DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).

Resistors = Ohms (Ω).

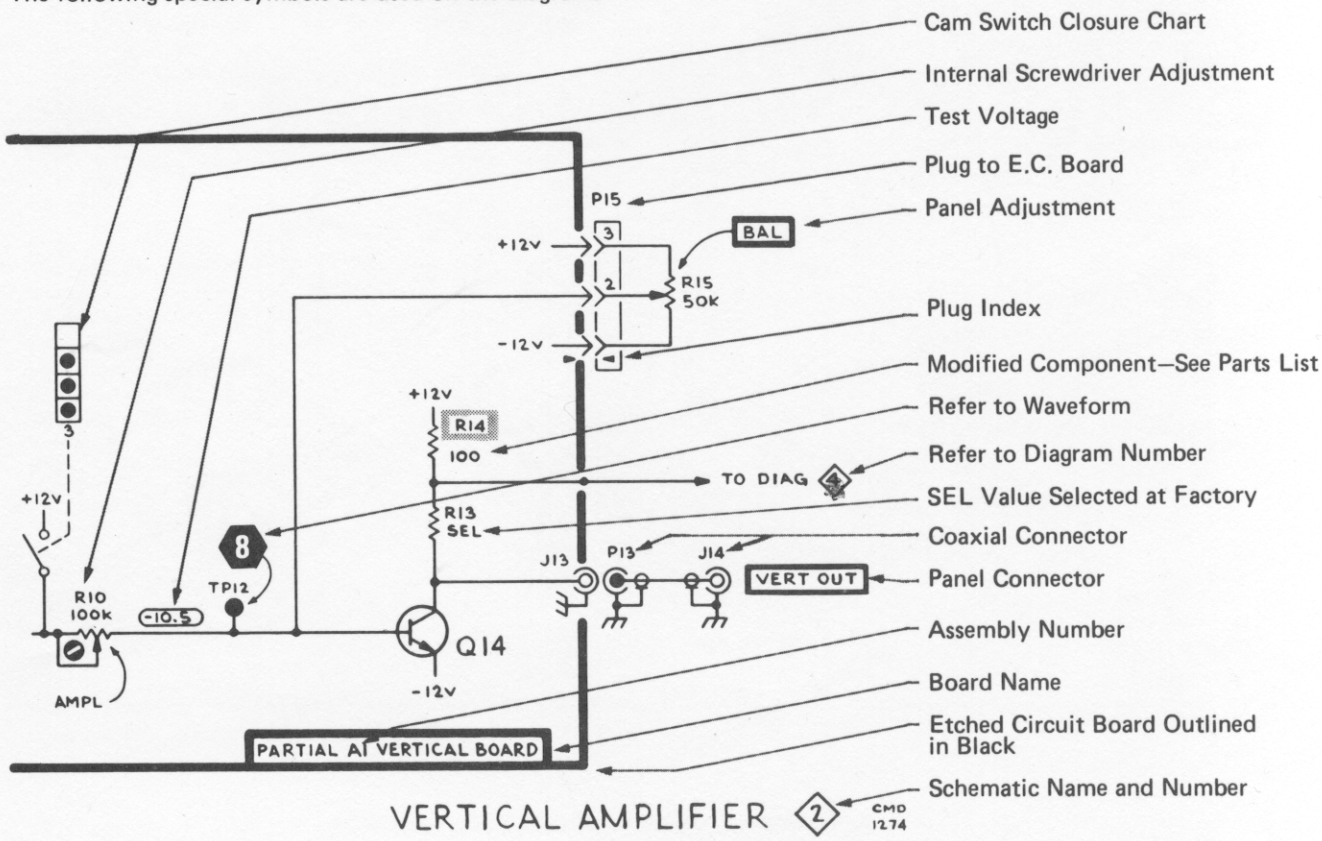
Symbols used on the diagrams are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CB	Circuit breaker
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
E	Spark Gap
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
HY	Hybrid circuit
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
P	Connector, movable portion
Q	Transistor or silicon-controlled rectifier
R	Resistor, fixed or variable
RT	Thermistor
S	Switch
T	Transformer
TC	Thermocouple
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal
Z	Phase shifter

The following special symbols are used on the diagrams:



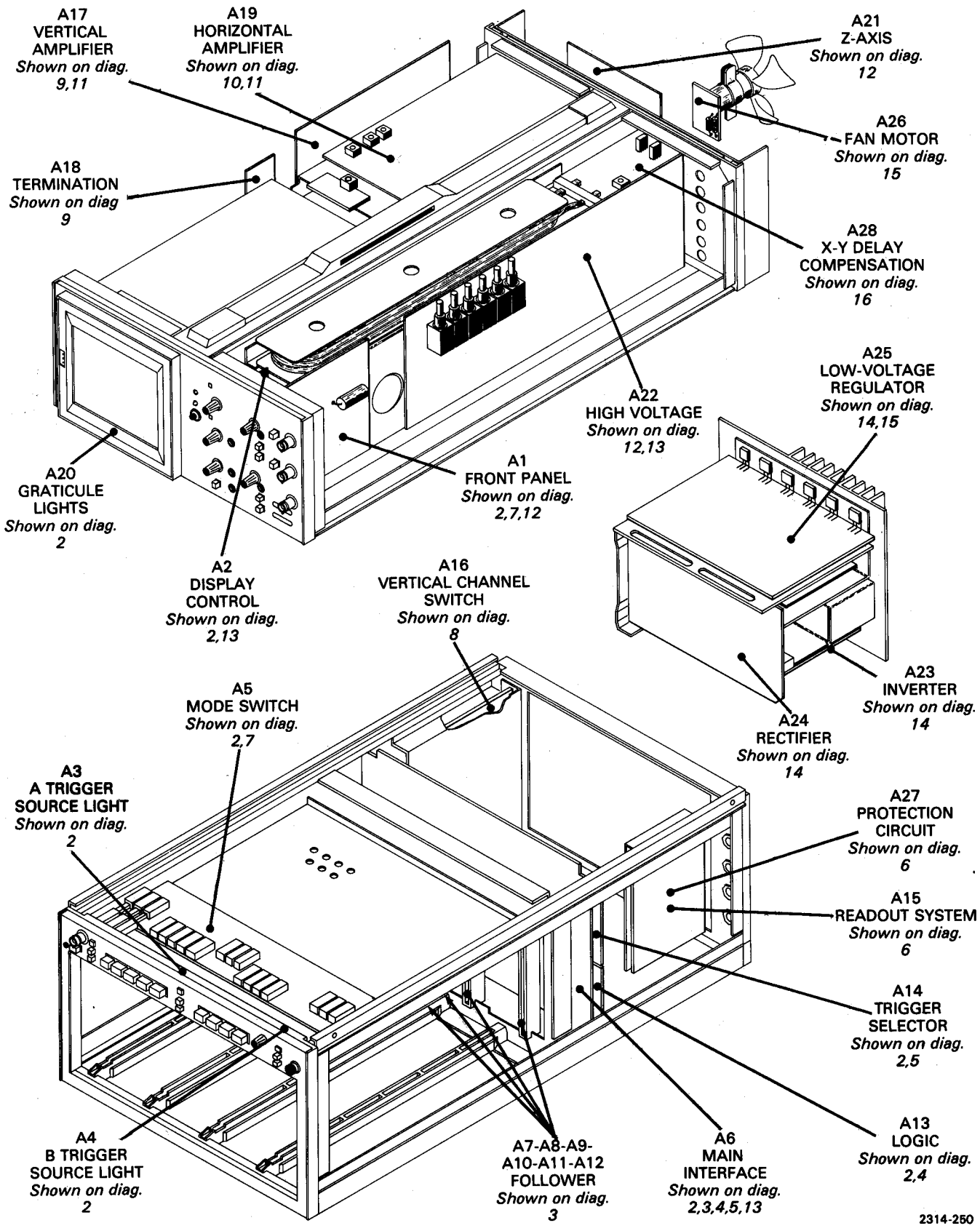


Figure 8-1. Location of circuit boards in the 7104.

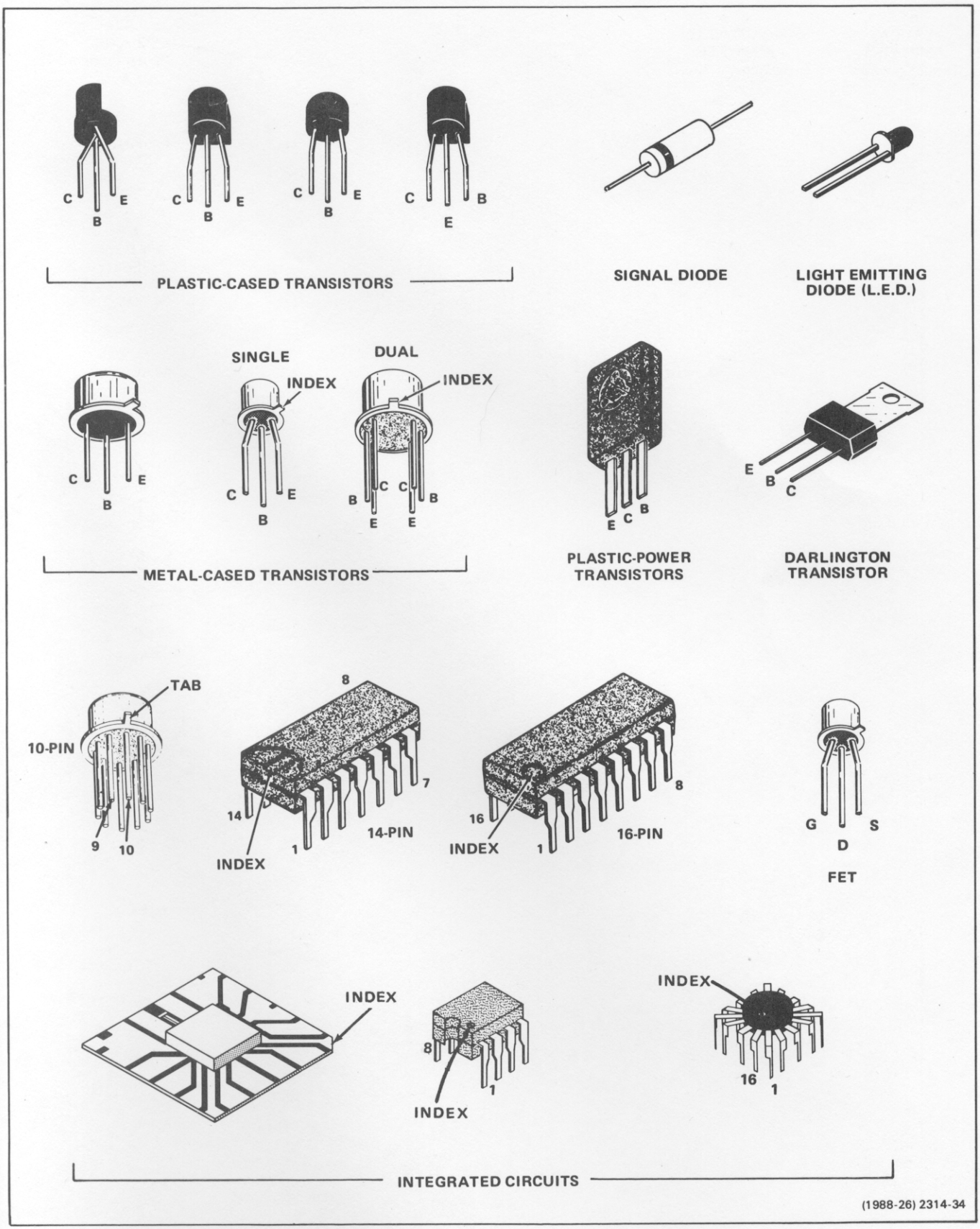
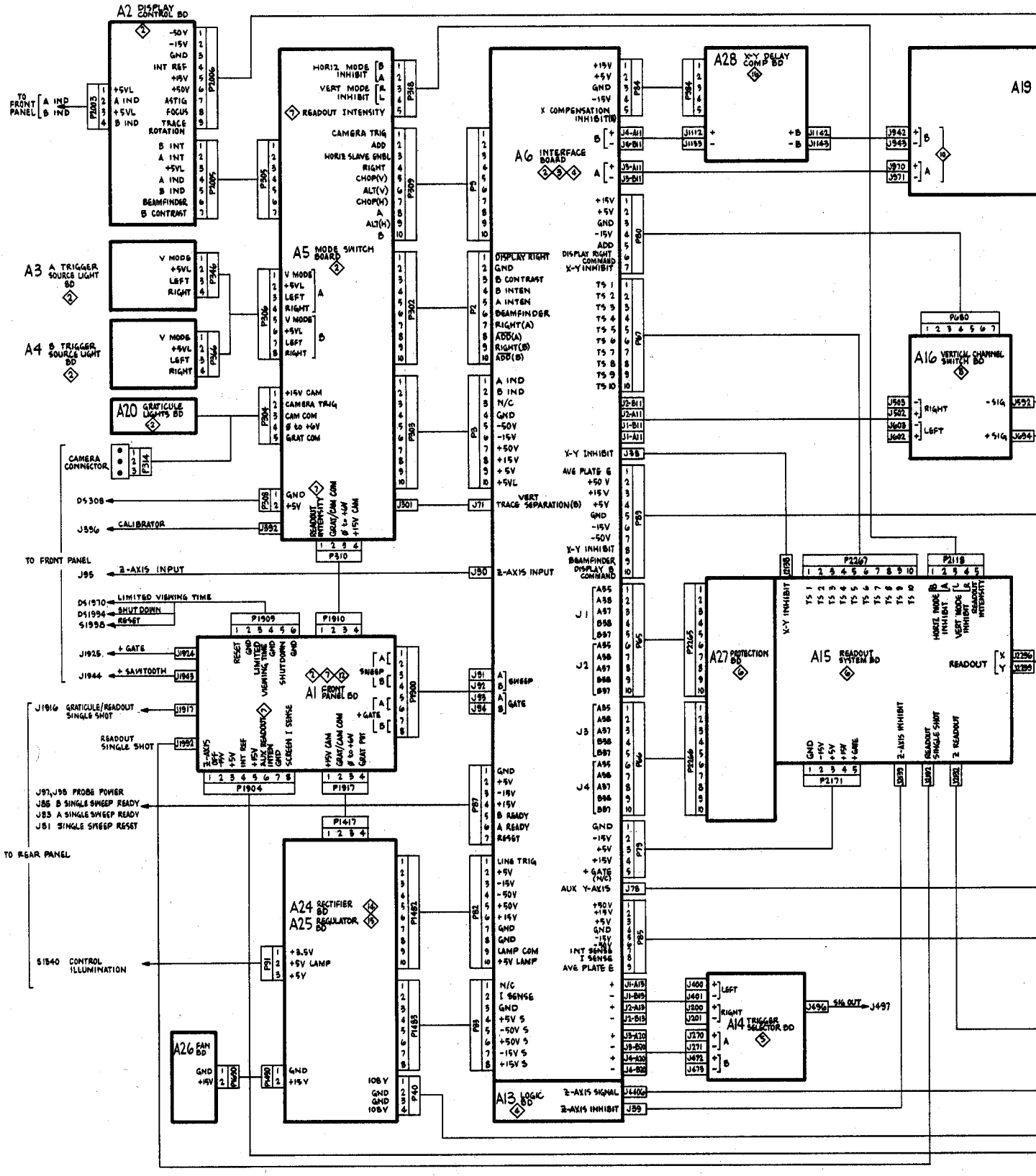


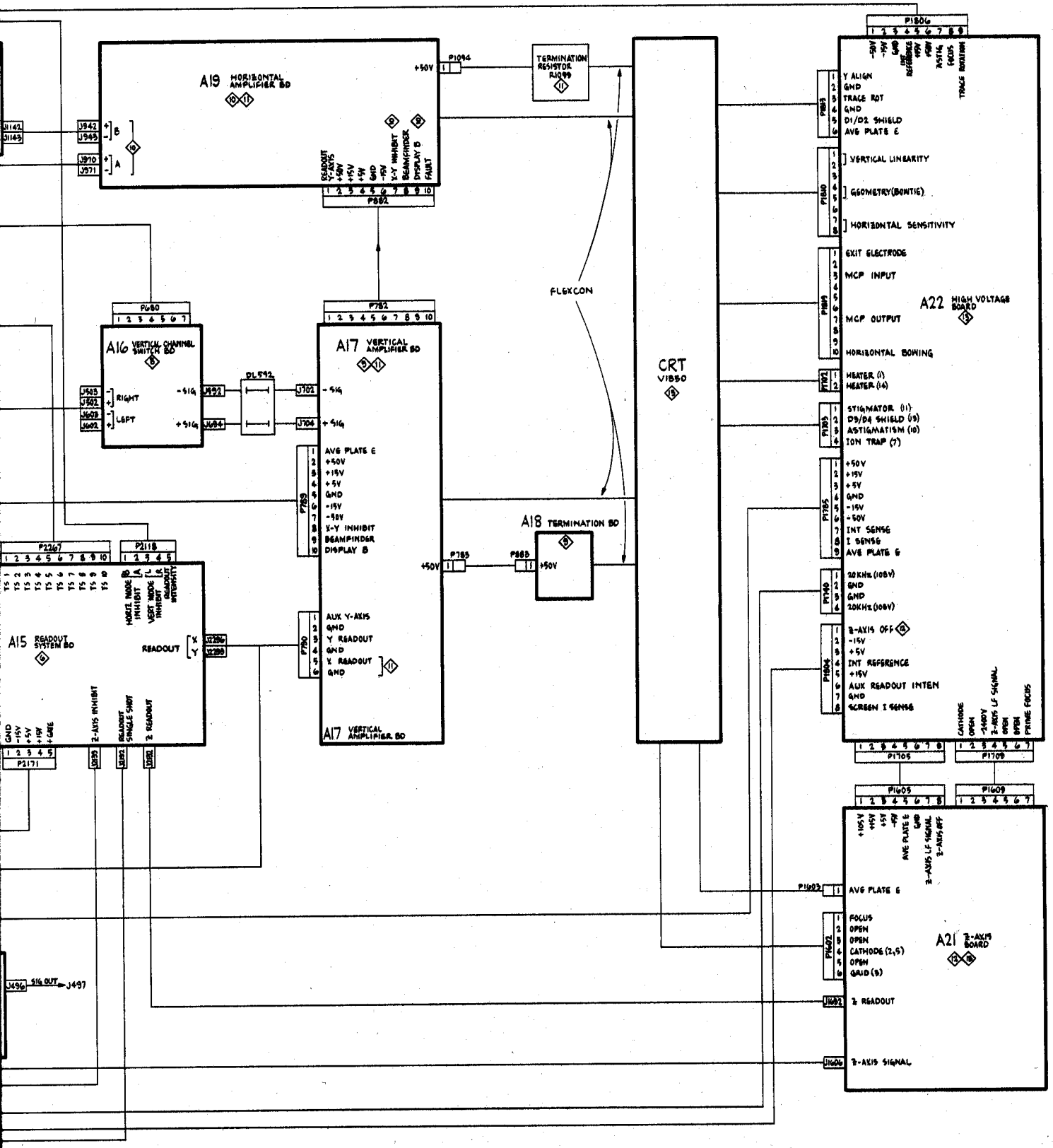
Figure 8-2. Semiconductor lead configurations.

@



7104

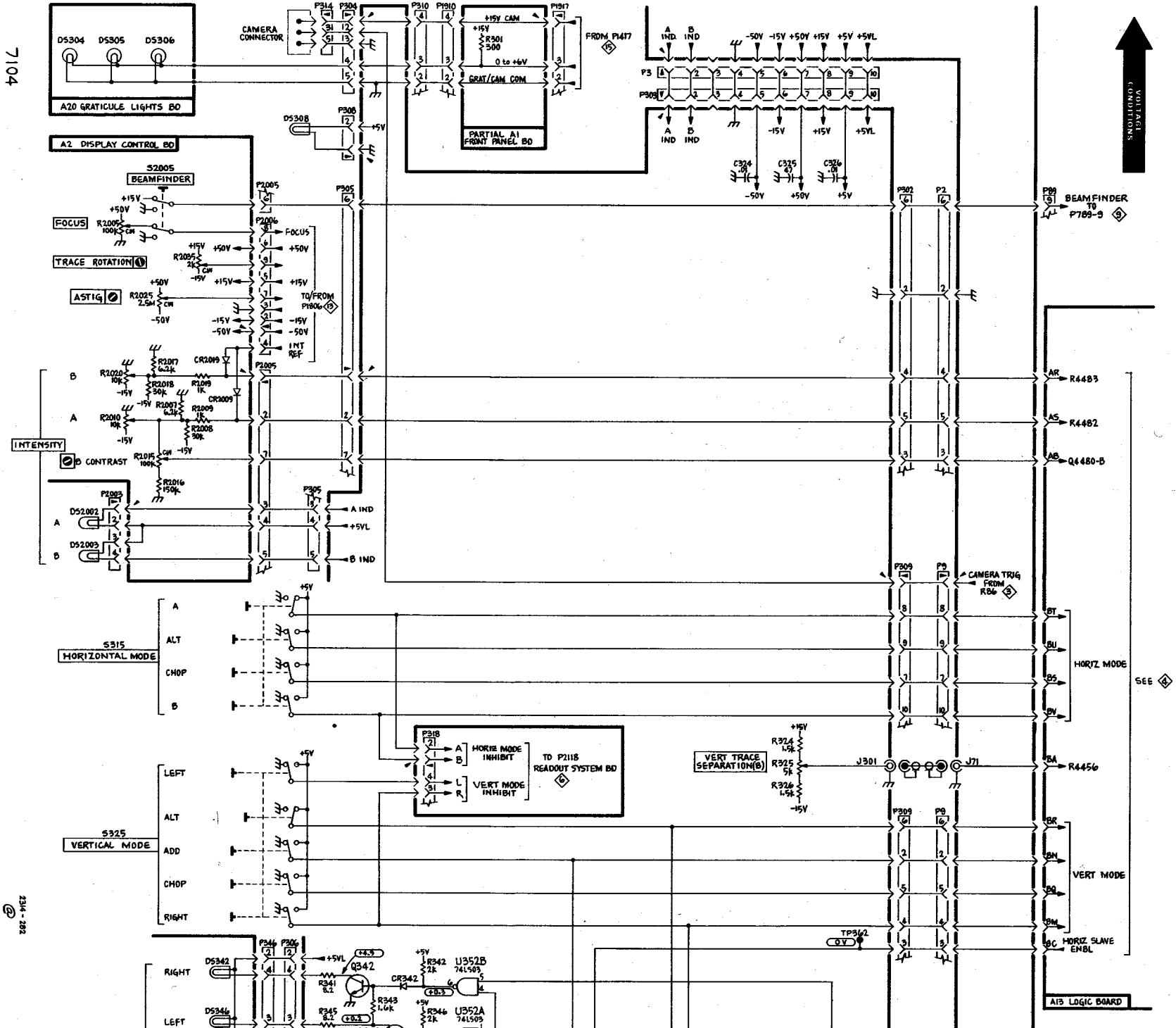
2314 - 281

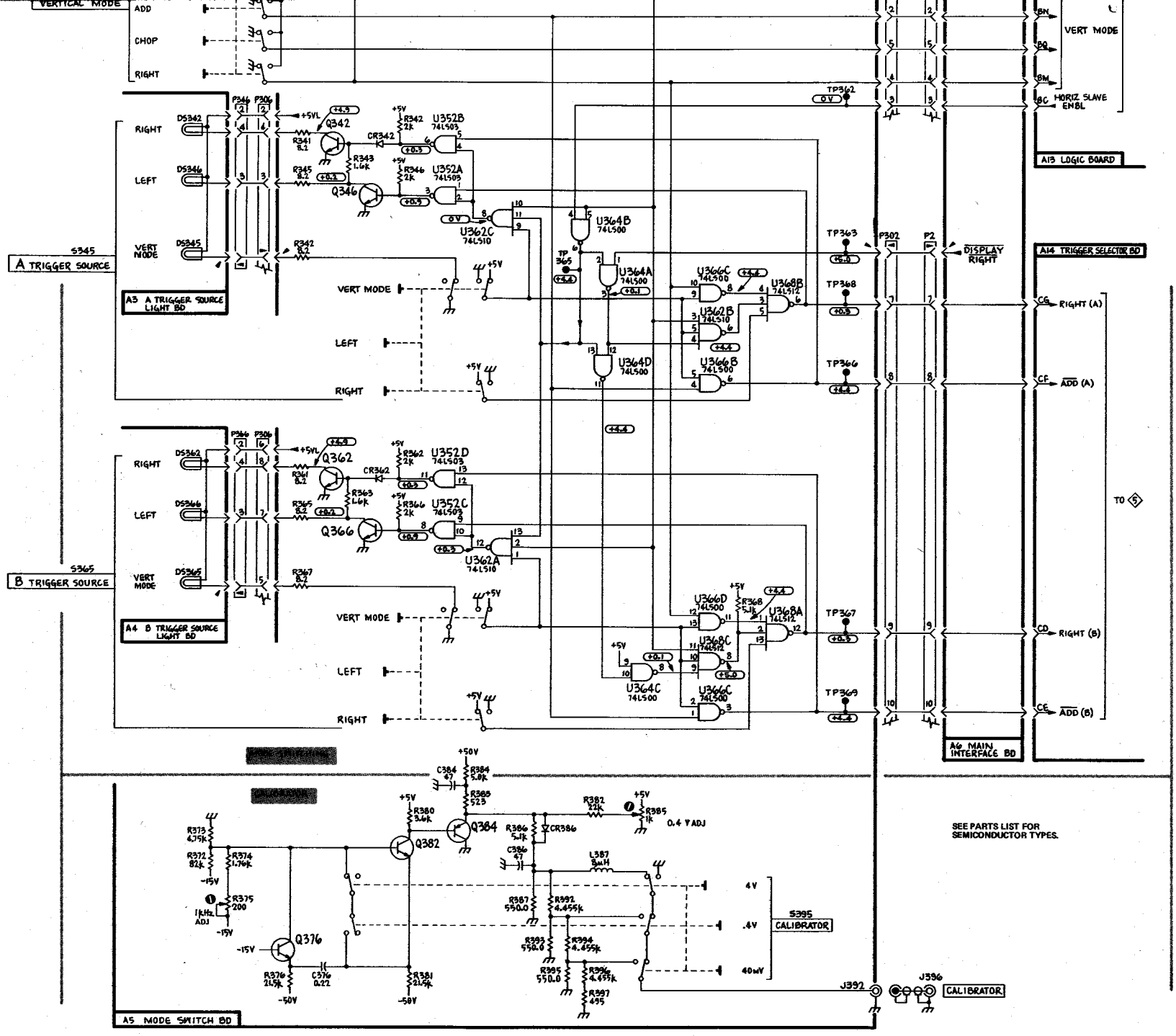

A19 HORIZONTAL AMPLIFIER BD
A16 VERTICAL CHANNEL SWITCH BD
A17 VERTICAL AMPLIFIER BD
A18 TERMINATION BD
A15 READOUT SYSTEM BD
A22 HIGH VOLTAGE BOARD
A21 Z-AXIS BOARD
CRT V1550
TERMINATION RESISTOR R1099
FLEXCON
P1094
P680
P782
P2267
P2118
P2171
P1804
P1805
P1709
P1609
P1603
P1602
P1600
P1699
P1702
P1705
P1740
P1804
P1605
P1607
P785
P883
P789
P790
J942
J943
J910
J971
J1142
J1143
J605
J602
J608
J602
J992
J994
J702
J706
J2296
J2298
J1496
J497
J1602
J1600
RIGHT
LEFT
DL592
+50V
+15V
+5V
GND
-15V
-50V
-5V
-5V REF
+5V REF
X-Y INHIBIT
BEAMFINDER
DISPLAY B
FAULT
READOUT
Y-AXIS
+50V
+15V
+5V
GND
-15V
-5V
Y ALIGN
TRACE ROT
D1/D2 SHIELD
AVG PLATE E
VERTICAL LINEARITY
GEOMETRY(BOWTIE)
HORIZONTAL SENSITIVITY
EXIT ELECTRODE
MCP INPUT
MCP OUTPUT
HORIZONTAL BOWING
HEATER (1)
HEATER (14)
STIGMATOR (11)
D3/D4 SHIELD (9)
ASTIGMATISM (10)
ION TRAP (7)
INT SENSE
I SENSE
20KHz(108V)
Z-AXIS OFF
INT REFERENCE
AUX READOUT INTEN
SCREEN I SENSE
FOCUS
OPEN
CATHODE (2,5)
GRID (3)
Z READOUT
Z-AXIS SIGNAL
AUX Y-AXIS
Y READOUT
X READOUT
2-AXIS INHIBIT
READOUT SINGLE SHOT
Z READOUT
+516 OUT
CABLE DISTRIBUTION
2314 - 281

VOLTAGE CONDITIONS

The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise (READOUT INTENSITY at OFF); VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).


7104
DS304 DS305 DS306
A20 GRATICULE LIGHTS BD
CAMERA CONNECTOR
P314 P304
P310 P1910
P1917
+15V CAM
+15V
R301 500
0 to +6V
GRAT/CAM COM
PARTIAL A1 FRONT PANEL BD
FROM P1417
A IND B IND
-50V -15V +50V +15V +5V +5VL
P3 P309
C324 .01 -50V
C325 47 +50V
C326 .01 +5V
DS308
P308
+5V
A2 DISPLAY CONTROL BD
S2005 BEAMFINDER
P2005 P305
P302 P2
P99 BEAMFINDER TO P789-9
FOCUS
TRACE ROTATION
ASTIG
R2005 100k CW
R2055 2k CW
R2025 2.5M CW
P2006
FOCUS
+50V +15V -15V -50V
TO/FROM P1806
INT REF
INTENSITY
B CONTRAST
A CONTRAST
R2017 6.2k
R2020 10k
R2018 50k
R2019 1k
CR2019
R2007 6.2k
R2010 10k
R2009 1k
R2008 50k
R2015 100k
R2016 150k
P2003
DS2002
DS2003
P305
A IND
+5VL
B IND
AR R4483
AS R4482
AB Q4480-B
P309 P9
CAMERA TRIG FROM R86
S315 HORIZONTAL MODE
A ALT CHOP B
S325 VERTICAL MODE
LEFT ALT ADD CHOP RIGHT
P318
A B HORIZ MODE INHIBIT
L R VERT MODE INHIBIT
TO P2118 READOUT SYSTEM BD
VERT TRACE SEPARATION(B)
R324 1.5k
R325 5k
R326 1.5k
J301 J71
BT BU BS BV HORIZ MODE
SEE 4
BA R4456
BR BN BQ BM VERT MODE
TP362 0V
BC HORIZ SLAVE ENBL
A13 LOGIC BOARD
P346 P306
DS342 DS346
RIGHT LEFT
Q342
R341 6.2
R343 1.6k
R345 6.2
CR342
R342 2k
R346 2k
U352B 74LS03
U352A 74LS03
+4.9 +0.5 +0.5
VOLTAGES CONDITIONS
2314-282



MODE SWITCH AND CALIBRATOR 2

2314-282

MODE SWITCH AND CALIBRATOR 2

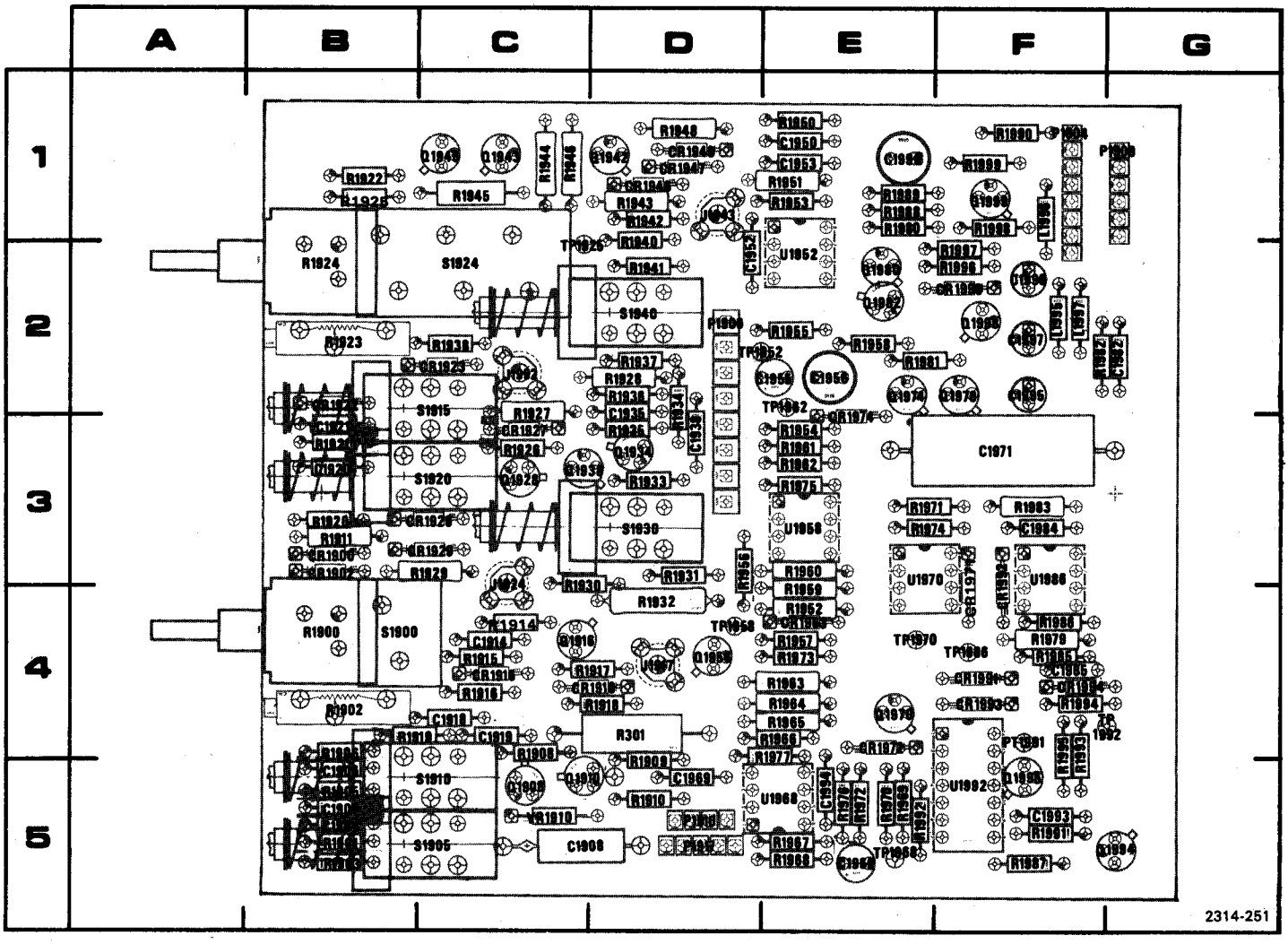
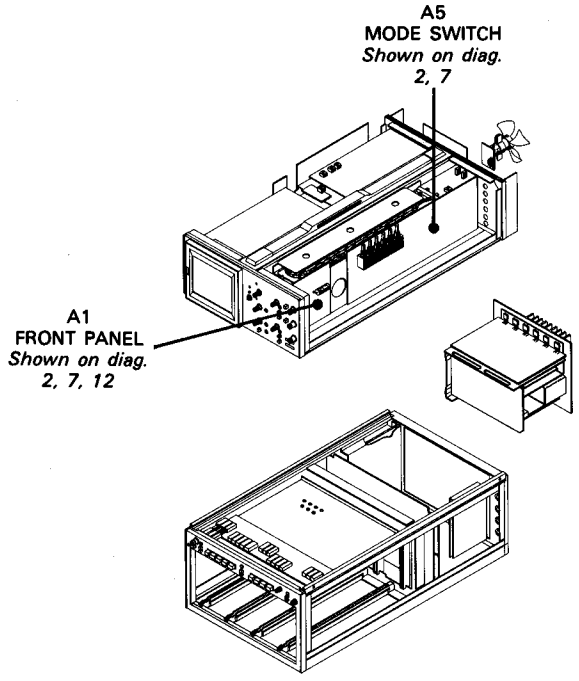
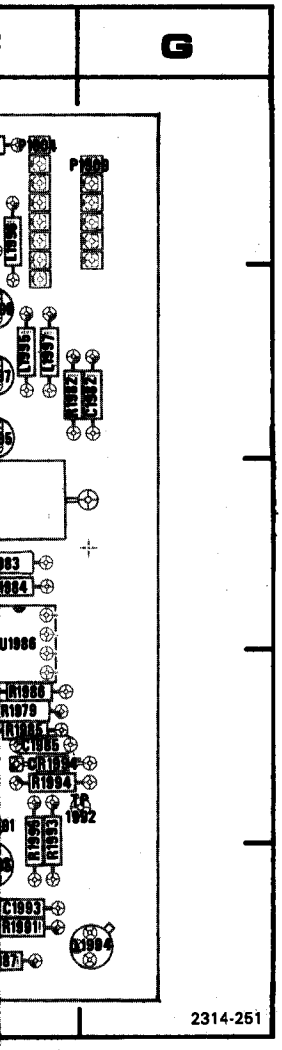


Figure 8-3. A1—Front Panel circuit board assembly.

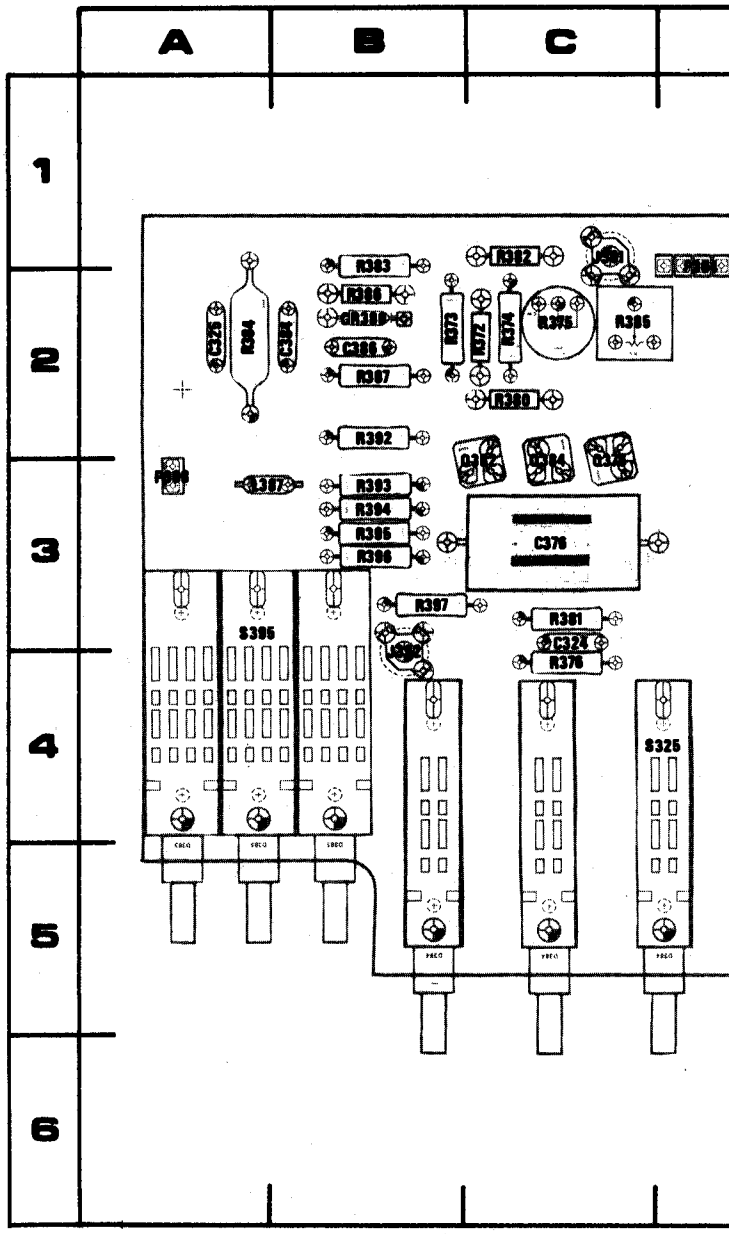


@

Locator for Figure 8-3.



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1901	5B	Q1910	5C	R1957	4E
C1904	5B	Q1916	4C	R1958	2E
C1906	5B	Q1928	3C	R1959	4E
C1908	5C	Q1934	3D	R1960	3E
C1914	4C	Q1938	3C	R1961	3E
C1915	4C	Q1942	1D	R1962	3E
C1918	4C	Q1943	1C	R1963	4E
C1919	4C	Q1946	1C	R1964	4E
C1920	3B	Q1956	4D	R1965	4E
C1921	3B	Q1970	4E	R1966	4E
C1935	2D	Q1974	2E	R1967	5E
C1938	3D	Q1978	2F	R1968	5E
C1950	1E	Q1980	2E	R1969	5E
C1952	2D	Q1982	2E	R1970	5E
C1953	1E	Q1994	5G	R1971	3E
C1955	2E	Q1995	5F	R1972	5E
C1956	2E	Q1998	2F	R1973	4E
C1968	5E	Q1999	1F	R1974	3E
C1969	5D			R1975	3E
C1971	3F	R301	4D	R1976	5E
C1982	2G	R1900	4B	R1977	4E
C1984	3F	R1901	5B	R1979	4F
C1985	4F	R1902	4B	R1980	1E
C1990	1E	R1903	5B	R1981	2E
C1993	5F	R1905	5B	R1982	2F
C1994	5E	R1906	4B	R1983	3F
C1995	2F	R1908	4C	R1985	4F
C1996	2F	R1909	5D	R1986	4F
C1997	2F	R1910	5D	R1987	5F
		R1911	3B	R1988	1E
CR1900	3B	R1914	4C	R1989	1E
CR1902	3B	R1915	4C	R1990	1F
CR1916	4C	R1916	4C	R1991	5F
CR1918	4D	R1917	4D	R1992	5E
CR1922	2B	R1918	4D	R1993	4F
CR1923	2C	R1919	4B	R1994	4F
CR1927	3C	R1920	3B	R1995	4F
CR1928	3C	R1921	3B	R1996	2F
CR1929	3C	R1922	1B	R1997	2F
CR1946	1D	R1923	2B	R1998	1F
CR1947	1D	R1924	2B	R1999	1F
CR1948	1D	R1925	1B		
CR1963	4E	R1926	3C	S1900	4B
CR1971	3F	R1927	3C	S1905	5C
CR1972	4E	R1928	2D	S1910	5C
CR1974	3E	R1929	3C	S1915	3C
CR1991	4F	R1930	3C	S1920	3C
CR1992	3F	R1931	3D	S1924	2C
CR1993	4F	R1932	4D	S1930	3D
CR1994	4F	R1933	3D	S1940	2D
CR1998	2F	R1934	3D		
		R1935	3D	TP1911	4F
J1917	4D	R1936	2D	TP1925	2C
J1924	3C	R1937	2D	TP1952	2D
J1943	1D	R1938	2C	TP1958	4D
J1992	2C	R1940	2D	TP1962	2E
		R1941	2D	TP1968	5E
L1995	2F	R1942	1D	TP1970	4E
L1996	1F	R1943	1D	TP1986	4F
L1997	2F	R1944	1C	TP1992	4F
		R1945	1C		
P1900	2D	R1946	1C	U1952	2E
P1904	1F	R1948	1D	U1958	3E
P1909	1G	R1950	1E	U1968	5E
P1910	5D	R1951	1E	U1970	3E
P1917	5D	R1952	4E	U1986	3F
		R1953	1E	U1992	5F
PT1991	4F	R1954	3E		
		R1955	2E	VR1910	5C
Q1908	5C	R1956	3D		



CKT NO
C324
C325
C326
C376
C384
C386
CR342
CR362
CR386
J301
J392
L387
P302
P303

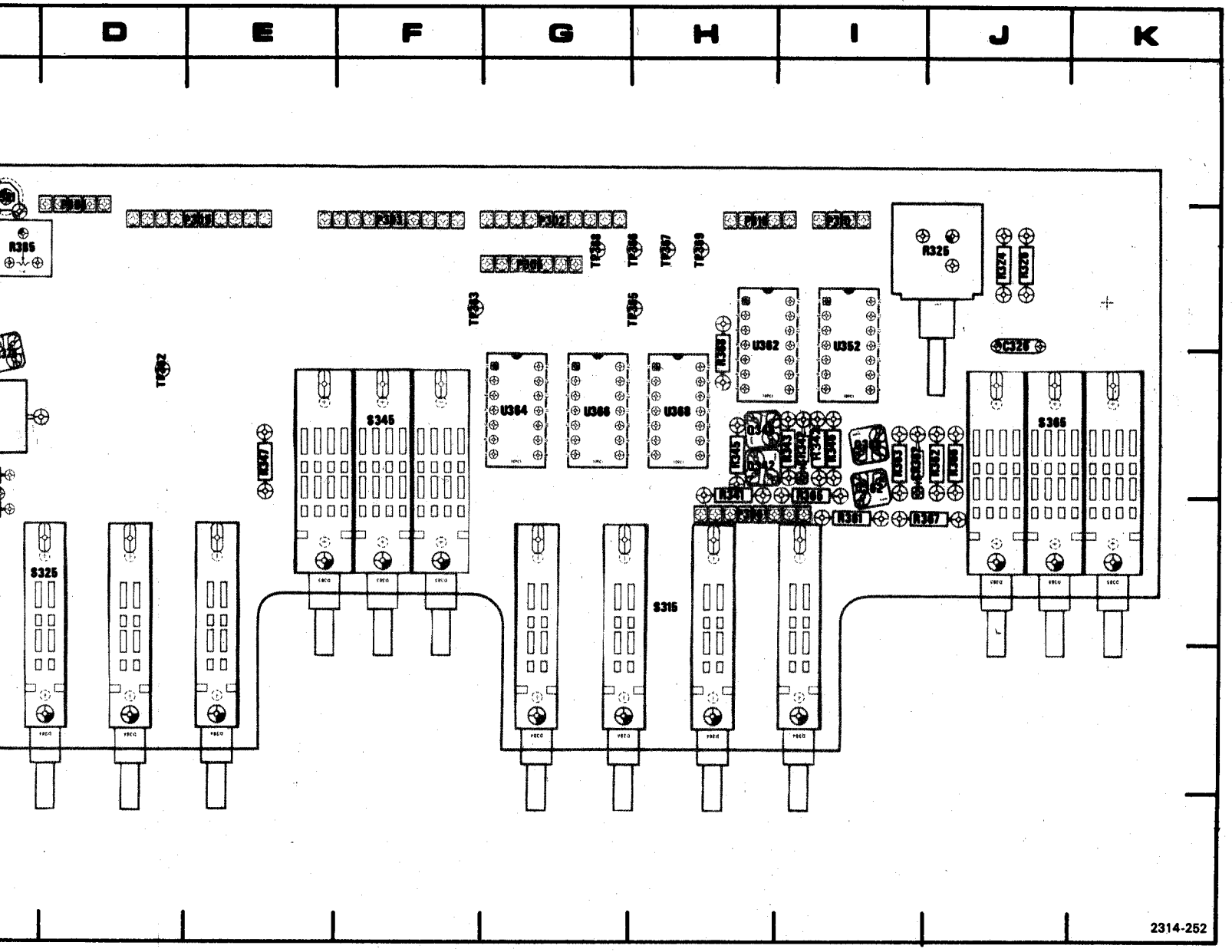


Figure 8-4. A5—Mode Switch circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C324	3C	P304	1D	R326	2J	R376	4C	S345	3F
C325	2A	P305	2G	R341	3H	R380	2C	S365	3J
C326	2J	P306	4H	R342	3I	R381	3C	S395	3A
C376	3C	P308	3A	R343	3I	R382	1C		
C384	2B	P309	2E	R345	3H	R383	1B	TP362	3D
C386	2B	P310	2I	R346	3I	R384	2A	TP363	2F
		P318	2H	R347	3E	R385	2C	TP365	2H
CR342	3I			R361	4I	R386	2B	TP366	2H
CR362	3I	Q342	3H	R362	3J	R387	2B	TP367	2H
CR386	2B	Q346	3H	R363	3I	R392	2B	TP368	2G
		Q362	3I	R365	3I	R393	3B	TP369	2H
J301	1C	Q366	3I	R366	3J	R394	3B		
J392	3B	Q376	3C	R367	4J	R395	3B	U352	2I
		Q382	3C	R368	3H	R396	3B	U362	2H
L387	3A	Q384	3C	R372	2C	R397	3B	U364	3G
				R373	2B			U366	3G
P302	2G	R324	2J	R374	2C	S315	4H	U368	3H
P303	2F	R325	2J	R375	2C	S325	4D		

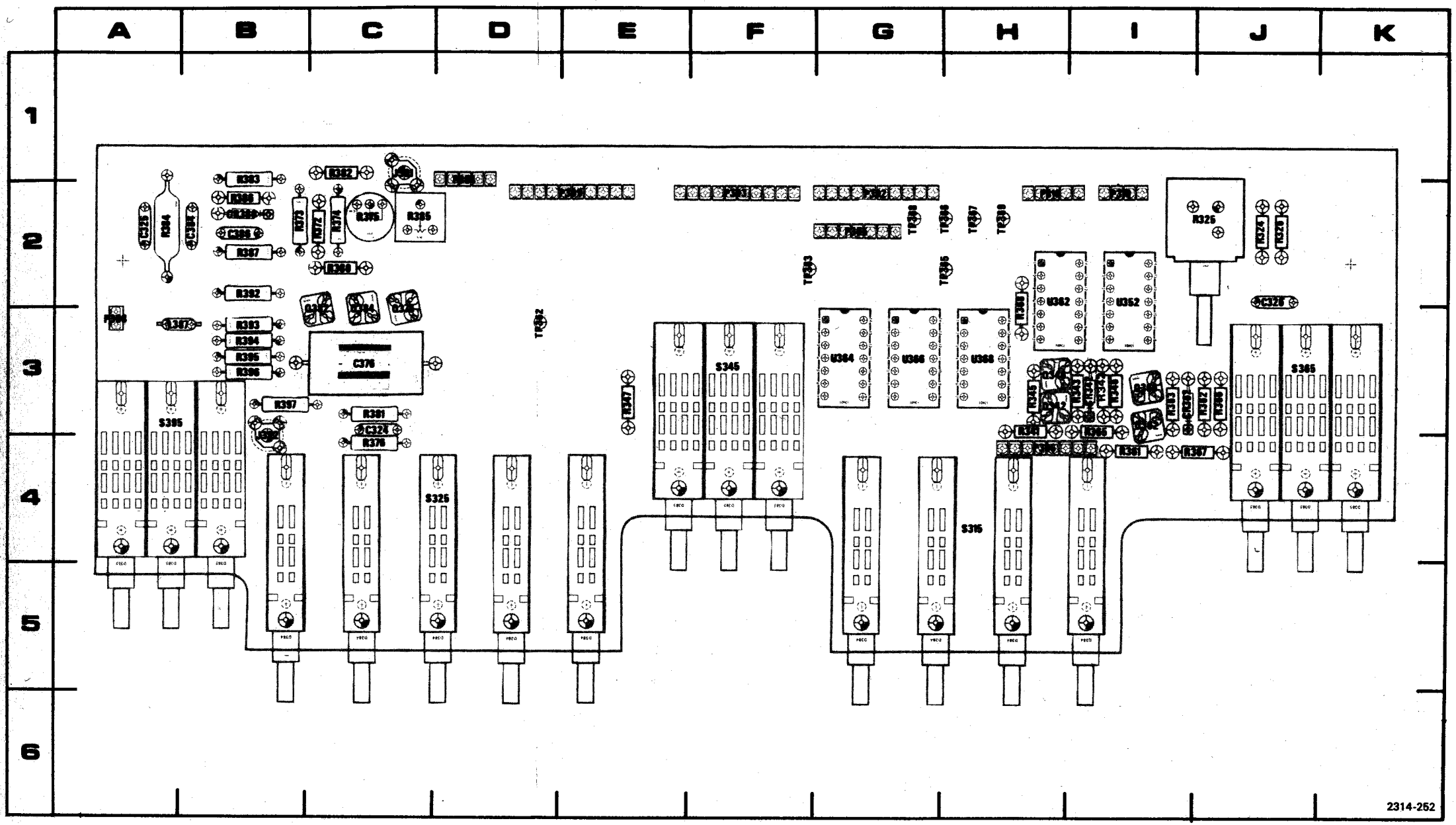


Figure 8-4. A5—Mode Switch circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C324	3C	P304	1D	R326	2J	R376	4C	S345	3F
C325	2A	P305	2G	R341	3H	R380	2C	S365	3J
C326	2J	P306	4H	R342	3I	R381	3C	S395	3A
C376	3C	P308	3A	R343	3I	R382	1C		

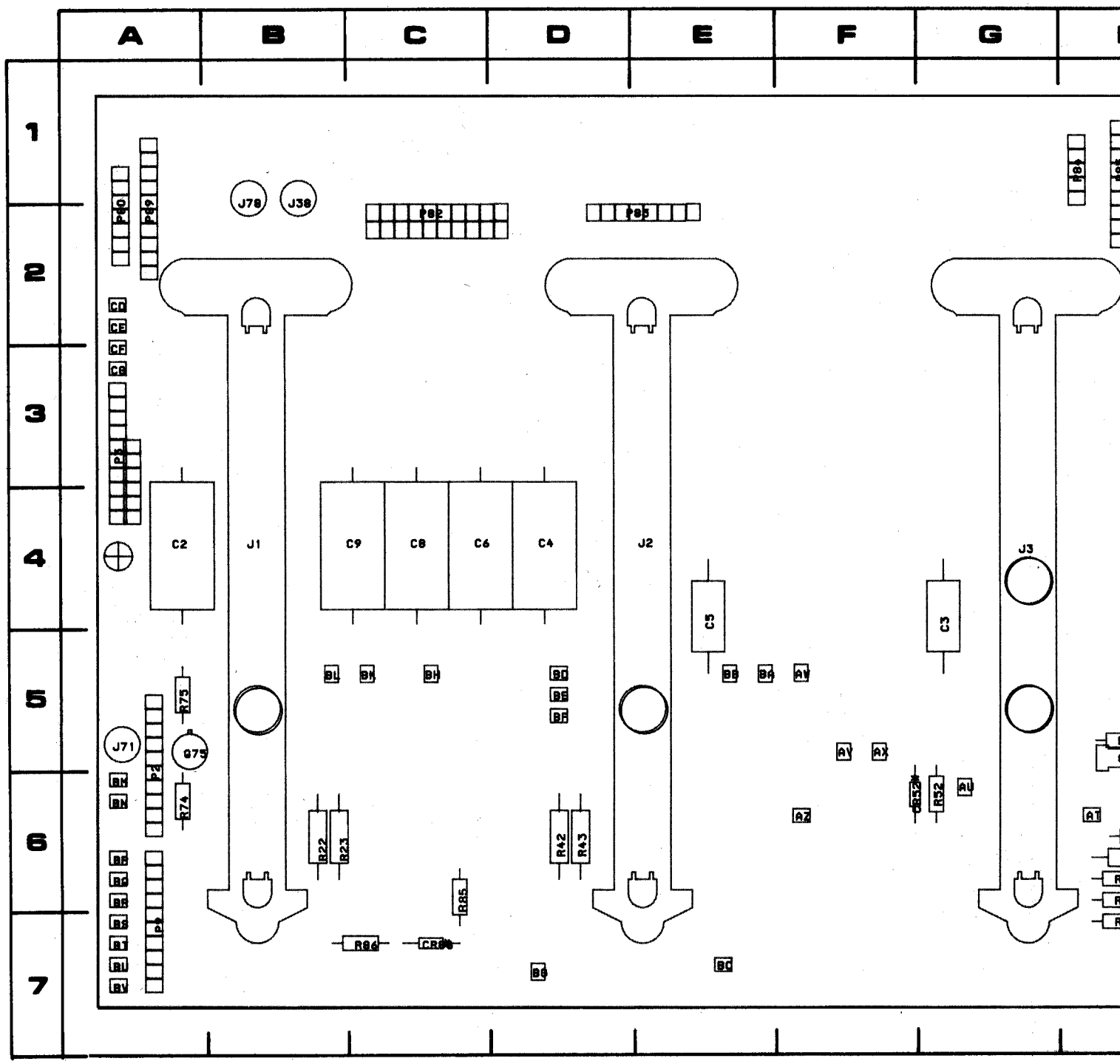


Figure 8-5. A6—Main Interface circuit board assembly.

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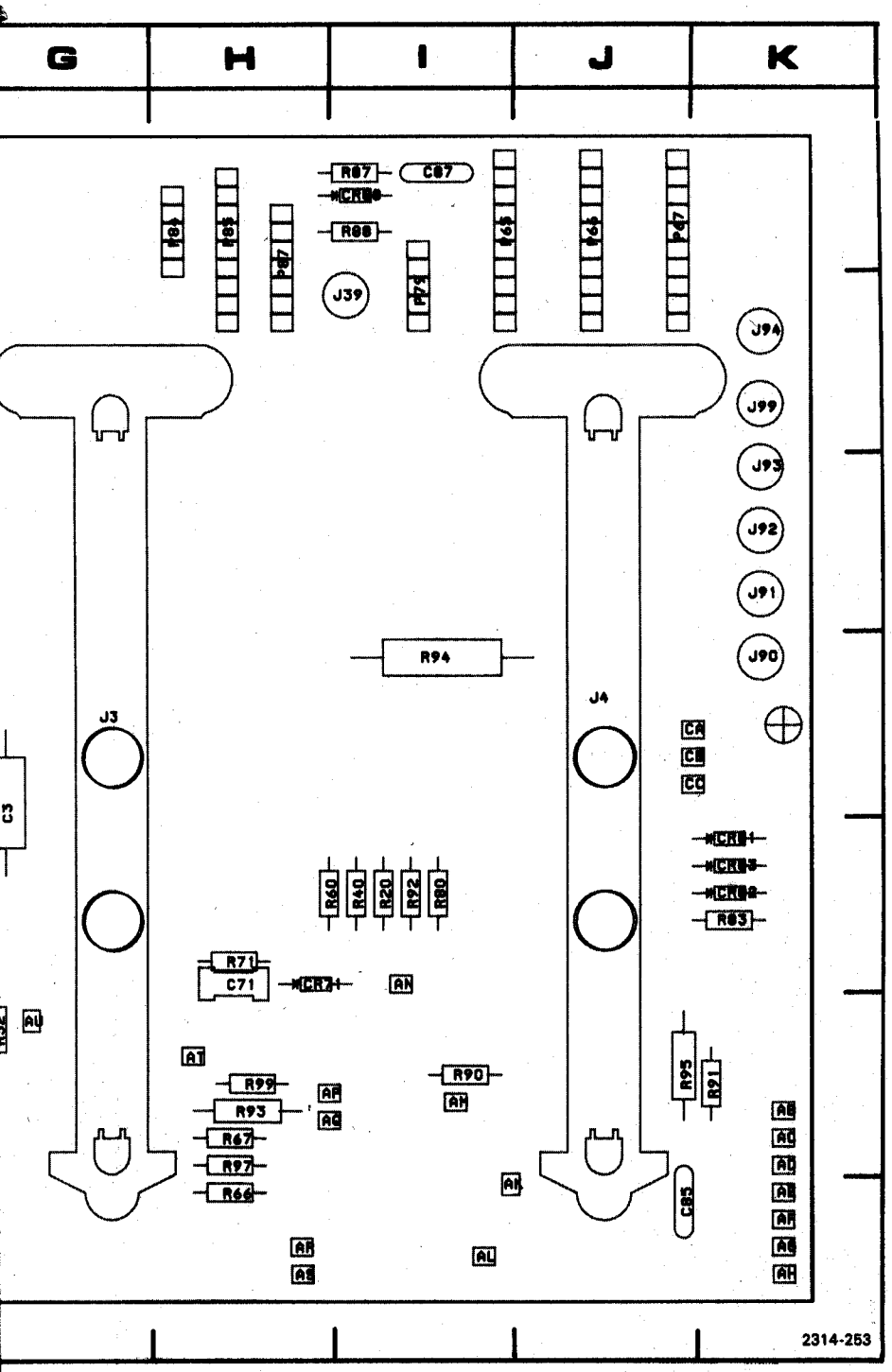
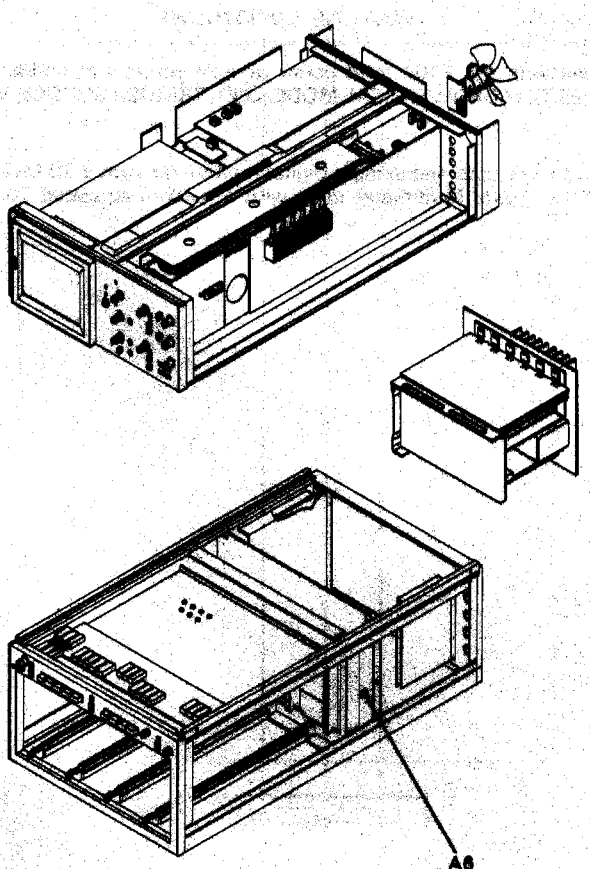


sembly.

Locator for Figure 8-5.

CKT NO	GRID COORD	CKT NO	GRID COORD
CR52	6F	P85	1H
CR71	5H	P87	1H
CR81	5K	P89	1A
CR82	5K	P9	7A
CR83	5K		
CR86	7C	Q75	5A
CR88	1I		
		R20	5I
J1	4B	R22	6B
J2	4E	R23	6B
J3	4G	R40	5I
J4	4J	R42	6D
J4	4J	R43	6D
J38	1B	R52	6G
J39	2I	R60	5H
J71	5A	R66	7H
J78	1B	R67	6H
J90	4K	R71	5H
J91	3K	R74	6A
J92	3K	R75	5A
J93	3K	R80	5I
J94	2K	R83	5K
J99	2K	R85	6C
		R86	7C
P2	5A	R87	1I
P3	3A	R88	1I
P9	7A	R90	6I
P65	1I	R91	6K
P66	1J	R92	5I
P67	1J	R93	6H
P79	2I	R94	4I
P80	1A	R95	6J
P82	2C	R97	6H
P83	2E	R99	6H
P84	1H		

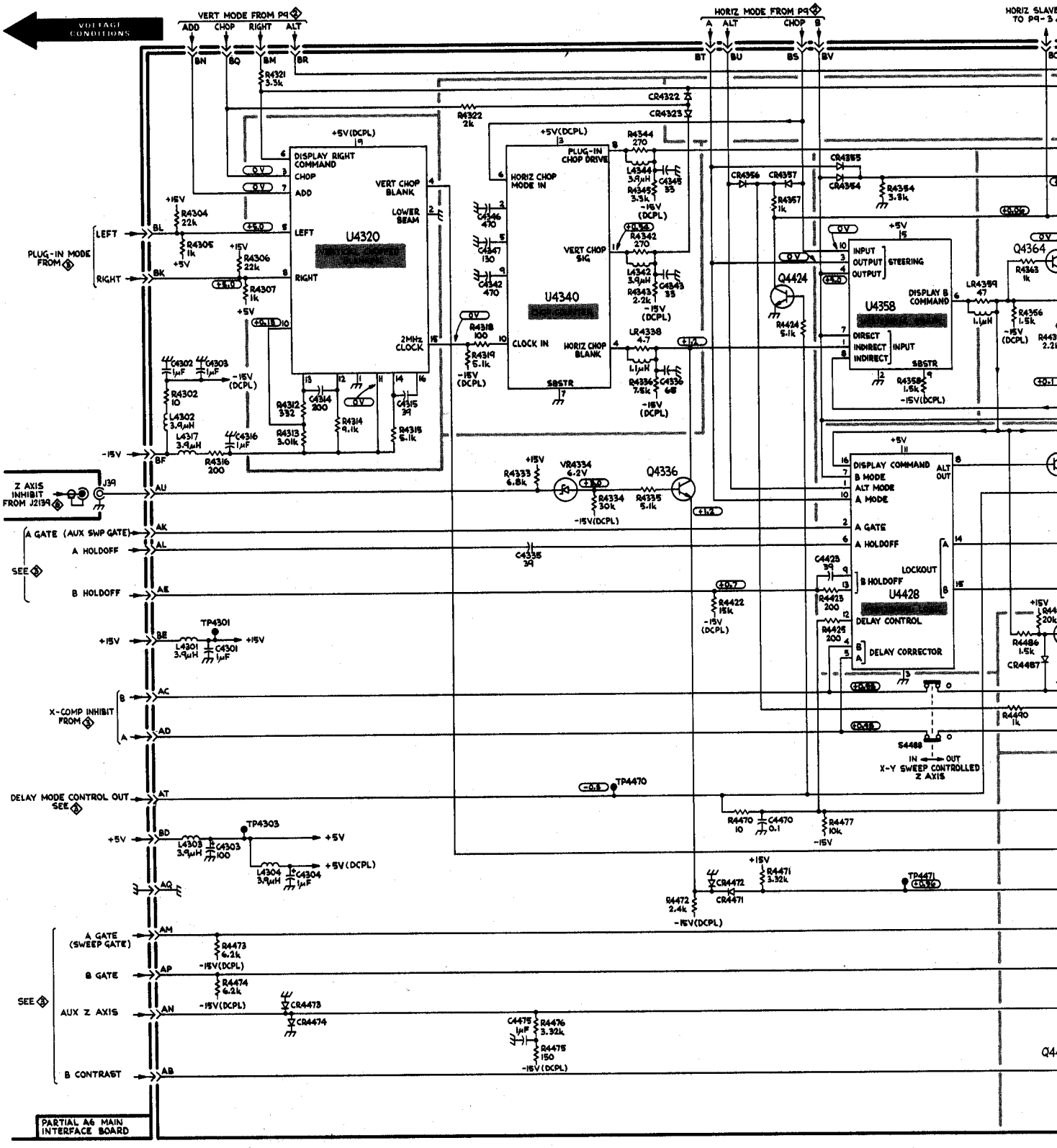


A6
MAIN
INTERFACE
Shown on diag.
2,3,4,5,13

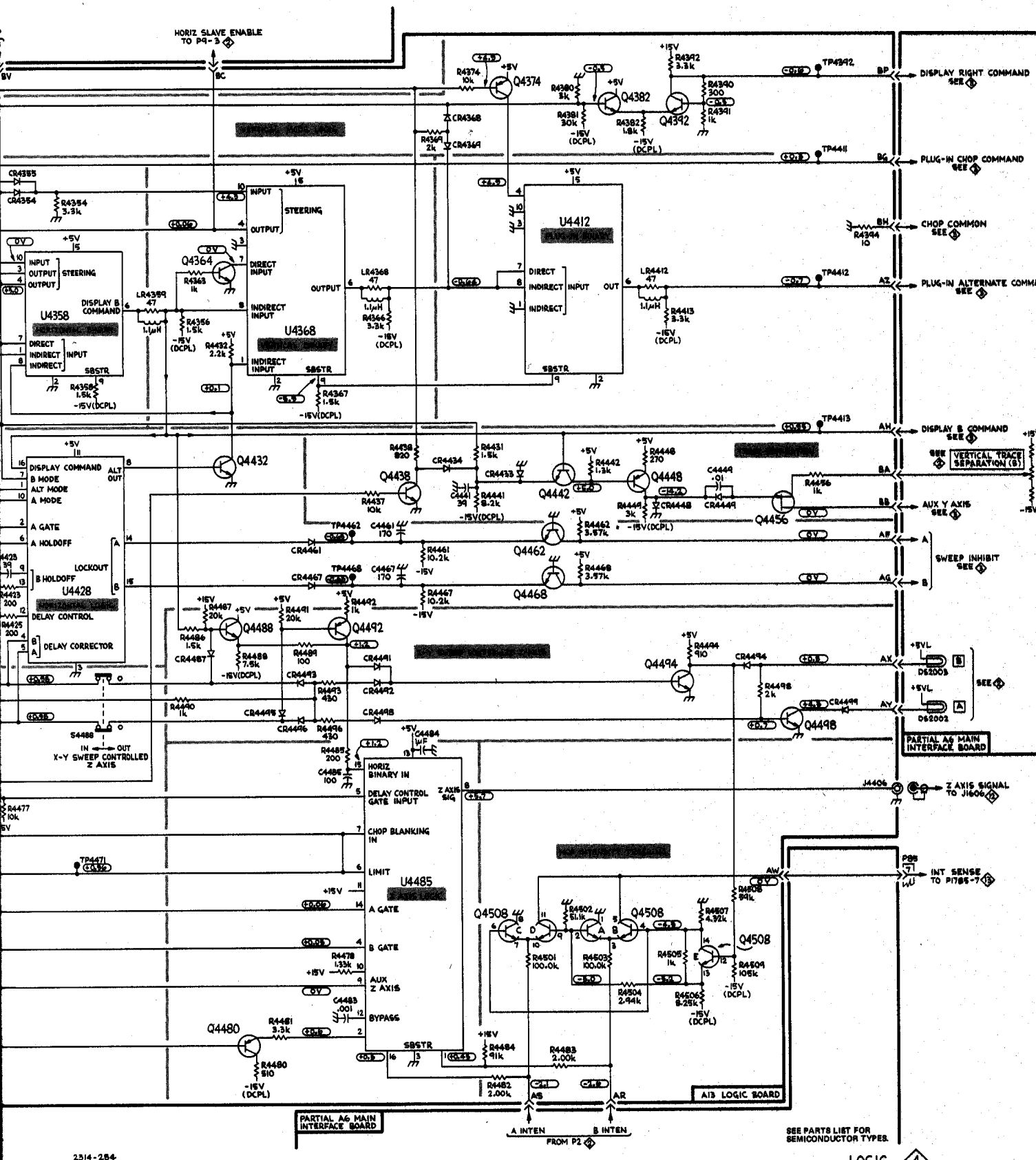
VOLTAGE CONDITIONS

The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise (READOUT INTENSITY at OFF); VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).


