

BEFORE READING

*PLEASE CHECK FOR CHANGE INFORMATION
AT THE REAR OF THIS MANUAL.*

THIS MANUAL REPRINTED NOVEMBER 1977

7603 / R7603

OSCILLOSCOPE

SERVICE

Serial Number _____

OPERATING INSTRUCTIONS

General

To effectively use the 7603, the operation and capabilities of the instrument must be known. This section describes the operation of the front- and rear-panel controls and connectors and gives simplified and general operating information.

PRELIMINARY INFORMATION

Operating Voltage

WARNING

This instrument is designed for operation from a power source with its neutral at or near earth (ground) potential with a separate safety-earth conductor. It is not intended for operation from two phases of a multi-phase system, or across the legs of a single-phase, three-wire system.

The 7603 can be operated from either a 110-volt or a 220-volt nominal line-voltage source. In addition, three operating ranges can be selected within each nominal line voltage source. The voltage-selector jumper on the Rectifier board (see Fig. 1-1) allows selection of the operating voltage. To convert the instrument from one regulating range to another, first disconnect the instrument from the power source. Then, slide out the power unit as described in the Maintenance section. Remove the voltage-selector jumper and re-install it on the set of pins which represent the desired regulating range. Select a range which is centered about the average line voltage to which the instrument is to be connected (see Table 1-1).

TABLE 1-1

Regulating Range and Fuse Data

Pins Selected	Regulating Range	
	110-volts nominal	220-volts nominal
LOW	90 to 110 volts	180 to 220 volts
MED	99 to 121 volts	198 to 242 volts
HI	108 to 132 volts	218 to 262 volts
Line Fuse	3.2 A slow-blow	1.6 A slow-blow

To convert from 110-volts to 220-volts nominal line voltage, or vice versa, remove the voltage-selector jumper and replace it with the spare jumper (stored on pins adjacent to voltage selector area). The jumpers are color-

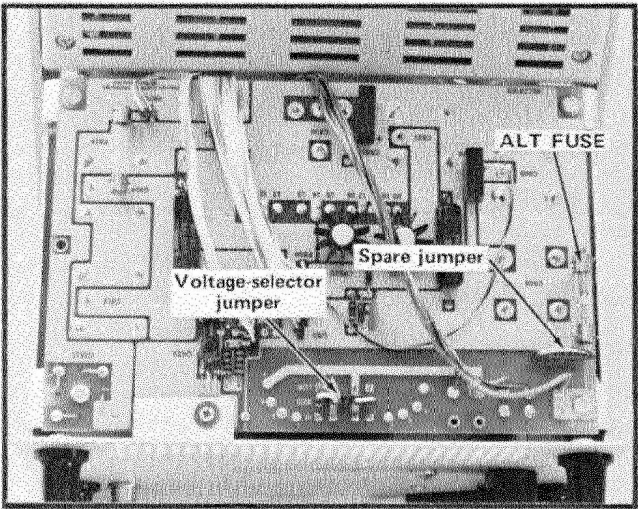


Fig. 1-1. Locations of voltage-selector jumper, spare jumper, and ALT FUSE in power unit (7603 shown).

coded to indicate the nominal voltage for which they are intended; brown for 110-volt nominal operation and red for 220-volt nominal operation. Change the line fuse to provide protection for the selected nominal line voltage. Use the fuse located in the ALT FUSE holder on the Rectifier board (see Fig. 1-1) or see Table 1-1 for value. Also, change the line-cord plug to match the power-source receptacle or use a suitable adapter.

Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

The 7603 is designed to be used with a three-wire AC power system. If a three- to two-wire adapter is used to connect this instrument to a two-wire AC power system, be sure to connect the ground lead of the adapter to earth (ground). Failure to complete the ground system may allow the chassis of this instrument to be elevated above ground potential and pose a shock hazard.

Operating Temperature

The 7603 can be operated where the ambient air temperature is between 0°C and +50°C. This instrument

SPECIFICATION

Information given in this manual applies to the R7603 Oscilloscope also, unless otherwise indicated. The R7603 is electrically identical to the 7603, but it is adapted for mounting in a standard 19-inch rack. Rackmounting instructions and a dimensional drawing for the R7603 are given in Section 6.

This instrument will meet the following electrical specifications after complete calibration as given in Section 5. The Operating Checkout procedure which is given in Section 1 provides a convenient method of checking instrument performance without making internal checks or adjustments. The following electrical characteristics apply over an ambient temperature range of 0°C to +50°C, except

as otherwise indicated. Warmup time for given accuracy is 20 minutes. Limits and tolerances given in the Supplemental Information column are provided for user information only, and should not be interpreted as Performance Requirements.

NOTE

Many of the measurement capabilities of this instrument are determined by the choice of plug-in units. The following characteristics apply to the 7603 Oscilloscope only. See the System Specification at the end of this section for specifications of the complete system.

VERTICAL DEFLECTION SYSTEM

Characteristic	Performance Requirements	Supplemental Information
Deflection Factor	Compatible with all 7000-series plug-in units.	
Between Compartments	Within 1%.	
Low Frequency Linearity	0.1 division or less compression or expansion of a center-screen 2 division signal when positioned anywhere vertically within the graticule area.	
Bandwidth	See system specifications for 7000-series instruments.	
7603 Vertical Amplifier only (6 div Reference; 0°C to +50°C)	DC to at least 115 MHz.	
Step Response Risettime	See system specifications for 7000-series instruments.	
Isolation Between Vertical Compartments	At least 100:1 from DC to 100 MHz.	
Delay Line		Permits viewing leading edge of trigger signal.
Chopped Mode		
Repetition Rate	1 MHz within 20%.	
Time Segment From Each Compartment	0.4 to 0.6 μ s.	

VERTICAL DEFLECTION SYSTEM (cont)

Characteristic	Performance Requirements	Supplemental Information
Difference In Delay Between Vertical Compartments		0.5 ns or less.
Vertical Display Modes	LEFT: Left vertical unit only. ALT: Dual trace, alternate between vertical units. ADD: Added algebraically. CHOP: Dual trace, chopped between vertical units. RIGHT: Right vertical unit only.	Selected by VERT MODE switch.

TRIGGERING

Characteristic	Performance Requirements	Supplemental Information
Trigger Source	LEFT VERT: From left vertical only. VERT MODE: Determined by vertical mode. RIGHT VERT: From right vertical only.	Selected by TRIGGER SOURCE switch.

HORIZONTAL DEFLECTION SYSTEM

Characteristic	Performance Requirements	Supplemental Information
Fastest Calibrated Sweep Rate	5 ns/div.	
Deflection Factor	Compatible with all 7000-series plug-in units.	
Low Frequency Linearity	0.1 div or less compression or expansion of a center-screen 2 div signal when positioned anywhere horizontally within the graticule area.	
Phase Shift Between the Vertical and Horizontal Amplifiers	Less than 2° from DC to 35 kHz.	
Frequency Response Bandwidth (8 div Reference)	At least 2 MHz.	

CALIBRATOR

Characteristic	Performance Requirements	Supplemental Information
Waveshape	Positive-going squarewave or DC (DC voltage selected by internal jumper).	
Voltage Output Range	40 mV, 0.4 V, and 4 V.	Into 1 M Ω load.
Voltage Output Accuracy		
+15°C to +35°C	Within 1%.	
0°C to +50°C	Within 2%.	
Current Output Accuracy	40 mA.	
+15°C to +35°C	Within 2%.	With optional current loop accessory (012-0259-00) connected between 4 V pin jack and ground pin jack.
0°C to +50°C	Within 3%.	
Repetition Rate		Approximately 1 kHz.
Output Resistance		
40 mV and 0.4 V		Approximately 50 Ω .
4 V		Approximately 450 Ω .

EXTERNAL Z AXIS INPUT

Characteristic	Performance Requirements	Supplemental Information
Sensitivity (Full Intensity Range)	2 V peak to peak.	
Useful Input Voltage Versus Repetition Frequency	2 V peak to peak, DC to 2 MHz; reducing to 0.4 V peak to peak at 10 MHz.	
Polarity of Operation	Positive-going signal decreases intensity.	
Maximum Input Voltage		10 V (DC to peak AC).
Input Resistance		Approximately 500 Ω .

OUTPUTS

Characteristic	Performance Requirements	Supplemental Information
Camera Power (P1041 at CRT Bezel)		
Pin 1 – +15 V		
Pin 3 – single sweep reset		
Pin 5 – ground		

CHARACTER GENERATOR

Characteristic	Performance Requirements	Supplemental Information
Character Size	Adjustable.	
Modes of Operation	Free-run independent of sweep.	Selected by internal READOUT mode switch.
	Triggered after sweep.	

DISPLAY (CRT) and OPTIONS

Characteristic	Performance Requirements			Supplemental Information
Cathode Ray Tube Type	T 7400.			
Graticule				
Type	Internal and illuminated.			
Area	8 X 10 div.			
Standard	1 div equals 1.22 cm.			
Option 4	1 div equals 1 cm.			
Option 6	1 div equals 1.22 cm (Spectrum Analyzer).			
Phosphor				
Standard	P31.			
Option 8	P11 or P7 on request.			
Beam Finder				Limits display to within graticule area when BEAM FINDER switch is actuated.
Photographic Writing Specifications	Phosphor	Standard	Option 4	Polaroid ¹ film type 107 (3000 ASA). Without film fogging techniques.
C53 Camera (f1.9 Lens 1:0.85 Image-to-Object Ratio)	P31	100 div/ μ s	180 cm/ μ s	
	P11	140 div/ μ s	260 cm/ μ s	

¹ Registered trademark Polaroid Corporation.

POWER SOURCE

Characteristic	Performance Requirements	Supplemental Information
Line Voltage Ranges		
110 V nominal	100 V \pm 10%.	
	110 V \pm 10%.	
	120 V \pm 10%.	
220 V nominal	200 V \pm 10%.	
	220 V \pm 10%.	
	240 V \pm 10%.	
Line Frequency		50 to 400 Hz.
Maximum Power Consumption (115 V AC; 60 Hz)		170 W, 1.9 A.
Fuse Data		
110 V line (F1000)		3.2 A slow blow.
220 V line (F1000)		1.6 A slow blow.
+130 V Supply (F855)		0.15 A fast blow.

SIGNALS OUT

Characteristic	Performance Requirements	Supplemental Information
VERT SIG OUT	See systems specifications for 7000-series instruments.	
Vertical Signals	LEFT, RIGHT, ALT, and ADD.	Selected by TRIG SOURCE switch.
Gain		
Into 50 Ω		25 mV/div.
Into 1 M Ω		0.5 V/div. \pm 20% system CRT to VERT SIG OUT.
Risetime (Into 50 Ω)		5 ns or less.
Aberrations		
Centering		\pm 1 div system CRT to VERT SIG OUT. (1.5 V into 1 M Ω or 75 mV into 50 Ω .)
Output Resistance		950 Ω within 2%.
+GATE OUT		
Gate Signals	MAIN, AUXILIARY, and DELAY.	Selected by Gate selector switch.
Output		
Into 50 Ω		0.5 V within 10%.
Into 1 M Ω		10 V within 10%.

SIGNALS OUT (cont)

Characteristic	Performance Requirement	Supplemental Information
Risetime (Into 50 Ω)		20 ns or less
Output Resistance		950 Ω within 2%.
+SAWTOOTH OUT		
Output		
Into 50 Ω		50 mV/unit time ² within 15%.
Into 1 M Ω		1 V/unit time ² within 10%.
Output Resistance		950 Ω within 2%.

ENVIRONMENTAL

Characteristic	Information
<p align="center">NOTE</p> <p><i>This instrument will meet the electrical characteristics given in the Performance Requirement column of the Specifications over the following environmental limits.</i></p>	
Temperature Range	
Operating	0°C to +50°C.
Non-operating	–55°C to +75°C.
Altitude	
Operating	15,000 ft.
Non-operating	Test limit 50,000 ft.
Transportation (packaged instrument, without plug-in units) qualifies under National Safe Transit test procedure 1A, Category II.	

PHYSICAL

Characteristic	Information
Ventilation	Safe operating temperature maintained by convection cooling. (7603) or forced air cooling (R7603). Automatic resetting thermal cutout protects instrument from overheating.

PHYSICAL (cont)

Characteristic	Information
Finish	Anodized aluminum front panel. Painted cabinet.
7603 Overall Dimensions (measured at maximum points)	
Height	11.4 in (28.9 cm).
Width	8.7 in (22.1 cm).
Length	24.0 in (60.9 cm).
Net Weight (instrument only)	30 lb (13.6 kg).
R7603 Overall Dimensions (measured at maximum points)	
Height	5.25 in (13.3 cm).
Width	19.0 in (48.2 cm).
Length	24.7 in (62.9 cm).
Net Weight (instrument only)	30 lb (13.6 kg).

