

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT
AND DEPOT MAINTENANCE MANUAL
INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS

OSCILLOSCOPES
AN/USM-140B,
AN/USM-140C,
AN/USM-141A,
AND AN/USM-141B

This copy is a reprint which includes current
pages from Changes 1 thru 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY
MAY 1966

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 5 May 1966

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The Adjutant General.

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CHANGE
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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 8 October 1971

**Organizational, Direct Support, General Support, and Depot Maintenance
Manual Including Repair Parts and Special Tools List
OSCILLOSCOPES AN/USM-140B, AN/USM-140C,
AN/USM-141A, AND AN/USM-141B**

TM 11-6625-535-15-1, 5 May 1966, is changed as follows:

1. Title is changed as shown above.
2. Remove and insert pages as indicated in the page list below:

Remove
None

Insert
A4 1 through A4-5
1 through 48

3. File this change sheet in the front of the publication for reference purposes.

By Order of the Secretary of the Army:

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***This change supersedes TM 11-6625-535-25P-1, 29 September 1966.**

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ARNG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 310-50.

The purpose of this temporary correction is to correct minor errors in NAVSHIPS 95706 dated 20 May 1964 which were not covered in temporary correction page T-1, and to indicate changes in model numbers of certain items of the AN/USM-140B equipment. Insert this sheet in the manual immediately behind the front cover.

Make the following pen-and-ink corrections in the text of the manual.

PAGE NO.	ACTION
v, vi, vii, 1-0, 1-3, 1-6, 1-7, 2-3, 3-11, 4-1, 4-2, 4-3, 6-1, 6-2, 6-26, i-2, i-4	Where applicable, change: "CW-511/USM-105" to "CW-511A/USM"; "MX-3078/USM" to "MX-3078A/USM"; "MX-2817/U" to "MX-2817A/U"; "MX-2962/USM" to "MX-2962B/USM"; add the suffix "A" after "AN/USM-141".
2-2	In Figure 2-2, change "1-1/2" to "2-3/8", "19-3/4" to "18-3/8".
5-17	After para 5-5a, add "An unused replacement 7308 tube may exhibit a stabilizing action for about twenty-four hours of operation after it is first placed in service. Tubes which have been "aged" at normal operating conditions for this period of time can be used for replacement if it is necessary to avoid a change in tube characteristics during this short break-in period. The V508 position in the MX-2930B/USM Dual Trace Preamplifier is sensitive in this respect and aged tubes are recommended for replacement use in this position.
5-25	In Figure 5-10, change "C405" to "L405".
5-26	In Figure 5-11, add callout "R270" to resistor directly above C408.
5-27	In Figure 5-13, change SWEEP OUTPUT to "J104".
5-67	In Figure 5-41, change ground on R258 to "-100V".
5-71	In Figure 5-43, at connector marked MILLIVOLTS add "J301".
5-73	In Figure 5-44, change R437 to "2K".
5-80	In Figure 5-48, below J105 change "166" to "horizontal channel"; below J1 change "162" to "vertical channel".

TEMPORARY CORRECTION T-1 TO THE TECHNICAL MANUAL FOR OSCILLOSCOPE AN/USM-140B, AN/USM-141A, NAVSHIPS 95706.

The purpose of this temporary correction is to correct minor errors in the text of NAVSHIPS 95706 dated 24 March 1964. Insert this sheet in the manual immediately behind the front cover.

Make the following pen-and-ink corrections in the text of the manual.

PAGE NO.	ACTION
iii	After paragraph 2-4, add suffix "A" after "AN/USM-141"
v	After figure 2-0, change "Supply" to "Shipping" after figure 2-3, add suffix "A" to "AN/USM-141".
4-4	In running foot, change "ORIGIANL" to "ORIGINAL".
4-7	In third paragraph, second line, delete "all"; in last paragraph, ninth line, delete "DC".
4-9	In step 6 RESULTS, add "C425" after "L506"; add line across chart between steps 7 and 8.
4-13	At test points All and A18 change arrow to point to "C"; in voltage chart, change A6-A9 voltage from "3" to "10".
4-17	In table 4-4, steps 14, 15, 16 add "Remove V301 and" before "Measure ."
4-33	In figure 4-9 add test point "C19, +41 v, 40v p-p" at junction of C213 and C214.
5-39	On etched circuits, for XV206, interchange the tube pin numbers "1" and "9".
5-41	On etched circuits, change "R227" to "R277"; in 5-24 caption, change "Previews" to "Preamp".
5-46	In Parts Location Index, delete C413; add "R429, D5" and "R437, B5".
5-59	Change value of R88 to "47K".
5-63	Change "R105" to "R1012".
5-67	In diagram and index change "R227" to R277".
5-77	Change value of C1507 to 10; change value of R591 and R592 to 1200; change value of R570 to 3900; in the transistor connection diagram, interchange "E" and "C".
6-1	Add "Table 6-1" before "List of Tables".
6-2	In A202 P/N change "R" to "L".
6-3	After "A403, POWER CABLE:" Add "CX-4704/U 8' 0' ".
6-4	For CR416, change "CR403" to "CR103".
6-5	For C212, change "Fixed Air" to "Adjustable, ceramic: 0-1 pf, sleeve on resistor body."
6-6	For C413 delete description and add "Same as C1".
6-9	For Q406 delete "Same as Q401" and add "JAN type 2N1309"; For Q410 delete "JAN type 2N1309" and add "Same as Q406"; For Q411 change "Same as Q410" to "Same as Q406".
6-13	Delete "R227"; "R277 RESISTOR: Same as RI".
6-17	For W401 change "CX-4704/U" to CO-03LGF(3/18)0206".
6-24	For R591 change "RC20GF182K" to "RC20GF122K".

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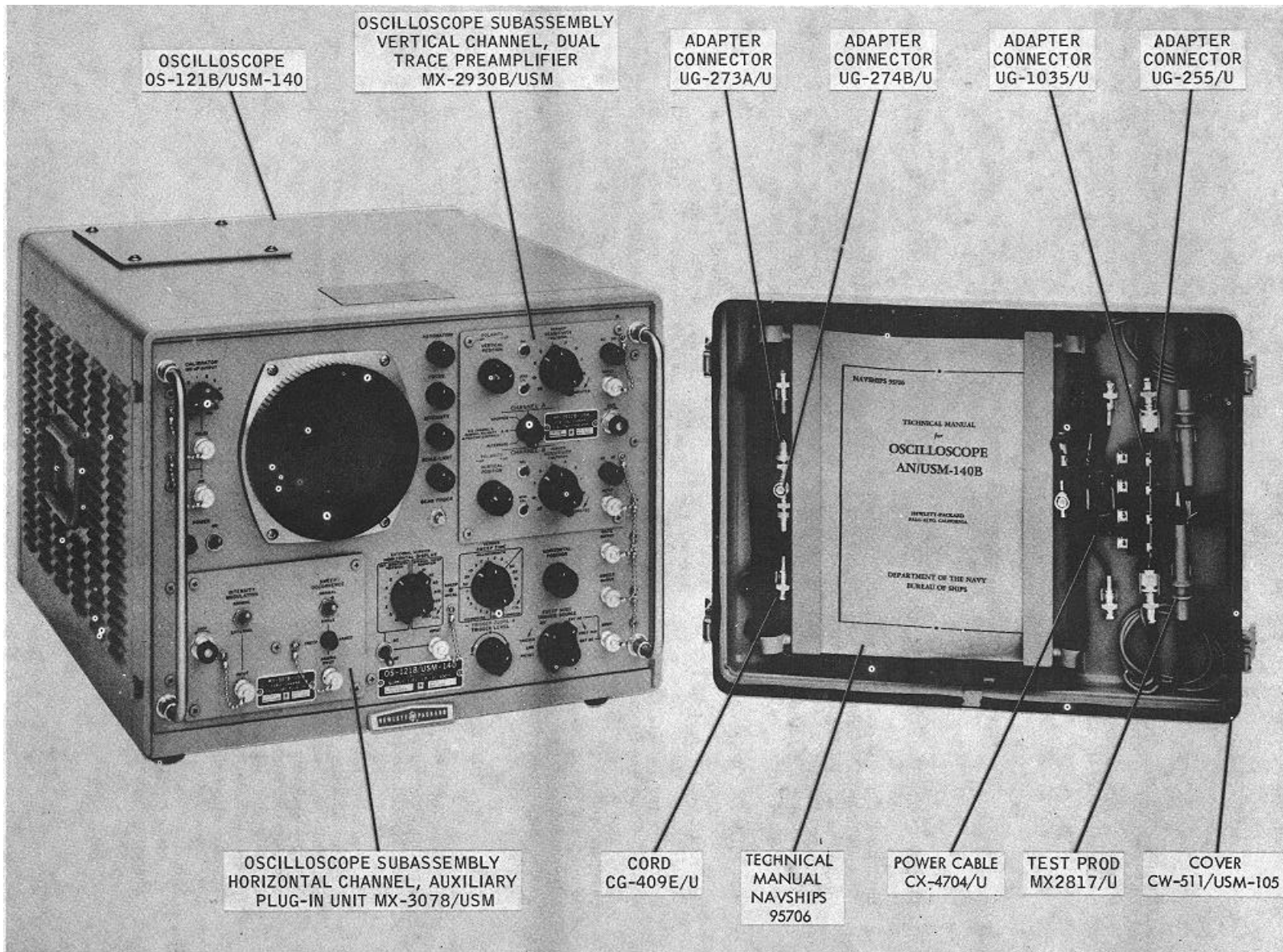


Figure 1-1. Oscilloscope AN/USM-140B

SECTION A INTRODUCTION

A-1. Indexes of Publications

a. *DA Pam 310-4.* Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. *DA Form 310-7.* Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

A-2. Forms and Records

a. *Reports of Maintenance and Unsatisfactory Equipment.* Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. *Report of Packaging yard Handling Deficiencies.* Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies)

as prescribed in AR 700-58/NAVSUP PUB 378/AFR 71-4/MCO P4030.29, and DSAR 4145.8.

c. *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33/AFM 75-18/MCO P4610.19A, and DSAR 4500.15.

A-3. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publication and Blank Forms) and forwarded direct to Commander, UIS Army Electronics Command, ATTN: AMSEL-MA-C, Fort Monmouth, NJ 07703.

AN/USM-140B
GENERAL DESCRIPTION

UNCLASSIFIED
NAVSHIPS 0967-133-7010

**SECTION I
GENERAL DESCRIPTION**

1-1. SCOPE

NAVSHIPS 95706 is a single-volume technical manual that includes operating and servicing instructions and a list of replaceable parts prepared in accordance with MIL-M-15071 E (SHIPS) for Oscilloscopes AN/USM-140B, AN/USM-140C, AN/USM-141A, and AN/USM-141B. The electrical specifications, operating and servicing instructions, schematic diagrams and parts list are identical for all models with noted exceptions. The AN/USM-140B and AN/USM-140C are portable models for benchtop use; the AN/USM-141A and AN/USM-141B are designed for permanent installation in a standard 19-inch wide rack. No other publications are required or supplied for these oscilloscopes at the date of this publication. Subsequent references to the Oscilloscopes in this manual will list only the cabinet model AN/USM-140B except to indicate minor differences in details.

1-1.1. Items Comprising an Operable Equipment

<i>FSN</i>	<i>Qty</i>	<i>Nomenclature</i>
6625-987-6603		Oscilloscope AN/USM-140B consisting of:
6625-400-2681	1	Oscilloscope OS-121B/USM-140
	1	Preamplifier, Dual Trace MX-2930B/USM (Plugged into OA-121/USM-140)
6625-961-5888	1	Auxiliary Plug-In MX-3078/USM (Plugged into OS-121/USM-140)
6625-973-4775	2	Prod, Test MX-4073/U (Mounted in equipment)
5935-823-0639	2	Connector, Adapter UG-255A/U (Mounted in equipment)
5935-149-3534		Connector, Adapter UG-273/U (Mounted in equipment)

<i>FSN</i>	<i>Qty</i>	<i>Nomenclature</i>
5995-985-7744		Cable Assembly, Power, Electrical CX-4704/U (8 ft 0 in.) (Mounted in equipment)
5995-752-8781	2	Cord CG-409F/U (Mounted in equipment)
5935-683-7892	2	Connector, Adapter: MIL type MS35173-274B (Mounted in equipment)
4935-992-6112	4	Adapter, Connector UG-1441/U

1-2. General Description

The AN/USM-140B is a precision high-speed oscilloscope for displaying the waveforms of electrical voltages at frequencies ranging from direct current to 22 megacycles (equivalent to a risetime of 16 nanoseconds). Vertical deflection sensitivity is continuously adjustable from 200 volts to 20 millivolts per centimeter; horizontal deflection sensitivity is continuously adjustable from 100 volts to 0.1 volt per centimeter at frequencies from direct current to 1 megacycle per second. Sweep rates are continuously adjustable from 15 seconds to 0.1 microsecond per centimeter. The sweep can be synchronized with an external signal or with the signal being viewed. Polarity and sensitivity of the synchronization are selectable to permit synchronization from different voltage points on complex waveforms. The AN/USM-140B is especially developed for general-purpose use in US Navy ship and shore electronic maintenance and research facilities. It is designed for versatility, and reliability under a wide range of environmental conditions, combined with wide frequency range, accurate calibration, and stable synchronization at high sweep rates. Sweep rate, sweep expansion and sensitivity controls are direct-reading. Each calibrated step-type control is equipped with a potentiometer to give

continuous adjustment between steps. Special features include: a beamfinder pushbutton to simplify the problem of finding and centering off-screen traces; a front-panel calibrator that provides squarewave voltages from 0.2 millivolt to 100 volts for checking the accuracy of the vertical and horizontal sensitivity selectors; an internal 200-nanosecond vertical signal delay to permit viewing the leading edge of the signal that triggers the sweep; sweep and gating output signals for use in external equipment. Typical uses for the oscilloscope include precise waveform analysis and oscillography used in the research, design and service of electronic circuits, waveform observations required for adjusting operating equipment such as radio transmitters, and precise measurements of time and frequency.

1-3. Description of Units

The AN/USM-140B consists of a major oscilloscope unit, two plug-in units which install in recesses in the front panel of the major unit, and a group of accessory cables and connectors stored in the detachable front cover.

a. OSCILLOSCOPE OS-121B/USM-140. The major unit, Oscilloscope OS-121B/USM140, contains the power supplies, horizontal amplifier, sweep generator, main vertical amplifier, cathode ray tube, calibrator and the controls associated with these circuits.

b. OSCILLOSCOPE SUBASSEMBLY, VERTICAL CHANNEL, DUAL TRACE PREAMPLIFIER.-This plug-in unit, MX-2930B/ USM, permits simultaneous observation of two separate vertical input signals, each signal being controlled and positioned independently. This unit provides three methods of observing the two input signals, 1) each input signal on alternate sweeps, 2) each input signal on alternate 1-microsecond segments of the two input waveforms, 3) the difference voltage of the two input signals combined. Either channel can be also selected for single-channel operation.

c. OSCILLOSCOPE SUBASSEMBLY, HORIZONTAL CHANNEL, AUXILIARY PLUG-

IN UNIT.-This plug-in unit, MX-3078/USM, is required for normal repetitive sweeps and provides for single-sweep operation with either manual or external arming of the sweep, and also permits intensity modulation of the trace by external signals.

1-4. Reference Data

The AN/USM-140B is designed for continuous usage in ambient temperatures from -28°C to +50° C with relative humidity up to 99%. Within this range, the equipment will operate with the performance and accuracy specified below.

a. EACH VERTICAL CHANNEL.-

(1) Sensitivity Range (both AC and DC coupling): Ten calibrated ranges in 1-2-5-10 sequence from 0.02 volt/cm to 20 volts/cm; accuracy ± 5 percent. Vernier control extends sensitivity to 50 volts/cm.

(2) Frequency Pass Band:

DC coupled: dc to 22 mc (down 3 db points at 22 mc), 0.016 μ sec rise time;

AC coupled: 2 cps to 22 mc between 3 db points (0.016 μ sec rise time).

(3) Input Impedance: 1 megohm $\pm 10\%$ shunted by 30 pf on all ranges. 10 megohms shunted by 10 pf when using Test Prod MX2817/U.

(4) Display Polarity: Selectable, + up or - up.

(5) Electronic Switching: Dual channel display by alternate sweep, or chopped at approximately 1 mc with trace blanking during switching.

b. DIFFERENTIAL INPUT.-

(1) Both input attenuators may be switched to one channel to give differential input. The input attenuators may be set separately to equalize input signals of different levels.

(2) Common Mode Rejection: At least 40 db at maximum sensitivity; at least 30 db when using attenuators.

c. SWEEP AND SYNCHRONIZATION.-

(1) Internal Sweep: 24 calibrated ranges

in 1-2-5-10 sequence from 0.1 $\mu\text{sec}/\text{CM}$ to 5 sec/cm , accuracy ± 3 percent. Vernier control extends slowest sweep to 15 sec/cm .

(2) Sweep Expansion: 7 calibrated ranges, in 1-2-5-10 sequence up to X100. Increases fastest sweep speed to 0.02 $\mu\text{sec}/\text{cm}$. Accuracy: X1, X2, and X5 ranges $\pm 3\%$; X10 and X20: $\pm 5\%$; X50 and X100: $\pm 10\%$, to 0.02 $\mu\text{sec}/\text{cm}$.

(3) Trigger Modes:

From external signals 0.5 volt peak-to-peak or greater;

from internal signals having 0.5 cm vertical deflection or greater;

from internal source of line frequency.

(4) Trigger Level and Slope: Uses positive or negative-going voltage, with trigger point continuously adjustable from -30 to +30 volts on external signals or any visible point on the waveform of internal signals.

(5) External Trigger Input Impedance: 1 megohm $\pm 10\%$ shunted by 70 pf.

(6) Sweep Output: -50 to +50 volts (approx).

(7) Gate Output: +50 volts (approx); length equal to duration of sweep.

d. HORIZONTAL AMPLIFIER.-

(1) Bandwidth:

DC coupled: dc to 1 me (down 3 db at 1 me);

AC coupled: 2 cps to 1 me between 3 db points.

(2) Sensitivity: 7 calibrated ranges, in 12-5-10 sequence from 0.1 volt/cm to 10 volts/cm. Vernier control extends sensitivity to 25 volts/cm.

(3) Input Impedance: 1 megohm $\pm 10\%$ shunted by 30 pf.

e. CALIBRATOR.-

(1) Voltage: 9 calibrated ranges in 1-25-10 sequence, from 0.2 millivolts to 100 volts peak-to-peak; accurate to within $\pm 3\%$.

(2) Waveform: 1000-cycle square wave, 1- μsec rise and decay time.

(3) Current: 5 milliamperes peak-to-peak, $\pm 3\%$.

(4) Loading: 1 megohm or greater.

f. CATHODE RAY TUBE.-P2 phosphor with compatible green filter. (P31 phosphor may also be used).

(1) Graticule: 10 cm long by 4 cm high graduated in centimeter squares with 2 mm subdivisions on horizontal and vertical axes. Adjustable, edge lighting.

(2) Deflection Plate Connection: Pin type terminals.

(3) Deflection Sensitivity:

Vertical: approximately 20 volts/cm.

Horizontal: approximately 35 volts/cm.

(4) Intensity Modulation: + 20 volt pulse blanks CRT trace of normal intensity.

g. POWER REQUIREMENTS: 115 vac, $\pm 10\%$; 50~ $\pm 10\%$, 60~ $\pm 10\%$, and 400~ $\pm 10\%$; single phase, approximately 480 watts.

h. DIMENSIONS: See figures 2-2 and 2-3.

1-5. Equipment Supplied

The equipment supplied under AN/USM-140B is listed in table 1-1. In addition to the basic oscilloscope and its two plug-in units, two test prods, two coaxial cables and an assortment of connector adapters are provided to facilitate connecting the oscilloscope to a variety of equipments and circuits. Test Prods MX-2817/U (MX-4037/U may also be used) are specially designed broadband probes equipped with alligator jaws for easy attachment to most forms of electrical conductors. Each test prod contains a compensated voltage divider that gives a 10-times increase in the input resistance of the oscilloscope channel with which it is used (vertical or horizontal input), with a reduced input capacity of 10 picofarads; use of the prod attenuates the input signal and reduces the height of the displayed waveform by a factor of 10.

Two BNC "TEE" adaptors are provided to facilitate connecting the same input signal to

two different input connectors. Four BNC-to-Binding Post adapters are supplied to permit connecting plain wire leads to the type BNC connectors on the oscilloscope. Two UHF-to-BNC adapters are supplied to permit connection to equipments using UHF connectors. Two eight-foot coaxial cables terminated in BNC

connectors are provided for connection to external equipments.

1-6. Equipment and Publications Required but not Supplied

A list of all equipments and publications required but not supplied is provided in table 1-2.

Change 3 1-4

TABLE 1-1. EQUIPMENT SUPPLIED WITH OSCILLOSCOPE AN/USM-140B AND AN/USM-141A

QTY PER EQUIP	NOMENCLATURE		UNIT NO.	OVERALL DIMENSIONS (IN.)			VOLUME (CU.IN.)	WEIGHT (LB)
	NAME	DESIGNATION		HEIGHT	WIDTH	DEPTH		
1	*Oscilloscope Assembly	AN/USM-140B		14-3/4	19-3/4	24	6700	103.5††
1	*Oscilloscope	OS-121B/USM-140	1	12-1/4	18	22-7/8	5100	84.5
1	Dual Trace Preamplifier	MX-2930B/USM	2	7	6	11-1/4	470	7
1	Auxiliary Plug-In	MX-3078/USM	3	4-5/8	6	10-7/8	285	2
2	Prod, test	MX-2817/U or	4					
	MX-4037/U							
2	Connector, adapter	UG-255/U						
2	Connector, adapter	UG-273A/U						
4	Connector, adapter	UG-1035/U or						
	UG- 1441/U							
1	Cable Assembly, Power, Electrical	CX-4704/U (8 ft. 0 inch)						
2	Cord (8 ft.0 inch)	CG-409E/U						
2	Connector, adapter	UG-274B/U						
2	Technical Manual	NAVSHIPS 95706						3.4
1	*Cover	CW-511/USM-150		14	19-1/2	3		4.5
1	**Oscilloscope Assembly	AN/USM-141A		12-7/32	19	24-3/16		92.5††
1	**Oscilloscope	OS-122A/USM-141	1†	12-7/32	19	24-3/16		78

* Not included in AN/USM- 141A

** Not included in AN/USM- 140B

Internal parts of AN/USM-141A are identical to AN/USM- 140B

Shipping weight: 136 lbs

TABLE 1-1A. EQUIPMENT SUPPLIED WITH OSCILLOSCOPE AN/USM-140C AND AN/USM-141B

QTY PER EQUIP	NOMENCLATURE		UNIT NO.	OVERALL DIMENSIONS (IN.)			VOLUME (CU.IN.)	WEIGHT (LB)
	NAME	DESIGNATION		HEIGHT	WIDTH	DEPTH		
1	*Oscilloscope Assembly	AN/USM-140C		14-3/4	19-3/4	24	6700	103.5 ††
1	*Oscilloscope	OS-121C/USM-140	1	12-1/4	18	22-7/8	5100	84.5
1	Dual Trace Preamplifier	MX-2930C/USM	2	7	6	11-1/4	470	7
1	Auxiliary Plug-In	MX-3078B/USM	3	4-5/8	6	10-7/8	285	2
2	Prod, test	MX-2817/U or	4					
	MX-4037/U							
2	Connector, adapter	UG-255/U						
2	Connector, adapter	UG-273A/U						
4	Connector, adapter	UG-1035/U or						
	UG- 1441/U							
1	Cable Assembly, Power Electrical	CX-4704/U (8 ft. 0 inch)						
2	Cord (8 ft. 0 inch)	CG-409E/U						
2	Connector, adapter	UG-274B/U						
2	Technical Manual	NAVSHIPS 95706 (with change 1 Navships 0967-133-7010)						4.4††
1	*Cover	CW-511/USM-105		14	19-1/2	3		4.5
1	**Oscilloscope Assembly	AN/USM-141B		12-7/32	19	24-3/16		92.5††
1	**Oscilloscope	OS-122B/USM-141	1†	12-7/32	19	24-3/16		78

* Not included in AN/USM-141B

** Not included in AN/USM-140C

† Internal parts of AN/USM-141B are identical to AN/USM-140C

†† Shipping weight: 136 lbs

TABLE 1-2. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	* DESIGNATION		
1	DC Voltmeter	CCUH-825-A-G	Precision measurement of low voltage power supply and other dc voltages	Voltage Range: 0 to 400 volts Input Impedance: 1 megohm minimum Accuracy: 0.05%
1	High Voltage DC Voltmeter	(AN/USM-98 or Fluke Model 801 or 803) AN/USM-116	Voltage and resistance measurements, high-voltage measurements	Voltage Range: to 5000 volts Input Impedance: 500 megohms min. Accuracy: 8%
1	Constant Amplitude	(Hewlett-Packard Model 410B) No preferred type Generator	Passband measurement	Frequency Range: 50 kc to 30 mc Output: 1 volt Accuracy: 2%
1	Voltmeter Calibrator	Tektronix 190A No preferred type	Calibrated signal source, dc and 400 cps ac	Voltage Range: 1 to 100 volts p-p Accuracy: 1%
1	Square Wave Generator	Hewlett-Packard Model 738A No preferred type	High frequency compensation setting	Rise Time: 3 nsec max. Output: 0.5 volt min.
1	Square Wave Generator	Tektronix 107 TS-583-B	Attenuator compensation setting over a wide frequency range	Rise Time: 0.1 4sec max. Output: up to 25 volts Frequency Range: 1 to 100 kc
1	Time-Mark Generator	(TS-583/U or Hewlett- Packard Model 211A) AN/USM-108 (Tektronix Model 180A)	Sweep time calibration	Range: 100 msec to 0.1 psec
1	Oscilloscope	AN USM-140()	Waveform comparison	Calibration: Vertical & horizontal Input Impedance: 10 megohm/10 pf Sensitivity: 1 mv/cm from dc to 300 kc
1	High-Gain Differential Amplifier (Oscilloscope Plug- In)	(Hewlett- Packard Model E03-170B) AM-3567/,'USM	Measuring low-level ac and ripple waveforms	Sensitivity: 50 mv,/cm from dc to above 2.0 mc

* First entry, preferred test instrument; second entry, commercial or military alternate.

TABLE 1-2. (Continued)

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	* DESIGNATION		
1	Tube Tester	AN/USM-118()	Testing tubes for dynamic and static characteristics	Calibration: ±0.3 pf to 50 pf Range: 1 mv full scale to 300 volts full scale
1	Q Meter	AN/URM-90	Capacitance measurement	
1	Electronic AC Voltmeter	ME-6E/U (ME-6/U or Hewlett-Packard Model 400 series)	AC voltage measurements	
1	Transistor Tester	TS-1100 ()/U	Testing transistors	
1	Main Vertical Amplifier Test Connector	Construct as shown in figure 5-1	To facilitate direct signal connection to main vertical amplifier	
1	Special Vertical Extender	Construct as shown in figure 4-12	To facilitate operation of vertical plug-in unit outside of oscilloscope	
1	52-Ohm Feed-Through 5:1 Attenuator	Tektronix 011-0060-00	Attenuation for Tektronix Instruments	
1	52-Ohm Feed-Through Termination for Tektronix Instruments	Tektronix 011-001 or 011-0049-00	Proper-Impedance Termination for Tektronix Instruments	
1	Instruction Book for DC Voltmeter	Fluke commercial manual for Model 801, 803 or 825A		
1	Instruction Book for High Voltage DC Voltmeter AN/USM- 116	NAVSHIPS 93808		
1	Instruction Book for Constant Amplitude Generator, Tektronix Model 190A	Tektronix commercial manual for Model 190A		
1	Instruction Book for Voltmeter Calibrator, Hewlett-Packard Model 738A	T.O. 33A1-12-265-1 (Hewlett-Packard commercial manual for Model 738A)		
1	Instruction Book for Square Wave Generator, Tektronix Model 107	T.O. 33A1-8-157-1 (Tektronix commercial Manual for Model 107)		
1	Instruction Book for Square Wave Generator TS-583-B or TS-583/U	TM 11-5024 (Hewlett- Packard commercial Manual for Model 211A)		

*First entry, preferred test instrument; second entry, commercial or military alternate.

TABLE 1-2. (Continued)

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	* DESIGNATION		
1	Instruction Book for Time Mark Generator AN/USM- 108	Tektronix commercial manual for Model 180A		
1	Instruction Book for High-Gain Differential Amplifier (Oscilloscope Plug-In) AM-3567/USM	NAVSHIPS 95680		
1	Instruction Book for Q Meter AN/URM-90	TM 11-2646A		
1	Instruction Book for Tube Tester AN/USM-118()	NAVSHIPS 93883		
1	Instruction Book for Electronic AC Voltmeter ME-6E/U	NAVSHIPS 95564		
1	Instruction Book for Transistor Tester TS-1100()/U	NAVSHIPS 95693		

1-7. AUXILIARY ACCESSORY EQUIPMENT.

A list of three accessory plug-in units which may be used with the AN/USM-140B is provided in table 1-3. These units are not supplied with the AN/USM140B, but may be procured separately to increase the oscilloscope's versatility. One unit, Time Delay Generator MX-2962/USM, can be used in place of the MX-3078/USM to provide an accurately calibrated,

adjustable time delay between the time of an externally generated sweep trigger and the start of the oscilloscope sweep. Refer to NAVSHIPS 94309 for instructions. The second is High-Gain Differential Amplifier, AM-3567/USM, which can be used in place of the MX-2930B/USM to permit display of the differential signals between two channels. The third is High-Gain WideBand Amplifier, AM-3568/USM, which can be used in place of the MX-2930B/USM to view low-level wide-band signals requiring high-gain.

TABLE 1-3. ACCESSORIES FOR OSCILLOSCOPE AN/USM-140B

MODEL	NAME	FUNCTION
AM-3567/USM	High-Gain Differential Amplifier	Used in place of Dual-Trace Preamplifier MX-2930B/USM for greater input sensitivity. Provides 1-millivolt sensitivity from dc to 300 kc 50-millivolt sensitivity from dc to 12 mc
AM-3568/USM	High-Gain Wide-Band Amplifier	Used in place of Dual-Trace Preamplifier MX-2930B/USM for viewing fast-rise signals. Provides single-channel, 30-mc passband with 0.05-volt/cm to 50-volt/cm sensitivity.
MX-2962/USM	Time Delay Generator	Used in place of Horizontal Channel Auxiliary Plug-in Unit MX-3078/USM to allow expansion of a portion of the waveform. Provides accurately calibrated, adjustable sweep delay. from 10 sec to 1 usec.

1-8. EQUIPMENT SIMILARITIES.

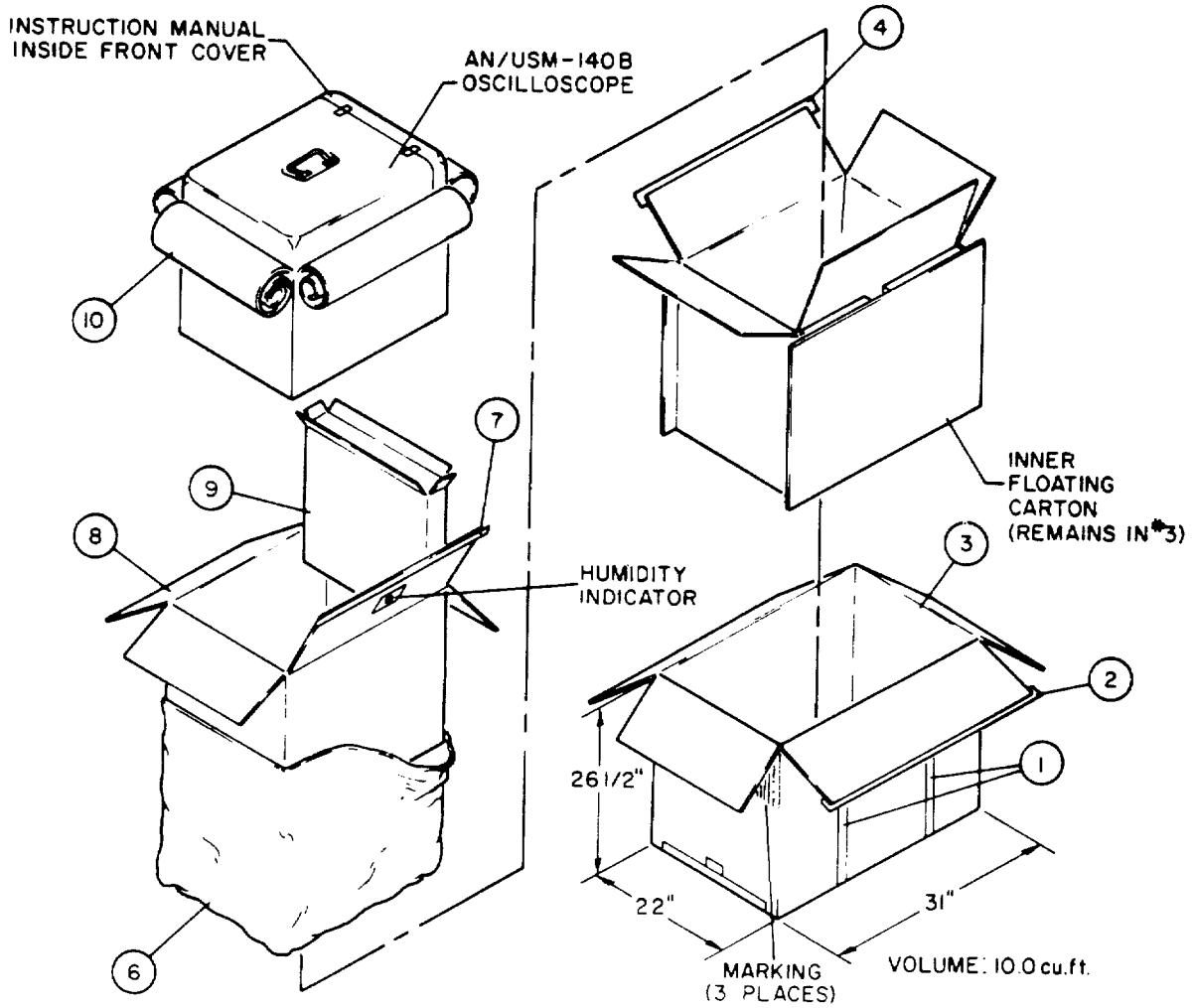
This manual covers both the AN/USM-140B and AN/USM-141 oscilloscopes. The AN/USM-141 is a rack-mount version of the AN/USM-140B, and the two are electrically identical, as described in paragraph 1-1.

