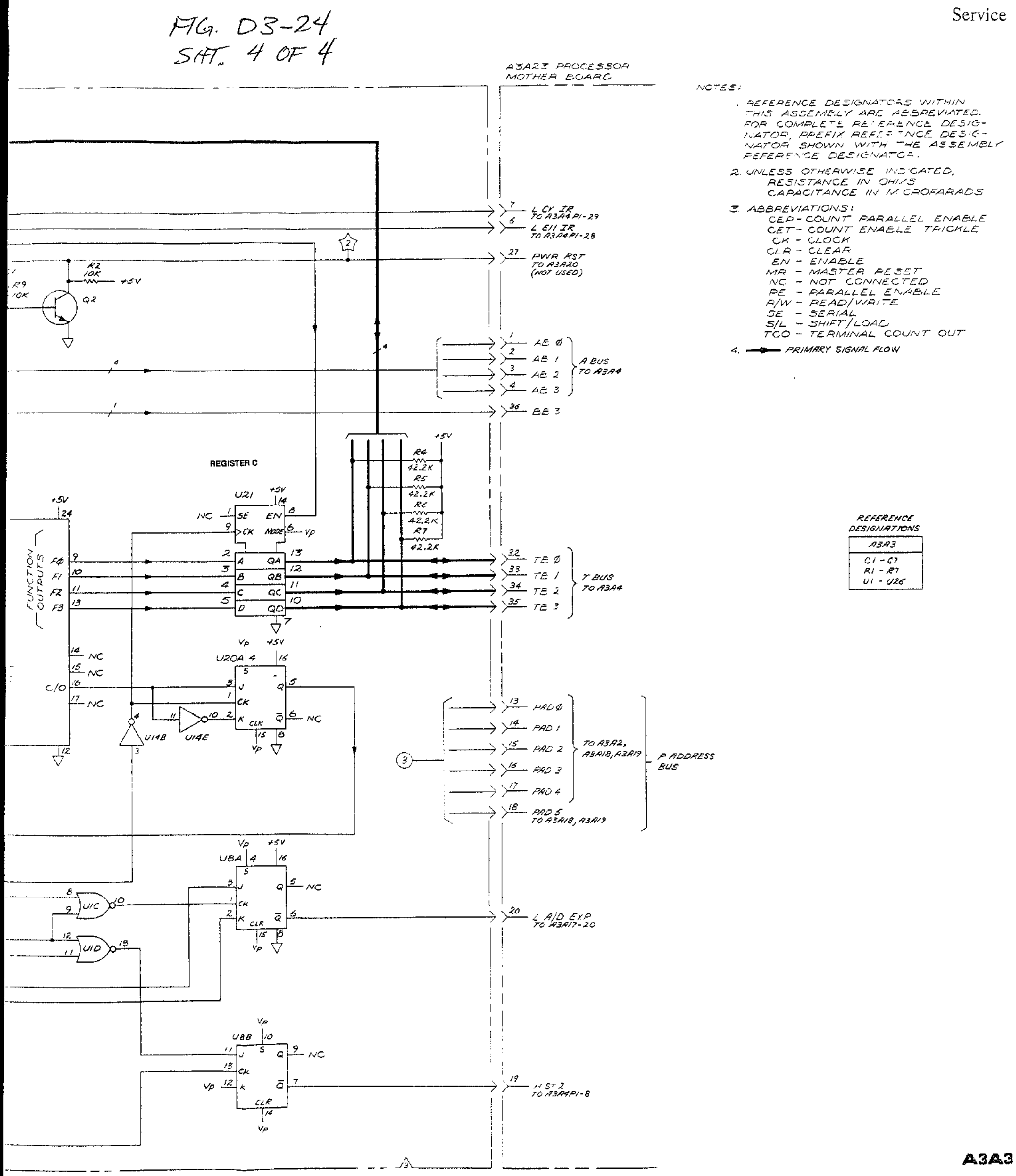


Figure D3-24. A3A3 Processor Control, Schematic

A3A4 PROCESSOR INTERFACE

General Description

The Processor Interface board can be divided into two separate functional sections. One section contains the input/output interface for the control processor, the PDB I REG, the input 3 state data selector, and the 4-16 output instruction decoder. This section is described in the Control Processor Theory of Operation. The remainder of the A4 board contains the clock generator and the pulse width modulator (PWM). The clock generator provides the approximately 7.5 MHz clock for the PWM and divides it by 10 to provide the two 750 kHz clocks for the control processor. The PWM takes the 4-1/2 digit offset words from the control processor and generates pulse widths proportional to these input words. The pulse width outputs then drive the PWM low pass filters on the D/A board, to obtain +6VDC reference offset voltages.

The basic operation of the pulse width modulator is shown in the timing on Figure D3-24A. At t=0, the control processor outputs a LOW TOGGLE PULSE width (LTPW) that forces U4A Q output low and stops the clocks going to the counter. The control processor then loads the 5 digit pulse width modulator counter by putting data on the PDB bus and loading the counters (U5—9) by outputting a LDPWM 1—5 command. LDPWM 1 is output twice, all others only once during each load period. The LDPWM 1 signal, in addition to loading U5, also goes to the clear of U4A to guarantee that the toggle-made flip-flop (U4A) output is low during the load period. After the counter is loaded, the central processor outputs another LTPW command. This forces TP4 high, enabling the clocks through U3C to the counter. Exactly 20000 clock pulses later, the LTPW command is again initiated, the counter is stopped and loaded with the next word.

The counter is a 4-1/2 digit BCD ripple counter. The output from U9, the least significant digit, toggles U8, etc., on up to the most significant digit stored in U6. The U6 output toggles bit A of U5, the one bit of the 4-1/2 digit offset. The remaining 3 bits of U5 are not clocked and so serve merely as register storage. QD is the sign bit, and QB and QC are the two PWM address lines that determines which 1 of the 4 pulse width filters on the D/ A should be driven.

The pulse width is generated by setting flip-flop U4B when a maximum count of 19999 is detected. U11, U17C, U3D form the 9 input AND gate to detect this state. Since U4B is always cleared at the start of the count, its output pulse width is directly proportional to the word stored in memory. If 0 is loaded in, the max count is not detected until 20000 clocks, but at that time, U4B is cleared again so no output pulse is generated. If 00010 is loaded in, a clock pulse 10 periods (1.3 usec) is generated. If the word is negative, as indicated by a high on QD output, then the output pulse is complemented by U17D and U10D to convert the 10's complement input word into a "magnitude only" pulse width.

The pulse width modulator is time multiplexed between the 4 offset words as shown in Figure D3-24B. First the word for CH2 phase is loaded, its pulse width determined and gated onto the PWM 4 line by decoder U16. The next time the PWM is loaded with CH1 phase, then with CH2 MAG/DELAY V OFFSET, then with CH1 MAG/DELAY OFFSET and finally again with the CH2 phase offset. U17A drives the PWM POL line from the QD sign bit and the phase address bit QC. The polarity is inverted for the PHASE PWMs due to the extra signal inversion on the A3A5 D/A board.

The clock generator on A4 consists of an LS TTL gate oscillator U2 operating around 7.5 MHz. Its output from U2A drives the PWM and also U1, which divides by 10 to generate the two clocks CKP and CHS for the central processor.

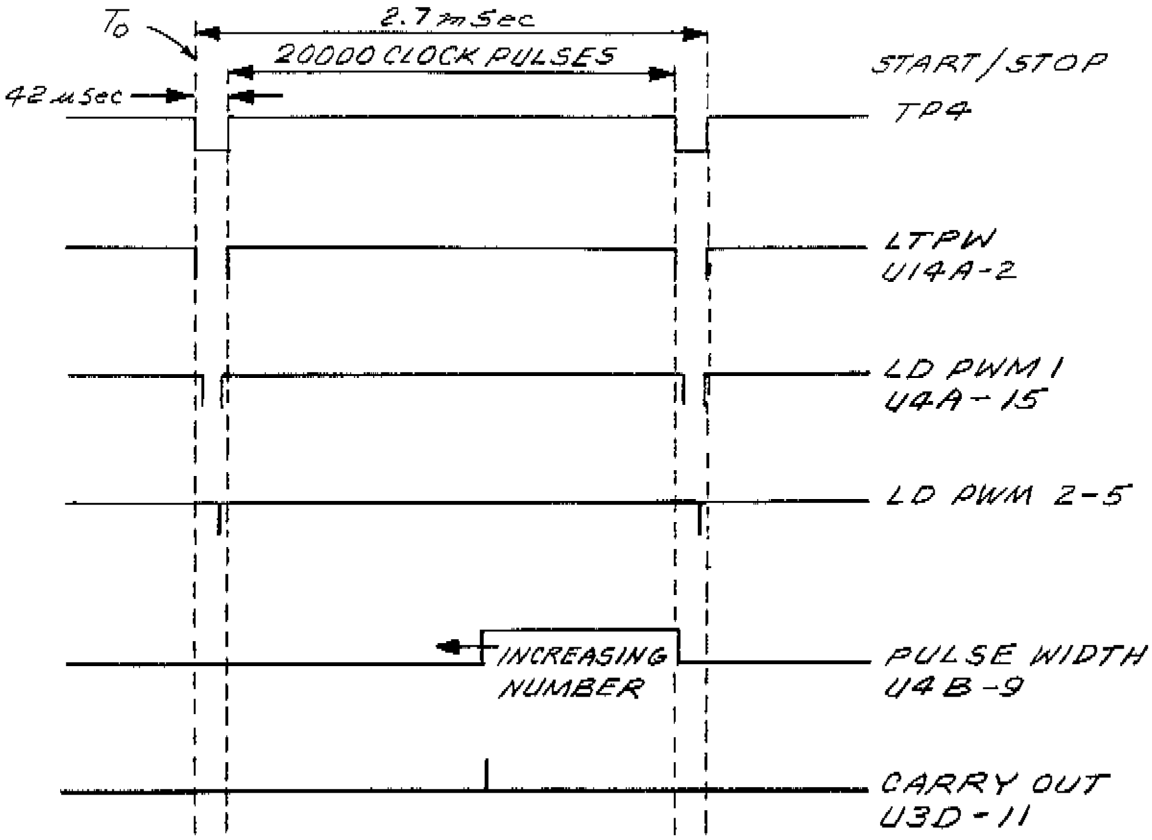
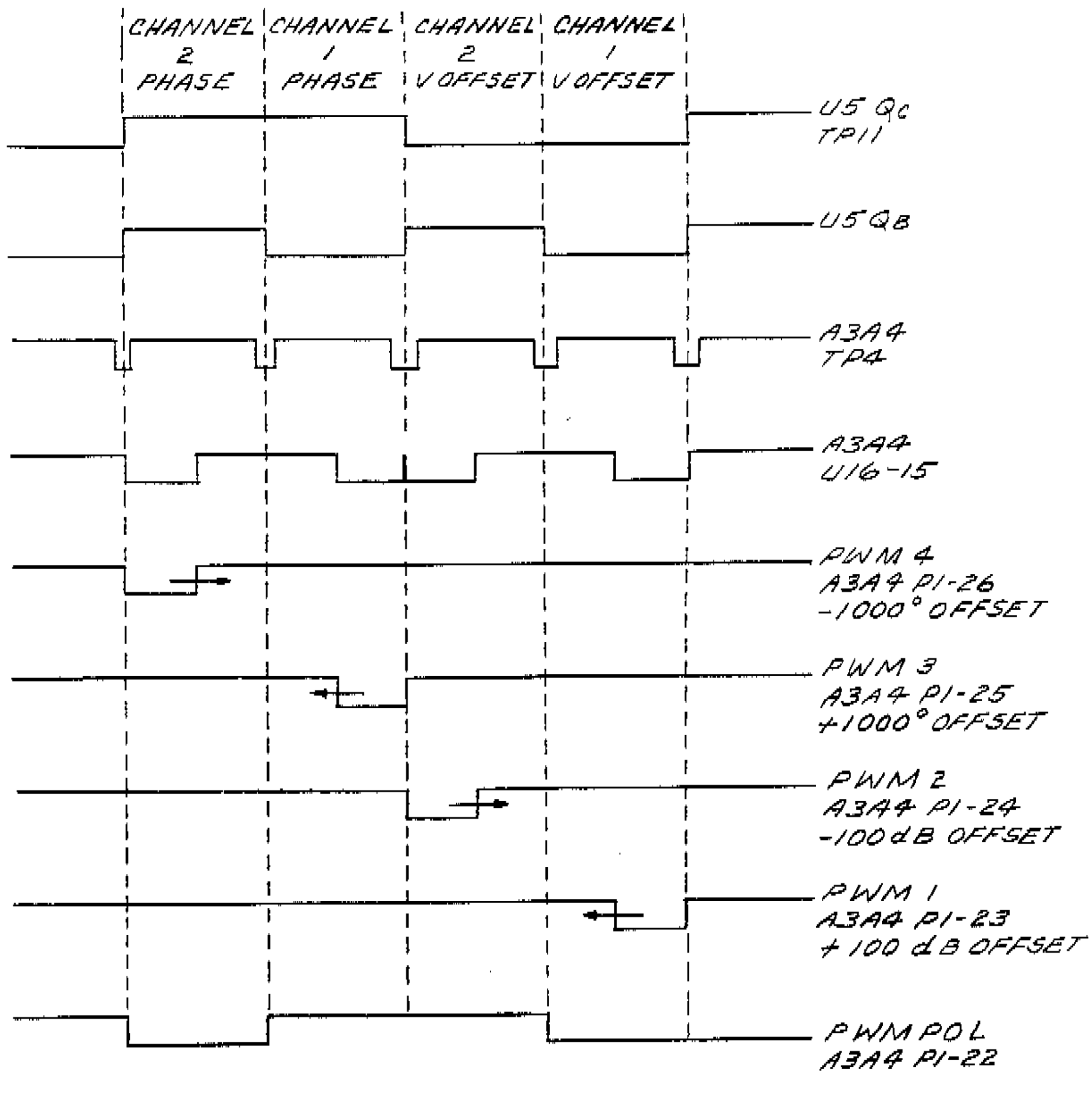


Figure D3-24A. Pulse Width Control Timing Diagram



D3-64c

Figure D3-24B. Pulse Width Modulator Timing Diagram

MNEMONIC TABLE

Signal	Full Name	Function/Description
AB Ø	A Bus Ø	A Bus Ø instruction decoder
AB 1	A Bus 1	A Bus 1 instruction decoder
AB 2	A Bus 2	A Bus 2 instruction decoder
AB3	A Bus 3	A Bus 3 instruction decoder
BB3	B Bus 3	Bit 3 of Register B Output
CK P	Clock P	Timing clock to Processor (≅800 kHz)
CK S	Clock S	Timing clock to Processor (≅800 kHz)
FR 1	Frequency Range 1	FR1 = Ø in .5 – 1300 MHz range
FR 2	Frequency Range 2	FR2 = Ø in .5 – 13 MHz range
H ST 2	High Strobe 2	Positive pulse to instruction decoder
L AD ST	Low Address Strobe	LAD ST = Ø → Address Clock (negative pulse)
L CK FP	Low Clock Front Panel	Clocks LEDs and Annunciators
L CK I/O	Low Clock, Input/Output	Clocks data to I/O
L CK IR	Low Clock I Register	Clocks data to I register
LD LS 1	Load Line Stretcher 1	Clock to Line Stretcher D/A Register
LD LS 2	Load Line Stretcher 2	Clock to Line Stretcher D/A Register
LD LS 3	Load Line Stretcher 3	Clock to Line Stretcher D/A Register
L EN FP	Low Enable, Front Panel	Enables front-panel drivers to read switches
L EN I/O	Low Enable, Input/Output	Enables I/O or A/D to input data
L EN IR	Low Enable, I Register	Enables input to Control Processor
L EXT 1	Low External 1	L EXT 1 = Ø → CH1 EXT input enabled
L EXT 2	Low External 2	L EXT 2 = Ø → CH1 EXT input enabled
L FP 1KHZ	Low Front Panel 1 kHz	Ø → 1 kHz IF BW in LOCAL
L FP FILT	Low Front Panel Filter	Ø → Filter enabled when in LOCAL
L FP POSN	Low Front Panel Position	Ø → Displays position of reference line in LOCAL
LPCP	Low Processor Clock Pulse	Clock for serial to parallel shift registers
LPSD	Low Processor Serial Data	Input to Shift Register
L REM	Low Remote	L REM = Ø → Remote
L STORE	Low Store	Signal from I/O or A/D requesting data input
PDB Ø	Processor Data Bus Ø	Part of 4-Bit Data Bus
PDB 1	Processor Data Bus 1	Part of 4-bit Data Bus
PDB 2	Processor Data Bus 2	Part of 4-Bit Data Bus
PDB 3	Processor Data Bus 3	Part of 4-Bit Data Bus
P DB	Processor Decimal Point	Multiplexed Processor Decimal Point
PWM 1	Pulse Width Modulator 1	CH1 Magnitude or Group Delay
PWM 2	Pulse Width Modulator 2	CH2 Magnitude or Group Delay
PWM 3	Pulse Width Modulator 3	CH1 Phase Input to D/A LPF
PWM 4	Pulse Width Modulator 4	CH2 Phase Input to D/A LPF
PWM POL	Pulse Width Modulator Polarity	Multiplexed Polarity; 1 = negative number
SWALT	Sweep Alternate	Controls Alternating Mode; 1 = CH1, Ø = CH2
TB Ø	T Bus Ø	Internal Bus to Digital Processor
TB 1	T Bus 1	Internal Bus to Digital Processor
TB 2	T Bus 2	Internal Bus to Digital Processor
TB 3	T Bus 3	Internal Bus to Digital Processor
TEST SET	Test Set	Input from Test Set (8503) Selects Calibration Offsets
WTH 1	Width 1	Coded Line from front-panel WIDTH switch
WTH 3	Width 3	Coded Line from front-panel WIDTH switch

FIG. D3-246
SHT. 1 OF 3

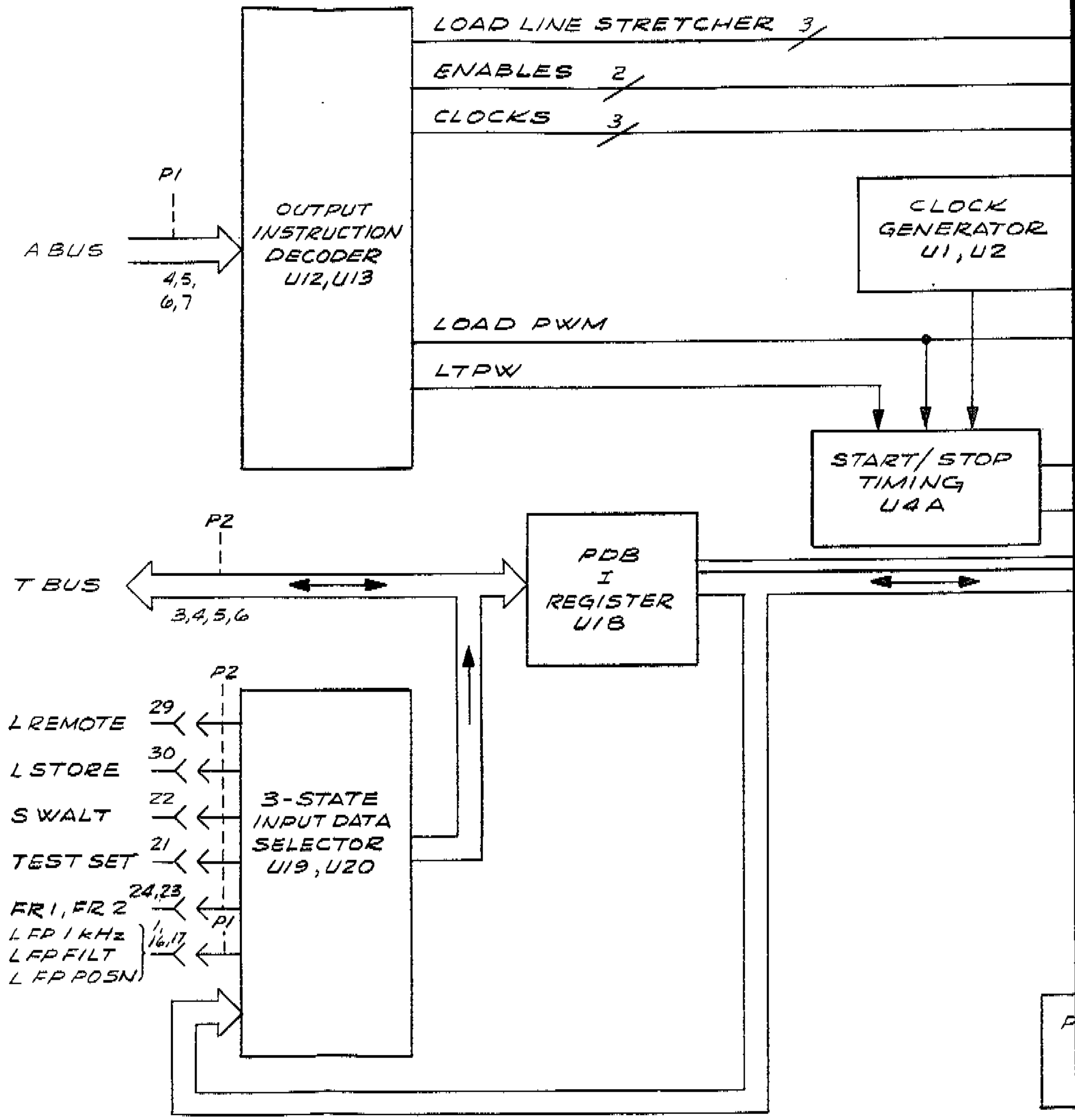


FIG. D3-24C
SHT. 2 OF 3

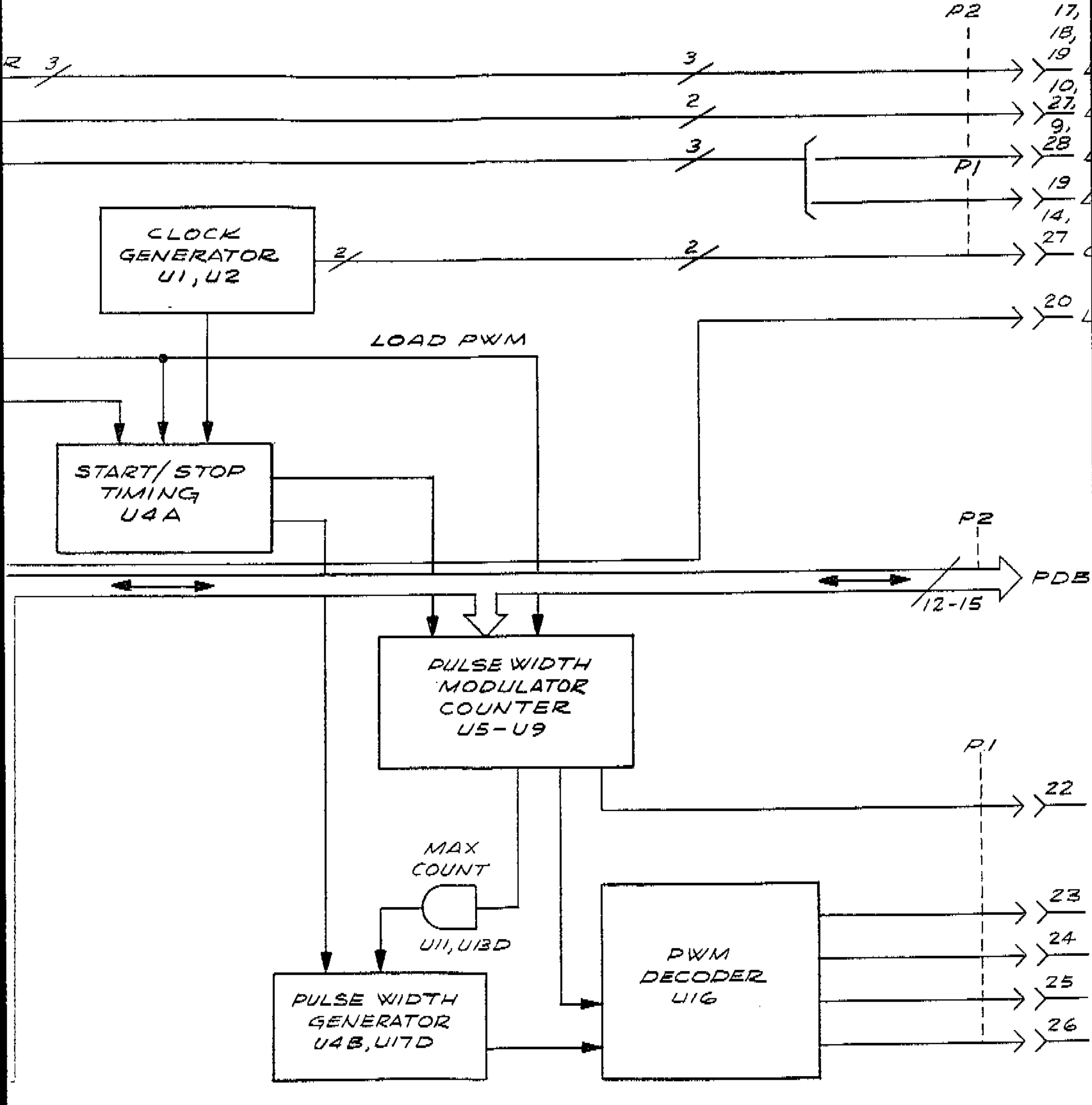


Figure D3-24C. A3A4 Proce

FIG. D3-24C
SHT. 3 OF 3

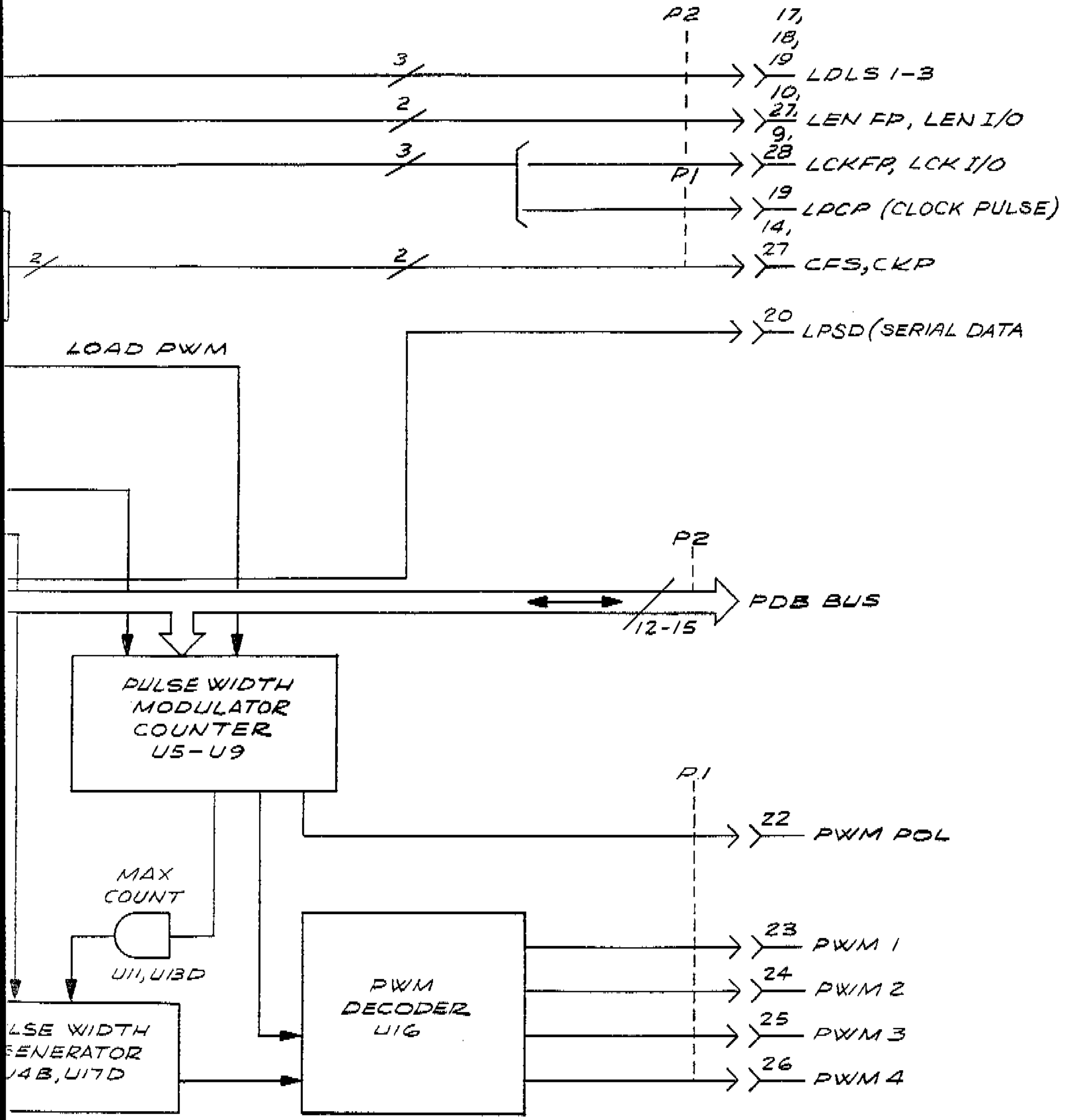


Figure D3-24C. A3A4 Processor Interface, Block Diagram

A3A4

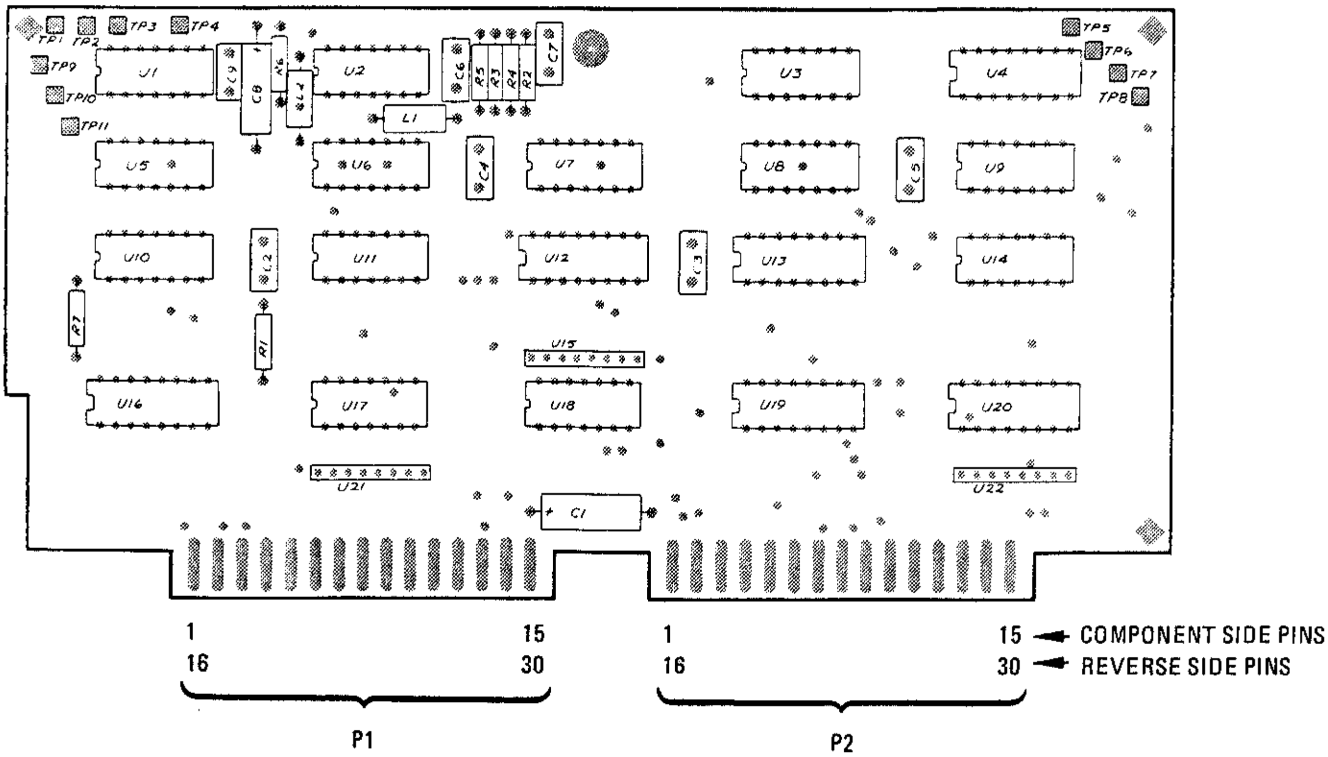


Figure D3-25. A3A4 Processor Interface Parts Location

FIG. D3-26
SHT. 1 OF 5

Width	WTH 2	WTH 3
START/STOP 1	1	0
START/STOP 2	1	0
ALT	0	0
CW±ΔF	0	1
CW	1	1

Range	FR 1	FR 2
.5 – 13 MHz	1	0
.5 – 130 MHz	1	1
.5 – 1300 MHz	0	1

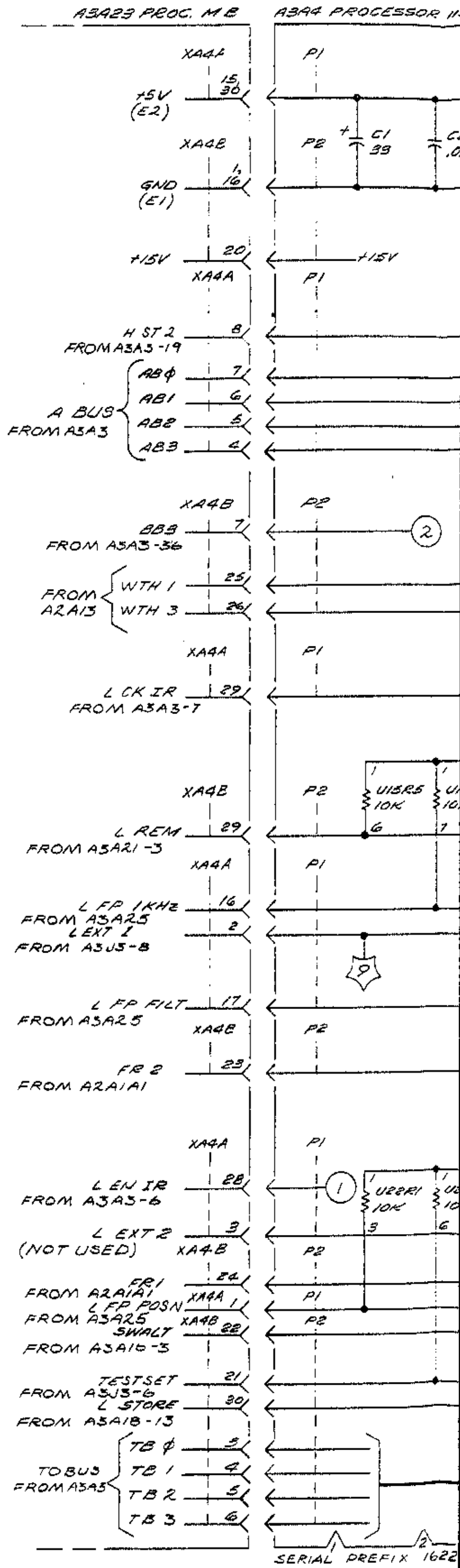


FIG. D3-26
SHT. 2 OF 5

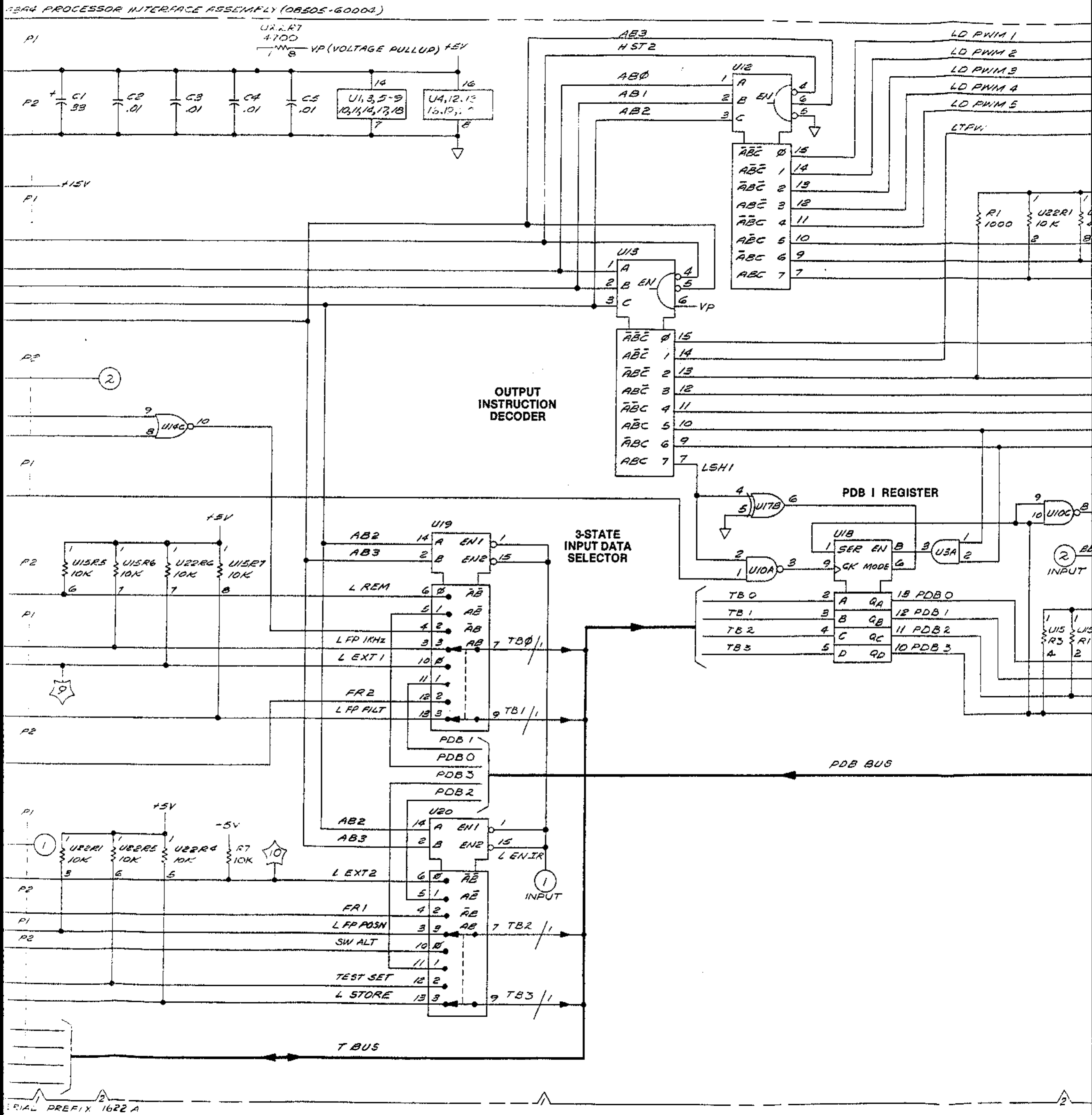


FIG. D3-26
SHT. 3 OF 5

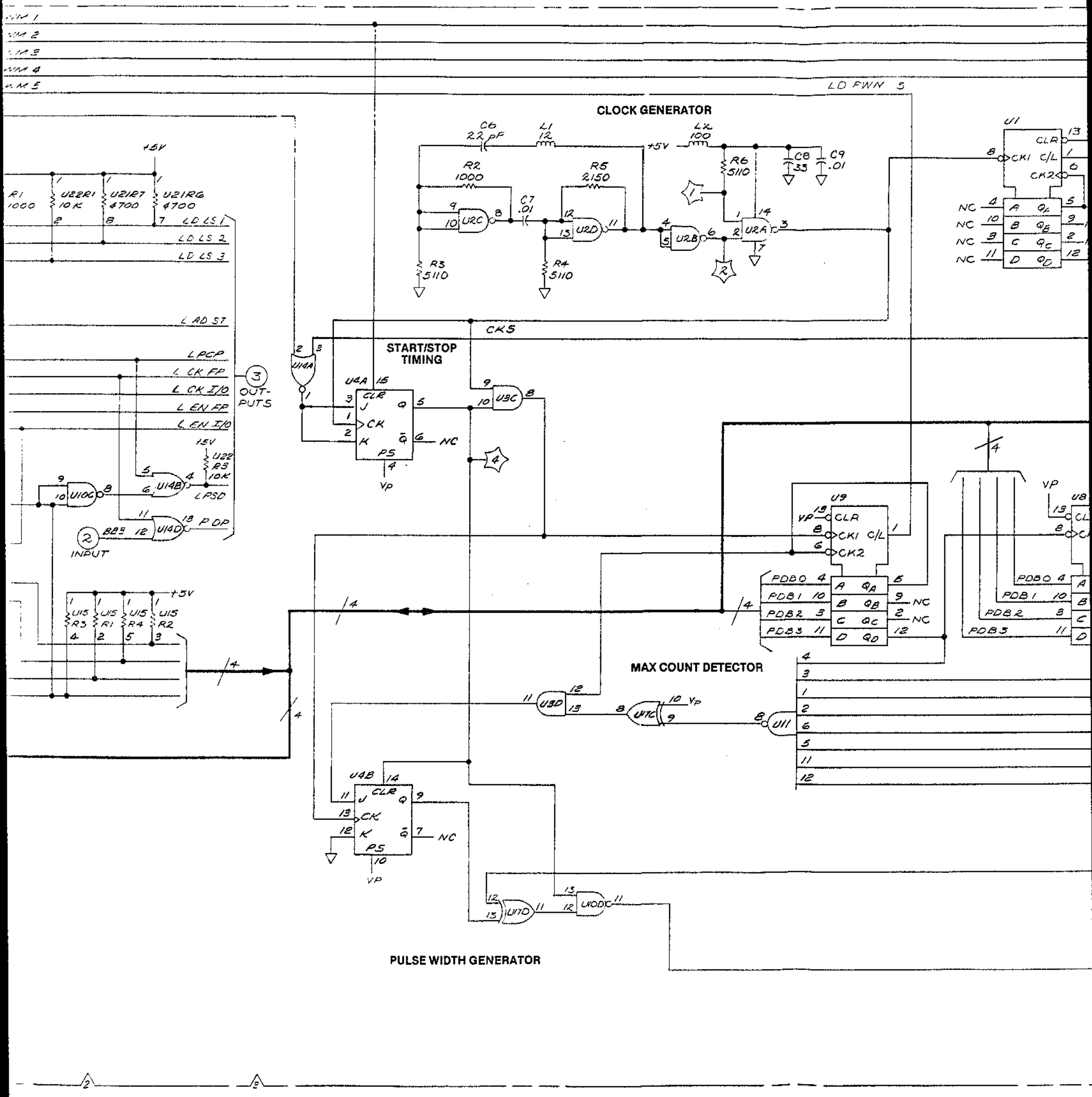


FIG. D3-26
SHT. 4 OF 5

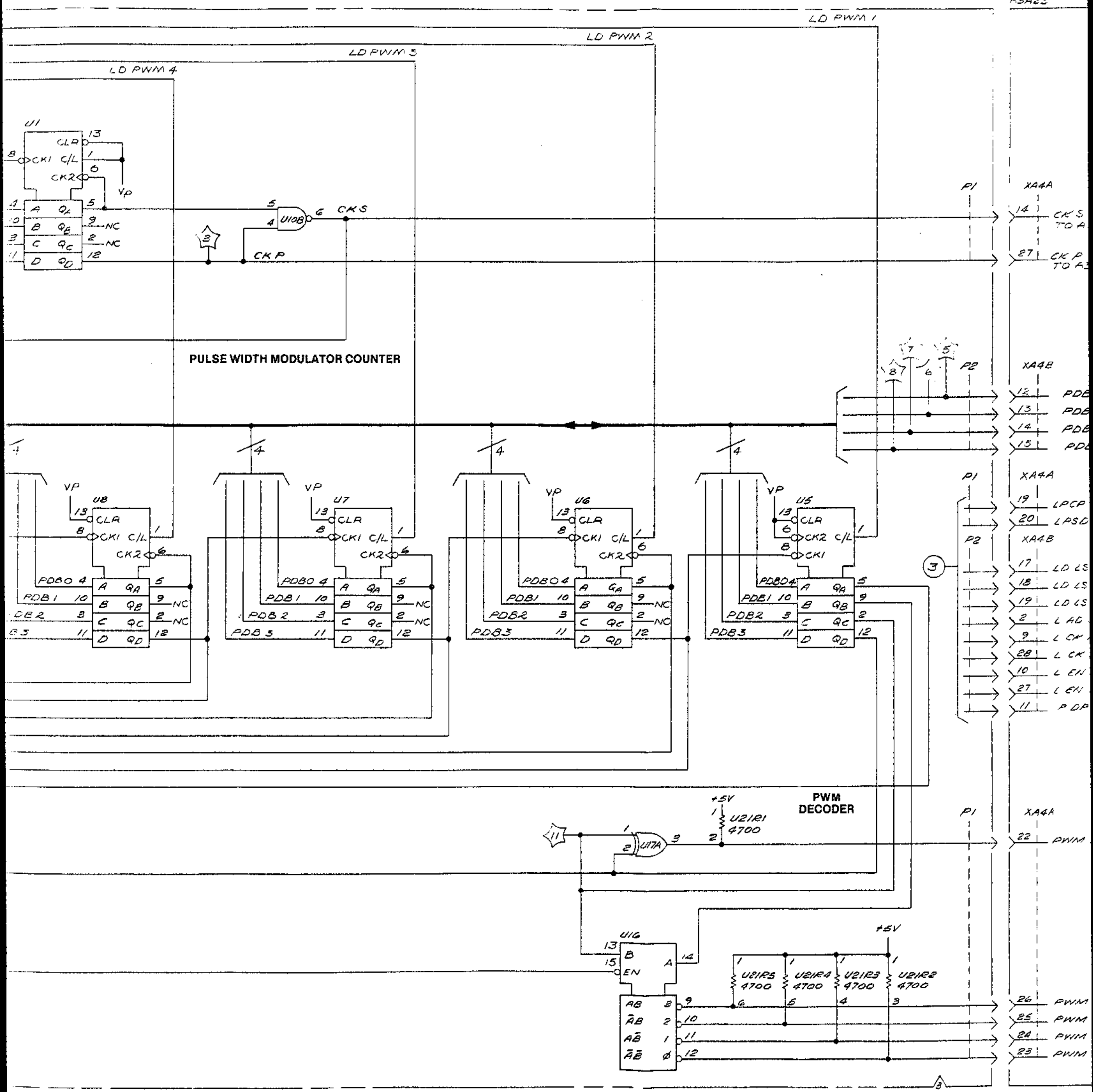


Figure D3-26

FIG. D3-26
SHT. 5 OF 5

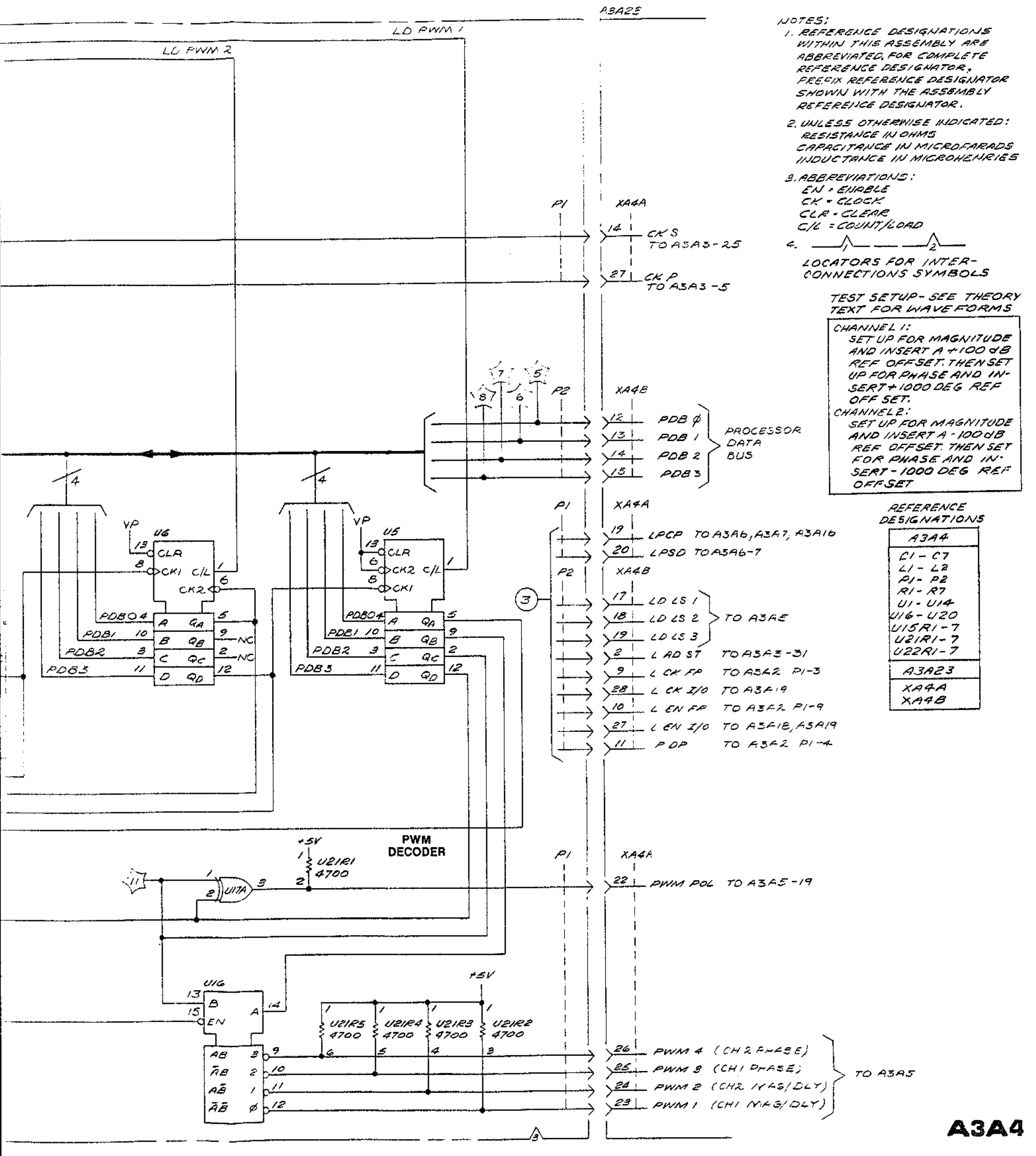


Figure D3-26. A3A4 Processor Interface, Schematic

A3A5 PROCESSOR D/A CONVERTER

General Description

The purpose of the Processor D/A board is to convert the digital PWM control signals from the Control Processor and Interface boards into calibrated analog voltages to be used as reference offsets and to scale the tuning and sweep ramp signals according to the specified electrical length. The circuitry to generate the DC offsets consists of a voltage reference, and four switch-driven low pass filters that average the pulse width information to obtain 4 DC voltages that correspond to the CH1 Mag/Delay offset, CH2 Mag/Delay offset, CH1 Phase Offset, and CH2 Phase Offset. The scaling of the ramps is accomplished by a 2-1/2 decade multiplying DAC that scales the ramp depending on the inserted electrical length. This scaled ramp is combined with one of the two phase offset signals to generate the composite PHASE OFFSET signal to the A9 Phase Offset board.

The voltage reference supplies a positive or negative reference voltage to the PWM low pass filters, depending on the PWM POL control lines. The original −6.2V reference is generated by VR1 in the feedback of op amp U5, with emitter follower Q1 supplying the extra current gain. The reference, after being scaled by the SCL adjustment R48, goes to switch U13C. If PWM POL is a 0, then the reference is switched to the Pin 3, positive input of U12, which then acts like a unity gain voltage follower, supplying an output voltage of −4.5 volts. When PWM POL is a "1", the reference is switched to the inverting input, and U12 then is a unity gain inverting amplifier. The positive output of +4.5 volts is adjusted to match the negative output with the BALance adjustment R45.

The four PWM control lines switch the analog switches U13A, U13B, U14B, U14C between either the reference voltage or ground. Since the pulse width is directly proportional to the digital offset as determined by the pulse width modulator on A4, the DC average of the switched signal directly represents the offset. This average is obtained by a 5 pole, 5 Hz low pass filter. The four amplifiers, U1 — U4, are the active element of the low pass filters and amplify the DC offsets by 9 to obtain the proper scale factors of .5V/10 dB or .5V/100 deg. Three of the amplifiers have offset voltage adjustments. OFS1, R29, removes the offset for the CH1 reference offset, V OFFSET1, OFS 2, R28, for the CH2 offset. P OFS 2, R27 is used to match the offset of U4, CH2 phase offset, to the offset of U3, CH1 phase offset.

Since only one phase offset can be processed at a time, switch U11 selects between the CH1 or CH2 phase offset. U11 is controlled by the PH12 signal which is generated by the Control Processor and comes from the input MXPX control register. A "1," in PH12, selects the CHANNEL 1 phase offset; a "2" selects CH2 phase offset. The output of the switch is summed into the inverting phase offset Summing Amplifier U10.

The control words for the LS multiplying DAC are calculated and sent out by the Control Processor U1A, the 4 line data bus PDB 0 – 3. Three clock lines LD LS1 – 3 (Load Line Stretcher) also come from the Interface board to clock the data on the data bus into the three 4-bit Storage Registers U18—U20. The control word consists of a 2-1/2 digit BCD word including sign, plus two control lines that correspond to the LS mode for the currently processed IF channel. ,For example, the Front Panel may be displaying PORT A EL LENGTH and mode, but if CH1 and CH2 are measuring PORT B, then the stored length and mode for PORT B are output to the DAC.

The LINE Stretcher has four different operating modes. In the OFF position, the analog multiplexer U8 switches ground into amplifier U7, which applies no input (0V) to the multiplying DAC. In the X1 position, the tuning voltage is selected through R39, a 196K

D3-68a

resistor. This applies a positive ramp of .78 volts max across the multiplying DAC. In the X10 mode, the tuning voltage is selected through R40, a 19.6K resistor, making the output go to 7.8 volts. In the MAX X10 /SCAN mode, the sweep ramp, after being inverted by U6, is selected. This applies a 5 volt ramp across the multiplying DAC, independent of the frequency controller frequency setting. This mode allows large effective lengths to be inserted over narrow frequency ranges, while the X1 and X10 modes are limited in range, since they are calibrated in terms of physical length.

The multiplying DAC consists of a BCD resistor ladder made up of discrete resistors R55 — R66 and 10 analog switches, U15, U16, U17 and U11C. The outputs of the storage registers drive the switches, switching in the appropriately weighted gain step. For example, the U19 pin 1 output is the "8" bit of the most significant digit, so in the max X10 /SCAN mode, it represents 800 degrees/scan. When this line goes high, R64, 20K, is switched in from the DAC input to U10 summing amplifier input, so the 5 volt input is amplified by .8 (R71/R64) to become a −4 volt ramp which corresponds to 800 of phase offset. To enable both positive and negative electrical length, the DAC is made bipolar by inverting the input ramp with U9 and then switching the inverted signal in or out with the polarity bit from U20–U21. The LS adjustment R70 on U9 removes the U9 input offset so that when the polarity is clamped, no additional DC phase offset is added, just the slope should change. To provide for finer resolution then the 2-1/2 digits provide, the DAC input also goes to two FD verniers where the electrical length can be continuously adjusted over 1-1/2 to 2 least significant digits.

One of the two vernier outputs is selected by U14A, depending on which IF input, A, or B is being processed at the time. The control signal IF SEL is a "1" to select port B; a "0" to select port A.

Inverting amplifier U10 serves as the summing junction and scaling for the DAC switch outputs, the vernier switch output and the DC phase offset. The output, the composite PH OFFSET, then has both a variable DC phase offset, as well as a variable height ramp representing electrical length phase offset.

FIG. D3-26A
SHT. 1 OF 3

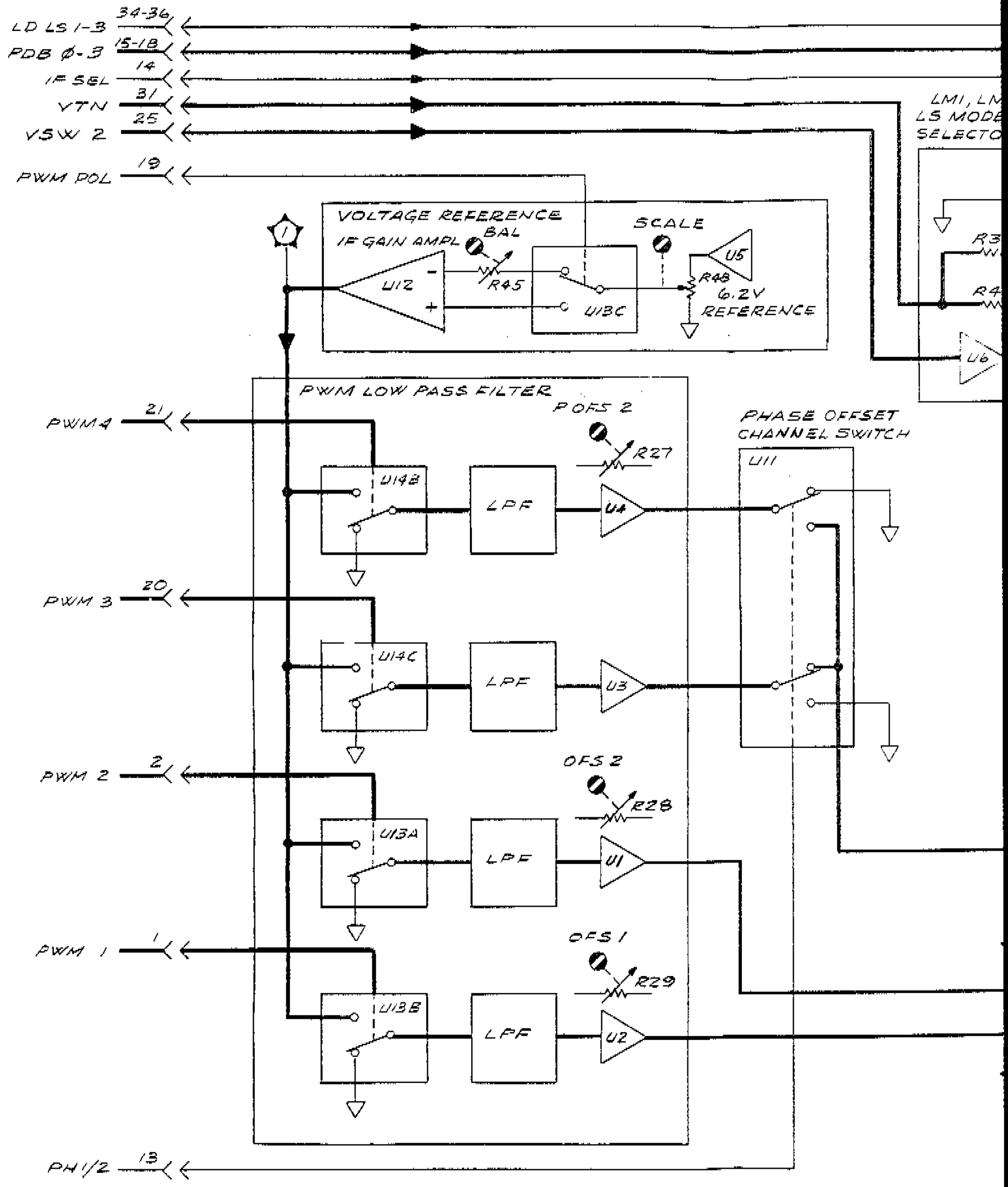


FIG. D3-26A
SHT. 2 OF 3

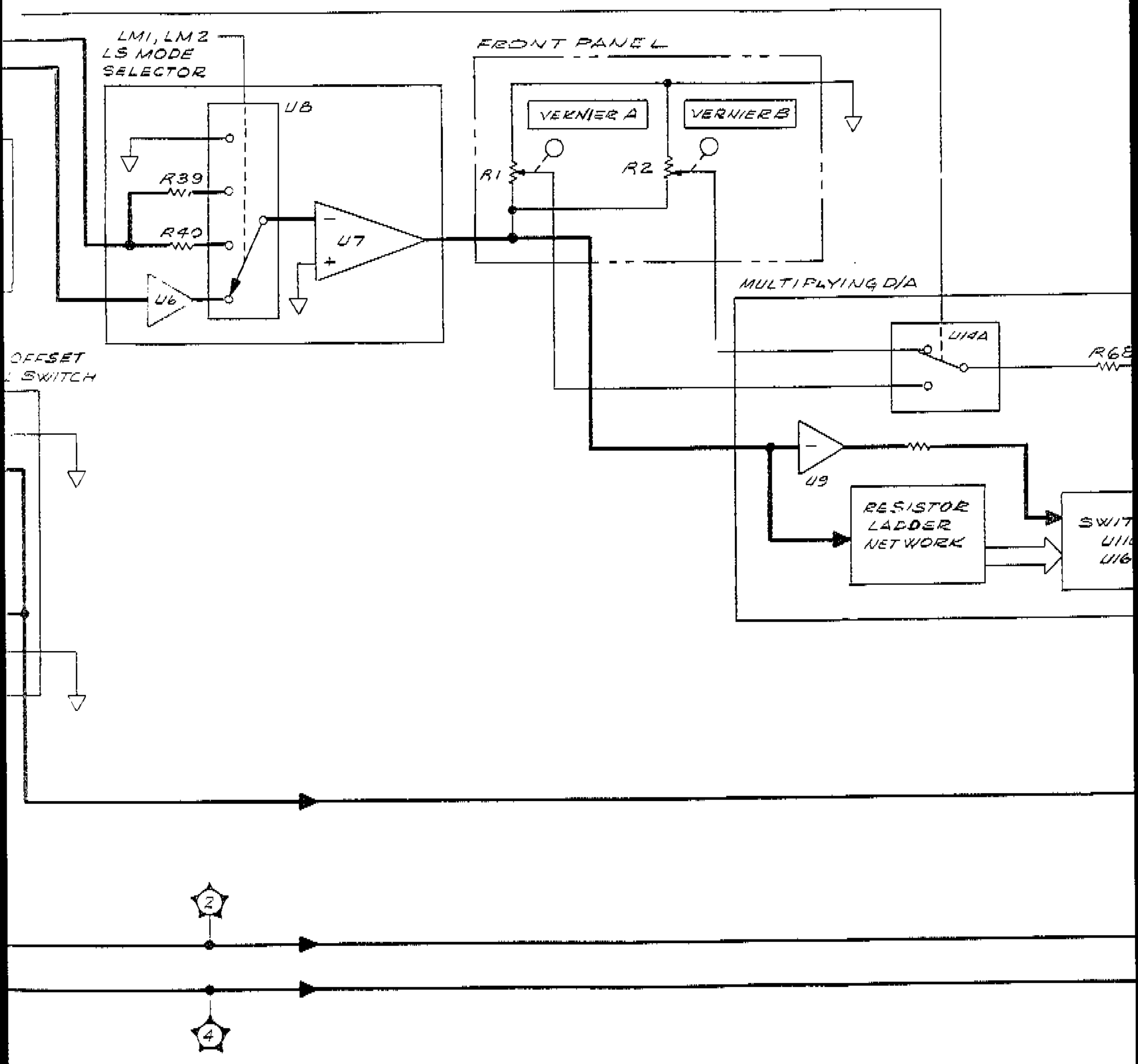


FIG. D3-26A
SHT. 3 OF 3

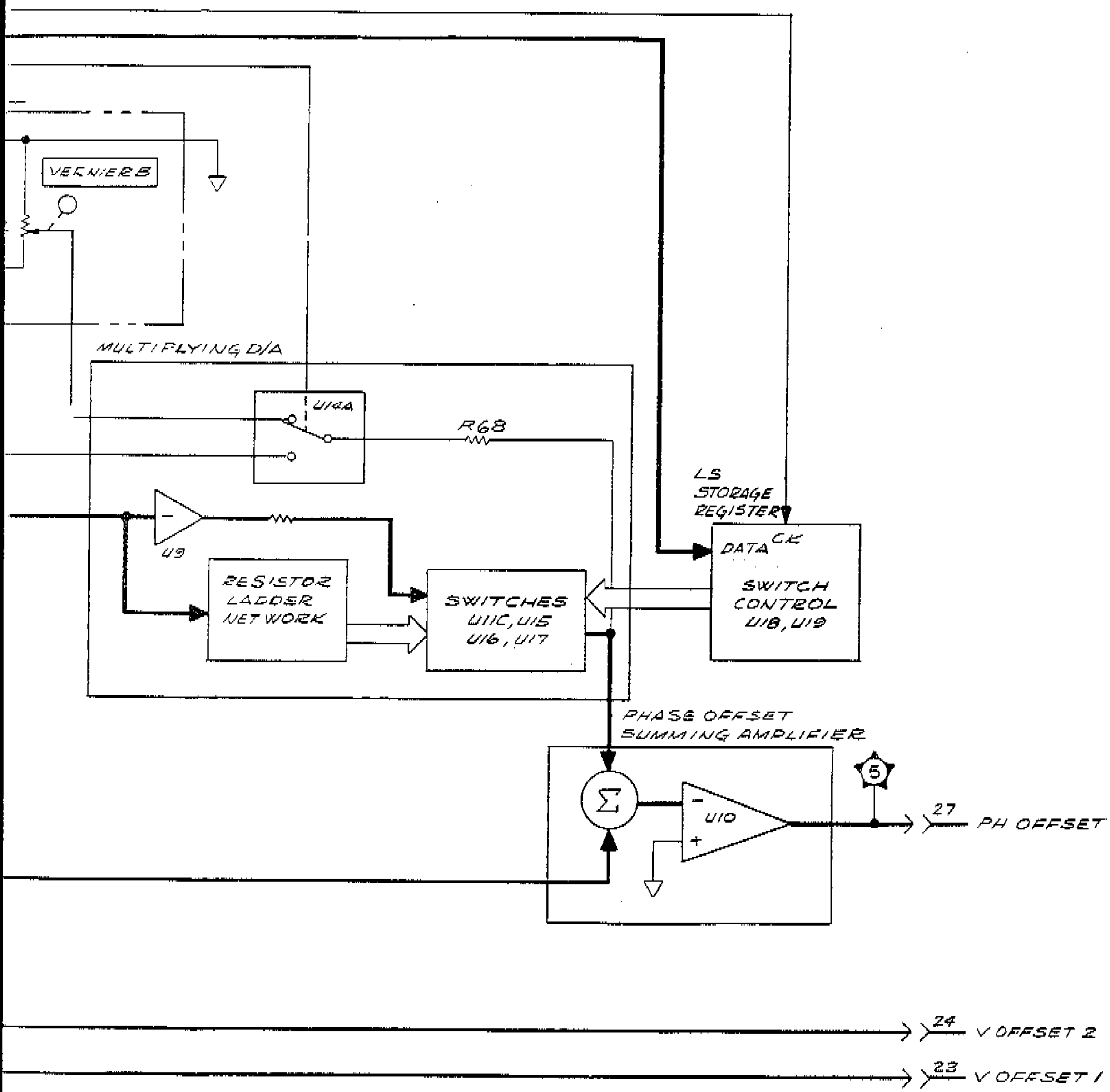


Figure D3-26A. A3A5 Processor D/A, Block Diagram

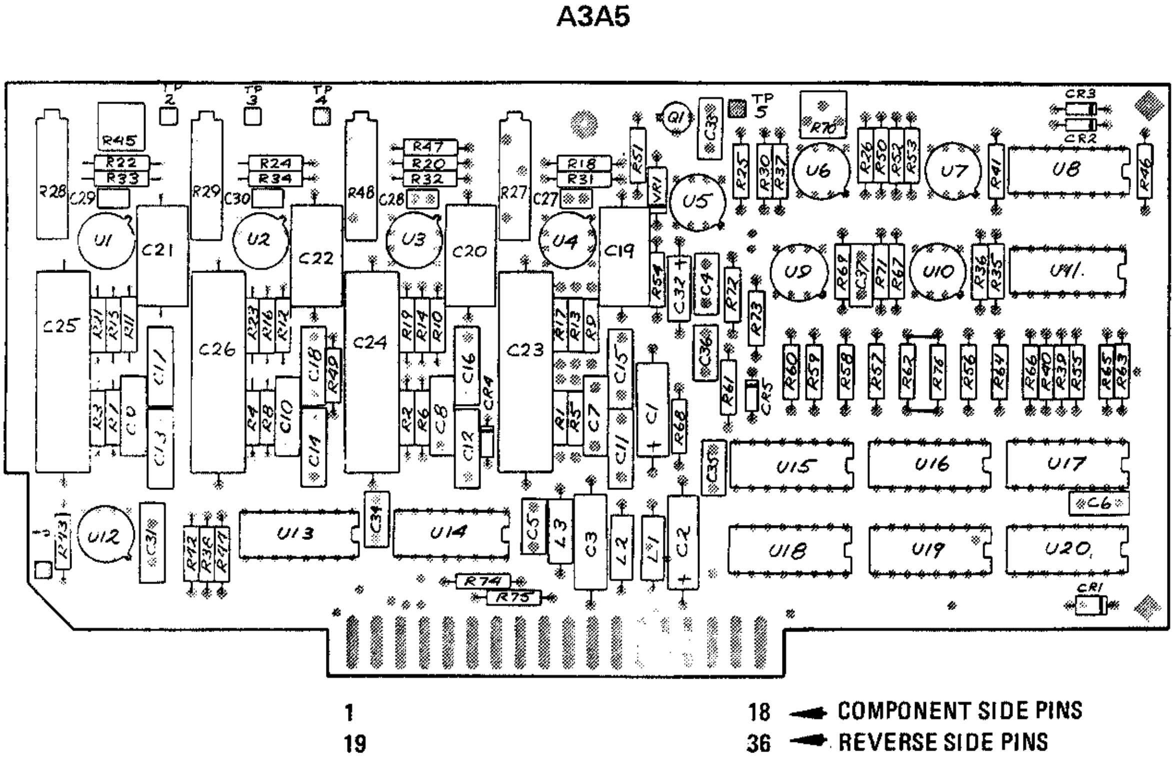
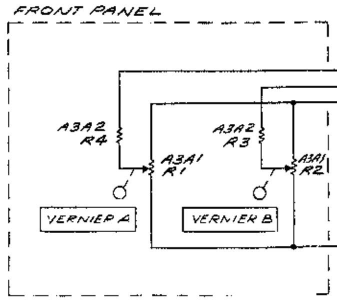
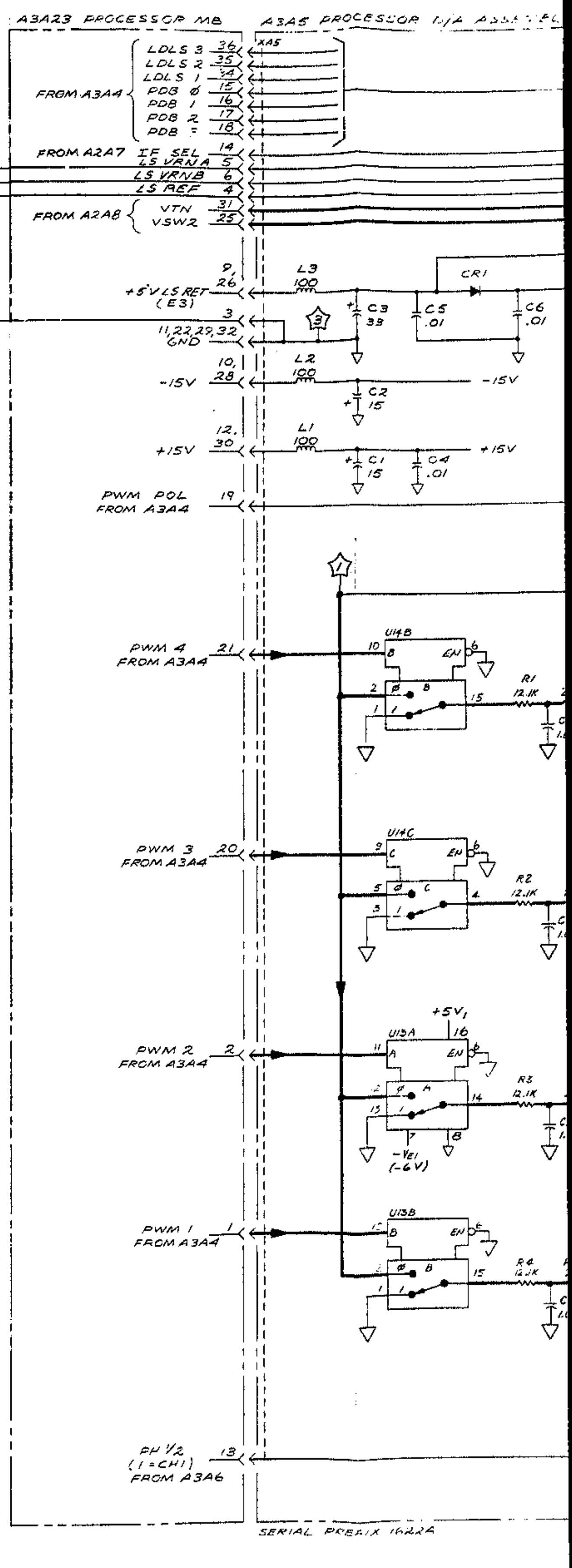


Figure D3-27. A3A5 Processor DA Parts Location

FIG. D3-28
SHT. 1 OF 4

DIGITAL INPUTS		DESCRIPTION
LD LS1 LD LS2 LD LS3	LOAD LINE STRETCHER	[illegible]
PDB ø-3	PROCESSOR DATA BUS	DATA INPUT
PWM POL	PULSE WIDTH MODULATOR POLARITY	1= -MAG/DLY OR + PHASE OFFSET
PWM 1	PULSE WIDTH MODULATOR 1	CHANNEL 1 MAG/DLY OFFSET
PWM 2	PULSE WIDTH MODULATOR 2	CHANNEL 2 MAG/DLY OFFSET
PWM 3	PULSE WIDTH MODULATOR 3	CHANNEL 1 PHASE OFFSET
PWM 4	PULSE WIDTH MODULATOR 4	CHANNEL 2 PHASE OFFSET

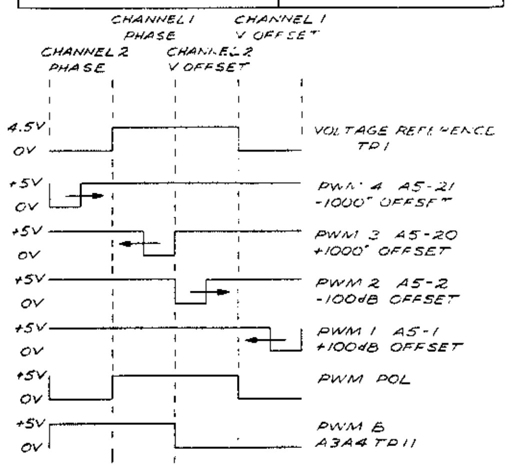


FIG. D3-28
SHT. 2 OF 4

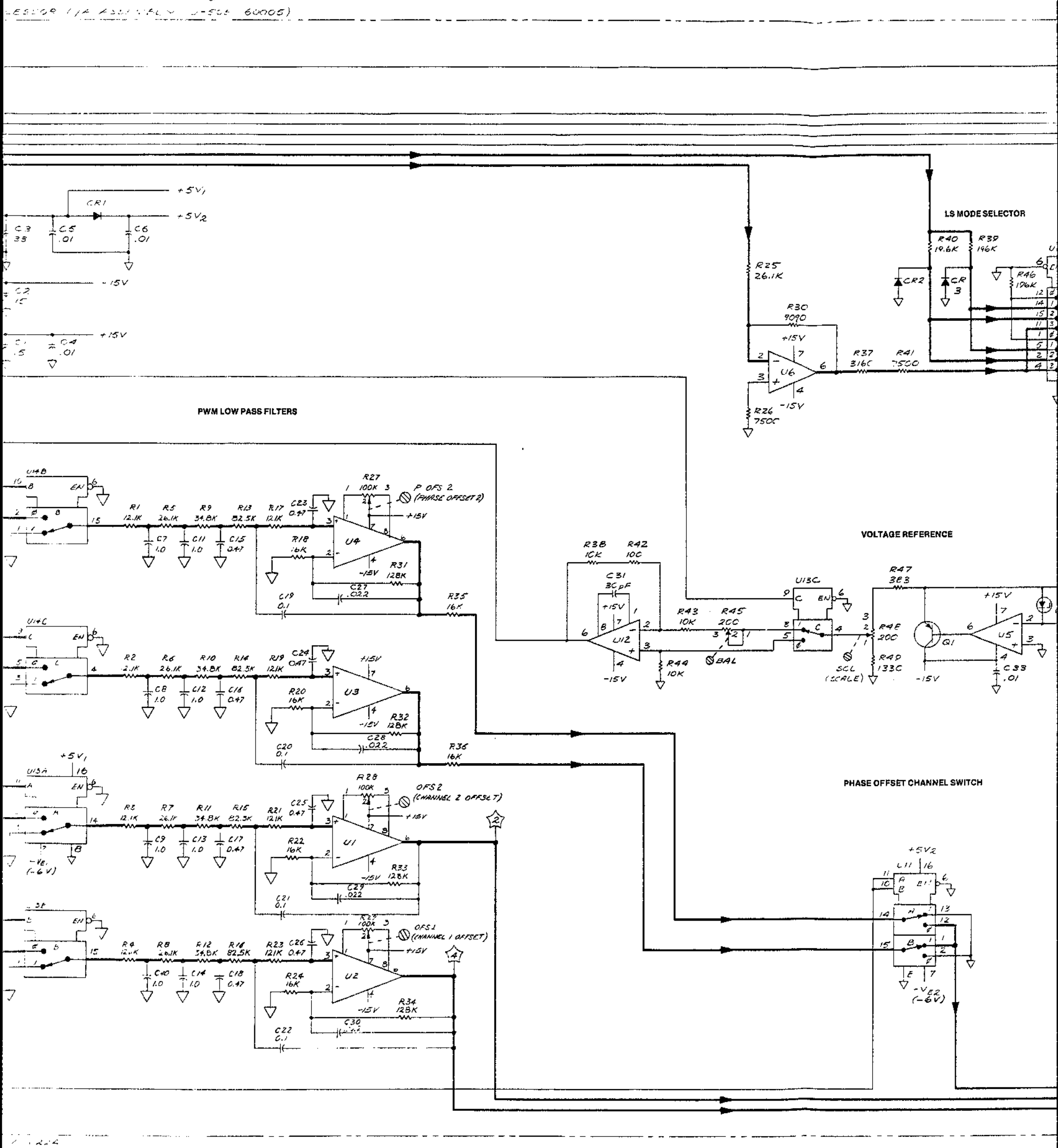
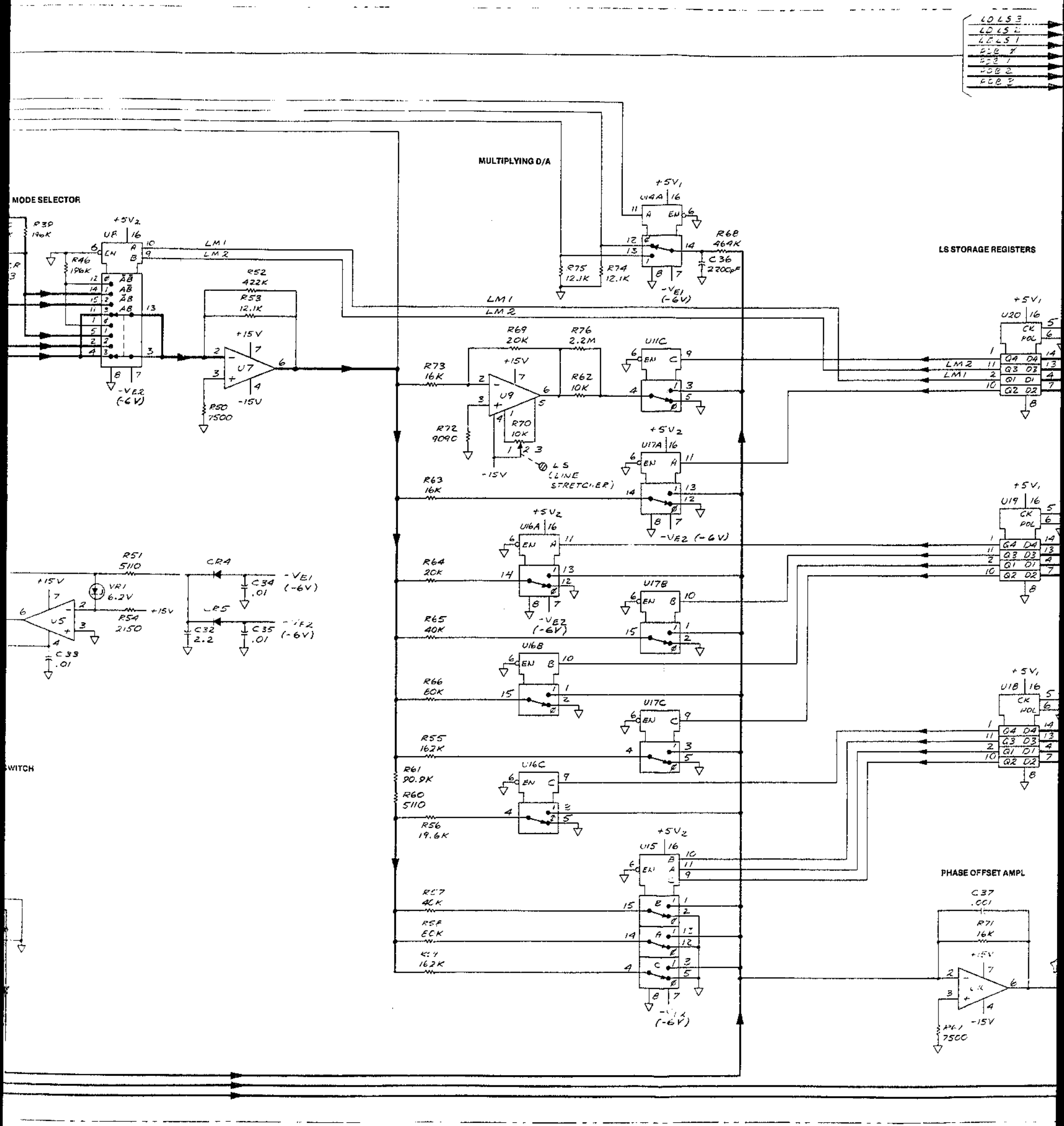


FIG. D3-28
SHT. 3 OF 4



Figu

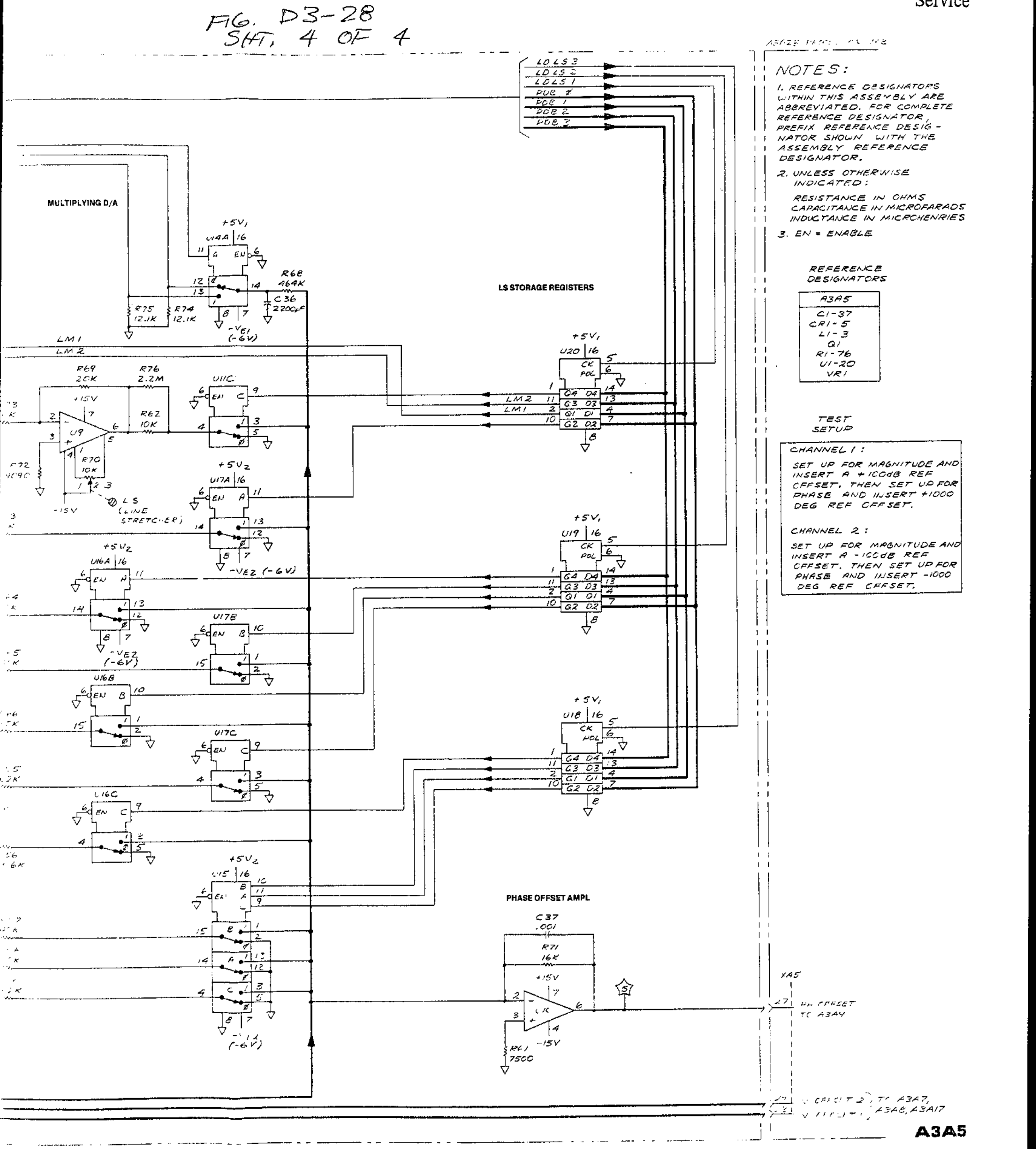


Figure D3-28. A3A5 Processor D/A, Schematic

A3A6 INPUT MULTIPLEXER

General Description

The A3A6 Input Multiplexer selects the magnitude, phase, or group delay detector outputs for display on the Channel 1 or Channel 2 CRT trace. Differential amplifier U4 subtracts LOG R from LOG AB for ratio measurements. Inputs to the CH1 and CH2 multiplexers are LOG AB (Port A or B input magnitude), LOG R (Port R input magnitude), LOG AB/R (Magnitude difference of Port A or Port B and Port R), DELAY (Group Delay) and PHASE (Phase difference between port A or Port B and Port R). The control register provides front panel switch position information for control of CH1 and CH2 Multiplexers. CH1 MPX and CH2 MPX outputs correspond to the input signal selected by the front panel.