STANDARD ACCESSORIES

Standard accessories supplied with the 7603 are given in the Mechanical Parts List illustrations. For optional accessories available for use with this instrument, see the Tektronix, Inc. catalog.

² Referenced to Time/Div setting.

7600-SERIES SYSTEM SPECIFICATIONS

Amplifier Plug-In Unit	Vertical System							
	Probe	BW	T _r	Accuracy			SIG OUT	
				EXT CAL 0 to 50°C	INT CAL 15 to 35°C	INT CAL 0 to 50°C	BW	T _r
7A11	Integral	100 MHz	3.5 ns	2%	3%	4%	60 MHz	5.9 ns
7A12	None	85 MHz	4.2 ns	2%	3%	4%	55 MHz	6.4 ns
	P6053			3%	4%	5%	55 MHz	6.4 ns
7A13	None	80 MHz	4.4 ns	1.5%	2.5%	3.5%	55 MHz	6.4 ns
	P6055			1.5%	2.5%	3.5%	45 MHz	7.8 ns
7A14	P6021	50 MHz	7.0 ns	2%	3%	4%	40 MHz	8.8 ns
	P6022	85 MHz	4.2 ns	2%	3%	4%	50 MHz	7.0 ns
7A15A	None	65 MHz	5.4 ns	3%	4%	5%	50 MHz	7.0 ns
	P6053			3%	4%	5%	50 MHz	7.0 ns
7A16	None	100 MHz	3.5 ns	2%	3%	4%	60 MHz	5.9 ns
	P6053			3%	4%	5%	60 MHz	5.9 ns
7A17	None	100 MHz	3.5 ns				15 MHz	24 ns
7A18	None	70 MHz	5.0 ns	2%	3%	4%	50 MHz	7.0 ns
	P6053			3%	4%	5%	50 MHz	7.0 ns
7A19	None or P6051	110 MHz	3.2 ns	2%	3%	4%	65 MHz	5.4 ns
	P6056/ P6057			3%	4%	5%	65 MHz	5.4 ns
7A22	None or Any	1.0 MHz ±10%	350 ns ±9%	2%	3%	4%	1.0 MHz ±10%	350 ns ±9%

The bandwidth of a vertical plug-in used in the horizontal compartment is 2 MHz except for the 7A22 which has a bandwidth of 850 kHz. The X-Y phase shift between 2 similar units is 2° at 35 kHz.

TIME BASE PLUG-INS

Time Base	Performance Feature	Max Sweep Rate	Triggering Freq Range
7B50	Delayed Sweep & Ext Amplifier	5 ns/div	DC to 100 MHz
7B51	Delaying Sweep	5 ns/div	DC to 100 MHz
7B52	Delayed & Mixed Sweeps	5 ns/div	DC to 100 MHz
7B53N	Delayed & Mixed Sweeps	5 ns/div	DC to 100 MHz
7B70	Delayed Sweeps & Ext Amplifier	2 ns/div	DC to 200 MHz
7B71	Delaying Sweep	2 ns/div	DC to 200 MHz
7B92	Display Switching	2 ns/div	DC to 250 MHz

SPECIAL PURPOSE and SAMPLING PLUG-INS

Plug-In	Performance Feature
7CT1N	Low Power Semiconductor Curve Tracer
7D13	Measures: Temperature, Voltage, Current, and Resistance
7D14	Directly Gated Counter to 525 MHz
7L12	1 MHz to 1.8 GHz Spectrum Analyzer
7M11	High Quality Dual Delay Line
7S11	Accepts Plug-In Sampling Heads
7S12	TDR and Sampling Applications
7T11	Random or Sequential; Equivalent or Real-Time Sampling

For more complete specifications on plug-in units for the 7600-Series Oscilloscope System, refer to the TEKTRONIX Catalog.

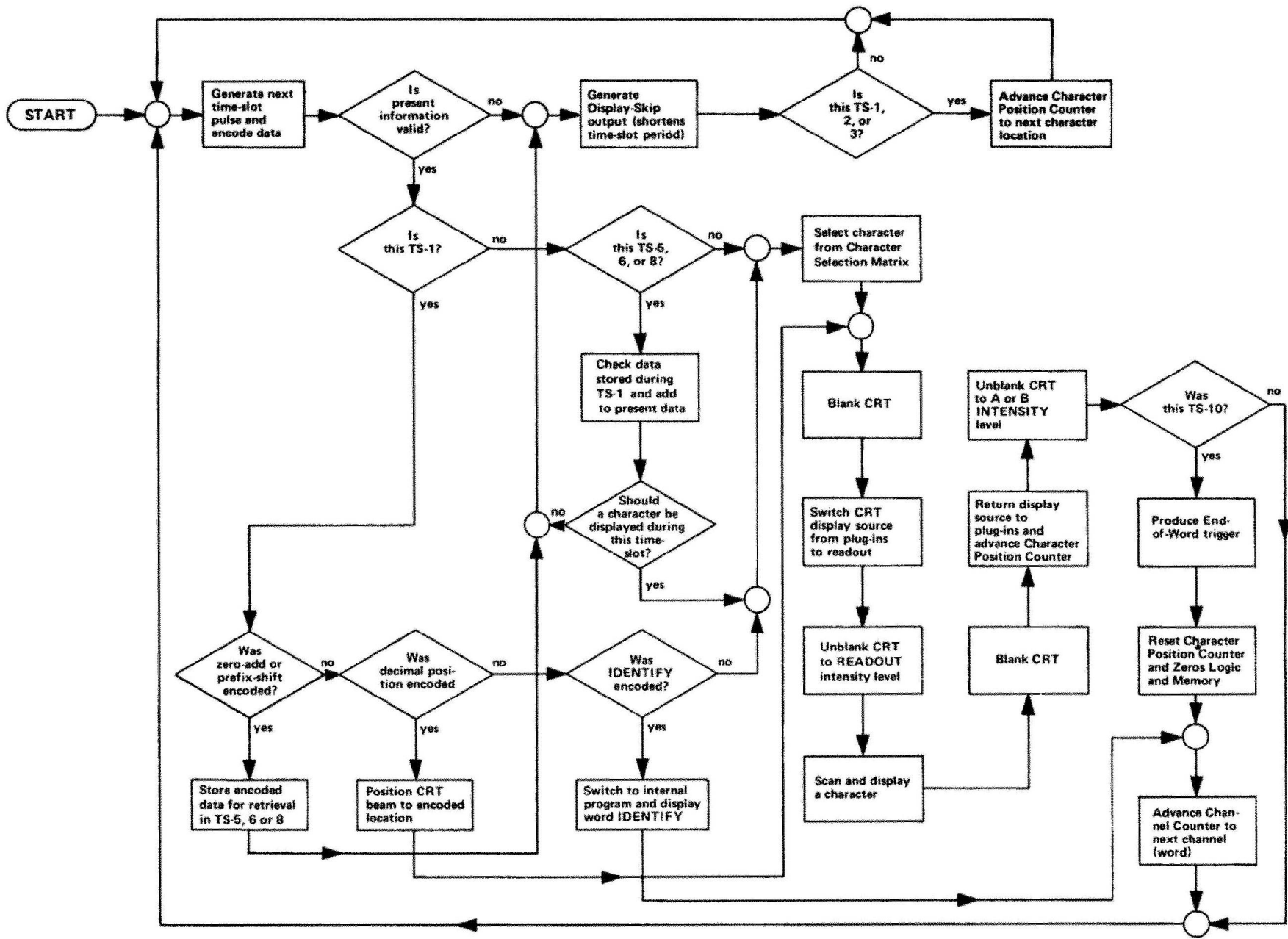
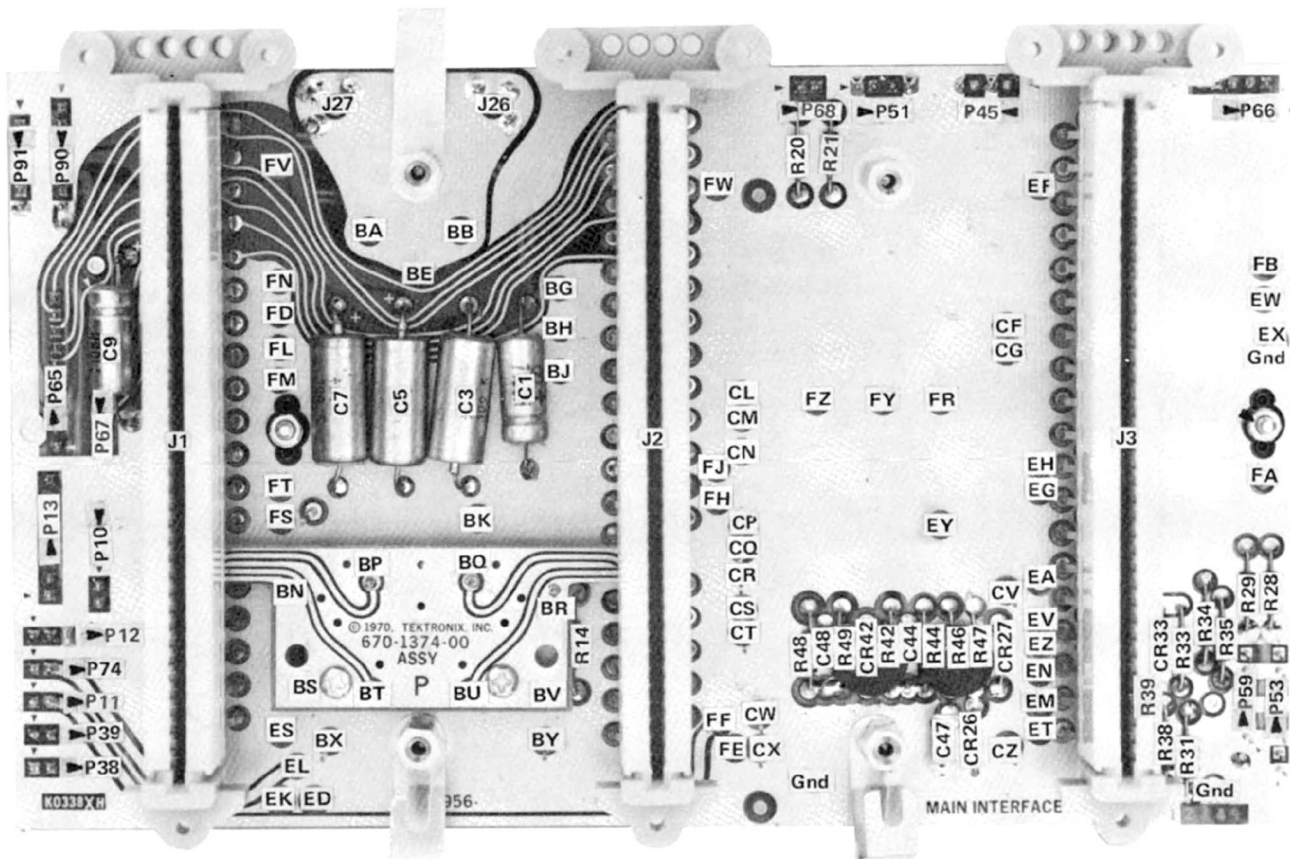
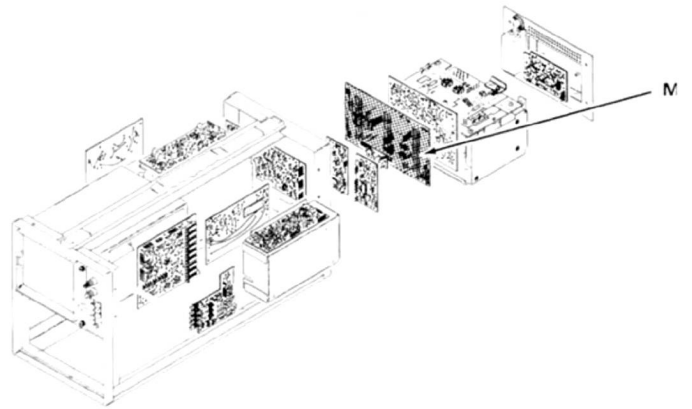


Fig. 4-37. Flow chart of character generation sequence by the Readout System.



On Back of Board 670-1374-00:

C16
C18
R12
R36

Fig. 8-1B. A1. Main Interface (front) circuit board below SN B160000.