VOLTAGE CONDITIONS
VERT MODE FROM P9
ADD
CHOP
RIGHT
ALT
HORIZ MODE FROM P9
A
ALT
CHOP
B
HORIZ SLAVE TO P9-3
BN
BQ
BM
BR
BT
BU
BS
BV
R4321 3.3k
CR4322
CR4323
R4322 2k
+5V(DCPL)
DISPLAY RIGHT COMMAND
CHOP
ADD
VERT CHOP BLANK
LOWER BEAM
LEFT
RIGHT
2MHz CLOCK
U4320
PLUG-IN MODE FROM
BL
BK
+15V
R4304 22k
R4305 1k
R4306 22k
R4307 1k
+5V
-15V (DCPL)
C4302 1μF
C4303 1μF
R4302 10
L4302 3.9μH
L4317 3.9μH
C4316 1μF
R4316 200
-15V
BF
C4314 200
R4312 332
R4313 3.01k
R4314 9.1k
C4315 39
R4315 5.1k
HORIZ CHOP MODE IN
VERT CHOP SIG
CLOCK IN
HORIZ CHOP BLANK
SBSTR
U4340
C4346 470
C4347 130
C4342 470
R4318 100
R4319 5.1k
PLUG-IN CHOP DRIVE
R4344 270
L4344 3.9μH
C4348 33
R4345 3.3k
R4342 270
L4343 3.9μH
C4343 33
R4343 2.2k
LR4338 4.7
1.1μH
R4336 7.6k
C4336 68
CR4355
CR4356
CR4357
CR4354
R4354 3.3k
R4357 1k
Q4424
R4424 5.1k
U4358
INPUT
OUTPUT
OUTPUT
STEERING
DISPLAY B COMMAND
DIRECT
INDIRECT
INPUT
INDIRECT
SBSTR
LR4359 47
1.1μH
R4358 1.5k
R4356 1.5k
Q4364
R4363 1k
Z AXIS INHIBIT FROM J2139
J139
BU
R4333 6.8k
VR4334 6.2V
R4334 30k
Q4336
R4335 5.1k
C4335 39
DISPLAY COMMAND
B MODE
ALT MODE
A MODE
A GATE
A HOLDOFF
B HOLDOFF
ALT OUT
LOCKOUT
U4428
DELAY CONTROL
DELAY CORRECTOR
C4423 39
R4423 200
R4425 200
R4422 15k
R4430 1k
R4486 1.5k
CR4487
S4488
IN
OUT
X-Y SWEEP CONTROLLED Z AXIS
A GATE (AUX SWP GATE)
A HOLDOFF
B HOLDOFF
SEE
AK
AL
AE
+15V
BE
TP4301
L4301 3.9μH
C4301 1μF
X-COMP INHIBIT FROM
AC
AD
DELAY MODE CONTROL OUT
AT
TP4470
R4470 10
C4470 0.1
R4477 10k
-15V
+5V
BD
TP4303
L4303 3.9μH
C4303 100
L4304 3.9μH
C4304 1μF
+5V(DCPL)
AQ
CR4472
CR4471
R4471 3.32k
TP4471
R4472 2.4k
-15V(DCPL)
A GATE (SWEEP GATE)
B GATE
AUX Z AXIS
B CONTRAST
AM
AP
AN
AB
R4473 6.2k
R4474 6.2k
CR4473
CR4474
C4475 1μF
R4476 3.32k
R4475 150
PARTIAL A6 MAIN INTERFACE BOARD

2314-284


HORIZ SLAVE ENABLE TO P9-3
DISPLAY RIGHT COMMAND SEE
PLUG-IN CHOP COMMAND SEE
CHOP COMMON SEE
PLUG-IN ALTERNATE COMMAND SEE
DISPLAY B COMMAND SEE
VERTICAL TRACE SEPARATION (S1) SEE
AUX Y AXIS SEE
SWEEP INHIBIT SEE
PARTIAL A6 MAIN INTERFACE BOARD
Z AXIS SIGNAL TO J1606
INT SENSE TO P1785-7
A13 LOGIC BOARD
PARTIAL A6 MAIN INTERFACE BOARD
A INTEN FROM P2
B INTEN
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
LOGIC 4
2314-284

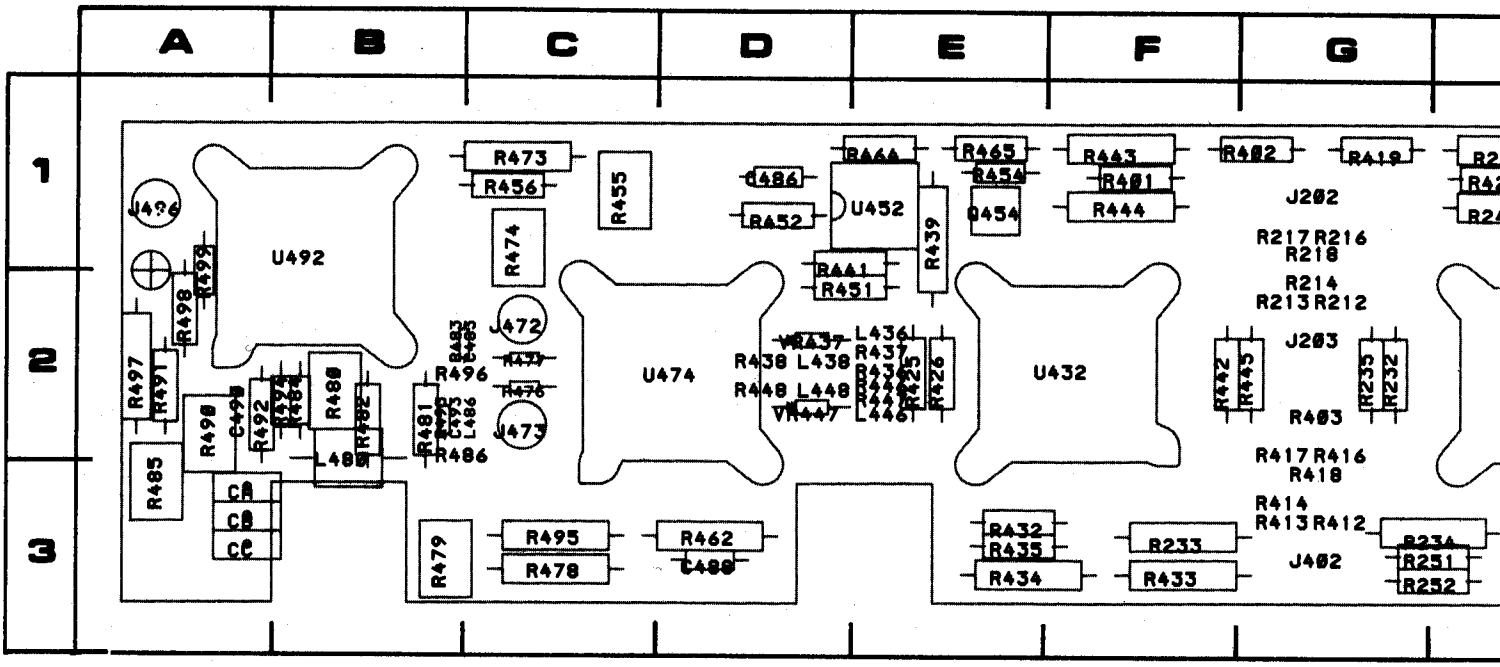
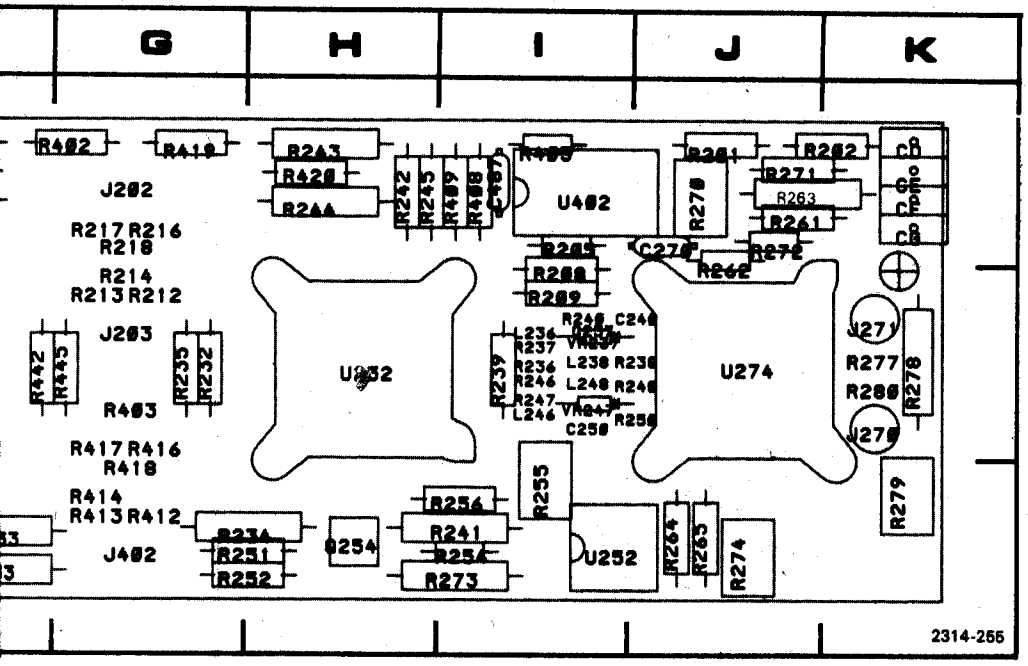


Figure 8-7. A14—Trigger Selector circuit board assembl

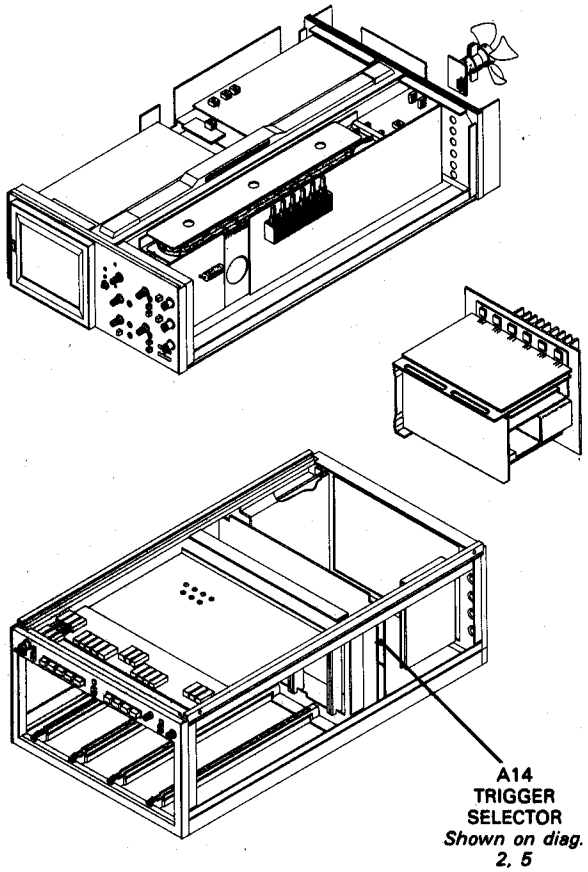
CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	C N
C237	2I	Q454	1E	R254	3I	R432	3E	R
C240	2I			R255	3I	R433	3F	R
C250	2I	R201	1J	R256	3I	R434	3E	R
C270	1J	R202	1J	R261	1J	R435	3E	R
C483	2C	R205	1I	R262	1J	R436	2E	R
C486	1D	R208	2I	R263	2J	R437	2E	R
C487	1I	R209	2I	R264	3J	R438	1D	R
C488	3D	R212	2G	R265	3J	R439	1E	R
C490	2A	R213	2G	R270	1J	R441	1D	R
C493	2B	R214	2G	R271	1J	R442	2F	R
		R216	1G	R272	1J	R443	1F	R
J202	1G	R217	1G	R273	3I	R444	1F	R
J203	2G	R218	1G	R274	3J	R445	2G	R
J270	2K	R232	2G	R277	2K	R446	2E	R
J271	2K	R233	3F	R278	2K	R447	2E	R
J402	3G	R234	3G	R279	3K	R448	1D	
J472	2C	R235	2G	R280	2K	R451	1D	U
J473	2C	R236	2I	R401	1F	R452	1D	U
J496	1A	R237	2I	R402	1G	R454	1E	U
		R238	2I	R403	2G	R455	1C	U
L236	2I	R239	2I	R405	1I	R456	1C	U
L238	2I	R240	2I	R408	1I	R462	3D	U
L246	2I	R241	3I	R409	1I	R464	1E	U
L248	2I	R242	1H	R412	3G	R465	1E	U
L436	2E	R243	1H	R413	3G	R473	1C	
L438	2D	R244	1H	R414	3G	R474	1C	V
L446	2E	R245	1H	R416	2G	R476	2C	V
L448	2D	R246	2I	R417	2G	R477	2C	V
L480	2B	R247	2I	R418	3G	R478	3C	V
L486	2C	R248	2I	R419	1G	R479	3B	
		R250	2I	R420	1H	R480	2B	
Q254	3H	R251	3G	R426	2E	R481	2B	

@



Selector circuit board assembly.

GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
3I	R432	3E	R482	2B
3I	R433	3F	R483	2B
3I	R434	3E	R484	2B
1J	R435	3E	R485	3A
1J	R436	2E	R486	2B
2J	R437	2E	R490	2A
3J	R438	1D	R491	2A
3J	R439	1E	R492	2A
1J	R441	1D	R493	2B
1J	R442	2F	R494	2B
1J	R443	1F	R495	3C
3I	R444	1F	R496	2B
3J	R445	2G	R497	2A
2K	R446	2E	R498	2A
2K	R447	2E	R499	1A
3K	R448	1D		
2K	R451	1D	U232	1H
1F	R452	1D	U252	3I
1G	R454	1E	U274	2J
2G	R455	1C	U402	1I
1I	R456	1C	U432	2F
1I	R462	3D	U452	1E
1I	R464	1E	U474	1D
3G	R465	1E	U492	1B
3G	R473	1C		
3G	R474	1C	VR237	2I
2G	R476	2C	VR247	2I
2G	R477	2C	VR437	1D
3G	R478	3C	VR447	1D
1G	R479	3B		
1H	R480	2B		
2E	R481	2B		



A14
TRIGGER
SELECTOR
Shown on diag.
2, 5

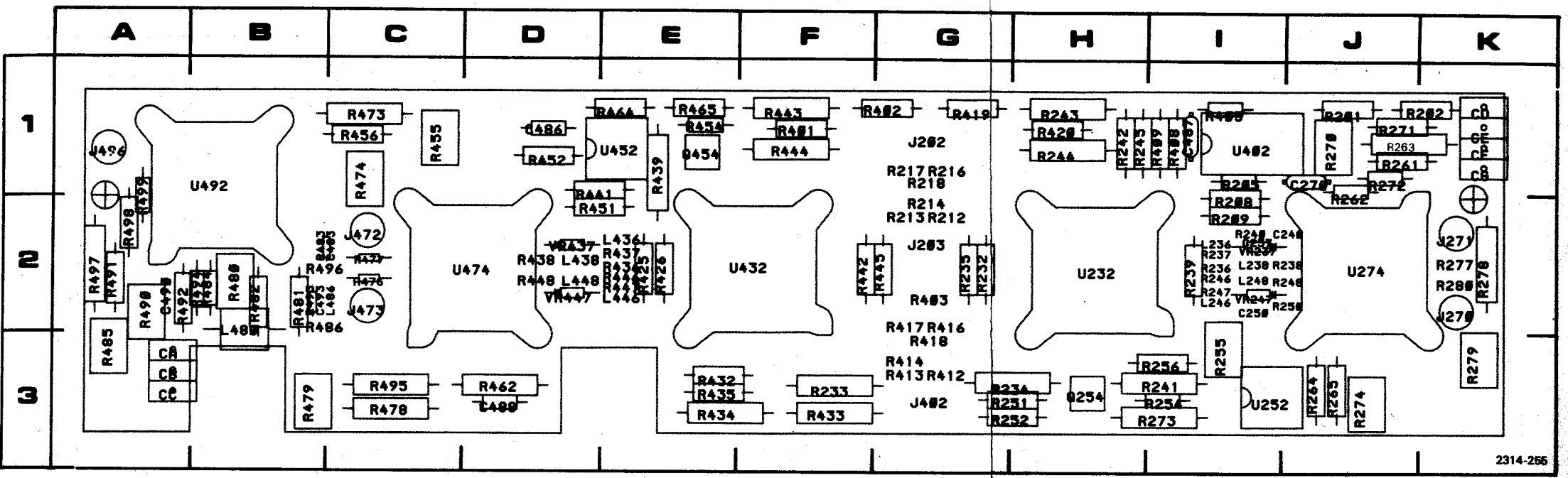
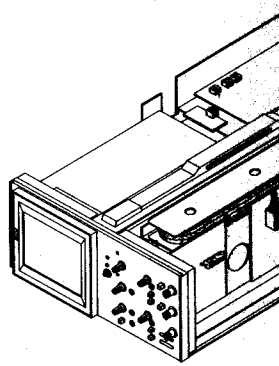


Figure 8-7. A14—Trigger Selector circuit board assembly.

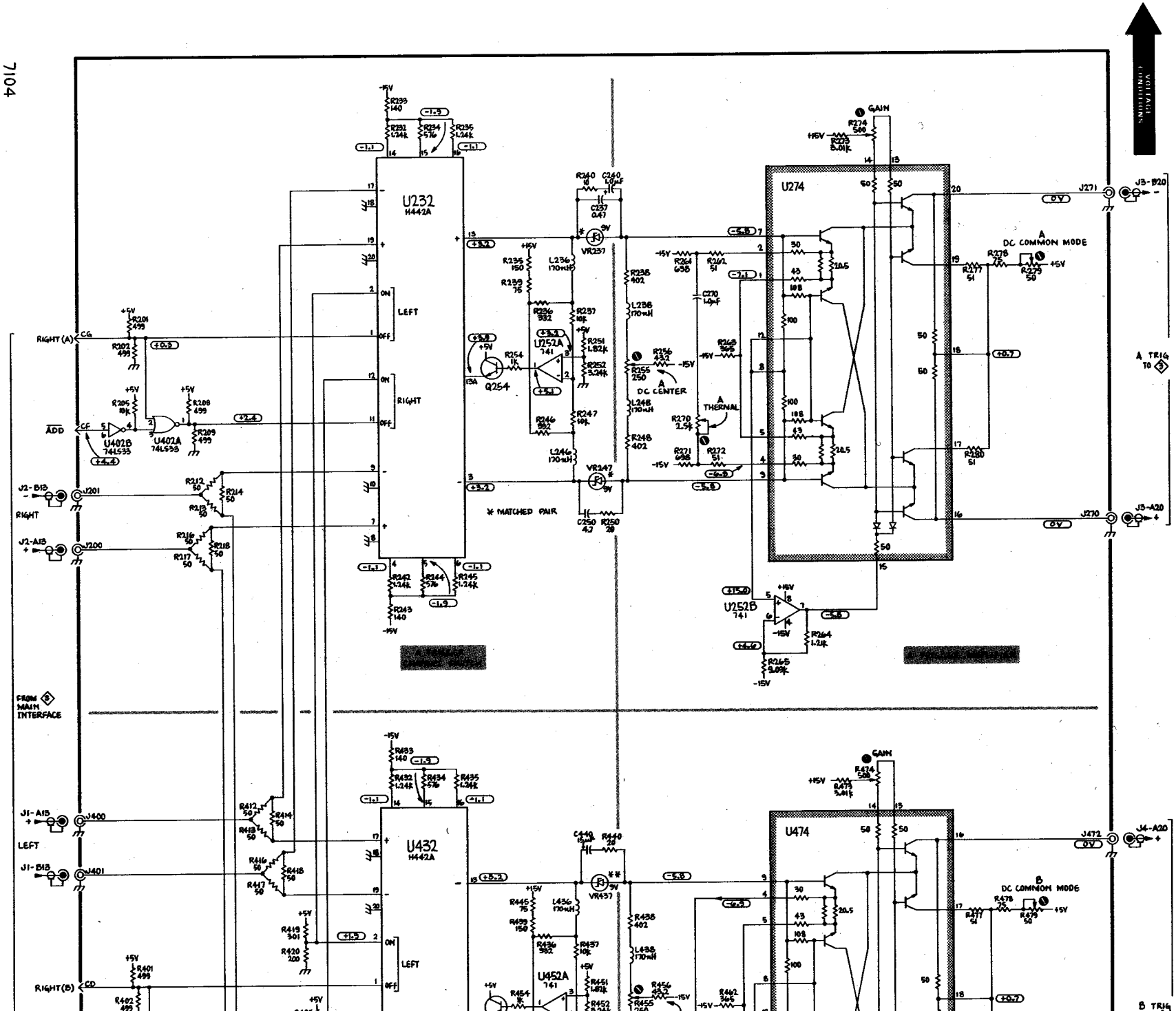
CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C237	2I	Q454	1E	R254	3I	R432	3E	R482	2B
C240	2I			R255	3I	R433	3F	R483	2B
C250	2I	R201	1J	R256	3I	R434	3E	R484	2B
C270	1J	R202	1J	R261	1J	R435	3E	R485	3A
C483	2C	R205	1I	R262	1J	R436	2E	R486	2B
C486	1D	R208	2I	R263	2J	R437	2E	R490	2A
C487	1I	R209	2I	R264	3J	R438	1D	R491	2A
C488	3D	R212	2G	R265	3J	R439	1E	R492	2A
C490	2A	R213	2G	R270	1J	R441	1D	R493	2B
C493	2B	R214	2G	R271	1J	R442	2F	R494	2B
		R216	1G	R272	1J	R443	1F	R495	3C
J202	1G	R217	1G	R273	3I	R444	1F	R496	2B
J203	2G	R218	1G	R274	3J	R445	2G	R497	2A
J270	2K	R232	2G	R277	2K	R446	2E	R498	2A
J271	2K	R233	3F	R278	2K	R447	2E	R499	1A
J402	3G	R234	3G	R279	3K	R448	1D		
J472	2C	R235	2G	R280	2K	R451	1D	U232	1H
J473	2C	R236	2I	R401	1F	R452	1D	U252	3I
J496	1A	R237	2I	R402	1G	R454	1E	U274	2J
		R238	2I	R403	2G	R455	1C	U402	1I
L236	2I	R239	2I	R405	1I	R456	1C	U432	2F
L238	2I	R240	2I	R408	1I	R462	3D	U452	1E
L246	2I	R241	3I	R409	1I	R464	1E	U474	1D
L248	2I	R242	1H	R412	3G	R465	1E	U492	1B
L436	2E	R243	1H	R413	3G	R473	1C		
L438	2D	R244	1H	R414	3G	R474	1C	VR237	2I
L446	2E	R245	1H	R416	2G	R476	2C	VR247	2I

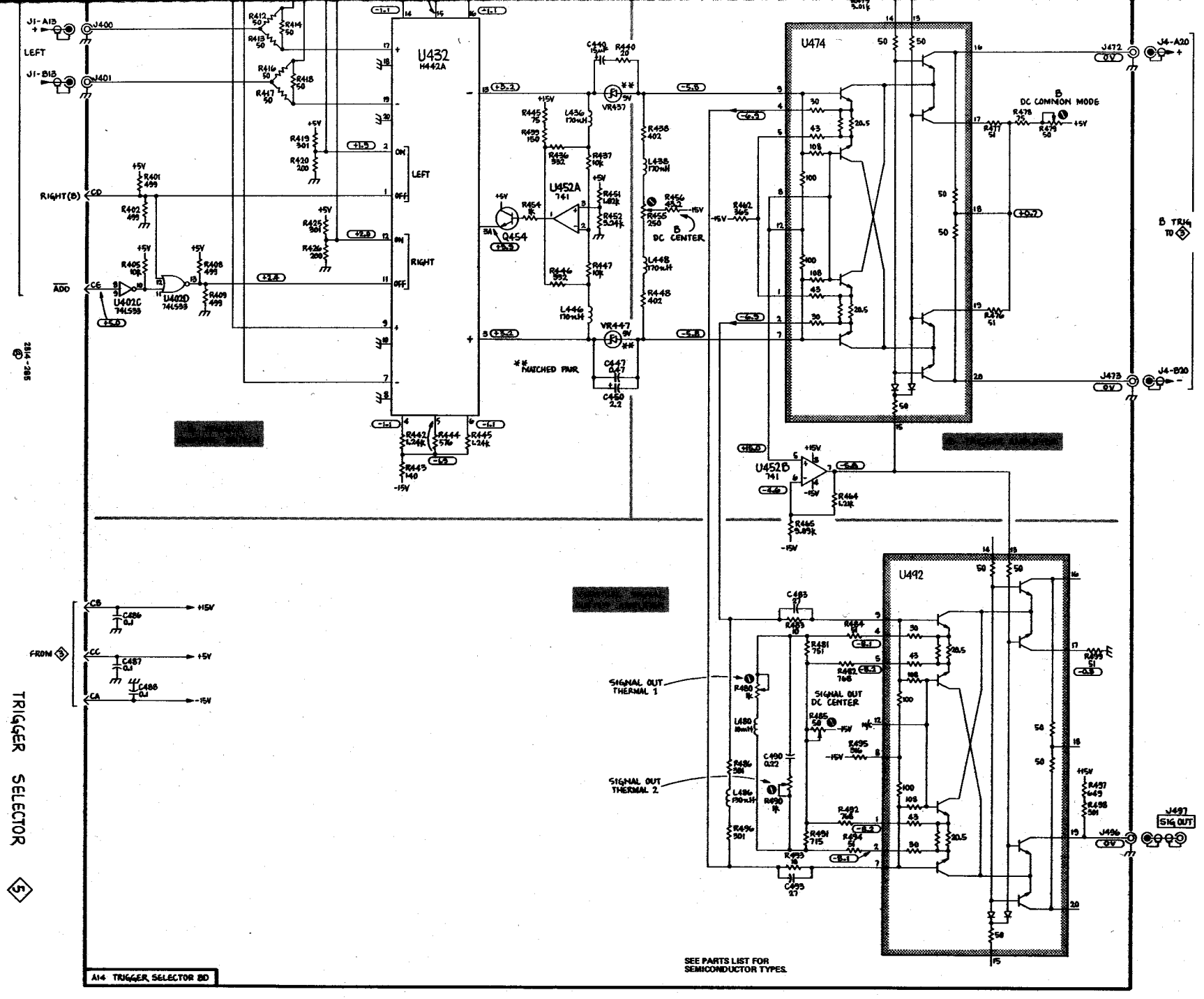


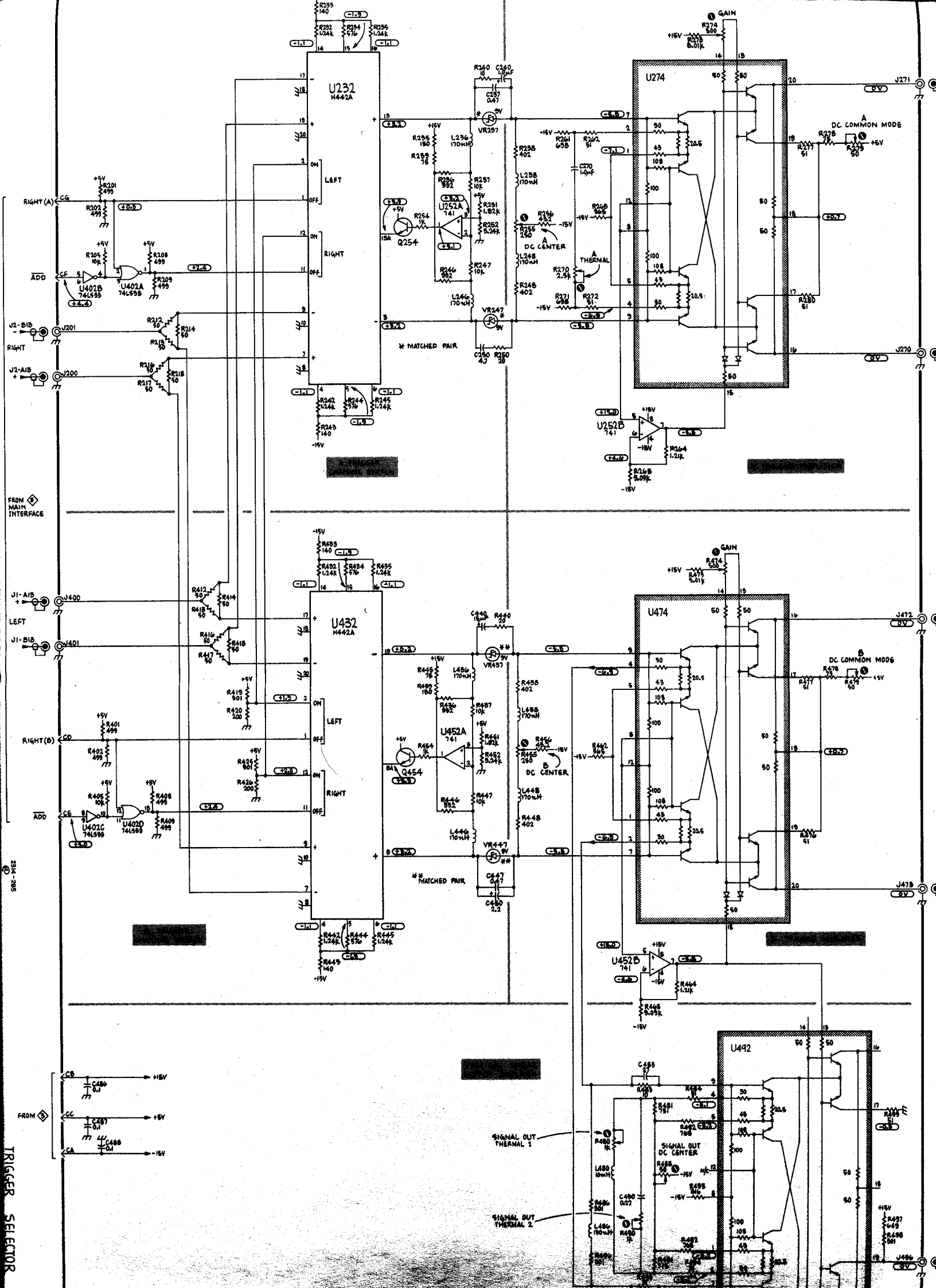
VOLTAGE CONDITIONS

The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise (READOUT INTENSITY at OFF); VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).


U232
H442A
U274
GAIN
DC COMMON MODE
DC CENTER
THERMAL
U252A
741
U252B
741
Q254
VR237
VR247
LEFT
RIGHT
ADD
RIGHT (A)
J2-B13
J2-A13
J201
J200
A TRIG TO
J271
J270
J3-B20
J3-A20
* MATCHED PAIR
FROM MAIN INTERFACE
U432
H442A
U474
U452A
741
VR437
LEFT
RIGHT (B)
J1-A13
J1-B13
J400
J401
J472
J4-A20
B DC COMMON MODE
B TRIG


TRIGGER SELECTOR
5
A14 TRIGGER SELECTOR BD
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
U432
U474
U492
U452A
U452B
Q454
LEFT
RIGHT
ADD
B DC COMMON MODE
B DC CENTER
B TRIG TO
SIGNAL OUT THERMAL 1
SIGNAL OUT THERMAL 2
SIGNAL OUT DC CENTER
SIG OUT
FROM
MATCHED PAIR


U232
H442A
U274
GAIN
LEFT
RIGHT
DC COMMON MODE
DC CENTER
THERMAL
U252A
741
U252B
741
Q254
VR257
VR247
* MATCHED PAIR
U201
U200
J271
J270
U432
H442A
U474
U452A
741
U452B
741
Q454
VR457
VR447
** MATCHED PAIR
U400
U401
J472
J473
FROM MAIN INTERFACE
RIGHT(A)
RIGHT(B)
ADD
U402B 74LS86
U402A 74LS86
U402C 74LS86
U402D 74LS86
U492
SIGNAL OUT THERMAL 1
SIGNAL OUT DC CENTER
SIGNAL OUT THERMAL 2
FROM
TRIGGER SELECTOR
2314-285

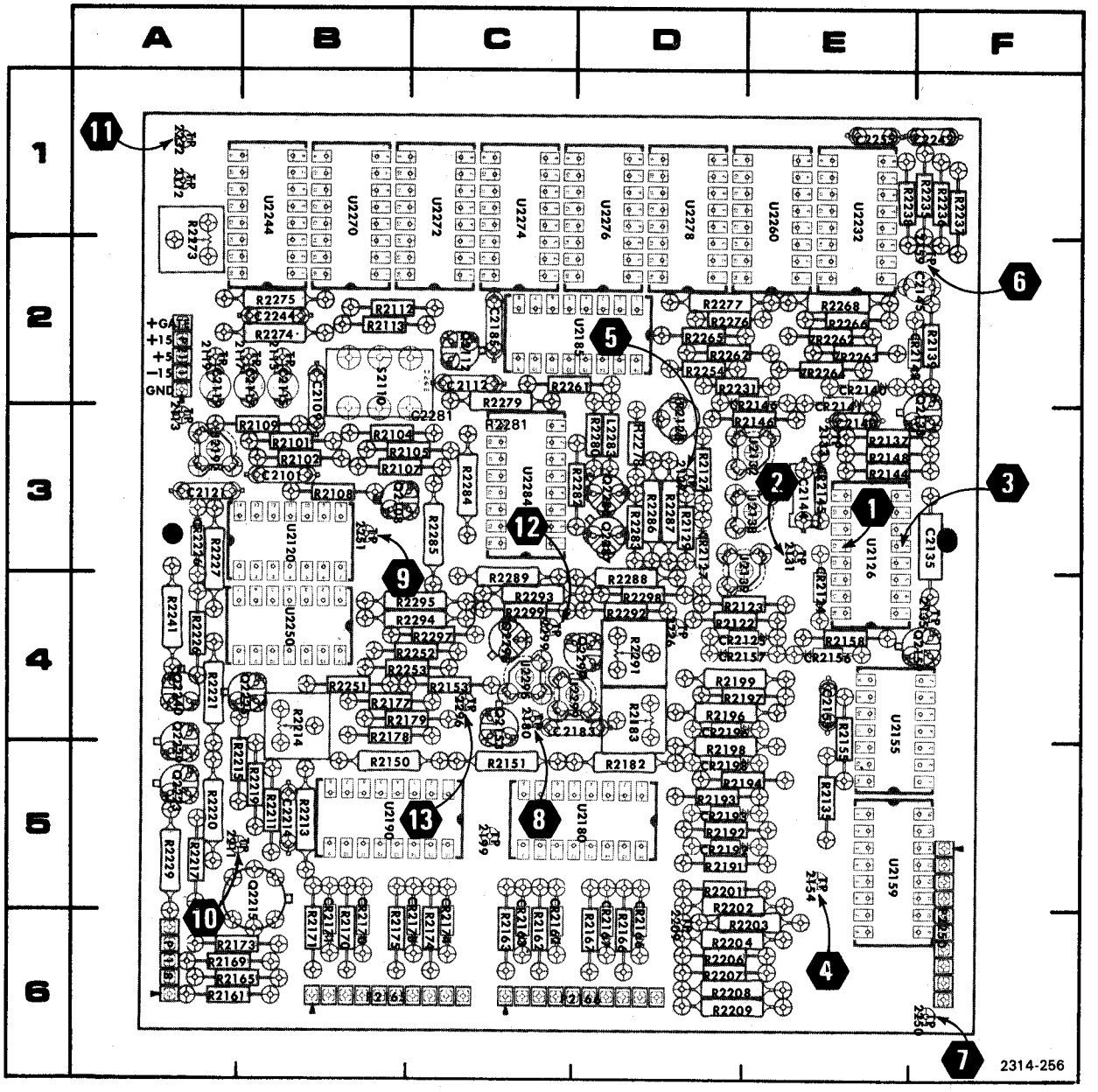
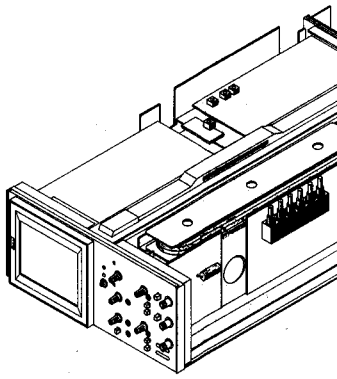
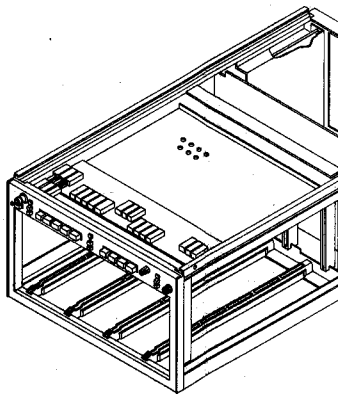


Figure 8-8. A15—Readout System circuit board assembly.

Locator for Figure 8-8.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C2101	3B	R2104	3B	R2254	2D
C2109	2B	R2105	3B	R2261	2C
C2112	2C	R2107	3B	R2262	2D
C2115	2B	R2108	3B	R2265	2D
C2117	2B	R2109	3B	R2266	2E
C2119	2A	R2112	2B	R2268	2E
C2121	3A	R2113	2B	R2274	2B
C2135	3F	R2122	4D	R2275	2B
C2140	3E	R2123	4D	R2276	2D
C2144	3E	R2127	3D	R2277	2D
C2145	2F	R2128	3D	R2278	3D
C2155	4E	R2129	3D	R2279	2C
C2183	4D	R2135	5E	R2280	3D
C2185	2C	R2137	3E	R2281	3C
C2214	5B	R2139	2F	R2282	3C
C2242	1F	R2144	3E	R2283	3D
C2244	2B	R2146	3E	R2284	3C
C2255	1E	R2148	3E	R2285	3C
C2281	3C	R2150	5B	R2286	3D
		R2151	5C	R2287	3D
CR2124	4E	R2153	4C	R2288	4D
CR2125	4D	R2155	4E	R2289	4C
CR2127	3D	R2158	4E	R2291	4D
CR2140	2E	R2161	6A	R2292	4D
CR2141	2E	R2162	6C	R2293	4C
CR2142	2F	R2163	6C	R2294	4B
CR2145	3E	R2165	6A	R2295	4B
CR2146	2D	R2166	6D	R2297	4C
CR2156	4E	R2167	6D	R2298	4D
CR2157	4D	R2169	6A	R2299	4C
CR2162	6C	R2170	6B		
CR2163	6C	R2171	6B	S2110	2B
CR2166	6D	R2173	6A		
CR2167	6D	R2174	6C	TP2112	1A
CR2170	6B	R2175	6B	TP2113	3A
CR2171	6B	R2177	4B	TP2115	2B
CR2174	6C	R2178	4B	TP2117	2A
CR2175	6C	R2179	4B	TP2119	2A
CR2192	5D	R2182	5D	TP2127	3D
CR2193	5D	R2183	4D	TP2131	3E
CR2196	4D	R2191	5D	TP2133	3E
CR2198	5D	R2192	5D	TP2135	4F
CR2226	3A	R2193	5D	TP2154	5E
		R2194	5D	TP2159	2F
J2132	3E	R2196	4D	TP2180	4C
J2138	3E	R2197	4D	TP2199	5C
J2139	4D	R2198	5D	TP2209	6D
J2192	3A	R2199	4D	TP2211	5A
J2296	4C	R2201	5D	TP2226	4D
J2299	4D	R2202	5D	TP2232	1A
		R2203	6D	TP2250	6F
L2283	3D	R2204	6D	TP2251	3B
		R2206	6D	TP2296	4C
P2118	6A	R2207	6D	TP2299	4C
P2165	6B	R2208	6D		
P2166	6D	R2209	6D	U2120	3B
P2171	2A	R2211	5B	U2126	3E
P2250	6F	R2213	5B	U2155	4E
		R2214	4B	U2159	5E
Q2108	3B	R2215	5A	U2180	5D
Q2112	2C	R2217	5A	U2185	2C
Q2138	3F	R2219	5B	U2190	5B
Q2153	4C	R2220	5A	U2232	1E
Q2159	4F	R2221	4A	U2244	1B
Q2215	5B	R2226	4A	U2250	4B
Q2223	5A	R2227	3A	U2260	1E
Q2225	4B	R2229	5A	U2270	1B
Q2229	5A	R2231	2D	U2272	1C
Q2240	4A	R2235	1F	U2274	1C
Q2286	3D	R2236	1F	U2276	1D
Q2287	3D	R2237	1F	U2278	1D
Q2296	4C	R2238	1E	U2284	3C
Q2299	4D	R2241	4A		
		R2251	4B	VR2262	2E
R2101	3B	R2252	4B	VR2263	2E
R2102	3B	R2253	4B	VR2264	2E





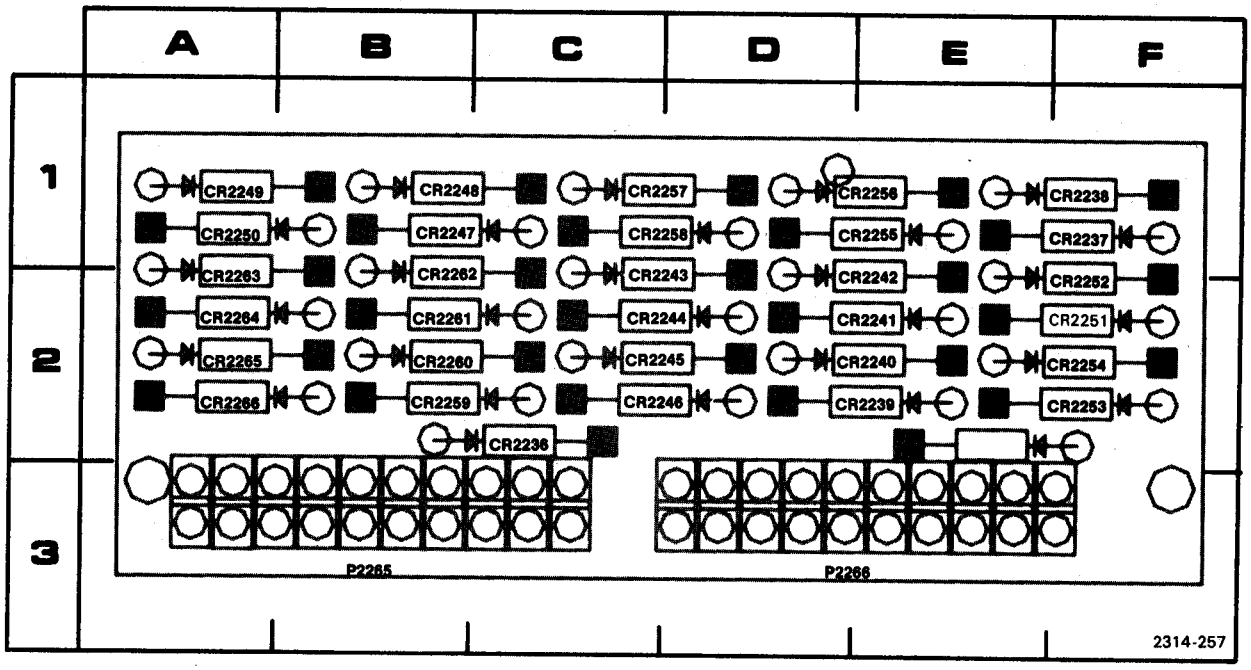
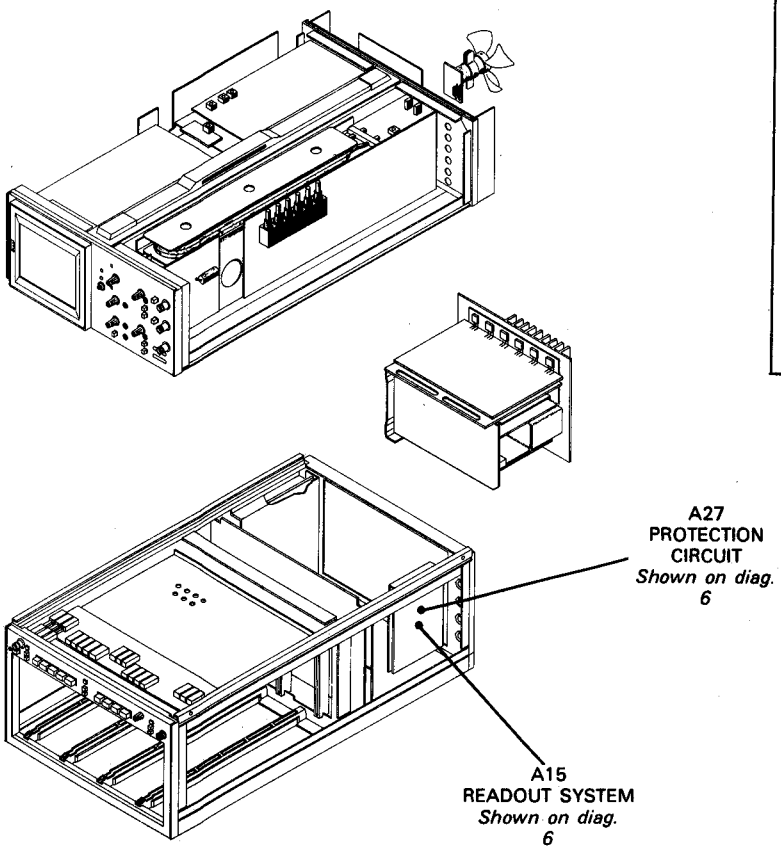


Figure 8-9. A27—Protection Circuit circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD
CR2236	2C	CR2253	2F
CR2237	1F	CR2254	2F
CR2238	1F	CR2255	1D
CR2239	2D	CR2256	1D
CR2240	2D	CR2257	1C
CR2241	2D	CR2258	1C
CR2242	2D	CR2259	2B
CR2243	2C	CR2260	2B
CR2244	2C	CR2261	2B
CR2245	2C	CR2262	2B
CR2246	2C	CR2263	2A
CR2247	1B	CR2264	2A
CR2248	1B	CR2265	2A
CR2249	1A	CR2266	2A
CR2250	1A		
CR2251	2F	P2265	3B
CR2252	2F	P2266	3D



VOLTAGE CONDITIONS

The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

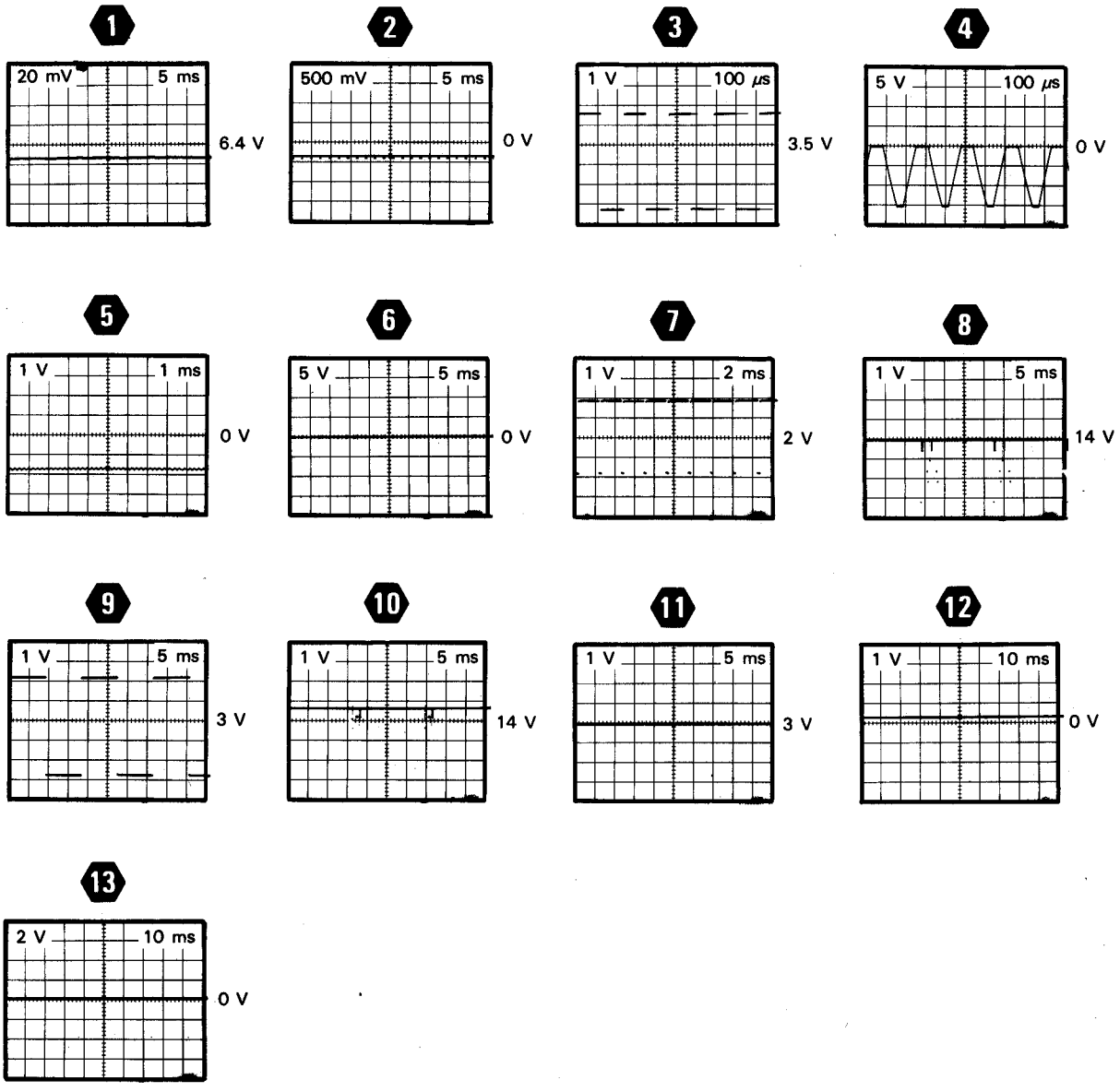
The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

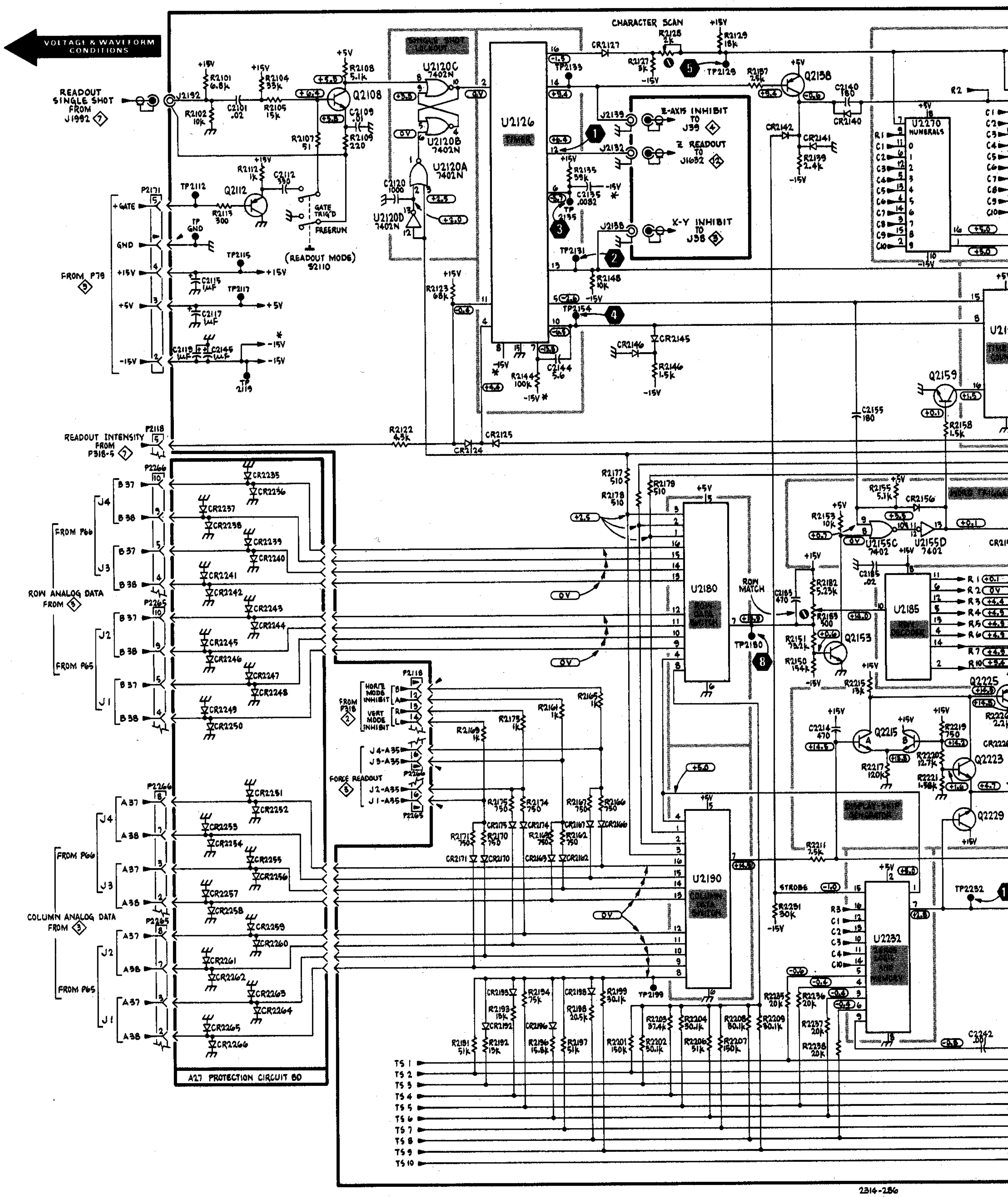
VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except A and B INTENSITY fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 MΩ input impedance and at least 60 MHz bandwidth. The test oscilloscope was externally triggered through a 1X probe connected to TP2251 on the 7104 A15 Readout System circuit board. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) A 7B-series time base was installed in the mainframe B HORIZ compartment and set for internal auto-trigger and 50 microsecond/division sweep rate.




VOLTAGE & WAVEFORM CONDITIONS
READOUT SINGLE SHOT FROM J1992
CHARACTER SCAN
SINGLE SHOT LOCKOUT
U2126 TIMER
Z-AXIS INHIBIT TO J39
Z READOUT TO J1632
X-Y INHIBIT TO J38
GATE TRIG'D
FREERUN
(READOUT MODE) S2110
FROM P78
READOUT INTENSITY FROM P318-5
ROW ANALOG DATA FROM
FROM P66
FROM P65
COLUMN ANALOG DATA FROM
A27 PROTECTION CIRCUIT BD
HORIZ MODE INHIBIT
VERT MODE INHIBIT
FROM P318
FORCE READOUT
U2180 ROW DATA SWITCH
U2190 COLUMN DATA SWITCH
ROW MATCH
U2185 ROW DECODER
WORD TRIGGER
DISPLAY SKIP GENERATOR
U2232 ZEROS LOGIC AND MEMORY
STROBE
U2270 NUMERALS
TIMER COUNTER
TS 1
TS 2
TS 3
TS 4
TS 5
TS 6
TS 7
TS 8
TS 9
TS 10
2314-286

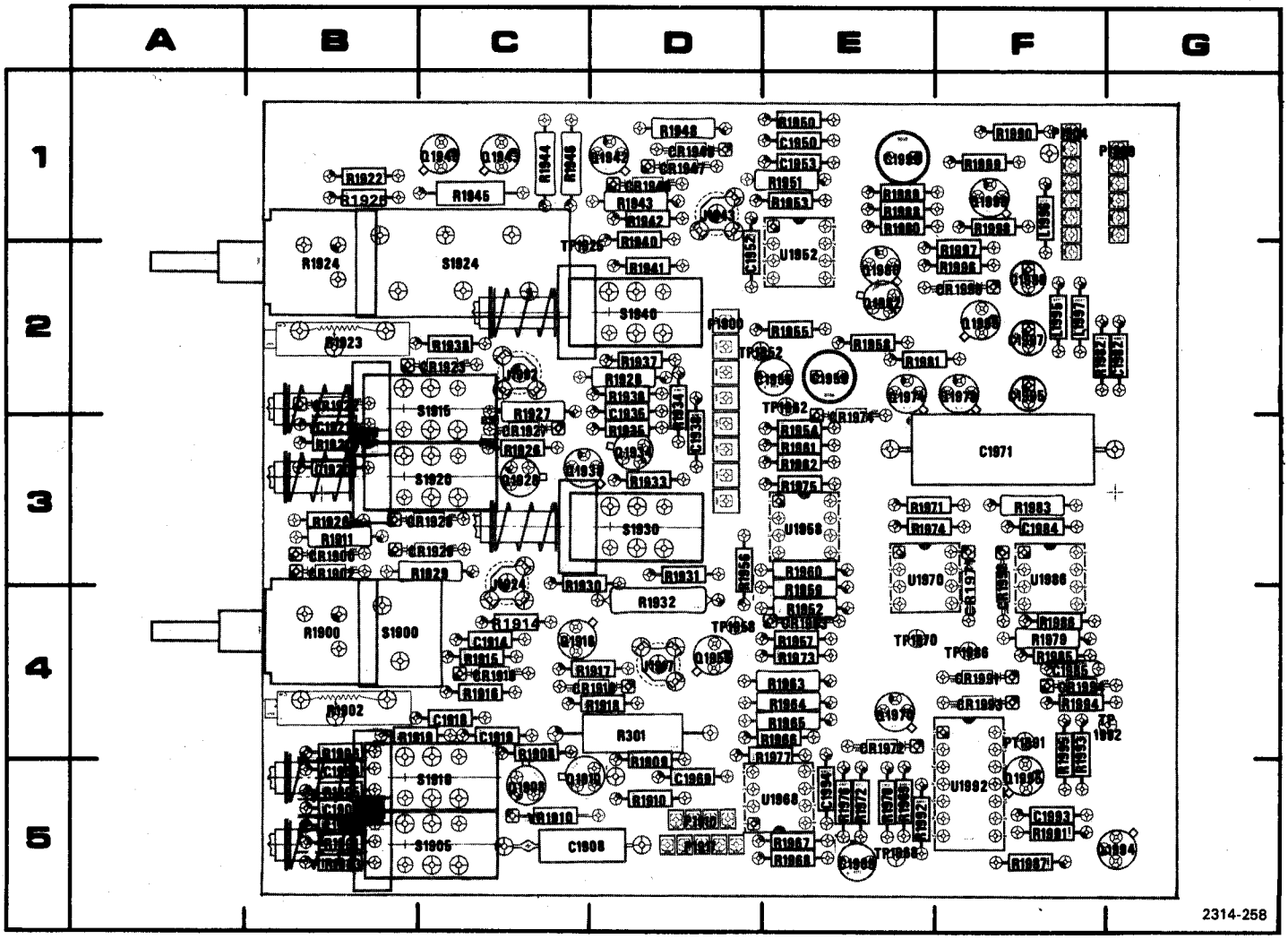
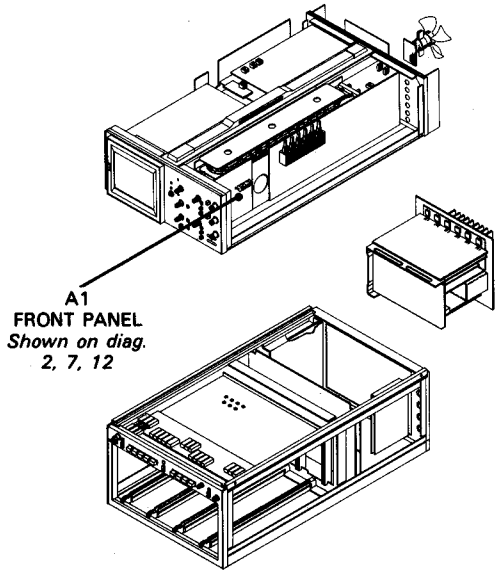


Figure 8-10. A1—Front Panel circuit board assembly.



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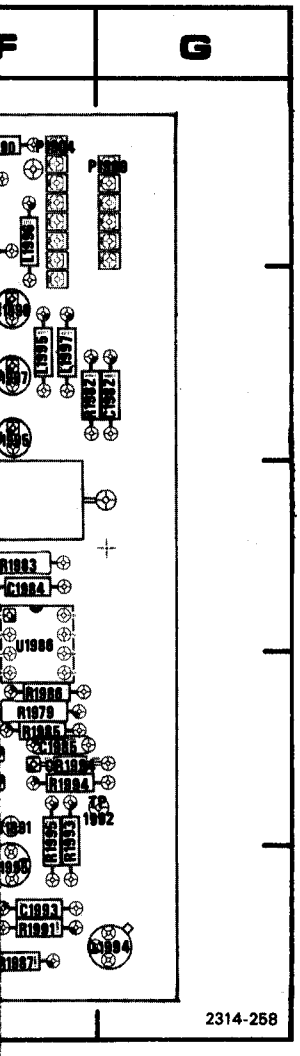


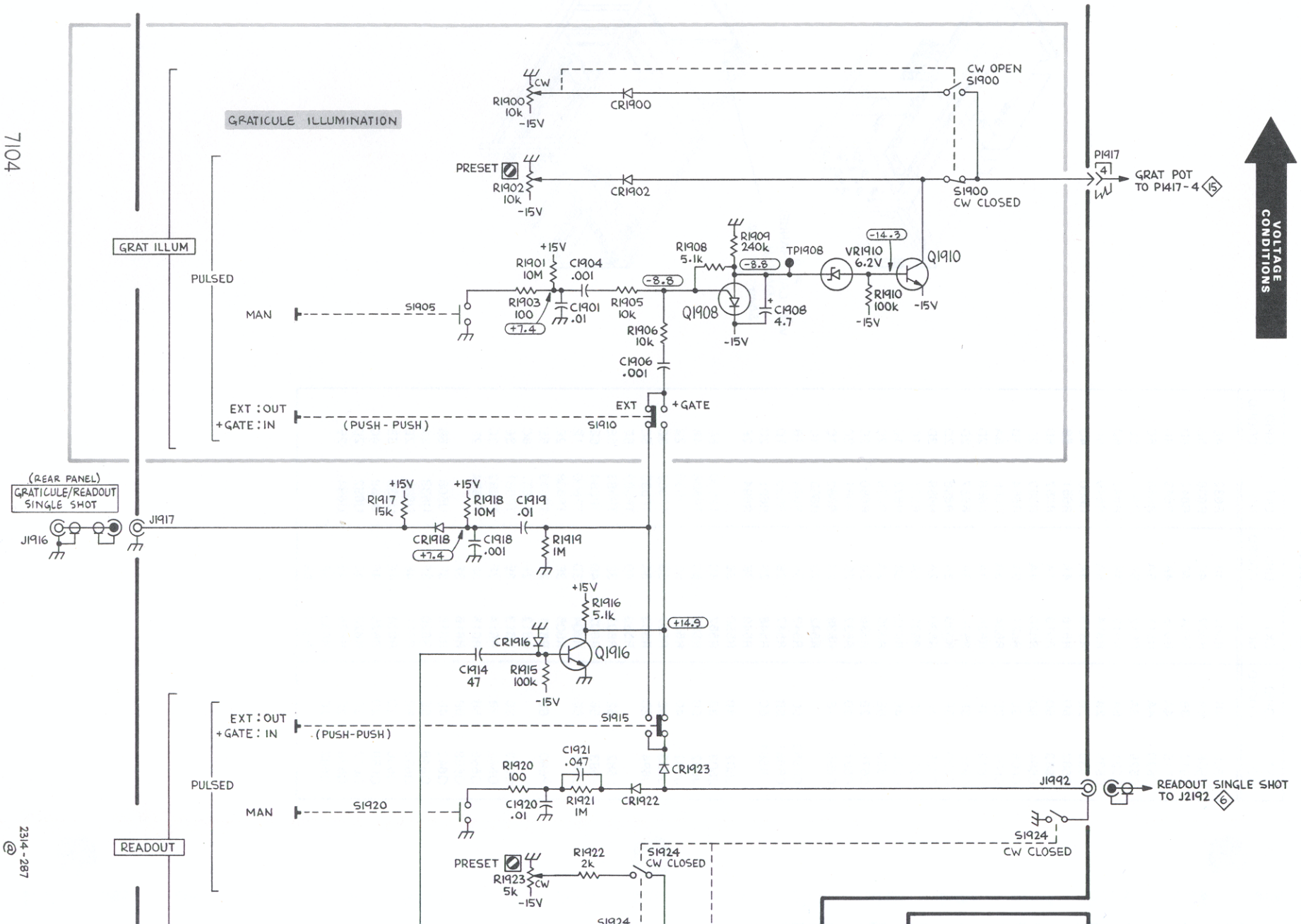
Locator for Figure 8-10.

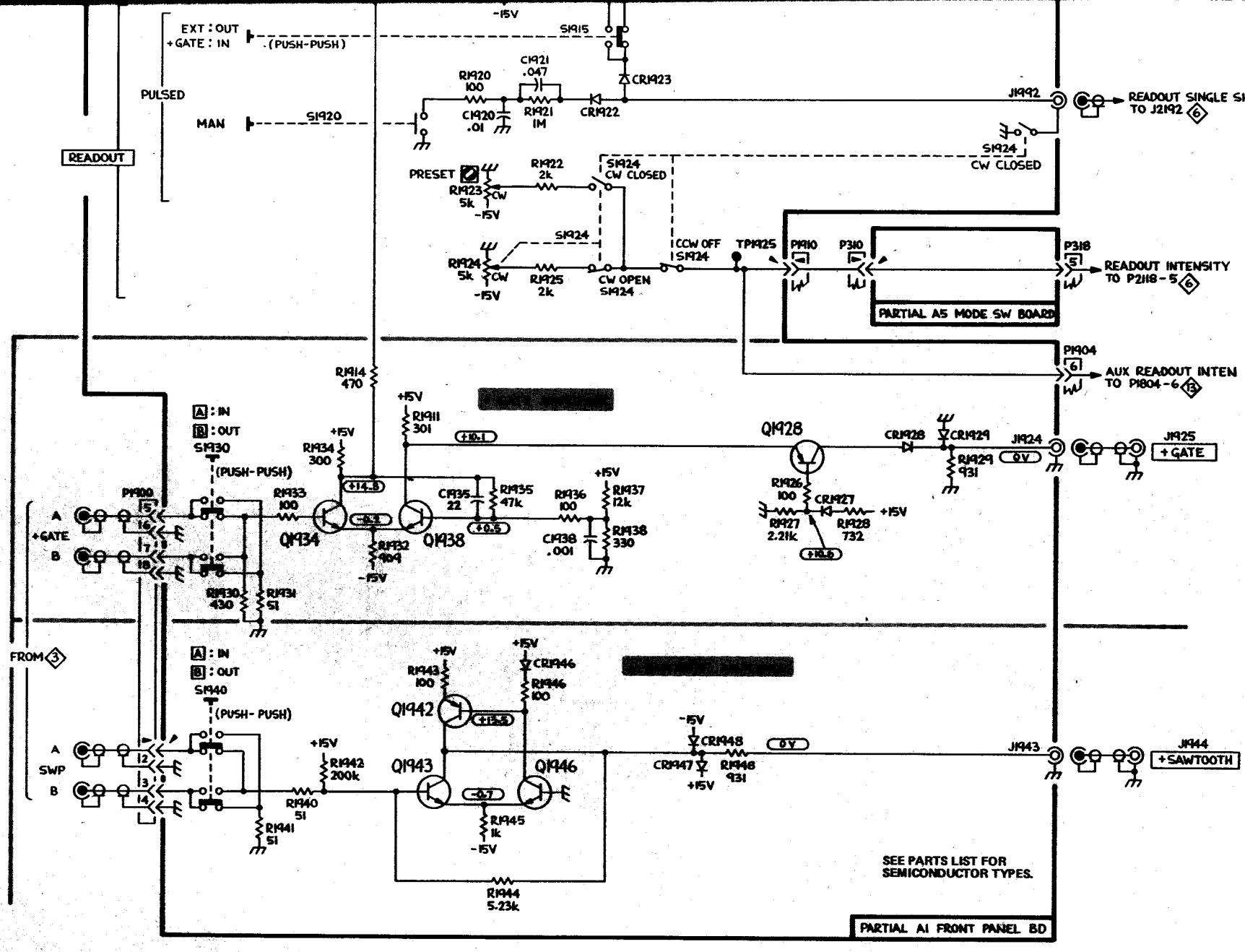
CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1901	5B	Q1910	5C	R1957	4E
C1904	5B	Q1916	4C	R1958	2E
C1906	5B	Q1928	3C	R1959	4E
C1908	5C	Q1934	3D	R1960	3E
C1914	4C	Q1938	3C	R1961	3E
C1915	4C	Q1942	1D	R1962	3E
C1918	4C	Q1943	1C	R1963	4E
C1919	4C	Q1946	1C	R1964	4E
C1920	3B	Q1956	4D	R1965	4E
C1921	3B	Q1970	4E	R1966	4E
C1935	2D	Q1974	2E	R1967	5E
C1938	3D	Q1978	2F	R1968	5E
C1950	1E	Q1980	2E	R1969	5E
C1952	2D	Q1982	2E	R1970	5E
C1953	1E	Q1994	5G	R1971	3E
C1955	2E	Q1995	5F	R1972	5E
C1956	2E	Q1998	2F	R1973	4E
C1968	5E	Q1999	1F	R1974	3E
C1969	5D			R1975	3E
C1971	3F	R301	4D	R1976	5E
C1982	2G	R1900	4B	R1977	4E
C1984	3F	R1901	5B	R1979	4F
C1985	4F	R1902	4B	R1980	1E
C1990	1E	R1903	5B	R1981	2E
C1993	5F	R1905	5B	R1982	2F
C1994	5E	R1906	4B	R1983	3F
C1995	2F	R1908	4C	R1985	4F
C1996	2F	R1909	5D	R1986	4F
C1997	2F	R1910	5D	R1987	5F
		R1911	3B	R1988	1E
CR1900	3B	R1914	4C	R1989	1E
CR1902	3B	R1915	4C	R1990	1F
CR1916	4C	R1916	4C	R1991	5F
CR1918	4D	R1917	4D	R1992	5E
CR1922	2B	R1918	4D	R1993	4F
CR1923	2C	R1919	4B	R1994	4F
CR1927	3C	R1920	3B	R1995	4F
CR1928	3C	R1921	3B	R1996	2F
CR1929	3C	R1922	1B	R1997	2F
CR1946	1D	R1923	2B	R1998	1F
CR1947	1D	R1924	2B	R1999	1F
CR1948	1D	R1925	1B		
CR1963	4E	R1926	3C	S1900	4B
CR1971	3F	R1927	3C	S1905	5C
CR1972	4E	R1928	2D	S1910	5C
CR1974	3E	R1929	3C	S1915	3C
CR1991	4F	R1930	3C	S1920	3C
CR1992	3F	R1931	3D	S1924	2C
CR1993	4F	R1932	4D	S1930	3D
CR1994	4F	R1933	3D	S1940	2D
CR1998	2F	R1934	3D		
		R1935	3D	TP1911	4F
J1917	4D	R1936	2D	TP1925	2C
J1924	3C	R1937	2D	TP1952	2D
J1943	1D	R1938	2C	TP1958	4D
J1992	2C	R1940	2D	TP1962	2E
		R1941	2D	TP1968	5E
L1995	2F	R1942	1D	TP1970	4E
L1996	1F	R1943	1D	TP1986	4F
L1997	2F	R1944	1C	TP1992	4F
		R1945	1C		
P1900	2D	R194	1C	U1952	2E
P1904	1F	R1948	1D	U1958	3E
P1909	1G	R1950	1E	U1968	5E
P1910	5D	R1951	1E	U1970	3E
P1917	5D	R1952	4E	U1986	3F
		R1953	1E	U1992	5F
PT1991	4F	R1954	3E		
		R1955	2E	VR1910	5C
Q1908	5C	R1956	3D		

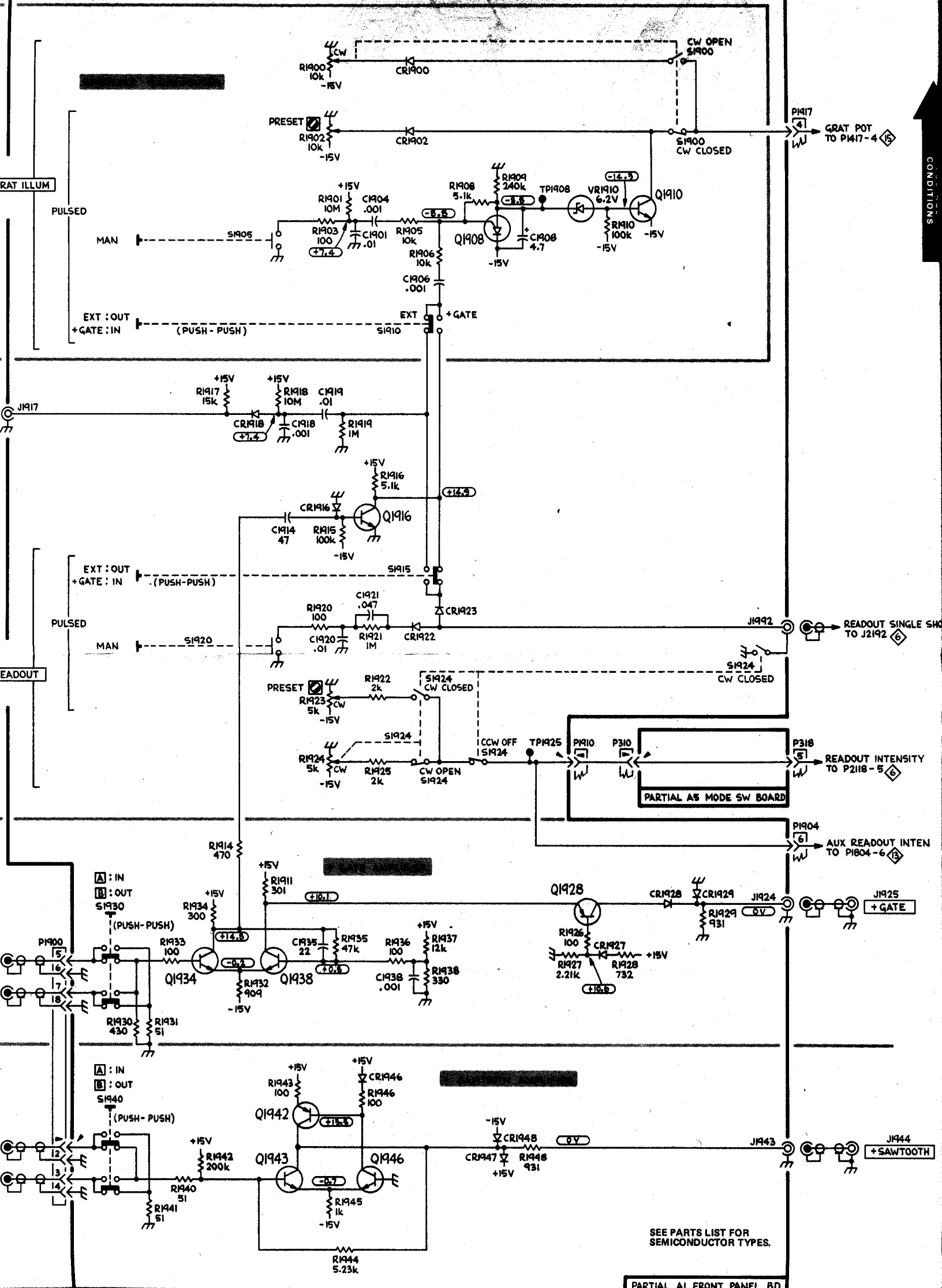
VOLTAGE CONDITIONS

The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).