1-9. FACTORY OR FIELD CHANGES.

Oscilloscope AN/USM-140B (and Oscilloscope AN/USM-141) are new instruments; no factory or field changes have been made as of date of issue.

1-10. PREPARATION FOR RESHIPMENT.

Electronic equipment must be packed with special care. The package in which the equipment is originally shipped is designed to give the instrument full protection from adverse environments and from the shock and vibration incurred in shipment. It should be preserved and utilized for reshipment wherever possible. When preparing the AN/USM-140B for shipment, stow the accessory probes, cables, and connectors in their holders inside the cover of the instrument, and lock the cover in place. If the factory-designed package is not in satisfactory condition, pack in accordance with MIL-P-116 and MIL-E-17555E.



UNPACKING INSTRUCTIONS
OPEN PACKAGE IN ORDER OF LISTING

ITEM	ACTION	MATERIAL
1	CUT	STEEL STRAPPING
2	REMOVE	TAPE - 3", GUMMED, FILAMENT
3	OPEN	CORRUGATED CARTON
4	REMOVE	TAPE - 3", GUMMED, FILAMENT
5	OPEN	INNER FLOATING CARTON
6	OPEN	BARRIER BAG (MOISTURE PROOF)
7	REMOVE	TAPE - 3", GUMMED, FILAMENT
8	OPEN	CORRUGATED CARTON
9	REMOVE	CORRUGATED DESICCANT COVER
10	OPEN	WRAPPER (PAPER)

Figure 2-0. Exploded View of Shipping Package for AN/USM-140B Oscilloscope

SECTION 2
INSTALLATION

2-1. UNPACKING AND HANDLING.

The oscilloscope is shipped with all electron tubes installed, including the cathode ray tube. Handle the instrument carefully when removing it from the shipping container.

Inspect the oscilloscope upon receipt for any damage which may have occurred in transit. Check for loose or broken knobs, bent or broken connectors, and dents or scratches on the cabinet and panel surface.

Statements concerning models AN/USM-140B and AN/USM-141A apply also to models AN/USM-140C and AN/USM-141B respectively unless otherwise indicated.

2-2. POWER REQUIREMENTS.

The oscilloscope is normally shipped from the factory for use on a single phase, 115-volt ac source. A power source of 230-volts may be used if proper connections are made within the oscilloscope, in accordance with the instructions given below. The frequency must be in the range of 50 to 440 cps. The power demand varies, dependent on the combination of plug-in units used. Maximum power demand does not exceed 600 watts. Make sure the power source is proper before plugging in the cord.

The power transformer has two 115-volt primary windings which are parallel-connected for 115-volt ac

operation. To convert to series connection for 230volt use, proceed as follows:

a. First remove the instrument cabinet as follows (not required for the rack-mounted AN/USM141):

(1) Carefully place the oscilloscope with its front panel down, resting it on its carrying handles.

(2) Remove the four cabinet-retaining screws from the rear of the instrument, and lift off the cabinet.

b. Locate the power transformer T401 (see figure 5-10.) Then change its primary wiring from parallel to series connection as follows, in accordance with the detail illustration in figure 2-1.

(1) Remove the jumpers between A1-A4 and A2-A5.

(2) Connect a jumper between A4-A5.

c. Locate the rectifier circuit board A401 which is also located on the chassis bottom as shown in figure 5-10. On the rectifier circuit board A401, remove jumper A. Replace it with a 100-K, 1/2 watt, 10% resistor. Remove jumper B and replace it with a 68-K, 1/2-watt, 10% resistor.

d. Replace fuses F401 and F402 with 4-ampere slow-blow type fuses. They are located behind the plug-in vertical preamplifier, accessible from the side of the instrument as shown in figure 5-11.

e. Replace the spare fuses with 4-ampere, slow-blow type. They are located at the side of the plug-in vertical preamplifier.

f. Replace the AN/USM-140B cabinet by the reverse of step a above.

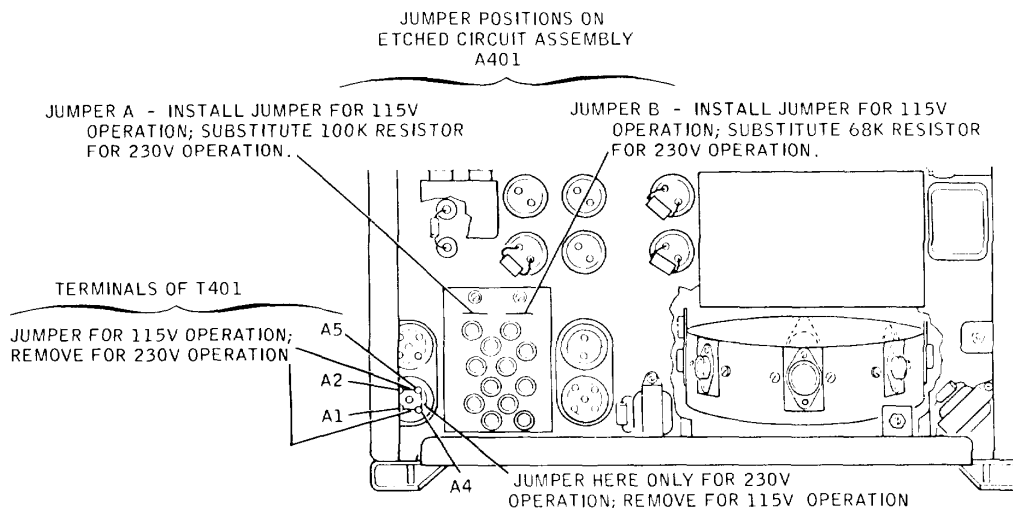


Figure 2-1. Power Connections for Operating the Oscilloscope on 230-volt Power Line

2-3. CABINET MODEL AN/USM-140B INSTALLATION.

The dimensions of the cabinet model oscilloscope are shown in figure 2-2. It may be mounted on a mobile test cart or placed on a bench, as desired. Position the oscilloscope to avoid room light reflections and to place all controls within convenient reach. Always provide adequate air circulation around the oscilloscope to ensure cooling. Do not crowd it into a tight enclosure which restricts air flow at sides and rear.

2-4. RACK MODEL AN/USM-141 INSTALLATION.

This oscilloscope model is provided in a rack mounting style to fit a standard 19-inch relay rack. This model is designated AN/USM-141. Figure 2-3 shows the dimensions of this instrument and indicates the installation details. The ends of the chassis

slides attach at the front and rear of the rack as shown in figure 2-3. These slides allow the chassis to be moved in and out without tilting. Panel mounting holes match standard relay panel design. The instrument is shipped with the chassis-mounted portion of each slide attached, and the rack-mounting slides and attaching hardware (as listed in figure 2-3) packed separately ready for installation. To install, mount the rails securely as shown in figure 2-3, and slide the instrument in. Make sure adequate cooling air is available within the rack. Enclosed racks should have air ducts and filters built in.

When the slide-mounted oscilloscope is pulled out from the rack, the slide mechanism has a stop that halts it at the halfway-out position. Depressing the exposed slide button permits extension of the instrument to the full-out position. The slide safety button must be released to allow the oscilloscope to be taken out of the rack from the full-out position.

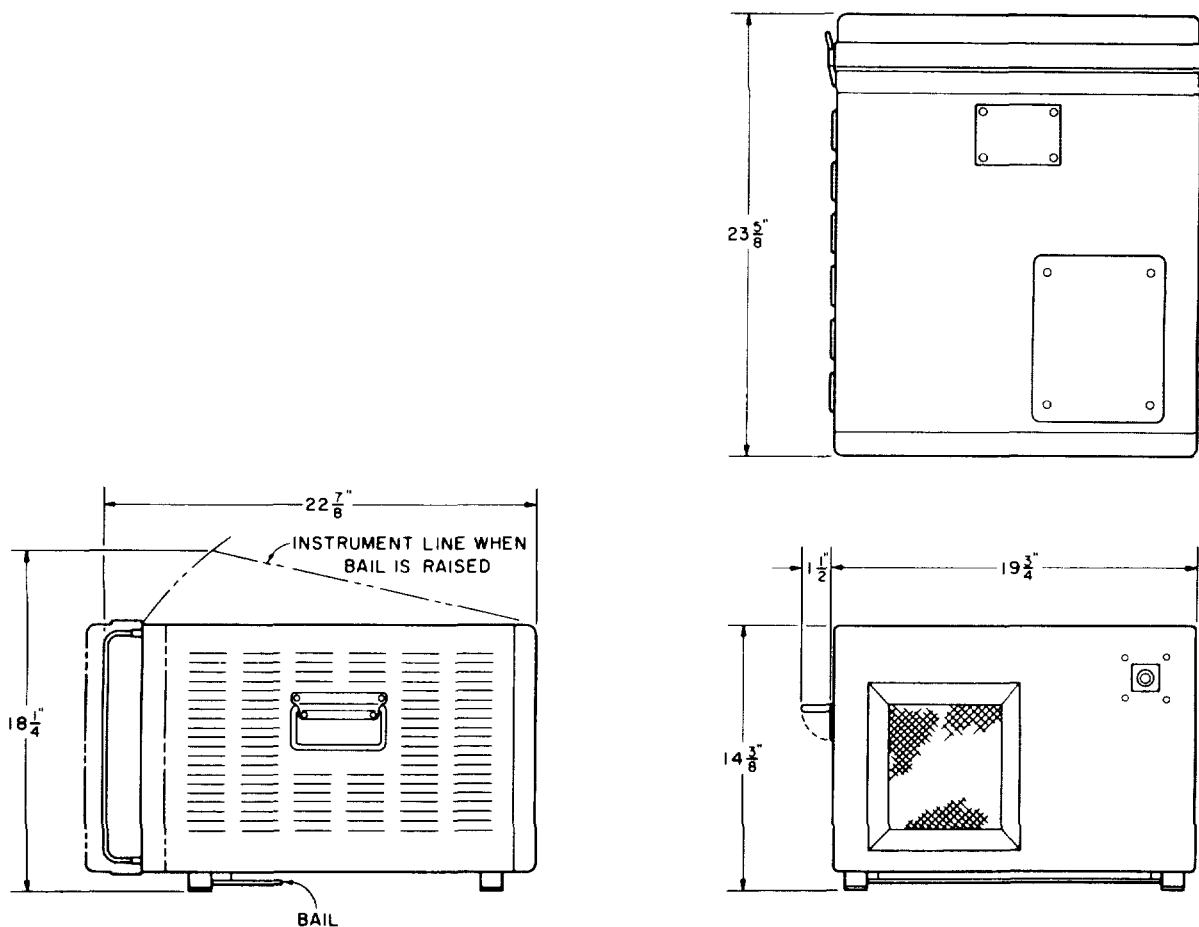


Figure 2-2. AN/USM-140B Dimensions

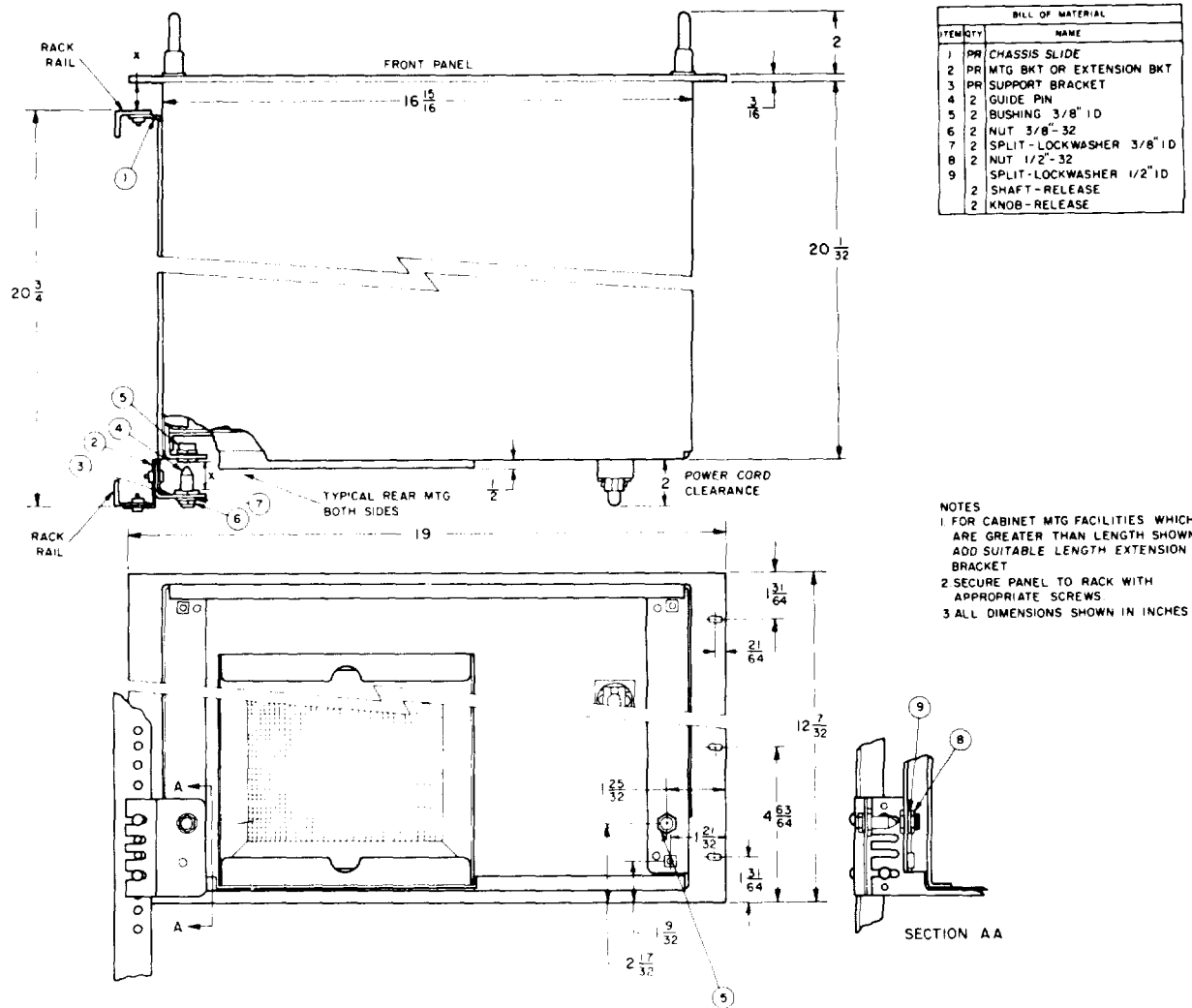


Figure 2-3. AN/USM-141 Dimensions

2-5. CABLES AND CONNECTORS.

The front cover of the oscilloscope cabinet provides the storage space for all cables and connectors that are needed to operate the oscilloscope. A list of the cables and connectors supplied is given in Table 1-1.

a. POWER CABLE.-An eight foot, three conductor power cable, CX-4704/U (8'0"), is supplied with the instrument. One end of the cable terminates in a plug which mates with a male jack on the rear of the instrument. The other end of the power cable terminates in a polarized three-contact male plug. One contact of the plug is an offset round pin which grounds the instrument chassis when the plug is used with a grounded receptacle.

To operate the instrument from a two-contact receptacle:

- (1) Rotate the offset pin to the side.

- (2) Loosen the screw on the offset pin and remove the green (ground) lead.

- (3) Connect the green lead to ground.

- (4) Insert the plug directly into the receptacle.

WARNING

If the green lead on the plug is not attached to ground when a two-contact receptacle is used, the instrument panel and cabinet may assume an off-ground potential and present a hazard to operating personnel.

b. TEST PRODS.-Two prods are supplied for connecting the two vertical input channels of the MX2930B/USM to two external signal sources. The test prods permit quick connection to almost any form of

uninsulated circuitry. They are equipped with alligator jaws that are opened by pressing the rear flange on the probe forward. Each probe reduces the waveform height to 1/10th before application to the oscilloscope input: this sacrifice in signal level is made to increase the shunt capacitive reactance and resistance presented to the signal source. The resultant input impedance permits the probe to be connected to most circuits without excessive loading of the circuit under test.

The prods have attached cables terminated in BNC connectors for connection to the vertical channel inputs. A simple external adjustment is provided for adjusting the frequency response of the prods without the need for any additional equipment. The frequency response and waveform height division ratio should be checked whenever exact response must be assured. Refer to figure 3-2.

c. Two BNC terminated cables are supplied for connecting any of the oscilloscope inputs directly to a BNC-terminated signal source.

d. Two UHF-to-BNC adapters are provided so that connections can easily be made to equipments having UHF connectors.

e. Two BNC-to-dual banana adapters are provided to make easy connection at the oscilloscope panel to ordinary test leads terminated in banana connectors.

2-6. THE CRT BEZEL, GRATICULE AND FILTER.

The bezel for the CRT will receive standard oscilloscope cameras which are designed to be fitted over and clamped to the bezel. When using a camera on the oscilloscope, the filter and graticule may be left in position or either one may be removed if desired.

The sharpest trace is obtained when using a medium intensity trace.

The graticule is etched on clear plastic. Both the graticule and filter are placed on the inside of the bezel next to the CRT face. The etched side of the graticule must be against the CRT face for least parallax. The filter is for use over the graticule to increase contrast between the trace and CRT face particularly when ambient light is bright and there are reflections on the CRT face. To remove or replace either the graticule or filter, remove the bezel by removing its four attaching screws.

2-7. INITIAL ELECTRICAL INSPECTION.

To energize the oscilloscope for the first time, and to check the oscilloscope for proper operation, follow the procedure given in figure 3-2. This procedure includes proper initial control adjustments to prepare the oscilloscope for use.

SECTION 3

OPERATION

3-1. FUNCTIONAL OPERATION.

Oscilloscope AN/USM-140B is a high-speed, precision instrument used to visually display electrical impulses and simple or complex recurrent waveforms. It consists primarily of a vertical amplifier and a horizontal amplifier which are connected to the deflection plates of a CRT. The vertical amplifier obtains signals from the vertical plug-in unit, amplifies them to the required voltage level, and applies the voltage to the vertical deflection plates of the CRT. The horizontal amplifier accepts either internally generated signals or externally supplied signals and amplifies them to the level required to drive the horizontal deflection plates of the CRT. The interaction of these two systems deflects the CRT beam in a manner that results in a visual display of the waveform on the face of the CRT.

The sweep generator which is part of the horizontal deflection system provides a variable range of sweep times to enable the operator to display one or several cycles of the waveform as required. This range is from 0.1 usec per cm to 5 seconds per cm.

In addition to the main oscilloscope unit the plug-in units listed in table 1-1 are covered in this manual. These plug-in units are designed for quick and easy installation or removal. A single locking knob holds each unit securely in the oscilloscope. No tools are needed to change them, and less than a minute is required.

The calibrator, which is an integral part of the oscilloscope, provides a convenient means of checking horizontal and vertical deflection. The calibrator generates a controlled 1-kc square-wave output which can be displayed on the CRT screen and used as a standard for the oscilloscope.

Two identical test prods are supplied as standard oscilloscope equipment. Isolation networks are built into the probes to reduce the input loading effect of the oscilloscope. The nominal scope input of 1 megohm shunted by 30 pf is changed to 10 megohms shunted by 10 pf at the probe tip. This results in a voltage drop of 10 to 1 in the probe.

3-2. PREPARATION FOR USE.

Before attempting to operate the oscilloscope, familiarize yourself with the functions of all the front panel controls and connectors, as given in paragraph 3-3, and read the operating precautions given in paragraph 3-4. Then refer to figure 3-2 for the initial turn-on and operating procedure.

3-3. DESCRIPTION OF CONTROLS AND CONNECTORS.

The controls and connectors of the oscilloscope which are normally used by the operator are shown in figure 3-1 and are described in table 3-1. The numbers in figure 3-1 relate each control to the descriptive text in table 3-1 and do not indicate a preferred order of operation.

3-4. OPERATING PRECAUTIONS.

a. Do not apply more than 600 volts peak to either the vertical or horizontal input connector or to the test prods.

b. Prior to turn on, set the INTENSITY control fully counterclockwise to avoid excessive intensity and possible burning of the CRT screen during warm up.

c. Allow at least two inches of clearance at the rear and both sides of the oscilloscope so its forced air cooling system will operate efficiently. Prevent warm air exhausted by other instruments from entering the air intake at the rear of the cabinet.

d. Check the air filter often. Clean it before it restricts air flow. Clean by dipping in warm soapy water. Rinse and dry before replacing. The filter removes easily by lifting the element up in its housing and pulling the bottom outward.

3-5. OPERATING PROCEDURES.

Procedures for turning on the oscilloscope, checking oscilloscope performance and obtaining various modes of operation are given in figures 3-2, 3-3, tables 3-2, 3-3, and paragraphs 3-6 through 3-14.

3-6. PROCEDURE FOR TURNING ON OSCILLOSCOPE; COMPENSATING TEST PRODS AND MAKING INITIAL ELECTRICAL INSPECTION.

The procedure of table 3-2, used in conjunction with figure 3-2, gives step-by-step instructions for turning on the oscilloscope, checking its operation and making initial adjustments in preparation for viewing an input signal.

3-7. SELECTING AND SYNCHRONIZING THE SWEEP AND ITS MAGNIFICATION.

The procedure of table 3-3, used in conjunction with figure 3-3, gives step-by-step instructions for synchronizing the oscilloscope sweep with an external signal or the signal being viewed, and for obtaining single sweep displays.

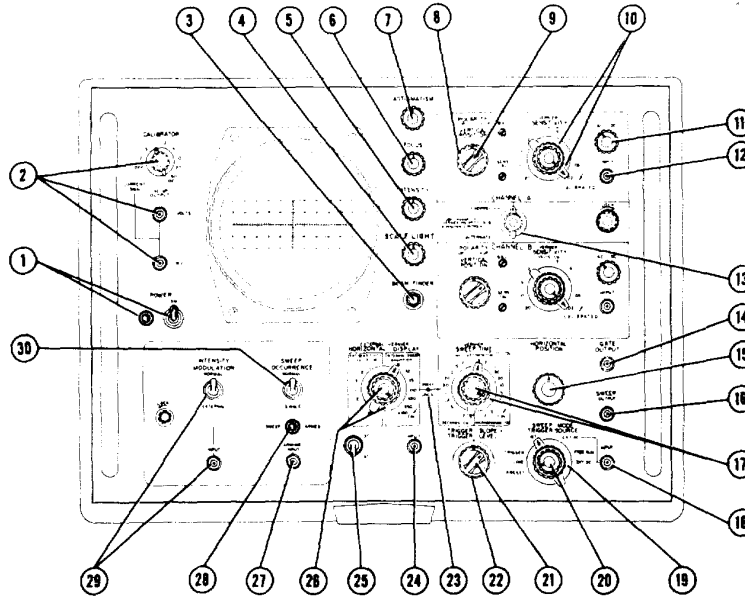


Figure 3-1. Oscilloscope Front-Panel Controls and Connectors

TABLE 3-1. DESCRIPTION OF FRONT-PANEL CONTROLS AND CONNECTORS
(INDEX NUMBERS REFER TO FIGURE 3-1)

ITEM	DESCRIPTION AND FUNCTION
1	POWER Switch. In ON position, turns on all power to the oscilloscope; in off position, removes all power from oscilloscope. The adjacent indicator lamp is illuminated when the oscilloscope is turned on.
2	CALIBRATOR Switch and VOLTS-MV Connectors (type BNC). A 1-kc square wave calibration signal is provided at the VOLTS and MV connectors, with a peak-to-peak amplitude (in volts or millivolts depending on the connector used) corresponding to the CALIBRATOR switch position. With the CALIBRATOR switch set at CURRENT, a 1-kc square wave with 5 milliamperes peak current (with source impedance of 200K) is provided at the VOLTS connector.
3	BEAM FINDER Pushbutton. Used to locate off-screen traces when the oscilloscope beam has been driven off-screen. When this button is pressed, the beam is confined to the screen, brightened and defocused. Then the beam can be centered on the screen by adjusting the HORIZONTAL POSITION and VERTICAL POSITION controls while holding the BEAM FINDER pushbutton depressed. Release of the pushbutton returns the oscilloscope to normal functioning.
4	SCALE Control. Adjusts the brightness of the graticule illumination.
5	INTENSITY Control. Adjusts the brightness of the oscilloscope trace.
6	FOCUS Control. Adjusts the sharpness of the trace in conjunction with the ASTIGMATISM control.
7	ASTIGMATISM Control. Adjusts the sharpness of the trace in conjunction with the FOCUS control.
8	VERTICAL POSITION Control (black). Adjusts the vertical position of the Channel A presentation (Channel B has an identical control).
9	POLARITY Switch (red). Selects the direction of beam deflection for Channel A presentation; in + UP position, a positive signal deflects the beam upward (Channel B has an identical control).
10	SENSITIVITY Switch (black) and VERNIER Control (red). These controls select the sensitivity of the CHANNEL A input circuit. Each step of the switch is calibrated in VOLTS/CM of vertical deflection. With the VERNIER control in the CALIBRATED position, sensitivity exactly corresponding to the switch setting is provided. Turning the VERNIER control counterclockwise from the CALIBRATED position reduces the height of the displayed waveform and provides continuous adjustment of sensitivity between steps. (Channel B has identical controls.) 11 AC-DC Switch. Selects capacitive (AC) or direct (DC) coupling for the vertical input signal. Set to DC for viewing pulses longer than about .01 second or when the DC component of the signal is desired. Set to AC to avoid beam displacement due to DC voltage on signal (Channel B has an identical control).

TABLE 3-1 (Continued)

ITEM	DESCRIPTION AND FUNCTION
12	INPUT Connector (type BNC). Receives the input signal to Channel A (Channel B has an identical connector).
13	Vertical Presentation Selector Switch. Selects mode of CRT presentation of trace(s) from the dual-channel preamplifier: CHANNEL A only; CHANNEL B only; A-B (difference between Channel A and Channel B); ALTERNATE (Channel A and Channel B in sequence on alternate sweeps); CHOPPED (Channel A and Channel B on alternate 1-usec segments of each sweep).
14	GATE OUTPUT Connector (type BNC). Provides a +50-volt unblanking pulse during horizontal sweep time of trace. Connected to ground during retrace.
15	HORIZONTAL POSITION Control. Adjusts the horizontal position of the presentation.
16	SWEEP OUTPUT Connector (type BNC). Provides a ramp voltage (approximately -50 to +50 volts) which coincides with the internal horizontal sweep.
17	SWEEP TIME Switch (black) and VERNIER Control (red). These controls select the horizontal sweep rate. The switch is calibrated in 1-2-5 steps, in MICROSECONDS/CM, MILLISECONDS/CM, and SECONDS/CM. With the VERNIER control in the CAL (calibrated) position, the sweep rate corresponds exactly to the switch setting. Turning the VERNIER control counterclockwise from the CAL position slows the sweep and provides continuous adjustment of sweep rate between steps.
18	INPUT Connector (type BNC). Accepts an external sweep triggering signal.
19	TRIGGER SOURCE Switch (black). Selects source of the sweep triggering signal (power LINE, INTERNAL, EXTERNAL AC, or EXTERNAL DC).
20	SWEEP MODE Control (red). Provides a variable adjustment of the sensitivity of the sweep circuit to the trigger signal. Allows selection of either triggered or free running sweep by rotating the control pointer to either the left-hand (TRIGGER) or right-hand (FREE-RUN) sector. When turned fully counterclockwise to the PRESET position, provides greatest sensitivity and permits stable triggering with nearly all signals.
21	TRIGGER SLOPE Switch (red). Selects the portion of the triggering waveform which triggers the sweep: + (positive-going slope) or (negative-going slope).
22	TRIGGER LEVEL Control (black). Selects the amplitude point on the input signal waveform at which the sweep will be triggered (range is ± 30 volts from the center 0 position).
23	SWEEP UNCAL Indicator. Is illuminated when the combined settings of the SWEEP TIME and HORIZONTAL DISPLAY switches place the sweep at an uncalibrated speed.
24	INPUT Connector (type BNC). Accepts an externally applied horizontal input signal.
25	AC-DC Switch. Selects capacitive coupling (AC) or direct coupling (DC) for the external horizontal input signal. Set to DC for externally-driven sweep times longer than 1 millisecond or when the DC component of the signal is desired. Set to AC to avoid beam displacement due to DC voltage on signal.
26	HORIZONTAL DISPLAY Switch (black) and EXTERNAL VERNIER Control (red). Within its EXT SENSITIVITY sector, the switch selects the sensitivity of the horizontal input circuit to an external signal, in VOLTS/CM of horizontal deflection. With the EXTERNAL VERNIER control in the CAL position, sensitivity exactly corresponding to the switch setting is provided. Turning the EXTERNAL VERNIER control counterclockwise from the CAL position reduces the width of the displayed waveform and provides continuous adjustment of sensitivity between steps. Within its INTERNAL SWEEP MAGNIFIER sector, the HORIZONTAL DISPLAY switch in the X1 position selects the internal sweep as established by the SWEEP TIME switch. In the X2 through X100 positions, the HORIZONTAL DISPLAY switch expands the waveform presentation horizontally by a factor corresponding to its setting, by increasing the sweep speed a corresponding amount over that selected by the SWEEP TIME switch.
27	ARMING INPUT Connector (type BNC). Accepts the external signal which arms the internal sweep circuit to allow triggering of one sweep when the SWEEP OCCURRENCE switch is set to SINGLE. (The arming signal must be a pulse of +15 to +25 volts with a duration of 1 to 200 microseconds.) 28 SWEEP ARMED Indicator. Indicates that the sweep circuit is ready to be triggered by an external or internal pulse for a single sweep. Lamp extinguishes after sweep starts.
29	INTENSITY MODULATION Switch and INPUT Connector (type BNC). Selects NORMAL mode (no intensity modulation) or EXTERNAL modulation of trace intensity. INPUT connector is for the external intensity modulating signal; +20 volts will provide complete blanking of a trace of normal intensity.
30	SWEEP OCCURRENCE. Selects either NORMAL- or SINGLE-sweep operation.

CAUTION

For proper operation, both plug-in units must be pushed in firmly and locked in place with their LOCK knobs. Lock the knobs by turning toward the adjacent side of the instrument following the arrow on the panel.

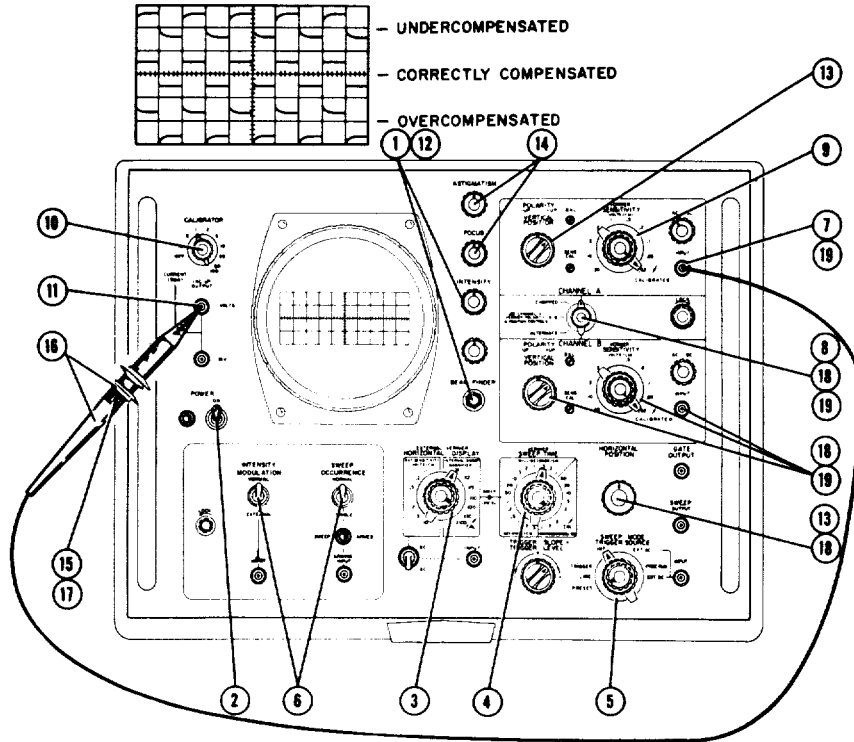


Figure 3-2. Procedure for Turning on Oscilloscope, Compensating Probe, and Making Initial Electrical Inspection

TABLE 3-2. PROCEDURE FOR TURNING ON OSCILLOSCOPE AND PREPARING IT FOR USE (STEP NUMBERS ARE KEYED TO INDEX NUMBERS ON FIGURE 3-2)

STEP	ACTION
1	Turn INTENSITY control fully counterclockwise.
2	Connect the oscilloscope to the 115-volt power source and switch POWER to ON. Allow five minutes warm up.
3	Set HORIZONTAL DISPLAY switch to X1; VERNIER control to CAL.
4	Set SWEEP TIME switch to .5 MILLISECONDS/CM.; VERNIER control to CAL.
5	Set SWEEP MODE control to PRESET; TRIGGER SOURCE switch to INT.
6	Set INTENSITY MODULATION and SWEEP OCCURRENCE switches to NORMAL.
7	Connect Test Prod BNC terminal to CHANNEL A INPUT connector.
8	Set Vertical Presentation Switch to CHANNEL A.
9	Set CHANNEL A SENSITIVITY switch to .05 VOLTS/CM.
10	Set CALIBRATOR switch to 2.
11	Connect Test Prod tip to CALIBRATOR VOLTS connector.
12	Rotate INTENSITY control clockwise until trace appears. If CRT remains blank, press BEAM FINDER button.