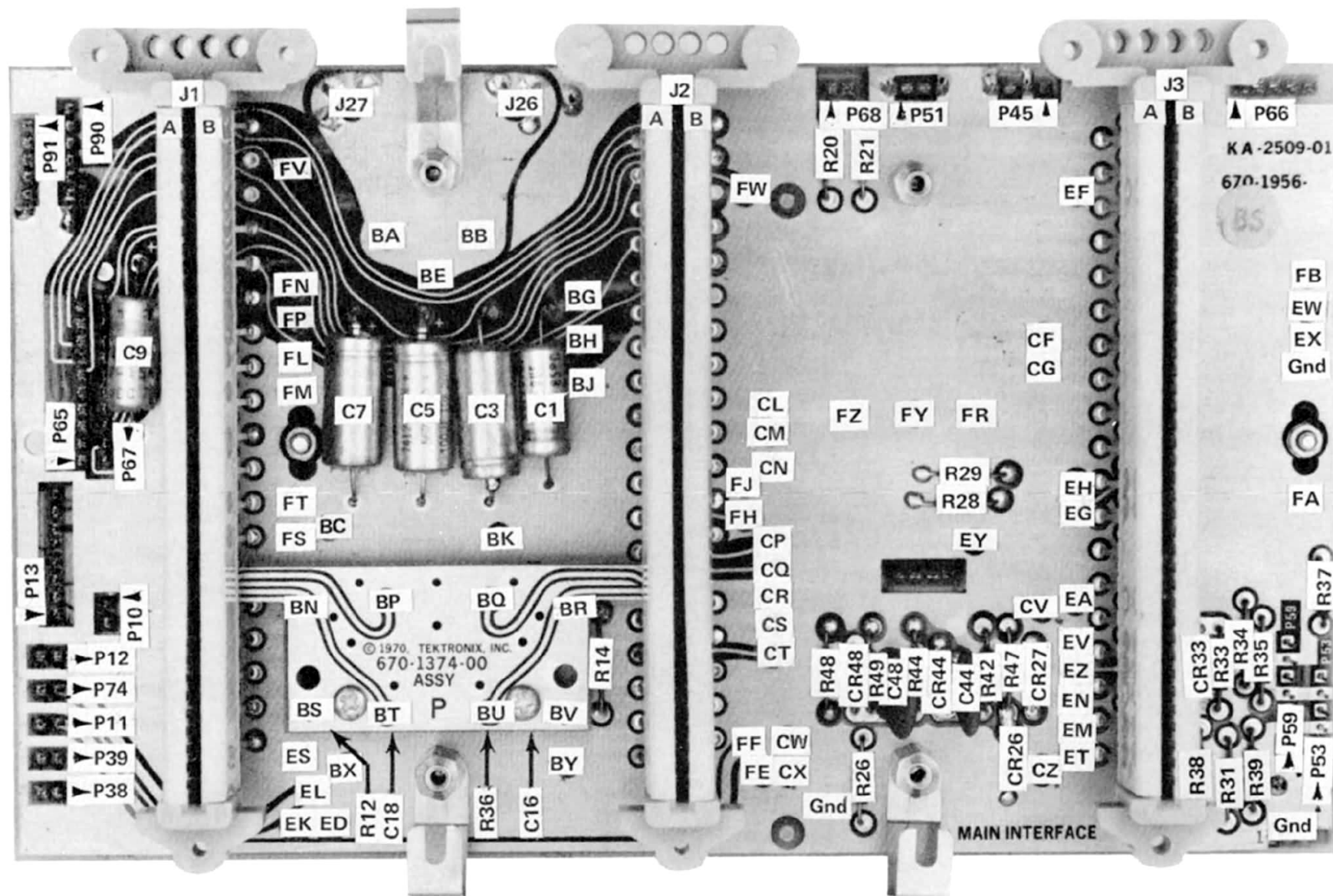
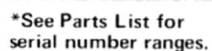
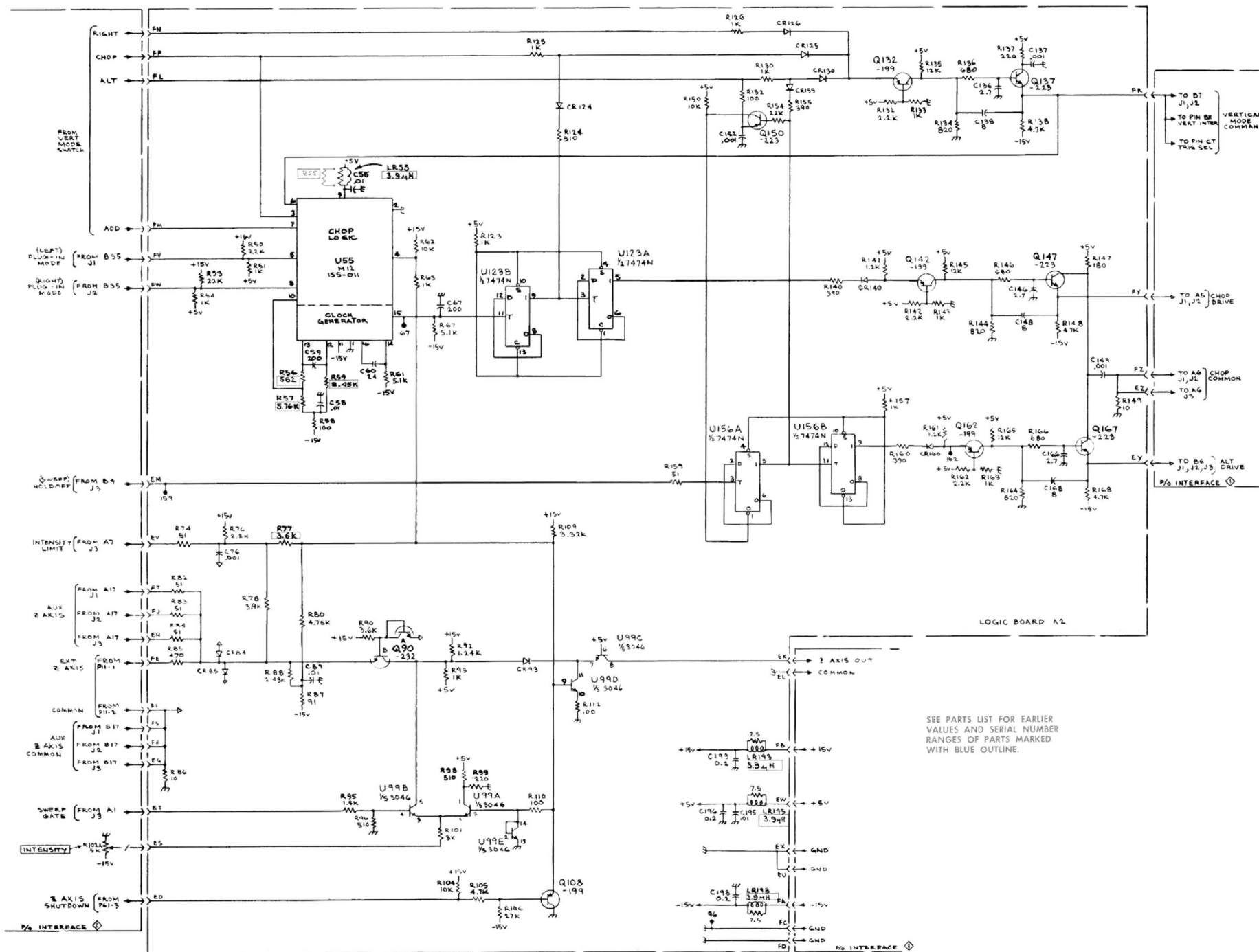
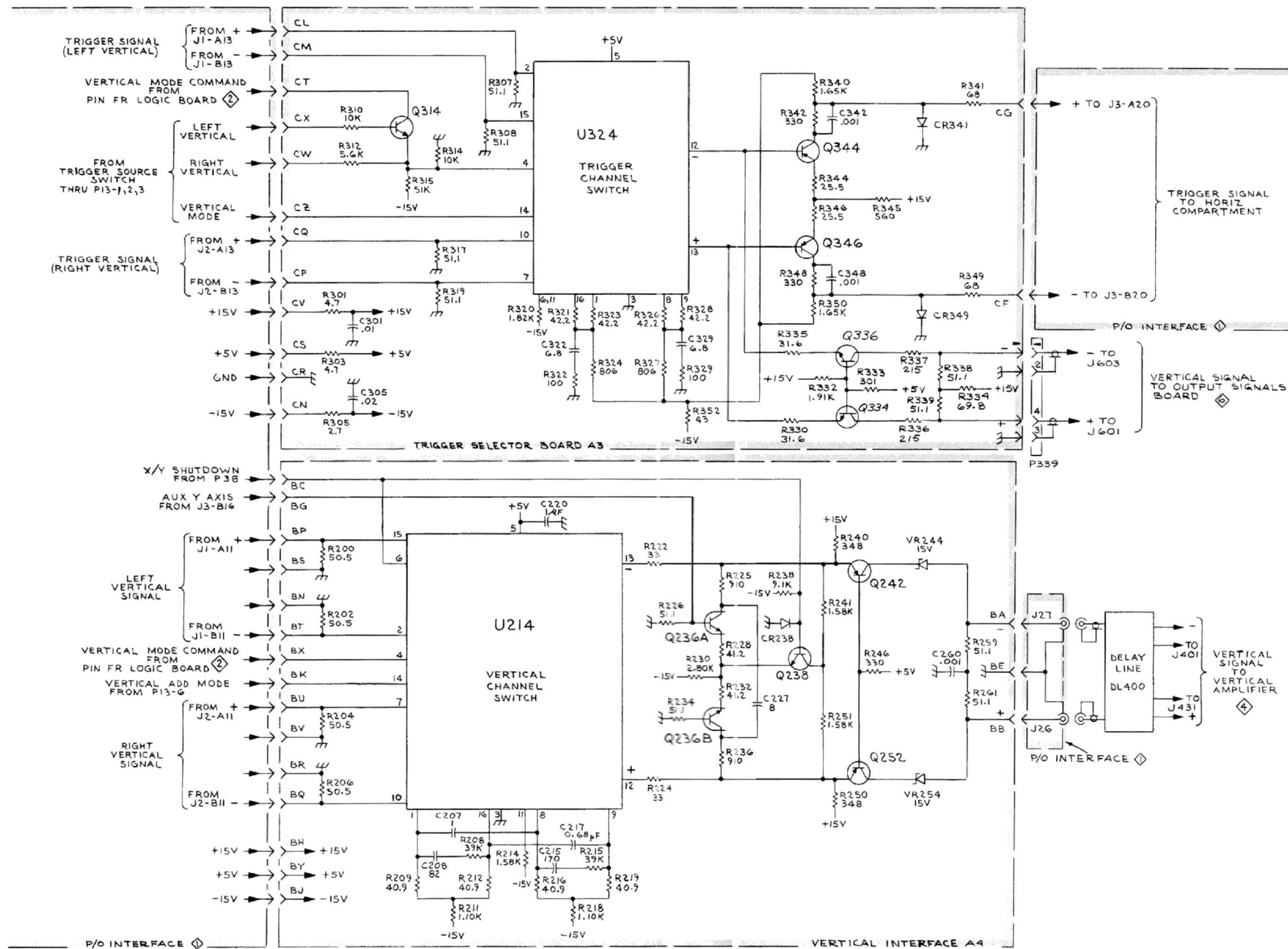