GRATICULE ILLUMINATION
CW
R1900 10k
-15V
CR1900
CW OPEN S1900
PRESET
R1902 10k
-15V
CR1902
S1900 CW CLOSED
P1417 4
GRAT POT TO P1417-4 15
GRAT ILLUM
PULSED
MAN
S1905
+15V
R1901 10M
C1904 .001
R1903 100
+7.4
C1901 .01
R1905 10k
-8.8
R1908 5.1k
R1909 240k
-8.8
TP1908
VR1910 6.2V
-14.3
Q1910
Q1908
C1908 4.7
R1910 100k
-15V
-15V
R1906 10k
C1906 .001
EXT : OUT
+GATE : IN
(PUSH-PUSH)
S1910
EXT
+GATE
VOLTAGE CONDITIONS
(REAR PANEL)
GRATICULE/READOUT SINGLE SHOT
J1916
J1917
+15V
R1917 15k
+15V
R1918 10M
C1919 .01
CR1918
+7.4
C1918 .001
R1919 1M
+15V
R1916 5.1k
+14.9
CR1916
Q1916
C1914 47
R1915 100k
-15V
EXT : OUT
+GATE : IN
(PUSH-PUSH)
S1915
PULSED
MAN
S1920
C1921 .047
R1920 100
C1920 .01
R1921 1M
CR1922
CR1923
J1992
READOUT SINGLE SHOT TO J2192 6
S1924 CW CLOSED
READOUT
PRESET
R1923 5k
CW
-15V
R1922 2k
S1924 CW CLOSED
2314-287


EXT : OUT
+GATE : IN
(PUSH-PUSH)
S1915
PULSED
MAN
S1920
READOUT
R1920 100
C1920 .01
C1921 .047
R1921 1M
CR1923
CR1922
J1992
READOUT SINGLE SHOT TO J2192 6
S1924 CW CLOSED
PRESET
R1923 5k
CW
-15V
R1922 2k
S1924 CW CLOSED
S1924
R1924 5k
R1925 2k
CW OPEN S1924
CCW OFF S1924
TP1925
P1910
P310
P318
READOUT INTENSITY TO P2118-5 6
PARTIAL A5 MODE SW BOARD
P1904
AUX READOUT INTEN TO P1804-6 13
R1914 470
+15V
R1911 301
A : IN
B : OUT
S1930
(PUSH-PUSH)
R1934 300
+10.1
Q1928
CR1928
CR1929
J1924
0V
J1925
+GATE
R1929 931
P1900
A
+GATE
B
R1933 100
+14.8
C1935 22
R1935 47k
R1936 100
R1937 12k
R1938 330
Q1934
Q1938
R1932 909
-15V
+0.5
C1938 .001
R1926 100
CR1927
R1927 2.21k
R1928 732
+10.6
R1930 430
R1931 51
FROM 3
A : IN
B : OUT
S1940
(PUSH- PUSH)
A
SWP
B
R1943 100
Q1942
+15.5
CR1946
R1946 100
R1942 200k
R1940 51
R1941 51
Q1943
Q1946
-0.7
R1945 1k
R1944 5.23k
CR1948
CR1947
R1948 931
J1943
J1944
+SAWTOOTH
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
PARTIAL A1 FRONT PANEL BD
SIGNALS OUT
7
2314-287
B


CW OPEN S1900
R1900 10k
CR1900
-15V
PRESET
R1902 10k
CR1902
S1900 CW CLOSED
P1917 4
GRAT POT TO P1417-4 15
CONDITIONS
RAT ILLUM
PULSED
MAN
S1905
+15V
R1901 10M
C1904 .001
R1903 100
C1901 .01
+7.4
R1905 10k
R1908 5.1k
R1909 240k
-6.5
TP1908
VR1910 6.2V
-14.9
Q1910
R1910 100k
-15V
Q1908
C1908 4.7
R1906 10k
C1906 .001
EXT : OUT
+GATE : IN
(PUSH-PUSH)
EXT
+GATE
S1910
J1917
+15V
R1917 15k
R1918 10M
C1919 .01
CR1918
+7.4
C1918 .001
R1919 1M
+15V
R1916 5.1k
+14.9
CR1916
Q1916
C1914 47
R1915 100k
-15V
EXT : OUT
+GATE : IN
(PUSH-PUSH)
S1915
PULSED
MAN
S1920
C1921 .047
R1920 100
C1920 .01
R1921 1M
CR1922
CR1923
J1992
READOUT SINGLE SHO TO J2192 6
S1924 CW CLOSED
EADOUT
PRESET
R1923 5k
CW
-15V
R1922 2k
S1924 CW CLOSED
S1924
R1924 5k
CW
-15V
R1925 2k
CW OPEN S1924
CCW OFF S1924
TP1925
P1910
P310
P318 5
READOUT INTENSITY TO P2118-5 6
PARTIAL A5 MODE SW BOARD
P1904 6
AUX READOUT INTEN TO P1804-6 13
R1914 470
+15V
R1911 301
+10.1
A : IN
B : OUT
S1930
(PUSH-PUSH)
+15V
R1934 300
+14.5
P1900
5
16
7
18
R1933 100
-0.4
Q1934
Q1938
C1935 22
R1935 47k
+0.6
R1936 100
+15V
R1937 12k
R1938 330
C1938 .001
R1932 909
-15V
R1930 430
R1931 51
Q1928
CR1928
CR1929
J1924
0V
J1925
+GATE
R1929 931
R1926 100
CR1927
+15V
R1927 2.21k
R1928 732
+10.6
A : IN
B : OUT
S1940
(PUSH-PUSH)
+15V
R1943 100
Q1942
+15.5
+15V
CR1946
R1946 100
-15V
CR1948
CR1947
+15V
R1948 931
0V
J1943
J1944
+SAWTOOTH
12
3
14
+15V
R1942 200k
Q1943
Q1946
-0.7
R1940 51
R1941 51
R1945 1k
-15V
R1944 5.23k
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
PARTIAL A1 FRONT PANEL BD

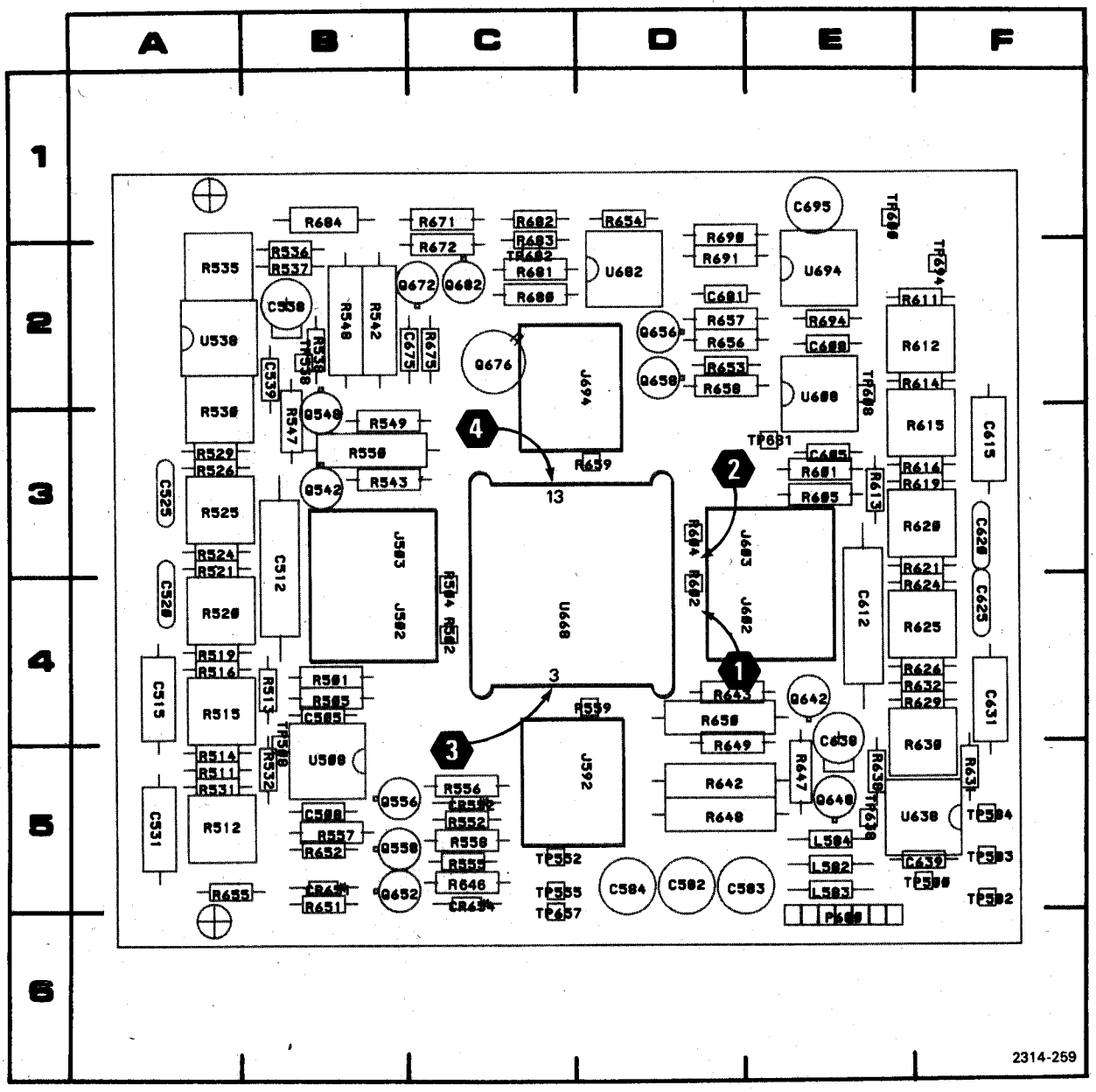
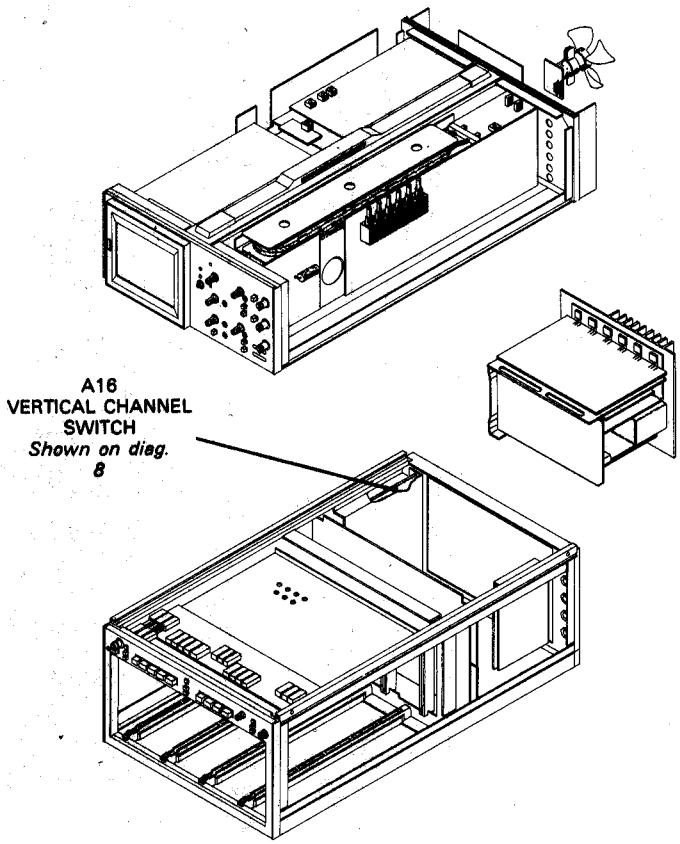
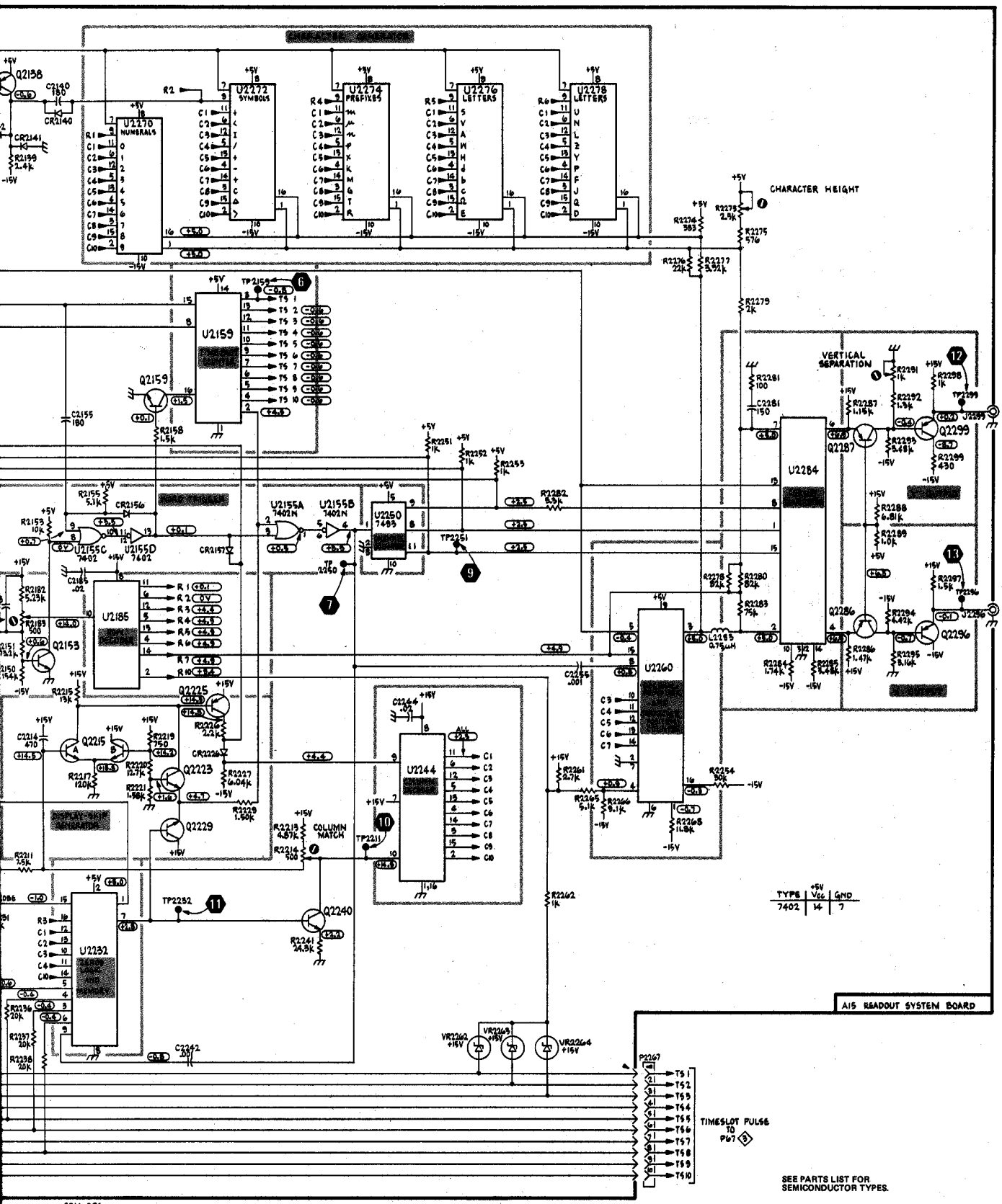


Figure 8-11. A16—Vertical Channel Switch circuit board assembly.

Locator for Figure 8-11.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C505	4B	R501	4B	R632	4E
C508	5B	R502	4C	R638	5E
C512	3B	R504	4C	R642	5D
C515	4A	R505	4B	R643	4D
C520	4A	R511	5A	R646	5C
C525	3A	R512	5A	R647	5E
C531	5A	R513	4B	R648	5D
C538	2B	R514	5A	R649	5D
C539	2B	R515	4A	R650	4D
C582	5D	R516	4A	R651	5B
C583	5D	R519	4A	R652	5B
C584	5D	R520	4A	R653	2D
C605	3E	R521	3A	R654	1D
C608	2E	R524	3A	R655	5A
C612	4E	R525	3A	R656	2D
C615	3F	R526	3A	R657	2D
C620	3F	R529	3A	R658	2D
C625	4F	R530	2A	R659	3D
C631	4F	R531	5A	R671	1C
C638	4E	R532	5B	R672	1C
C639	5E	R535	2A	R675	2C
C675	2B	R536	2B	R680	2C
C681	2D	R537	2B	R681	2C
C695	1E	R538	2B	R682	1C
		R542	2B	R683	1C
CR552	5C	R543	3B	R684	1B
CR651	5B	R547	3B	R690	1D
CR654	5C	R548	2B	R691	2D
		R549	3B	R694	2E
J502	4B	R550	3B		
J503	3B	R552	5C	TP500	5E
J592	5D	R555	5C	TP508	4B
J602	4D	R556	5C	TP538	2B
J603	3E	R557	5B	TP552	5C
J694	2D	R558	5C	TP555	5C
		R559	4D	TP582	5E
L582	5E	R601	3E	TP583	5E
L583	5E	R602	4D	TP584	5E
L584	5E	R604	3D	TP600	1E
		R605	3E	TP608	2E
P680	6E	R611	2F	TP638	5E
		R612	2F	TP657	6C
Q542	3B	R613	3E	TP681	3E
Q548	3B	R614	2F	TP682	2C
Q556	5B	R615	3F	TP694	2F
Q558	5B	R616	3F		
Q642	4E	R619	3F	U508	5B
Q648	5E	R620	3F	U538	2A
Q652	5B	R621	4E	U608	2E
Q656	2D	R624	4E	U638	5E
Q658	2D	R625	4E	U668	4C
Q672	2C	R626	4E	U682	2D
Q676	2C	R629	4E	U694	2E
Q682	2C	R630	5E		
		R631	5E		





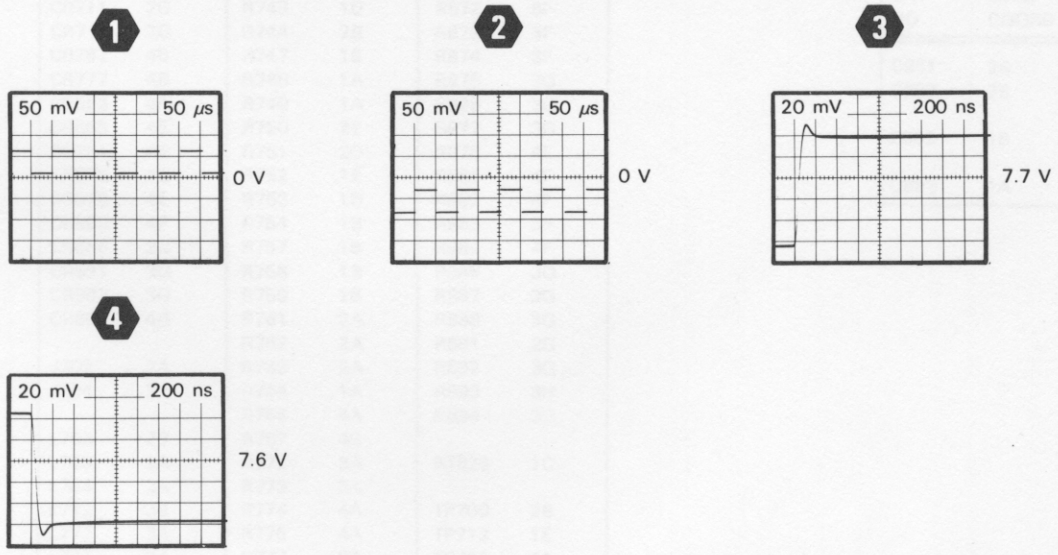
READOUT SYSTEM

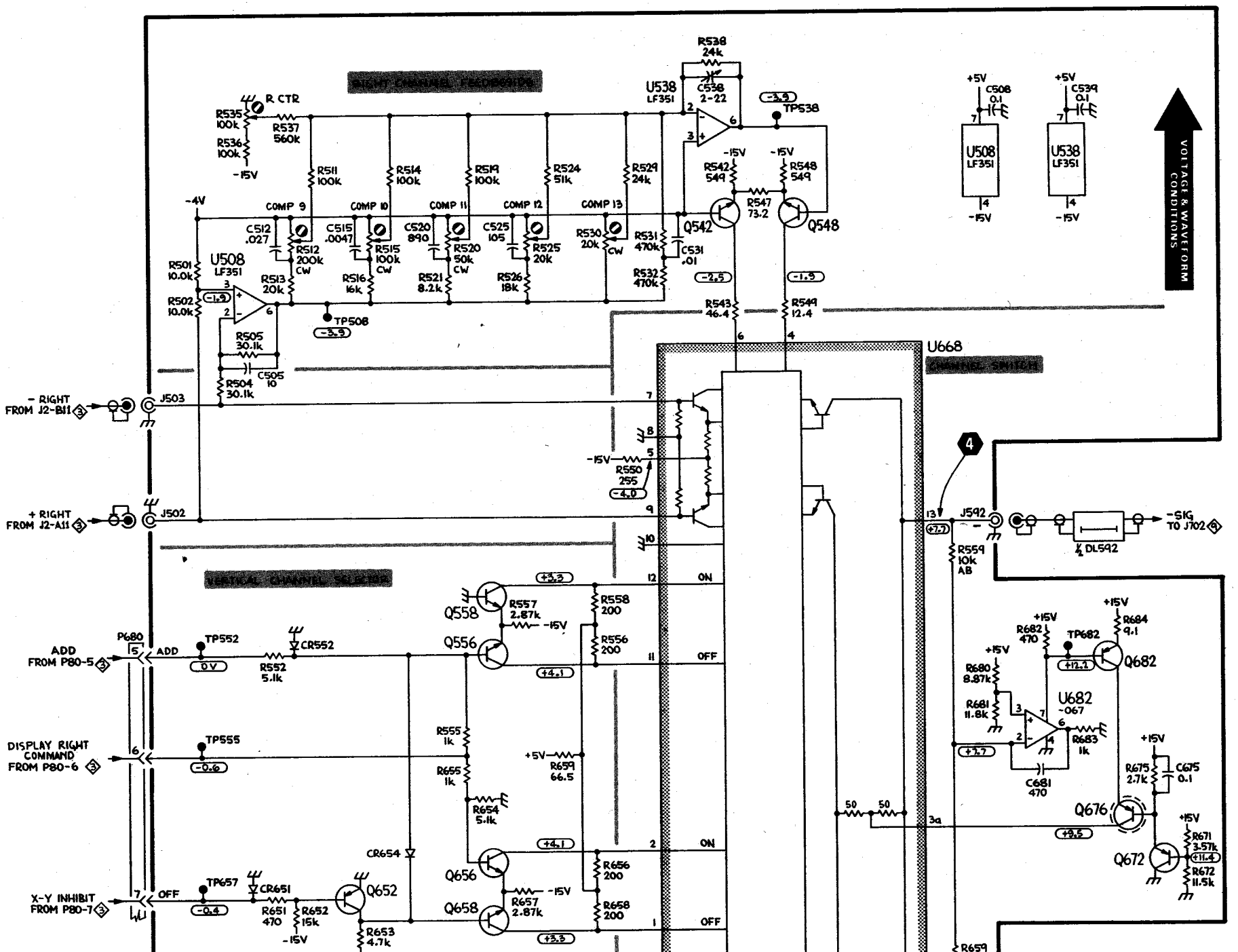
VOLTAGE AND WAVEFORM CONDITIONS

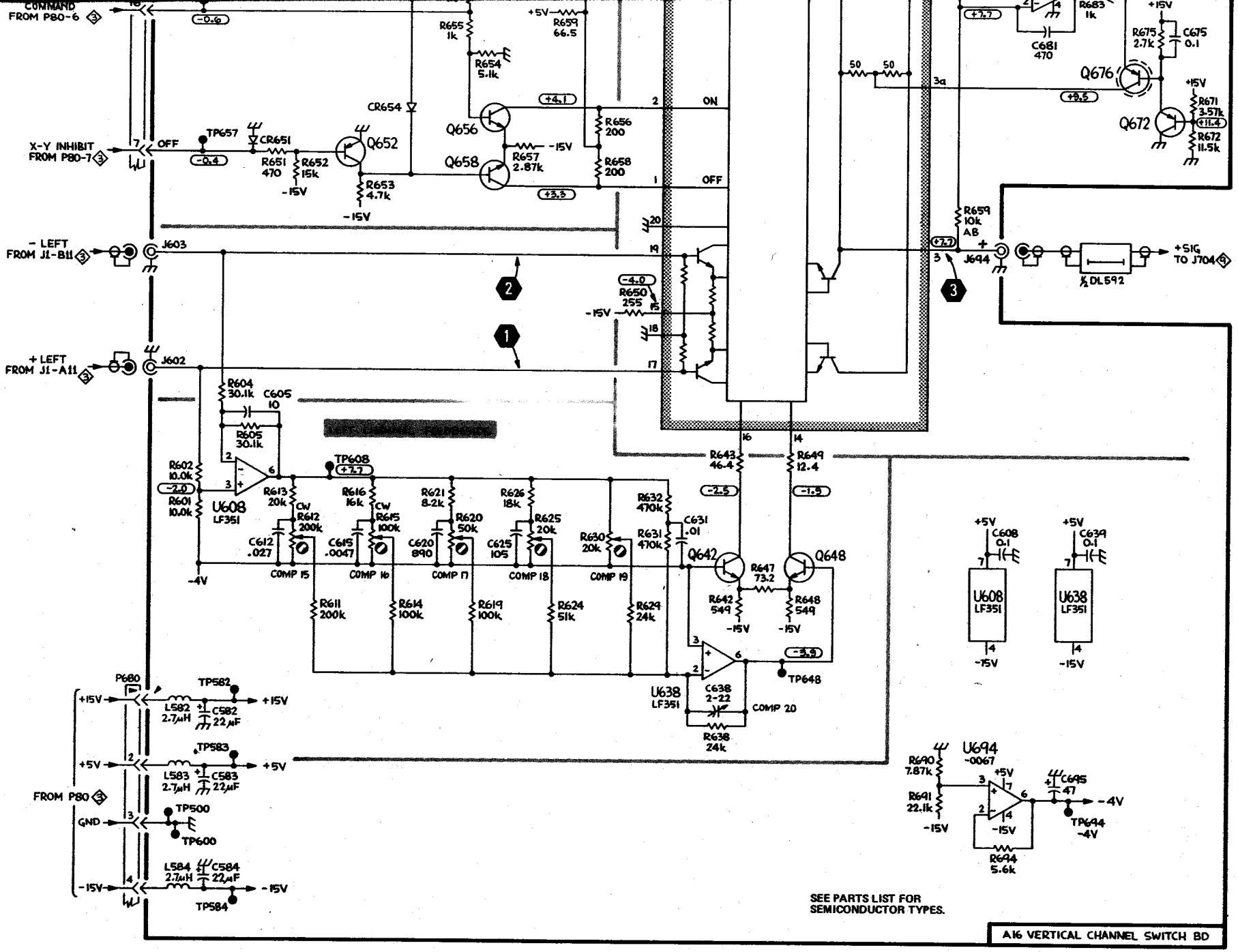
The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B.

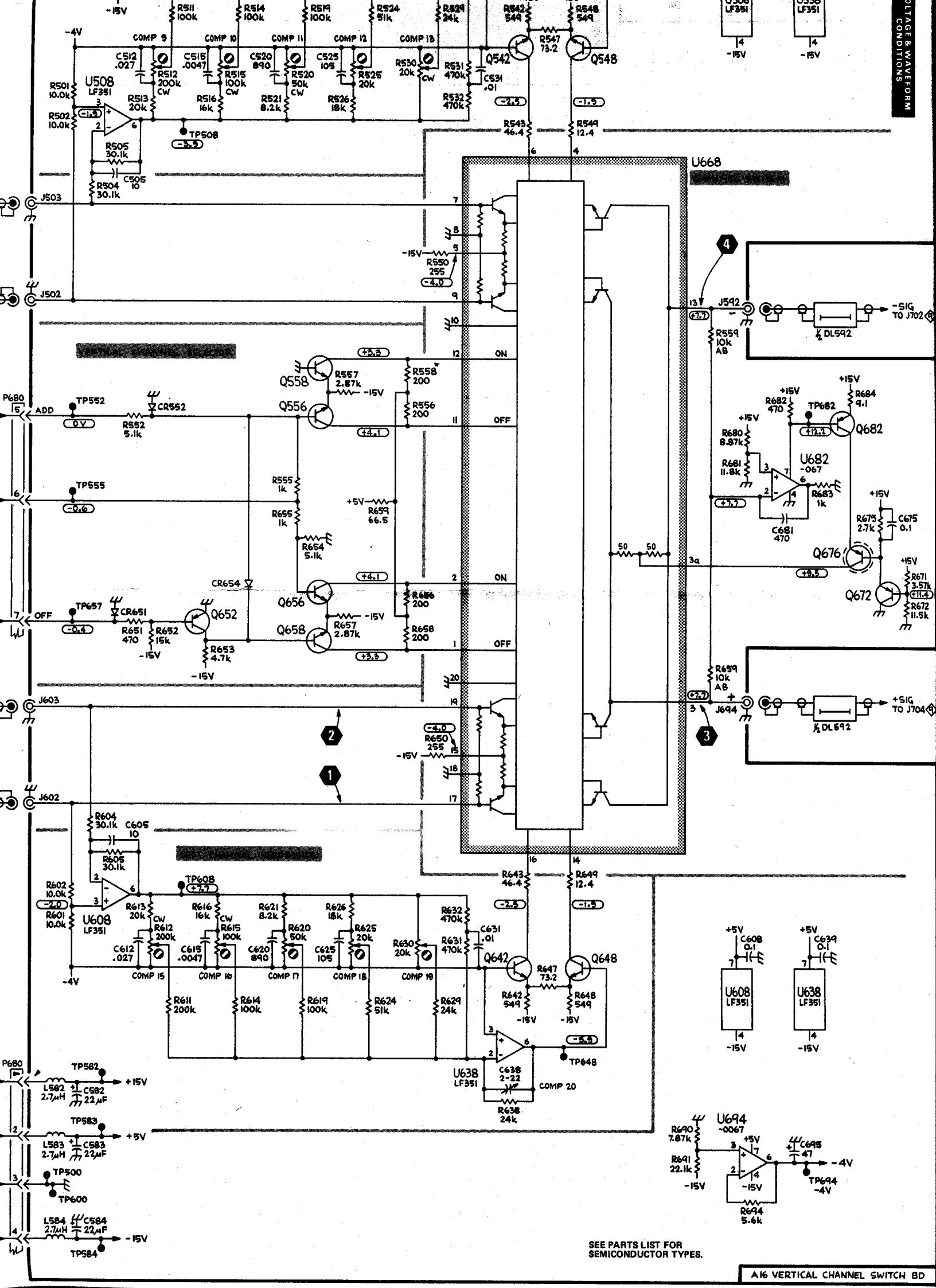
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth. The test oscilloscope was externally triggered from the Pretrig out connector of a 067-0587-02 Calibration Fixture installed in the 7104 LEFT VERT compartment. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) Calibration Fixture: +Step Response, 10 kHz Rep Rate, 6 divisions of vertical display centered at 0 volts. Test oscilloscope time base: 50 ns/div, +Slope, Auto, AC, Ext. A 7B-series time base was installed in the 7104 B HORIZ compartment and set for a free running sweep.




RIGHT CHANNEL PROGRAMMER
R CTR
R535 100k
R536 100k
R537 560k
-15V
R538 24k
C538 2-22
U538 LF351
TP538
R511 100k
R514 100k
R519 100k
R524 51k
R529 24k
COMP 9
COMP 10
COMP 11
COMP 12
COMP 13
C512 .027
C515 .0047
C520 890
C525 105
R512 200k CW
R515 100k CW
R520 50k CW
R525 20k
R530 20k CW
R531 470k
R532 470k
C531 .01
R542 549
R547 73.2
R548 549
Q542
Q548
U508 LF351
R501 10.0k
R502 10.0k
R513 20k
R516 16k
R521 8.2k
R526 18k
TP508
R505 30.1k
C505 10
R504 30.1k
R543 46.4
R549 12.4
+5V C508 0.1
+5V C539 0.1
U508 LF351
U538 LF351
-15V
VOLTAGE & WAVEFORM CONDITIONS
U668
- RIGHT FROM J2-B11
+ RIGHT FROM J2-A11
J503
J502
R550 255
VERTICAL CHANNEL SELECTOR
ADD FROM P80-5
P680
TP552
CR552
R552 5.1k
Q558
Q556
R557 2.87k
R558 200
R556 200
ON
OFF
DISPLAY RIGHT COMMAND FROM P80-6
TP555
R555 1k
R655 1k
R654 5.1k
R659 66.5
X-Y INHIBIT FROM P80-7
TP657
CR651
R651 470
R652 15k
R653 4.7k
Q652
CR654
Q656
Q658
R657 2.87k
R656 200
R658 200
J592
-SIG TO J702
½ DL592
R559 10k AB
50
50
TP682
Q682
R682 470
R684 9.1
R680 8.87k
R681 11.8k
U682 -067
R683 1k
C681 470
R675 2.7k
C675 0.1
Q676
Q672
R671 3.57k
R672 11.5k
R659


COMMAND FROM P80-6
X-Y INHIBIT FROM P80-7
OFF
ON
TP657
CR651
CR654
Q652
Q656
Q658
R651 470
R652 15k
R653 4.7k
R654 5.1k
R655 1k
R656 200
R657 2.87k
R658 200
R659 66.5
-15V
+5V
+4.1
+3.3
-0.4
-0.6
- LEFT FROM J1-B11
+ LEFT FROM J1-A11
J603
J602
R604 30.1k
C605 10
R605 30.1k
R602 10.0k
R601 10.0k
U608 LF351
TP608
R613 20k
R616 16k
R621 8.2k
R626 18k
R632 470k
R630 20k
R631 470k
C631 .01
R612 200k
R615 100k
R620 50k
R625 20k
C612 .027
C615 .0047
C620 890
C625 105
COMP 15
COMP 16
COMP 17
COMP 18
COMP 19
R611 200k
R614 100k
R619 100k
R624 51k
R629 24k
-4V
R643 46.4
R649 12.4
Q642
Q648
R647 73.2
R642 549
R648 549
U638 LF351
C638 2-22
COMP 20
R638 24k
TP648
-2.0
-2.5
-1.5
-5.9
R659 10k AB
J694
+SIG TO J704
½ DL592
R650 255
-4.0
+7.7
+11.4
+9.5
Q676
Q672
R675 2.7k
C675 0.1
C681 470
R683 1k
R671 3.57k
R672 11.5k
50
50
3a
C608 0.1
C639 0.1
U608 LF351
U638 LF351
P680
TP582
TP583
TP500
TP600
TP584
L582 2.7μH
C582 22μF
L583 2.7μH
C583 22μF
L584 2.7μH
C584 22μF
FROM P80
GND
U694 -0067
R690 7.87k
R691 22.1k
R694 5.6k
C695 47
TP694 -4V
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
A16 VERTICAL CHANNEL SWITCH BD


VOLTAGE & WAVEFORM CONDITIONS
U668
VERTICAL CHANNEL SELECTION
LEFT CHANNEL SELECTION
U508 LF351
U608 LF351
U638 LF351
U682 -067
U694 -0067
Q542
Q548
Q642
Q648
Q556
Q558
Q656
Q658
Q652
Q676
Q672
Q682
J503
J502
J603
J602
J592
J694
P680
TP508
TP552
TP555
TP657
TP608
TP648
TP682
TP582
TP583
TP500
TP600
TP584
TP694
CR552
CR654
CR651
COMP 9
COMP 10
COMP 11
COMP 12
COMP 13
COMP 15
COMP 16
COMP 17
COMP 18
COMP 19
COMP 20
ADD
ON
OFF
-SIG TO J702
+SIG TO J704
½ DL592
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
A16 VERTICAL CHANNEL SWITCH BD

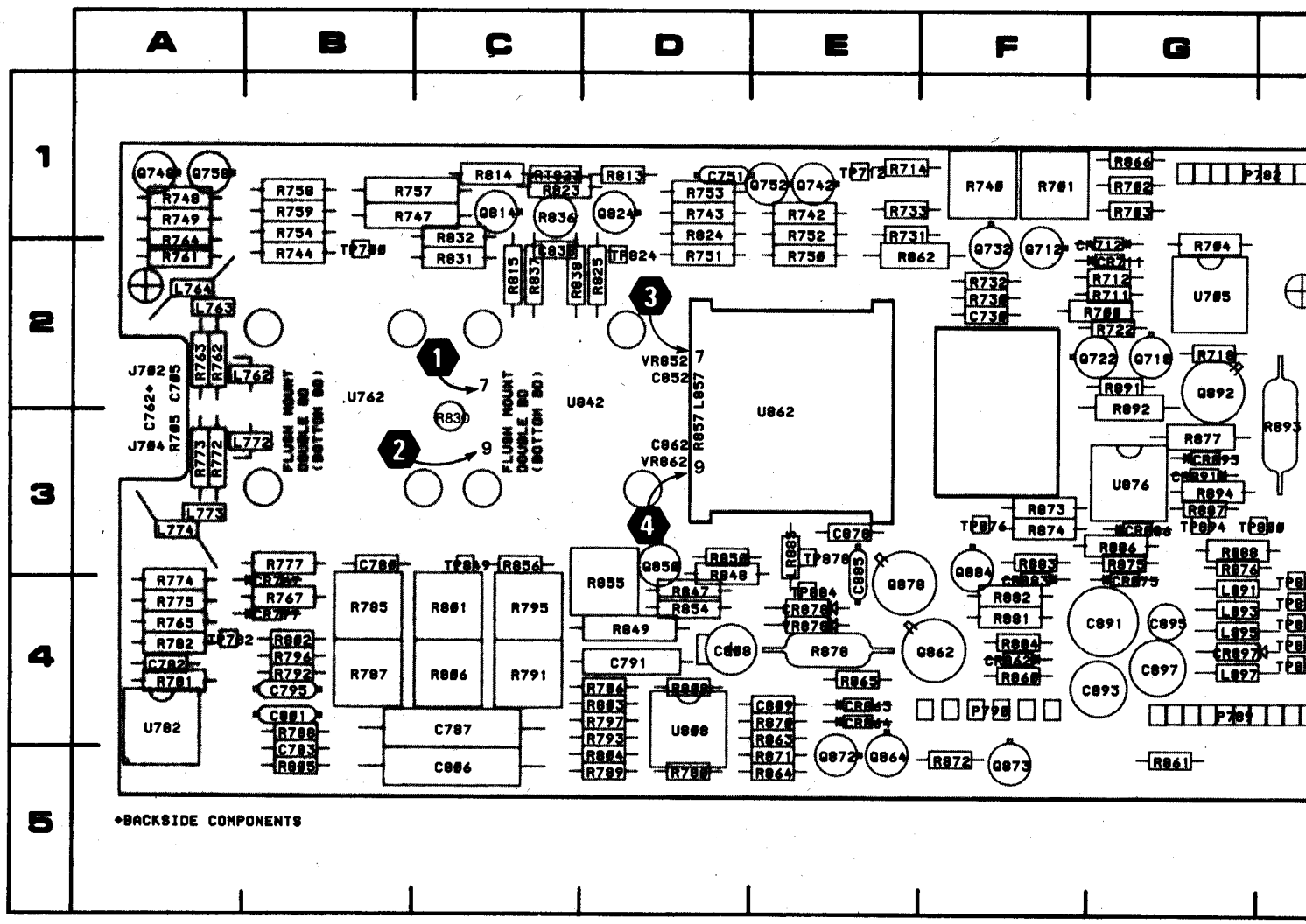
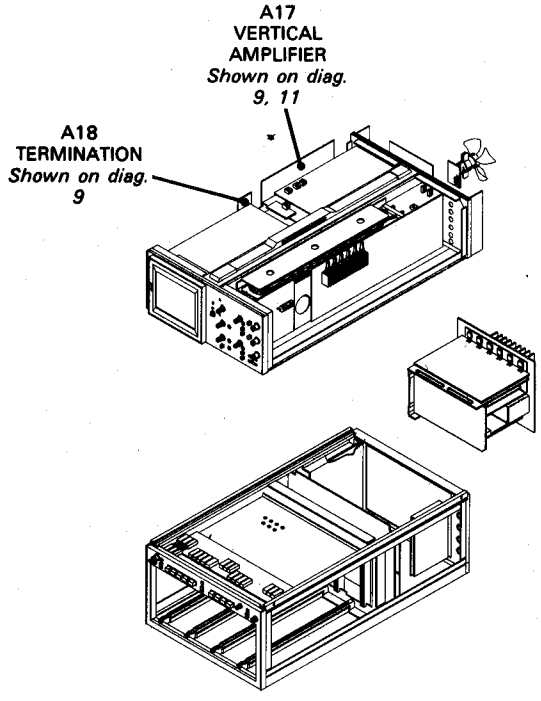


Figure 8-12A. A17-Vertical Amplifier circuit board assembly.



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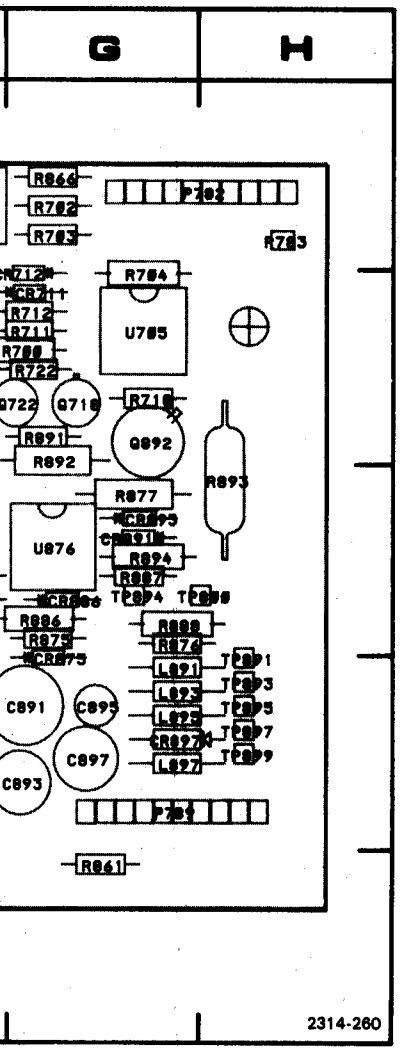


Locator for Figure 8-12A.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C705	2A	Q864	5E	R824	1D
C730	2F	Q872	5E	R825	2D
C751	1D	Q873	5F	R831	2C
C762	3A	Q878	4E	R832	1C
C780	3B	Q884	3F	R836	1C
C782	4A	Q892	2G	R837	2C
C783	5B			R838	2C
C787	4C	R700	2G	R847	4D
C791	4D	R701	1F	R848	3D
C795	4B	R702	1G	R849	4D
C801	4B	R703	1G	R850	3D
C806	5C	R704	2G	R854	4D
C808	4D	R705	3A	R855	4D
C809	4E	R711	2G	R856	3C
C838	2C	R712	2G	R857	3D
C852	2D	R714	1E	R860	4F
C862	3D	R718	2G	R861	5G
C878	3E	R722	2G	R862	2E
C885	4E	R730	2F	R863	4E
C891	4G	R731	1E	R864	5E
C893	4G	R732	2F	R865	4E
C895	4G	R733	1E	R866	1G
C897	4G	R740	1F	R870	4E
		R742	1E	R871	5E
CR711	2G	R743	1D	R872	5F
CR712	2G	R744	2B	R873	3F
CR767	4B	R747	1B	R874	3F
CR777	4B	R748	1A	R875	3G
CR862	4F	R749	1A	R876	3G
CR863	4E	R750	2E	R877	3G
CR864	4E	R751	2D	R878	4E
CR875	4G	R752	1E	R881	4F
CR878	4E	R753	1D	R882	4F
CR883	4F	R754	1B	R883	3F
CR886	3G	R757	1B	R884	4F
CR891	3G	R758	1B	R886	3G
CR893	3G	R759	1B	R887	3G
CR897	4G	R761	2A	R888	3G
		R762	2A	R891	2G
J702	2A	R763	2A	R892	3G
J704	3A	R764	1A	R893	3H
		R765	4A	R894	3G
L762	2B	R767	4B		
L763	2A	R772	3A	RT823	1C
L764	2A	R773	3A		
L772	3B	R774	4A	TP700	2B
L773	3A	R775	4A	TP712	1E
L774	3A	R777	3B	TP782	4A
L857	2D	R780	5D	TP800	3G
L891	4G	R781	4A	TP824	2D
L893	4G	R782	4A	TP849	3C
L895	4G	R785	4B	TP876	3F
L897	4G	R786	4D	TP878	3E
		R787	4B	TP884	4E
LR885	3E	R788	4B	TP891	4H
		R789	5D	TP893	4H
P782	1G	R791	4C	TP894	3G
P783	1H	R792	4B	TP895	4H
P789	4G	R793	4D	TP897	4H
P790	4F	R795	4C	TP899	4H
		R796	4B		
Q712	2F	R797	4D	U705	2G
Q718	2G	R801	4D	U762	2B
Q722	2G	R802	4B	U782	4A
Q732	2F	R803	4D	U808	4D
Q742	1E	R804	5D	U842	2C
Q748	1A	R805	5B	U862	3E
Q752	1E	R806	4C	U876	3G
Q758	1A	R808	4D		
Q814	1C	R813	1D	VR852	2D
Q824	1D	R814	1C	VR862	3D
Q850	3D	R815	2C	VR878	4E
Q862	4F	R823	1C		

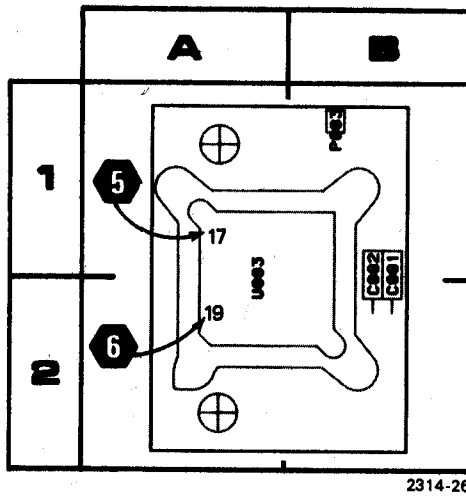


Figure 8-12B. A18-Termination circuit board as

CKT NO	GRID COORD
C881	2B
C882	2B
P883	1B
U883	1A

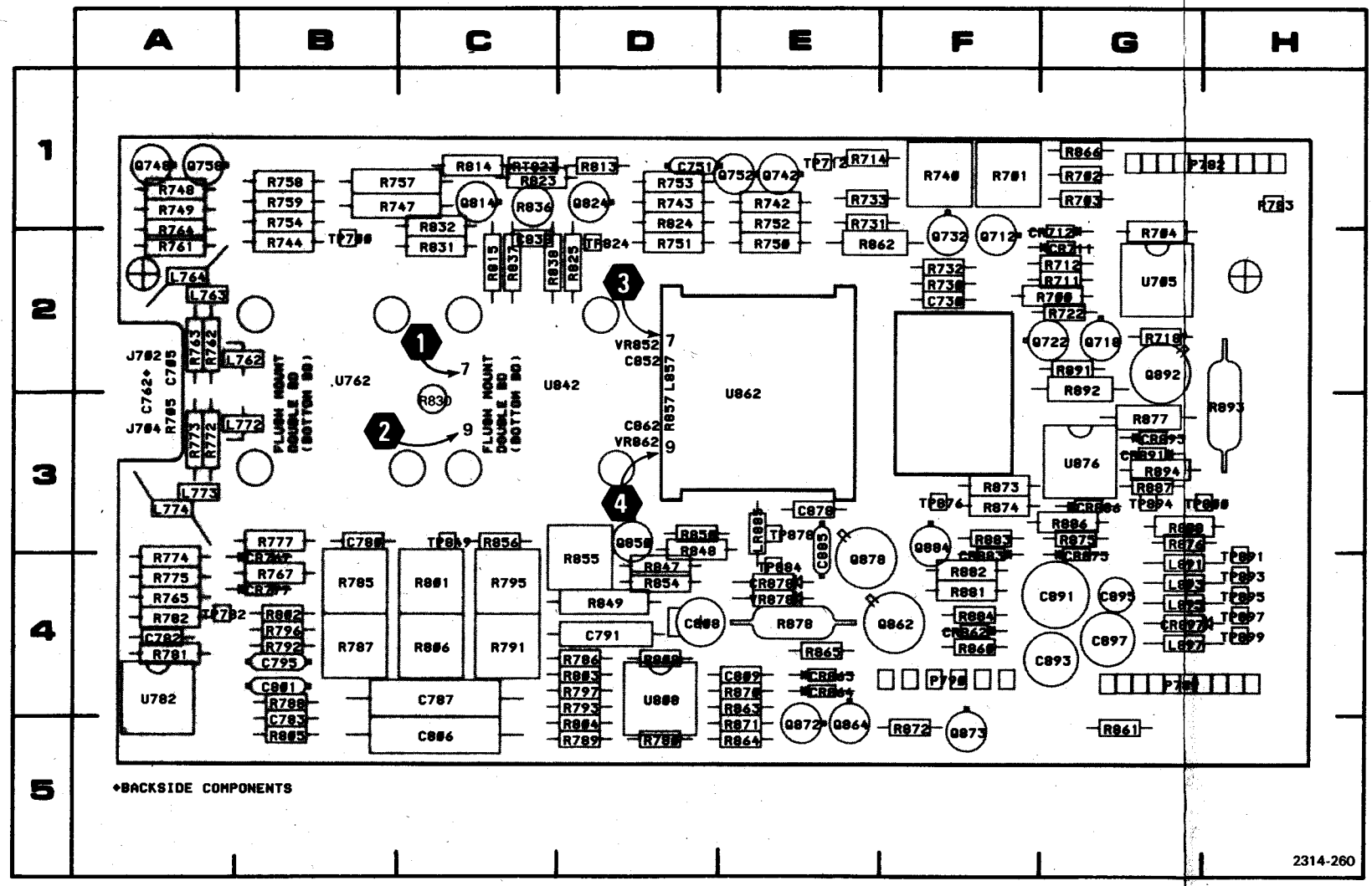
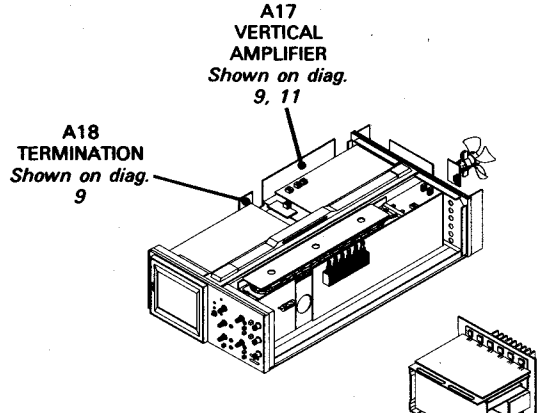


Figure 8-12A. A17-Vertical Amplifier circuit board assembly.



Locator for Figure 8-12A

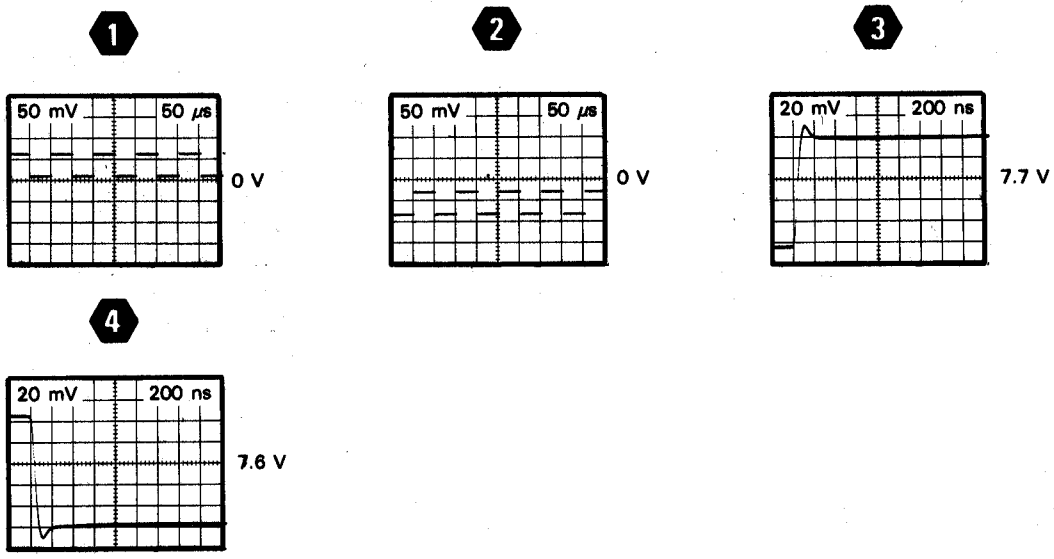
CKT NO	GRID COORD	CKT NO	GRID COORD
C705	2A	Q864	5E
C730	2F	Q872	5E
C751	1D	Q873	5F
C762	3A	Q878	4E
C780	3B	Q884	3F
C782	4A	Q892	2G
C783	5B		
C787	4C	R700	2G
C791	4D	R701	1F
C795	4B	R702	1G
C801	4B	R703	1G
C806	5C	R704	2G
C808	4D	R705	3A
C809	4E	R711	2G
C838	2C	R712	2G
C852	2D	R714	1E
C862	3D	R718	2G
C878	3E	R722	2G
C885	4E	R730	2F
C891	4G	R731	1E
C893	4G	R732	2F
C895	4G	R733	1E
C897	4G	R740	1F
		R742	1E
CR711	2G	R743	1D
CR712	2G	R744	2B
CR767	4B	R747	1B
CR777	4B	R748	1A
CR862	4F	R749	1A
CR863	4E	R750	2E
CR864	4E	R751	2D
CR875	4G	R752	1E
CR878	4E	R753	1D
CR883	4F	R754	1B
CR886	3G	R757	1B
CR891	3G	R758	1B
CR893	3G	R759	1B
CR897	4G	R761	2A
		R762	2A
J702	2A	R763	2A
J704	3A	R764	1A
		R765	4A
L762	2B	R767	4B
L763	2A	R772	3A
L764	2A	R773	3A
L772	3B	R774	4A
L773	3A	R775	4A
L774	3A	R777	3B
L857	2D	R780	5D
L891	4G	R781	4A
L893	4G	R782	4A
L895	4G	R785	4B
L897	4G	R786	4D
		R787	4B
LR885	3E	R788	4B
		R789	5D
P782	1G	R791	4C
P783	1H	R792	4B
P789	4G	R793	4D
P790	4F	R795	4C
		R796	4B

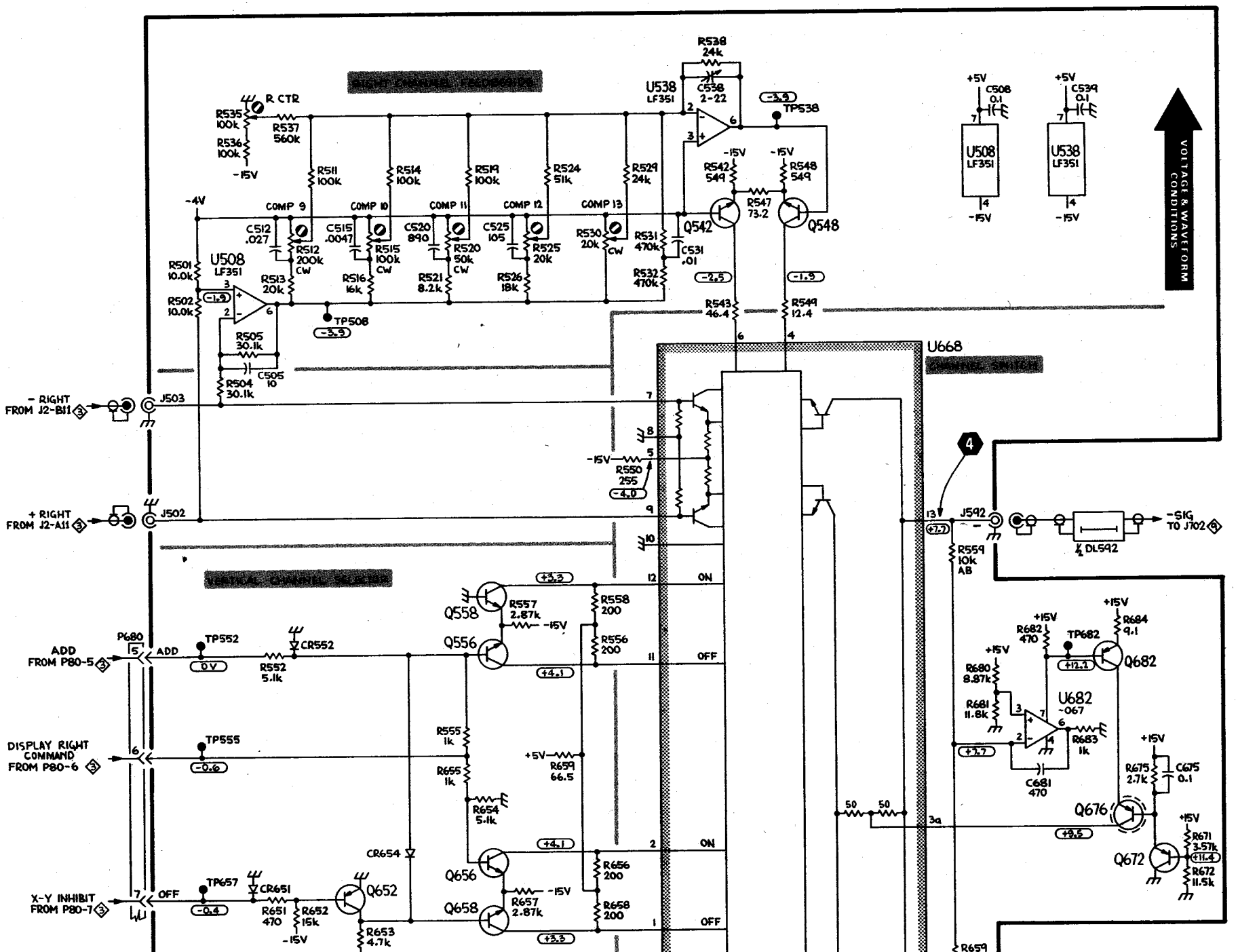
VOLTAGE AND WAVEFORM CONDITIONS

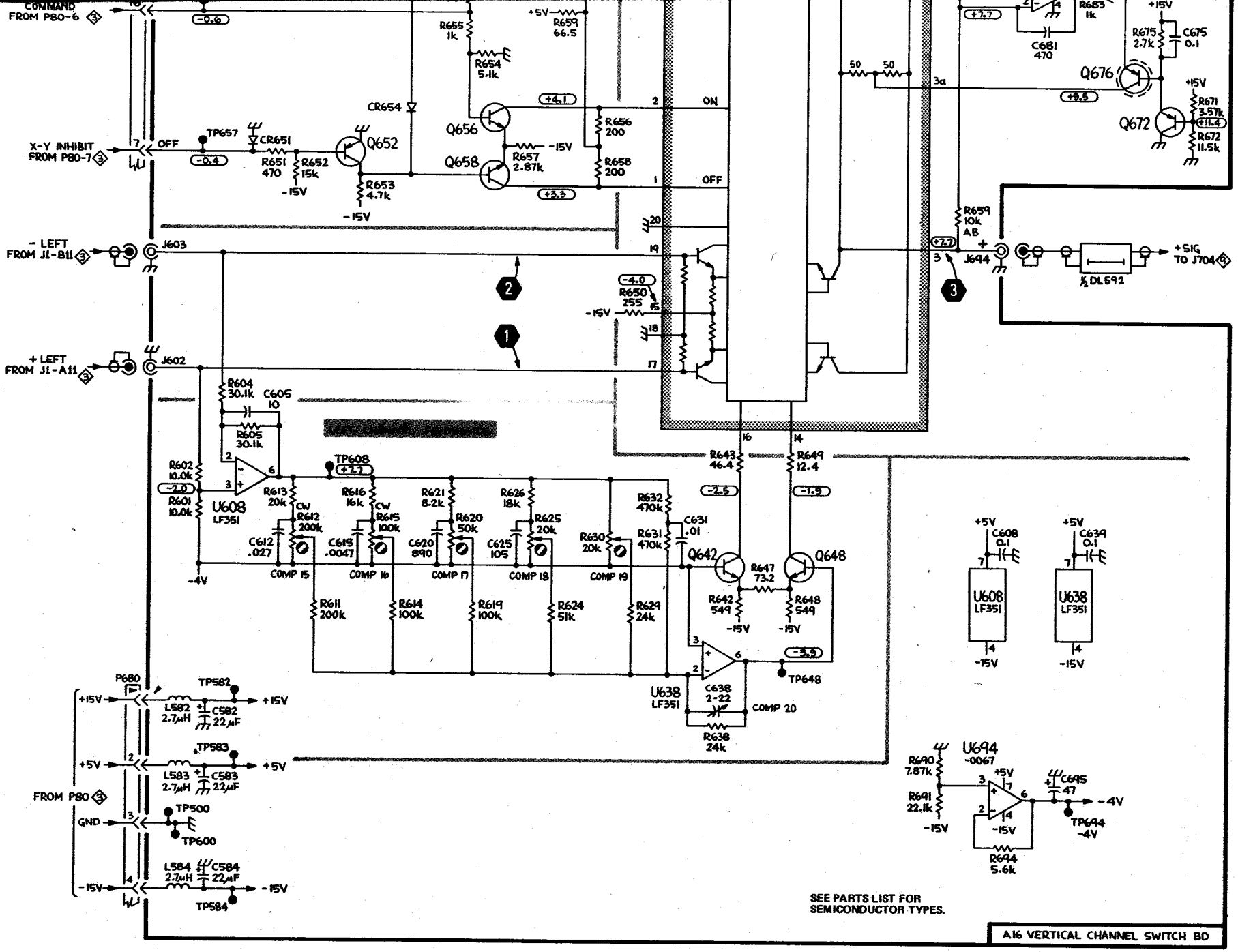
The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B.

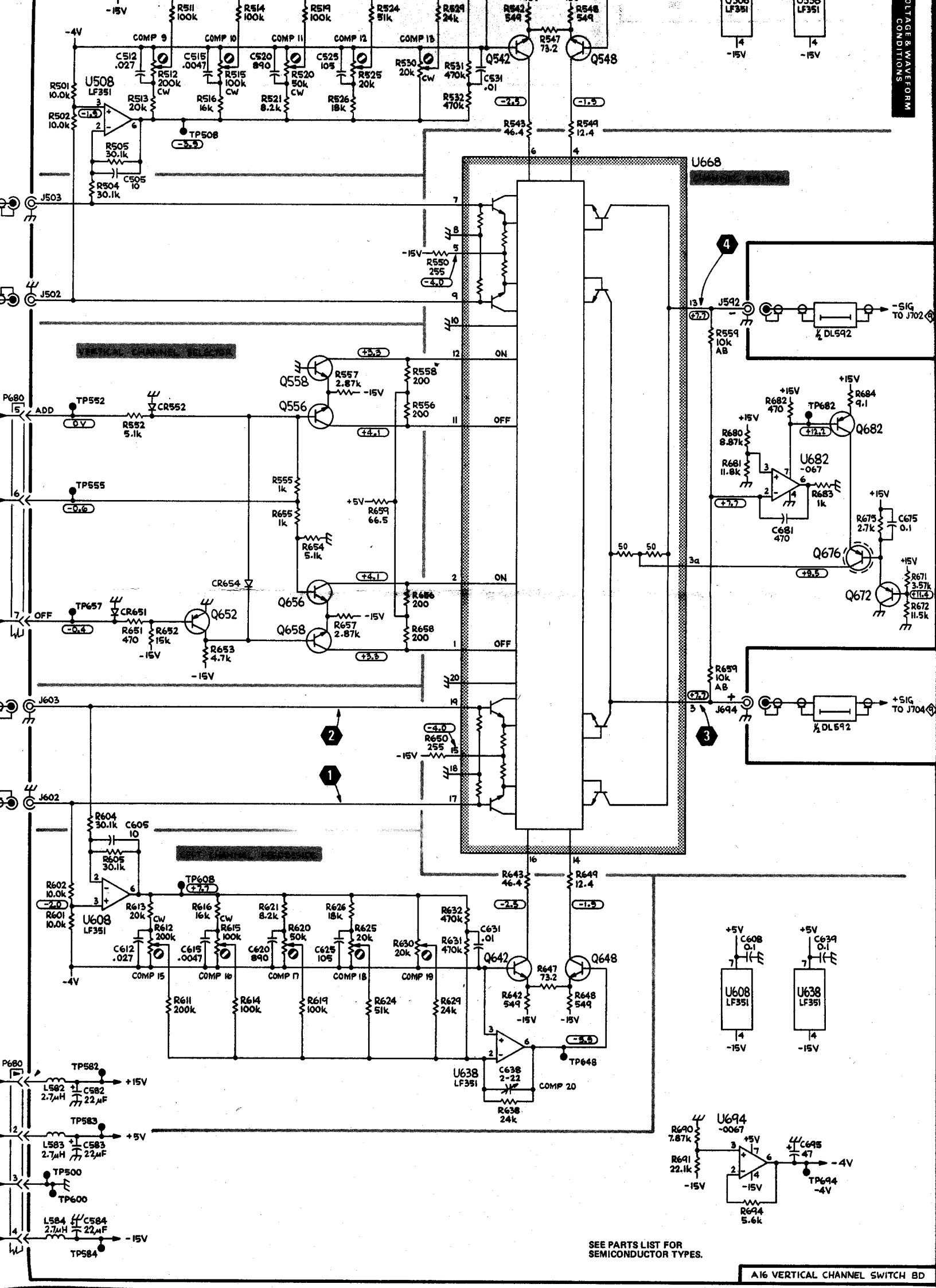
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth. The test oscilloscope was externally triggered from the Pretrig out connector of a 067-0587-02 Calibration Fixture installed in the 7104 LEFT VERT compartment. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) Calibration Fixture: +Step Response, 10 kHz Rep Rate, 6 divisions of vertical display centered at 0 volts. Test oscilloscope time base: 50 ns/div, +Slope, Auto, AC, Ext. A 7B-series time base was installed in the 7104 B HORIZ compartment and set for a free running sweep.




RIGHT CHANNEL PROGRAMMER
R CTR
R535 100k
R536 100k
R537 560k
-15V
R538 24k
C538 2-22
U538 LF351
TP538
R511 100k
R514 100k
R519 100k
R524 51k
R529 24k
COMP 9
COMP 10
COMP 11
COMP 12
COMP 13
C512 .027
C515 .0047
C520 890
C525 105
R512 200k CW
R515 100k CW
R520 50k CW
R525 20k
R530 20k CW
R531 470k
R532 470k
C531 .01
R542 549
R547 73.2
R548 549
Q542
Q548
U508 LF351
R501 10.0k
R502 10.0k
R513 20k
R516 16k
R521 8.2k
R526 18k
TP508
R505 30.1k
C505 10
R504 30.1k
R543 46.4
R549 12.4
+5V C508 0.1
+5V C539 0.1
U508 LF351
U538 LF351
-15V
VOLTAGE & WAVEFORM CONDITIONS
U668
- RIGHT FROM J2-B11
+ RIGHT FROM J2-A11
J503
J502
R550 255
VERTICAL CHANNEL SELECTOR
ADD FROM P80-5
P680
TP552
CR552
R552 5.1k
Q558
Q556
R557 2.87k
R558 200
R556 200
ON
OFF
DISPLAY RIGHT COMMAND FROM P80-6
TP555
R555 1k
R655 1k
R654 5.1k
R659 66.5
X-Y INHIBIT FROM P80-7
TP657
CR651
R651 470
R652 15k
R653 4.7k
Q652
CR654
Q656
Q658
R657 2.87k
R656 200
R658 200
J592
-SIG TO J702
½ DL592
R559 10k AB
50
50
TP682
Q682
R682 470
R684 9.1
R680 8.87k
R681 11.8k
U682 -067
R683 1k
C681 470
R675 2.7k
C675 0.1
Q676
Q672
R671 3.57k
R672 11.5k
R659


COMMAND FROM P80-6
X-Y INHIBIT FROM P80-7
OFF
ON
TP657
CR651
CR654
Q652
Q656
Q658
R651 470
R652 15k
R653 4.7k
R654 5.1k
R655 1k
R656 200
R657 2.87k
R658 200
R659 66.5
-15V
+5V
+4.1
+3.3
-0.4
-0.6
- LEFT FROM J1-B11
+ LEFT FROM J1-A11
J603
J602
R604 30.1k
C605 10
R605 30.1k
R602 10.0k
R601 10.0k
U608 LF351
TP608
R613 20k
R616 16k
R621 8.2k
R626 18k
R632 470k
R630 20k
R631 470k
C631 .01
R612 200k
R615 100k
R620 50k
R625 20k
C612 .027
C615 .0047
C620 890
C625 105
COMP 15
COMP 16
COMP 17
COMP 18
COMP 19
R611 200k
R614 100k
R619 100k
R624 51k
R629 24k
-4V
R643 46.4
R649 12.4
Q642
Q648
R647 73.2
R642 549
R648 549
U638 LF351
C638 2-22
COMP 20
R638 24k
TP648
-2.0
-2.5
-1.5
-5.9
R659 10k AB
J694
+SIG TO J704
½ DL592
R650 255
-4.0
+7.7
+11.4
+9.5
Q676
Q672
R675 2.7k
C675 0.1
C681 470
R683 1k
R671 3.57k
R672 11.5k
50
50
3a
C608 0.1
C639 0.1
U608 LF351
U638 LF351
P680
TP582
TP583
TP500
TP600
TP584
L582 2.7μH
C582 22μF
L583 2.7μH
C583 22μF
L584 2.7μH
C584 22μF
FROM P80
GND
U694 -0067
R690 7.87k
R691 22.1k
R694 5.6k
C695 47
TP694 -4V
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
A16 VERTICAL CHANNEL SWITCH BD


VOLTAGE & WAVEFORM CONDITIONS
U668
VERTICAL CHANNEL SELECTION
LEFT CHANNEL SELECTION
U508 LF351
U608 LF351
U638 LF351
U682 -067
U694 -0067
Q542
Q548
Q642
Q648
Q556
Q558
Q656
Q658
Q652
Q676
Q672
Q682
J503
J502
J603
J602
J592
J694
P680
TP508
TP552
TP555
TP657
TP608
TP648
TP682
TP582
TP583
TP500
TP600
TP584
TP694
CR552
CR654
CR651
COMP 9
COMP 10
COMP 11
COMP 12
COMP 13
COMP 15
COMP 16
COMP 17
COMP 18
COMP 19
COMP 20
ADD
ON
OFF
-SIG TO J702
+SIG TO J704
½ DL592
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
A16 VERTICAL CHANNEL SWITCH BD

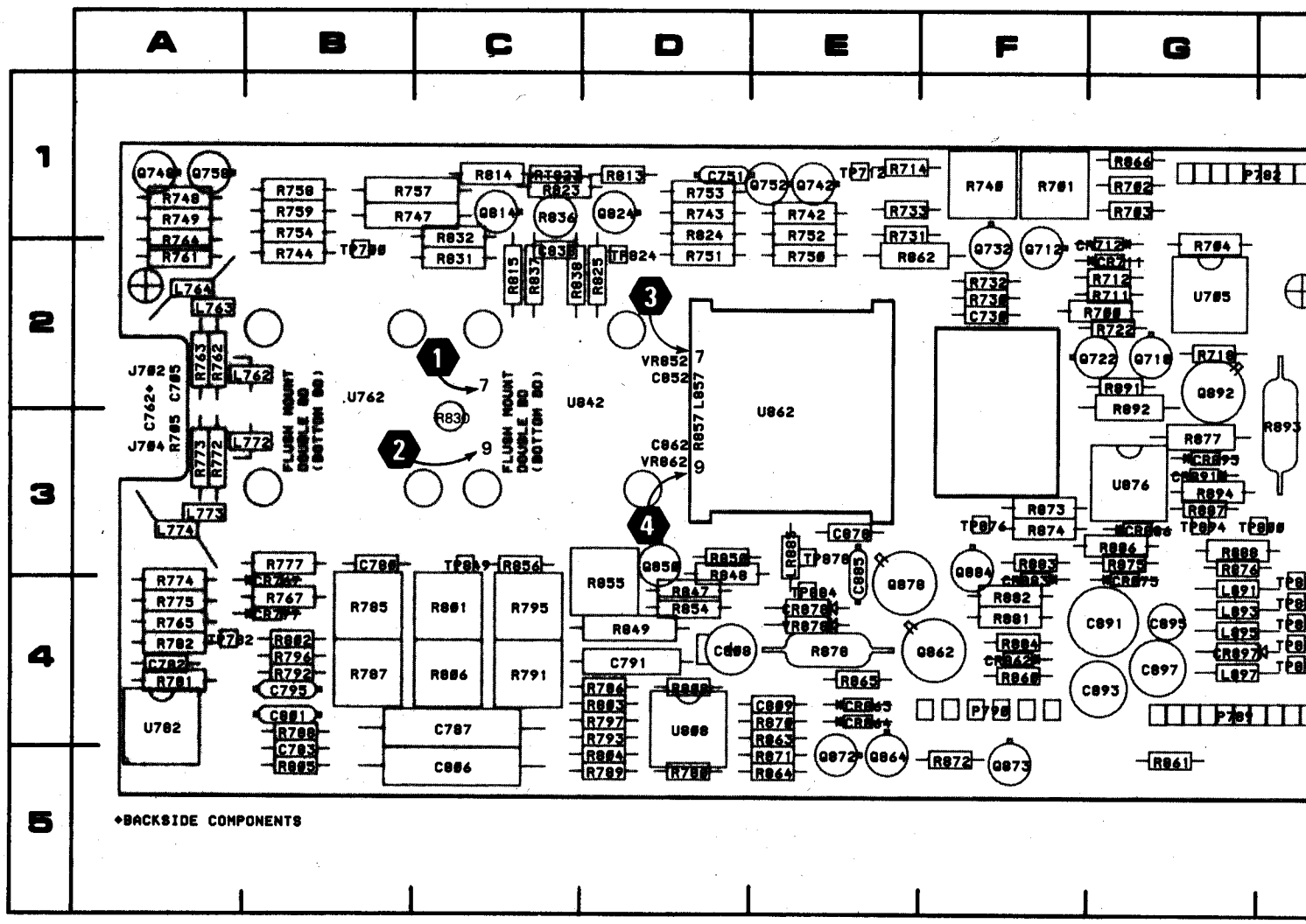
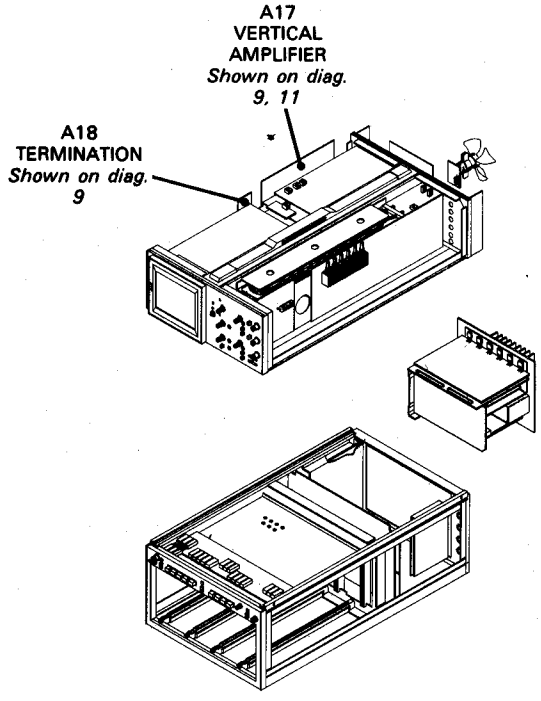


Figure 8-12A. A17-Vertical Amplifier circuit board assembly.