TABLE 3-2. (Continued)

STEP	ACTION
13	Adjust HORIZONTAL POSITION and CHANNEL A VERTICAL POSITION controls until trace is centered on screen. If necessary, readjust INTENSITY.
14	Adjust FOCUS and ASTIGMATISM controls to obtain a1 thin trace.
15	Loosen knurled locknut behind rear flange on prod.
16	Holding vinyl sheath behind locknut, rotate rear flange to obtain the best square wave (set insert). Check that vertical deflection is four centimeters (corresponding to .05 volts/cm sensitivity with 2 volts calibrator output and 10:1 attenuation in probe).
17	Tighten prod locknut without changing adjustment.
18	Turn Vertical Presentation Switch to CHANNEL B. Repeat the procedure of steps 9 through 17 for Channel B and the other test prod.
19	Repeat procedure with the Vertical Presentation Switch set to ALTERNATE and with both prods connected to the calibrator (one driving Channel A and one driving Channel B) to test)both channels simultaneously.
20	The oscilloscope is ready for use. To display a single signal connect either probe to the signal and switch the Vertical Presentation Switch to the corresponding channel. Adjust the SENSITIVITY, HORIZONTAL DISPLAY and SWEEP TIME switches and the TRIGGER controls as necessary to obtain and synchronize the desired display. (Refer to table 3-3 and figure 3-3 for more detailed instructions.) For dual-trace operation and other specialized functions, refer to paragraphs 3-7 through 3-11.

3-8. HORIZONTAL DEFLECTION BY EXTERNAL SIGNALS.

After performing turn-on procedure in table 3-2, steps 1 through 14, connect the external signal to the Horizontal INPUT connector (24, figure 3-1) through either a test prod, a BNC-terminated coaxial cable, or plain wire leads with a BNC -to-binding post adapter. Then set the HORIZONTAL DISPLAY selector (26, figure 3-1) within its EXT SENSITIVITY sector to obtain the desired deflection in VOLTS, CM. To read the voltage of the horizontal deflection directly from the CRT trace, set the EXTERNAL VERNIER (26, figure 3-1) to CAL. Set the Input Coupling switch (25, figure 3-1) to AC or DC as required (refer to item 25, table 3-1).

3-9. DUAL-TRACE OPERATION.

Dual-trace operation is used to compare two different input signals, such as the input and output signals of an amplifier or network.

The vertical plug-in provides two types of dual-trace operation as selected by the Vertical Presentation Switch (13, figure 3-1): ALTERNATE and CHOPPED. On ALTERNATE operation, the output of one channel is shown on the CRT during one sweep and

the output of the other channel during the next sweep. On chopped operation channels are switched at a one-megacycle rate, so both signals appear ill alternate 1-microsecond segments during each sweep.

Alternate operation is for comparing two signals which require use of high sweep speeds. However, for most accurate time comparisons, the sweeps must be triggered by an external signal that is synchronized with both vertical signals. In many cases, one of the vertical signals can be used as the trigger signal as well (by making appropriate external connections). Internal triggering on the vertical signal cannot be used l)because of the instability that might be produced by the dual-channel display switching. When signal frequency permits, greater accuracy can be obtained by comparing the two signals during a single sweep, as made possible by chopped operation.

Chopped operation is for comparing two signals while using sweep speeds below about five, micro-seconds/centimeter (which are low compared to the 1-megacyclet switching rate). This type of operation permits precise time comparisons because both signals are displayed during the same sweep. In general, external triggering is required. If internal triggering is attempted, the one-megacycle switching signal may trigger the sweep and cause an unstable presentation.

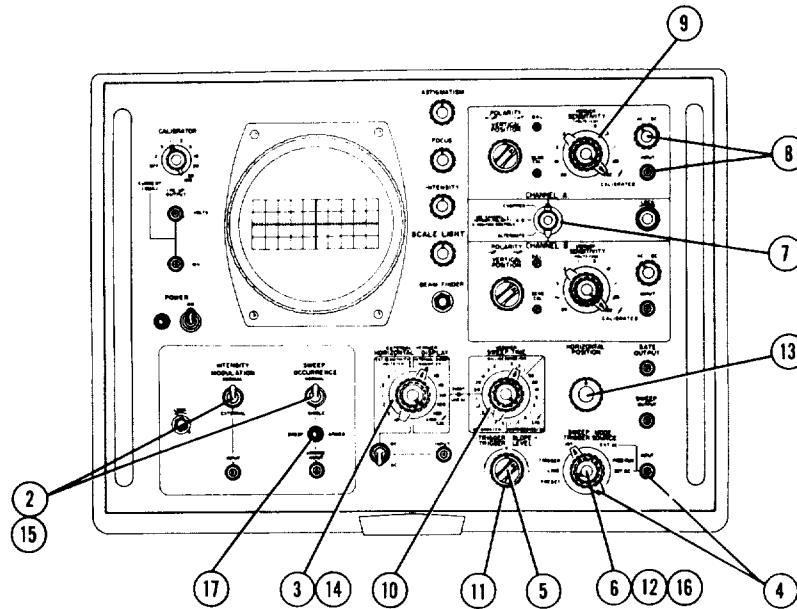


Figure 3-3. Selecting and Synchronizing the Sweep and Sweep Magnification

**TABLE 3-3. SELECTING AND SYNCHRONIZING THE SWEEP AND SWEEP MAGNIFICATION
(STEP NUMBERS ARE KEYED TO INDEX NUMBERS ON FIGURE 3-3)**

STEP	ACTION
1	Perform turn on procedure as described in steps 1-14 of figure 3-2 and table 3-2.
2	For normal operation with recurrent sweep, check that INTENSITY MODULATION and SWEEP OCCURRENCE switches are set to NORMAL.
3	Set HORIZONTAL DISPLAY switch to X1.
4	To provide for internal triggering from the vertical presentation waveform (normally used with single-channel or A-B differential display), set TRIGGER SOURCE switch to INT. If sweep is to be triggered by an external signal, connect signal to trigger INPUT connector and set TRIGGER SOURCE switch to EXT AC or EXT DC.
5	Set TRIGGER SLOPE switch to trigger on positive- or negative-going slope of the triggering signal as desired. When internal triggering is being used, reversing the POLARITY switch of the channel being monitored reverses the side of the wave that triggers the sweep in addition to inverting the display.
8	Set SWEEP MODE control to PRESET. For most sync signals and frequencies the PRESET SWEEP position gives stable synchronization.
7	Select CHANNEL A or CHANNEL B with Vertical Presentation Switch.
8	Connect signal which is to be checked to INPUT connector of channel selected, and set AC-DC switch for type of coupling desired.
9	Set SENSITIVITY switch for vertical deflection desired. To read voltage of vertical deflection, set VERNIER control to CALIBRATED.

TABLE 3-3. (Continued)

STEP	ACTION
10	Set SWEEP TIME switch for horizontal display desired. To read time from the horizontal deflection of the trace, set VERNIER control to CAL. Otherwise, set VERNIER control as desired to synchronize the sweep with the frequency of the vertical signal to produce a display containing a specific number of cycles or other desired features of the waveform.
11	Adjust TRIGGER LEVEL control to the voltage point on the waveform that should begin the sweep.
12	If necessary readjust SWEEP MODE and/or TRIGGER LEVEL controls to stabilize the sweep. When the trigger frequency is approximately 10 mc or higher, the FREE RUN position of the SWEEP MODE control may be the best position.
13	Adjust the HORIZONTAL POSITION control so that the portion of trace to be observed or magnified is under the center vertical line of graticule.
14	Set the HORIZONTAL DISPLAY switch to the desired degree of magnification. If combination of selected sweep and degree of magnification produces a sweep faster than 0.02 usec/cm, the SWEEP UNCAL indicator will light indicating that sweep time is no longer calibrated.
15	For observation of transient pulses and other signals that cannot use recurrent sweep, operate the oscilloscope in the single sweep mode as follows: Set the SWEEP OCCURRENCE switch to SINGLE. (Make all other vertical, horizontal, and trigger control settings as desired, in accordance with the previous directions.) Then apply a +15 to +25 volt (peak) pulse with a duration of 1 to 200 <i>n</i> sec to the ARMING INPUT connector, whenever a single sweep is desired. Once the circuit is armed, the next internal or external trigger pulse will trigger a sweep.
16	Arming can also be accomplished without applying an external pulse to the ARMING INPUT connector by use of the SWEEP MODE control. If the desired position of the SWEEP MODE control for proper triggering is outside the PRESET position, turn the SWEEP MODE control quickly to PRESET and back to the desired position to arm the sweep. If the desired position of the SWEEP MODE control is the PRESET position, momentarily switch the control out of PRESET and back to PRESET to arm the sweep. In either case, the next internal or external trigger pulse will trigger a sweep.
17	After an external arming pulse is received, or the SWEEP MODE control is switched as in step 16, the SWEEP ARMED indicator lights. This indicator extinguishes as sweep begins.

3-10. DIFFERENTIAL OPERATION.

Differential operation, as selected by the A-B position of the Vertical Presentation Switch (13, figure 3-1), permits observation of the difference between two signal voltages. It is useful for observing signals which are balanced with respect to ground.

In differential operation, ripple or stray pickup which is common to the two main signals is attenuated. With both the CHANNEL A and CHANNEL B SENSITIVITY switches (10, figure 3-1) set to .02 VOLTS/CM, common-mode signals are attenuated at least 100: 1; with the SENSITIVITY switches at other settings, common-mode signals are attenuated at least 20: 1. However, the amplitude of common-mode signals (before attenuation) should not exceed the equivalent of 100 centimeters of deflection. For example, if both SENSITIVITY switches are set to .02 VOLTS/CM, the common-mode signal should not exceed 2 volts (20 volts at probe input). Excessive common-mode signals overload the amplifiers, causing distortion.

When in differential operation, the most accurate difference signal and greatest common-mode rejection

is obtained when the two input signals to the oscilloscope are balanced and both SENSITIVITY switches are set to the same setting.

During differential operation, the SENSITIVITY and the AC-DC Input Coupling switches (10 and 11, figure 3-1) of both channels operate on their respective signals; however, only the Channel A VERTICAL POSITION, POLARITY, and VERNIER controls (8, 9, and 10, figure 3-1) are effective.

3-11. SINGLE-SWEEP OPERATION.

Single-sweep operation is intended for viewing transients and other one-shot signals and periodic signals which cannot be viewed using normal recurrent-sweep operation. In single-sweep operation, the sweep generator is disabled at the end of each sweep and must be armed before it can generate another horizontal sweep trace. The sweep generator can be armed automatically with an external signal or manually with the SWEEP MODE control. Detailed instructions for single-sweep operation are given in steps 15 through 17 of table 3-3.

3-12. OPERATION WITH INTENSITY MODULATION.

First perform turn-on procedure in table 3-2. Then set INTENSITY MODULATION switch (29, figure 3-1) to EXTERNAL and connect the external signal to the Intensity Modulation INPUT connector just below the switch. A signal of +20 volts peak will blank the trace when the trace is set for average intensity. Negative voltages brighten the trace.

3-13. OPERATION WITH DIRECT CONNECTION TO CRT FOR VERTICAL DEFLECTION.

WARNING

Before making connections directly to the deflection plates of the CRT, disconnect the oscilloscope from the ac power source. The exposed terminals used for making direct-deflection connections operate at bias voltages of about 200 volts dc.

- a. With power disconnected from the oscilloscope, remove the access plate on the top of the cabinet, which exposes the CRT direct deflection terminals as shown in figure 3-4.
- b. Remove the leads from vertical deflection plate terminals D3 and D4.
- c. Connect input coupling components to provide for input signal and bias voltage coupling as shown in figure 3-4. Use capacitors with good high-frequency response, such as C103 listed in table 6-2. With the bias connections shown, the front panel VERTICAL POSITION control remains effective.
- d. For single-ended input, ground the common signal lead at the point shown by the dashed ground lead in figure 3-4. For balanced input, leave both signal leads ungrounded.
- e. Connect the input power cord and turn the oscilloscope on. The procedures previously described for horizontal sweep operation can be used, except that an external signal must be used for triggering the sweep.

3-14. SUMMARY OF OPERATING PROCEDURES.

Refer to table 3-2 and figure 3-2 for a summary operating procedure. Summary information about the function of any particular control(s) can be found in table 3-1 which is keyed to control locations shown in figure 3-1.

3-15. TURN-OFF PROCEDURE.

When the oscilloscope is not being used but it is necessary to leave it turned on for instant service, rotate the INTENSITY control fully counterclockwise to extinguish the trace and prevent burning the CRT. At all other times, turn the intensity control fully counterclockwise and turn the POWER switch off to remove all power from the oscilloscope.

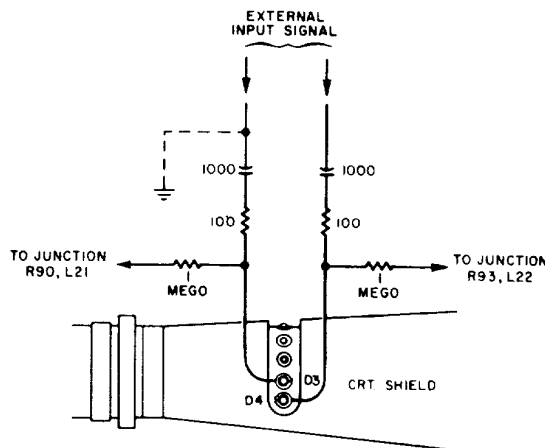


Figure 3-4. Connections for Direct Deflection Operation

3-16. OPERATOR'S MAINTENANCE.

Maintenance by operating personnel is limited to checking and adjusting vertical sensitivity and balance, cleaning the air filter, replacing fuses, or emergency replacement of electron tubes and semiconductors. Fuses for the +110 volt and -100 volt power supplies, plus spare fuses for these supplies, are located at the rear of the horizontal plug-in compartment. Fuses for the +370 volt supply, 6.3 volt supply and the power line, plus a spare fuse for each, are located at the rear of the vertical plug-in compartment (see figure 5-11). Localization of trouble to a particular electron tube or semiconductor often requires technical skill and use of trouble-shooting techniques. In many cases a calibration adjustment is required when a tube is replaced. Therefore, only a technician should replace tubes and semiconductors, except in an emergency.

3-17. OPERATING CHECKS AND ADJUSTMENTS.

The following tests show the operating condition of the oscilloscope. The checks consist of testing vertical and horizontal sensitivity calibration, and vertical balance. Vertical sensitivity calibration need be checked only occasionally under normal circumstances. However, if the oscilloscope is subjected to extreme environmental conditions or is to be used to the full extent of its rated accuracy, vertical sensitivity calibration should be checked each time the oscilloscope is put into operation.

- a. VERTICAL SENSITIVITY CHECK.-Perform the turn-on procedure given in figure 3-2 and table 3-2, checking Channel A and Channel B in turn. If a test prod is used in this test, set the CALIBRATOR

switch to 2 and input sensitivity to .05 VOLTS/CM and if necessary, adjust the CHANNEL A SENS. CAL. (screwdriver adjustment on panel of Dual Trace Preamplifier) on the panel to obtain a square wave exactly 4 cm high. If a plain wire connection is used for the calibration voltage input, set the CALIBRATOR to .2 to produce the same deflection. Repeat the procedure for Channel B. If either channel cannot be adjusted to the proper sensitivity, the oscilloscope should be calibrated in accordance with the procedure given in Section 5.

b. BALANCE CHECK.-Balance is properly set if the presentation for either channel has no vertical shift when the sensitivity VERNIER control for that channel is rotated, or when the POLARITY switch is switched between + UP and UP. The adjustment is not critical and need be set only when the shift is enough to be annoying. Proceed as follows:

(1) With the oscilloscope turned on, set the Vertical Presentation Switch to CHANNEL A and SWEEP MODE to FREE RUN.

(2) Adjust Channel A BAL (screwdriver adjustment on panel of Dual Trace Preamplifier) to obtain minimum vertical shift of trace as Channel A. POLARITY is switched between + UP and UP.

(3) Repeat for Channel B.

c. HORIZONTAL SENSITIVITY CHECK.

(1) Connect VOLTS output of CALIBRATOR to INPUT connector of horizontal amplifier (24, figure 3-1) using a plain wire connection.

(2) Set CALIBRATOR switch to 5.

(3) Set the HORIZONTAL DISPLAY control to EXT., SENSITIVITY to 1 VOLTS/CM, and set the EXTERNAL VERNIER control to CAL.

(4) The trace should be deflected 5 centimeters ± 0.25 cm. If the horizontal deflection is outside the above range, the oscilloscope should be calibrated in accordance with the procedure given in Section 5.

3-18. PREVENTIVE MAINTENANCE.

The air filter installed over the air intake on the rear of the cabinet prevents dust and dirt from entering the oscilloscope. The filter must be cleaned periodically so as not to restrict air flow into the cabinet. For the cleaning procedure, see paragraph

5-2a. The fan motor requires one drop of oil in each bearing once every six months, in continuous operation (see paragraph 5-2b).

WARNING

This instrument contains voltages as high as 8600 volts, which can cause death on contact. Turn the instrument off before touching any internal part.

3-19. EMERGENCY MAINTENANCE.

a. THERMAL SWITCH.-The oscilloscope has a thermal switch which opens the main power circuit if the temperature within the cabinet exceeds 140°F, $\pm 5^\circ$ F. If the instrument goes off during operation remove the Dual Trace Preamplifier plug-in with POWER still turned ON, and observe the neon lamp to the right of the fuse bracket inside the plug-in compartment. If the lamp is lit, the oscilloscope was overheated. Turn off the POWER switch, and investigate the cause of overheating. Be sure there is adequate clearance around the cabinet for the free circulation of air, that the air entering the cabinet is not preheated by recirculation, that the air filter is clean, and that the motor turns the fan at normal speed (approximately 2400 rpm). The thermal switch will automatically reclose the main power circuit when the temperature inside the cabinet returns to 120°F, $\pm 5^\circ$ F. Before returning the oscilloscope to service, be sure the fan is operating.

b. FUSE REPLACEMENT. If the oscilloscope fails to operate when connected to a proper power source, check all fuses by substitution. (See paragraph 3-16 and figure 5-11 for fuse locations.)

c. EMERGENCY REPLACEMENT OF TUBES AND SEMICONDUCTORS.-In an emergency, operating personnel can replace tubes and semiconductors listed in table 3-2 without making the indicated adjustment. However, a technician should make the indicated adjustment as soon as possible after the replacement is made. In non-emergency conditions, tube replacement should be carried out as a part of systematic trouble shooting, following the procedure of Section 4. (See paragraph 5-2b for instructions for access to the oscilloscope chassis and figure 5-6 for an overall tube and semiconductor illustration.)

TABLE 3-4. ADJUSTMENTS REQUIRED FOLLOWING TUBE AND SEMICONDUCTOR REPLACEMENT

TUBE OR SEMICONDUCTOR	FUNCTION	ADJUSTMENT
<u>Main Vertical Amplifier</u> (Etched Circuit Assemblies A1 and A2; figures 5-14 and 5-15)		
V1	Cathode Follower	None
V2	Input Amplifier/Cathode Follower	Main Vertical Amplifier Gain and High Frequency Compensation (paragraph 5-4f)
V3	Input Amplifier/Cathode Follower	Main Vertical Amplifier Gain and High Frequency Compensation (paragraph 5-4f)
V4	Internal Trigger Amplifier/ Cathode Follower	None
V5	Internal Trigger Amplifier/ Cathode Follower	None
V6	Cathode Follower	None
V7	Constant Current Generator	None
V10	Cathode Follower	None
V11 through V13	Output Amplifier	Main Vertical Amplifier Gain and High Frequency Compensation (paragraph 5-4f)
<u>Sweep Generator</u> (Etched Circuit Assembly A101; figure 5-17)		
CR101	Clamp	None
CR102	Limiter	None
CR103	Limiter	None
CR104	Switch Diode	Sweep Time Calibration (paragraph 5-4e(2))
V1i01	Trigger Amplifier	Trigger Symmetry (paragraph 5-4e(1))
V103	Trigger Generator	None
V104	Gate Generator	Preset (paragraph 5-4e(1))
V105	Gate Generator/Clamp	Preset (paragraph 5-4e(1))
V107	Cathode Follower	None
V109	Integrator	Sweep Time Calibration (paragraph 5-4e(2))
V113	Bias Control Cathode Follower	None
V114	Cathode Follower	None
V115	Output Cathode Follower	None
<u>Horizontal Amplifier</u> (Etched Circuit Assemblies A202 and A203; figures 5-23 and 5-24)		
Q201/202	Differential Amplifier	All Horizontal Amplifier Adjustments (par. 5-4d)
V201	External Input Cathode Follower/Input Cathode Follower	External Vernier Balance (paragraph 5-4d(1))
V202	Cathode Follower	X100 Gain and Balance (paragraph 5-4d(2))
V203	Cathode Follower	None
V204/205	Differential Amplifier	All Horizontal Amplifier Adjustments (par. 5-4d)
V206	Output Cathode Follower	None
V207	Capacitance Driver	Capacitance Driver (paragraph 5-4d(3))

TABLE 3-4. (Continued)

TUBE OR SEMICONDUCTOR	FUNCTION	ADJUSTMENT
<u>High Voltage Power Supply</u> (Etched Circuit Assemblies A301 and A302; figures 5-26 and 5-27)		
V301 V304 V305	Amplifier R.F. Oscillator CRT	High Voltage, R321 (paragraph 5-4b) None All Main Vertical Amplifier and Horizontal Amplifier Adjustments (paragraphs 5-4d and f)
V308 through V311	Rectifier	None
<u>Calibrator</u> (Etched Circuit Assembly A301; figure 5-26)		
V306 V307	Multivibrator Clamp Diode/Disconnect Diode	None None
<u>Low Voltage Power Supplies</u> (Etched Circuit Assemblies A401 and A402; figures 5-28 and 5-29)		
CR401 through CR415 CR413 CR414/415 CR416 Q401 through Q419 V401	Rectifier Reference Diode Rectifier Reference Amplifier, Emitter Followers, Regulators Voltage Regulator	None None None 6.3 Volt Supply (paragraph 5-4a(2)) None -100 Volt Supply (paragraph 5-4a(1))
<u>MX-2930A/USM Dual Trace Preamplifier</u> (Etched Circuit Assemblies A501 and A502; figures 5-31 and 5-32)		
CR501 through CR506 Q501/502 Q503/504 V501 V502 V503 V504 V505 V506 V507 V508	Coupling, Clamp Diodes Differential Amplifier Differential Amplifier Cathode Follower Transistor Driver Output Cathode Follower Cathode Follower Transistor Driver Output Cathode Follower Amplifier/Cathode Follower Switching Multivibrator	None Sensitivity Calibration and Vernier Balance, Channel A (paragraphs 5-4g(1) and (2)) Sensitivity Calibration and Vernier Balance, Channel B Vernier Balance, Channel A (paragraph 5-4g(1)) Sensitivity Calibration and Vernier Balance, Channel A (paragraphs 5-4g(1) and (2)) None Vernier Balance, Channel B (paragraph 5-4g(1)) Sensitivity Calibration and Vernier Balance, Channel B (paragraphs 5-4g(1) and (2)) None None Multivibrator Frequency (paragraph 5-4g(6))
<u>MX-3078,USM Auxiliary Plug-In</u> (figure 5-36)		
CR1	Limiter	None

SECTION 4

TROUBLE SHOOTING

4-1. INTRODUCTION.

This section contains information that can be used to quickly and efficiently locate and correct the cause of an equipment malfunction or performance degradation. The basic troubleshooting technique is based on the following six logical steps:

a. **SYMPTOM RECOGNITION.** Not all malfunctions are immediately obvious in normal use, such as performance degradation. Such faults will be exposed, however, in the Reference Standards Procedures of Section 5. The technician should be critical of any variation in equipment performance to indicate the "not so apparent" malfunctions.

b. **SYMPTOM ELABORATION.** When a malfunction is suspected, the technician should test all performance characteristics to gain as much information as possible about the oscilloscope performance. When all the information is collected about the response to front-panel controls, CRT display behavior, etc., it will then be easier to localize the faulty section.

c. **DETERMINING PROBABLE FAULTY SECTION.** A thorough understanding of the principles of operation of the oscilloscope, which are included in this section, will help the technician to make a logical choice as to which circuit or section could cause the improper performance. In most cases it is a good procedure to "think through" or list the faulty sections stage by stage before proceeding with trouble shooting. This Troubleshooting Section is arranged with a separate theory description and troubleshooting procedures for each major section, including functional and servicing block diagrams, to aid in understanding individual circuits and localizing troubles to them.

d. **LOCATING THE FAULTY FUNCTION.** Refer to the list of probable faults made in step c and, if necessary, arrange them into the most efficient testing order. The troubleshooting procedures in this section are designed to isolate tests to the major sections of the oscillograph.

e. **LOCALIZING THE FAULTY CIRCUIT.** When the faulty major section has been isolated, there still remain several possibilities of faulty circuits within that section.

f. **FAILURE ANALYSIS:** When the faulty circuit or component has been discovered, it is important to review the steps that led to its discovery to determine where the primary fault may be. For example, a faulty vacuum tube may have been caused by an undiscovered shorted capacitor in its circuit. Any additional information about the circuit performance gathered at the very beginning of the troubleshooting procedure can be very useful now. This review is necessary to make certain that the discovered fault is the cause and not the result of the malfunction.

g. **TEST EQUIPMENT REQUIRED FOR TROUBLE SHOOTING.** Table 4-1 lists the test equipment required for trouble shooting.

h. **WIRING COLOR CODE.** Where color coding is not the same in all models, the color coding, for Model AN/USM-140C and AN/USM-141B, is shown in parentheses.

4-2. OVERALL OSCILLOSCOPE.

a. **FUNCTIONAL DESCRIPTION OF OSCILLOSCOPE.** The oscilloscope produces a graphical picture of applied voltage variations on the face of a CRT. Figure 4-1 is an overall functional block diagram of the oscilloscope. The functional sections are:

- (1) Low-Voltage Power Supply
- (2) High-Voltage Power Supply
- (3) Beam Finder Circuit
- (4) Main Vertical Amplifier
- (5) Horizontal Amplifier
- (6) Sweep Generator
- (7) MX-3078/USM Horizontal Plug-In
- (8) Calibrator Circuit
- (9) MX-2930B/USM Vertical Plug-In

b. **LOW-VOLTAGE POWER SUPPLIES.** The low-voltage power supplies provide the voltages required by the oscilloscope and plug-in units. All DC voltages provided by the supplies (except to the fan) are regulated.

c. **HIGH-VOLTAGE POWER SUPPLY.** The high-voltage power supply generates the high voltages required for operation of the CRT.

d. **BEAM FINDER CIRCUIT.** The beam finder circuit intensifies and centers the CRT display so that "lost" traces may be located and adjusted.

e. **MAIN VERTICAL AMPLIFIER.** The main vertical amplifier amplifies the signals received from the vertical plug-in and applies the signals to the vertical deflection plates of the CRT. The main vertical amplifier also applies a synchronization signal derived from the vertical input signal to the sweep generator for internal triggering of the sweep.

f. **HORIZONTAL AMPLIFIER.** The horizontal amplifier converts the sweep or external horizontal signal to a balanced signal, amplifies it, and applies it to the horizontal deflection plates of the CRT.

g. **SWEEP GENERATOR.** The sweep generator generates a linearly rising voltage to sweep the CRT beam horizontally across the CRT screen. The sweep generator thus provides a linear time base on which to display the vertical signals. The generator can be operated as a triggered or free-running circuit. A delay line (0.2 microsecond) is provided within the main vertical amplifier to delay the displayed signal long enough to allow the sweep generator to be triggered before the signal appears on the CRT.

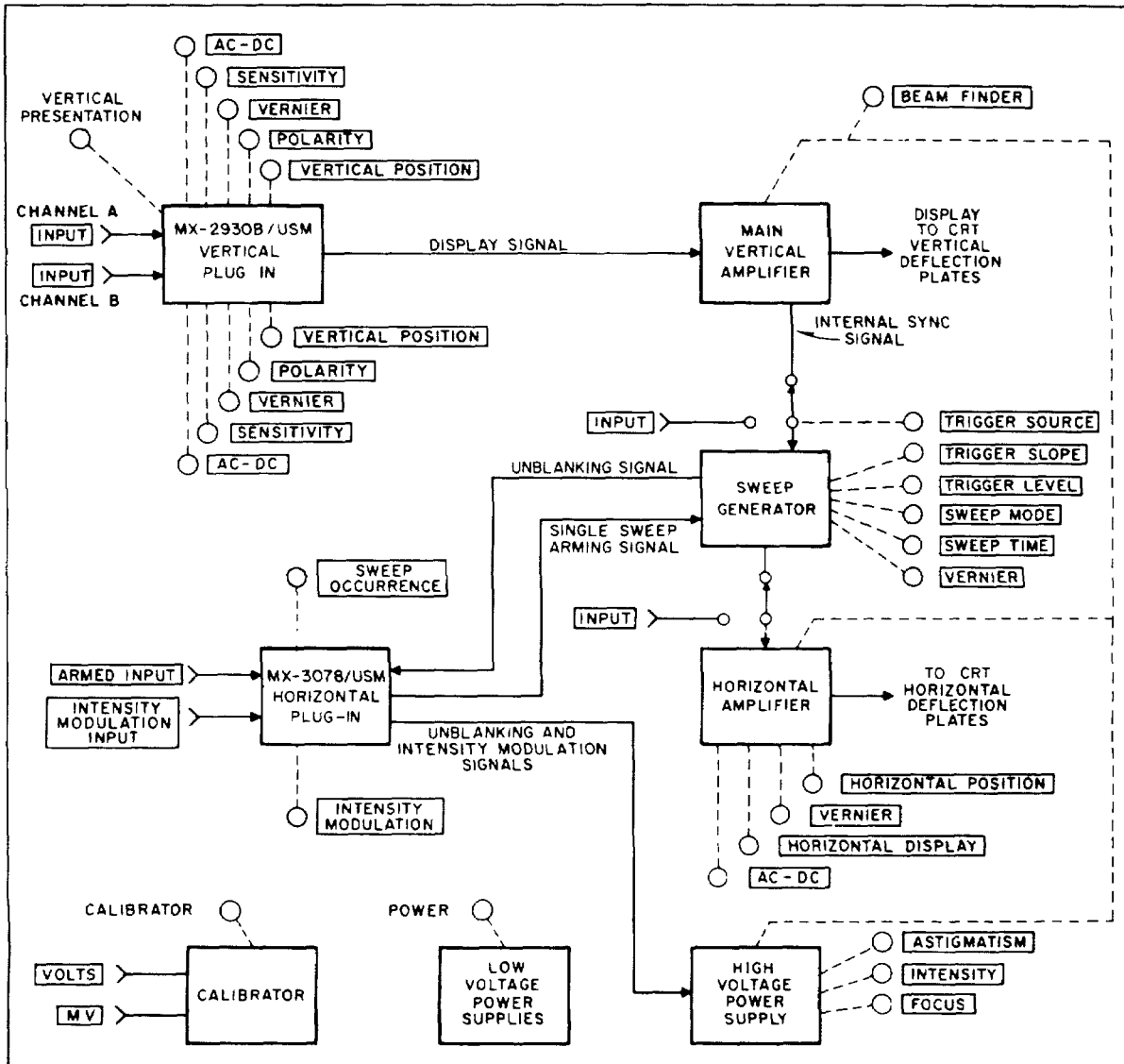


Figure 4-1. Overall Functional Block Diagram

h. MX-3078/USM HORIZONTAL PLUG-IN. The horizontal plug-in unit makes provision for single sweep operation and for external intensity modulation.

i. MX-2930B/USM VERTICAL PLUG-IN. -This Dual Trace Preamplifier plug-in unit receives the two separate vertical input signals and provides separate attenuation or preamplification as required, with separate sensitivity, positioning, and polarity controls for each channel. This plug-in unit can provide for the following display modes: one signal only, two signals displayed on alternate sweeps, two signals chopped for display on the same sweep, or a difference signal resulting from the subtraction of two signals. In any of these modes, after making the appropriate signal combination, the unit converts the signal into balanced form and applies it to the input of the main vertical amplifier.

j. CALIBRATOR CIRCUIT. The calibrator circuit generates a 1-kilocycle square wave for checking the calibration of the vertical and horizontal amplifiers and for compensating for test prods.