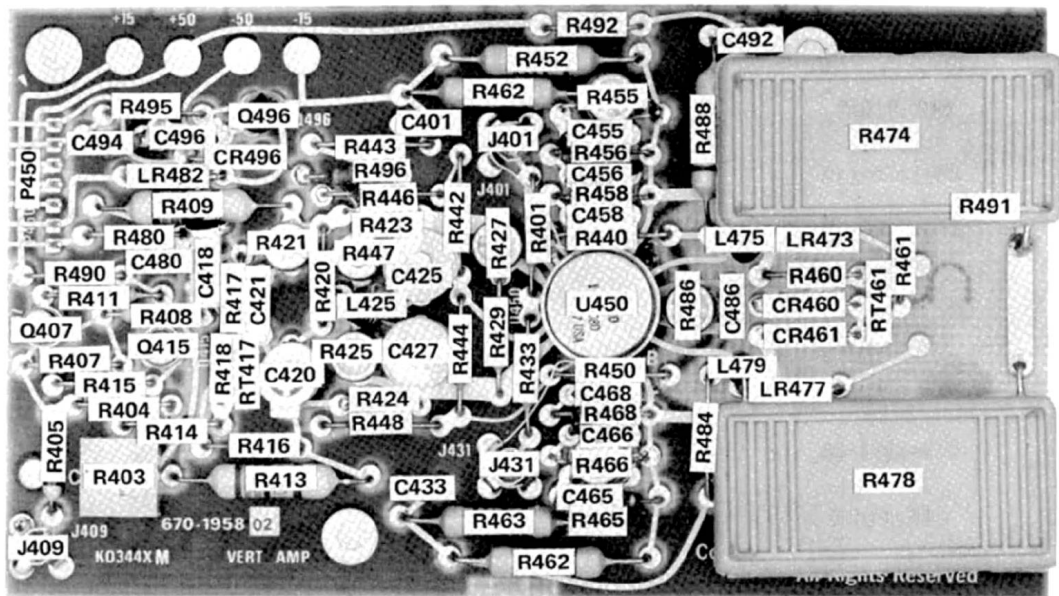
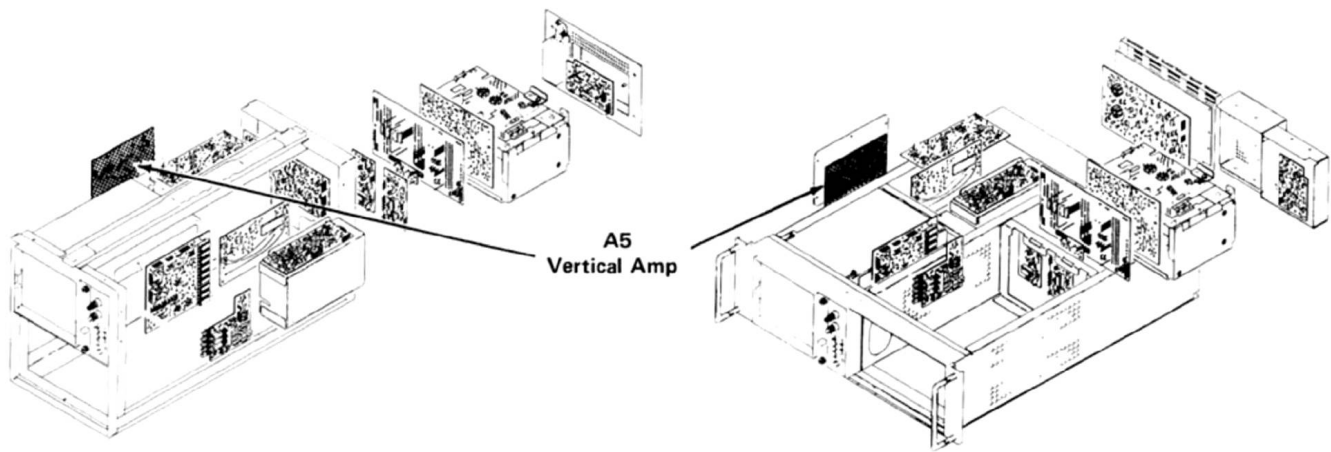
Fig. 8-1A. AI. Main Interface (front) circuit board, SN B160000-up.



C67 Located on back of board.

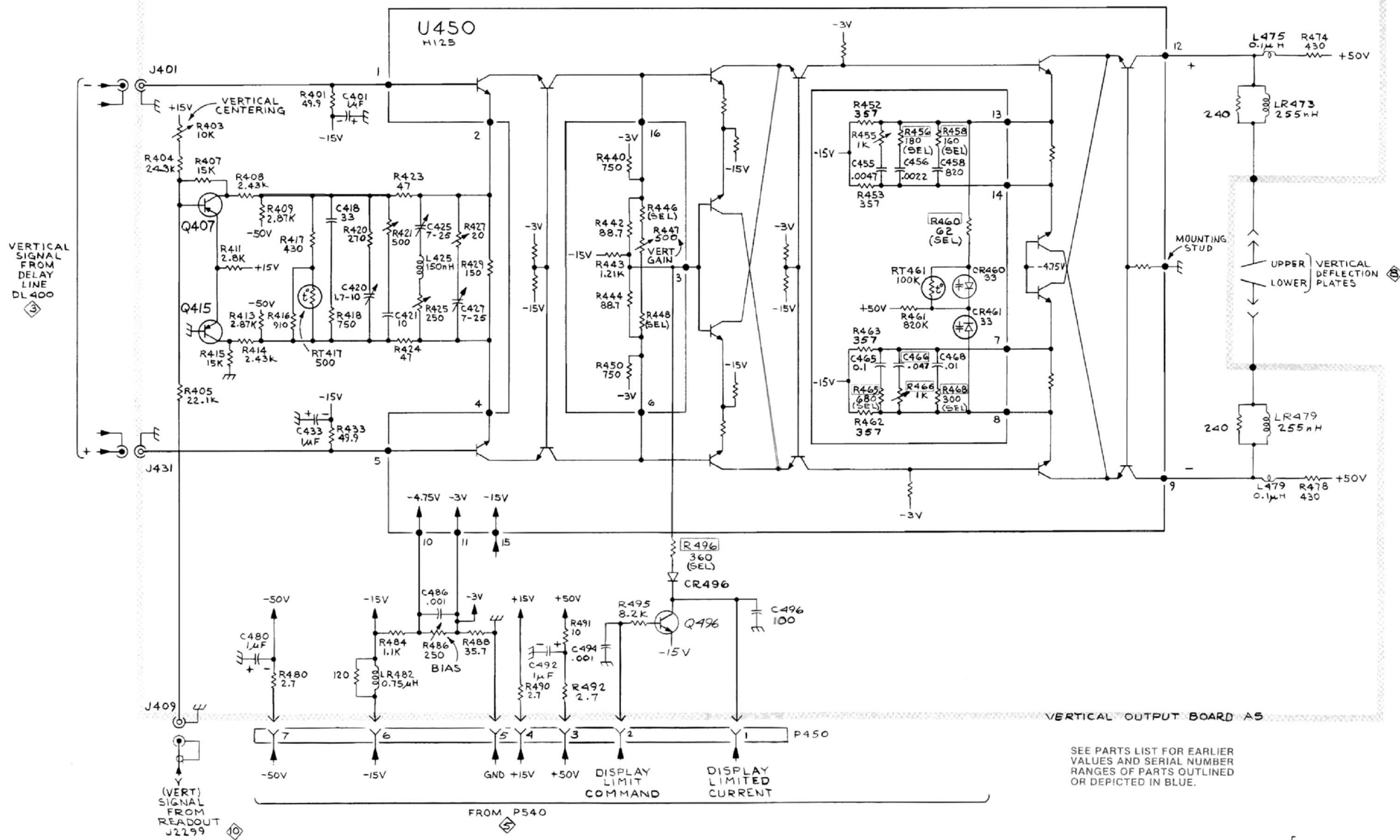






*See Parts List for
serial number ranges.

Fig. 8-6. A5. Vertical Amp circuit board.



A6
Horizontal Amplifier

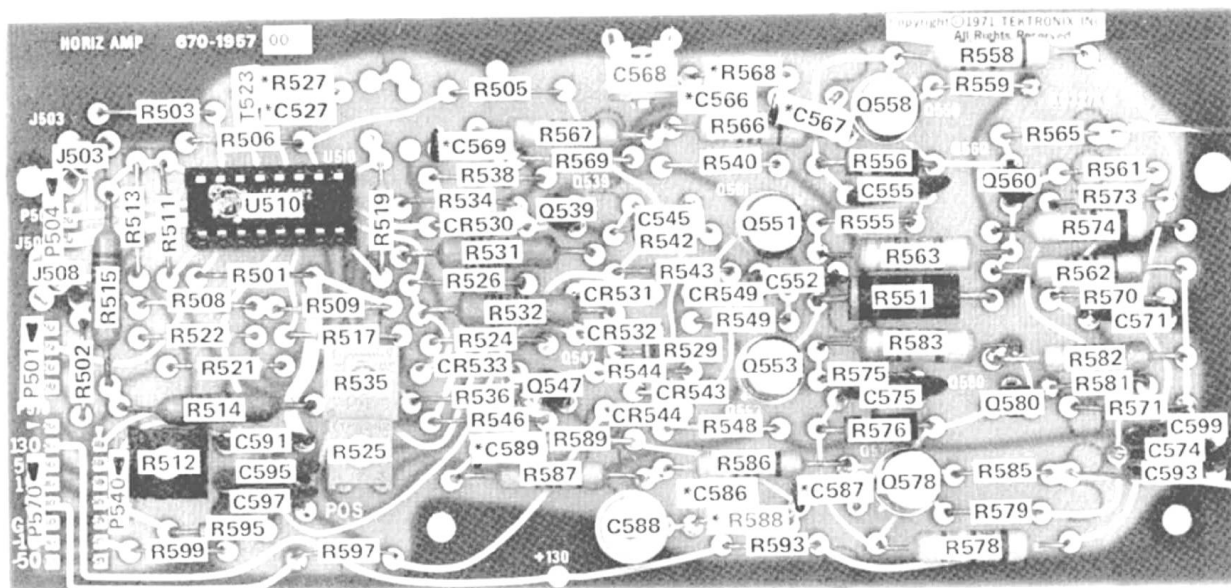
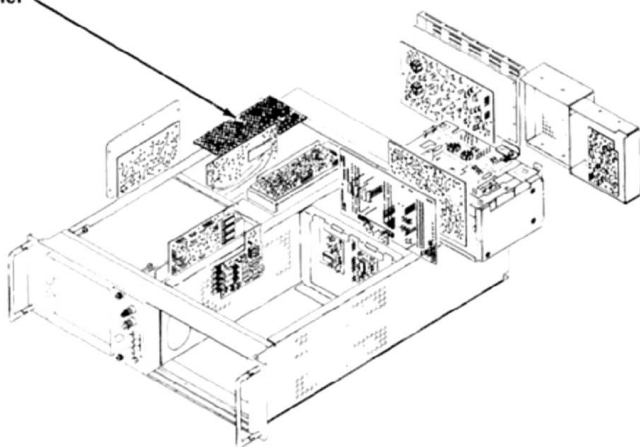
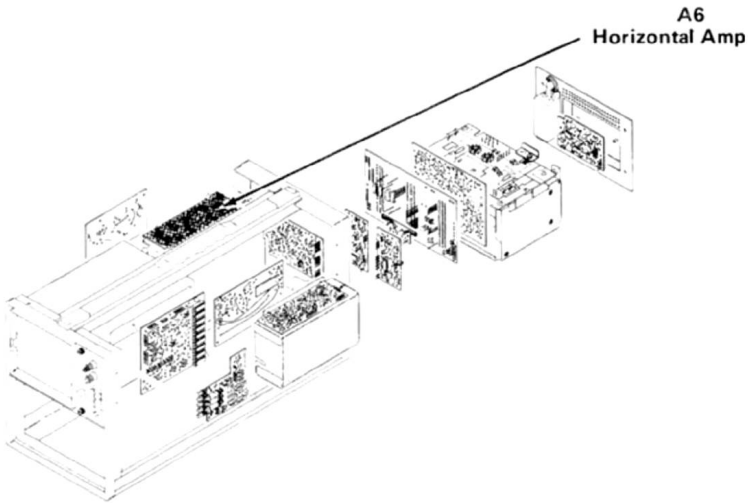
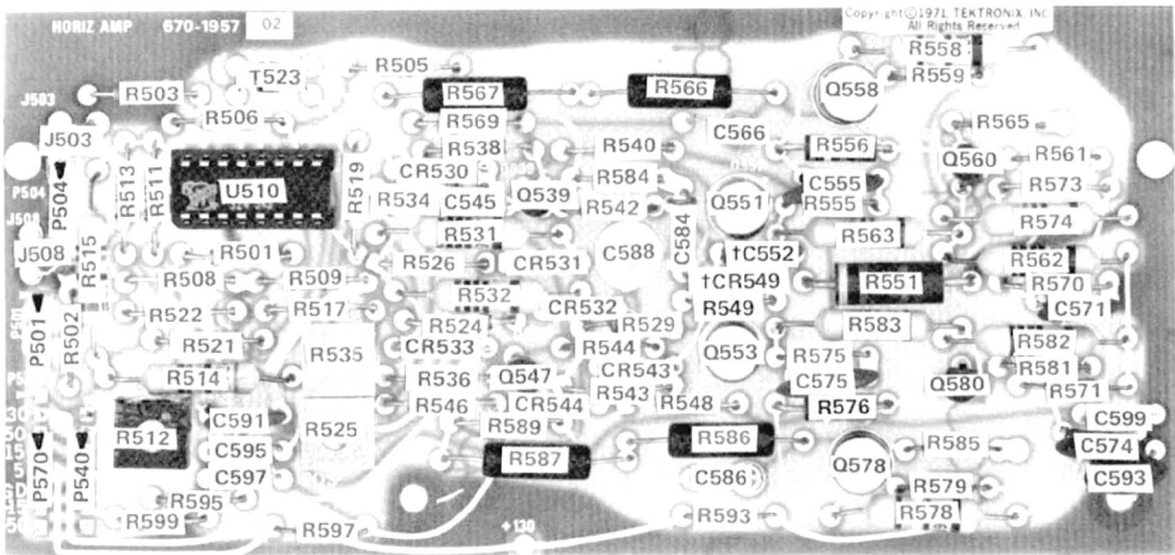


Fig. 8-7B. A6. Horizontal Amplifier circuit board below SN B060000.