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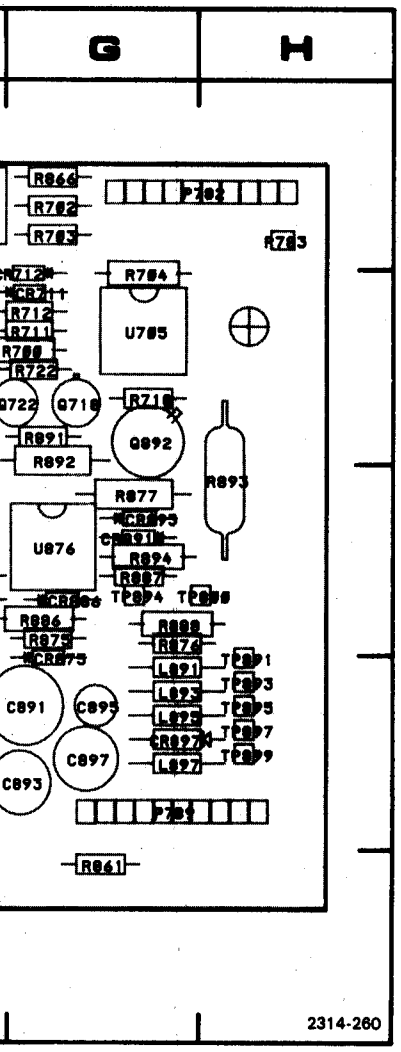


Locator for Figure 8-12A.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C705	2A	Q864	5E	R824	1D
C730	2F	Q872	5E	R825	2D
C751	1D	Q873	5F	R831	2C
C762	3A	Q878	4E	R832	1C
C780	3B	Q884	3F	R836	1C
C782	4A	Q892	2G	R837	2C
C783	5B			R838	2C
C787	4C	R700	2G	R847	4D
C791	4D	R701	1F	R848	3D
C795	4B	R702	1G	R849	4D
C801	4B	R703	1G	R850	3D
C806	5C	R704	2G	R854	4D
C808	4D	R705	3A	R855	4D
C809	4E	R711	2G	R856	3C
C838	2C	R712	2G	R857	3D
C852	2D	R714	1E	R860	4F
C862	3D	R718	2G	R861	5G
C878	3E	R722	2G	R862	2E
C885	4E	R730	2F	R863	4E
C891	4G	R731	1E	R864	5E
C893	4G	R732	2F	R865	4E
C895	4G	R733	1E	R866	1G
C897	4G	R740	1F	R870	4E
		R742	1E	R871	5E
CR711	2G	R743	1D	R872	5F
CR712	2G	R744	2B	R873	3F
CR767	4B	R747	1B	R874	3F
CR777	4B	R748	1A	R875	3G
CR862	4F	R749	1A	R876	3G
CR863	4E	R750	2E	R877	3G
CR864	4E	R751	2D	R878	4E
CR875	4G	R752	1E	R881	4F
CR878	4E	R753	1D	R882	4F
CR883	4F	R754	1B	R883	3F
CR886	3G	R757	1B	R884	4F
CR891	3G	R758	1B	R886	3G
CR893	3G	R759	1B	R887	3G
CR897	4G	R761	2A	R888	3G
		R762	2A	R891	2G
J702	2A	R763	2A	R892	3G
J704	3A	R764	1A	R893	3H
		R765	4A	R894	3G
L762	2B	R767	4B		
L763	2A	R772	3A	RT823	1C
L764	2A	R773	3A		
L772	3B	R774	4A	TP700	2B
L773	3A	R775	4A	TP712	1E
L774	3A	R777	3B	TP782	4A
L857	2D	R780	5D	TP800	3G
L891	4G	R781	4A	TP824	2D
L893	4G	R782	4A	TP849	3C
L895	4G	R785	4B	TP876	3F
L897	4G	R786	4D	TP878	3E
		R787	4B	TP884	4E
LR885	3E	R788	4B	TP891	4H
		R789	5D	TP893	4H
P782	1G	R791	4C	TP894	3G
P783	1H	R792	4B	TP895	4H
P789	4G	R793	4D	TP897	4H
P790	4F	R795	4C	TP899	4H
		R796	4B		
Q712	2F	R797	4D	U705	2G
Q718	2G	R801	4D	U762	2B
Q722	2G	R802	4B	U782	4A
Q732	2F	R803	4D	U808	4D
Q742	1E	R804	5D	U842	2C
Q748	1A	R805	5B	U862	3E
Q752	1E	R806	4C	U876	3G
Q758	1A	R808	4D		
Q814	1C	R813	1D	VR852	2D
Q824	1D	R814	1C	VR862	3D
Q850	3D	R815	2C	VR878	4E
Q862	4F	R823	1C		

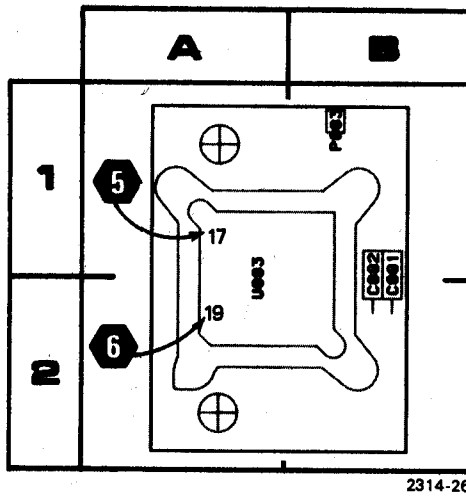


Figure 8-12B. A18-Termination circuit board as

CKT NO	GRID COORD
C881	2B
C882	2B
P883	1B
U883	1A

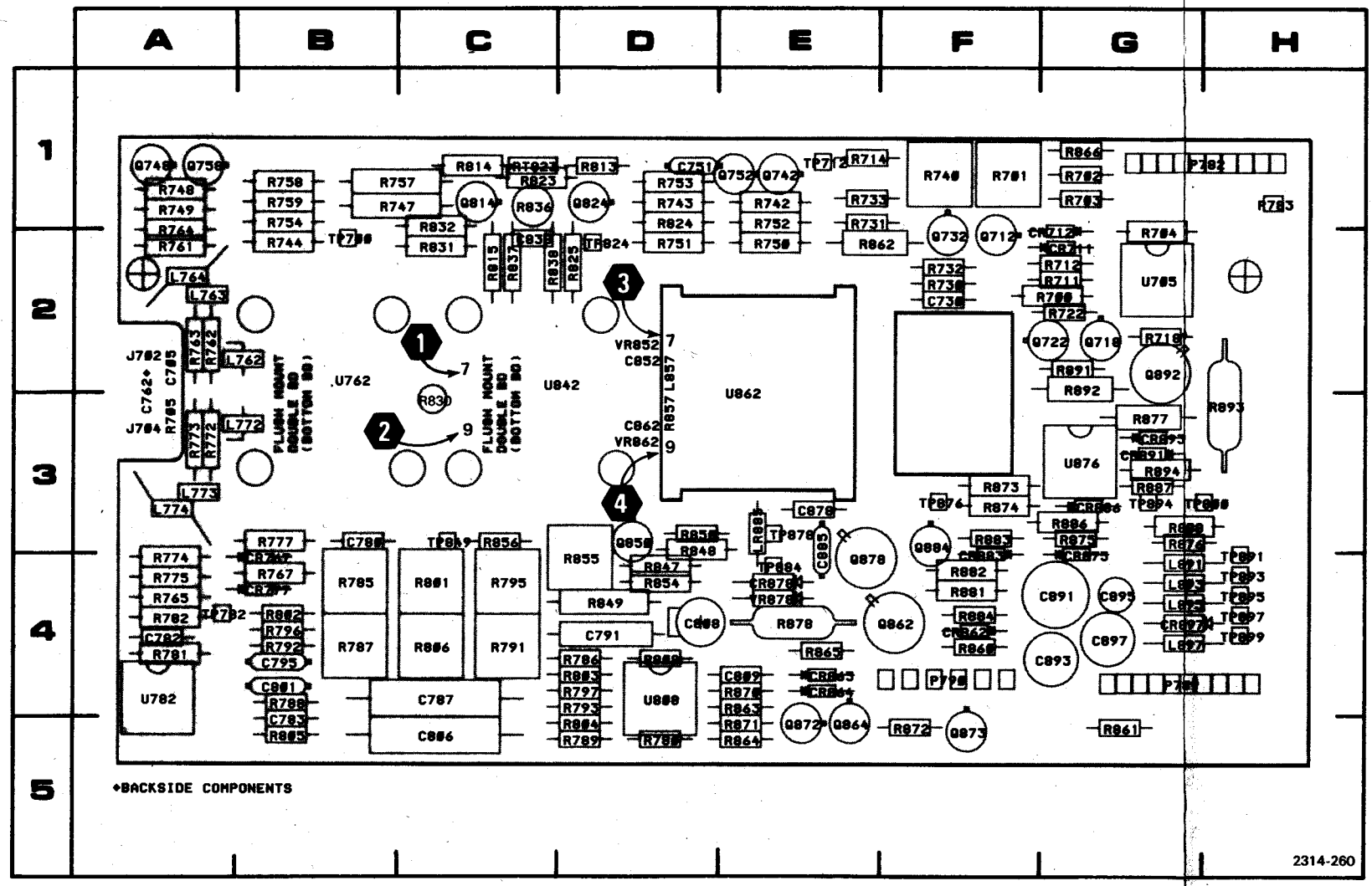
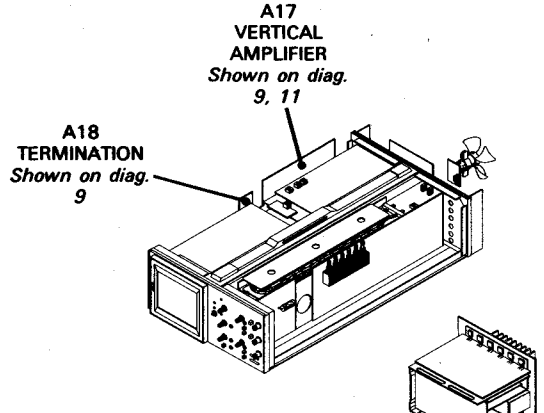


Figure 8-12A. A17-Vertical Amplifier circuit board assembly.



Locator for Figure 8-12A

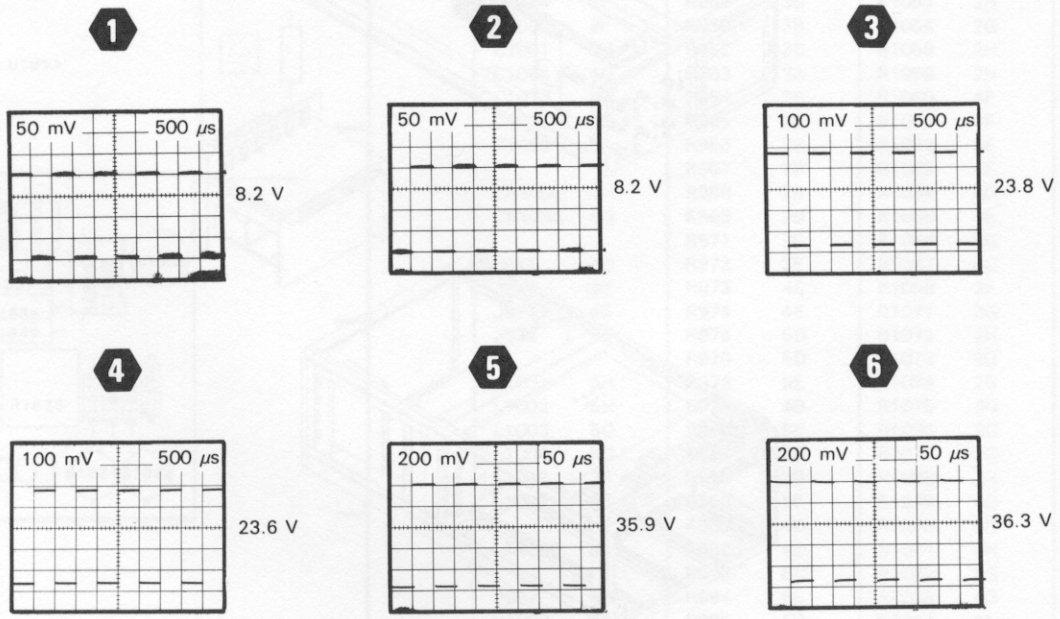
CKT NO	GRID COORD	CKT NO	GRID COORD
C705	2A	Q864	5E
C730	2F	Q872	5E
C751	1D	Q873	5F
C762	3A	Q878	4E
C780	3B	Q884	3F
C782	4A	Q892	2G
C783	5B		
C787	4C	R700	2G
C791	4D	R701	1F
C795	4B	R702	1G
C801	4B	R703	1G
C806	5C	R704	2G
C808	4D	R705	3A
C809	4E	R711	2G
C838	2C	R712	2G
C852	2D	R714	1E
C862	3D	R718	2G
C878	3E	R722	2G
C885	4E	R730	2F
C891	4G	R731	1E
C893	4G	R732	2F
C895	4G	R733	1E
C897	4G	R740	1F
		R742	1E
CR711	2G	R743	1D
CR712	2G	R744	2B
CR767	4B	R747	1B
CR777	4B	R748	1A
CR862	4F	R749	1A
CR863	4E	R750	2E
CR864	4E	R751	2D
CR875	4G	R752	1E
CR878	4E	R753	1D
CR883	4F	R754	1B
CR886	3G	R757	1B
CR891	3G	R758	1B
CR893	3G	R759	1B
CR897	4G	R761	2A
		R762	2A
J702	2A	R763	2A
J704	3A	R764	1A
		R765	4A
L762	2B	R767	4B
L763	2A	R772	3A
L764	2A	R773	3A
L772	3B	R774	4A
L773	3A	R775	4A
L774	3A	R777	3B
L857	2D	R780	5D
L891	4G	R781	4A
L893	4G	R782	4A
L895	4G	R785	4B
L897	4G	R786	4D
		R787	4B
LR885	3E	R788	4B
		R789	5D
P782	1G	R791	4C
P783	1H	R792	4B
P789	4G	R793	4D
P790	4F	R795	4C
		R796	4B

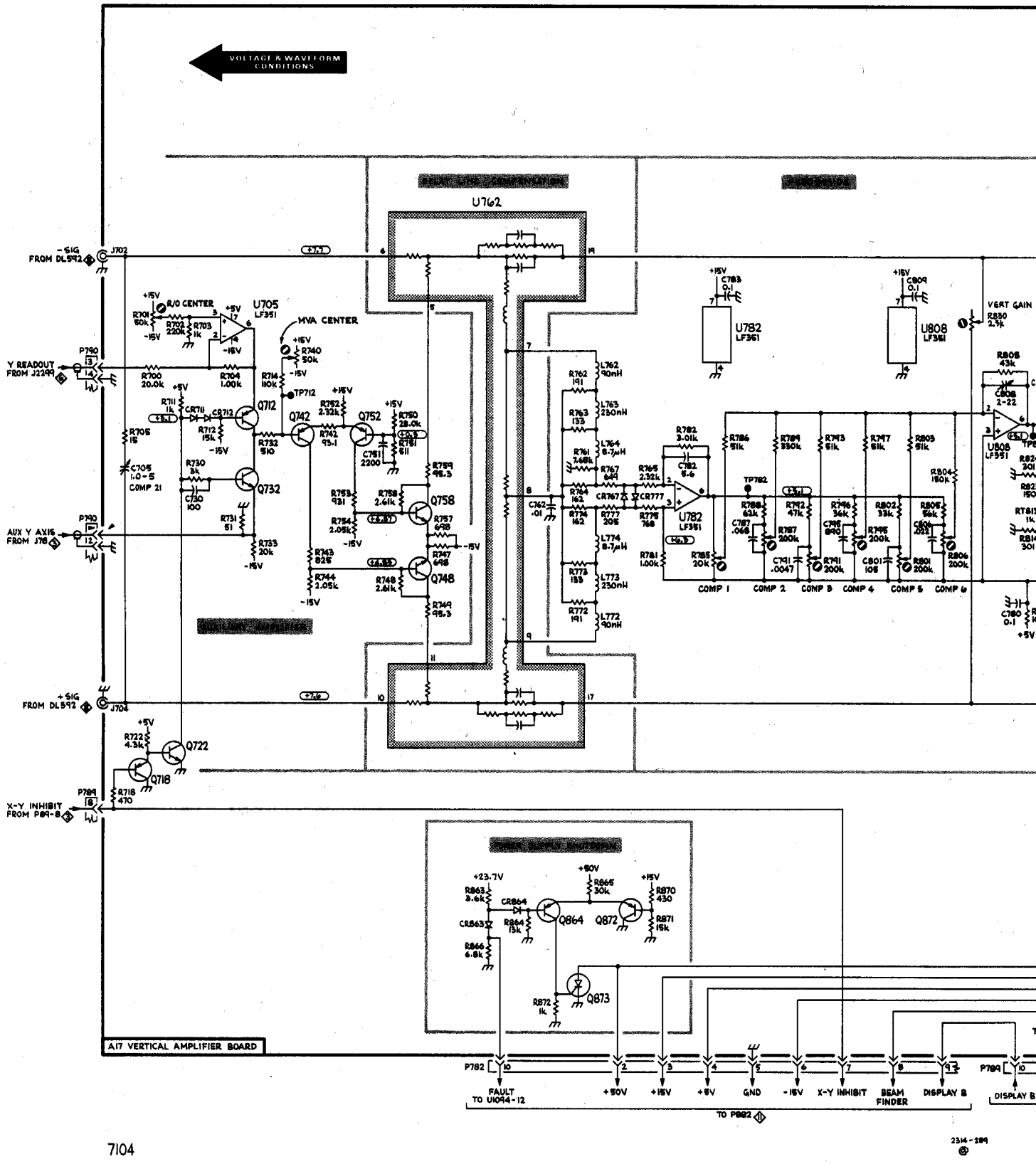
VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B; CALIBRATOR, 4V.

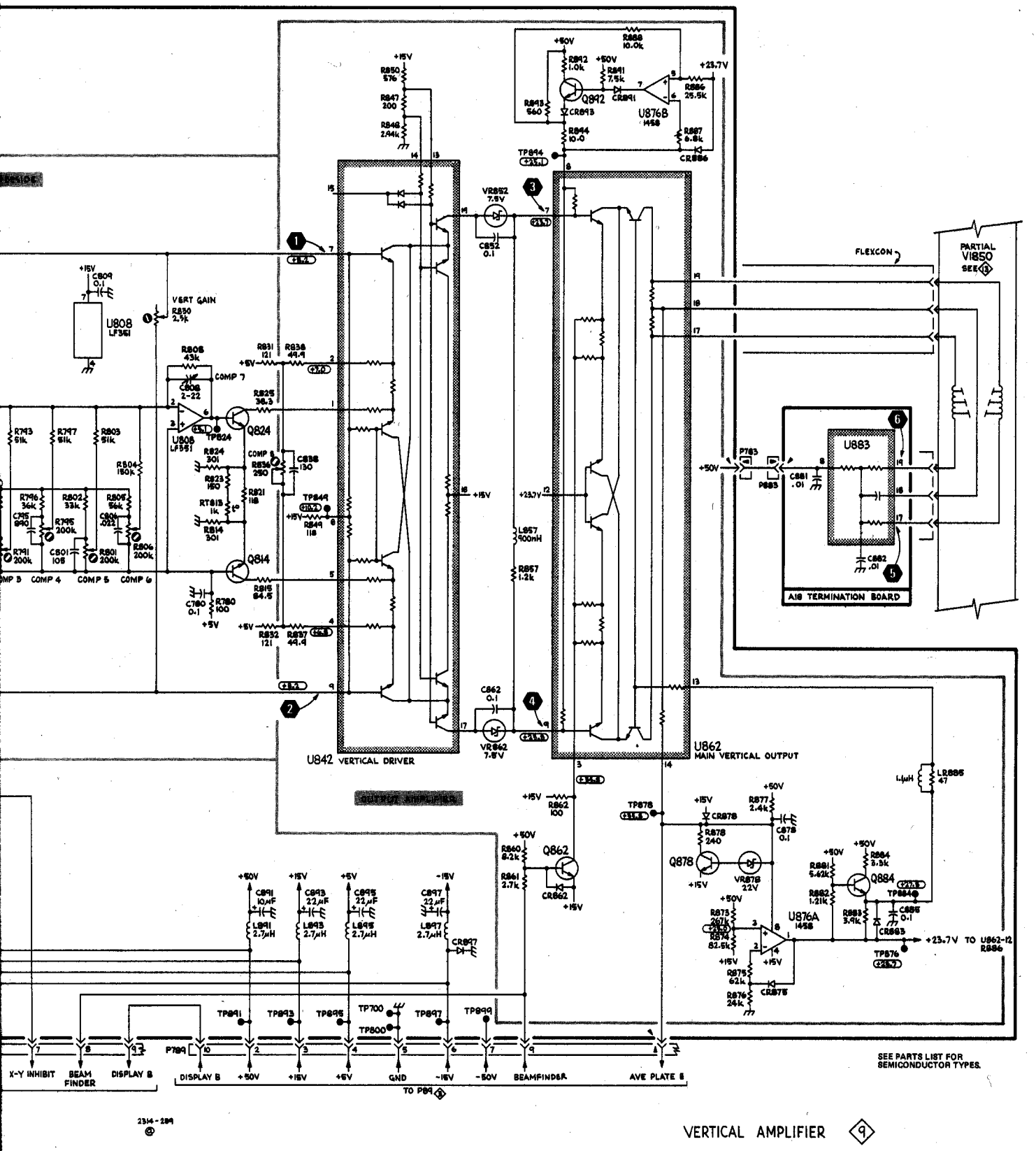
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

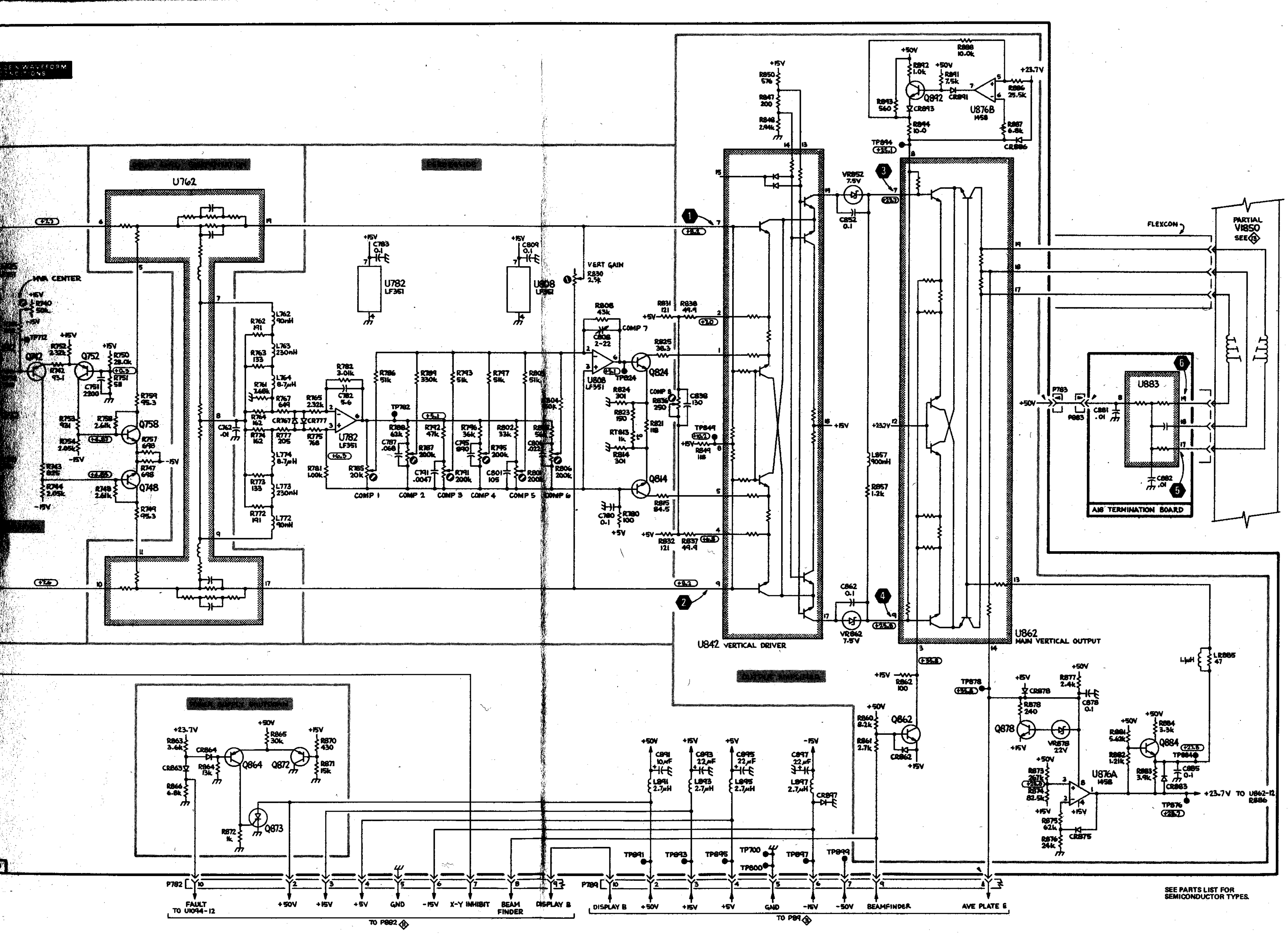
Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 MΩ input impedance and at least 60 MHz bandwidth. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) A 7B-series vertical amplifier plug-in was installed in the 7104 LEFT VERT compartment and a 7B-series time base plug-in in the 7104 B HORIZ compartment. The vertical amplifier was set for a 6 to 8 division 7104 display with the CALIBRATOR output fed to the vertical amplifier input. The oscilloscope time base was externally triggered with the CALIBRATOR signal.

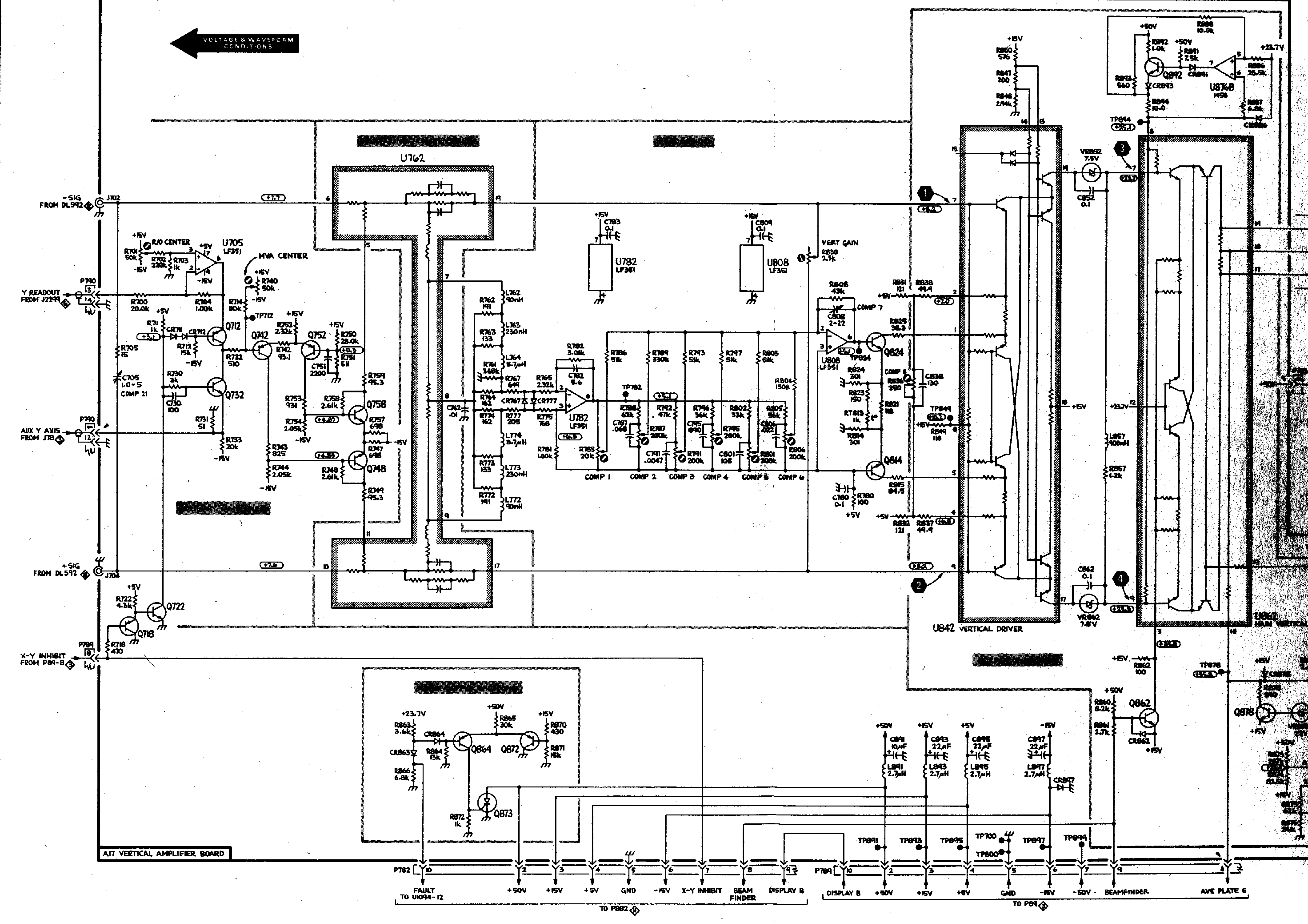



VOLTAGE & WAVEFORM CONDITIONS
U762
U782 LF361
U808 LF361
U705 LF351
U782 LF351
U808 LF351
-SIG FROM DL592
+SIG FROM DL592
Y READOUT FROM J2299
AUX Y AXIS FROM J78
X-Y INHIBIT FROM P84-8
R/O CENTER
MVA CENTER
VERT GAIN
COMP 1
COMP 2
COMP 3
COMP 4
COMP 5
COMP 6
A17 VERTICAL AMPLIFIER BOARD
FAULT TO U1094-12
+50V
+15V
+5V
GND
-15V
X-Y INHIBIT
BEAM FINDER
DISPLAY B
TO P882

2314-289


U842 VERTICAL DRIVER
U862 MAIN VERTICAL OUTPUT
U808 LF361
U808 LF351
U883
A18 TERMINATION BOARD
U876A 1458
U8768 1458
FLEXCON
PARTIAL V1850 SEE 18
VERT GAIN R830 2.5k
COMP 7
COMP 4
COMP 5
COMP 6
Q824
Q814
Q842
Q862
Q878
Q884
VR852 7.5V
VR862 7.5V
VR878 2.2V
CR843
CR891
CR886
CR862
CR878
CR875
CR897
CR883
L857 400nH
L895 1.4µH
L891 2.7µH
L893 2.7µH
L895 2.7µH
L897 2.7µH
TP824
TP844
TP849
TP878
TP884
TP876
TP891
TP893
TP895
TP700
TP800
TP897
TP899
P783
P883
P789
+23.7V TO U862-12 R886
X-Y INHIBIT
BEAM FINDER
DISPLAY B
DISPLAY B
+50V
+15V
+5V
GND
-15V
-50V
BEAMFINDER
AVE PLATE B
TO P84
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2314-284
VERTICAL AMPLIFIER 9


U762
U782 LF361
U808 LF361
VERT GAIN R830 2.5k
U808 LF351
U782 LF351
COMP 1
COMP 2
COMP 3
COMP 4
COMP 5
COMP 6
COMP 7
COMP 8
U842 VERTICAL DRIVER
U862 MAIN VERTICAL OUTPUT
U876B 1458
U876A 1458
A18 TERMINATION BOARD
U883
PARTIAL V1850
FLEXCON
HVA CENTER
P782
P784
FAULT TO U1044-12
+50V
+15V
+5V
GND
-15V
X-Y INHIBIT
BEAM FINDER
DISPLAY B
-50V
BEAMFINDER
AVE PLATE E
TO P882
TO P881
+23.7V TO U862-12 R886
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.


VOLTAGE & WAVEFORM CONDITIONS
U762
U705 LF351
R/O CENTER
MVA CENTER
-SIG FROM DL592
+SIG FROM DL592
Y READOUT FROM J2299
AUX Y AXIS FROM J78
X-Y INHIBIT FROM P89-8
U782 LF351
U808 LF351
VERT GAIN
COMP 1
COMP 2
COMP 3
COMP 4
COMP 5
COMP 6
COMP 7
COMP 21
U842 VERTICAL DRIVER
U876B 1458
A17 VERTICAL AMPLIFIER BOARD
P782
FAULT TO U1044-12
+50V
+15V
+5V
GND
-15V
X-Y INHIBIT
BEAM FINDER
DISPLAY B
TO P882
P789
-50V
BEAMFINDER
AVE PLATE E
TO P89

2314-289

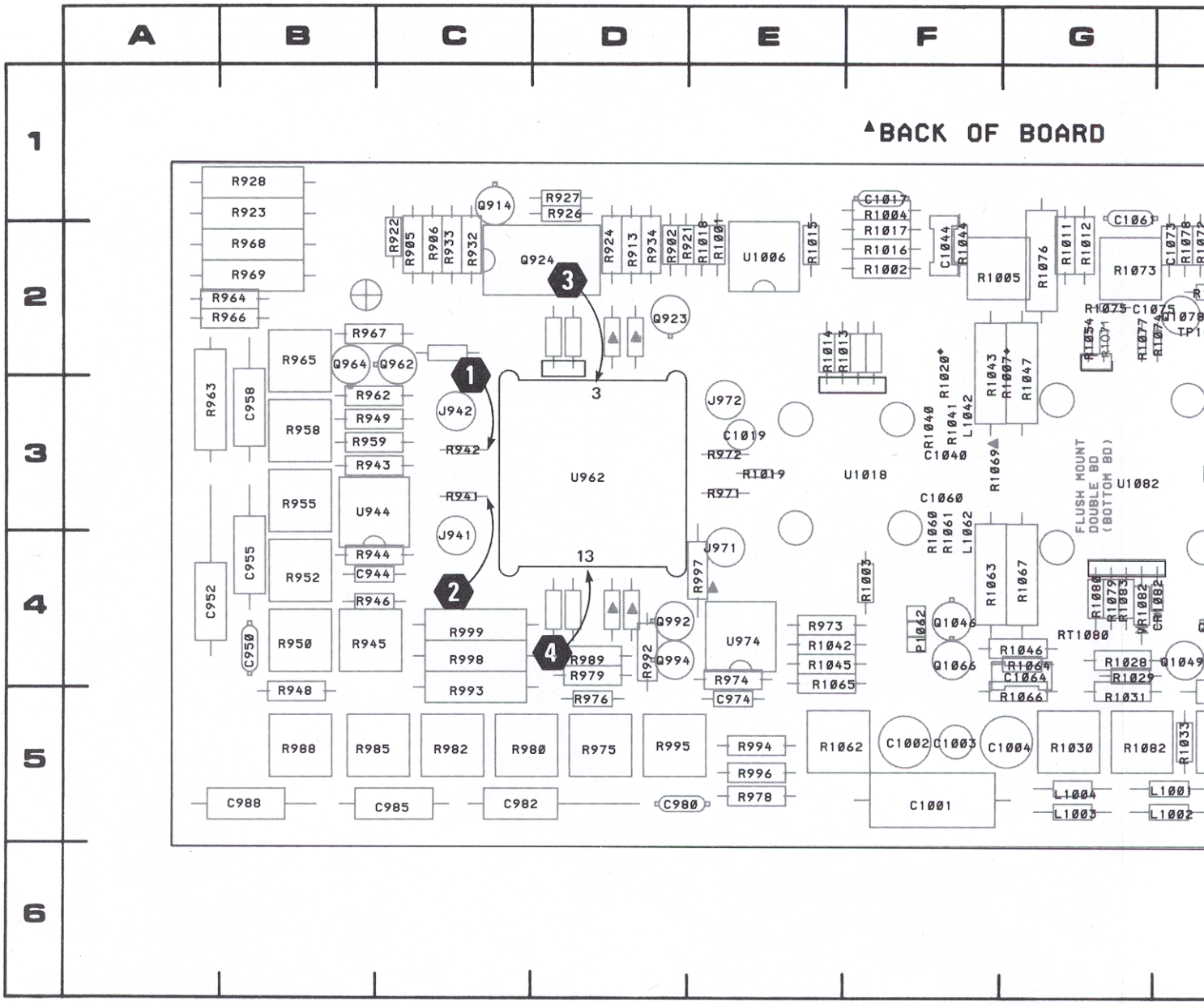
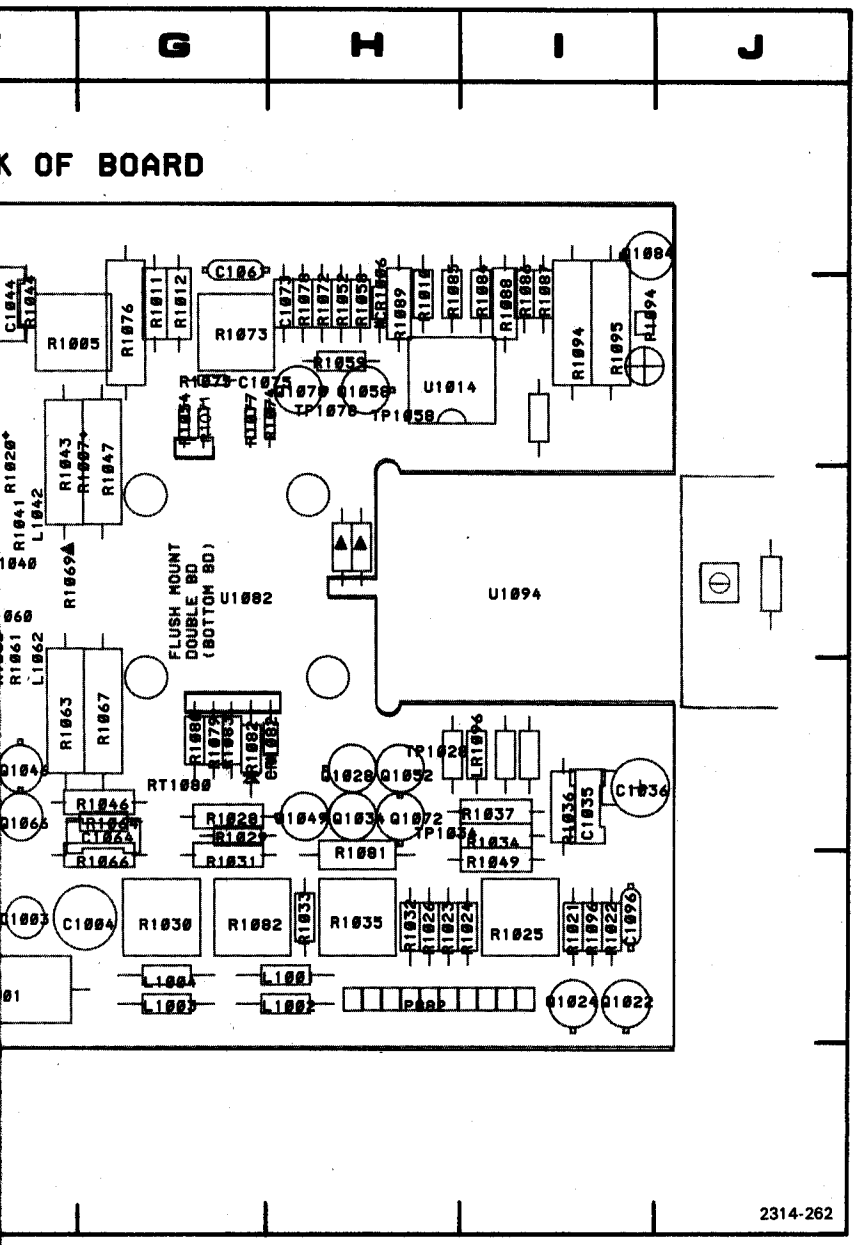


Figure 8-13. A19 Horizontal Amplifier circuit board assembly.



board assembly.

Locator for Figure 8-13.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C944	4B	R923	1B	R1029	4G
C950	4B	R924	2D	R1030	5G
C952	4A	R926	1D	R1031	5G
C955	4B	R927	1D	R1032	5H
C958	3B	R928	1B	R1033	5H
C974	5E	R932	2C	R1034	4I
C980	5D	R933	2C	R1035	5H
C982	5C	R934	2D	R1036	4I
C985	5C	R941	3C	R1037	4I
C988	5B	R942	3C	R1040	3F
C1001	5F	R944	4B	R1041	3F
C1002	5F	R945	4B	R1042	4E
C1003	5F	R946	4B	R1043	3F
C1004	5G	R948	5B	R1044	2F
C1017	1F	R949	3B	R1045	4E
C1019	3E	R950	4B	R1046	4G
C1035	4I	R952	4B	R1047	2G
C1036	4I	R955	3B	R1049	5I
C1044	2F	R958	3B	R1052	2H
C1060	3F	R959	3B	R1054	2G
C1061	2G	R962	3B	R1058	2H
C1064	4G	R963	3A	R1059	2H
C1073	2H	R964	2B	R1060	4F
C1075	2G	R965	2B	R1061	4F
C1096	5I	R966	2B	R1062	5E
		R967	2B	R1063	4F
CR1006	2H	R968	2B	R1064	4G
CR1082	4G	R969	2B	R1065	4E
		R971	3E	R1066	5G
J941	4C	R972	3E	R1067	4G
J942	3C	R973	4E	R1069	3F
J971	4E	R974	4E	R1071	2G
J972	3E	R975	5D	R1072	2H
		R976	5D	R1073	2G
L1001	5H	R978	5E	R1074	2G
L1002	5H	R979	4D	R1075	2G
L1003	5G	R980	5C	R1076	2G
L1004	5G	R982	5C	R1077	2G
L1042	3F	R985	5B	R1078	2H
L1062	4F	R988	5B	R1079	4G
		R989	4D	R1080	4G
LR1096	4I	R992	4D	R1081	5H
		R993	5C	R1082	5G
P882	5H	R994	5E	R1083	4G
P1062	4F	R995	5D	R1084	1I
P1094	1I	R996	5E	R1085	2H
		R997	4E	R1086	1I
Q914	1C	R998	4C	R1087	1I
Q923	2D	R999	4C	R1088	1I
Q924	2D	R1001	2E	R1089	2H
Q964	2B	R1002	2F	R1094	1I
Q992	4D	R1003	4F	R1095	1I
Q994	4D	R1004	1F	R1096	5I
Q1022	5I	R1005	2F		
Q1024	5I	R1007	2G	RT1080	4G
Q1028	4H	R1010	2H		
Q1034	4H	R1011	2G	TP1028	4H
Q1046	4F	R1013	2E	TP1034	4H
Q1049	4H	R1014	2E	TP1058	2H
Q1052	4H	R1015	2E	TP1078	2H
Q1058	2H	R1016	2F		
Q1066	4F	R1017	2F	U944	3B
Q1072	4H	R1018	2E	U962	3D
Q1078	2H	R1019	3E	U974	4E
Q1084	1I	R1020	3F	U1006	2E
		R1021	5I	U1014	2H
R902	2D	R1022	5I	U1018	3F
R905	2C	R1023	5H	U1082	3G
R906	2C	R1024	5I	U1094	3I
R913	2D	R1025	5I		
R921	2D	R1026	5H	VR1082	4G
R922	2C	R1028	4G		

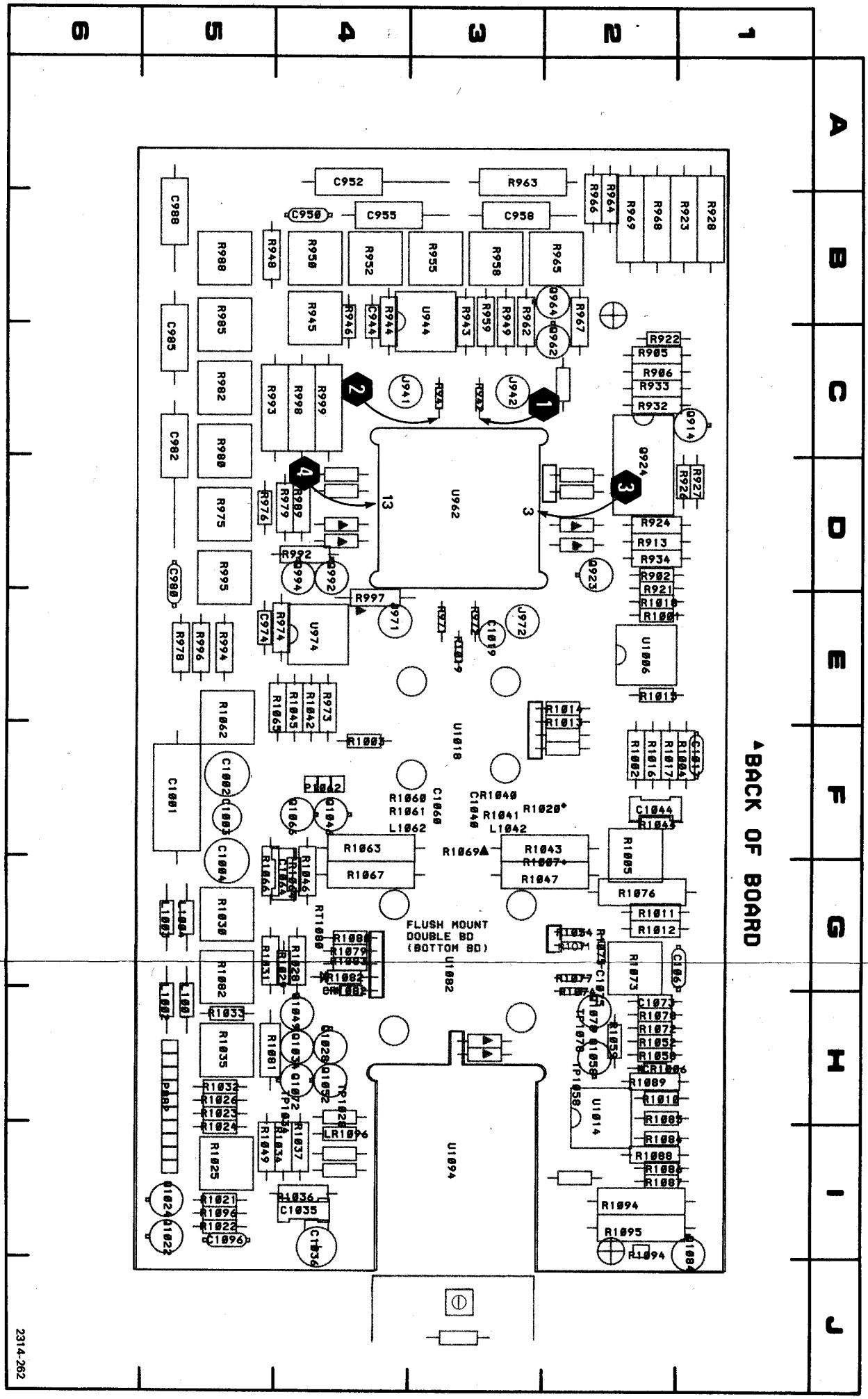
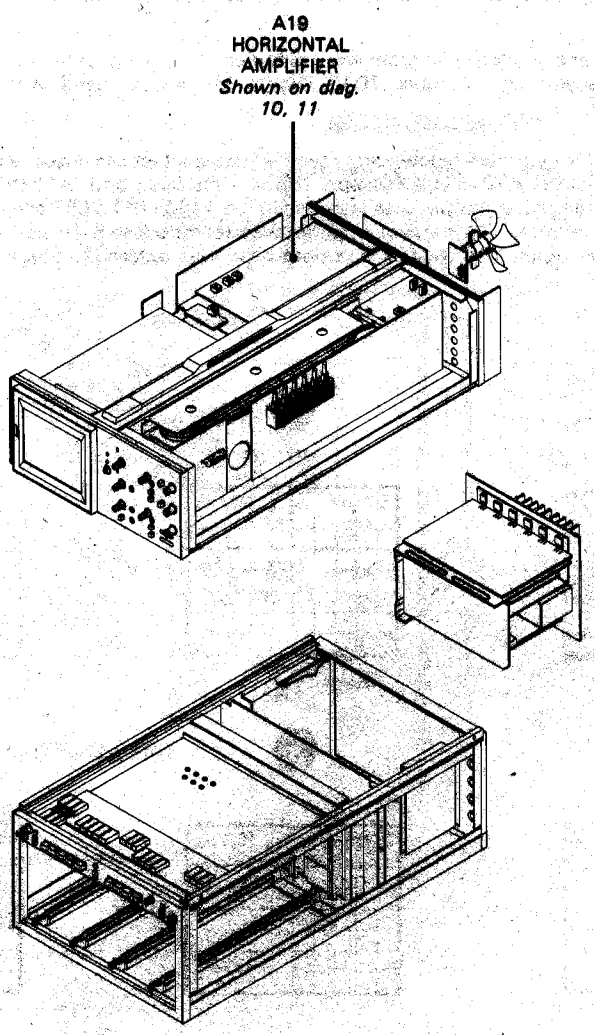


Figure 8-13. A19 Horizontal Amplifier circuit board assembly.

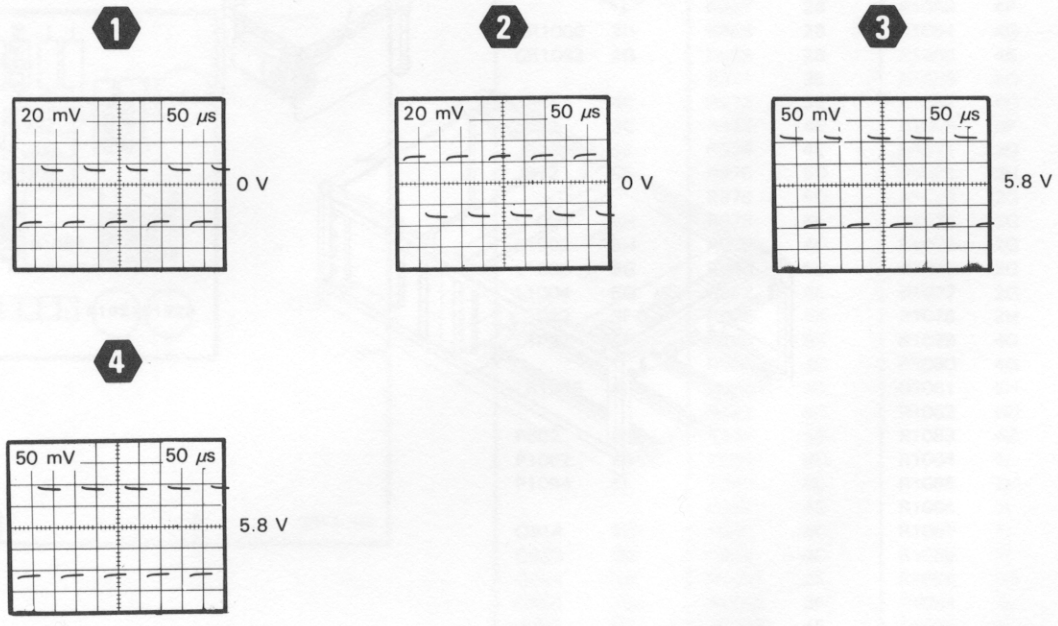

A19
HORIZONTAL
AMPLIFIER
Shown on diag.
10, 11

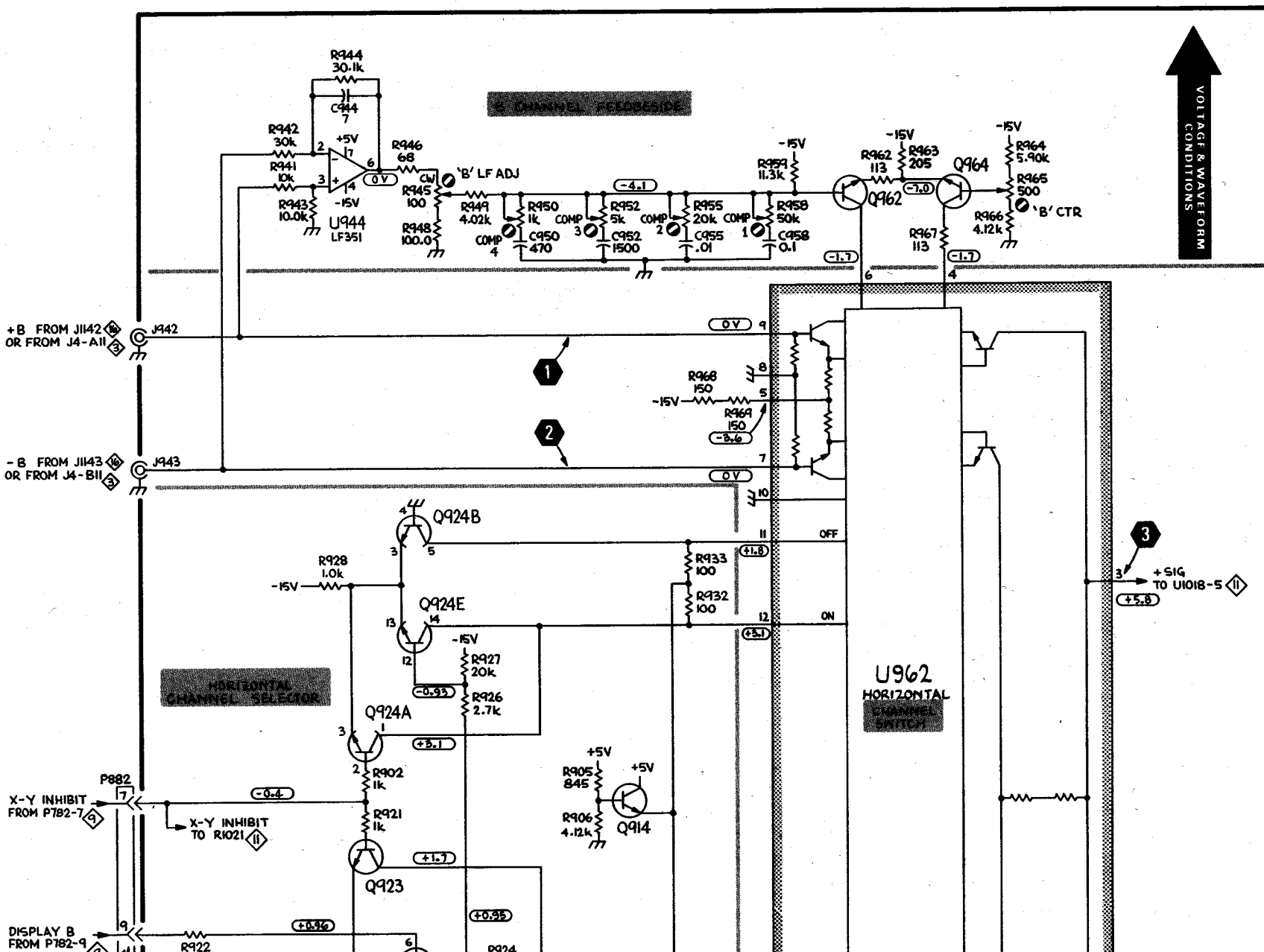
VOLTAGE AND WAVEFORM CONDITIONS

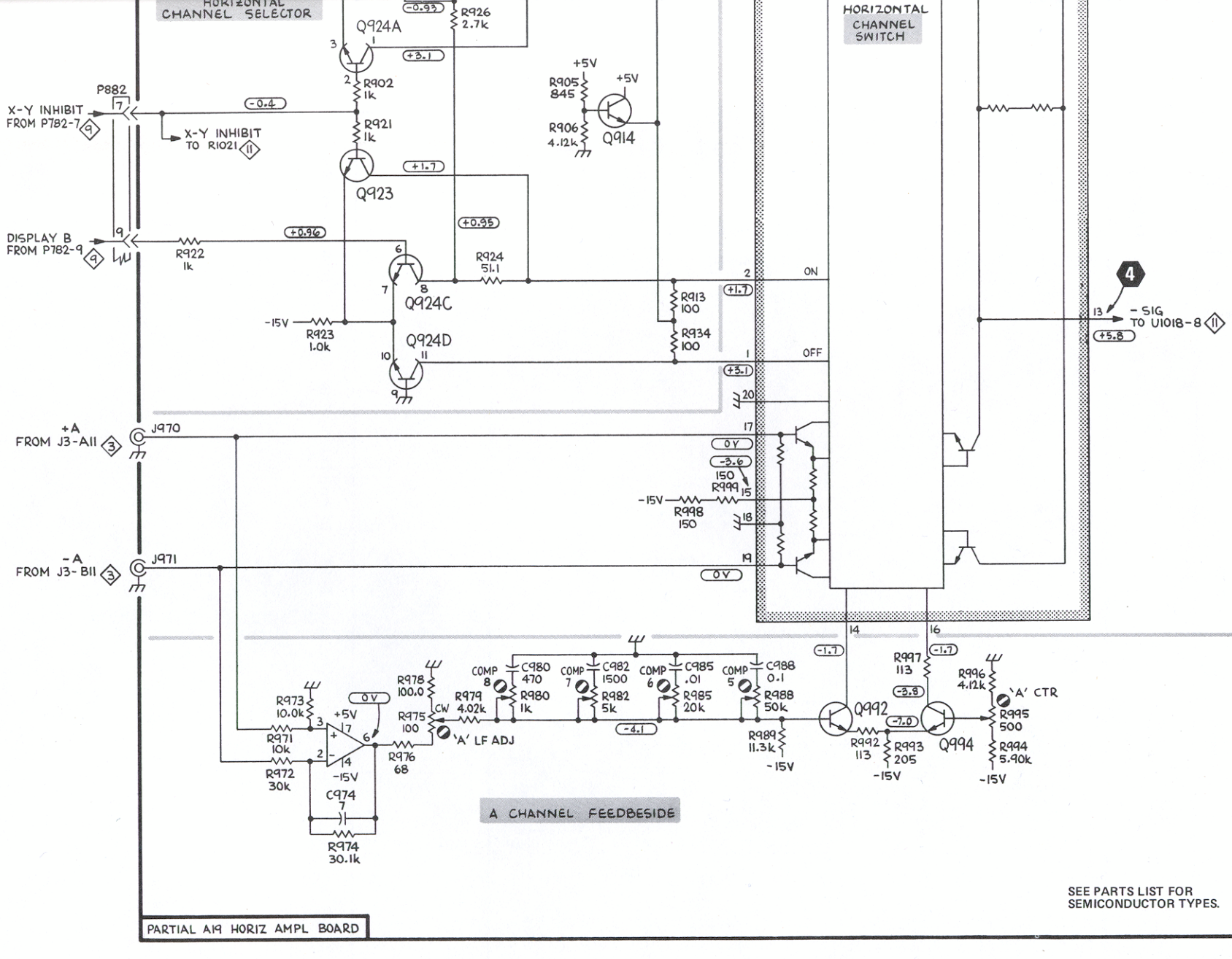
The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B; CALIBRATOR, 4V.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 MΩ input impedance and at least 60 MHz bandwidth. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) A 7A-series vertical amplifier plug-in was installed in the 7104 B HORIZ compartment and the CALIBRATOR output was connected to the vertical amplifier input. The B INTENSITY control and vertical amplifier was set to display 6 to 8 horizontal divisions on the 7104. The test oscilloscope was externally triggered on the +Slope of the CALIBRATOR signal.

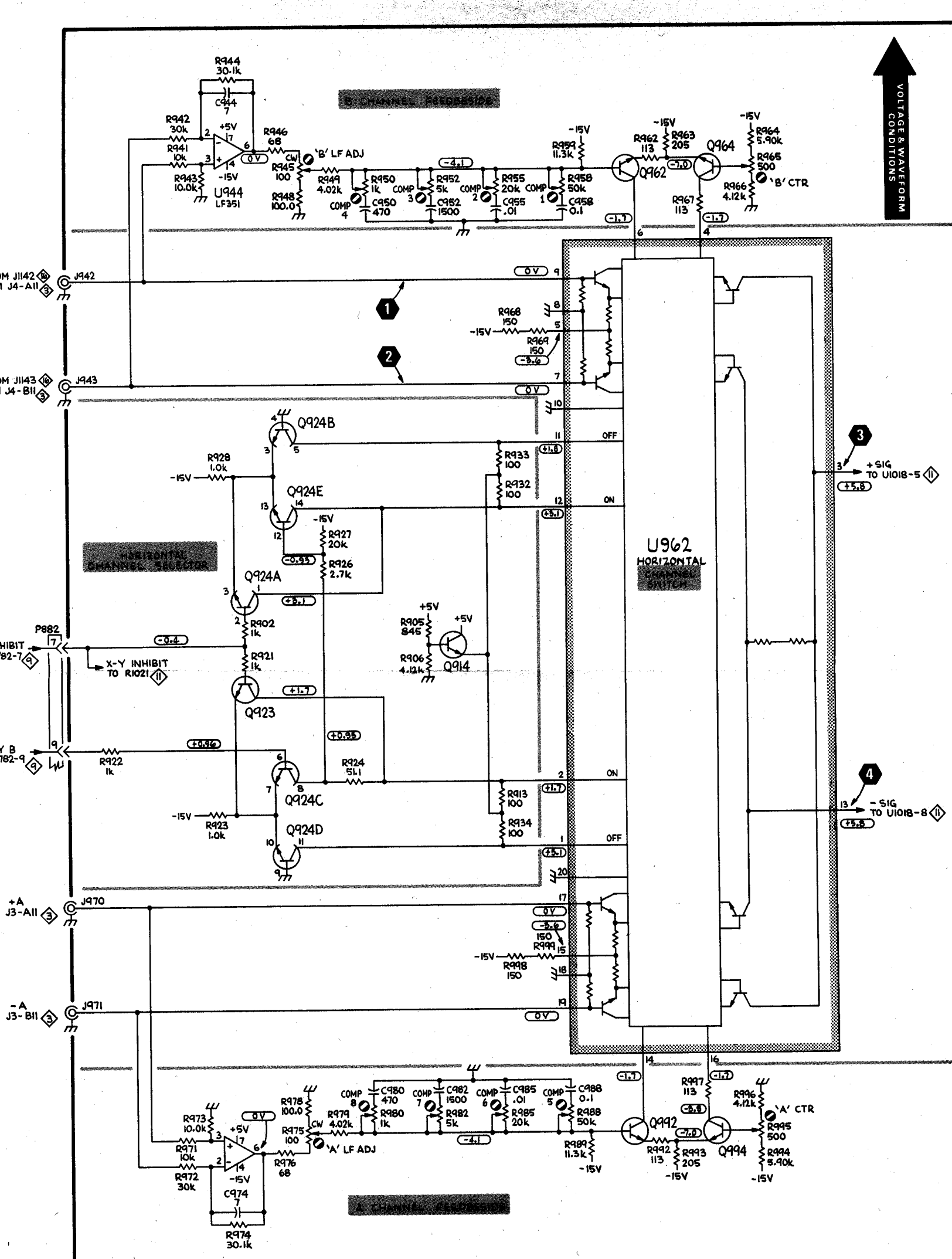



B CHANNEL PC COMPONENT SIDE
VOLTAGE & WAVEFORM CONDITIONS
R944 30.1k
C944 7
R942 30k
R941 10k
R943 10.0k
U944 LF351
+5V
-15V
0V
R946 68
R945 100
'B' LF ADJ
R948 100.0
R949 4.02k
R950 1k
R952 5k
R955 20k
R958 50k
COMP
C950 470
C952 1500
C955 .01
C958 0.1
-4.1
R959 11.3k
Q962
R962 113
R963 205
Q964
R964 5.90k
R965 500
'B' CTR
R966 4.12k
R967 113
-7.0
-1.7
+B FROM J1142 OR FROM J4-A11
J942
-B FROM J1143 OR FROM J4-B11
J943
R968 150
R969 150
-3.6
Q924B
Q924E
Q924A
R928 1.0k
R933 100
R932 100
OFF
ON
+1.8
+5.1
R927 20k
R926 2.7k
-0.93
HORIZONTAL CHANNEL SELECTOR
U962 HORIZONTAL CHANNEL SWITCH
+SIG TO U1018-5
+5.8
P882
X-Y INHIBIT FROM P782-7
X-Y INHIBIT TO R1021
-0.4
R902 1k
R921 1k
Q923
+1.7
+5V
R905 845
R906 4.12k
Q914
DISPLAY B FROM P782-9
+0.96
R922
+0.55
R924
1
2
3



SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

HORIZONTAL CHANNEL SWITCH 10


VOLTAGE & WAVEFORM CONDITIONS
B CHANNEL FEEDBACK
HORIZONTAL CHANNEL SELECTOR
A CHANNEL FEEDBACK
U962 HORIZONTAL CHANNEL SWITCH
U944 LF351
Q924A
Q924B
Q924C
Q924D
Q924E
Q923
Q914
Q962
Q964
Q992
Q994
'B' LF ADJ
'A' LF ADJ
'B' CTR
'A' CTR
X-Y INHIBIT TO R1021
+SIG TO U1018-5
-SIG TO U1018-8
J942
J943
J970
J971
P882
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
PARTIAL A19 HORIZ AMPL BOARD

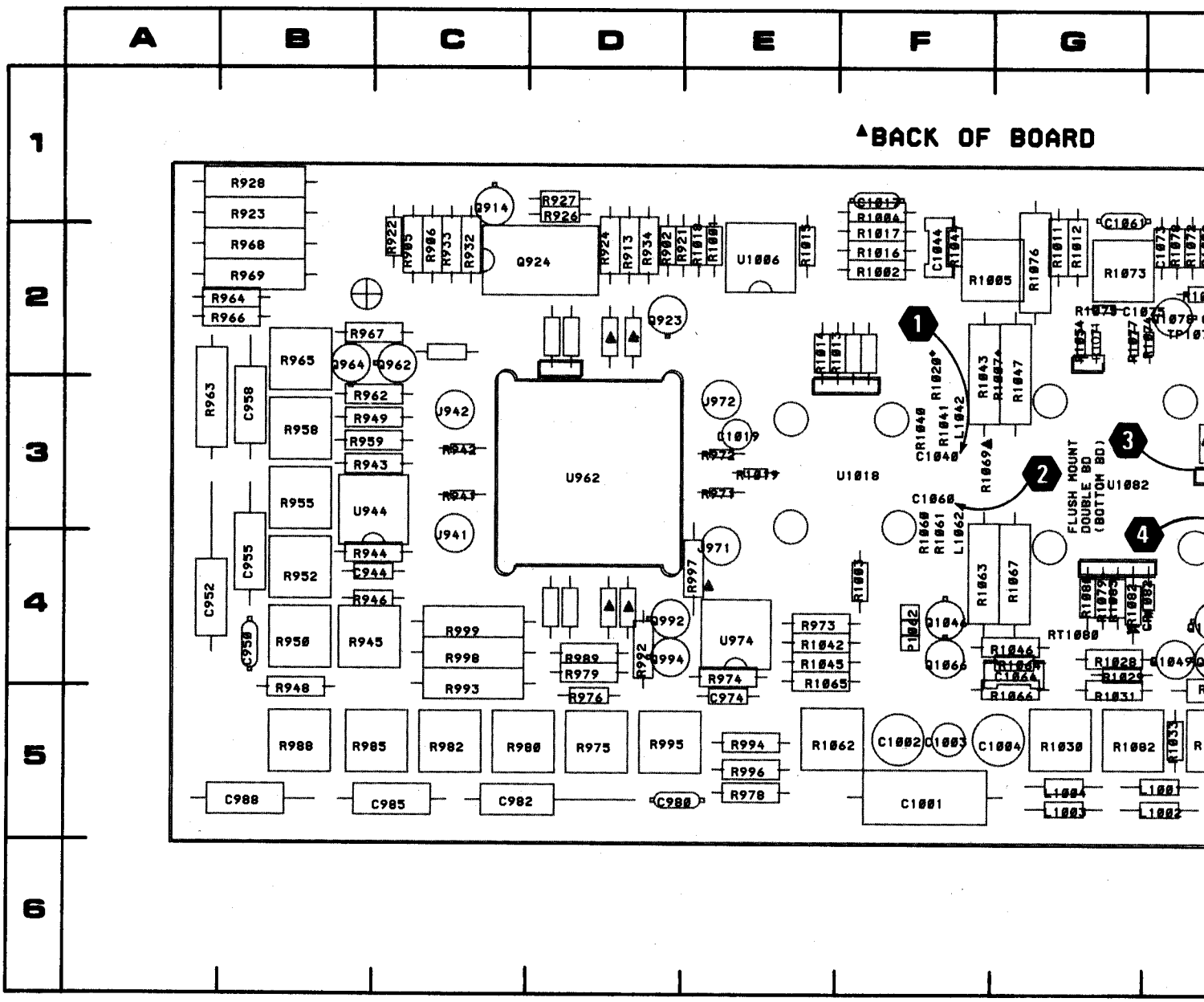
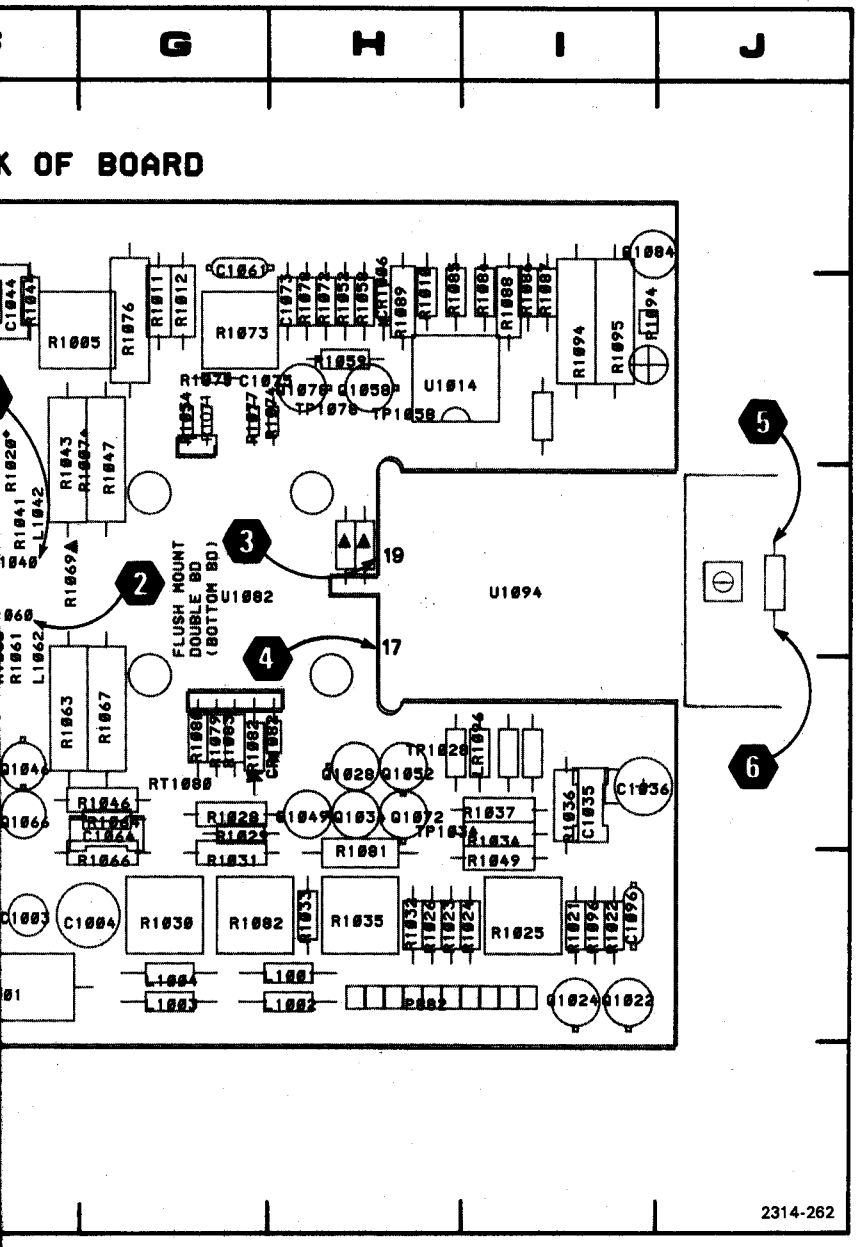


Figure 8-14. A19—Horizontal Amplifier circuit board assembly.