4-3. OVERALL OSCILLOSCOPE TROUBLE SHOOTING

Before attempting any trouble-shooting procedure, first make an overall preliminary check of the equipment. Look for external defects such as a dirty filter, broken or loose controls, damaged CRT or graticule, and damaged input connectors. Then remove the cabinet following the directions in paragraph 5-2b, and with power removed,

check for broken or bulging components, loose tubes, and frayed wiring. If this check does not reveal any fault, proceed with the following tests.

a. TEST EQUIPMENT AND SPECIAL TOOLS. Test equipment required for trouble shooting is listed in table 4-1. No special tools are required.

b. TROUBLE-SHOOTING PROCEDURE. A procedure for trouble-shooting the over-all oscilloscope is given in table 4-2. This procedure utilizes CRT presentations in response to particular control settings as a means of localizing trouble. Where improper presentations are obtained, table 4-2 directs the technician to a probable circuit or section of the oscilloscope which deserves a more detailed check. Further checking can then be performed by referring to the trouble-shooting text and servicing block diagram for the circuit concerned in this section of the manual, where test voltages and other trouble-shooting data are presented. Test voltages are also given on the schematic diagrams in Section 5.

c. SERVICING BLOCK DIAGRAM. A servicing block diagram for the over-all oscilloscope is shown in figure 4-2. This diagram provides an alternate means of trouble-shooting by measuring waveforms at various test points as shown. Physical locations of the test points referenced in all servicing block diagrams and schematics are shown in figures 4-14 through 4-22.

TABLE 4-1. TEST EQUIPMENT REQUIRED FOR TROUBLE SHOOTING

DESIGNATION	NAME
AN/USM-98	DC Voltmeter
AN/USM-116	High-Voltage Voltmeter
ME-6/U	AC Voltmeter
AN/USM-90	Q Meter
AN/USM-108	Time-Mark Generator
Model 107	Square Wave Generator (Tektronix)
AN/USM-140B	Oscilloscope with High-Gain
with	Differential
AM-3567/USM	Amplifier Plug-In
NOTE: See table 1-2 for full description.	

CAUTION

If any tubes are replaced as a part of trouble shooting, circuit adjustments may be required before the oscilloscope can be operated. Refer to table 3-4 for a complete listing of tubes and the adjustments required when certain tubes are replaced. Tube locations are shown in figure 5-6.

TABLE 4-2. OVER-ALL OSCILLOSCOPE TROUBLE SHOOTING

STEP	ACTION	RESULTS	NEXT STEP
1	Connect oscilloscope to power source and turn the POWER switch ON.	POWER ON indicator lights and fan operates.	4
		POWER ON indicator lights and fan doesn't operate.	2
		If both POWER ON indicator and fan don't operate, check line fuses F401 and F402, the power cable, and the power switch.	
2	Check overheat indicator behind vertical plug-in unit.	If indicator is on, thermal relay has turned power off. Remove the cause of overheating.	
		Indicator light is off.	3
3	Check ± 6.3 volts supply fuse F406 behind vertical plug-in unit.	If fuse F406 is good, check the fan.	
		If fuse is faulty, replace F406, and then refer to the trouble-shooting procedures for the ± 6.3 volt supply in the low-voltage power supply.	
4	Set the INTENSITY FOCUS, ASTIGMATISM controls for a clear bright spot or trace. Use the BEAM bright spot or HORIZONTAL and VERTICAL POSITION controls to center the trace.	Clear bright trace appears on screen.	5
		Blurred spot appears when BEAM FINDER pressed but can't be centered. Note whether offset is vertical or horizontal, then refer to the trouble-shooting procedures for the vertical or horizontal amplifiers.	
		If trace appears only when the BEAM FINDER is pressed and the INTENSITY set fully clockwise, check the V107 circuit in the sweep generator.	
		If nothing appears on the CRT screen with the BEAM FINDER pressed and the INTENSITY set fully clockwise, refer to the low- and high-voltage power supply trouble-shooting procedures. Also check the output stages of the vertical and horizontal amplifiers, or the CRT.	

TABLE 4-2. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
5	Set Channel A SENSITIVITY to .02, CALIBRATOR to 100, SWEEP TIME to .5 MILLISECONDS/CM, and the TRIGGER SOURCE to INT. Connect CALIBRATOR MV OUTPUT to the Channel A INPUT. Set the SWEEP MODE to FREE RUN then to PRE-SET. Repeat for Channel B.	Square wave appears on CRT on both free-running and preset sweep.	6
		If only one channel of dual channel amplifier functions normally, check	
		If little or no deflection from either channel of dual channel amplifier, refer to trouble-shooting procedures for main vertical amplifier, dual channel plug-in unit, and calibrator.	
		If presentation is unstable or present only with SWEEP MODE set to FREE RUN, check the trigger circuits, including V3, V4, and V5 in the main vertical amplifier, and V101 and V103 in the sweep generator.	
		If sweep appears far out of calibration, check sweep calibration or calibrator frequency.	
		If both vertical sensitivity and sweep appear far out of calibration, check all DC supply voltages.	
6	Leave control settings and connections as in step 5 above, except set Vertical Presentation Switch to CHOPPED and then to ALTERNATE.	Dual channel presentation on CRT. Normal operation on steps 5 and 6 indicates all major circuits are operating. Rotate switches and controls to check all possibilities.	
		If dual channel presentation occurs on CHOPPED only, check V507 circuit in dual channel plug-in unit.	
7	Disconnect dual trace amplifier by sliding it partially out of oscilloscope.	If sweep is approximately centered vertically ± 2 cm, check the dual channel plug-in unit.	
		If sweep remains vertically offset, check the main vertical amplifier.	

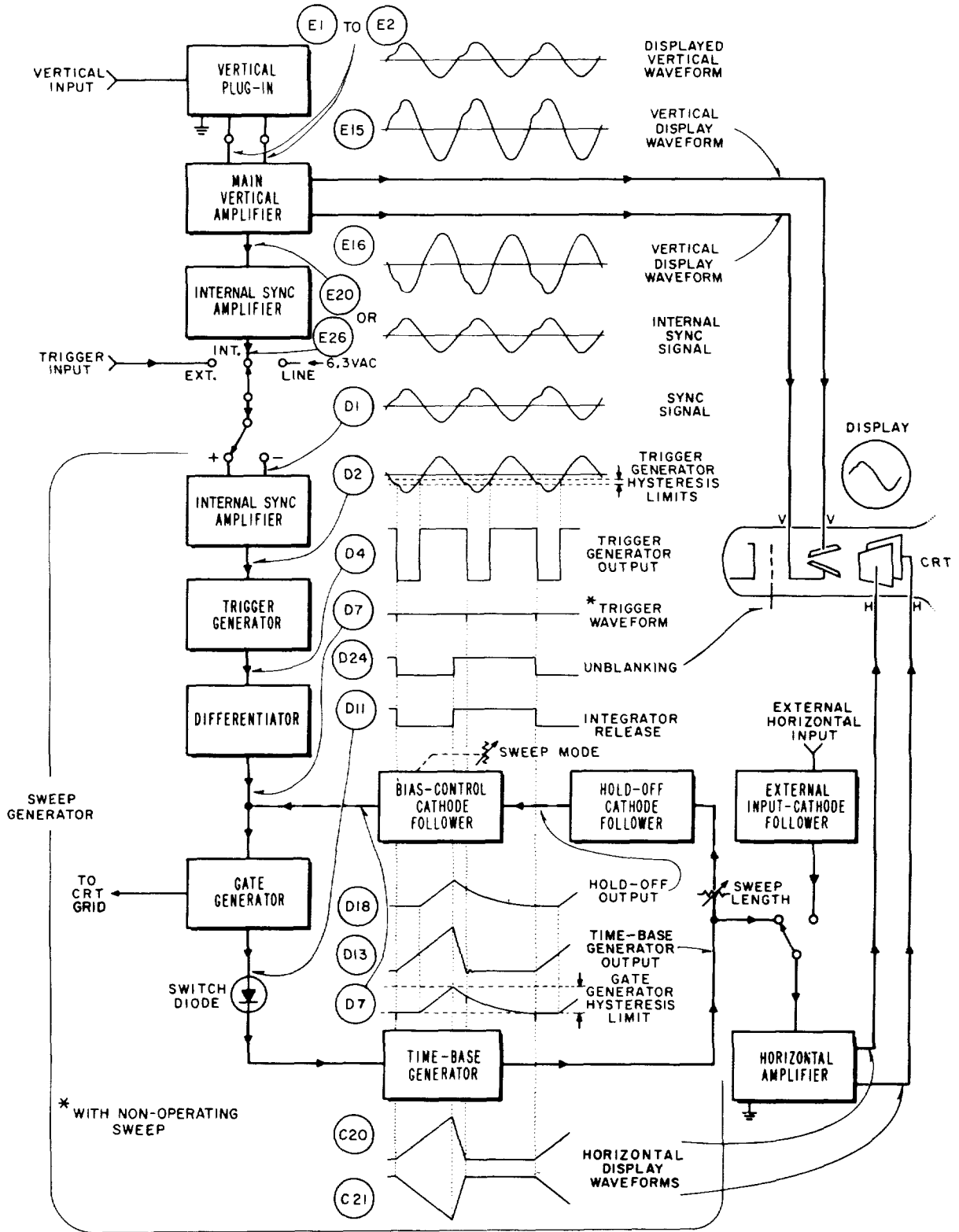


Figure 4-2. Overall Servicing Block Diagram

4-4. LOW-VOLTAGE POWER SUPPLY.

a. **LOW-VOLTAGE POWER SUPPLY FUNCTIONAL DESCRIPTION.** The low-voltage power supply section is a group of regulated DC supplies consisting of four voltage-regulator circuits on one etched circuit assembly (A402) which are powered by four sets of solid-state rectifiers on a separate etched circuit assembly (A401). The Low-Voltage Power Supply Functional and Servicing Block Diagram, Figure 4-3, shows the functional relationship of all circuits in the low-voltage power supply and gives test points and voltages as an aid in trouble shooting. The four regulator circuits supply 12.6 volts, -100 volts, +110 volts, and +260 volts. The output of the +260 volt regulator is connected in series with the output of the +110 volt regulator in order to supply +370 volts. Each supply has an adjustment potentiometer to set its output voltage accurately; however, the -100 volt supply must be set first as its output voltage is used as a reference voltage for the +110 and +370 volt supplies and as an operating voltage in the 12.6 volt supply. The -100 volt supply uses a type 5651 gas regulator tube for its reference voltage; the 12.6 volt supply uses a breakdown diode to supply its reference voltage.

All four regulators operate in the same manner. In each regulator, a series regulator transistor (such as Q413 in the -100 volt supply) acts as an adjustable resistance in series with the load. A comparison amplifier (such as Q410 and Q411 in the -100 volt supply) compares a sample of the regulator output voltage (obtained from R450 and R451 in the -100 volt supply) against a stable reference voltage (obtained from V401 in the -100 volt supply). Any DC shift or AC ripple in the output voltage is amplified and applied to the base of the series regulator transistor. The signal is applied to the base with the proper polarity and amplitude to instantly adjust the resistance of the series element to counteract the initial change in output voltage and hold the output constant.

The 12.6 volt supply provides DC current for all tube heaters. The supply is ungrounded, and the heaters are connected in two equal-current parallel strings. The two strings are connected in series, the mid point is grounded, and the ends are connected across the 12.6 volt supply. Correct voltage adjustment consists of setting the 12.6 volts exactly and making sure that the voltages across the two strings are equal to within +0.2 volts. A greater inequality means that some tube heater is open or shorted, or that an improper type of tube has been installed.

b. **LOW-VOLTAGE POWER SUPPLY TROUBLE SHOOTING.** Trouble symptoms in any of the low-voltage power supplies can be divided into four classes: (1) no output; (2) high or low output voltage that cannot be adjusted to proper value; (3) output voltage that does not remain constant as the line voltage is varied $\pm 10\%$ from 115 volts; and (4) a ripple level on the output that is greater than specified. Table 4-3 is a trouble-shooting chart for the low-voltage power supply. The step-by-step procedure given in table 4-3 is based on the trouble shooting techniques discussed below.

Since the four regulator circuits are interdependent, the first step in trouble shooting is to determine which supply is faulty, and the first supply to check is the -100 volt supply, since it serves as a reference for the other supplies. This is done by measuring the -100 volt supply first to be sure it operates properly, and then proceeding with the 12.6 volt supply, +110 volt supply and the +370 volt supply in that order. First measure the DC output voltage of the regulator under test, then adjust the line voltage 10%, while making the same measurement, to assure that the regulator operates properly when exposed to line voltage variations. Next measure the ripple level on the output of the regulator (with an oscilloscope), and then adjust the line voltage ± 10 while repeating the same measurement. These measurements will identify the trouble symptom; and the trouble can be further localized by following subsequent steps of the trouble-shooting chart.

The cause of the symptoms of high and low output voltage and poor regulation are most often located by measuring the DC voltages at the transistor elements and comparing them with the voltages given on the block diagram (figure 4-3) and the schematic diagram (figure 5-44). Because of the large degree of degenerative feedback in each regulator circuit, some trouble symptoms may be difficult to isolate. For such cases, an additional set of voltages is given in parentheses on both the block and schematic diagrams. These voltages are taken with the feedback loop opened in the one supply being measured. The feedback loop in each regulator is opened by disconnecting the lead from the regulator circuit on the etched board to the base of the associated transistor mounted on the fan shroud as specified in the block and schematic diagram notes. The leads to the transistors mounted on the fan shroud are shown in detail in figure 4-20. Within each supply, the leads connect as follows: to test point A29 in the 12.6 volt supply, A9 in the -100 volt supply, A16 in the +110 volt supply, and A22 in the +370 volt supply.

To better understand the symptom of high ripple level in the output voltage of a power supply regulator, consider that the complete circuits consist of the DC power source (rectifiers and filter), complete regulator circuit, and the load. The ripple level across the load is equal to the ripple level across the DC power source minus the ripple level across the series regulator. The ripple across the series regulator is a function of the DC gain of the regulator amplifier. The ripple level across the DC power source is a function of the line voltage, the filter capacity, and the inductance that follows the rectifiers. An increase in ripple can be caused by a loss in gain in the regulator amplifier (which would also cause a loss of DC regulation), or it could be caused by a loss in capacity or inductance in the input filter (which may not be accompanied by a loss of DC regulation), or it may be caused by a large undesired increase in load current resulting from a short circuit. Ripple voltage measurement tests are included in the trouble-shooting chart, table 4-3, and are also indicated in tabular form, keyed to test points, on both the block and schematic diagrams. Test point locations are shown in figure 4-14.

USEFUL ILLUSTRATIONS OF THE
LOW-VOLTAGE POWER SUPPLY

Illustration	Figure No.	Page No.	Illustration	Figure No.	Page No.
Block Diagram	4-3	4-13, 4-14	Location of Parts	4-20	4-53
Location of Test Points	4-14	4-47		5-28	5-46
				5-29	5-47, 5-48
			Schematic Diagram	5-44	5-73, 5-74

TABLE 4-3. LOW-VOLTAGE POWER SUPPLY TROUBLE SHOOTING

STEP	ACTION	RESULTS	NEXT STEP
1	Measure the DC voltages and AC ripple (peak-to-peak amplitude and frequency) at the supply outputs (test points A1 through A5) with the line voltage at 115 volts, 103 volts, and 127 volts.	One or more incorrect DC voltages which cannot be adjusted to correct value	2
		DC voltages good, but excessive ripple present on one or more supplies	3
2	Measure DC voltage at: A1 A2 A3 A4 A5	Not +6.3 volts	4
		Not -6.3 volts	4
		Not -100 volts	14
		Not +110 volts	23
		Not +370 volts	32
3	Set SWEEP MODE just out of PRESET. Measure peak-to-peak ripple between: *A1-A2 ($\pm 6.3V$) A3-GND (-100V) A4-GND (+110V) *A4-A5 (+370V) *Differential oscilloscope (AN/USM-140B with AM-3567/USM plug-in) required for these measurements.	More than about 2.5 mv peak-to-peak	11
		More than about 2 mv peak-to-peak	20
		More than about 4.5 mv peak-to-peak	29
		More than about 7 mv peak-to-peak	37
<u>± 6.3 VOLT SUPPLY</u>			
4	Check fuse F406 and replace if faulty.	Voltages at A1 and A2 return to ± 6.3 volts	1
		If replacement fuse blows, check fan motor and check for short between +6.3 and -6.3 busses.	
		Voltage between A1 and A2 is correct (12.6 volts) but is not approximately balanced to ground	5
		Fuse not faulty	6
5	Measure DC voltage between test points A2 and H1 (filament circuit) and between A3 and H2.	Voltage correct (about 0.04 volt)	10
		Voltage incorrect	6

TABLE 4-3. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
6	Measure DC voltage between test points A1 and A30.	Voltage correct (about 18 volts)	7
		If voltage is not about 18 volts, check CR414, CR415, L406, C425 or ± 6.3 volt supply load.	
7	Pull off base lead of Q416 and measure DC voltage at test points A1 and A2.	Voltages correct (A1 = +5.5 volts; A2 = -5.5 volts)	8
		Voltages incorrect	9
8	With Q416 base lead still off, measure DC voltage at test point A29.	If voltage is correct (about -12.6 volts, check Q415.	
		If voltage is incorrect, check Q414.	
9	With Q416 base lead still off, measure DC voltage at test point A30.	If voltage is correct (about -12.5 volts), check CR414 and CR416.	
		If voltage is incorrect, check Q416 and Q417.	
10	Check voltage drops between test points A2/A3 and all H test points shown on filament schematic diagram.	Incorrect voltages will point to group of tubes causing unbalance. Replace tubes to correct unbalance.	
11	Measure AC voltage between test points A30 and A1 with differential oscilloscope (AN/USM- 140B with AM- 3567/USM Plug-In).	Peak-to-peak voltage is less than about 1.2 volts	12
		If ripple is greater than about 1.2 volts, and frequency is 60 cps, check CR414 and CR415.	
		If ripple is high ;ued 120 cps, check C425, L406, CR414, CR415, or load on i6.3 volt supply.	
12	Measure AC voltage between test points A27 and A28.	Peak-to-peak voltage is at least 30 times that measured in step 3 (typically 75 mv)	13
		If AC voltage is much less than 30 times that measured in step 3, check Q414 and CR416.	
13	Measure AC voltage between test points A28 and A30.	If AC voltage is much less than 16 times that measured in step 12 (typically 1.2 volts), check Q415, Q416, and Q417.	
<u>-100 VOLT SUPPLY</u>			
14	Check fuse F405 and replace if faulty.	Voltage at A3 returns to -100 volts	1
		Replacement fuse blows	15
		Fuse not faulty	17
15	Turn instrument off. Disconnect white/ violet (or white/black) lead from test point A3. Measure resistance to ground from test point A3 and from this lead.	If resistance at A3 is less than about 13K ohms, check load on - 100V supply for shorts.	
		If resistance at white/violet (or white/ black) lead is less than about 2000 ohms, check for short within the -100V supply.	
		Both resistances normal	16

TABLE 4-3. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
16	Connect dummy loads to -100 volt, +110 volt, and +370 volt supplies as follows: connect a resistance of 165 ohms (75 watts) between ground and white/violet (or white/black) lead removed from test point A3. Disconnect white/orange (or orange/white) lead from test point A4, and connect a resistance of 125 ohms (150 watts) between ground and white/orange (or orange/white) lead. Disconnect white/red (or red/orange) lead from test point A5, and connect a resistance of 1160 ohms (150 watts) between ground and white/red (or red/orange) lead. Turn instrument ON.	If voltage at test point A3 returns to - 100 volts, check load for shorts.	
		If F405 blows again, check for short in -100 volt supply.	
17	Pull off base lead of Q413 and measure DC voltage at test point A3.	Voltage correct (about -52 volts)	18
		Voltage incorrect	19
18	With Q413 base lead still off, measure DC voltage at test point A8.	If voltage is correct (about -57 volts), check Q412.	
		If voltage is incorrect, check Q410 and Q411.	
19	With Q413 base lead still off, measure DC voltage at test point A11.	If voltage is correct (about -143 volts), check diodes CR409 through CR412, or -100 volt supply load.	
		If voltage is incorrect, check Q413 and Q419.	
20	Measure AC voltage between test point A11 and ground.	Peak-to-peak voltage is less than about 8 volts.	21
		If ripple is greater than about 8 volts and frequency is 60 cps, check diodes CR409 through CR412.	
		If ripple is high and 120 cps, check C416, C420, L404, L405, CR409 through CR412, or load on - 100V supply.	
21	Measure AC voltage between test points A6 and A9 with differential oscilloscope (AN/USM- 140B with AM- 3567/USM Plug-In).	Peak-to-peak voltage is at least 1.5 times that measured in step 3 (typically 3 mv)	22
		If AC voltage is much less than 1.5 times that measured in step 3, check Q410, Q411, and Q412.	
22.	Measure AC voltage between test points A9 and A11.	If AC voltage is much less than 2500 times that measured in step 21 (typically 8 volts), check Q413 and Q419.	
<u>+110 VOLT SUPPLY</u>			
23	Check fuse F404 and replace if faulty.	Voltage at A4 returns to normal	1
		Replacement fuse blows	24
		Fuse not faulty	26

TABLE 4-3. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
24	Turn instrument off. Disconnect white/orange (or orange/white) lead from test point A4. Measure resistance to ground from test point A4 and from white/orange lead.	If resistance at A4 is less than about 55K ohms, check load on +110 volt supply for shorts.	25
		If resistance at white/orange (or orange/white) lead is less than about 3000 ohms, check for short within the +110 volt supply.	
		Both resistances normal	
25	Connect dummy loads to +110 volt, -100 volt, and +370 volt supplies as follows: connect resistance of 125 ohms (150 watts) between ground and white/orange (or orange/white) lead removed from test point A4. Disconnect white/violet (or white/black) lead from test point A3, and connect resistance of 165 ohms (75 watts) between ground and white/violet (or white/black) lead. Disconnect white/red (or red/orange) lead from test point A5, and connect resistance of 1160 ohms (150 watts) between ground and white/red (or red/orange) lead.	If voltage at A4 returns to +110 volts, check load for shorts.	
		If F404 blows again, check for short in +110 volt supply.	
26	Pull off base lead of Q409 and measure DC voltage at test point A4.	Voltage correct (about +80 volts)	27
		Voltage incorrect	28
27	With Q409 base lead still off, measure DC voltage at test point A15.	If voltage is correct (about -10 volts, check Q408.	
		If voltage is incorrect, check Q406 and Q407.	
28	With Q409 base lead still off, measure DC voltage at test point A18.	If voltage is correct (about -16 volts), check diodes CR405 through CR408, or +110 volt supply load.	
		If voltage is incorrect, check Q418.	
29	Measure AC voltage between test points A18 and A4 with differential oscilloscope (AN/USM-140B with AM-3567/USM Plug-In).	Peak-to-peak voltage is less than about 11 volts	30
		If ripple is greater than about 11 volts, and frequency is 60 cps, check diodes CR405 through CR408.	
		If ripple is high and 120 cps, check C408, C411, L402, L403, CR405 through CR408, or load on +110 volt supply.	
30	Measure AC voltage between test points A13 and A16.	Peak-to-peak voltage is at least 4 times that measured in step 3 (typically 20 mv)	31
		If AC voltage is much less than 4 times that measured in step 3, check Q406, Q407, and Q408.	
31	Measure AC voltage between test points A16 and A18.	If AC voltage is much less than 500 times that measured in step 30 (typically 10 volts), check Q409 and-Q418.	

STEP	ACTION	RESULTS	NEXT STEP
<u>+370 VOLT SUPPLY</u>			
32	Check fuse F403 and replace if faulty.	Voltage at A5 returns to normal	1
		Replacement fuse blows	33
		Fuse not faulty	35
33	Turn instrument off. Disconnect white/red (or red/orange) lead from test point A5. Measure resistance to ground from test point A5 and from white/red (or red/orange) lead.	If resistance at A5 is less than about 17K ohms, check load on +370 volt supply for shorts.	
		If resistance at white/red (or red/orange) lead is less than about 13K ohms, check for short within the +370 volt supply.	
		Both resistances normal	34
34	Connect dummy loads to +370 volt, -100 volt, and +110 volt supplies as follows: connect resistance of 1160 ohms (150 watts) between ground and white/red (or red/orange) lead removed from test point A5. Disconnect white, violet (or white/black) lead from test point A3, and connect resistance of 165 ohms (75 watts) between ground and white/violet (or white/black) lead. Disconnect white/orange (or orange/white) lead from test point A4, and connect resistance of 125 ohms (150 watts) between ground and white/orange (or orange/white) lead.	If voltage at A5 returns to +370 volts, check load for shorts.	
		If F403 blows again, check for short in +370 volt supply.	
35	Pull off base lead of Q405 and measure DC voltage at test point A5.	If voltage is correct (about +320 volts), check Q401 or Q402.	
		Voltage incorrect	36
36	With Q405 base lead still off, measure DC voltage at test point A25.	If voltage is correct (about -15 volts), check diodes CR401 through CR404, or +370 volt supply load.	
		If voltage is incorrect, check Q403, Q404, and Q405.	
37	Measure AC voltage between test points A25 and A5 with differential oscilloscope (AN/USM- 140B with AM- 3567/USM Plug-In).	Peak-to-peak voltage is less than about 11 volts.	38
		If ripple is greater than about 11 volts, and frequency is 60 cps, check diodes CR401 through CR404.	
		If ripple is high and 120 cps, check C401, C403, CR401 through CR404, or load on +370 volt supply.	
38	Measure AC voltage between test points A20 and A22.	Peak-to-peak voltage is at least 0.8 times that measured in step 3 (typically 10 mv)	39
		If AC voltage is much less than 0.8 times that measured in step 3, check Q401 and Q402.	
39	Measure AC voltage between test points A22 and A25.	If AC voltage is much less than 1000 times that measured in step 38 (typically 11 volts), check Q403, Q404, and Q405.	

4-5. HIGH-VOLTAGE POWER SUPPLY.

a. HIGH-VOLTAGE POWER SUPPLY FUNCTIONAL DESCRIPTION. The high-voltage power supply consists of a single 50-kilocycle oscillator supplying power to three different sets of rectifiers: (1) +8500 volts for the CRT post accelerator; (2) -1500 volts for the CRT cathode; and (3) an additional -1600 volts for the CRT control grid. The reason for the additional -1600 volt supply is to permit this supply to be varied for intensity control and intensity modulation without affecting the voltage applied to the cathode. The High-Voltage Power Supply Functional and Servicing Block Diagram, figure 4-4, shows the functional relationship of all circuits in the highvoltage power supply, and gives test points and voltages as an aid in trouble shooting.

The amplitude of the 50-kc oscillator is regulated by feedback taken from the -1500 volt CRT cathode voltage. A sample of the -1500 volts is fed through a voltage divider and the H. V. ADJ potentiometer (R321) to the grid of the regulator amplifier, whose cathode is grounded. Any shift in the -1500 volts is amplified in both V301A and B and applied to the screen grid of the oscillator tube V304. If the -1500 volt output tends to decrease (vary in a positive direction), the voltage applied to the oscillator grid also goes positive and increases the oscillation amplitude. If the -1500 volts should tend to increase, the oscillation amplitude would be decreased by the applied screen voltage, and thus the -1500 volts is held constant in either case. A shift in the +8500 and -1600 volt supplies is not sensed by the regulator amplifier unless that shift also causes a shift in the -1500 volt supply. The +8500 volts is obtained by voltage doubling in V308 and V309. During the negative half cycle at terminal 1 on T301, V309 conducts and charges C305 to about 4300 volts. During the positive half cycle V308 conducts with the +4300 volts charge in series with (adding to) the transformer voltage. C306 and C315 bypass the 50-ke ripple.

The high-voltage oscillator is located on etched circuit A301 mounted under a cover on the upper left side of the oscilloscope chassis as shown in figure 5-9. When the cover is removed, voltages in excess of 8500 volts are exposed.

b. HIGH-VOLTAGE POWER SUPPLY TROUBLE SHOOTING. Malfunctions in the high-voltage power supply fall into three classes: (1) no voltage, or incorrect voltage that cannot be adjusted, (2) output voltage which does not remain constant when the intensity control is adjusted over its full range, and (3) excessive noise in the output voltage. The first step in trouble shooting the high-voltage supply is to classify the trouble symptom by observation of the CRT trace. No voltage, or high or low voltage are usually identified by such symptoms as no spot when the beam finder is pressed, a poorly focused spot, a spot that cannot be turned off, a high or low horizontal and vertical deflection sensitivity. The step-by-step trouble-shooting procedure is given in table 4-4. Trouble-shooting techniques are further discussed below.

Poor regulation of the high voltages is usually identified as such by a change in horizontal and vertical

sensitivity as the intensity control is varied over its full range.

Noise in the high-voltage power supply usually appears as undesired intensity modulation of the spot. The usual cause is corona discharge, arcing, or breakdown of capacitors and other dielectrics in the +8500-volt supply components. To locate the source of such a malfunction, first look for signs of arcing while the oscilloscope is operating; darkening the room may help. If no signs of arcing appear, measure the DC voltage at the test points and note any signs of jumpiness. Look for the test point where jumpiness is greatest. If the source of the breakdown still cannot be located, make resistance checks of suspect components or substitute new parts for C305, C306, C315, associated wires, R311, etc.

WARNING

Use great care in making voltage measurements when trouble shooting the high-voltage supply. The high-voltage power supply produces lethal voltages as high as +8500V. Read and understand each step before beginning. Work with one hand only and do not touch exposed wires or terminals with power applied.

USEFUL ILLUSTRATIONS OF THE HIGH-VOLTAGE POWER SUPPLY

Illustration	Figure No.	Page No.
Block Diagram	4-4	4-19, 4-20
Location of Test Points	4-15	4-48
Location of Parts	5-26	5-43
	5-27	5-45
Schematic Diagram	5-43	5-71, 5-72

4-6. BEAM FINDER CIRCUIT.

a. BEAM FINDER CIRCUIT FUNCTIONAL DESCRIPTION. The BEAM FINDER pushbutton switch reduces both the horizontal and vertical amplifier gains and momentarily brightens the CRT display. As a result, any elusive trace is brought to an on-screen position on the CRT and can be located with the regular positioning controls to remain in the center when the BEAM FINDER switch is released.

A simplified schematic of the beam finder circuit is shown in figure 4-5. The connection of the beam finder circuit to the main vertical amplifier is also shown in the functional block diagram of figure 4-8. To reduce the horizontal gain, the switch adds R268 in series with the cathode supply for V204/V205, greatly reducing the current supplied to this stage. Thus, with the BEAM FINDER pushed, the stage gain is low enough to restrict the deflection to within the exposed face of the CRT.

To reduce the vertical gain, the switch adds R88 in series with the cathode supply for V11A/V12B and V11B/V13B. The vertical gain is further reduced by lowering the common cathode voltage for V12A and V13A. A stabilizing resistor, R99, is used

TABLE 4-4. HIGH-VOLTAGE POWER SUPPLY TROUBLE SHOOTING

STEP	ACTION	RESULTS	NEXT STEP
1	Measure DC voltage at supply outputs (test points B1, B2, and B3).	If voltages are correct, check CRT.	
		One or more voltages are incorrect	2
2	Remove CRT socket.	If voltages return to normal, replace CRT.	
		Voltages still incorrect	3
3	Measure DC voltage at test points B1, B2, and B3.	Voltage at B1 incorrect	14
		Voltage at B2 incorrect	13
		Voltage at B3 incorrect	15
		All voltages low If all voltages high, check V301.	4
4	Observe waveform at test point B9.	If indication is normal (50-kc sine wave, indicated on schematic), check rectifiers and load on all three supplies.	
		Waveform incorrect, intermittent, or not present	5
5	Remove rectifiers V308 through V311, and observe waveform at test point B9.	Indication returns to normal	6
		Waveform still incorrect (Replace rectifiers for next step.)	7
6	Replace rectifiers one at a time and re-check waveform at test point B9.	Note which supply stops or causes incorrect oscillation. Check components including transformer T301 for that supply.	
7	Remove V301 and measure DC voltage at test point B8.	Voltage about -47 volts (voltage shown on 11 schematic in parentheses)	
		Voltage incorrect or intermittent	8
8	Measure DC voltage at test point B9.	Voltage about +366 volts	9
		Voltage incorrect	10
9	Measure DC voltage at test point B7.	If voltage is correct (+180 volts), check V304, T301, or C304.	
		If voltage is incorrect, check R302 and C303.	
10	Measure DC voltage at test point B10.	If voltage is correct (+370 volts), check V304, T301, or C304.	
		If voltage is incorrect, check L301 or +370 volt supply.	
11	Measure DC voltage at test point B5.	Voltage about -43 volts	12
		Voltage incorrect	13
12	Re-install V301 and measure DC voltage at test point B7.	Voltage about +170 volts	13
		If voltage is incorrect, check V301.	
13	Remove V301 and measure DC voltage at test point B2.	Voltage about -1940 volts	14
		Voltage incorrect	16

TABLE 4-4. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
14	Remove V301 and measure DC voltage at test point B1.	Voltage about -1760 volts	15
		If voltage is incorrect, check V310, C307, and C311.	
15	Remove V301 and measure DC voltage at test point B3.	If voltage is correct (10, 100 volts), check CRT and voltages at CRT elements.	
		If voltage is incorrect, check V308 and V309.	
16	Remove V301 and measure DC voltage at test point B2.	If voltage is correct (-1940 volts), check V311 and C308.	
		If voltage reading of -1940 volts is not obtained, check V311, C308, and T301.	