*See Parts List for
serial number ranges.



†CR549 & C552 transposed in
some instruments.



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Fig. 8-7A. A6. Horizontal Amplifier circuit board SN B060000-up.

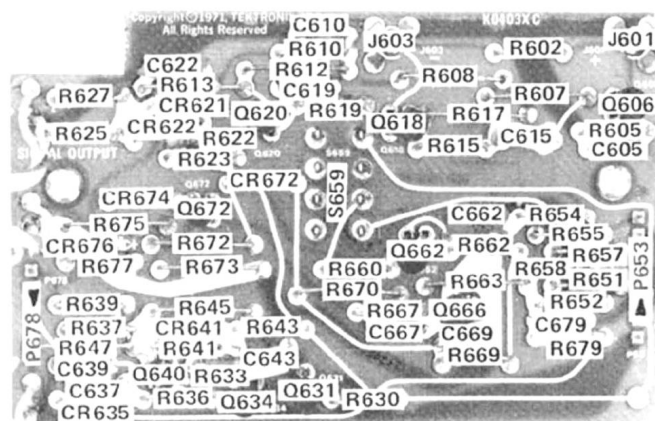
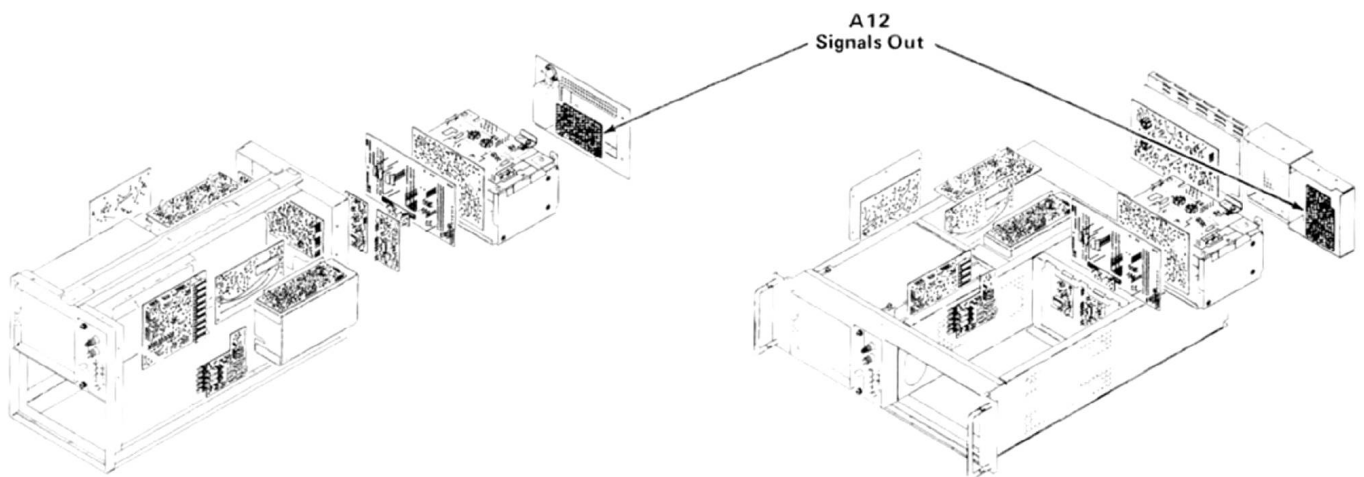
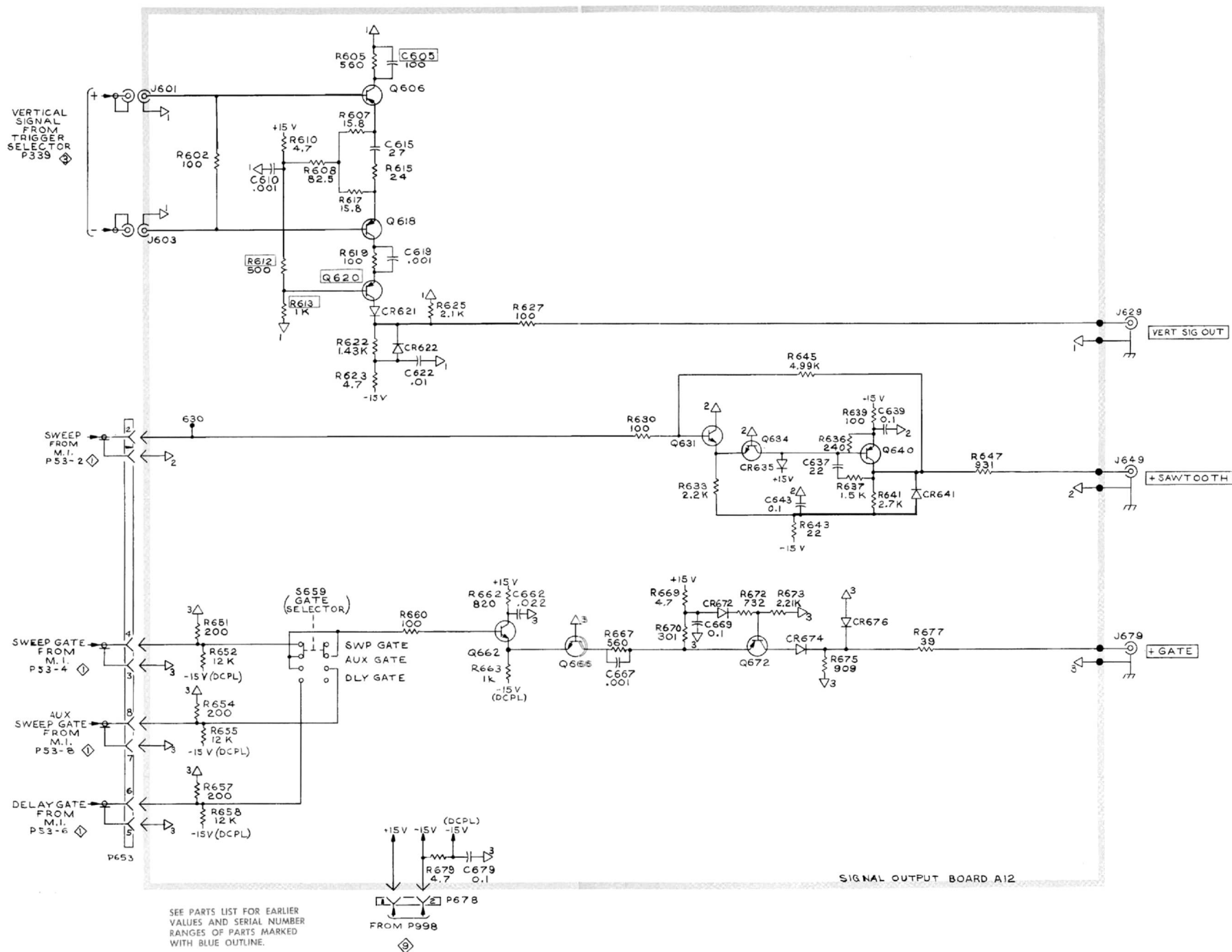


Fig. 8-8. A12. Signal Output circuit board.



SEE PARTS LIST FOR EARLIER
VALUES AND SERIAL NUMBER
RANGES OF PARTS MARKED
WITH BLUE OUTLINE.

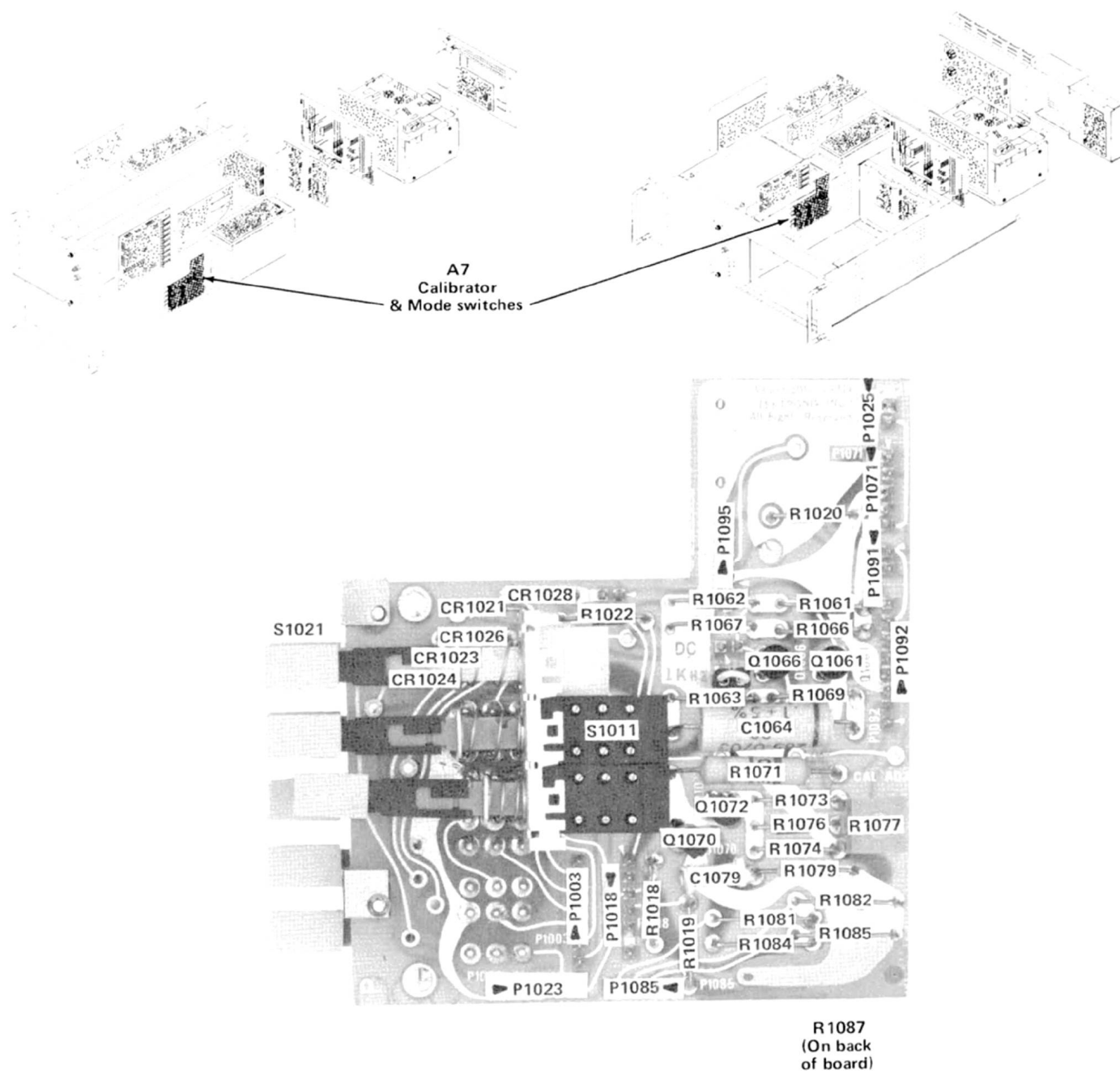
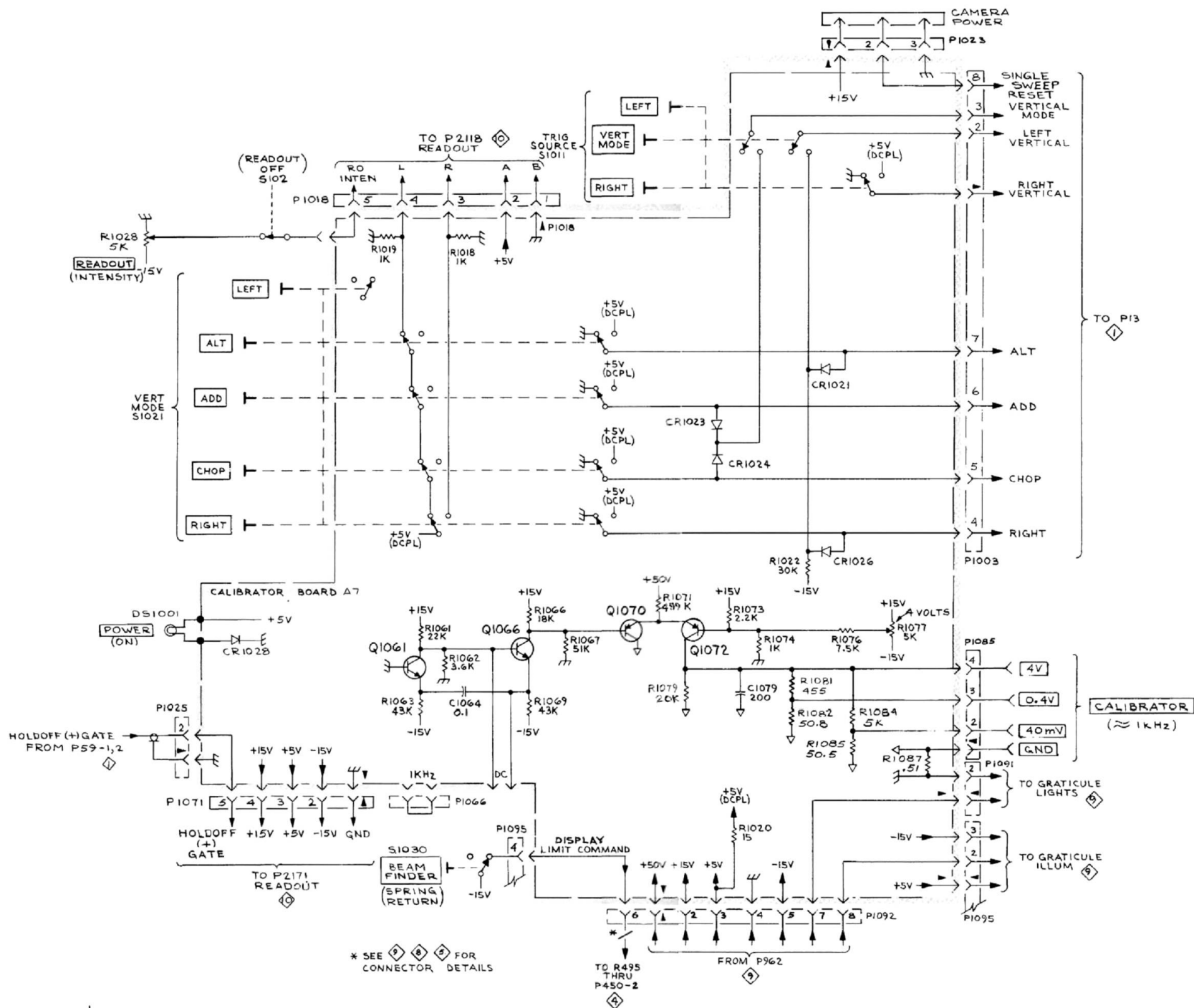