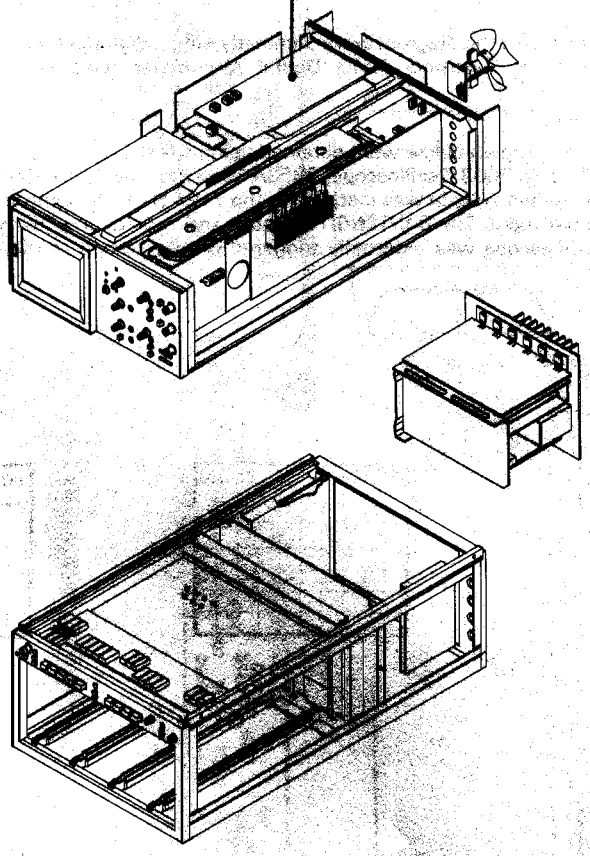


uit board assembly.

Locator for Figure 8-14.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C944	4B	R923	1B	R1029	4G
C950	4B	R924	2D	R1030	5G
C952	4A	R926	1D	R1031	5G
C955	4B	R927	1D	R1032	5H
C958	3B	R928	1B	R1033	5H
C974	5E	R932	2C	R1034	4I
C980	5D	R933	2C	R1035	5H
C982	5C	R934	2D	R1036	4I
C985	5C	R941	3C	R1037	4I
C988	5B	R942	3C	R1040	3F
C1001	5F	R944	4B	R1041	3F
C1002	5F	R945	4B	R1042	4E
C1003	5F	R946	4B	R1043	3F
C1004	5G	R948	5B	R1044	2F
C1017	1F	R949	3B	R1045	4E
C1019	3E	R950	4B	R1046	4G
C1035	4I	R952	4B	R1047	2G
C1036	4I	R955	3B	R1049	5I
C1044	2F	R958	3B	R1052	2H
C1060	3F	R959	3B	R1054	2G
C1061	2G	R962	3B	R1058	2H
C1064	4G	R963	3A	R1059	2H
C1073	2H	R964	2B	R1060	4F
C1075	2G	R965	2B	R1061	4F
C1096	5I	R966	2B	R1062	5E
		R967	2B	R1063	4F
CR1006	2H	R968	2B	R1064	4G
CR1082	4G	R969	2B	R1065	4E
		R971	3E	R1066	5G
J941	4C	R972	3E	R1067	4G
J942	3C	R973	4E	R1069	3F
J971	4E	R974	4E	R1071	2G
J972	3E	R975	5D	R1072	2H
		R976	5D	R1073	2G
L1001	5H	R978	5E	R1074	2G
L1002	5H	R979	4D	R1075	2G
L1003	5G	R980	5C	R1076	2G
L1004	5G	R982	5C	R1077	2G
L1042	3F	R985	5B	R1078	2H
L1062	4F	R988	5B	R1079	4G
		R989	4D	R1080	4G
LR1096	4I	R992	4D	R1081	5H
		R993	5C	R1082	5G
P882	5H	R994	5E	R1083	4G
P1062	4F	R995	5D	R1084	1I
P1094	1I	R996	5E	R1085	2H
		R997	4E	R1086	1I
Q914	1C	R998	4C	R1087	1I
Q923	2D	R999	4C	R1088	1I
Q924	2D	R1001	2E	R1089	2H
Q964	2B	R1002	2F	R1094	1I
Q992	4D	R1003	4F	R1095	1I
Q994	4D	R1004	1F	R1096	5I
Q1022	5I	R1005	2F		
Q1024	5I	R1007	2G	RT1080	4G
Q1028	4H	R1010	2H		
Q1034	4H	R1011	2G	TP1028	4H
Q1046	4F	R1013	2E	TP1034	4H
Q1049	4H	R1014	2E	TP1058	2H
Q1052	4H	R1015	2E	TP1078	2H
Q1058	2H	R1016	2F		
Q1066	4F	R1017	2F	U944	3B
Q1072	4H	R1018	2E	U962	3D
Q1078	2H	R1019	3E	U974	4E
Q1084	1I	R1020	3F	U1006	2E
		R1021	5I	U1014	2H
R902	2D	R1022	5I	U1018	3F
R905	2C	R1023	5H	U1082	3G
R906	2C	R1024	5I	U1094	3I
R913	2D	R1025	5I		
R921	2D	R1026	5H	VR1082	4G
R922	2C	R1028	4G		

A19
HORIZONTAL
AMPLIFIER
Shown on diag.
10, 11



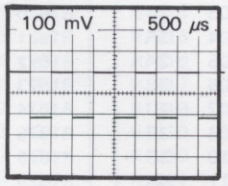
VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B; CALIBRATOR, 4V.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

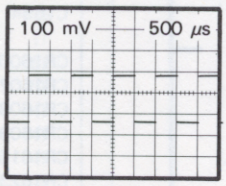
Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 mΩ input impedance and at least 60 MHz bandwidth. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) A 7A-series vertical amplifier plug-in was installed in the 7104 B HORIZ compartment and the CALIBRATOR output was connected to the vertical amplifier input. The B INTENSITY control and vertical amplifier was set to display 6 to 8 horizontal divisions on the 7104. The test oscilloscope was externally triggered on the +Slope of the CALIBRATOR signal.

1



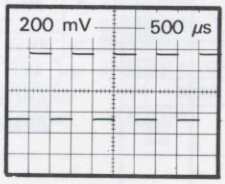
7.6 V

2



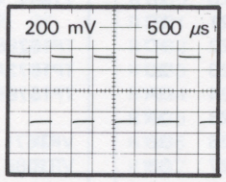
7.6 V

3



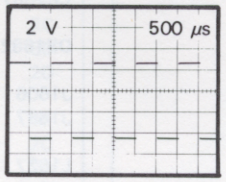
11 V

4



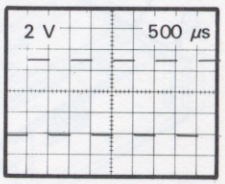
11 V

5

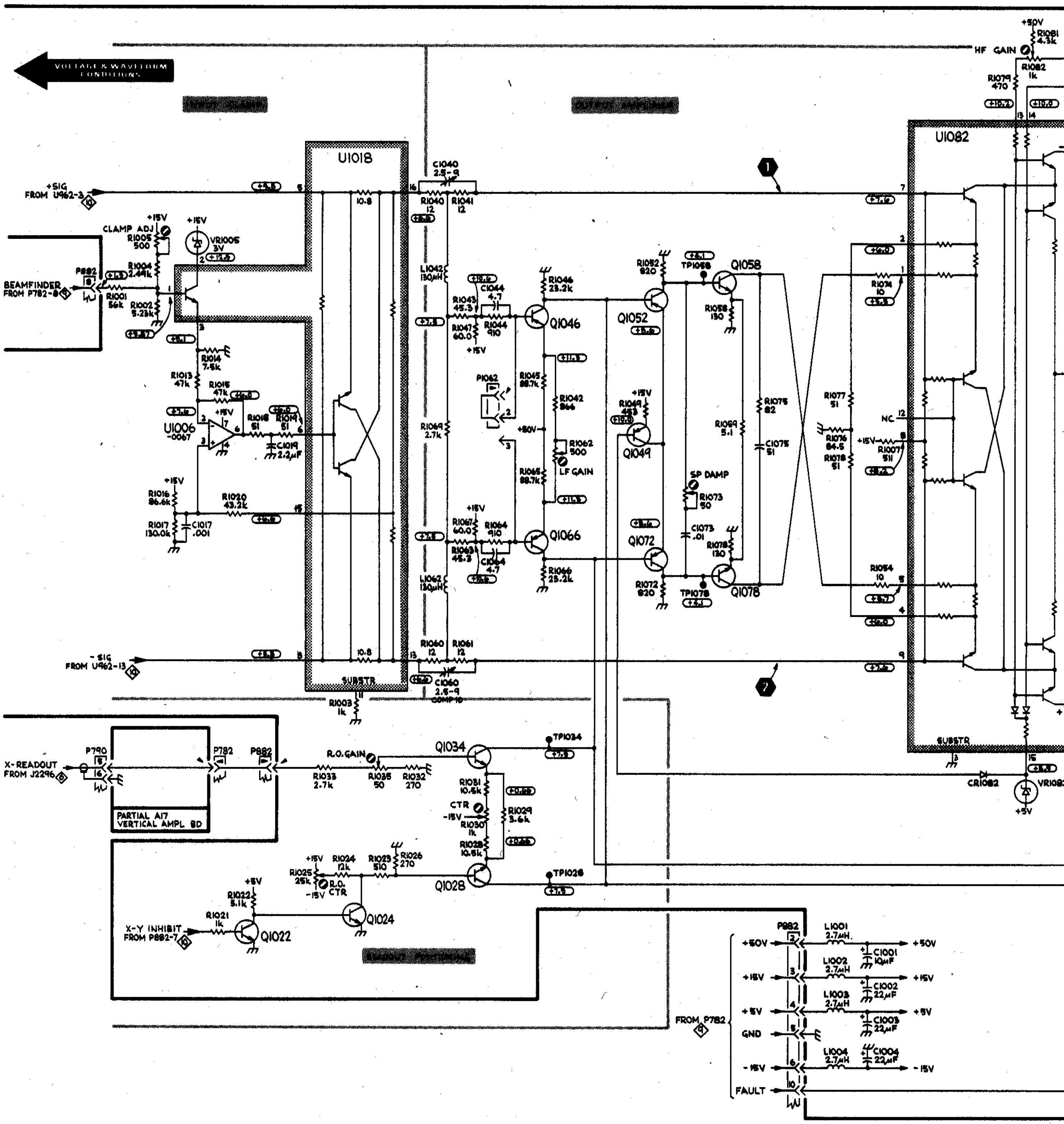


33.8 V

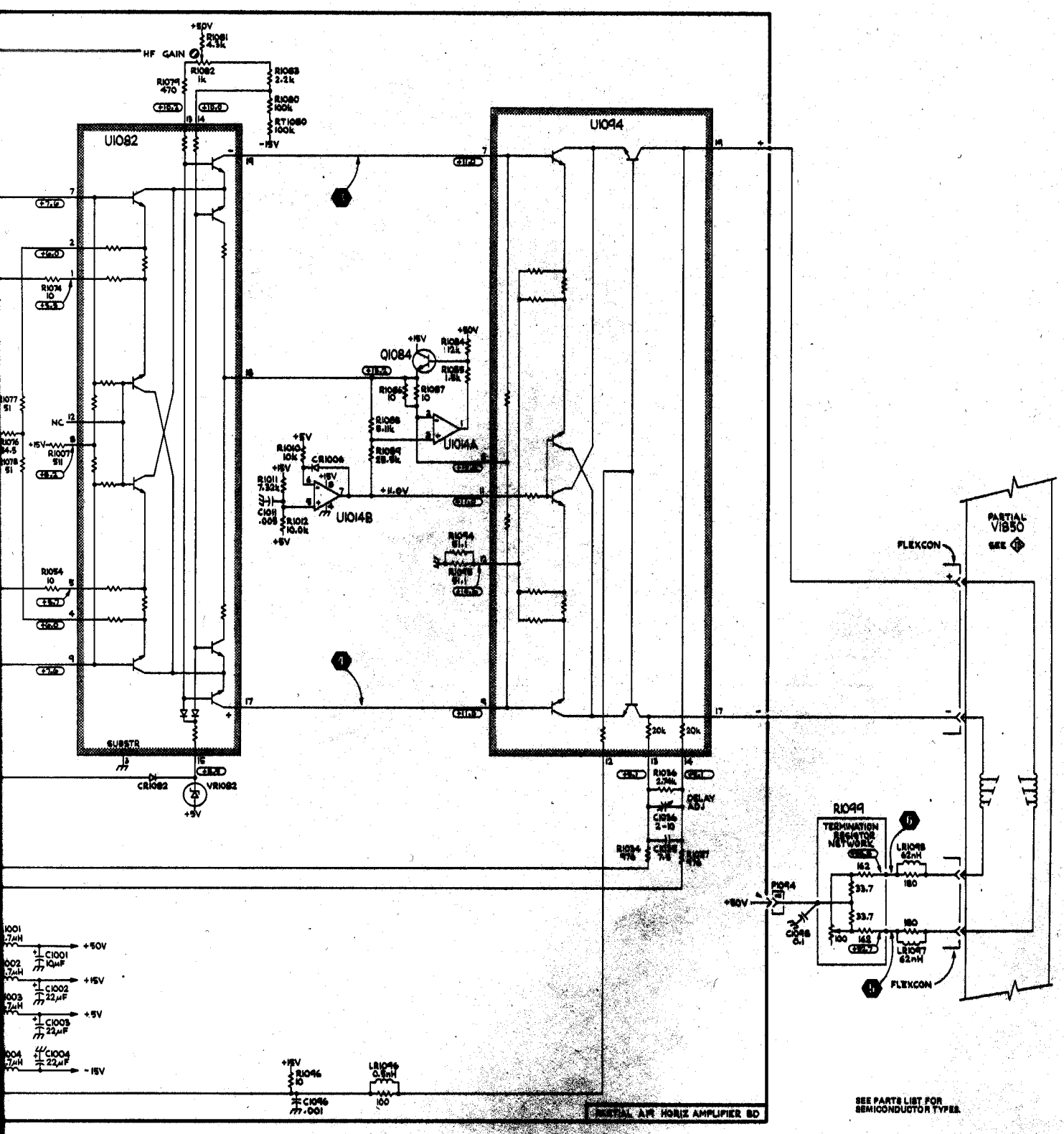
6



33.8 V


VOLTAGE & WAVEFORM CONDITIONS
U1018
U1082
U1006
+SIG FROM U962-3
-SIG FROM U962-13
BEAMFINDER FROM P782-8
CLAMP ADJ
X-READOUT FROM J2296
X-Y INHIBIT FROM P882-7
PARTIAL A17 VERTICAL AMPL BD
HF GAIN
LF GAIN
SP DAMP
R.O. GAIN
R.O. CTR
CTR
Q1022
Q1024
Q1028
Q1034
Q1046
Q1049
Q1052
Q1058
Q1066
Q1072
Q1078
TP1034
TP1028
TP1058
TP1078
VR1005
CR1082
P790
P782
P882
P1062
SUBSTR
NC
FROM P782
+50V
+15V
+5V
GND
-15V
FAULT
L1001 2.7μH
L1002 2.7μH
L1003 2.7μH
L1004 2.7μH
C1001 10μF
C1002 22μF
C1003 22μF
C1004 22μF

2514-241



2514-291

HORIZONTAL AMPLIFIER

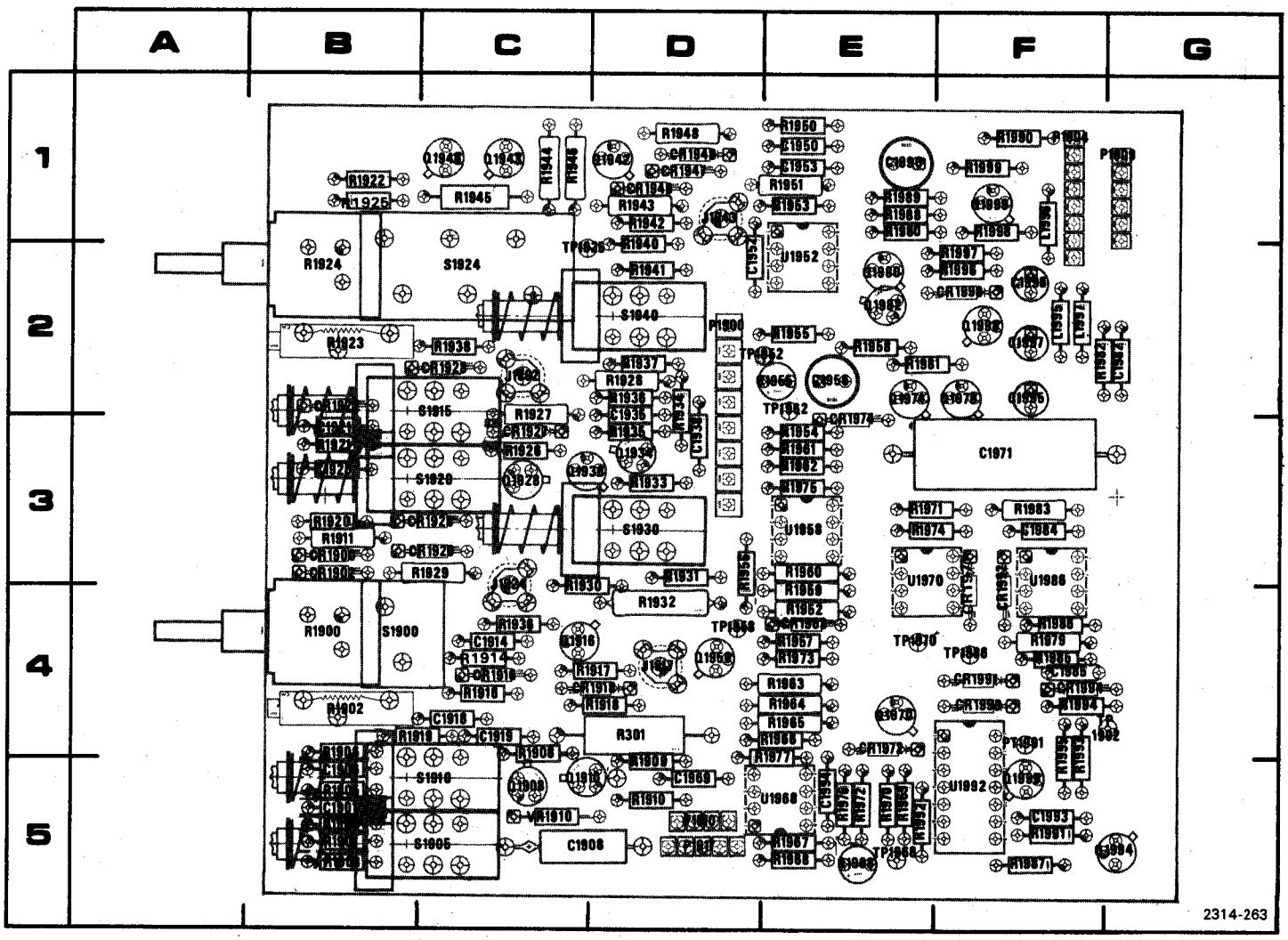


Figure 8-15. A1—Front Panel circuit board assembly.

Locator for Figure 8-15.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1901	5B	Q1910	5C	R1957	4E
C1904	5B	Q1916	4C	R1958	2E
C1906	5B	Q1928	3C	R1959	4E
C1908	5C	Q1934	3D	R1960	3E
C1914	4C	Q1938	3C	R1961	3E
C1915	4C	Q1942	1D	R1962	3E
C1918	4C	Q1943	1C	R1963	4E
C1919	4C	Q1946	1C	R1964	4E
C1920	3B	Q1956	4D	R1965	4E
C1921	3B	Q1970	4E	R1966	4E
C1935	2D	Q1974	2E	R1967	5E
C1938	3D	Q1978	2F	R1968	5E
C1950	1E	Q1980	2E	R1969	5E
C1952	2D	Q1982	2E	R1970	5E
C1953	1E	Q1994	5G	R1971	3E
C1955	2E	Q1995	5F	R1972	5E
C1956	2E	Q1998	2F	R1973	4E
C1968	5E	Q1999	1F	R1974	3E
C1969	5D			R1975	3E
C1971	3F	R301	4D	R1976	5E
C1982	2G	R1900	4B	R1977	4E
C1984	3F	R1901	5B	R1979	4F
C1985	4F	R1902	4B	R1980	1E
C1990	1E	R1903	5B	R1981	2E
C1993	5F	R1905	5B	R1982	2F
C1994	5E	R1906	4B	R1983	3F
C1995	2F	R1908	4C	R1985	4F
C1996	2F	R1909	5D	R1986	4F
C1997	2F	R1910	5D	R1987	5F
		R1911	3B	R1988	1E
CR1900	3B	R1914	4C	R1989	1E
CR1902	3B	R1915	4C	R1990	1F
CR1916	4C	R1916	4C	R1991	5F
CR1918	4D	R1917	4D	R1992	5E
CR1922	2B	R1918	4D	R1993	4F
CR1923	2C	R1919	4B	R1994	4F
CR1927	3C	R1920	3B	R1995	4F
CR1928	3C	R1921	3B	R1996	2F
CR1929	3C	R1922	1B	R1997	2F
CR1946	1D	R1923	2B	R1998	1F
CR1947	1D	R1924	2B	R1999	1F
CR1948	1D	R1925	1B		
CR1963	4E	R1926	3C	S1900	4B
CR1971	3F	R1927	3C	S1905	5C
CR1972	4E	R1928	2D	S1910	5C
CR1974	3E	R1929	3C	S1915	3C
CR1991	4F	R1930	3C	S1920	3C
CR1992	3F	R1931	3D	S1924	2C
CR1993	4F	R1932	4D	S1930	3D
CR1994	4F	R1933	3D	S1940	2D
CR1998	2F	R1934	3D		
		R1935	3D	TP1911	4F
J1917	4D	R1936	2D	TP1925	2C
J1924	3C	R1937	2D	TP1952	2D
J1943	1D	R1938	2C	TP1958	4D
J1992	2C	R1940	2D	TP1962	2E
		R1941	2D	TP1968	5E
L1995	2F	R1942	1D	TP1970	4E
L1996	1F	R1943	1D	TP1986	4F
L1997	2F	R1944	1C	TP1992	4F
		R1945	1C		
P1900	2D	R1946	1C	U1952	2E
P1904	1F	R1948	1D	U1958	3E
P1909	1G	R1950	1E	U1968	5E
P1910	5D	R1951	1E	U1970	3E
P1917	5D	R1952	4E	U1986	3F
		R1953	1E	U1992	5F
PT1991	4F	R1954	3E		
		R1955	2E	VR1910	5C
Q1908	5C	R1956	3D		

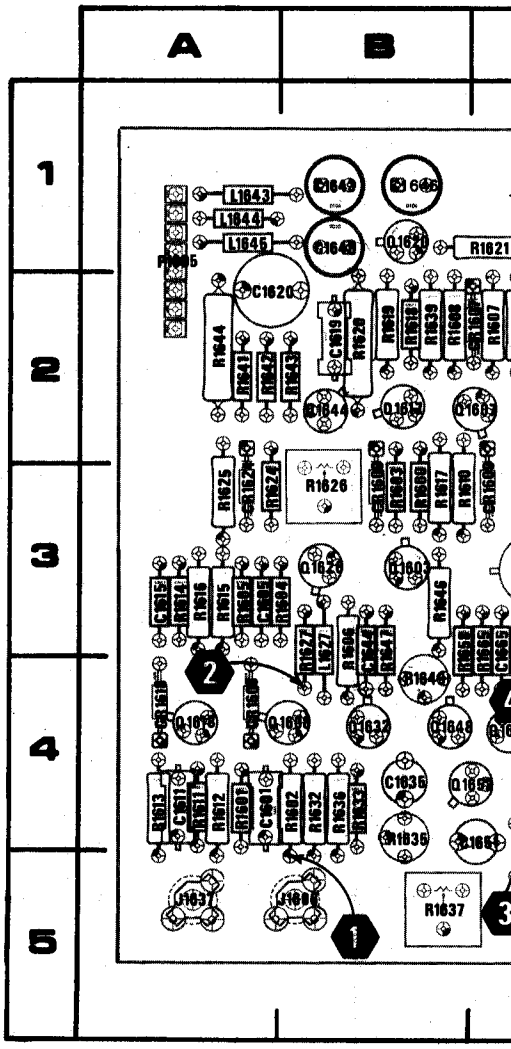
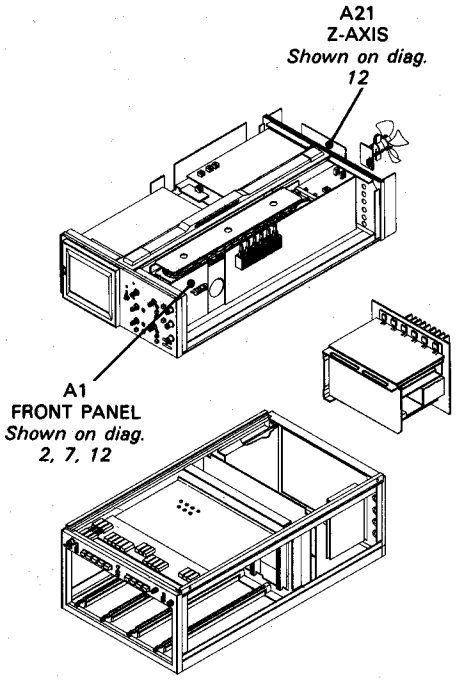


Figure 8-16. A21—Z-



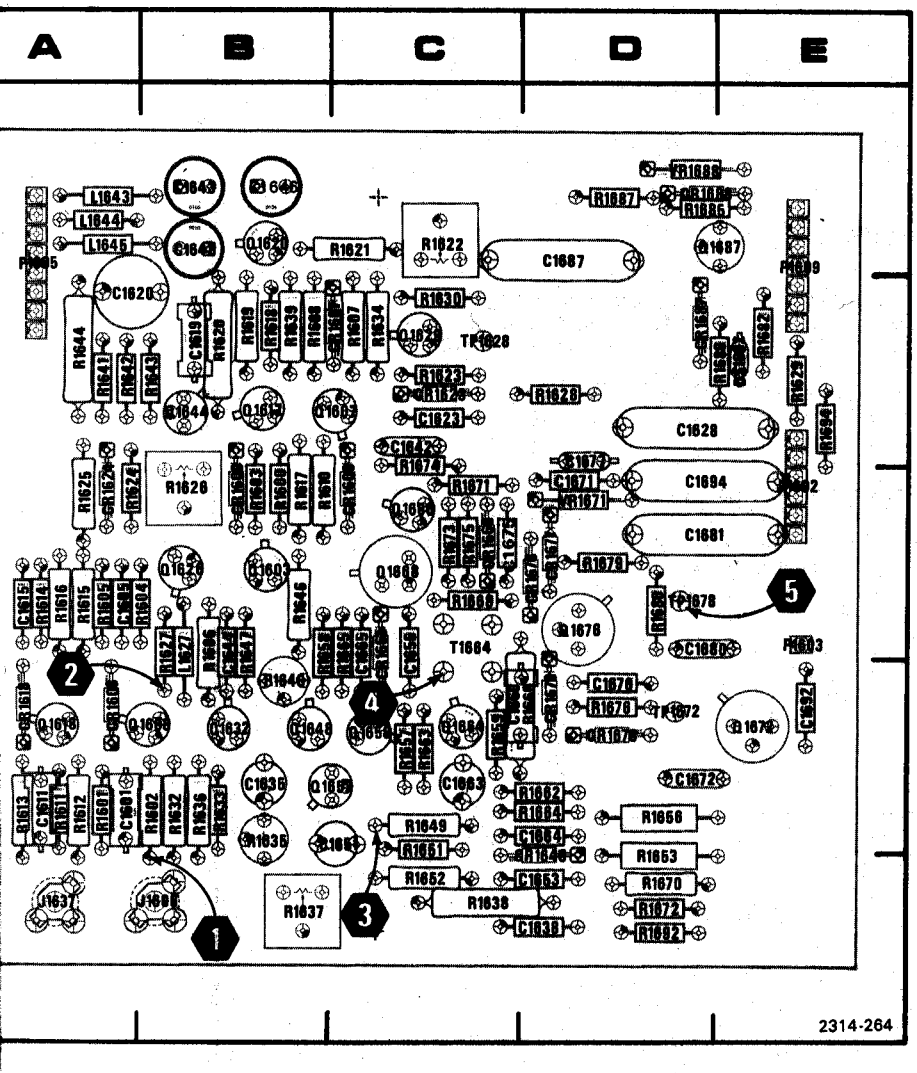


Figure 8-16. A21—Z-Axis circuit board assembly.

Locator for Figure 8-16.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1601	4A	L1645	1A	R1630	2C
C1605	3A			R1632	4B
C1611	4A	P1602	3E	R1633	4B
C1615	3A	P1603	3E	R1634	2C
C1619	2B	P1605	1A	R1635	4B
C1620	2A	P1609	1E	R1636	4B
C1623	2C			R1637	5B
C1628	2D	Q1603	3B	R1638	5C
C1635	4B	Q1607	2C	R1639	2B
C1638	5D	Q1608	4B	R1641	2A
C1642	2C	Q1617	2B	R1642	2A
C1643	1B	Q1618	4A	R1643	2B
C1644	3B	Q1620	1B	R1644	2A
C1645	1B	Q1626	3B	R1645	4B
C1651	4C	Q1629	C	R1646	3B
C1653	5D	Q1632	4B	R1647	3B
C1656	3C	Q1644	2B	R1649	4C
C1660	4C	Q1648	4B	R1651	4C
C1663	4C	Q1652	4B	R1652	5C
C1664	4D	Q1658	4C	R1653	4D
C1665	3C	Q1664	4C	R1656	4D
C1671	3D	Q1666	3C	R1657	4C
C1672	4D	Q1668	3C	R1658	3B
C1675	3C	Q1672	4E	R1659	4C
C1676	4D	Q1676	3D	R1660	4D
C1677	2D	Q1687	1D	R1662	4D
C1680	3D			R1663	4C
C1681	3D	R1600	3B	R1664	4D
C1687	1D	R1601	4A	R1665	3C
C1692	4E	R1602	4B	R1668	3C
C1694	3D	R1603	3B	R1670	5D
		R1604	3A	R1671	3C
CR1600	3B	R1605	3A	R1672	5D
CR1607	2C	R1606	3B	R1673	3C
CR1608	4A	R1607	2C	R1674	2C
CR1609	3C	R1608	2B	R1675	3C
CR1618	4A	R1610	3B	R1676	4D
CR1623	2C	R1611	4A	R1679	3D
CR1624	3A	R1612	4A	R1680	3D
CR1649	4D	R1613	4A	R1682	2E
CR1665	3C	R1614	3A	R1685	1D
CR1666	3C	R1615	3A	R1687	1D
CR1675	4D	R1616	3A	R1688	2E
CR1676	3D	R1617	3B	R1692	5D
CR1677	3D	R1618	2B	R1694	2E
CR1678	4D	R1619	2B		
CR1687	2D	R1620	2B	T1664	3C
		R1621	1C		
DS1682	2E	R1622	1C	TP1628	2C
		R1623	2C	TP1672	4D
J1606	5B	R1624	3A	TP1678	3D
J1637	5A	R1625	3A		
		R1626	3B	VR1671	3D
L1627	3B	R1627	3B	VR1688	1D
L1643	1A	R1628	2D		
L1644	1A	R1629	2E		

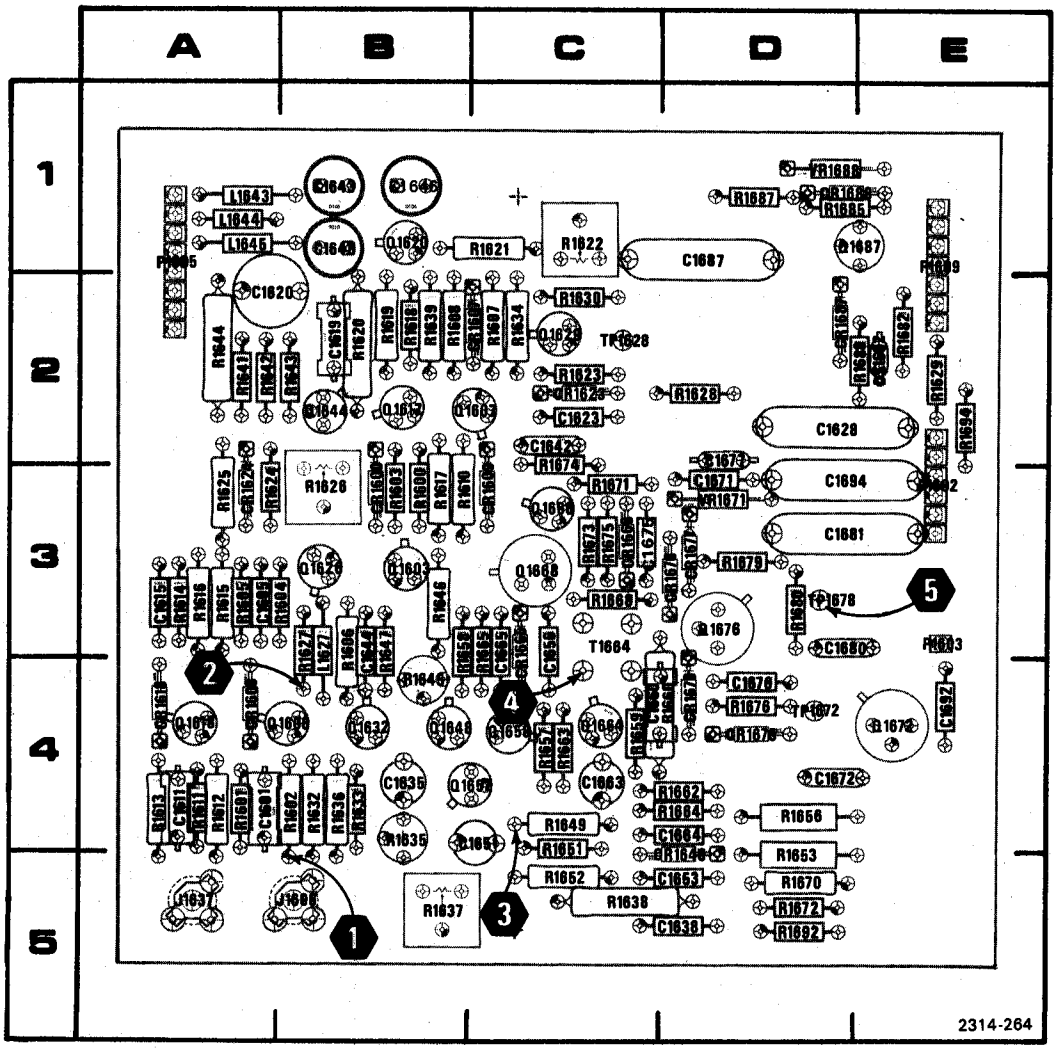
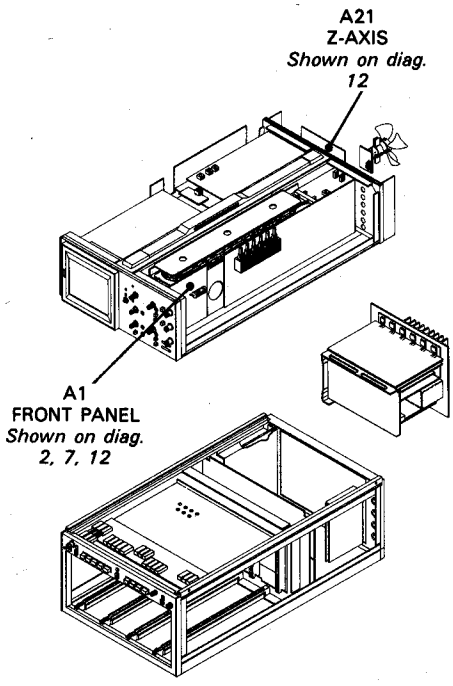


Figure 8-16. A21—Z-Axis circuit board assembly.

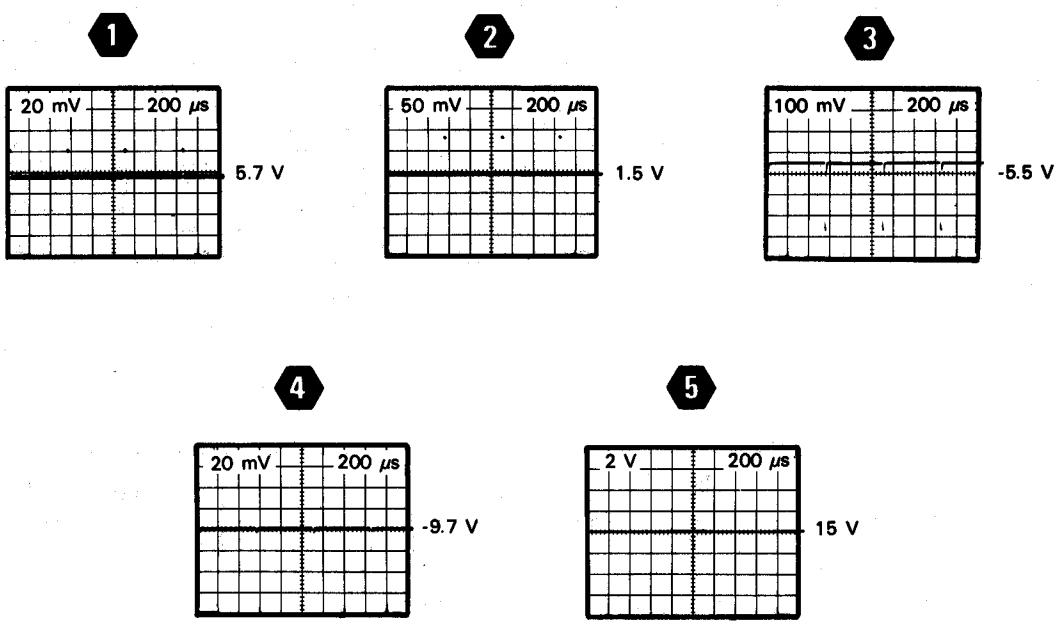


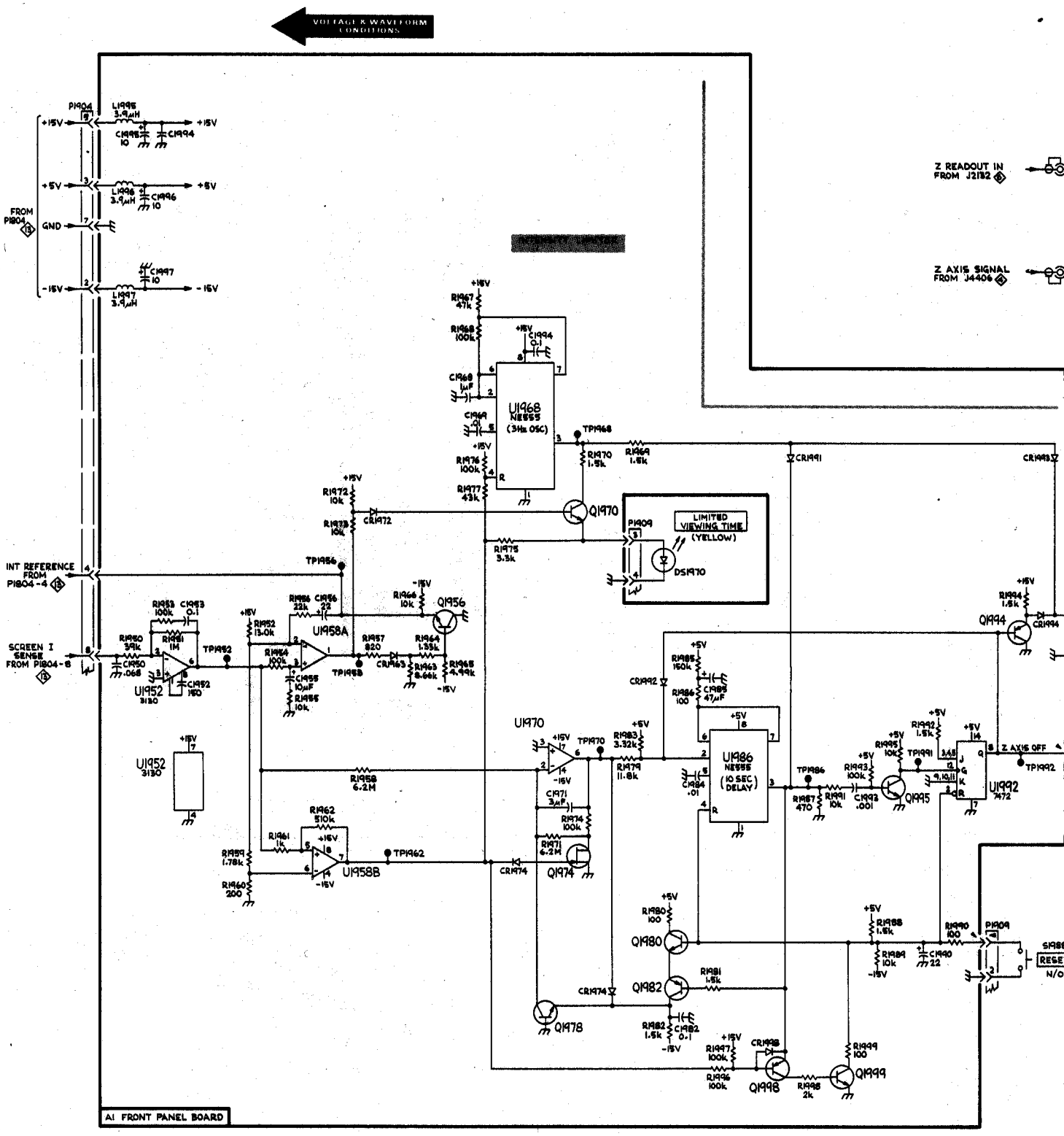
VOLTAGE AND WAVEFORM CONDITIONS

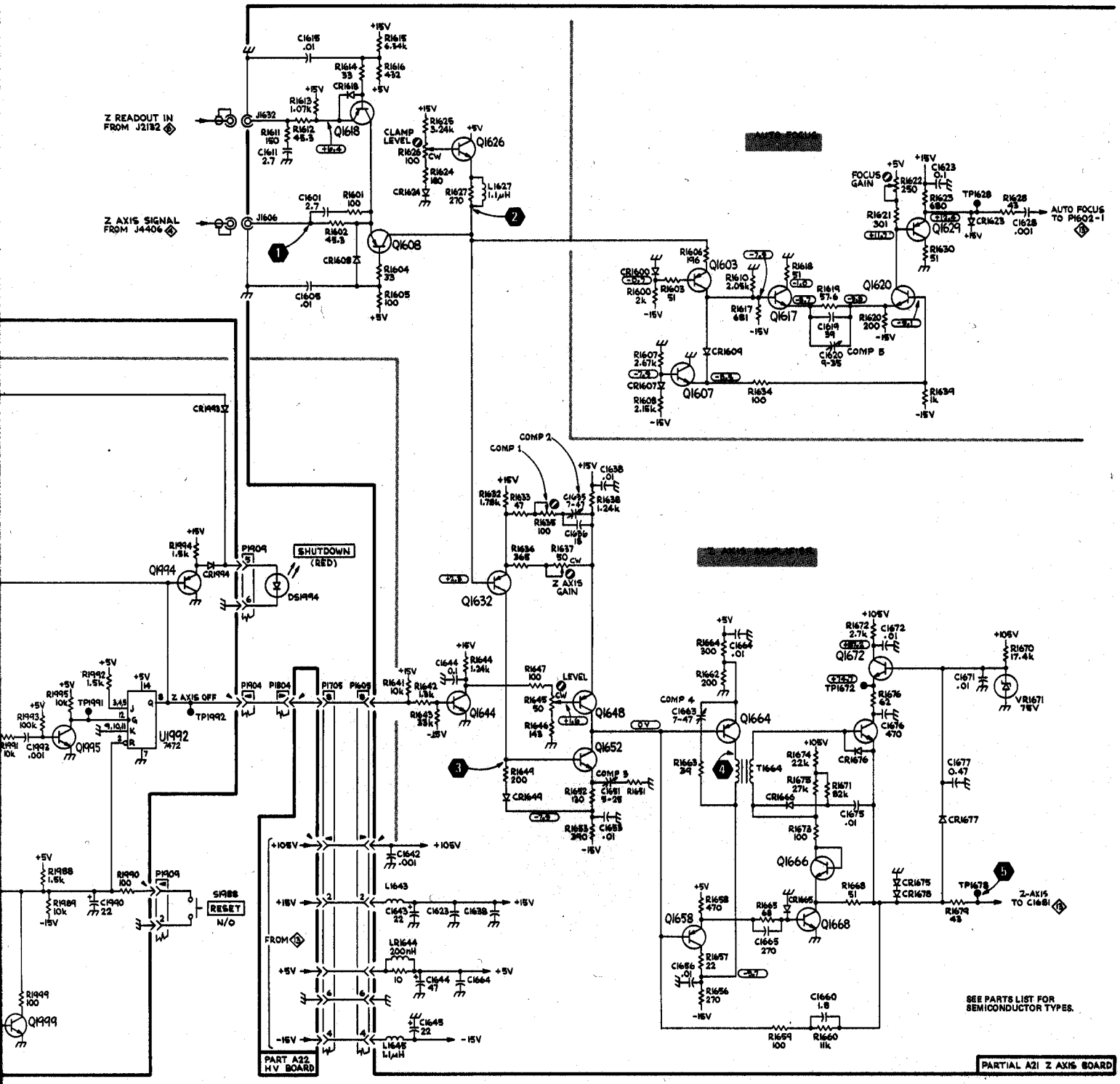
The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

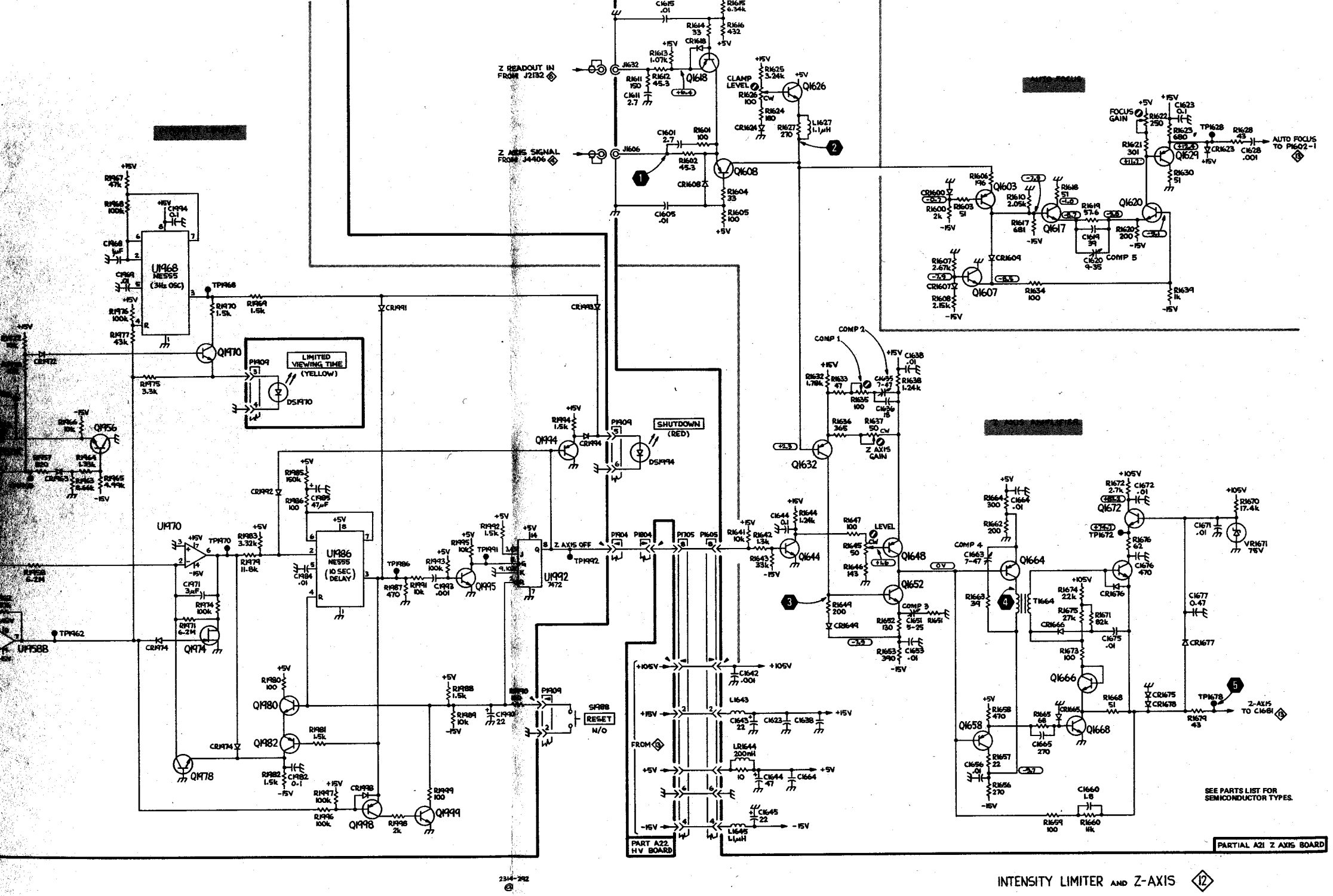
Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 MΩ input impedance and at least 60 MHz bandwidth. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) A 7B-series time base plug-in was installed in the 7104 B HORIZ compartment and set to free run at 50 microsecond/division. The B INTENSITY control was turned clockwise until the LIMITED VIEWING TIME indicator was lit.




VOLTAGE & WAVEFORM CONDITIONS
Z READOUT IN FROM J2132
Z AXIS SIGNAL FROM J4406
P1904
+15V
+5V
GND
-15V
FROM P1804
L1995 3.9μH
L1996 3.9μH
L1997 3.9μH
C1995 10
C1996 10
C1997 10
C1994
+15V
+5V
-15V
INT REFERENCE FROM P1804-4
SCREEN I SENSE FROM P1804-8
U1952 3130
U1958A
U1958B
U1968 NE555 (3Hz OSC)
U1970
U1986 NE555 (10 SEC DELAY)
Q1956
Q1970
Q1974
Q1978
Q1980
Q1982
Q1994
Q1995
Q1998
Q1999
LIMITED VIEWING TIME (YELLOW)
DS1970
P1909
U1992 7472
Z AXIS OFF
TP1952
TP1956
TP1958
TP1962
TP1968
TP1970
TP1986
TP1991
TP1992
CR1972
CR1974
CR1991
CR1992
CR1993
CR1994
CR1998
A1 FRONT PANEL BOARD



INTENSITY LIMITER AND Z-AXIS 12


Z READOUT IN FROM J2132
Z ABS SIGNAL FROM J4406
CLAMP LEVEL
FOCUS GAIN
AUTO FOCUS TO P1602-1
COMP 1
COMP 2
COMP 3
COMP 4
COMP 5
Z AXIS GAIN
LEVEL
Z AXIS OFF
LIMITED VIEWING TIME (YELLOW)
SHUTDOWN (RED)
RESET
U1468 NE555 (3Hz OSC)
U1486 NE555 (10 SEC DELAY)
U1492 7472
Q1468
Q1470
Q1474
Q1478
Q1480
Q1482
Q1486
Q1488
Q1494
Q1495
Q1498
Q1499
Q1603
Q1607
Q1617
Q1620
Q1626
Q1629
Q1632
Q1644
Q1648
Q1652
Q1658
Q1664
Q1666
Q1668
Q1672
TO P1602-1
TO C1681
FROM
PART A22 HV BOARD
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
PARTIAL A21 Z AXIS BOARD
2314-292
INTENSITY LIMITER AND Z-AXIS 12

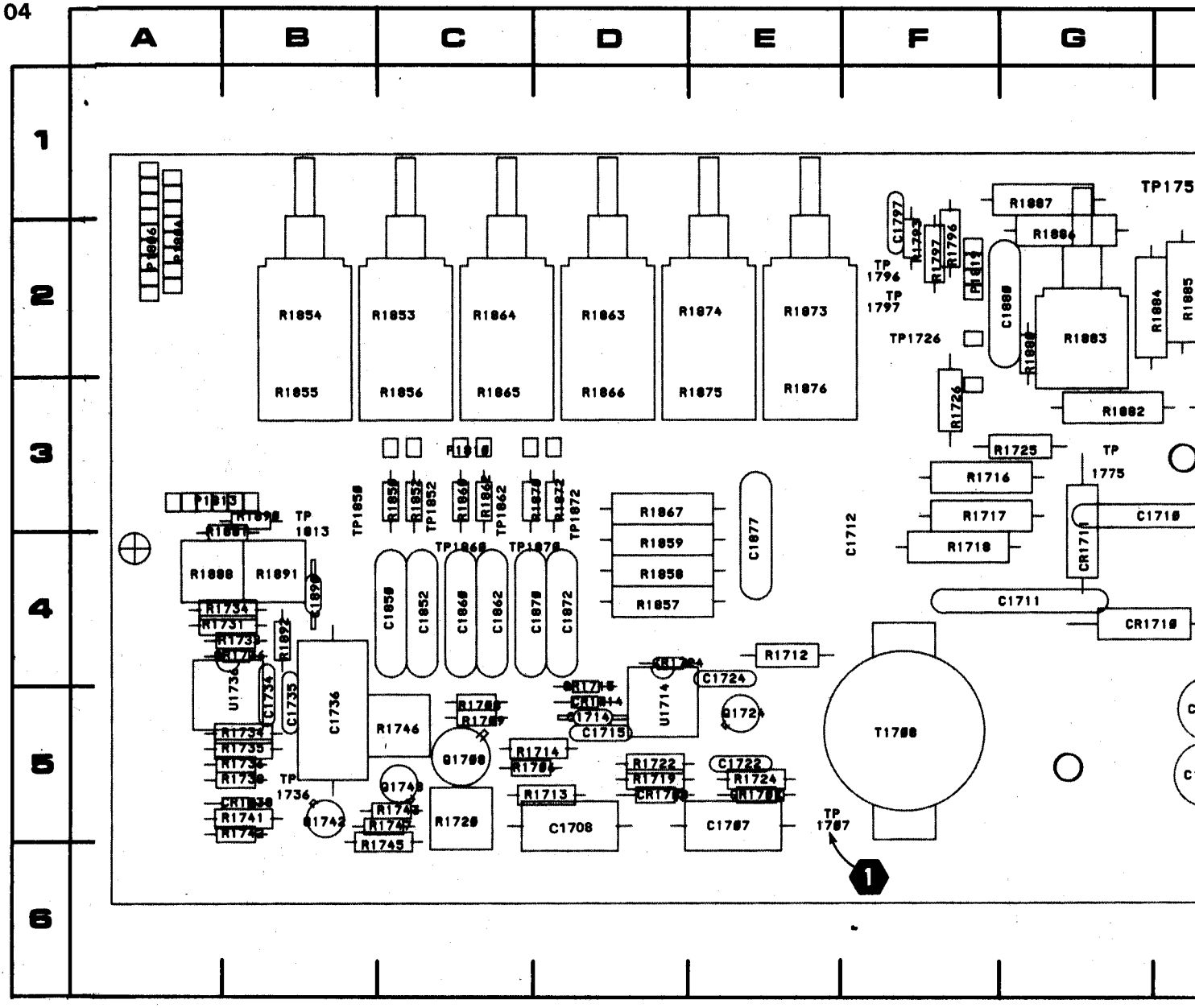


Figure 8-17. A22—High Volt

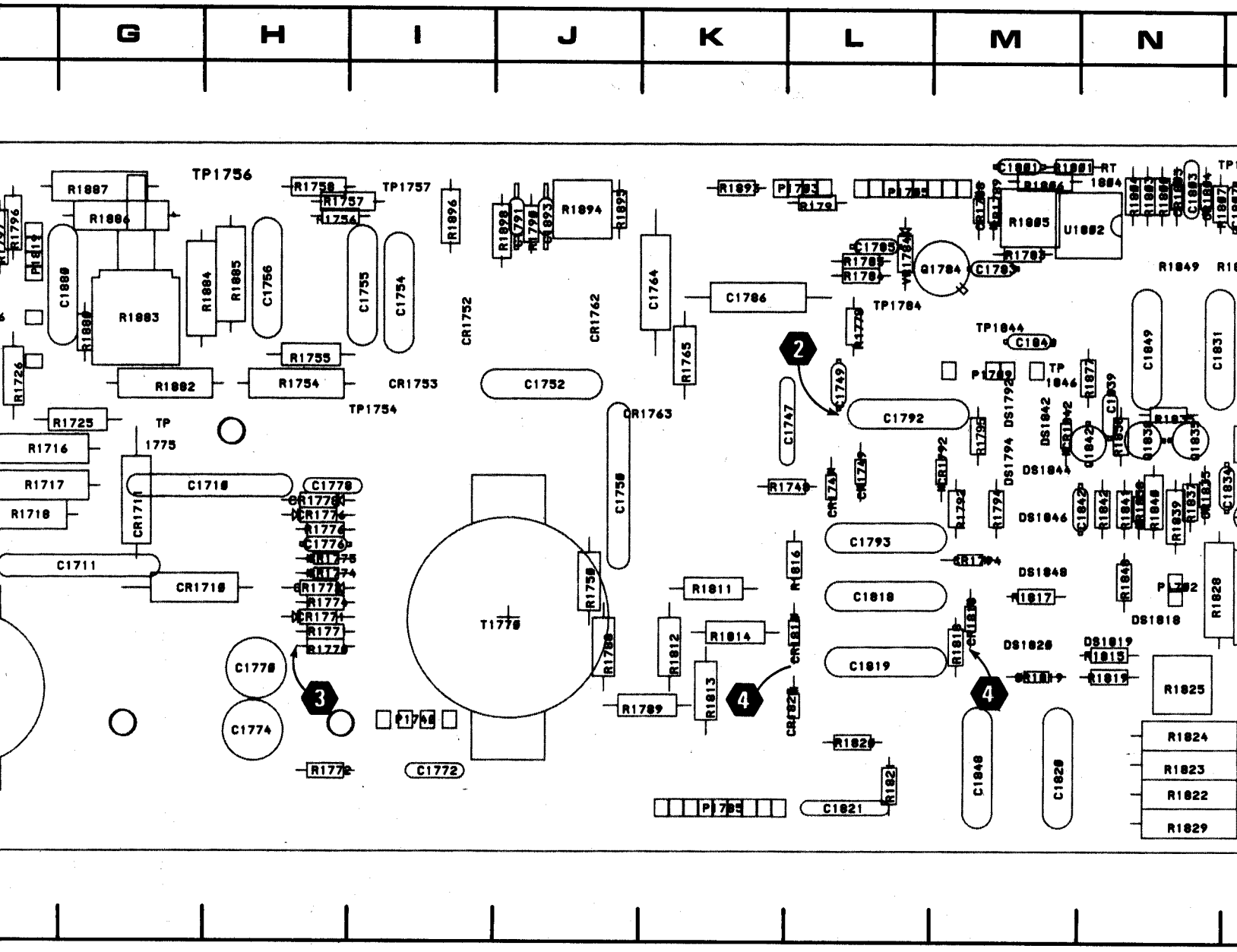
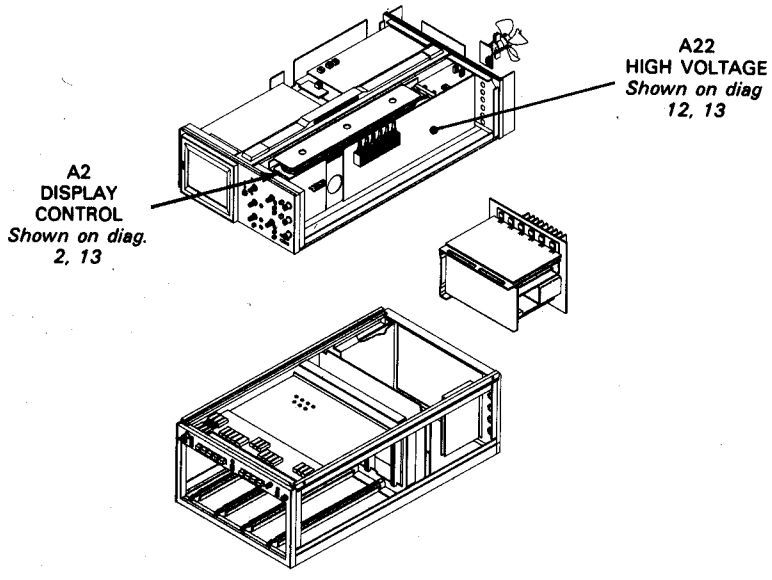
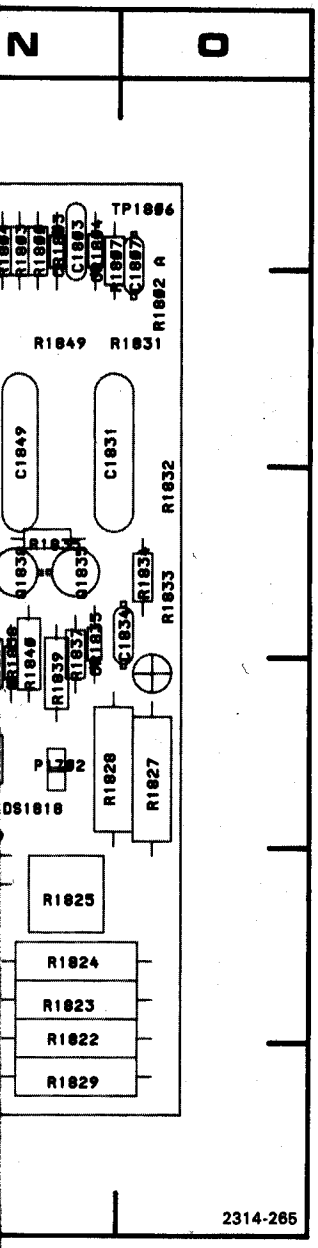


Figure 8-17. A22—High Voltage circuit board assembly.





Locator for Figure 8-17

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1710	3H	C1846	2M	CR1816	4L	R1709	5C	R1788	4H	R1837	3N	R1891	4B
C1711	4G	C1848	5M	CR1818	4M	R1712	4E	R1789	5K	R1838	3N	R1892	4B
C1712	3F	C1849	2N	CR1819	5M	R1713	5D	R1790	1H	R1839	3N	R1893	1K
C1714	5D	C1850	4C	CR1820	5L	R1714	5D	R1791	1L	R1840	3N	R1894	1H
C1715	5D	C1852	4C	CR1835	4O	R1716	3G	R1792	3M	R1841	3N	R1895	1K
C1722	5E	C1860	4C	CR1838	3N	R1717	3G	R1793	2F	R1842	3N	R1896	1I
C1724	4E	C1862	4C	CR1842	3N	R1718	3F	R1794	3M	R1848	4N	R1898	2J
C1734	4B	C1870	4D			R1719	5D	R1795	3M	R1849	2N		
C1735	4B	C1872	4D	DS1792	3M	R1720	5C	R1796	2F	R1850	3C	RT1804	1N
C1736	5B	C1877	3E	DS1794	3M	R1722	5D	R1797	2F	R1852	3C		
C1747	3L	C1880	2G	DS1818	4N	R1724	5E	R1800	1N	R1853	2C	T1708	5F
C1749	3L	C1890	4B	DS1819	4N	R1725	3G	R1801	1M	R1854	2B	T1770	4H
C1750	3K	C1893	1H	DS1820	4M	R1726	3F	R1802	1O	R1855	2B		
C1752	3H			DS1842	3M	R1731	4B	R1803	1N	R1856	2C	TP1707	5F
C1754	2I	CR1707	5E	DS1844	3M	R1733	4B	R1804	1N	R1857	4D	TP1726	2F
C1755	2I	CR1708	5D	DS1846	3M	R1735	5B	R1805	1M	R1858	4D	TP1736	5B
C1756	2H	CR1710	4H	DS1848	4M	R1736	5B	R1806	1M	R1859	3D	TP1754	3I
C1764	2K	CR1711	3G			R1738	5B	R1807	1O	R1860	3C	TP1756	1H
C1770	4H	CR1714	4D	P1019	2F	R1741	5B	R1811	4K	R1862	3C	TP1757	1I
C1772	5I	CR1715	4D	P1702	4N	R1742	5B	R1812	4K	R1863	2D	TP1775	3G
C1774	5H	CR1724	4E	P1703	1L	R1743	5C	R1813	5K	R1864	2C	TP1784	2L
C1776	4H	CR1736	4B	P1705	1L	R1745	5C	R1814	4K	R1865	2C	TP1796	2F
C1778	3H	CR1738	5B	P1709	2M	R1746	5C	R1815	4N	R1866	2D	TP1797	2F
C1783	2M	CR1747	3L	P1740	5I	R1747	5C	R1816	4L	R1867	3D	TP1806	1O
C1785	2L	CR1749	3L	P1785	5K	R1748	3L	R1817	4M	R1870	3D	TP1813	3B
C1786	2K	CR1752	2I	P1804	2A	R1750	4H	R1818	4M	R1872	3D	TP1844	2M
C1791	1H	CR1753	3I	P1806	2A	R1754	3H	R1819	5N	R1873	2E	TP1846	2M
C1792	3L	CR1762	2H	P1810	3C	R1755	2H	R1820	5L	R1874	2E	TP1850	3C
C1793	4L	CR1763	3K	P1813	3B	R1756	1I	R1821	5L	R1875	2E	TP1852	3C
C1797	1F	CR1771	4H			R1757	1I	R1822	5N	R1876	2E	TP1860	3C
C1801	1M	CR1772	4H	Q1708	5C	R1758	1H	R1823	5N	R1877	3N	TP1862	3C
C1803	1N	CR1774	4H	Q1724	5E	R1765	2K	R1824	5N	R1880	2G	TP1870	3D
C1807	1O	CR1775	4H	Q1742	5B	R1770	4H	R1825	5N	R1881	3B	TP1872	3D
C1818	4L	CR1776	3H	Q1748	5C	R1771	4H	R1827	4O	R1882	3G		
C1819	4L	CR1778	2H	Q1784	2M	R1772	5H	R1828	4O	R1883	2G	U1714	4E
C1820	5N	CR1788	1M	Q1835	3N	R1774	4H	R1829	6N	R1884	2H	U1736	4B
C1821	5L	CR1789	1M	Q1838	3N	R1776	4H	R1831	2O	R1885	2H	U1802	2N
C1831	2O	CR1792	3M	Q1842	3N	R1778	2L	R1832	3O	R1886	1G		
C1834	3O	CR1794	4M			R1783	2M	R1833	3O	R1887	1G	VR1784	2L
C1839	3N	CR1803	1N	R1706	5D	R1784	2L	R1834	3O	R1888	4B		
C1842	3N	CR1804	1O	R1708	5C	R1785	2L	R1835	3N	R1890	3B	CR1804	1O

Locator for Figure 8-18

CKT NO	GRID COORD	CKT NO	GRID COORD
CR2009	2D	R2010	2E
CR2019	2D	R2015	2C
		R2016	2D
P2003	2D	R2017	2D
P2005	1D	R2018	2D
P2006	1D	R2019	2D
		R2020	2C
R2005	2B	R2025	2B
R2007	2D	R2035	1A
R2008	2D		
R2009	2C	S2005	2A

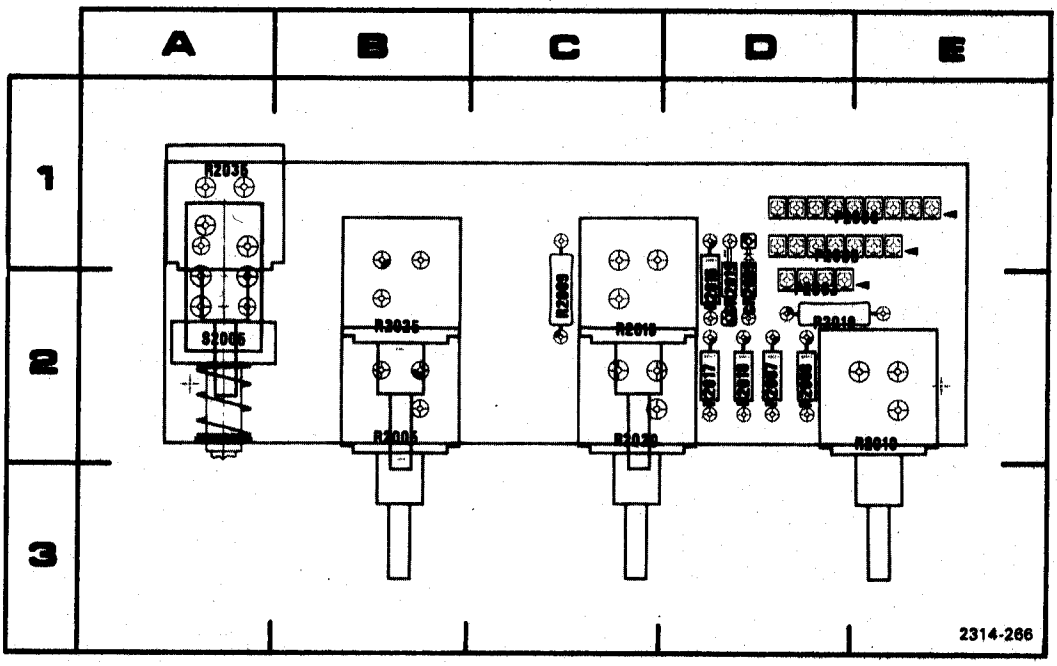


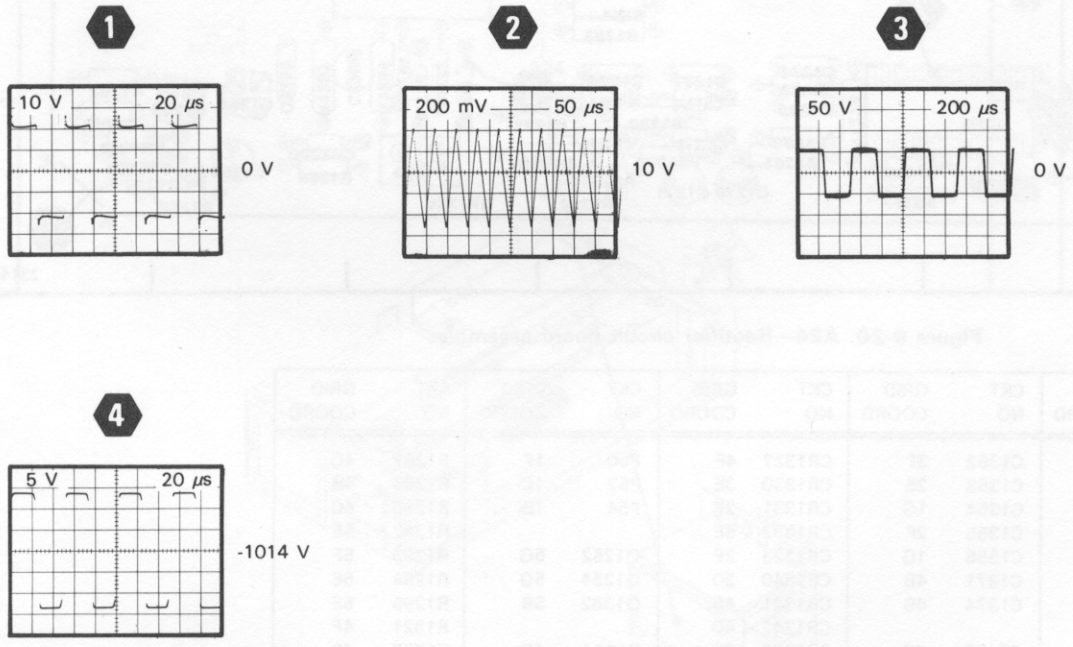
Figure 8-18. A2—Display Control circuit board assembly.