Control Register

The Input Multiplexer control register is the first in a series of three serial fed control registers in the analog section of the Signal Processor. This control register consists of two 4-bit serial shift registers (U2A, U2B) and has parallel outputs. Both shift registers are clocked by the Low Processor Clock Pulse (LPCP) signal from the A4 Processor Interface Assembly. The LPSD (Low Processor Serial Data) input to the U2A shift register is the 32-bit serial data string from the A4 Processor Interface Assembly that provides front-panel switch position information. The information on the LPSD line is serially clocked through control registers on three Signal Processor analog board assemblies (A6, A7, and A16). The three control registers are eight shift registers with the last output of each shift register providing the data input to the next shift register in the series. The U2A and U2B parallel outputs represent front panel INPUT and MODE switch positions and control the CH1 and CH2 Multiplexers selection of input signals. PH-1/2 is the last control register output, so it is also fed to the A7 Resoltuion Control Assembly as the data input for the next control register.

Differential Amplifier

U4 is a unity gain differential amplifier that generates the ratio magnitude signal LOG AB/R by subtracting LOG R (reference magnitude) from LOG AB (test magnitude). The RATIO OFFS (R7) adjustment removes the offset of the differential amplifier (U4) and is adjusted for a zero volt output when the reference and test inputs are identical. LOG AB/R is sent to the CH1 and CH2 Multiplexers where it is selected for ratio magnitude measurements and is also sent to the A8 Polar Converter Assembly to supply magnitude information during POLAR mode operation.

CH1 and CH2 Multiplexers

CH1 and CH2 multiplexers contain identical 8:1 analog selectors with the main difference in operation being the control inputs from the control register (U2A, U2B). The CH1 analog selector is controlled by the Channel 1 INPUT and MODE front panel switches and the CH2 analog selector is controlled by the Channel 2 INPUT and MODe switches. The logic state levels required to select each input are shown in the schematic for each analog selector. For example, to select a Channel 1 magnitude ratio measurement (A/R or B/R) the control inputs (A, B, C) to U5 must be ABC (A = 0, B = 1, C = 1). The eight analog inputs to the multiplexers are clamped to the +5V and −7.5V power supplies or ground using low voltage diodes (CR1—16, CR21 and CR22) to protect against potentially harmful transients on the switch inputs.

POLAR X and POLAR Y inputs cannot be selected by U5 and U6 in local mode, since no combination of front-panel settings will cause all three control inputs (ABC) to go high. For special applications, POLAR X and POLAR Y can be selected by Multiplexers (U5 and U6) in remote mode. When selected in this manner, POLAR X and POLAR Y are displayed in rectangular coordinates. EXT CH1 input can be selected by A6U5 in local mode if A4TP4 on the A4 Processor Interface Assembly is shorted to ground. EXT CH2 can be selected by A6U6 in local mode if A4TP10 is shorted to ground. EXT CH1 input (but not EXT CH2 input) can be selected in remote mode.

Voltage follower amplifiers U1 and U3 buffer and drive the analog switch outputs (CH1 MPX and CH2 MPX) to the A7 Resolution Control Assembly and the A17 Marker I Assembly. Adjustments CH1 OFFS (R13) and CH2 OFFS (R14) remove the input offsets of amplifiers U1 and U3 when inputs are grounded.

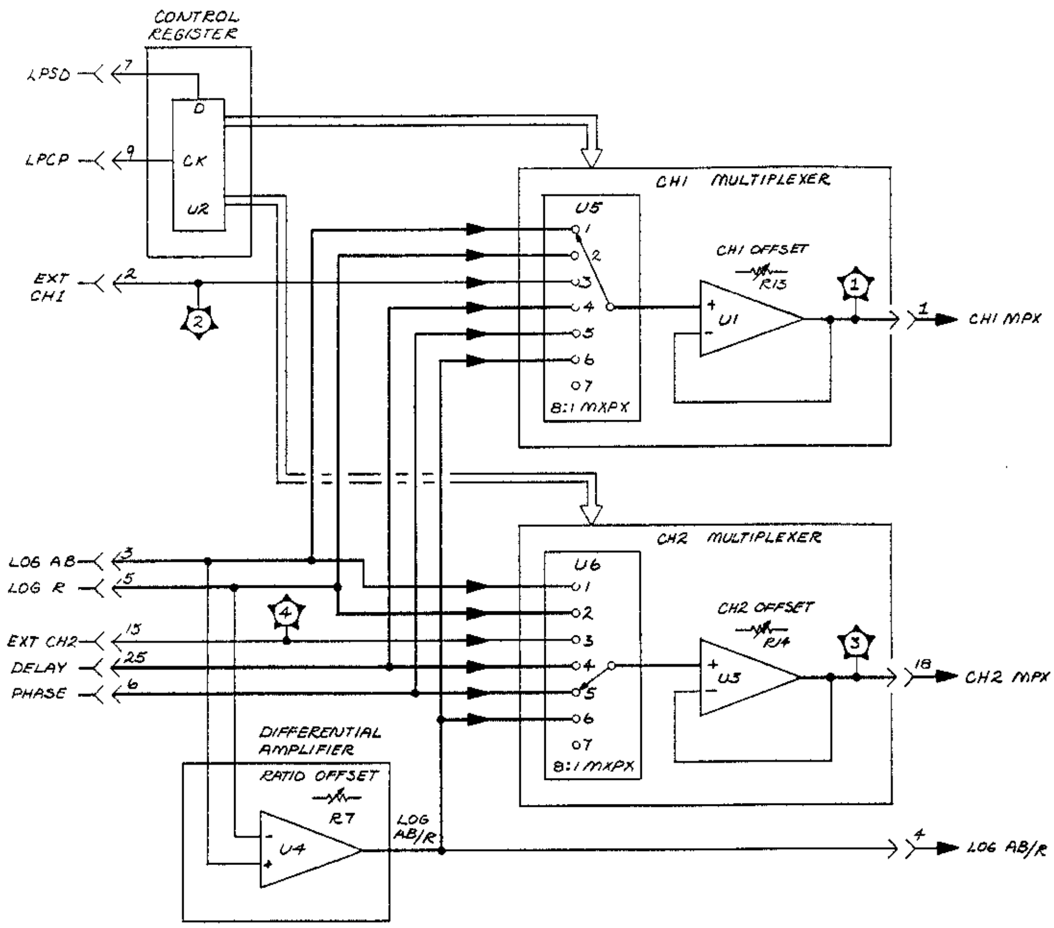


Figure D3-28A. A3A6 Input Multiplex E.ock Diagram

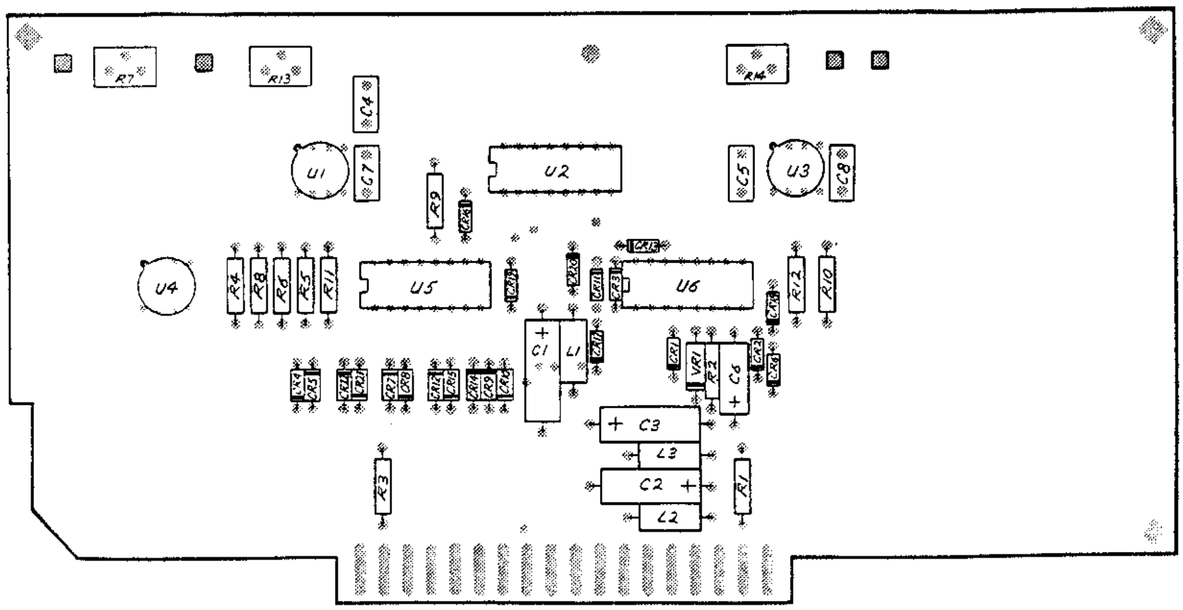


Figure D3-29. A3A6 Input Multiplex Parts Locations

FIG. D3-30

SHT. 1 OF 3

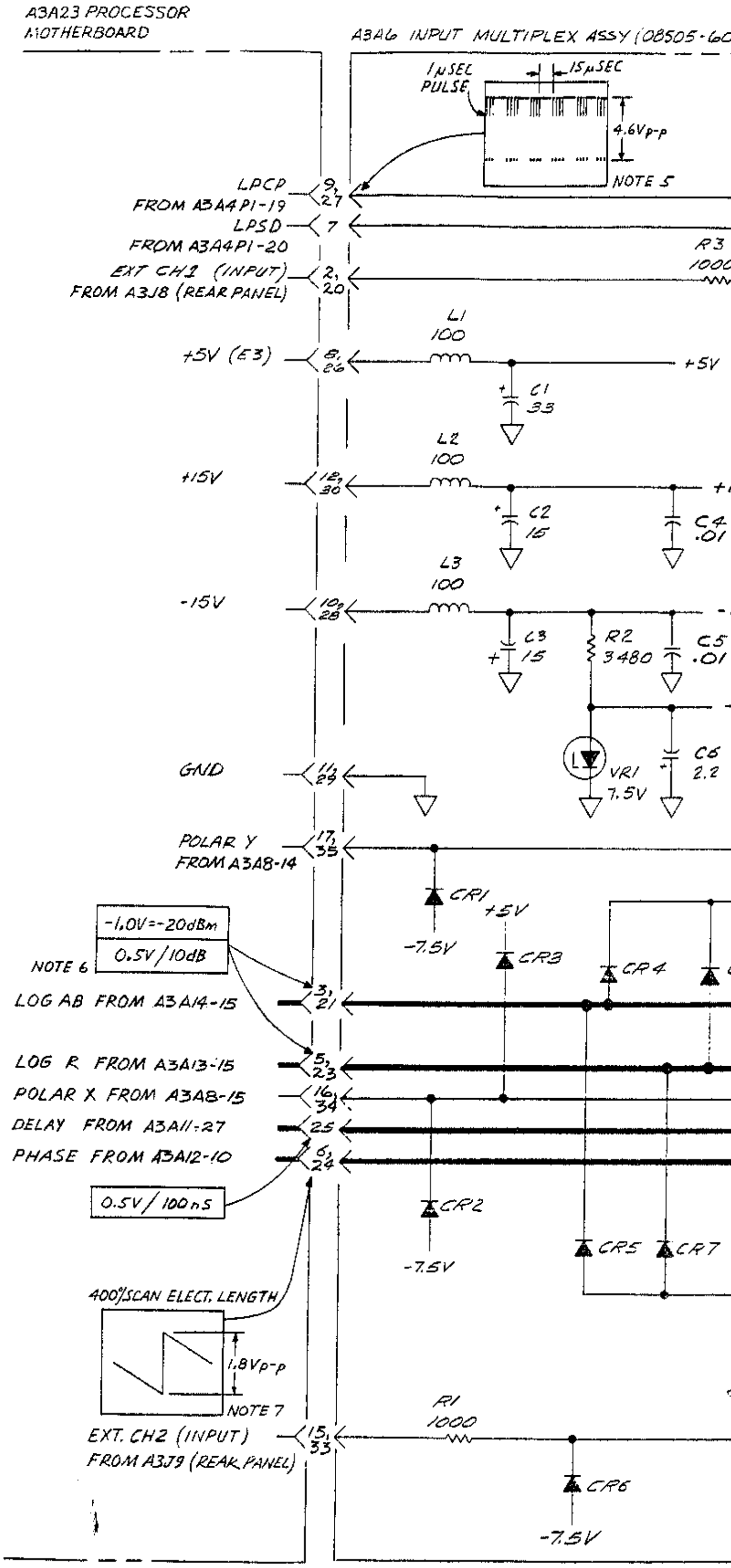
CONTROL REGISTER OUTPUT TABLE

U2 CONTROL REGISTER OUTPUTS		DESCRIPTION
U2-5	MPX A1	CH1 MULTIPLEXER CONTROL
U2-4	MPX B1	CH1 MULTIPLEXER CONTROL
U2-3	MPX A2	CH2 MULTIPLEXER CONTROL
U2-10	MPX B2	CH2 MULTIPLEXER CONTROL
U2-13	MPX C1	CH1 MULTIPLEXER CONTROL
U2-12	MPX C2	CH2 MULTIPLEXER CONTROL
U2-2	PH ½	1 WHEN PHASE OR POLAR SELECTED

MULTIPLEXER CONTROL TABLE

U5/U6 CONTROL INPUTS C	B	A	MULTIPLEXER SIGNAL SELECTED
0	0	0	A MAGNITUDE
0	0	1	B MAGNITUDE
0	1	0	R MAGNITUDE
0	1	1	EXTERNAL (1 OR 2)
1	0	0	GROUP DELAY
1	0	1	PHASE
1	1	0	MAG
1	1	1	POLAR (X OR Y)

NOTE: 1>4.0V, 0<0.4V



SERIAL PREFIX 1622A

FIG. D3-30
SHT. 2 OF 3

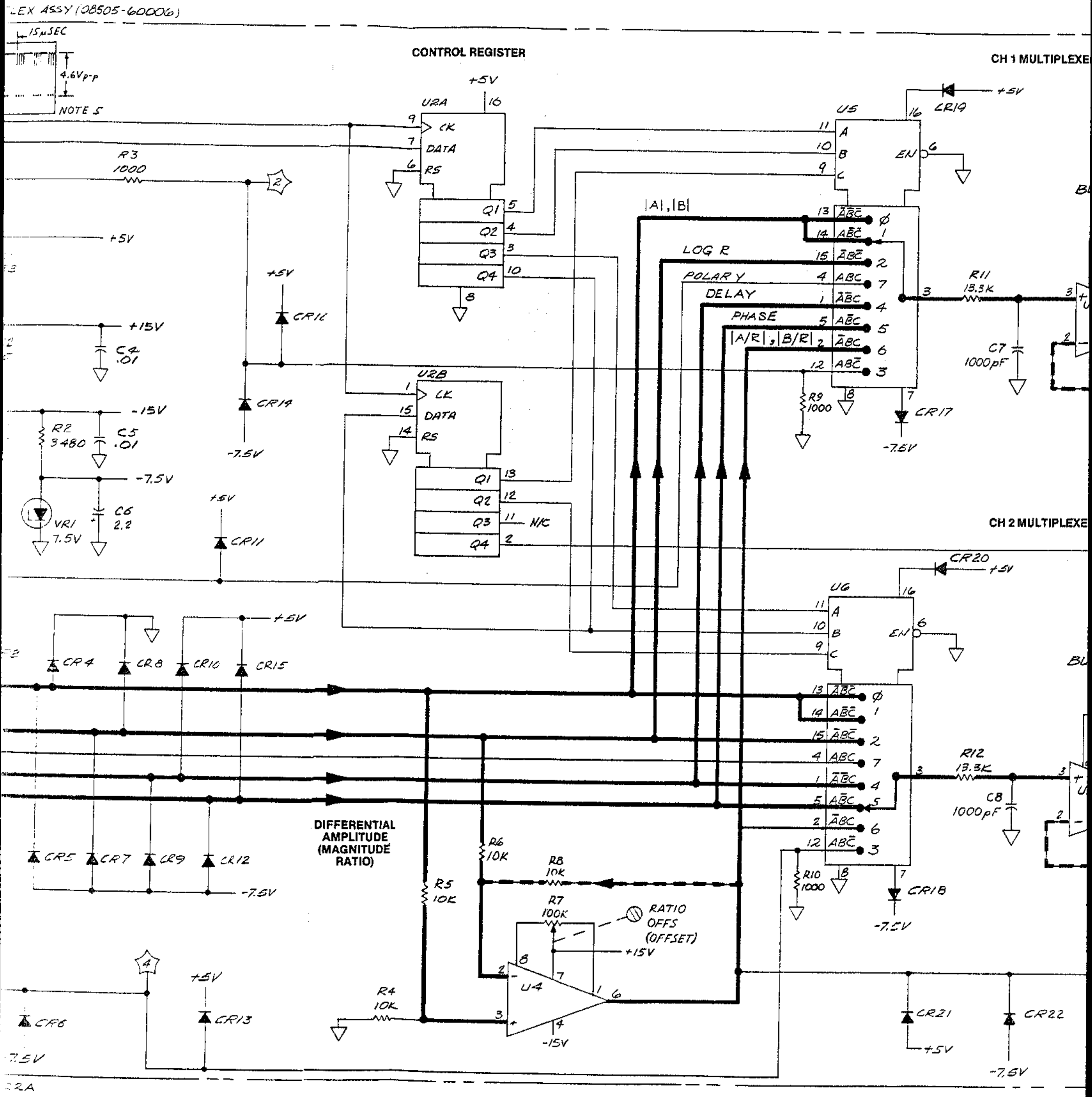
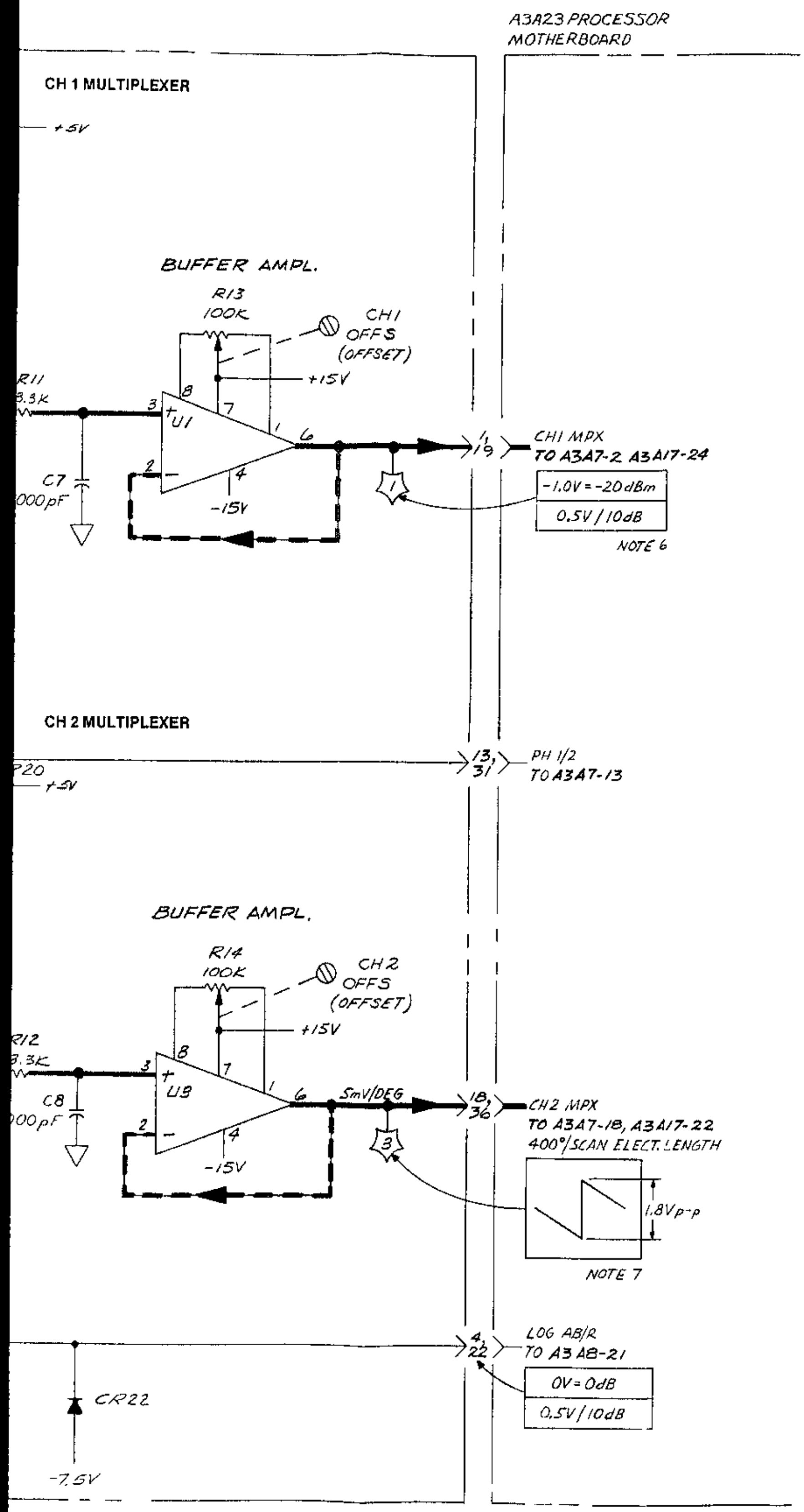


FIG. D3-30
SHT 3 OF 3



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
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MICROHENRIES
3. ⟶ INDICATES PRIMARY SIGNAL FLOW PATH.
   ⟵ INDICATES PRIMARY FEEDBACK PATH.
4. EN = ENABLE
   CK = CLOCK
   RS = RESET
5. LPCP (LOW PROCESSOR CLOCK PULSE):
   32 ONE-μSEC PULSES ARE GENERATED FOLLOWING EACH SWEEP OF THE CRT TRACE.
6.

CHANNEL 1 SETUP
MODE: MAG INPUT: A SCALE/DIV: 2dB PORT A INPUT: -20dBm @ 30 MHz REF OFFSET: -10 dB CHANNEL 2: OFF

7.

CHANNEL 2 SETUP
MODE: PHASE INPUT: A/R (DEG PHASE) SCALE/DIV: 45 DEG ELECTRICAL LENGTH: 400° SCAN REF OFFSET: 0° (BOTH PHASE & MAG) CHANNEL 1: OFF

REFERENCE DESIGNATIONS

A3A6
C1-8 CR1-22 L1-3 R1-14 U1-6 VR1

A3A6

Figure D3-30. A3A6 Input Multiplex, Schematic

A3A7 RESOLUTION CONTROL

General Description

The A7 Resolution Control Assembly scales, selects, and filters the dc signals used for the Channel 1 and Channel 2 CRT displays. Channel 1 and 2 signals are processed by identical circuitry consisting of a scaling amplifier, signal multiplexer, and selectable bandwidth low-pass filter for each channel. The scaling amplifier is a switchable gain amplifier that scales the channel input signal according to the front panel SCALE/DIV switch. The signal multiplexer selects either the scaling amplifier output for a rectangular CRT display or a polar input signal for a polar CRT display (POLAR Y on Channel 1 and POLAR X on Channel 2). Each selectable bandwidth low-pass filter filters the respective channel output according to the bandwidth selected on the CRT Display front panel.

Control Register

The control register (U6A, U6B, U8A, U8B) is the second in a series of three serial fed control registers. The clock is the Low Processor Clock Pulse (LPCP) input from the A4 Processor Interface Assembly. A 32-bit data string, Low Processor Serial Data (LPSD), containing front-panel switch position data is generated on the A4 Processor Interface Assembly. The data is serially stepped through an 8-bit shift register on the A6 input Multiplexer. The last output of this shift register, PH 1/2, is used as the data input to the A7 Resolution Control control register. The parallel outputs of the control register provide resolution and bandwidth control signals for the A7 Resolution Control Assembly and other assemblies in the Signal Processor.

Scaling Amplifiers

The Channel 1 Scaling Amplifier (U4) is an inverting, summing, operational amplifier with switchable feedback resistors that provide the correct gain for each of the eight front panel SCALE/DIV switch settings. The inputs to the scaling amplifier are CH 1 MPX from the A6 Input Multiplexer and V OFFSET 1 from the A5 Processor D/A Assembly. These input signals to the scaling amplifier are controlled by analog switch U12. Switch A in U12 is held in the 0 position by the ground on the switch A control input (U12-11) to compensate for the switch impedance in the V OFFSET path through switch B. The V OFFSET 1 input is a dc voltage corresponding to the front panel offset (REF OFFSET) entered and is switched into the scaling amplifier input only when magnitude or group delay measurements are selected. If the CH 1 MPX input represents phase, the PH 1 control input for U12 switch B goes high (+5V) and the V OFFSET signal is shunted to ground. U12 switch C switches R3 in parallel with R2 whenever the PH 1 EXP control signal goes high (+5V). This occurs when a phase measurement is made and the SCALE/DIV switch is in the 45, 90 or 180 DEG position. The gain of CH1 MPX input is increased to alter the normal 50, 100, 200 SCALE/DIV switch sequence to a 45, 90, 180 degree phase sequence. The 8:1 analog multiplexer (U5) selects the scaling amplifier feedback resistor and is controlled by the RES A1, RES B1, and RES C1 control register outputs. This control line logic corresponds to the SCALE/DIV switch setting. The feedback resistance selected varies from 10K, for a 20dB/div scale and a 0.25 voltage gain, to 2 MEG for a voltage gain of 50 and a .1dB/div scale. The U4 amplifier output is limited to ±2.5 Vdc by diodes CR5 and CR7. The CH1 OFFSET (R8) adjustment is used to remove the input offset of operational amplifier U4. For a 0.00 dB magnitude, this adjustment forces the Channel 1 CRT trace to coincide with the Reference Line trace as the SCALE/DIV is increased from 20dB/DIV to .1dB/DIV. Operation of the Channel 2 Scaling Amplifier (U10) is identical with the Channel 1 Scaling Amplifier.

Signal Multiplexers

The Channel 1 and Channel 2 Signal Multiplexers select the signal that is low pass filtered and used for display on the respective Channel 1 or 2 CRT trace. Channel 1 Signal Multiplexer is U1 and contains three analog switches. Switch U1C selects either the scaling amplifier output (U4-6) or ground and is controlled by the POSN SEL input from the A16 Blanking Logic Assembly. When the front panel REF LINE POSN pushbutton is depressed, POSN SEL goes high during retrace to establish the reference line on the CRT display. Switch U1B then selects either the switch U1C output or the POLAR Y output from the A8 Polar Converter when the L POLAR ALT control input is low (For Channel 2, switch U11B selects POLAR X when L POLAR ALT is low). The output of switch U1B normally passes straight through switch U1A. However, when a diamond marker is being drawn on the CRT trace, L MK INT goes low and R36 is switched into the signal path by switch U1A. This decreases the Low Pass Filter (U7) bandwidth and smooths out the noise so the diamond is recognizable in noisy signals. Channel 2 Signal Multiplexer (U11) operation is similar to Channel 1.

Low-Pass Filter

The Channel 1 selectable bandwidth low-pass filter is a two-pole, unity gain active filter. The active element is the voltage follower U3. Capacitors switched into the circuit by U7 decrease the bandwidth from 10 kHz to 1 kHz or 30 Hz depending on the L FILT and 1 KHz control logic inputs to analog switch U7. These control lines are determined from the BW and VIDEO FILTER pushbuttons on the CRT display section front panel. The POSN SEL enable input to U7 switches the capacitors out of the circuit during sweep retrace when the REF LINE POSN pushbutton is depressed. Channel 2 low pass filter operation is the same as Channel 1. The CH1 FILT and CH2 FILT outputs are scaled for −0.25V/CRT division above reference line. Both outputs go to the A15 Analog Display Multiplex I Assembly and also to the A3J1 NORMALIZER rear panel connector.

FIG. D3-30A
SHT. 1 OF 3

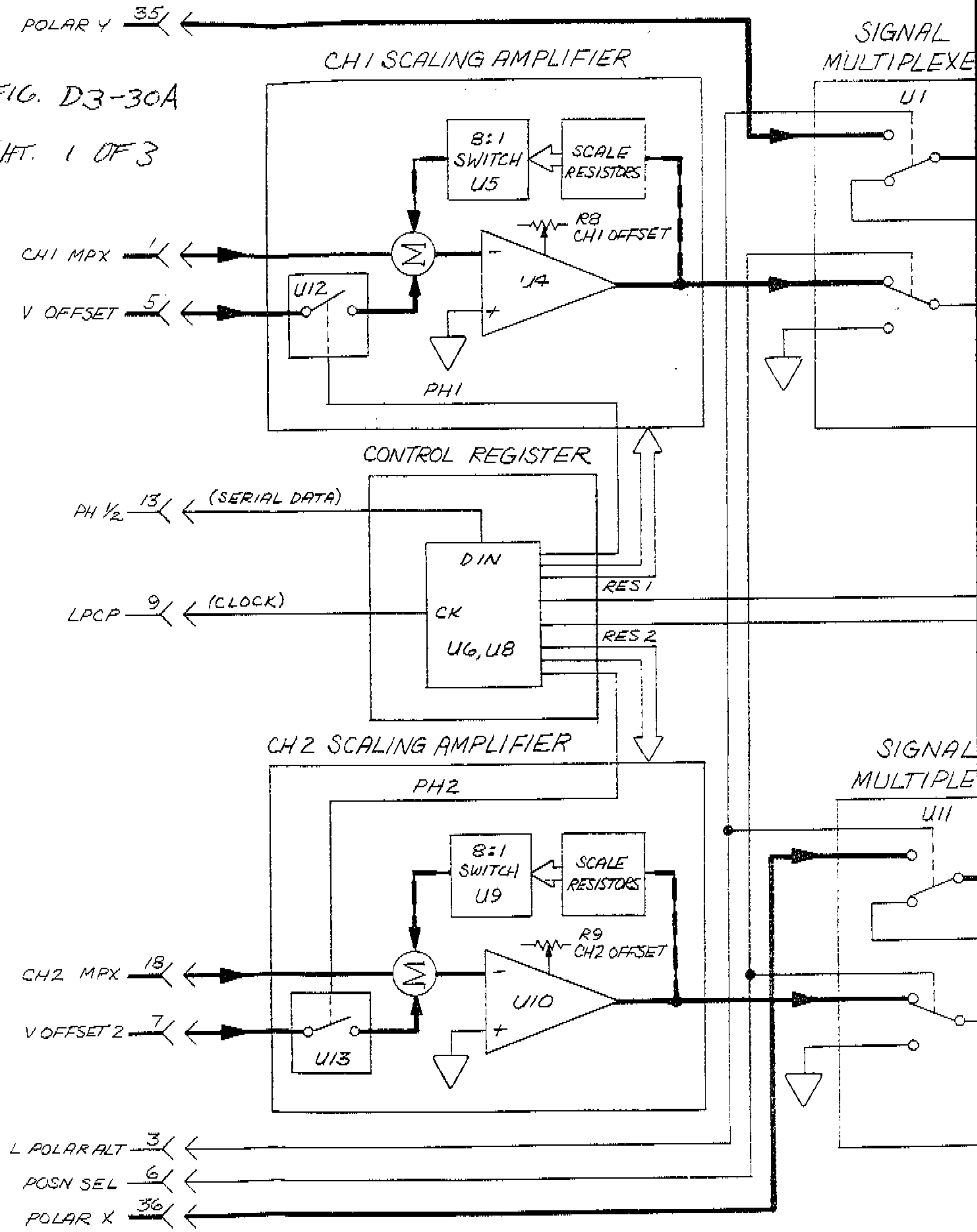


FIG. D3-30A, SHT. 2 OF 3

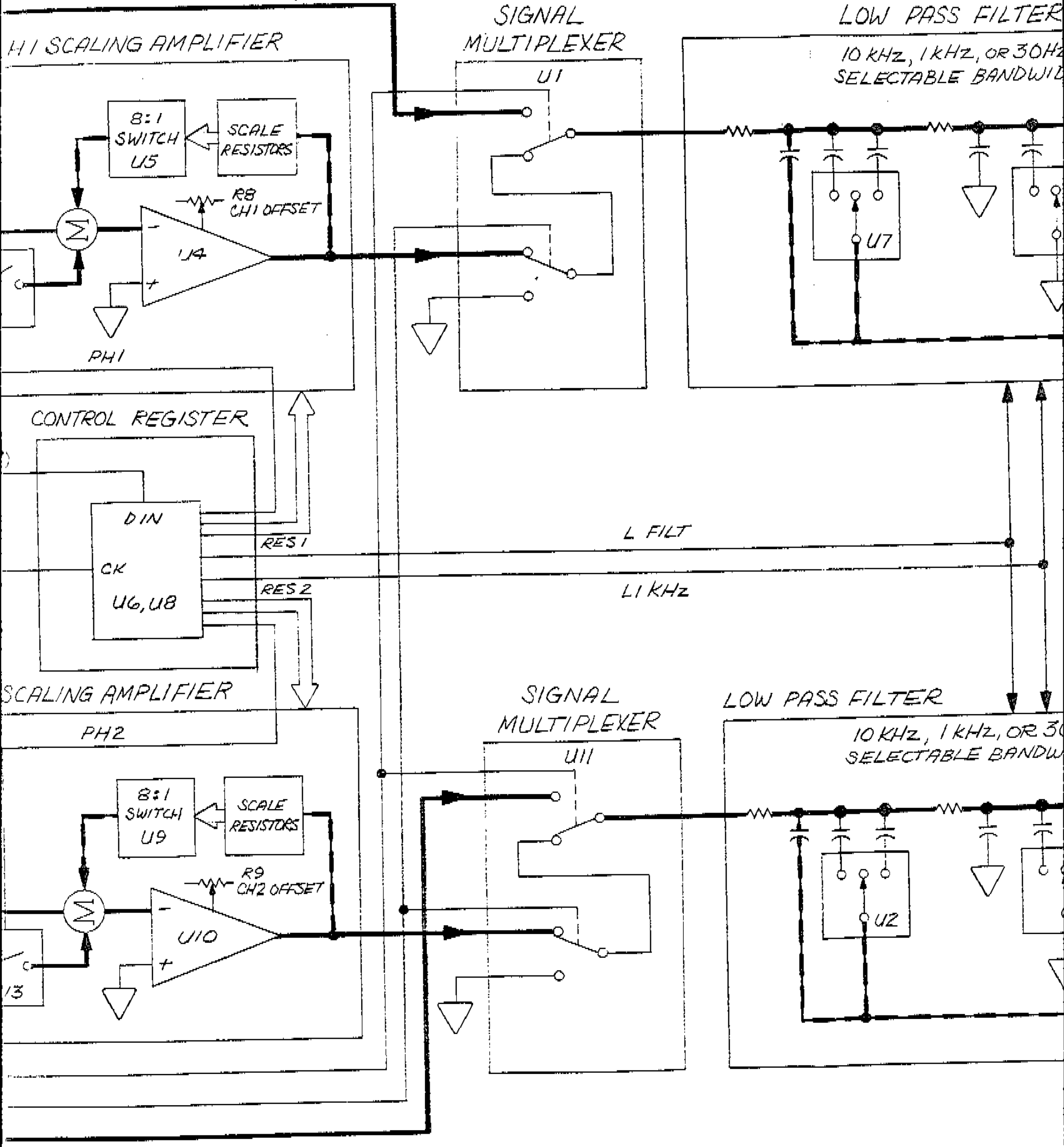


FIG. D3-30A
SHT. 3 OF 3

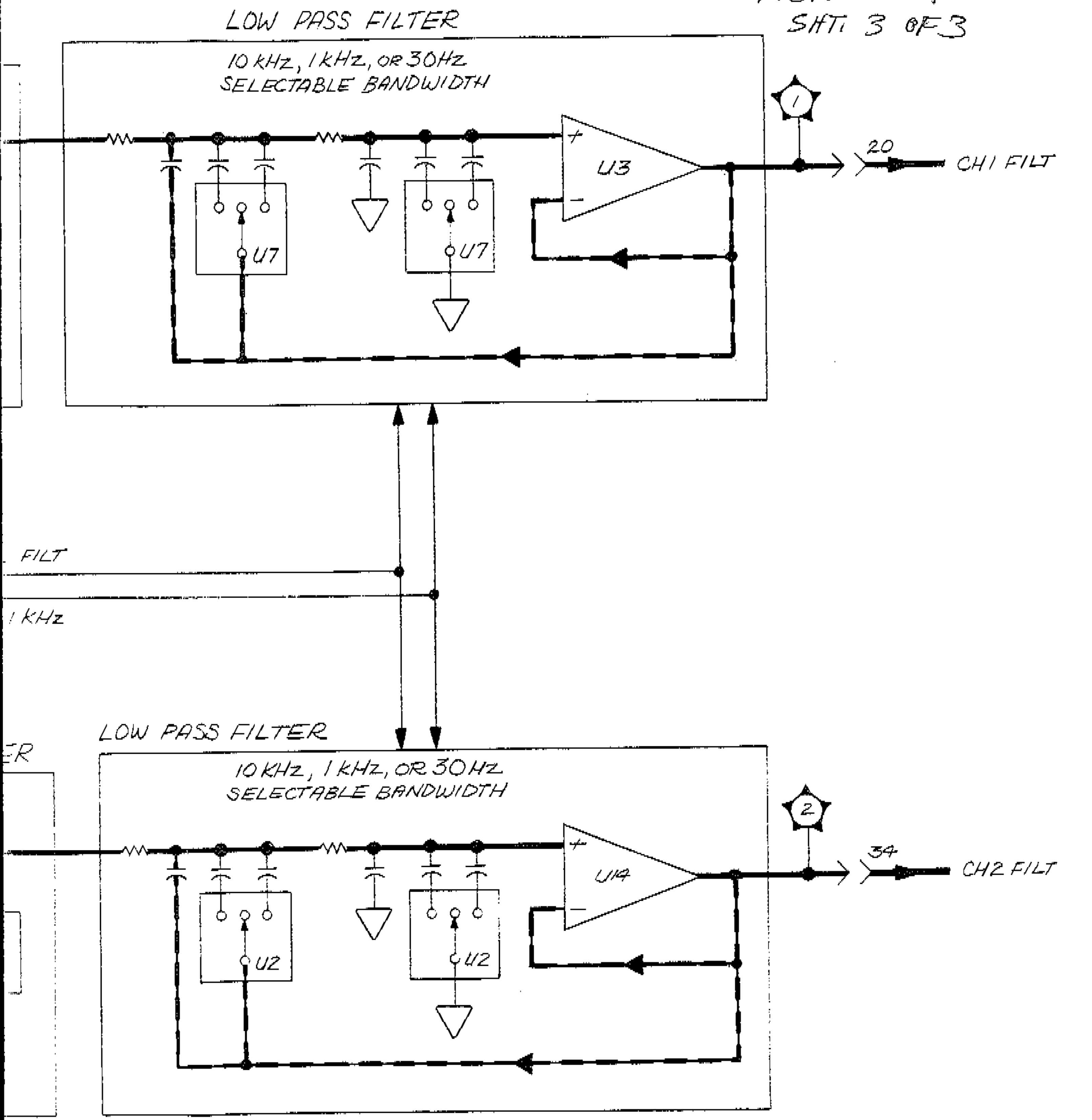


Figure D3-30A. A3A7 Resolution Control, Block Diagram

A3A7

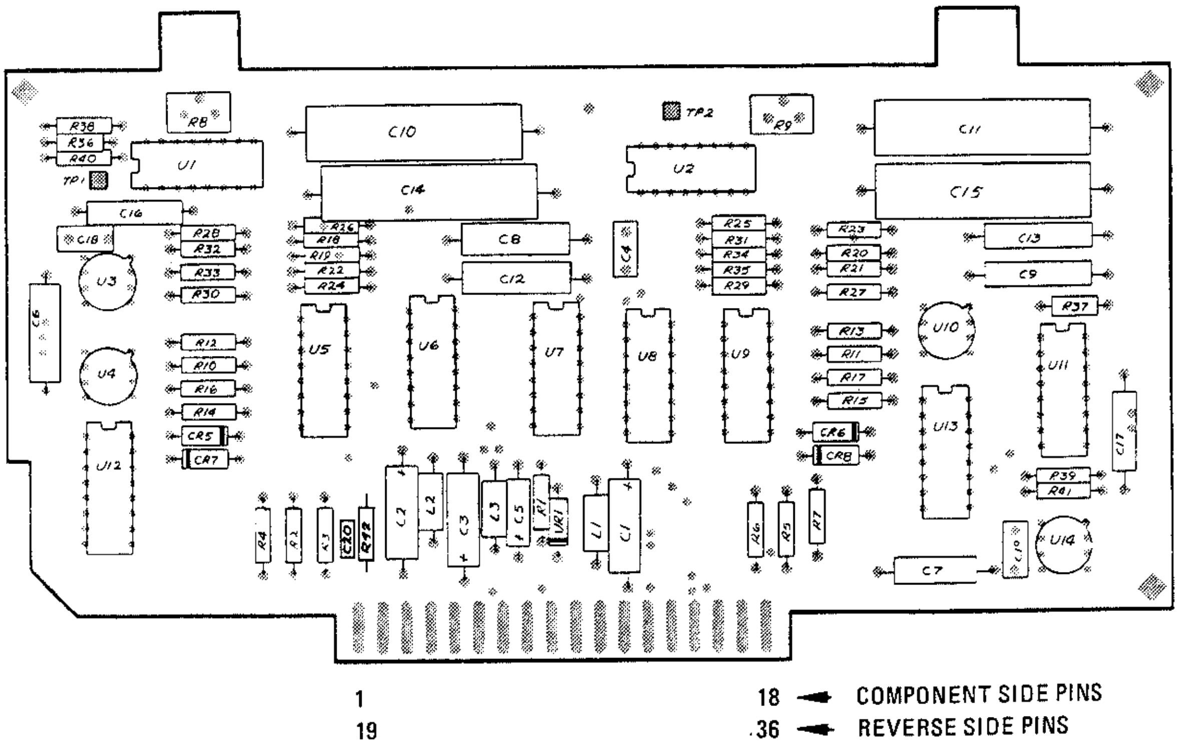


Figure D3-31. A3A7 Resolution Control Parts Locations

FIG. D3-32
SHT. 1 OF 4

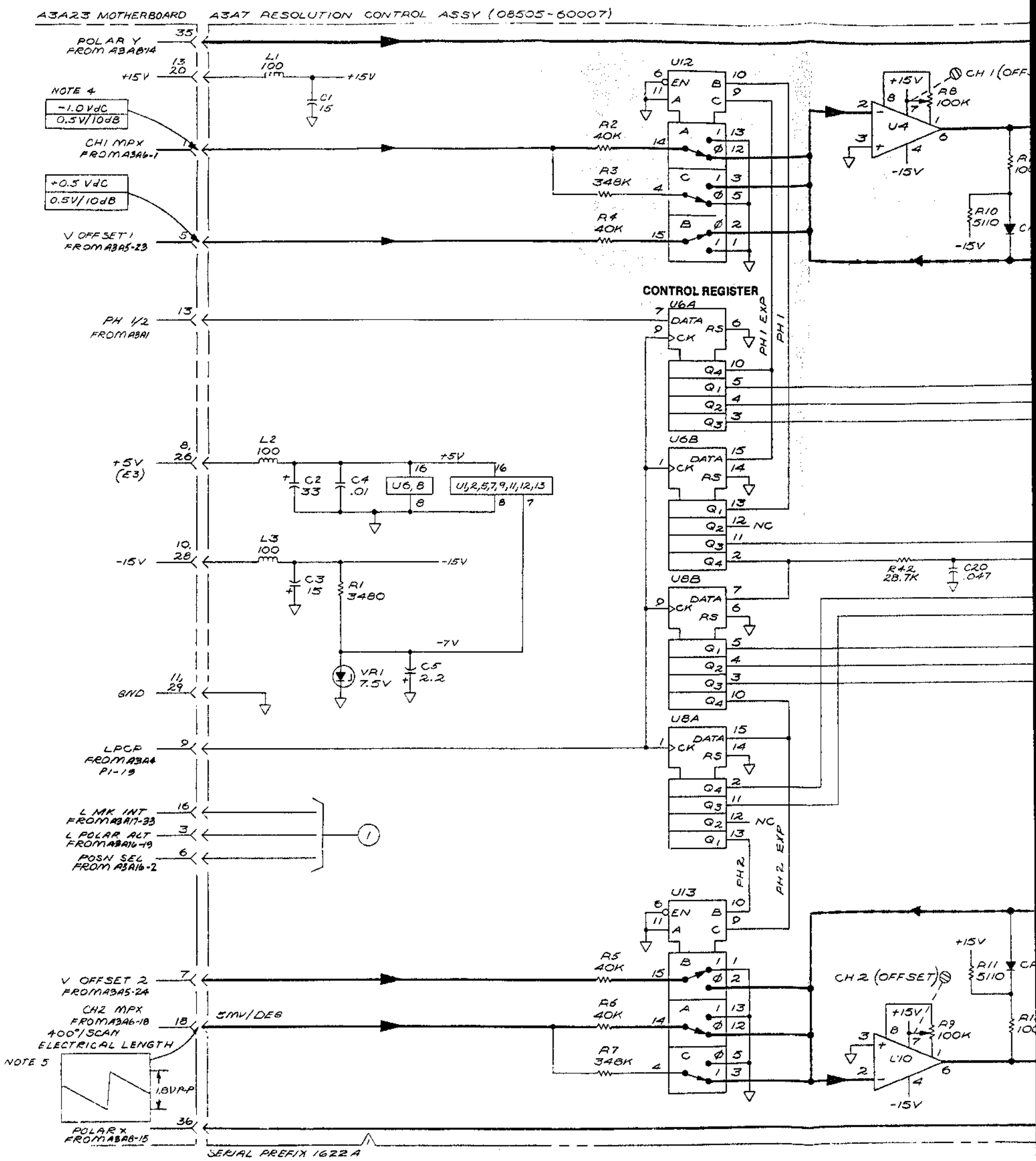


FIG. D3-32
SHT. 2 OF 4

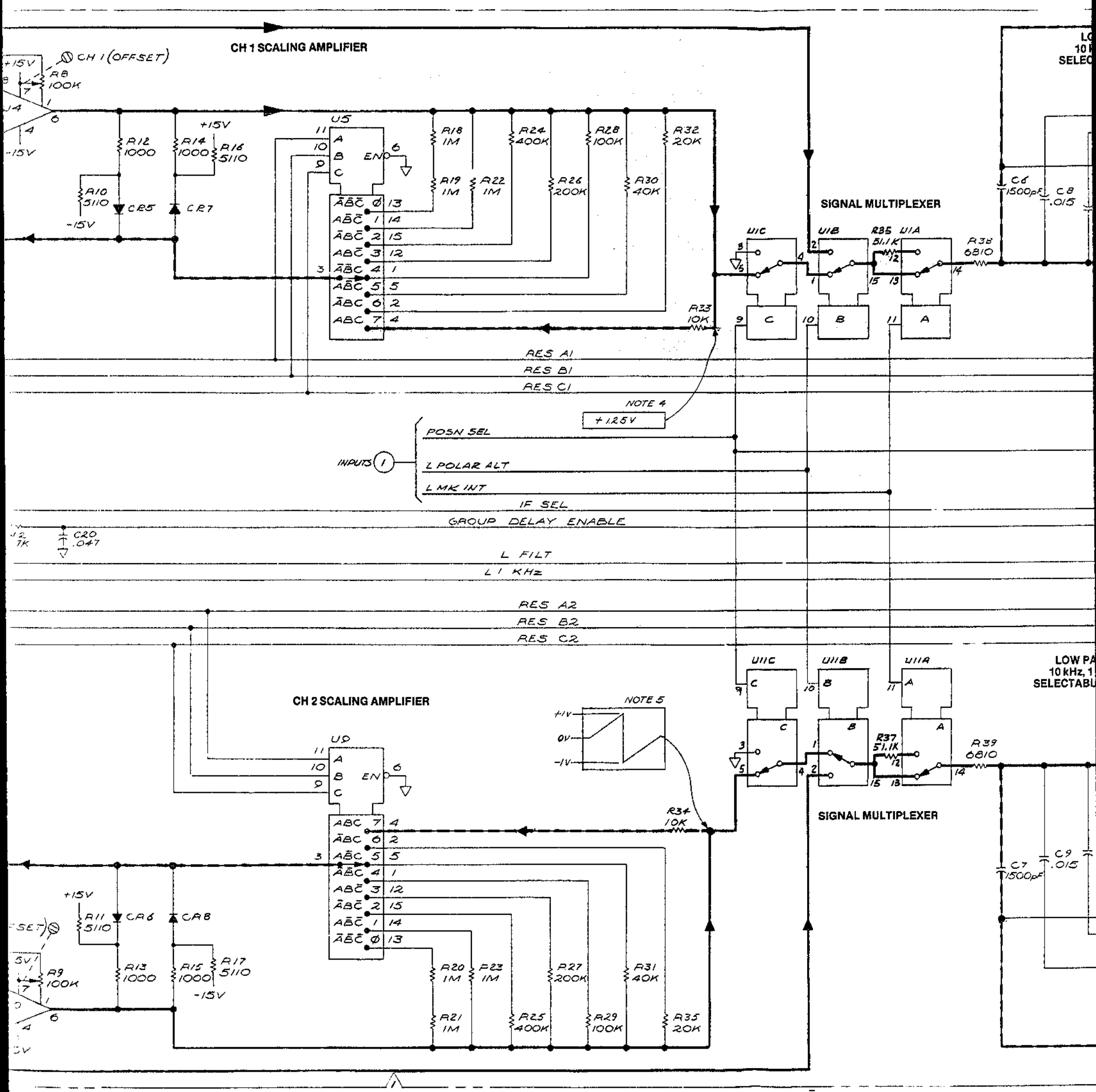


FIG. D3-32
SHT. 3 OF 4

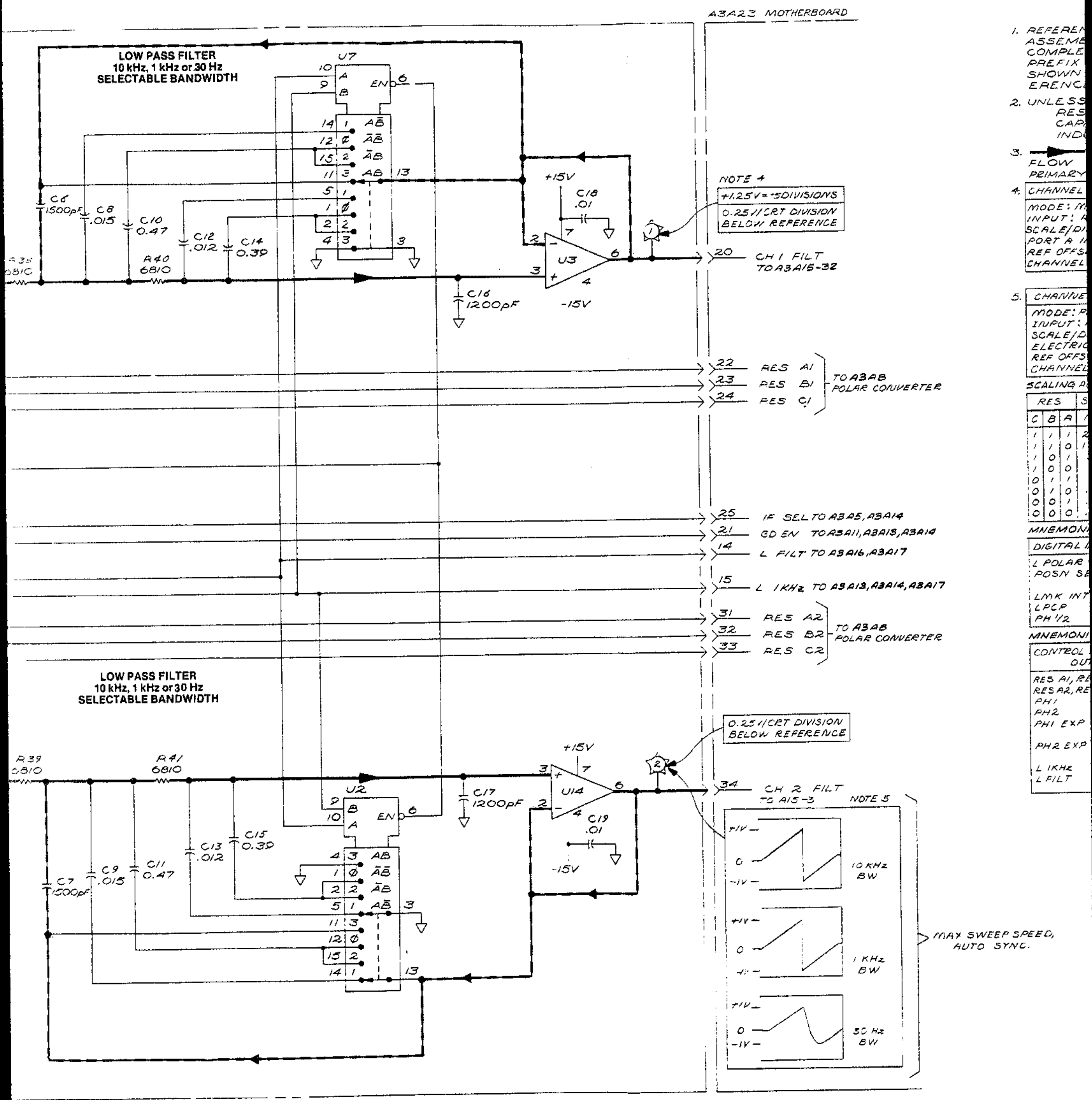
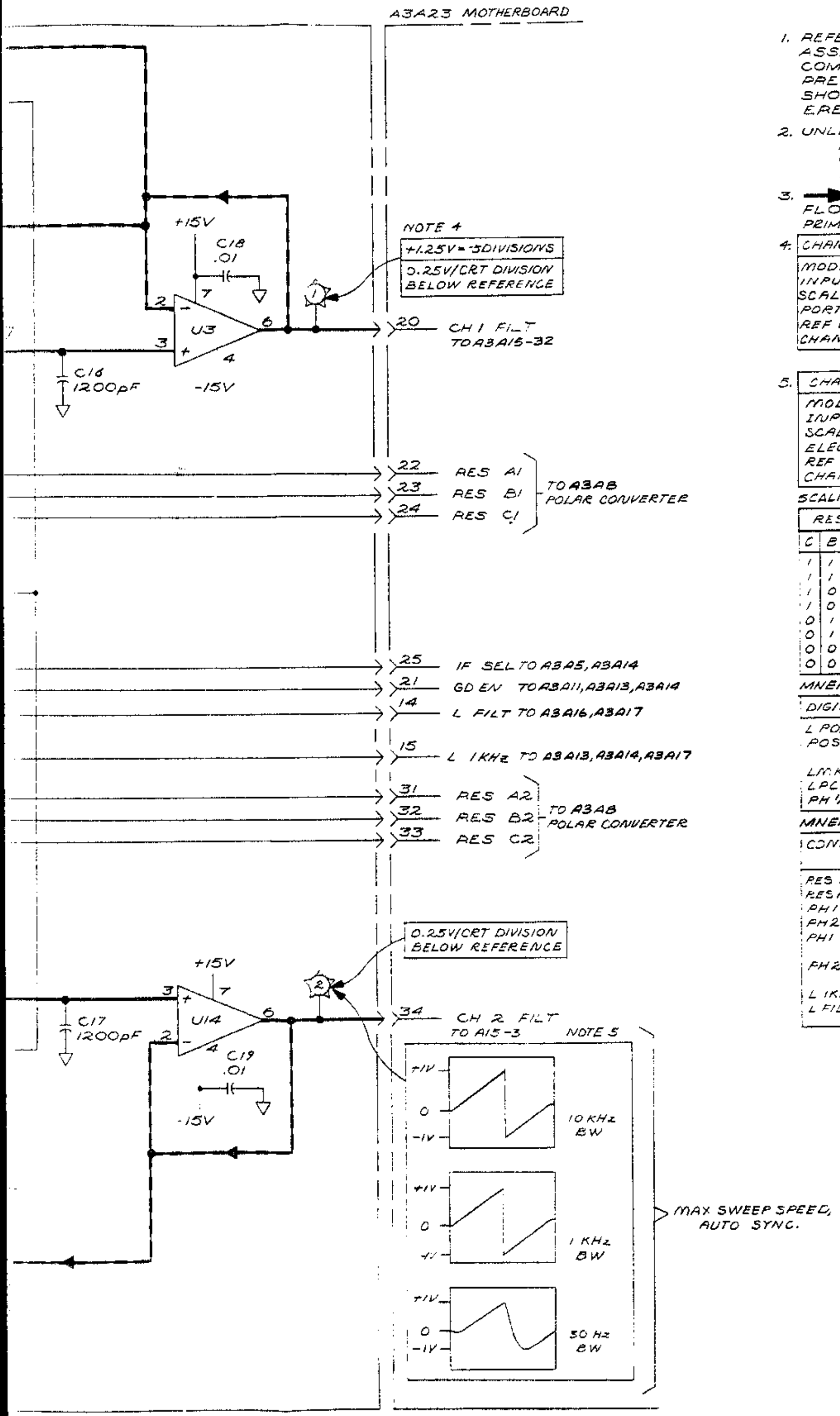


Figure D3-32.

FIG. D3-32
SHT. 4 OF 4



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
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MICROHENRIES
3. ——▶—— INDICATES PRIMARY SIGNAL FLOW PATH; ——◀—— INDICATES PRIMARY FEEDBACK PATH.
4. | CHANNEL 1 SETUP |
   |---|
   | MODE: MAG
INPUT: A
SCALE/DIV: 2dB
PORT A INPUT -20dBm @ 30MHz
REF OFFSET: 10dB
CHANNEL 2: OFF |
5. | CHANNEL 2 SETUP |
   |---|
   | MODE: PHASE
INPUT: A/R (0 DEG PHASE)
SCALE/DIV: 45 DEG
ELECTRICAL LENGTH: 400°/SCAN
REF OFFSET: 0° (BOTH PHASE & MAG)
CHANNEL 1: OFF |

SCALING AMPL GAIN & TRUTH TABLE

RES			SCALE / DIV		U4, U10 VOLTAGE GAIN	
C	B	A	MAG	PHASE	MAG	PHASE
1	1	1	20 dB	180 DEG	0.25	0.278
1	1	0	10 dB	90 DEG	0.5	0.556
1	0	1	5 dB	45 DEG	1.0	1.111
1	0	0	2 dB	20 DEG	2.5	2.5
0	1	1	1 dB	10 DEG	5.0	5.0
0	1	0	.5 dB	5 DEG	10	10
0	0	1	.2 dB	2 DEG	25	25
0	0	0	.1 dB	1 DEG	50	50

MNEMONICS FOR DIGITAL INPUTS

DIGITAL INPUTS	DISCRIPTION
L POLAR ALT	0 WHEN POLAR MODE IS SELECTED
POSN SEL	1 DURING SWEEP RETRACE WHEN REF LINE POSN SELECTED
LMK INT	0 DURING A MARKER DIAMOND
LPCP	CLOCK INPUT FOR CONTROL REGISTER
PH 1/2	DATA INPUT FOR CONTROL REGISTER

MNEMONICS FOR CONTROL REGISTER OUTPUTS

CONTROL REGISTER OUTPUTS	DISCRIPTION
RES A1, RES B1, RES C1	CHANNEL 1 SCALE/DIV SWITCH SETTINGS
RES A2, RES B2, RES C2	CHANNEL 2 SCALE/DIV SWITCH SETTINGS
PH1	1 WHEN CHANNEL 1 PHASE SELECTED
PH2	1 WHEN CHANNEL 2 PHASE SELECTED
PH1 EXP	1 WHEN CHANNEL 1 PHASE AND SCALE/DIV = 45, 90 OR 180
PH2 EXP	1 WHEN CHANNEL 2 PHASE AND SCALE/DIV = 45, 90 OR 180
L 1KHz	0 WHEN 1KHz BANDWIDTH IS SELECTED
L FILT	0 WHEN VIDEO FILTER IS SELECTED

REFERENCE DESIGNATIONS

A3A7
C1-20
CR5-8
L1-3
R1-42
U1-14
VR1

A3A7

Figure D3-32. A3A7 Resolution Control, Schematic

A3A8 POLAR CONVERTER

General Description

The purpose of the A8 Polar Converter is to generate the deflection signals necessary to display both magnitude and phase information in a polar format on the CRT display as shown in Figure D3-32A. Instead of displaying magnitude, or phase, versus frequency, the polar display represents magnitude versus phase, where phase is the angular rotation (θ) from the horizontal zero degree axis and magnitude is the radial distance (M) from the center of the display. The Polar Converter outputs are POLAR X ($|M|$ Cos θ) and POLAR Y ($|M|$ Sine θ). LOG AB/R provides the magnitude (M) information and represents the Log A/R or Log B/R magnitude. This logarithmic signal is scaled, offset and then exponentiated to produce a linear representation of the difference in magnitude of the test port input (A or B)and the reference port input (R). The LINEAR output from the exponentiator is used to amplitude modulate the IF LS POLAR input from the A10 Phase Offset Assembly and develop a 100 kHz IF signal that contains both magnitude and reference port (R) phase information. After the IF LS POLAR signal is amplitude modulated, it is mixed with the BPF IF TEST (A or B phase) input to generate the POLAR X ($|M|$ Cos θ) output. The POLAR Y output ($|M|$ Sine θ) is generated by first shifting the amplitude modulated IF LS POLAR signal by −90 degrees, then mixing it with the BPF IF TEST input.

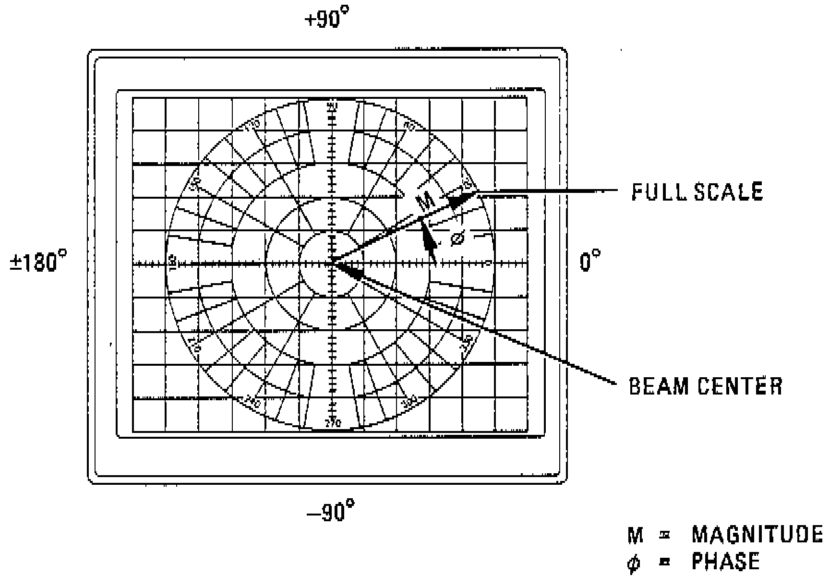


Figure D3-32A. Polar Display

Input Scaling and Offsetting

The LOG AB/R input is summed with either the Channel 1 or Channel 2 magnitude offset voltage (V OFFSET 1 or V OFFSET 2), then inverted and scaled by amplifier U1A. Selection of the V OFFSET 1 or V OFFSET 2 inputs is controlled by the SWALT control input to U9. When SWALT is high (+5 volts), Channel 1 information is processed, so the V OFFSET 1 input is switched through U9B to the U1 amplifier summing node (U1 pin 2); V OFFSET 2 is shunted to ground through switch U9C. When SWALT goes low (0 volts), Channel 2 information is processed and V OFFSET 2 is fed through switch U9C to the U1A amplifier with V OFFSET 1 being shunted to ground. An additional offset from the Linear

Expansion D/A stage is summed into the input of amplifier U1A for making scale changes in the polar display. The R82 FULL SCALE adjustment (B) establishes an offset on the output of U1A so that a 0 dB input (LOG AB/R plus V OFFSET) results in a full scale exponentiator output (TP2) of $\approx +3.5$ volts and a unity radius circle on the CRT display (SCALE/DIV is POLAR FULL 1). The R88 EXP SCALING adjustment (A) establishes the correct scale factor for driving the exponentiator. This scale factor is adjusted so that a -20 dB offset change in the U1A amplifier input results in approximately a $+0.86$ volt change of the U1A output and changes the exponentiator output (TP2) by a factor of 0.1. For example, changing the U1A input from 0 dB to -20 dB, changes the exponentiator output from $+3.5$ volts to 350 millivolts. When the front panel BEAM CENTER pushbutton is pressed, the POSN SEL control input to U9 goes high ($+5$ Volts) during sweep retrace. This switches in a large negative offset (-4.6 Volts) through switch U9A to the U1A amplifier summing node and forces the expontentiator output to zero. The POLAR X and POLAR Y outputs go to their zero radius (zero magnitude) of approximately 0 volts.

Linear Expansion D\A

For POLAR MODE operation, the front panel SCALE/DIV switch settings are labeled corresponding to the reflection coefficient that gives a full scale polar display when making a reflection measurement (1 to .01). The Channel 1 or Channel 2 resolution control inputs (RES A,B,C) are selected by the U10 multiplexer under the control of the SWALT input (CH 1 = 1, CH2 = 0). The three selected resolution control inputs control the 8:1 analog switch U8. This analoig switch selects an offset input to amplifier U1A to provide a full scale polar display that corresponds to the POLAR FULL scale selected. This offset varies from zero for a POLAR FULL scale of 1 to an equivalent offset of $+40$ dB for a POLAR FULL scale of .01. The resistive network (R68-70, R72-75) supplying the offsets to the U8 multiplexers is biased by the $+4$ volt output of voltage followr U1B. This biasing voltage is set by R80 LINEAR SCALING adjustment (C). When the .1 POLAR FULL scale is selected, the control inputs for U8 (A = 1, B = 1, C = 0) select the offset current from U8 pin 12. This means the U1B output goes through series resistors R68 and R69, through switch U8 (pins 12 to 3), to the summing node of U1A Input Scaling Amplifier. This results in an additional 50 μa current to the summing node, which corresponds to a $+20$ dB offset.

Exponentiator

The Exponentiator (Q1, U3, U4) receives the logarithmically scaled U1A output and generates a voltage proportional to its exponential. Since the exponential is the inverse of taking the log, the exponentiator output is a linear representation of the logarithmic inputs (LOG AB/R plus offsets). Zener diode VR3 provides a reference voltage to the input of amplifier U3. This amplifier uses the reference voltage to produce a 2 μa reference current through Q1A. Due to the exponential relationship of the Q1 emitter-base junctions, the Q1B output collector current is exponentially related to the logarithmic input at the base of Q1A. The positive temperature coefficient of R91 compensates for the temperature dependency of this exponential relationship. The Q1B output current is converted to a voltage by amplifier U4 with feedback resistor R76. The U4 output is limited to approximately $+5$ volts by zener diode VR2 in the feedback loop. The output of the exponentiator (TP2) is linearly scaled, with 0 volts corresponding to a BEAM CENTER display and $+3.5$ volts corresponding to a full scale (outer polar graticule) magnitude display. This signal is used as the V_X input to U5 and as an auxiliary rear panel output.

Linear Amplitude Multiplier

The Linear Amplitude Multiplier (U5, Q2—4) adds magnitude information to the 100 kHz IF LS POLAR sine wave input from the A10 Phase Offset Assembly by linearly scaling its amplitude with the LINEAR exponentiator output. The 100 kHz IF LS POLAR Input represents the reference port (R) phase information combined with any additional offsets entered from the front panel. This signal is buffered by Q4 and becomes the V_y input to the U5 multiplier. The V_x input to the multiplier (U5) is a linearly scaled dc voltage corresponding to the ratio of test and reference port magnitudes (A/R or B/R) from the exponentiator. The U5 multiplier mixes the V_x and V_y inputs to give a 100 kHz output containing both magnitude and phase information (V_xV_y). The U5 multiplier output current is converted to a voltage by a feedback pair amplifier (Q2, Q3) using R46 as the feedback resistor. The multiplier (U5) has an offset adjustment for each input signal (V_x, V_y). The IF BAL (R10) adjustment nulls the offset of the V_x input from the exponentiator so there is no multiplier 100 kHz IF output when the V_x input is zero volts. This corresponds to the center of the polar display (BEAM CENTER). The MAG BAL (R18) adjustment nulls the offset of the 100 kHz IF input (V_y) so that if the 100 kHz input is removed, the multiplier output goes to zero and the linear magnitude input (V_x)has no effect on the output. The output signal at TP3 is a 100 kHz IF signal with the amplitude corresponding to the ratio of the test port (A or B) to the reference port (R) with its phase representing reference port (R) phase information.

90 Degree Phase Shifter

The 100 kHz IF input from the Linear Amplitude Multiplier is phase shifted by −90 degrees before being used to create the POLAR Y Polar Converter output. The phase shift is introduced by an all pass active filter U2. The phase frequency response of the filter is determined by C20, R54, and R55. The QUAD (R55) adjustment is set for exactly −90 degree phase shift for a 100 kHz input. Misalignment of the potentiometer results in an ellipsoidal polar display instead of a circular display. The output of U2 provides the signal input to the Y-axis Balanced Mixer U6.

Limiting Amplifier

The BPF IF TEST input to the Limiting Amplifier (Q5, Q6) is a 100 kHz sine wave from the A12 Phase Detector and contains phase information corresponding to the test port (A or B) input. The two square wave outputs from the collector of Q5 and Q6 are 180 degrees out of phase and are used for the LO switching inputs to Balanced Mixers U6 and U7.

X-Axis Output Mixer and Filter

The signal input to Balanced Mixer U7 is the 100 kHz IF output from the Linear Amplitude Multiplier and contains both magnitude and reference port (R) phase information. The LO switching input to the mixer comes from the differential outputs of limiting amplifier Q5 and Q6, and contains test port (A or B) phase information. The balanced mixer has two adjustments. X BAL (R44) nulls the 100 kHz LO switching feedthrough to the mixer output by setting the signal input ac offset on U7 pins 1 and 4. X-Y GAIN (R19) sets the signal gain of the mixer and is adjusted to equalize the POLAR X and POLAR Y output scale factors. The negative mixer output (U7, pin 9) is filtered and inverted by amplifier U11B, then summed with the mixer positive current output (U7, pin 6). This combined signal is filtered by the unity gain active filter U12 to remove 100 kHz and higher order mixing products.

Y-Axis Output Mixer and Output Filter

The signal input to Balanced Mixer U6 comes from U2 and is phase shifted −90 degrees from the X-axis balance mixer input. Operation of the Y-axis output mixer and filter is similar to the X-axis stage. The LO switching input to Balanced Mixer U6 is the limited outputs of Q5 and Q6 and the mixer output is filtered and converted from a differential to a single-ended signal by U11A and U12B. The U6 mixer has a Y BAL (R40) adjustment to null the 100 kHz feedthrough, but the input signal gain is fixed by R22.