Fig. 8-9. A7. Calibrator and Mode switches circuit board.



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7603

(A)

CALIBRATOR &
FRONT PANEL SWITCHING

mgf
173

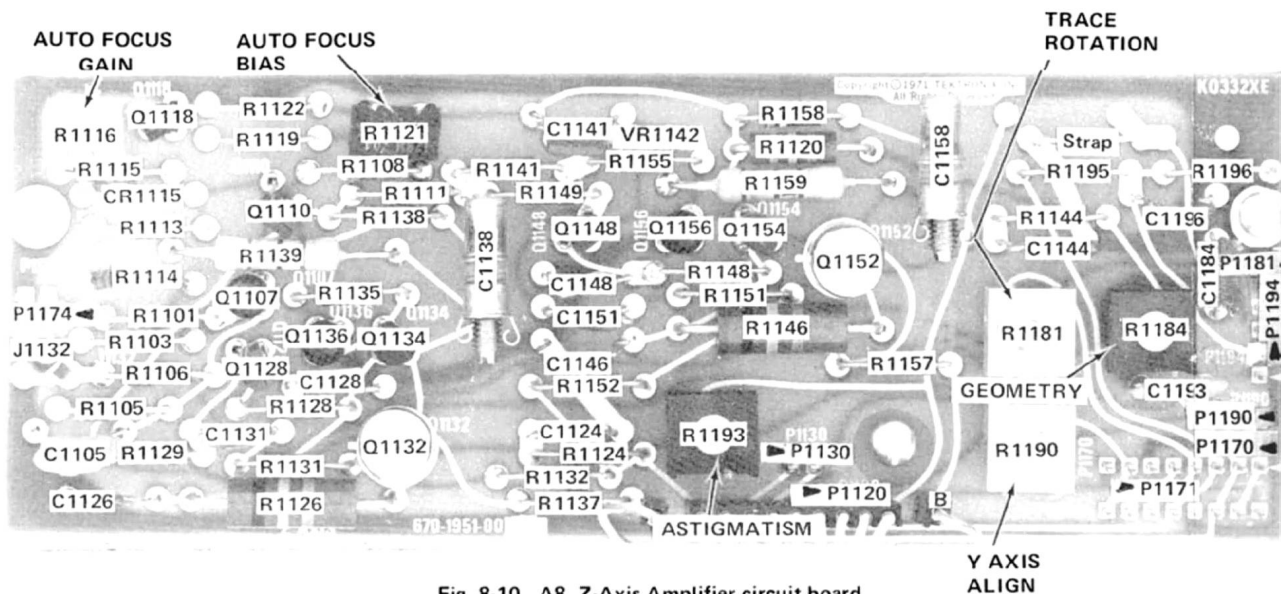


Fig. 8-10. A8. Z-Axis Amplifier circuit board.

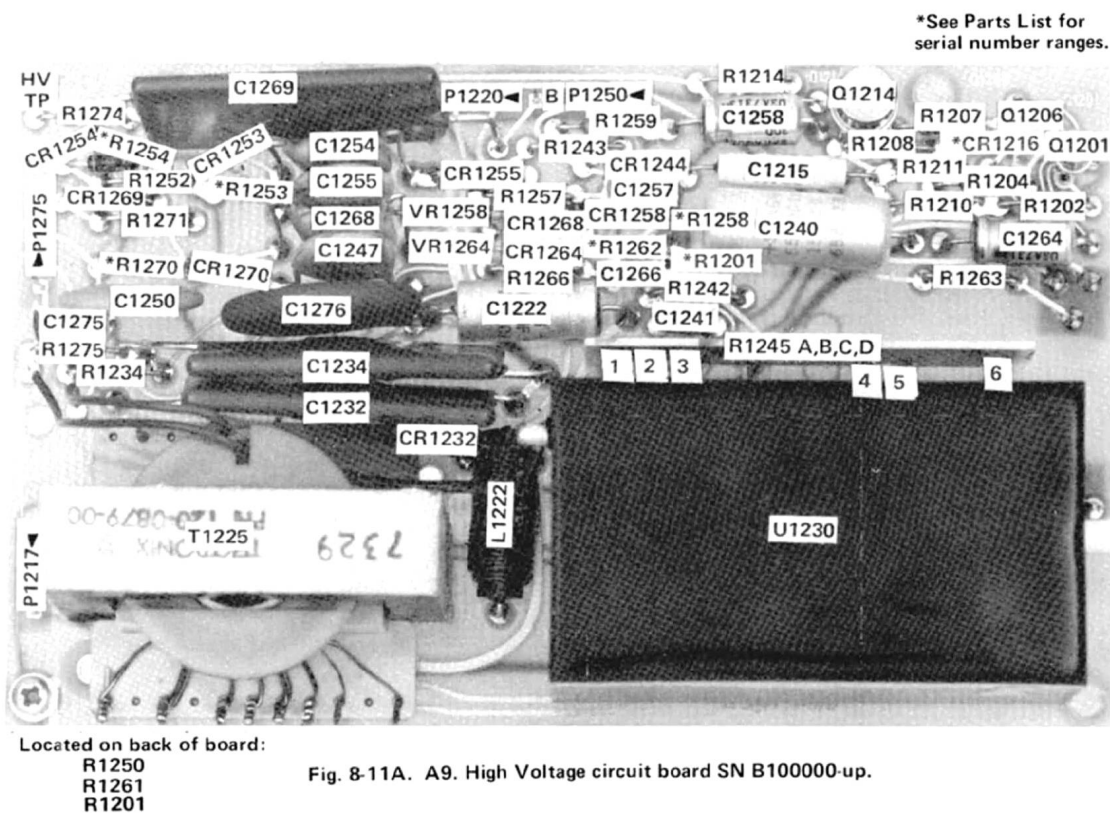
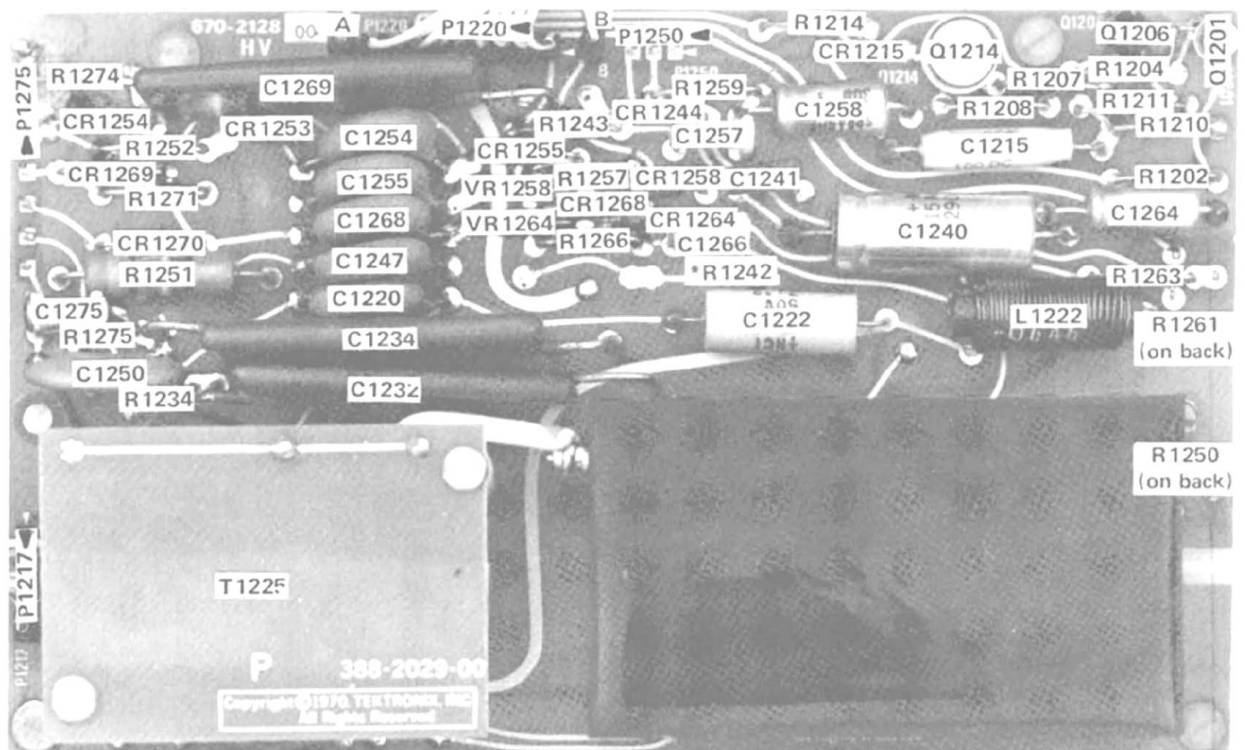
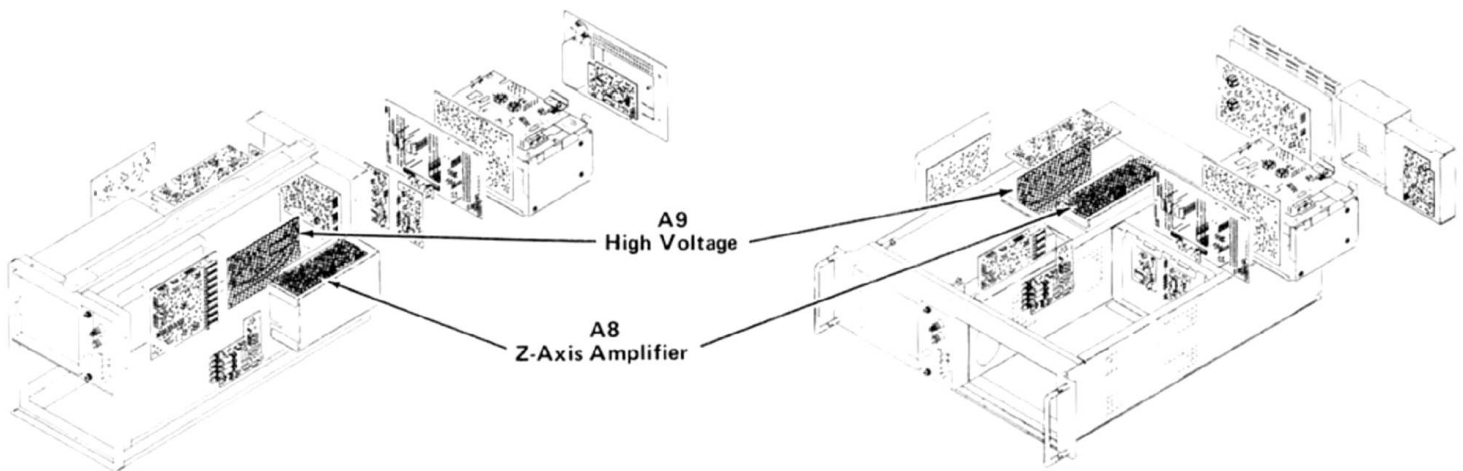
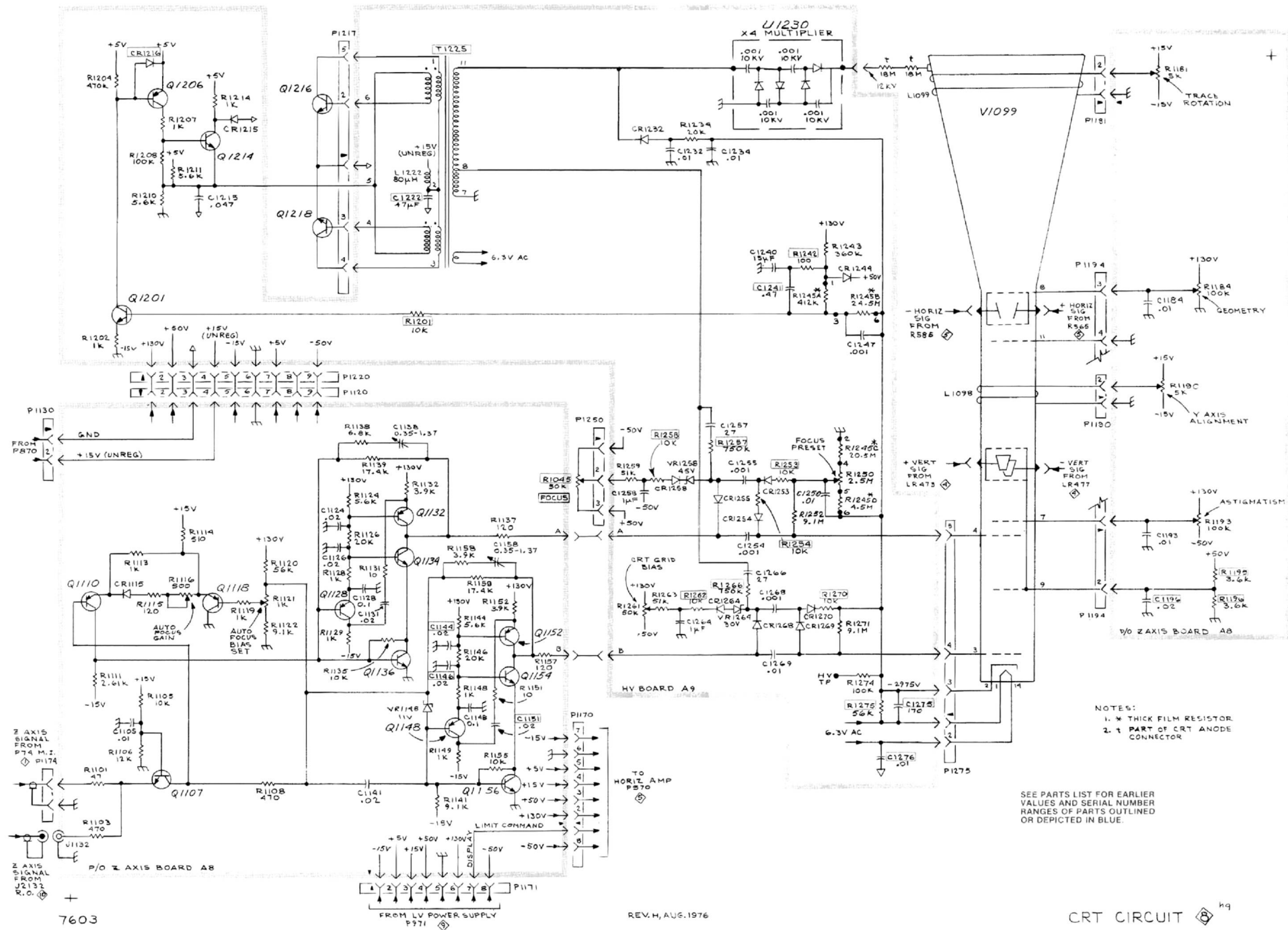