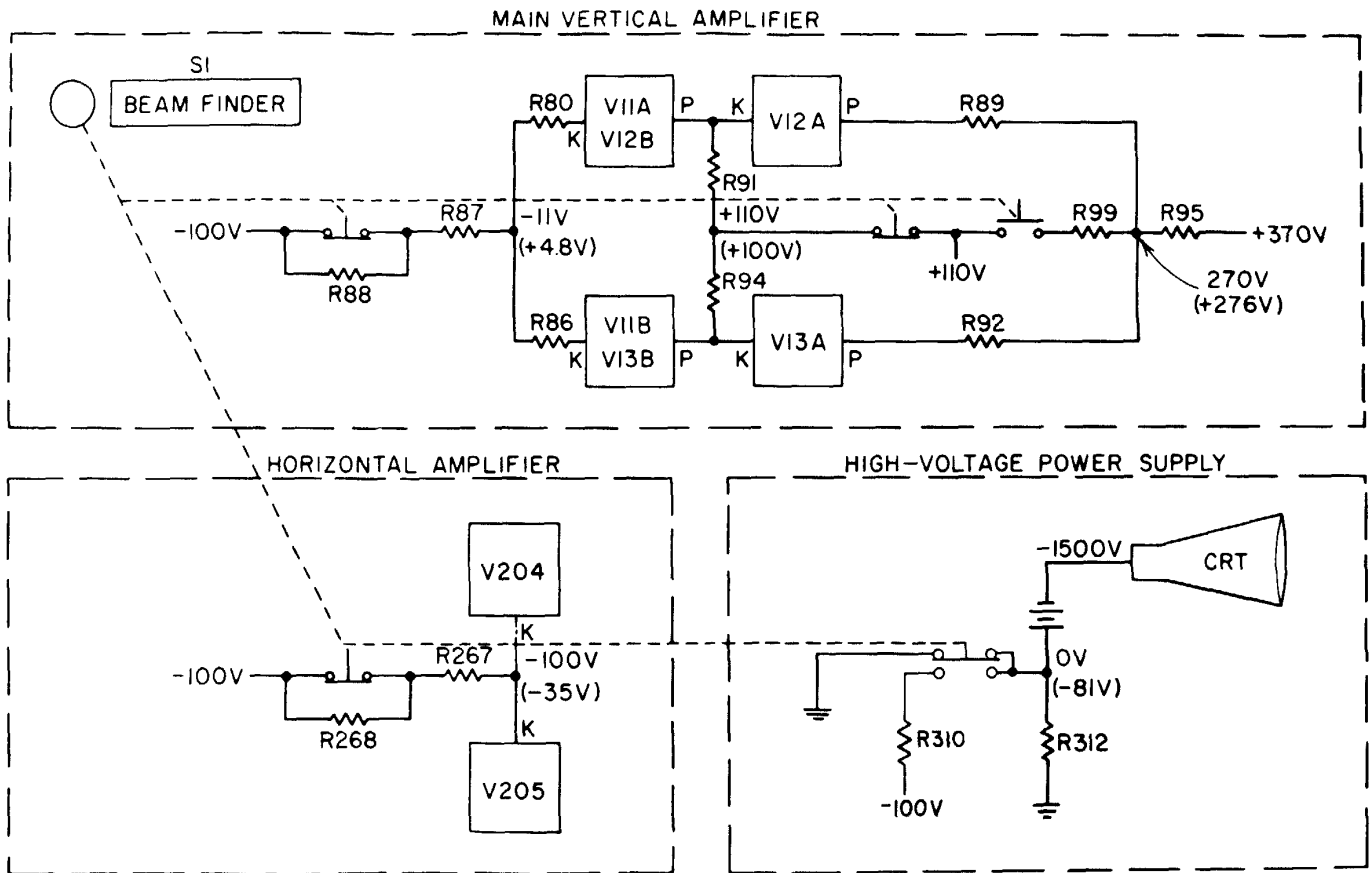
to keep the plate potential constant for these two tubes. As a result of these conditions, the vertical gain is low enough with the BEAM FINDER switch pressed that the beam cannot be deflected off the CRT face.

In the high-voltage supply, the -1500 volt cathode supply for the CRT is returned to -83 volts instead of to ground when the BEAM FINDER is pressed. This additional negative voltage at the CRT cathode causes the grid to become relatively more positive, and thereby overrides any cut-off bias voltage which may exist between the CRT grid and cathode, producing a brightened, defocused beam.

b. BEAM FINDER CIRCUIT TROUBLE SHOOTING. Trouble shooting the beam finder circuit assumes that the high-voltage supply, the main vertical amplifier, and the horizontal amplifier are known to be operating satisfactorily. Trouble symptoms in the beam finder circuit fall into four classes:

(1) spot cannot be centered horizontally, (2) spot cannot be centered vertically, (3) spot does not brighten, or (4) no spot.

The first step in trouble shooting the beam circuit is to measure the voltage differences given in figure 4-5. These will indicate the general location of the trouble. From the class of trouble and its general location, a logical choice can be made as to the faulty components. Tubes within the suspected circuit should be checked by comparison, and the required adjustments should be made if any tubes are replaced. If the tubes are operating correctly, check the BEAM FINDER switch, S1. With all power removed from the oscilloscope, use an ohmmeter to check continuity of the opened and closed circuits in the four-pole switch. If the switch, its wiring, and all connections are satisfactory, check the passive elements in the suspected circuit.



NOTE:

1. DC VOLTAGES MEASURED TO GROUND WITH A VTVM (AN/USM-116 OR EQUIVALENT).
2. VOLTAGES WITHOUT PARENTHESES ARE NORMAL VOLTAGES; VOLTAGES IN PARENTHESES ARE MEASURED WHILE BEAM FINDER SWITCH IS PRESSED.

Figure 4-5. Simplified Schematic, Beam Finder Circuit

4-7. MAIN VERTICAL AMPLIFIER.

a. MAIN VERTICAL AMPLIFIER FUNCTIONAL DESCRIPTION. The main vertical amplifier receives a balanced input signal from the MX-2930B/USM Vertical Plug-In Amplifier, amplifies this signal, and drives the CRT deflection plates. The main vertical amplifier consists of two etched circuit assemblies A1 and A2 located on each side of the upper oscilloscope chassis (see figure 5-9). The signal from the input circuit A1 is coupled to the output amplifier A2 through a pair of 0.2 microsecond delay lines DL1 and DL2 located around the fan housing, as shown in figure 5-4. The Main Vertical Amplifier Functional and Servicing Block Diagram is shown in figure 4-8.

Input etched circuit A1 includes a balanced input Cathode Follower V1 followed by a balanced Cascode Amplifier V2 and V3, and a separate four-stage, single-ended amplifier that supplies the internal sync signal to the sweep generator for use in generating an internal sweep trigger. By taking the sync signal from the vertical amplifier ahead of the delay lines, it is possible to start the sweep before the vertical signal that initiated the sync is presented to the CRT. Thus, the vertical signal is automatically synchronized with a horizontal time-variable sweep.

The cascode amplifier is a two-stage amplifier with a conventional grid-coupled input and a grounded-grid output. It is used to obtain the high gain of a pentode and the low noise of a triode. Figure 4-6 shows a simplified schematic of the V2/IV3 balanced cascode amplifier circuit. A positive input signal from the input cathode follower is fed to the control grid of V2B. The signal is amplified and the phase is shifted 180°. There is no additional phase shift in the grounded-grid section. The Gain Adj resistor, R13, in the cathode circuit adjusts the gain of the cascode amplifier and sets the overall gain of the main vertical amplifier.

Output amplifier A2 includes an input Cathode Follower V6, a Cascode Amplifier A11, A12, and A13 supplemented by a Constant Current Generator to permit DC coupling between the input and output stages. The Cross-Coupled Cathode Follower (shown in simplified form in figure 4-6) consists of tube V6A and B which provides a high input impedance load to the delay line and a low output impedance to drive the following cascode amplifier. To compensate for the tendency of the load to increase with frequency, the cathode followers are cross-coupled. Cross-coupling places the plate impedance of the opposite side in parallel with the cathode impedance of the first side, thus decreasing it. The crosscoupling capacitors C23 and C24 add this parallel impedance at the high frequencies only.

Constant Current Generator V7 provides a constant direct current through coupling resistors R52 and R68, thus producing a constant DC drop of about 150 volts across each resistor and allowing the following cascode amplifier grids to be operated at near 0 volts. A simplified schematic of this circuit is shown in figure 4-7. There is no significant loss in signal across the voltage-dropping network. R50 and R67 apply a small signal to each grid of V7, thereby maintaining a constant current through the tube as the plate voltage changes through the signal cycle. Capacitors C22 and C25 prevent DC shorting of the voltage drop; inductors L19

and L20 provide series resonance with the input capacity of V11A/B, V12B, and V13B to increase high frequency gain. Resistors R53 and R69 isolate the output capacity of V7 from the grids of V10, V11, V12, and V13. V8 and V9 are safety devices that prevent the voltage applied to the following grids from rising excessively in the event V7 fails or is removed from the socket during operation.

The final Cascode Amplifier uses parallel input triodes to double the gain without increasing the plate capacity in the output. The additional current required by the two parallel triodes is drawn through R91 and R94.

The cathode follower stages of V10A and V10B are used only when a special scanner plug-in unit is installed in place of the MX-3078/USM Auxiliary Plug-In Unit. At other times this stage has no effect on the main vertical amplifier circuit operation.

In the servicing block diagram (figure 4-8) and the schematic diagram for the main vertical amplifier (figure 5-37), the DC voltages shown at the test points are measured with the balanced amplifier stages in exact balance. In practice, various degrees of unbalance are normal. When the vertical position control is adjusted to balance the voltages of a particular stage, the voltages should be within about 10% of those shown and the CRT trace will normally be within 1 centimeter of center. Stage gain measurements are usually made at frequencies between 400 cycles and 20 kilocycles to avoid the loading effect of the test prod. Gain can also be measured at DC, using a DC voltmeter and by adjusting the vertical position control to provide the signal. The DC gain is equal to the AC gain.

b. MAIN VERTICAL AMPLIFIER TROUBLE SHOOTING. Trouble symptoms in the main vertical amplifier fall into four classes: (1) the spot cannot be centered vertically (DC unbalance); (2) high noise level (ripple or microphonics); (3) incorrect midband sensitivity; or (4) poor high-frequency (pulse) response. Three separate procedures are given for trouble shooting these problems in the troubleshooting chart, table 4-5. The procedure given for trouble shooting for DC unbalance should also be used in trouble shooting for excessive noise level. Before trouble shooting a problem of sensitivity, be sure that the DC balance and the CRT deflection sensitivity are satisfactory (CRT deflection sensitivity can be checked in response to horizontal deflection, indicating that proper high-voltage power supply voltages are applied to the CRT). Since proper pulse (high frequency) response depends upon suitable balance and midband sensitivity, the procedure for trouble shooting high frequency response is presented last in table 4-5, and presumes that the balance and midband sensitivity are properly set. The troubleshooting techniques upon which the step-by-step procedures of table 4-5 are based are discussed below.

The quickest way to isolate the source of noise or DC unbalance is to connect a jumper across corresponding circuit points on the top and bottom sides of the vertical amplifier. If this eliminates the noise or unbalance the trouble is ahead of the short; if the trouble persists, the source is after the short. The

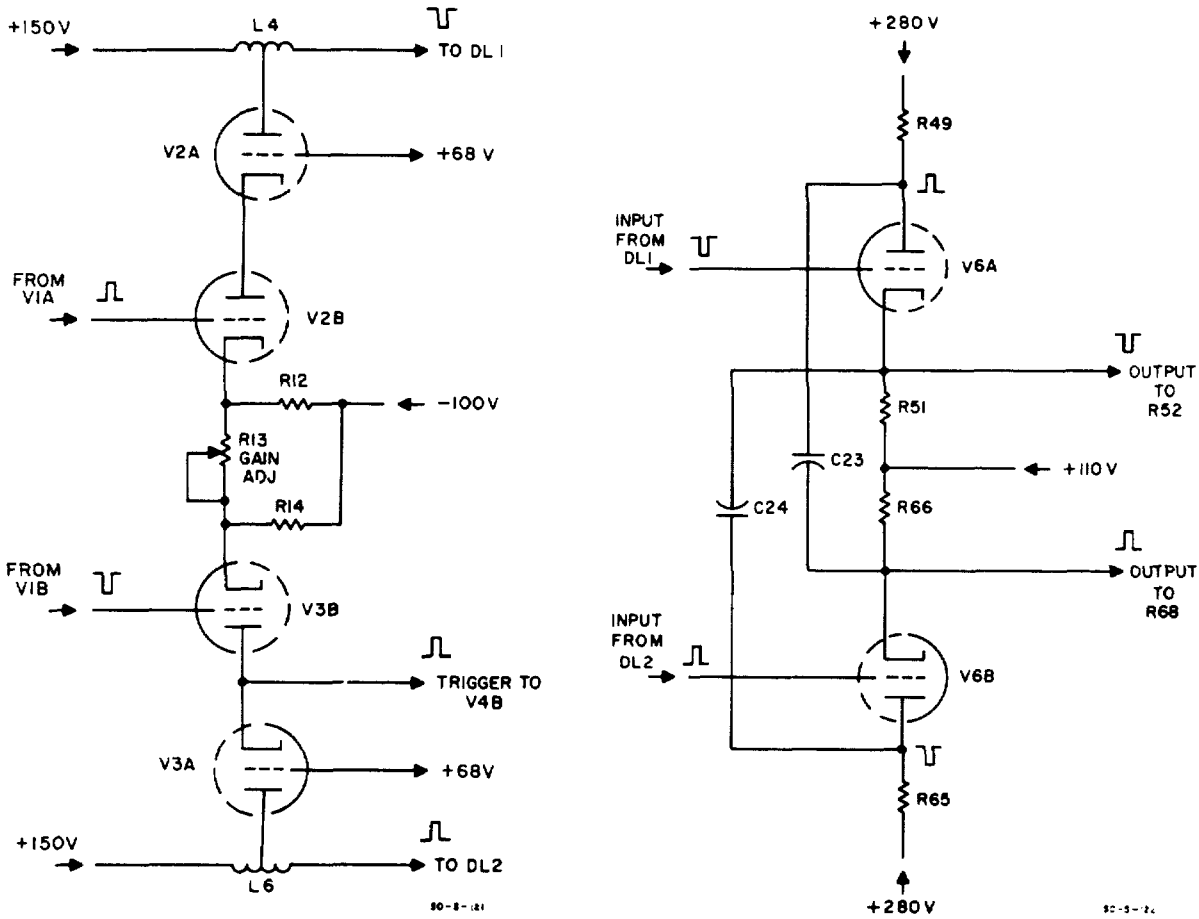


Figure 4-6. Cascode Amplifier/Simplified Schematic Diagram and Cross-Coupled Cathode Follower

noise level in the output, across test points E15 and E16, should not exceed 0.2 volt peak-to-peak. Sharp taps on the rear of the chassis should not produce a spot deflection of more than 5 millimeters.

The trouble-shooting procedure of table 4-5 utilizes this method of a "half-split" sequence, i.e., making the first test midway in the amplifier, the second test midway in the amplifier half found defective by the first test, and so on. After the trouble is isolated to a stage, the faulty part can be located by making DC voltage measurements and comparing them to the voltages given on the servicing block diagram and the schematic diagram.

Insufficient sensitivity (low gain) in the amplifier is usually caused by a weak tube, incorrect heater, or defective plate supply voltage. The method used to

isolate the source of low sensitivity is to apply a 400-cycle sine-wave signal directly to the vertical amplifier and then to make the AC measurements as shown on the servicing block diagram, figure 4-8. Again the "half-split" method is used, beginning at the center of the amplifier to determine which half is defective, going to the center of the defective half for the second test, and so on. The AC measurements are made across the two sides of the amplifier to simplify the readings. The measuring instrument used must not shift the vertical position of the trace when it is connected to the circuit. After the stage causing low sensitivity is repaired, adjust the Vert Gain control, R13, to obtain 2.5-centimeters vertical deflection with an 0.5-volt peak-to-peak input.

Before trouble shooting a problem of high frequency response, be sure that the DC balance and midband sensitivity are satisfactory. The test for correct pulse response is to apply a 1-mc square wave of near-perfect shape to the oscilloscope input. If any undershoot or overshoot is observed on the CRT, the most likely cause is a defective tube, lack of proper adjustment following replacement of a tube, or physical damage to the delay lines, their terminations, or any of the series-peaking coils on the vertical amplifier etched circuit assemblies.

USEFUL ILLUSTRATIONS OF THE
MAIN VERTICAL AMPLIFIER

Illustration	Figure No.	Page No.
Block Diagram	4-8	4-27, 4-28
Location of Test Points	4-19	4-52
Location of Parts	5-14	
	5-15	5-31
Schematic Diagram	5-37	5-59, 5-60

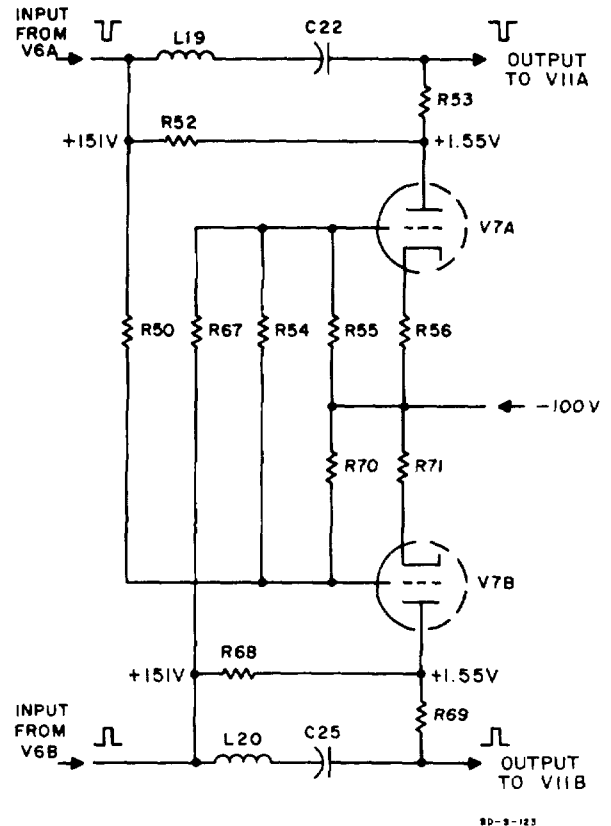


Figure 4-7. Constant Current Generator Simplified Schematic Diagram

TABLE 4-5. MAIN VERTICAL AMPLIFIER TROUBLE SHOOTING

STEP	ACTION	RESULTS	NEXT STEP
DC UNBALANCE			
1	Remove Dual Channel Vertical Plug-In. Set up controls to get spot or trace on screen.	Trace or spot is within ± 2 cm of center	2
		Trace or spot greater than ± 2 cm from center	3
2	Insert MX-2930B/USM Dual Channel Vertical Plug-In. Allow to warm up. Set to CHANNEL A and center spot with VERTICAL POSITION control. Repeat for CHANNEL B.	Trace can be centered in both CHANNEL A and CHANNEL B, with positioning controls near center of range. Main vertical and dual channel plug-in operating normally.	
		If trace can't be centered by one or the other or both positioning controls, with control approximately in center of range, refer to Dual Channel Plug-In Trouble Shooting procedure.	
3	Connect jumper between test points E5 and E6.	Trace centers	4
		Trace doesn't center	5

TABLE 4-5. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
4	Connect jumper between test points E3 and E4.	If trace centers, check DC voltages around V1A and V1B.	
		If trace doesn't center, check DC voltages around V2 and V3.	
5	Connect jumper between test points E11 and E12.	Trace centers	6
		Trace doesn't center	8
6	Connect jumper between test points E9 and E10.	Trace centers	7
		If trace doesn't center, check DC voltages around V7A/B.	
7	Connect jumper between test points E7 and E8.	If trace centers, check delay line.	
		If trace doesn't center, check DC voltages around V6A/B.	
8	Connect jumper between test points E13 and E14.	If trace centers, check DC voltages around V11A/B, V12B, V13B.	
		Trace doesn't center	9
9	Connect jumper between test points E15 and E16.	If trace centers, check DC voltages around V12A and V13A.	
		If trace doesn't center, check CRT and connections to CRT.	
SENSITIVITY			
10	Set up equipment as in table 5-7, step 10.	If peak-to-peak deflection is 4 cm \pm 0.2 cm, main vertical sensitivity is correctly set.	
		Peak-to-peak deflection is not 4 cm \pm 0.2 cm	11
11	Adjust Vert Gain R13 for peak-to-peak deflection of 4 cm \pm 0.2 cm.	If gain can be adjusted to correct sensitivity, main vertical amplifier is operating correctly.	
		R13 can't adjust deflection to 4 cm	12
12	Adjust R13 for maximum gain. Set CALIBRATOR signal to 0.5 volts peak-to-peak.	If vertical deflection is greater than 2.5 cm (peak-to-peak), main vertical amplifier is operating correctly. Repeat step 11.	
		Less than 2.5 cm deflection	13
13	Measure AC voltage between test points E5 and E6 with differential oscilloscope (AN/USM-140B with AM-3567/USM Plug-In).	AC voltage approximately 2.9 volts peak-to-peak	16
		AC voltage less than about 2.9 volts peak-to-peak	14
14	Measure AC voltage between test points E3 and E4.	If AC voltage is about 0.48 volt peak-to-peak, measure DC voltages around V2A/B and V3A/B, including heaters.	
		AC voltage low (less than about 0.48 volt peak-to-peak)	15

TABLE 4-5. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
15	Measure AC voltage between test points E1 and E2.	If AC voltage is about 0.5 volt peak-to-peak, measure DC voltages around V1A/B including heaters.	
		If AC voltage is low, check instrument set up.	
16	Measure AC voltage between test points E11 and E12.	AC voltage about 2.46 volts peak-to-peak	19
		AC voltage low (less than about 2.46 volts peak-to-peak)	17
17	Measure AC voltage between test points E9 and E10.	If AC voltage is about 2.54 volts peak-to-peak, check DC voltage around V7A/B, including heaters.	
		AC voltage low (less than about 2.54 volts peak-to-peak)	18
18	Measure AC voltage between test points E7 and E8.	If AC voltage is about 2.8 volts peak-to-peak, check DC voltages around V6A/B, including heaters.	
		If AC voltage is low (less than about 2.8 volts peak-to-peak), check delay line.	
19	Measure AC voltage between test points E13 and E14.	AC voltage about 0.84 volt peak-to-peak	20
		If AC voltage is low (less than about 0.84 volt peak-to-peak), check DC voltages around VIIA/B, V12B, and V13B.	
20	Measure AC voltage between test points E15 and E16.	If AC voltage is about 19.2 volts peak-to-peak, check connections to CRT, high-voltage power supply, and CRT.	
		If AC voltage is low (less than about 19.2 volts peak-to-peak), check DC voltages around V12A and V13A, including heaters.	
HIGH FREQUENCY RESPONSE			
21	Check main vertical amplifier rise time as in table 5-7, step 12.	If rise time (10-90%) is 11 nanoseconds or less, high frequency response is correct.	
		Rise time greater than 11 nanoseconds	22
22	Check DC unbalance by removing all connections from J1 (vertical plug-in connector).	Spot within +2 cm of center of screen If spot is not within ± 2 cm of center of screen, refer to DC unbalance trouble shooting procedure (step 1 of this procedure).	23
23	Check main vertical sensitivity as in table 5-7, step 10.	Peak-to-peak deflection is 4 cm ± 0.2 cm	24
		If peak-to-peak deflection is not 4 cm ± 0.2 cm, refer to sensitivity trouble shooting procedure (step 10 of this procedure).	

TABLE 4-5. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
24	Check main vertical amplifier passband as in table 5-7, step 11.	If 3-db point is higher than 30 mc, passband is correct.	
		3-db point is lower than 30 mc	25
25	Make a continuous check of frequency response from 50 kc to 35 mc.	If there are 110o dips or peaks in response, and 3-db point is higher than 30 mc, response is correct.	
		Dips or peaks present, or 3-db point is lower than 30 mc	26
26	Check DC voltages at test points E15 and E16 with spot centered.	Voltages are +180 volts -10 volts	27
		If voltages are not +180 volts 10 volts, make DC measurements throughout the amplifier until fault is located. Correct fault and repeat step 21.	
27	Set up equipment as in table 5-7. Adjust C31 (see Figure 5-3) and vertical deflection plate lead dress for flat top on pulse. Adjust C20, L1, and L2 for best corner on pulse.	If rise time (10-90%) is 11 nanoseconds or less, pulse response is correct.	
		If, with best setting of adjustments, rise time is greater than 11 nanoseconds: a. Check vertical deflection plate leads for poor connections. b. Replace tubes one at a time in the following order: V1, V6, V7, V12, V13, V11, V2, V3, V10, and V4. c. Short out inductor on opposite sides of the amplifier. If shorting on one side has same effect on pulse rise as opposite side, inductors are not faulty. If not, check and replace. Check pairs in the following order: L1 - L2 L3 -L5 L13 - L16 L14 - L17 L6- L3 L4- L6 L19- L20 L21 - L22 d. Check C22 and C25 by paralleling with good one or replacing. e. If there are steps on the pulse top at multiples of 0.2 microseconds apart, replace delay lines.	

4-8. HORIZONTAL AMPLIFIER.

a. HORIZONTAL AMPLIFIER FUNCTIONAL DESCRIPTION. The horizontal amplifier amplifies the internal sweep signal or an external signal applied to the horizontal INPUT connector, and drives the horizontal deflection plates of the CRT. The horizontal amplifier consists of three etched circuit boards: A201, located on the bottom (center, front) of the instrument; A203, located perpendicular to A201; and A202, the output circuit, located on the top (center, rear) of the instrument (see figures 5-9 and 5-10).

The Horizontal Amplifier Functional and Servicing Block Diagram is shown in figure 4-9. The sweep signal is applied through the HORIZONTAL DISPLAY switch to cathode follower V201A. From V201A the signal passes through cathode follower V202A and one side of a balanced attenuator to one input of a differential amplifier. Cathode follower V202B controls the second input to the differential amplifier through the other side of the balanced attenuator. The input to cathode follower V202B is grounded through a resistance.

The differential amplifier amplifies the difference between its two input signals and provides a balanced output signal, which is applied to cathode followers V206A and V206B. These cathode followers drive the CRT deflection plates. Cathode follower V206B also drives capacitance driver V207, which acts as the cathode resistance for cathode follower V206A. The capacitance driver, which is effective only at high frequencies due to the small value of coupling-capacitor C216, takes a small amount of signal from the cathode of V206B (positive-going sweep), inverts the signal, and adds it (in-phase) to the negative-going sweep at the cathode of V206A. Cap Driver Adj, C216, adjusts the amount of signal added so that differences in slope at the start of the sweep at both cathodes of V206 are canceled, resulting in a linear sweep at high sweep speeds.

External horizontal signals applied to the INPUT connector pass through an attenuator, cathode follower V201B, and the HORIZONTAL DISPLAY switch to cathode follower V201A. Otherwise the operation is the same as described above for the sweep signal.

The HORIZONTAL DISPLAY switch selects the signal to be applied to the horizontal deflection plates. The switch also controls the input attenuator and the balanced attenuator. The balanced attenuator provides a means of sweep expansion and in combination with the input attenuator provides steps of external horizontal sensitivity. The EXTERNAL VERNIER control varies the series resistance in the output of cathode follower V201B and thereby varies the output of V201B. The range of the EXTERNAL VERNIER is sufficient to provide continuous adjustment of external horizontal sensitivity between the calibrated settings of the HORIZONTAL DISPLAY switch.

A section of the BEAM FINDER switch is in the common cathode circuit of V204 and V205. When pressed, the switch reduces the gain so that an unbalance prior to V204 and V205 cannot deflect the CRT beam off the screen.

b. HORIZONTAL AMPLIFIER TROUBLE SHOOTING. Trouble symptoms in the horizontal amplifier fall into four classes: (1) the spot cannot be centered horizontally (DC unbalance); (2) high noise level (ripple or microphonics); (3) incorrect midband sensitivity; or (4) poor high-frequency response. Three separate trouble-shooting procedures are given for trouble shooting these problems in the trouble-shooting chart, figure 4-6. The procedure given for trouble shooting for DC unbalance should also be used in trouble shooting for excessive noise level. Before trouble shooting a problem of sensitivity, be sure that the DC balance and the CRT deflection sensitivity are satisfactory (CRT deflection sensitivity can be checked in response to vertical deflection, indicating that proper high-voltage power supply voltages are applied to the CRT). Since high-frequency response depends upon suitable balance and midband sensitivity, the procedure for trouble shooting high-frequency response is presented last in table 4-6, and presumes that the balance and midband sensitivity are properly set. The troubleshooting techniques upon which the step-by-step procedure of table 4-6 is based are discussed further below. Voltage measurements at test points are shown on both the servicing block diagram (figure 4-9) and the schematic diagram (figure 5-41).

The quickest way to isolate the source of noise or DC unbalance is to connect a jumper across corresponding circuit points on the top and bottom sides of the horizontal amplifier. If so doing eliminates the noise or unbalance, the trouble is ahead of the short; if the trouble symptom persists, the source is after the short. The noise level in the output, across test points C20 and C21, should not exceed 7 millivolts peak-to-peak. Sharp taps on the rear of the chassis should not produce a spot deflection of more than 5-millimeters.

The trouble-shooting procedure given in table 4-6 presents the above method of a "half-split" sequence, i. e., making the first test midway in the amplifier, the second test midway in the amplifier half that is found defective by the first test, and so on. After the trouble is isolated to a stage, the faulty part can be located by making DC voltage measurements and comparing them to the voltages given on the servicing block diagram and the schematic diagram.

Insufficient sensitivity (low gain) in the amplifier is usually caused by a weak tube, incorrect heater, or defective plate supply voltage. The method used to isolate the cause of low sensitivity is to apply a 400-cycle sine-wave signal to the front-panel horizontal INPUT connector and then make AC voltage measurements at the test points shown in the servicing block diagram. Again the "half-split" sequence is used, beginning at the center of the amplifier to determine which half of the amplifier is low in sensitivity, and then going to a point midway in the defective amplifier half. The AC measurements are made across the two sides of the amplifier to simplify the readings. The measuring instrument used must not shift the horizontal position of the trace when it is connected to the circuit. After the stage causing low sensitivity is repaired, apply a 1.0-volt

peak-to-peak input signal with the HORIZONTAL DISPLAY control set to 0.1 VOLTS/CM, and adjust the EXT. GAIN control, R212, to obtain 10-centimeters vertical deflection.

Before trouble shooting a problem of high-frequency response, be sure that the DC balance and midband sensitivity are satisfactory. The test for correct frequency response is to apply a 1-volt peak-to-peak, 400-cycle sine wave to the horizontal INPUT and note

the deflection sensitivity as in the previous procedure. Then change the input frequency to 1 megacycle while holding the input level constant, and note how much the deflection sensitivity decreases. The most likely cause of poor high-frequency response is a weak tube or lack of proper circuit adjustment following replacement of a tube.

TABLE 4-6. HORIZONTAL AMPLIFIER TROUBLE SHOOTING

STEP	ACTION	RESULTS	NEXT STEP
DC UNBALANCE			
1	Set the HORIZONTAL DISPLAY switch between INTERNAL SWEEP X1 and .1 VOLTS/CM positions.	If spot is exactly in the center of the graticule horizontally, DC balance is correct.	
		Spot not centered	2
2	Refer to paragraph 5-4d(1) (Balance) and perform adjustments.	If adjustments put spot exactly in the center of the graticule horizontally, DC balance is correct.	
		Adjustments don't center spot	3
3	Set the HORIZONTAL DISPLAY switch to 0.1. Short test point C13 to C14.	Spot appears on screen	4
		Spot does not appear on screen	7
4	Short test points C11 and C12.	Spot appears on screen	5
		If spot does not appear, check V203 circuit.	
5	Short test points C8 and C9.	Spot appears on screen	6
		If spot does not appear, check Q201 and Q202 circuits.	
6	Short test points C6 and C7.	If spot appears, check attenuator.	
		If spot does not appear, check V202 circuit.	
7	Short test points C16 and C17.	If spot appears, check V204 and V205 circuits.	
		Spot does not appear on screen	8
8	Short test points C20 and C21.	If spot appears, check V206A and B circuits.	
		If spot does not appear, check: a. V207 circuits b. Connections to CRT horizontal deflection plates c. Low-voltage power supply d. High-voltage power supply e. CRT	

TABLE 4-6. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
SENSITIVITY			
9	Check Horizontal Sensitivity Calibration as in table 5-5, steps 5 and 6.	If horizontal sensitivity meets performance standards, amplifier is correctly set.	
		Horizontal sensitivity does not meet performance standards	10
10	Make Horizontal Amplifier gain and balance adjustments as outlined in paragraph 5-4d.	Gain adjustments can be made	9
		Gain adjustments cannot be made	11
11	Set up equipment as in step 9. Measure the AC voltage between test points C13 and C14 with differential oscilloscope (AN/USM-140B with AM-3567/USM Plug-In).	AC voltage approximately 3.4 volts peak-to-peak	12
		AC voltage less than 3.4 volts peak-to-peak	14
12	Measure the AC voltage between test points C16 and C17.	AC voltage approximately 300 volts peak-to-peak	13
		If AC voltage is less than 300 volts peak-to-peak, check V204 and V205 circuits.	
13	Measure the AC voltage between test points C20 and C21.	If AC voltage is approximately 290 volts peak-to-peak, check: a. Connections to CRT b. DC voltage on CRT horizontal deflection plates c. V207 circuit d. CRT e. High-voltage power supply f. Low-voltage power supply	
		If AC voltage is less than 290 volts peak-to-peak, check circuit around V206A and B	
14	Measure the AC voltage between ground and test points C8 and C9.	AC voltage about 0.19 volt peak-to-peak at C8, and 0.175 volt at C9	15
		AC voltage at C8 and C9 not as above	16
15	Measure the AC voltage between test points C11 and C12.	If AC voltage is approximately 3.7 volts peak-to-peak, check circuit around V203A and B.	
		If AC voltage is less than 3.7 volts peak-to-peak, check circuit around Q201 and Q202.	
16	Measure the AC voltage between test point C5 and ground.	AC voltage approximately 0.4 volt peak-to-peak	17
		AC voltage less than 0.4 volt peak-to-peak	18

TABLE 4-6. (Continued).