FIG. D3-32B
SHT. 1 OF 3

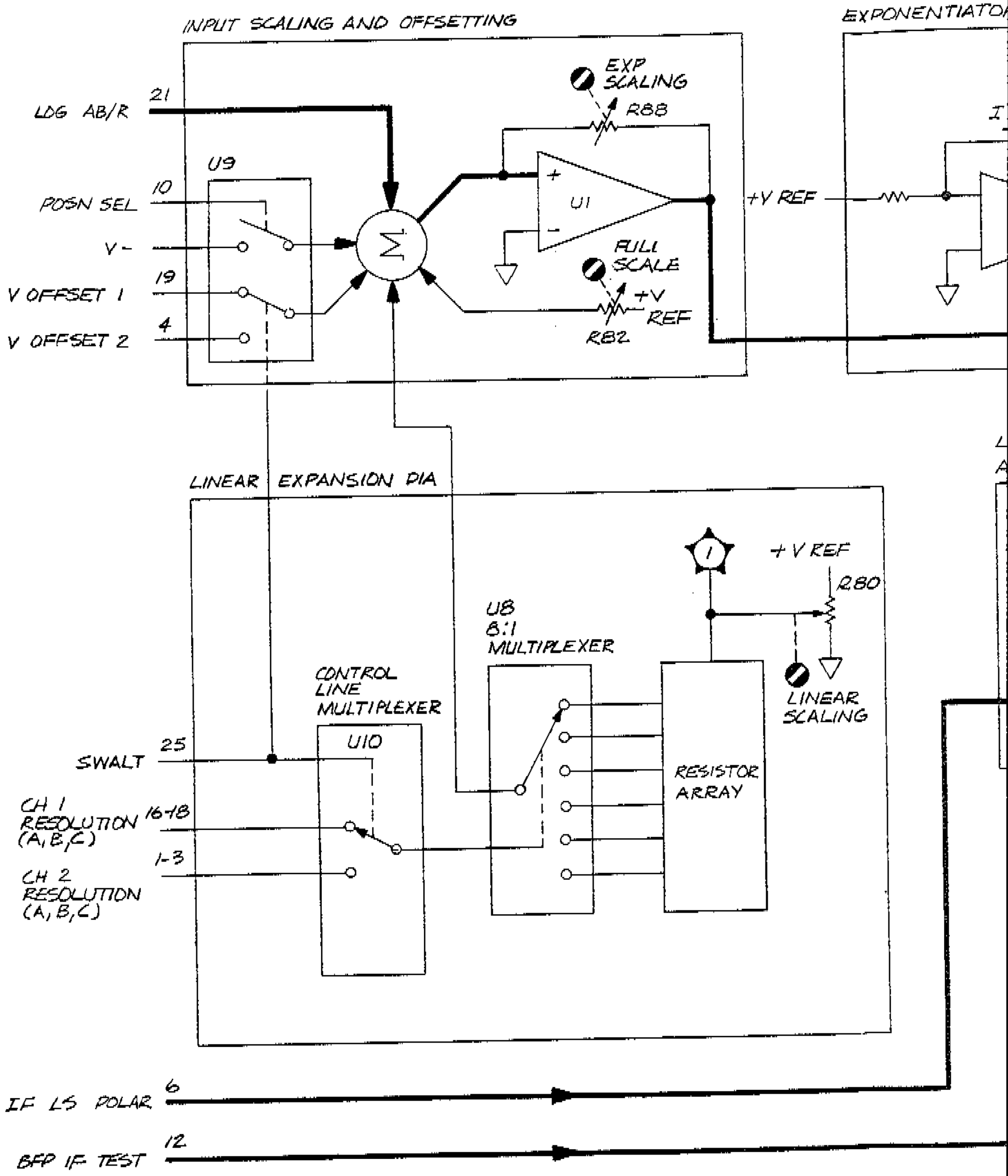


FIG. D3-32B
SHT. 2 OF 3

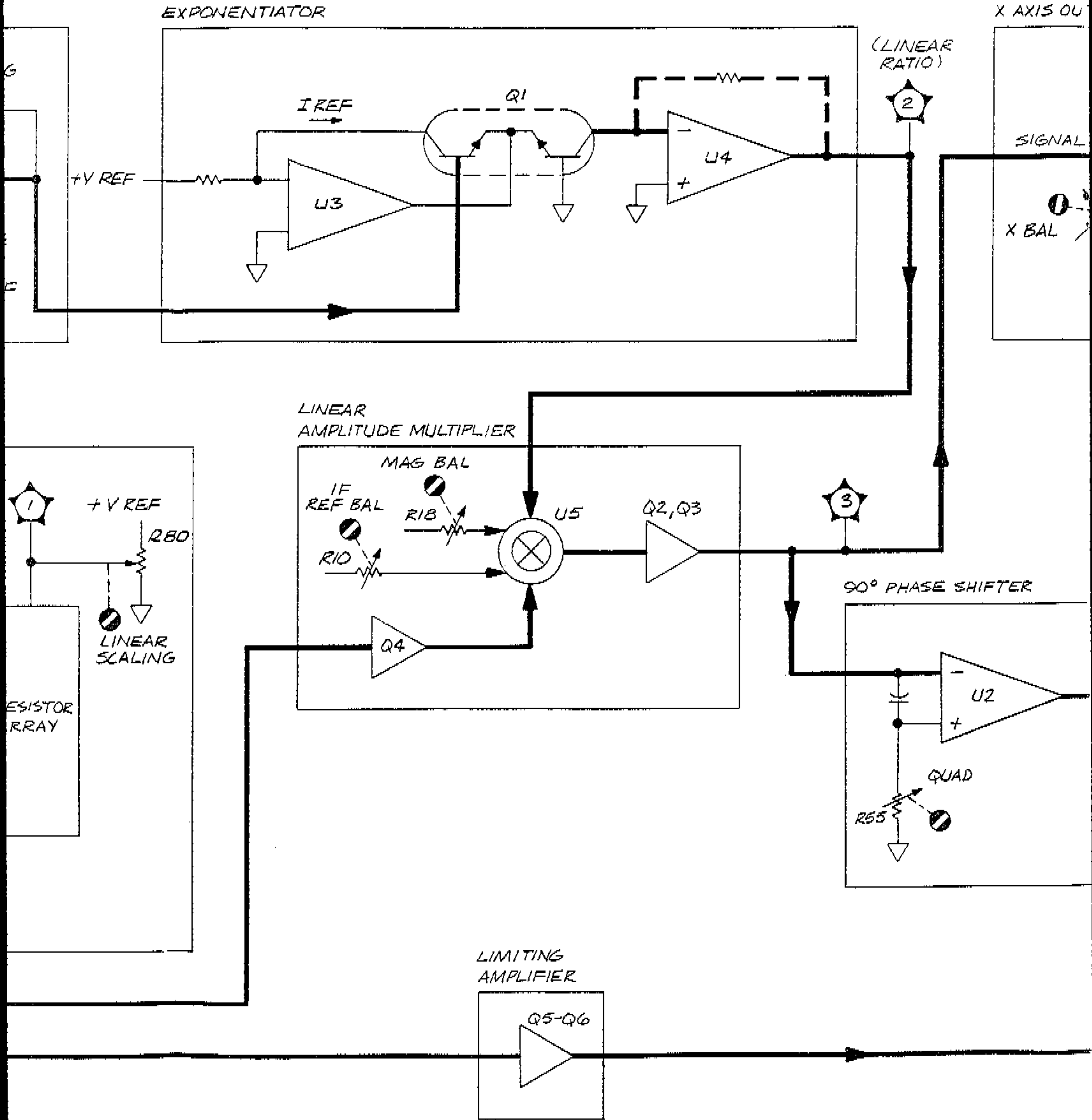


FIG. D3-32B
SHT. 3 OF 3

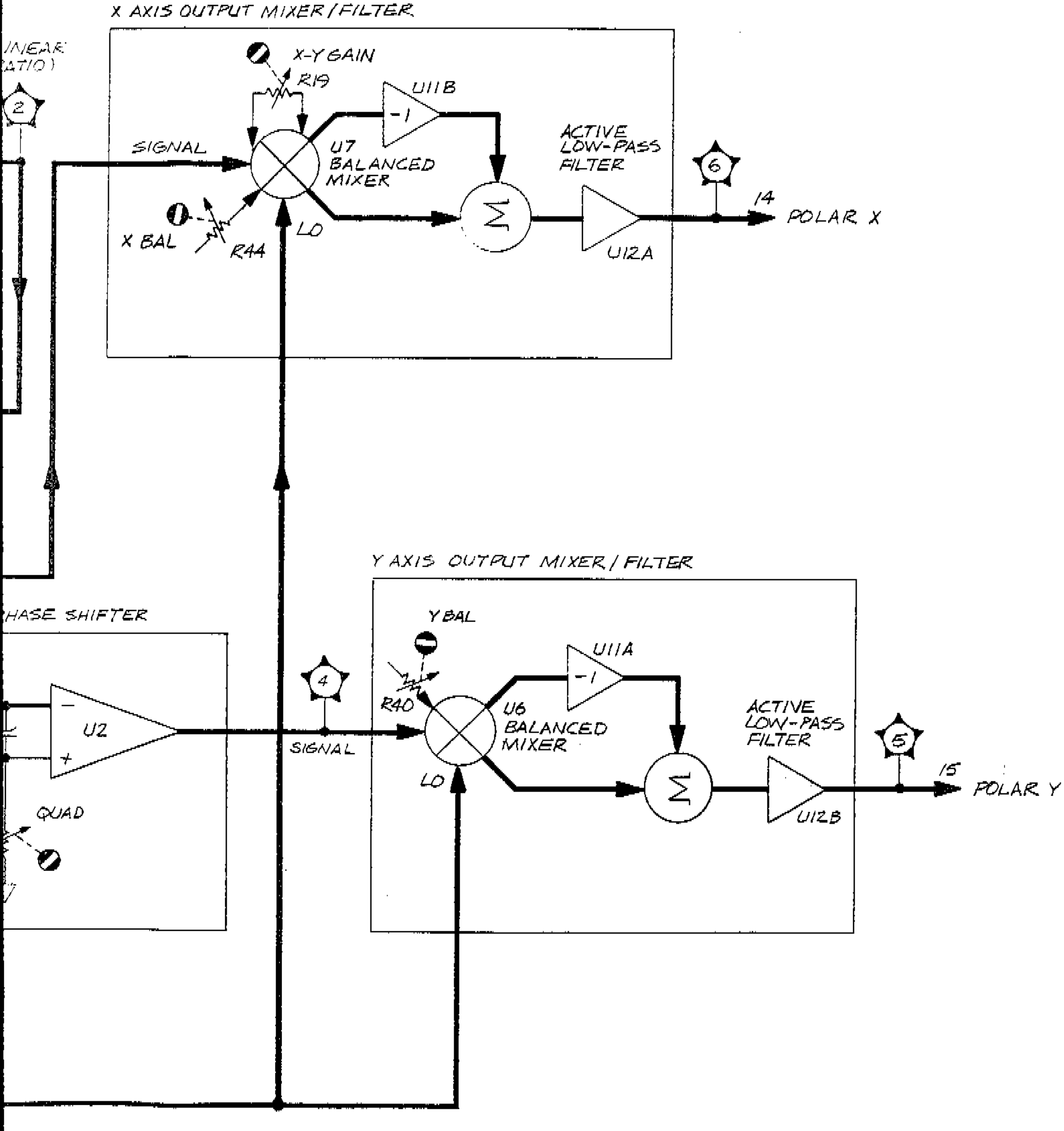


Figure D3-32B. A3A8 Polar Converter, Block Diagram

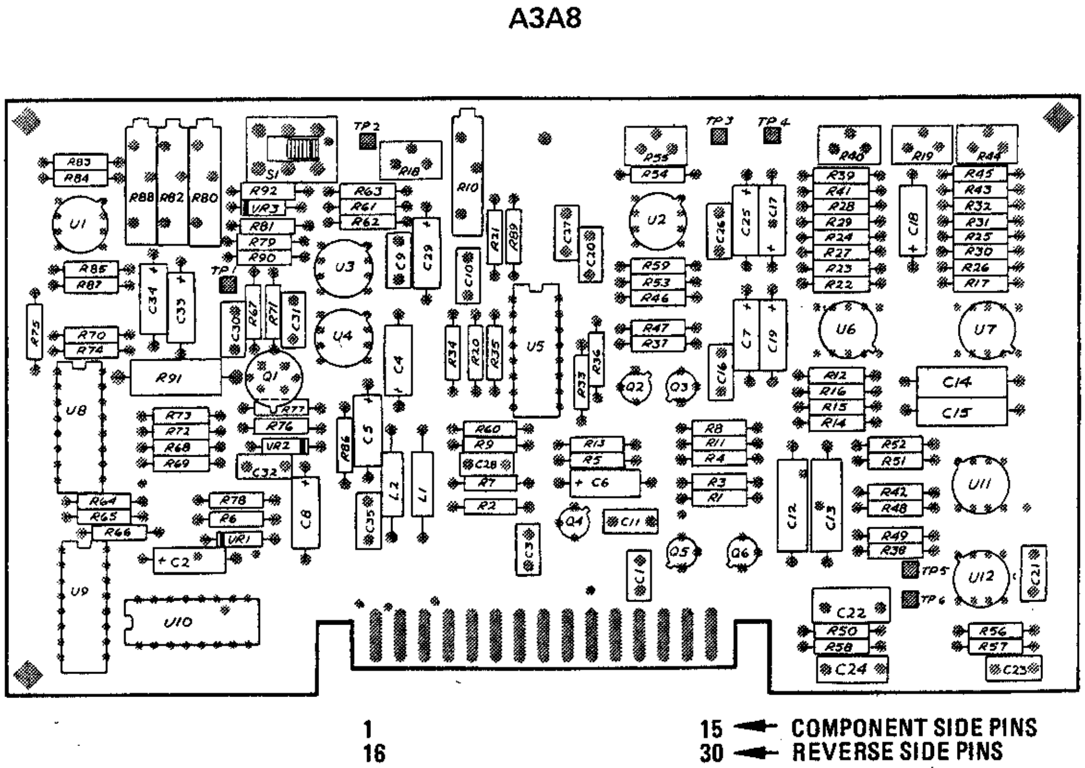
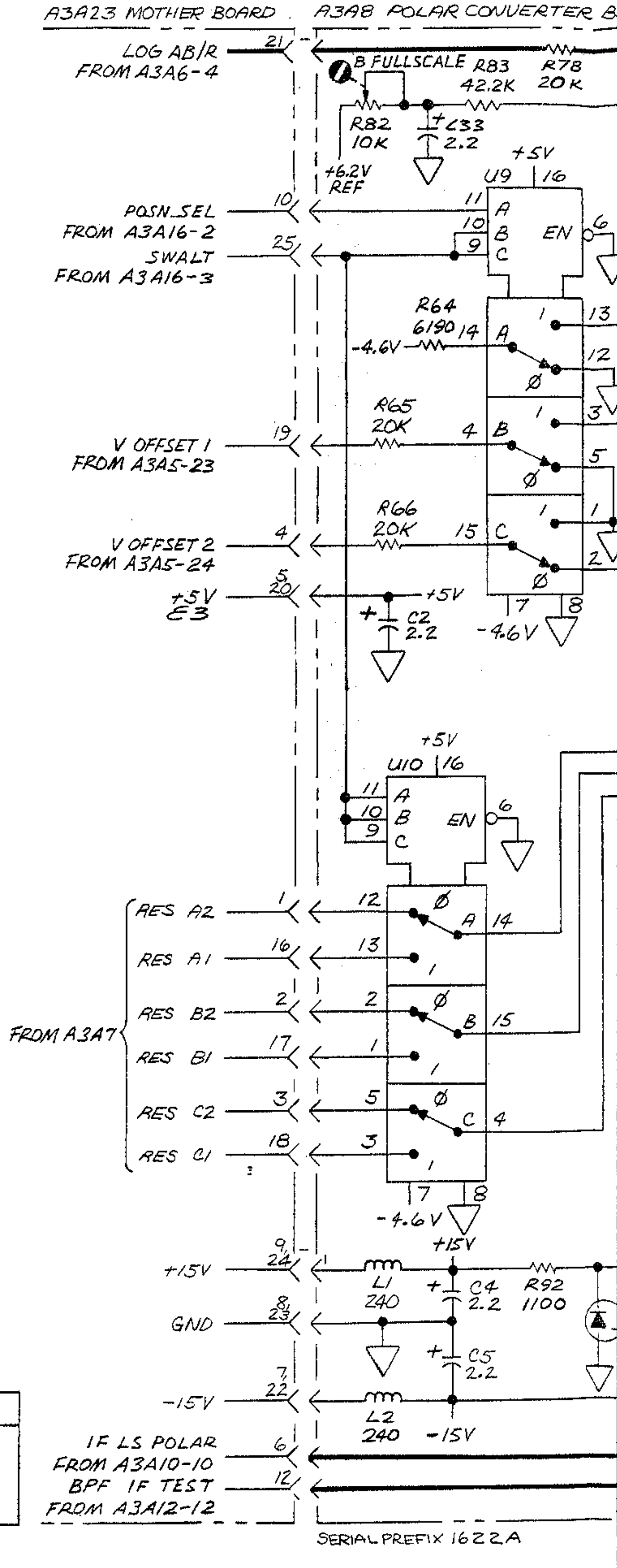


Figure D3-33. A3A8 Polar Converter Parts Locations

FIG. D3-34
SHT. 1 OF 5

TEST SETUP
CHANNEL 1
MODE: POLAR PHASE
INPUT: A/R
SCALE/DIV: POLAR FULL 1
ELECTRICAL LENGTH: 400°/SCAN
REF OFFSET: 0 (BOTH PHASE AND MAG)
CHANNEL 2: OFF
REF LINE POSN: ON

RES			SCALE/DIV
C	B	A	POLAR FULL
1	1	0	1
1	0	1	.5
1	0	0	.2
0	1	1	.1
0	1	0	.05
0	0	1	.02
0	0	0	.01

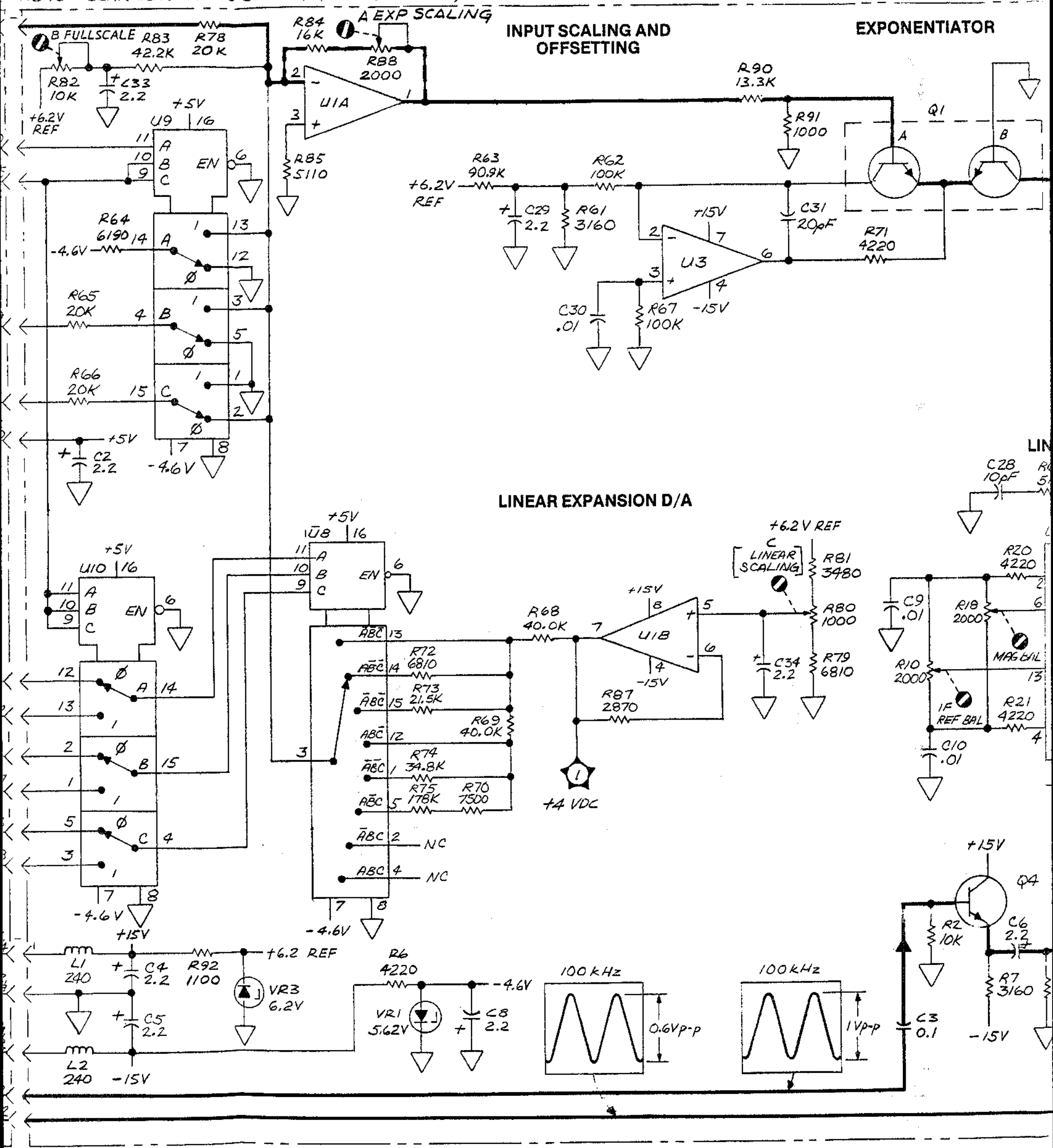


CONTROL INPUTS	DESCRIPTION
POSN SEL	1 WHEN BEAM CENTER SELECTED
SWALT	1 DURING CHANNEL 1 SWEEP
RES A1, B1, C1	CHANNEL 1 SCALE/DIV CONTROL INPUTS
RES A2, B2, C2	CHANNEL 2 SCALE/DIV CONTROL INPUTS

SERIAL PREFIX 1622A

FIG. D3-34
SHT. 2 OF 5

A3A8 POLAR CONVERTER BD ASSY (08505-60008)



SERIAL PREFIX 1622A

FIG. D3-34
SHT. 3 OF 5

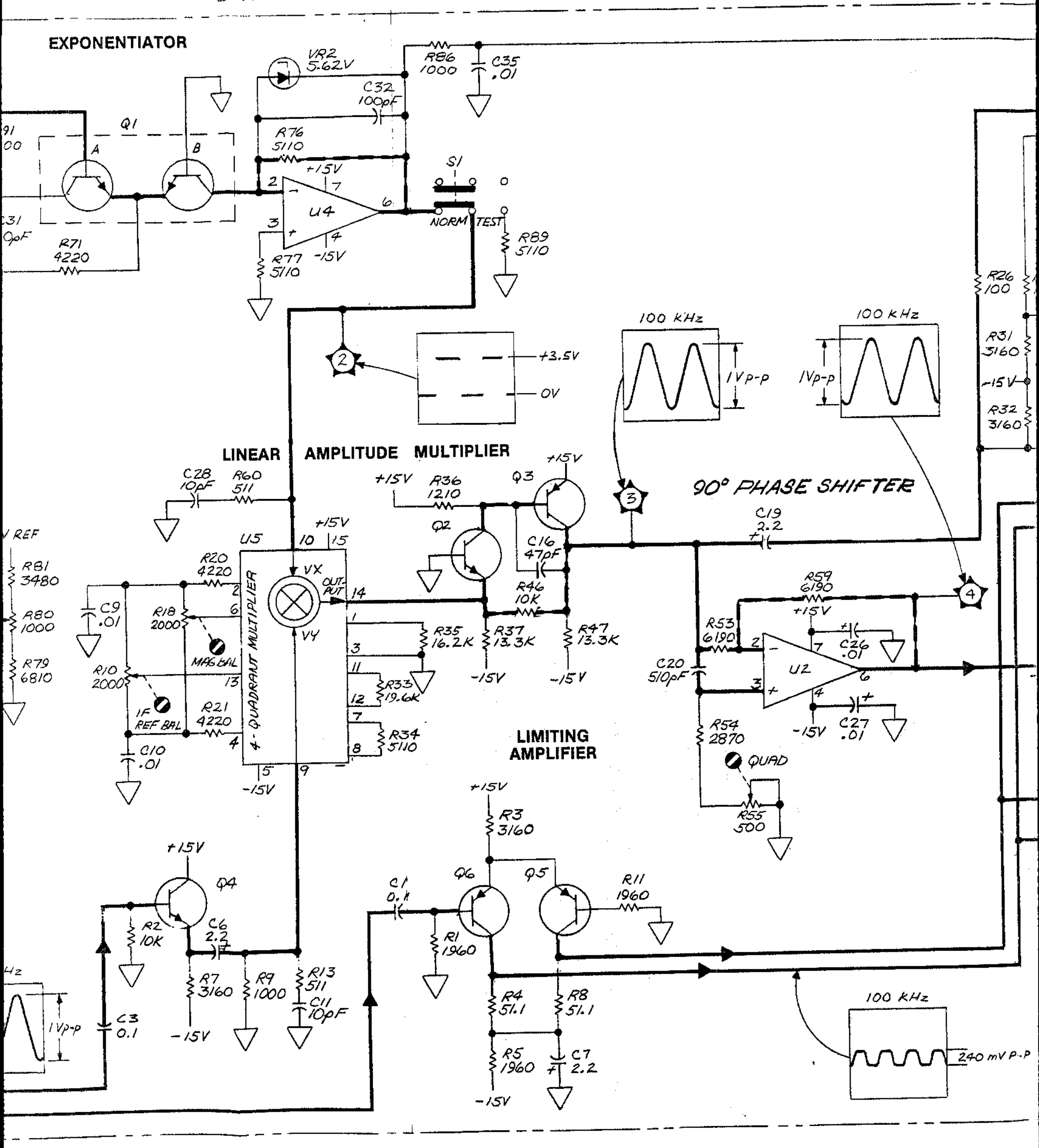


FIG. D3-34
SHT. 4 OF 5

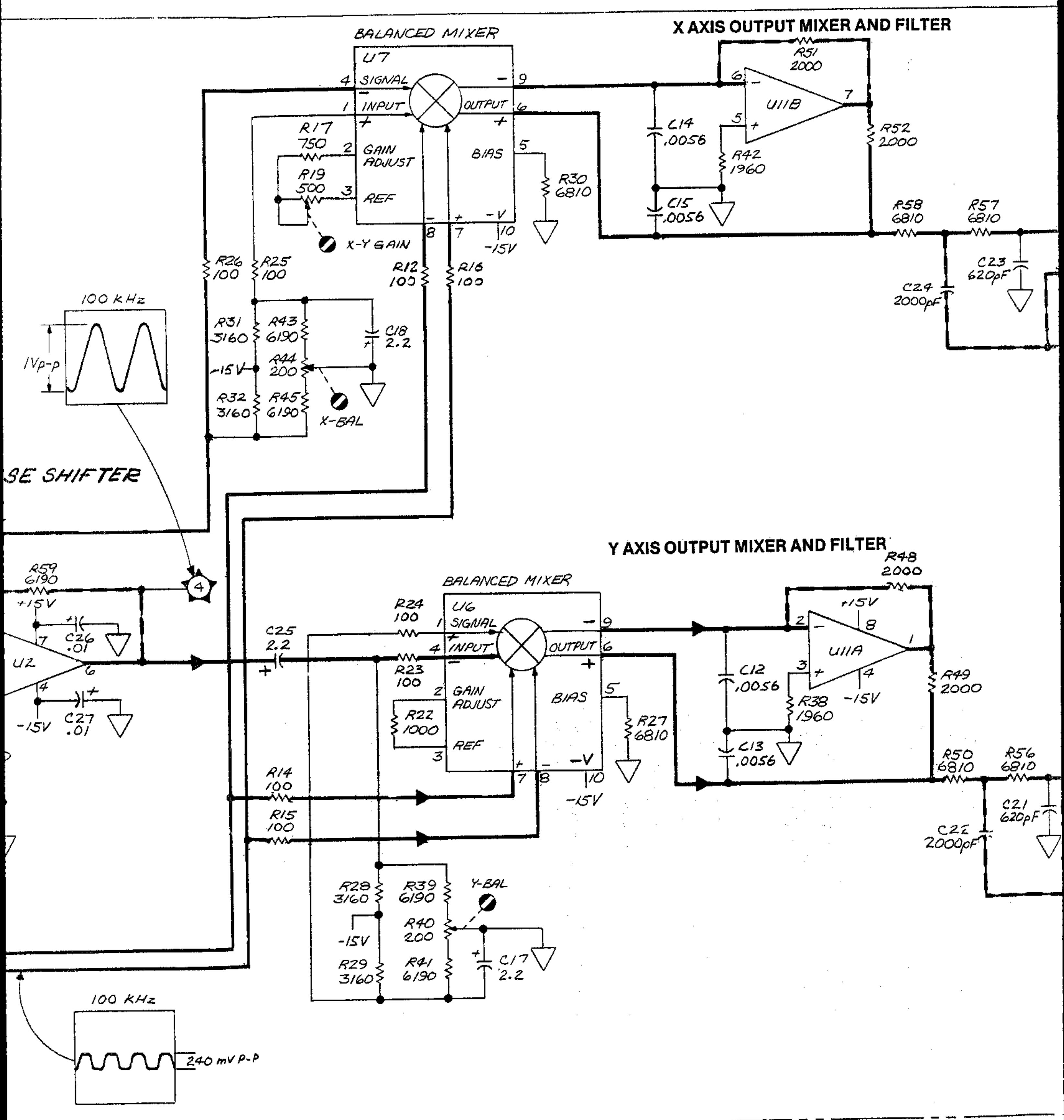
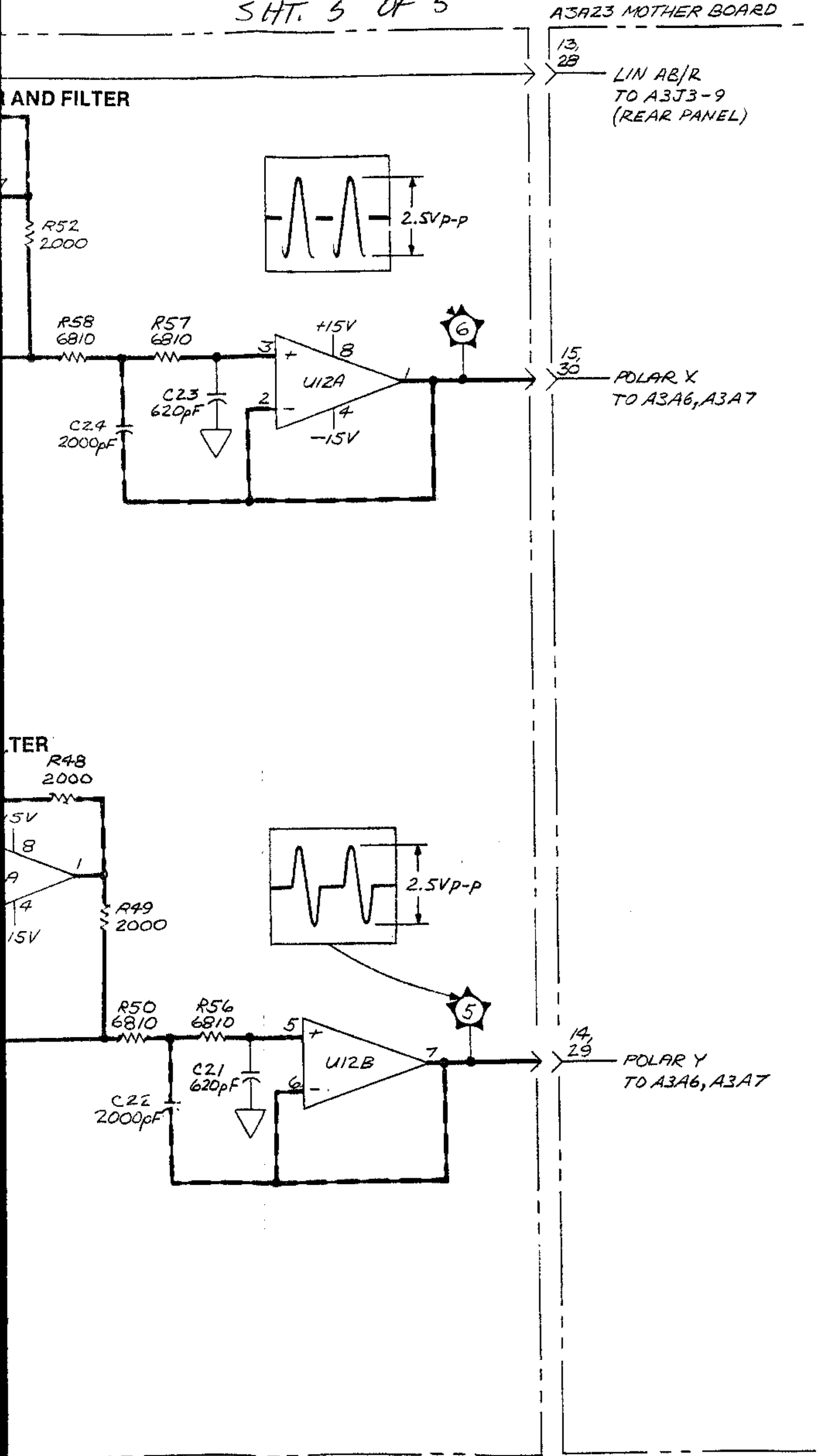


FIG. D3-34
SHT. 5 OF 5



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
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MICROHENRIES

REFERENCE DESIGNATIONS

A3A8
C1-35
L1-2
Q1-6
R1-92
S1
U1-12
VR1-3

A3A8

Figure D3-34. A3A8 Polar Converter, Schematic

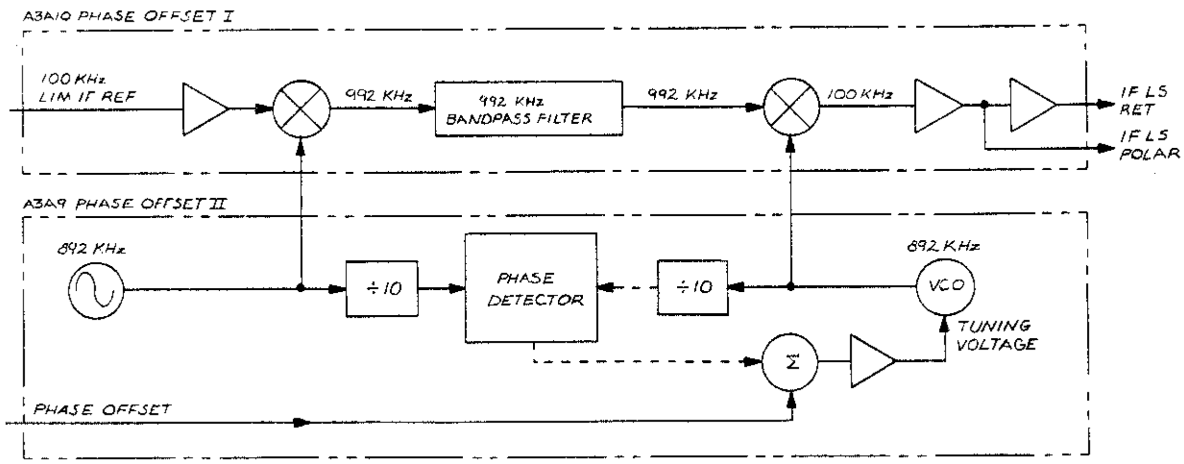
A3A9 PHASE OFFSET II AND A3A10 PHASE OFFSET I ASSEMBLIES

General Description

The two Phase Offset Assemblies, A3A9 and A3A10, make up a voltage controlled phase shifter capable of shifting a 100 kHz signal up to plus or minus 1750 degrees. The signal affected by this phase shifter is the 100 kHz LIM IF REF (limited IF reference) from Phase Detector Assembly A3A12, which also receives the phase shifted output. Electrically, the two Phase Offset Assemblies are part of the 100 kHz IF signal flow path in A3A12.

The amount of phase offset is controlled by the PH OFFSET (phase offset) input to Phase Offset II Assembly A3A9 from the Processor D/A Converter Assembly, A3A5. This input is a dc level which varies in direct proportion to the RF frequency at the RF Source/Converter Assembly's RF output connector. As its level changes, the phase offset input imposes a directly proportional phase shift on the 100 kHz IF. In effect, this electronically developed phase shift is identical with the phase shift that would be imposed on the RF signal in different lengths of coaxial cable. For this reason, assemblies A3A9 and A3A10 collectively are called the electrical line stretcher (LS).

Figure D3-34A is a simplified block diagram showing the relationship of the two Phase Offset Assemblies. The 100 kHz LIM IF REF Input to A3A10 from Phase Detector Assembly A3A12 is converted to 992 kHz by mixing it with 892 kHz from a fixed-frequncy, crystal-controlled oscillator on A3A9, and selecting the upper sideband from the mixer output.



D3-82a

Figure D3-34A. A3A9/A3A10 Phase Offset Simplified Block Diagram

In a second mixer, the 992 kHz signal is mixed with a 892 kHz signal from a voltage-controlled oscillator to restore the signal path frequency to 100 kHz. Now, however, the 100 kHz is offset from its input phase by an amount equal to the phase difference between the crystal-controlled 892 kHz oscillator and the voltage-controlled 892 kHz oscillator. This phase difference is proportional to the level of the phase offset (PH OFFSET) input to A3A9.

The phase difference between the two oscillators is developed in a phase lock loop, which comprises two divide-by-10 counters, a phase detector, and a summing stage. The outputs of the two oscillators are divided by 10 to produce two 89.2 kHz signals. These two 89.2 kHz signals, which have the same phase difference as the two 892 kHz signals they were derived from, are compared in the phase detector.

In the phase detector, a dc voltage is generated which represents the phase difference between the outputs of the two oscillators. This dc level is algebraically summed with the phase offset input to produce an error voltage which controls the 892 kHz VCO. Since the error voltage is a function of both the phase offset input level and the phase difference between the two oscillators, the VCO is phase locked to the fixed-frequency, crystal-controlled oscillator at a phase angle established by the phase offset input level.

Ordinarily, the maximum phase shift obtainable would be plus or minus 180 degress. But in this circuit, dividing the original frequency of the two oscillators by 10 expands the maximum phase shift to plus or minus 1800 degrees. Not all of this phase shift capability is used, however. To avoid any possiblity of the loop being forced to break its phase lock by being shifted too far, the phase deviation is limited to plus or minus 1750 degrees by a clamp on the phase offset input which limits the control voltage range.

A3A9 PHASE OFFSET II Circuit Descriptions

3.57 MHz Crystal Oscillator and Divide-by-4 Counter. The 892 kHz reference frequency is developed on assembly A3A9 in a crystal-controlled 3.57 MHz oscillator and a divide-by-four counter. The oscillator, connected in a Colpitts configuration, includes transistor Q1 and 3.57 MHz crystal Y1. Oscillations are maintained by positive feedback from Q1's collector through Z1 to Q1's emitter. Inductor L6 and capacitors C9 and C10 form a resonant circuit (with peak resonance near 3.5 MHz) which is the collector load for Q1.

The 3.57 MHz output of the oscillator is fed to a divide-by-four circuit made up of two D-type flip-flops, U1A and U1B. Both flip-flops have their Q outputs connected to their D inputs so that each of them functions is a divide-by-two counter. Flip-flop U1A divides the 3.57 MHz down to 1.785 MHz and U1B divides it again down to 892 kHz. The square-wave output of U1B is fed to the count-up input of divide-by-10 counter U2.

NOTE

The reference frequency produced by the crystal oscillator and divide-by-four counter is nominally 892.5 kHz. Slight variations from this frequency may be observed in different instruments. Although the actual frequency is not critical, it must be stable.

Voltage-Controlled Oscillator. The 892 kHz voltage-controlled oscillator (VCO) is an emitter-coupled, free-running multivibrator comprising transistors Q2 and Q3. Its frequency is controlled by an error voltage from the summing node/integrator circuit which is applied to the gate of FET Q4. Capacitor C28, resistors R37 and R44, and Q3's collector load are the primary frequency determining elements. Of these elements, Q3's collector load is the only one that is variable, and it is controlled by Q4. Thus, any variation in the voltage level at the gate of Q4 varies the VCO output frequency.

The multivibrator's square-wave output, abbreviated LS IF VTO and taken from the collector of Q2, is split into two signal paths. One path feeds off the assembly through R35 to the other Phase Offset Assembly, A3A10. The second signal path applies the multivibrator output to the count-up input of divide-by-10 counter U4.

Switch S1 in the control input to the multivibrator enables the phase loop to be broken for troubleshooting and for adjustment of the multivibrator output frequency. With the loop locked, the "A" frequency adjust potentiometer, R42, should be set to place a −2 volts bias on the gate of Q4.

Divide-by-10 Counters and Phase Detector. The 892 kHz square-wave output of the reference (crystal) oscillator and the VCO square-wave output are each divided by 10 in two decade counters, U2 and U4. If both signals are in phase before being divided, they will still be in phase after the division, but their mutual frequency will be one-tenth its former value. If, however, the signals are out of phase before their division (that is, at different freqencies), not only will each frequency be one-tenth of what it was, but the phase difference will be one-tenth the original phase difference.

Phase detector U3 compares the phase of the 89.2 kHz signal from the reference oscillator with the phase of the VCO signal, and produces an 89.2 kHz (nominal) pulse train in which the pulse widths correspond directly with the phase difference between the two signals.

The pulse train from U3 drives differential current switch Q7-Q8. This switch grounds the reference current from the reference current source when its input from U3 is high, and feeds the reference current to the filter/amplifier when its input is low.

Reference Current Source. The reference current source is composed of breakdown diode VR1, dual transistor Q5, and transistor Q6. One of the two transistors in Q5 is connected as a series current regulator with R6 as its emitter resistor. Breakdown diode VR1, in the emitter circuit of the other Q5 transistor, establishes a voltage reference of 6.2 volts (nominal) that also appears across R6. This sets the level of the current flow in the Q5 series regulator transistor. Transistor Q6, driven by the other Q5 transistor, adds the base currents of the two Q5 transistors to the series regulator collector current. Adding the base currents to the output current compensates for current leakage to the base of the series regulator transistor and makes the output current independent of Q5's current gain.

Current Switch. The current switch, transistors Q7 and Q8, is driven by the output from phase detector U3. This output is an 89 kHz pulse train with pulse characteristics that vary in accordance with the direction and amount of phase offset. At zero degrees phase offset, the positive-going and negative-going halves of each 360-degree pulse cycle have identical widths. As the phase offset is increased in the plus direction, the positive-going halves of the pulse cycles decrease in width while the negative-going halves increase in width. Conversely, if the phase offset direction is minus, the positive-going half cycles become wider while the negative-going half cycles become correspondingly narrower. These changes in the pulse characteristics have no effect on the pulse frequency, which remains at 89 kHz. When they are applied to the current switch, the positive-going portions of the pulses turn Q7 off, causing the source current to be diverted through Q8 and R12 to ground. When the pulses are in the negative-going portion of their cycle, Q7 is turned on and the source current flows through it to the filter/amplifier.

Thus, the source current through the switch to the filter/amplifier is on and off for equal periods when the phase offset is zero; on longer than it is off for plus phase offsets; and off longer than it is on for minus phase offsets.

Filter/Amplifier. The current from the current switch is fed through a low pass filter to eliminate the 89 kHz componentharmonics. Amplifier U6 then converts the current into a voltage which varies from 0 to −12 volts in direct proportion to the input current level. Feedback from the amplifier output to the current input is applied through resistor R22. Additional filtering is supplied by an 89.2 kHz notch filter, C18 and L10, in parallel with R22. Variable inductor L10 enables the notch filter to be fine-tuned to null out 89 kHz.

Summing Node/Integrator. The input to integrating amplifier U7 is an error signal produced by summing the output of amplifier U6 with the phase offset control input (PH OFFSET). Potentiometer R16 (C) is set to match the scale of the phase offset control input to the scale of the voltage output of U6. Since the control input is bipolar, the achievement of a symetrical plus or minus 1700 degrees operating range necessitates the addition of some positive dc offset at the summing junction. The required amount of offset is added through potentiometer R29 (B), which connects between the summing junction and a +6.2-volt regulated supply, VR2 and R34.

With R16 and R29 properly adjusted, the error signal input to U7 is zero when the phase loop is locked to the desired amount of phase offset. Amplifier U7 operates as an integrating amplifier because of the integrating effect of capacitor C26 and resistor R41 in its feedback path. In the absence of an error signal at its input, U7 produces a dc output of approximately −2 volts, which is applied to the VCO.

If the phase offset control input (PH OFFSET) is changed to select a different amount of phase offset, or if it is changing linearly to maintain the same phase offset through a change of the RF output, the resulting error input to U7 will be integrated and produce a change in the dc applied to the VCO. The VCO will then speed up or slow down just long enough to shift the offset in the requried direction and return the error signal to zero. Once the loop is locked, the VCO input goes back to normal (approximately −2 volts) and the VCO runs at its normal frequency

A feedback path from the integrator output through 5.6-volt breakdown diode VR3 to decade counter U4 ensures against phase lock failure in the event of an overly large error signal. If the integrator output goes too negative (down to −5.6 volts), the feedback inhibits counter U4. This, in turn, permits the loop to slew back to its normal operating range and lock up.

Clamping Circuits. Two clamping circuits, U5A and U5B, are connected to the phase offset control input to prevent the phase lock loop from being driven beyond its maximum operating range. Potentiometer R26 (E) sets the positive clamping point, and R27 (D) sets the negative clamping point. When properly adjusted, R26 and R27 set the limits of the phase offset to plus and minus 1750 degrees.

D3-82d

NOTE

Potentiometer R26 clamps the positive-going excursion of the phase offset control input to limit the minus phase offset to a maximum of 1750 degrees. On the A3A9 schematic diagram, the designation − CLAMP at R26 refers to the phase offset direction rather than to the control input voltage direction. The same applies for potentiometer R27, which is labeled + CLAMP but actually clamps the negative excursion of the phase offset control input to limit the phase offset range in the plus direction.

The positive threshold of the phase offset control voltage is approximately equal to the output of U5A. If the control voltage attempts to exceed the threshold level, diode CR1 will become forward biased and draw current through U5A's output from the phase offset control input. The additional current drain will then increase the voltage drop across R14 and restrict any further increase in the offset control voltage applied to the summing junction.

The negative threshold is maintained in the same manner as the positive threshold. The threshold level is fixed by the negative output of U5B. If the control input reaches the threshold level, diode CR2 becomes forward biased and U5B pulls additional current across R14 to clamp the negative control level.

A3A10 PHASE OFFSET I Circuit Descriptions

Input Amplifier/Filter. The limited IF reference (LIM IF REF) from Phase Detector Assembly A3A12 is buffered by a differential limiting amplifier, Q5 and Q6. The amplifier output, taken from the collector of Q5, is fed through a tunable low pass filter. Variable inductor L4 is adjusted to set the filter's peak response at 100 kHz. Emitter follower buffer Q3 isolates the filter from the following mixer stage.

Mixer U3. Mixer U3 mixes the 100 kHz sine wave it receives from buffer Q3 with the 892 kHz line stretcher IF crystal (LS IF CRYS) input from Phase Offset II Assembly A3A9. Before it is applied to the mixer, however, the 892 kHz input is converted into a differential square-wave by the differential amplifier transistors in U4. The two outputs from U4 drive the mixer's + input, pin 7, and its − input, pin 8.

Balance adjustment R8 (BAL) is used to null the 892 kHz switching signal at the mixer output. Capacitor C12, by coupling the high frequency components of the 100 kHz signal into the mixer's + signal input at pin 1, provides additional low-frequency filtering of the input signal.

992 kHz Bandpass Filter. The mixer output, pin 6, contains both a 792 kHz component and a 992 kHz component, in addition to higher mixing products. A parallel-series resonant filter separates the 792 kHz components from the 992 kHz components by more than 70 dB. In this filter, L5 is a variable high-Q pot core inductor which parallel resonates with C18 at 992 kHz to peak the filter's output response. At 792 kHz, however, L5 is in series resonance with the parallel combination of C20 and C17, which shorts out the 792 kHz components. Amplifier U1, with positive feedback through R29, is arranged as a negative-impedance amplifier and has a gain of two. It compensates for the losses in inductor L5 and increases the null effect on 792 kHz.

L5 is adjusted to peak the filter response at 992 kHz. Capacitor C17, in parallel with C20, is factory-selected to make sure the null is maximum at 792 kHz. Capacitor C16, in parallel with C18, is a temperature compensating capacitor which compensates for the temperature coefficient of L5.

The filter output is buffered by a unity-gain, feedback-pair amplifier. Field effect transistor Q1 provides a high input impedance while Q2 provides the amplifier's gain. The amplifier drives a three-pole filter which further attenuates the higher order mixing components. From this filter, the signal is fed out of the bandpass filter circuit through emitter follower Q4, which drives the second mixer, U5.

Mixer U5 and Output Filter/Amplifier. Mixer U5 mixes the 992 kHz sine wave from Q4 with the 892 kHz square-wave LS IF VTO from the Phase Offset II Assembly. The gain of the input signal is fixed by resistor R38 and output load resistor R52. The mixer's output from pin 6 is low-pass filtered to eliminate all but the 100 kHz frequency component. This 100 kHz sine wave is then sent to Polar Converter Assembly A3A8 as the IF LS POLAR input.

Emitter follower U2B, in the filter output, also drives one side of differential limiting amplifier U2A. Transistor U2D is the constant current bias for amplifier U2A. The other side of the differential amplifier is dc biased from potentiometer R45, the phase trimmer. R45 loads a small amount of equivalent phase shift to the limited signal which, after being buffered by U2C, is fed to Phase Detector Assembly A3A12 as the IF LS RET signal. The phase shift imposed by R45 allows a precise matching between the polar phase measurement on the CRT and the rectangular measurement obtained from Phase Detector Assembly A3A12.

Troubleshooting

Phase Offset I Assembly A3A10 is in the signal flow path of the 100 kHz IF reference signal used for a phase measurement, and should not affect a phase measurement unless a phase offset is entered (REF OFFSET or Electrical Length). The affect of A3A9 and A3A10 on a phase measurement is checked by performing a phase measurement and noting the phase indication; then removing A3A10 (jumpering A3XA10-4 to A3XA10-6) and repeating the phase measurement. There should be no difference in the two phase measurements.

FIG. D3-34B
SHT. 1 OF 2

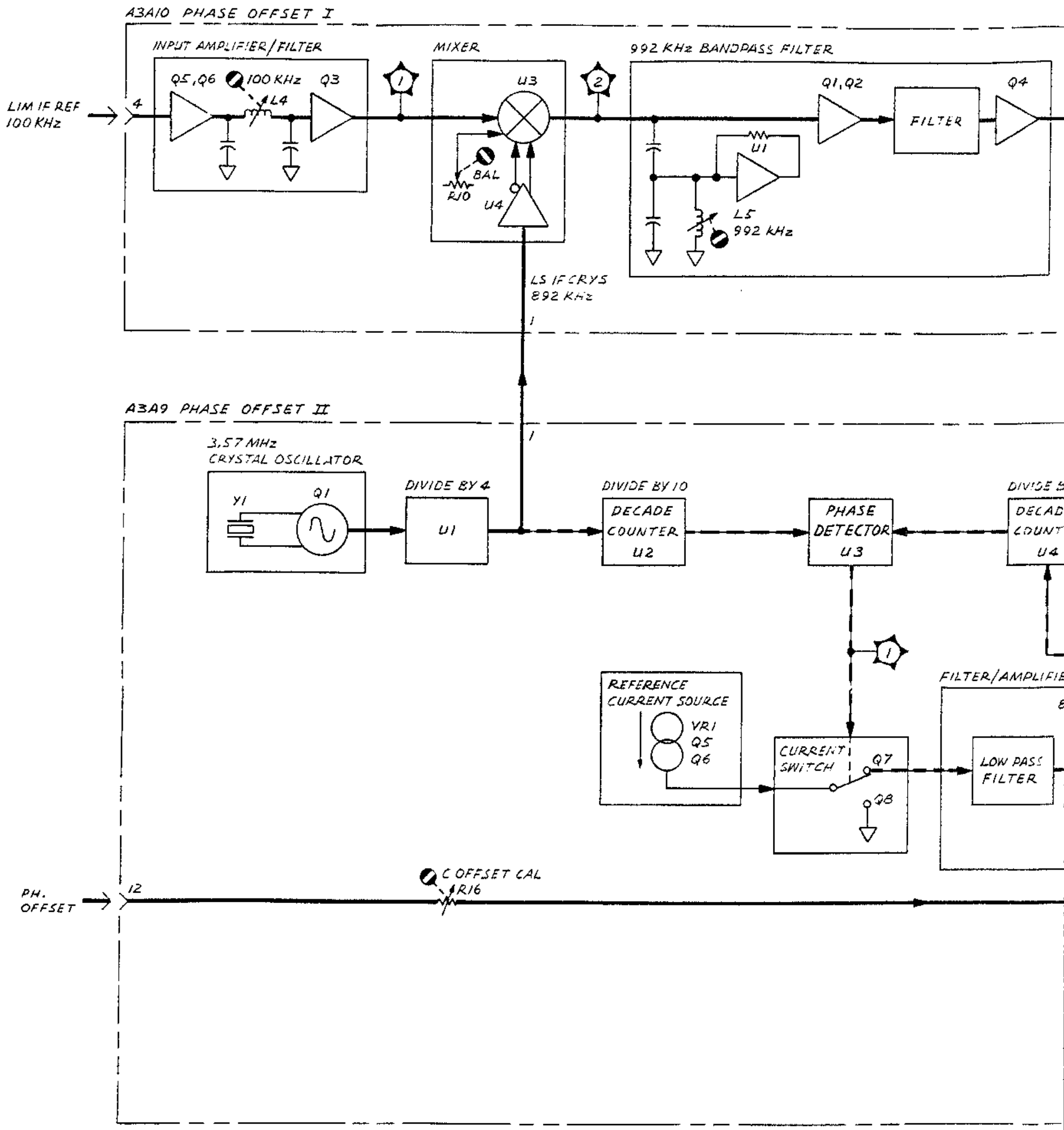


FIG. D3-34B
SHT. 2 OF 2

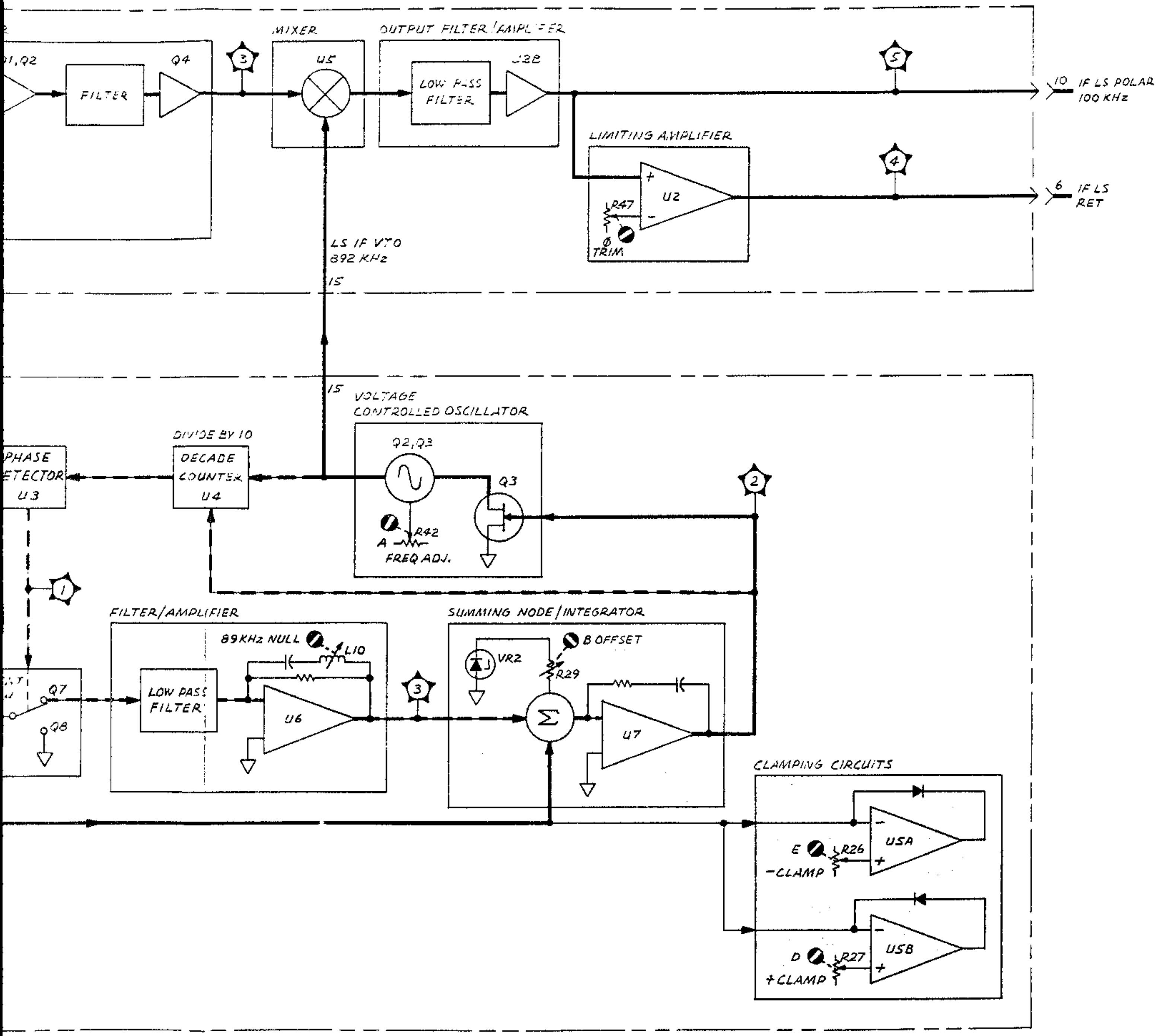


Figure D3-34B. A3A9/A3A10 PHASE OFFSET II, Block Diagram

A3A9

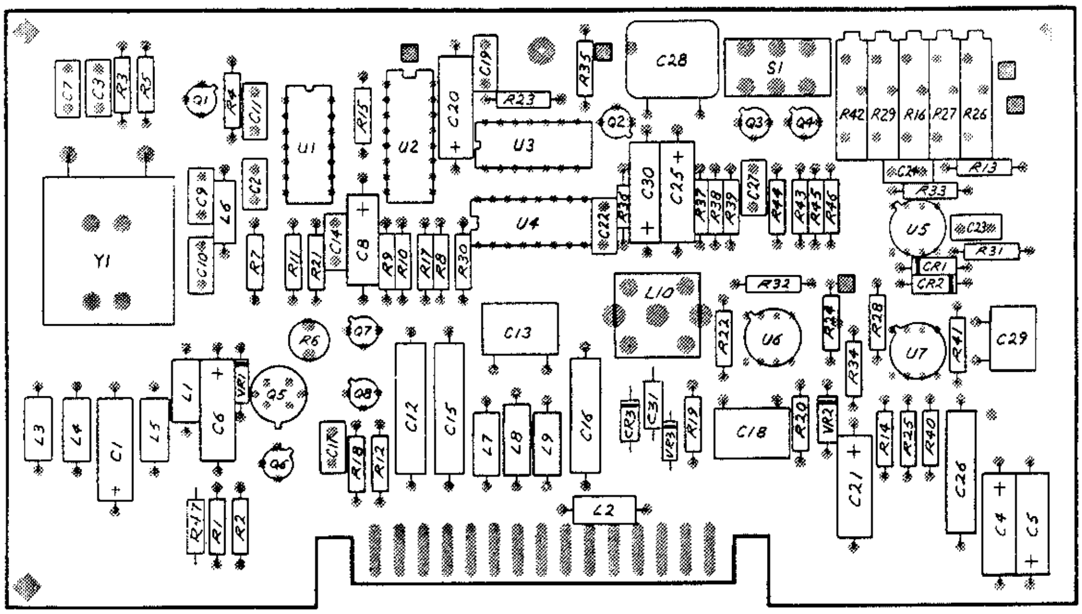


Figure D3-35. A3A9 Phase Offset II Parts Locations

FIG. D3-36
SHT. 1 OF 5

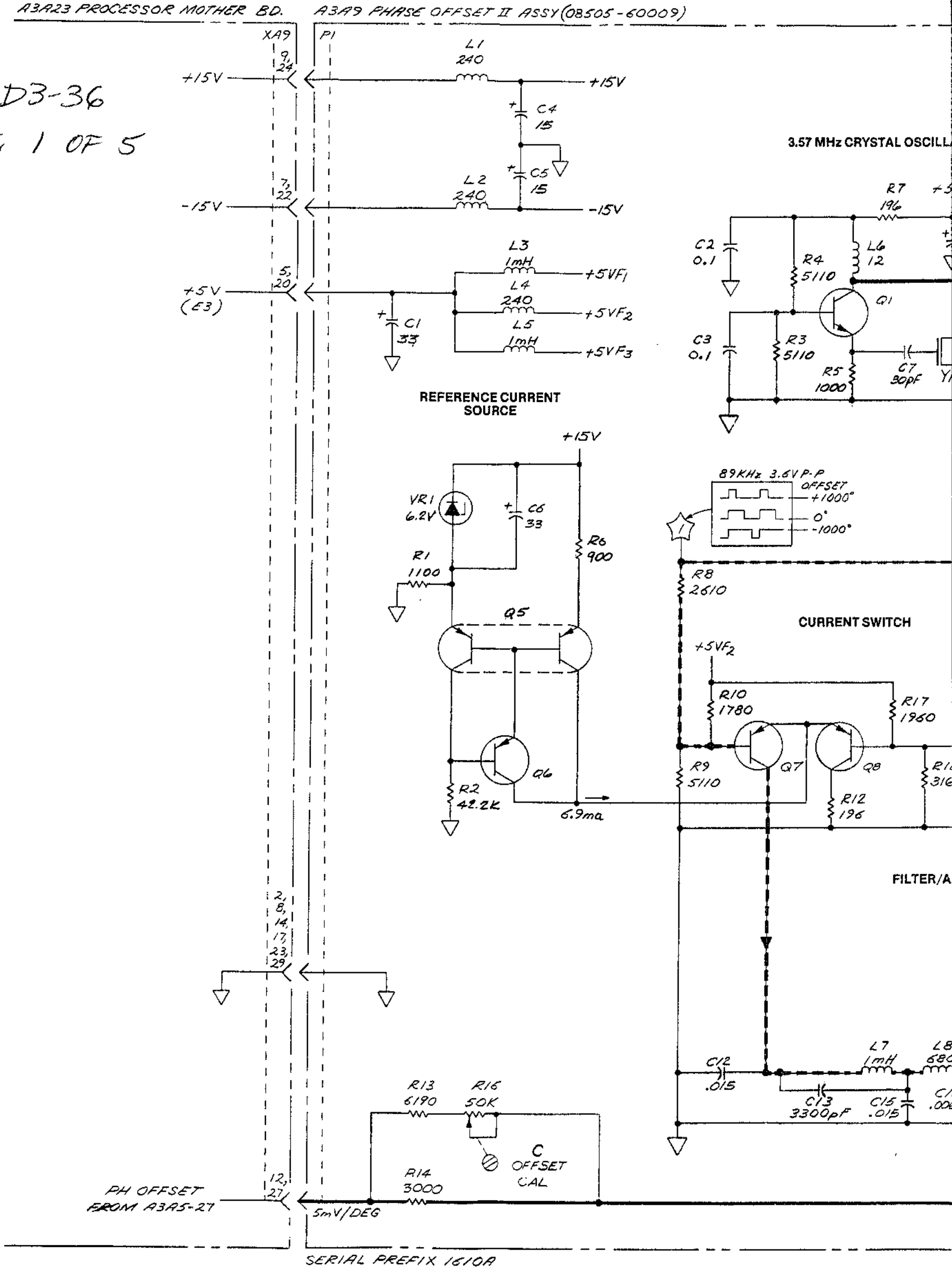


FIG. D3-36
SHT. 2 OF 5

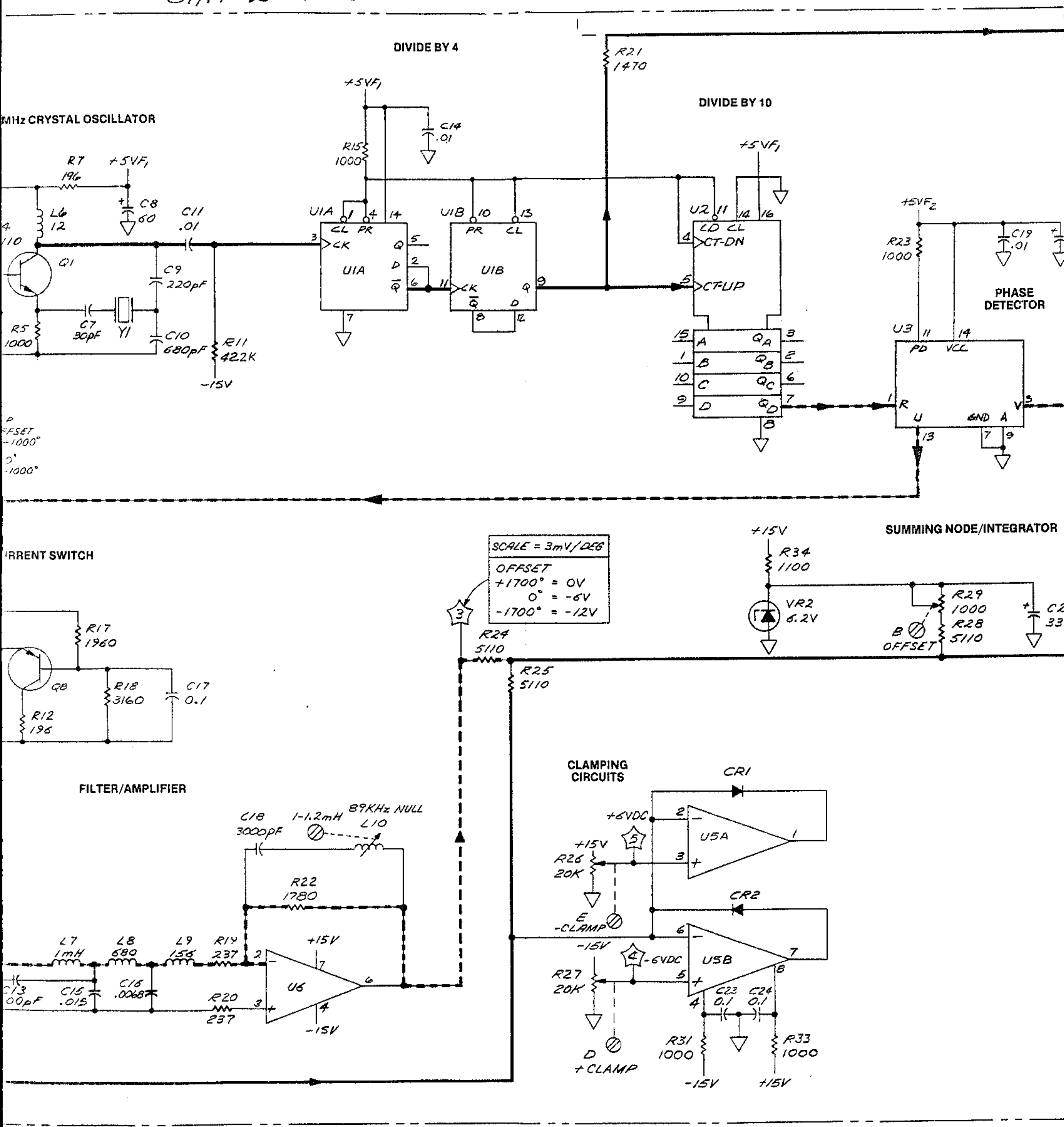


FIG D3-36
SHT. 3 OF 5

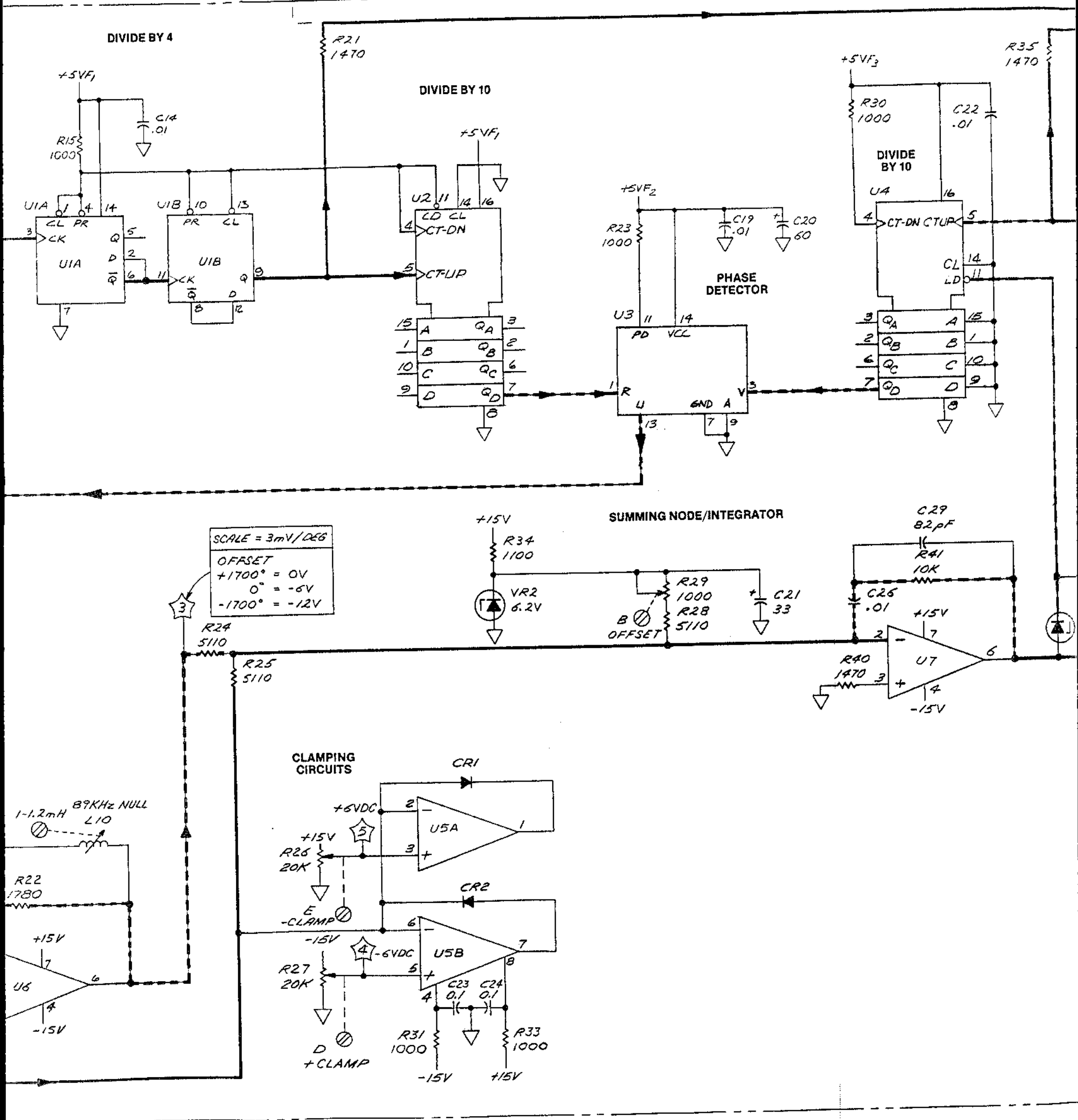


FIG. D3-36
SHT. 4 OF 5

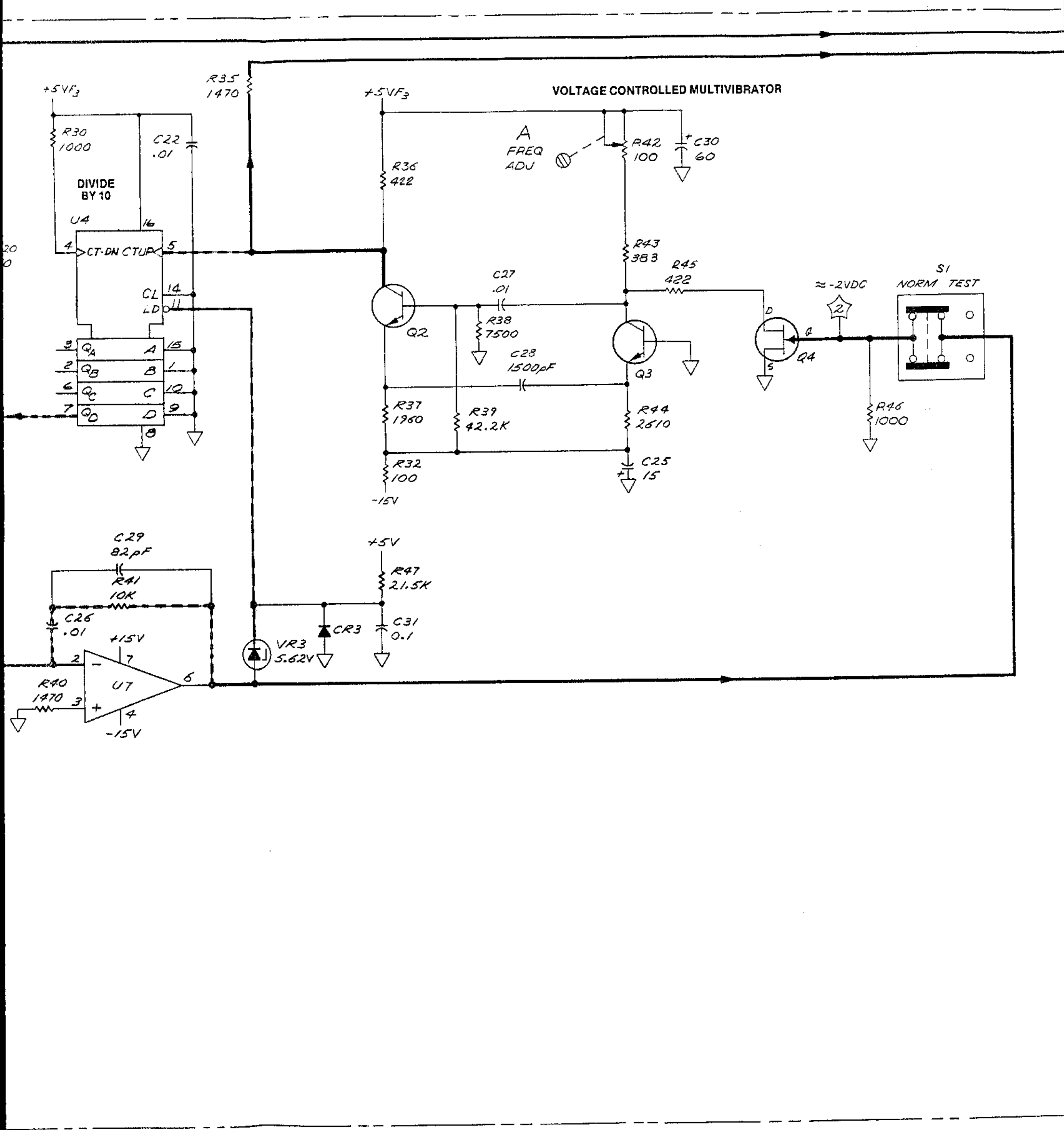
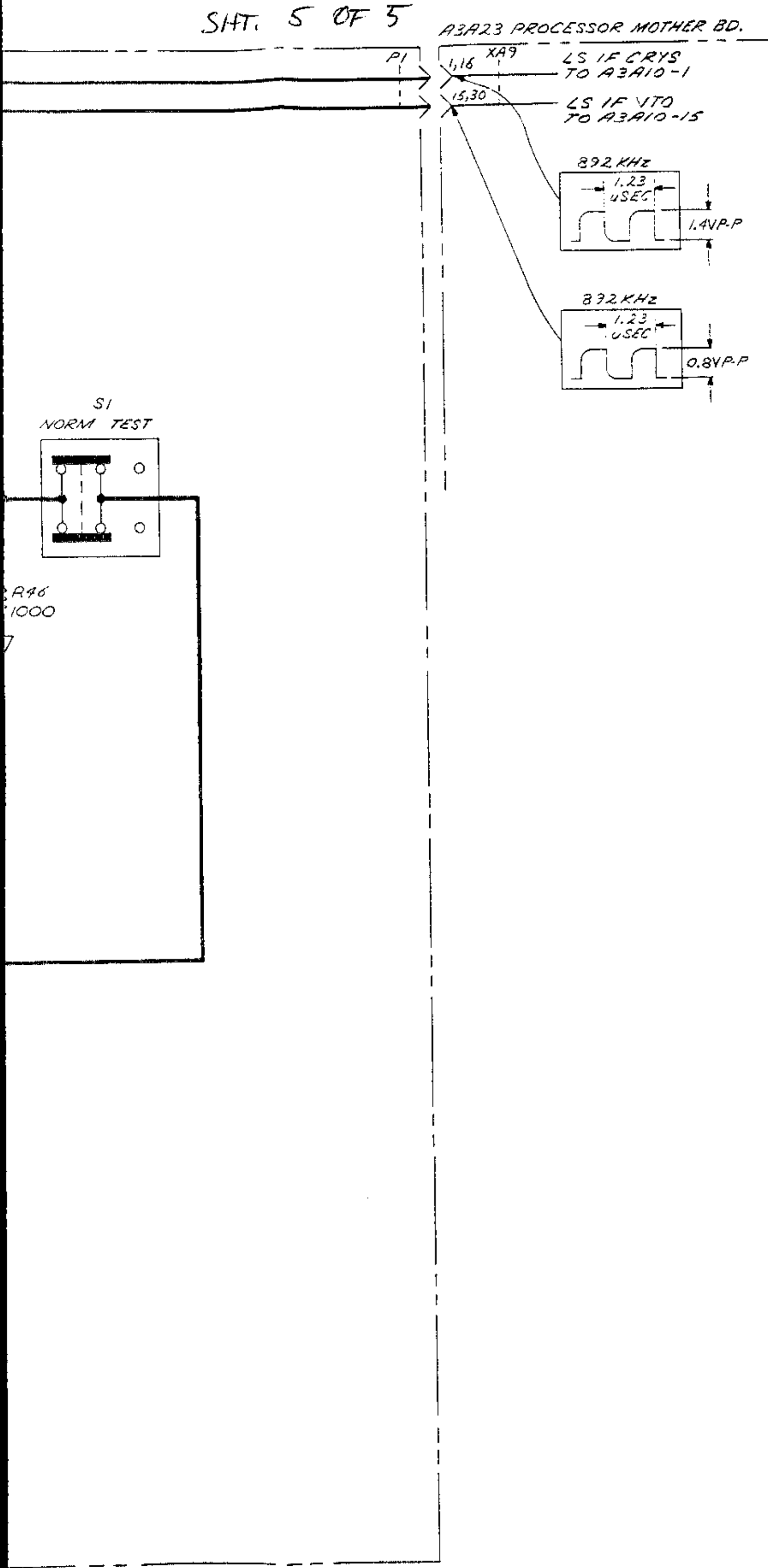


FIG. D3-36
SHT. 5 OF 5



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
   CAPACITANCE IN MICROFARAD
   INDUCTANCE IN MICROHENRIES

TEST SETUP
CHANNEL 1
MODE : PHASE
INPUT : A/R
SCALE / DIV : 45 DEG
REF OFFSET : AS REQUIRED
CHANNEL 2 : OFF

REFERENCE DESIGNATIONS

A3A9	A3A23
C1 - 31	XA9
CR1 - 3	
L1 - 10	
Q1 - 8	
R1 - 47	
S1	
U1 - 7	
VR1 - 3	
Y1	

A3A9

Figure D3-36. A3A9 PHASE OFFSET II, Schematic

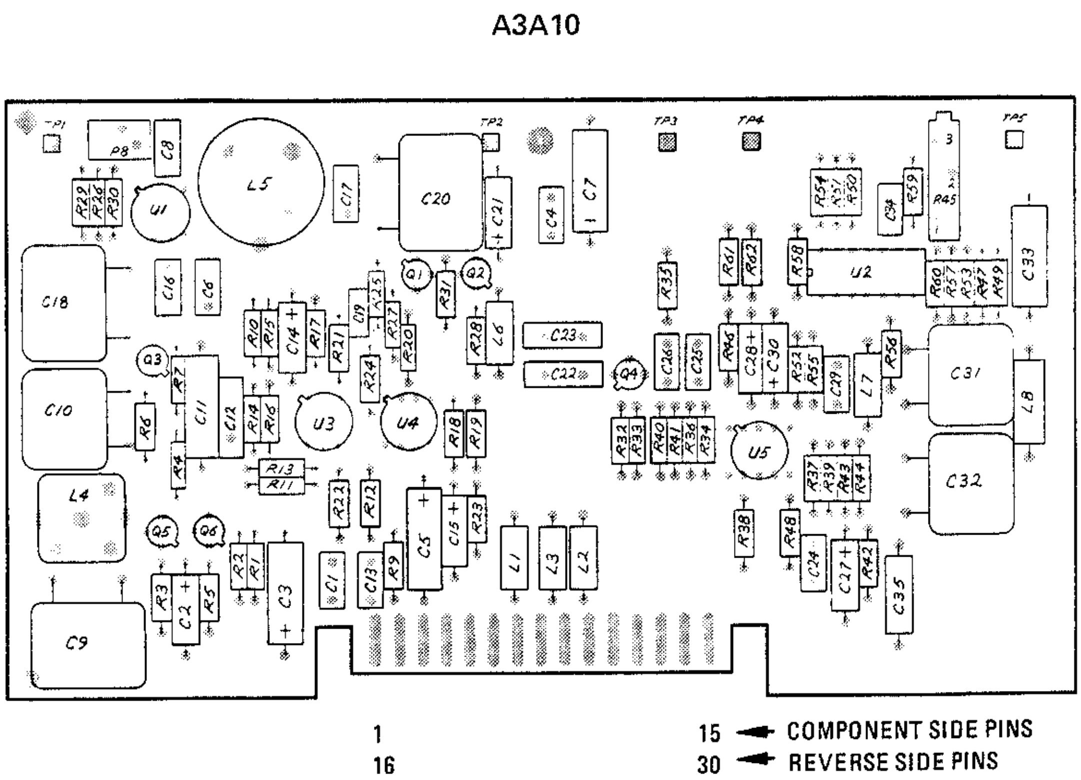


Figure D3-37. A3A10 Phase Offset I Parts Locations

FIG. D3-38
SHT. 1 OF 4

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
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MICROHENRIES

TEST SETUP	
CHANNEL 1 :	
MODE :	PHASE
INPUT :	A/R
SCALE/DIV :	45 DEG
REF OFFSET :	FOR +90° PHASE
CHANNEL 2 :	OFF

REFERENCE DESIGNATIONS

A3A10
C1 - C35
L1 - L8
Q1 - Q6
R1 - R62
U1 - U5

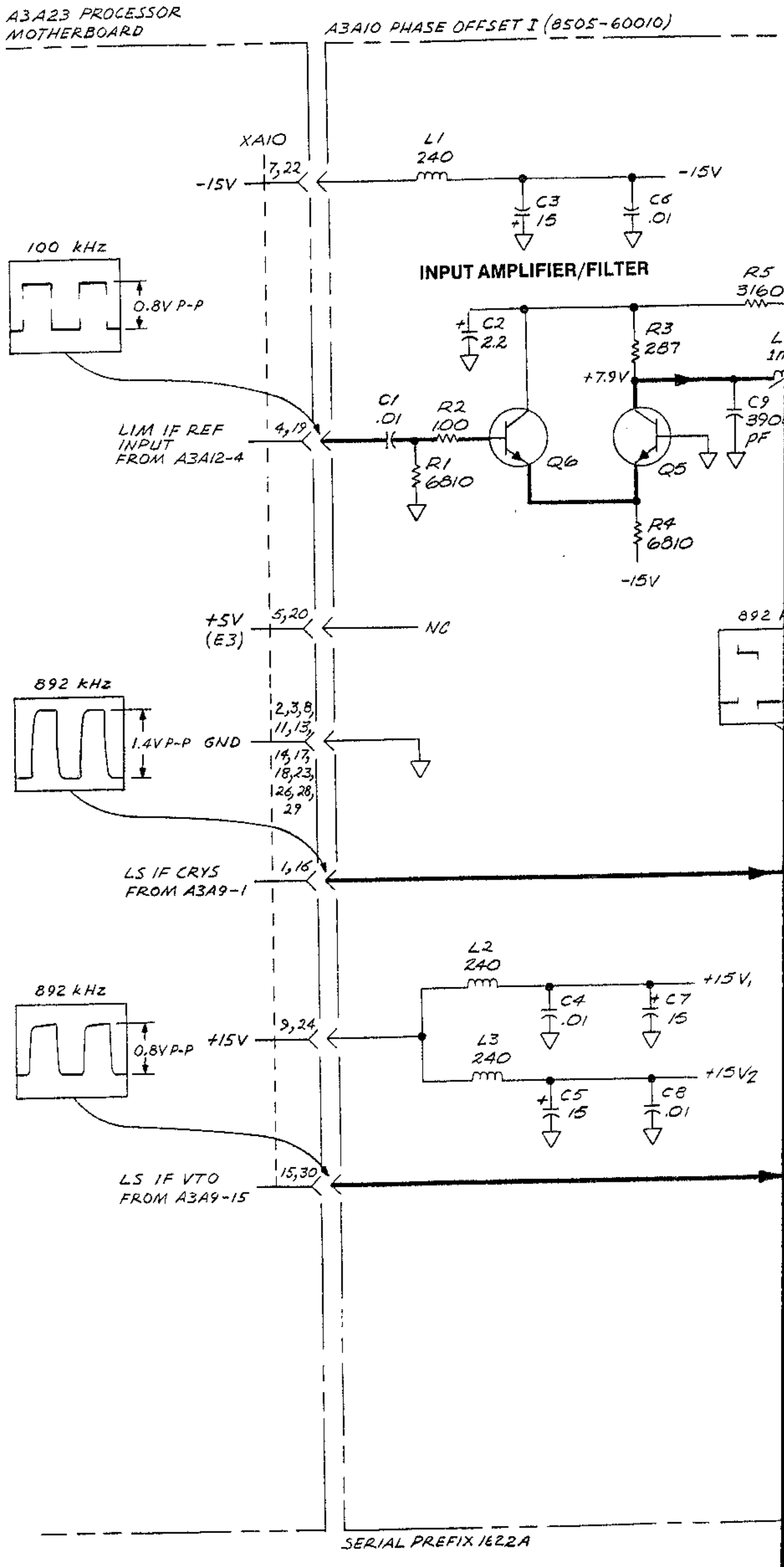


FIG. D3-38
SHT. 2 OF 4

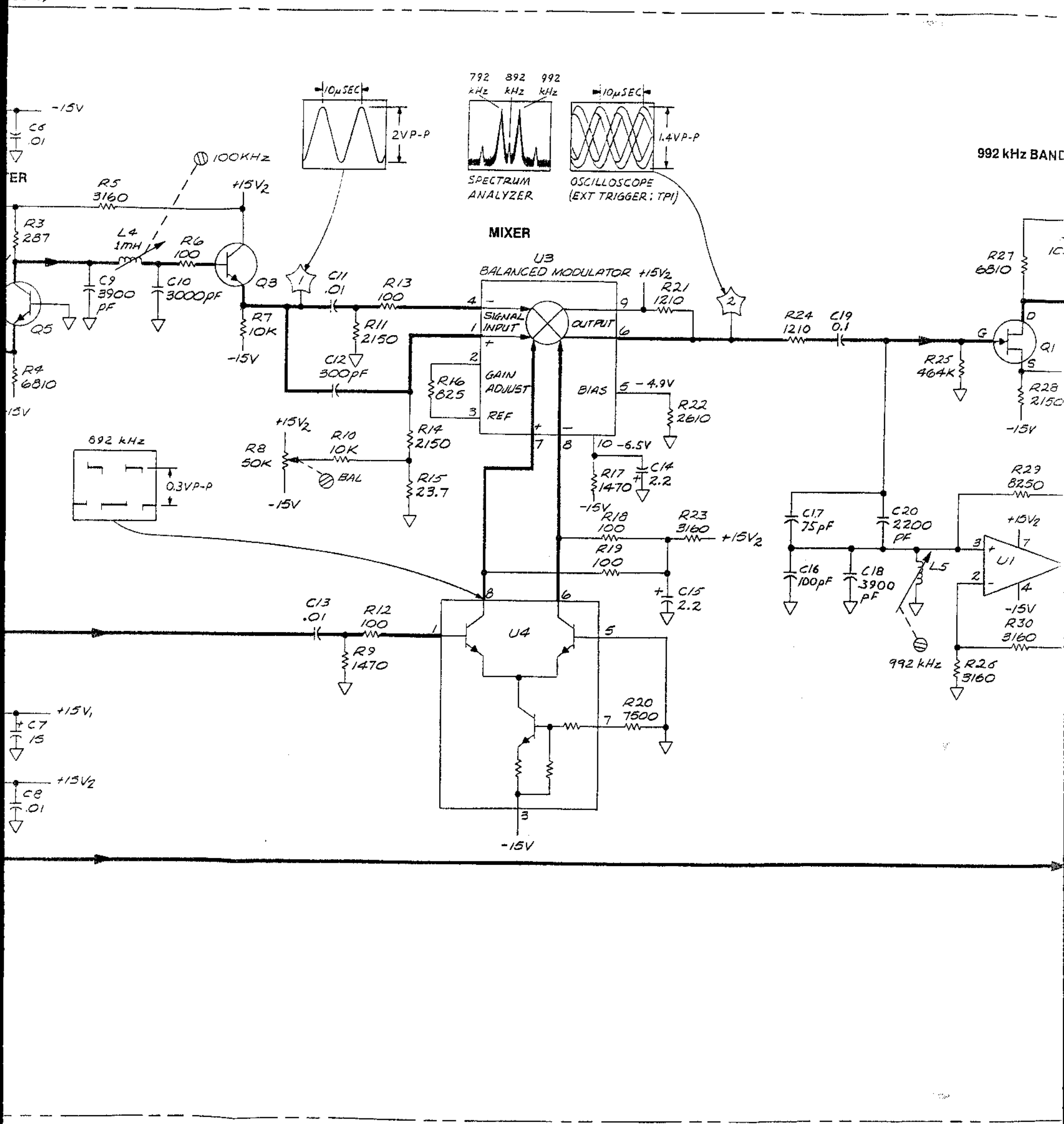


FIG. D3-38
SHT. 3 OF 4

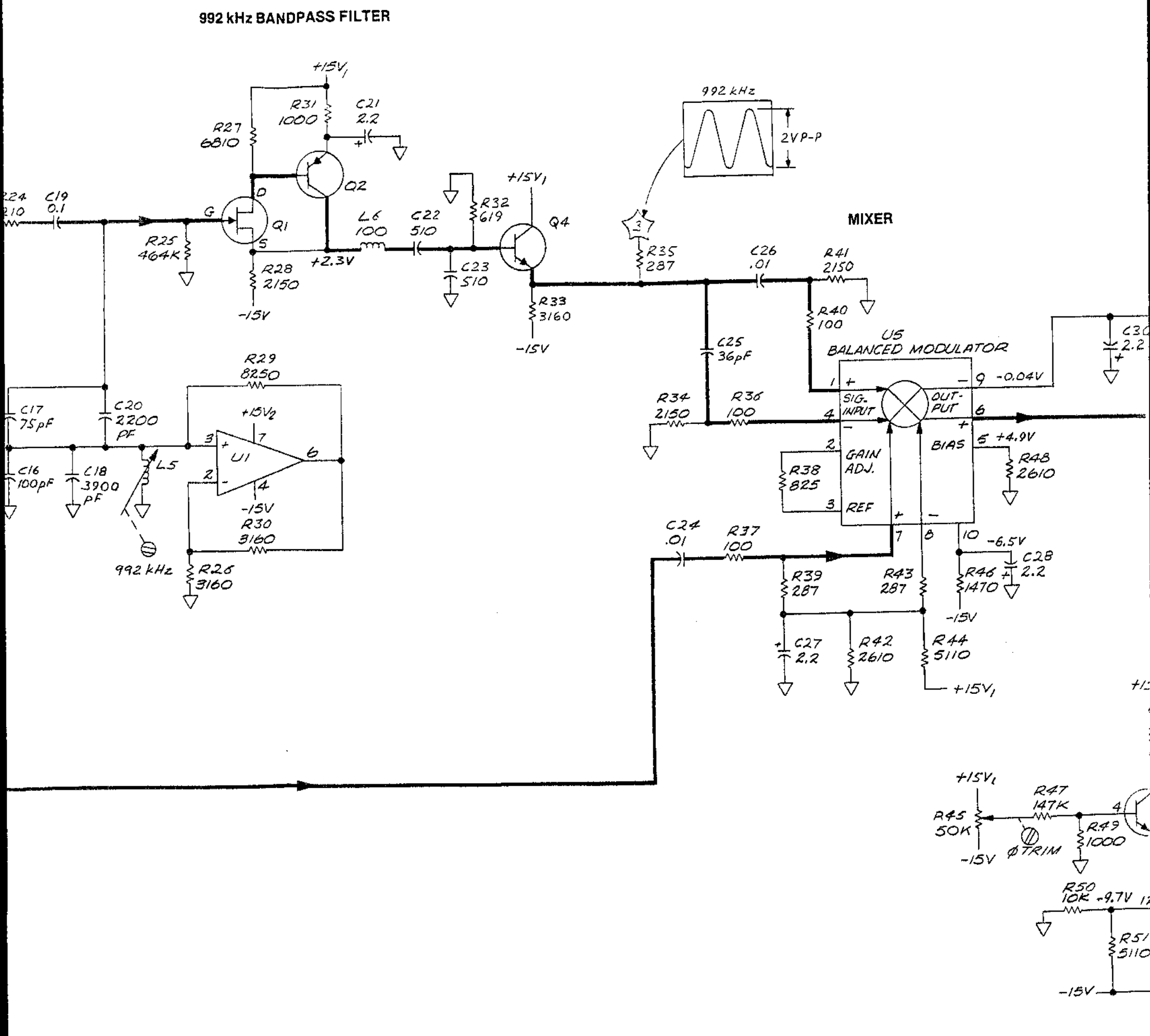


FIG. D3-38
SHT. 4 OF 4

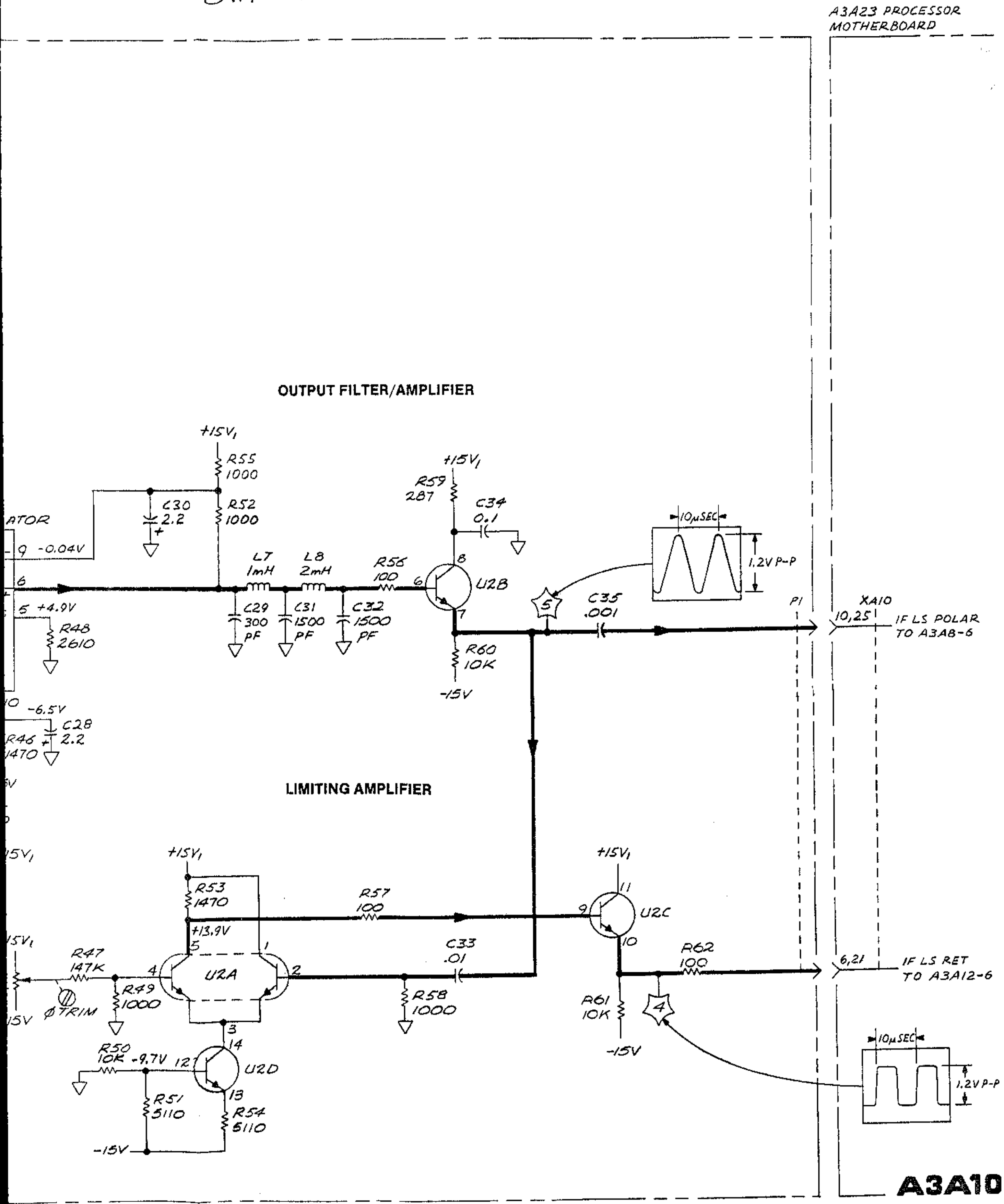


Figure D3-38. A3A10 Phase Offset I, Schematic

A3A11 GROUP DELAY DETECTOR

General Theory

Group delay is a measure of the time delay introduced in a signal as it passes through a device. Group Delay is also equal to the rate of change of phase with respect to frequency.

$$t_D = (t_T - t_R) = -\frac{\frac{d\phi}{dt}}{\frac{dF}{dt}} = -\frac{\Delta f}{\frac{dF}{dt}} = -\frac{d\phi}{dF}$$

t_D = group delay [seconds]
t_T = travel time through device under test (D.U.T.)
t_R = travel time through reference
$d\phi$ = change in phase
dF = change in frequency [Hertz]
Δf = difference in frequency between IF Test and IF Ref.