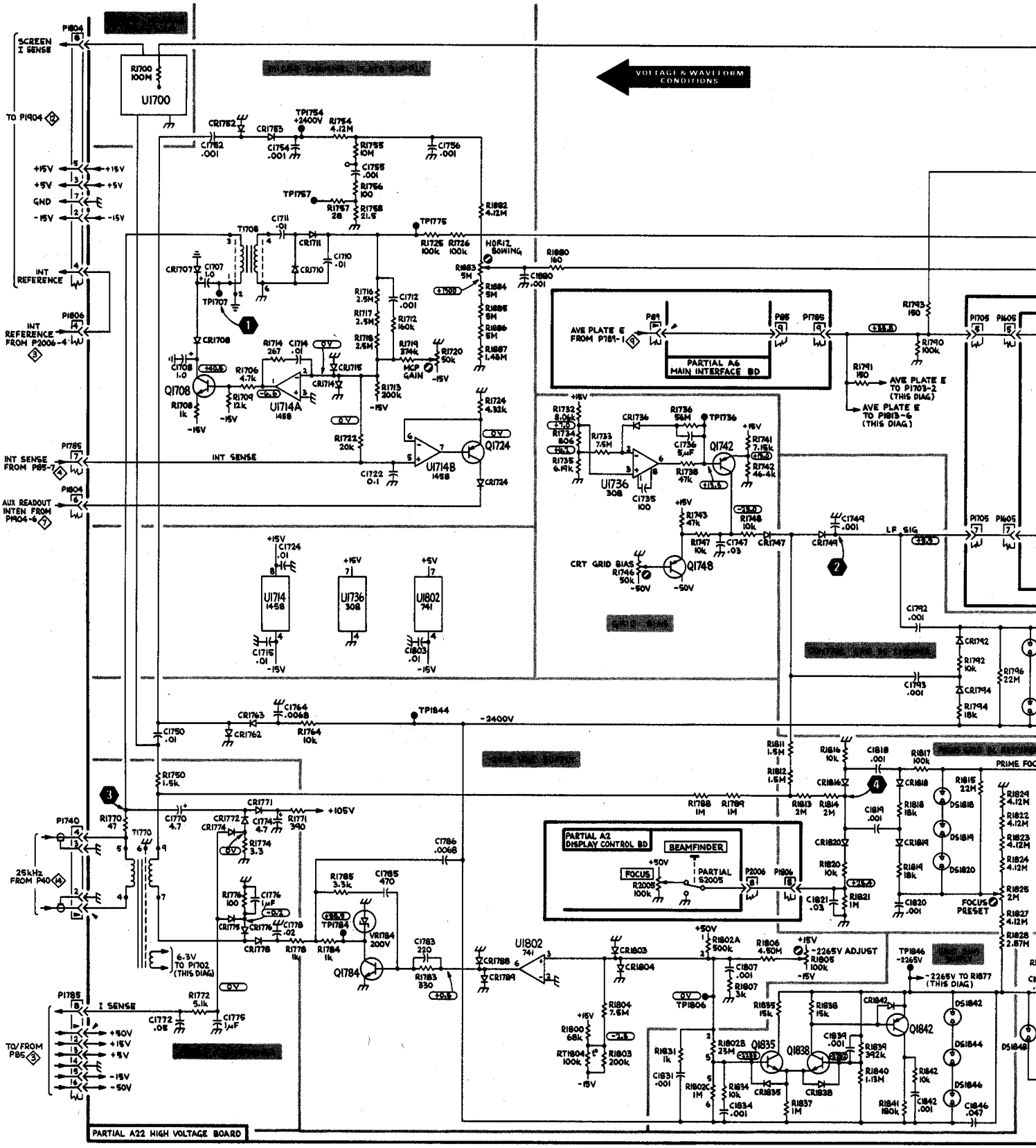
VOLTAGE AND WAVEFORM CONDITIONS

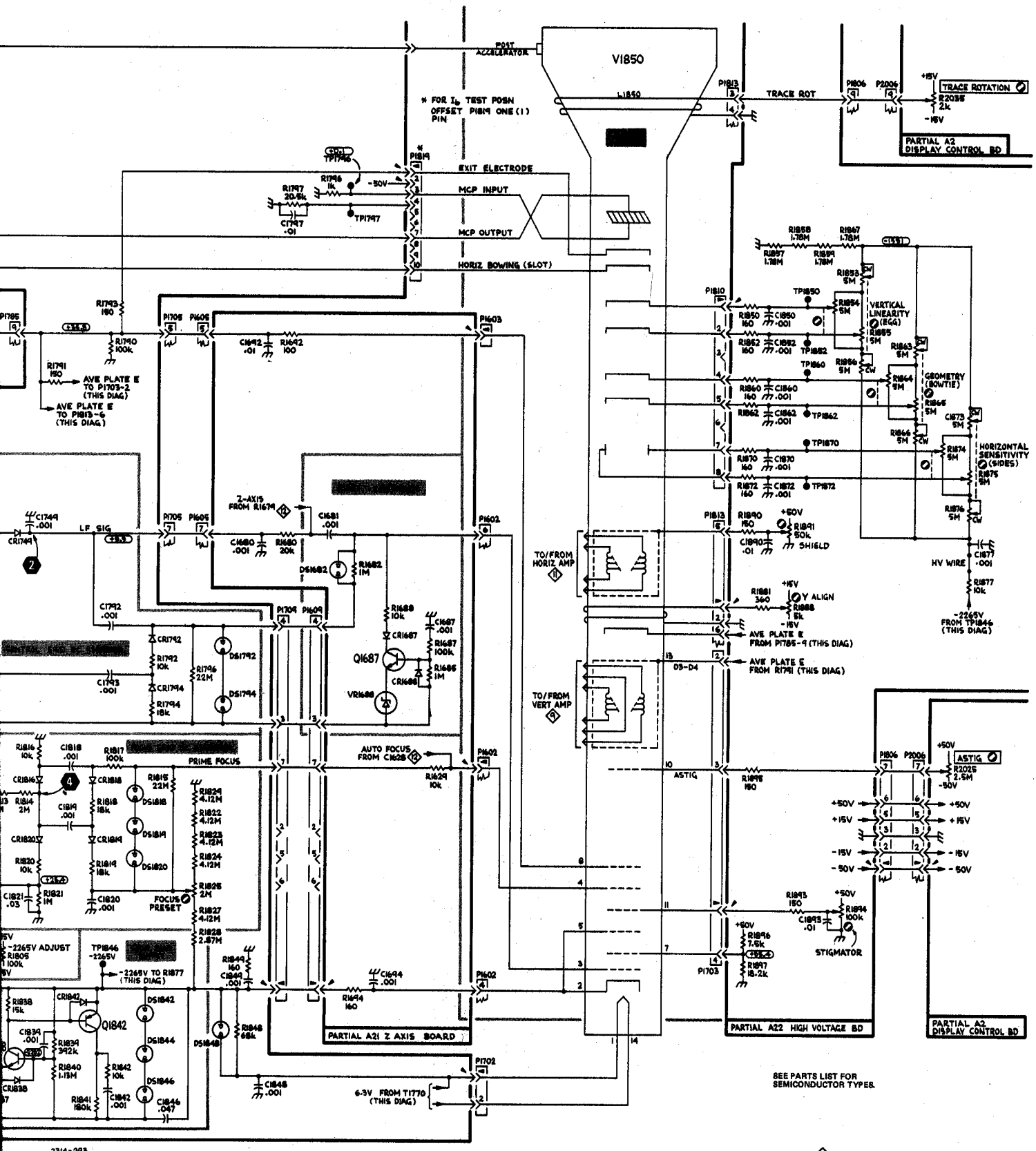
The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance and a high voltage probe. (Tektronix DM501 Digital Multimeter and Tektronix P6013A, 12 kV, 1000X probe, part number 010-0117-01.)

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 MΩ input impedance and at least 60 MHz bandwidth. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.)




VOLTAGE & WAVEFORM CONDITIONS
U1700
SCREEN I SENSE
INT REFERENCE
INT REFERENCE FROM P2006-4
INT SENSE FROM P85-7
AUX READOUT INTEN FROM PM04-6
25kHz FROM P40
TO/FROM P85
I SENSE
6.3V TO P1702 (THIS DIAG)
AVE PLATE E FROM P151-1
AVE PLATE E TO P1703-2 (THIS DIAG)
AVE PLATE E TO P1813-6 (THIS DIAG)
PARTIAL A6 MAIN INTERFACE BD
PARTIAL A2 DISPLAY CONTROL BD
BEAMFINDER
PARTIAL S2005
FOCUS
FOCUS PRESET
PRIME FOC
HORIZ BOWING
MCP GAIN
CRT GRID BIAS
LF SIG
~2265V ADJUST
~2265V TO R1877 (THIS DIAG)
PARTIAL A22 HIGH VOLTAGE BOARD



CRT CIRCUIT 13

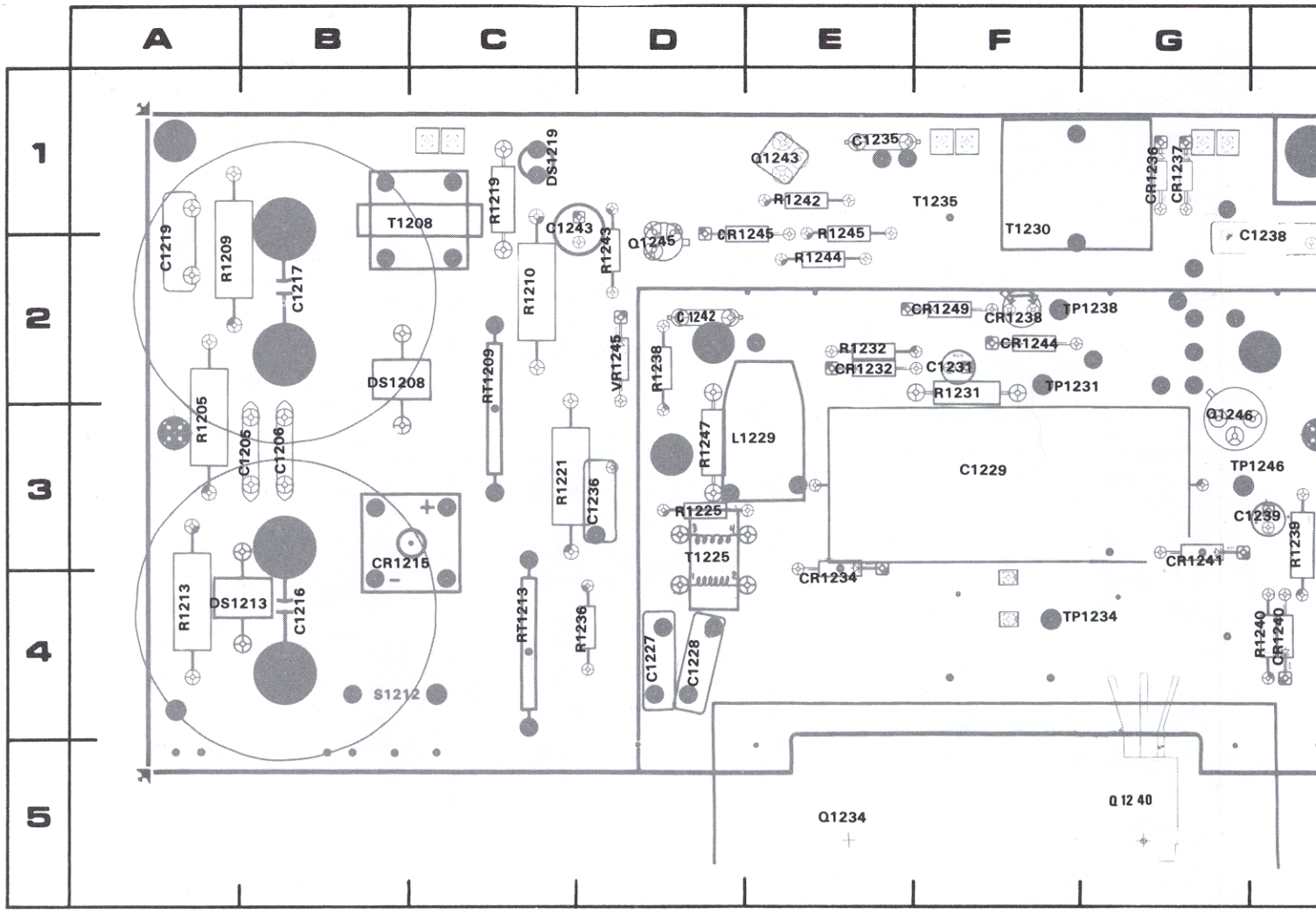
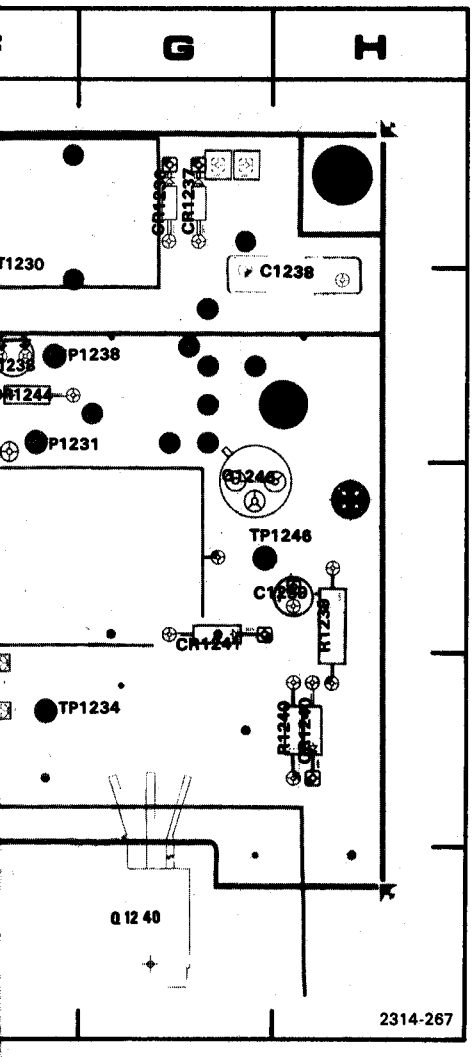
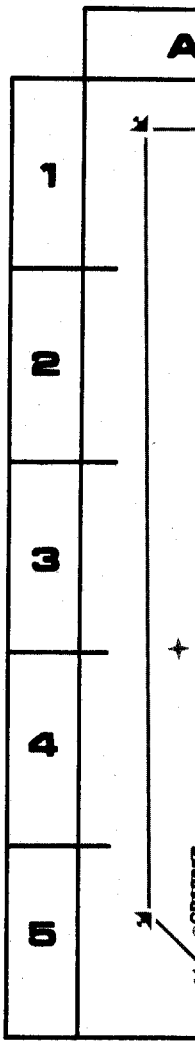


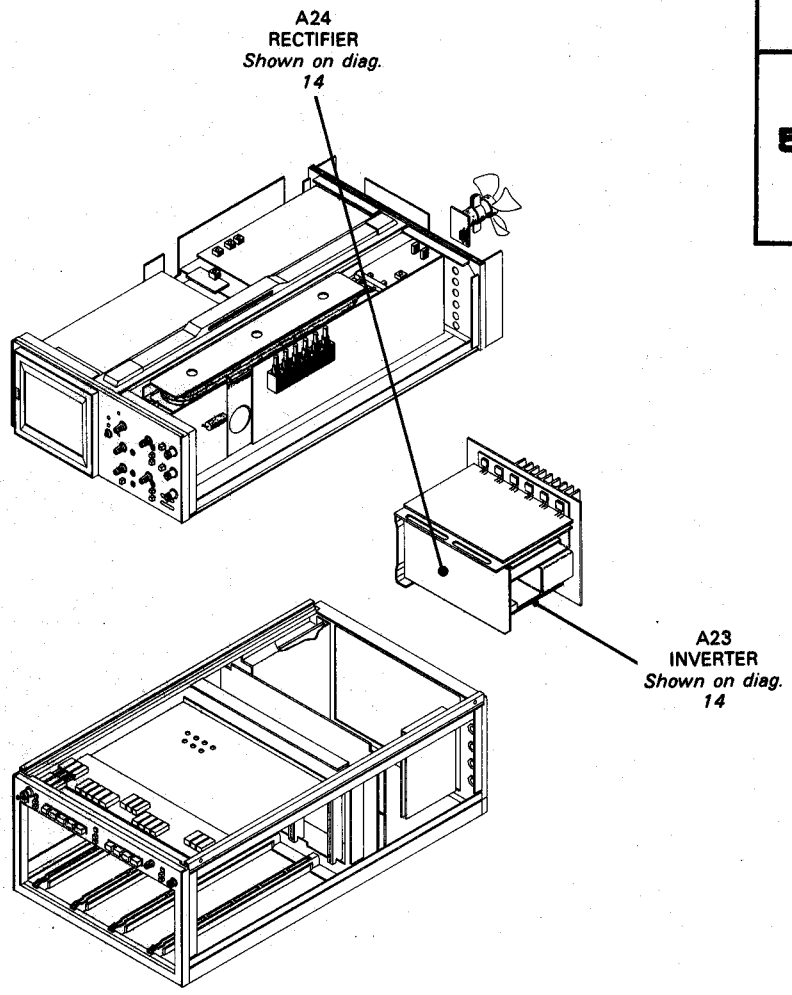
Figure 8-19. A23—Inverter circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1205	3B			DS1219	1C	R1221	3C	RT1213	4C
C1206	3B	CR1215	3B			R1225	3D		
C1216	4B	CR1232	2E	L1229	3E	R1231	2F	S1212	4B
C1217	2B	CR1234	4E			R1232	E		
C1219	2A	CR1236	1G	Q1234	5E	R1236	4D	T1208	1C
C1227	4D	CR1237	1G	Q1240	5G	R1238	2D	T1225	3D
C1228	4D	CR1238	2F	Q1243	1E	R1239	3H	T1230	1F
C1229	3F	CR1240	4H	Q1245	2D	R1240	4H	T1235	1F
C1231	2F	CR1241	3G	Q1246	3G	R1242	1E		
C1235	1E	CR1244	2F			R1243	2D	TP1231	2F
C1236	3D	CR1245	2D	R1205	3A	R1244	2E	TP1234	4G
C1238	2H	CR1249	2F	R1209	2A	R1245	1E	TP1238	2F
C1239	3G			R1210	2C	R1247	3D	TP1246	3G
C1242	2D	DS1208	2B	R1213	4A				
C1243	1C	DS1213	4A	R1219	1C	RT1209	2C	VR1245	2D





GRID COORD
4C
4B
1C
3D
1F
1F
2F
4G
2F
3G
2D



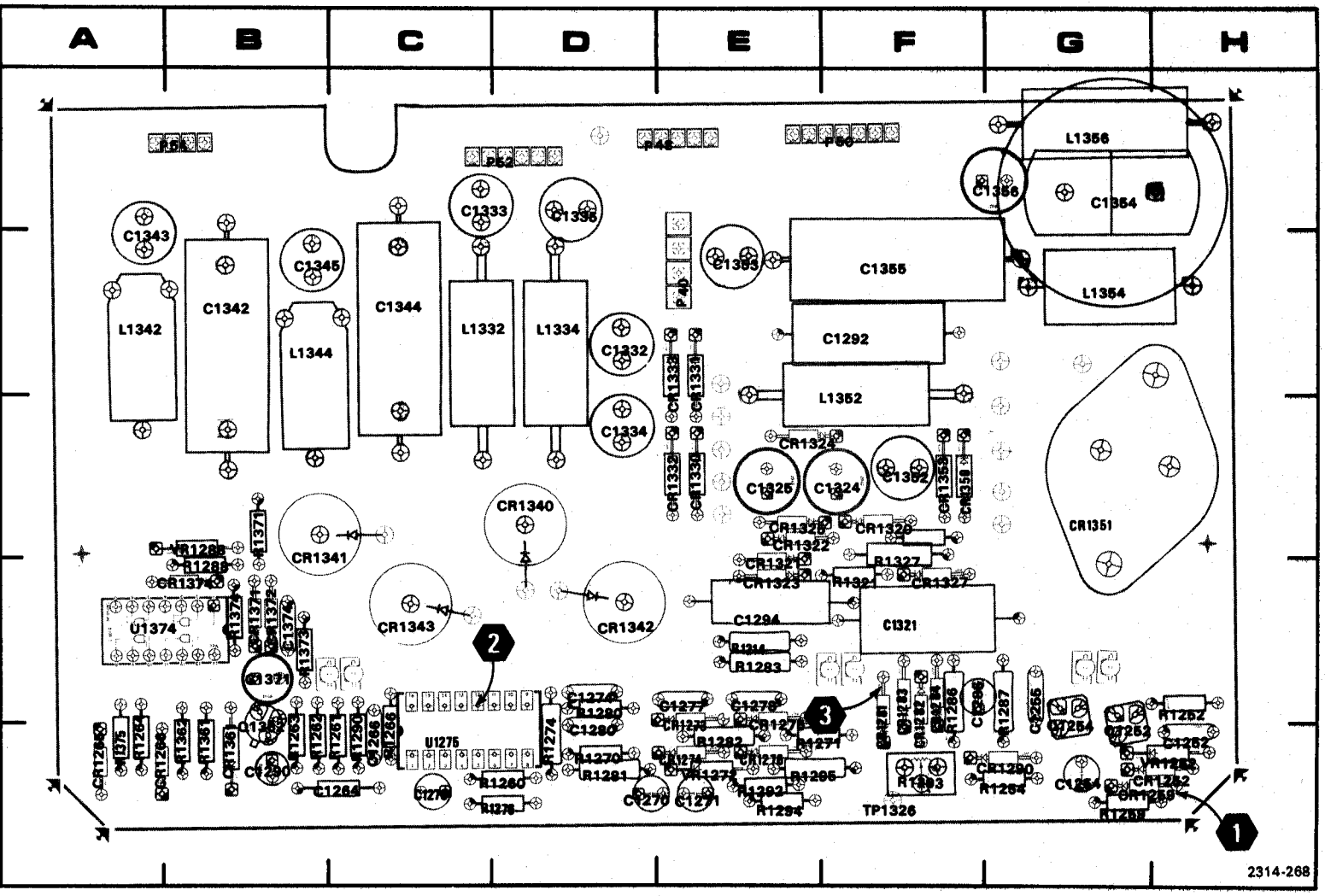


Figure 8-20. A24—Rectifier circuit board assembly.

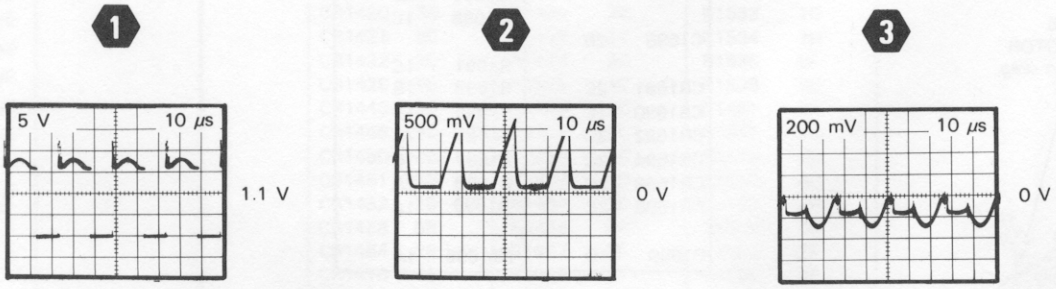
CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1252	5H	C1352	3F	CR1327	4F	P50	1F	R1287	4G
C1254	5G	C1353	2E	CR1330	3E	P52	1C	R1288	4B
C1255	4G	C1354	1G	CR1331	2E	P54	1B	R1290	4C
C1264	4C	C1355	2F	CR1332	3E			R1292	5E
C1266	4C	C1356	1G	CR1333	2E	Q1252	5G	R1293	5F
C1270	5D	C1371	4B	CR1340	3D	Q1254	5G	R1294	5E
C1271	5E	C1374	4B	CR1341	4B	Q1362	5B	R1295	5E
C1274	4D			CR1342	4D			R1321	4F
C1276	4C	CR1252	5G	CR1343	3C	R1214	4E	R1327	4F
C1277	4E	CR1259	5G	CR1350	3F	R1252	4H	R1361	5B
C1278	4E	CR1265	5A	CR1351	3G	R1254	5G	R1362	5B
C1280	5D	CR1266	5A	CR1353	3F	R1259	5G	R1371	3B
C1286	4F	CR1273	5E	CR1361	5B	R1260	5D	R1373	4B
C1290	5B	CR1274	5E	CR1371	4B	R1261	4C	R1374	4B
C1292	2F	CR1275	5E	CR1372	4B	R1262	5B	R1375	5A
C1294	4E	CR1276	5E	CR1374	4B	R1263	5B		
C1321	4F	CR1281	4F			R1264	5A	TP1326	5F
C1324	3F	CR1282	4F	L1332	2C	R1266	4C		
C1325	3E	CR1283	4F	L1334	2D	R1270	5D	U1275	4C
C1332	2D	CR1284	4F	L1342	2A	R1271	5E	U1374	4A
C1333	1C	CR1290	5G	L1344	2B	R1274	5D		
C1334	3D	CR1320	3F	L1352	3F	R1276	5D	VR1252	5H
C1335	1D	CR1321	4E	L1354	2G	R1280	4D	VR1272	5E
C1342	2B	CR1322	3E	L1356	1G	R1281	5D	VR1288	3B
C1343	2A	CR1323	4E			R1282	5E		
C1344	2C	CR1324	3E	P40	2E	R1283	4E		
C1345	2B	CR1325	3E	P48	1D	R1286	4F		

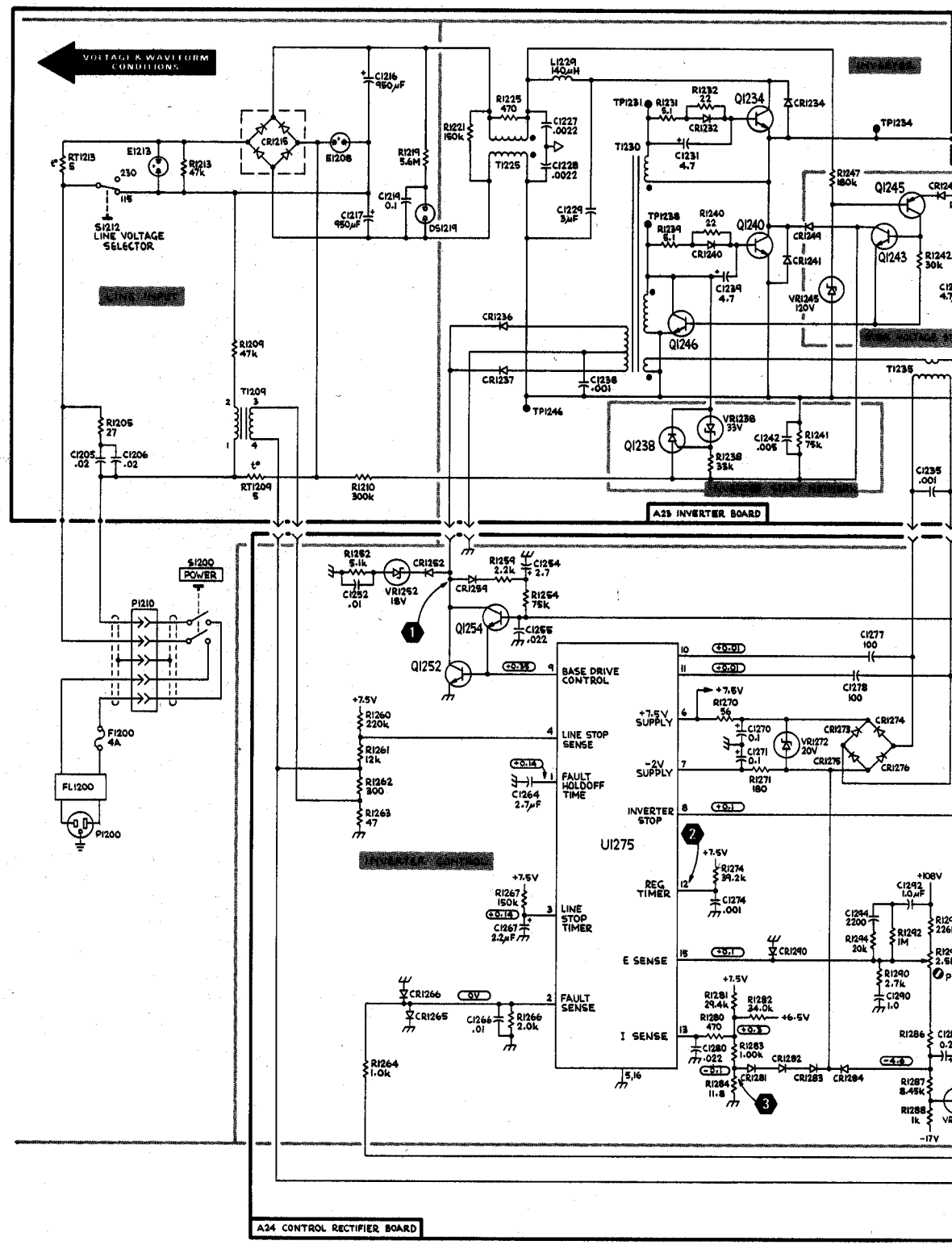
VOLTAGE AND WAVEFORM CONDITIONS

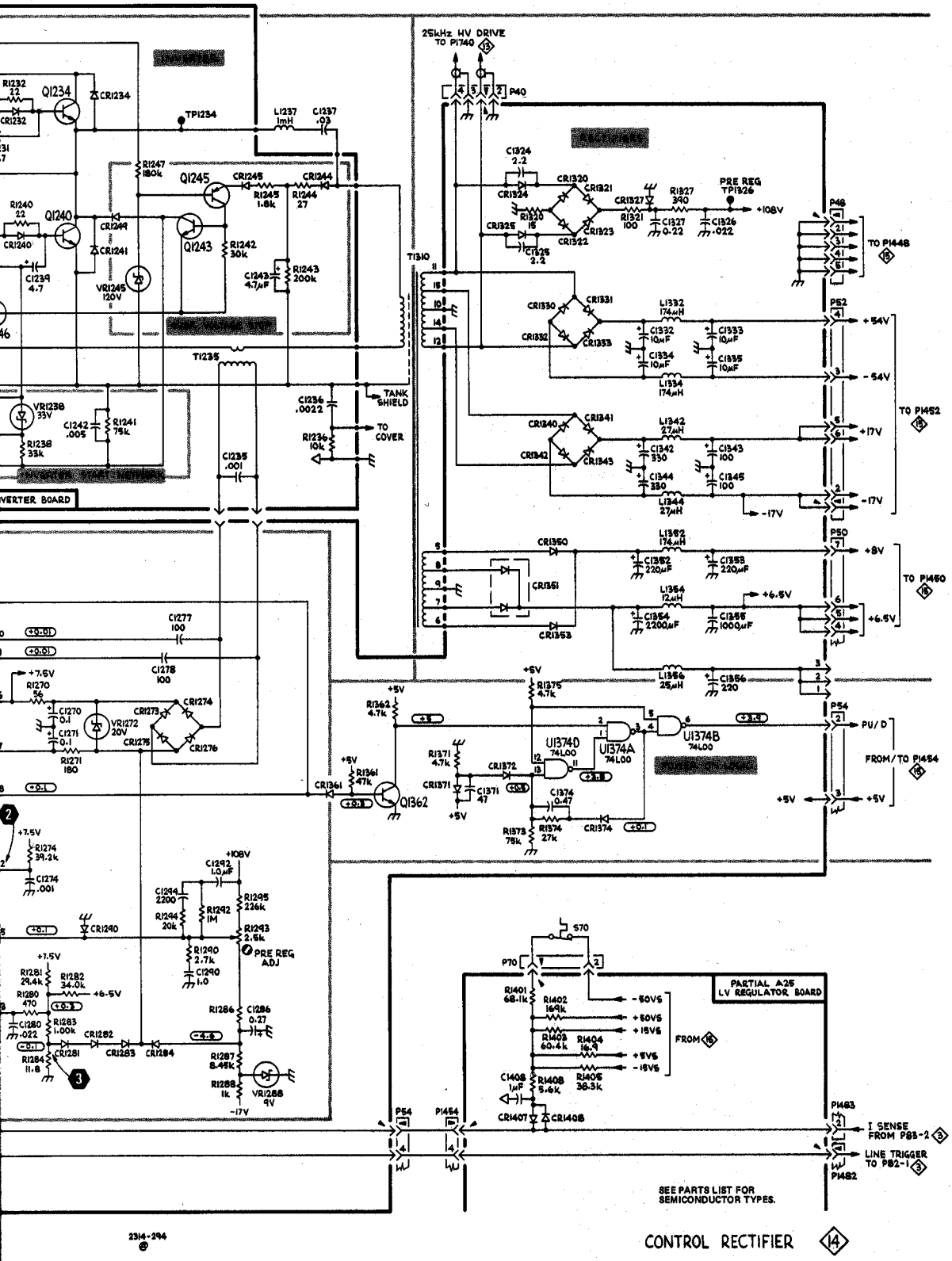
The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance. (Tektronix DM501 Digital Multimeter.)

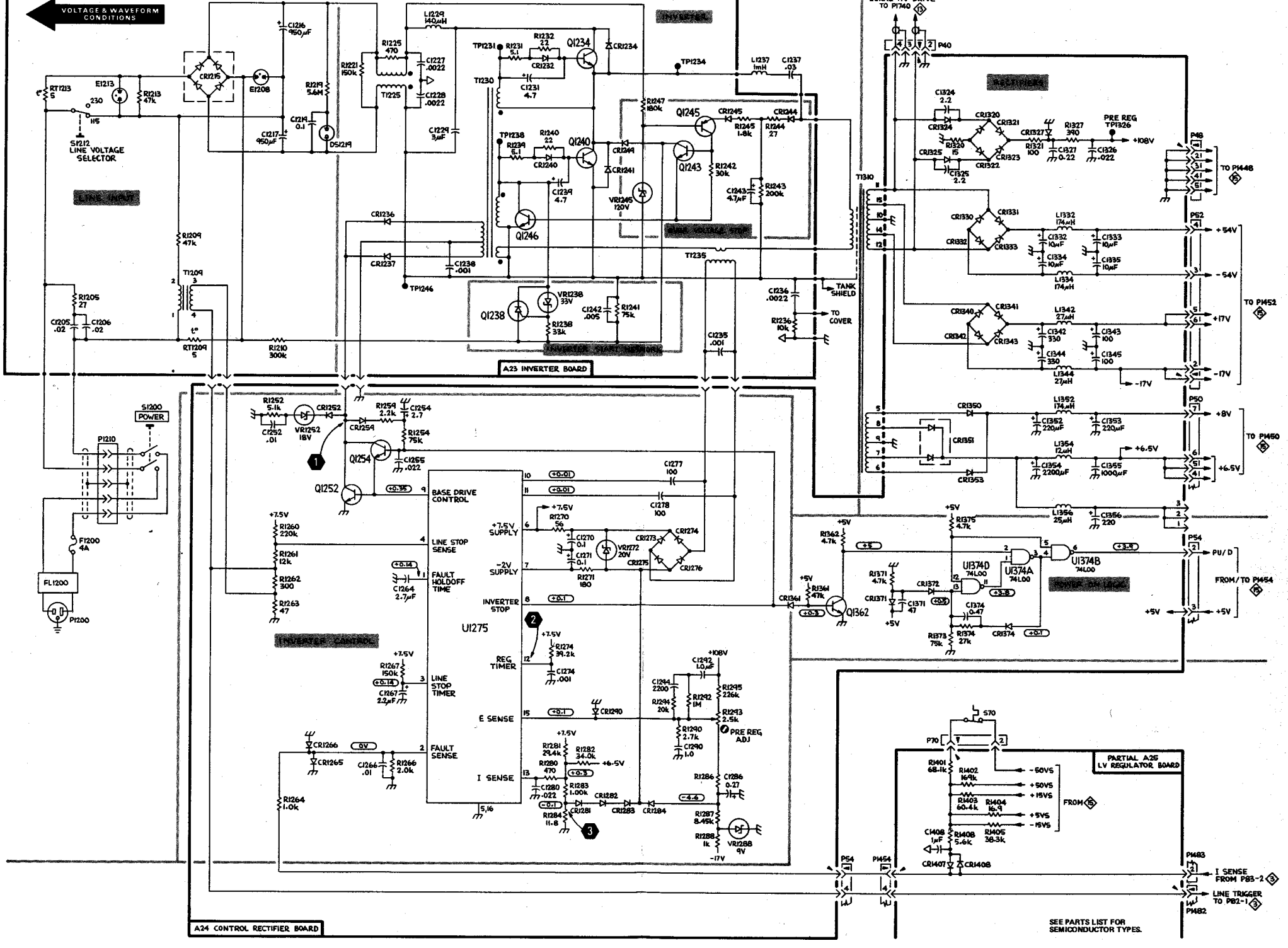
Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 MΩ input impedance and at least 60 MHz bandwidth. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.)




VOLTAGE & WAVEFORM CONDITIONS
LINE INPUT
S1212 LINE VOLTAGE SELECTOR
RT1213 5
E1213
R1213 47k
230
115
CR1216
E1208
C1216 950µF
C1217 950µF
C1219 0.1
DS1219
R1219 5.6M
R1221 150k
R1225 470
L1229 140µH
T1225
C1227 .0022
C1228 .0022
C1229 3µF
T1230
TP1231
R1231 6.1
R1232 2.2
CR1232
Q1234
CR1234
TP1234
C1231 4.7
R1247 180k
Q1245
CR1244
TP1238
R1239 6.1
R1240 22
CR1240
Q1240
CR1249
CR1241
Q1243
R1242 30k
C1239 4.7
VR1245 120V
Q1246
CR1236
CR1237
C1238 .001
TP1246
T1235
R1209 47k
T1209
R1205 27
C1205 .02
C1206 .02
RT1209 5
R1210 300k
Q1238
VR1238 35V
C1242 .005
R1241 75k
R1238 33k
C1235 .001
A23 INVERTER BOARD
S1200 POWER
P1210
F1200 4A
FL1200
P1200
R1252 5.1k
C1252 .01
VR1252 18V
CR1252
R1254 2.2k
C1254 2.7
CR1259
R1254 75k
Q1254
C1255 .022
Q1252
BASE DRIVE CONTROL
C1277 100
C1278 100
+7.5V SUPPLY
R1270 56
C1270 0.1
C1271 0.1
VR1272 20V
CR1273
CR1274
CR1276
R1271 180
-2V SUPPLY
INVERTER STOP
R1260 220k
R1261 12k
R1262 300
R1263 47
LINE STOP SENSE
FAULT HOLDOFF TIME
C1264 2.7µF
INVERTER CONTROL
U1275
R1267 150k
C1267 2.2µF
LINE STOP TIMER
REG TIMER
R1274 39.2k
C1274 .001
C1292 1.0µF
+10.8V
C1294 2200
R1294 20k
R1292 1M
E SENSE
CR1290
R1290 2.7k
C1290 1.0
CR1266
CR1265
C1266 .01
R1266 2.0k
FAULT SENSE
R1264 1.0k
R1281 29.4k
R1282 34.0k
+6.5V
R1280 470
I SENSE
C1280 .022
R1283 1.00k
CR1282
CR1283
CR1284
CR1281
R1284 11.8
R1287 8.45k
R1288 1k
-17V
A24 CONTROL RECTIFIER BOARD



CONTROL RECTIFIER 14


VOLTAGE & WAVEFORM CONDITIONS
LINE INPUT
INVERTER
RECTIFIER
A23 INVERTER BOARD
A24 CONTROL RECTIFIER BOARD
PARTIAL A25 LV REGULATOR BOARD
INVERTER CONTROL
POWER SWITCH
S1212 LINE VOLTAGE SELECTOR
S1200 POWER
TO P1740
TO P1448
TO P1452
TO P1450
FROM/TO P1454
TO COVER
TANK SHIELD
+54V
-54V
+17V
-17V
+8V
+6.5V
PU/D
I SENSE FROM P83-2
LINE TRIGGER TO P82-1
PRE REG TP1326
+108V
BASE DRIVE CONTROL
+7.5V SUPPLY
LINE STOP SENSE
-2V SUPPLY
FAULT HOLDOFF TIME
INVERTER STOP
REG TIMER
LINE STOP TIMER
E SENSE
FAULT SENSE
I SENSE
U1275
PRE REG ADJ
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

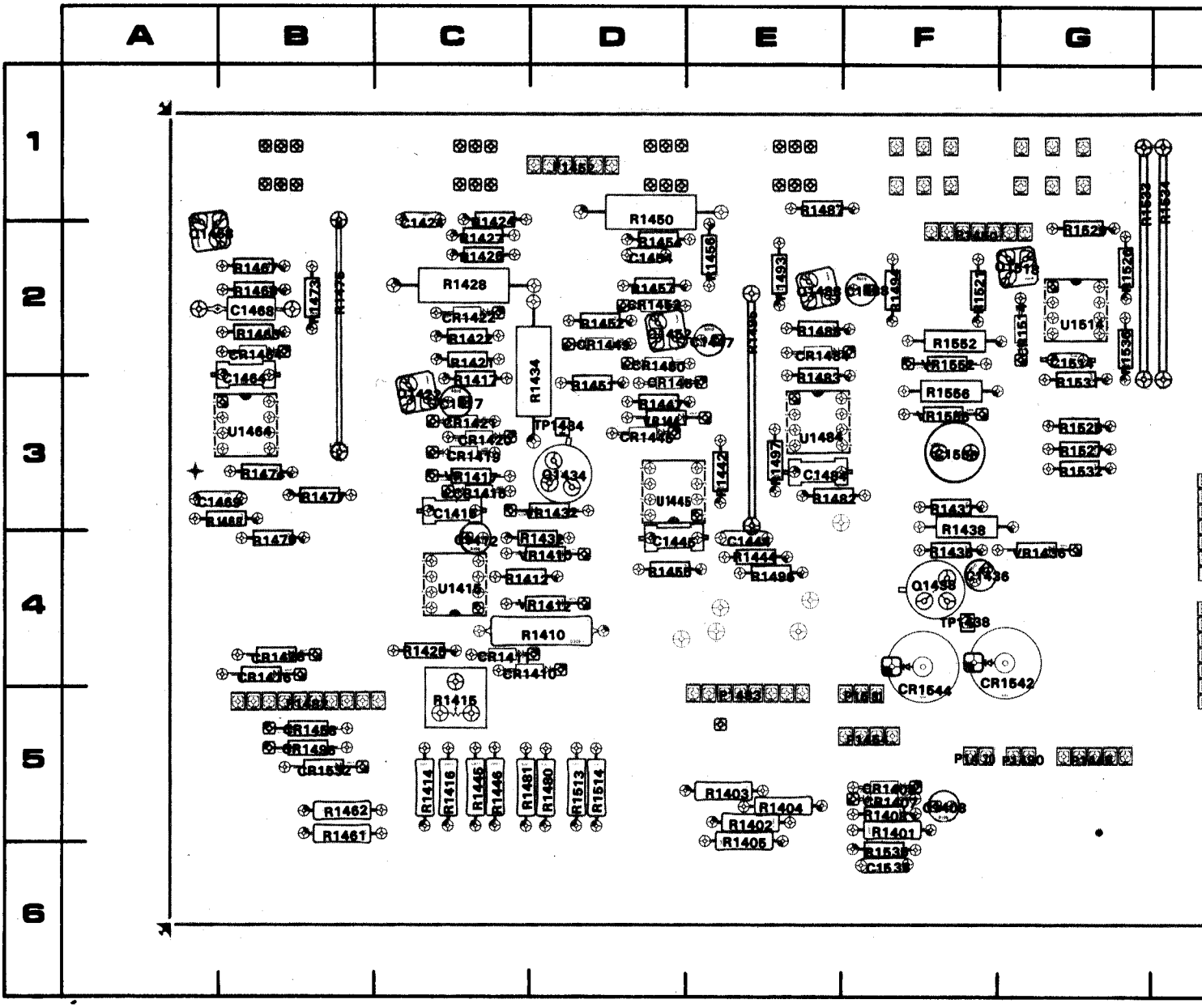
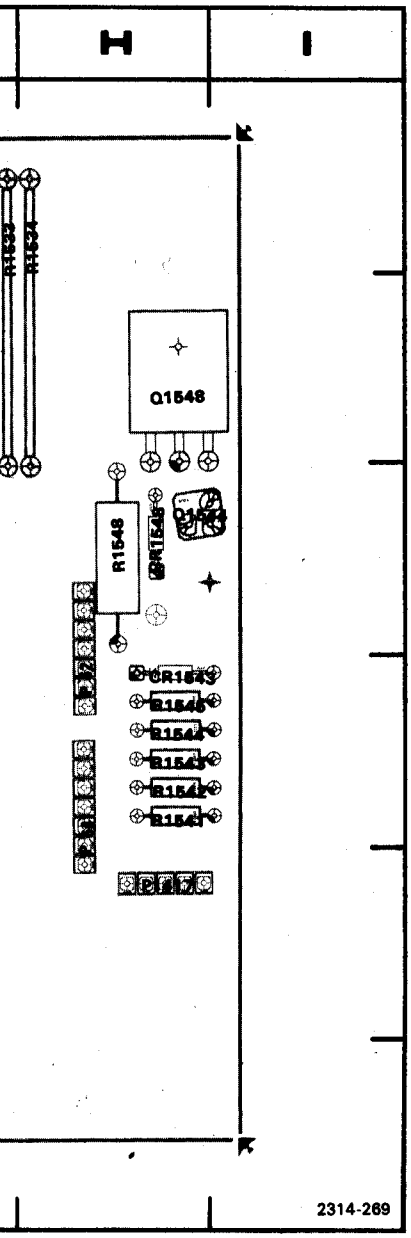
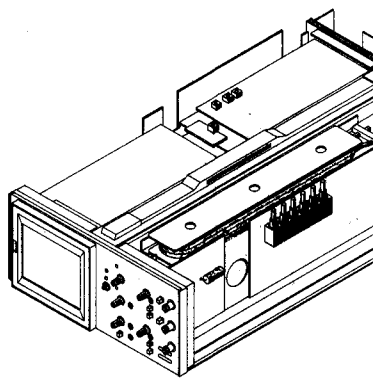


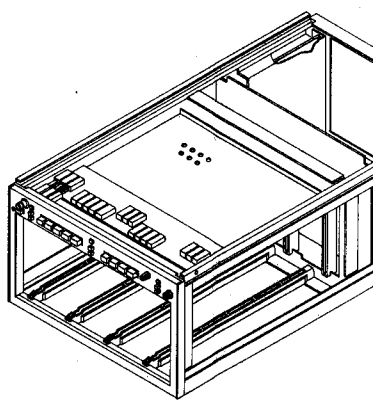
Figure 8-21. A25—Low-Voltage Regulator circuit board assembly.



Locator for Figure 8-21.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1408	5F	P1490	5G	R1473	2B
C1412	4C	P1591	5F	R1474	3C
C1415	3C			R1475	2B
C1417	3C	Q1422	3C	R1476	4B
C1424	2C	Q1434	3D	R1477	3C
C1436	4F	Q1438	4F	R1480	5D
C1444	4E	Q1452	2D	R1481	5C
C1445	4D	Q1468	2B	R1482	3E
C1447	2E	Q1488	2E	R1483	3E
C1454	2D	Q1518	2G	R1485	2E
C1464	3C	Q1544	3H	R1487	1E
C1468	2B	Q1548	2H	R1488	2E
C1469	3C			R1493	2E
C1484	3E	R1401	5F	R1494	2F
C1488	2F	R1402	5E	R1496	4E
C1514	2G	R1403	5E	R1497	3E
C1535	6F	R1404	5E	R1513	5D
C1556	3F	R1405	5E	R1514	5D
		R1408	5F	R1521	2F
CR1407	5F	R1410	4D	R1526	2G
CR1408	5F	R1412	4C	R1527	3G
CR1410	4C	R1414	5C	R1528	3G
CR1411	4C	R1415	4C	R1529	2G
CR1415	3C	R1416	5C	R1531	3G
CR1419	3C	R1417	3C	R1532	3G
CR1420	3C	R1421	2C	R1533	1G
CR1421	3C	R1422	2C	R1534	1H
CR1422	2C	R1424	2C	R1535	6F
CR1428	4B	R1425	4C	R1536	2G
CR1445	3D	R1426	2C	R1541	4H
CR1449	2D	R1427	2C	R1542	4H
CR1450	2D	R1428	2C	R1543	4H
CR1451	3D	R1432	4D	R1544	4H
CR1452	2D	R1434	3D	R1545	4H
CR1458	5B	R1436	4F	R1548	3H
CR1464	2B	R1437	3F	R1552	2F
CR1476	4B	R1438	3F	R1556	3F
CR1484	2E	R1442	3E		
CR1496	5B	R1444	4E	TP1438	4F
CR1514	2G	R1445	5C	TP1484	3D
CR1532	5B	R1446	5C		
CR1542	4G	R1447	3D	U1415	4C
CR1543	4H	R1450	2D	U1445	3D
CR1544	5F	R1451	3D	U1464	3C
CR1548	3H	R1452	2D	U1484	3E
		R1454	2D	U1514	2G
P62	4H	R1455	4D		
P1417	5H	R1456	1E	VR1410	4D
P1448	5G	R1457	2D	VR1412	4D
P1450	2F	R1461	5B	VR1417	3C
P1452	1D	R1462	5B	VR1432	3D
P1454	5F	R1463	2B	VR1436	4G
P1470	5F	R1467	2B	VR1447	3D
P1482	5B	R1468	2B	VR1552	2F
P1483	5E	R1469	3C	VR1556	3F





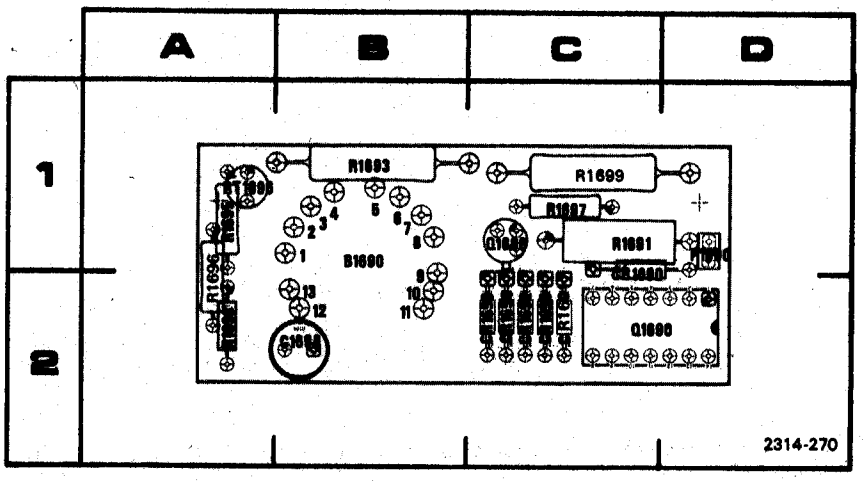
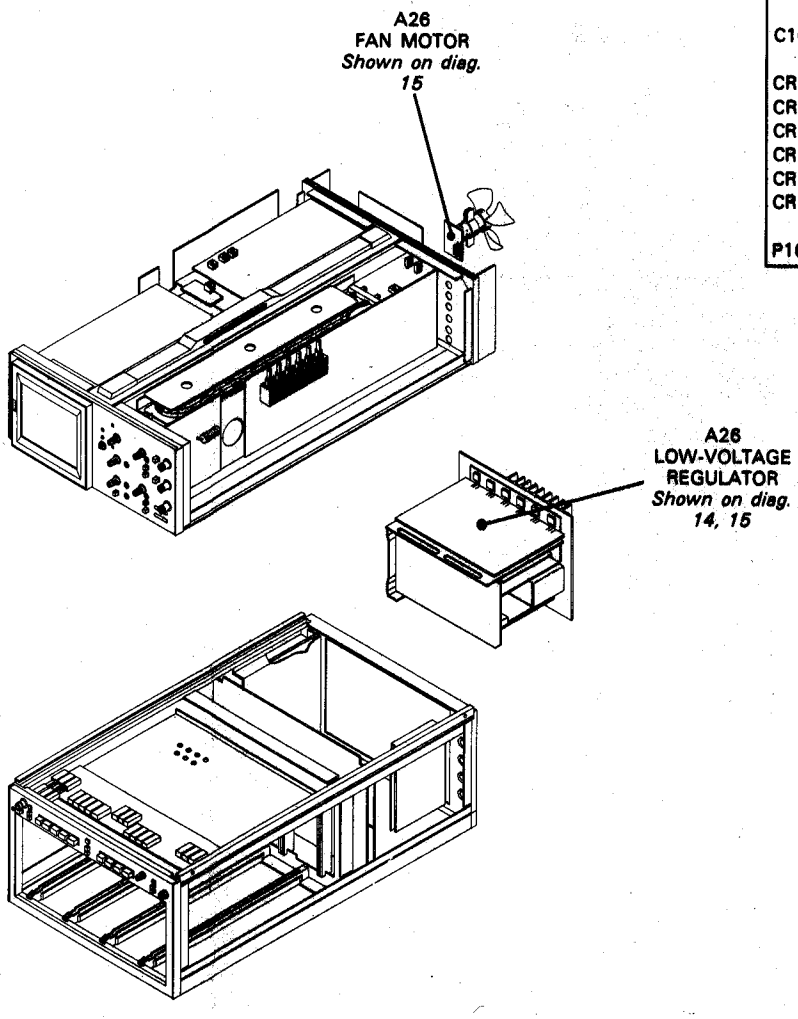


Figure 8-22. A26—Fan Motor circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD
B1690	1B		
		Q1690	2C
		Q1698	1C
C1698	2B		
		R1691	1C
CR1691	2C	R1693	1B
CR1690	1C	R1695	1A
CR1692	2C	R1696	2A
CR1694	2C	R1697	1C
CR1696	2C	R1698	2A
CR1698	2C	R1699	1C
P1690	1D	RT1696	1A



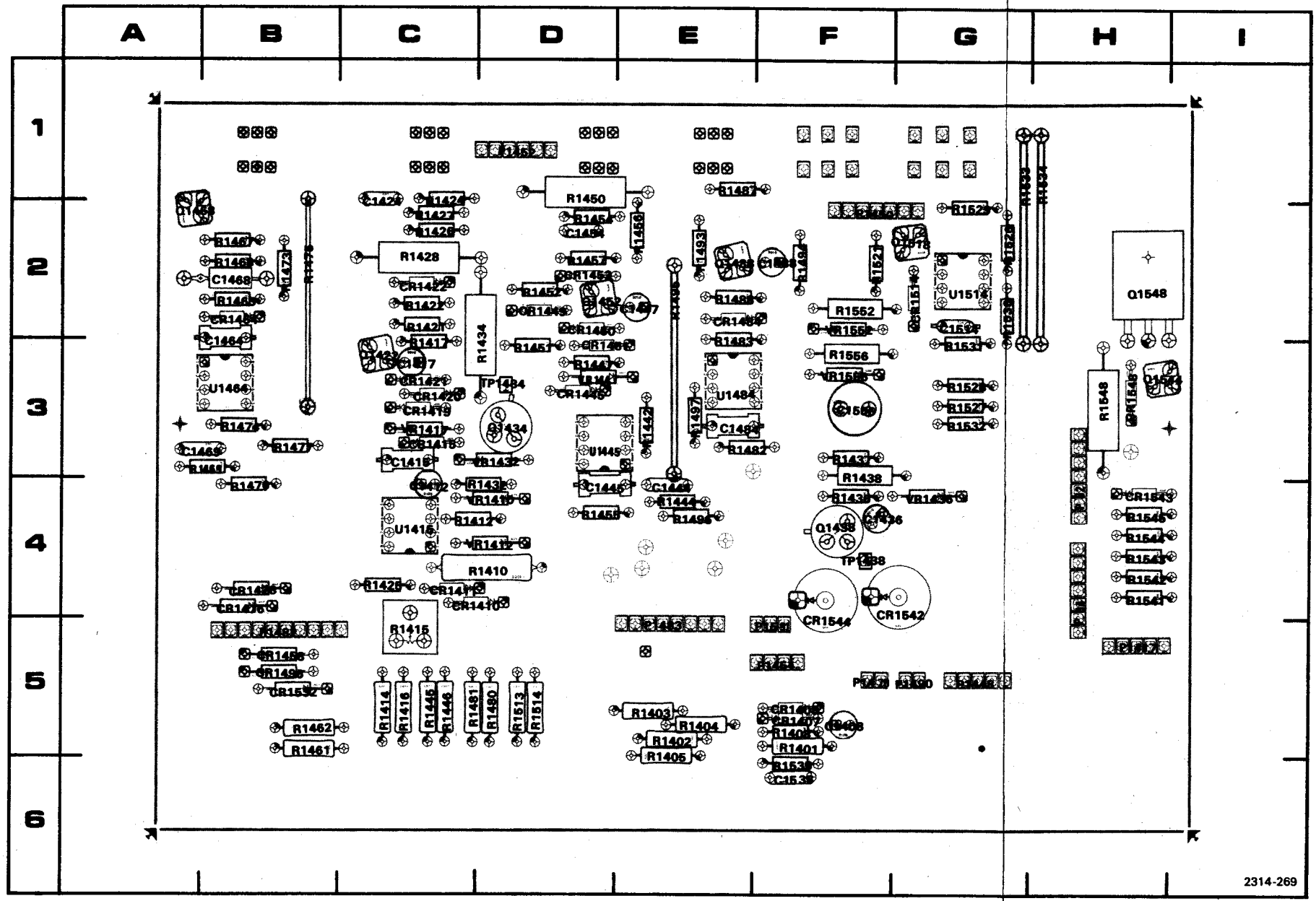
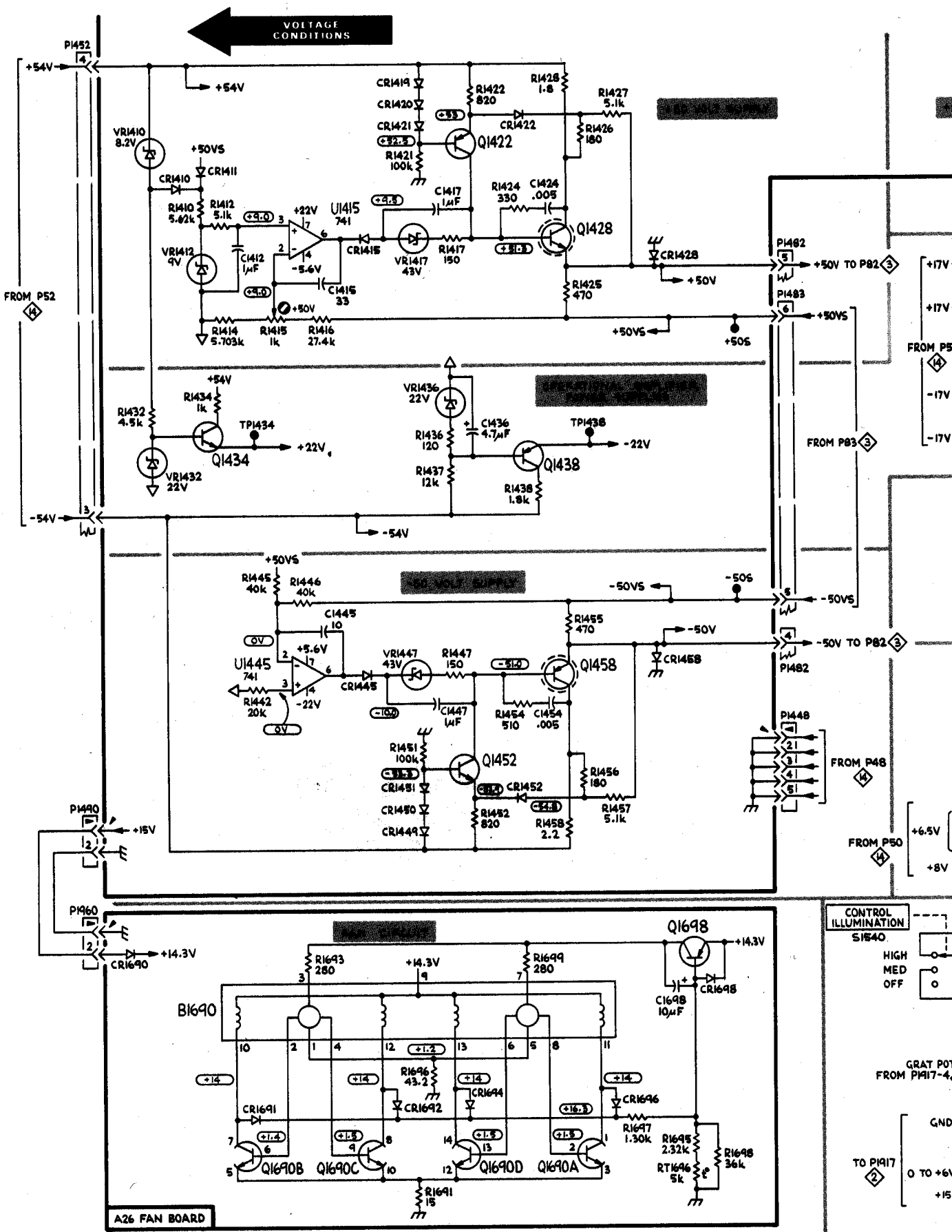


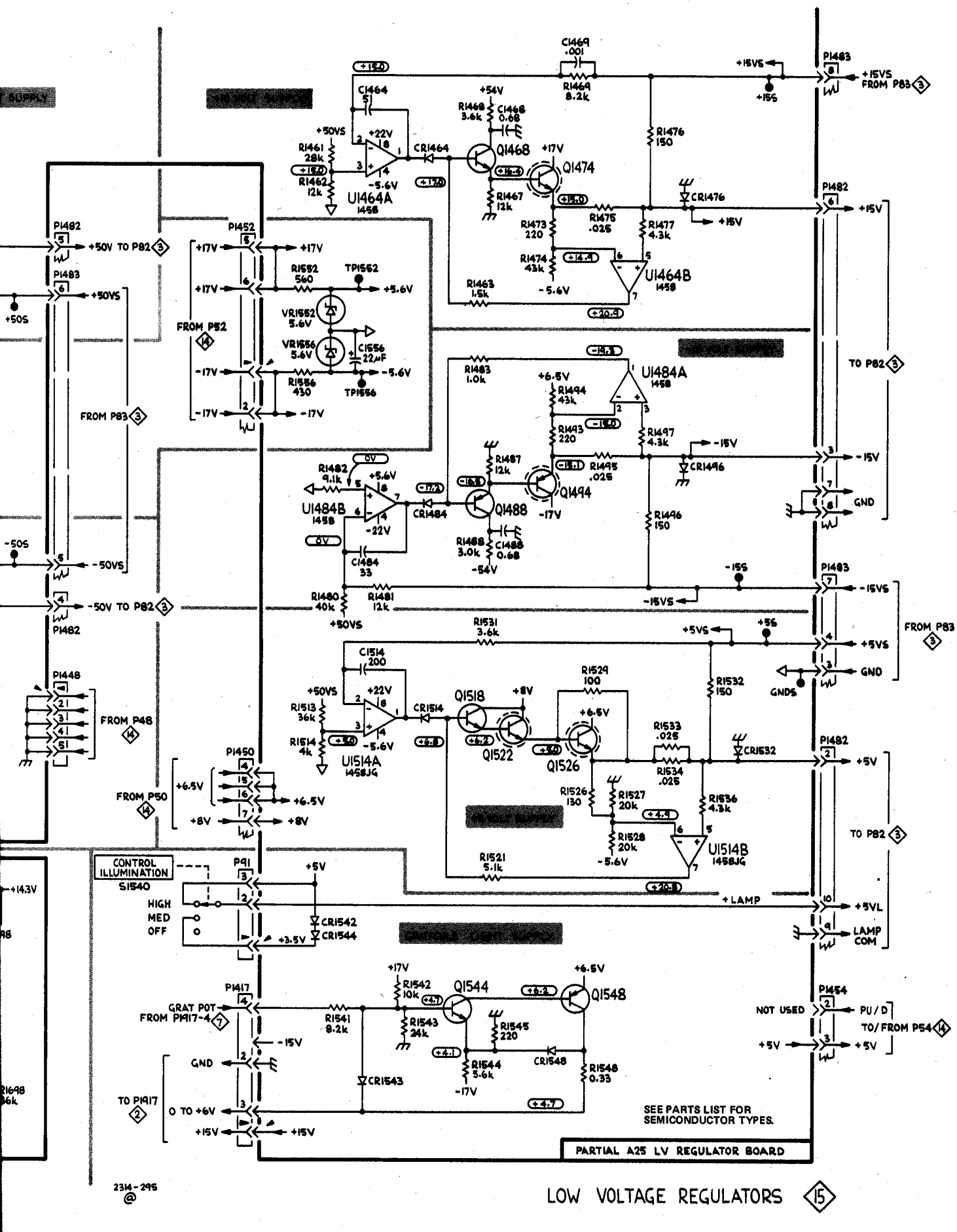
Figure 8-21. A25—Low-Voltage Regulator circuit board assembly.

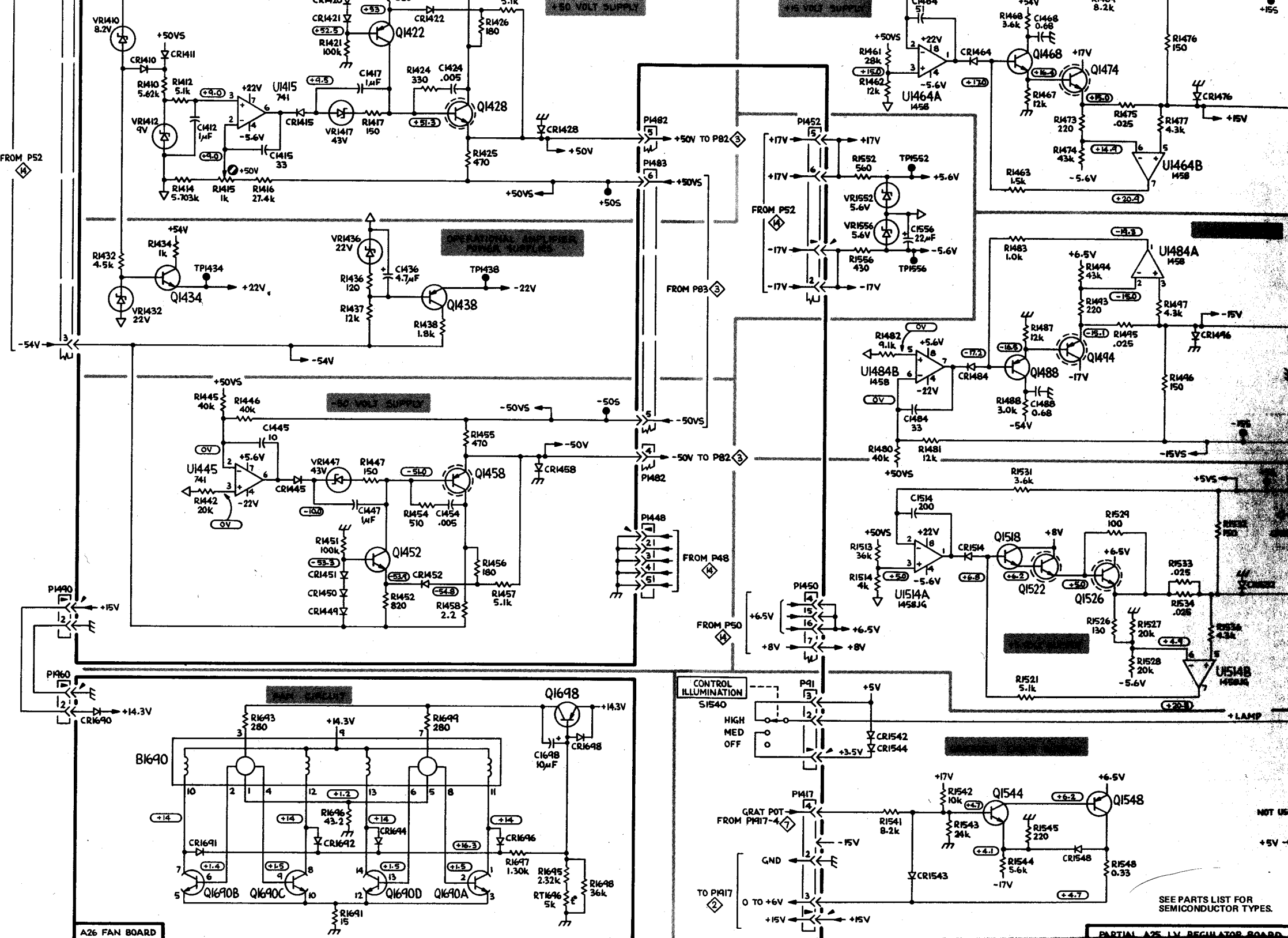
VOLTAGE CONDITIONS

The voltages shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B. No plug-in units were installed.

The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).