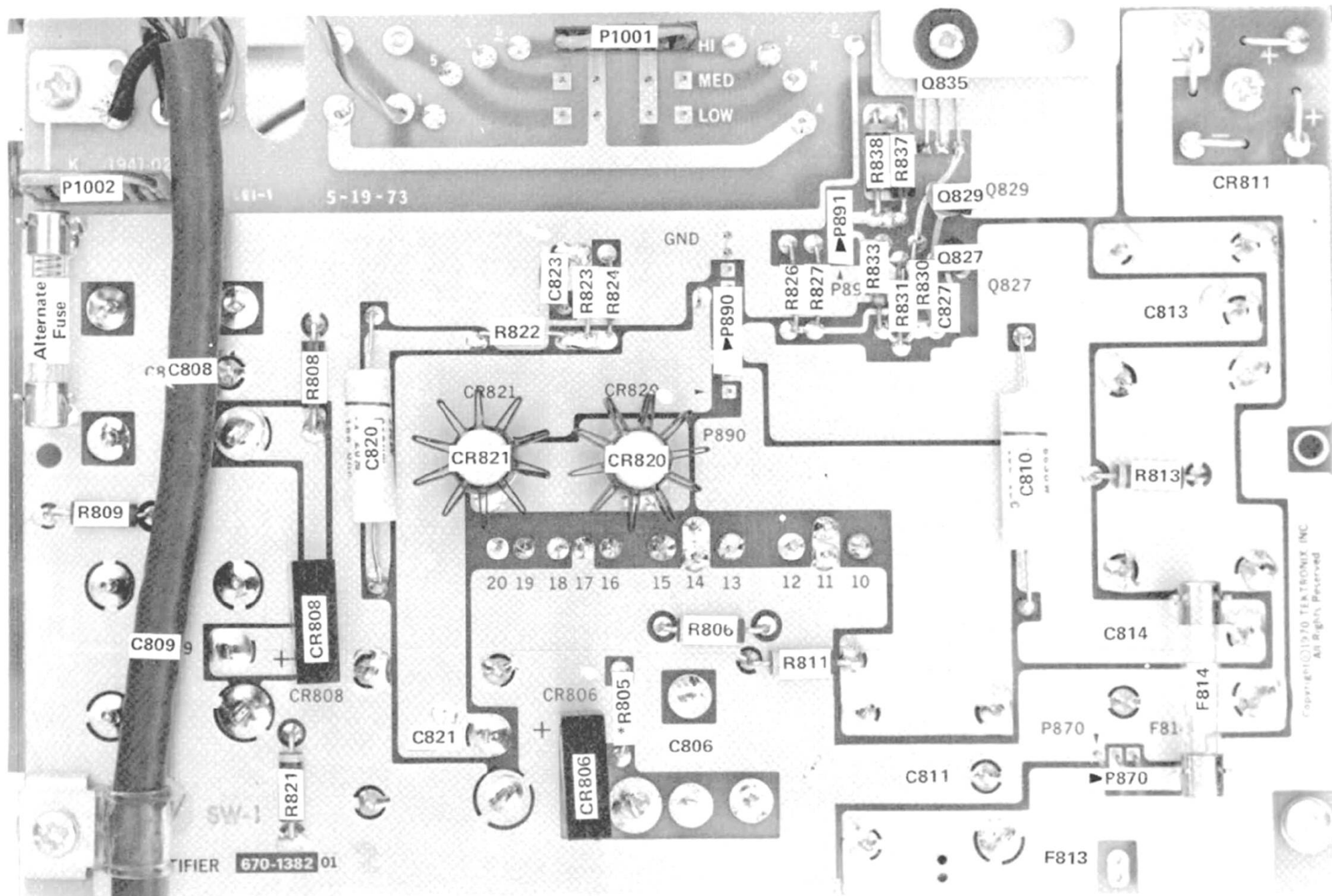
Fig. 8-11A. A9. High Voltage circuit board SN B100000-up.



*R1242 added to back of board SN B010175.
Later moved to front.

Fig. 8-11B. A9. High Voltage circuit board below SN B100000.





*See Parts List for
serial number ranges.

Fig. 8-13A. A10. Rectifier circuit board B061550-up.

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Added to back of board :

*C827

*CR975

7603/R7603 Service

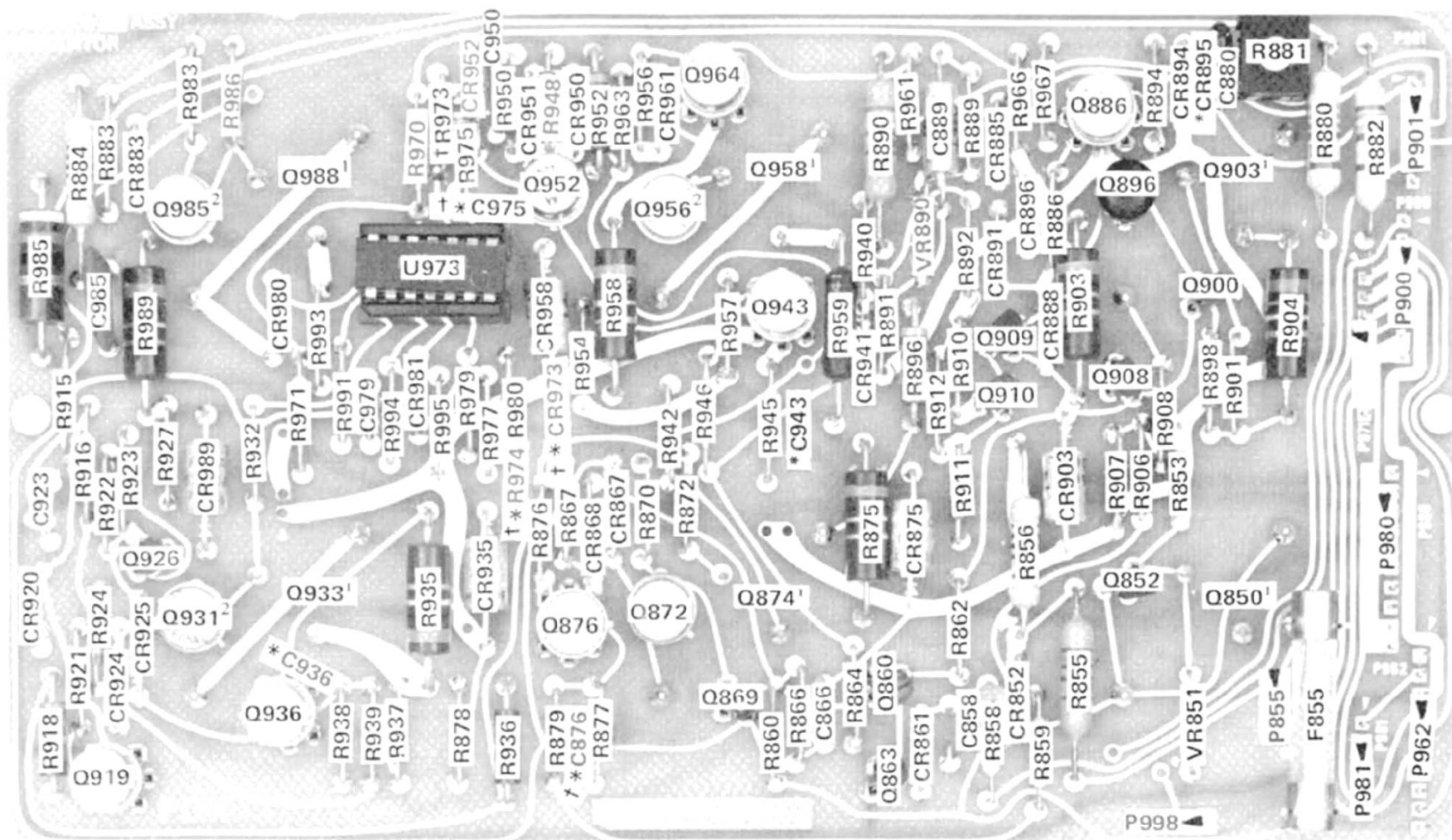


Fig. 8-12. A11. Low-Voltage Regulator circuit board.