Refer to Figure D3-38A for a simplified block diagram of the A3A11 Group Delay Detector.

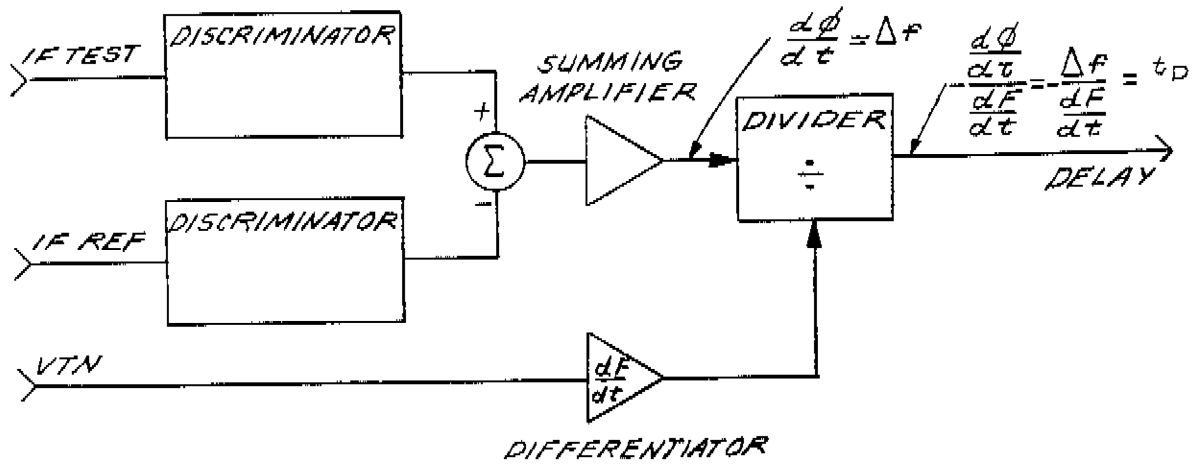


Figure D3-38A. A3A11 Group Delay Detector Simplified Block Diagram

General Description

The frequency of each IF signal is measured by a discriminator which produces an output signal proportional to the frequency of the signal at the input of the discriminator. The outputs of the two discriminators are connected to a summing amplifier/LPF which produces a signal equal to the difference between the two signals Δf. The A1 RF Source also supplies a tuning signal which changes value in accordance with the RF frequency. A differentiator circuit differentiates the tuning signal to produce a signal which indicates the instantaneous rate of change (slope) of frequency dF/dt from the A1 RF Source. Both the frequency difference signal, Δf, and the slope signal, dF/dt, are applied to divider circuit where the result is a signal which indicates the group delay caused by the device under test.

$$-\frac{\frac{d\phi}{dt}}{\frac{dF}{dt}} = -\frac{\Delta f}{\frac{dF}{dt}} = t_D$$

Detailed Description

Both the IF TEST and IF REF Signals pass through gated amplifiers composed of Q1, 2 and Q15, 16 before going to discriminators which produce dc signals having current proportional to the input frequency. Since the discriminators operate open loop, a calibrator circuit is provided to periodically calibrate both discriminators. The calibrator is composed of a 100 kHz multivibrator going to the input of both discriminators. At the same time the signal is applied to the discriminators, a switch, U4A, is closed connecting the output of the summing amplifier to the feedback sample hold circuit U2. U2 is used as an integrator and is connected to gain control element of the IF TEST discriminator. When the input signals to both discriminators are the same, the output of the summing amplifier is zero. After a few milliseconds, the multivibrator is turned off and the switch U4A is opened and normal operation is resumed. This calibration procedure is repeated during every retrace, or every second, if the sweep of the swept frequency generator takes longer than a second.

The outputs of the discriminators are applied to the summing amplifier. The output of the summing amplifier is the difference between the two discriminator outputs which is proportional to the frequency difference ΔF. The tuning voltage, VTN, is connected to a differentiator which differentiates the tuning voltage to produce a signal proportional to the rate of change of frequency dF/dt. The output of the differentiator is connected to the divider circuit through a synchronous low pass filter. The output of the summing amplifier is also applied to the divider. The divider produces an analog output signal proportional to the ratio of $-\Delta F/(dF/dt)$. This signal then passes through a sample and hold circuit.

Synchronous Low Pass filter and the sample and hold circuit are controlled by the timing and control logic so that during a sweep of the A1 RF Source both circuits remain closed allowing the signals applied to them to pass through.

When making small freq/time steps (long scan time, or narrow frequency sweeps) the frequency rate of change, dF/dt, becomes so small that the IF phase noise causes an objectionably noisy group delay output. To minimize phase noise, the group delay detector then goes into a 1 kHz sampling mode. When the group delay detector is in the 1 kHz sampling mode, a sawtooth signal generator is turned on by the timing and control logic. This sawtooth signal is applied to the A1 RF Source through VGD.

The sawtooth signal is summed into the tuning voltage in the A1 RF Source so that the tuning voltage has the 1 kHz sawtooth superimposed on the ramp.

The threshold level at which the sawtooth generator is triggered is determined by Comparator U11B. In order to provide a smooth slope, a synchronous low pass filter samples the output of the differentiator at the peak of each sawtooth and holds that value until the end of the next sawtooth. This signal is applied to the divider and the output of the divider is likewise sampled by the sample and hold circuit to produce a smooth output signal.

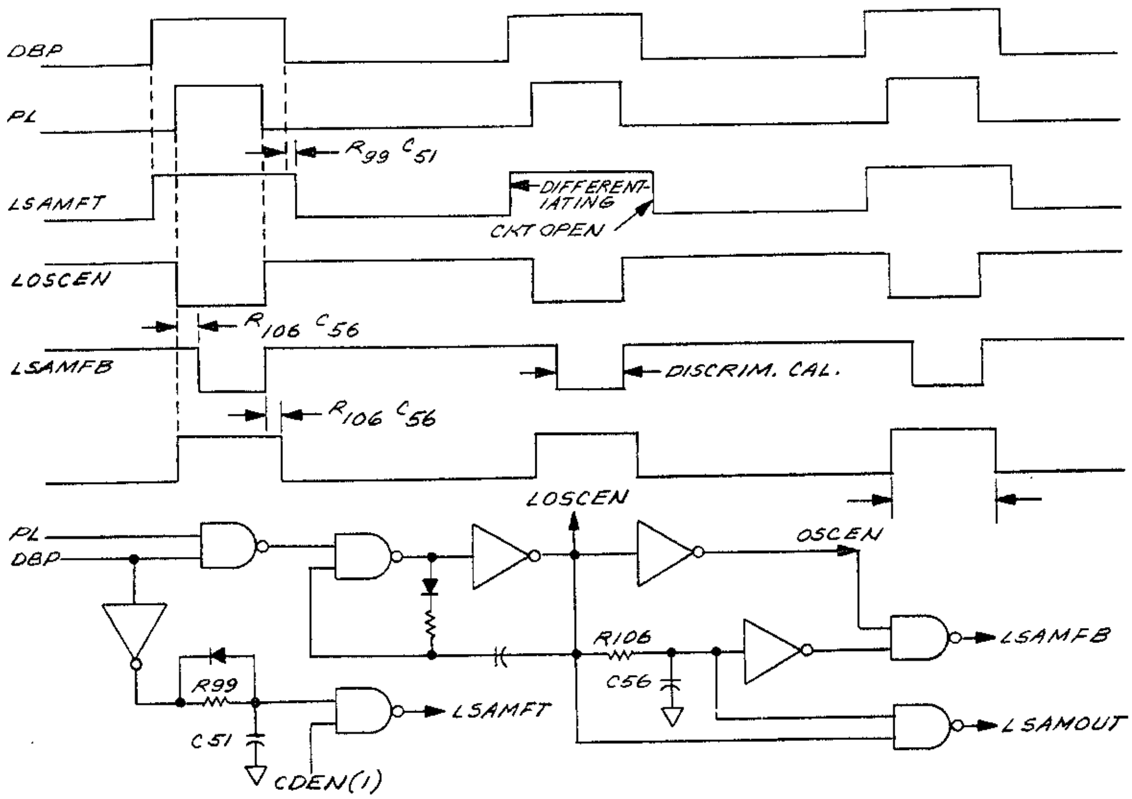


Figure D3-38B. A3A11 Group Delay Detector Continuous Mode Timing Diagram

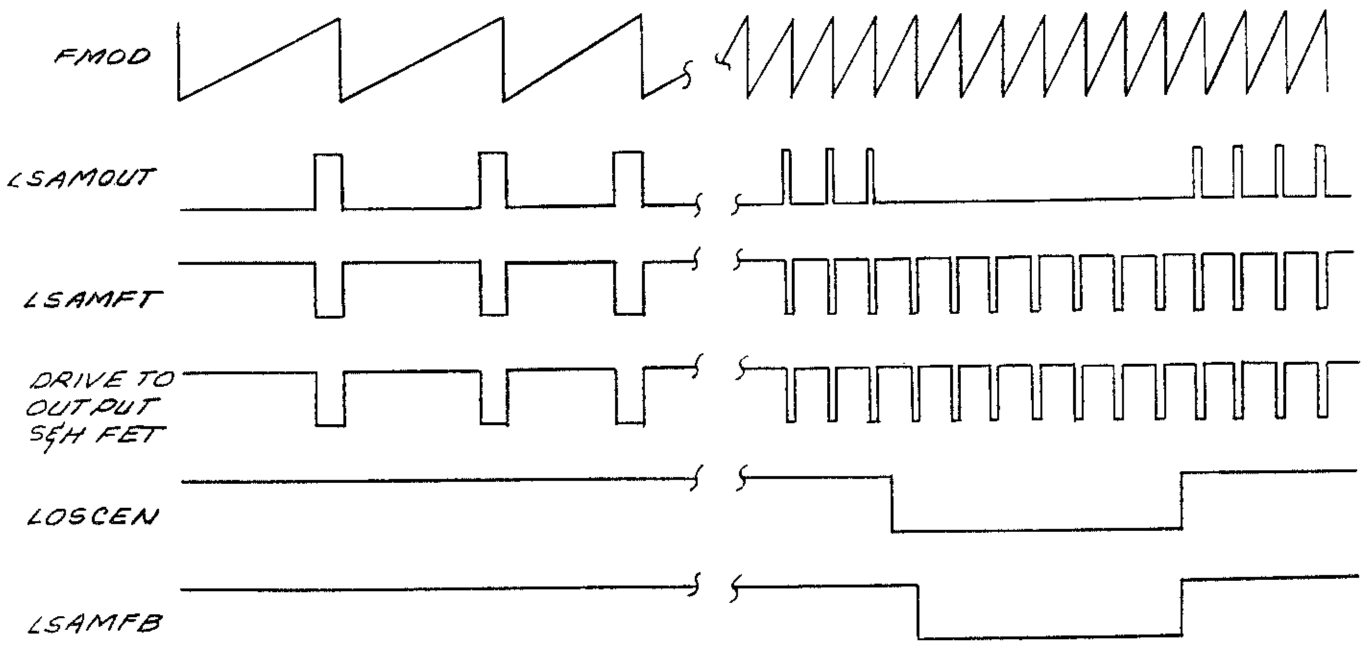


Figure D3-38C. A3A11 Group Delay Detector Sampling Timing Diagram

FIG. D3-38D
SHT 1 OF 2

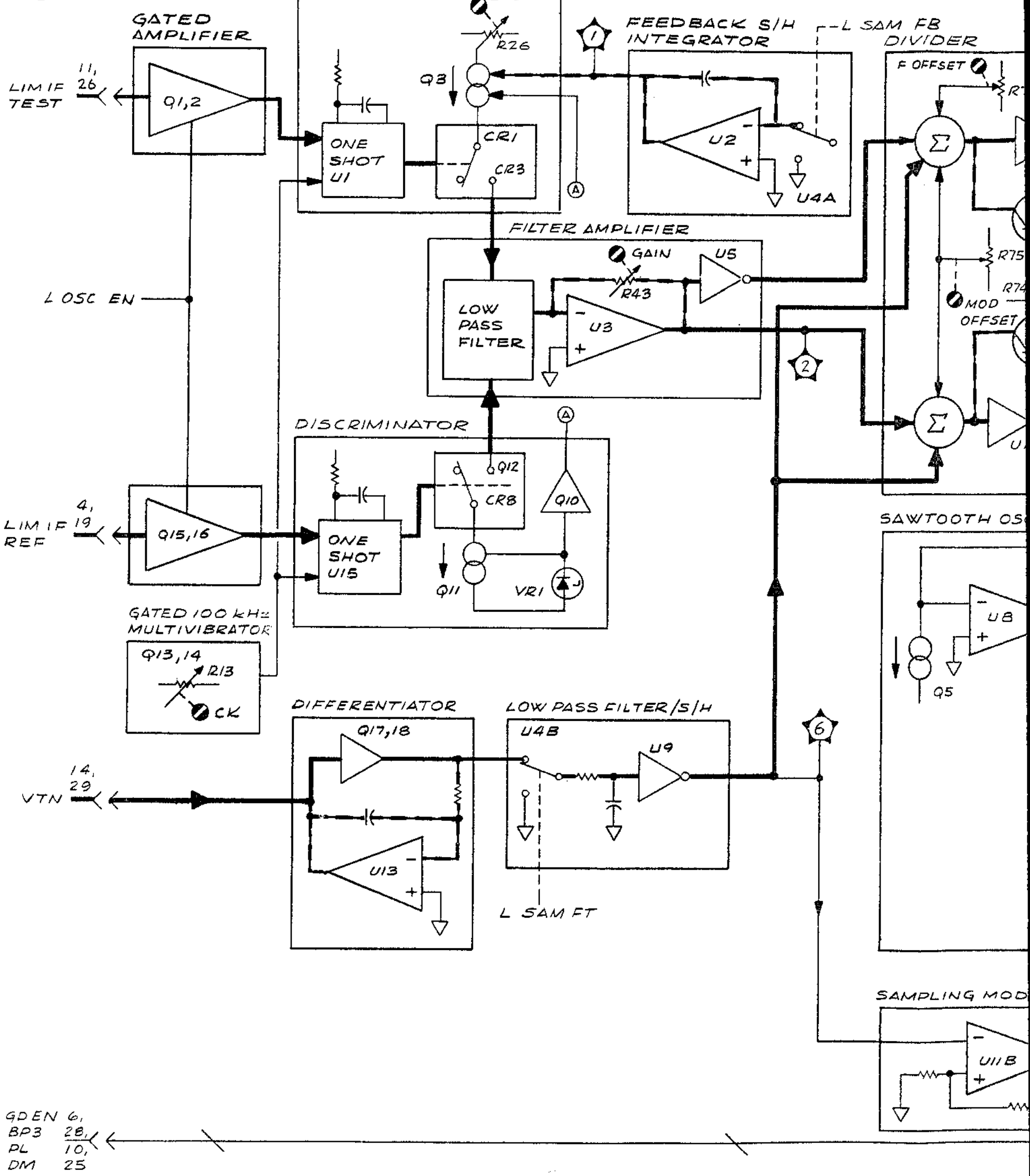


FIG. D3-38D
SHT. 2 OF 2

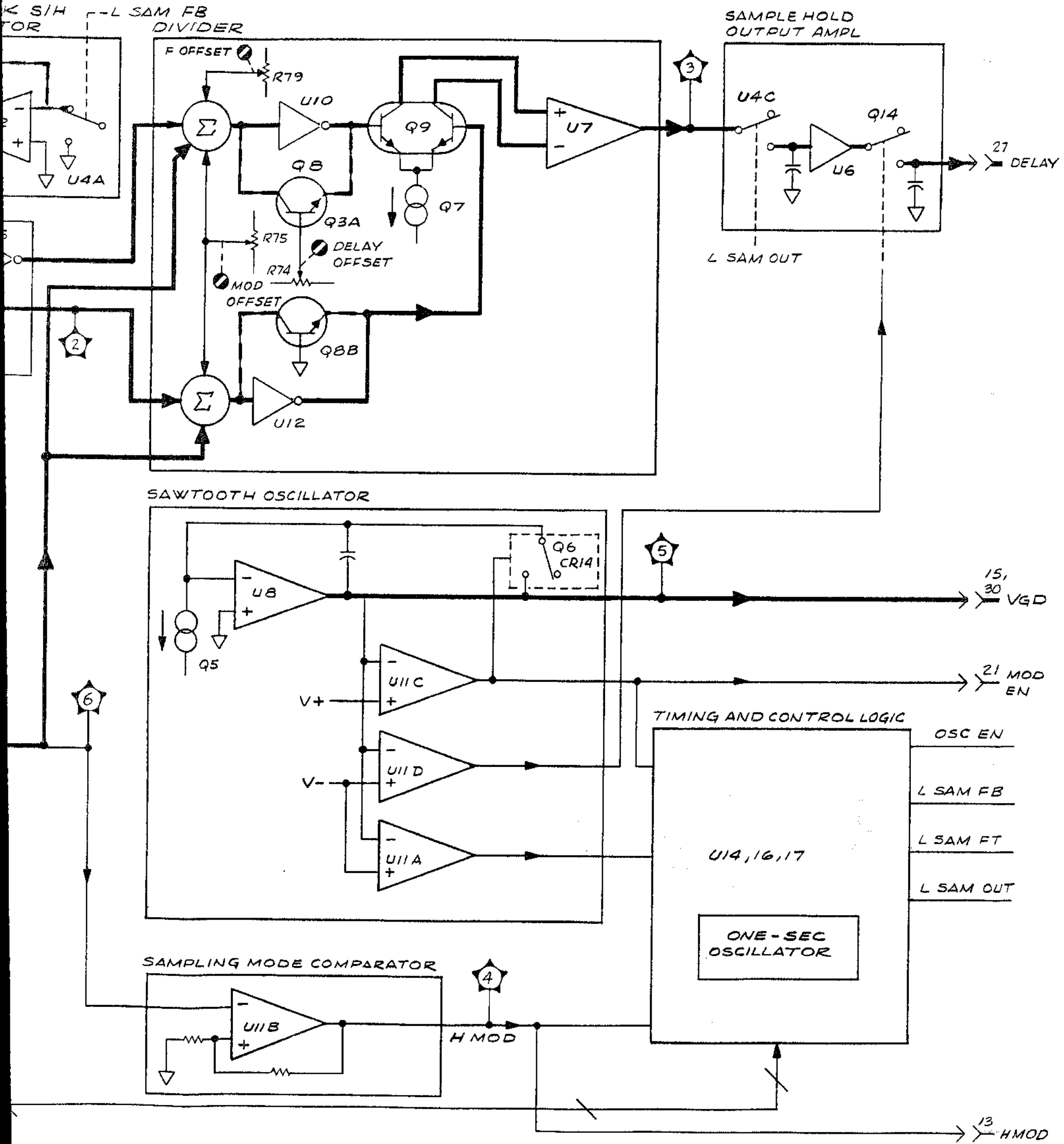


Figure D3-38D. A3A11 Group Delay Detector, Block Diagram

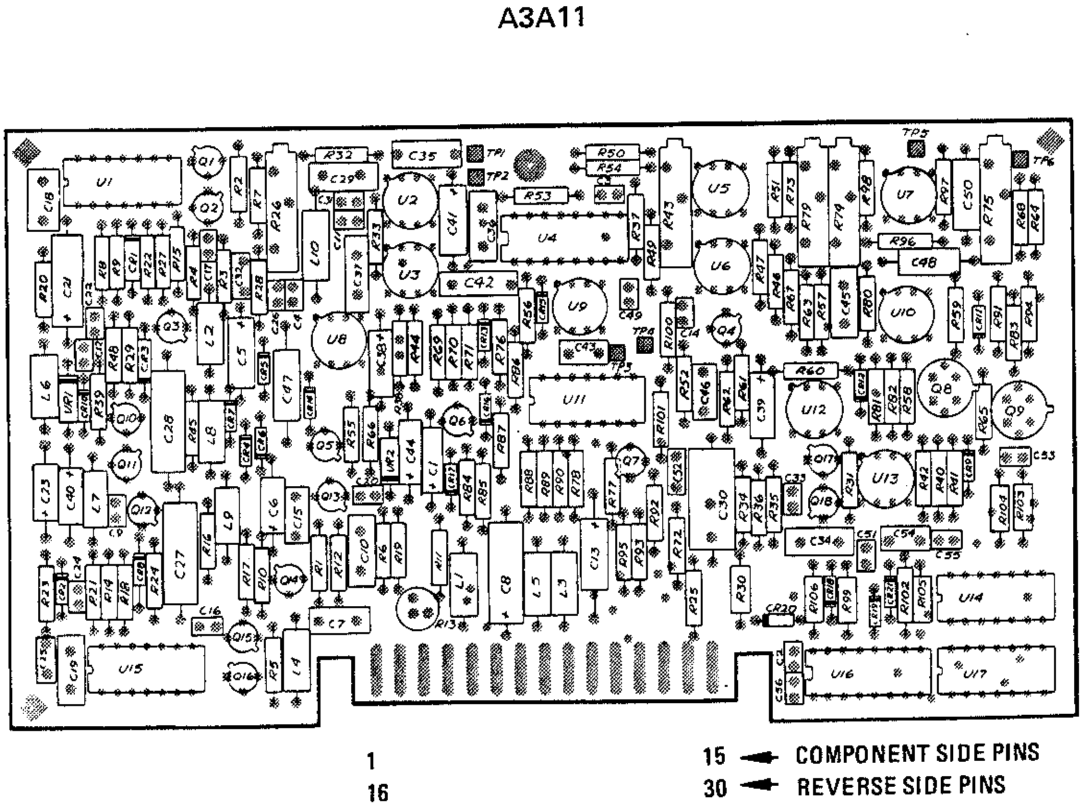


Figure D3-39. A3A11 Group Delay Detector Parts Locations

FIG. D3-40
SHT. 1 OF 3

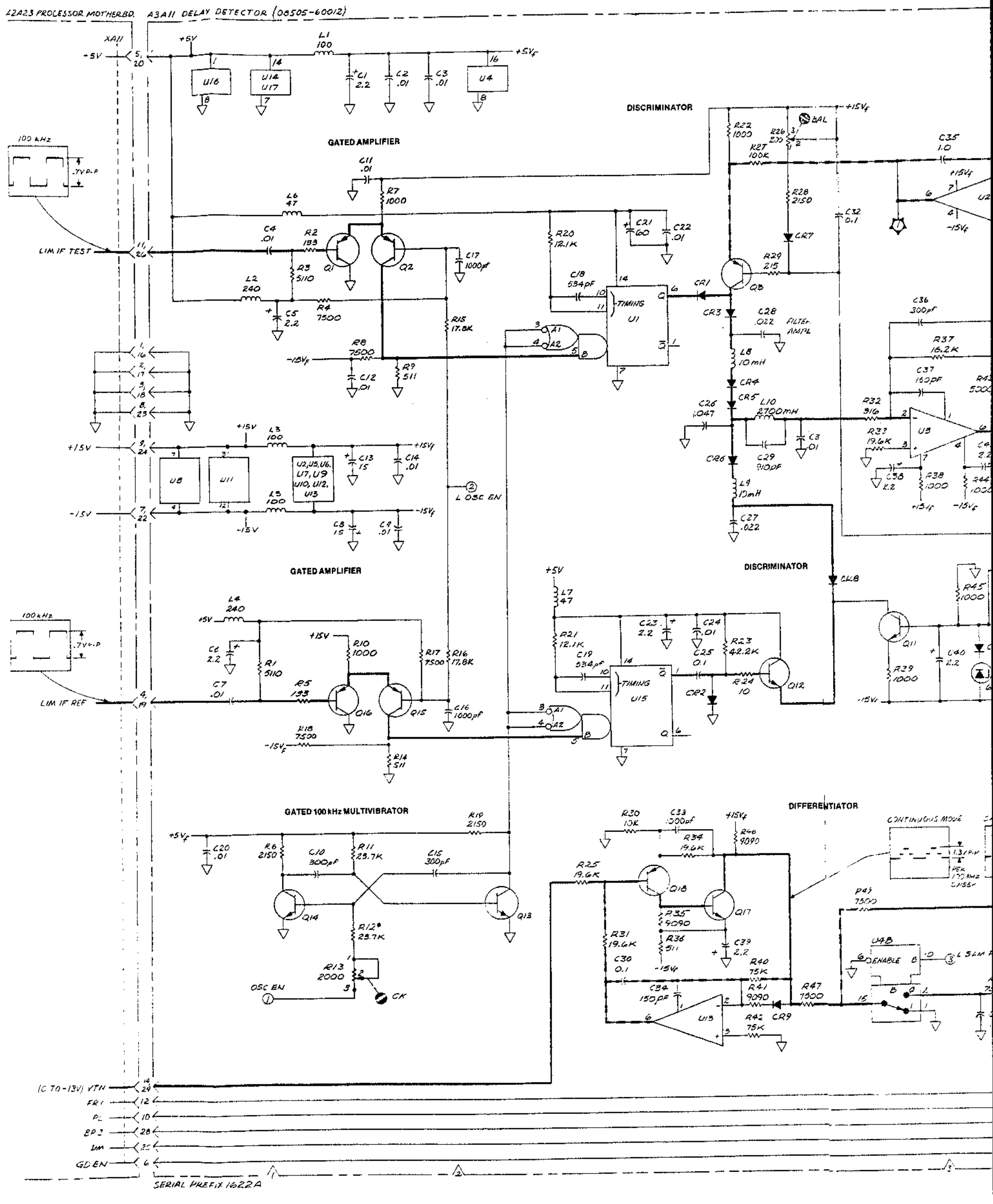


FIG. D3-40
SHT. 2 OF 3

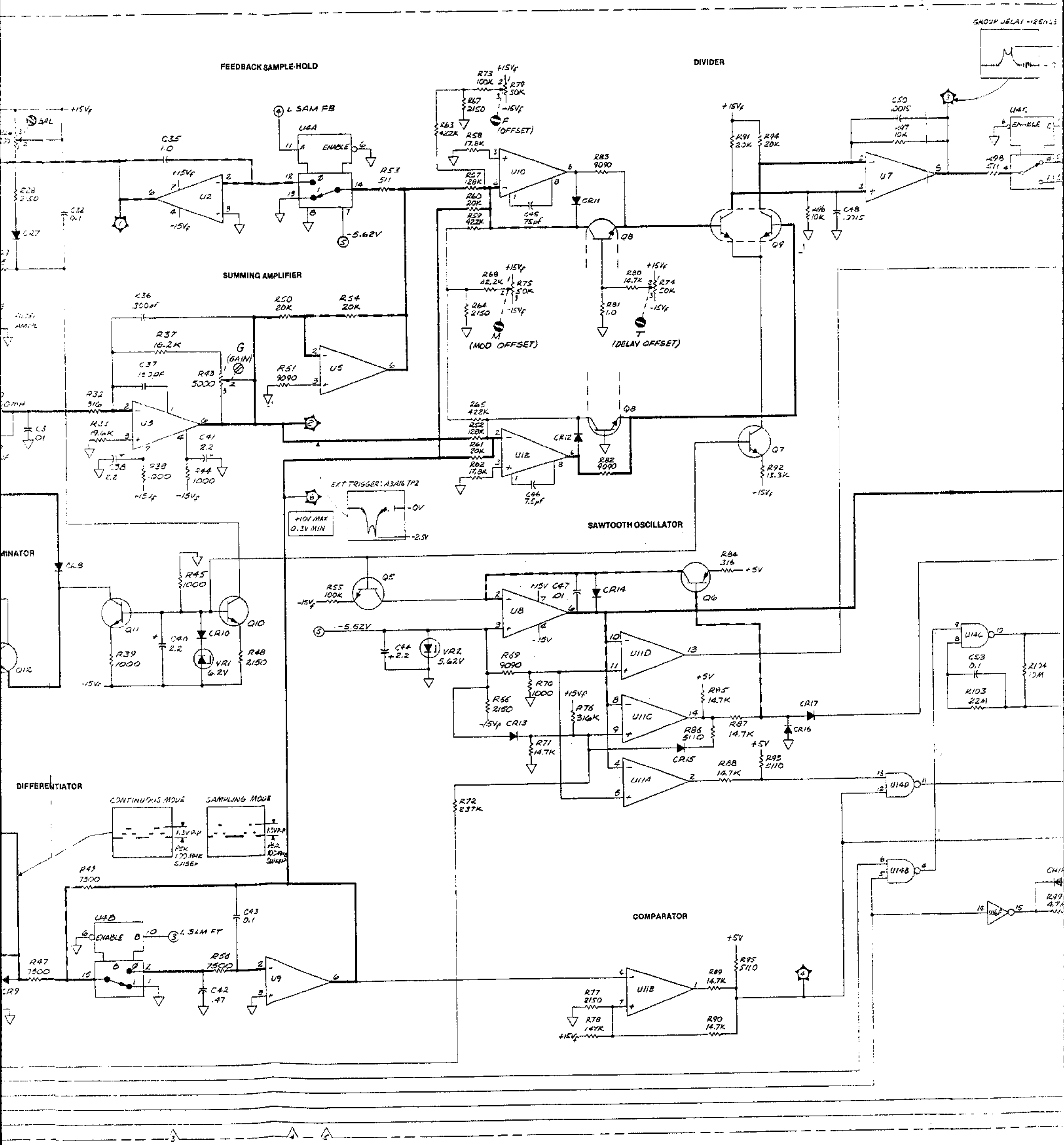


FIG. D3-40
SHT. 3 OF 3

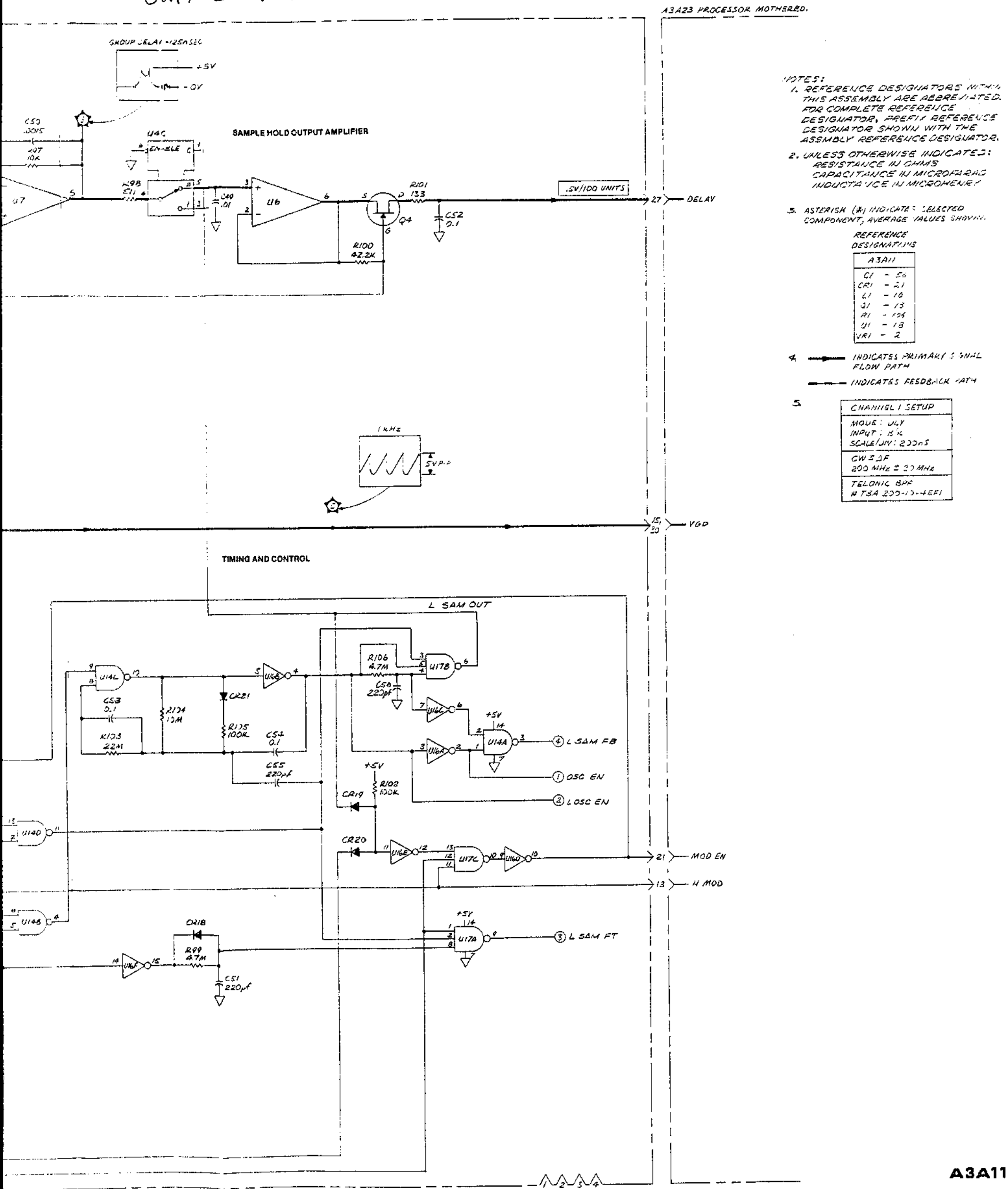


Figure D3-40. A3A11 Group Delay Detector, Schematic

A3A12 PHASE DETECTOR

General Description

The A12 Phase Detector Assembly receives two filtered and buffered 100 kHz IF signals from the A13 and A14 Magnitude Detector Assemblies. The IF REF input is the Port R 100 kHz IF signal from A13 and IF TEST is the 100 kHz IF signal, Port A or B, selected and processed by A14. Two identical limiter chains amplify and limit these signals over the 100 dB dynamic operating range of the 8505A. The output of the IF TEST limiter chain is shaped by a Schmitt trigger amplifier and applies to the reset (R) input of the flip-flop phase detector (U3). The output of the IF REF limiter chain leaves the board as LIM IF REF and gets offset in phase by the A9 and A10 Phase Offset assemblies. The Phase Offset output signal, IF LS RET, returns to the Phase Detector and is shaped by a Schmitt trigger amplifier before being applied to the set (S) input of the flip-flop phase detector. The duty cycle of the flip-flop outputs (Q, Q) are proportional to the phase difference of its inputs and are used to drive a current switch (Q2/Q3). The current switch output is low-pass filtered, amplified and offset to provide a dc level PHASE output that is proportional to the phase difference of the two 100 kHz IF inputs to the flip-flop phase detector (U3). The Phase Detector output (PHASE) therefore represents the phase relationship of IF input Port A or B to the reference input Port R.

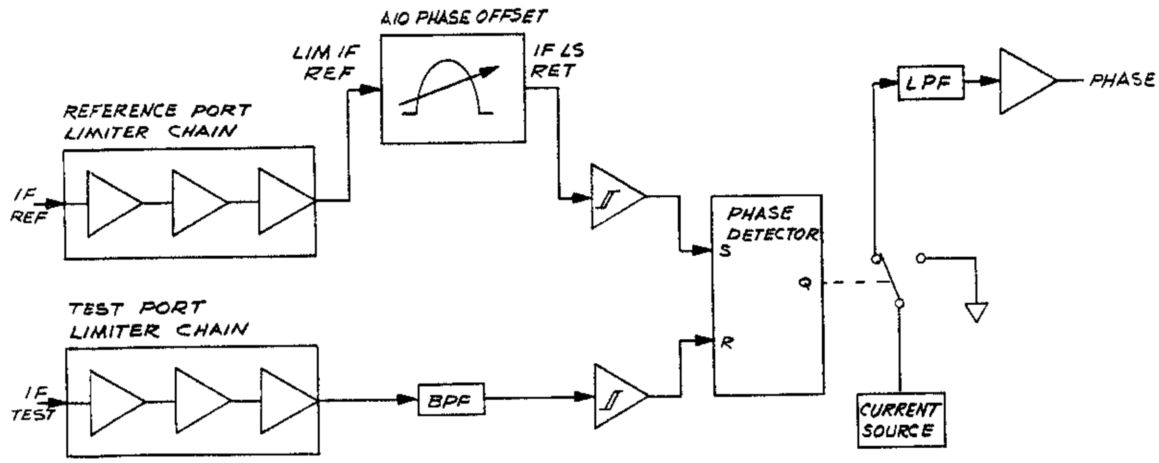


Figure D3-40A. A3A12 Phase Detector Simplified Block Diagram

Limiting Amplifiers and Bandpass Filters

Both the IF REF and IF TEST 100 kHz inputs from the A13/A14 Magnitude Detectors go through identical limiter chains consisting of two limiting amplifiers followed by a band-pass filter then another limiting amplifier. Because both limiter chains are identical, only the IF REF chain is explained in detail. The first limiting amplifier stage uses dual transistor Q7 as a differential amplifier and Q6 as the output buffer. This stage has a gain of approximately 26 dB. The IF REF 100 kHz input is differentially amplified with IF REF RET, which is grounded on the A13 Magnitude Detector, to eliminate ground loops and maintain greater than 110 dB isolation between the IF REF and IF TEST inputs. The second limiting stage provides approximately 40 dB gain and uses two wide-bandwidth Emitter Coupled

Logic (ECL) limiting differential amplifiers (U6A, U6B). The input offset of this stage is removed by adjusting R19 (REF BAL 1). Nulling this offset results in a symmetrical square-wave output and minimizes even order harmonics that would cause level dependent errors in the phase measurement. Bandpass filter (L7, C21) filters the 100 kHz IF signal to eliminate signal noise due to the high amplification of the first two limiting amplifiers. Inductor L7 (RØ) is adjusted to center the bandpass frequency at 100 kHz. Emitter follower Q1 buffers the filtered IF signal and drives the final limiting amplifier stage consisting of two ECL limiting differential amplifiers (U1A, U1B). Operation of this limiting amplifier stage is identical with the second limiting stage (U6A, U6B). REF BAL 2 (R31) removes its input offset. The Limited IF Reference output (LIM IF REF) from U1A goes to the A10 Phase Offset Assembly where offsets in phase can be added before it is returned to the Phase Detector as IF LS RET. The LIM IF REF signal is also sent to the A11 Group Delay Detector where it is used for group delay measurements. The IF TEST limiting amplifier chain has two outputs. The LIM IF TEST output (TP7) is used on the A11 Group Delay Detector for group delay measurements and the other output is used to drive the Equalizer Bandpass Filter (L11, C35).

Equalizer BP Filter

The purpose of the Equalizer BP Filter (L11, C35) is to introduce a time delay to the IF TEST signal that is equal to the time delay introduced into the LIM IF REF signal on the A10 Phase Offset Assembly. The filter is aligned for a 100 kHz center frequency by adjusting L11 (LSØ). Emitter follower Q4 buffers the bandpass filter output and drives the BPF IF TEST signal going to a Schmitt trigger amplifier (U4) and the A8 Polar Converter Assembly.

Schmitt Trigger Amplifiers (U2 and U4)

The purpose of the two Schmitt trigger amplifiers (U2, U4) is to take the slow rise time IF inputs and generate a square wave with very fast rise time (2 nsec). Both trigger amplifiers use the same type ECL limiting differential amplifier used in the limiter stages, but positive feedback is used to generate the required "snap" action. Schmitt trigger amplifier U2 receives the 100 kHz IF LS RET input from the A10 Phase Offset Assembly. This IF LS RET signal is the LIM IF REF output from the reference limiting amplifier chain with any phase offsets entered on the front panel added by the A10 Phase Offset Assembly. Voltage divider network (R42, R43) determines the amount of positive feedback in U2 Schmitt trigger amplifier for providing a sharp edged square wave output to the U3 flip flop phase detector. U4 Schmit trigger amplifier receives the 100 kHz BPF IF TEST signal from the Equalizer BP Filter and its operation is similar to the U2 Schmit trigger amplifier in the reference line. However, a small amount of hysterisis feedback from the final Phase output is summed into the positive feedback loop. This provides a small amount of control over the trigger threshold of U4 to give a slight phase offset of the square-wave output to the flip-flop phase detector (U3) and prevent random switching between the plus and minus 180 degree transition points.

Flip Flop Phase Detector

U3 flip flop phase detector is an ECL flip flop with edge sensitive SET (S) and RESET (R) inputs. On the rising edge of the SET input (Reference) the Q output will go high and on the rising edge of the RESET input (Test) the Q output will return low as shown in the timing diagram (Figure D3-40B). The Q output pulse width is the difference between the leading edges of the two IF input square waves. So as the phase difference between the 100 kHz IF inputs changes from −180 degrees to +180 degrees, the Q output will change from a narrow pulse to a pulse almost as wide as the time period for 100 kHz (10 μsec). The Q output pulse width is then a direct linear function of the phase shift between the reference and test IF inputs.

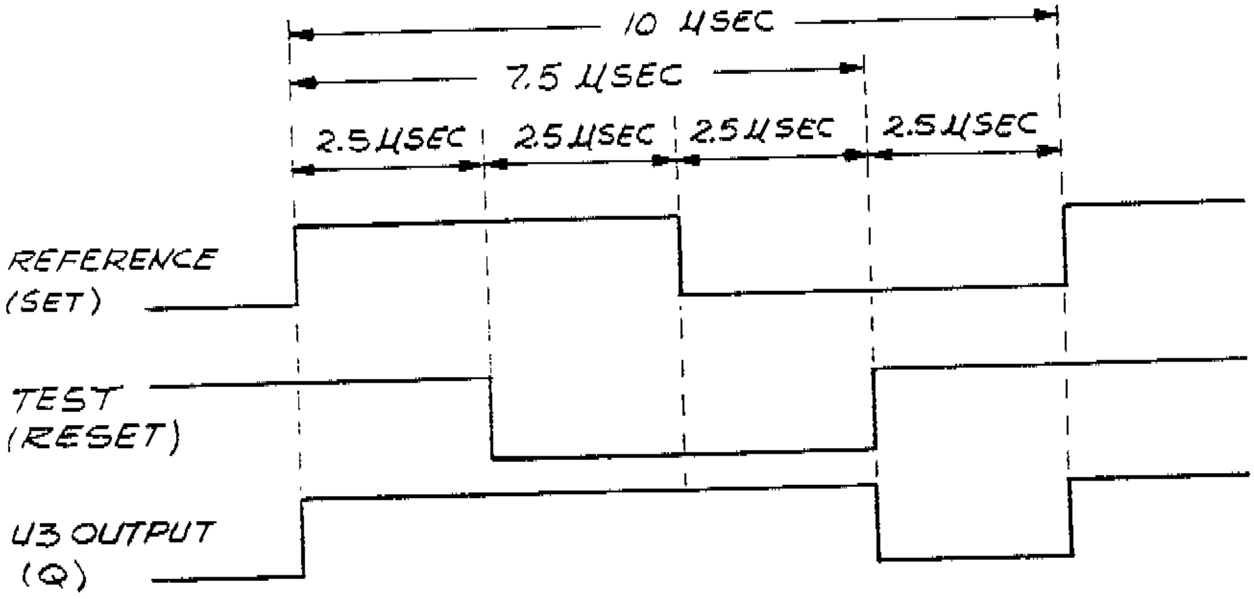


Figure D3-40B. U3 Flip-Flop Phase Detector Operation for +90° Phase Difference

Current Switch and Current Source

The flip flop phase detector outputs (Q, $\overline{Q}$) control a current switch (Q2, Q3) which switches the output of a reference current source (Q8, Q9, VR2). The current source consists of dual transistor Q8, zener diode VR2 and transistor Q9. VR2 establishes a reference voltage across R50 and R51. Potentiometer R50 (SCL) is used to adjust the current output of the current source and set the scale factor of the PHASE output. Q9 takes the base currents from Q8A and Q8B and adds them to the Q8A output. This compensates for current leakage through the base and makes the output independent of Q8 current gain. Depending on the U3 phase detector outputs (Q, $\overline{Q}$), the current switch directs the current source output either through Q2 to ground or through Q3 to the Filter/Offset Amplifier (U7). This results in a pulsed signal to the Filter/Offset Amplifier that has an average value directly proportional to the phase difference between the reference and test inputs to the U3 phase detector.

Filter/Offset Amplifier and LPF/Output Amplifier

The current switch Q3 output is low-pass filtered and amplified by U7 to produce a dc voltage scaled for 5 mV/degree of phase difference between the reference and test Port IF inputs. An offset voltage is supplied by VR1 to the positive input of U7. This voltage is adjusted by R57 (OFF) to provide an output that is symmetrical around zero volts (i.e. 0V 7 0 deg, +0.9V 7 +180 deg, −0.9V 7 −180 deg). This scaled dc voltage is again low-pass filtered and amplified by unity gain amplifier U8 to provide the 5 mV/degree PHASE out-

FIG. D3-40C

SHT. 1 OF 5 A3A12 PHASE DETECTOR

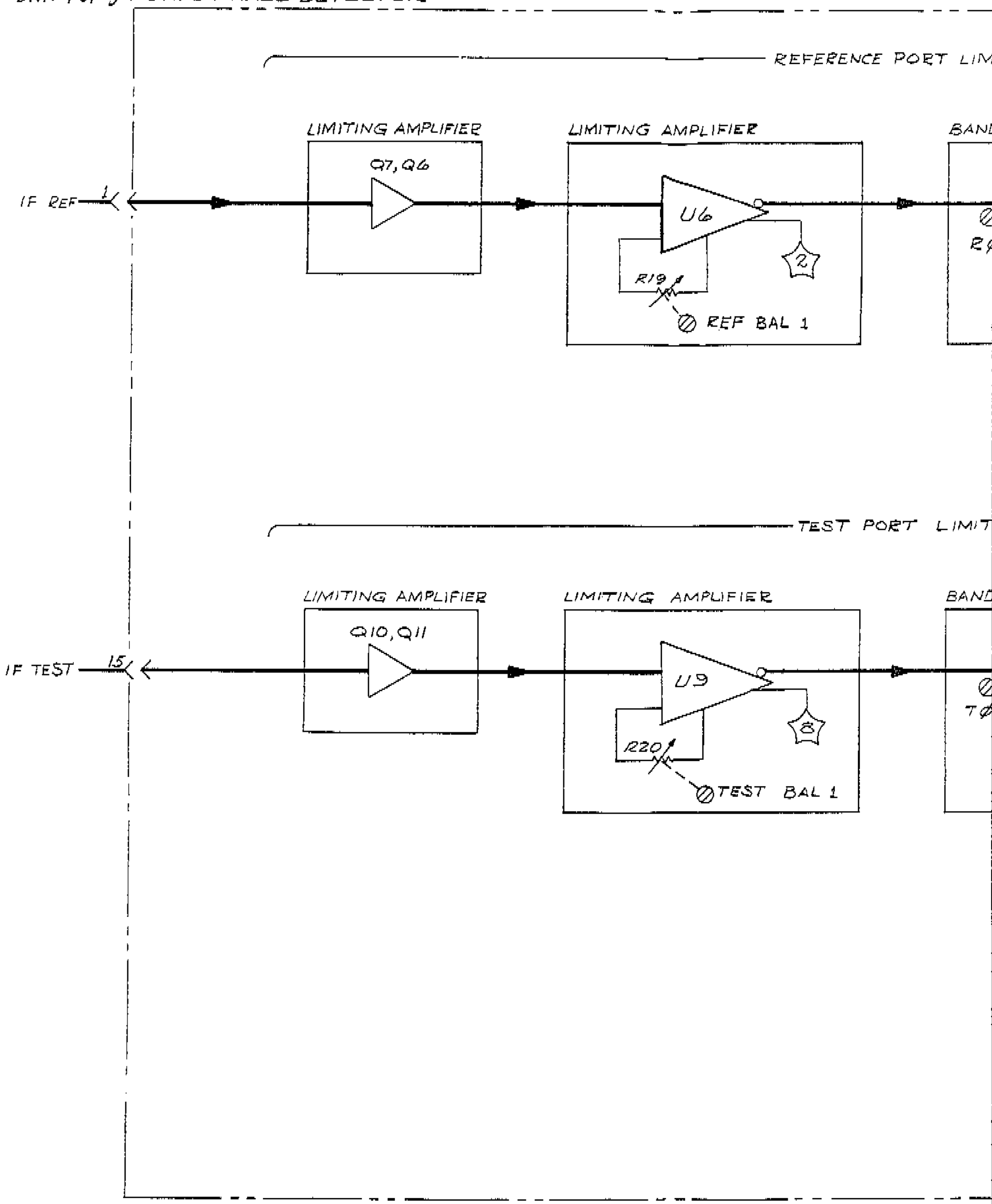


FIG. D3-40C
SHT. 2 OF 5

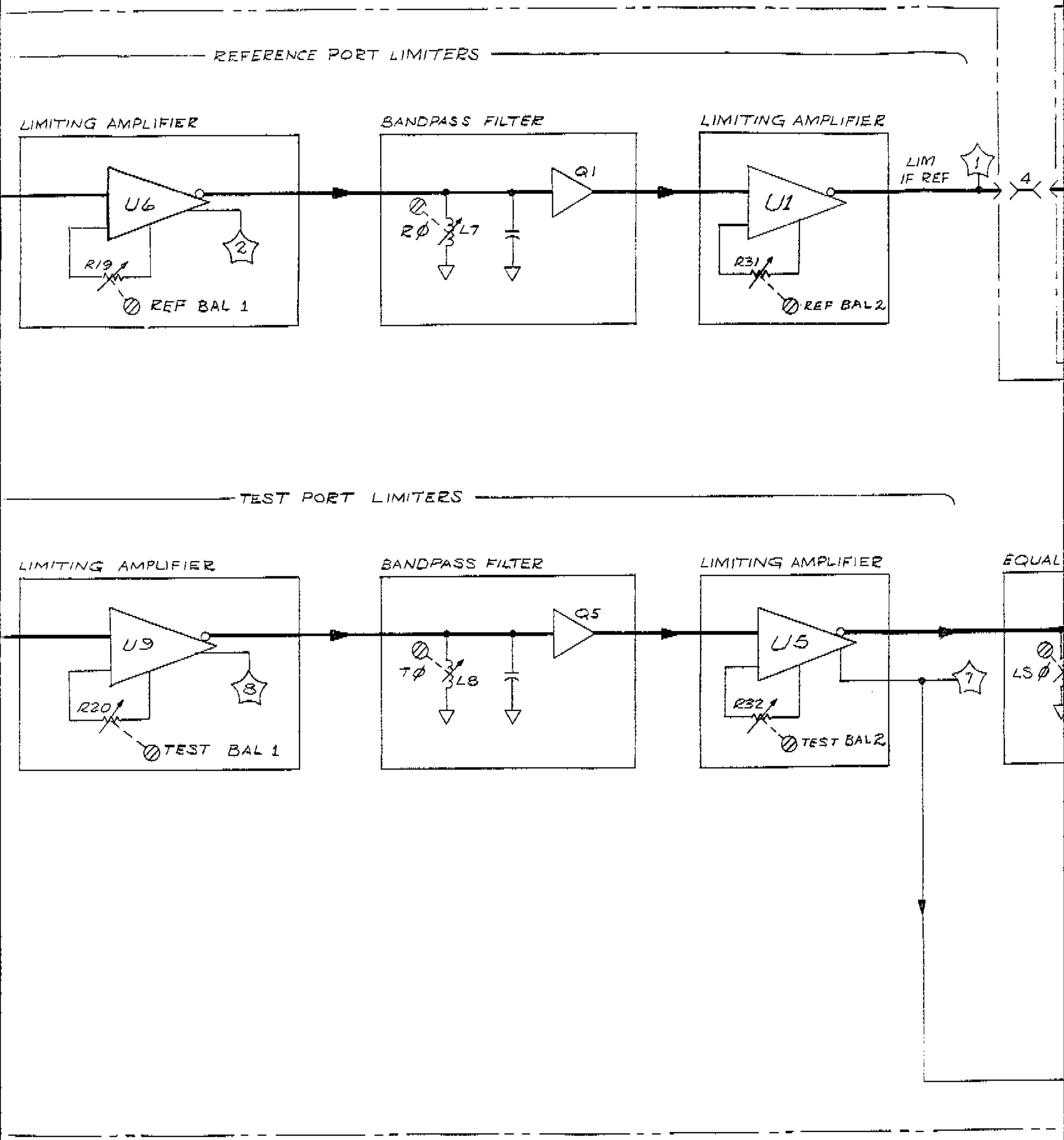


FIG. D3-40C
SHT. 3 OF 5

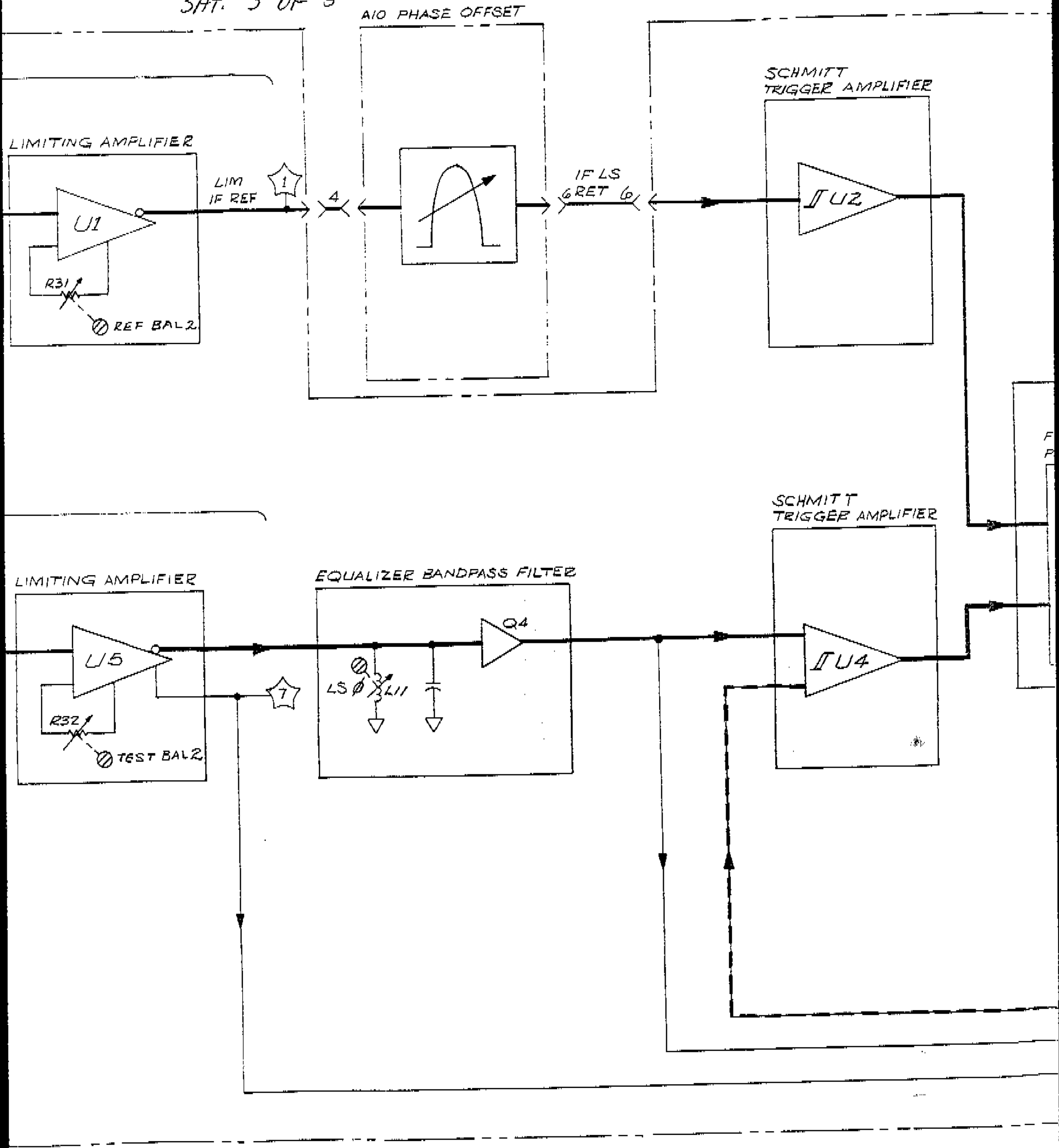


FIG. D3-40 C
SHT. 4 OF 5

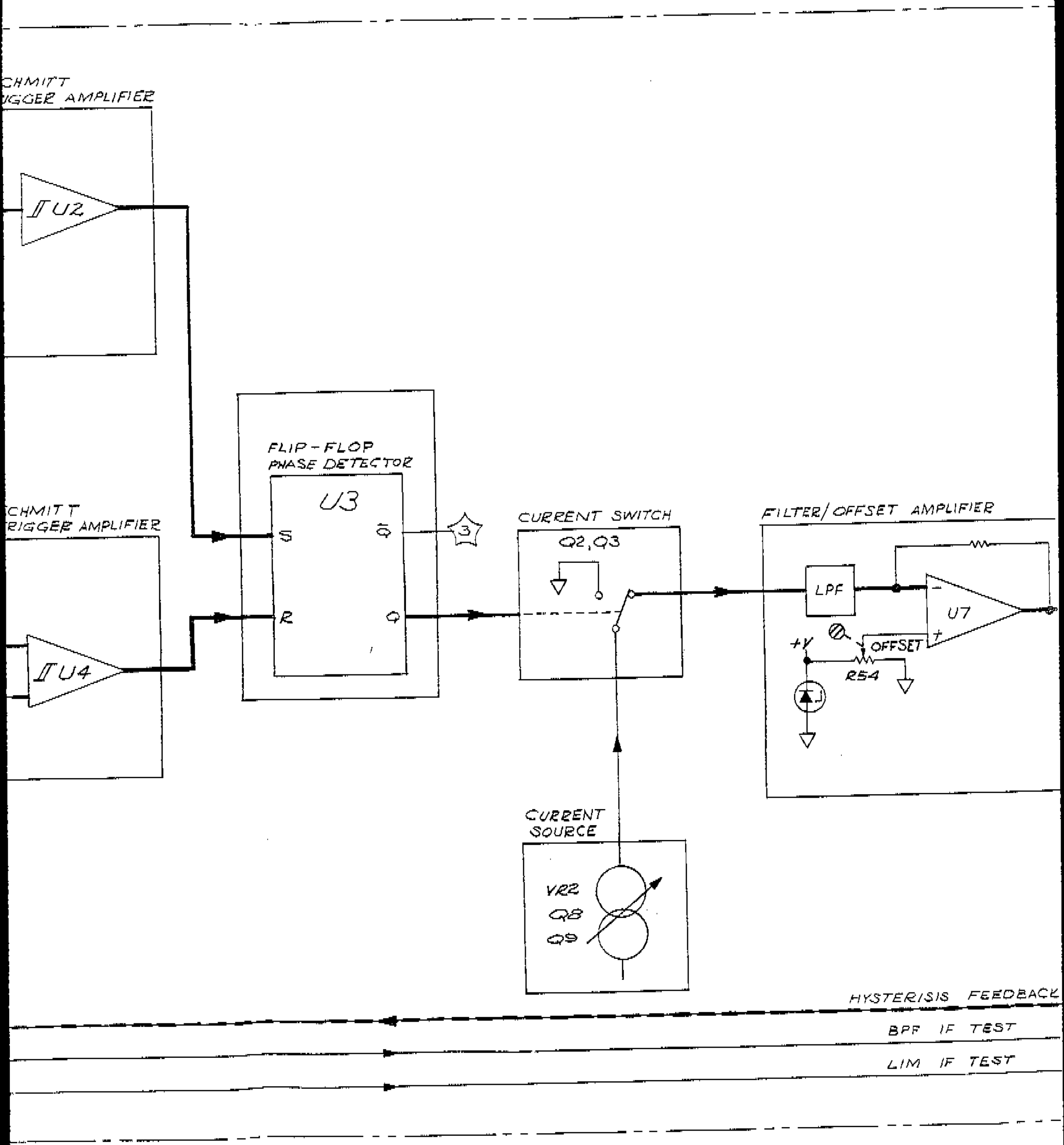


FIG. D3-40C
SHT. 5 OF 5

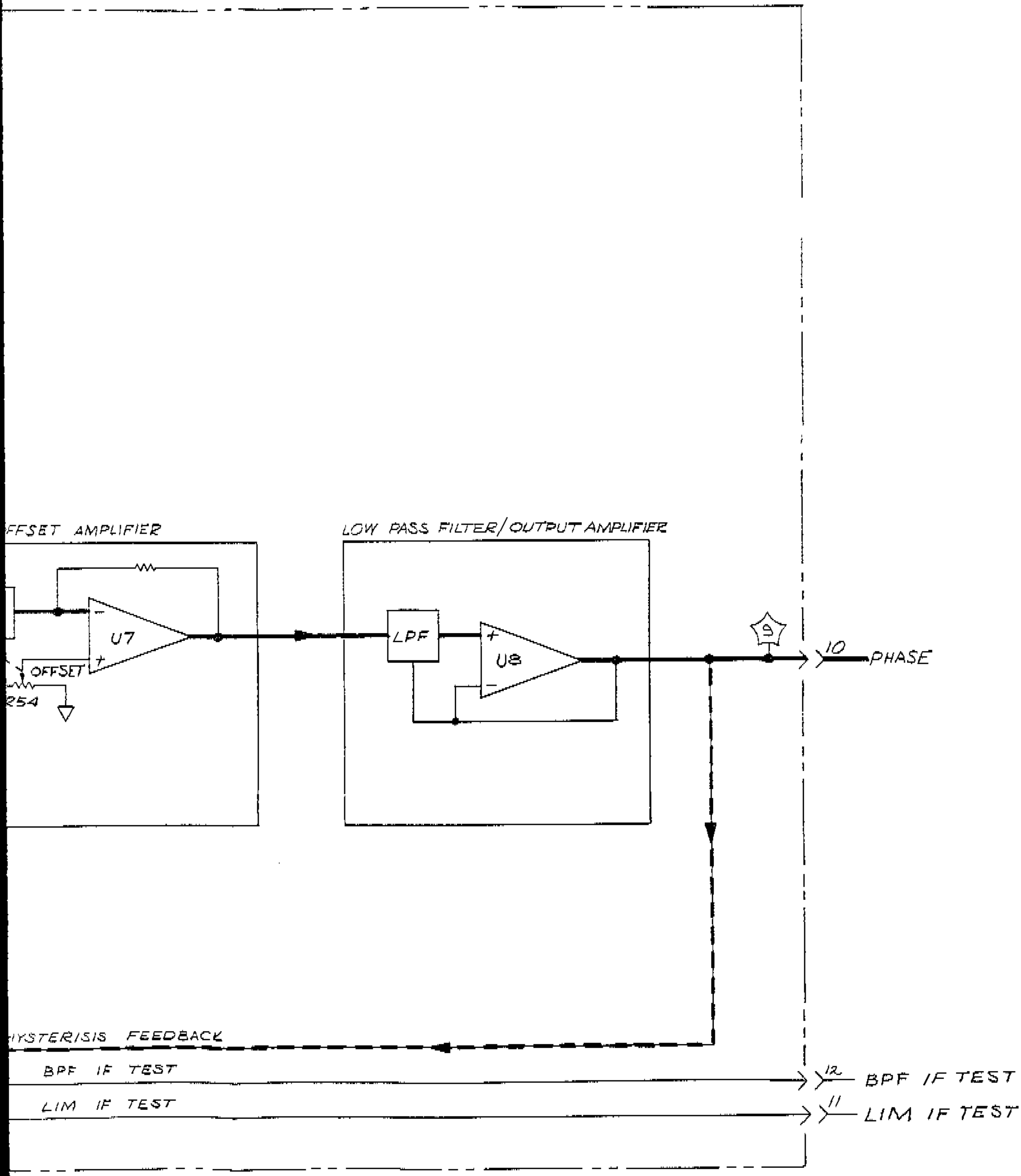


Figure D3-40C. A3A12 Phase Detector, Block Diagram

A3A12

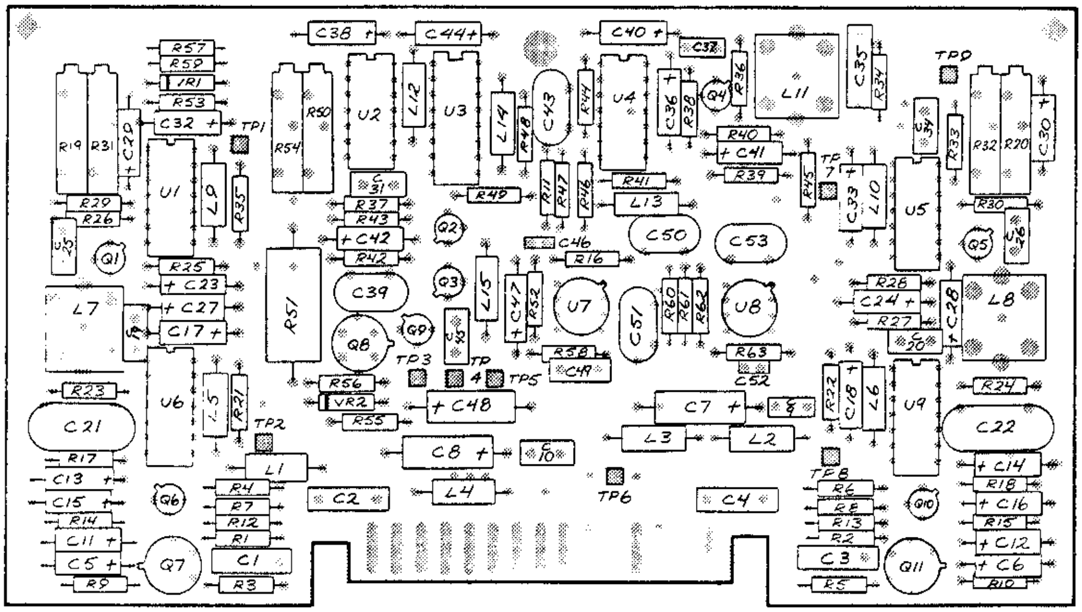
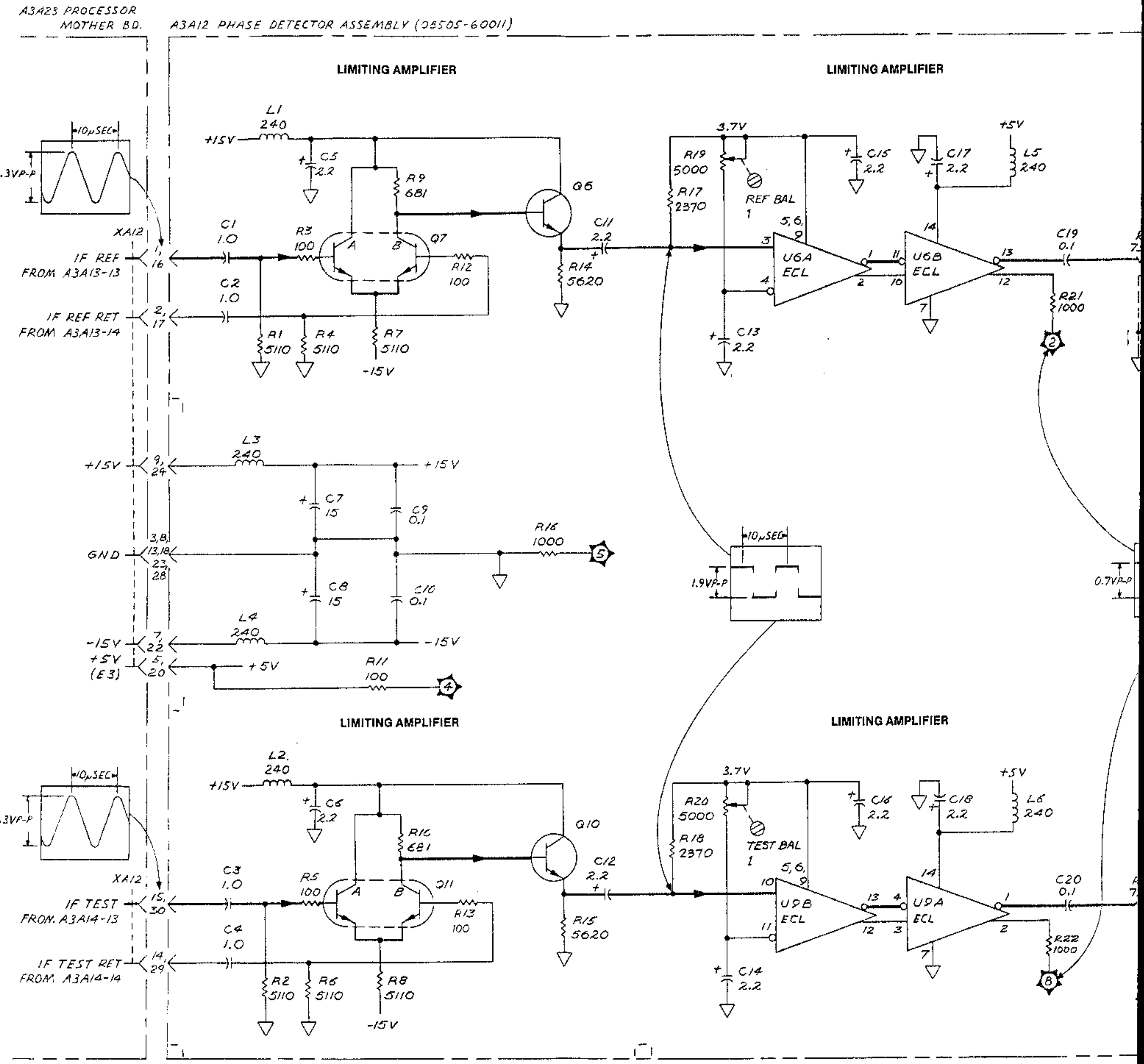


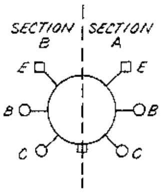
Figure D3-41. A3A12 Phase Detector Parts ***Locations***

FIG. D3-42
SHT. 1 OF 4



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATOR, PREFIX REFERENCE SHOWN WITH THE ASSEMBLY REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED, RESISTANCE IN OHMS, CAPACITANCE IN MICROFARADS, INDUCTANCE IN MICROHENRIES
3. ——▶—— INDICATES PRIMARY SIGNAL FLOW PATH
   ——▶—— INDICATES LOCAL FEEDBACK PATH
4. U1, U2, U4, U5, U6 AND U9 ARE EMITTER COUPLED LOGIC (ECL) AMPLIFIERS HAVING 0.7V p-p OUTPUTS.



DUAL TRANSISTOR
Q7, 8, AND 11 TERMINALS
(TOP VIEW)

REFERENCE DESIGNATIONS

A3A12
C1 - 53
L1 - 15
Q1 - 11
R1 - 63
U1 - 9
VR1 - 2

TEST SET
CHANNEL 1 :
MODE : PHASE
INPUT : A/R
SCALE/DIV : 45 DEG
REF OFFSET :
AS REQUIRED FOR +9
ELECTRICAL LENGT
400°/SCAN FOR TP 9
RF INPUT : -dBm FOR
CHANNEL 2 : OFF

FIG. D3-42
SHT. 2 OF 4

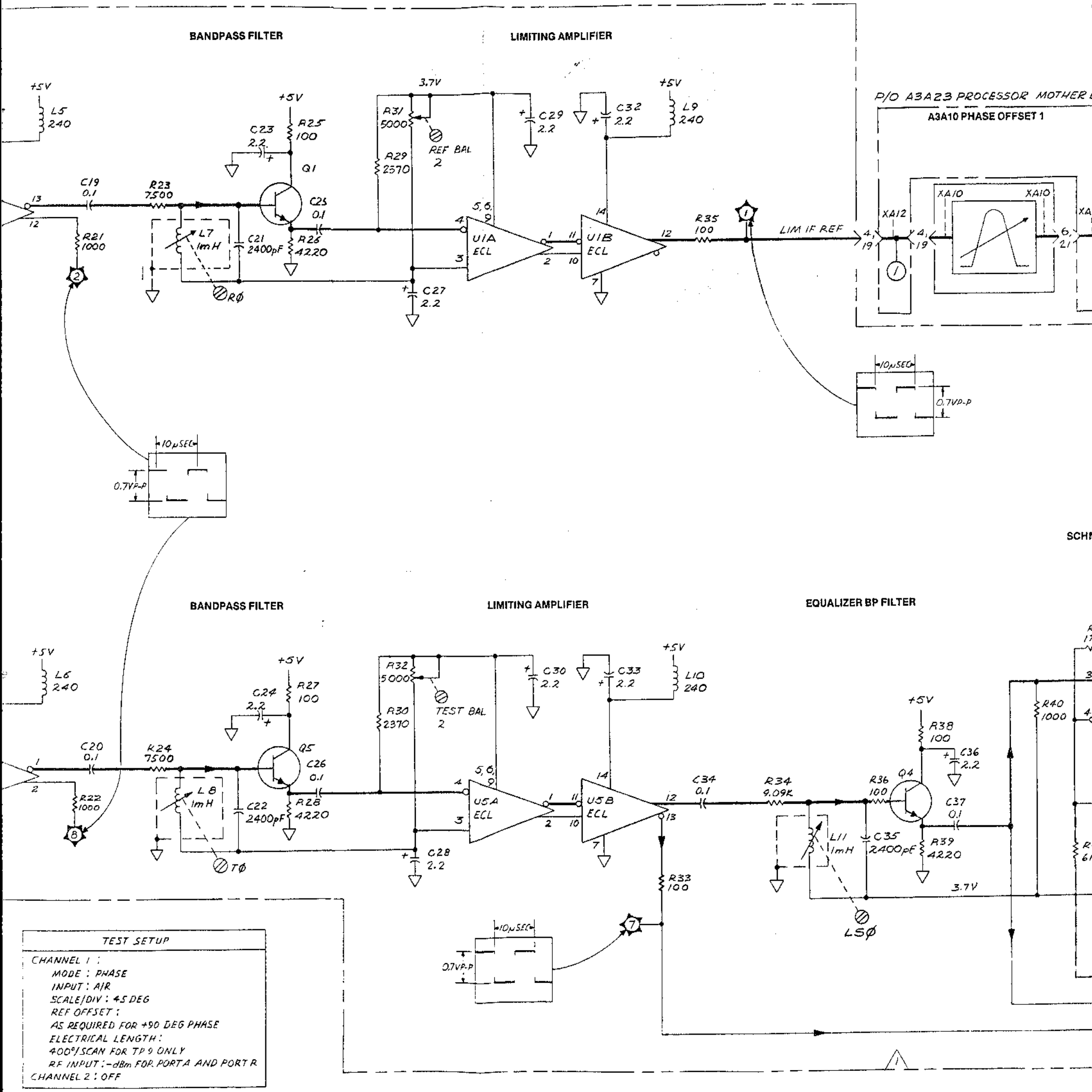


FIG. D3-42
SHT. 3 OF 4

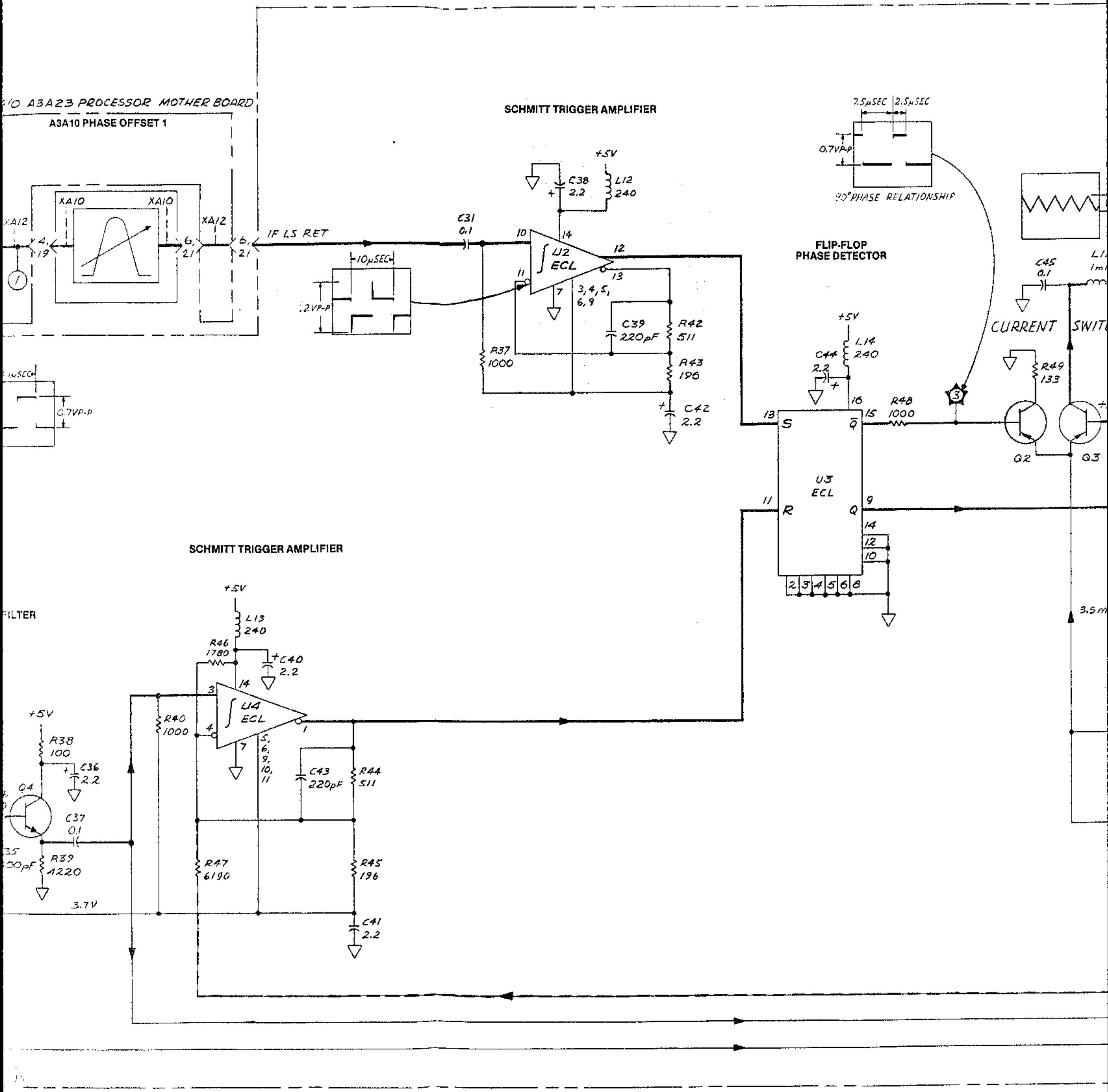


FIG. D3-42
SHT. 4 OF 4

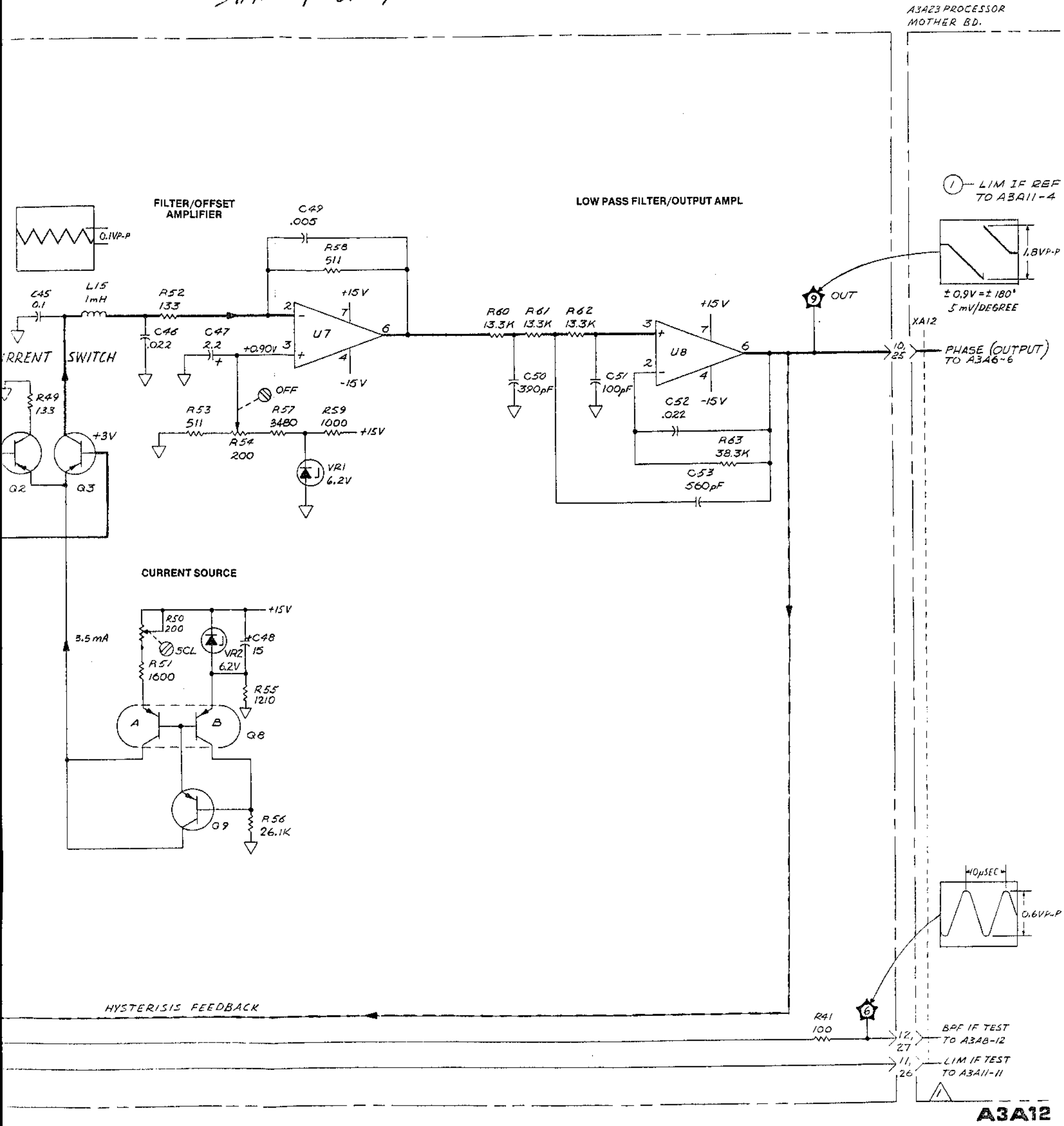


Figure D3-42. A3A12 Phase Detector, Schematic

A3A13 / A3A14 MAGNITUDE DETECTOR

General Description

The primary purpose of the A13/A14 Magnitude Detectors is to produce a dc signal that is proportional to the magnitude of the 100 kHz IF input signal from the A1 Source/Converter. Both Magnitude Detectors (A13 and A14) are electrically identical and the only difference between assemblies is the IF input signals processed. The A13 assembly receives the IF Port R input and the A14 assembly receives the IF Port A and IF Port B inputs. Each Magnitude Detector selects, scales, and filters a 100 kHz IF input and sends this processed IF signal to the A12 Phase Detector for phase measurements. This processed IF signal is also rectified to obtain a dc current. A logger then generates a voltage that is proportional to the log of this dc current. After this voltage is scaled and properly offset, it represents the absolute magnitude od the R, A, or B IF input signal selected.