VOLTAGE CONDITIONS
P1452
+54V
VR1410 8.2V
+50VS
CR1411
CR1410
R1410 5.62k
R1412 5.1k
VR1412 9V
C1412 1μF
U1415 741
+22V
-5.6V
C1415 33
CR1415
VR1417 43V
R1417 150
C1417 1μF
R1424 330
C1424 .005
Q1428
CR1428
R1425 470
P1482
+50V TO P82
P1483
+50VS
+50S
R1414 5.703k
R1415 1k
R1416 27.4k
FROM P52
CR1419
CR1420
CR1421
R1421 100k
R1422 820
Q1422
CR1422
R1426 180
R1427 5.1k
R1428 1.8
+54V
R1432 4.5k
R1434 1k
Q1434
TP1434
+22V
VR1432 22V
VR1436 22V
C1436 4.7μF
R1436 120
R1437 12k
Q1438
TP1438
-22V
R1438 1.8k
FROM P83
-54V
+50VS
R1445 40k
R1446 40k
C1445 10
U1445 741
+5.6V
-22V
R1442 20k
VR1447 43V
R1447 150
CR1445
C1447 1μF
Q1458
R1455 470
CR1458
-50V
-50V TO P82
P1482
-50VS
-50S
R1454 510
C1454 .005
P1448
FROM P48
R1451 100k
Q1452
CR1451
CR1450
CR1449
CR1452
R1452 820
R1456 180
R1457 5.1k
R1458 2.2
P1490
+15V
FROM P50
+6.5V
+8V
P1960
+14.3V
CR1690
Q1698
C1698 10μF
CR1698
R1693 280
R1699 280
B1690
R1696 43.2
CR1691
CR1692
CR1694
CR1696
R1697 1.30k
R1695 2.32k
RT1696 5k
R1698 36k
Q1690B
Q1690C
Q1690D
Q1690A
R1691 15
A26 FAN BOARD
CONTROL ILLUMINATION
S1540
HIGH
MED
OFF
TO P1917
GND
2314-295


+15.0
C1469 .001
R1469 8.2k
+15VS
P1483
+15VS FROM P83
+15S
C1464
+54V
R1468 3.6k
C1466 0.68
+50VS
R1461 28k
+22V
CR1464
Q1468
+17V
Q1474
R1476 150
R1462 12k
-5.6V
U1464A 1458
R1467 12k
+15.0
CR1476
P1482
+15V
R1473 220
R1475 .025
R1477 4.3k
R1474 43k
+14.4
U1464B 1458
R1463 1.5k
-5.6V
+20.5
P1482
+50V TO P82
P1452
+17V
R1552 560
TP1552
+5.6V
P1483
+50VS
+50S
FROM P82
VR1552 5.6V
VR1556 5.6V
C1556 22μF
-17V
R1556 430
TP1556
-5.6V
FROM P83
-15.5
R1483 1.0k
U1484A 1458
+6.5V
R1494 43k
R1493 220
-15.0
R1497 4.3k
-15V
TO P82
R1487 12k
-15.1
R1495 .025
CR1496
Q1494
0V
R1482 9.1k
+5.6V
-17.2
U1484B 1458
CR1484
Q1488
-17V
GND
-22V
R1496 150
R1488 3.0k
C1488 0.68
-50S
C1484 33
-15S
P1483
-50VS
-50V TO P82
R1480 40k
R1481 12k
-15VS
P1482
+50VS
R1531 3.6k
+5VS
+5S
FROM P83
C1514 200
R1529 100
P1448
+50VS
+22V
Q1518
+8V
R1532 150
GNDS
GND
R1513 36k
CR1514
+6.6V
FROM P48
R1514 4k
-5.6V
+5.0
+6.8
Q1522
Q1526
R1533 .025
CR1532
P1482
+5V
U1514A 1458JG
R1534 .025
P1450
+6.5V
FROM P50
R1526 130
R1527 20k
R1536 4.3k
+4.9
TO P82
R1528 20k
-5.6V
U1514B 1458JG
R1521 5.1k
+20.8
CONTROL ILLUMINATION S1540
P91
+5V
+LAMP
P1482
+5VL
HIGH
MED
OFF
CR1542
CR1544
+3.5V
LAMP COM
+17V
R1542 10k
Q1544
+6.5V
Q1548
P1417
GRAT POT FROM P1417-4
R1541 8.2k
R1543 24k
R1545 220
P1454
NOT USED
PU/D
TO/FROM P54
-15V
+5V
GND
CR1543
R1544 5.6k
CR1548
R1548 0.33
-17V
TO P1417
0 TO +6V
+15V
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
PARTIAL A25 LV REGULATOR BOARD
2314-295
LOW VOLTAGE REGULATORS 15

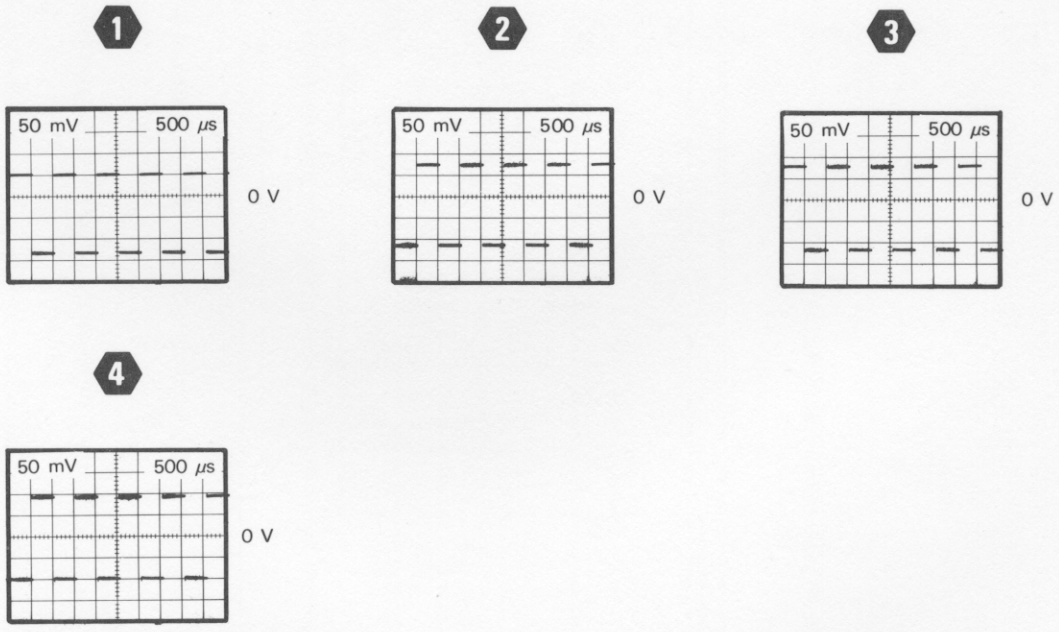

+50 VOLT SUPPLY
+15 VOLT SUPPLY
OPERATIONAL AMPLIFIER POWER SUPPLIES
-50 VOLT SUPPLY
FAN CIRCUIT
CONTROL ILLUMINATION
S1540
HIGH
MED
OFF
+LAMP
FROM P52
FROM P83
FROM P48
FROM P50
TO P82
TO P91
TO P1417
GRAT POT FROM P1417-4
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
A26 FAN BOARD
PARTIAL A25 LV REGULATOR BOARD

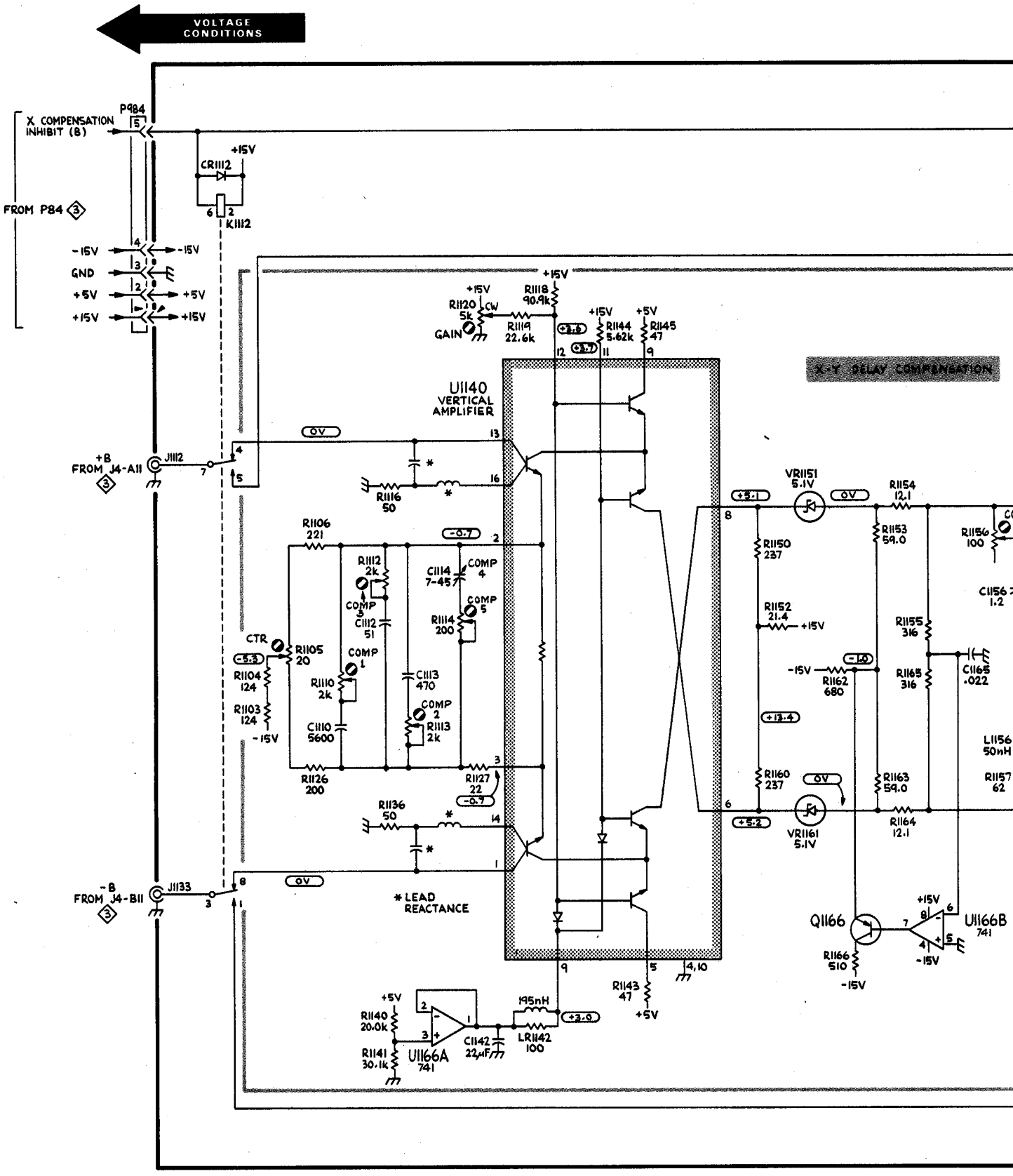
VOLTAGE AND WAVEFORM CONDITIONS

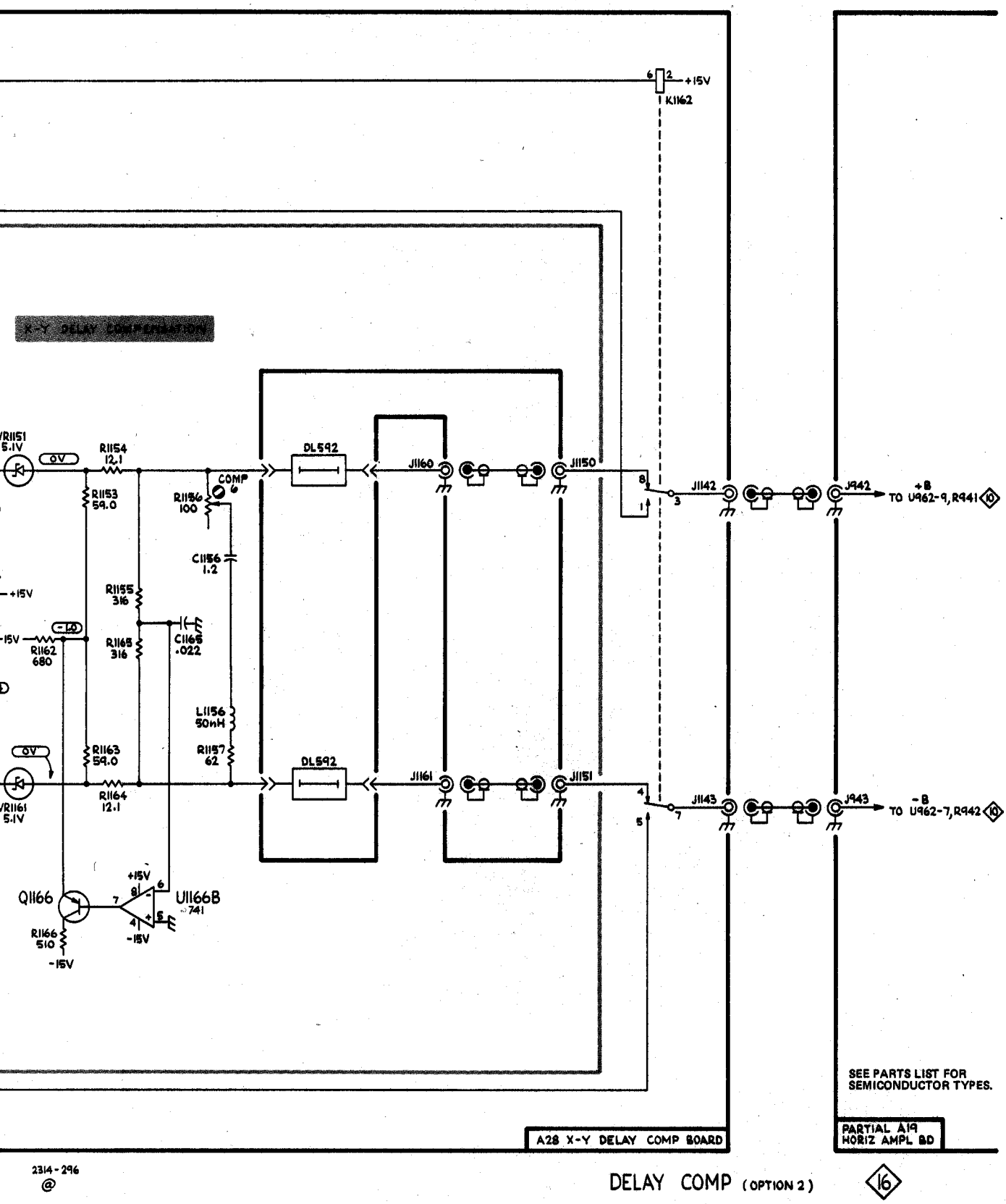
The voltages and waveforms shown were obtained with the 7104 front panel variable controls at midrange except INTENSITY controls fully counterclockwise; VERTICAL MODE, LEFT; TRIGGER SOURCE, VERT MODE; HORIZONTAL MODE, B; CALIBRATOR, 4V.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with a readout-equipped 7000-series Oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 1 MΩ input impedance and at least 60 MHz bandwidth. (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with a 10X probe.) A 7A-series vertical amplifier plug-in was installed in the 7104 B HORIZ compartment and the CALIBRATOR output was connected to the vertical amplifier input. The B INTENSITY control and Vertical Amplifier was set to display 6 to 8 horizontal divisions on the 7104. The test oscilloscope was externally triggered on the +Slope of the CALIBRATOR signal.



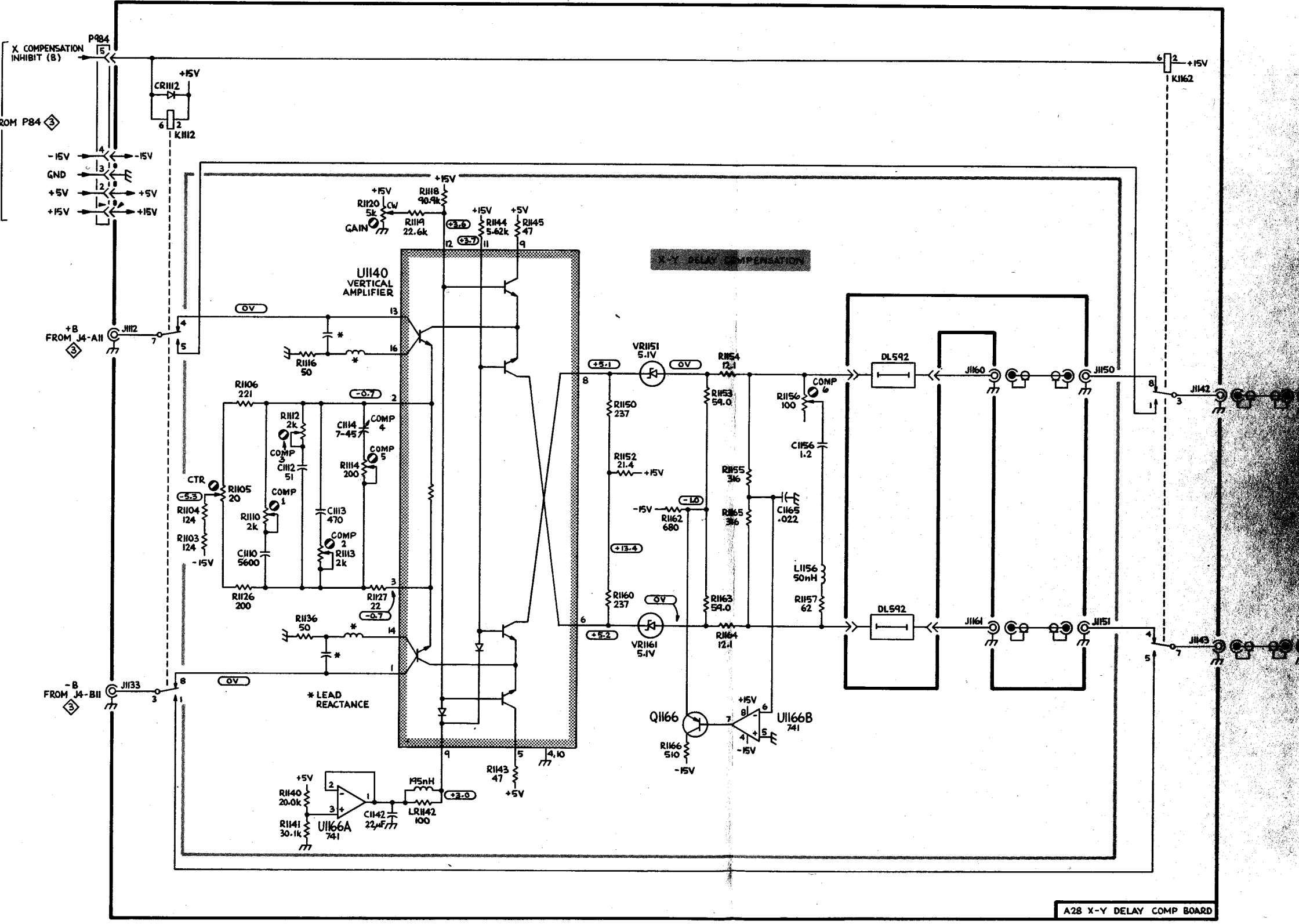

VOLTAGE CONDITIONS
X COMPENSATION INHIBIT (8)
P984
FROM P84
CR1112
K1112
-15V
GND
+5V
+15V
U1140 VERTICAL AMPLIFIER
X-Y DELAY COMPENSATION
R1118 90.9k
R1120 5k CW
GAIN
R1119 22.6k
R1144 5.62k
R1145 47
R1116 50
R1106 221
R1112 2k
C1112 51
C1114 7-45
R1114 200
R1105 20
CTR
R1104 124
R1103 124
R1110 2k
C1110 5600
C1113 470
R1113 2k
R1126 200
R1127 22
R1136 50
VR1151 5.1V
R1154 12.1
R1150 237
R1153 59.0
R1156 100
R1152 21.4
R1155 316
R1162 680
R1165 316
C1165 .022
R1160 237
R1163 59.0
R1164 12.1
VR1161 5.1V
L1156 50nH
R1157 62
J1112
J1133
+B FROM J4-A11
-B FROM J4-B11
* LEAD REACTANCE
Q1166
U1166B 741
R1166 510
R1140 20.0k
R1141 30.1k
U1166A 741
C1142 22μF
195nH
LR1142 100
R1143 47



2314-296

DELAY COMP (OPTION 2)

16


X COMPENSATION INHIBIT (B)
P984
FROM P84
CR1112
K1112
K1162
-15V
GND
+5V
+15V
R1118 90.9k
R1120 5k CW
GAIN
R1119 22.6k
R1144 5.62k
R1145 47
U1140 VERTICAL AMPLIFIER
X-Y DELAY COMPENSATION
+B FROM J4-A11
J1112
-B FROM J4-B11
J1133
R1116 50
R1106 221
R1112 2k
C1114 7-45
C1112 51
R1114 200
CTR
R1105 20
R1104 124
R1103 124
R1110 2k
C1110 5600
C1113 470
R1113 2k
R1126 200
R1127 22
R1136 50
* LEAD REACTANCE
VR1151 5.1V
VR1161 5.1V
R1154 12.1
R1153 54.0
R1156 100
R1150 237
R1152 21.4
R1155 316
R1165 316
R1162 680
C1156 1.2
C1165 .022
L1156 50nH
R1157 62
R1160 237
R1163 54.0
R1164 12.1
DL592
J1160
J1150
J1161
J1151
J1142
J1143
Q1166
R1166 510
U1166B 741
R1140 20.0k
R1141 30.1k
U1166A 741
C1142 22µF
195nH
LR1142 100
R1143 47
A28 X-Y DELAY COMP BOARD

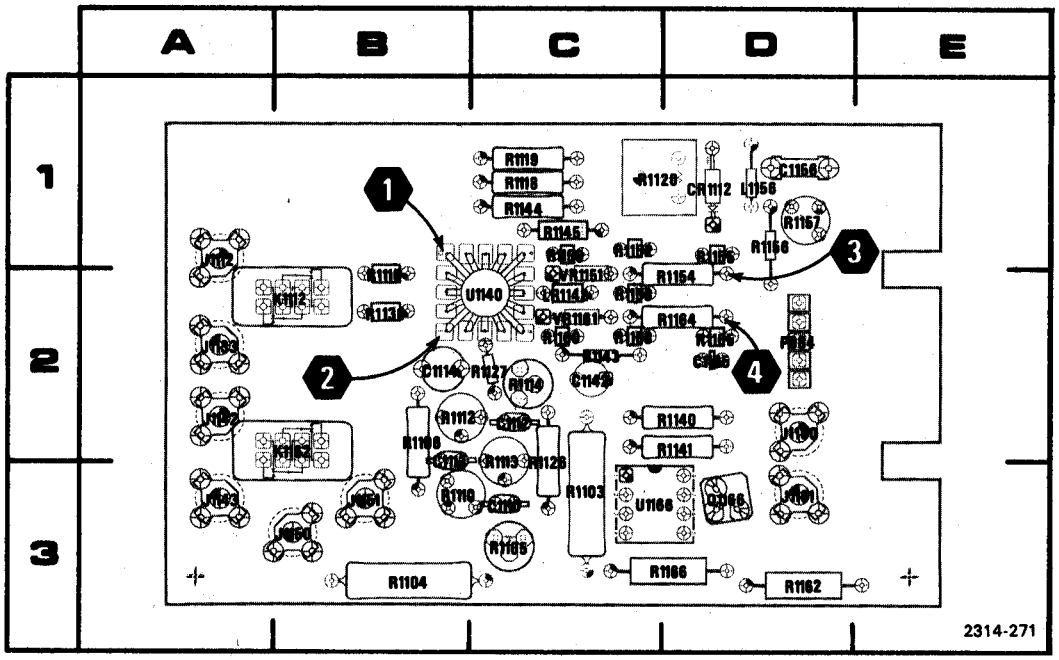
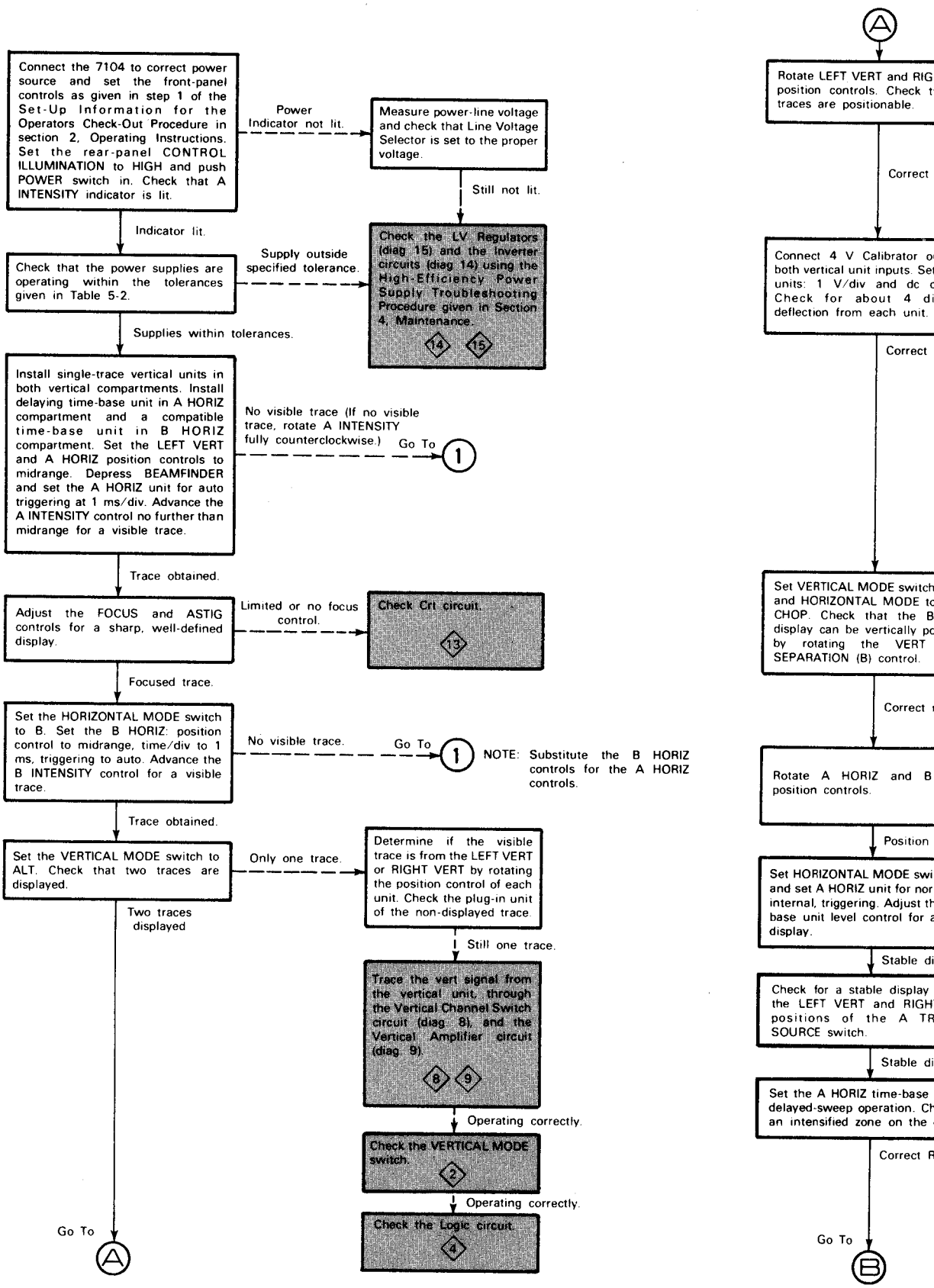


Figure 8-23. A28—X-Y Delay Compensation circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C1110	3C			R1141	2D
C1112	2C	LR1142	2C	R1143	2C
C1113	3B			R1144	1C
C1114	2B	P984	2D	R1145	1C
C1142	2C			R1150	1C
C1156	1D	Q1166	3D	R1152	1C
C1165	2D			R1153	2C
		R1103	3C	R1154	2D
CR1112	1D	R1104	3B	R1155	1D
		R1105	3C	R1156	1D
J1112	1A	R1106	2B	R1157	1D
J1133	2A	R1110	3B	R1160	2C
J1142	2A	R1112	2B	R1162	3D
J1143	3A	R1113	3C	R1163	2C
J1150	3B	R1114	2C	R1164	2D
J1151	3B	R1116	2B	R1165	2D
J1160	2D	R1118	1C	R1166	3D
J1161	3D	R1119	1C		
		R1120	1C	U1140	2C
K1112	2B	R1126	3C	U1166	3C
K1162	2B	R1127	2C		
		R1136	2B	VR1151	2C
L1156	1D	R1140	2D	VR1161	2C

TROUBLESHOOTING CHART INSTRUCTIONS:

1. **Beginning at the top left block of the chart proceed downward until the 7104 does not perform as indicated.**
2. **Then follow the dashed line as the symptom indicates. Each shaded block indicates a circuit which may be the cause of the malfunction. Refer to Sectio Theory of Operation, for a detailed discussion of the circuit, and Section 8, Diagrams and Circuit Board Illustrations, for the circuit schematic.**



7104 TROUBLESHOOTING CHART

ated.
be the cause of the malfunction. Refer to Section 3,
Illustrations, for the circuit schematic.

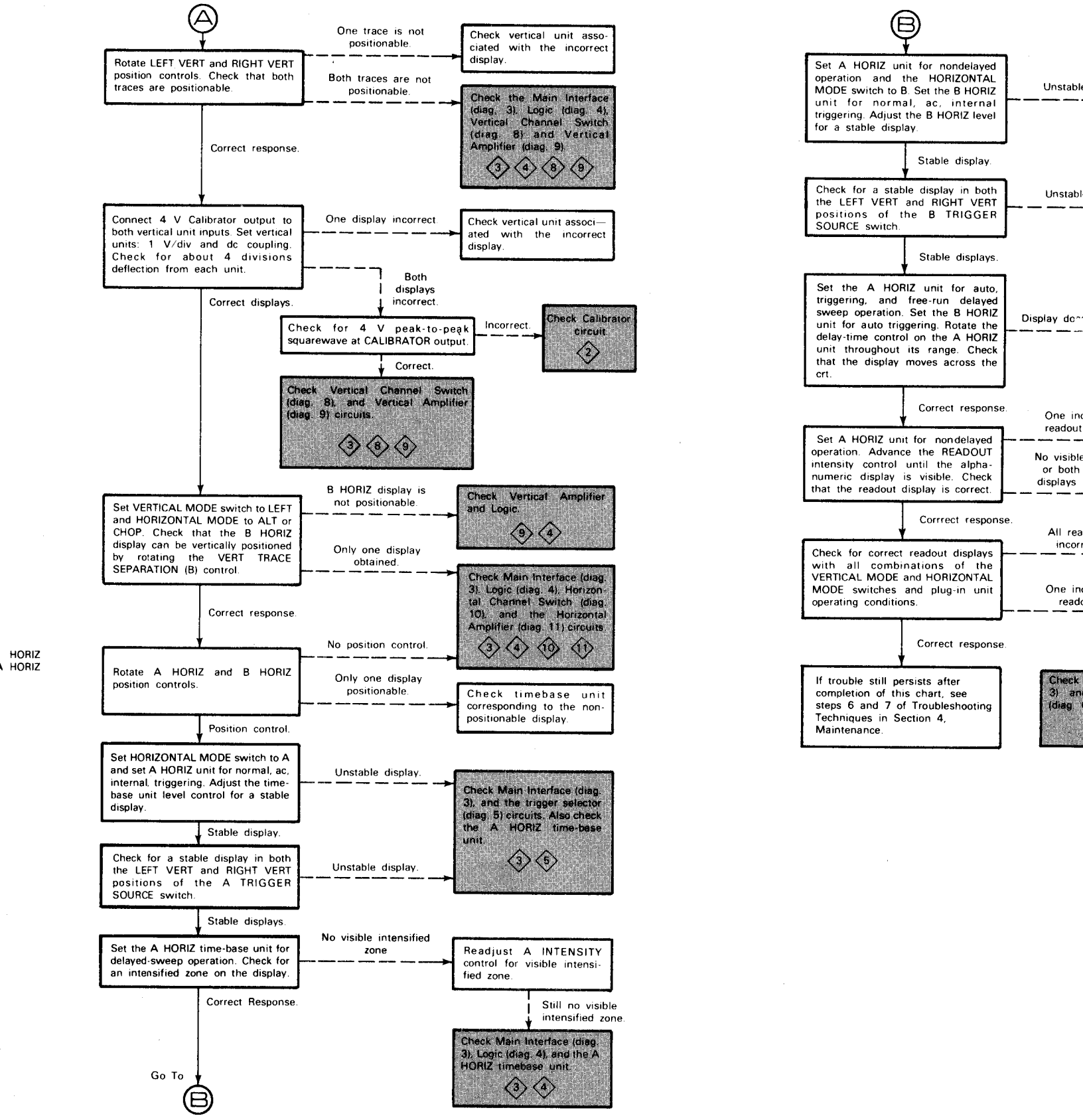
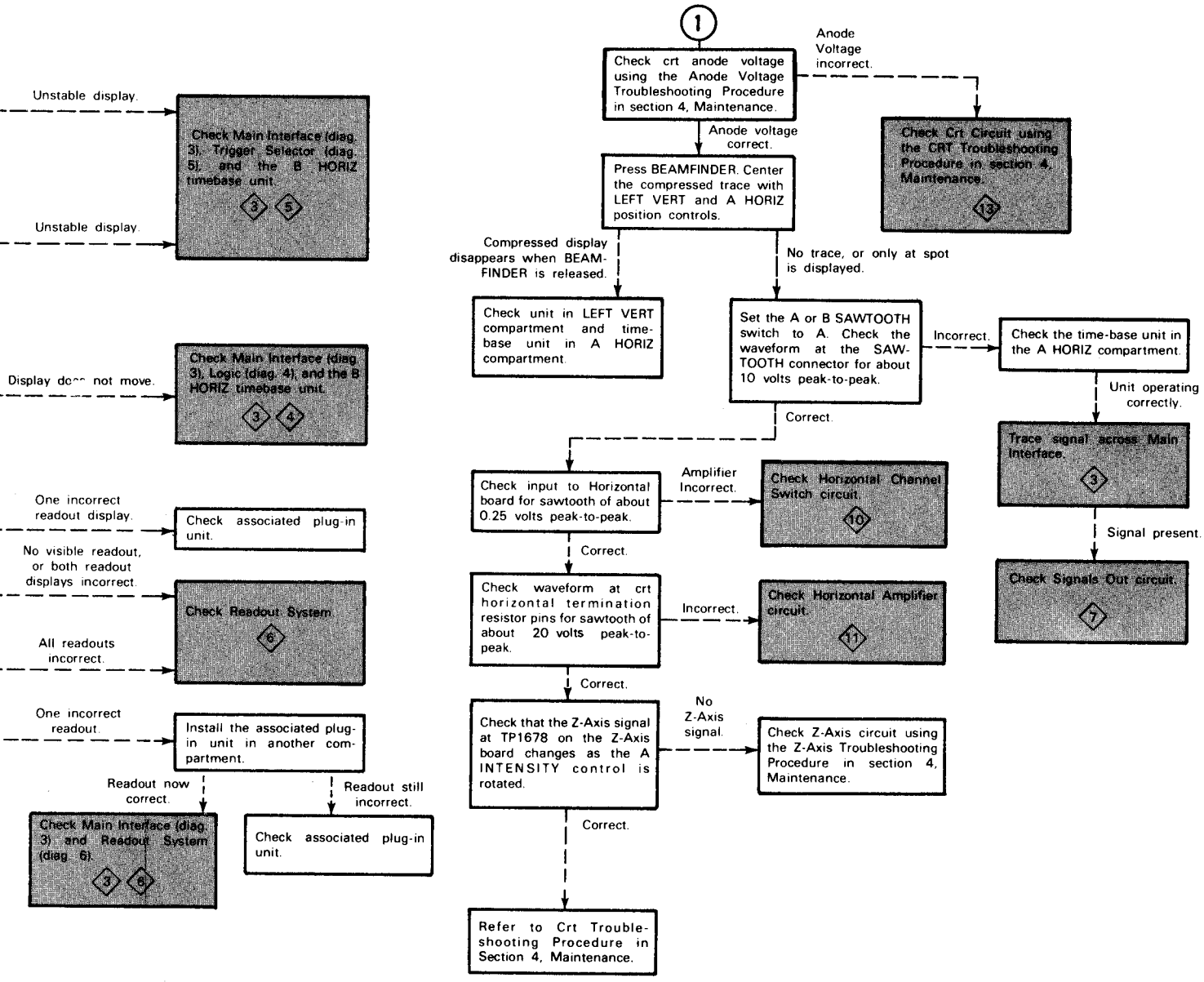


Figure 8-24. 7104 Troubleshooting Chart.


1
Check crt anode voltage using the Anode Voltage Troubleshooting Procedure in section 4, Maintenance.
Anode Voltage incorrect.
Check Crt Circuit using the CRT Troubleshooting Procedure in section 4, Maintenance.
13
Anode voltage correct.
Press BEAMFINDER. Center the compressed trace with LEFT VERT and A HORIZ position controls.
Compressed display disappears when BEAM-FINDER is released.
Check unit in LEFT VERT compartment and time-base unit in A HORIZ compartment.
No trace, or only at spot is displayed.
Set the A or B SAWTOOTH switch to A. Check the waveform at the SAW-TOOTH connector for about 10 volts peak-to-peak.
Incorrect.
Check the time-base unit in the A HORIZ compartment.
Unit operating correctly.
Trace signal across Main Interface.
3
Signal present.
Check Signals Out circuit.
7
Correct.
Check input to Horizontal board for sawtooth of about 0.25 volts peak-to-peak.
Amplifier Incorrect.
Check Horizontal Channel Switch circuit.
10
Correct.
Check waveform at crt horizontal termination resistor pins for sawtooth of about 20 volts peak-to-peak.
Incorrect.
Check Horizontal Amplifier circuit.
11
Correct.
Check that the Z-Axis signal at TP1678 on the Z-Axis board changes as the A INTENSITY control is rotated.
No Z-Axis signal.
Check Z-Axis circuit using the Z-Axis Troubleshooting Procedure in section 4, Maintenance.
Correct.
Refer to Crt Trouble-shooting Procedure in Section 4, Maintenance.
Unstable display.
Check Main Interface (diag. 3), Trigger Selector (diag. 5), and the B HORIZ timebase unit.
3
5
Unstable display.
Display does not move.
Check Main Interface (diag. 3), Logic (diag. 4), and the B HORIZ timebase unit.
3
4
One incorrect readout display.
Check associated plug-in unit.
No visible readout, or both readouts displays incorrect.
Check Readout System.
6
All readouts incorrect.
One incorrect readout.
Install the associated plug-in unit in another com-partment.
Readout now correct.
Check Main Interface (diag. 3) and Readout System (diag. 6).
3
6
Readout still incorrect.
Check associated plug-in unit.

@

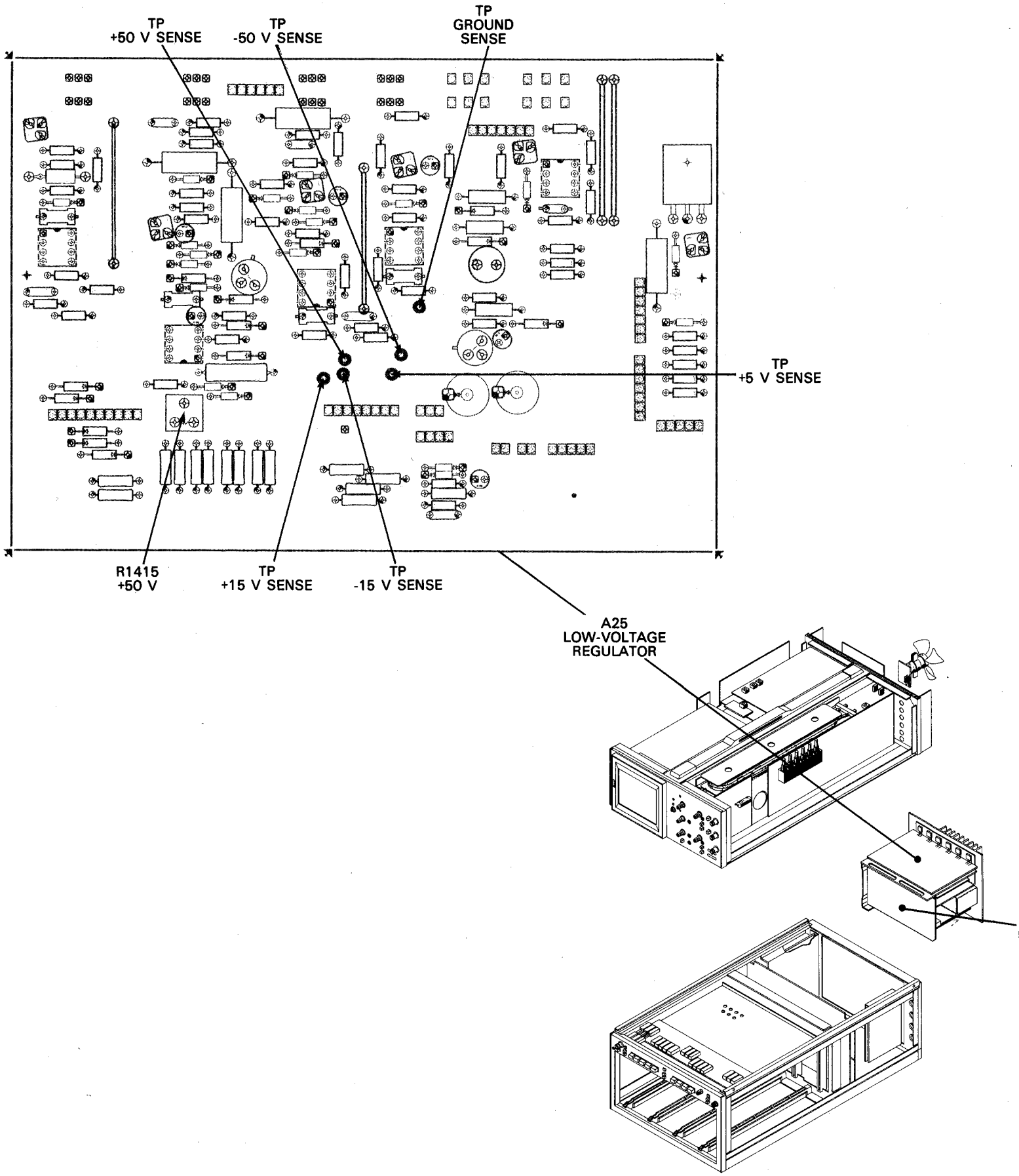
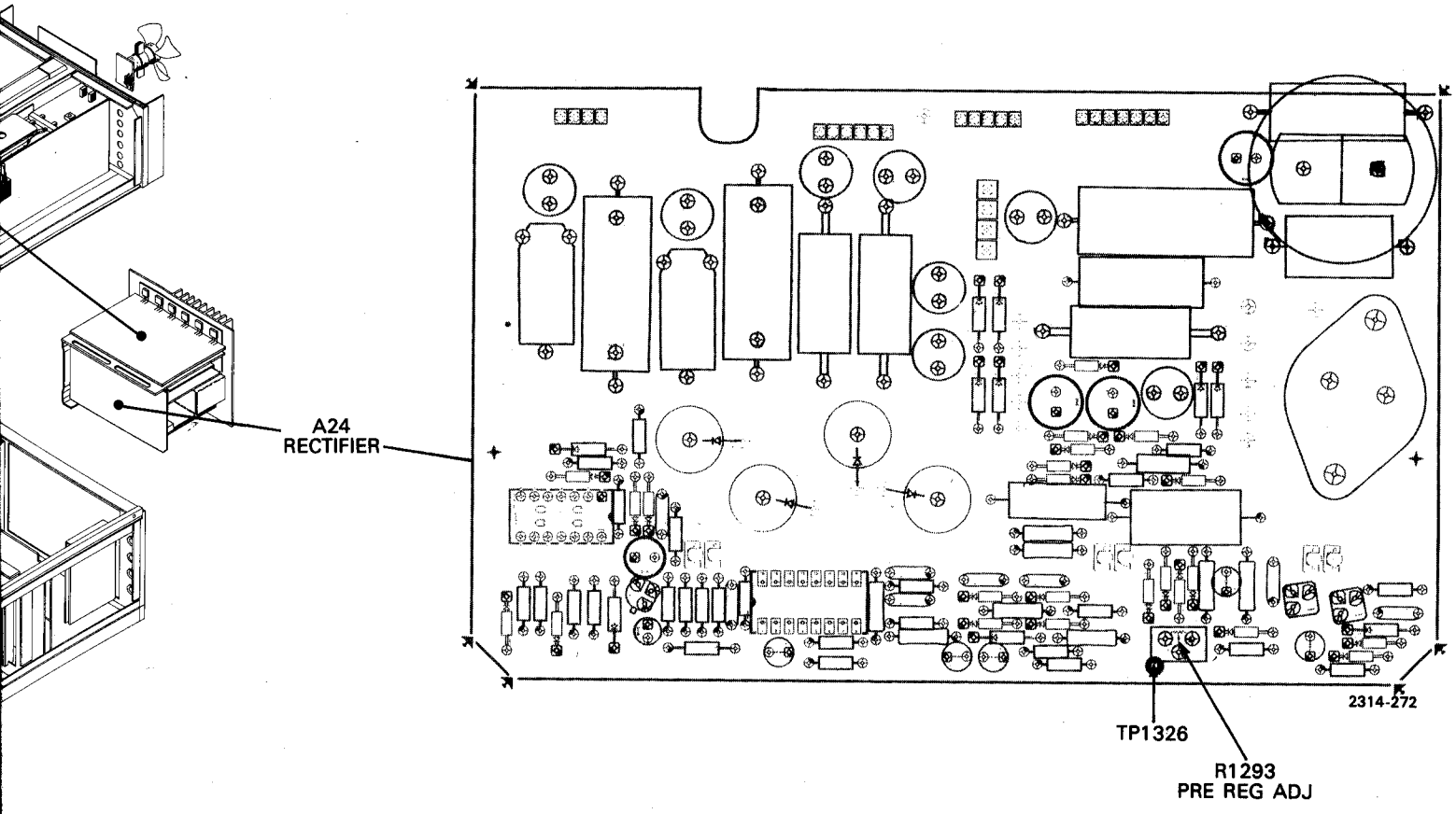
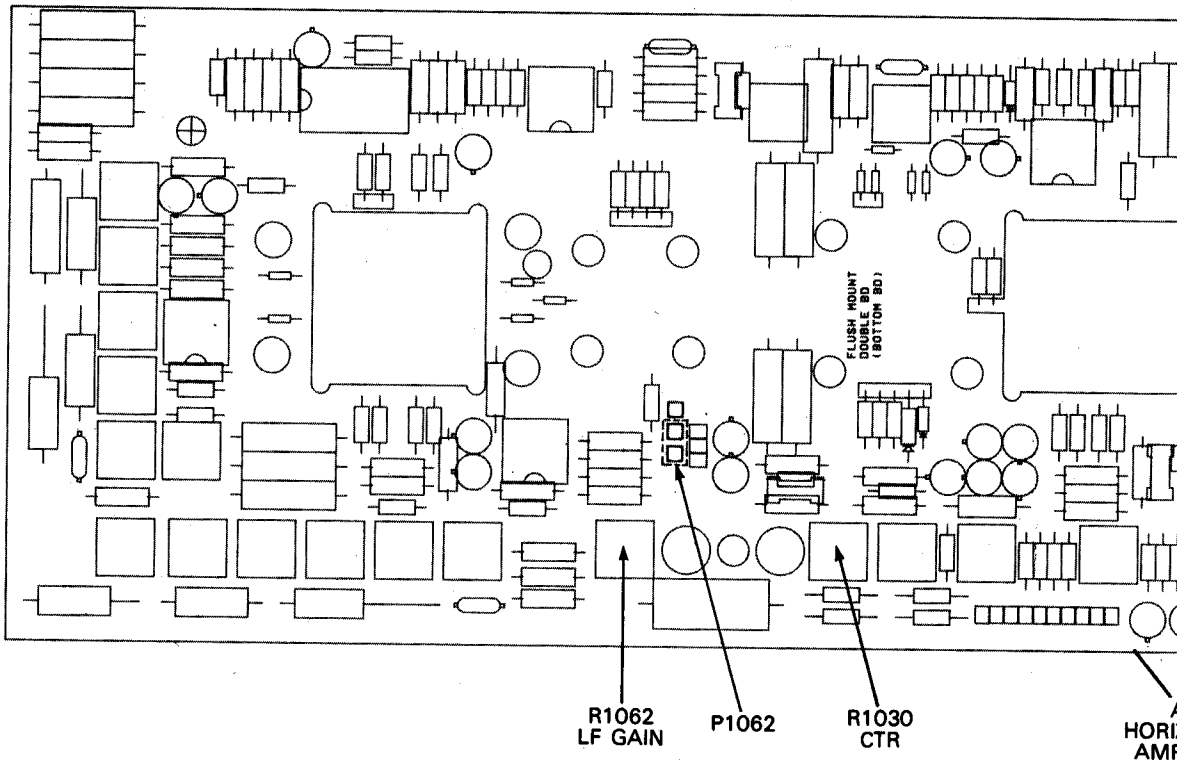
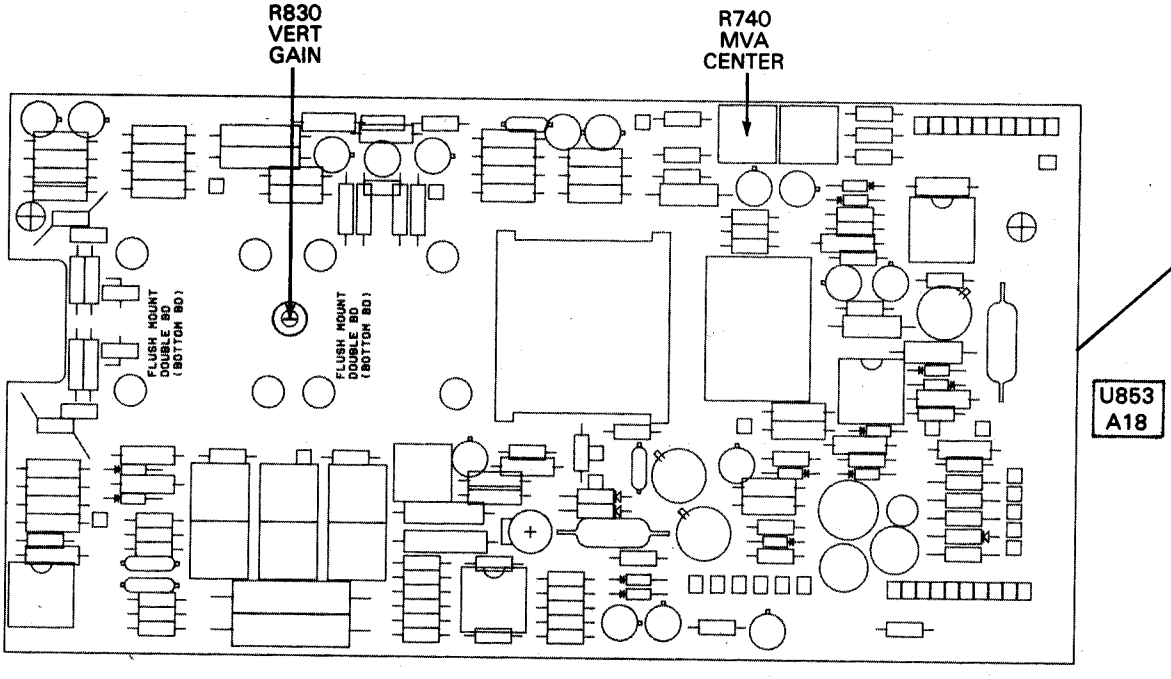


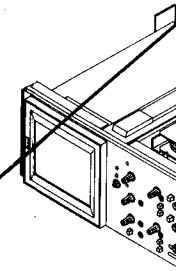
Figure 8-25. Test Point and Adjustment L

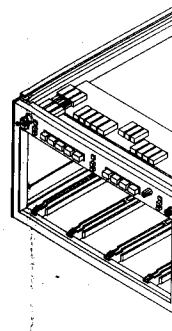


Test Point and Adjustment Locations A.


FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
R1062
LF GAIN
P1062
R1030
CTR


R830
VERT
GAIN
R740
MVA
CENTER
FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
U853
A18


A17
VERTICAL
AMPLIFIER



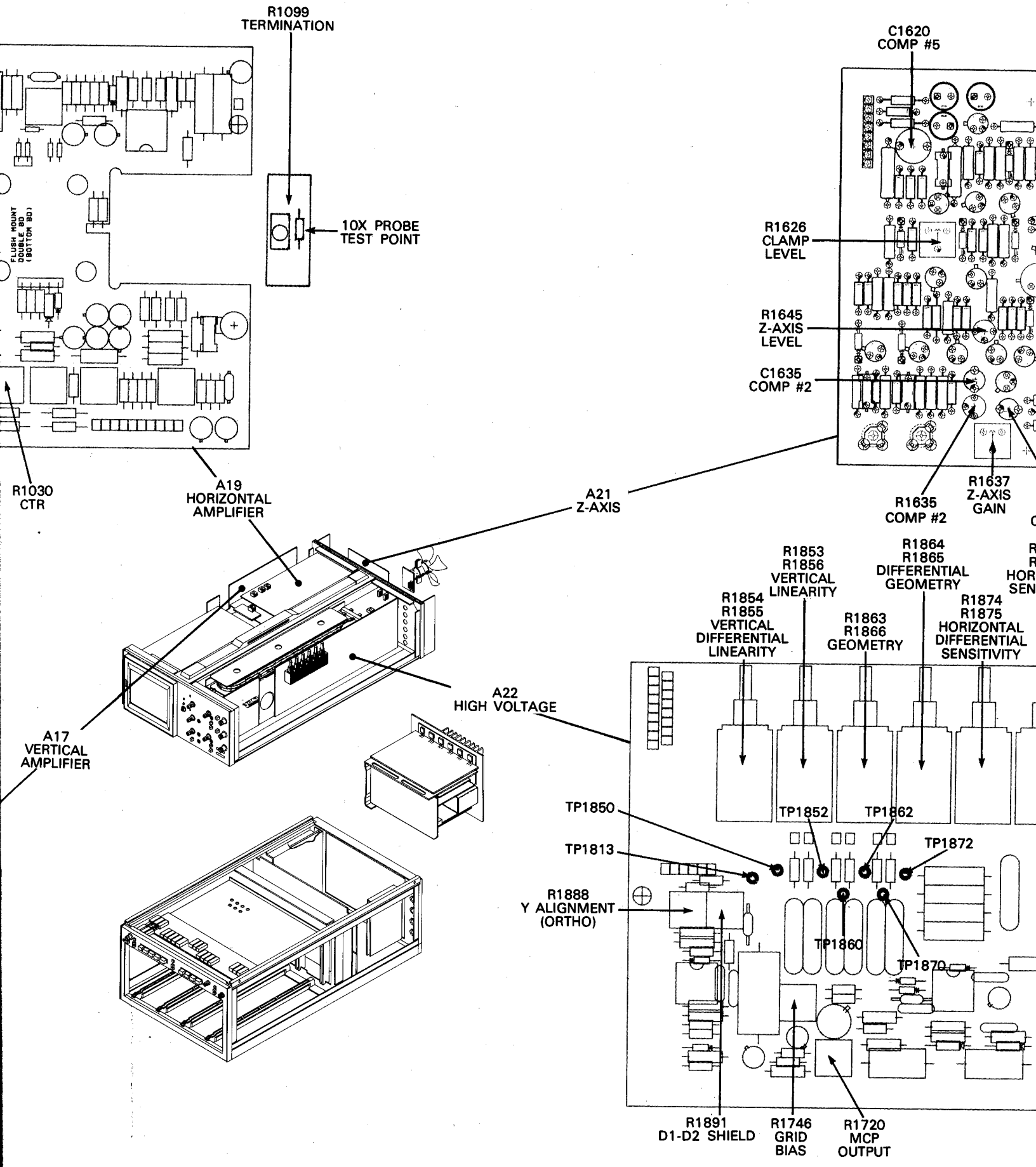
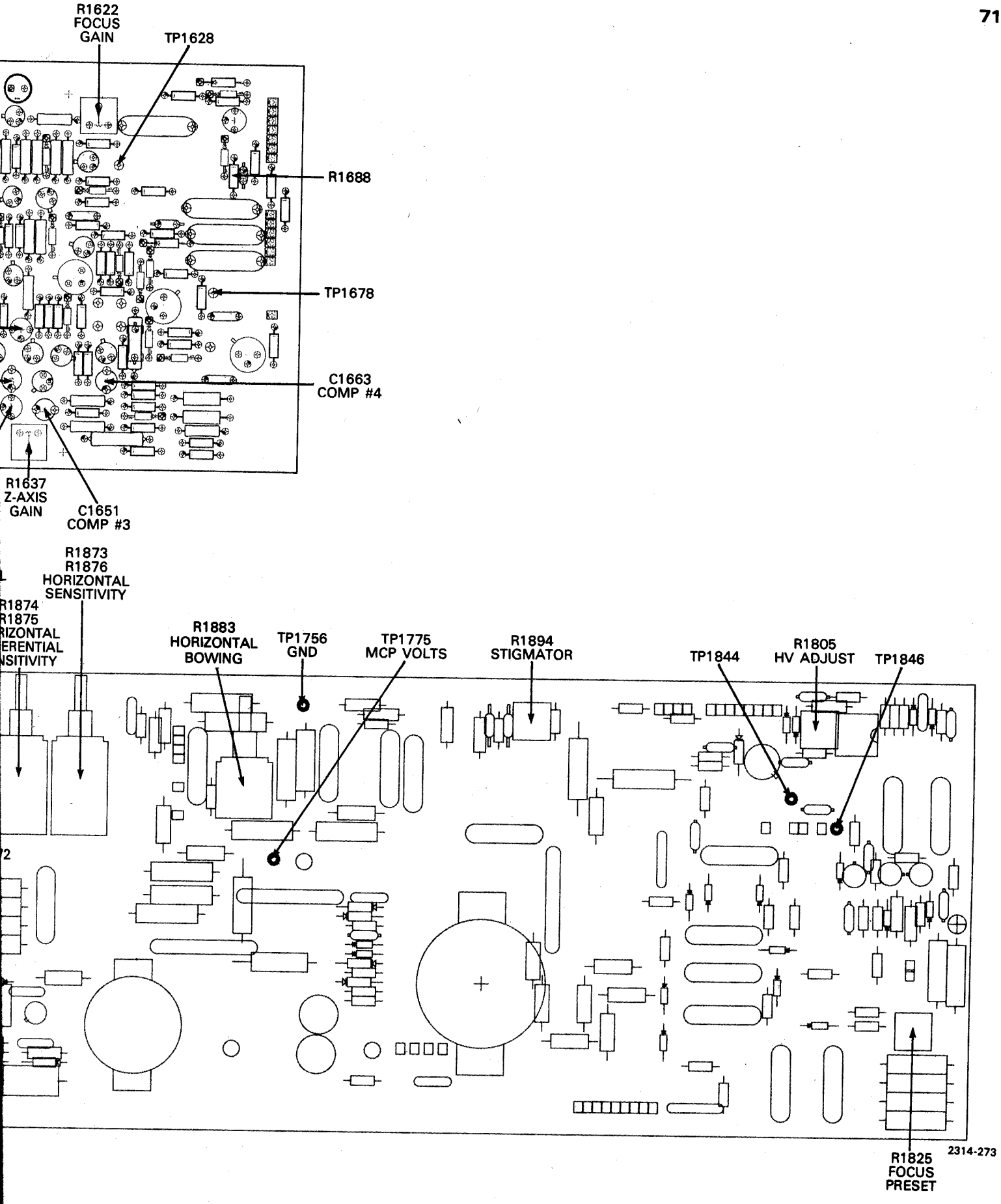
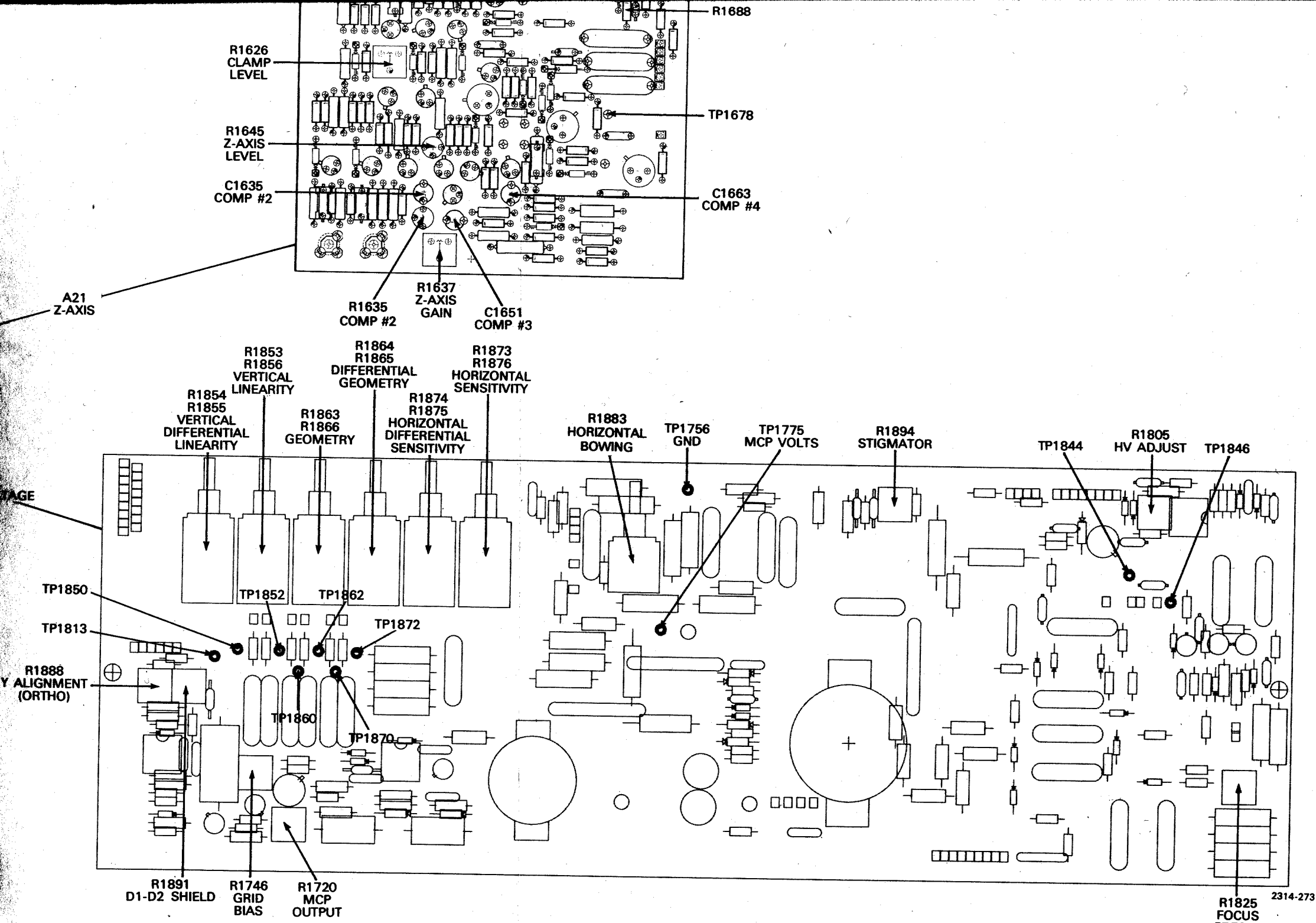


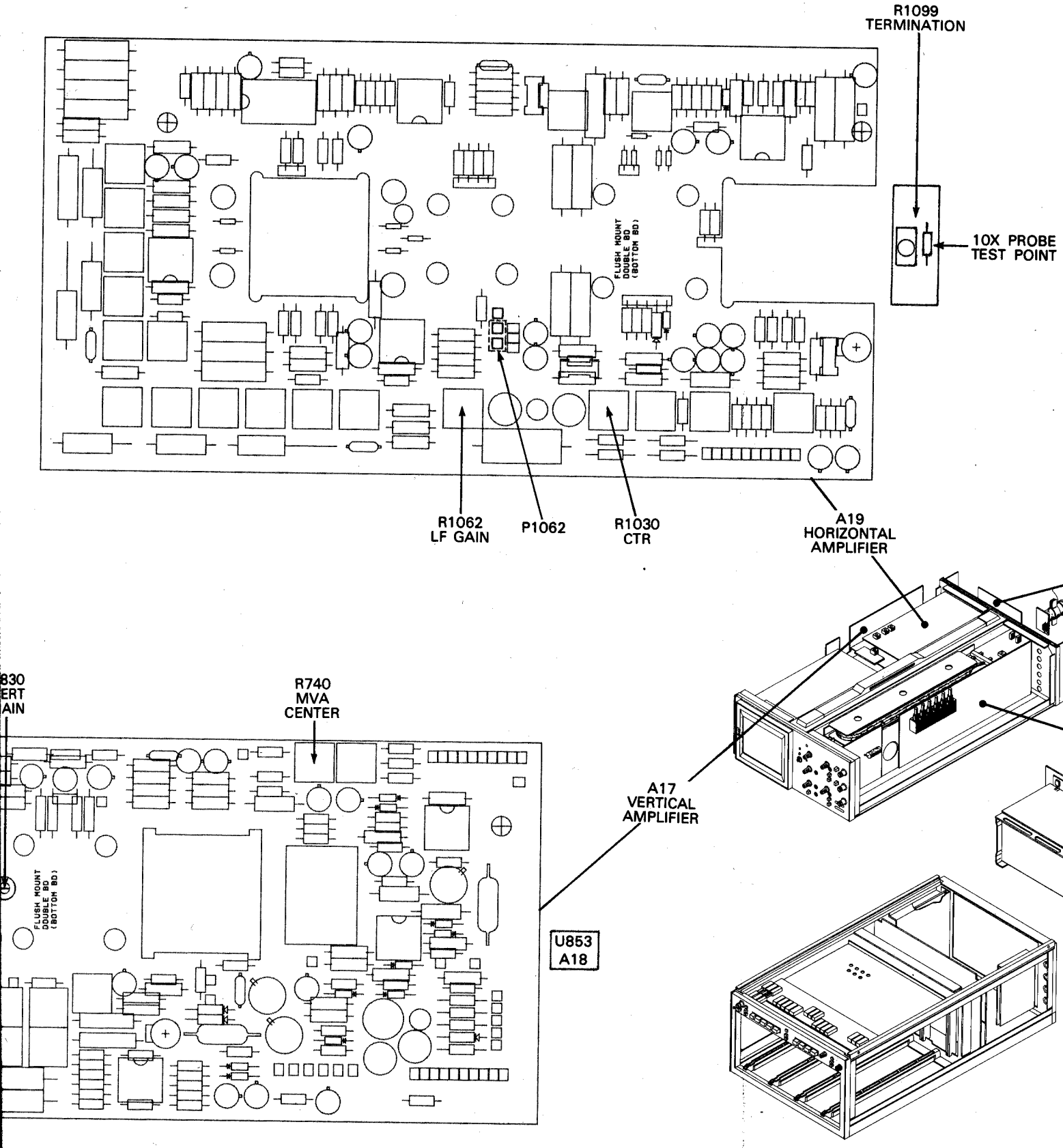
Figure 8-26. Test Point and Adjustment Locations B.


R1622
FOCUS
GAIN
TP1628
R1688
TP1678
C1663
COMP #4
R1637
Z-AXIS
GAIN
C1651
COMP #3
R1873
R1876
HORIZONTAL
SENSITIVITY
R1874
R1875
RIZONTAL
ERENTIAL
NSITIVITY
R1883
HORIZONTAL
BOWING
TP1756
GND
TP1775
MCP VOLTS
R1894
STIGMATOR
TP1844
R1805
HV ADJUST
TP1846
R1825
FOCUS
PRESET
2314-273

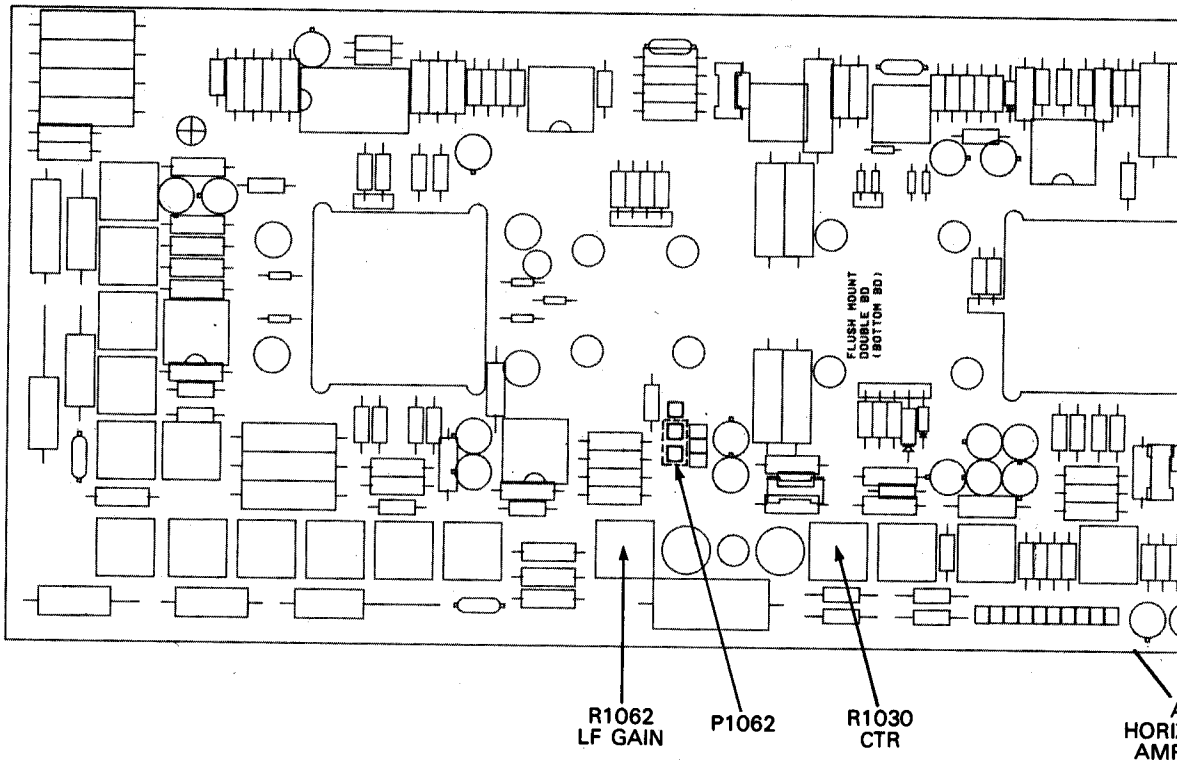
@

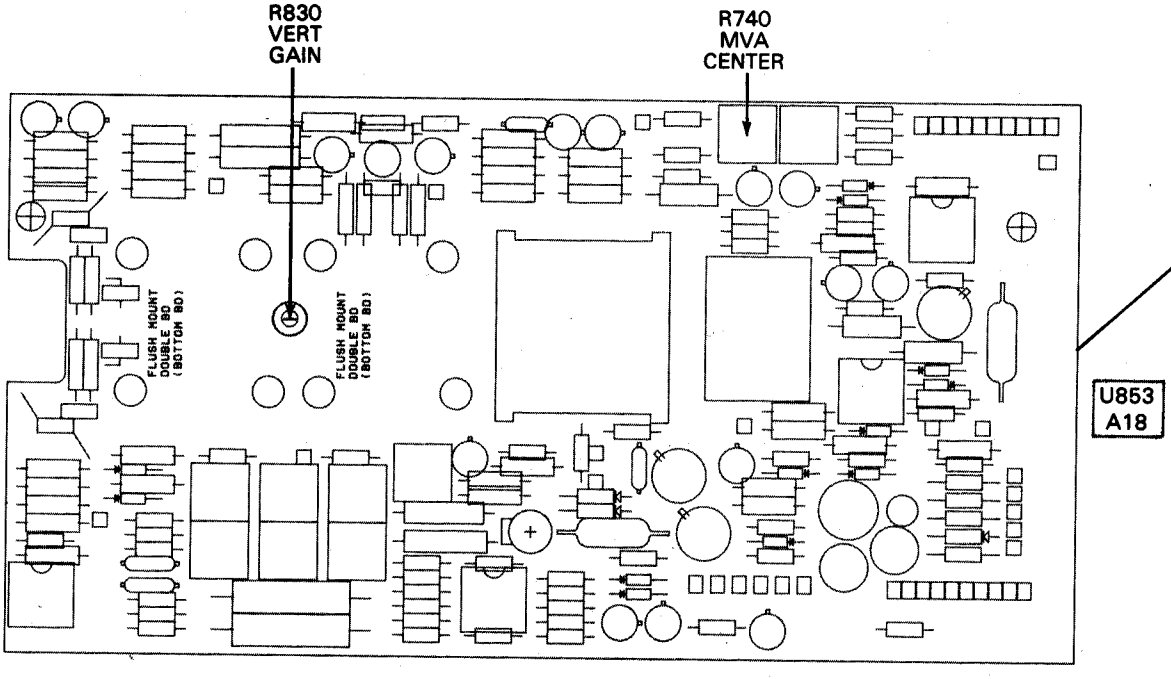


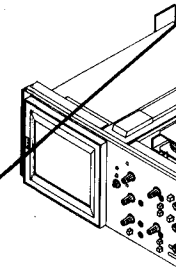
26. Test Point and Adjustment Locations B.