STEP	ACTION	RESULTS	NEXT STEP
17	Measure the AC voltage between ground and test points C6 and C7.	If AC voltage is about 0.23 volt peak-to-peak at C6 and 0.13 volt peak-to-peak at C7, check circuit around V202A and B.	
		If AC voltages at C6 and C7 are less than above, check attenuator.	
18	Measure the AC voltage between test point C3 and ground.	If AC voltage is approximately 0.93 volt peak-to-peak, check circuit around V201A.	
		AC voltage less than 0.93 volt peak-to-peak	19
19	Measure the AC voltage between test point C2 and ground.	If AC voltage is approximately 1 volt peak-to-peak, check circuit around V201B.	
		If AC voltage is less than 1 volt peak-to-peak, check set up or input circuit.	
HIGH FREQUENCY RESPONSE			
20	Set up equipment as in table 5-5.	If frequency at which deflection on CRT decreases to 7.1 cm (3-db point) is greater than 1 mc, horizontal passband is acceptable.	
		3-db point less than 1 mc	21
21	Make adjustments as in paragraph 5-4d(3) (frequency compensation and external frequency compensation).	If adjustments can be made, passband is acceptable.	
		Adjustments cannot be made	22
22	Check DC balance and sensitivity as in DC unbalance, step 1, and table 5-5 horizontal sensitivity calibration.	DC balance and horizontal sensitivity correct	23
		If DC balance and horizontal sensitivity are incorrect, use DC Unbalance and	21
		Sensitivity trouble-shooting procedures to isolate the faulty component. Replace faulty component.	
23	Determine from step 2 if poor passband is in internal horizontal amplifier or external horizontal amplifier only.	Problem in external horizontal amplifier only	24
		Problem in internal horizontal amplifier	25
24	Check V201B and associated circuitry.	Replace defective component and repeat external frequency compensation, paragraph 5-4d	
25	Check DC voltage at horizontal deflection plates.	If voltage is +150 volts \pm 10 volts, check deflection plate lead dress.	
		If voltage is not +150 volts \pm 10 volts, make DC measurements in amplifier to locate faulty stage. Check stages in the following order: V204, V205, V207, V206, V203, Q201, V202, V201, CRT, and high-voltage power supply.	

4-9. SWEEP GENERATOR.

a. SWEEP GENERATOR FUNCTIONAL DESCRIPTION. The sweep generator produces a linear sawtooth waveform for sweeping the spot across the CRT. It also includes the circuit for synchronizing the start of the sawtooth with a specific voltage level on an applied signal. The sweep generator consists of two sections, the sweep generator circuit and the synchronizing circuit, both located on etched circuit A101 on the bottom of the oscilloscope chassis (see figure 5-10). The output of the sweep generator is connected through the HORIZONTAL DISPLAY switch to the horizontal amplifier. The Sweep Generator Functional and Servicing Block Diagram shows the functional circuit arrangement of the sweep generator. The circuits and operating modes are described below.

(1) SYNCHRONIZING CIRCUIT. The synchronizing circuit consists of an input amplifier V101 and a Schmitt trigger V103. The input amplifier is composed of two triodes, V1011A and V101B, which receive the input sync signals as selected by TRIGGER SOURCE switch S101. When the amplified signal drives the V103 grid through the lower hysteresis limit, V103 produces a negative pulse at the plate of V103B, which is differentiated by the following coupling network to supply a negative spike to the input grid of V104A/V105A, also a Schmitt trigger.

The Schmitt trigger circuit is a form of bi-stable multivibrator used where fast-rising signals are required. Figure 4-10 shows a simplified Schmitt trigger circuit with input and output waveforms. The output of the circuit is a voltage step, either positive or negative depending upon the slope of the input. The input voltage levels at which a Schmitt trigger circuit switches are its hysteresis limits. Note that the circuit does not switch unless the input crosses both limits.

The TRIGGER LEVEL control sets the zero-signal output level of trigger amplifier V101. Since the trigger amplifier is DC coupled to trigger generator V103, the control determines the voltage levels the trigger signal must cross if the amplified trigger signal is to cross the hysteresis limits of V103. The TRIGGER SLOPE switch determines whether or not the trigger amplifier inverts the trigger signal and thereby determines whether the sweep starts on the positive-going or negative-going portion of the trigger signal.

(2) SWEEP GENERATOR CIRCUIT. Gate generator V104/V105A is a Schmitt circuit with wide hysteresis limits. Between sweeps, the A section of bias control cathode follower V113 holds the bias at the input of the gate generator close to the lower hysteresis limit. Trigger generator V103 applies both positive and negative triggers. The positive triggers are reduced in amplitude and have no effect, but a negative pulse drives the input to the gate generator below the lower hysteresis limit and causes the gate generator to switch.

When it switches, gate generator V104/V105A provides a positive and a negative gate. The positive gate is applied to the high voltage power supply to turn on the CRT beam and to the front-panel GATE OUTPUT connector for external use. The negative gate applies reverse bias to switch diode CR104. Prior to the

gate, the switch diode had been forward-biased and had been holding the input to integrator V109 at about zero volts. The negative gate opens the diode switch and frees the input to the integrator.

Once freed, the input to integrator V109 starts going negative because it is connected to -100 volts through the sweep resistor. The integrator amplifies and inverts its input to produce a large, positive-going output which is applied back to the input through cathode follower V115 and the sweep capacitor. As a result, the voltage at the input to integrator V109 changes by about one volt during sweep time. The voltage across the sweep resistor, then, changes by about 1%, and the current through the resistor changes by the same amount. The current through the sweep resistor is the charging current for the sweep capacitor; therefore the voltage across the sweep capacitor changes quite linearly with time, and the sweep signal is a nearly linear voltage ramp.

The SWEEP TIME switch changes the value of sweep resistor or capacitor to change the sweep time. The sweep output is applied to the horizontal amplifier and to the front-panel SWEEP OUTPUT connector.

An attenuated sweep signal is applied to the input of gate generator V104/V105A through hold-off cathode follower V114A and section B of bias control cathode follower V113. This signal drives the input of the gate generator up to the upper hysteresis limit and causes the gate generator to switch back to its pre-sweep state. The gate generator then ends the gates, blanking the CRT and forward-biasing switch diode CR104. The switch diode returns the input to integrator V109 to its pre-sweep level, discharging the sweep capacitor.

During the time period of one sweep, hold-off cathode follower V114A charges a hold-off capacitor. After the sweep ends, this capacitor lets the input to gate generator V104/V105A down slowly enough to prevent that circuit from being triggered again until the remaining sweep circuits have recovered completely. The SWEEP TIME switch changes the size of the hold-off capacitor to match the selected sweep time.

Clamp V105B ensures that each sweep starts from the same voltage level, about -50 volts.

The SWEEP MODE control determines the no-signal bias at the input to gate generator V104/V105A by setting the bias on the A section of bias control cathode follower V113. With the control set to PRESET or in the TRIGGER portion of its adjustable range, the gate generator bias cannot drop below its lower hysteresis limit unless the trigger generator provides a trigger. With the control set in the FREE RUN portion of its adjustable range, the gate bias is allowed to drop below its lower hysteresis limit. Thus as the hold-off capacitor discharges, it lets the gate generator bias all the way down to the lower hysteresis limit, and another sweep starts automatically without requiring a trigger.

(3) SINGLE SWEEP OPERATION. The SWEEP OCCURRENCE switch selects normal or single-sweep operation. Normal operation is discussed above. For single-sweep operation, the

SWEEP OCCURRENCE switch converts V113 into a Schmitt circuit. As the sweep signal from hold-off cathode follower V114A rises to end the gate from the gate generator, the sweep signal also switches the Schmitt circuit of V113 so that V113B conducts and V113A is cut off. The B section of V113 then holds the input to gate generator V104/V105A high enough so that triggers from the trigger generator cannot actuate the gate generator, and the sweep generating circuits are effectively disabled. A positive signal applied to V113A switches the Schmitt circuit of V113 so that V113A conducts and V113B is cut off. The "A" section of V113 then sets the input to the gate generator according to the setting of the SWEEP MODE control, and the sweep generating circuits are effectively armed. The switching signal for V113A can be an external signal applied to the ARMING INPUT connector or an internal signal obtained from the SWEEP MODE control when the control is rotated just out of PRESET.

b. SWEEP GENERATOR TROUBLE SHOOTING. To begin trouble shooting the sweep generator, first determine whether the sync circuit operates satisfactorily by measuring the output waveform at test point D4 (see figure 4-18). AC and DC voltage measurements and waveforms useful in trouble shooting, and conditions for their measurement, are given in both the block diagram (figure 4-11) and the schematic diagram (figure 5-38). If the waveform is not present or is low in amplitude, check AC waveforms in the sync circuit. Waveforms on the schematic are given for a 2-volt peak-to-peak 400-cycle sine-wave input at INPUT J101. If the waveform has the indicated amplitude, an incorrect non-operating sweep will probably be due to a fault in the sweep generator circuit. Trouble symptoms in the sweep circuit fall into three classes: (1) sweep out of calibration, (2) non-linearity, or (3) no sweep. A step-by-step procedure for localizing the cause of a non-operative sweep is given in the trouble-shooting chart for the sweep generator, table 4-7. Trouble shooting techniques for improper calibration and non-linearity, and a further discussion of the technique for localizing the trouble causing a non-operative sweep are given below.

If the sweep rate as measured with a time-mark generator is found to be out of calibration (on only certain ranges, the probability is that the adjustment for those ranges is not properly set. If all ranges are out of calibration, the probability is that the horizontal amplifier sensitivity is not properly set or the CRT sensitivity is down.

If the sweep is found to be non-linear the probability is that the horizontal amplifier or the CRT is defective: check the horizontal amplifier according to its trouble-shooting procedure for poor high frequency response.

If the sweep circuit produces no sweep signal, the first item to check is the waveform at test point D4, to determine whether the gate generator receives and input signal. Then measure the output of the gate generator at test point D11 (see figure 4-18) to see if it has been switched (-6.8 volts if it has; -3.6 volts if it has not). If the gate generator has not been switched, check tubes in gate

and hold-off circuits (V104, V105, V113, and V114). If the gate generator has been switched, check tubes and diodes in the integrating circuit (V109, V115, V105B, CR103, and CR104). A non-operating sweep can be caused by faults other than defective tubes. Table 4-7 gives a systematic procedure for locating the cause of a non-operating sweep.

USEFUL ILLUSTRATIONS OF THE
SWEEP GENERATOR

Illustration	Figure No.	Page No.
Block Diagram	4-11	4-39, 4-40
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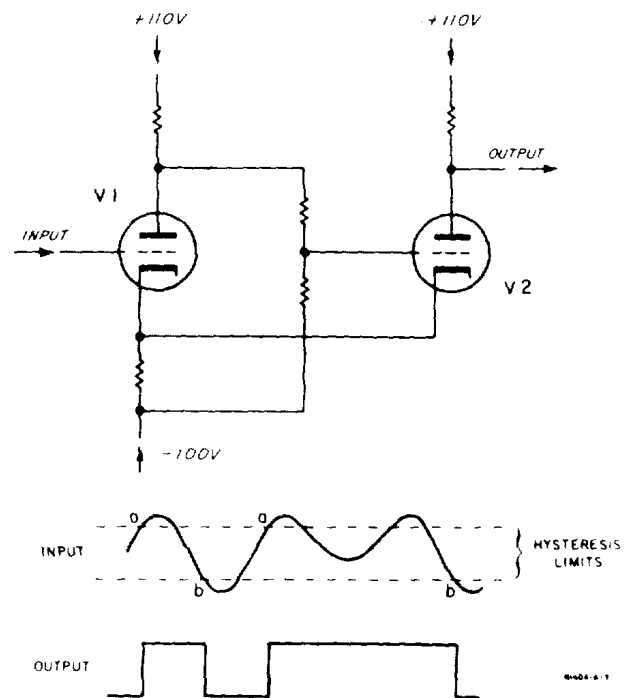


Figure 4-10. Schmitt Trigger Simplified Circuit with Waveforms

TABLE 4-7. SWEEP GENERATOR TROUBLE SHOOTING

STEP	ACTION	RESULTS	NEXT STEP
NO SWEEP			
1	Unsolder the C109 end of R124.		2
2	With a clip lead, connect R124 to ground then -100 volts. Measure the DC voltage at test point D15.	DC voltage changes from -50 volts to +84 volts	3
		Not as above	9
3	Same as step 2. Measure the DC voltage at test point D19.	-67 volts to -3 volts	4
		Not as above	6
4	Same as step 2. Measure the DC voltage test point D6.	-38 volts to -5 volts	5
		Not as above	8
5	Same as step 2. Measure the DC voltage test point D21.	+9 volts (normal)	
		If not +9 volts, SWEEP MODE is not in PRESET, or problem is in preset circuit or V113A.	
6	Same as step 2. Measure the DC voltage at test point D17.	-75 volts to -8.4 volts If not as above, check sweep length circuit.	7
7	Same as step 2. Measure the DC voltage at test point D18.	If voltage is -67 volts to -3 volts, check horizontal plug-in connections (be sure plug-in is set for NORMAL sweep).	
		If not as above, check V114A circuit.	
8	Same as step 2. Measure the DC voltage at test point D20.	If -38 volts to -.04 volt, V113B is operating correctly.	
		If not as above, check V113 circuit.	
9	Same as step 2. Measure the DC voltage at test point D11.	-4.2 volts to -6.6 volts	10
		If not as above, refer to steps 14 and 16, or check CR103.	
10	Same as step 2. Measure the DC voltage at test point D13.	+67 volts to -332 volts	11
		Not as above	12
11	Same as step 2. Measure the DC voltage at test point D-4.	If -58 volts to +83 volts, check V115 circuit.	
		If not as above, check circuit around R156, C123, R157, and R313, or high-voltage power supply.	
12	Same as step 2. Measure the DC voltage at test point D12.	If -4.6 to -7.0 volts, check V109 circuit.	
		If not as above, check CR104 circuit.	
13	Same as step 2. Measure the DC voltage at test point D16.	If -50.8 volts to -52.0 volts, check CR103 and V105B circuit.	
		Not as above	14

TABLE 4-7. (Continued)

STEP	ACTION	RESULTS	NEXT STEP
14	Same as step 2. Measure the DC voltage at test point D8.	+7.8 volts to +110 volts	15
15	Same as step 2. Measure the DC voltage at test point D9.	If not as above, check V105 circuit, V104A/B circuit, and CR101.	
		If -51.7 volts to -16.7 volts, check V105A circuit.	
16	Same as step 2. Measure the DC voltage at test point D10.	Not as above	16
		If -1.83 volts to -17.6 volts, check V104B.	

4-10. CALIBRATOR CIRCUIT.

a. CALIBRATOR CIRCUIT FUNCTIONAL DESCRIPTION. The calibrator is located on the high-voltage power supply etched circuit assembly, and is shown on the schematic diagram for the high voltage power supply, figure 5-43. It consists of a type 7308 tube (V306) connected as a free-running 1KC multivibrator, a diode clamp V307A to limit the positive-going voltage at the output plate of the multivibrator, and a second diode V307B in series with the output signal to prevent the voltage at the CALIBRATOR output connectors from going negative as the output plate passes the 0-volt level during half of the cycle. Thus, the calibrator circuit produces an output 1KC square wave voltage which is clipped on negative and positive peaks at 0 and +110 volts. This output is applied to an attenuator which provides calibrated outputs in volts and millivolts. When the CALIBRATOR switch is set to OFF, the output side of the multivibrator is cut off by an applied grid bias of -100 volts.

b. CALIBRATOR CIRCUIT TROUBLE SHOOTING. Problems in the calibrator fall into four categories: (1) no output, (2) poor symmetry and/or

period, (3) low amplitude on all ranges, or (4) poor calibration on some ranges. Table 4-8 is the troubleshooting chart for the calibrator circuit.

In all cases of trouble, except for poor calibration on only some of the ranges (category 4), first check tubes V306 and V307 while observing the output waveform and the output plate waveform as instructed in the procedure of table 4-8. Although tube element voltages are shown in the schematic diagram for the calibrator, practically all troubles will be found by replacing tubes and observing the output waveform. Poor calibration on only certain ranges almost certainly points to damaged resistors in the range selector switch S302.

WARNING

Very high voltages are present in the vicinity of the calibrator circuit. Turn off the oscilloscope when making connections.

TABLE 4-8. CALIBRATOR CIRCUIT TROUBLE SHOOTING

STEP	ACTION	RESULTS	NEXT STEP
1	Check calibrator waveform at CALIBRATOR OUTPUT (test point F1).	No output	2
		Symmetry not within 45% to 55%	3
		Period not within 0.9 to 1.1 milliseconds	3
		Amplitude not within $\pm 3\%$ on all ranges	3
		Poor waveform	3
		Amplitude not within $\pm 3\%$ on certain ranges	4
2	Check waveform at test point F3 or F5	If waveform is as indicated on schematic, check V307 by replacement.	
		If waveform is incorrect, check V306 by replacement.	
3	Check V306 and V307 by replacement, and observe output waveform.	If no improvement, check resistors and capacitors in multivibrator circuit.	
4	Turn instrument off and measure resistors on CALIBRATOR range switch.	If comparison with the values shown on the schematic diagram shows a value to be in error, replace the resistor.	

4-11. MX-2930B/USM VERTICAL PLUG-IN UNIT.

a. MX-2930B/USM VERTICAL PLUG-IN FUNCTIONAL DESCRIPTION. This Dual-Trace Preamplifier vertical plug-in unit receives one or two input signals from external sources, amplifies them, combines them in one of four different ways, and applies them to the main vertical amplifier input. The plug-in contains two separate differential amplifiers on etched circuit A501 and a switching circuit on etched circuit A502. The outputs of both amplifier channels are connected in parallel, and each provides a balanced output to drive the main vertical amplifier. The front-panel Vertical Presentation Switch (S505), however, allows only one amplifier to operate at a time. S505 operates the switching circuit to turn on either one amplifier or the other (individual Channel A or Channel B operation), or to alternately turn on one amplifier during one sweep and the other amplifier on the next sweep (ALTERNATE operation), or to turn on the amplifiers alternately in 1-microsecond segments during each sweep (CHOPPED operation). A fourth mode of operation, A-B, connects the A and B channel inputs to opposite sides of the Channel A differential amplifier.

The Vertical Plug-In Functional and Servicing Block Diagram, figure 4-13, gives a simplified version of the circuits and switching arrangements. Basically, the circuit consists of two identical input attenuators, two identical amplifier channels, and a switching circuit as described in detail below.

(1) INPUT ATTENUATORS. Each input attenuator divides its signal in a calibrated ratio for each setting of the SENSITIVITY switch to give sensitivities of 0.02 to 20 volts per centimeter. Except for the 0, 02 VOLTS/CM range, each range is provided with a compensating attenuator (Atten Comp) to maintain these ratios for high frequencies by capacitive division. Each range also has a capacitor (Cap. Adj) for adjusting input capacity, so that frequency compensation with the test prod will be constant on all ranges.

(2) AMPLIFIERS. Each of the two amplifying channels consists of four stages: two balanced cathode follower stages, a common-base transistor amplifier, and a balanced output cathode follower stage. The SENS CAL control, R504 (R546), varies the bias on the second cathode follower stage, causing a gain variation of between 0.4 and 0.7. The BAL control, R508 (R543), balances the DC levels at the cathodes of V502A/B (V505A/B), so that no vertical shift takes place when the POLARITY switch is operated. The signal from V502A/B (V505A/B) drives the emitters of the transistor amplifier Q501/Q502 (Q503, Q504). This stage is controlled by the switching circuit, being either cut off or operating as determined by the bias supplied through CR501 (CR505). The output cathode followers drive the main vertical amplifier in the AN/USM-140B. The VERTICAL POSITION control, R520 (R530), varies the DC levels at the grids of V503A/B (V506A B), and since the main vertical amplifier is also DC-coupled, these DC levels will determine the vertical position of the trace on the CRT.

(3) SWITCHING CONTROL CIRCUIT. The switching control circuit consists of a multi-vibrator, an amplifier, and a Vertical Presentation Switch. With the Vertical Presentation Switch at position A, both the input and output of the switch signal amplifier are disconnected, and the signal from input A is connected

to the A Channel amplifier (V501A/B), and the input B to the B Channel (V504A/B) amplifier. Negative bias is applied to switch off the B half (V508B) of the multivibrator. CR505 conducts, applying a positive voltage to the bases of transistors Q503, Q504, thereby switching off Channel B. With the A half (V508A) conducting, diode CR501 cuts off, and with Q501, Q502 conducting, Channel A is free to amplify the signal from input A. The reverse is true with the Vertical Presentation Switch on position B.

On CHOPPED, the negative bias is eliminated, and the switching multivibrator free runs at a frequency set by C509 and C510, switching on and off Channels A and B. Breakdown diode CR506 limits the saturation to assure the multivibrator self-starting. During chopping, the transient at the beginning of each chop is high. Blanking out the oscilloscope trace at such times erases the transients from observation, and the smooth chopped traces shown in figure 4-18 result. The blanking signal to the CRT is derived from the switching multivibrator, transferred through CR502 and CR503, amplified by V507A, and isolated by cathode follower V507B. Diode CR504 clips off all the negative pulses; the positive pulses are applied to the cathode of the CRT to blank the switching transient.

On A-B, the switching multivibrator switches Channel A on and Channel B off. The signal input to B is applied to the lower half of differential amplifier A, and the differential input, Channel A minus Channel B, is amplified and presented.

On ALTERNATE, the switching multi-vibrator is rendered bi-stable by applying negative bias on both halves. Pulses, from the oscilloscope, and synchronized with the horizontal sweep signal, are amplified by the switch signal amplifier (V507A /B) to trigger the switching multi-vibrator, presenting the signals A and B on the screen on alternate sweeps.

b. MX-2930B/USM VERTICAL PLUG-IN TROUBLE SHOOTING. Trouble shooting the vertical plug-in unit presumes that the main vertical amplifier in the oscilloscope is known to be operating satisfactorily. Trouble symptoms in the plug-in unit fall into six classes: (1) the spot cannot be centered vertically (DC balance) in one of the channels; (2) high noise level (ripple or microphonics) in one of the channels, (3) midband sensitivity is low in one of the channels, (4) poor high-frequency (pulse) response, (5) no ALTERNATE operation, or (6) no CHOPPED operation.

Test points and voltage measurements that are useful in trouble shooting are shown on the servicing block diagram, figure 4-13 and the schematic diagram, figure 5-46. A vertical plug-in extender which permits operation of the vertical plug-in unit outside the chassis for convenient access to test points, etc., can be constructed as shown in figure 4-12.

The first step in trouble shooting is to determine if the trouble symptom occurs in one or both of the amplifier channels or in the switching circuit. To determine if the switching circuit operates, measure its tube socket voltages and compare them against those given in the block diagram or schematic diagram.

For the switching multi-vibrator to turn on the Channel A (Channel B) amplifier, a negative voltage must appear at the plate of V508B (V508A). When the Vertical Presentation Switch is set to ALTERNATE, each unblanking pulse from the sweep generator must cause V508 to switch from one state to the opposite state. When set to CHOPPED, V508 must oscillate at approximately 1 megacycle. To trouble shoot either of the amplifiers, refer to the trouble-shooting data given for the main vertical amplifier.

The quickest way to isolate the source of noise or DC unbalance in either of the amplifiers is to connect a jumper across the corresponding circuit test points on the top and bottom sides of the amplifier. If so doing eliminates the noise or unbalance, the trouble is ahead of the short; if the trouble symptom persists, the trouble is after the short.

Before trouble shooting a problem of sensitivity, be sure that the DC balance is satisfactory, and that the main vertical amplifier sensitivity is properly set. Low gain in the amplifier is usually caused by a weak tube or transistor or incorrect supply voltages. AC measurements for obtaining the gain of each stage are given in the block diagram, for an input of 0.05 volts peak-to-peak. Use a differential oscilloscope (AN. USM-140B with AM-3567/USM Plug-In) for measuring low-level peak-to-peak voltages between test points indicated. Progress in numerical order through both

amplifiers until the low gain stage is located. Set the Vertical Presentation Switch to the appropriate channel position for measuring channel gain.

Before trouble shooting a problem of high-frequency response, be sure that the attenuator compensation adjustments are correctly set, and that DC balance, R508 (R543), and midband sensitivity, R504 (R546), are satisfactory. The most likely cause of inadequate high-frequency response is a defective tube or transistor or lack of proper circuit adjustment following replacement of a tube or transistor. Be sure that L501, L502, L511, and L512 have been correctly set.

USEFUL ILLUSTRATION OF THE MX-2930B USM
VERTICAL PLUG-IN

Illustration	Figure No.	Page No.
Block Diagram	4-13	4-45, 4-46
Location of Test Points	4-21	4-54
	4-22	4-54
Location of Parts	5-30	5-49
	through	through
	5-34	5-55
Schematic Diagram	5-46	5-77, 5-78