Input Amplifier, Input Switch and IF Switch Driver

Each Magnitude Detector has two Input Amplifiers and Input Switches for selection of the 100 kHz IF input signal fed to the Switchable Gain Amplifier.

Each of the IF Input signals (R, A, and B) is fed to a two transistor differential amplifier with high common-mode rejection. A four pole series-shunt switch following each input amplifier either shunts the amplifier output current through two diodes to ground, or passes the current through two "on" FETs to the Switchable Gain Amplifier. The two Input Switches are controlled by the output of the differential switch driver (Q3, Q7). The Port A 100 kHz IF input is selected when the IF SEL input to the IF switch driver is low (0 Vdc). This drives the Q7 collector to approximately −7 Vdc, turning off FETs Q24 and Q25 and biasing diodes CR4 and CR6 on to give greater than 120 dB isolation from the Port B IF input. A low IF SEL voltage also drives Q3 collector to approximately +00 Vdc turning on FETs Q20 and Q21 and biasing diodes CR3 and CR5 off. This allows the Port A 100 kHz IF to pass through the FETs to the Switchable Gain Amplifier. The Port B 100 kHz IF is selected when the IF SEL input is high (+4.5 Vdc).

Switchable Gain Amplifier and Gain Switch Driver

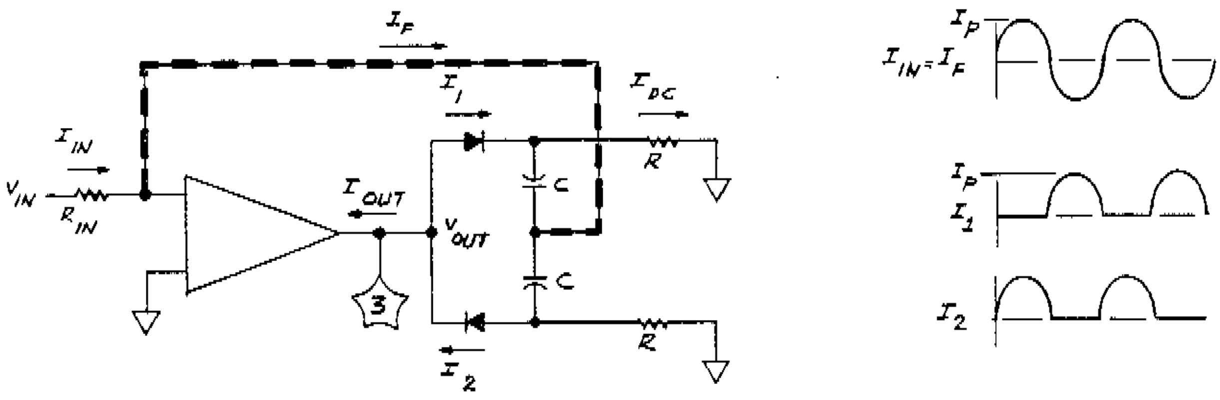
The Switchable Gain Amplifier is a summing amplifier (Q5, Q8) that has two resistors (R39, R46) in the feedback loop for determining gain. FET switch Q1 switches R39 in or out of the feedback loop to change the summing amplifier gain. When the A1 Source/Converter INPUT LEVEL switch is in the −10 dBm position, the IFG (IF Gain) input to the Gain Switch Driver (Q2, Q29, Q30) is +4 Vdc. This drives Q2 collector to + 14.5 Vdc to turn on FET switch Q1 and short feedback resistor R39. This reduces the resistance in the summing amplifier feedback loop to provide an overall gain of +9 dB for the selected 100 kHz IF. Setting the A1 Source/Converter INPUT LEVEL switch to the −30 dBm position grounds the IFG input to the Gain Switch Driver. This turns Q2 off and the −14 Vdc on its collector shuts FET switch Q1 off to add R39 into the summing amplifier feedback loop for an overall gain of approximately +29 dB. The limiter (Q4, Q6) is connected across the feedback of the summing amplifier to prevent overloaidng any subsequent circuits. Whenever the summing amplifier output exceeds 3 volts peak-to-peak, Q4 and Q6 will conduct, shunting the feedback resistors, and greatly reduce the effective gain.

Bandpass Filter / Amplifier, Filter Switch Driver, and Buffer Amplifiers

The IF Bandpass Filter is a parallel resonant circuit consisting of L3, C24 and C26. The center frequency of the filter is adjusted by L3 (PHASE) with fine tuning provided by C26 (100 kHz TRIM). Bandwidth of the filter is controlled by changing the series input resistance to the filter. When the 10 kHz BW pushbutton is pressed, the L 1 kHz input to the Filter Switch Driver goes high (+4 Vdc) to drive Q27 collector to +14.5 Vdc. This forward biases CR10 and switches in R52, in parallel with R50, resulting in a 1.5K series input resistance and giving the bandpass filter a 10 kHz bandwidth. If 1 kHz BW is selected, then Q27 is turned off and CR10 is back biased. This removes R52 from the circuit and increases the input series resistance to 16.2K, decreasing the filter bandwidth to 1 kHz. GD EN (Group Delay Enable) is ORed with the L 1 kHz input to the Filter Switch Driver by CR1 and CR2. This inhibits the 1 kHz BW if the Signal Processor is measuring group delay. Q9 and Q10 form a feedback pair amplifier with a gain of about 8.5 dB. The small amount of positive feedback around the amplifier, as adjusted by R54 (AMP), compensates for any losses in the bandpass filter. When R54 (AMP) is adjusted correctly, the output signal level at TP2 will remain the same with changes in bandwidth. The Buffer Amplifiers consist of two emitter follower amplifiers (Q11, Q12). Q12 supplies the 100 kHz IF signal for the A12 Phase Detector Assembly and Q11 drives the rectifier circuit.

Rectifier

The Rectifier is basically an amplifier with a pair of diodes in the feedback loop as shown in the simplified schemtic below. Because the amplifier has a large gain, the feedback current (I_f) is equal to the input current (I_{in})



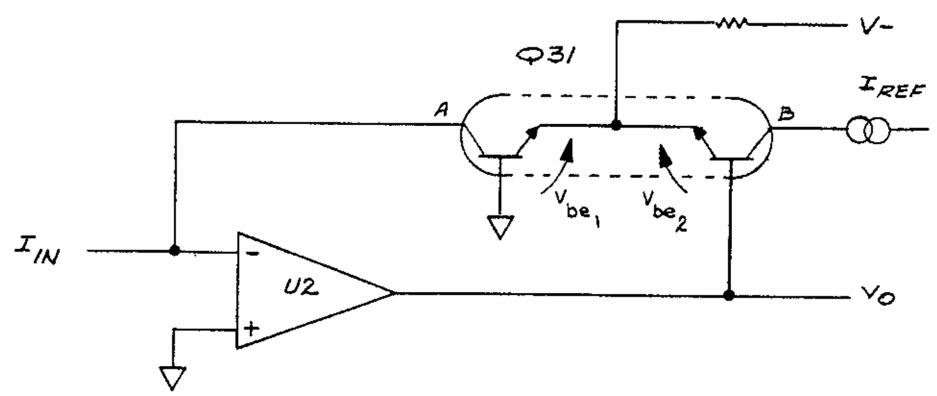
For the 100 kHz IF frequency, the impedance of capacitor C is small compared to R so the ac components of I_1 and I_2 combine to form the feedback current (I_f). However, the dc component of I_1 must flow through the resistor. This means the dc output current (I_{dc} to the Logger is the average of I_1 and is proportional to the input current (I_{in}). This relationship is independent of the diode or amplifier characteristics since the amplifier has enough gain to force the feedback current to equal the input current.

D3-96 b

The input stage to the amplifier in the Rectifier is Q13, a common-base stage. The output of Q13 is fed to an adjustable bandpass filter using L4 (B) to align the amplifier response at low levels. The filter is buffered by emitter follower Q16 which drives the common emitter complimentary output stage (Q14, Q15). L5 establishes a zero volt dc bias on the output. The 100 kHz IF signal is then ac coupled into the two Schottky rectifier diodes CR12 and CR13. Capacitors C44 and C45 couple the ac signal back to the emitter of Q13, the amplifier's summing node. Some positive feedback is tapped off the amplifier output back to the base of Q13. The amount of positive feedback is determined by R71 (A) and is used to establish the bottom level of the Rectifier performance at approximately − 120 dBm input level. The dc output from CR12 gets additionally filtered by C46 and C48 to remove residual ac components on the signal fed to the DC Logger.

DC Logger

The basic configuration of the DC Logger is as shown below and consists of an FET input operational amplifier with a transistor base-emitter junction in the feedback loop.



The IREF input to the collector of Q31B is kept at a constant current of 10 μA by operational amplifier U1. The 10 μA current is determined by the 6.2V zener reference supplied by VR1 and the value of R86. The positive temperature coefficient of R80 corrects for any changes on the output of the DC Logger due to temperature. Since the dc output impedance of the Rectifier is extremely high, and the bias current into U2 operational amplifier is much less than 1 nA, the output of U2 (using Q31 as the transistor-diode feedback) is directly proportional to the log of the input current over the entire 100 dB of operating range (2 mA to 20 nA).

DC Output Amplifier

The dc output voltage from the DC Logger is inverted by operational amplifier U3 and scaled to a factor of .5V/10 dB by the adjustment of R91 (SCL). The offset adjustment R96 (I OFF) establishes the reference point of − 0.5 volts at − 10 dBm RF input to the Source / Converter IF ports (R, A or B). R99 (G OFF) is switched into the circuit when the Source / Converter INPUT LEVEL switch is in the − 30 dBm position. This offset is switched in by

D3-96 C

Q29 output of the Gain Switch Driver going to + 14 Vdc and turning FET Q17 on. The purpose of R99 (G OFF) is to compensate for the extra 20 dB gain of the Switchable Gain Amplifier when the Source/Converter INPUT LEVEL switch is in the – 30 dBm position. This means the Log output of the Magnitude Detector remains calibrated with changes in the OUTPUT LEVEL switch position.

Troubleshooting Hints

1. Do not probe the Rectifier circuit when the RF input to the Source/Converter is less than – 60 dBm. Probing this circuit at low IF signal levels causes distortion.

2. If a problem is believed to be in the Rectifier or DC Logger circuits, perform the Magnitude Detector adjustment procedure in Pragraph A5-30. Difficulty in adjustment of L4 or R71 indicates a problem in the Rectifier circuitry. Try replacing both CR12 and CR13.

3. The summing node (U2 pin 2) for the DC Logger amplifier should be 0 volts dc. If not, the problem is most likely in the DC Logger. The summing node may be shorted to ground and operation of the rectifier verified.

FIG. D3-42A
SHT. 1 OF 3

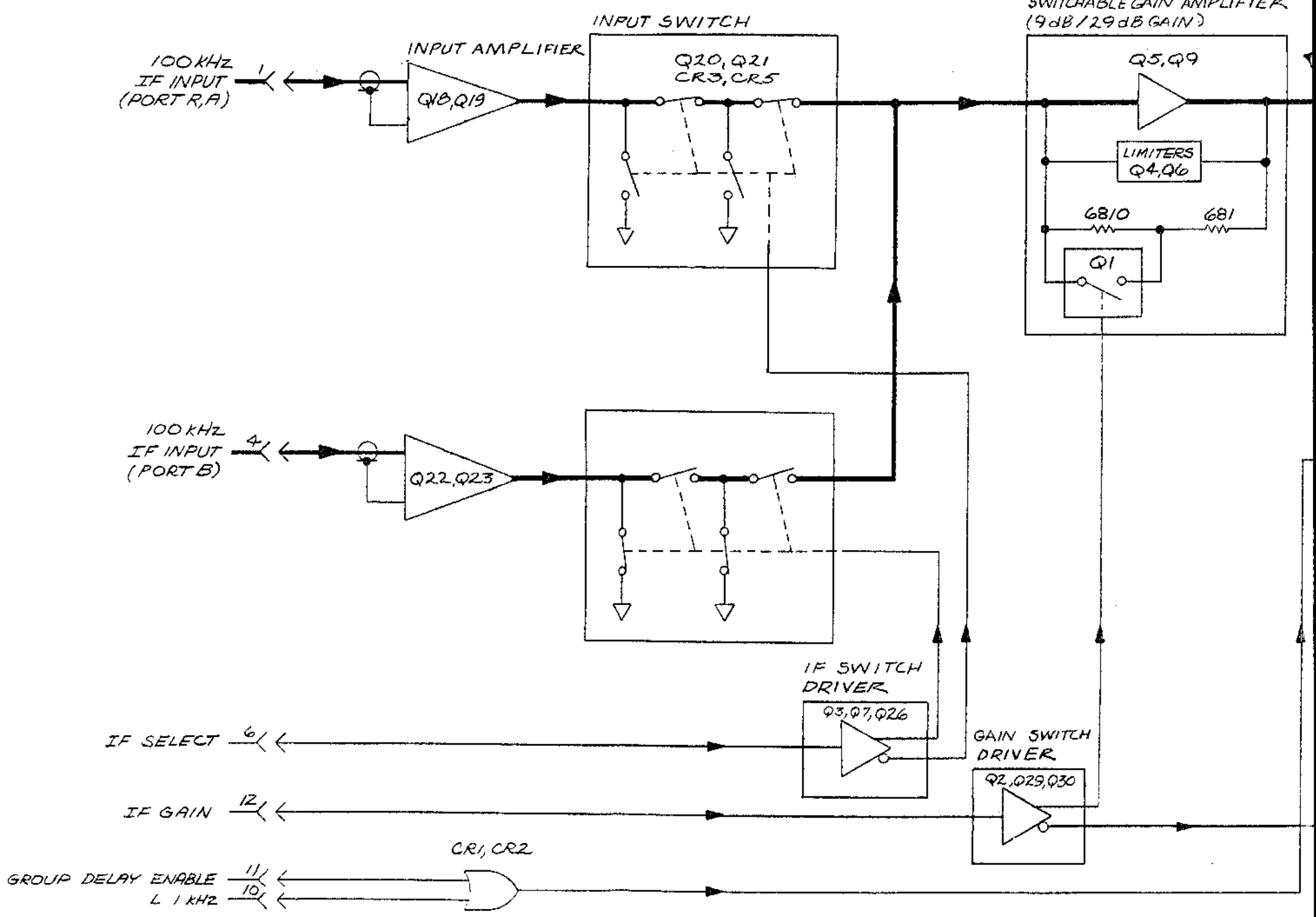


FIG. D3-42A
SHT. 2 OF 3

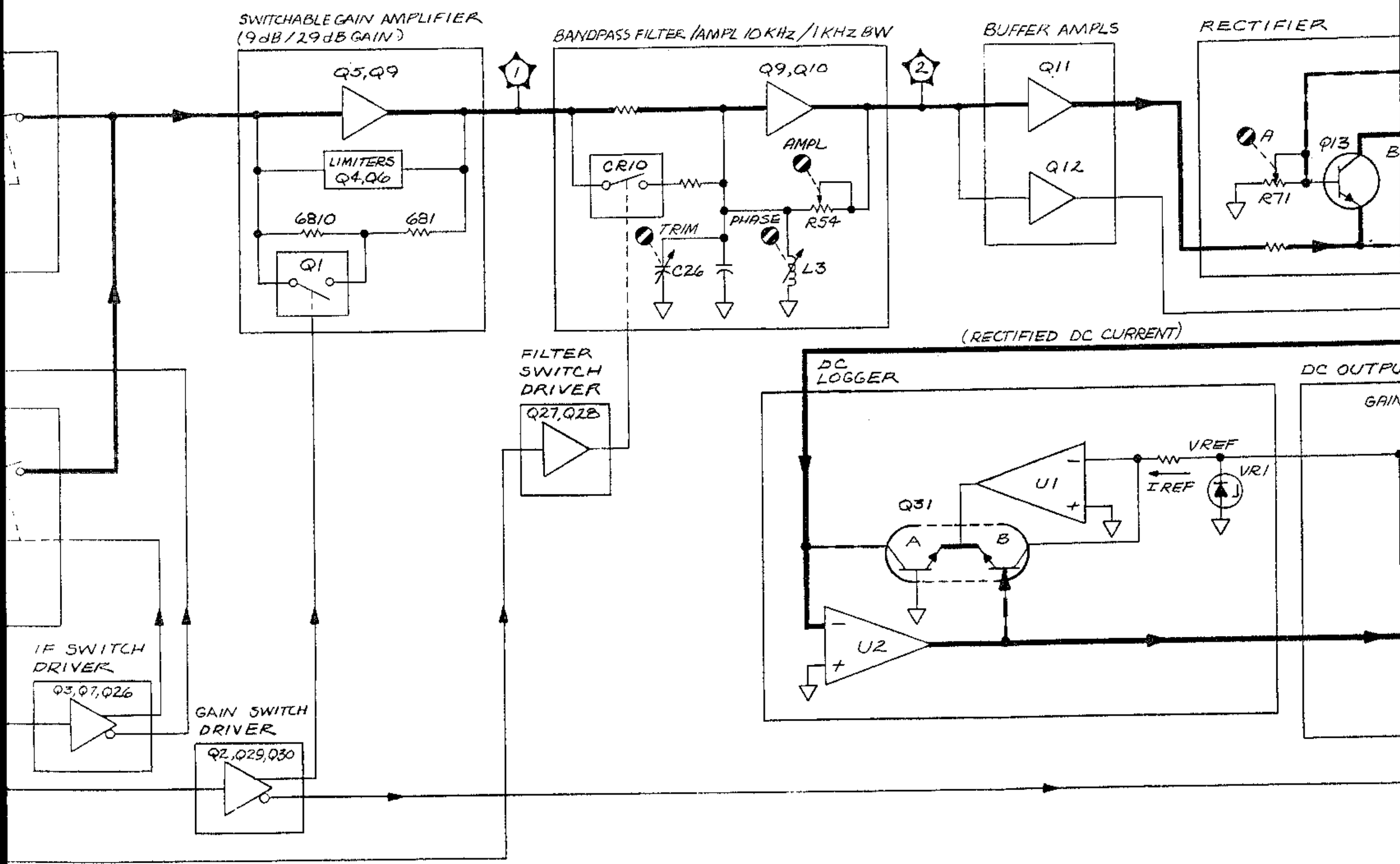


FIG. D3-42A
SHT 3 OF 3

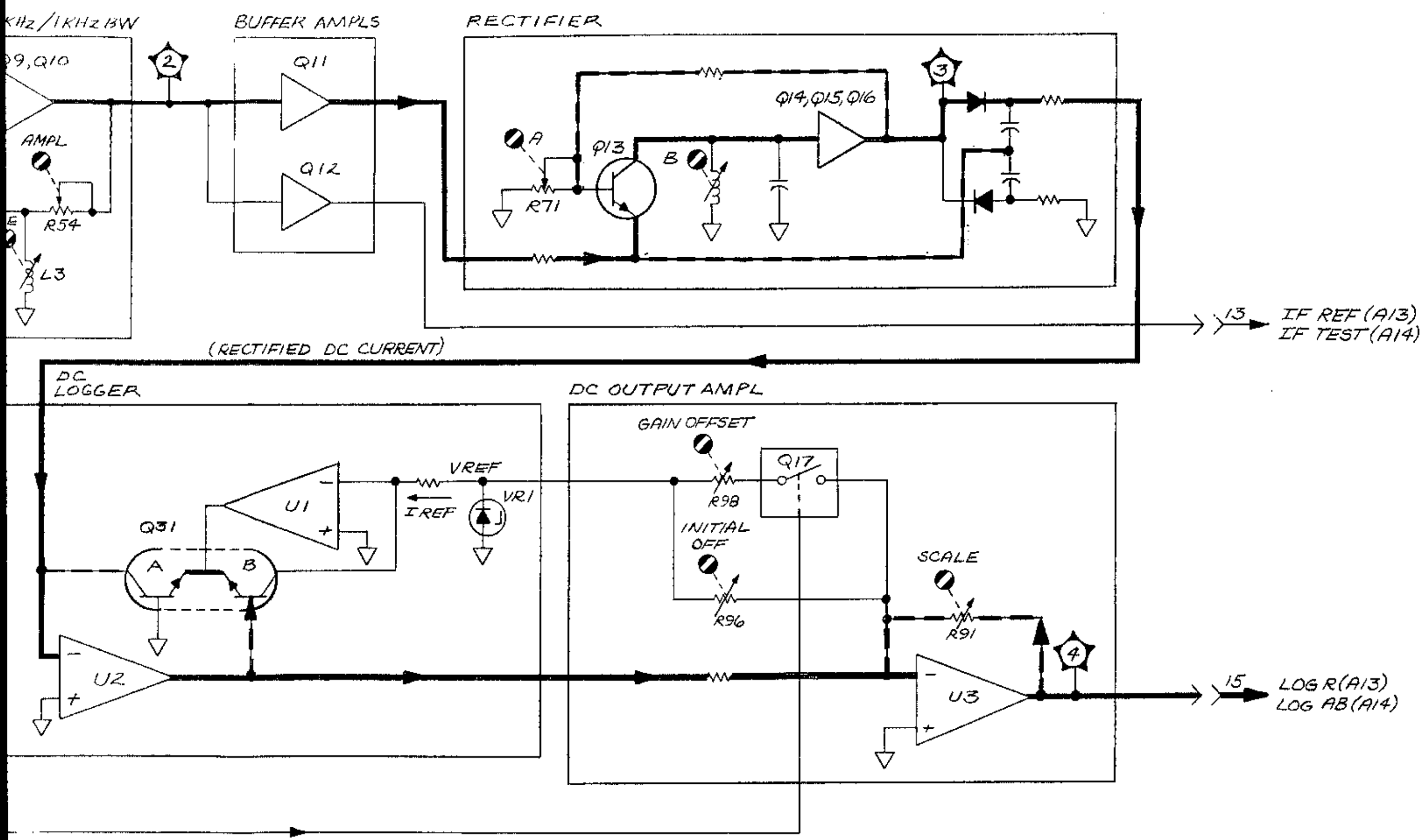
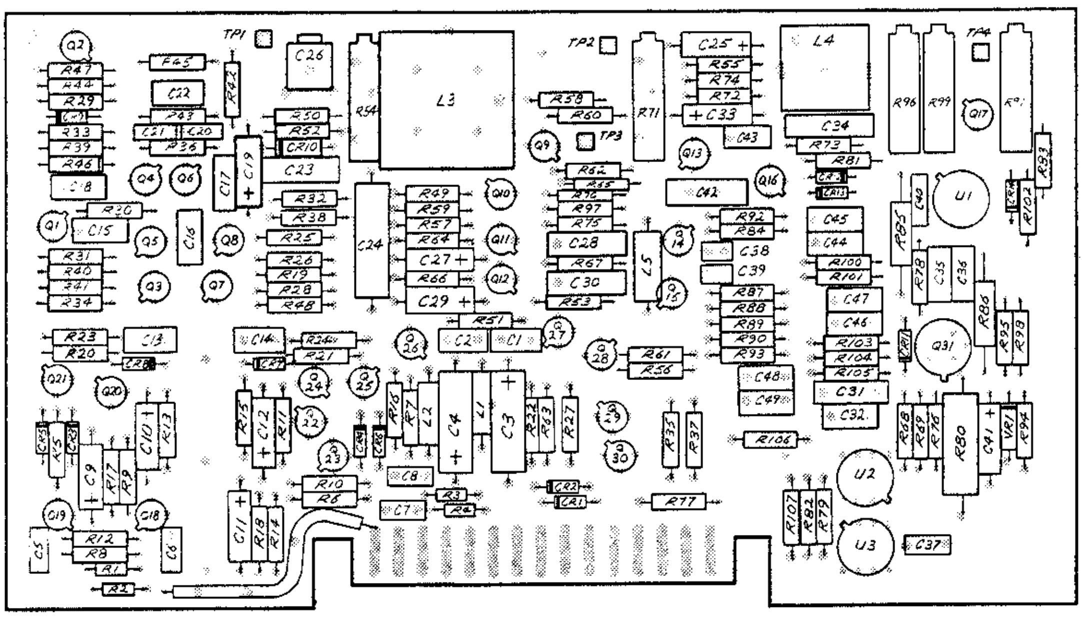


Figure D3-42A. A3A13/A14 Magnitude Detector, Block Diagram

A3A13/14

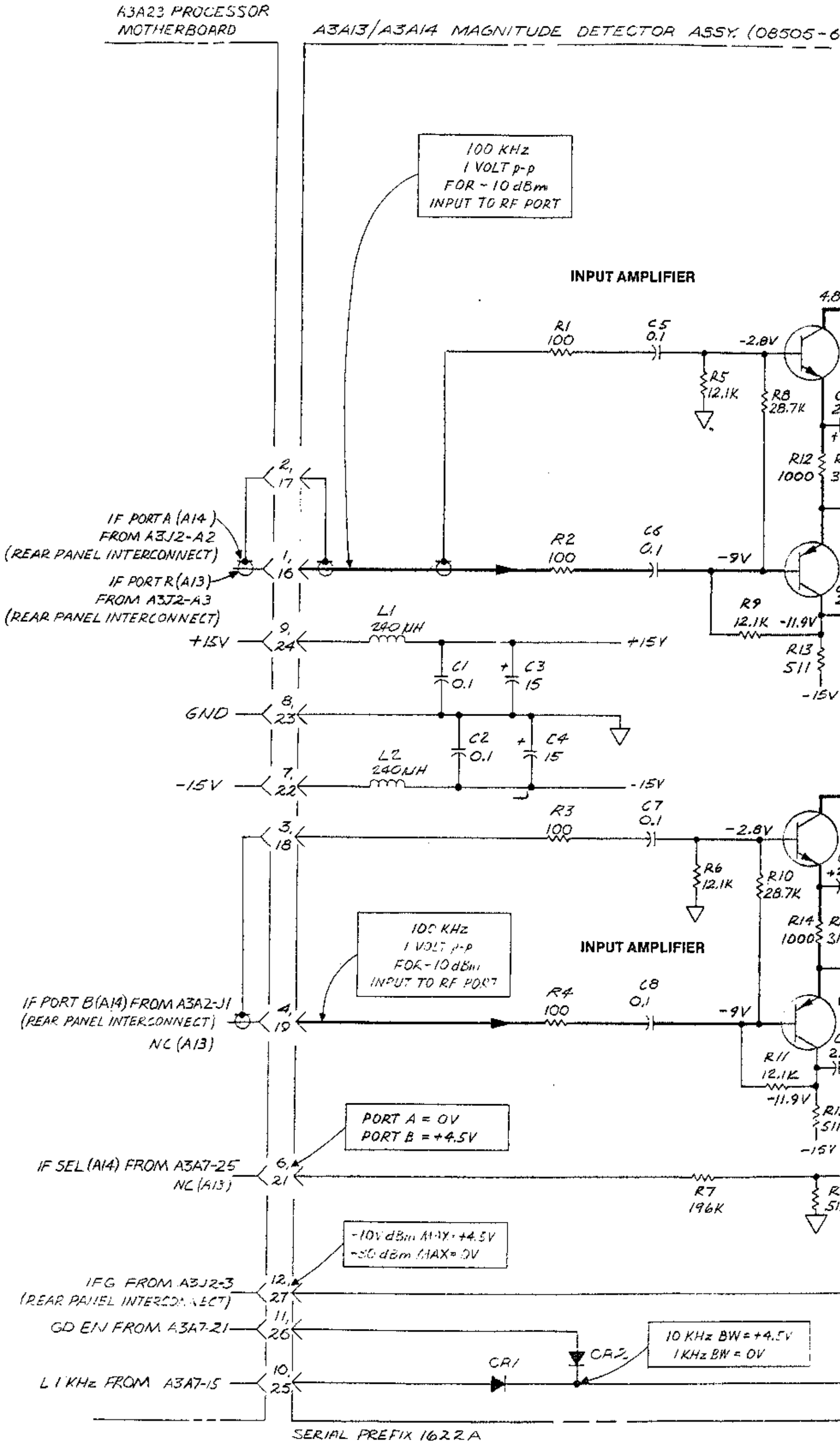


1
16

15 ◄— COMPONENT SIDE PINS
30 ◄— REVERSE SIDE PINS

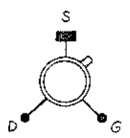
Figure D3-43. A3A13/14 Magnitude Detector Parts Locations

FIG. D3-44
SHT. 1 OF 4



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 ALL RESISTOR VALUES IN OHMS, ALL CAPACITOR VALUES IN MICROFARADS.
3. R80 IS TEMP. COMP.—RESISTOR, +3400 PPM/°C.
4. ——▶—— INDICATES PRIMARY SIGNAL FLOW PATH; — —◀— — INDICATES PRIMARY FEEDBACK PATH.



FIELD EFFECT TRANSISTOR TERMINALS TOP VIEW

A3A13/14
C1 - 49
CR1 - 14
L1 - 5
Q1 - 31
R1 - 107
U1 - 3
VR1

CONTROL INPUTS	DESCRIPTION
IF SEL	1 SELECTS PORT A INPUT
IFG	1 FOR -10 dBm MAX INPUT LEVEL
GD EN	1 WHEN OPERATING IN GROUP DELAY MODE
L 1KHz	0 WHEN 1 KHz BW SELECTED

FIG. P3-44
SHT. 2 OF 4

(08505-60013)

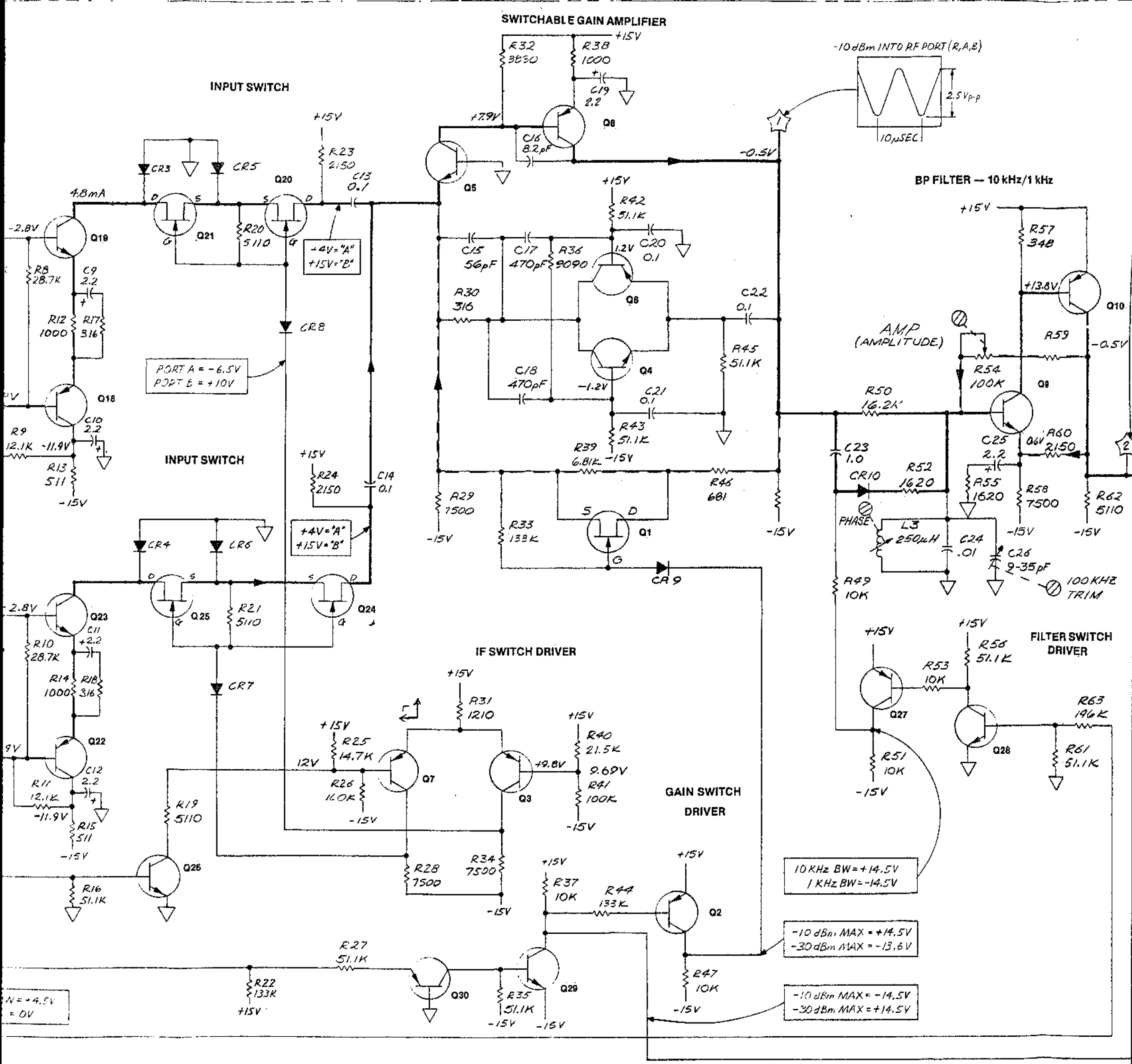


FIG. D3-44
SHT. 3 OF 4

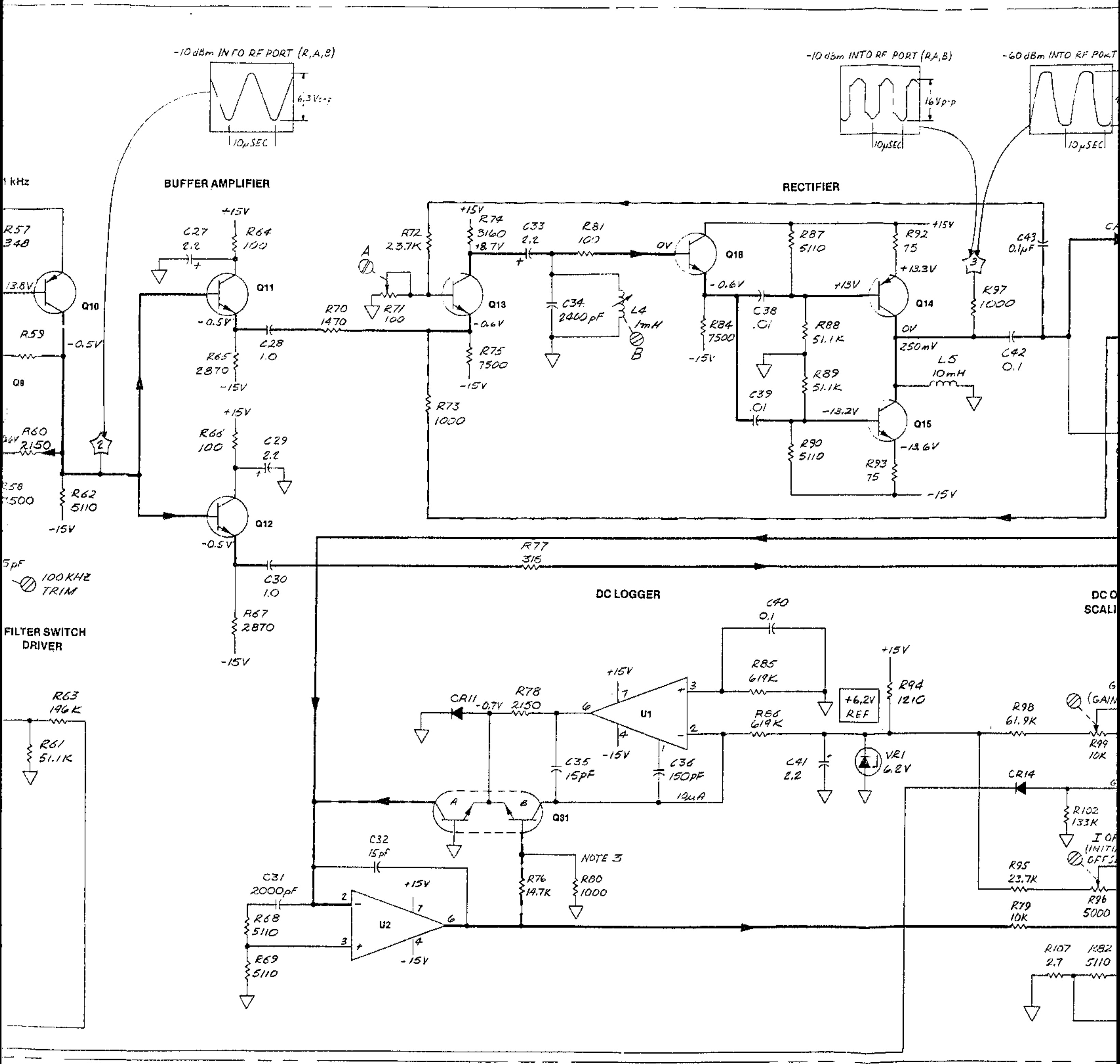


FIG. D3-44
SHT. 4 OF 4

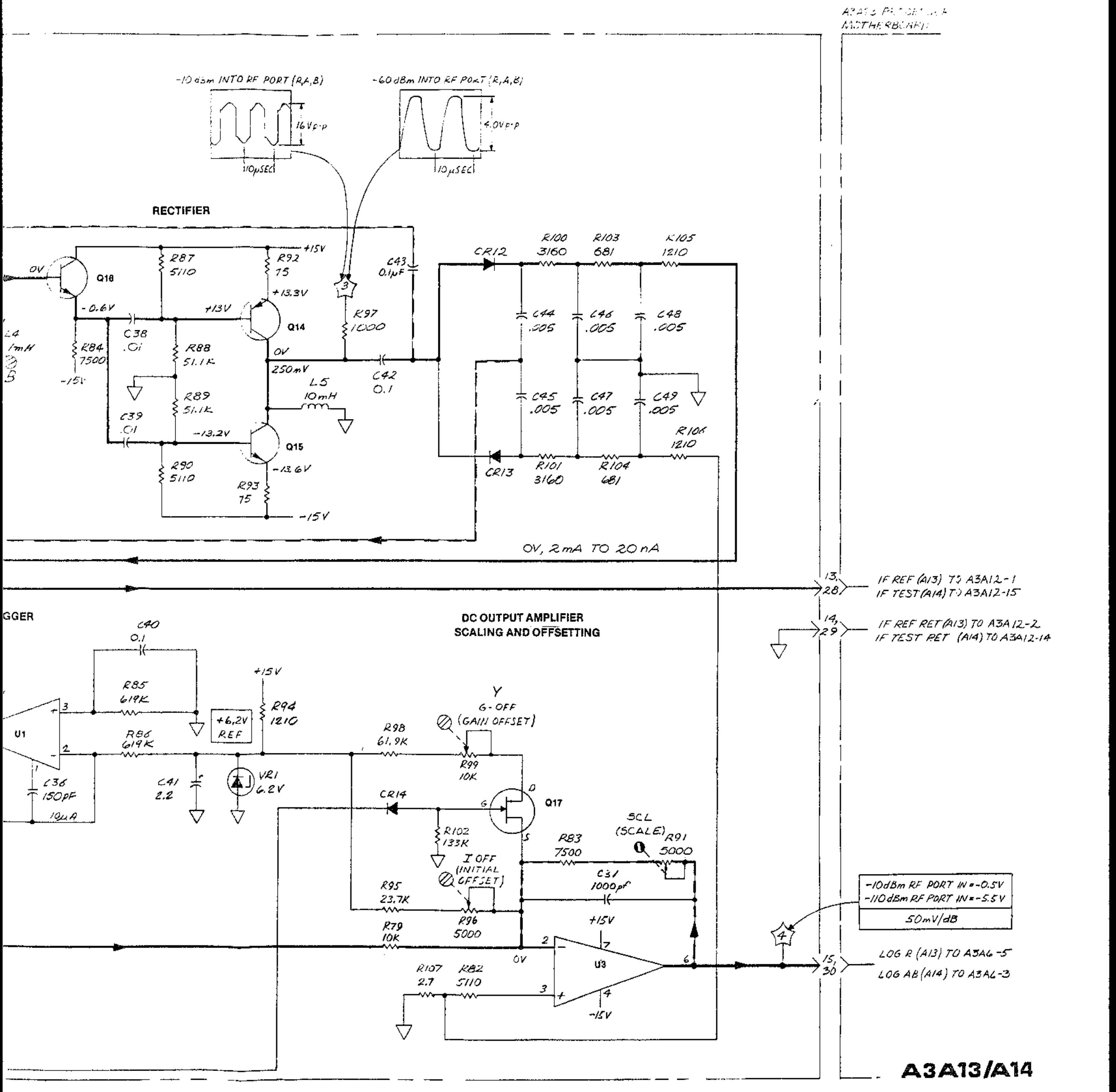


Figure D3-44. A3A13/A14 Magnitude Detector, Schematic

A3A15 ANALOG MULTIPLEXER

General Description

The A3A15 Analog Multiplexer processes several X and Y axis input signals to provide the correct X and Y axis deflection voltages for either a rectangular or polar CRT display. The differences in signal flow for rectangular and polar displays is shown in Figure D3-44A and explained as follows:

Rectangular Display: The Y summing amplifiers (U2, U3) sum and invert the respective channel input signal (CH 1 FILT, CH 2 FILT) with the front panel reference line position offsets (RECT POSN 1, RECT POSN 2) and the diamond marker Y-axis deflection voltage (DIA Y) to develop the CRT display Y-axis deflection voltages for each channel (Y CH 1, Y CH 2). The sweep ramp input (VSW 2) is summed with the front panel horizontal position offset (RECT X POSN) in the X Sweep Amplifier (U5) and then summed with the diamond marker X-axis deflection voltage to develop the swept horizontal CRT deflection voltage. The Z-Axis Summing Amplifier (Q1) provides some CRT trace intensity control and is used to increase the trace intensity when drawing a diamond marker.

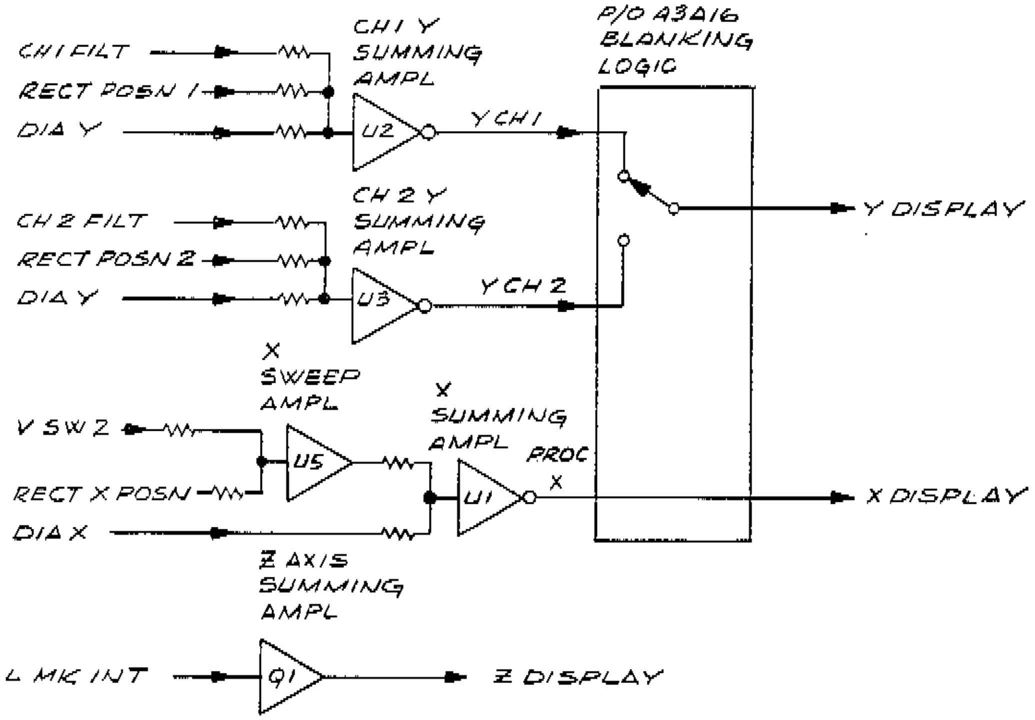
Polar Display: The polar Y-axis input signal is carried on the CH 1 FILT line and the polar X-axis input is carried on the CH 2 FILT input line. When both Channel 1 and Channel 2 are displayed, the Channel 1 and Channel 2 display signals are processed on alternate sweeps. The CH 1 Y Summing Amplifier (U2) sums the CH 1 FILT input with the front panel BEAM CTR Y offset and the diamond marker Y-axis deflection voltage (DIA Y) to obtain the polar display Y-axis deflection voltage (Y CH 1). The X Summing Amplifier (U1) sums the CH 2 FILT Input with the front panel BEAM CTR X offset and the diamond marker X-axis deflection voltage to obtain the polar display X-axis deflection voltage (PROC X). The Z-Axis Summing Amplifier (Q1) provides some CRT trace intensity control and is used to increase the trace intensity when drawing a diamond marker.

CH 1 Y Summing Amplifier

Rectangular Display: CH 1 FILT is a dc voltage representing the Channel 1 magnitude, phase or group delay measurement and is the primary input to the CH 1 Y Summing Amplifier (U2). The CH 1 FILT Input and the diamond marker Y-axis deflection voltage (DIA Y) are summed through resistors R14 and R19. The Low Polar Alternate (L POL ALT) control input to switch U6B is high (+5V) selecting the Channel 1 position offset (RECT POSN 1) as the third input to the CH 1 Y Summing Amplifier (U2). This RECT POSN1 input is used to set the Reference Line Position of the Channel 1 CRT trace from the CRT Display Section front panel. Summing amplifier U2 sums and inverts these inputs to provide the Channel 1 CRT Y-axis deflection voltage (Y CH 1). The CH 1 Y adjustment (R31) sets the gain of summing amplifier U2 and is adjusted for a Y CH 1 output of −0.25 volts/division below the center CRT graticule. Diodes CR8 and CR11 limit the Y CH 1 output to approximately ±1.5 volts to avoid overdriving the CRT Y-axis deflection amplifier. PLOT Y 1 is an auxiliary output to the rear panel CHAN 1 connector A3J4.

Polar Display: The CH 1 FILT input carries the polar Y-axis information for the channel being displayed on the CRT. When both channels are displayed, the Channel 1 and Channel 2 polar Y-axis inputs are carried on the CH 1 FILT Input during alternate sweeps. The CH 1 FILT Input is summed with the diamond marker Y-axis deflection voltage (DIA Y) through resistors R14 and R19 and fed to the inverting input of summing amplifier U2. The third input to summing amplifier U2 is the polar Y-axis position offset (BEAM CTR Y) from the CRT Display Section Front panel. This signal is selected by switch U6C when the

Rectangular CRT Display



Polar CRT Display

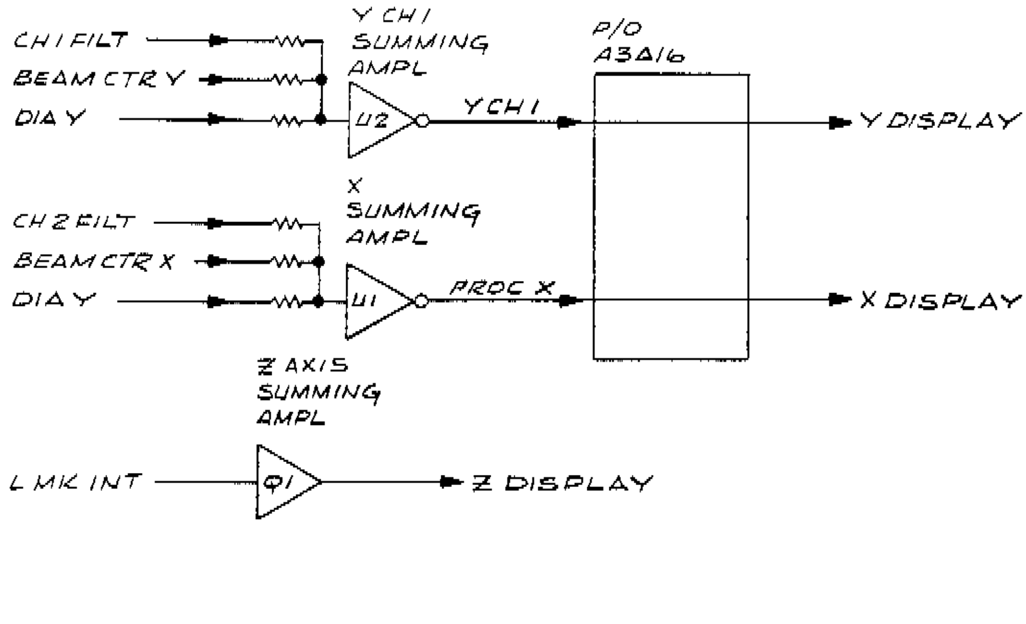


Figure D3-44A. A3A15 Analog Multiplexer Simplified Block Diagrams for Rectangular and Polar CRT Displays

L POL ALT control input goes low (0 volts) and is used for centering the polar display in the Y-axis. The three inputs to amplifier U2 are summed and inverted to provide the CRT polar Y-axis deflection voltage (Y CH 1).

CH 2 Y Summing Amplifier (Rectangular Display Only)

CH 2 FILT is a dc voltage representing the Channel 2 magnitude, phase or group delay measurement and is the primary input to the CH 2 Y Summing Amplifier (U3). The CH 2 FILT, marker diamond Y-axis deflection voltage (DIA Y) and the Channel 2 position offset (RECT POSN 2) are summed through resistors R22, R23, and R24, then applied to the inverting input of amplifier U3. The Channel 2 DIA Y summing resistor (R22) is larger than the Channel 1 DIA Y summing resistor (R19) so the diamond marker is noticeably smaller on the Channel 2 CRT trace. Ch 2 Y Summing Amplifier (U3) inverts the combined input and diodes CR9 and CR12 limit the Y CH 2 output to approximately ±1.5 volts. The CH 2 Y adjustment (R33) sets the gain of summing amplifier U3 for a Y CH 2 output of −0.25 volts/division below the center CRT graticule. PLOT Y 2 is an auxiliary output to the rear panel CHAN 2 connector A3J5.

X Sweep Amplifier (Rectangular Display Only)

The Level Sweep Enable (LEV SW EN) control input to U4C is normally held high by +5 volts through resistor R11 to select the VSW2 sweep ramp as the primary input to summing amplifier U5. The Level Sweep (LEV SW) input to U4C can only be selected when the LEV SW EN control input from the rear panel TEST SET connector A3J3 is grounded. The SWP WIDTH adjustment (R1) controls the size of the VSW2 ramp input to U5 and is used to adjust the width of the CRT trace. The other summing input to U5 is the RECT X POSN line from the CRT Display Section front panel and controlled by the X POSN screwdriver adjustment. This adjustment is used to center the horizontal position of the CRT trace. Amplifier U5 sums and inverts these inputs to provide an inverted sweep ramp with a dc offset determined by the CRT Display Section front panel X POSN adjustment.

X Summing Amplifier

Rectangular Display: The Low Polar Alternate (L POL ALT) control input to switches U4A and U4B goes high (+5V) and switch U4B selects the U5 inverted sweep ramp output as the only input to the inverting side of summing amplifier U1. Summing amplifier U1 inverts the sweep ramp input and then sums it with the diamond marker X-axis deflection voltage (DIA X) to provide the sweep ramp output (PROC X). Diodes CR10 and CR13 limit the PROC X output to approximately ±1.5 volts to avoid overdriving the CRT X-axis deflection amplifier. PLOT X is an auxiliary output to the rear panel SWEEP connector A3J6.

Polar Display: The L POL ALT control input to switches U4A and U4B goes low (0 volts) to select CH 2 FILT and BEAM CTR X as inputs to the inverting side of summing amplifier U1. The CH 2 FILT input carries the polar X-axis information for the channel being displayed on the CRT. When both channels are displayed, the Channel 1 and Channel 2 polar X-axis inputs are carried on the CH 2 FILT input during alternate sweeps. The BEAM CTR X input is the horizontal position offset from the CRT Display Section front panel that is used to center the polar display in the X axis. The CH 2 FILT and BEAM CTR X inputs are summed through resistors R26 and R17, inverted by U1, and then summed with the diamond marker X-axis deflection voltage (DIA Y). The U1 output (PROC X) provides the polar display X-axis deflection voltage for the CRT polar display.

Z-Axis Summing Amplifier (Operation Same for Rectangular and Polar Displays)

The Z-Axis Summing Amplifier (Q1, U6A) provides a Z-axis bias voltage (Z DISP) for the Z-axis deflection amplifier on the A3A27 Blanking Amplifier to give some control over the maximum CRT trace intensity level and the relative intensity of the marker diamonds. Switch U6A selects either the summing amplifier Q1 output or the Z NORM input for use as the Z DISP output. The Low Normalizer (L NORM) control input to switch U6A comes from the rear panel NORMALIZER interconnect A3J1 and is held high by +5 volts through a resistor on the A3A16 Blanking Logic Assembly. With a high (+5 volts) on the control input, switch U6A selects the output of summing amplifier Q1. The Low Marker Intensity (L MK INT) input to Q1 goes low (0 volts) when a marker diamond is being drawn and biases Q1 off. This forces the Q1 output (Z DISP) to −0.33 volts to increase the CRT trace intensity while drawing a marker diamond. The External Z (EXT Z) input to Q1 comes from the rear panel Z input connector A3J10 and is summed with the L MK INT input to Q1. This EXT Z input can be used to externally control the CRT trace intensity.

D3-101/102 a

FIG. D3-44B
SHT 1 OF 2

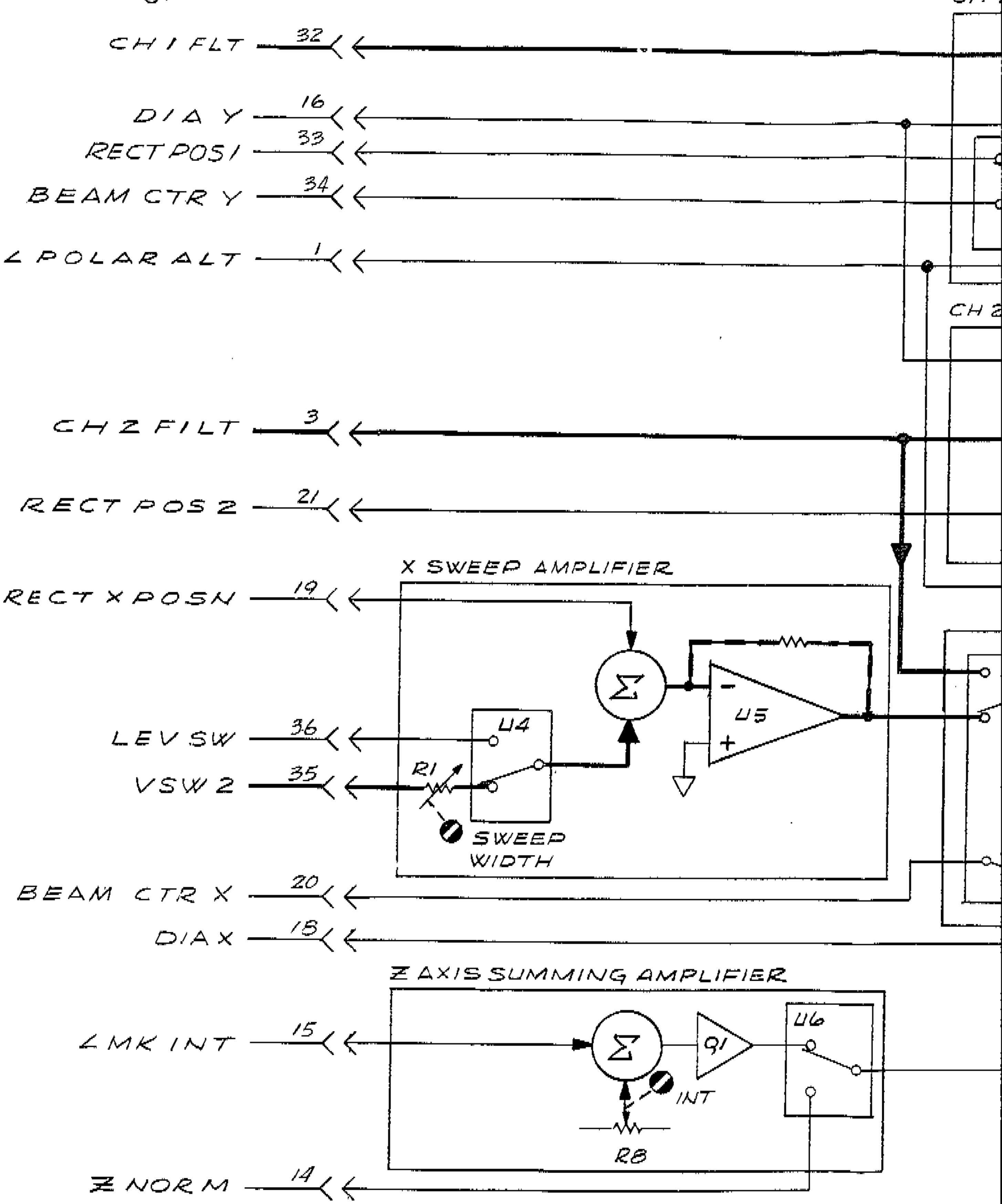


FIG. D3-44B
SHT 2 OF 2

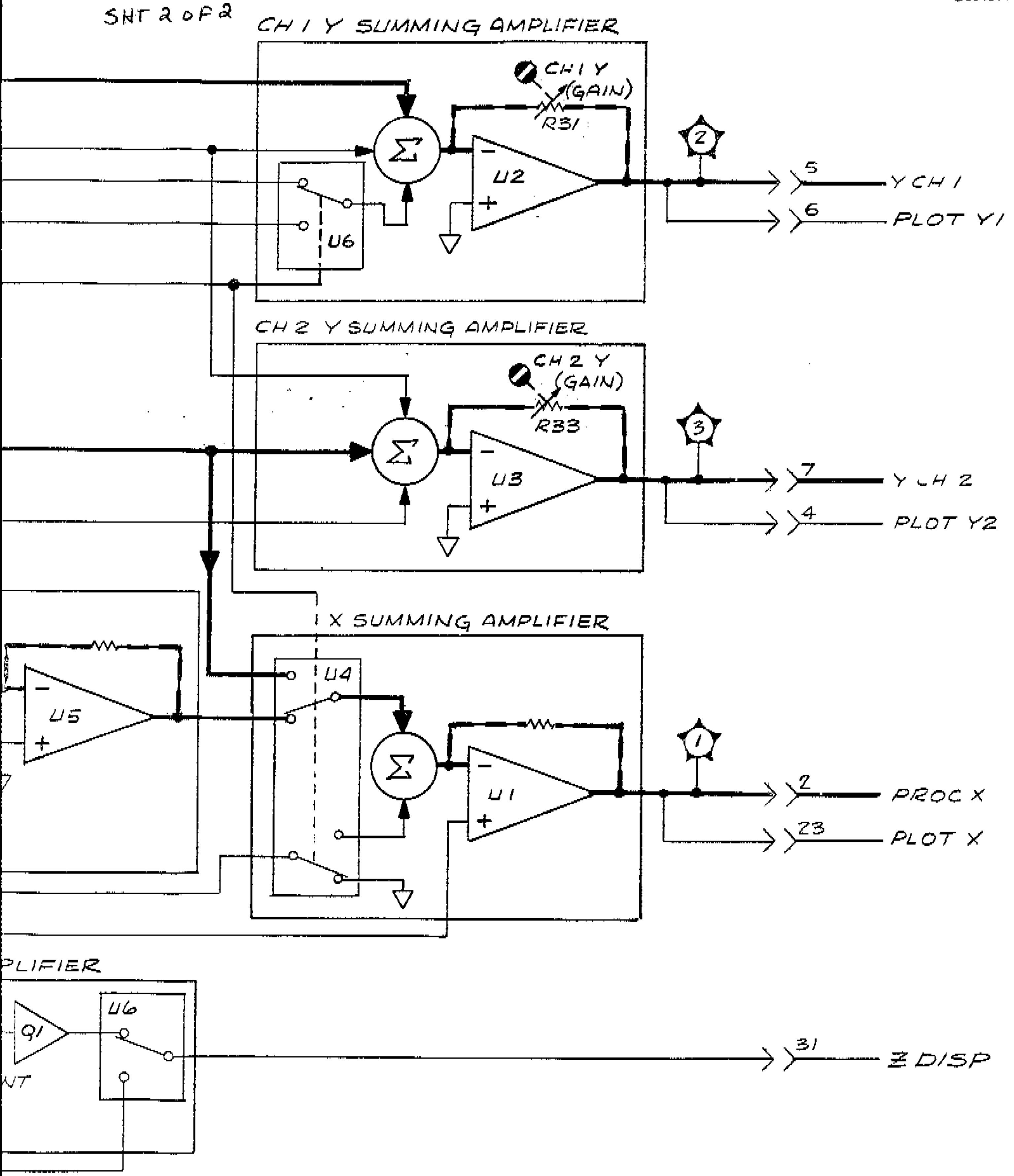


Figure D3-44B. A3A15Analog Display Multiplex I, Block Diagram

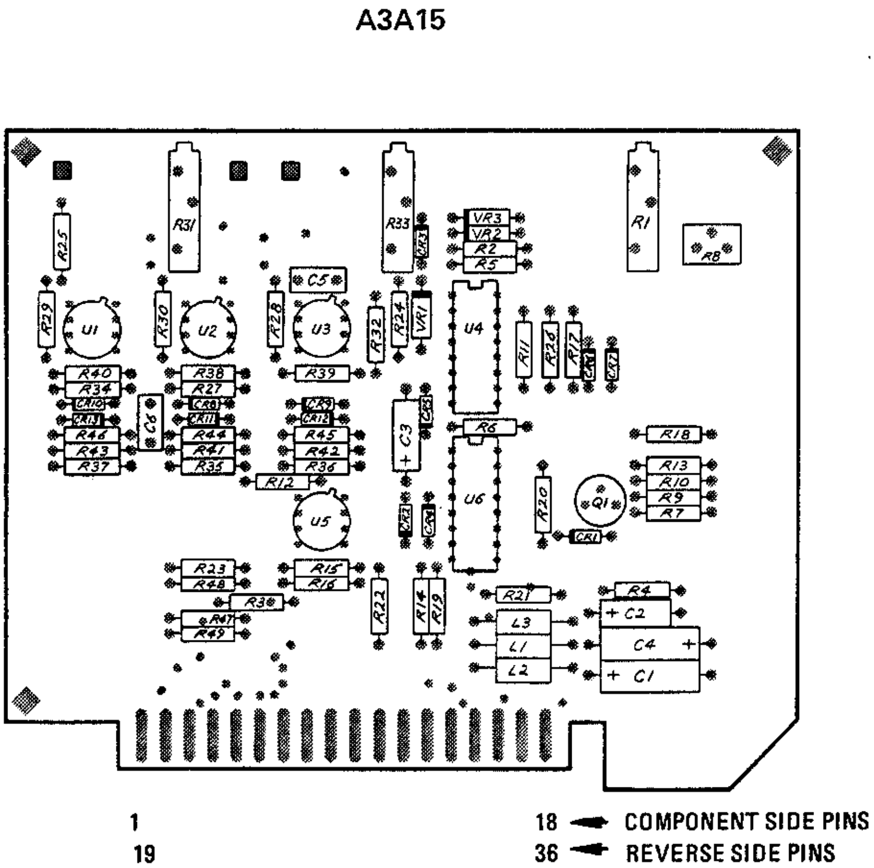


Figure D3-45. A3A15 Analog Display Multiplex I Parts Locations

FIG. D3-46
SHT. 1 OF 3

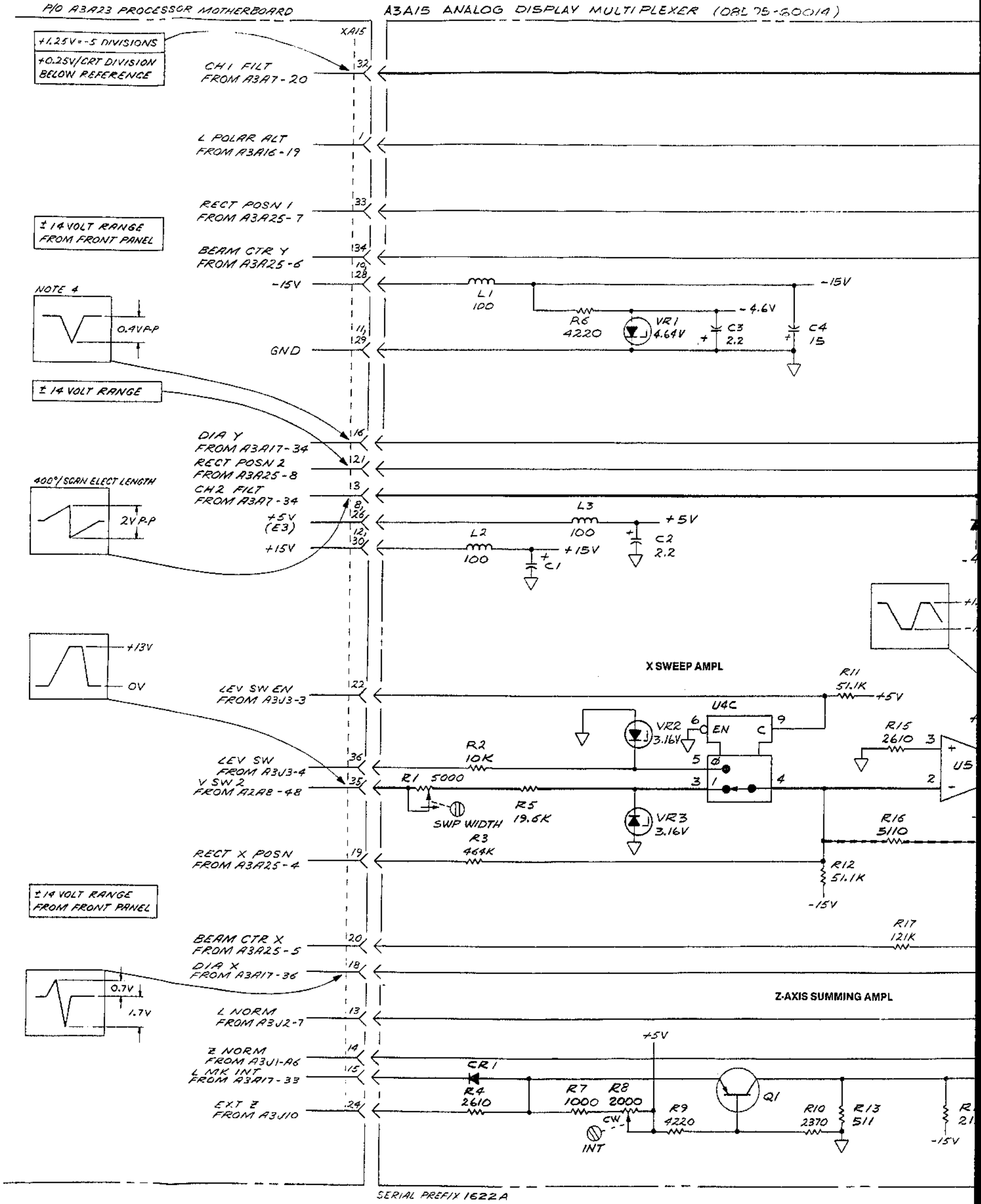


FIG. D3-46
SHT. 2 OF 3

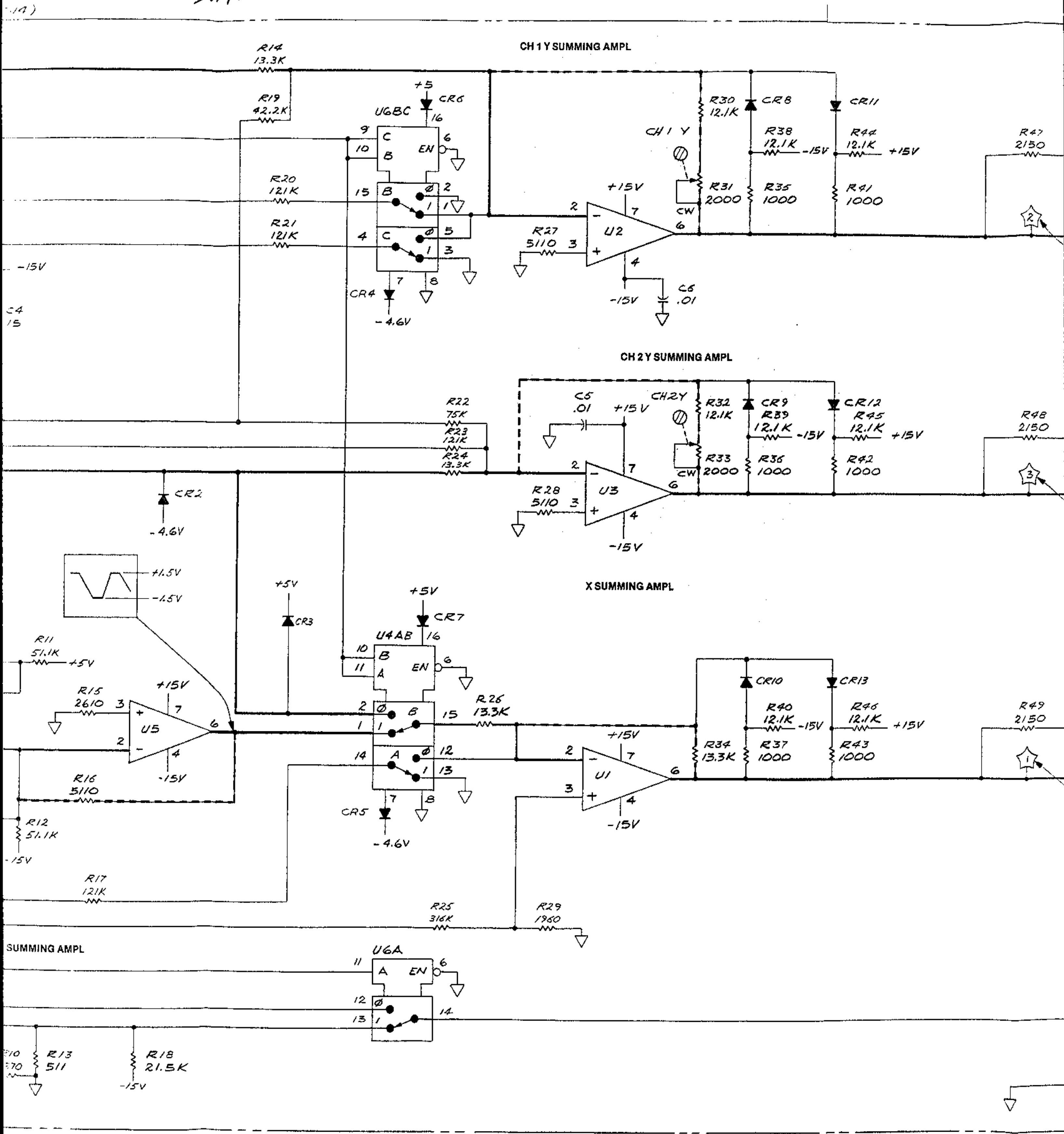
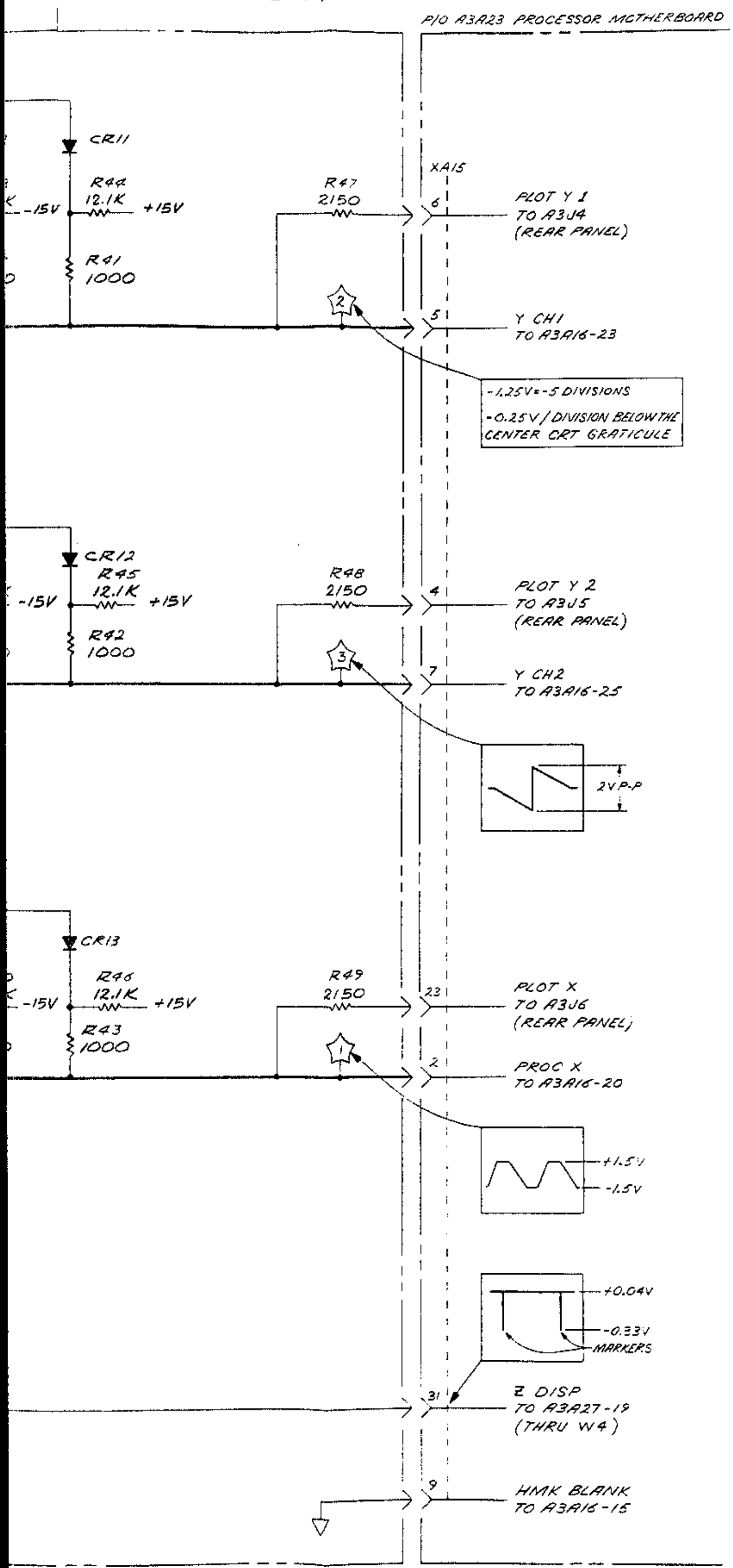


FIG. D3-46
SHT. 3 OF 3



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
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MICROHENRIES
3. EN = ENABLE
4. DIA Y WAVEFORM SHOWN IS FOR DRAWING A MARKER ABOVE THE TRACE. DOWN MARKERS HAVE AN INVERTED WAVEFORM.

CHANNEL 1 SETUP
MODE : MAG
INPUT : A
SCALE/DIV : 2dB
PORT A INPUT : -20dBm @ 30MHz
REF OFFSET : -10dB
CHANNEL 2 : OFF

CHANNEL 2 SETUP
MODE : PHASE
INPUT : A/R (0 DEG PHASE)
SCALE/DIV : 45 DEG
ELECTRICAL LENGTH : 400°/SCAN
REF OFFSET : 0° (BOTH PHASE AND MAG)
CHANNEL 1 : OFF

CONTROL INPUT	DESCRIPTION
L POLAR ALT	0 WHEN DISPLAYING POLAR
LEV SW EN	0 ENABLES LEVEL SWEEP INPUT
L NORM	0 SWITCHES IN NORMALIZER INPUTS
L MK INT	0 DURING MARKER DIAMOND

REFERENCE DESIGNATIONS

A3A15	A3A23
C1-C6 CR1-CR13 L1-L3 P1 Q1 R1-R49 U1-U6 VR1-VR3	XA3

A3A15

Figure D3-46. A3A15 Analog Display Multiplex I, Schematic

A3A16 BLANKING LOGIC ASSEMBLY

General Description

The circuits on the Blanking Logic Board perform three functions: they convert inputs from Frequency Control Assembly A2 into timing and blanking signals for the CRT display; they alternate the Channel 1 vertical display signal (Y CH 1) and the Channel 2 vertical display signal (Y CH 2) to transform them into one vertical deflection signal; and they select either the Processor X and Y inputs, or X and Y inputs from the Normalizer as the X and Y inputs to the display. The blanking logic timing is shown in Figure D3-46A.

Control Register

The signals that control the functions performed on this board are stored in 8-bit, serial-to-parallel shift register U7. An LPCP (low processor clock pulse) clock input from Processor Interface Board A3A4 and serial data, L FILT (low filter), from Resolution Control Board A3A7, update the register contents.

Sweep Alternate (SW ALT) Flip-Flop

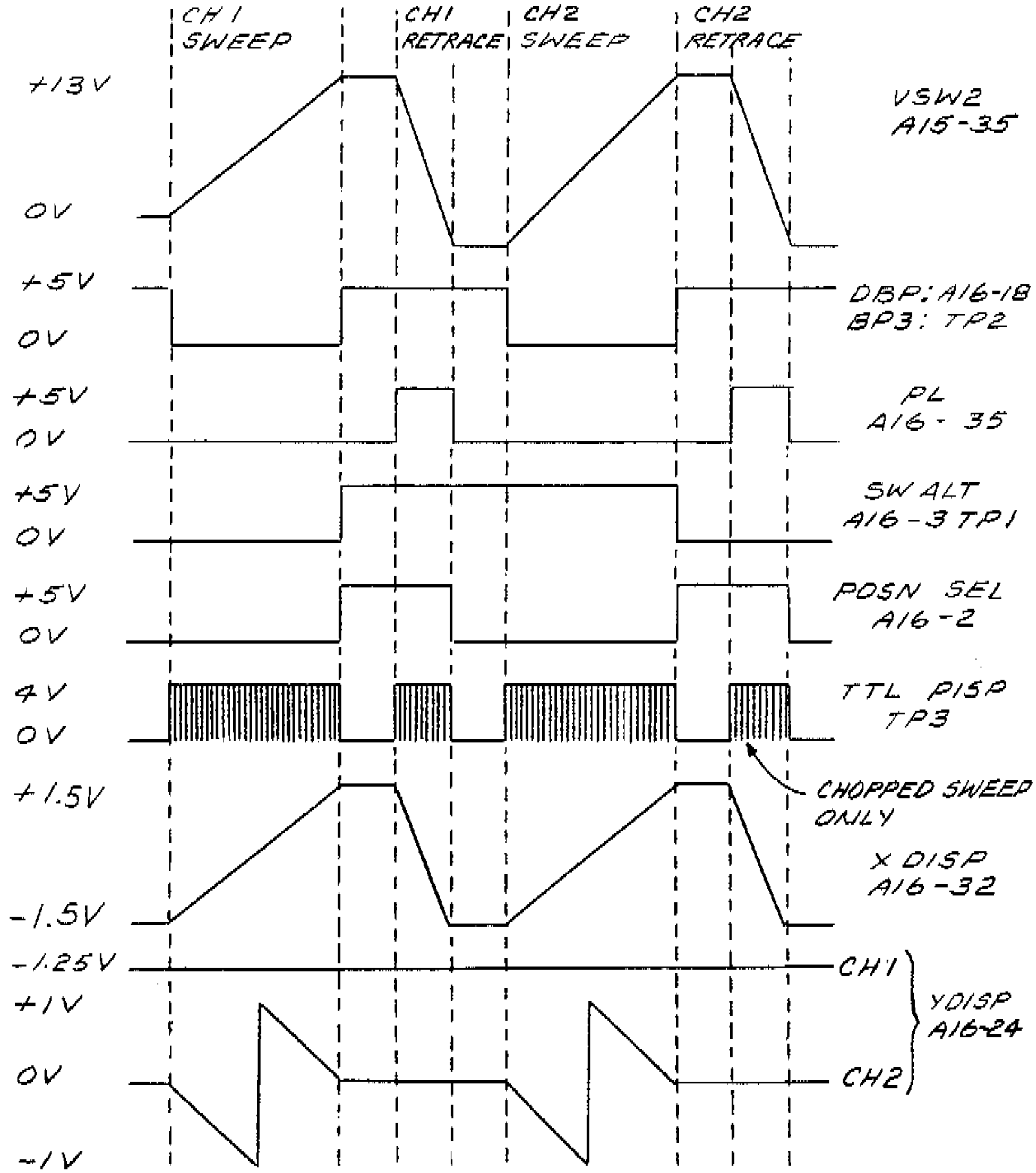
Two of the control register outputs, L OFF 1 (low = Channel 1 off) and L OFF 2 (low = Channel 2 off), buffered by inverters U3C and U3E, are applied to the J and K inputs of sweep alternate flip-flop U1B. (They are also fed to rear-panel connectors for use in external test instruments.) Sweep alternate flip-flop U1B is clocked by the BP3 (blanking pulse 3) input from Sweep Select Board A2A8 in the Frequency Control Assembly. If both display channels are on, the L OFF 1 and L OFF2 lines are both high; therefore, both the J and the K inputs to U1B are high. Thus, on the positive-going, leading edge, of BP3 at the end of each sweep, the flip-flop SW ALT (sweep alternate) output changes state. The SW ALT signal, in this case, is high for one sweep and low for the next.

The SW ALT signal is distributed throughout the 8505A to synchronize all channel 1 processing and then all channel 2 processing, whenever both channels must be processed alternately instead of simultaneously. For example: The Polar Converter can process only one channel at a time. Therefore, if both channels are in the polar mode, the SW ALT input to the Polar Converter causes the channel 1 and channel 2 signals to be processed one after the other. Other, similarly limited, processing functions are timed by the SW ALT signal to operate on one channel, then the other. In effect, the SW ALT signal is a command: a high ("1") SW ALT signal means "process channel 1," and a low ("0") SW ALT signal means "process channel 2."

If one channel is one and the other is off, sweep alternate flip-flop U1B remains in one state, producing either a high SW ALT output or a low SW ALT output, depending on which channel is on.

Reference Position Timing

Reference line (or beam center dot) position timing is accomplished in the circuit comprised of J-K flip-flop U1A and NAND gates U6A, U6C, U2A, and U2D. During the sweep portion of the CRT display, the normal conditions for this circuit are: all three inputs to NAND gate U6A are low, setting the U6A output high. The $\overline{Q}$ output of flip-flop U1A is high because of a low POSN input to its J terminal and the +5 volts on its K terminal. NAND gate U2A, with both of its inputs high, has a low POSN SEL (position select) output.



NOTE:
EXTERNAL TRIGGER : SW ALT (A3A16-3)
REF LINE POSN PUSHBUTTON : DEPRESSED

D3-104 b

Figure D3-46A. Blanking Logic Timing Diagram

Now, if the REF LINE POSN/BEAM CENTER pushbutton on the CRT display control panel is pressed, the POSN line from U7A, pin 3, will go high. Nothing will change, however, until the end of the sweep period. As the sweep ends, the positive-going, leading edge, of BP3 (blanking pulse 3) clocks the flip-flop, which now has a high J input from the POSN line. This causes the flip-flop's $\overline{Q}$ output to go low, which results in a high POSN SEL output from NAND gate U2A.

Approximately one-third of the way through BP3, the positive-going PL (pen lift) pulse and the start of the retrace period occur. With all three of its inputs high, NAND gate U6A's output goes low. Inverted in U2D, this low U6A output resets the flip-flop, causing the $\overline{Q}$ output to again go high. NAND gate U2A still has one high input and one low input (although the polarities have reversed); therefore, its POSN SEL output remains high.

Approximately two-thirds of the way through BP3, the PL pulse ends. At this point, gate U6A, with at least one input (PL) low, switches its output from low to high. Since gate U2A now has two high inputs, its POSN SEL output goes low, ending the position select period. At the end of BP3 (that is, when BP3 goes low again), the original sweep period conditions are restored.