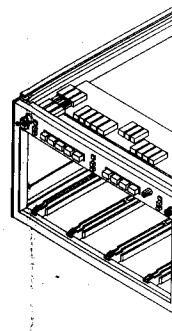

R1099
TERMINATION
10X PROBE
TEST POINT
FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
R1062
LF GAIN
P1062
R1030
CTR
A19
HORIZONTAL
AMPLIFIER
R740
MVA
CENTER
A17
VERTICAL
AMPLIFIER
U853
A18

Fig


FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
R1062
LF GAIN
P1062
R1030
CTR


R830
VERT
GAIN
R740
MVA
CENTER
FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
U853
A18


A17
VERTICAL
AMPLIFIER



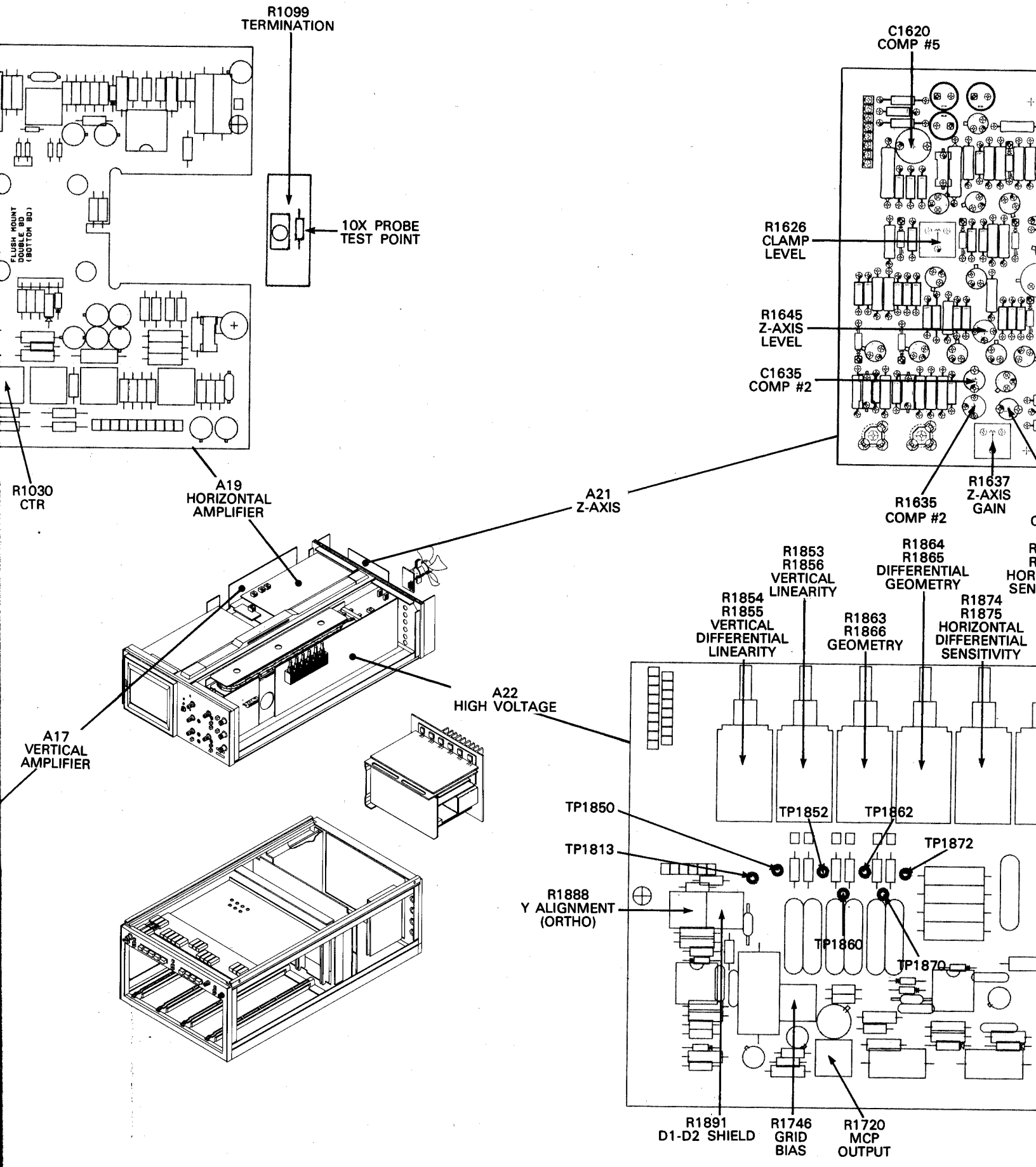
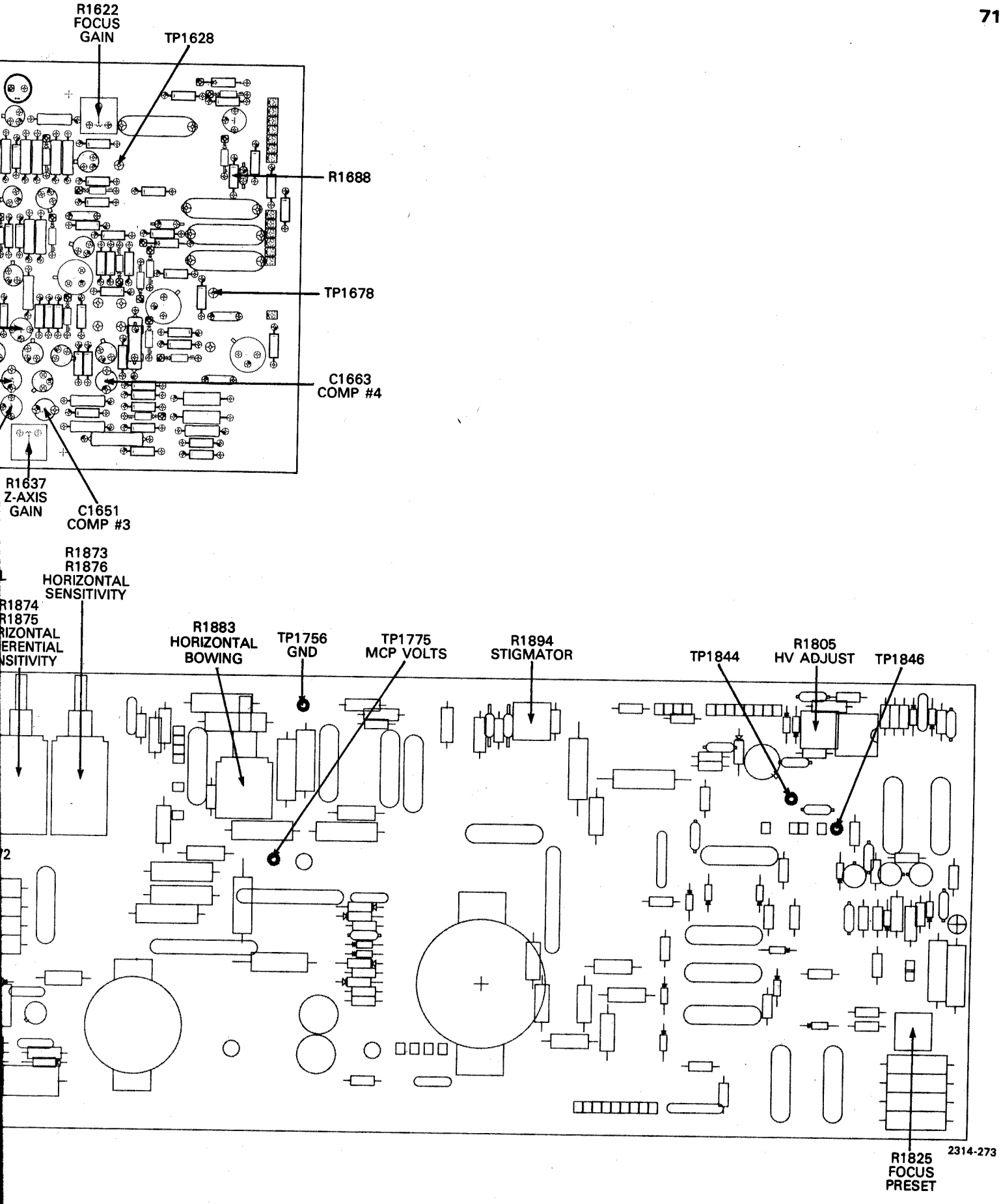
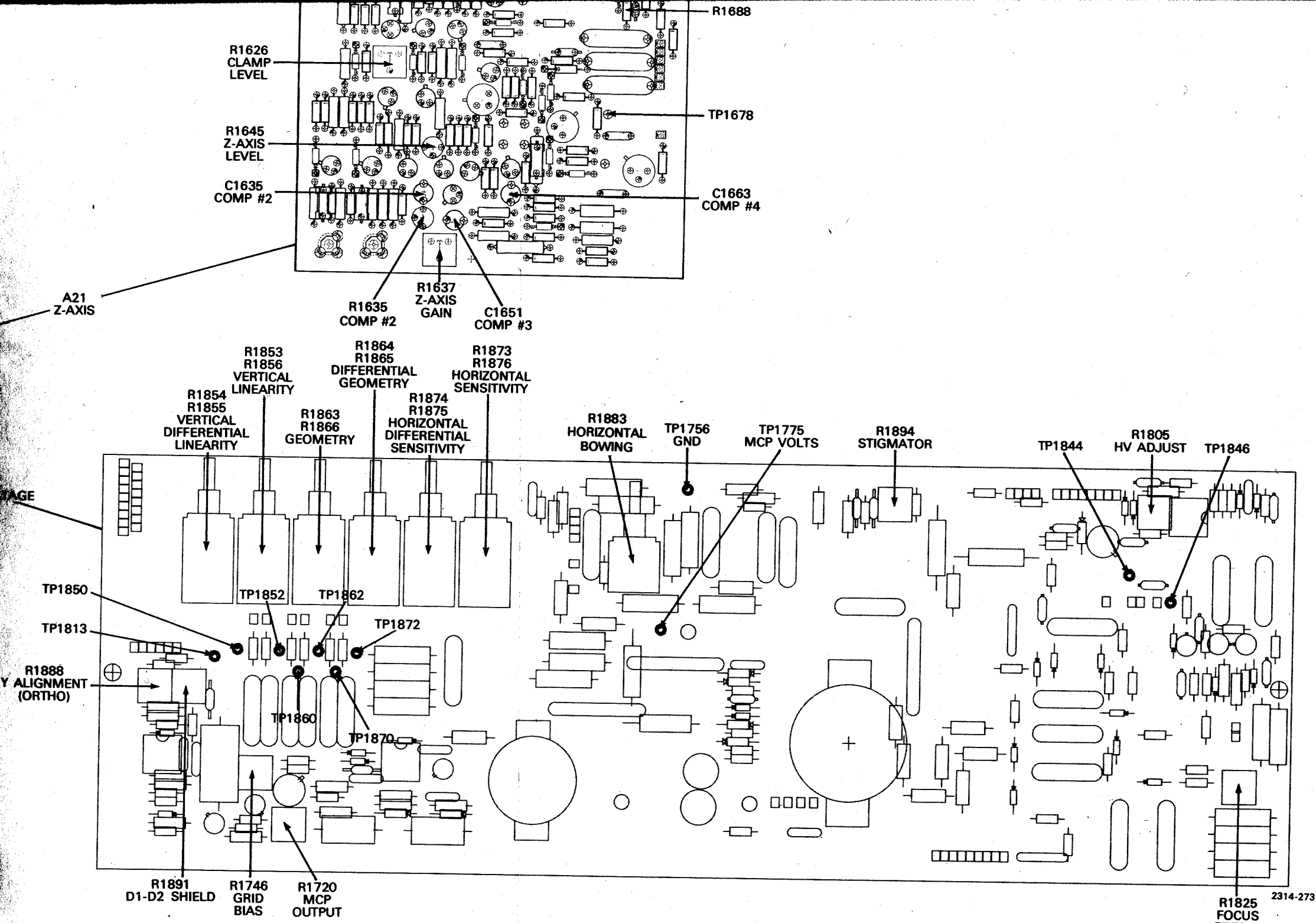


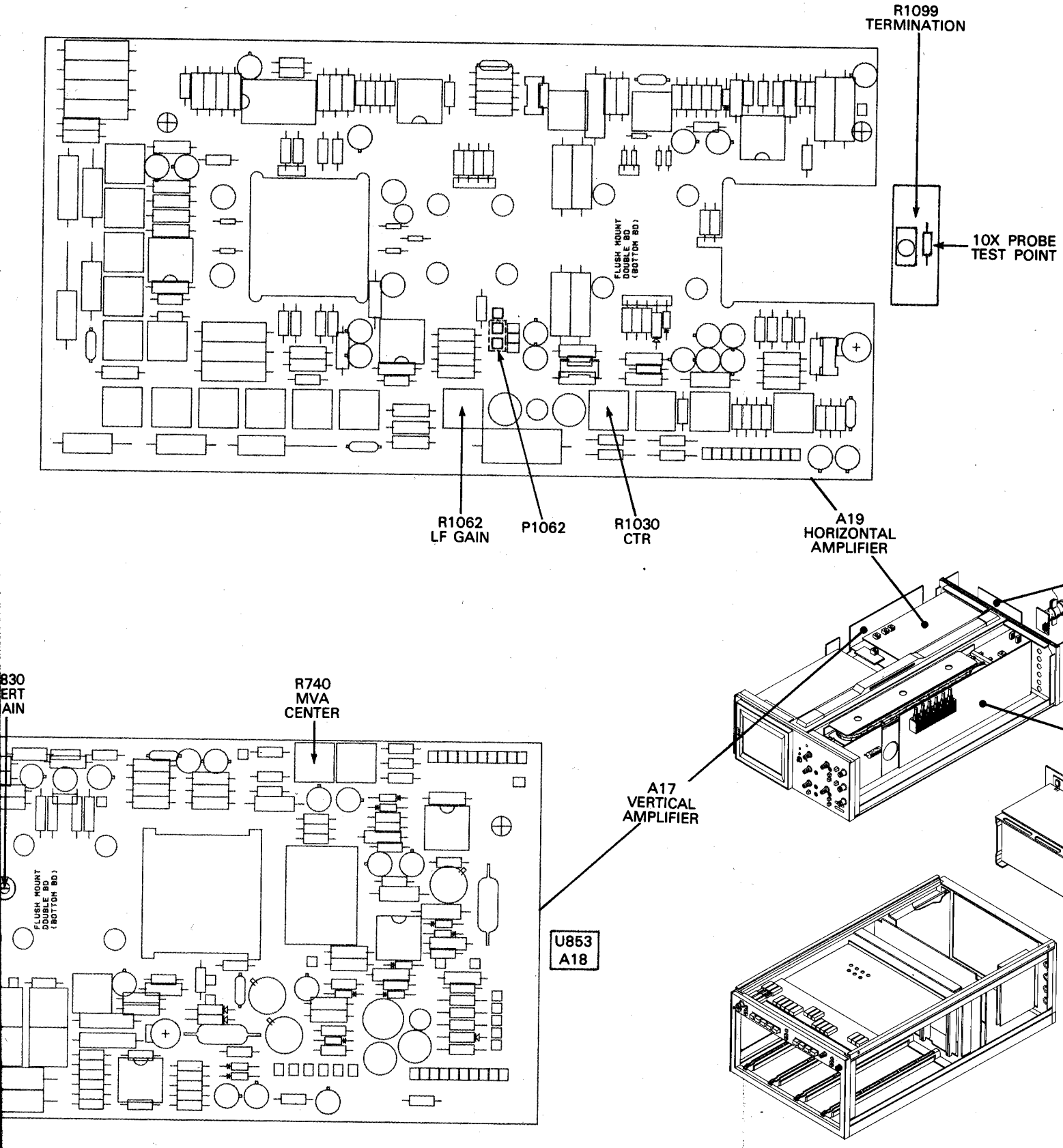
Figure 8-26. Test Point and Adjustment Locations B.


R1622
FOCUS
GAIN
TP1628
R1688
TP1678
C1663
COMP #4
R1637
Z-AXIS
GAIN
C1651
COMP #3
R1873
R1876
HORIZONTAL
SENSITIVITY
R1874
R1875
RIZONTAL
ERENTIAL
NSITIVITY
R1883
HORIZONTAL
BOWING
TP1756
GND
TP1775
MCP VOLTS
R1894
STIGMATOR
TP1844
R1805
HV ADJUST
TP1846
R1825
FOCUS
PRESET
2314-273

@



26. Test Point and Adjustment Locations B.


R1099
TERMINATION
10X PROBE
TEST POINT
FLUSH MOUNT
DOUBLE BD
(BOTTOM BD)
R1062
LF GAIN
P1062
R1030
CTR
A19
HORIZONTAL
AMPLIFIER
R740
MVA
CENTER
A17
VERTICAL
AMPLIFIER
U853
A18

Fig

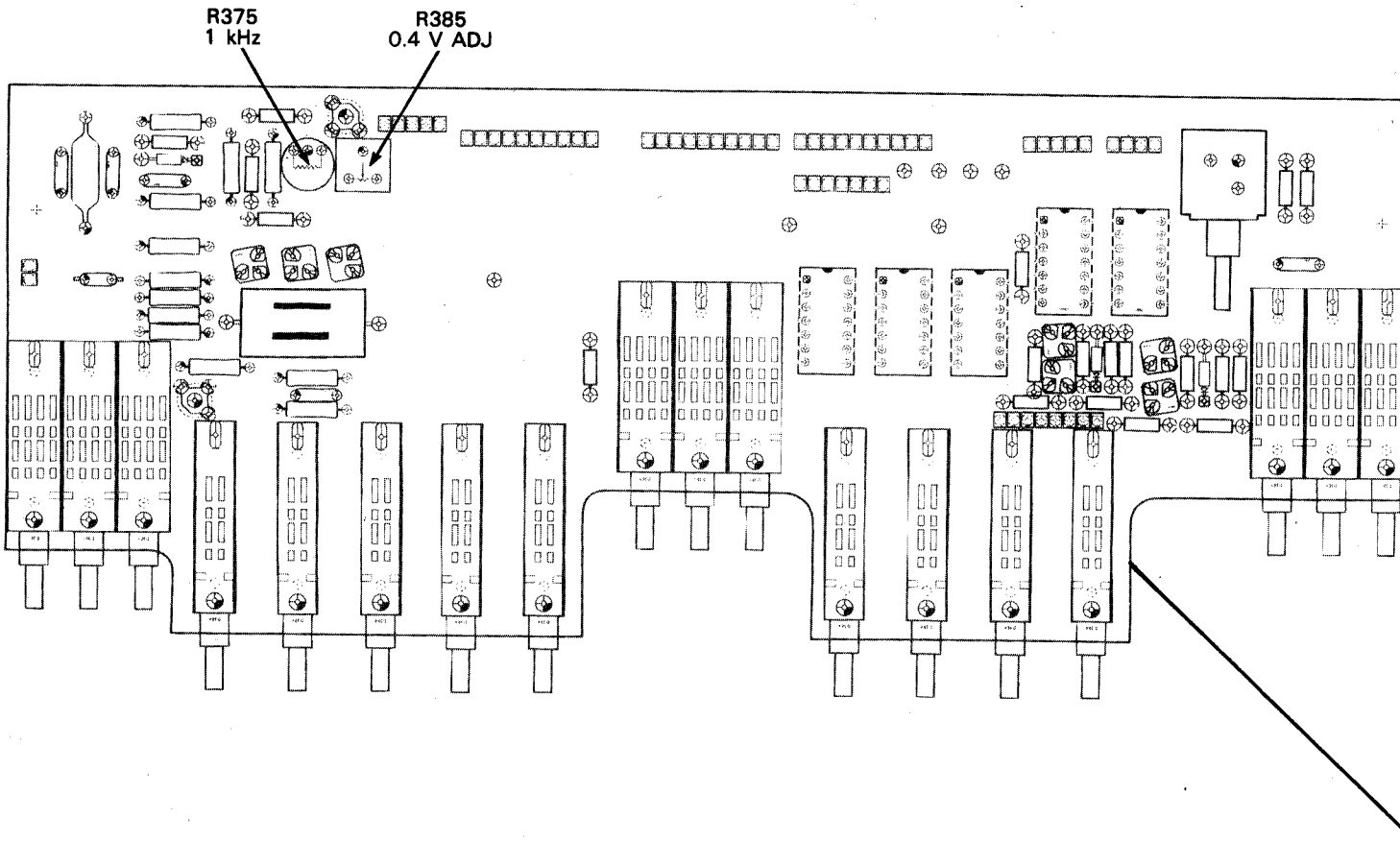
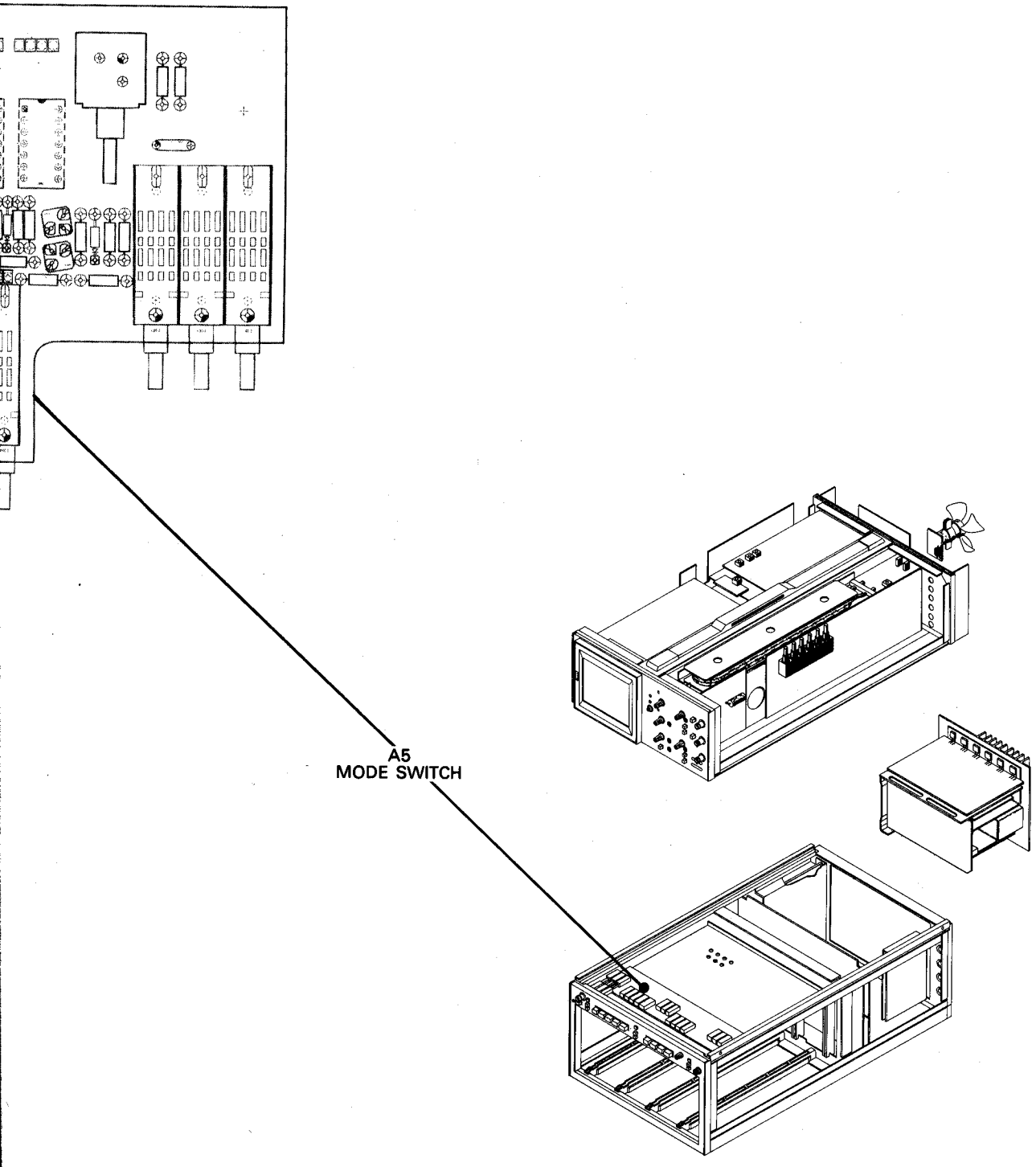


Figure 8-27. Test Point and Adjustment Location



2314-274

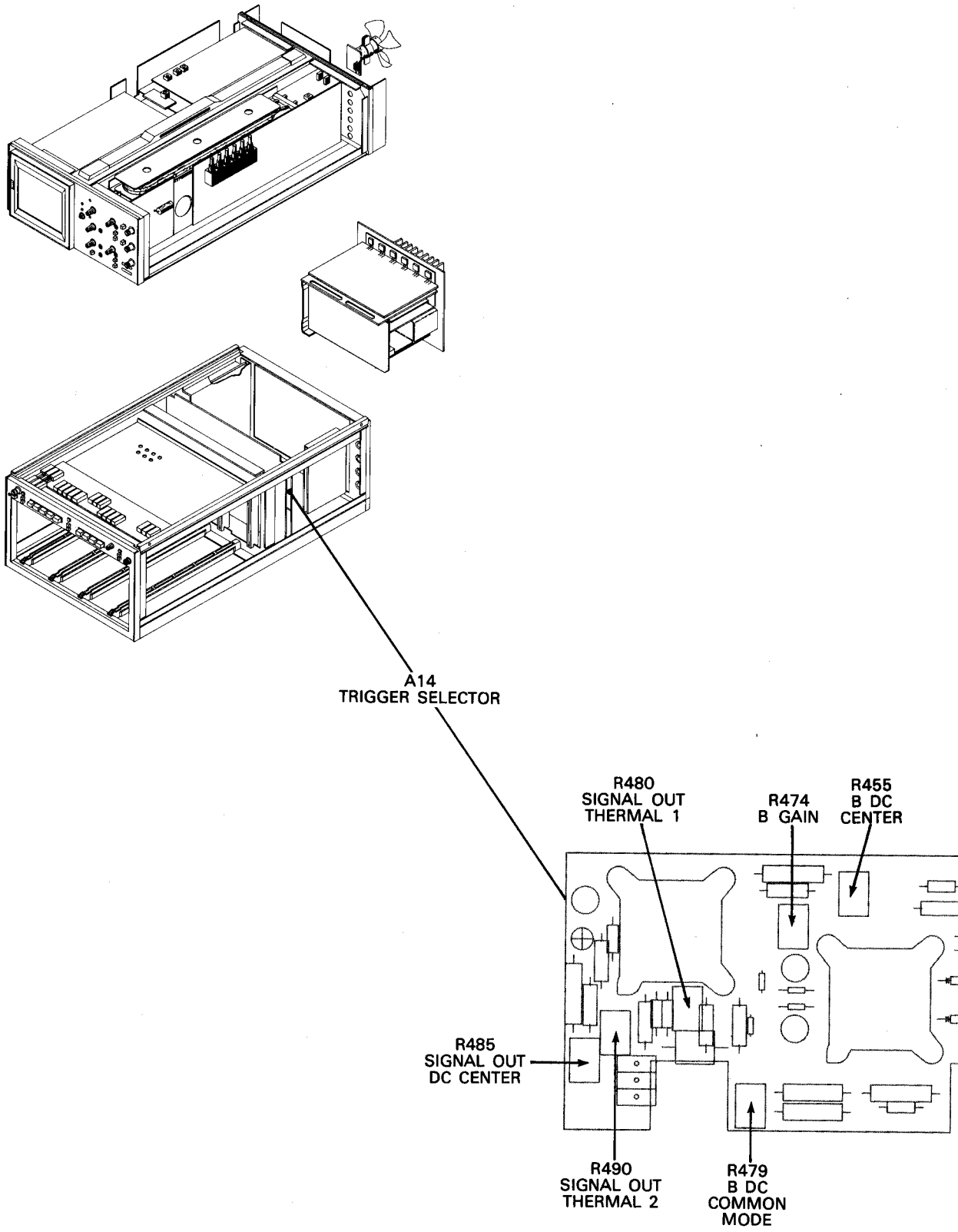
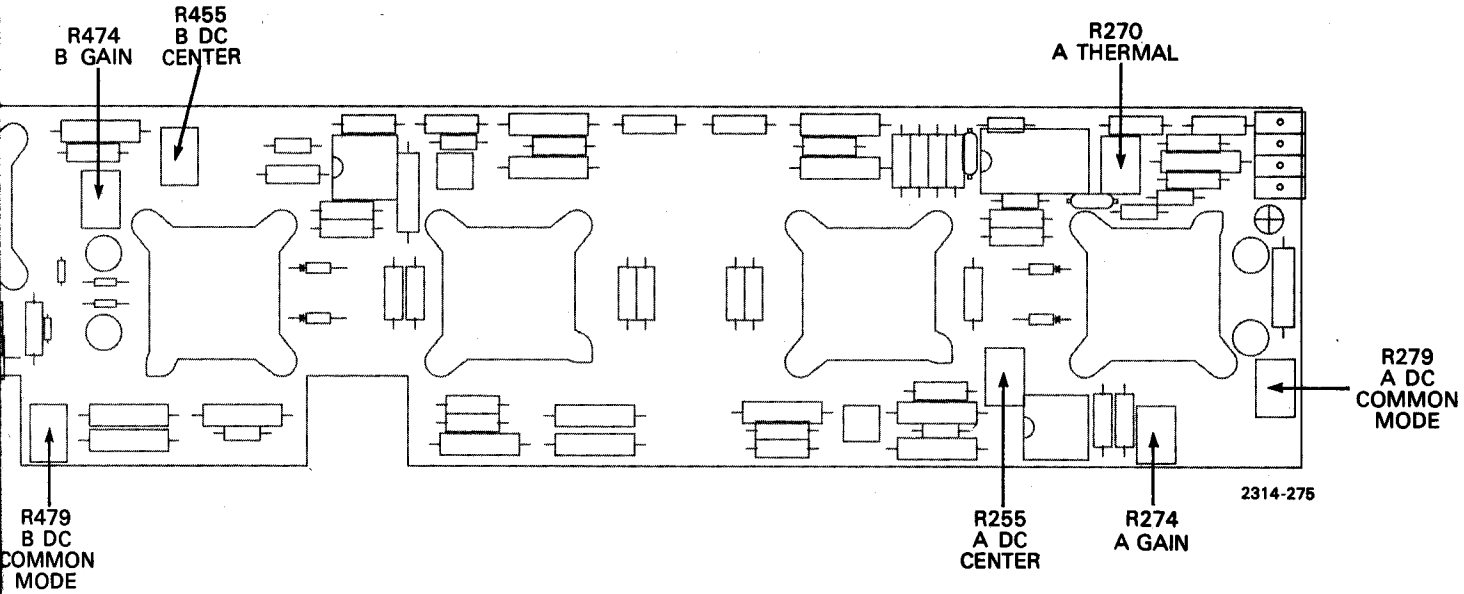


Figure 8-28. Test Point and Adjustment Locati



t Point and Adjustment Locations D.

@

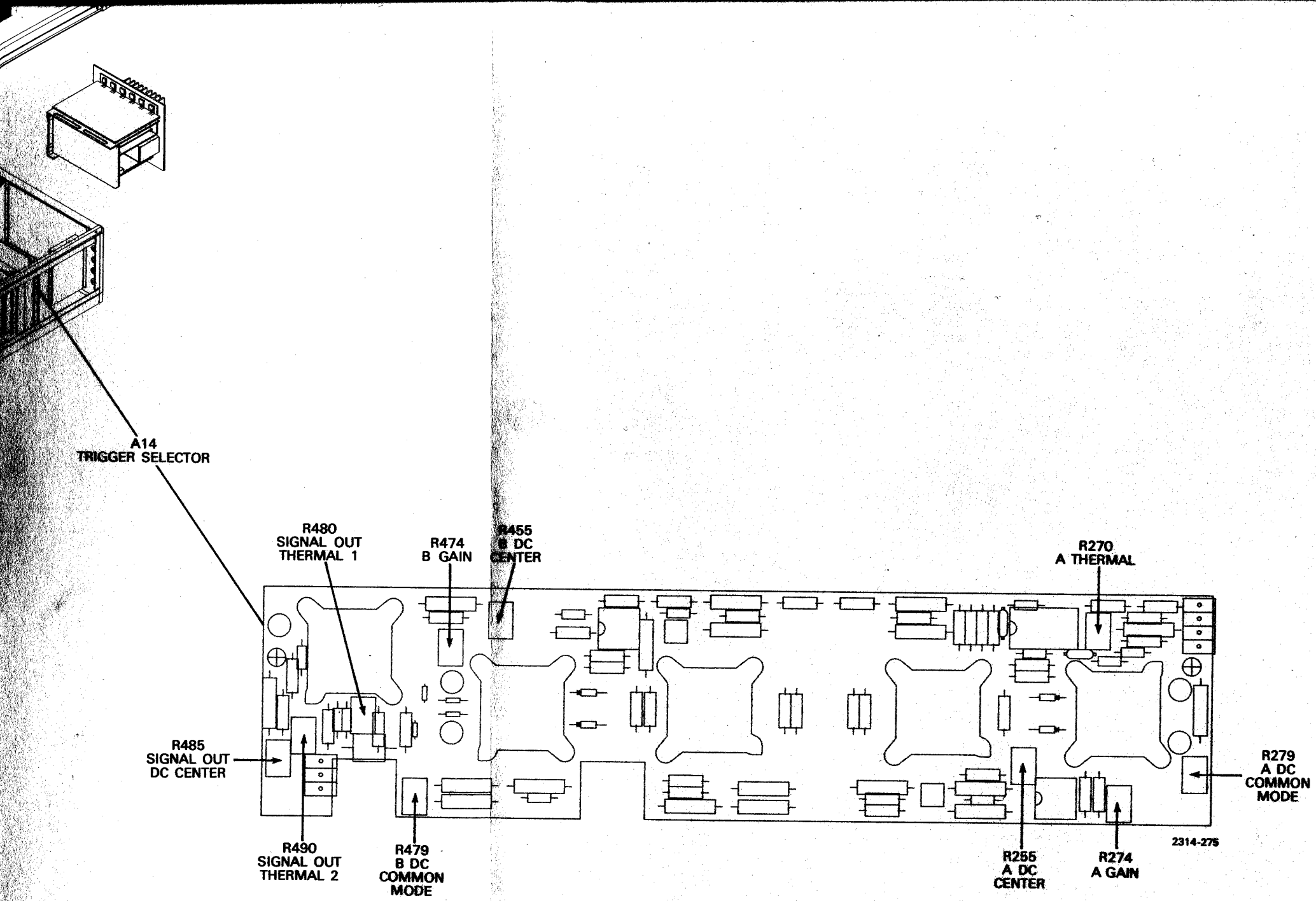


Figure 8-28. Test Point and Adjustment Locations D.

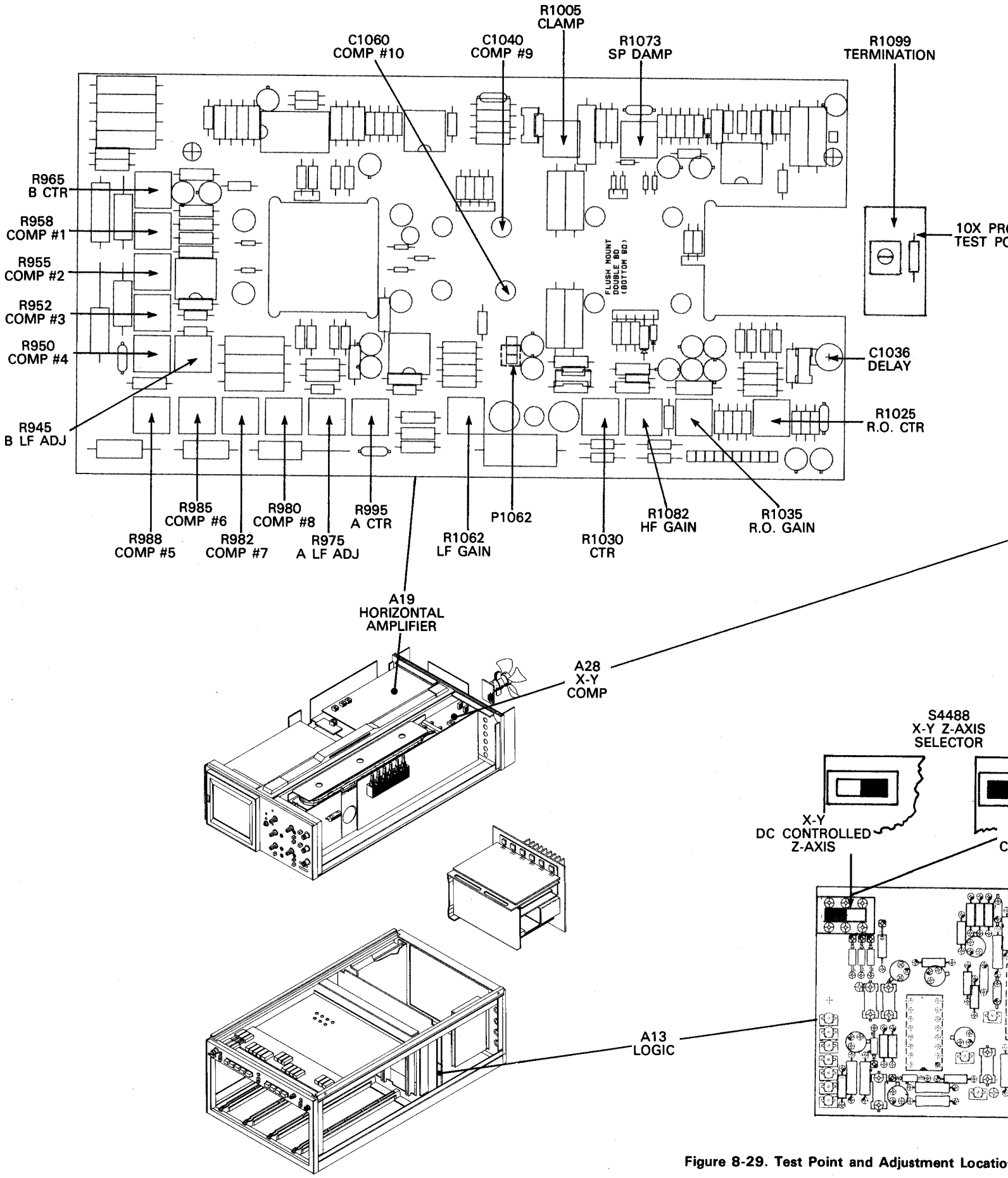
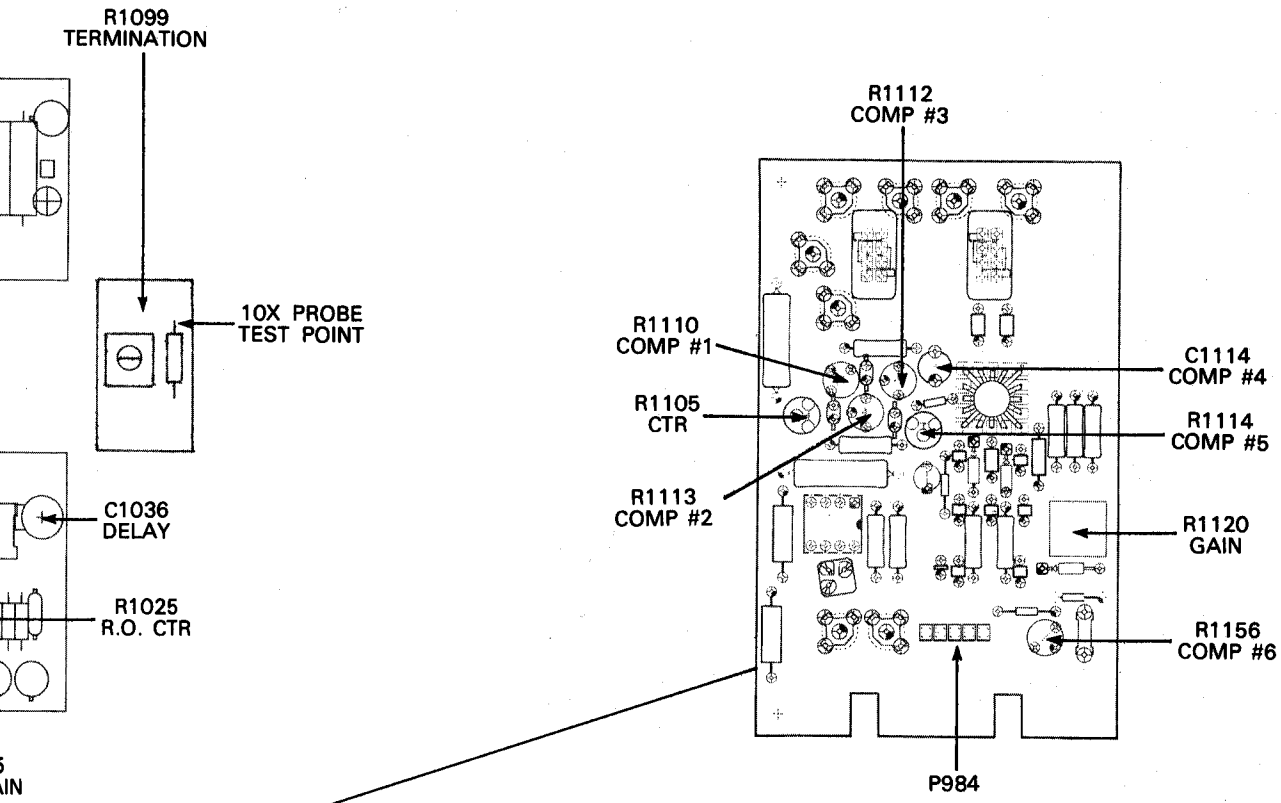
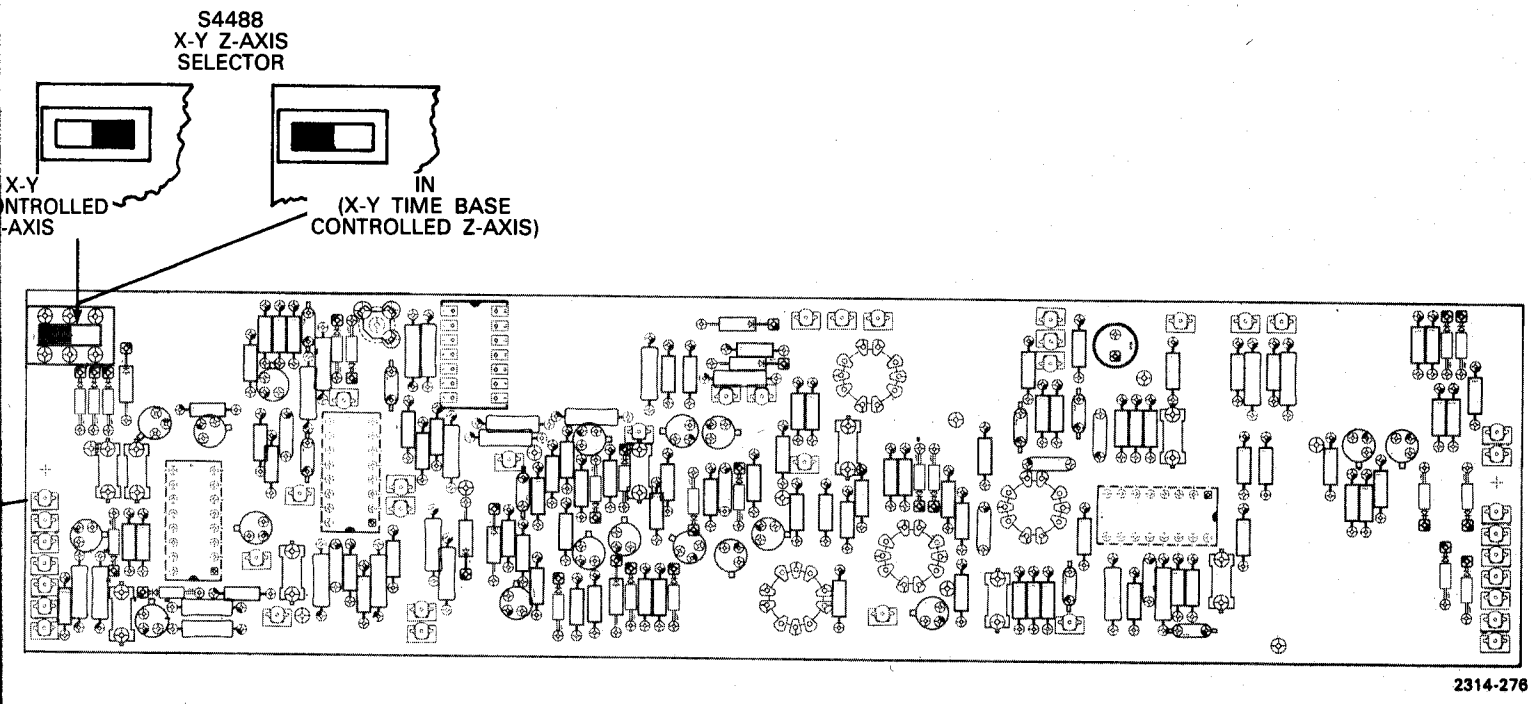


Figure 8-29. Test Point and Adjustment Locatio

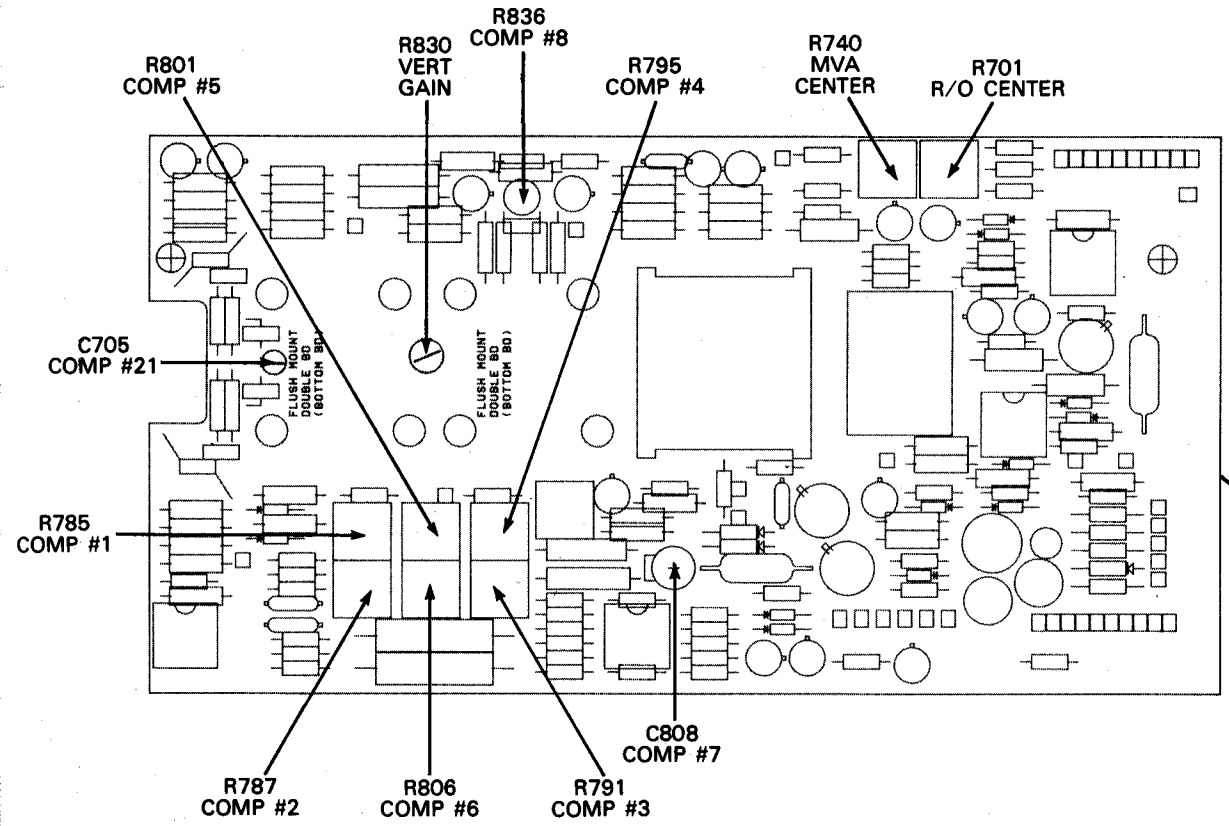


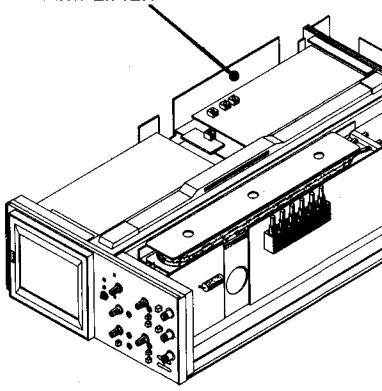


2314-276

Point and Adjustment Locations E.

@





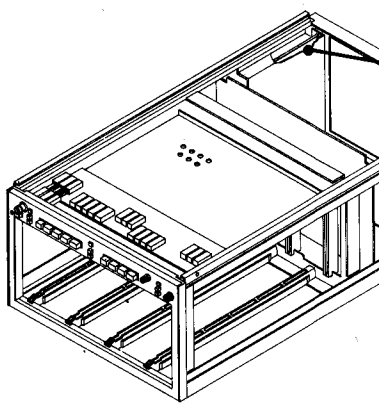
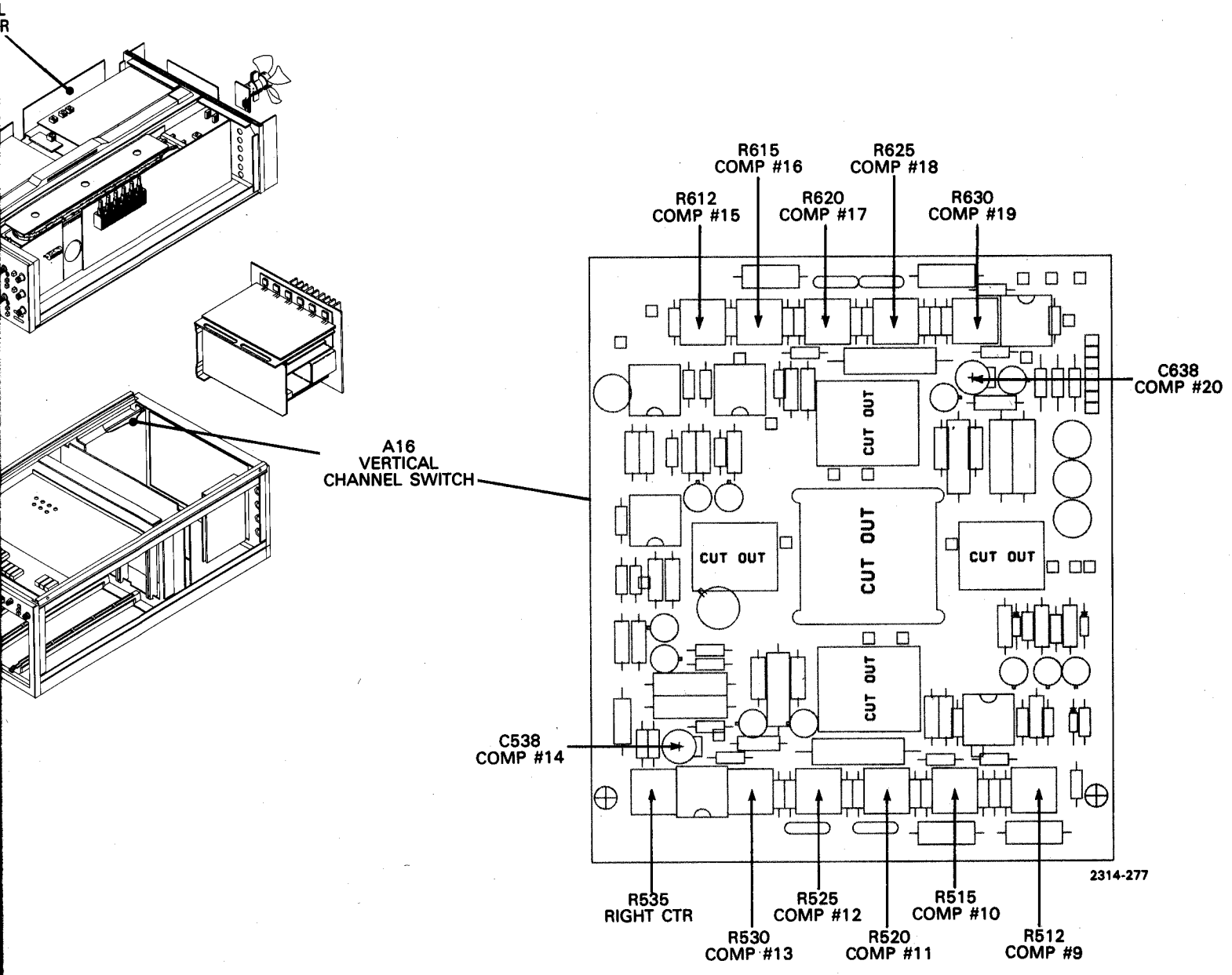


Figure 8-30. Test Point and Adjust



. Test Point and Adjustment Locations F.

@

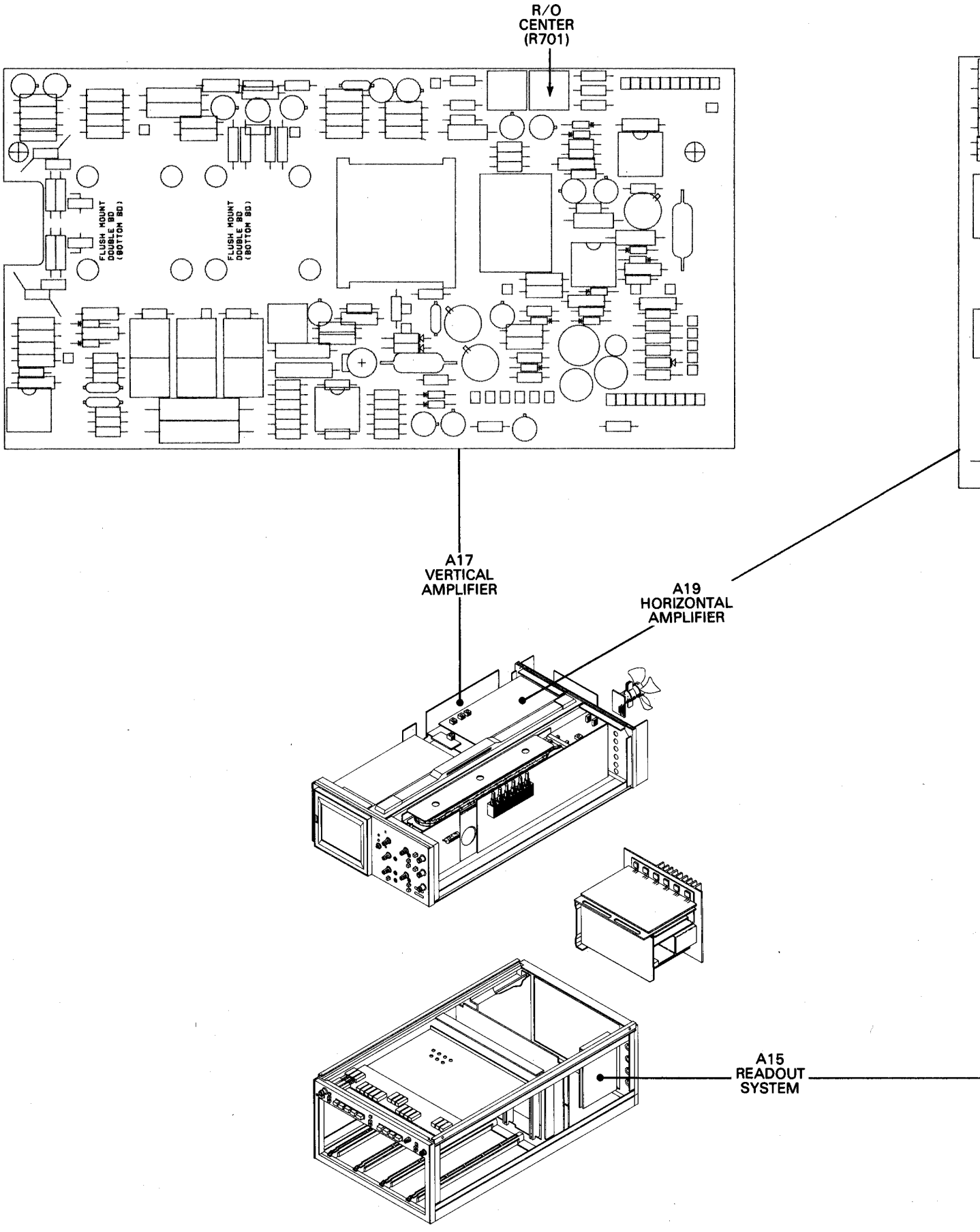
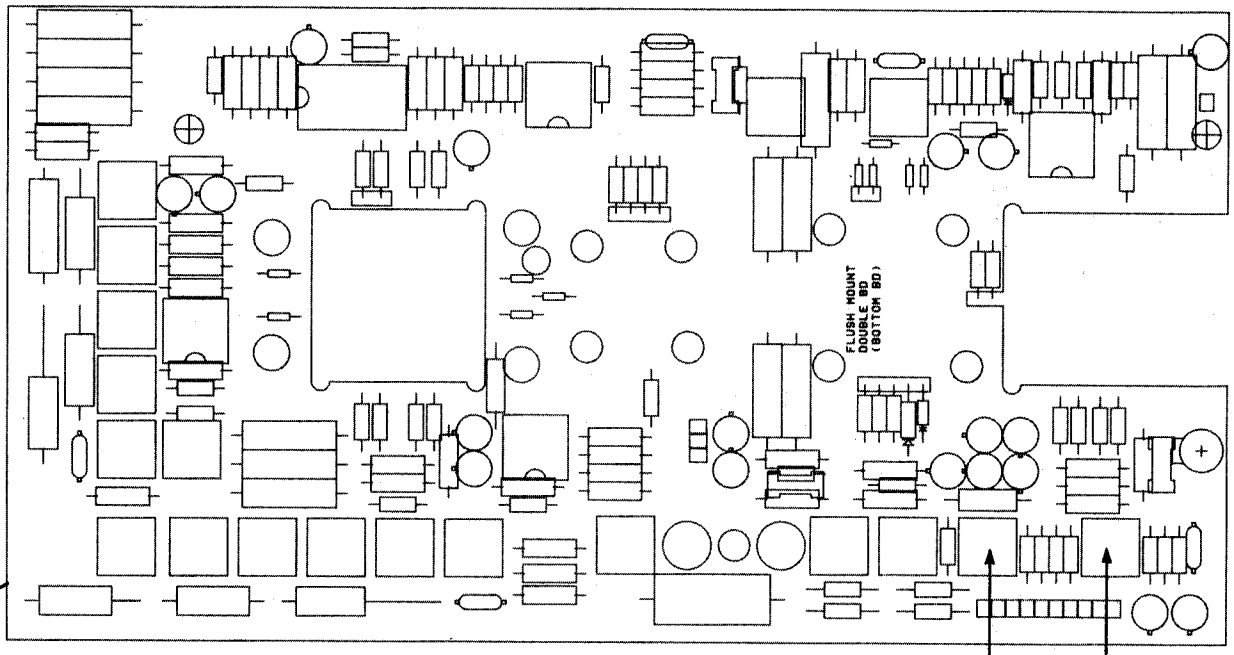
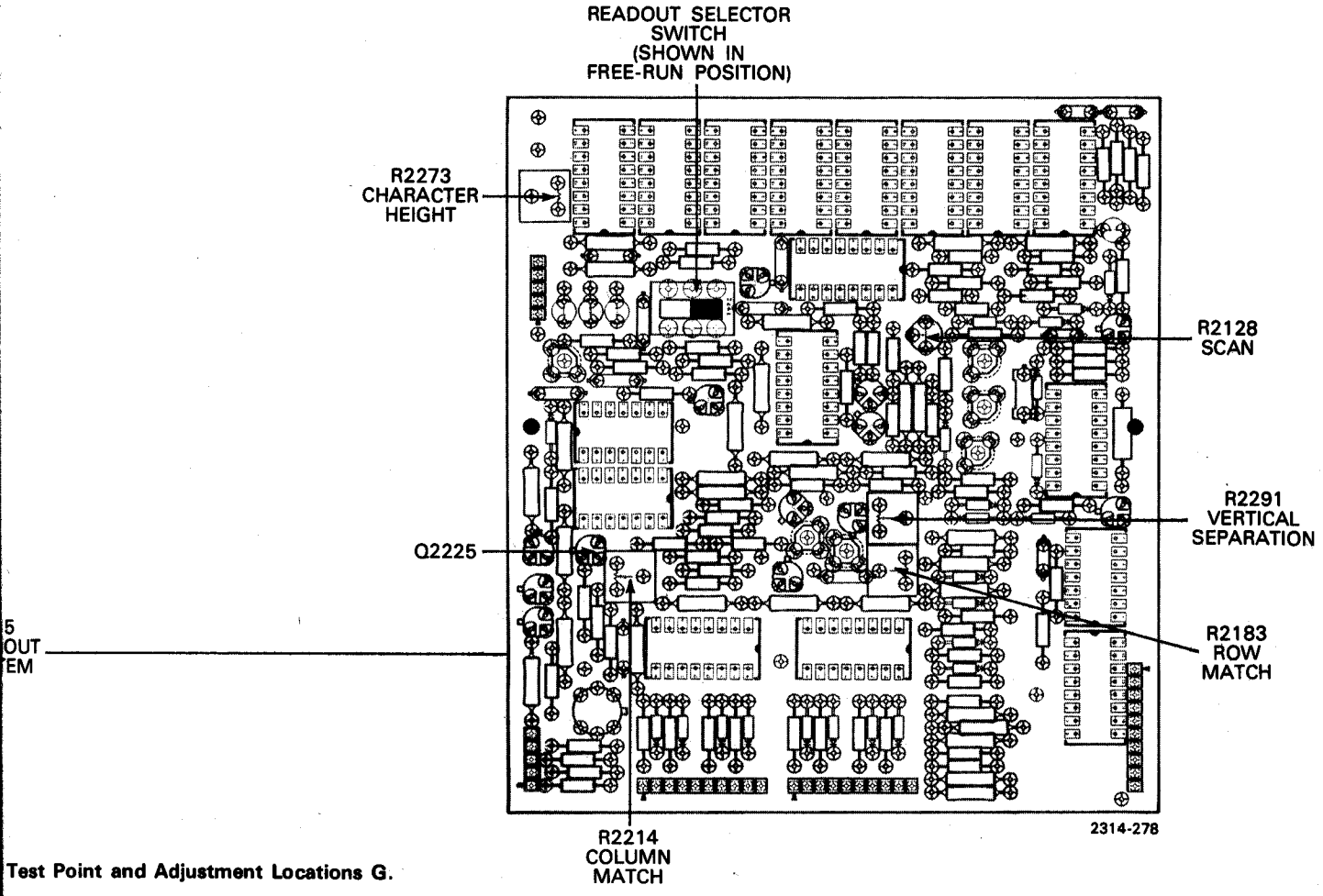


Figure 8-31. Test Point and Adjustment





Test Point and Adjustment Locations G.

@

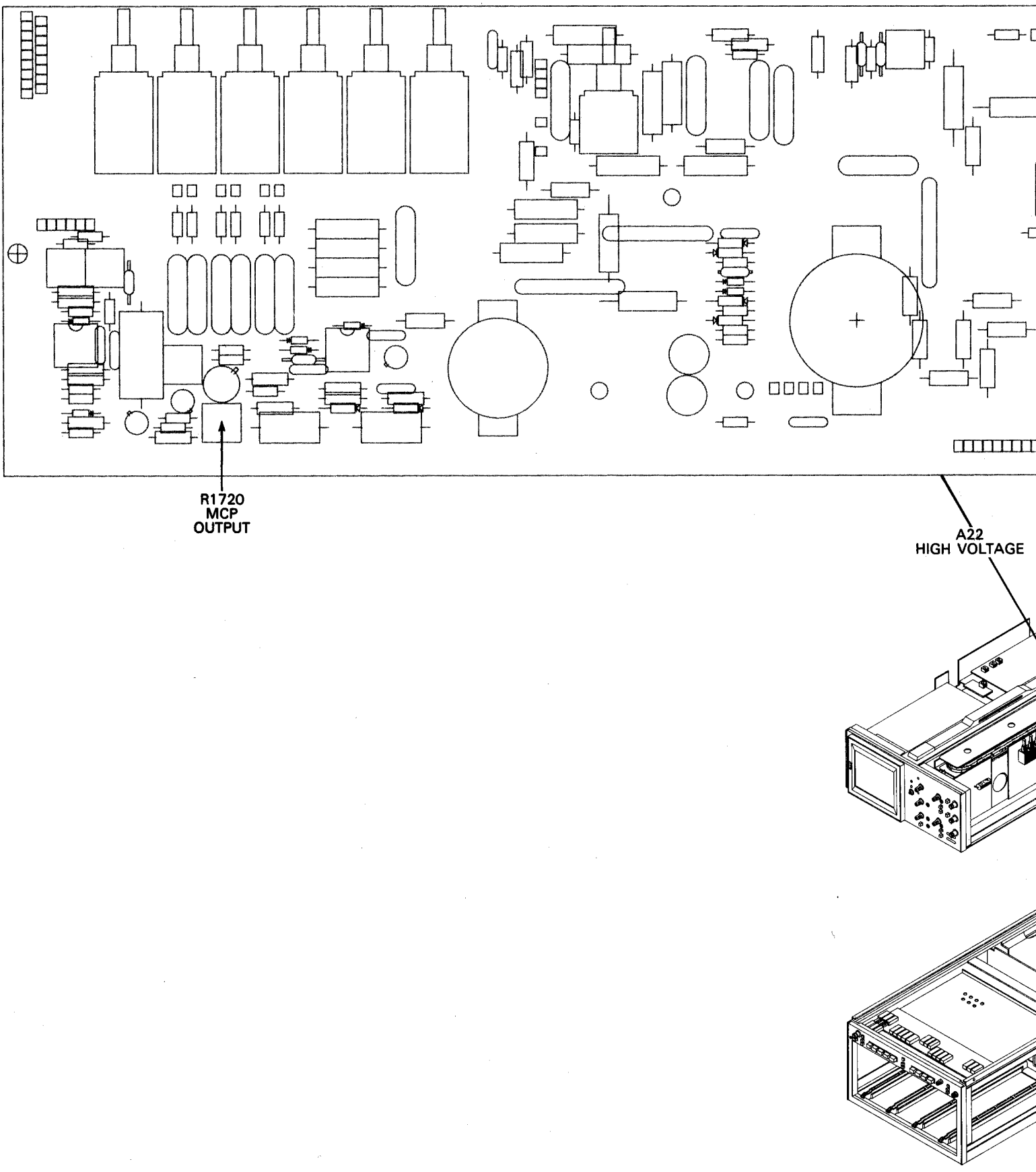
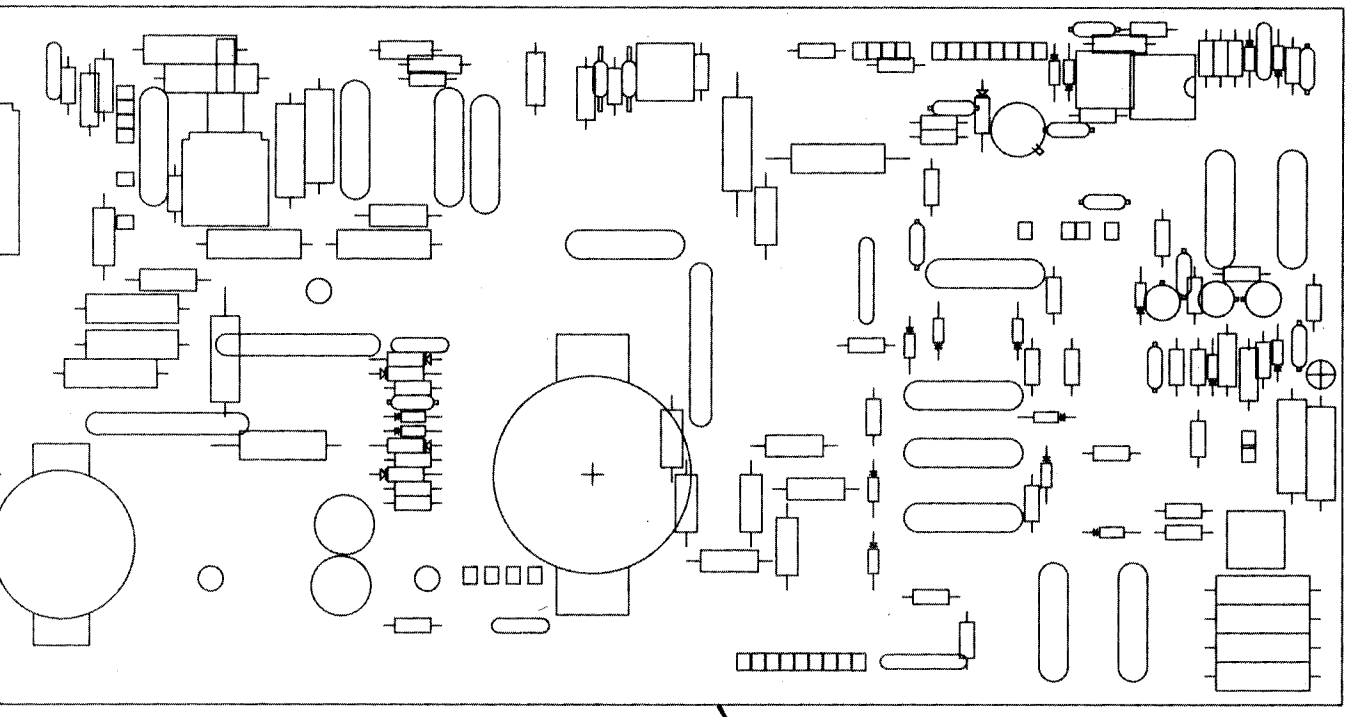
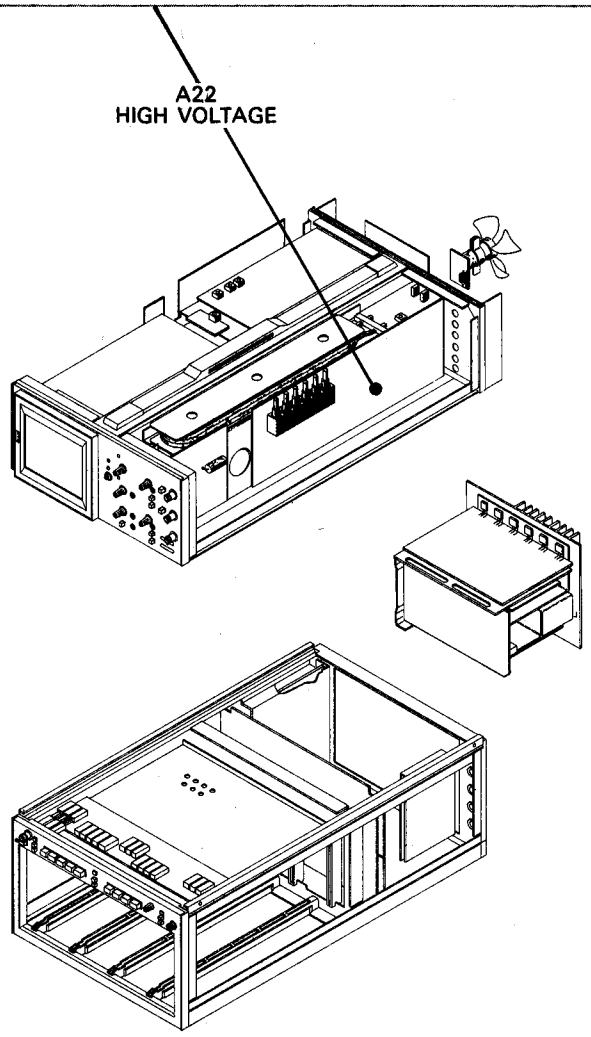


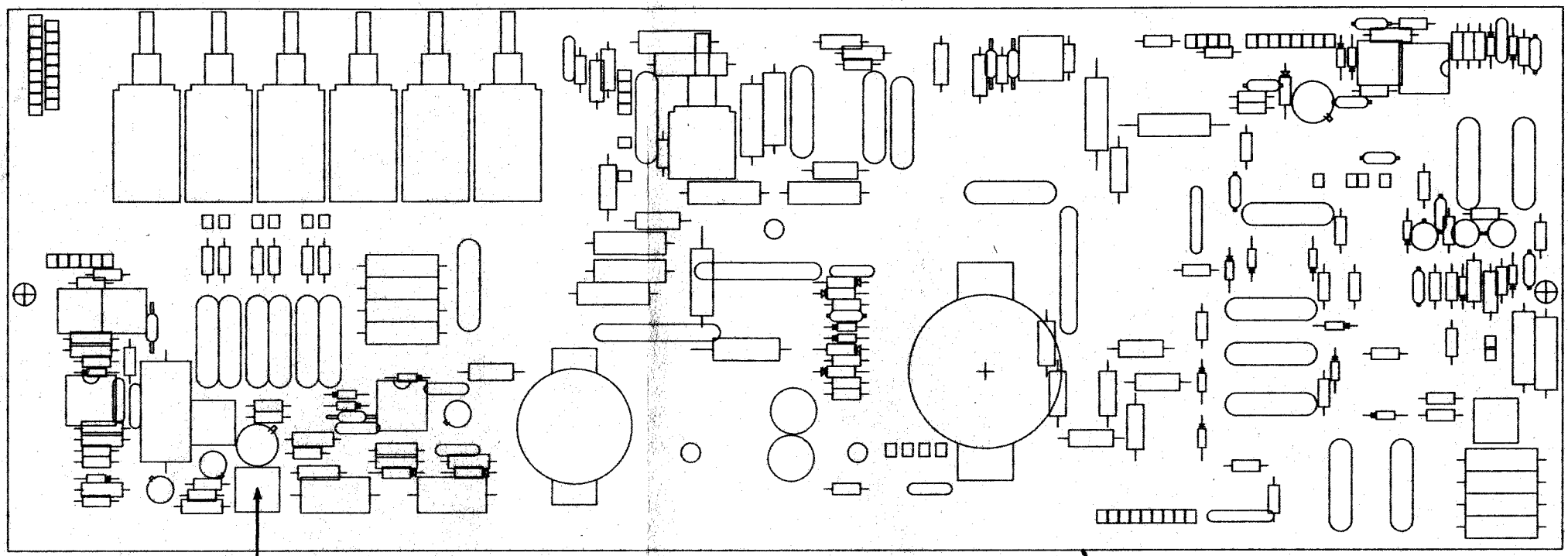
Figure 8-32. Test Point and Adjustment Locations H.

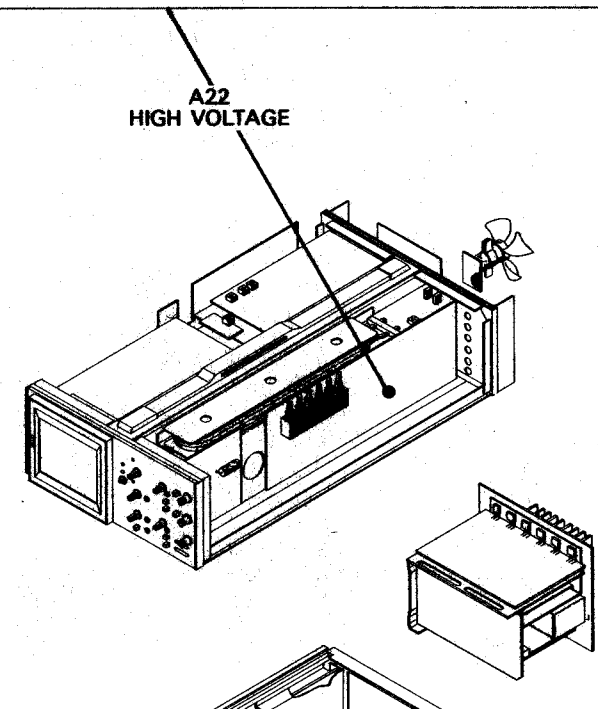




2314-279

Test Point and Adjustment Locations H.


R1720
MCP
OUTPUT


A22
HIGH VOLTAGE