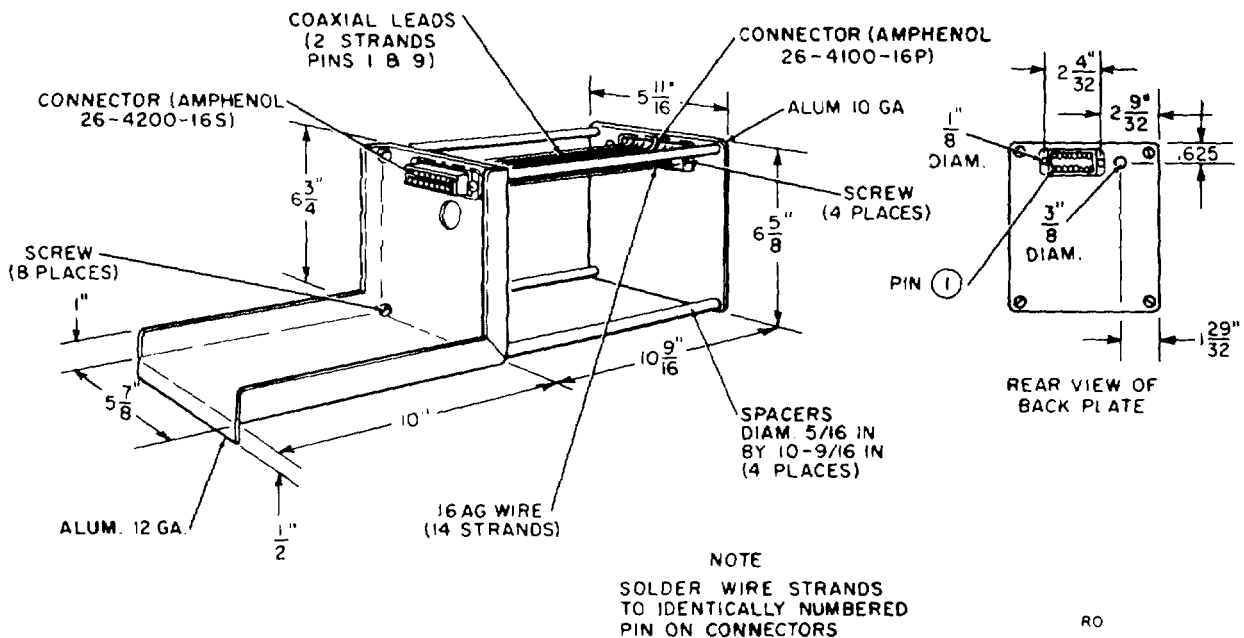


Figure 4-12. Construction of Vertical Plug-In Extender 162A-39A

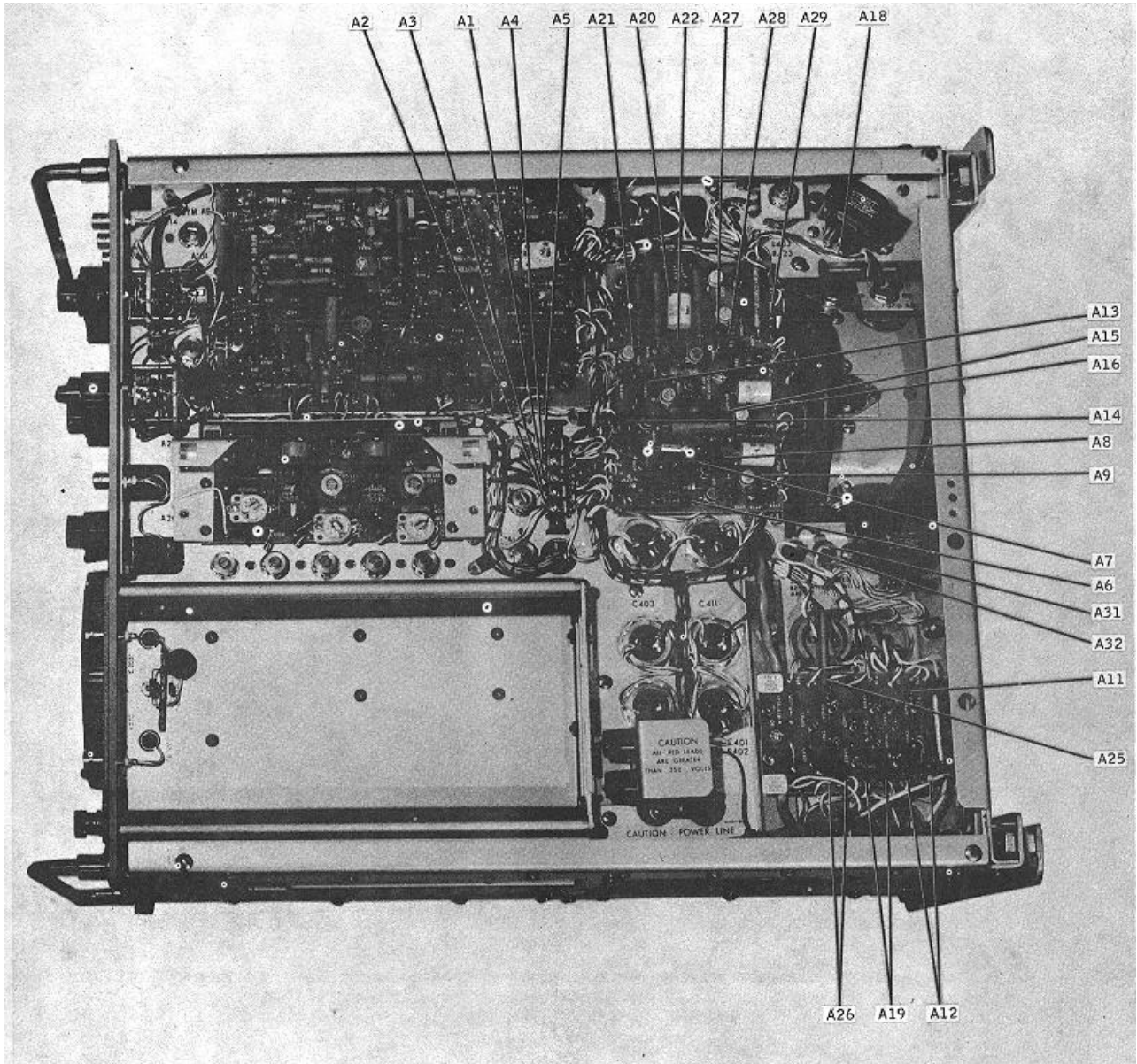


Figure 4-14. Bottom View, Location of Test Points on Low-Voltage Power Supply

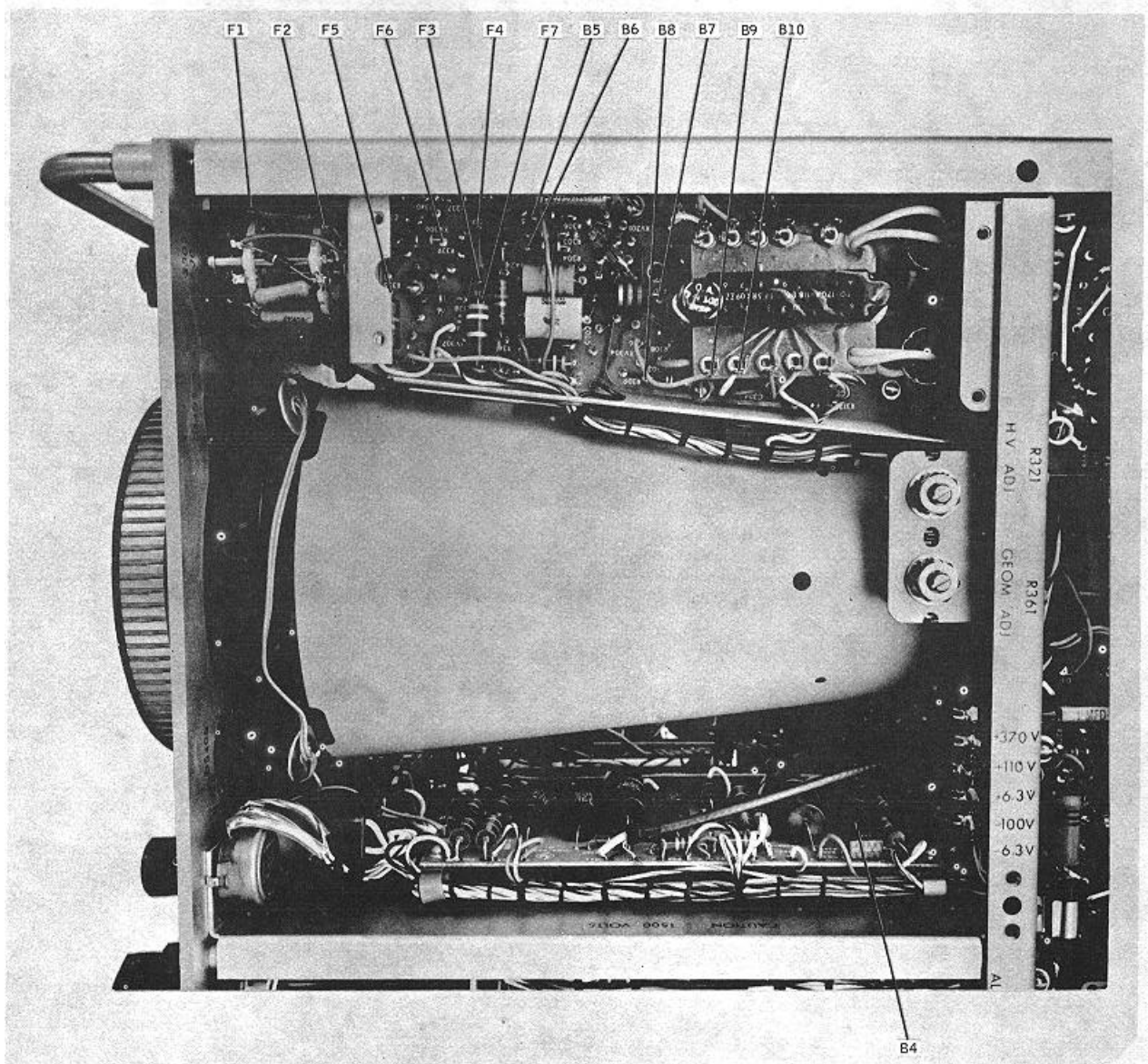


Figure 4-15. Top View, Location of Test Points on High-Voltage Power Supply

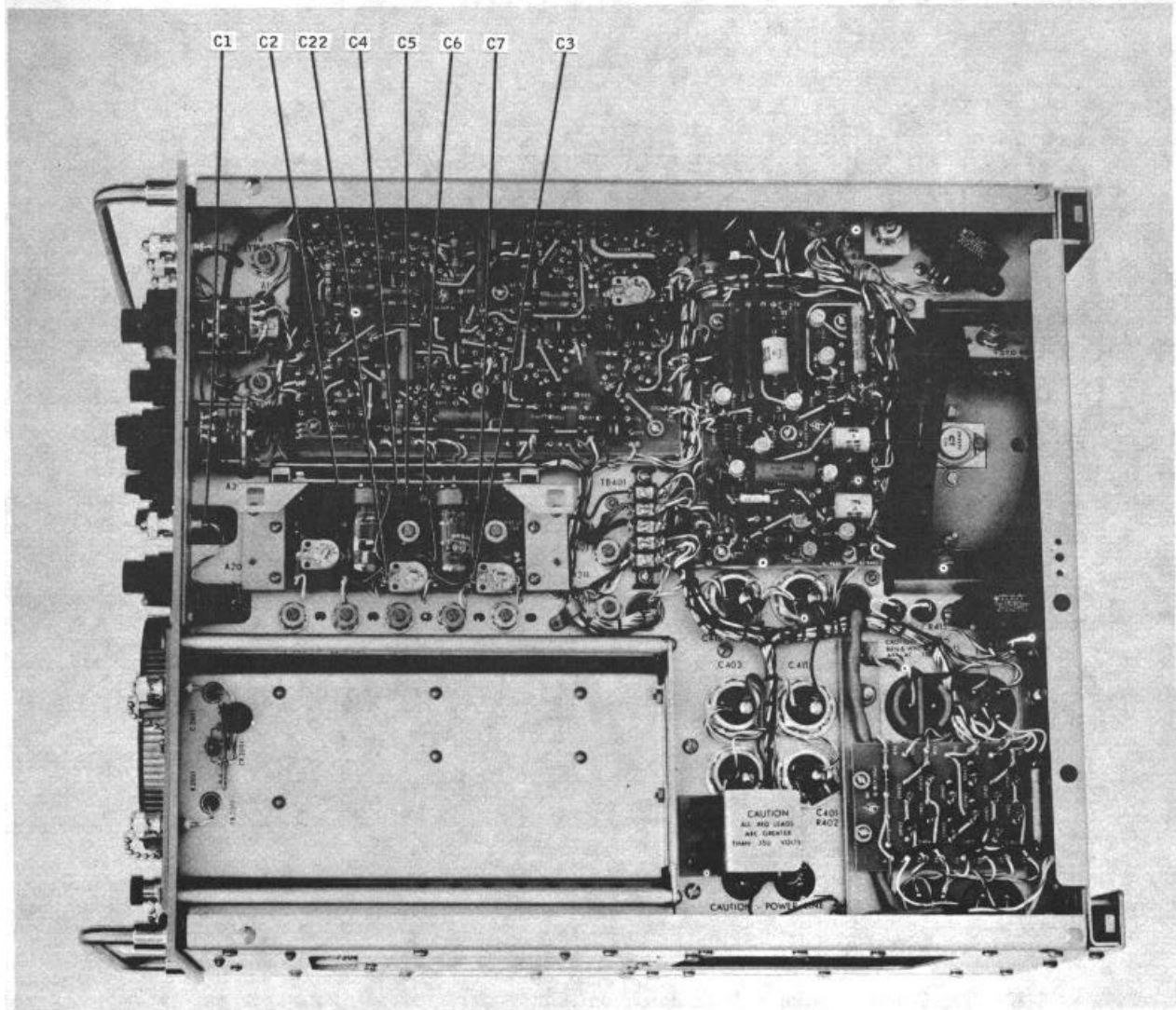


Figure 4-16. Bottom View, Location of Test Points on Horizontal Preamplifier Assembly

ORIGINAL

UNCLASSIFIED

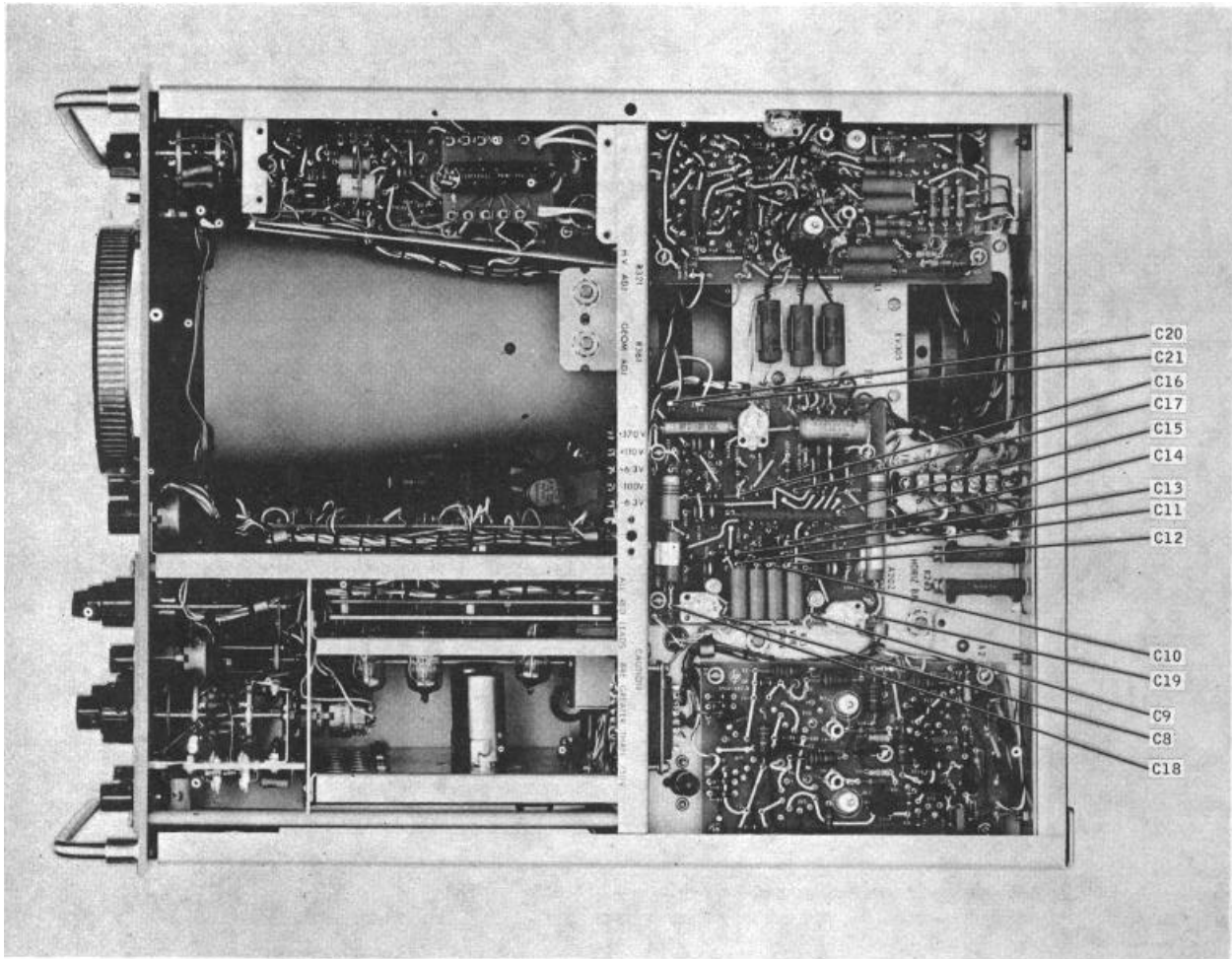


Figure 4-17. Top View, Location of Test Points on Main Horizontal Amplifier and Driver Assembly

ORIGINAL

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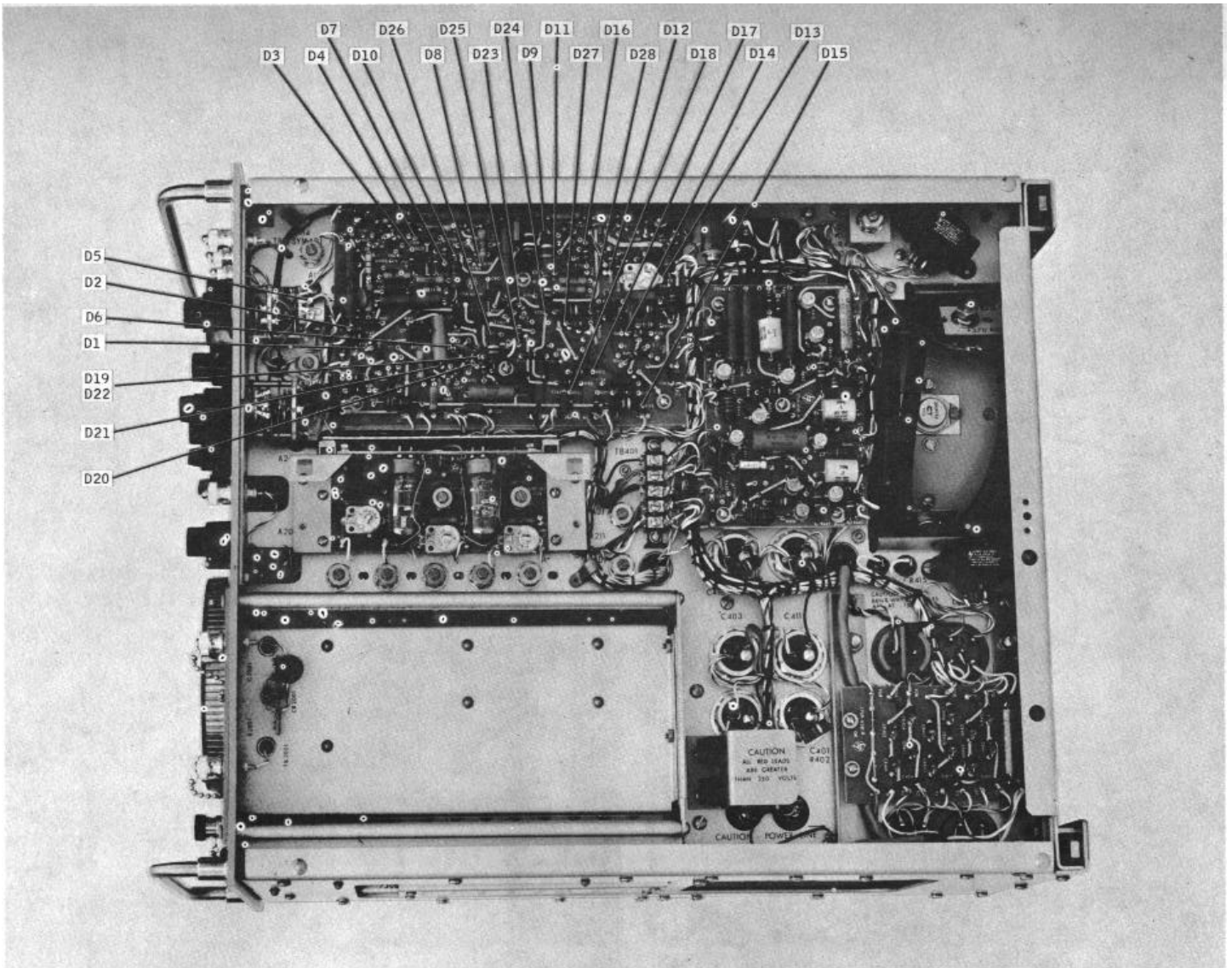


Figure 4-18. Bottom View, Location of Test Points on Sweep Generator Assembly

ORIGINAL

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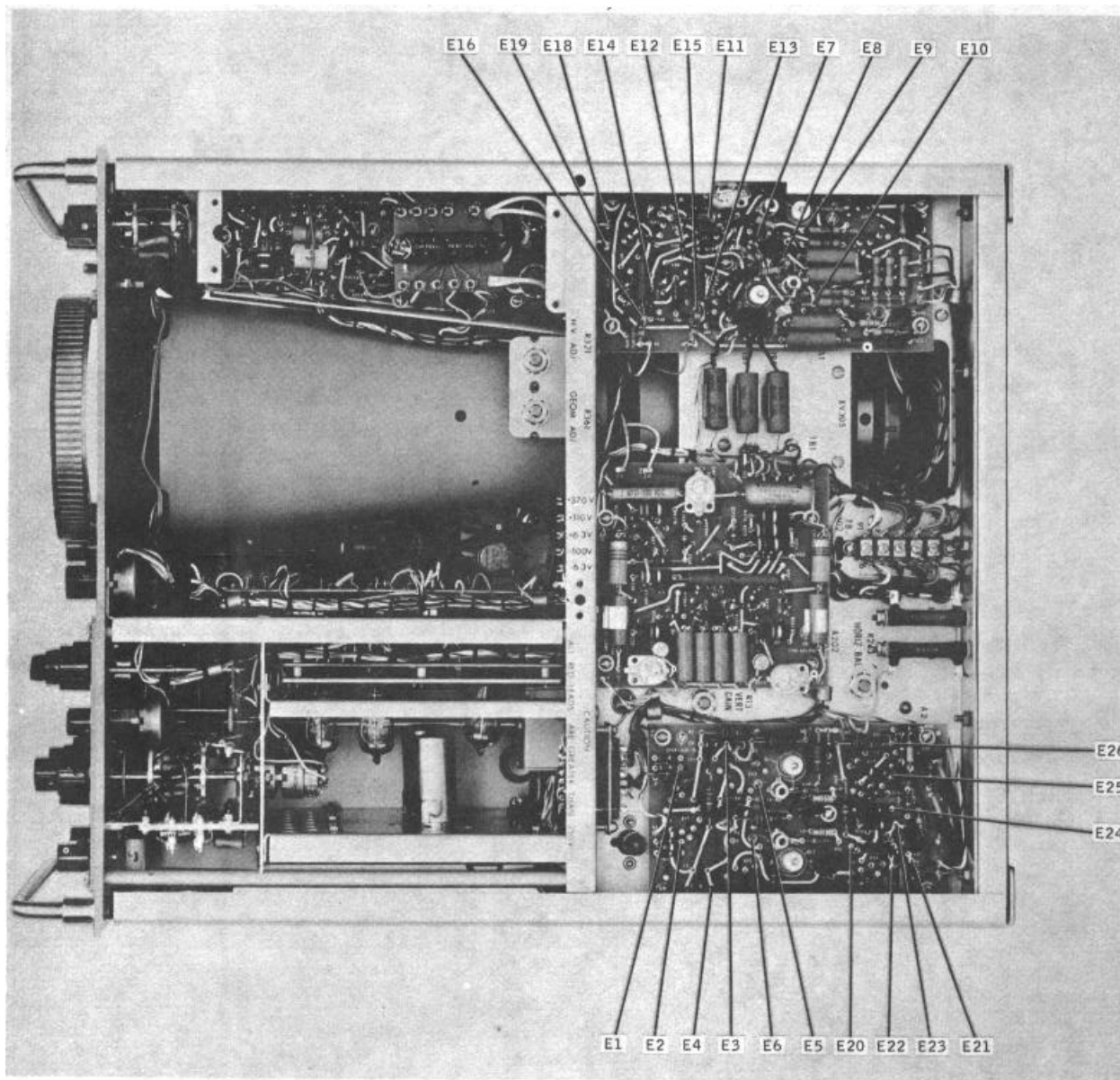


Figure 4-19. Top View, Location of Test Points on Main Vertical Amplifier Assembly

ORIGINAL

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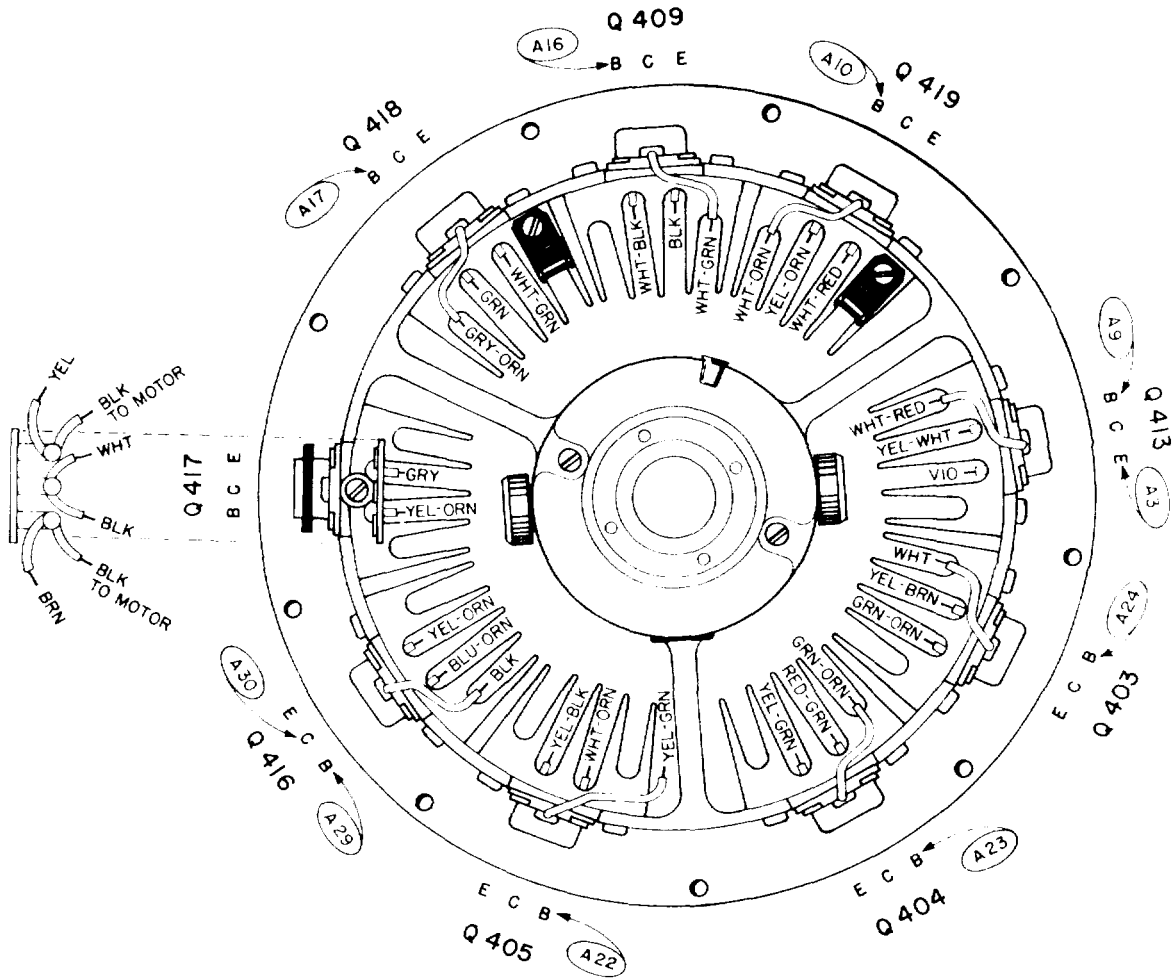


Figure 4-20A. Fan Shroud and Power Transistor Assembly, Location of Test Points and Connections
AN/USM-140C

CHANGE 1

UNCLASSIFIED

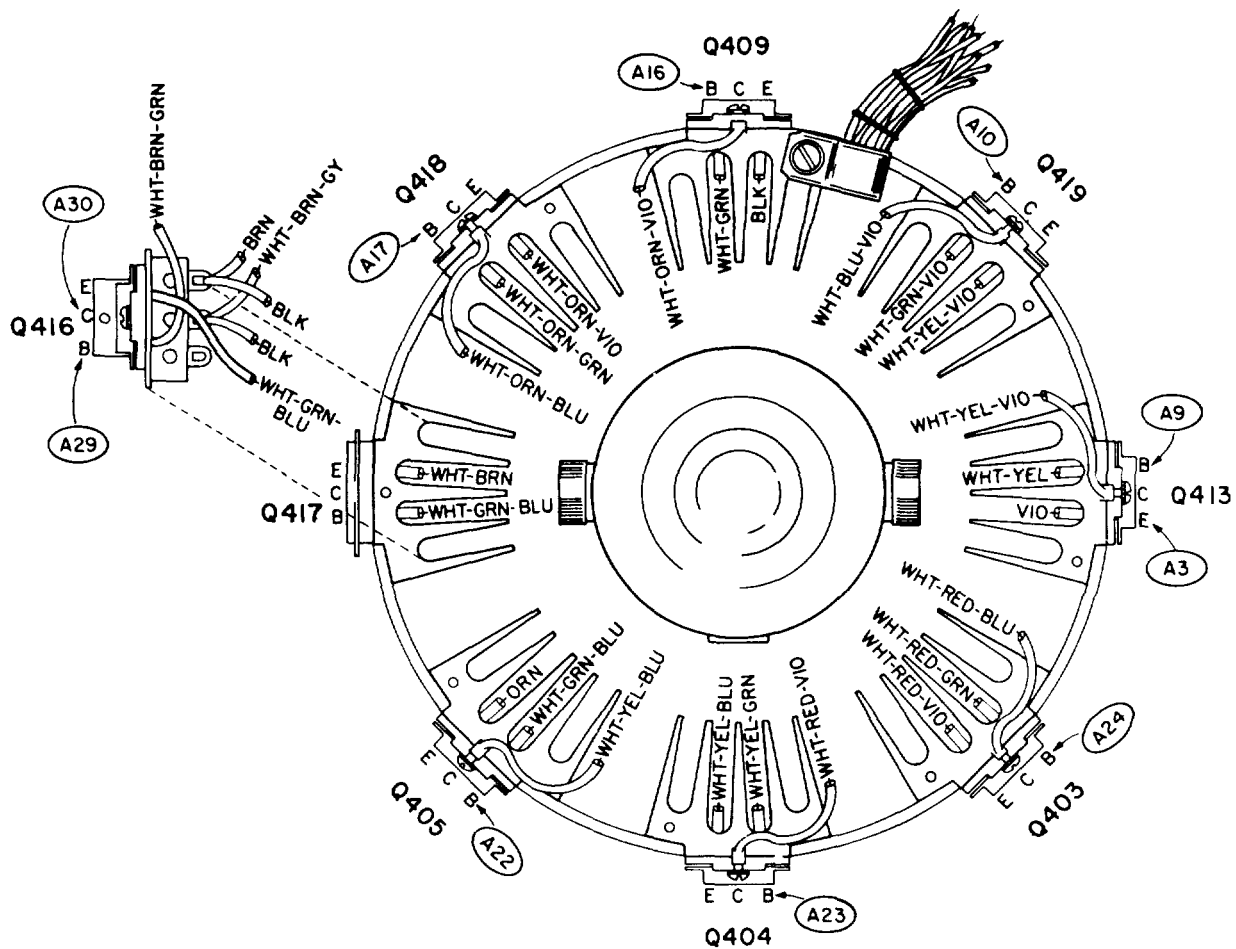


Figure 4-20. Fan Shroud and Power Transistor Assembly, Location of Test Points and Connections

ORIGINAL

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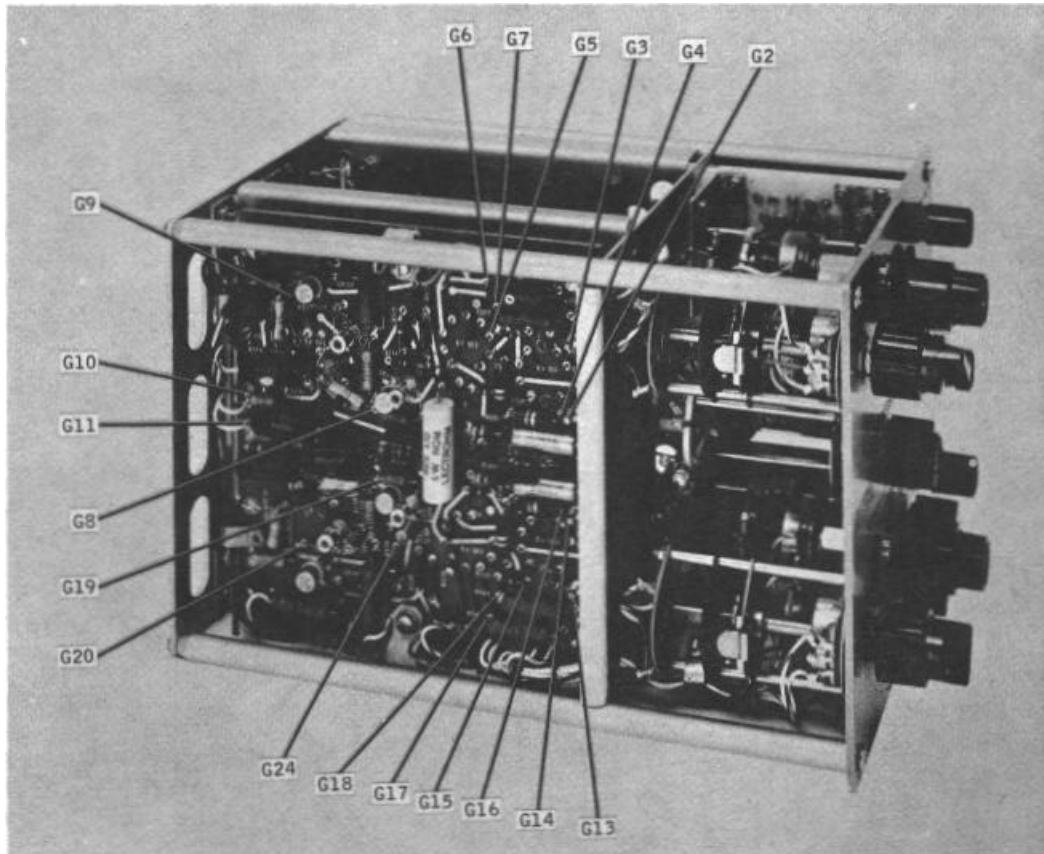


Figure 4-21. Left Side View of MX-2930B/USM Vertical Plug-In Assembly, Location of Test Points

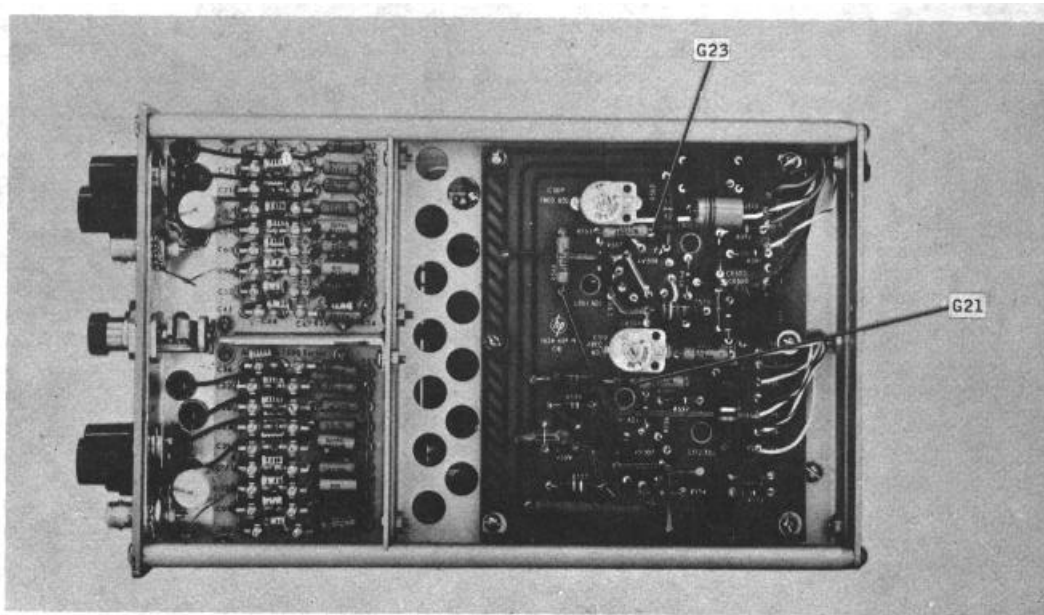


Figure 4-22. Right Side View of MX-2930B/USM, Location of Test Points

ORIGINAL

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SECTION 5
MAINTENANCE

5-1. FAILURE, AND PERFORMANCE AND OPERATIONAL REPORTS.

Note

The Bureau of Ships no longer requires the submission of failure reports for all equipments. Failure Reports and Performance and Operational Reports are to be accomplished for designated equipments (refer to Electronics Installation and Maintenance Book, NAVSHIPS 900, 000) only to the extent required by existing directives. All failures shall be reported for those equipments requiring the use of Failure Reports.

5-2. PREVENTIVE MAINTENANCE.

Preventive maintenance consists mainly of cleaning the air filter and checking the fan motor brushes. In addition the instrument should be given a periodic visual inspection for potential sources of trouble, which should include inspection for loose switch knobs, unseated vacuum tubes, loose or frayed wires, burned or bulging components, etc.

a. **SERVICING THE AIR FILTER.** The air filter is located on the rear of the instrument cabinet. Inspect the filter bi-weekly and clean it as often as necessary. Monthly cleaning is sufficient in normal operating environments; when the instrument is used in extremely dusty environments, the filter must be cleaned more often. Proceed as follows:

- (1) Remove filter by pushing it down and pulling on its top edge.
- (2) Wash filter in warm water and detergent; then dry it thoroughly.
- (3) Prepare and maintain a maintenance check-off list for the air filter, using the following format:

WEEK OF	AIR FILTER	
	CLEANING NOT REQUIRED	CLEANED

b. **FAN MOTOR.** Every six months, add one or two drops of 10-weight machine oil to the motor bearings. The motor can be lubricated through the access hole in the right side gusset when the gusset cover plate is removed. This plate is secured by two screws. Also inspect the motor brushes and replace them when they are worn to 3/16 inch in length. Proceed as follows:

- (1) Remove the cabinet for access to the fan, by resting the oscilloscope front panel down, supported by the guard rails, and removing the four retaining screws from the

rear, allowing the cabinet to be lifted off.

(2) Remove the eight fan shroud screws and open the motor supporting strap.

(3) Slip the entire fan, shroud, and motor out the rear of the chassis, noting cable dress and shroud position. See figures 4-20 and 5-10. Twist slightly to give transistors clearance.

(4) Remove and inspect the brushes.

Clean, replace, and dress as necessary. Brushes should be contoured to fit commutator to minimize arcing and bounce. Use air pressure to blow dust from brush holders and fan case.

(5) Add one or two drops of SAE 10 machine oil to motor bearings. Wipe off excess oil to avoid dust coating.

(6) Prepare and maintain a maintenance check-off list for the fan motor, using the following for mat:

MONTH	FAN MOTOR BRUSHES	BEARINGS
	REPLACEMENT REPLACED NOT REQD	LUBRICATE

(7) To reinstall assembly, reverse the above procedure. In AN/USM-140B or AN/USM-141A, position the heat sink bracket (with two transistors) at 3 o'clock and position fan motor leads in notch of motor bracket. In AN/USM/140C or AN/USM141B, position the access port in the fan shroud at 6 o'clock.