The DBP (display blanking pulse) from Frequency Control Assembly A2 is high during retrace and low during sweep. This signal, along with the LEV SW EN (level sweep enable) input are applied to NAND gate U6C. Since in the absence of a high POSN input, NAND gate U6A's output is always high, the normal output from U6C is high during the sweep period and low during blanking. The low output from U6C forces the output of NAND gate U8 to go high during the DBP (display blanking pulse) period and set the TTL DISP (CRT blanking) low to blank the CRT.

If, however, the POSN line is high, the output of U6A will go low during the PL (pen list) pulse period and inhibit the CRT blanking. With no blanking imposed on it, the CRT will display the reference position line or beam center dot (polar mode) during the PL portion of the retrace period.

Chop Oscillator

The chop oscillator consists of two NAND gates, U4D and U2B, and inverter U3A connected as a free-running multivibrator. A feedback network made up of voltage-divider resistors R10 and R13, and capacitor C8 sets the oscillation frequency to approximately 120 kHz.

The chop oscillator is shut off by a low L ALT input to U2B from the control register. A high L ALT input turns the oscillator on. With the oscillator running, each sweep on the CRT is broken (chopped) into small segments and channels 1 and 2 are displayed on alternating segments. The chop oscillator output is fed to NAND gate U6B where, with the SEL and L POLAR ALT outputs of the control register, it determines the operation of the analog multiplexer stage.

Analog Multiplexer

The analog multiplexer, U9, is a triple, two-channel multiplexer integrated circuit, which selects the vertical and horizontal deflection signals supplied to the CRT's deflection amplifiers. Multiplexer U9B is controlled through NAND gate U6B by outputs from the chop oscillator and control register U7. It selects either Y CH 1 (channel 1 vertical deflection) or Y CH 2 (channel 2 vertical deflection) and transfers its selection to multiplexer section U9C. With a high control input from gate U6B, U9B selects Y CH 1. A low control input causes it to select Y CH 2.

D3-104C

The output of NAND gate U6B depends on the states of the three inputs applied to it: chop oscillator, SEL, and L POLAR ALT. When the chop oscillator is off, its output is high; the oscillator output has no effect on U6B's output unless the other two inputs to U6B are high and the oscillator is running. The states of the SEL and L POLAR ALT inputs to U6B are established in control register U7. The SEL input synchronizes the channel 1 and channel 2 vertical deflection outputs with the sweep alternate (SW ALT) timing. If the other two inputs to U6B are high, a high SEL selects the channel 2 vertical deflection input (Y CH 2) and a low SEL selects channel 1's vertical deflection input (Y CH 1).

L POLAR ALT is high for rectangular displays and low for the polar mode. A low L POLAR ALT signal is a command to display only the channel 1 vertical deflection. (Note that in the polar mode, the vertical deflection voltage path is channel 1; channel 2 has the X information.)

The manner in which NAND gate U6B is switched selects one of three possible outputs from multiplexer section U9B. One kind of output consists of alternating segments of Y CH1 and Y CH 2 in every sweep. This "chopped" output is produced by the chop oscillator. Another output consists of alternating sweeps of Y CH 1 and Y CH 2, controlled by the SEL output of the control register. The third kind of output is the polar mode output consisting of Y CH 1 only.

Analog multiplexer sections U9A and U9C select the source of the horizontal (X DISP) and vertical (Y DISP) deflection signals applied to the display CRT. In the absence of a low L NORM input from the 8505A's rear-panel receptacle A3J1 (NORMALIZER INTERCONN), the control inputs to U9A and U9C are held high through pull-up resistor U5R3. These high control inputs route the Signal Processor X and Y deflection signals to the display CRT's deflection amplifiers (A3A28 and A3A29). If the L NORM line is set low by a low input from the Normalizer, U9A and U9C will route the Normalizer X and Y inputs to the deflection amplifiers.

Blanking Combination Logic

The blanking combination logic stage combines all the blanking inputs into a single composite TTL blanking line, called TTL DISP (Transistor-Transistor Logic). (Blanking occurs when the TTL DISP line goes low.) Normally, the negative-going blanking pulses are developed by eight-input NAND gate U8 and inverted in two-input NAND gate U4C.

Unless the chop oscillator is running, the eight inputs to U8 are high throughout the sweep period, and U8's output is low. Inverted in U4C, this low U8 output produces a TTL DISP level of approximately +4 volts. One or more low inputs to U8 will set the TTL DISP output low to approximately zero volts and blank the CRT.

If the chop oscillator is running, the leading and trailing edges of its output pulse, differentiated by capacitors C7 and C6 respectively, form negative-going pulses approximately 2 microseconds wide. These pulses blank the CRT during the switching of analog multiplexer U9B to prevent switching transients from being displayed during the sweep period, and to allow the deflection amplifiers time to react to a different set of signal inputs. Development of the TTL DISP blanking for a chopped sweep is shown in Figure D3-46B.

Normal blanking is a function of the DBP (display blanking pulse) applied to NAND gate U6C. The output of U6C goes low to blank the CRT whenever all three of its inputs are high. (Note that the LEV SW EN line is held high through a pull-up resistor on the A3A15 assembly in the absence of a low input from the test set through rear-panel connector A3J3.) The blanking timing is established by the reference position timing circuit (see above). Three other signals also affect the blanking. These signals are the L OFF, LEV SW

BLNK, and LPCP (low processor clock pulse) blanking. With any one of these signals low, the CRT will be blanked.

When a Normalizer is used with the 8505A, blanking is controlled by inputs from the Normalizer to inverter U3B, and to NAND gates U4A and U4C; U8, in this case, is effectively disabled by a low L NORM input from the Normalizer.

Pen Lift Driver

The Pen Lift Driver buffers the PL signal received from Frequency Control Assembly A2. Transistors Q1 and Q2, both connected in an inverting common emitter configuration, drive the rear-panel PL output. During the sweep period, the PL output is low.

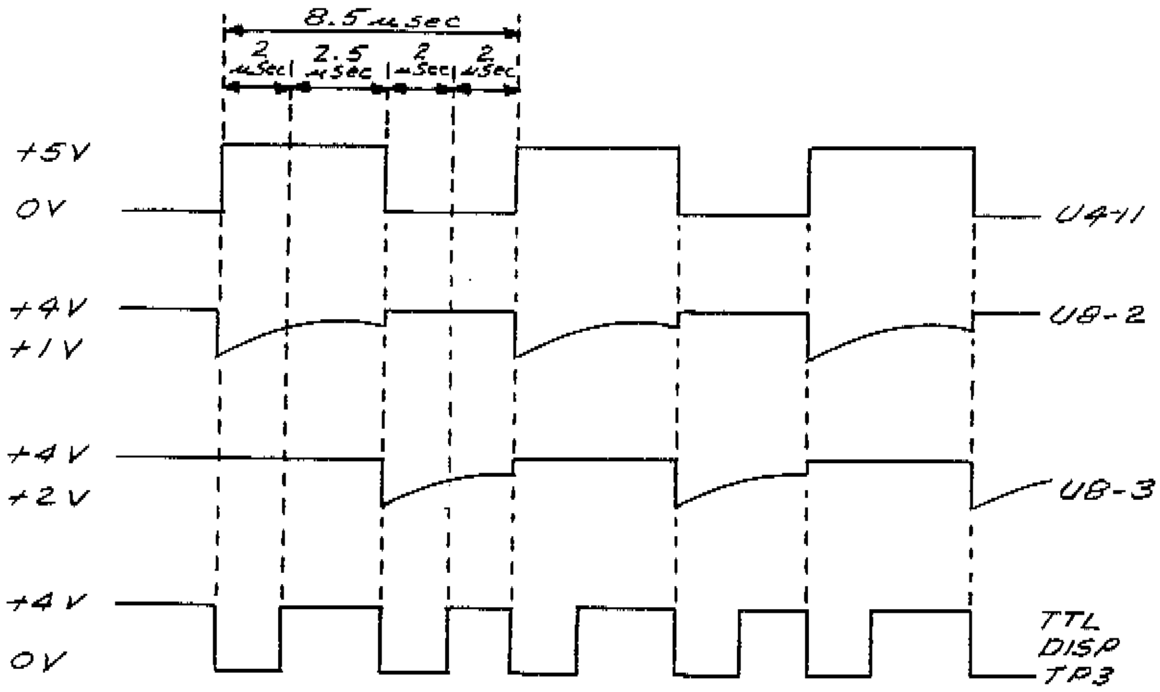


Figure D3-46B. Blanking Logic for Chopped CRT Display

FIG. D3-46C
SHT 1 OF 2

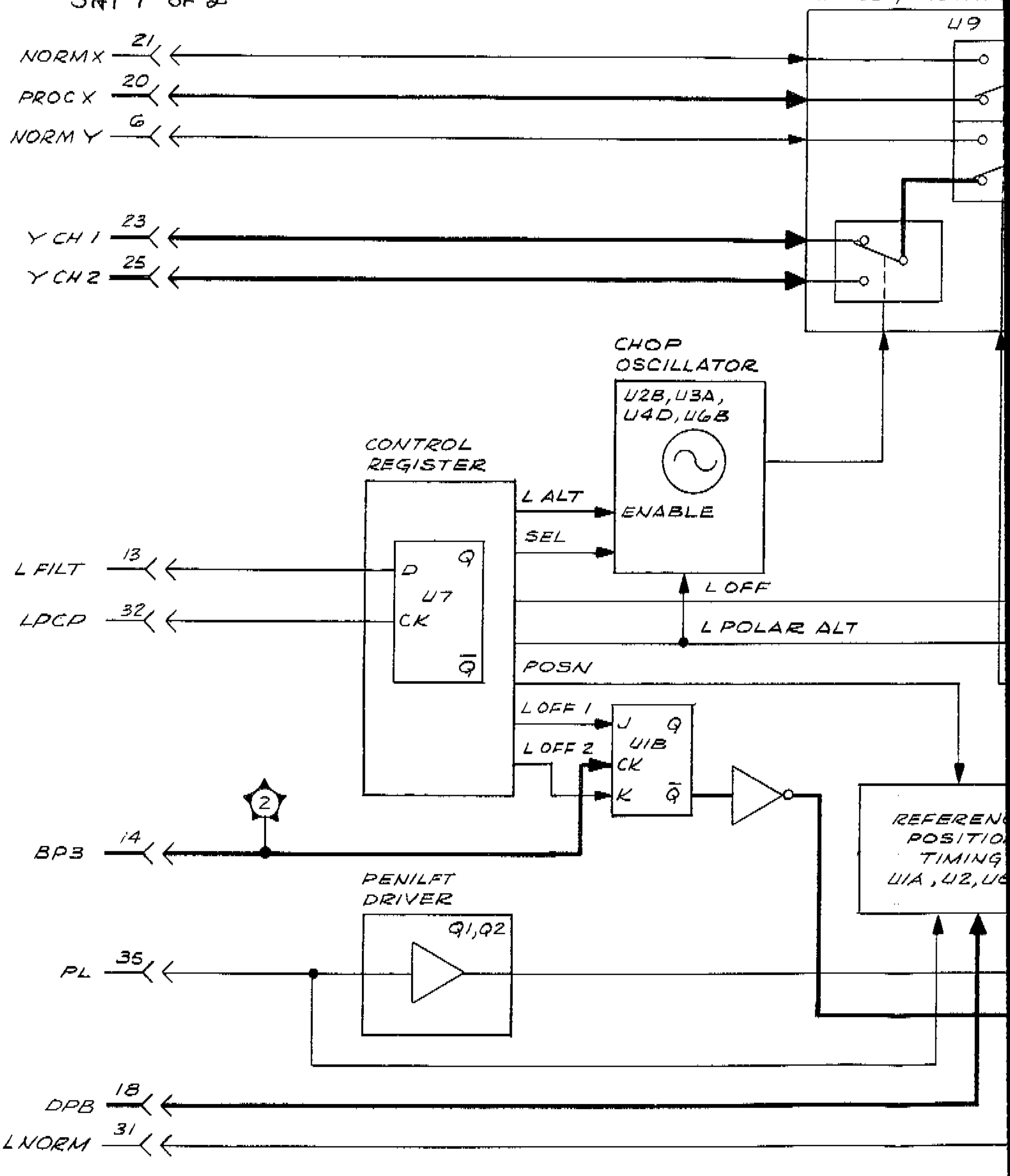


FIG. D3-46C
SHT. 2 OF 2

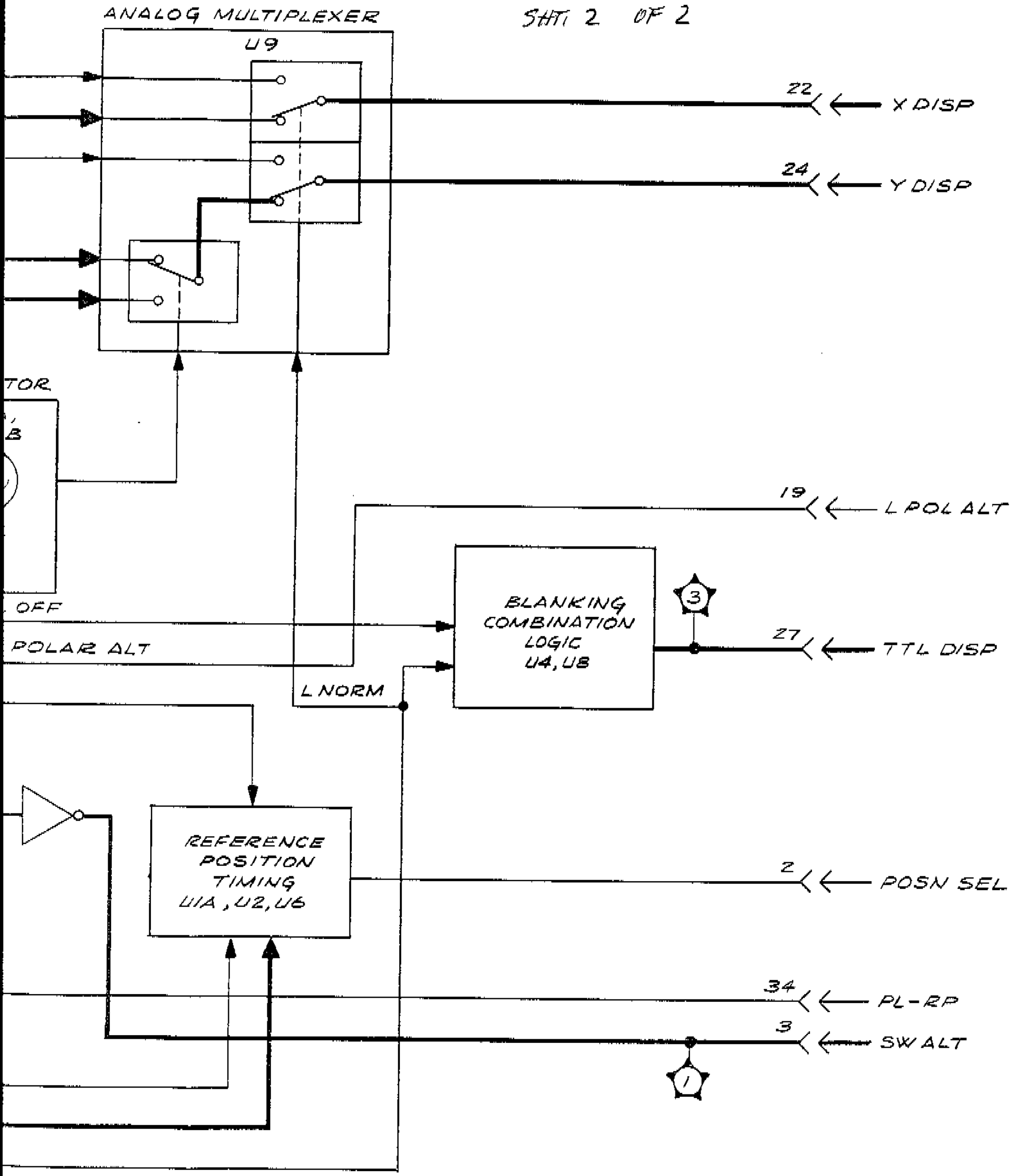


Figure D3-46C. A3A16 Blanking Logic, Block Diagram

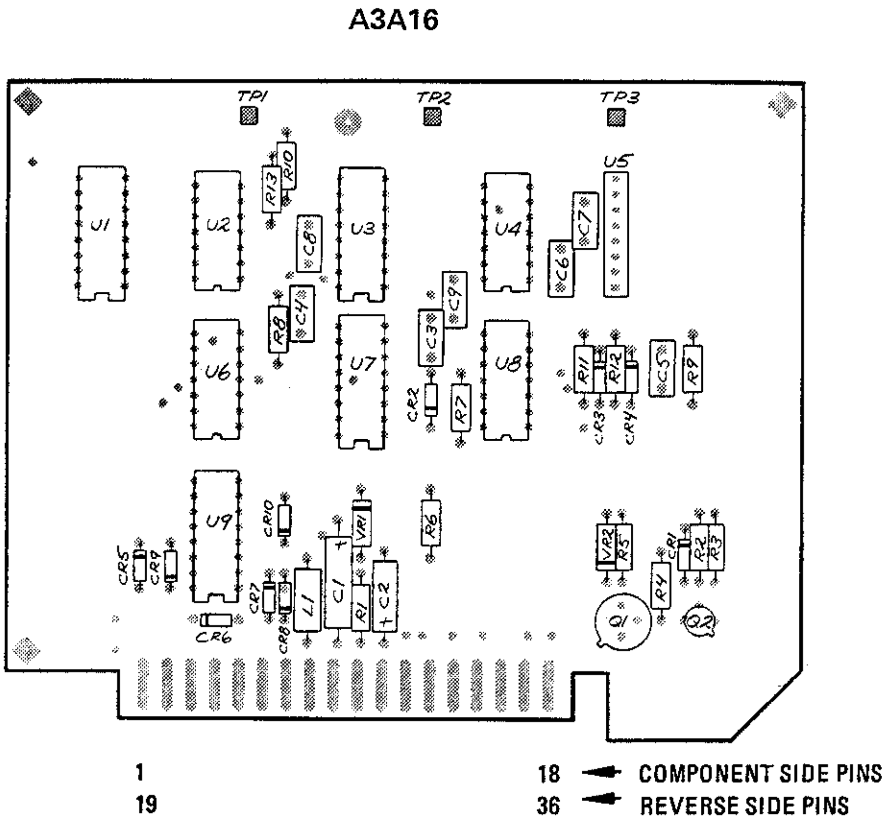


Figure D3-47. A3A16 Blanking Logic Parts Locations

FIG. D3-48
SHT. 1 OF 4

CONTROL REGISTER OUTPUTS

MNEMONIC	DESCRIPTION
PH ALT (U7-13)	1 WHEN CRT IS DISPLAYING PHASE
SEL (U7-12)	1 SELECTS CHANNEL 2 FOR DISPLAY
POLAR ALT (U7-11)	1 WHEN POLAR MODE IS SELECTED
L OFF (U7-2)	Ø WHEN CHANNEL 1 AND 2 ARE OFF
L ALT (U7-5)	Ø WHEN IN ALTERNATE SWEEP MODE
OFF 1 (U7-4)	1 WHEN CHANNEL 1 IS OFF
POSN (U7-3)	1 WHEN REF LINE POSN / BEAM CENTER IS DEPRESSED
OFF 2 (U7-10)	1 WHEN CHANNEL 2 IS OFF

DIGITAL INPUTS

CONTROL INPUTS	DESCRIPTION
BP3	Ø DURING SWEEP TRACE
PL	1 DURING SWEEP RETRACE
LEV SW EN	Ø SWITCHES IN DBP BLANKING
DBP	Ø DURING SWEEP
LEV SW BLNK	Ø FOR EXTERNAL BLANKING
HMK BLK	Ø NOT USED (GROUNDED ON A3A15)
L NORM	Ø SWITCHES IN NORMALIZER INPUTS
NORM TTL	Ø FOR CRT BLANKING FROM NORMALIZER

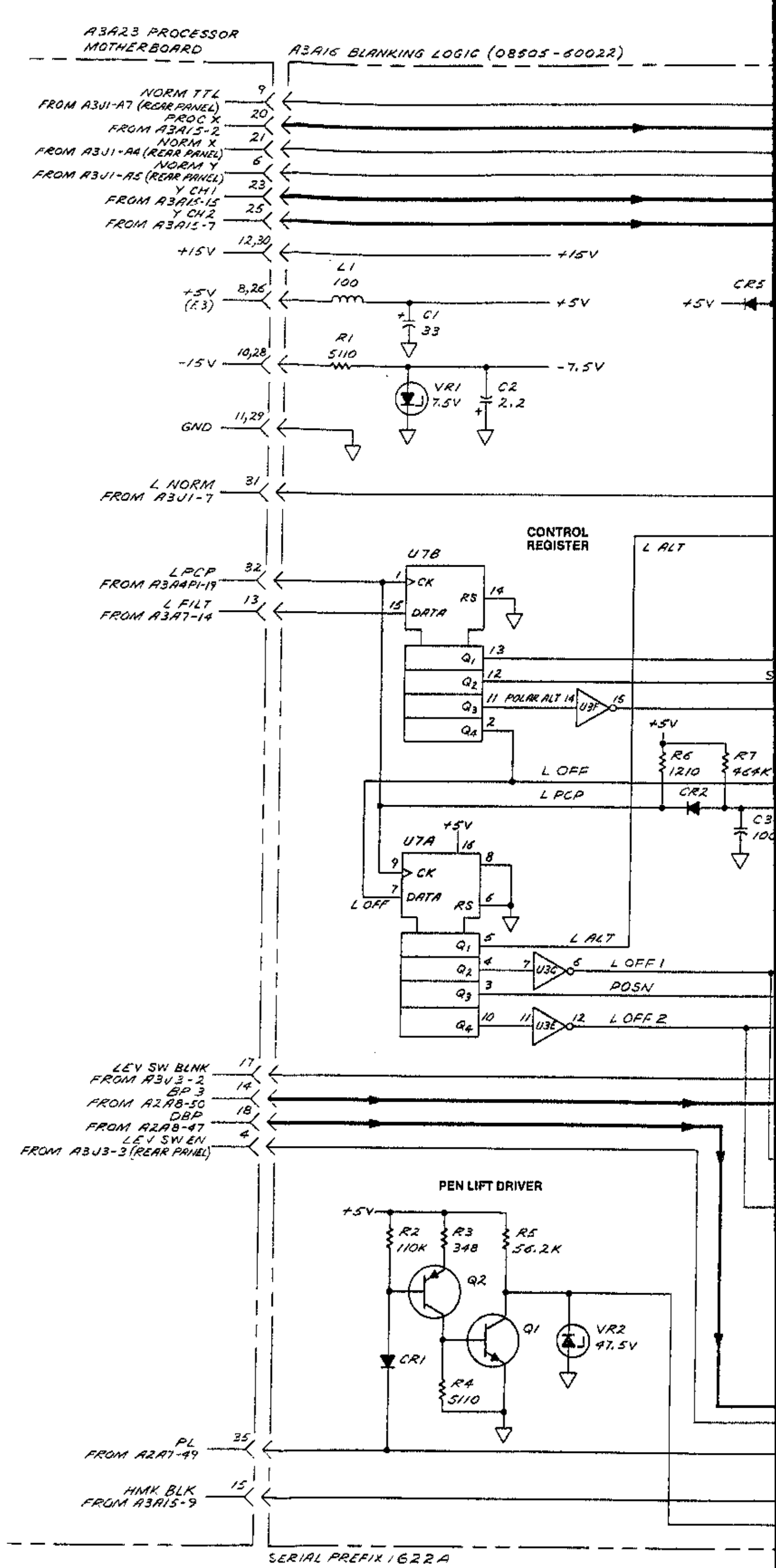


FIG. D3-48
SHT. 2 OF 4

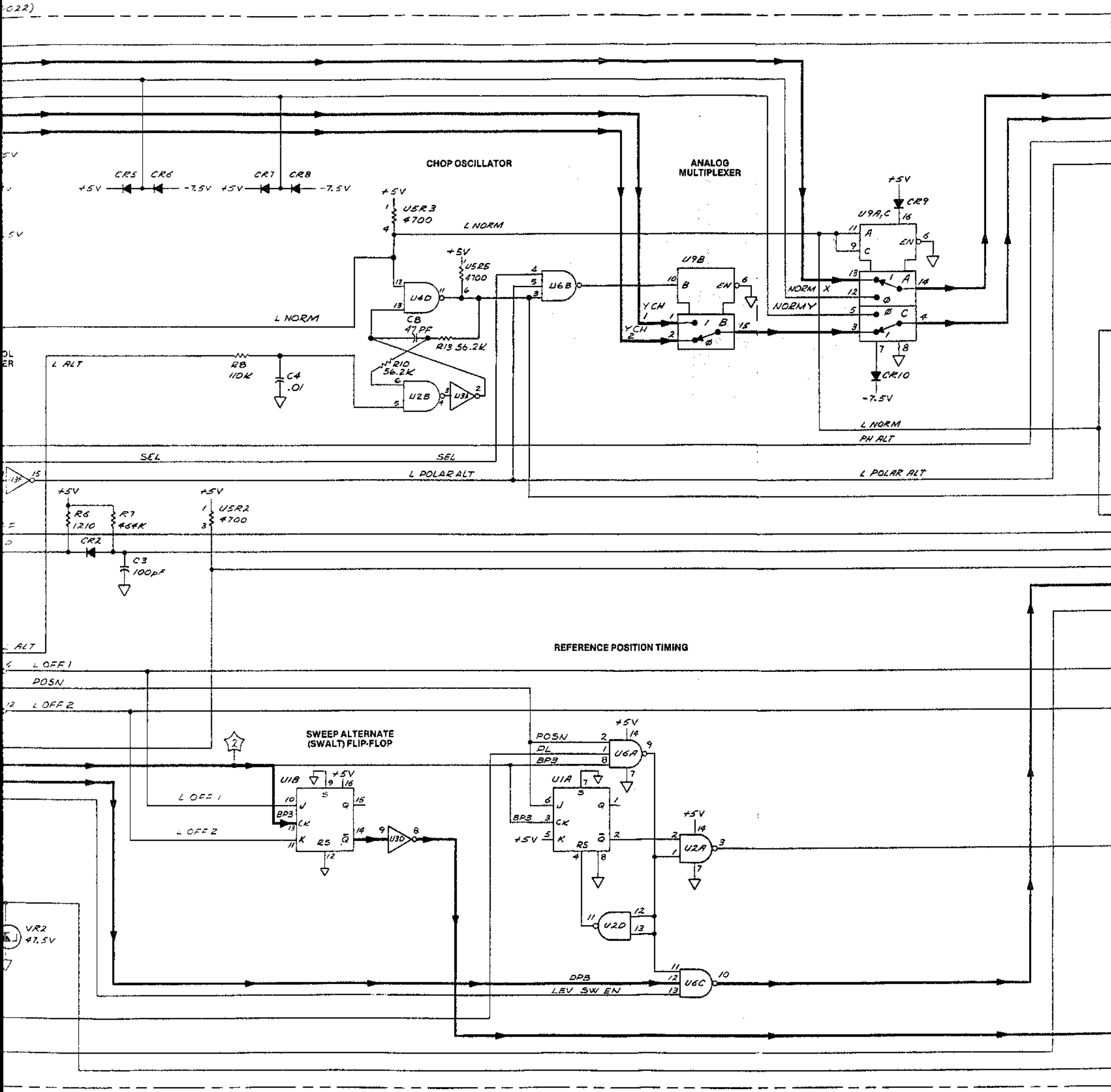


FIG. D3-48
SHT. 3 OF 4

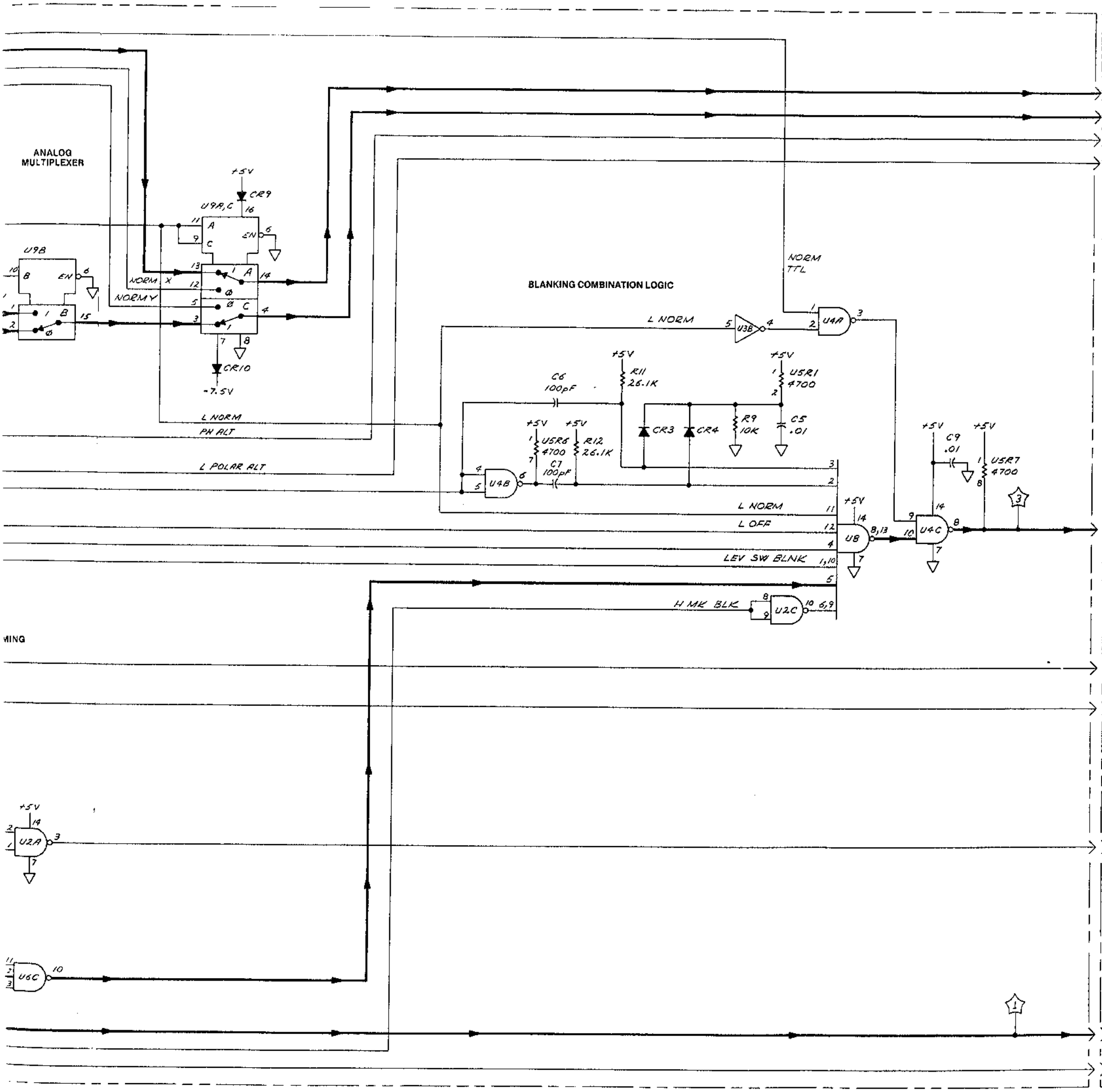
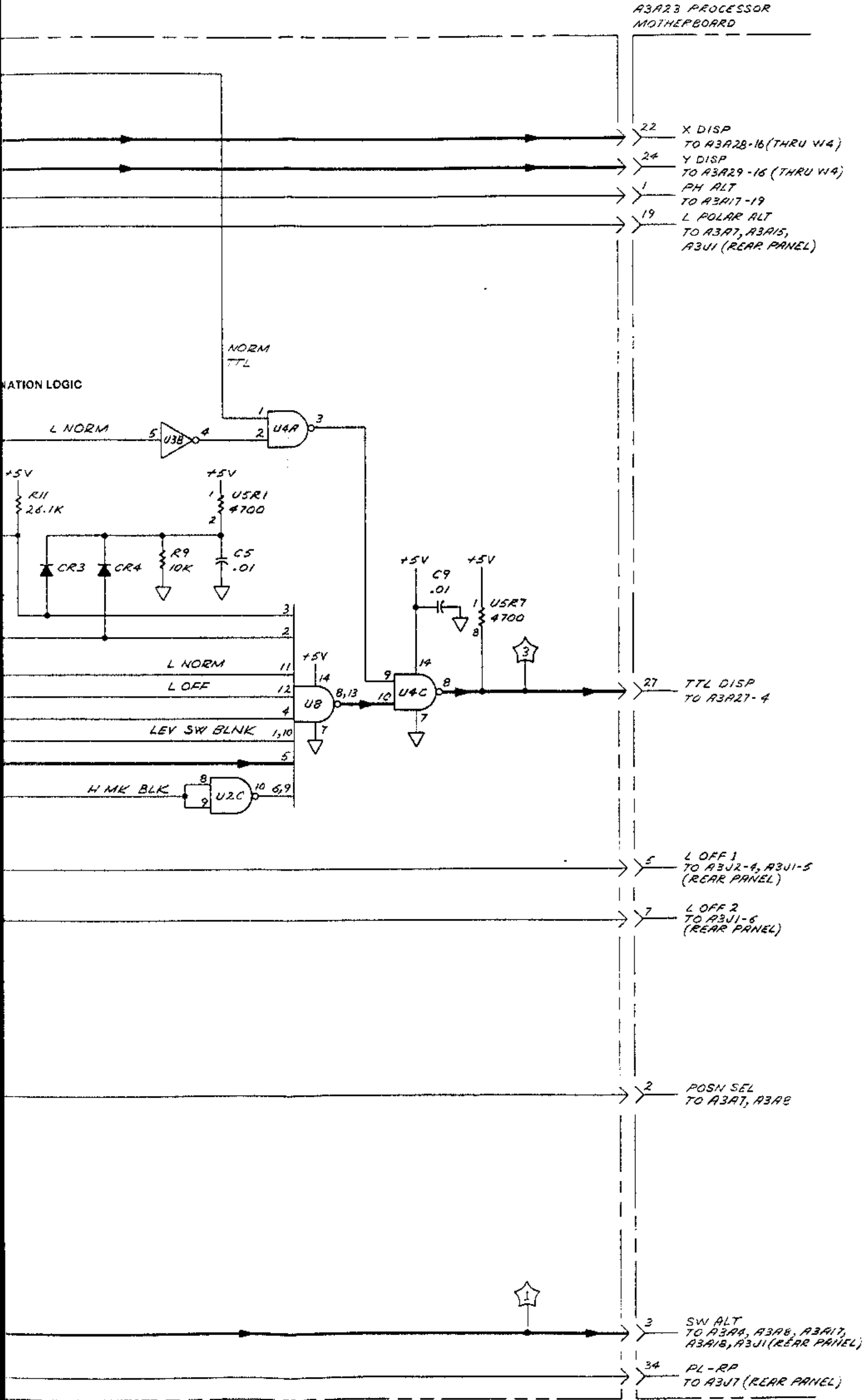


FIG D3-48
SHT. 4 OF 4



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; CAPACITANCE IN MICROFARADS; INDUCTANCE IN MICROHENRIES
3. ——— PRIMARY SIGNAL FLOW

CHANNEL 1 SETUP

MODE : MAG
INPUT : A
SCALE / DIV : 2dB
PORT A INPUT : -20dBm @ 30MHz
REF OFFSET : -10dB
CHANNEL 2 : OFF

CHANNEL 2 SETUP

MODE : PHASE
INPUT : A/R (0 DEG PHASE)
SCALE / DIV : 45 DEG
ELECTRICAL LENGTH : +400° SCAN
REF OFFSET : 0 (BOTH PHASE AND MAGNITUDE)
CHANNEL 1 : OFF

REFER TO THEORY TEXT FOR WAVEFORMS

REFERENCE DESIGNATIONS

C1 - C9
CR1 - CR10
L1
Q1 - Q2
R1 - R13
U1 - U9
VR1 - VR2

A3A16

Figure D3-48. A3A16 Blanking Logic, Schematic

A3A17 MARKER I ASSEMBLY

General Description

The A3A17 Marker I Assembly contains two separate circuit functions: (1) analog circuitry for the dual slope analog-to-digital converter (A/D Converter) and (2) Diamond Generator for drawing the diamond markers. The A/D Converter takes an instantaneous marker measurement, then converts this measurement to digital logic and provides a digital marker measurement output. The analog circuitry for the conversion is contained on the A3A17 Marker I Assembly and the digital counter, timing/control and output circuits are contained on the A3A18 Marker II Assembly. The Diamond generator provides the X and Y deflection voltages that draw the diamond markers on the CRT trace.

A/D Converter

The A/D Converter uses the dual slope conversion technique as shown in Figure D3-48A. This technique consists of integrating the selected channel input voltage for a fixed period of time (T ≈ 4 msec). At the end of this charge time, the integrator output voltage is directly proportional to the selected channel input voltage. The integrator is then discharged at a constant rate by switching in a fixed reference voltage, either $+V_{REF}$ or $-V_{REF}$ depending on the integrator output voltage polarity. Since the rate of discharge is constant, the integrator discharge time is directly proportional to the selected channel input. This discharge time is measured by counting a fixed frequency clock to provide the digital output. The A3A18 Marker II Assembly contains the digital counter and provides the timing/control logic to generate the fixed integration time (T ≈ 4 msec) and control signals for the analog switches (U1, U8C).

Input Multiplexing, Scaling and Filter Amplifier

The input stage of the A/D Converter selects the analog inputs used for the marker measurement, provides different scale factors to permit autoranging of the measurement and low-pass filters the input signal according to the front panel BW and VIDEO FILTER pushbuttons. The CH 1 MPX and CH 2 MPX analog inputs to the A/D Converter represent magnitude, phase or group delay values as selected by the A6 Input Multiplexer. The V OFFSET 1 and V OFFSET 2 analog inputs are offset voltages representing magnitude or group delay offsets entered on the front panel. The SW ALT control input controls switches U8 and U9 to select either Channel 1 or Channel 2 inputs for processing (SW ALT: CH 1 = 1). When both channels are displayed, the Channel 1 and Channel 2 information is processed on alternate sweeps. If the selected channel input is a phase measurement, the PH ALT control input to U10 is high (+5 volts), forcing the U10A and U10B outputs low and shunting the respective V OFFSET Input to ground through switch U8 or U9; the selected CH MPX input is fed to the input of amplifier U6. The selected V OFFSET and CH MPX inputs are summed at the input of amplifier U6 for magnitude and group delay measurements. The inverting Scaling Amplifier U6 normally has a gain of 0.4 as determined by feedback resistor R17, selecting by U9C, and the 40K input resistors R2 through R5. A +10 volt input to amplifier U6 gives a −4 volt output to the Sample-Hold circuit. When the U6 input signal is small, the A3A3 Processor Control Assembly can change the L A/D EXP control input to U9C from a high (+5 volts) to a low (0 volts) and switch R9 and R11 into the feedback loop of U6. This changes the U6 gain to 4.0 and increases the A/D Converter resolution so that readouts with 0.01 dB and 0.1 degree resolution can be obtained. INPUT OFFSET adjustment (R10) removes the offset of U6 so that a change in amplifier gain will not affect the measurement due to a change in U6 output offset. The front panel BW and VIDEO FILTER pushbuttons control the bandwidth of amplifier U6 by selecting different feedback capacitor (C9—C13) through analog switch U7. The U7 control inputs are L FILT (0 = VIDEO FILTER), L 1KHZ (0 = 1KHz BW) and L A/D EXP (0 = small channel input signal). If neither the VIDEO FILTER or 1 KHZ BW is selected, both the L FILT and L 1KHZ control inputs are high (+5 volts) and the U7 ENABLE Input (U7-6) is high (+5 volts) to disable the U7 analog switch. This opens all U7 switch connections and leaves C13 as the only capacitor in the U6 feedback loop to give an amplifier bandwidth of 10 kHz.

Sample-Hold

The Sample-Hold (S-H) circuitry tracks the output of amplifier U6 until a Data Marker (DM) pulse is received on the A3A18 Marker II Assembly. This S-H circuit then holds the instantaneous U6 output voltage until the marker measurement is completed. Prior to a DM pulse input to A3A18 Marker II Assembly (start of marker measurement conversion cycle), the A/D RESET input from A3A18 is high (+5 volts) to turn off transistors Q1 and Q2. This keeps FET switch Q3 turned on so the voltage on capacitor C16 tracks the output of amplifier U6. When the DM pulse triggers the A3A18 Marker II Assembly, the A/D RESET line goes low (0 volts) to turn on transistors Q1 and Q2. This clamps the gate of FET Q3 to −15 volts and turns it off. The voltage input to amplifier U2 is held by capacitor C16 and represents the Channel 1 or Channel 2 marker value. When the marker measurement is completed, the A/D RESET line returns to a high (+5 volts) and capacitor C16 again tracks the amplifier U6 output until the next DM pulse. Capacitor C16 is buffered by the high impedance voltage follower U2. The A/D OFFSET adjustment (R30) is set to null the U2 sample-hold and A/D Converter input offsets.

Analog Multiplexer

Analog Multiplexer U1 is controlled by the A/D REF 1 and A/D REF 2 lines from the A3A18 Marker II Assembly. Prior to the marker measurement, the A/D REF 1 and A/D REF 2 control lines are high (+5 volts) to ground the input of integrator U5. When a Data Marker (DM) pulse triggers the A3A18 Marker II Assembly, the A/D REF 2 control line goes low (0 volts) to select the Sample-Hold U2 output for charging the integrator (U5) over a fixed time period of four milliseconds. At the end of this fixed charge time, A/D REF 1 goes low (0 volts) and A/D REF 2 either stays low (0 volts) to select $+V_{REF}$ or goes high (+5 volts) to select $-V_{REF}$ for discharging the integrator. Polarity of the reference voltage selected is opposite of the Sample-Hold (U2) output polarity. When the marker measurement is completed, both A/D REF 1 and A/D REF 2 return high (+5 volts) until another Data Marker (DM) is received on the A3A18 Marker II Assembly.

Voltage Reference

The voltage references used to determine the constant discharge rate of the integrator (U5) are derived from a 6.2 volt Zener diode (VR2) in the feedback loop of operational amplifier U3B. Emitter follower Q4 provides additional current gain for amplifier U3B and the SCALE adjustment (R41) establishes the −4 volt reference output to analog multiplexer U1. Operational amplifier U3A inverts this reference to obtain the +4 volt reference. SYMMETRY adjustment (R31) matches the +4 volt reference with the −4 volt reference.

Integrator

The integrator consists of operational amplifier U5 with capacitor C20 in the feedback loop. Prior to a marker A/D conversion, the integrator input is grounded by analog multiplexer U1. Switch U8C, controlled by the A/D RESET Line, places resistor R44 in parallel with integration capacitor C20 to reset the intergrator output to zero volts. When the A3A18 Marker II Assembly receives a Data Marker (DM) pulse, the A/D RESET Line goes low (0 volts) to remove resistor R44 from the feedback loop and shunt the current through it to ground. While the marker A/D conversion is in process, the rate of change in the integrator output voltage (TP1) is directly proportional to the integrator input voltage selected by analog multiplexer U1 (Sample-Hold output, $+V_{REF}$ or $-V_{REF}$).

Comparator

Comparator U4 senses the integrator output polarity and provides the A/D POL output to the A3A18 Marker II Assembly for generating the A/D REF 1 and A/D REF 2 control signals for the A17U1 Analog Multiplexer. The A/D POL output is also used to stop the marker measurement count on the A3A18 Marker II Assembly. During the integrator (U5) charge time, the comparator output goes high (+5 volts) for a negative integrator output and low (0 volts) for a positive integrator output. When the integrator discharge ramp output crosses zero volts, the comparator A/D POL output changes logic level to stop the counter on the A3A18 Marker II Assembly. The A/DRESET line biases the comparator's positive input (U4-2) approximately +10 millivolts to avoid random oscillations on the comparator output when not making a marker measurement.

Diamond Generator

The Diamond Generator consists of two input latches, a clamped ramp amplifier, an X-axis diamond shaping circuit and a Y-axis diamond shaping circuit. The DIA X and DIA Y outputs provide the X and Y axis deflection voltages for drawing the diamond markers on the CRT trace.

Input Latches (U11A, U11B) and Clamped Ramp Amplifier

When either the DM (Data Marker) or MP (Marker Pulse) input momentarily goes high (+5 volts), input latch U11A, U11B is set to give a +5 volt output on U11B pin 9 and start generation of the diamond marker. However, when operating in manual sweep mode, the PL (Pen Lift) input goes high (+5 volts) and forces the latch output (U11-9) low (0 volts) to prevent drawing the diamond marker. A high latch output turns on transistor Q13 to bias on transistor Q11. This reverse biases the emitter-base junction of transistor Q14, turning it off. Prior to receiving a DM or MP input, transistor Q14 was biased on and clamped the output of operational amplifier U12 to +0.6 volts. When transistor Q14 is turned off, U12 becomes an inverting amplifier with a gain of 200, as determined by the ratio of capacitor C17 to capacitor C18. The sweep ramp input (VSW2) is buffered by emitter follower Q15 and then amplified by U12. The U12 output (TP4) is a ramp starting at +0.6 volts and going negative at a rate directly proportional to the slope of the VSW2 input. When the U12 output reaches approximately −6.5 volts, transistor Q8 turns off and the collector voltage goes to +5 volts to reset input latch U11A, U11B. This clamps the operational amplifier U12 output back to +0.6 volts until the next diamond marker is drawn. The U12 output ramp width is dependent on the VSW2 input sweep rate as selected by the front panel SCAN TIME SEC switch and vernier. For example, selecting a SCAN TIME SEC of 0.1 seconds gives a U12 output ramp width of approximately 250 microseconds. Changing the SCAN TIME SEC switch to 1 second changes the U12 output ramp width to approximately 2.5 milliseconds. This results in approximately the same relative marker to trace intensity as the sweep speed is varied.

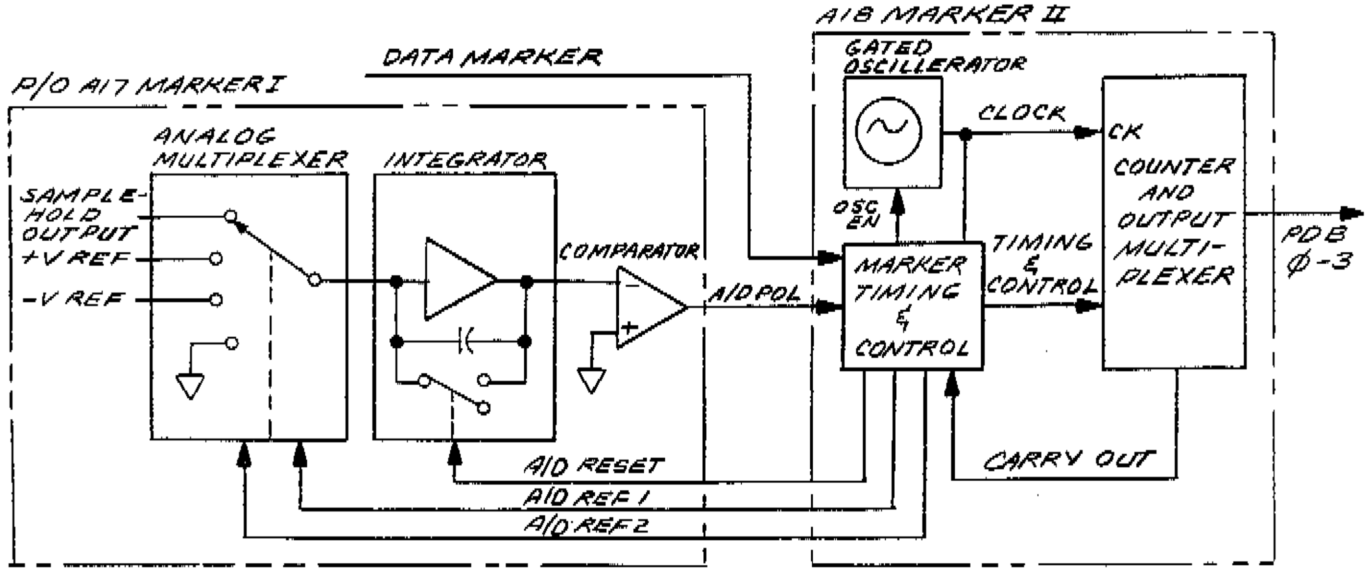
X Shaping Circuit

The U12 ramp output (TP4) is used by both the X and Y shaping circuits to generate the DIA X and DIA Y diamond marker deflection outputs. The X shaping circuit consists of transistors Q9, Q10 and Q12. The DIA X output (See A3A17 schematic for waveform) is generated by inverting the negative input ramp for the *positive* sloped portions of the DIA

X waveform and not inverting the input ramp for the *negative* sloped portion of the DIA X waveform. When the clamped ramp amplifier output starts going negative, transistors Q9 and Q12 are biased on and invert the ramp input to the base of Q10. Transistor Q10 is saturated and the Q10 collector (DIA X) follows the positive sloped ramp input. When the clamped ramp amplifier output reaches approximately −1.5 volts, Q9 and Q12 turn off and the input to Q10 is fed through resistor R56. Since Q10 is still saturated, the Q10 collector (DIA X) follows the negative sloped ramp input. When the clamped ramp amplifier output reaches approximately −5.2 volts, transistor Q10 comes out of saturation and becomes an inverting amplifier. This results in the DIA X output again becoming a positive sloped ramp.

Input Latch (U10D, U11C) and Y Shaping Circuit

The Y shaping circuit consists of transistors Q5, Q6 and Q7 and uses the clamped ramp amplifier output (TP4) to generate the DIA Y diamond marker deflection voltage. The DIA Y output is a "V" shaped waveform for drawing the diamond marker above the CRT trace and an inverted "V" shaped waveform for drawing the diamond marker below the CRT trace (See A3A17 schematic for DIA Y waveform). When the clamped ramp amplifier output (TP4) starts going negative, transistor Q7 is saturated and the Q7 collector follows the negative sloped ramp input. About halfway down the negative ramp input, Q7 comes out of saturation and becomes an inverting amplifier. This results in the Q7 output becoming a positive sloped ramp to complete the "V" shaped waveform. Transistors Q5 and Q6 invert the Q7 output and the Q6 output is either shunted to ground through diode CR11 or switched in as the DIA Y output through diode CR10. When the Q6 output is switched through diode CR10, it is summed with the Q7 output through a 2:1 resistor network (R59, R63) and the DIA Y output is an inverted "V" to draw a down pointed diamond marker. The direction of the diamond marker (up or down) is determined by input latch U10D, U11C. A high (+5 volts) Data Marker (DM) input forces latch U11C pin 10 output low (0 volts) to turn on diode CR11. This results in the Q7 output being used to draw an up diamond marker. A high (+5 volts) Marker Pulse (MP) input sets latch U11C pin 10 output high (+5 volts) to turn off diode CR11 and the Q6 output is shunted through diode CR10 to draw a down diamond marker.



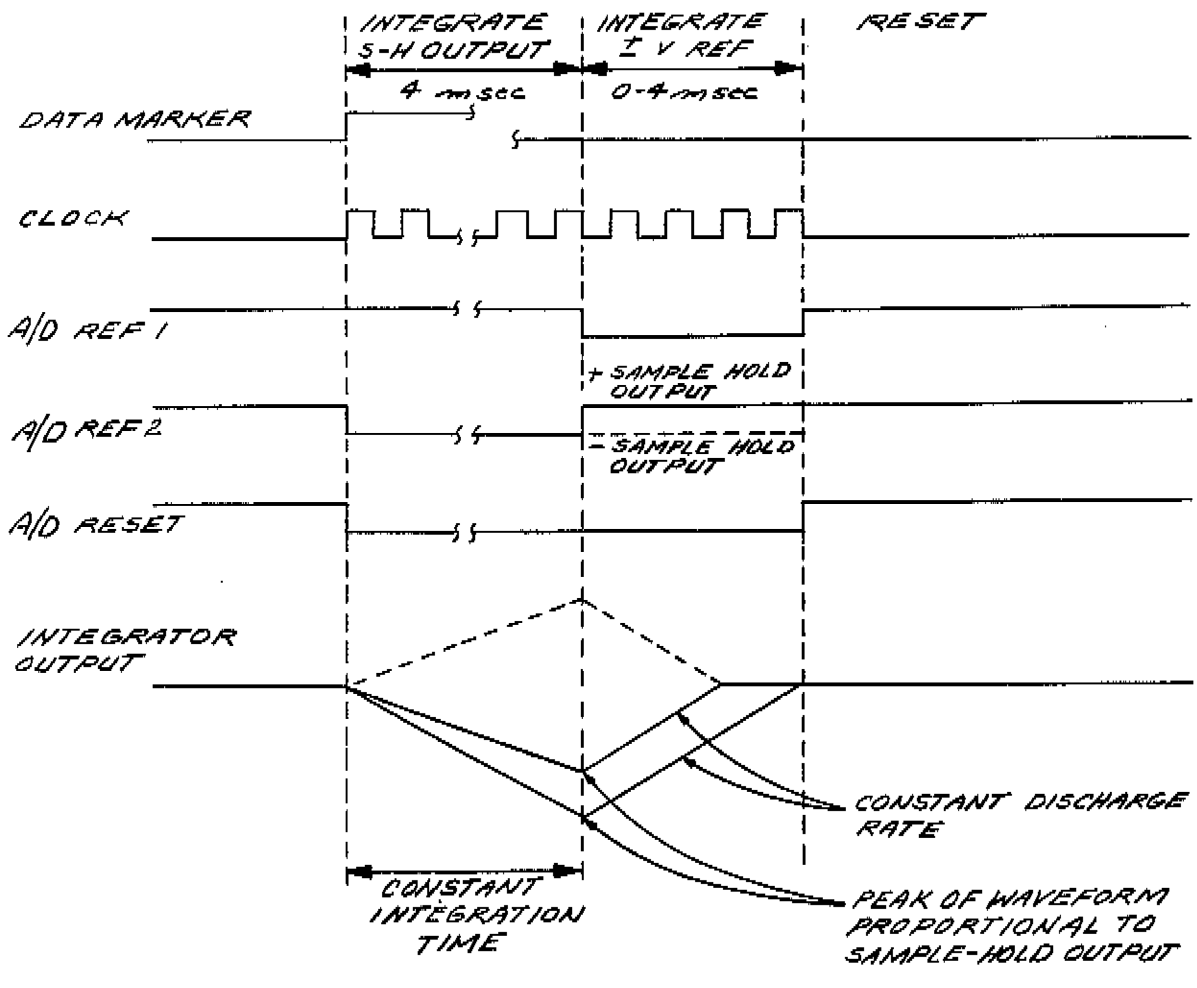


Figure D3-48A. A/D Converter Block Diagram and Timing Diagram

MNEMONIC TABLE

Signal	Full Name	Function/Description
A/D POL	Analog-to-Digital Polarity	Refer to Circuit Description
A/D REF 1	Analog-to-Digital Reference 1	Refer to Circuit Description
A/D REF 2	Analog-to-Digital Reference 2	Refer to Circuit Description
A/D RESET	Analog-to-Digital Reset	Refer to Circuit Description
CH 1 MPX	Channel 1 Multiplex	±5V Detector Output
CH 2 MPX	Channel 2 Multiplex	±5V Detector Output
DIA X	Diamond X	Horizontal Deflection Voltage for Marker Diamond
DIA Y	Diamond Y	Vertical Deflection Voltage for Marker Diamond
DM	Data Marker	Data Marker pulse from A2 Frequency Control (up-diamond)
L 1KHz	Low 1 kHz	∅ = 1 kHz
L A/D EXP	Low Analog-to-Digital Expand	∅ = X10 Expand
L FILT	Low Filter	∅ = 1 kHz IF BW when in LOCAL
L MK INT	Low Marker Intensifier	Low during marker diamond for intensification
MP	Marker Pulse	Marker Pulse from A2 Frequency Control (down-diamond)
PH ALT	Phase Alternate	1 = currently displaying phase
PL	Pen Lift	1 = lifted pen
SW ALT	Sweep Alternate	Controls Alternating Modes; 1 = CH1, ∅ = CH2
V OFFSET 1	Offset Voltage 1	D/A offset voltage for CH1
V OFFSET 2	Offset Voltage 2	D/A offset voltage for CH2
VSW 2	Sweep Voltage 2	Sweep Voltage 2 from A2 Frequency Control

FIG. D3-48B
SHT. 1 OF 3

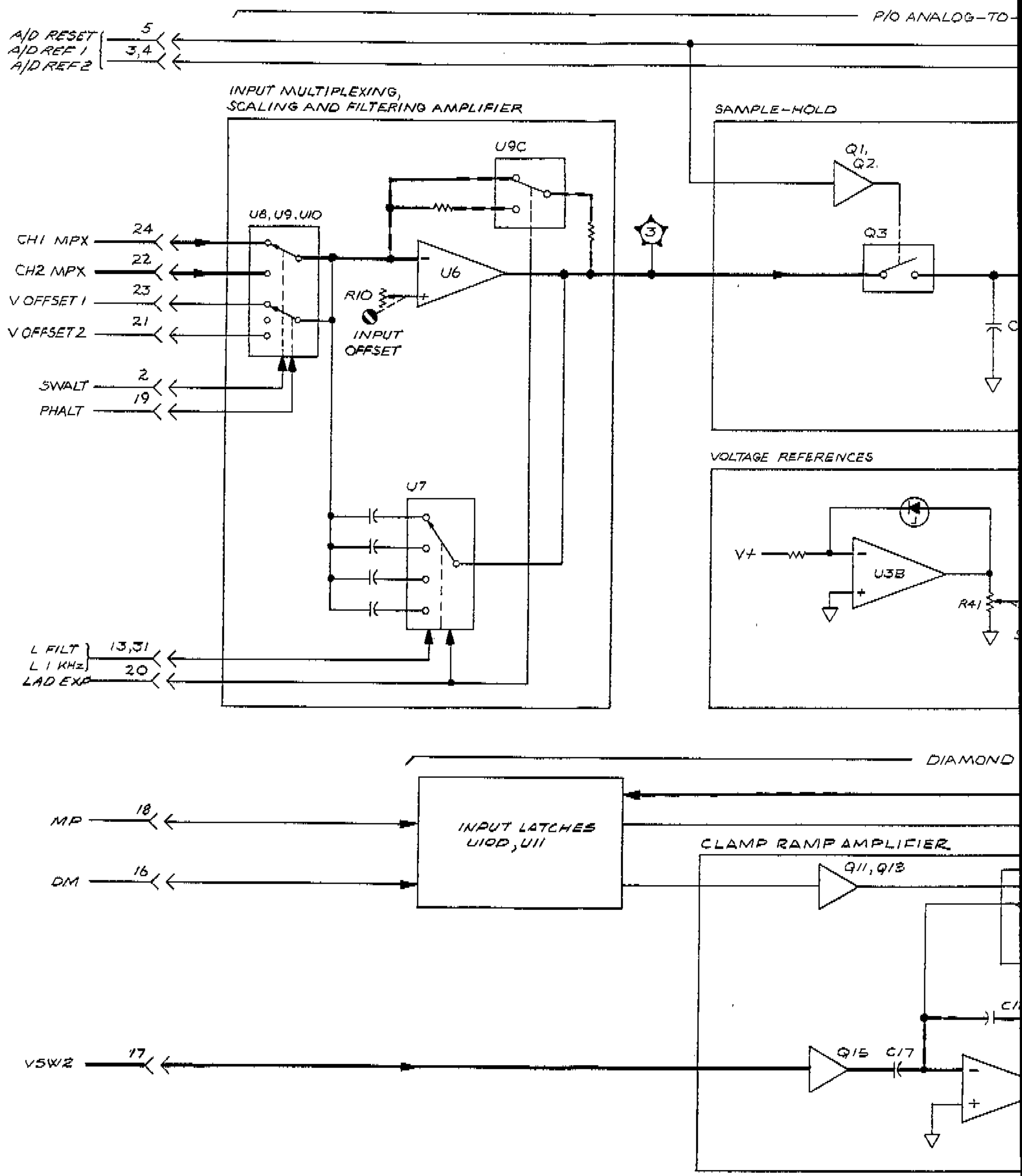


FIG. D3-48B
SHT. 2 OF 3

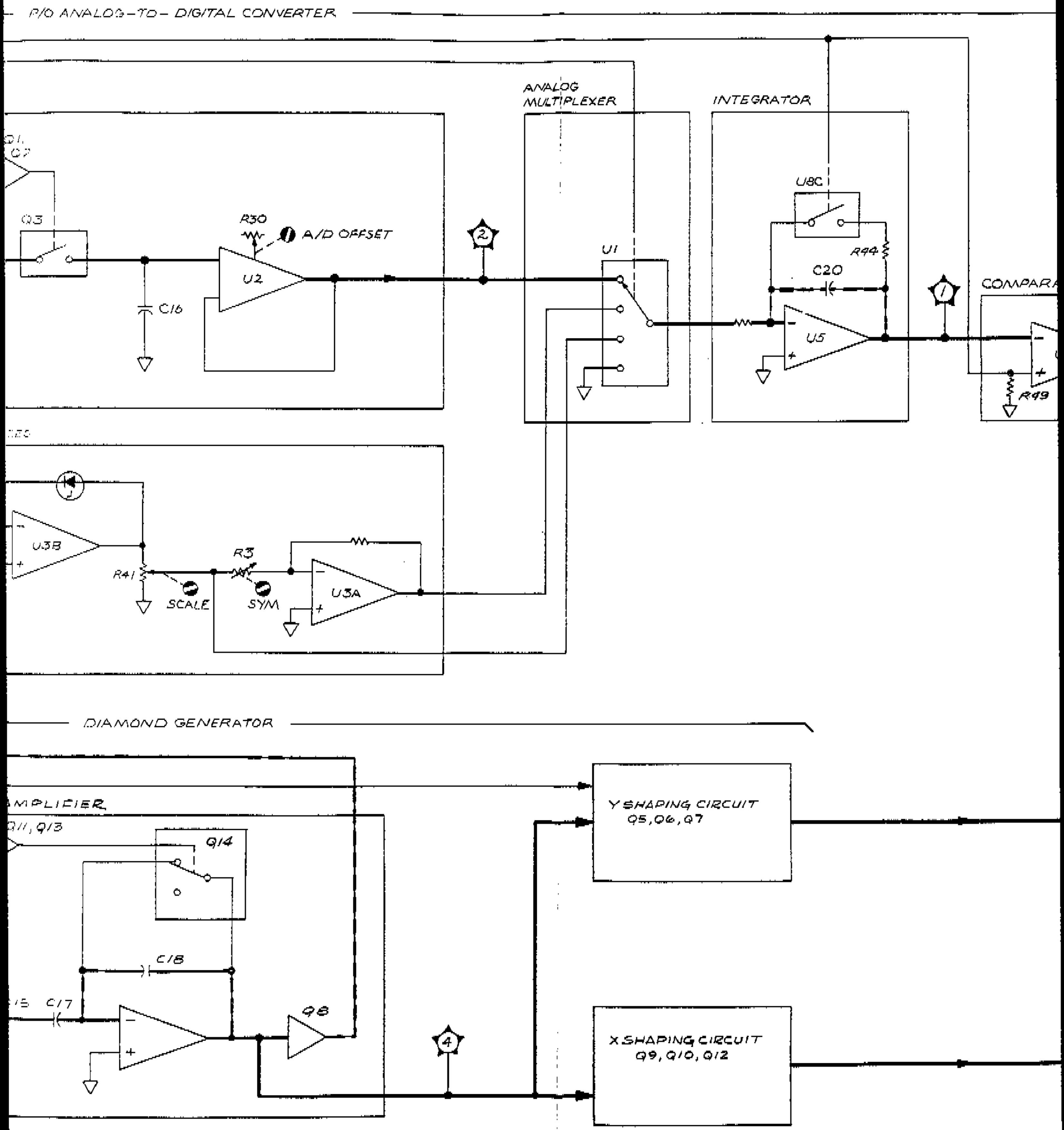


Figure D3-48B.

FIG. D3-48B
SHT. 3 OF 3

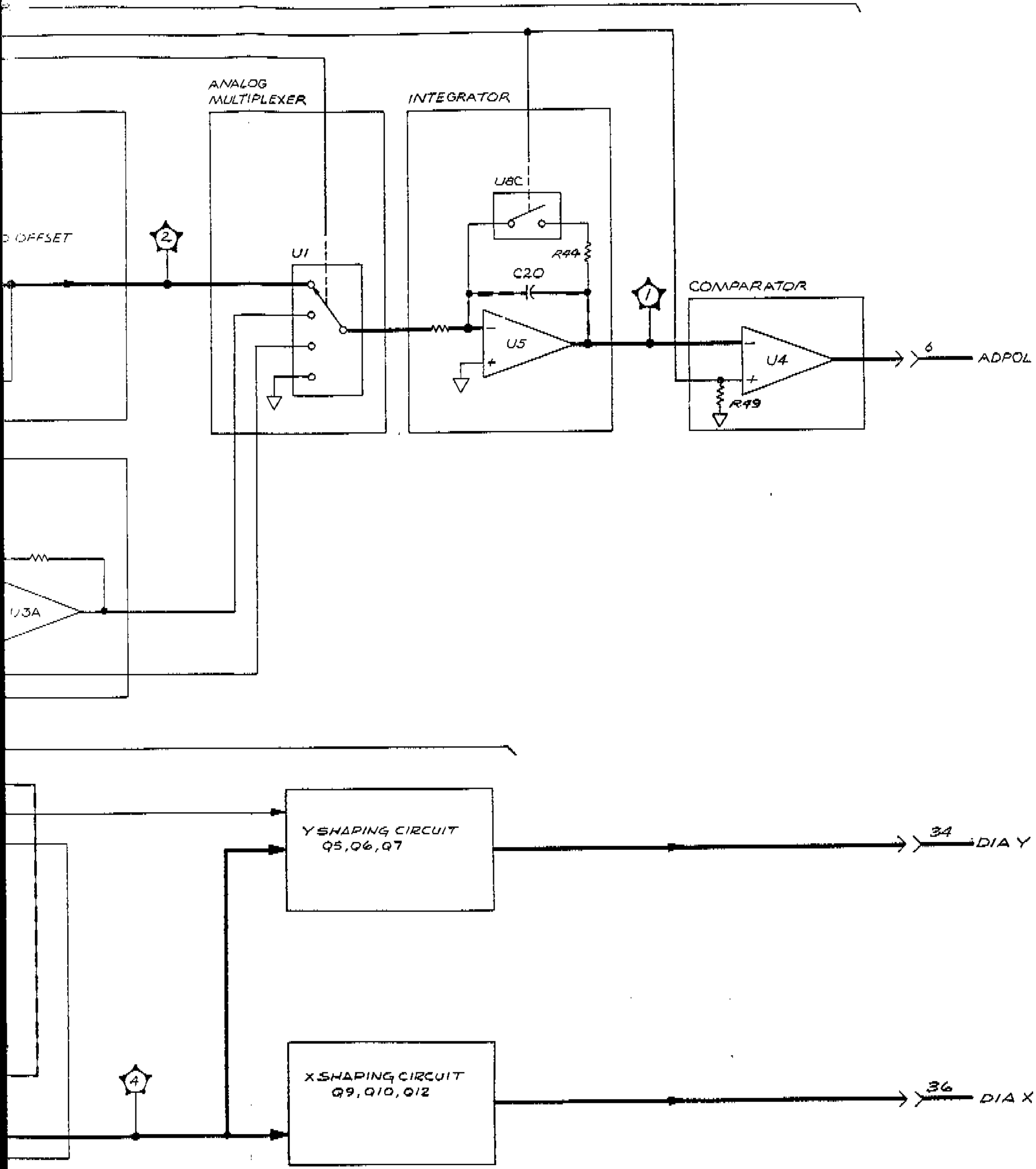


Figure D3-48B. A3A17 Marker I, Block Diagram

A3A17

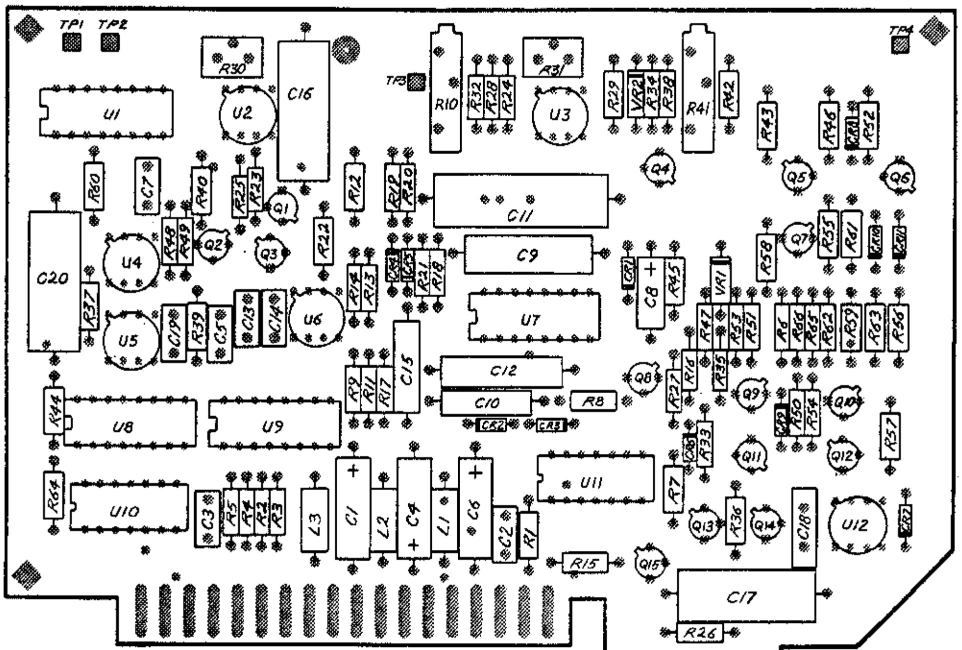


Figure D3-49. A3A17 Marker I Parts Locations

FIG. D3-50
SHT. 1 OF 4

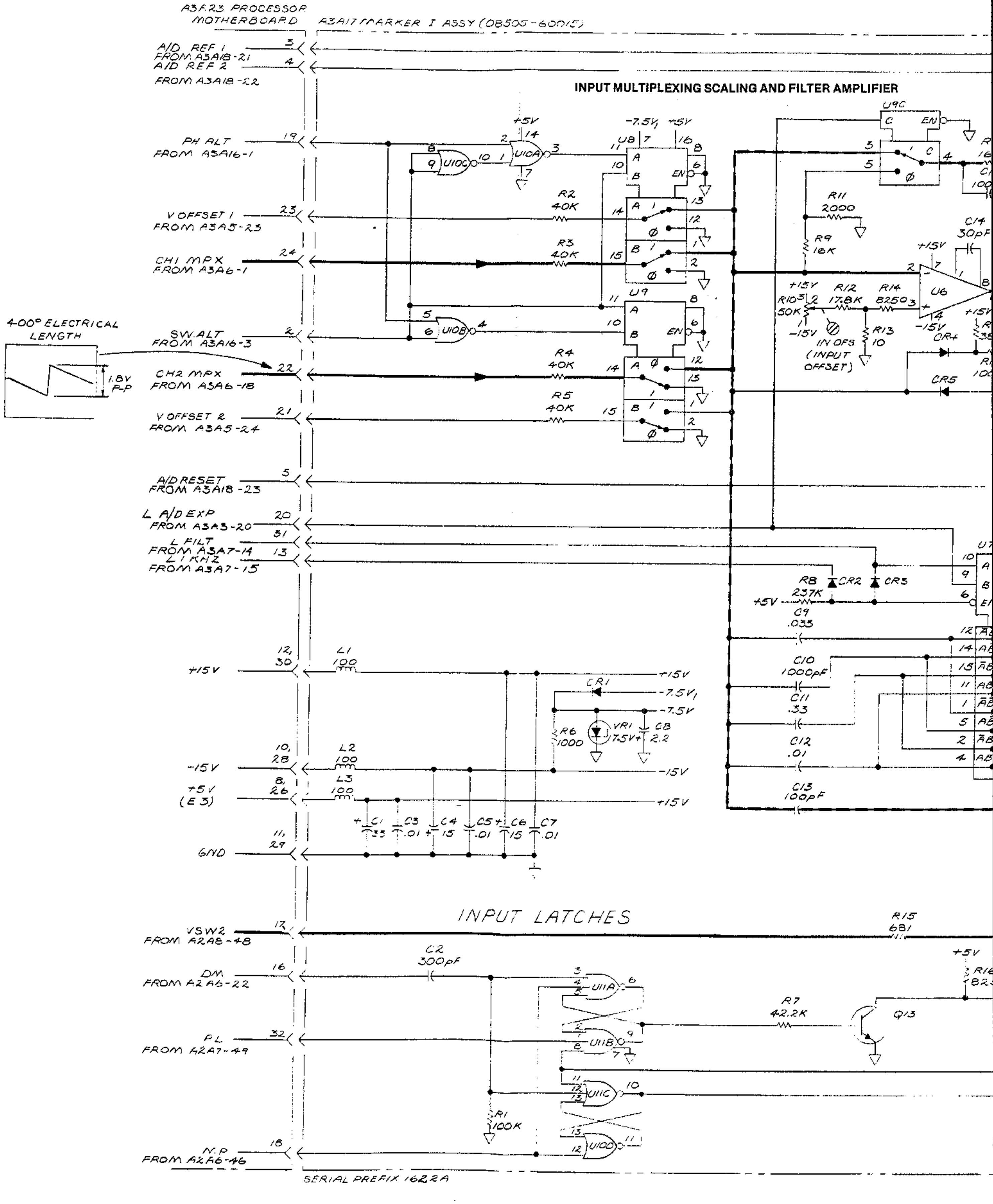


FIG. D3-50
SHT. 2 OF 4

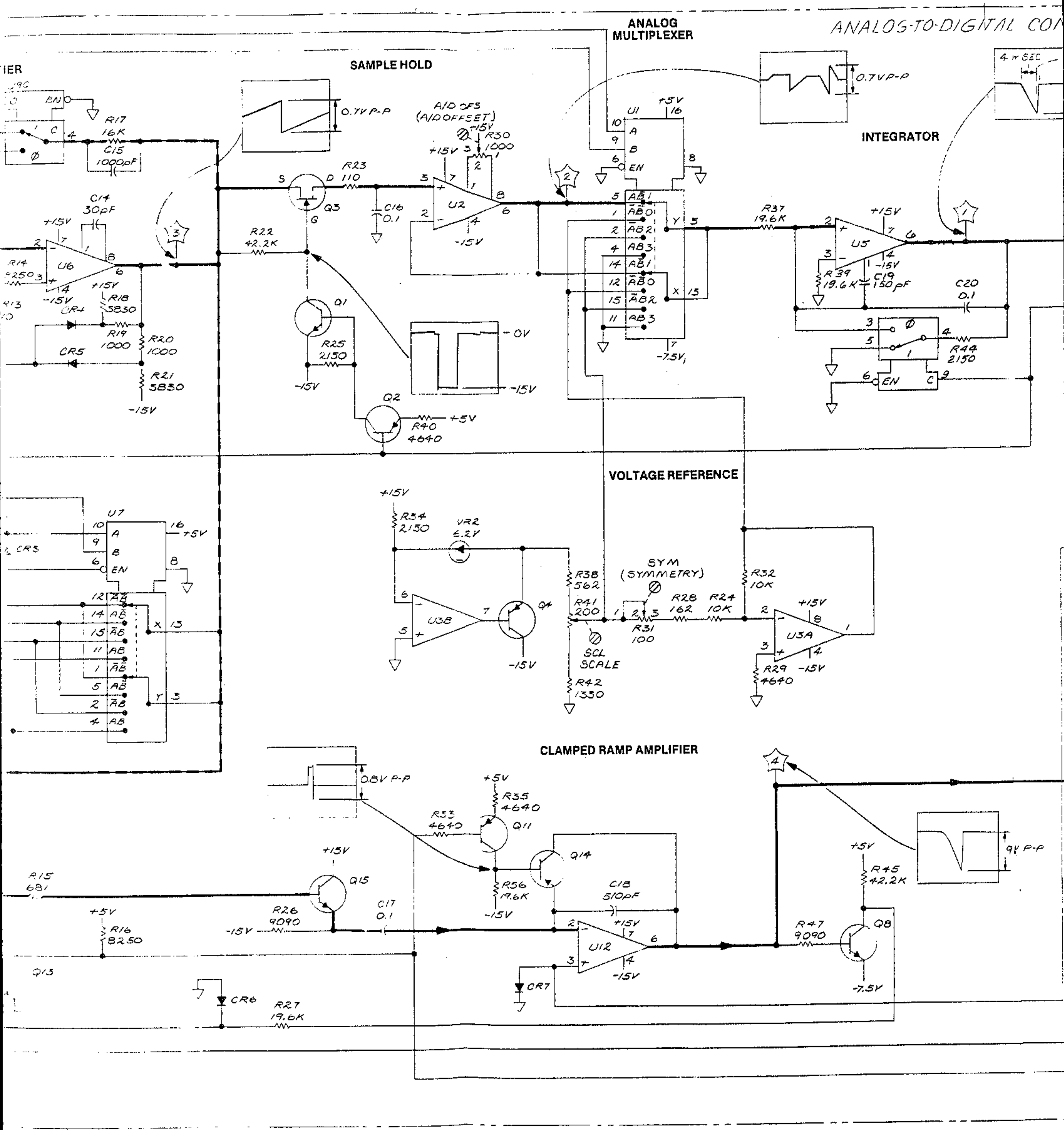


FIG. D3-50
SHT. 3 OF 4

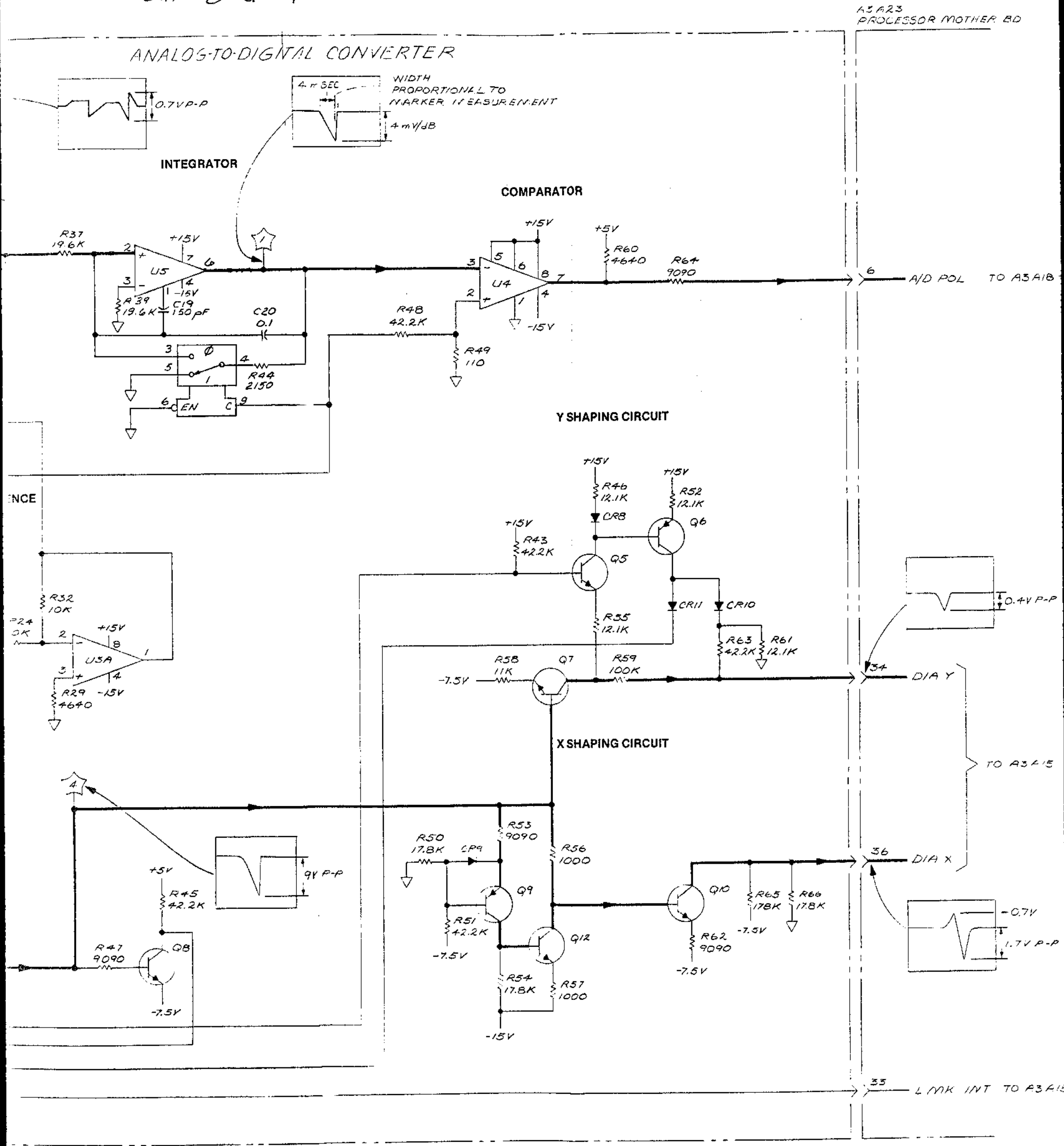
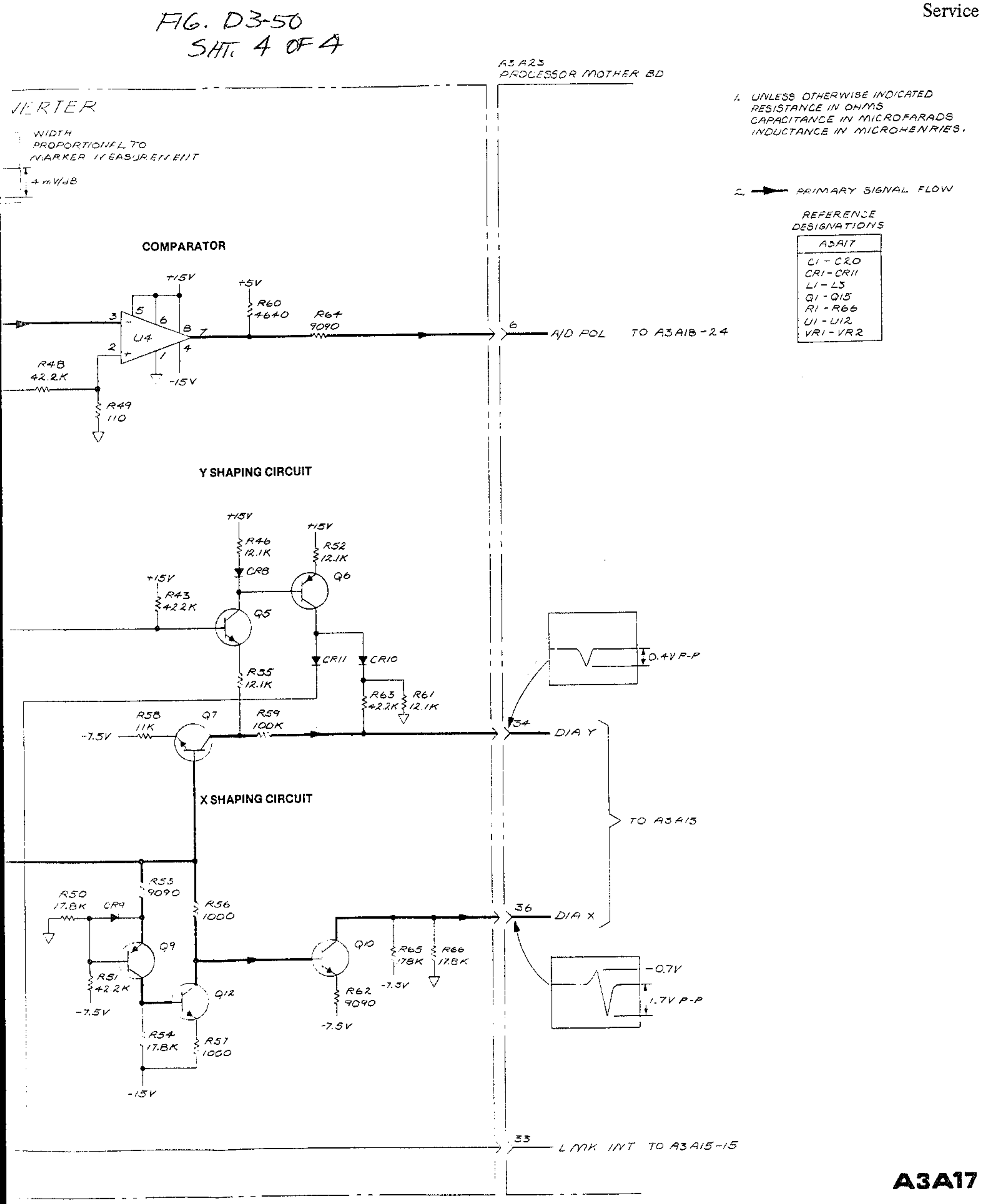


Figure D3



A3A17

Figure D3-50. A3A17 Marker I, Schematic

A3A18 MARKER II ASSEMBLY

General Description

The A3A17 Marker I and A3A18 Marker II assemblies for a 3 1/2 digit dual slope analog-to-digital converter (A/D Converter.). A3A18 provides the timing and control logic for converting the marker measurement (magnitude, phase or group delay) from an analog voltage to BCD (Binary Coded Decimal) logic, and then transfer this BCD data onto the Processor Data Bus (PDB 0-3) when the A3A3 Processor Control Assembly is ready for the new data. The A3A17 Marker I Assembly performs the analog functions necessary for the A/D conversion.