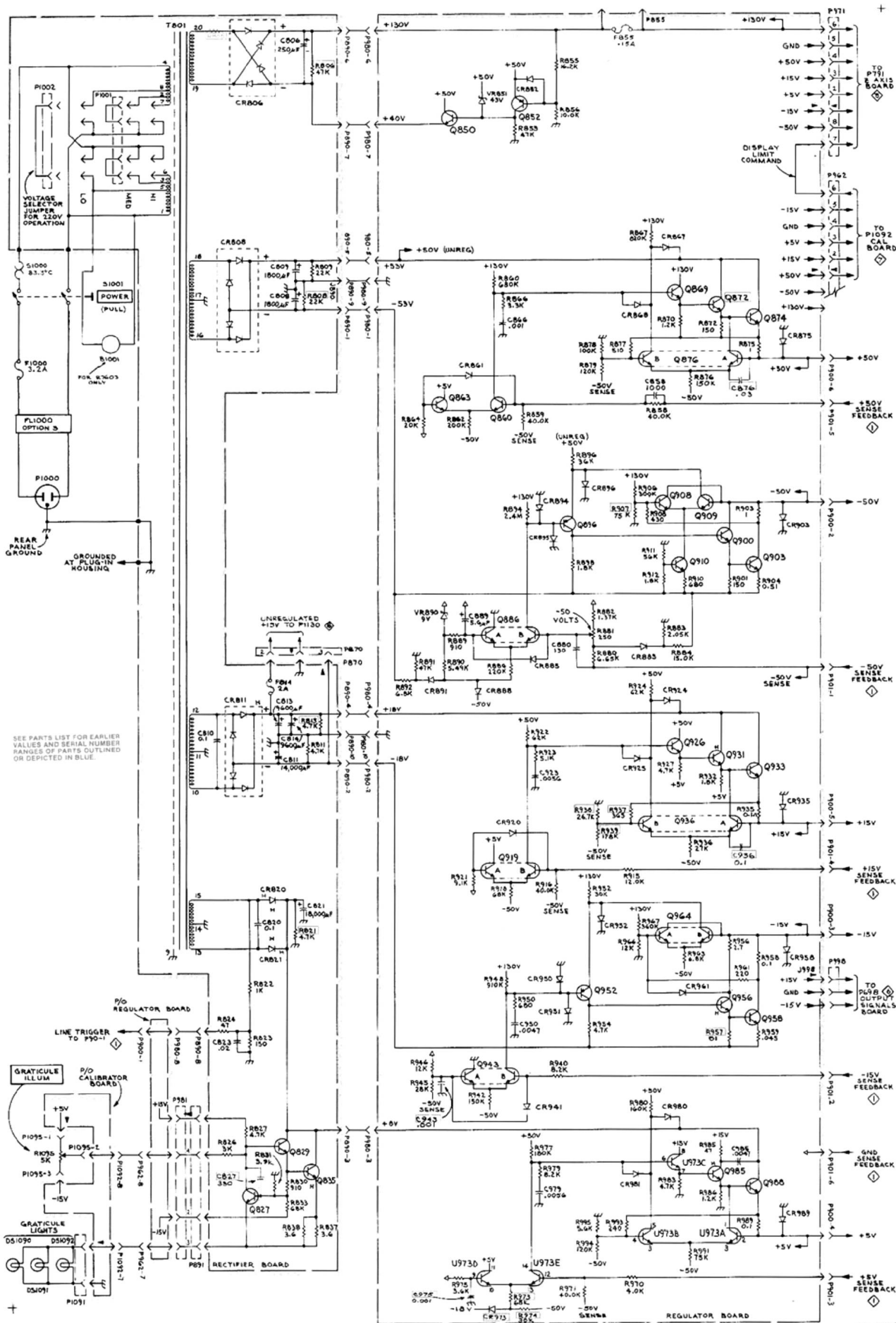
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¹ Mounted on heat sink

² Have heat sinks

† Located on back of board some serial numbers.

*See Parts List for
serial number ranges.



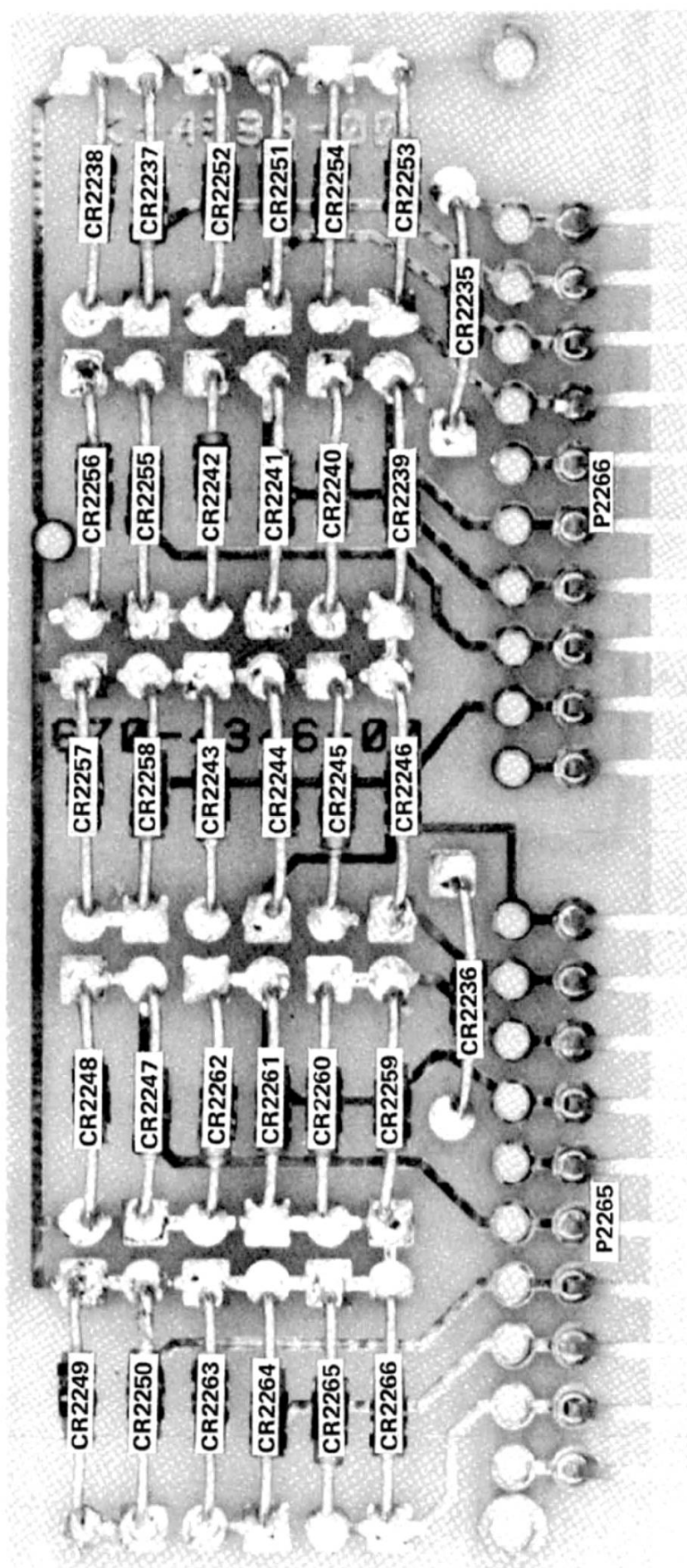


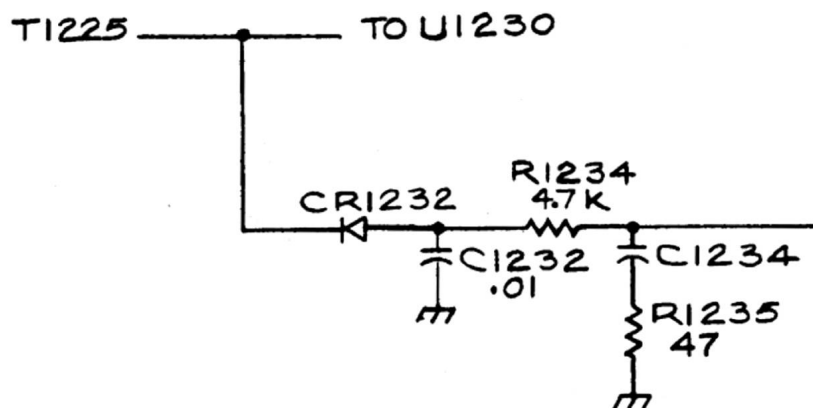
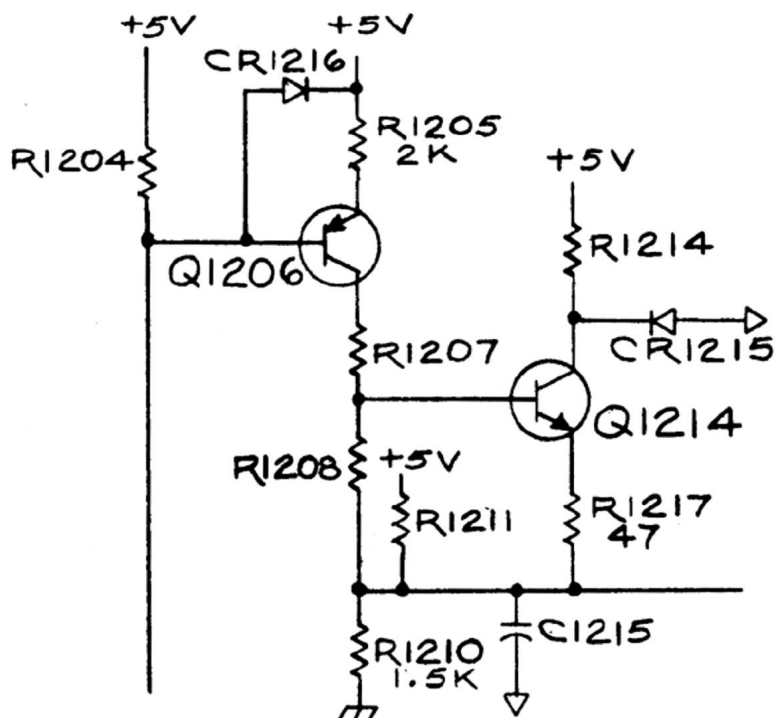
FIG. 8-14A A14. Protection circuit board (SN B260000 & UP).

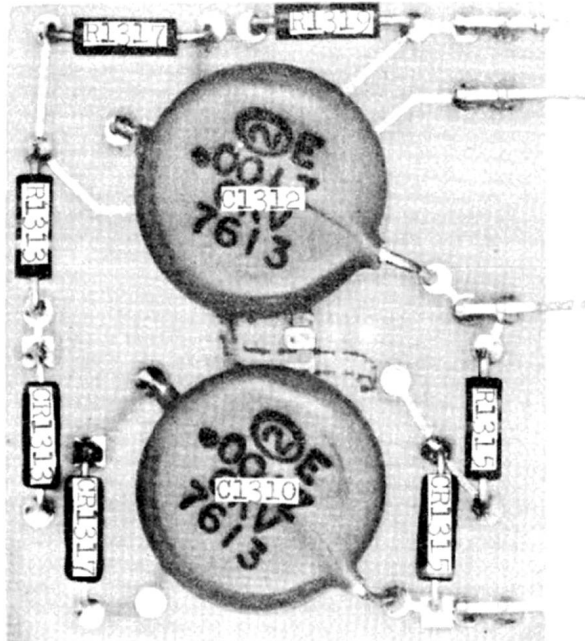
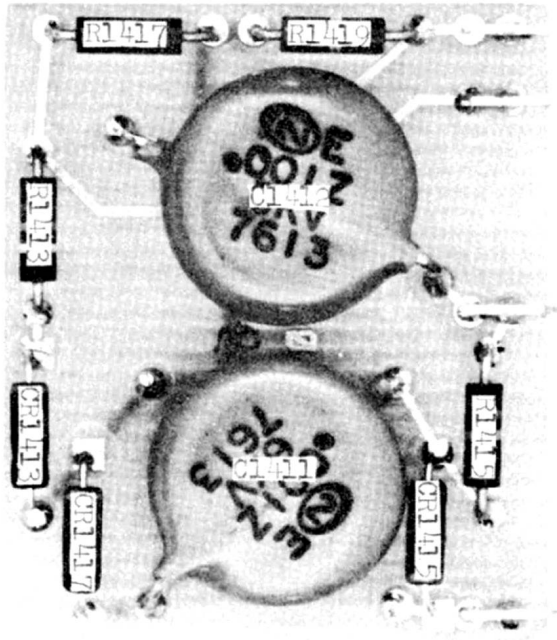
CHANGE:

DESCRIPTION

SCHEMATIC CHANGES

DIAGRAM 8 CRT CIRCUIT - Partial



CHANGE:	DESCRIPTION
	 <p>Focus DC Restorer circuit board (670-4856-00)</p>
	 <p>C1410 mounted on back of board.</p> <p>Z Axis DC Restorer circuit board (670-4856-01)</p>
	<p>PAGE 6 OF 6</p>