A/D Converter

The A/D Converter uses the dual slope conversion technique as shown in Figure D3-50A. This technique consists of integrating the selected channel input for a fixed time period ($T \approx 4$ msec) as determined by the gated oscillator and counter on the A3A18 Marker II Assembly. At the end of this charge time, the integrator output voltage is directly proportional to the selected channel input voltage. The A3A18 Marker II Assembly then checks the polarity of the integrator output and selects the correct reference voltage for discharging the integrator. With the reference voltage applied, the integrator discharges at a constant rate, and the discharge time is directly proportional to the selected channel input. This discharge time is measured by counting a fixed frequency clock on the A3A18 assembly. When the integrator output crosses zero volts, the gated oscillator is stopped and the counter holds the marker measurement in BCD (Binary Coded Decimal) logic.

Initial Conditions

Timing and control logic for the A/D conversion is centered around the 3-bit state register consisting of flip-flops U3A, U3B and U10A. A timing diagram and flow chart for the marker A/D conversion are shown in Figure D3-50B. Prior to receiving a Data Marker (DM) start trigger, the state register outputs (S2, S1, S0) are all low (0 volts). This low state is decoded by NAND gate U13A to generate a low reset signal that clears the 3 1/2 digit counter (U6, U7, U8). NOR gate U2B inverts the U13A output to give a high reset signal for resetting counter flip-flop U12A (one bit) and polarity flip-flop U12B. NAND gate U9B inverts the most significant state register bit (S2) to give a high (+5 volts) A/D RESET out for resetting the A3A17 Marker I Assembly integrator. NAND gates U9A and U9B also decode the state register to provide high (+5 volts) A/D REF 1 and A/D REF 2 outputs to the A3A17 assembly.

Integrate Sample-Hold Output

The leading edge of the Data Marker (DM) input pulse clocks flip-flop U10A and sets S2 high (+5 volts) and the U10A-2 output low (0 volts). This turns on the 500 kHz gated oscillator (Q1, Q2) and the 3 1/2 digit counter (U6, U7, U8, U12A) starts counting from zero. Simultaneously, the A/D RESET and A/D REF 2 outputs drop low (0 volts) to enable the A3A17 Marker I Assembly integrator to integrate the sampled channel input signal. The integrator continues integrating until the 3 1/2 digit counter reaches a count of 1999 ($T \approx 4$msec) when NAND gate U4B provides a low (0 volt) overflow output. This forces NAND gate U9C output high (+5 volts) and, on the next clock edge, flip-flop U3A S1 output toggles to a high state (+5 volts). U3A-2 toggles low (0 volts) and switches exclusive OR gate U11B output low. This stops the counter at a count of 0000 and holds NAND gate U9C output high (+5 volts). On the next clock edge, the U3A S1 output toggles low (0 volts) and the U3B S0 output is clocked high (+5 volts). The S0 leading edge clocks the A/D POL input into flip-flop U12B to determine the integrator output polarity for selecting the reference voltage to discharge the integrator.

Integrate Reference Voltage

State register S2 and S0 outputs are high, so NAND gate U9A A/D REF1 output drops low and the A/D REF 2 line stays low if the integrator output polarity was positive (A/D POL = 0). This switches the positive reference voltage into the integrator. If the integrator output was negative (A/D POL = 1), the A/D REF 2 line is forced high and the negative reference voltage is selected as the input to the integrator. On the next clock leading edge, the U3A S1 output toggles back to a high and U3A-2 goes low. This switches exclusive OR gate U11B output back to a high and enables the 3 1/2 digit counter again. The counter starts counting from zero and continues counting until the integrator output crosses zero volts. At this time, the A/D POL input changes states, and goes from low to high or high to low. Since the new A/D POL logic level is not clocked through U12B, the inputs to exclusive OR gate U11D become identical (both high or both low) and the U11D output switches low. Since the S1 ad S0 state register outputs are high, the U11D low zero crossing output is gated by NOR gate U5A to reset flip-flop U10A and switch S2 low. This turns off the gated oscillator (Q1, Q2) and sets the A/D REF 1, A/D REF 2, and A/D RESET lines back high to reset the integrator for the next A/D conversion. If the 3 1/2 digit counter reaches its overflow count of 1999 before the integrator output crosses zero volts, the overflow signal (U4B-4) is gated with the counter clock through NOR gate U5C. This signal is applied to exclusive OR gate U11C and the Polarity/Zero Crossing Detector genertes a false zero crossing signal to reset flip-flop U10A (S2 = 0) and stop the gated oscillator with the 3 1/2 digit counter holding the 1999 count.

Transfer Data

When the Data Marker (DM) triggers the start of the A/D conversion, it also clocks the value of SWALT (CH 1 = 1, CH 2 = 0) into the flip-flop U10B. This tells the address comparator which channel is being sampled and converted. When the conversion is complete, the gated oscillator is stopped and the S2, S1 and S0 state register outputs read 011 respectively. The A3A18 Marker II Assembly must now hold the marker measurement data until the A3A3 Procesor Control Assembly is ready to receive the data.

The address comparator monitors the four most significant address bits (PAD 5 thru PAD 2) to detect the correct marker address from the A3A3 Processor Control Assembly. When PAD 5 through PAD 2 read 1010 for a Channel 1 marker measurement or 1011 for a Channel 2 marker mesurement, the correct marker address is detected and the NAND gate U13B output goes low (0 volts) to give a low marker address signal. The Low Marker Address switches NOR gate U2A output high (U5B output low) and inverter U1C resistor Q3 collector low to generate a Low Store (L STORE) output. This L STORE output is a wire-ORed line, shared by the A3A18 Marker II and A3A19 I/O Storage assemblies, which the A3A4 Processor Interface Assembly reads to determine when either A3A18 or A3A19 is ready to write in new data.

The A3A3/A4 Processor Controller/Interface assemblies respond to the store request (L STORE) by sending out four Low Enable Input/Output (LEN I/O) pulses to enable the transfer of four 4-bit bytes onto the P Data Bus (PDB0-3). The LEN I/O input to A3A18 is gated by NOR gate U2C whenever there is a valid marker address and the 3 1/2 digit counter contains new data. Inverter U1B drives the L 3-STATE ENABLE line to enable data selectors U14 and U15. The two least significant address bits (PAD ϕ, PAD 1) select which of the counter outputs (U6, U7, U8 or SIGN/ONE byte) is transferred onto the P Data Bus for each of the four enable pulses.

The gated LEN I/O pulses (U2C output) reset state register flip-flop U3A (S1 = 0) and the S2, S1 and S0 state register outputs now read 001 respectively. When the A3A3 Processor Control Assembly is finished reading the marker measurement data, it changes the marker address (PAD 5 through PAD 2); the L Marker Address line goes high (U13B output) and state register flip-flop U3B is reset (S0 = 0). This completes the total cycle; the state register is back to a 000 state and the counter is cleared, ready for a new marker A/D conversion.

D3-112 b

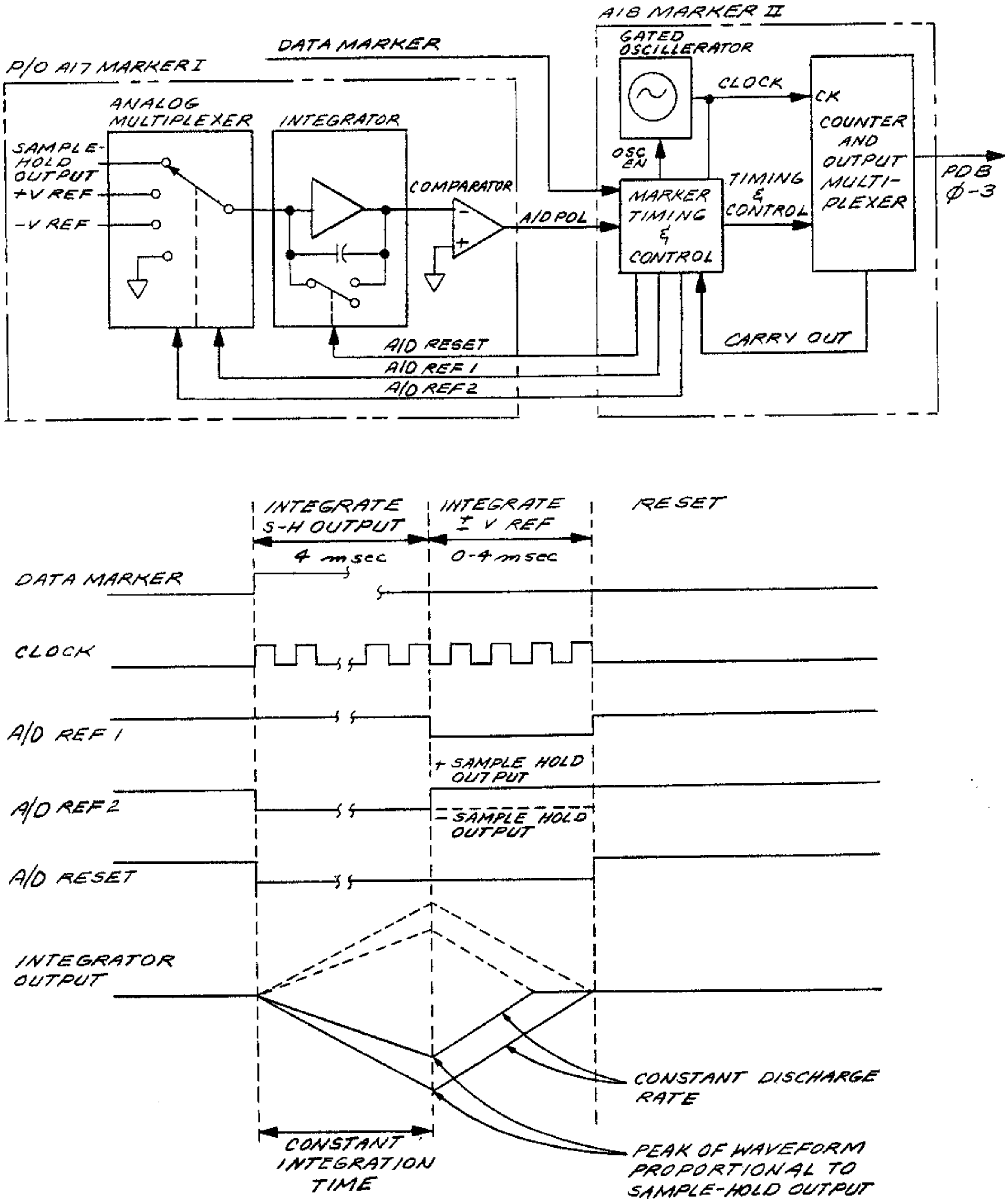


Figure D3-50A. A/D Converter Block, Diagram and Timing Diagram

FIG. D3-50B
SHT. 1 OF 2

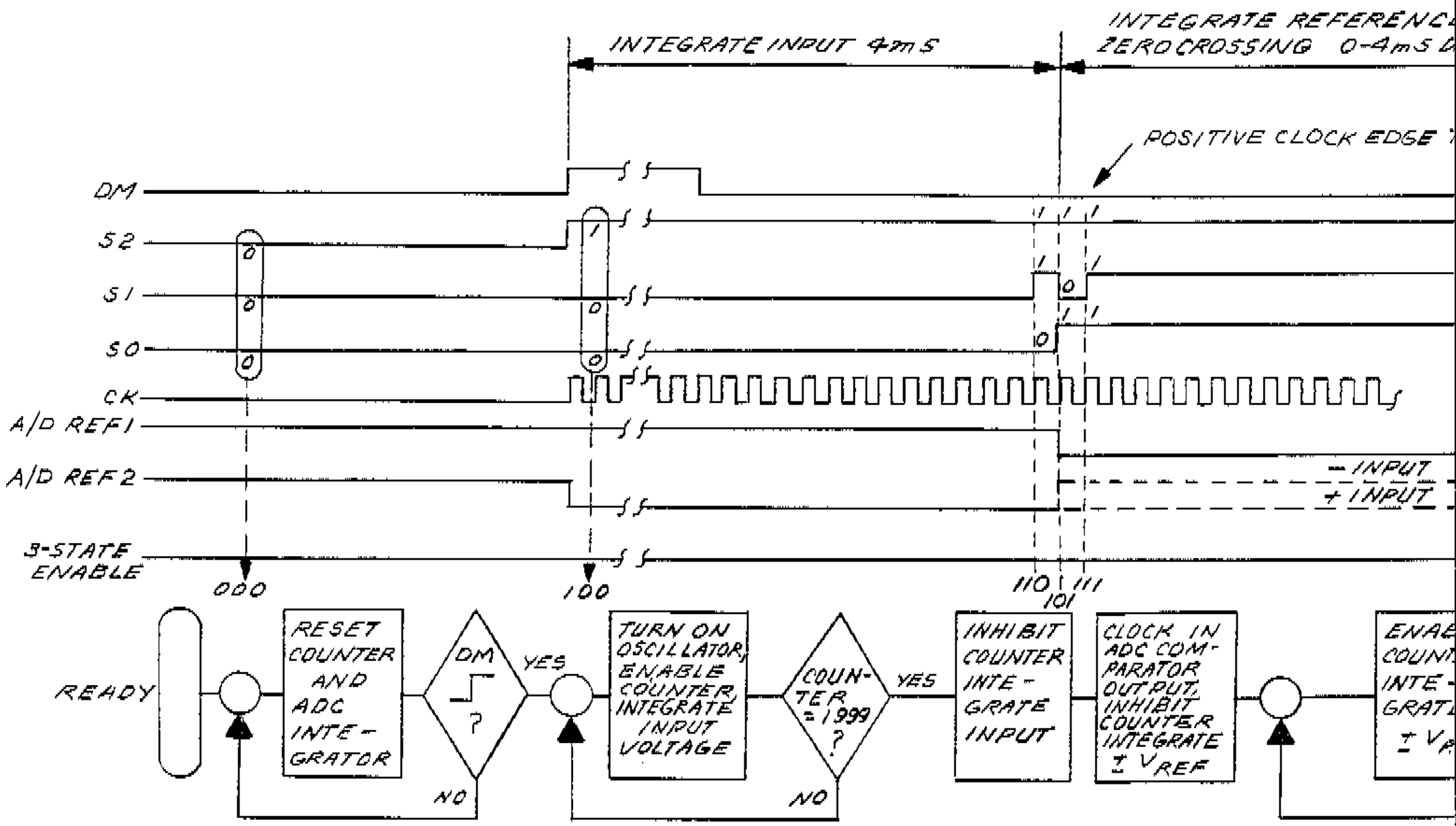


Figure D3-50B.

FIG. D3-50B
SHT. 2 OF 2

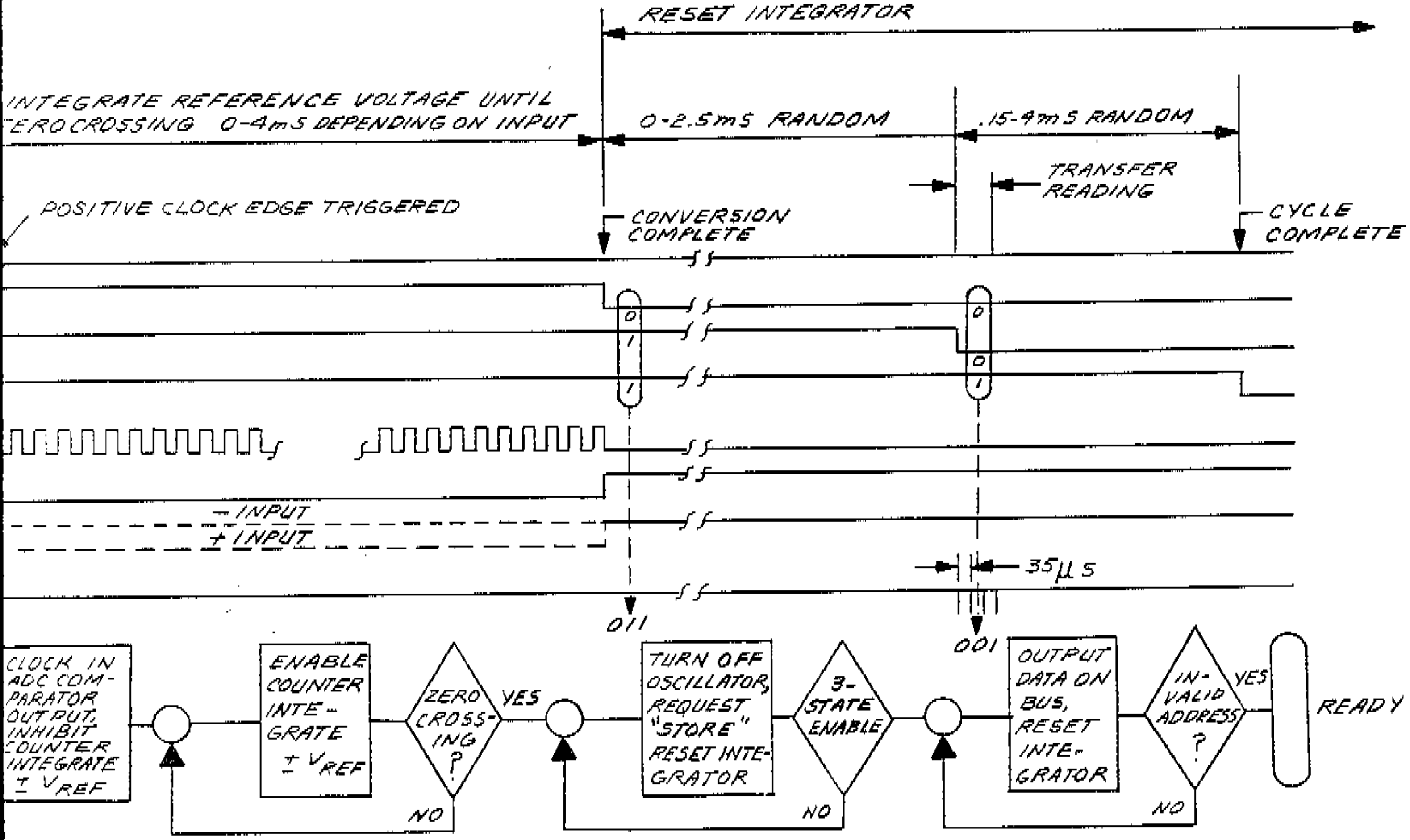


Figure D3-50B. A3A18 Marker II Timing Diagram and Flow Chart

FIG. D3-50B
SHT. 1 OF 3

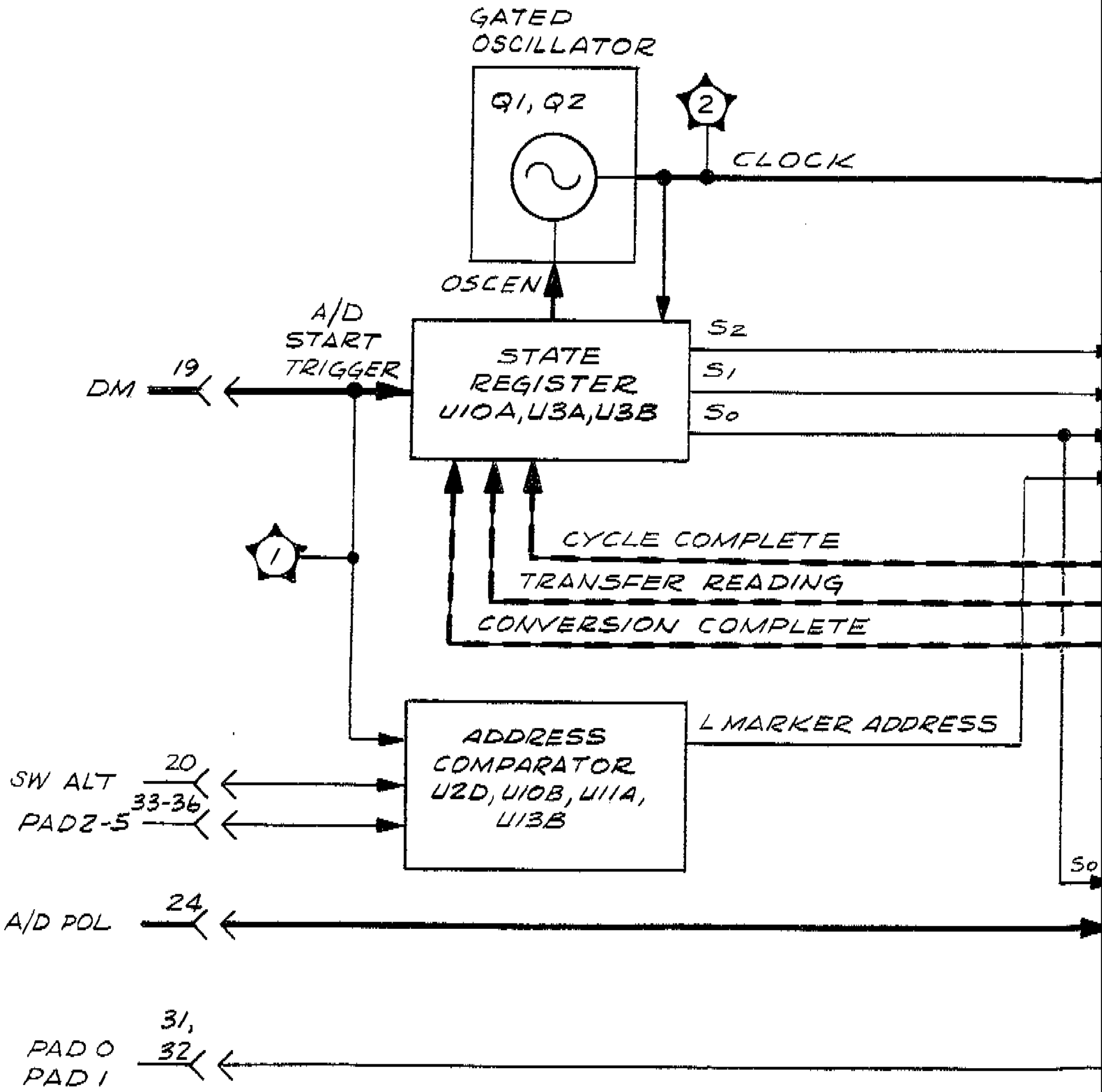


FIG. D3-50B
SHT. 2 OF 3

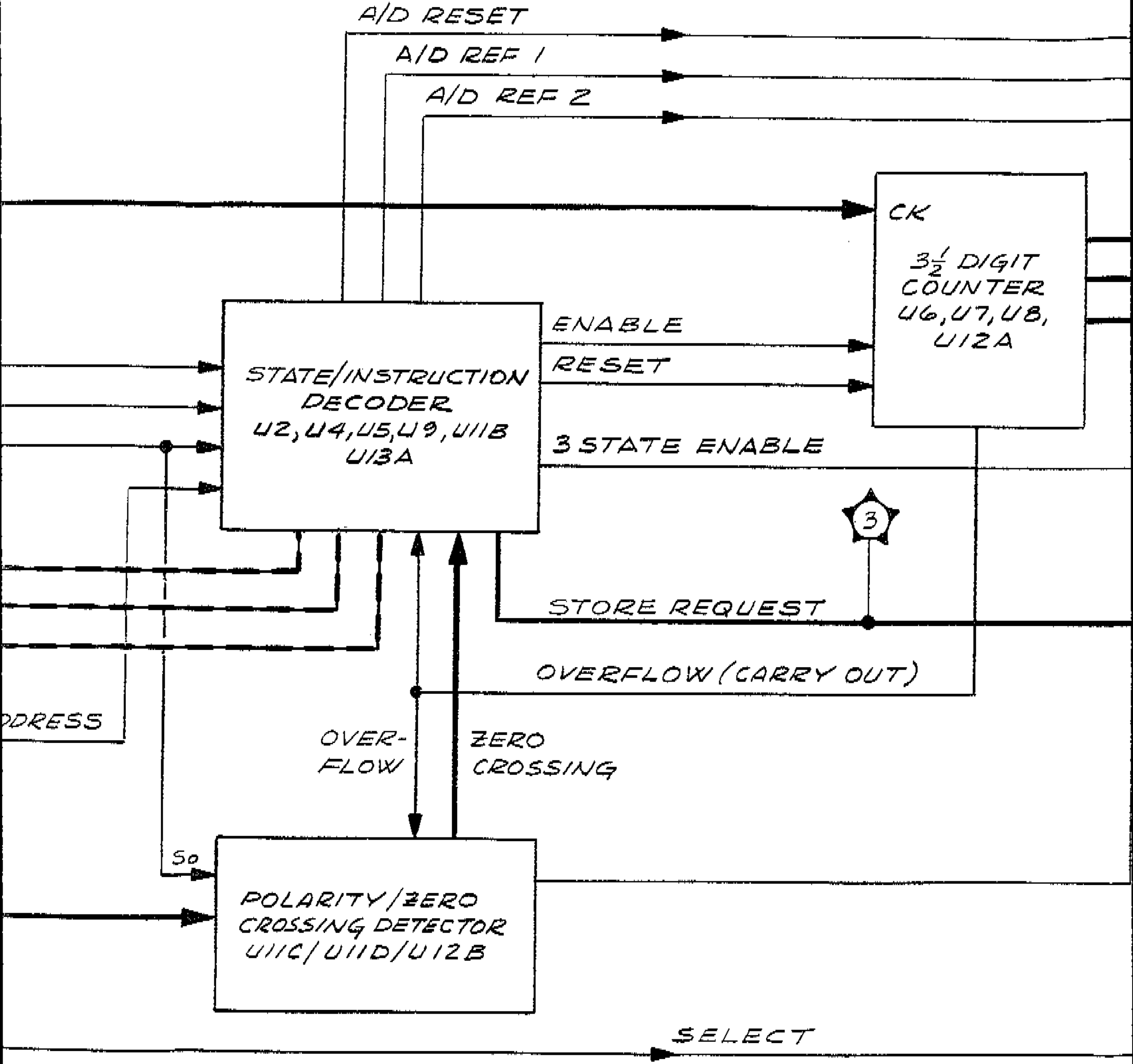


FIG. D3-50B
SHT. 3 OF 3

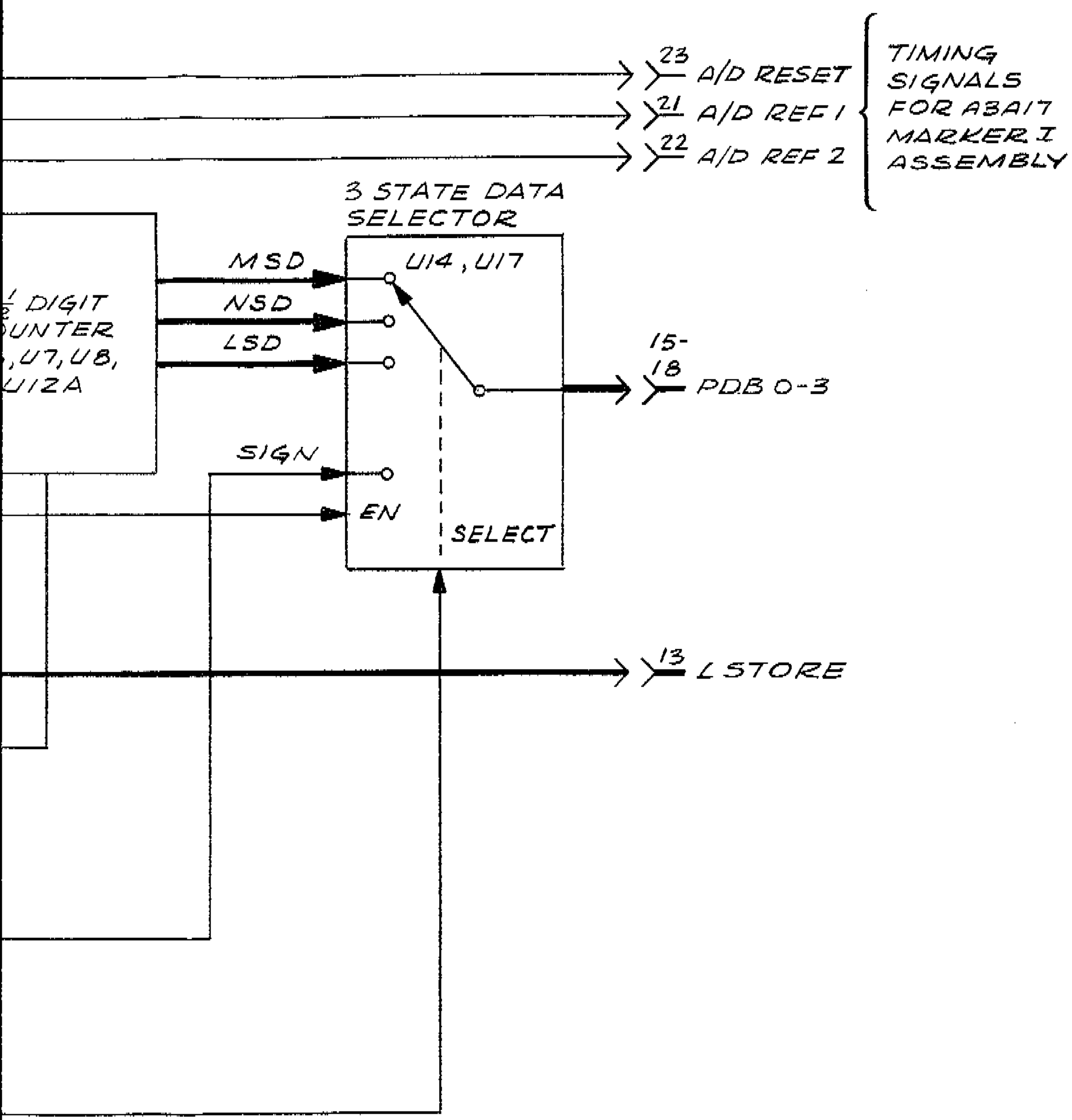


Figure D3-50B. A3A18 Marker II, Block Diagram

A3A18

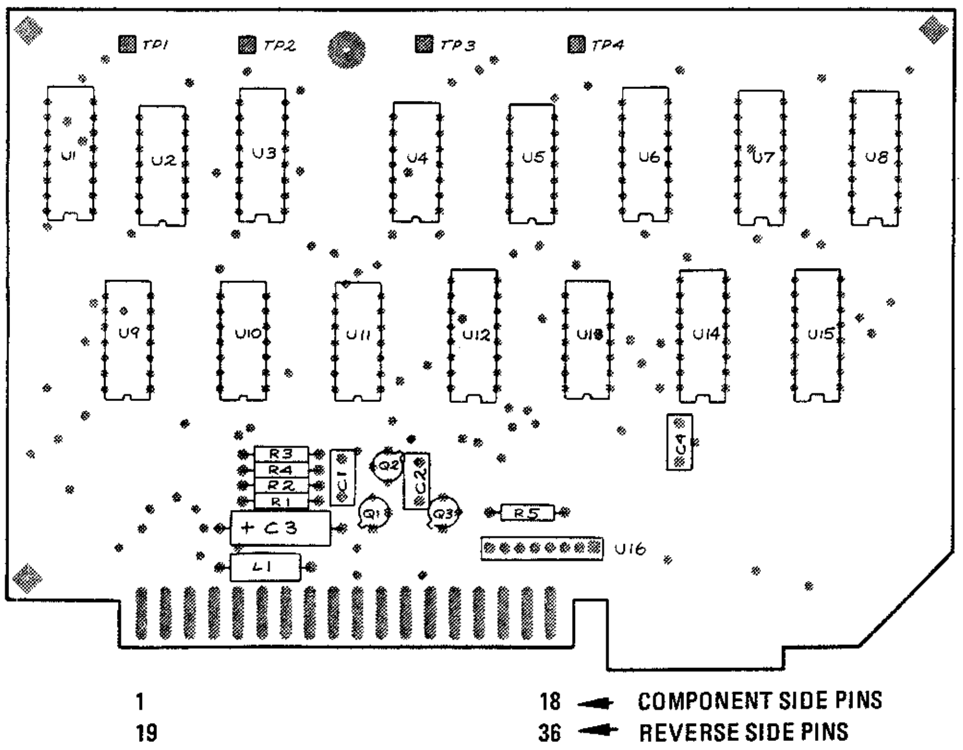


Figure D3-51. A3A18 Marker II Parts Locations

FIG. D3-52
SHT. 1 OF 4

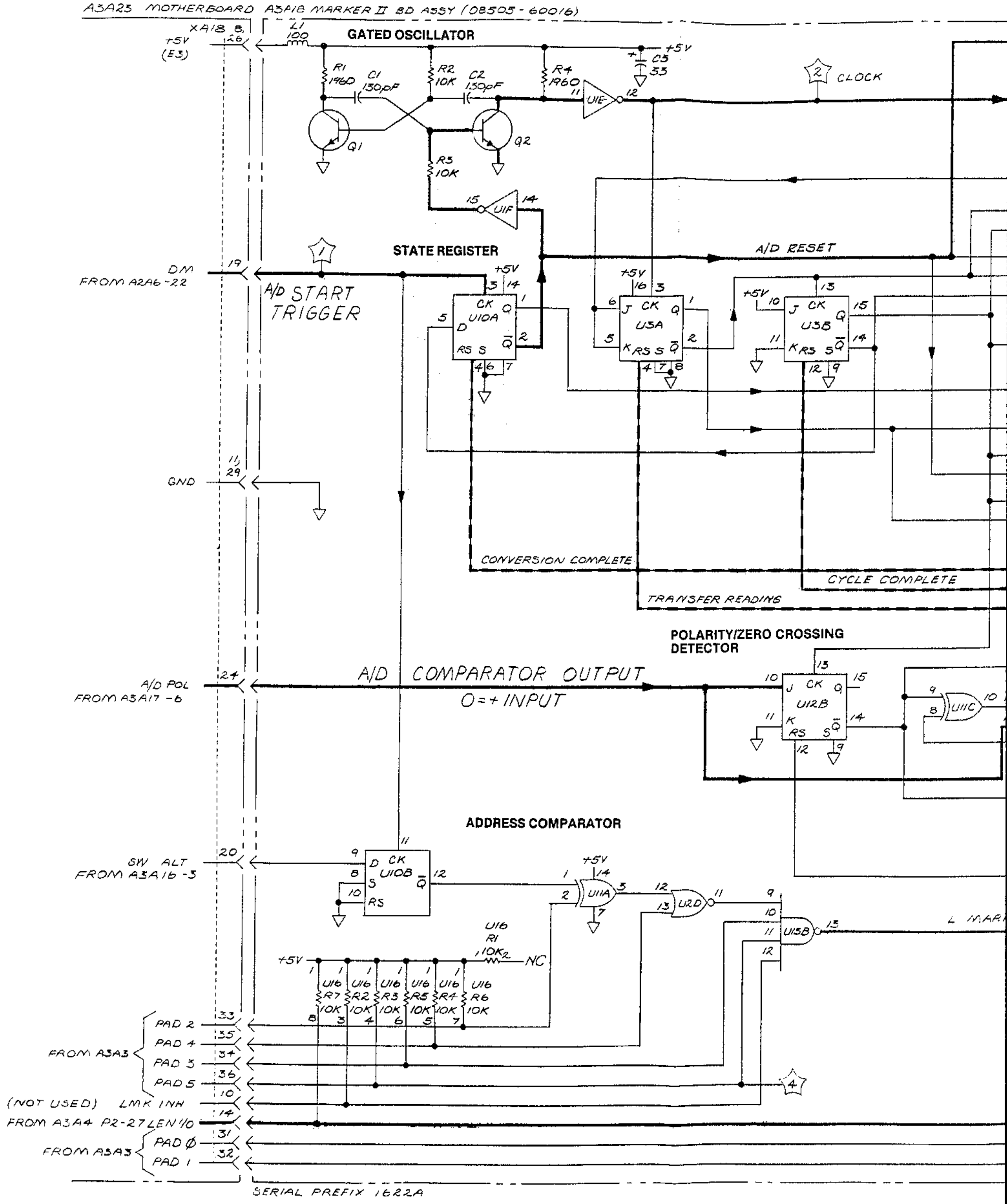


FIG. D3-52
SHT. 2 OF 4

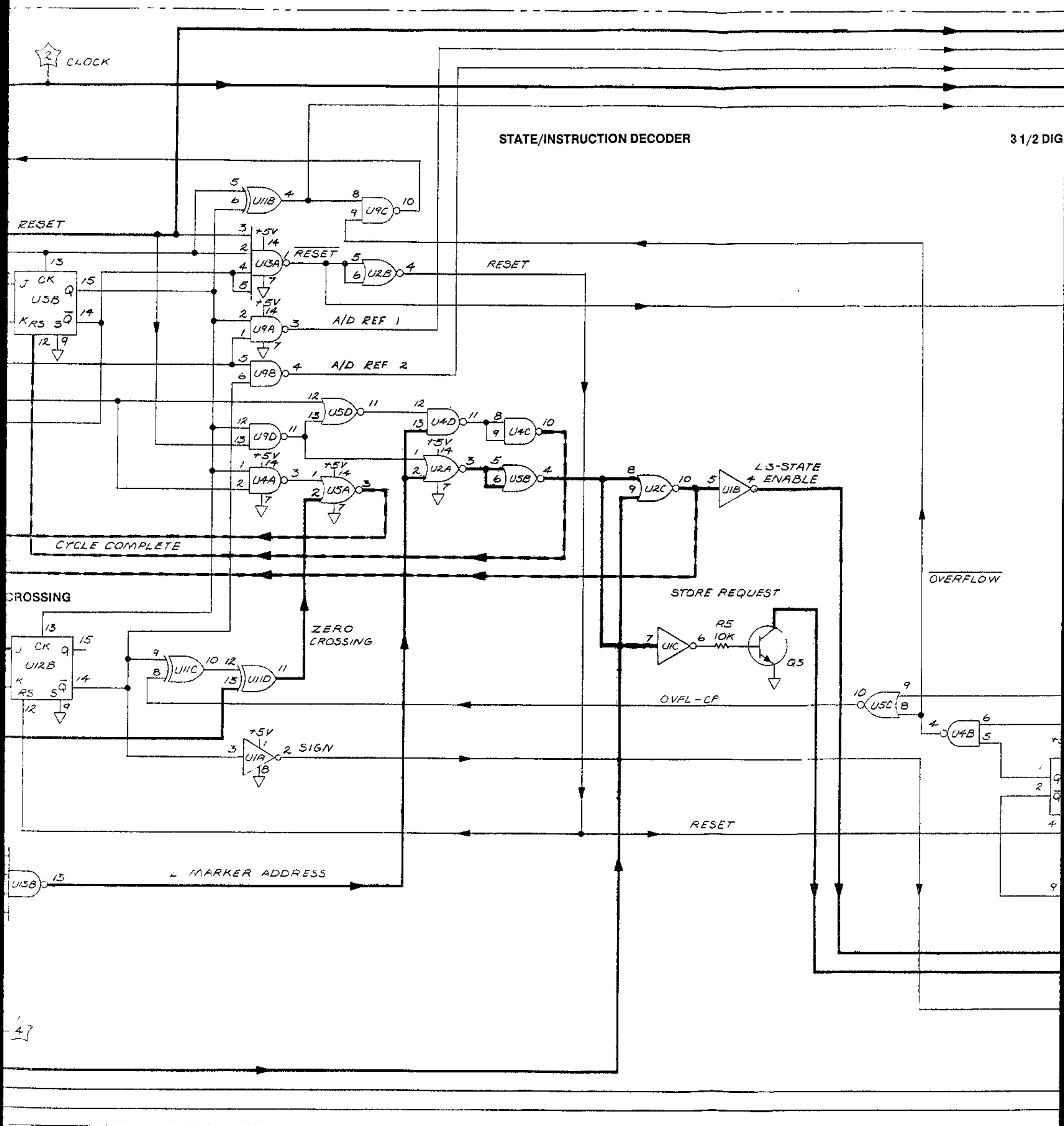


FIG. D3-52
SHT. 3 OF 4

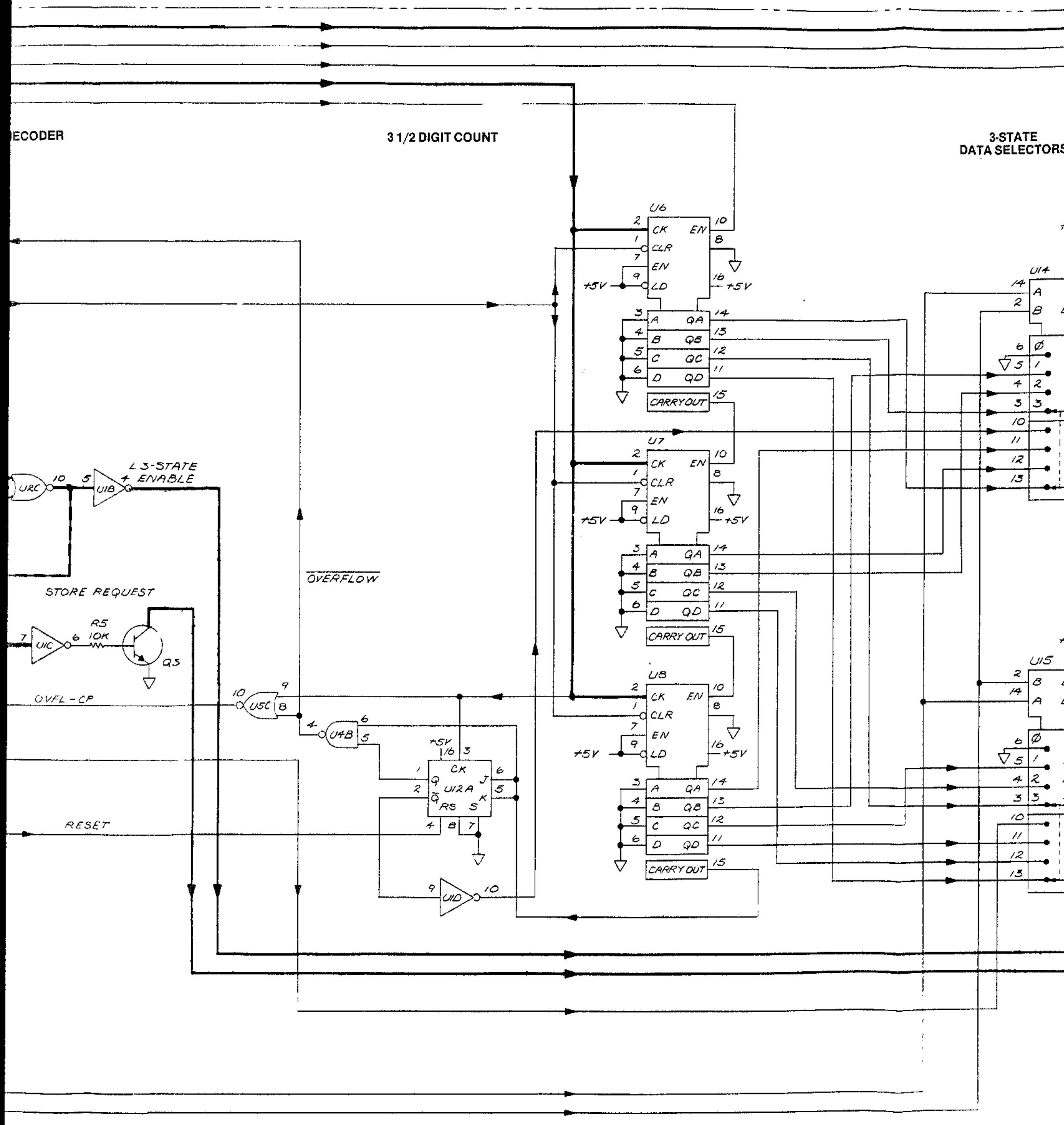


FIG. D3-52
SHT. 4 OF 4

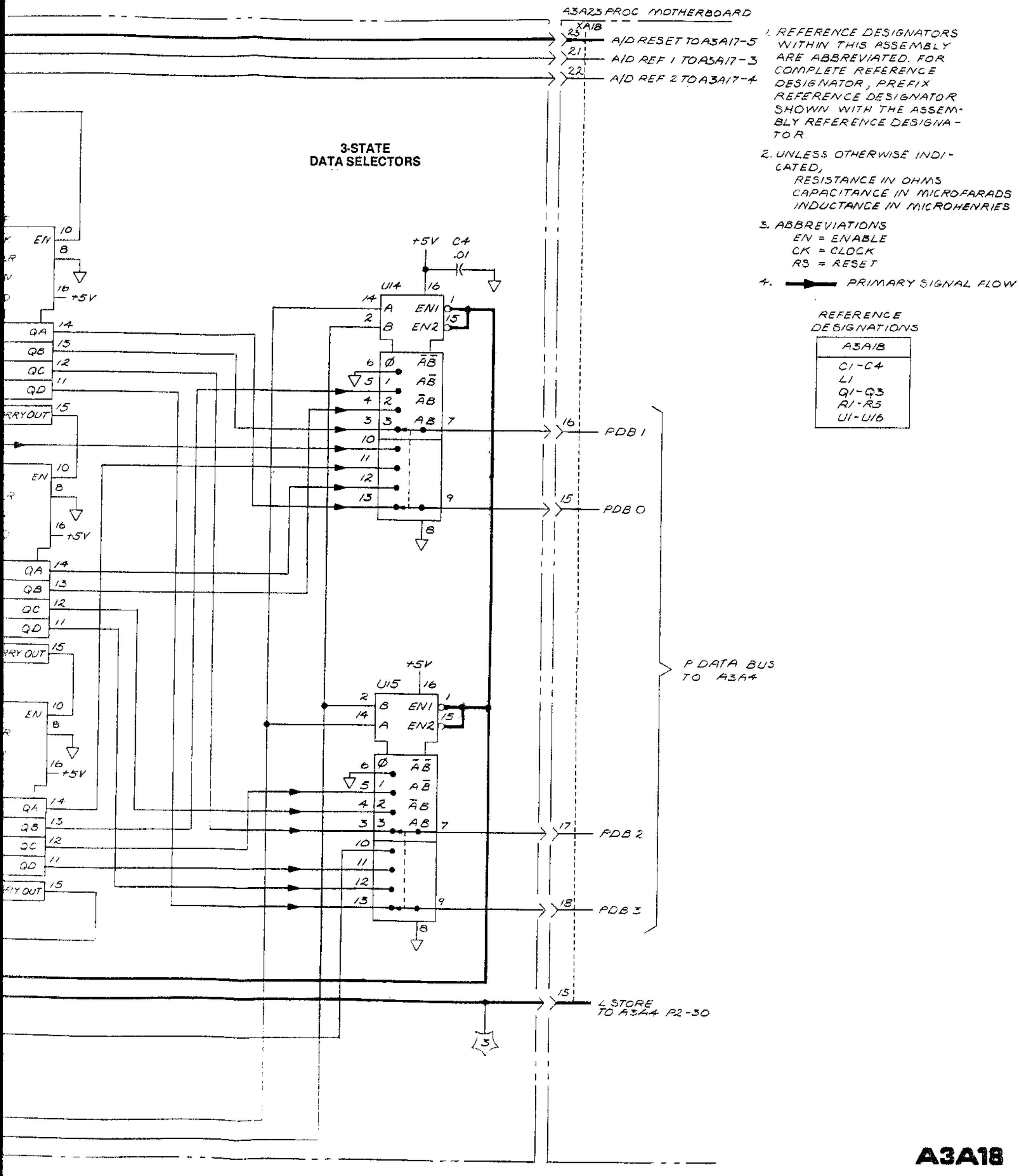
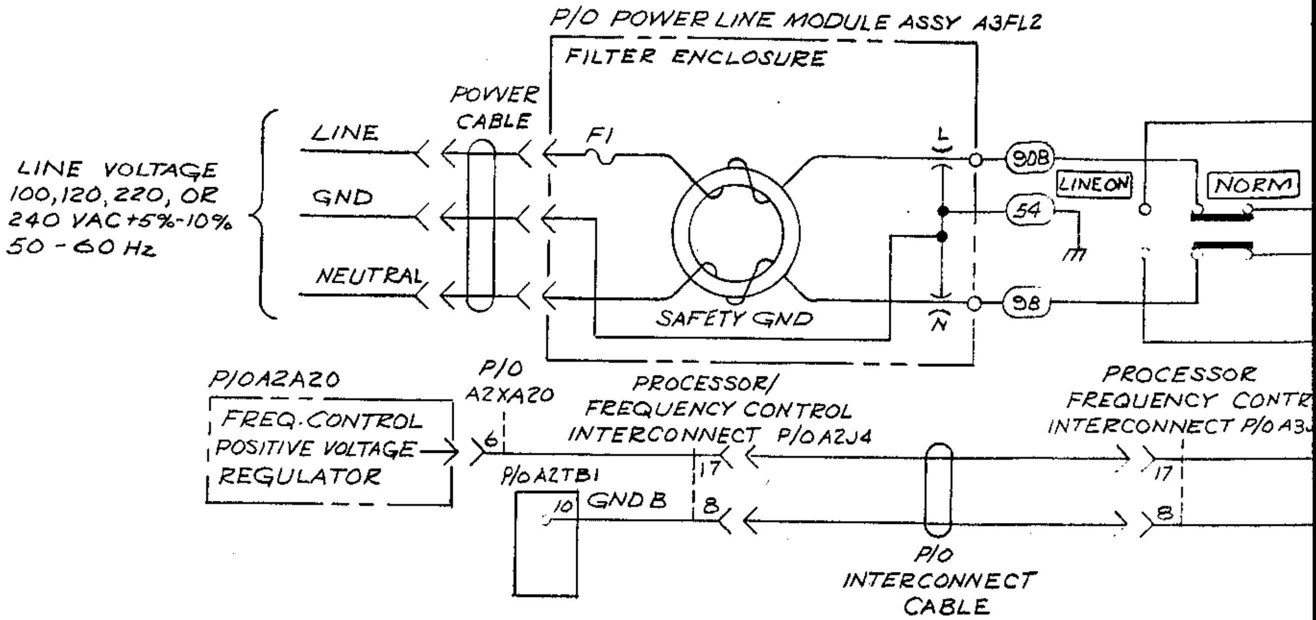
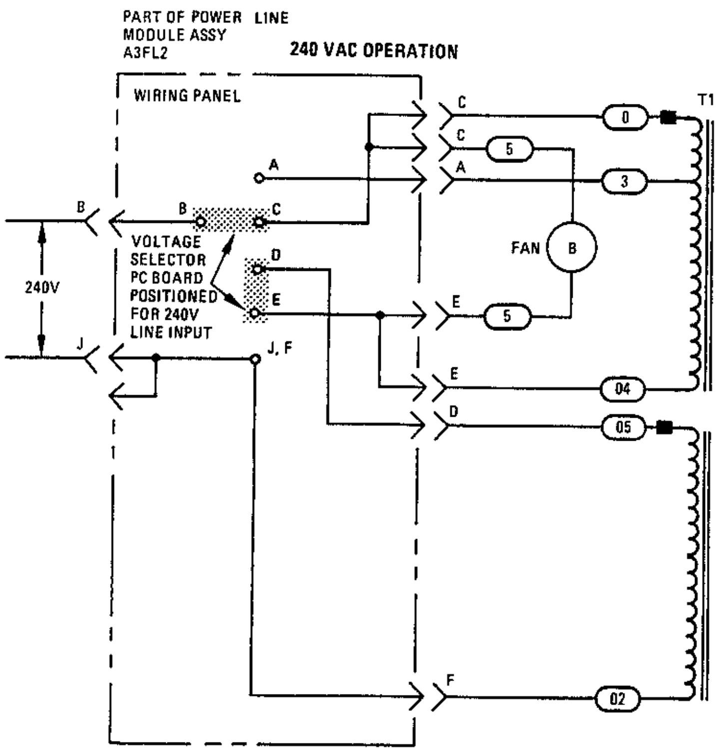


Figure D3-52. A3A18 Marker II, Schematic

FIG. D3-52A
SHT. 1 OF 4





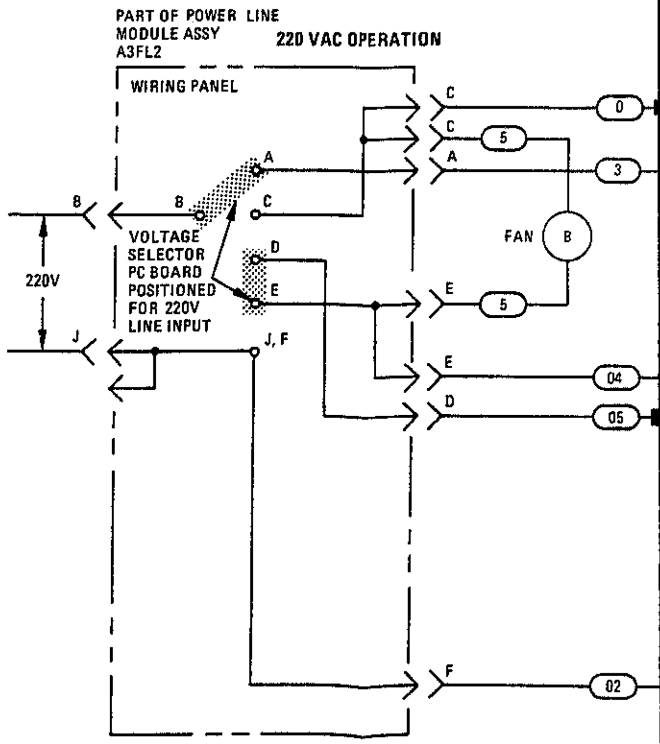


FIG. D3-52A
SHT. 2 OF 4

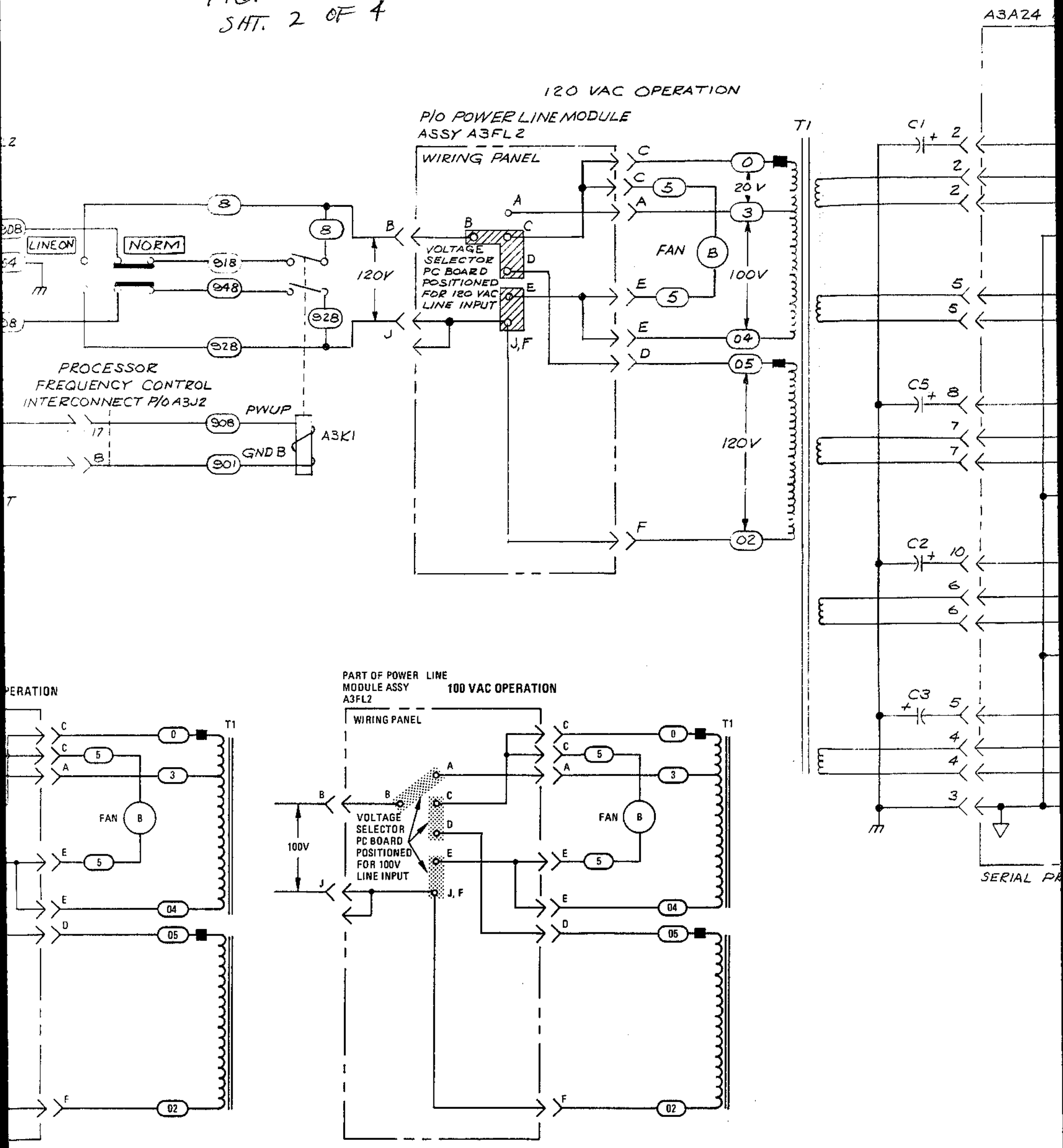


FIG. D3-52A
SHT. 3 OF 4

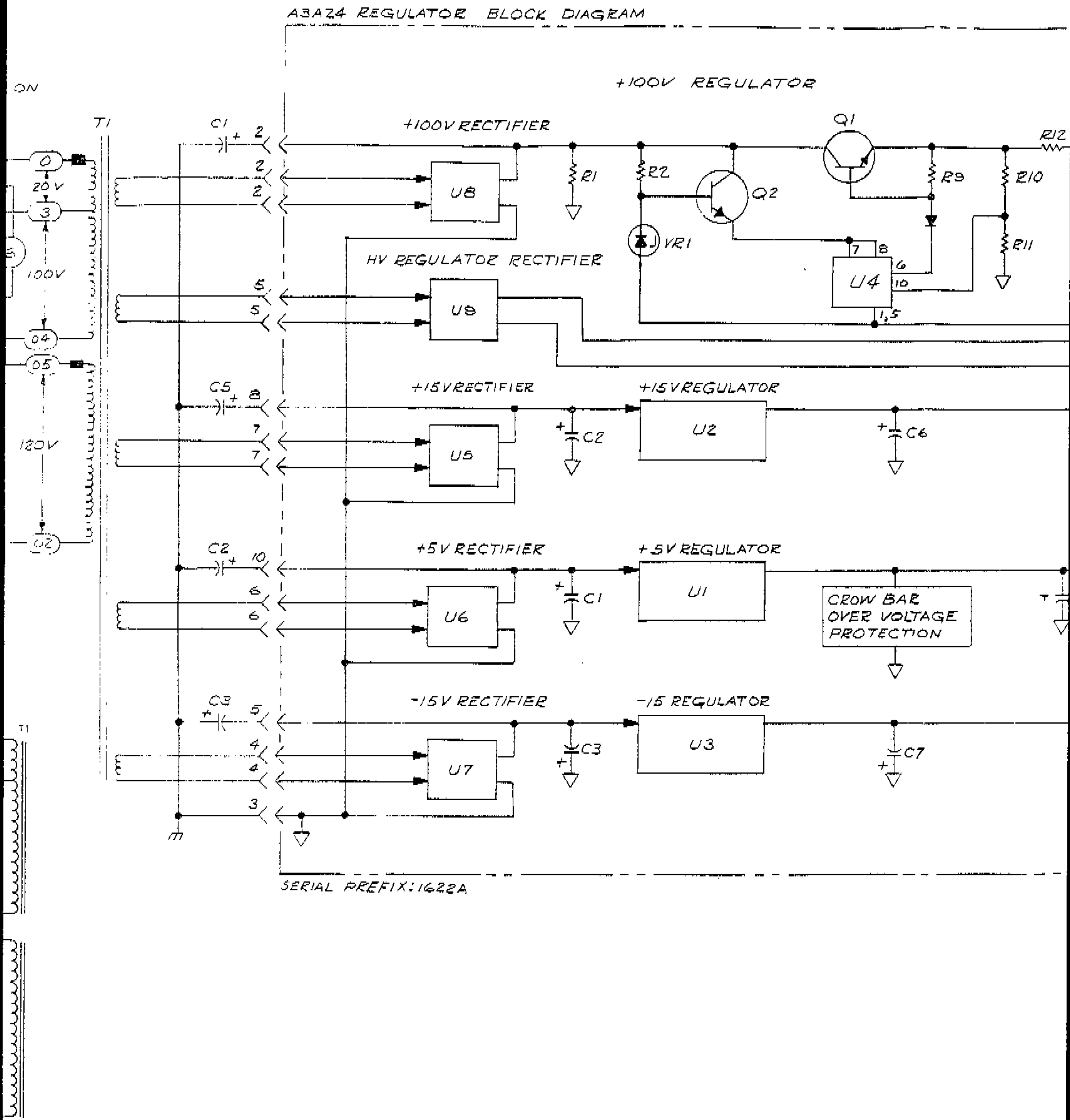


FIG. D3-52A
SHT. 4 OF 4

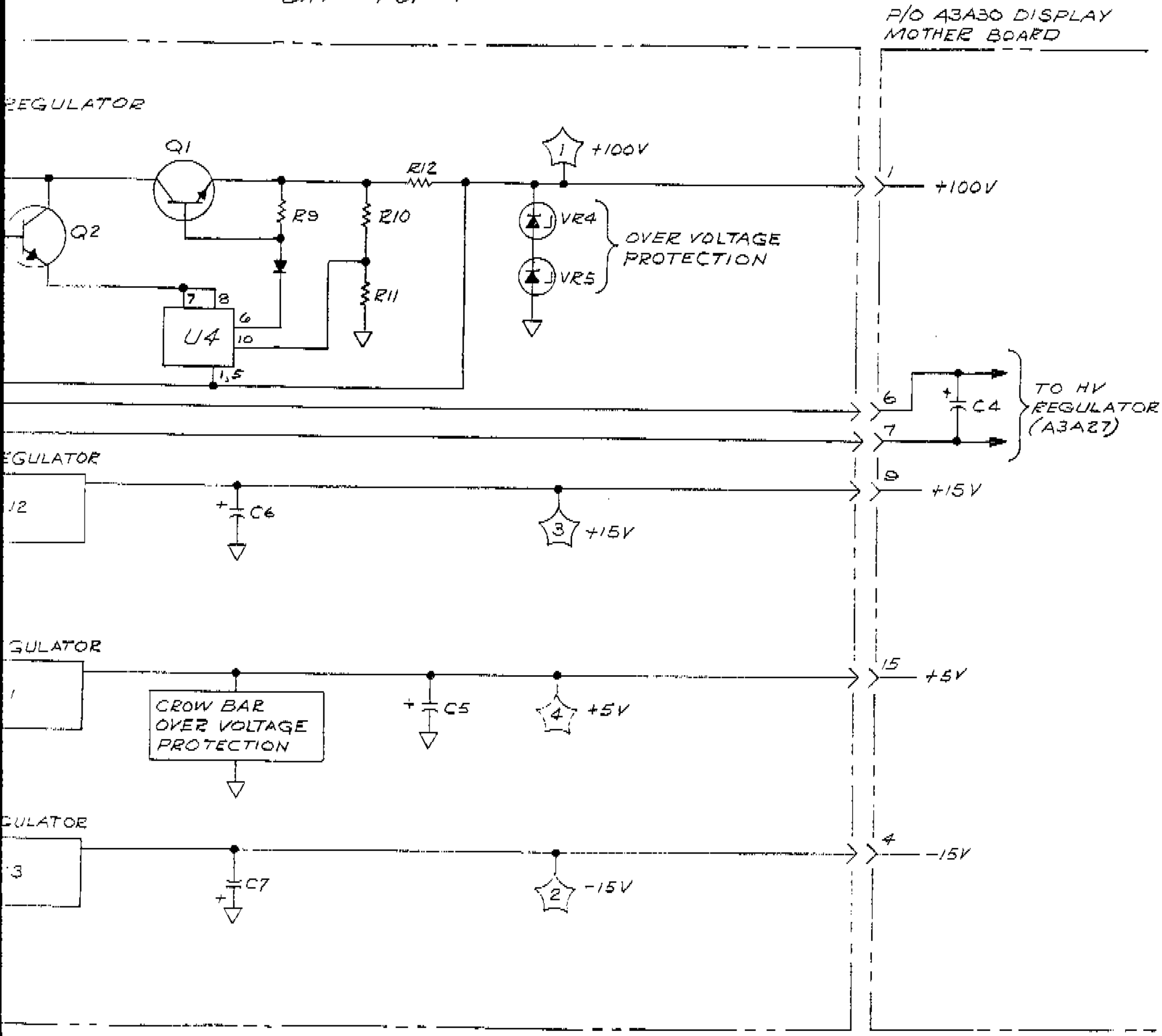


Figure D3-52A. A3A24 Regulator, Block Diagram

A3A24

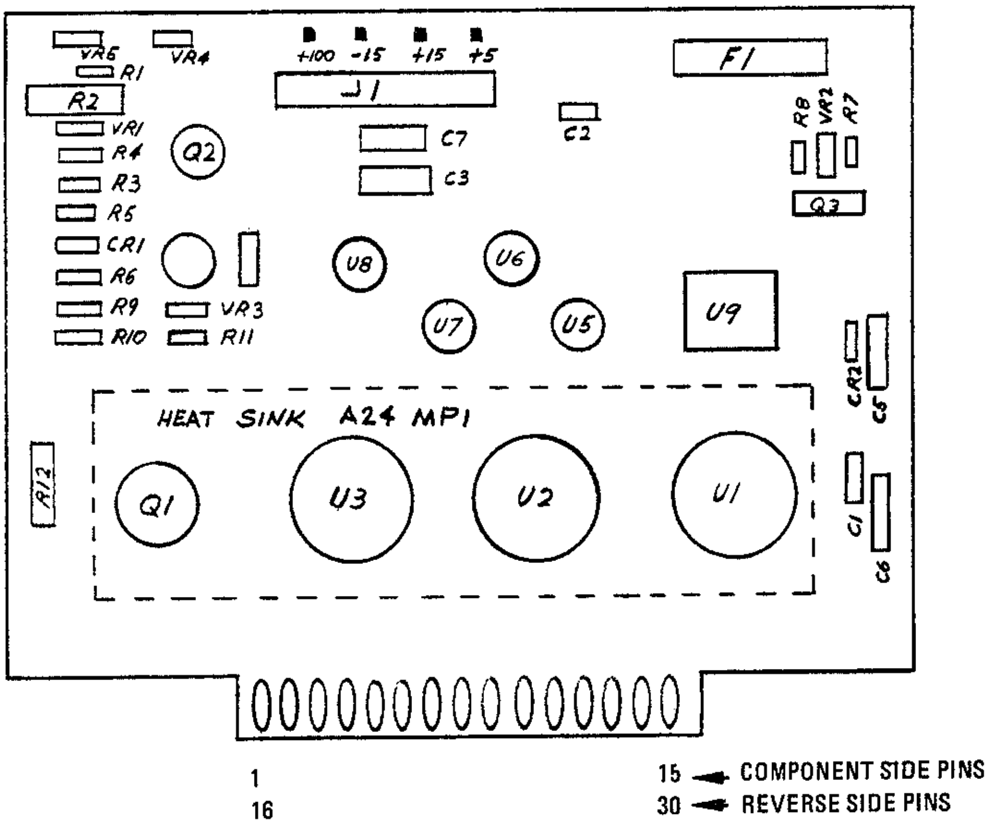


Figure D3-52B. A3A24 Voltage Regulator Board Parts Locations

FIG. D3-53
SHT. 1 OF 3

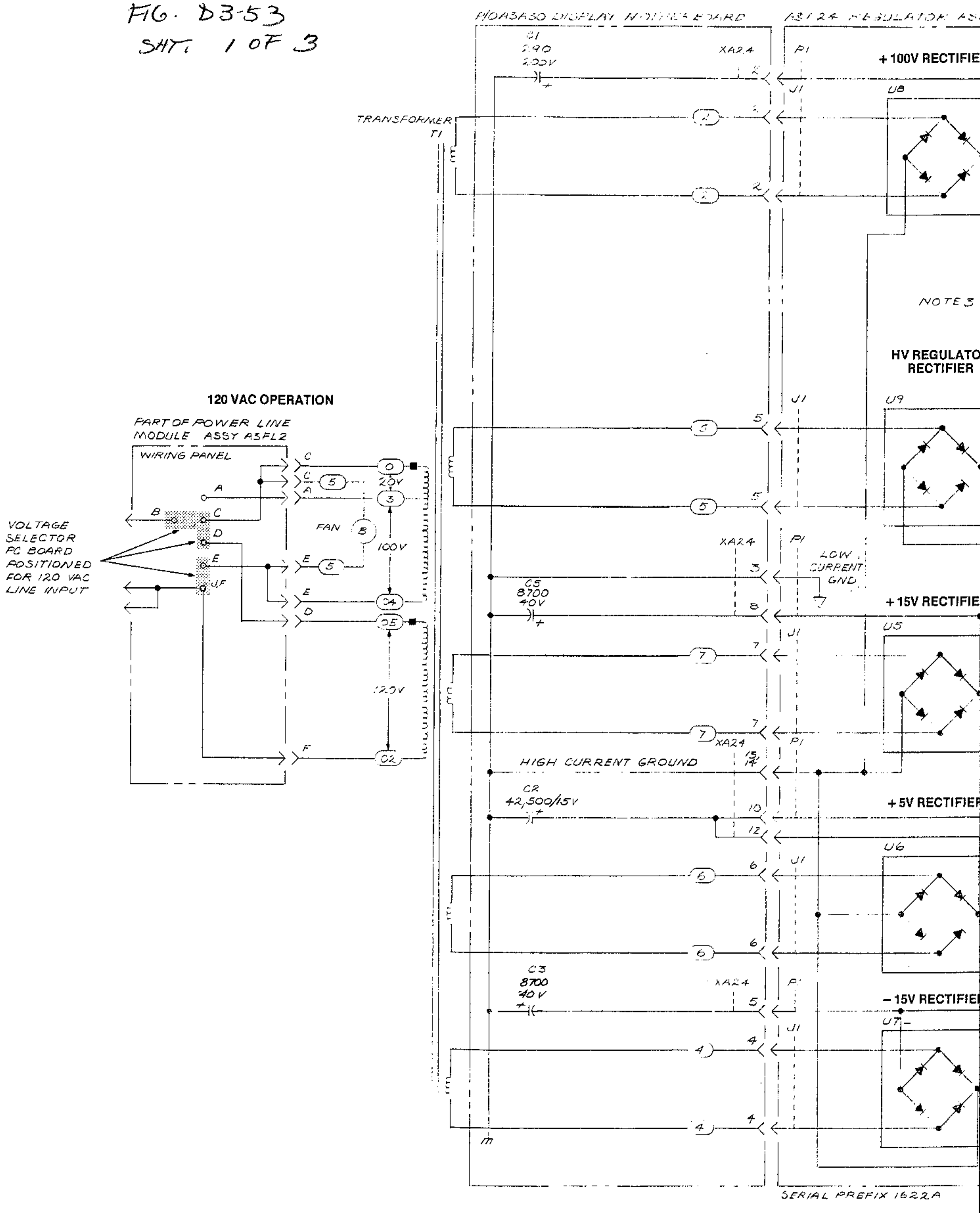


FIG. D3-53
SHT. 2 OF 3

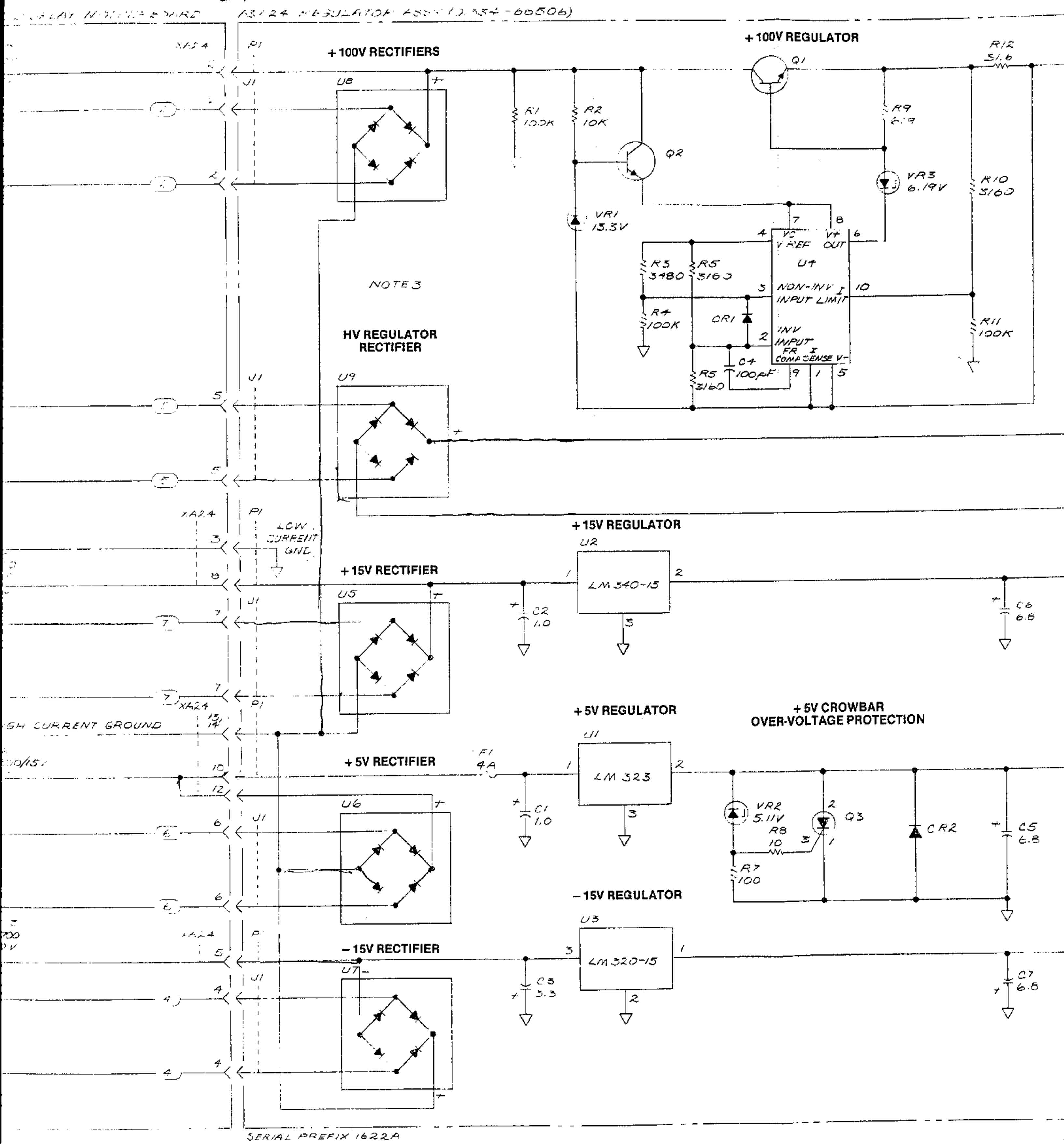


FIG. D3-53
SHT. 3 OF 3

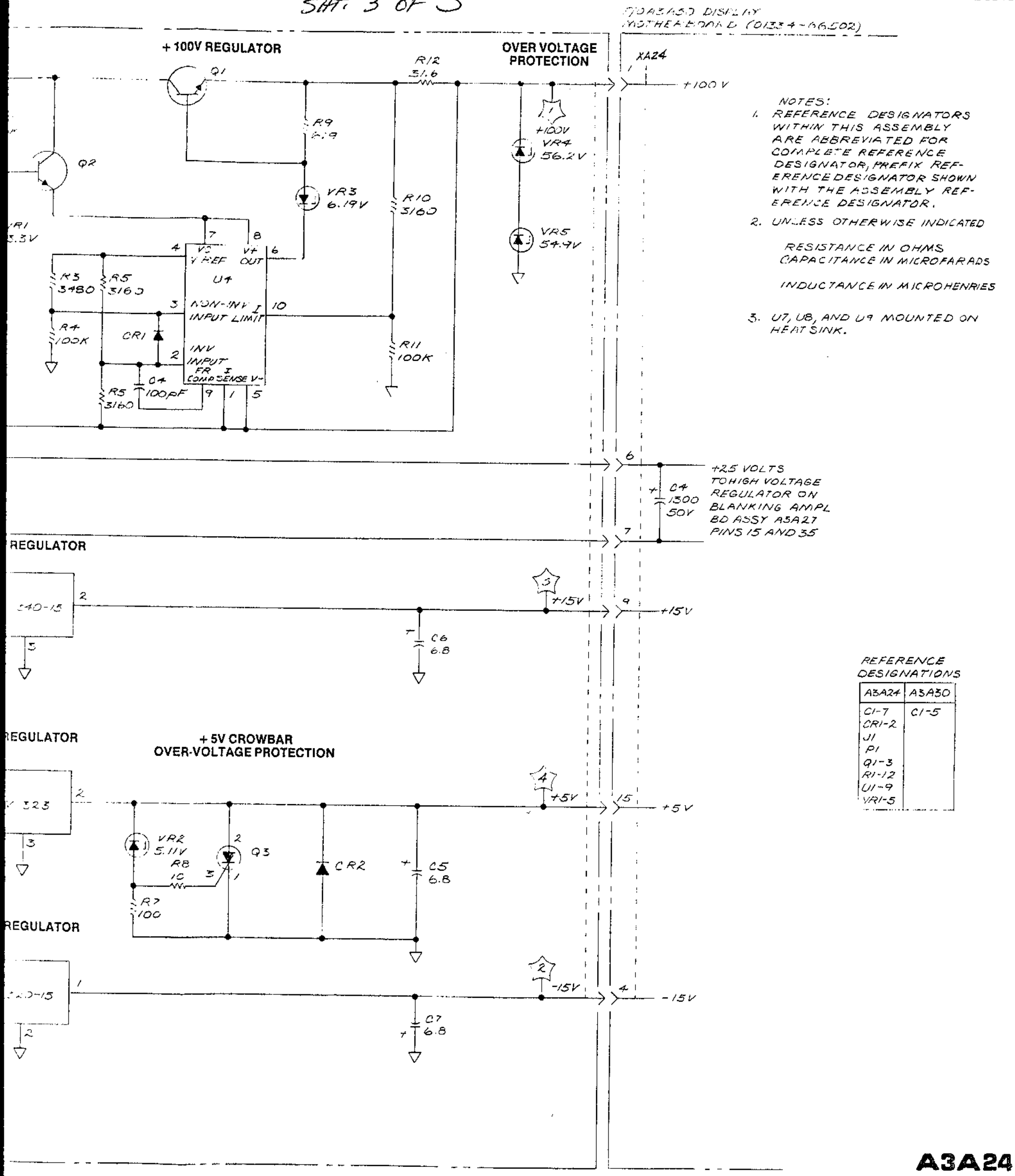


Figure D3-53. A3A24 Regulator, Schematic

FIG. D3-54
SHT. 1 OF 4

SIGNAL	DEFINITION	DESCRIPTION
BEAM CTR X	BEAM CENTER X	X-AXIS DISPLAY OFFSET FOR POLAR
BEAM CTR Y	BEAM CENTER Y	Y-AXIS DISPLAY OFFSET FOR POLAR
HTR	HEATER	FLOOD GUN HEATER VOLTAGE TO CRT
LFP 1kHz	LOW FRONT PANEL 1kHz	LFP 1kHz = Ø → 1kHz IF BW WHEN IN LOCAL
LFP FILT	LOW FRONT PANEL FILTER	LFP FILT = Ø → FILTER ENABLED WHEN IN LOCAL
LFP POSN	LOW FRONT PANEL POSITION	LFP POSN = Ø → DISPLAYS POSITION OF REFERENCE LINE WHEN IN LOCAL
RECT POSN 1	RECTANGULAR POSITION 1	OFFSET VOLTAGE FROM REF LINE POSN CH1 CONTROL
RECT POSN 2	RECTANGULAR POSITION 2	OFFSET VOLTAGE FROM REF LINE POSN CH2 CONTROL
RECT X POSN	RECTANGULAR X POSITION	OFFSET VOLTAGE FROM X POSN CONTROL
T.A.	TRACE ALIGNMENT	OFFSET VOLTAGE FROM TRACE CONTROL TO CRT

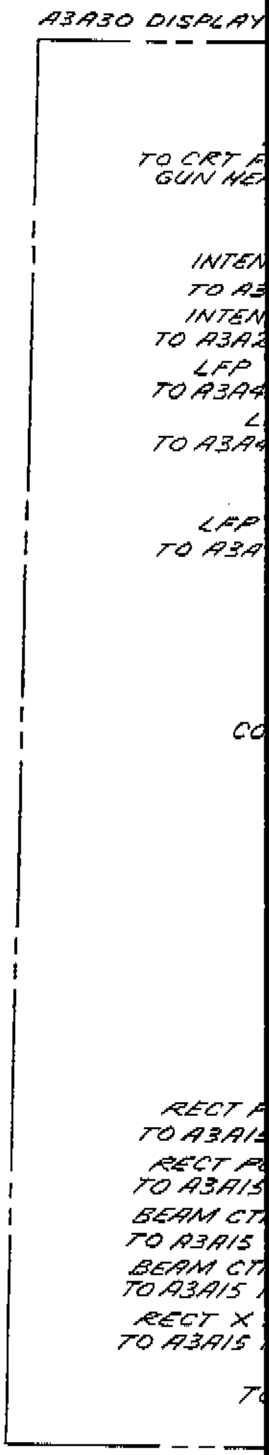
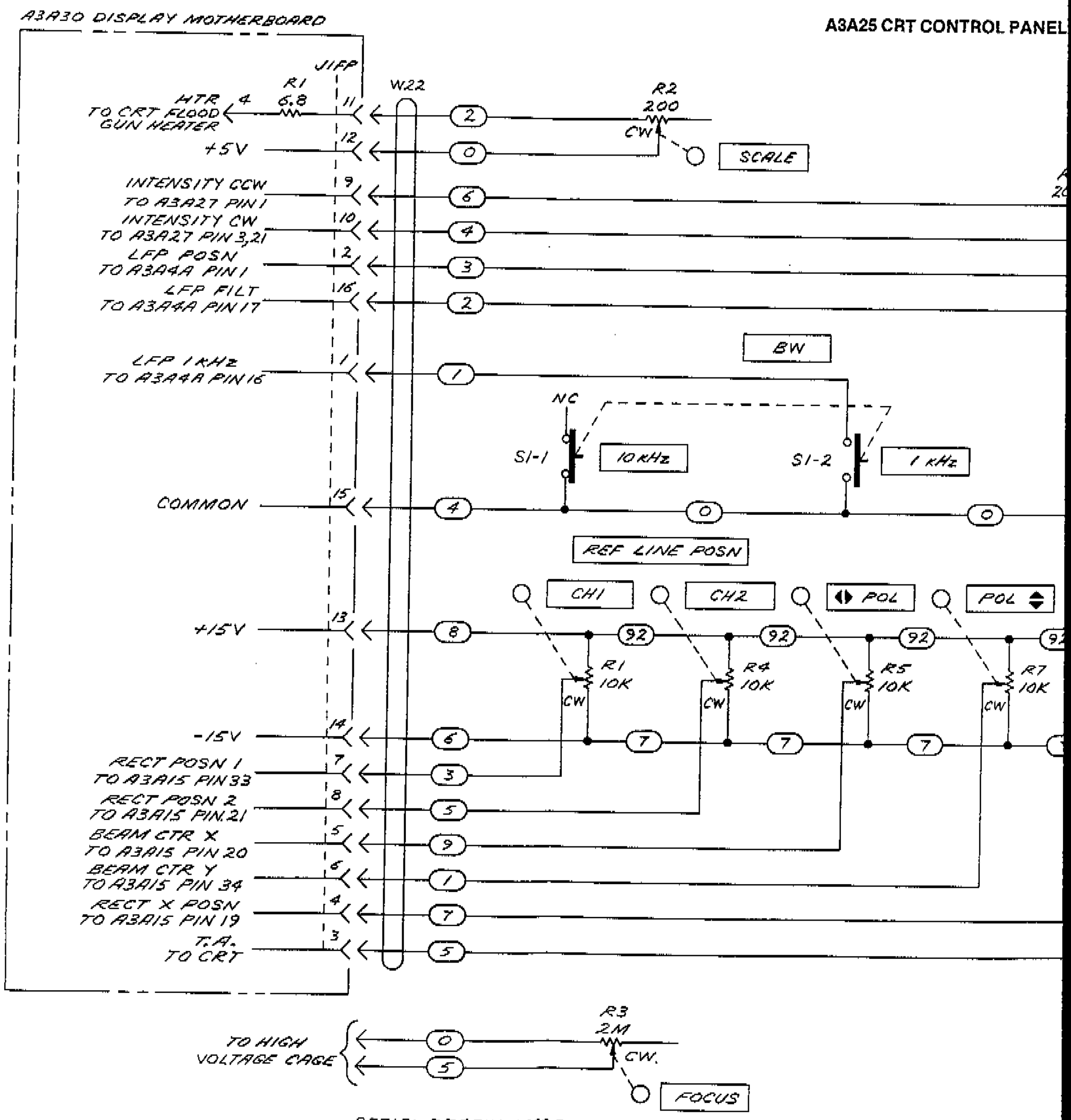


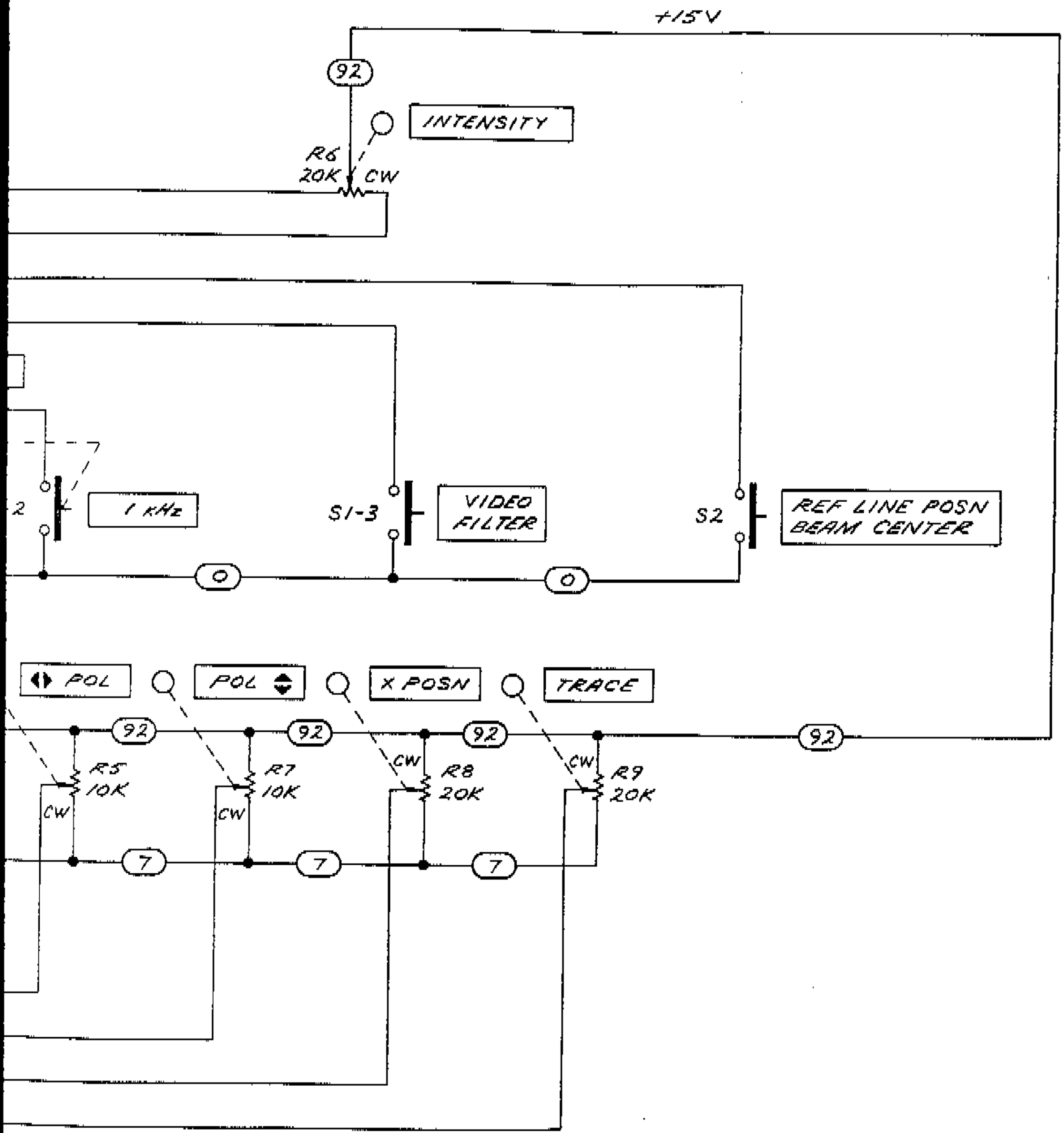
FIG. D3-54
SHT. 2 OF 4



SERIAL PREFIX 1622A

FIG. D3-54
SHT. 3 OF 4

A3A25 CRT CONTROL PANEL (01334-00207)



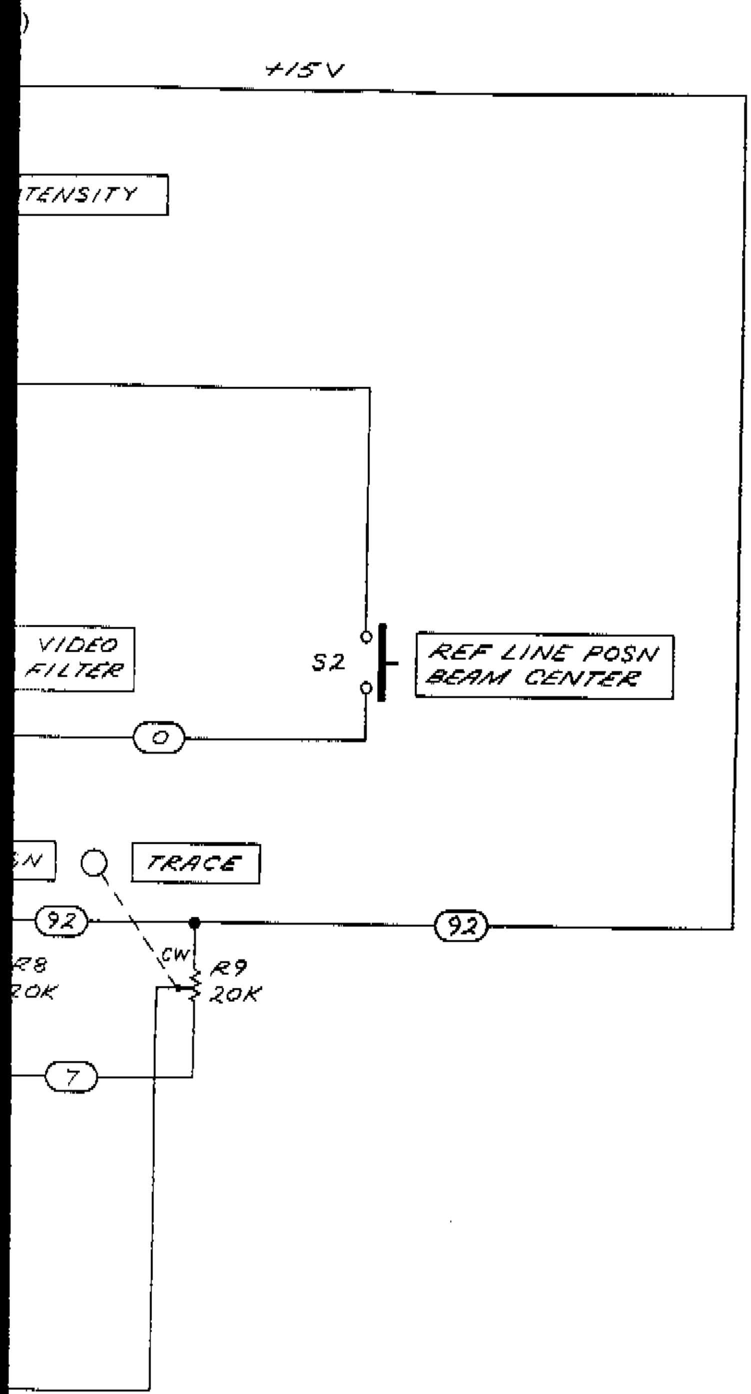
NOTES:

1. REFERENC
ASSEMBLY
COMPLETE
PREFIX R
SHOWN WIT
DESIGNAT

2. UNLESS OT
RESISTANC

Figure D3-54. A3A2

FIG. D3-54
SHT. 4 OF 4



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

REFERENCE DESIGNATIONS

A3A25
R1-R9 S1, S2

A3A25

Figure D3-54. A3A25 CRT Control Panel, Schematic

A3A26 HIGH-VOLTAGE POWER SUPPLY THEORY OF OPERATION

A3A26 High-Voltage Power Supply

High voltage oscillator A3A27Q14 generates a sine-wave voltage signal across the primary of T1. The amplified signal is rectified by A3A26CR1 and filtered by A3A26C1, A3A26C4 and A3A26R4 to generate −4000 Vdc cathode voltage. This voltage is sampled by the feedback network A3A26R3 and A3A26C3 and then compared to a reference signal and fed into IC regulator A3A27U1. A3A27U1 then regulates the dc level of the base winding of T1 that drives A3A27Q14, maintaining cathode voltage at −4000 volts.

The grid voltage is provided by generating a bias voltage level with respect to the cathode voltage. This bias voltage is generated by capacitively coupled clipped sine-wave signal at the junction of A3A26C2, A3A26C5, A3A26R5 and A3A26R9. The bias signal is regulated by INT LIM ADJ and INTENSITY controls.

The focus voltage is determined by a resistive divider string and A3A26R14 Focus Limit. The post accelerator potential of +18 kV is supplied by sextupler HV multiplier assembly.

Troubleshooting the High-Voltage Power Supply

Malfunction of the high-voltage power supply will usually result in loss of beam spot or unstable intensity. Troubleshooting may be accomplished by resistance checks of the high-voltage oscillator, high-voltage transformer, and regulator circuits. In the event of complete failure, check fuse A3A27F1. If fuse is all right, check −15V supply. Failure of the −15V supply will turn off high-voltage oscillator A3A27Q14. In the event of sextupler failure, replace the assembly.

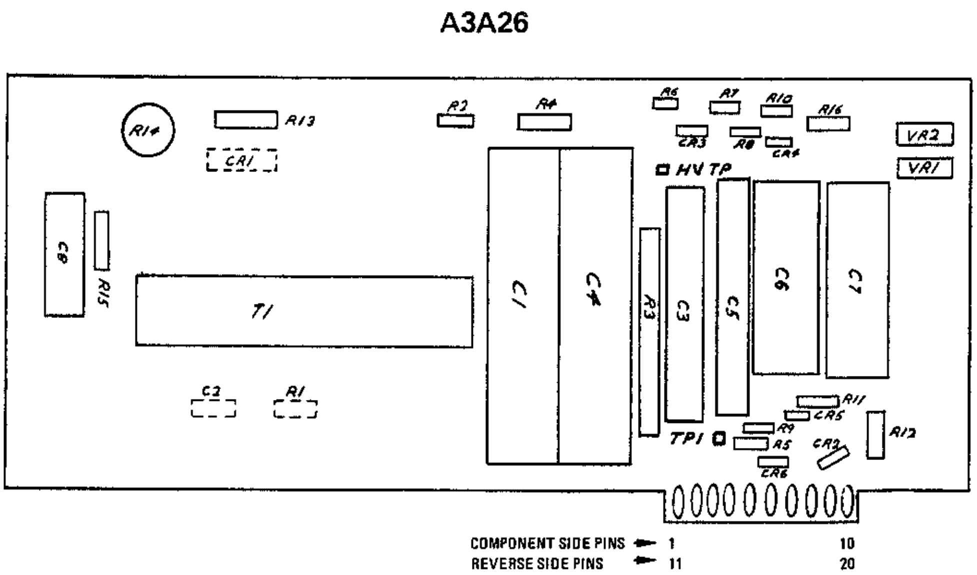


Figure D3-54A. A3A26 High Voltage Assembly Parts Locations

FIG. D3-55
SHT. 1 OF 4

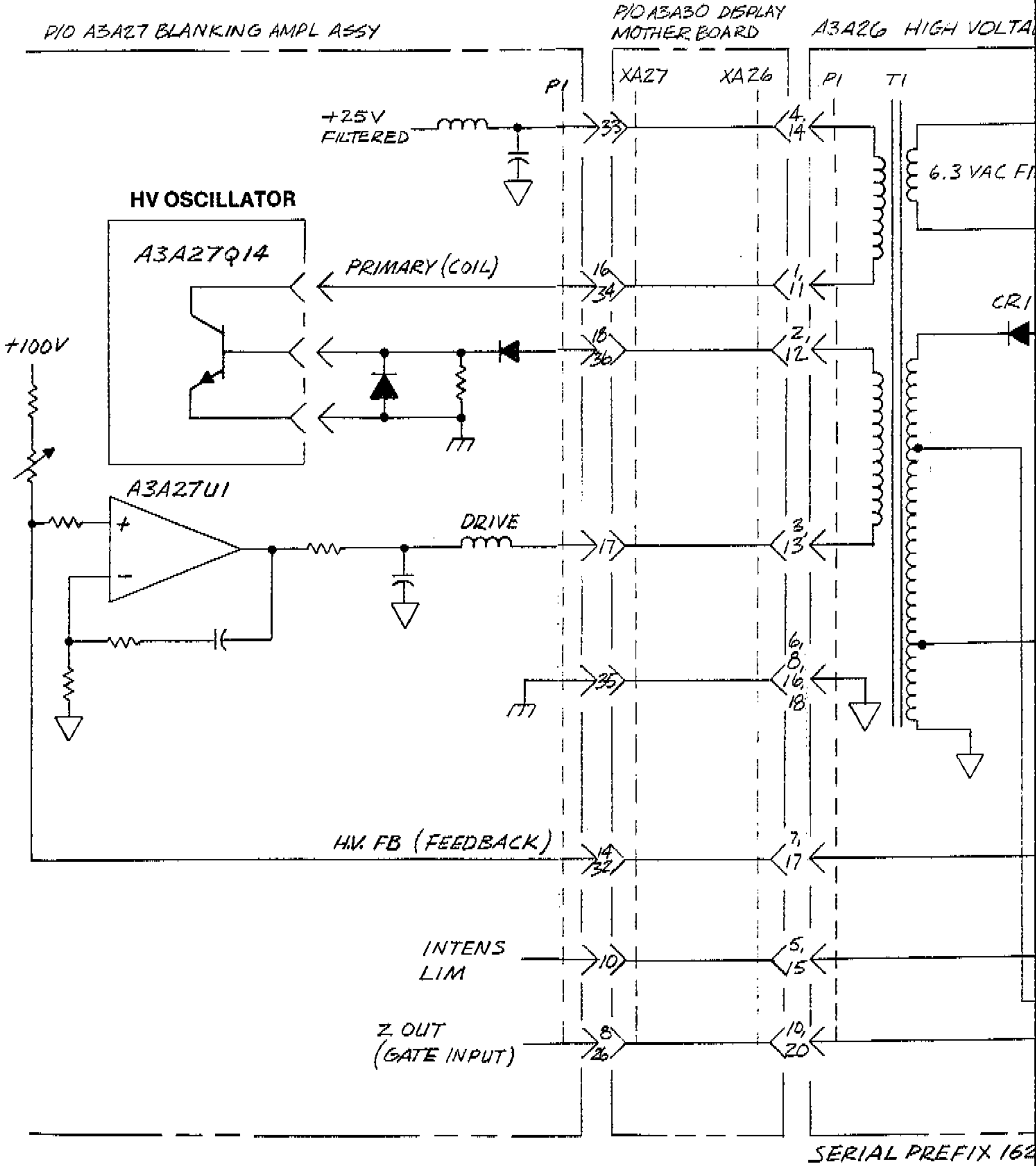


FIG. D3-55
SHT. 2 OF 4

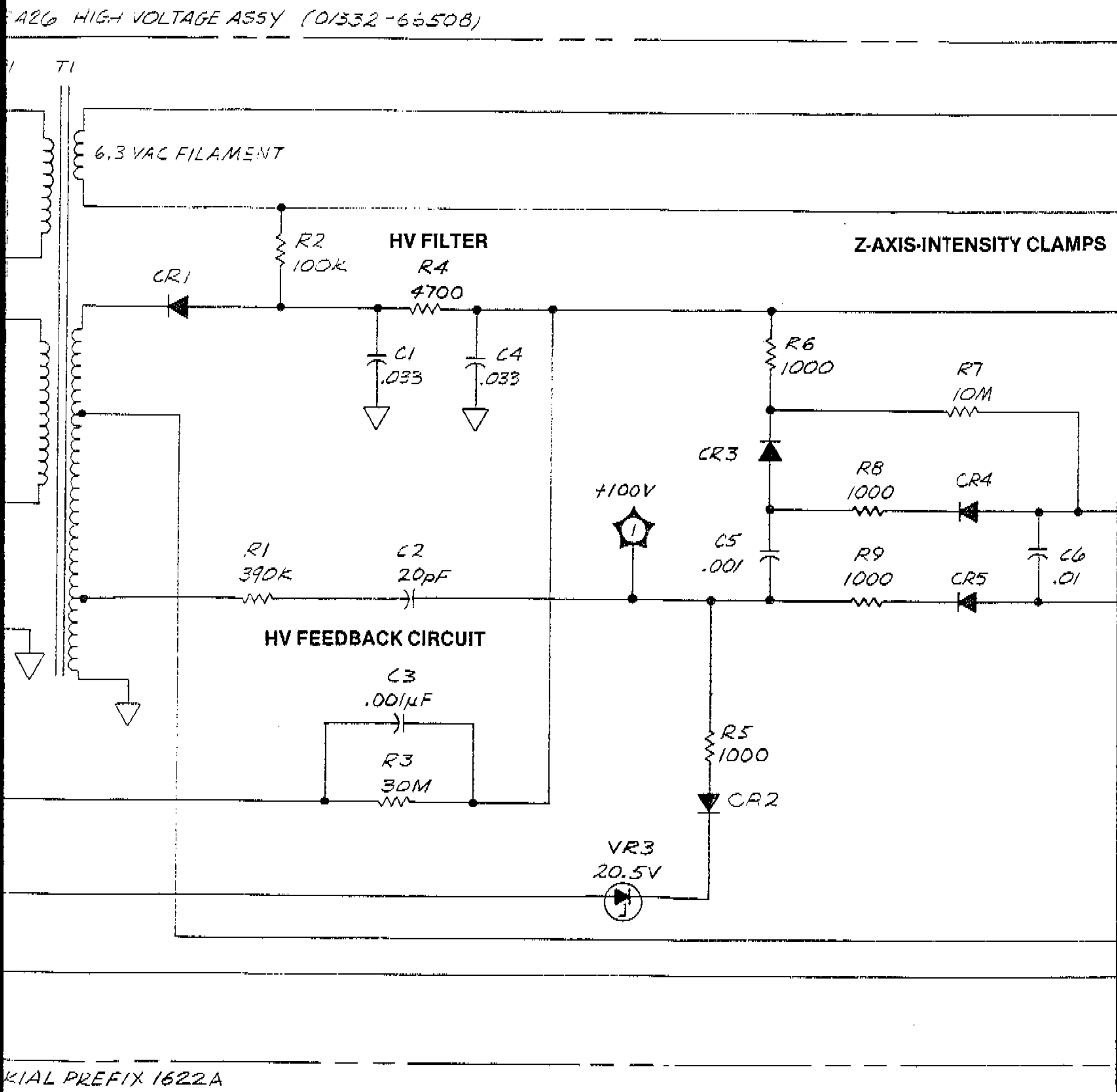


FIG. D3-55
SHT. 3 OF 4

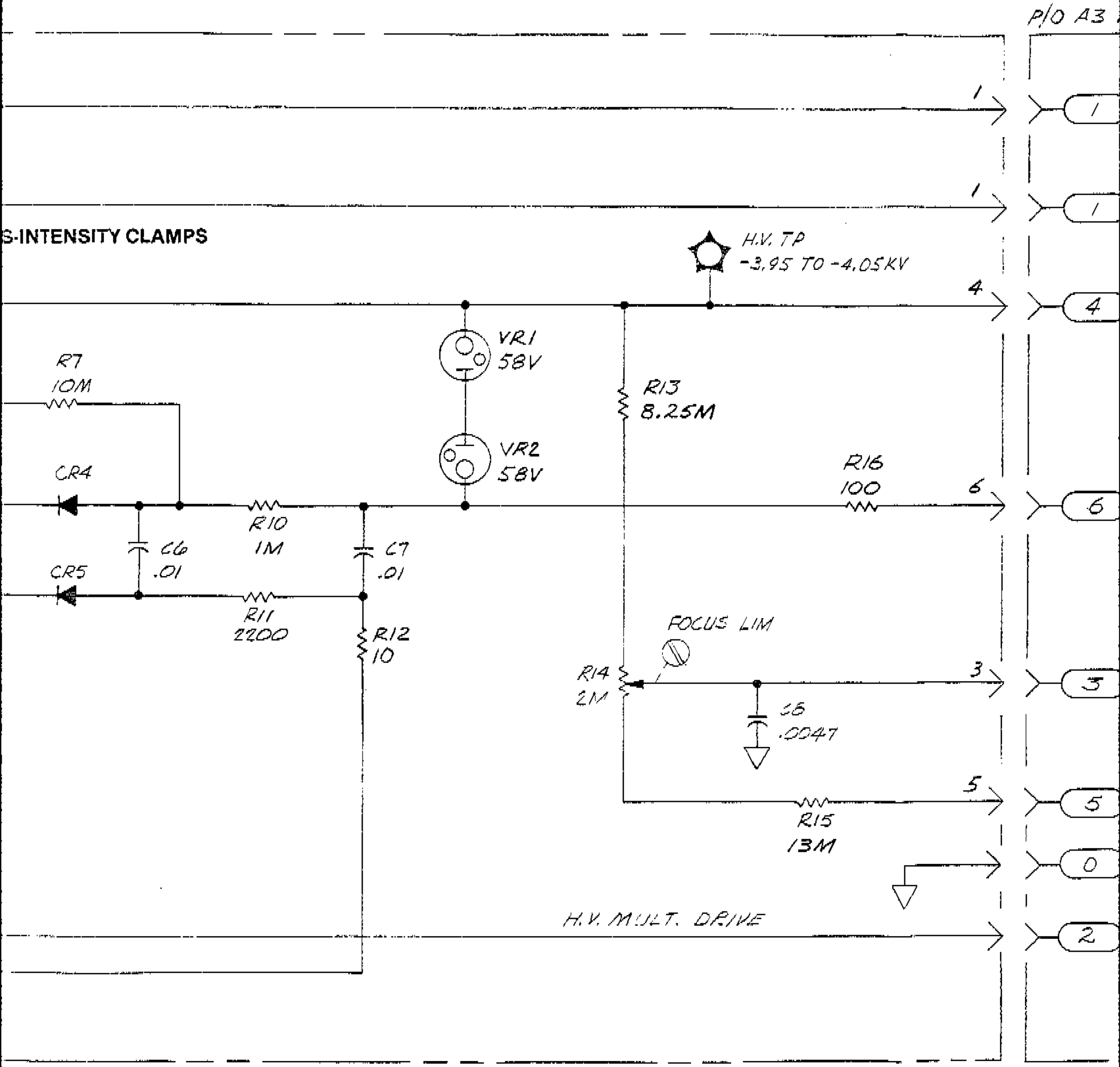
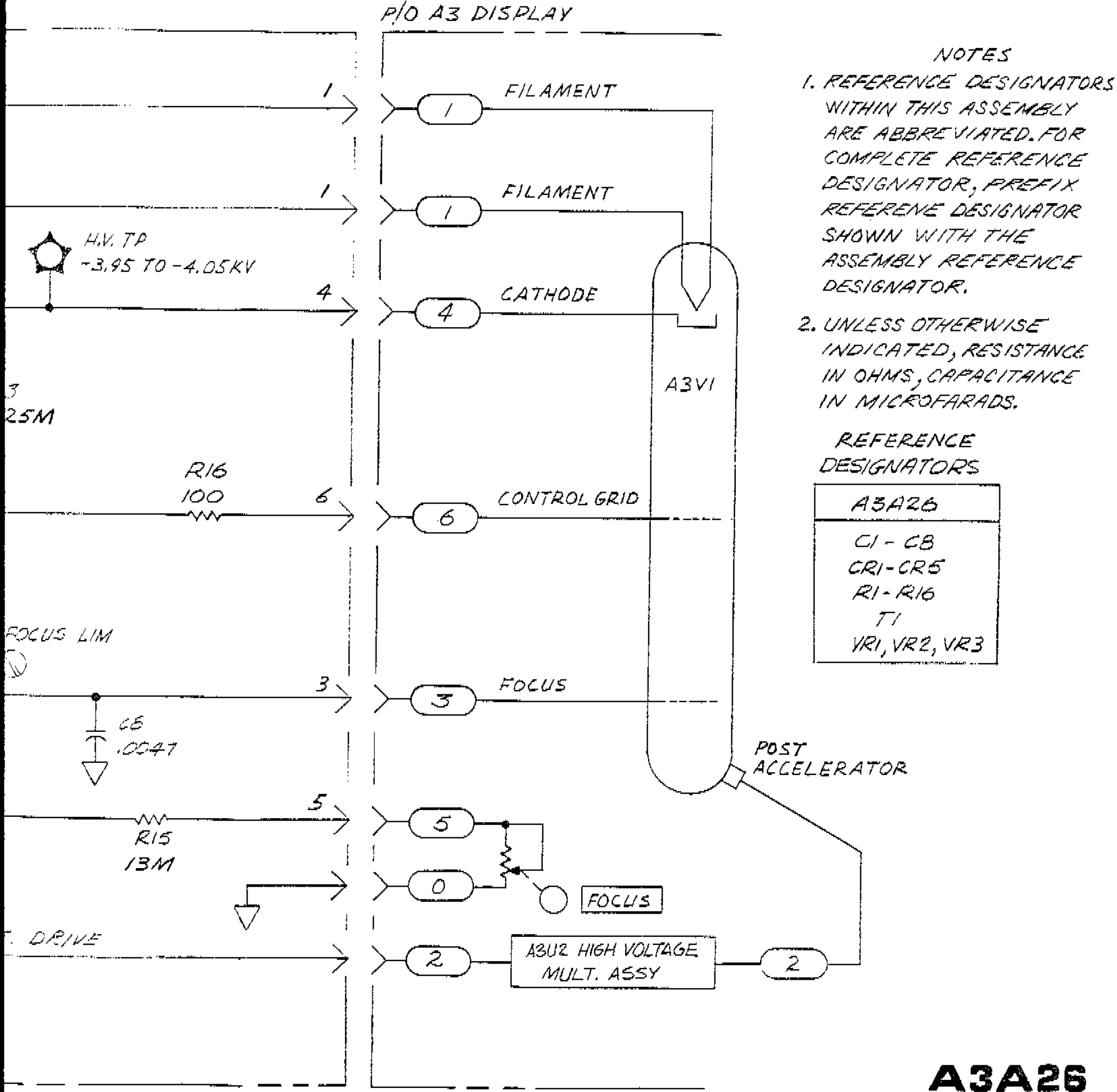


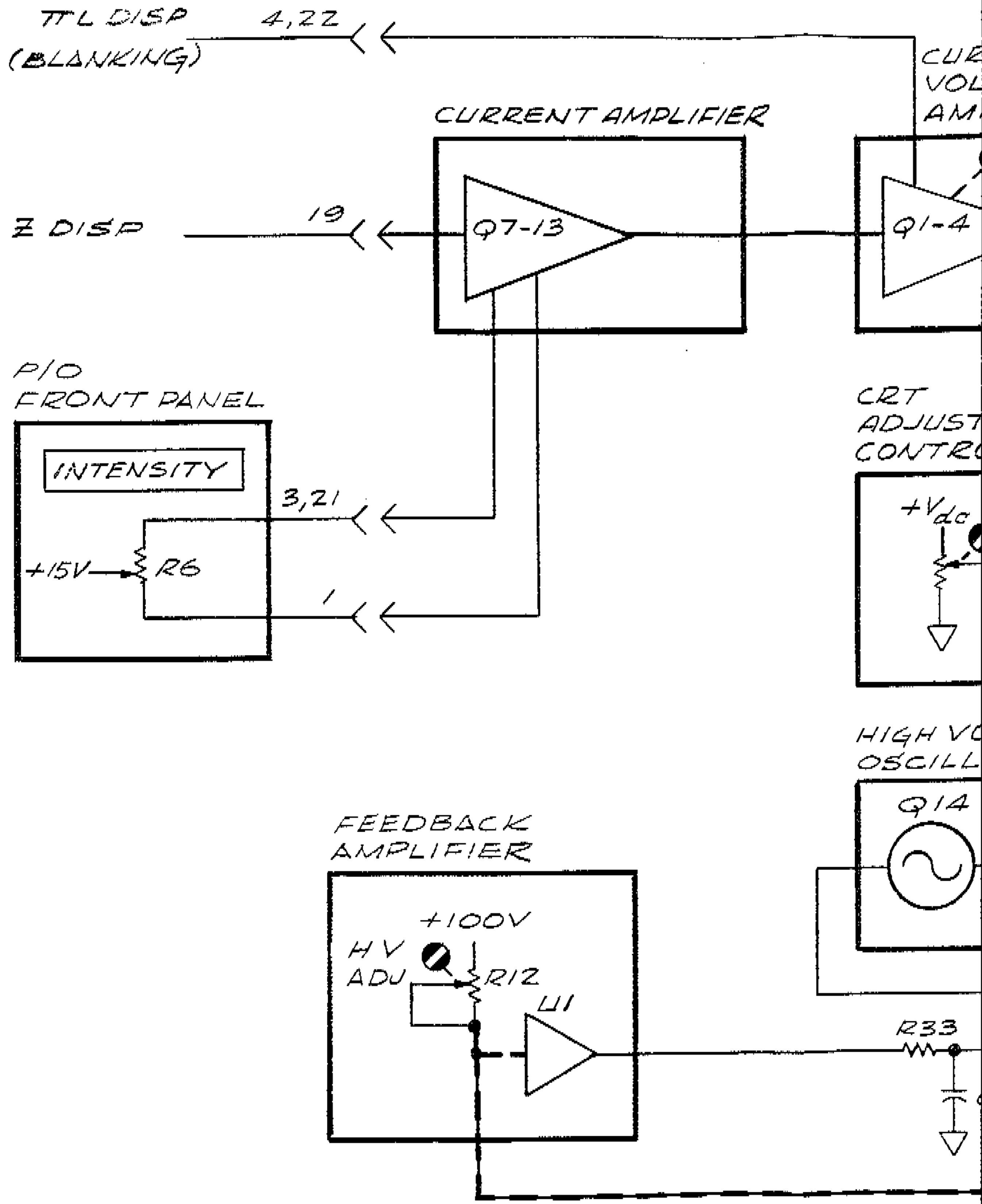
FIG. D3-55
SHT. 4 OF 4



A3A26

Figure D3-55. A3A26 High Voltage, Schematic

FIG. D3-55A
SHT. 1 OF 2



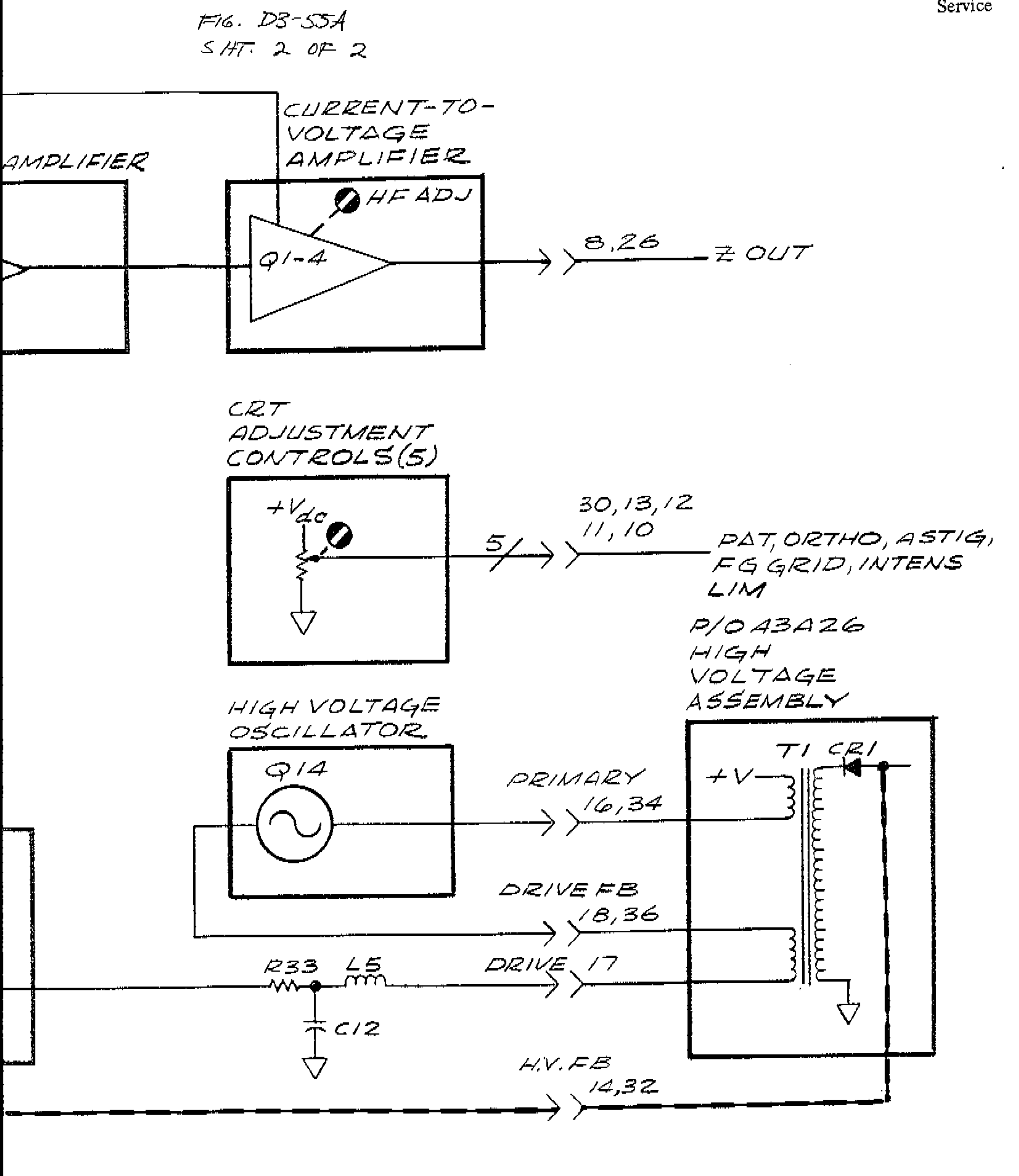


Figure D3-55A. A3A27 Blanking Amplifier, Block Diagram

A3A27

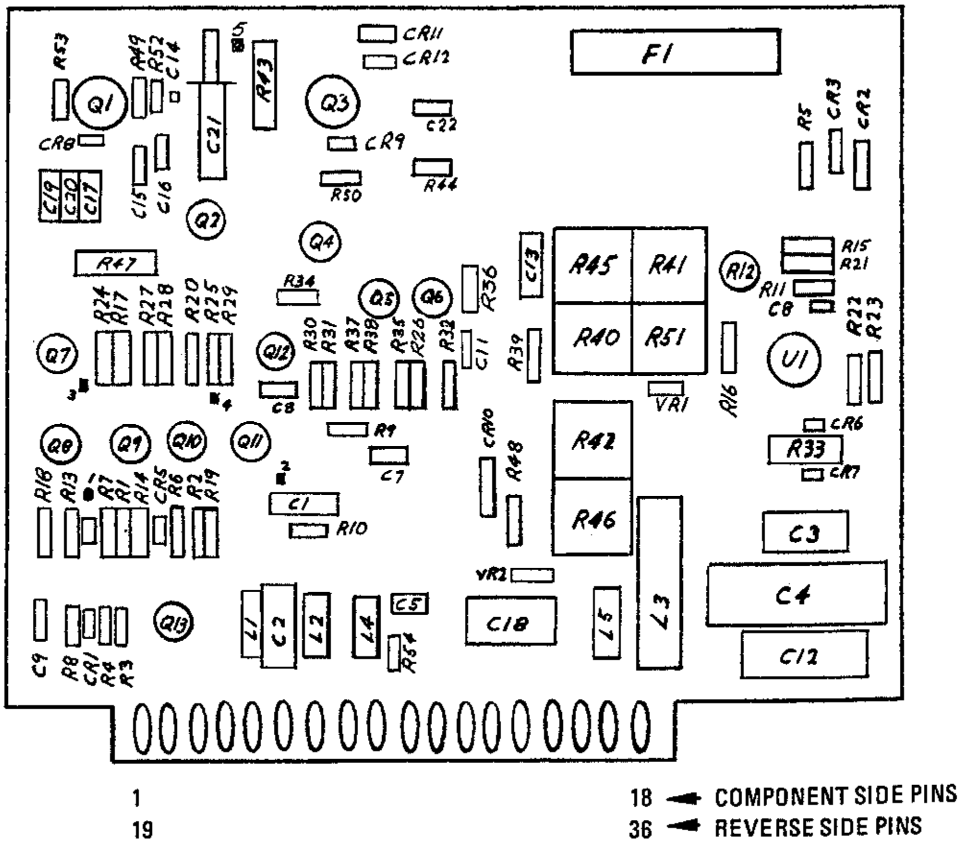


Figure D3-55B. A3A27 Blanking Amplifier Parts Locations

FIG. D3-56
SHT. 1 OF 4

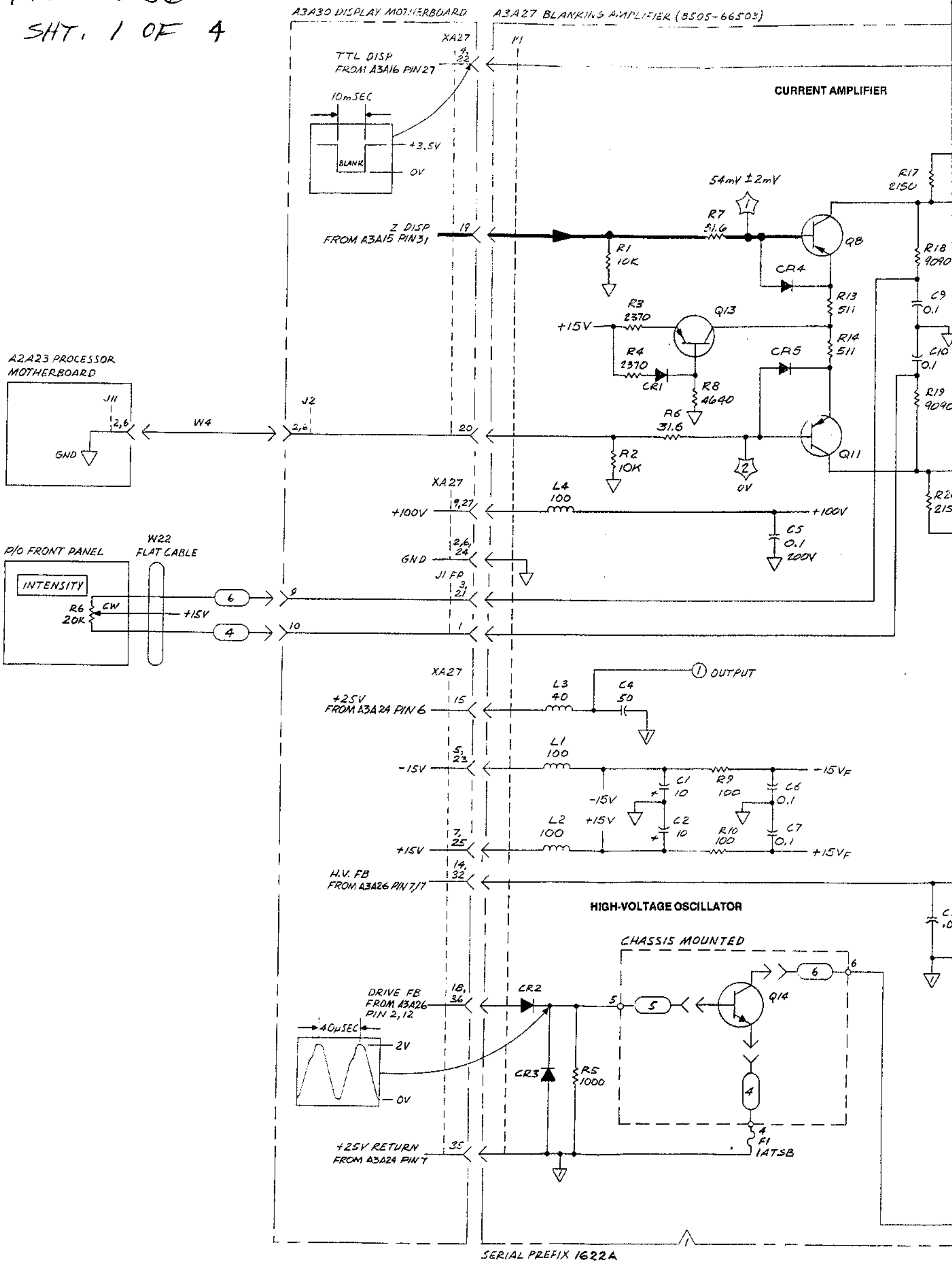


FIG. D3-56
SHT. 2 OF 4

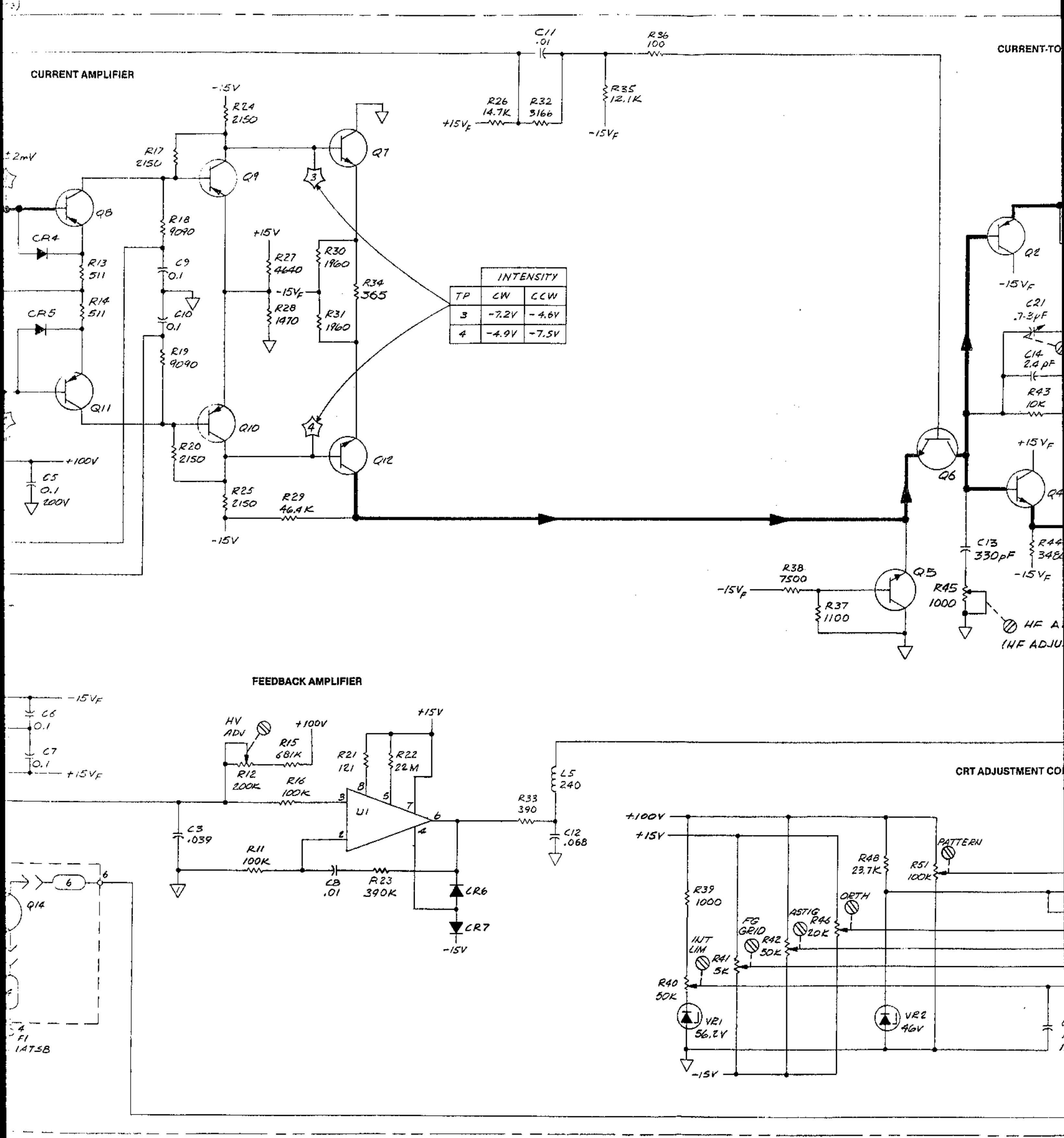
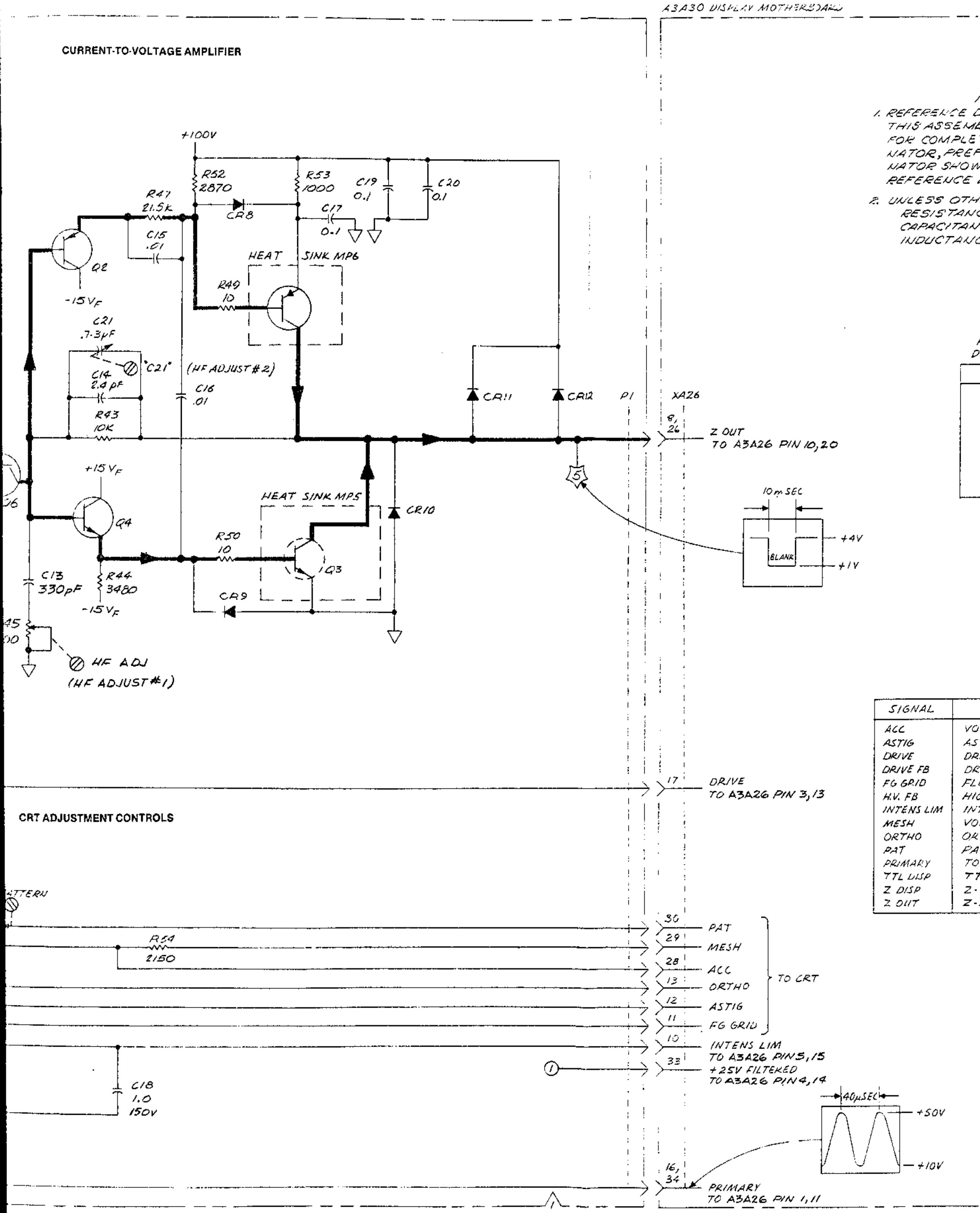


FIG. D3-56
SHT. 3 OF 4



NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIAT[ED] FOR COMPLETE REFERENCE DESIG-NATOR, PREFIX REFERENCE DESIG-NATOR SHOWN WITH THE ASSEMB[LY] REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS CAPACITANCE IN MICROFARAD INDUCTANCE IN MICROHENRIES

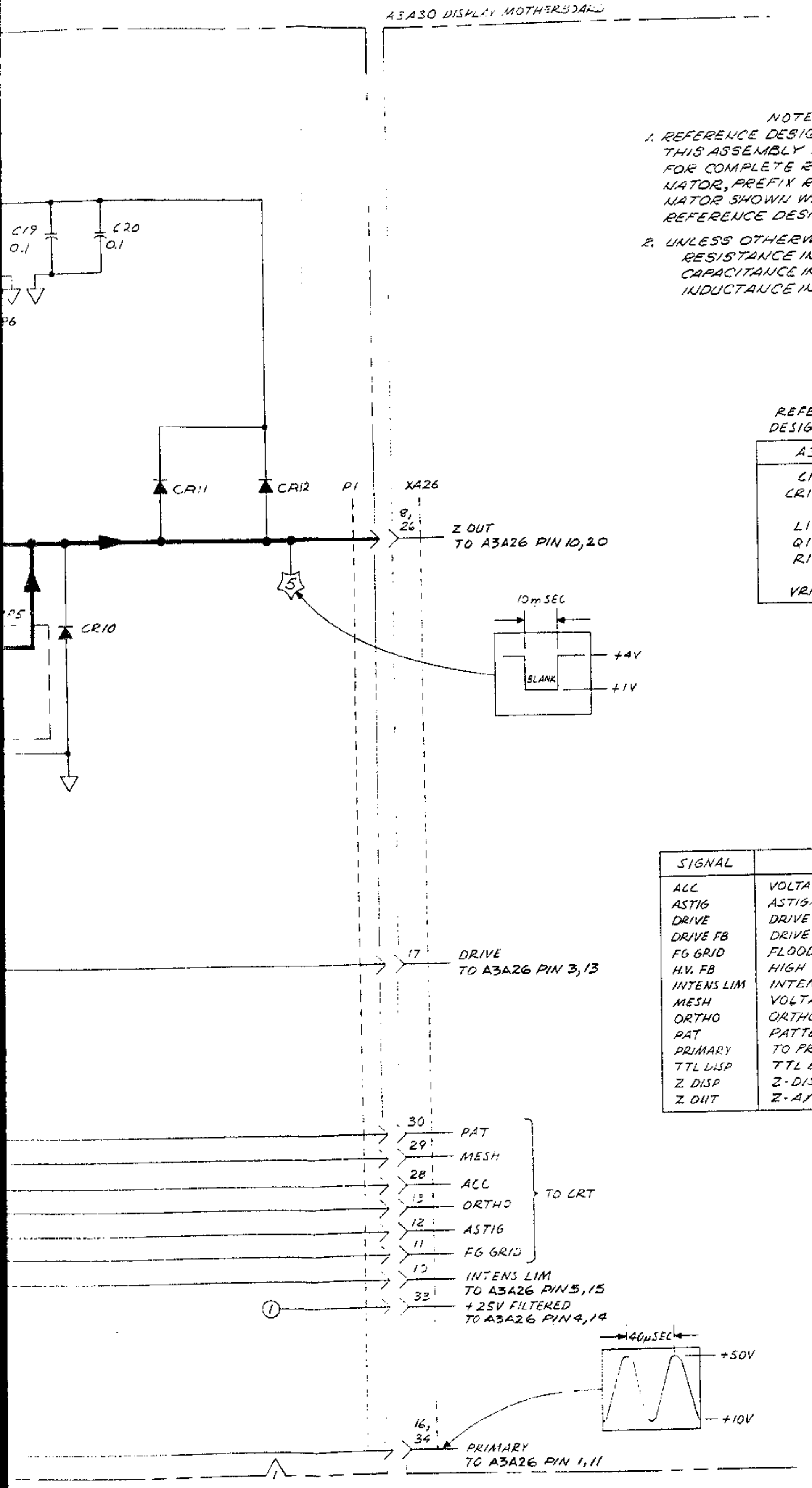
REFERENCE DESIGNATORS

A3A27
C1 - C21
CR1 - CR12
F1
L1 - L5
Q1 - Q14
R1 - R54
U1
VR1 - VR2

SIGNAL	
ACC	VOLTAGE TO CRT ACCELERAT
ASTIG	ASTIGMATISM CONTROL TO CR
DRIVE	DRIVE FOR HIGH VOLTAGE TR
DRIVE FB	DRIVE FEEDBACK
FG GRID	FLOOD GUN GRID BIAS
H.V. FB	HIGH VOLTAGE FEEDBACK
INTENS LIM	INTENSITY LIMIT TO HIGH
MESH	VOLTAGE TO CRT MESH
ORTHO	ORTHOGONALITY; ADJUSTS
PAT	PATTERN CONTROL TO CRT
PRIMARY	TO PRIMARY OF A3A26T1
TTL DISP	TTL DISPLAY - BLANKING
Z DISP	Z-DISPLAY - Z AXIS INTEN
Z OUT	Z-AXIS BLANKING

Figure D3-56. A3A27 B

FIG. D3-56
SHT. 4 OF 4



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
   CAPACITANCE IN MICROFARAD
   INDUCTANCE IN MICROHENRIES

REFERENCE DESIGNATORS

A3A27
C1 - C21
CR1 - CR12
F1
L1 - L5
Q1 - Q14
R1 - R54
U1
VR1 - VR2

SIGNAL	DEFINITION
ACC	VOLTAGE TO CRT ACCELERATOR
ASTIG	ASTIGMATISM CONTROL TO CRT
DRIVE	DRIVE FOR HIGH VOLTAGE TRANSFORMER A3A26T1
DRIVE FB	DRIVE FEEDBACK
FG GRID	FLOOD GUN GRID BIAS
H.V. FB	HIGH VOLTAGE FEEDBACK
INTENS LIM	INTENSITY LIMIT TO HIGH VOLTAGE ASSEMBLY A3A26
MESH	VOLTAGE TO CRT MESH
ORTHO	ORTHOGONALITY; ADJUSTS PERPENDICULARITY OF X AND Y TRACES
PAT	PATTERN CONTROL TO CRT
PRIMARY	TO PRIMARY OF A3A26T1
TTL DISP	TTL DISPLAY - BLANKING FOR CRT
Z DISP	Z-DISPLAY - Z AXIS INTENSITY
Z OUT	Z-AXIS BLANKING

A3A27

Figure D3-56. A3A27 Blanking Amplifier, Schematic

A3A28/A29 X/Y DEFLECTION AMPLIFIERS

The X and Y deflection amplifiers are identical and only the X axis deflection amplifier will be discussed.

Current Source

Q13 is a constant current source for the input Current Amplifier. Q13 provides 2 mA of current.

Current Amplifier

X-DISP, the horizontal input signal from the blanking logic board drives the base of Q11 in the differential Current Amplifier. This differential amplifier, A28Q7, A28Q10, A28Q11, A28Q12, A28Q14 and A28Q15 provides a signal gain of about 100. The POSN control, A28R15, in the base leads of Q12 and Q15, allows the trace position to be varied. GAIN control, A28R27, sets the voltage level that controls the horizontal gain.

Current to Voltage Amplifier

A28Q2, A28Q5, A28Q6 and A28Q3, A28Q8, A28Q9 are each a feedback amplifier connected together as a differential current to voltage amplifier. A current of about 2.2 mA at the amplifier's input will give about +50V at the collectors of Q2 and Q3 to drive the horizontal deflection plates. High frequency compensation and feedback is provided by A28R31, C12, R30 and C11. The HF ADJ control A28R29 provides HF Damping (rise time) adjustment.

FIG. D3-56A
SHT. 1 OF 2

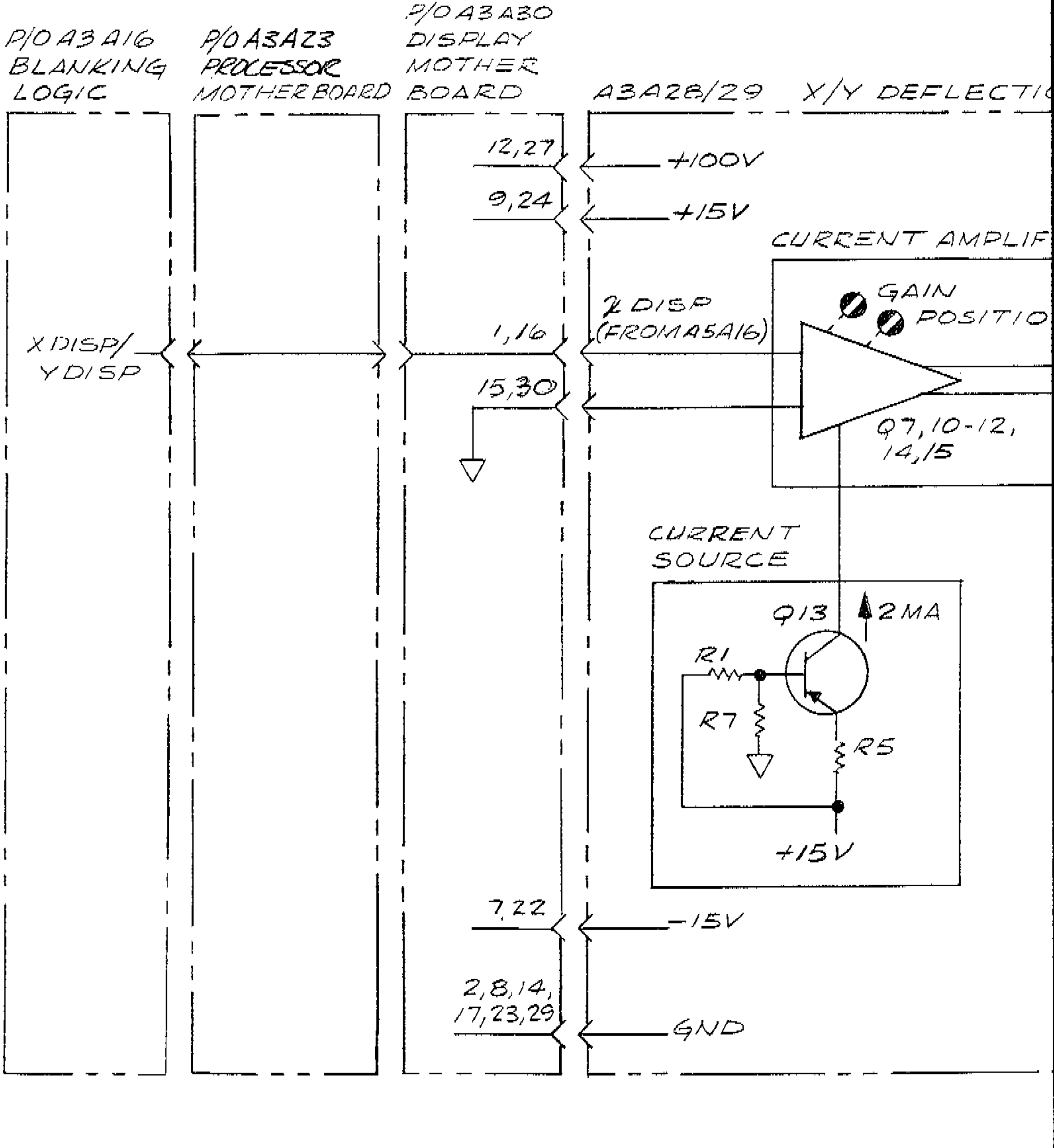


FIG. D3-56A
SHT. 2 OF 2

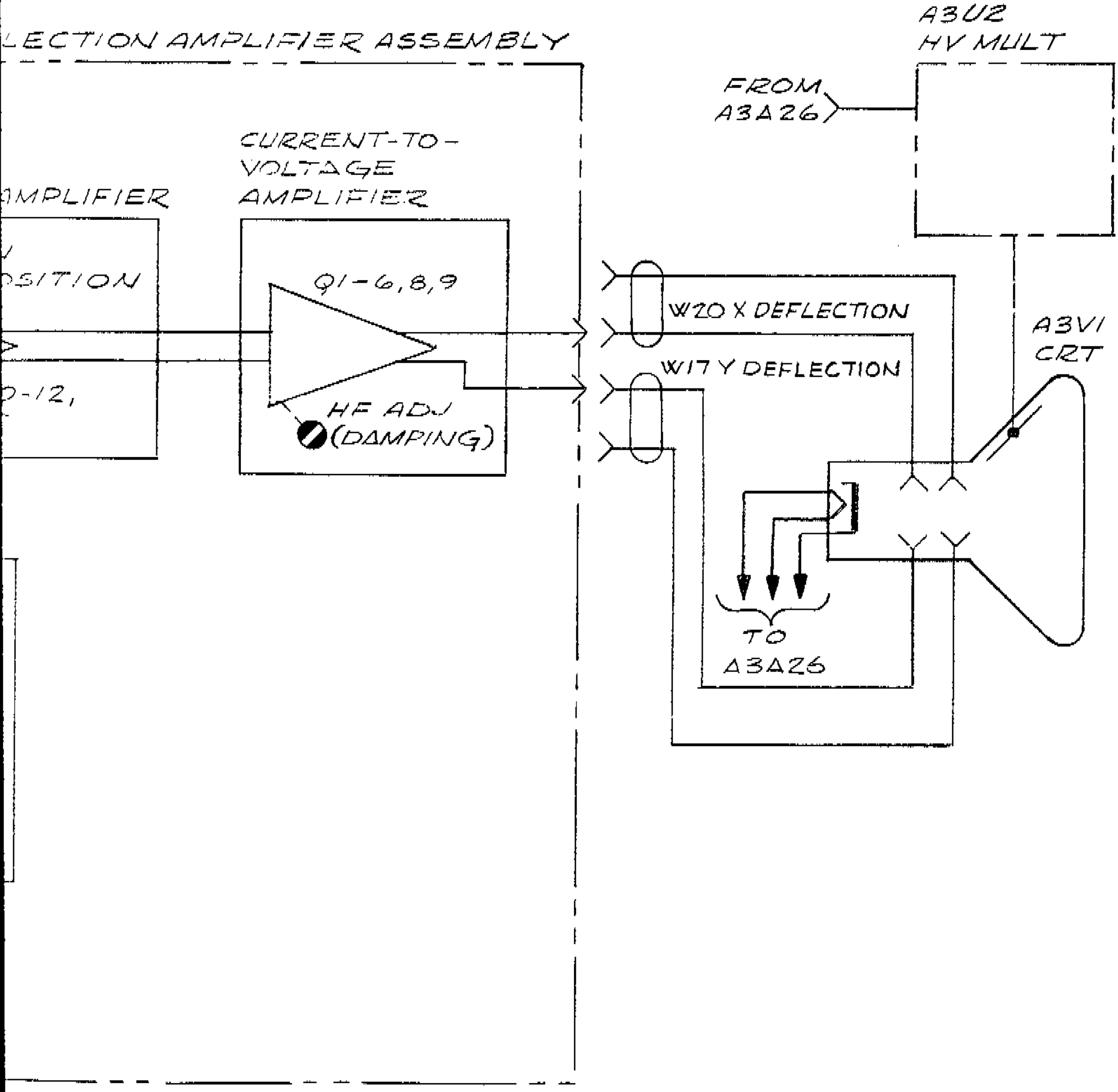


Figure D3-56A. A3A28/29 Deflection Amplifier, Block Diagram

A3A28/29

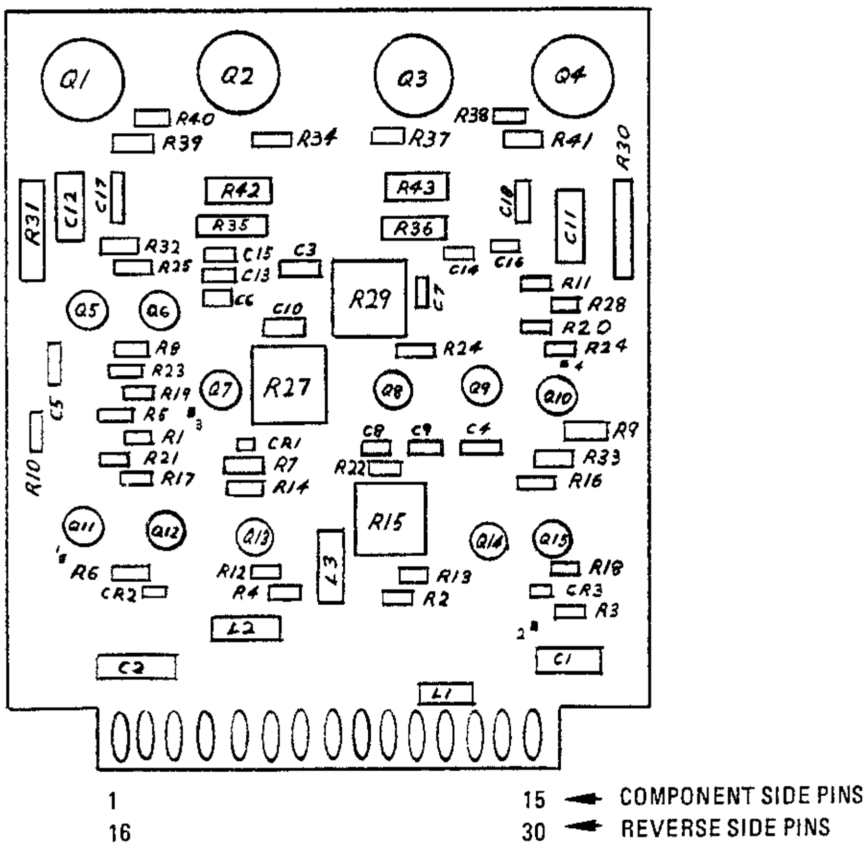
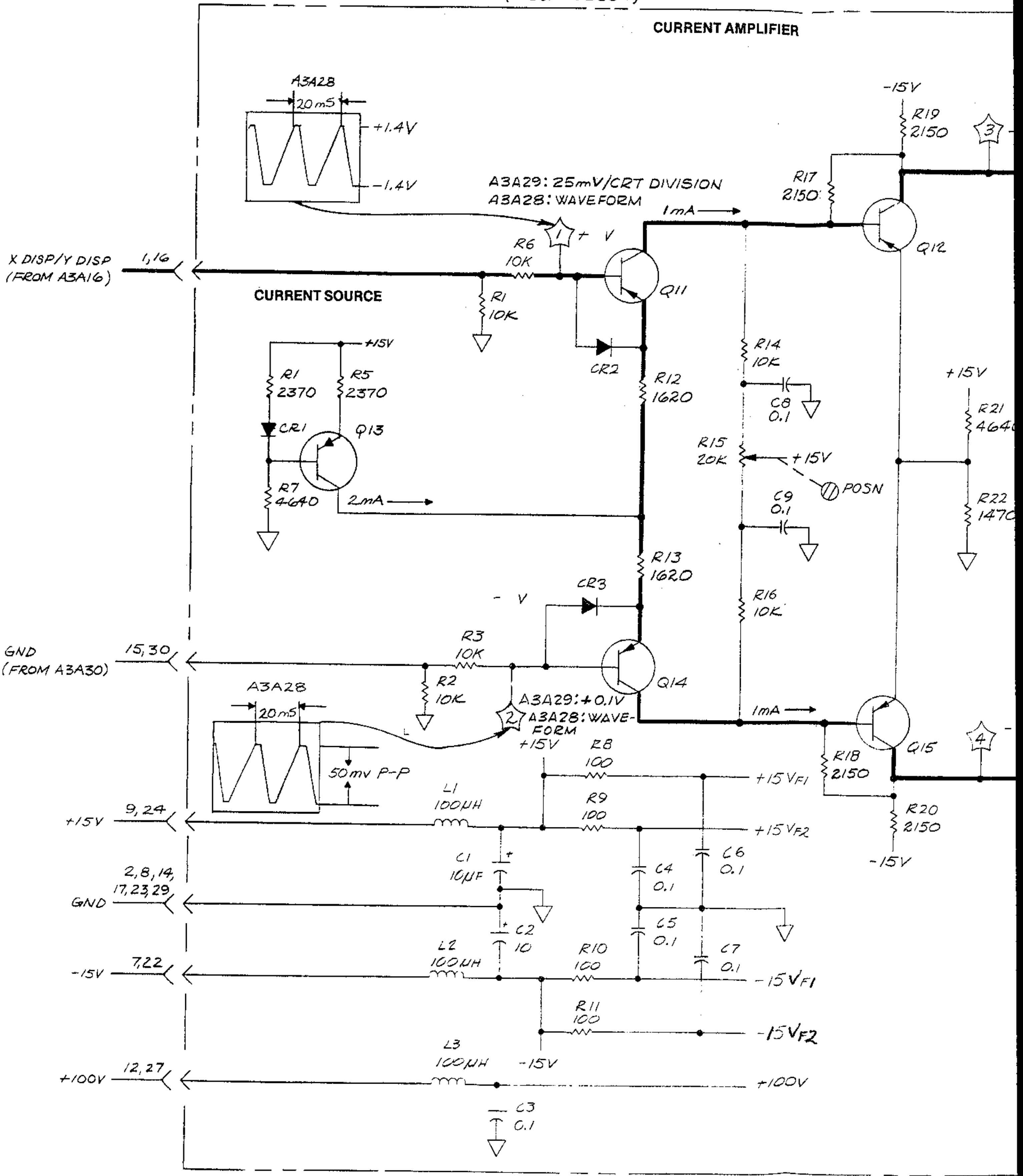


Figure D3-56B. A3A28/29 Deflection Amplifier Parts Locations

FIG. D3-57
SHT. 1 OF 3

A3A28/29 DEFLECTION AMPLIFIER (01334-66504)



SERIAL PREFIX 1622A

FIG. D3-57
SHT. 2 OF 3

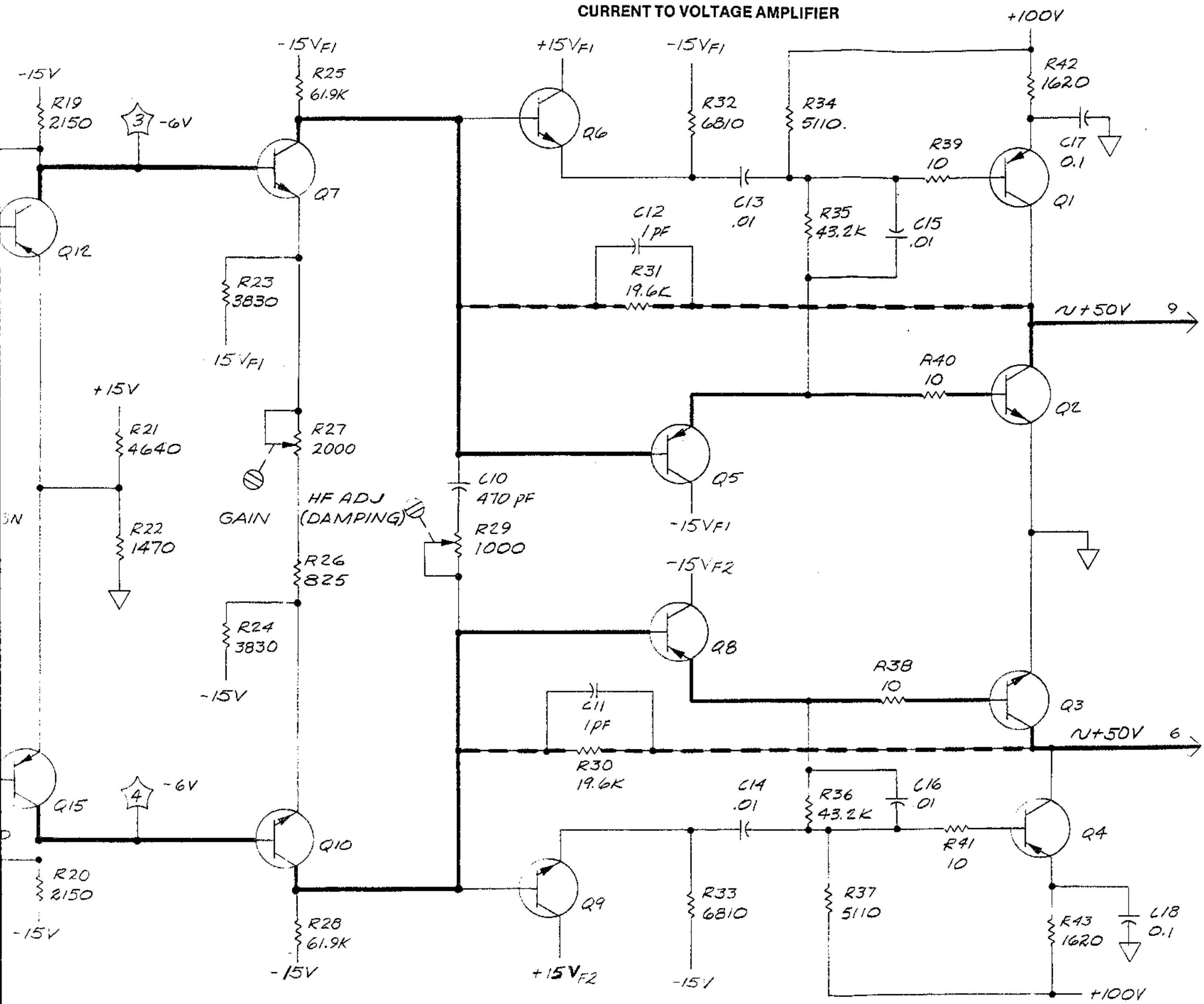
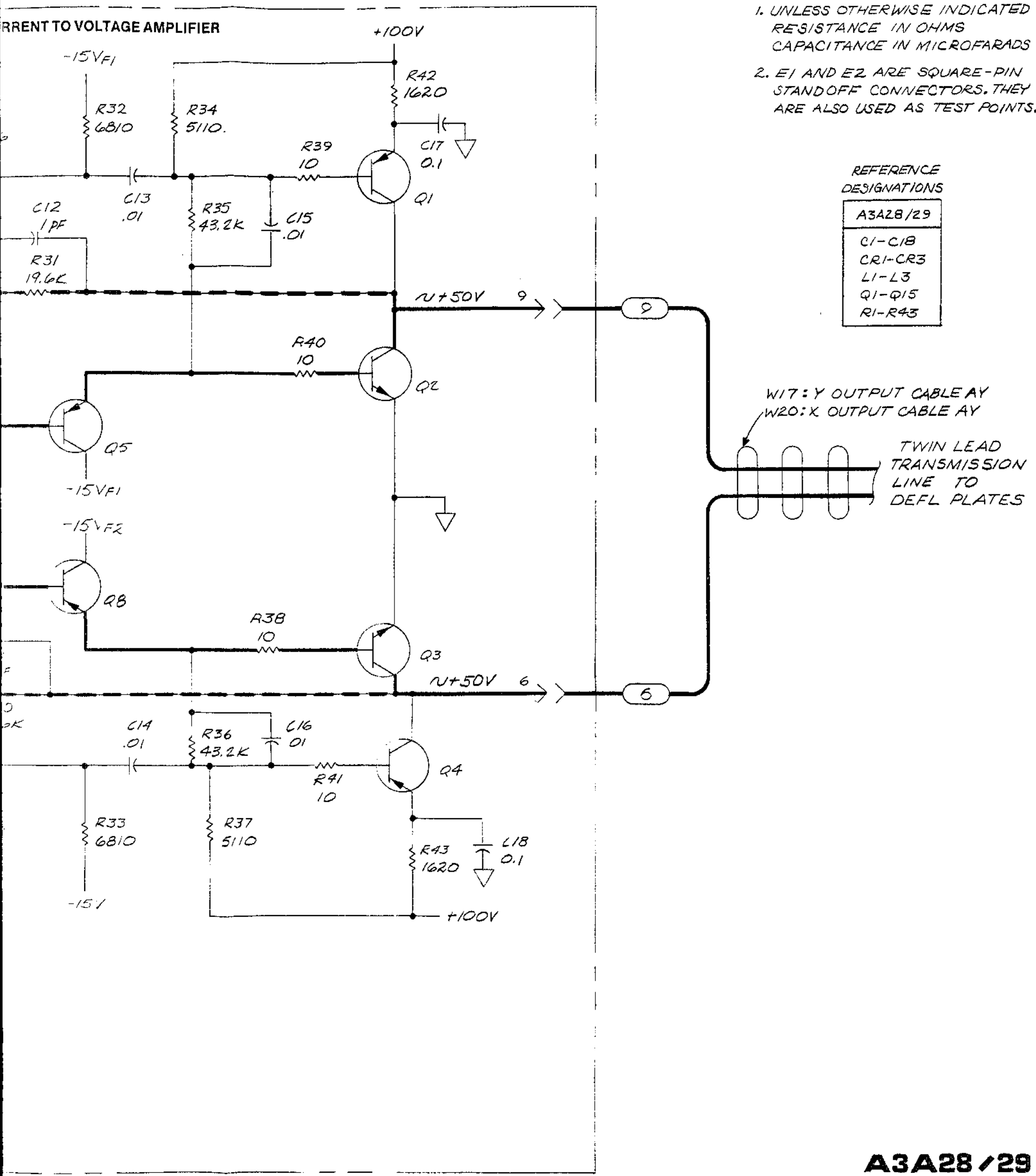


FIG. D3-57
SHT. 3 OF 3

NOTES
1. UNLESS OTHERWISE INDICATED
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
2. E1 AND E2 ARE SQUARE-PIN
STANDOFF CONNECTORS. THEY
ARE ALSO USED AS TEST POINTS.



REFERENCE DESIGNATIONS

A3A28/29
C1-C18
CR1-CR3
L1-L3
Q1-Q15
R1-R43

A3A28/29

Figure D3-57. A3A28/29 Deflection Amplifier, Schematic

CHAPTER D
SIGNAL PROCESSOR

SECTION IV
MANUAL CHANGES

D4-1. INTRODUCTION

D4-2. This section contains instructions for adapting this chapter of the manual to 8505A Network Analyzers having serial numbers lower than those listed on the title page. To adapt this chapter to your 8505A, refer to Table D4-1 and make all the changes listed opposite the serial number or serial number prefix indicated on the serial number plates on the top and bottom units of your 8505A.

Table D4-1. Chapter D Changes by 8505A Serial Number

Serial Number Prefix	Make Changes
1625A, 1622A	No change
1618A	A
1614A, 1610A	A, B
1606A, 1602A	A, B, C

D4-3. CHAPTER D CHANGE INSTRUCTIONS

CHANGE A

Page D2-7, Table D2-2:
- Add A3A3C7 HP Part Number 0180-0229, CAPACITOR-FXD 33 UF+−10% 10Vdc TA
- Delete A3A3C8 .
- Delete A3A3CR1.
- Delete A3A3Q1.
- Delete A3A3Q2.
- Delete A3A3R8.
- Delete A3A3R9.

CHANGE A (Cont'd)

Page D3-62, Figure D3-23:
Replace Figure D3-23 parts location in the manual with the parts location diagram shown below.

A3A3

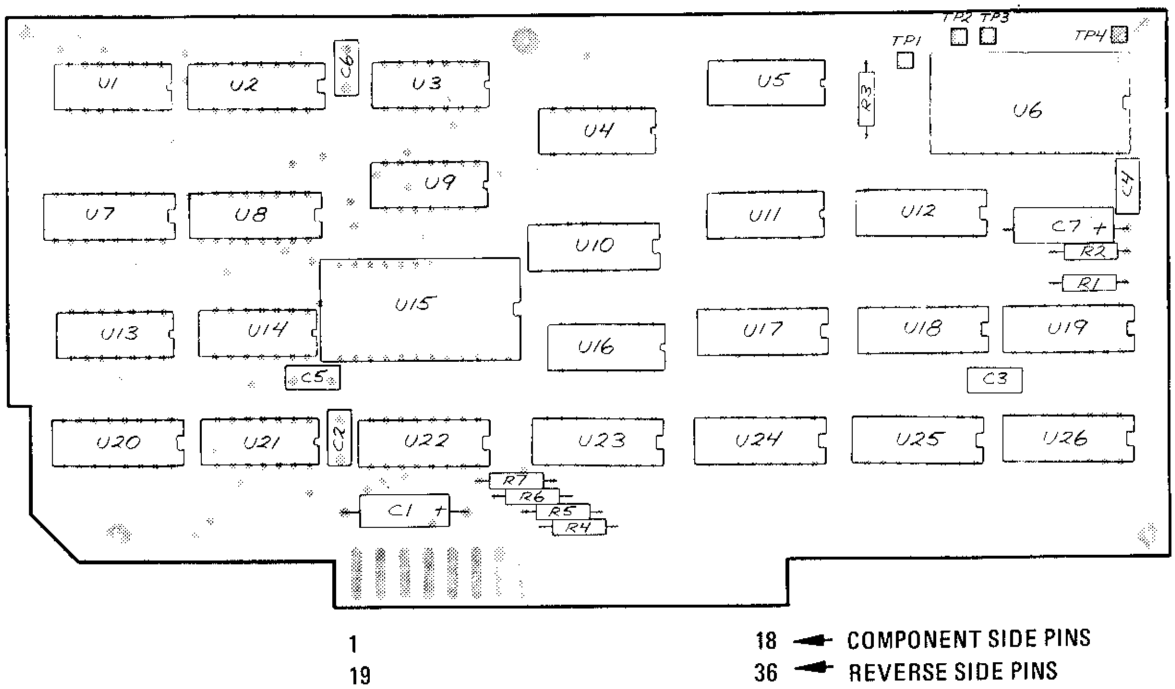


Figure D3-23. A3A3 Processor Control Parts Location (Change A)

Page D3-63, Figure D3-24:
Add C7, 33 UF capacitor from TP2 to ground (PWR RESET line). The positive side of the capacitor connects to TP2.
Delete C8, CR1, Q1, Q2, R8, R9, and R10.

CHANGE B

Page D2-11, Table D2-2:
Delete A3A7C20.

Page D2-12, Table 2-2:
Change A3A7R36 and A3A7R37 to HP Part No. 0683-2255, RESISTOR-FXD 2.2M 5% .25W FC TC = −900/+1100.
Delete A3A7R42.

Page D3-77, Figure D3-31:
Delete C20 and R42.

Page D3-77, Figure D3-32:
Delete C20 and R42 and jumper across R42 resistor circuit.
Change value of R36 and R37 to 2.2 Megohm.

CHANGE C

Page D2-15, Table D2-2:
Delete A3A9C31, and A3A9CR1-CR3.
Change A3A9R13 to HP Part No. 0757-0443 RESISTOR 11K 1% .125W F TC = 0+- 100.
Change A3A9R14 to HP Part No. 0811-1940 RESISTOR 2610 Ohm 1% .25W PWWTC=0+- 100.

Page D2-16, Table D2-2:
Delete A3A9R47 and A3A9VR3.

Page D3-84, Figure D3-35:
Delete C31, CR1 through CR3, R47, and VR3 from parts identification drawing.

Page D3-85, Figure D3-36:
Delete VR3, CR1 thru CR3, C31, and R47 and connect pin A3A9U4-11 to A3A9U4-4.
Change R13 to 11K ohms.
Change R14 to 2610 ohms.