5-2A. WIRING COLOR CODE.

Where color coding is not the same in all models, the color code is shown in parentheses for Model AN/USM140C.

5-3. REFERENCE STANDARDS PROCEDURES.

Note

The procedures listed below constitute the minimum number of reference standards which will indicate, when completed, the relative performance of tile oscilloscope and its plug-in units. Each group of tests represents a functional section of the instrument. The procedures are listed in the suggested sequence of performance, and the power supply test must always be performed first, as indicated, to assure that all units are being supplied proper power. Otherwise, however, deviation from the listed order will in no way affect the unity or result of the reference standards.

TABLE 5-1. REFERENCE STANDARDS PROCEDURES

SECTION	ACTION REQUIRED	PROCEDURE STEPS
Power Supply (Table 5-3)	Check DC voltages	(step 1)
	AC ripple voltages	(step 2)
Calibrator (Table 5-4)	Check voltage amplitude	(step 3)
	Check voltage divider	(step 4)
Horizontal Amplifier (Table 5-5)	Check sensitivity	(steps 5 and 6)
	Check bandwidth	(step 7)
Sweep Generator (Table 5-6)	Check sweep time	(step 8)
	Check trigger sensitivity	(step 9)
Vertical Amplifier (Table 5-7)	Check sensitivity	(step 10)
	Check bandwidth	(step 11)
	Check rise time	(step 12)
MX-2930B/TJSM Vertical Plug-In (Table 5-8)	Check vertical sensitivity	(steps 13 and 14)
	Check vertical pulse response	(step 15)
	Check vertical bandwidth	(step 16)
	Check isolation	(step 17)
	Check common mode rejection	(step 18)
	Check chopped display	(step 19)
	Check alternate display	(step 20)

Test equipment required to complete the Reference Standards Procedures is listed in table 5-2. Figure 5-1 shows the test connector that must be fabricated to allow test of the main vertical amplifier with the vertical channel plug-in unit removed.

TABLE 5-2. TEST EQUIPMENT FOR REFERENCE STANDARDS PROCEDURES

DESIGNATION	NAME
Model 738A	Voltmeter Calibrator (Hewlett-Packard)
AN/USM-108	Time-Mark Generator
Model 107	Square Wave Generator (Tektronix)
Model 190A	Constant-Amplitude Signal Generator (Tektronix)
AN/USM-ME-30/U	AC Voltmeter Voltmeter

NOTE: See table 1-2 for full description.

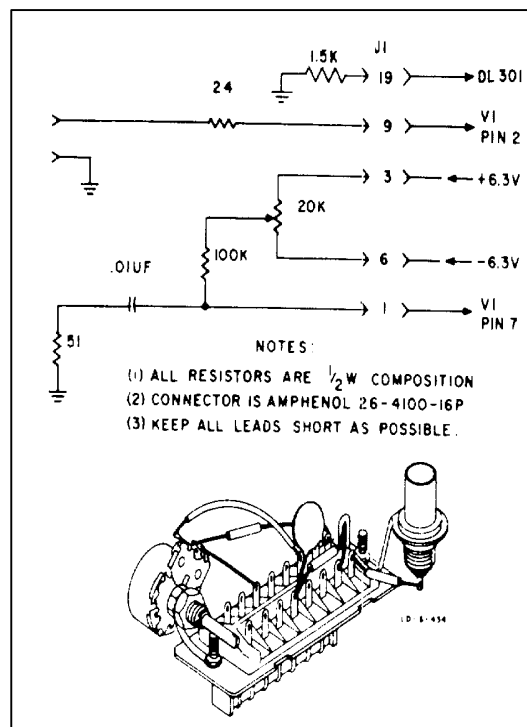
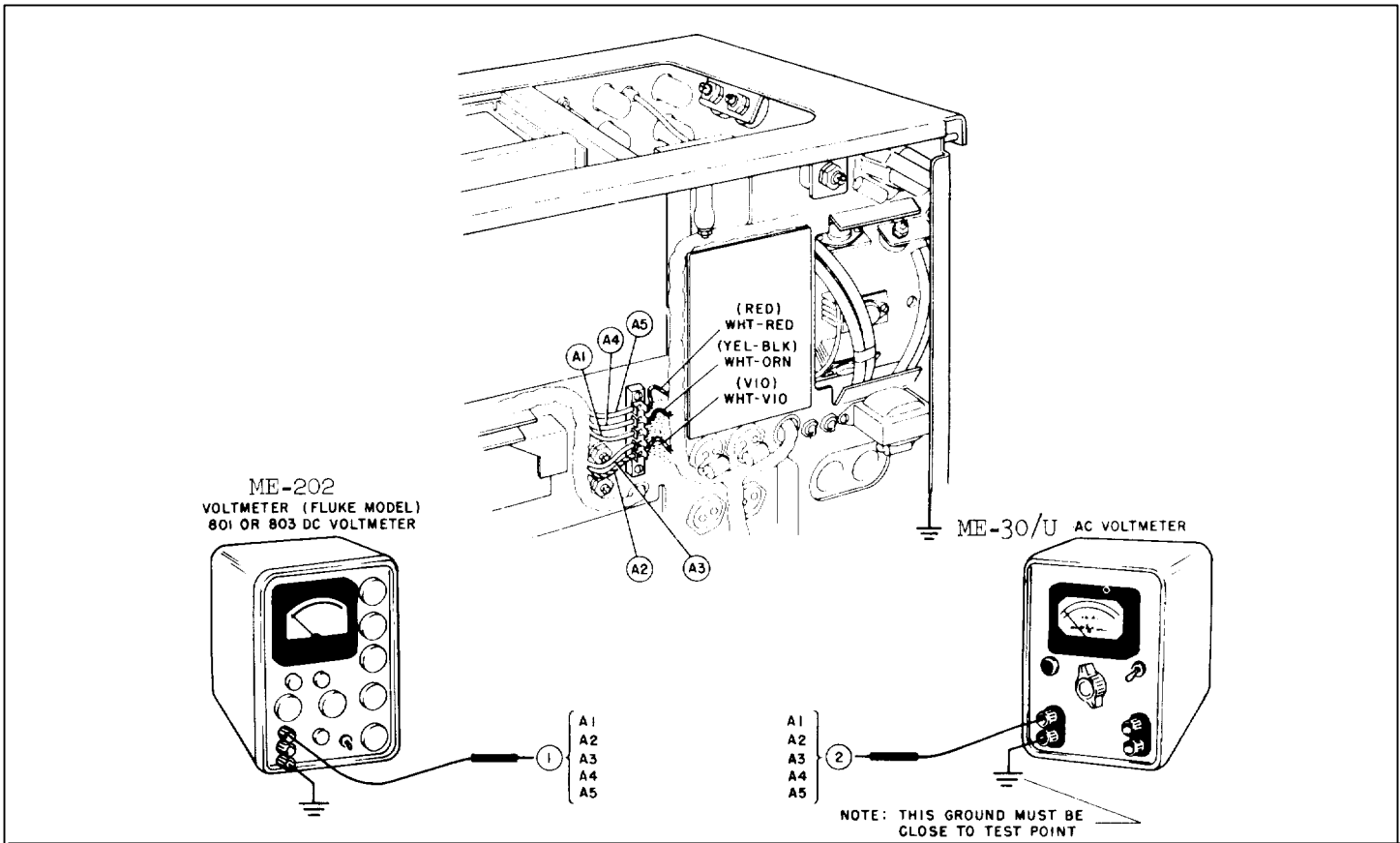


Figure 5-1. Main Vertical Amplifier Test Connector

TABLE 5-3. POWER SUPPLY



Control Settings:

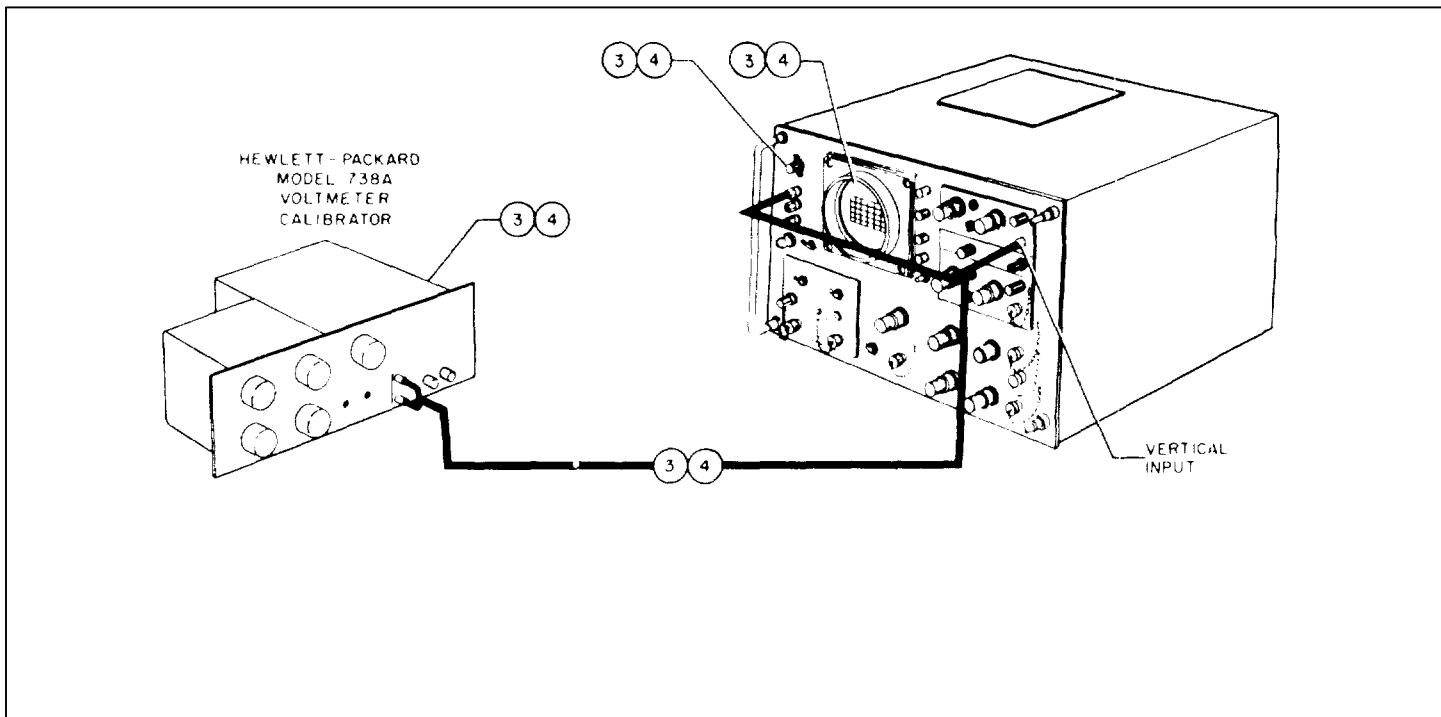
Power on
Chassis Grounded

Test Equipment Required:

AN/USM-98 Voltmeter
ME-6/U AC Voltmeter

STEP NO.	ACTION REQUIRED	READ INDICATION ON	PERFORMANCE STANDARDS
1	Check DC voltages	AN/USM-98 Voltmeter	A1 +6.3 volts \pm 1 volt A2 -6.3 volts \pm 1 volt
	PROCEDURE: Remove the Oscilloscope from the cabinet (see paragraph 5-2b) and ground the chassis. Turn the instrument ON and allow a few minutes warm up. Ground an AN/USM-98 Voltmeter to the chassis and measure the voltages at the test points shown in table 5-3.		A3 -100 volts \pm 0.4%, A4 +110 volts \pm 0.4% A5 +370 volts \pm 1%
2	Check AC ripple voltage	ME-6/U AC Voltmeter	A1 7 MVAC A2 7 MVAC
	PROCEDURE: Disconnect the AN/USM-98 Voltmeter and ground a ME-6/U AC Voltmeter to the chassis. Measure the ripple voltages at the test points shown in table 5-3. The AC ripple should be as listed at the right. These voltages are greater than the typical voltages listed on the schematic and are the maximum allowable.		A3 3 MVAC A4 7 MVAC A5 18 MVAC

TABLE 5-4. CALIBRATOR



Control Settings:

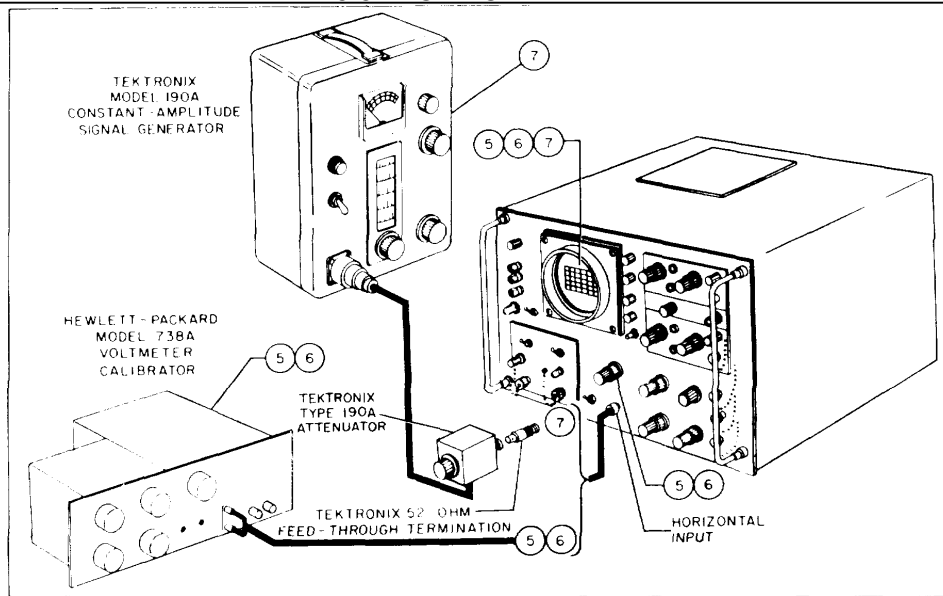
HORIZONTAL DISPLAY to X1
TRIGGER SOURCE to INT
SWEEP MODE to PRESET
SWEEP TIME to 2 MILLISECONDS/CM
VERTICAL SENSITIVITY to 2 VOLTS/CM
CALIBRATOR to OFF

Test Equipment Required:

Hewlett-Packard Model 738A
Voltmeter Calibrator

STEP NO.	ACTION REQUIRED RQU	READ INDICATION ON	PERFORMANCE STANDARDS
3	Check amplitude of CALIBRATOR voltage	Oscilloscope	The amplitudes of the square wave and sine wave should not differ by more than 3%
PROCEDURE: Set the Voltmeter Calibrator for a 10-volt, 400-cycle peak-to-peak output, and connect this signal to the vertical INPUT. Set sensitivity vernier for 4cm amplitude of the sine wave on the CRT. Leave vernier at this setting, disconnect the Voltmeter Calibrator, set the CALIBRATOR control at 10-volt output, and connect the CALIBRATOR output at VOLTS to the vertical INPUT. Note the exact amplitude of the square wave.			
4	Check CALIBRATOR voltage divider	Oscilloscope	Same as above
PROCEDURE: Check all the CALIBRATOR voltage ranges by comparing equal voltages from the CALIBRATOR output and from the Voltmeter Calibrator. Use the same procedure as above.			

TABLE 5-5. HORIZONTAL AMPLIFIER

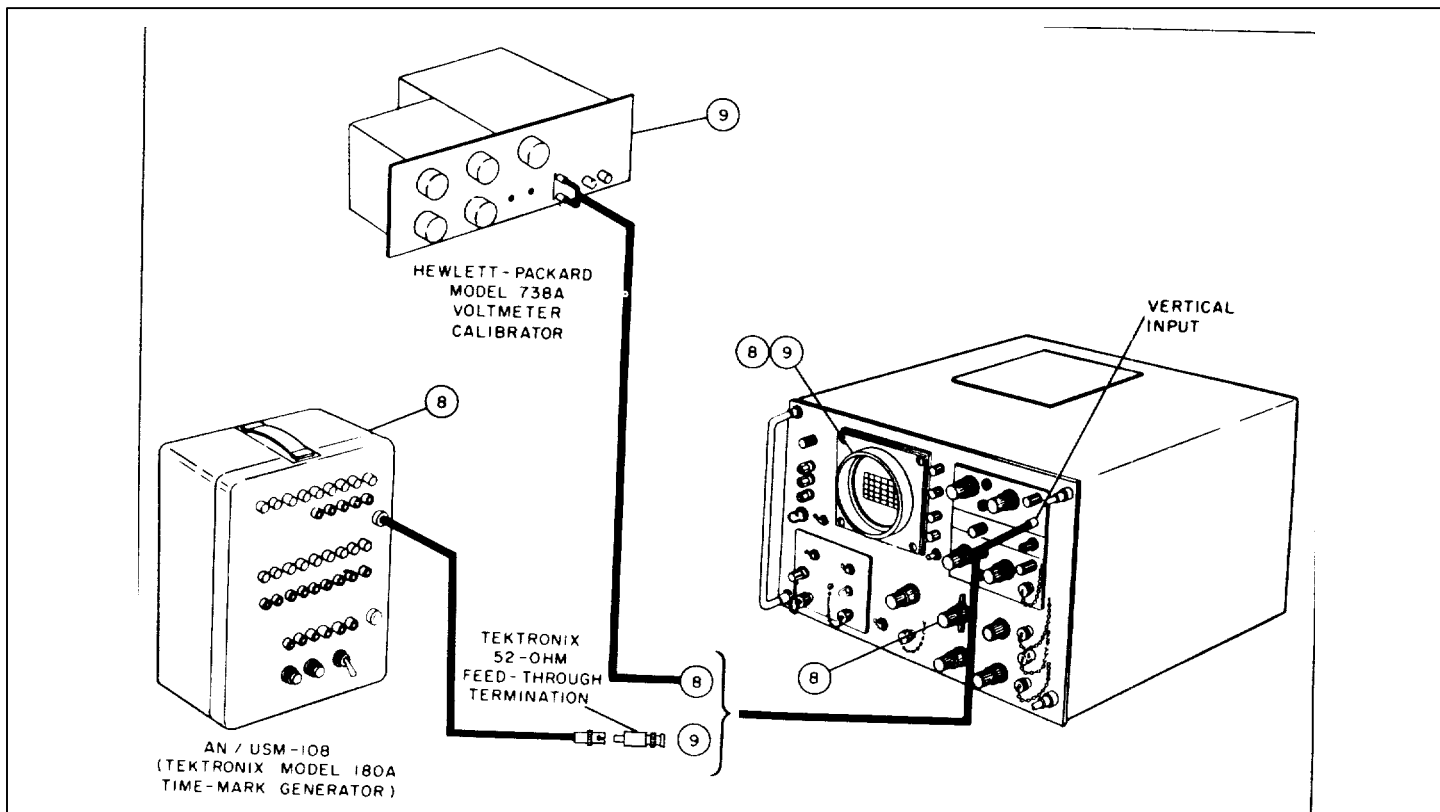


Control Settings:
AC-DC SWITCH to AC
EXTERNAL VERNIER to CAL

Test Equipment Required:
Hewlett-Packard Model 738A
Voltmeter Calibrator
Tektronix Model 190A Constant-Amplitude
Signal Generator

STEP NO.	ACTION REQUIRED	READ INDICATION ON	PERFORMANCE STANDARDS
5	Check horizontal sensitivity	Oscilloscope	A. Trace extends 10 ± 0.3 cm B. Trace extends 5 ± 0.15 cm
	PROCEDURE: Connect 1 volt peak-to-peak from Voltmeter Calibrator to horizontal INPUT. Adjust position controls to center horizontal trace. A. Set HORIZONTAL DISPLAY to .1 VOLTS/CM B. Set HORIZONTAL DISPLAY to .2 VOLTS/CM		
6	Check horizontal sensitivity range	Oscilloscope	A. Trace extends 10 ± 0.3 cm B. Trace extends 5 ± 0.15 cm
	PROCEDURE: With the test set-up as in step 13, increase the voltages from the Voltmeter Calibrator to 10 times the voltage shown on the HORIZONTAL DISPLAY switch. The CRT should show trace A. When the HORIZONTAL DISPLAY switch is moved to the next higher setting, the CRT should show trace B. Repeat this procedure in sequence for the entire range of the HORIZONTAL DISPLAY switch.		
7	Check horizontal bandwidth	Oscilloscope	The frequency at which the deflection on the CRT decreased to 7.1 cm (3 db point) should be greater than 1 mc.
	PROCEDURE: Reset HORIZONTAL DISPLAY to .1 VOLTS/CM and disconnect the Voltmeter Calibrator. Center spot with the positioning controls and BEAM FINDER if necessary. Connect 50-kc output from Signal Generator to the horizontal INPUT of the Oscilloscope. Adjust 50-kc amplitude for 10-cm deflection on the CRT. Increase the frequency from the Signal Generator and note the deflection on CRT.		

TABLE 5-6. SWEEP GENERATOR



Control Settings:

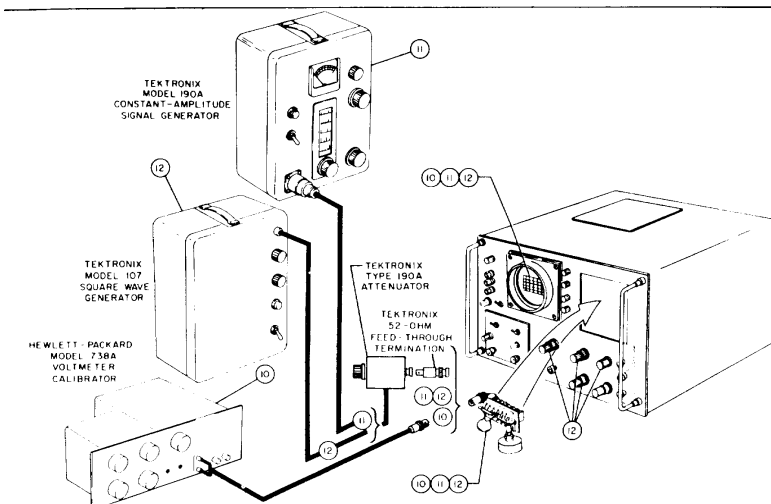
HORIZONTAL DISPLAY to X1
TRIGGER SOURCE to INT
SWEEP MODE to TRIGGER
SWEEP TIME to 1 MICROSECOND/CM
Adjust VERTICAL SENSITIVITY for 1-CM Deflection

Test Equipment Required:

AN USM-108 Time-Mark Generator
Hewlett-Packard Model 738A Voltmeter
Calibrator

STEP NO.	ACTION REQUIRED	READ INDICATION ON	PERFORMANCE STANDARDS
8	Check sweep time	Oscilloscope	1 marker per 1 cm ±3% in each case
	PROCEDURE: Connect 1-μsec time marks from Time-Mark Generator to vertical INPUT, check that the SWEEP TIME control is 1 MICROSECOND/CM, and note the CRT display. Change the SWEEP TIME control to 1 MILLISECOND/CM and then to 1 SECOND/CM and simultaneously set the Time-Mark Generator to produce the corresponding time markers (i.e., 1 millisecond markers and 1 second markers).		
9	Check sweep trigger sensitivity	Oscilloscope	Sweep triggered without jitter
	PROCEDURE: Disconnect the Time-Mark Generator. Change the VERTICAL SENSITIVITY control to 1 VOLT/CM, the VERNIER to CALIBRATED, the SWEEP TIME to 1 MILLISECOND/CM, SWEEP MODE to PRESET, and TRIGGER LEVEL to 0. Connect a 0.2-volt peak-to-peak signal from the Voltmeter Calibrator to the vertical INPUT.		

TABLE 5-7. MAIN VERTICAL AMPLIFIER

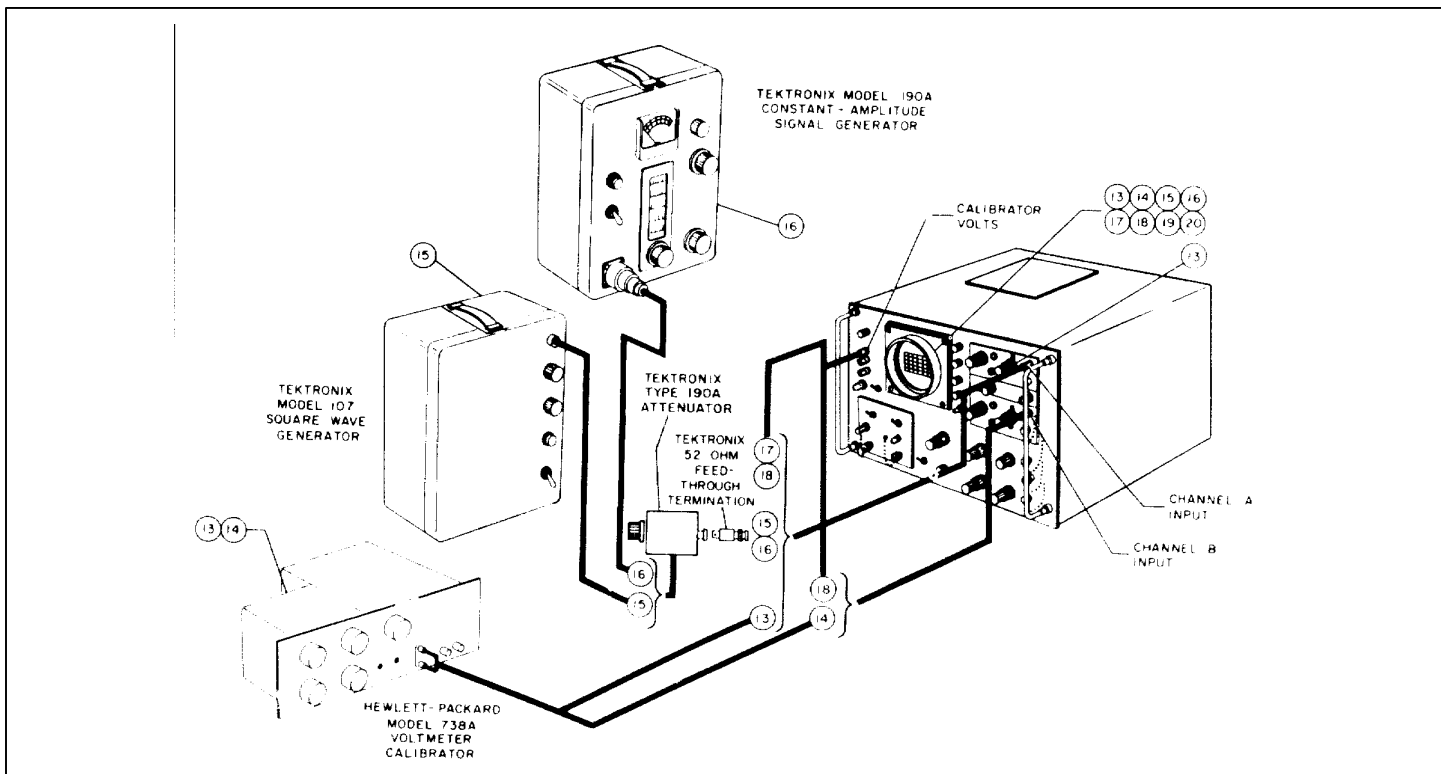


Control Settings:
Remove Vertical Plug-In and Insert Test Connector
(See Figure 5-1)
HORIZONTAL DISPLAY to X1
SWEEP TIME to 2 MILLISECONDS/CM
TRIGGER SOURCE to INT
SWEEP MODE to PRESET
TRIGGER LEVEL to 0

Test Equipment Required:
Hewlett-Packard Model 738A Voltmeter
Calibrator
Tektronix Model 190A Constant-Amplitude
Signal Generator
Tektronix Model 107 Square Wave Generator

STEP NO.	ACTION REQUIRED	READ INDICATION ON	PERFORMANCE STANDARDS
10	Check Main Vertical Amplifier sensitivity	Oscilloscope	Peak-to-peak deflection of 4 ± 0.2 cm
	PROCEDURE: Connect a 400-cps, 0.8-volt peak-to-peak signal from the Voltmeter Calibrator to the Main Vertical Amplifier through the test connector.		
11	Check Main Vertical Amplifier bandwidth	Oscilloscope	Frequency at which deflection on CRT decreases to 2.8 cm (3 db point) should be greater than 35 mc
	PROCEDURE: Connect the 50-kc output from the Signal Generator to the Main Vertical Amplifier through the test connector. Adjust the 50-kc amplitude for a 4-cm deflection on the CRT. Increase the frequency from the Signal Generator and note the deflection on the CRT.		
12	Check Main Vertical Amplifier rise time	Oscilloscope	Rise time (10-90%): 11 nsec (0.55 cm) or less
	PROCEDURE: Set the HORIZONTAL DISPLAY to X5, SWEEP TIME to .1 MICROSECOND/CM, and TRIGGER LEVEL to +. Connect a 1-mc, 0.5-volt square wave from the Square Wave Generator to the Main Vertical Amplifier through the test connector. Center the leading edge of the square wave with the control on the test connector and the HORIZONTAL POSITION control. Adjust the TRIGGER LEVEL to shift the leading edge of the square wave as far to the right as possible.		

TABLE 5-8. MX-2930B/USM VERTICAL PLUG-IN



Control Settings:

CHANNEL A + B VERNIER to CAL
AC-DC SWITCH to AC
Vertical Presentation Switch to CHANNEL A
SWEEP MODE to PRESET
SWEEP TIME to 5 MILLISECONDS/CM
SENSITIVITY CONTROL VERNIER to CALIBRATED
TRIGGER SOURCE to INT

Test Equipment Required:

Hewlett-Packard Model 738A Voltmeter Calibrator
Tektronix Model 107 Square Wave Generator
Tektronix Model 190A Constant-Amplitude Signal Generator

STEP NO.	ACTION REQUIRED	READ INDICATION ON	PERFORMANCE STANDARDS
13	Check Channel A vertical sensitivity	Oscilloscope	A. 5 ± 0.25 cm ($\pm 5\%$) deflection
	<p>PROCEDURE Set the Voltmeter Calibrator to 400-cycle 0.1-volt peak-to-peak output and couple this signal to the Channel A INPUT. Set the SENSITIVITY control to .02 VOLTS/CM. CRT deflection should be as in A. Repeat this check at each position of the SENSITIVITY control. Set the Voltmeter Calibrator output as necessary to provide adequate deflection on the CRT. Performance should be as in B.</p>		<p>B. Deflection should be $\frac{\text{output voltage}}{\text{SENSITIVITY}} = \text{cm}$ with a tolerance of 5% in each case</p>
14	Check Channel B vertical sensitivity	Oscilloscope	Same as above
	<p>PROCEDURE: Same as above, except Vertical Presentation Switch to CHANNEL B and Voltmeter Calibrator to Channel B INPUT.</p>		

TABLE 5-8. (Continued)

STEP NO.	ACTION REQUIRED	READ INDICATION ON	PERFORMANCE STANDARDS
15	Check vertical pulse response	Oscilloscope	Overshoot on leading edge of applied signal must not exceed 3%.
	PROCEDURE: Change SWEEP TIME control to 0.2 MICROSECOND/CM and Channel A SENSITIVITY to 0.02 VOLTS/CM. Set the Square Wave Generator to produce a 0.25-volt AC peak-to-peak 500-kc signal and couple this to the Channel A INPUT. Change the Vertical Presentation Switch back to CHANNEL A. Repeat for CHANNEL B.		
16	Check vertical bandwidth	Oscilloscope	The frequency must be at least 22 mc when the deflection is 2.8 cm
	PROCEDURE: Set the SENSITIVITY control to .02 VOLT/CM, the HORIZONTAL DISPLAY switch to X1, and connect a 50-kc sine wave from a Constant-Amplitude Signal Generator to the Channel A INPUT. Adjust the input signal level for a CRT deflection of exactly 4 centimeters. Without changing the signal level, increase the signal frequency until the height of the display is reduced to 2.8 centimeters. Repeat for CHANNEL B.		
17	Isolation check	Oscilloscope	The height of CRT display should not Vertical exceed 0.3 cm
	PROCEDURE: Disconnect the Square Wave Generator. Change the Presentation switch to CHANNEL B, the SENSITIVITY control to 0.5 VOLT/CM on Channel A and .02 VOLT/CM on Channel B, the HORIZONTAL DISPLAY to XI, the SWEEP TIME control to 1 MILLISECOND/CM, and center the display with the VERTICAL POSITION control. Apply a 20-volt square wave to Channel A INPUT from the CALIBRATOR output. After noting the deflection, check the reverse coupling by reversing the settings and connection of Channels A and B and their controls.		
18	Common mode rejection check	Oscilloscope	A&B Input Deflec- SENSI- Volt- tion TIVITY age (cm)
	PROCEDURE: Connect the output of the CALIBRATOR to Channel A and B INPUTS in parallel (through a T-connector). Change the Vertical Presentation Switch to A-B, the AC-DC switch to DC, and keep the HORIZONTAL DISPLAY switch at X1. Measure the common mode rejection on all SENSITIVITY ranges and note that the deflections correspond to the table at the right.		.02 2 1 .05 5 3 .10 10 3 .20 20 3 .50 50 3 1 100 3 2 100 1.5 5 100 0.6 10 100 0.3 20 100 0.15
19	Chopped display check	Oscilloscope	The chopped period should be between 0.9 and 1.1 microsecond. The transition between the chopped traces should be blanked out at normal intensity levels
	PROCEDURE: Remove all connections from the INPUT jacks. Set the Vertical Presentation Switch to CHOPPED, the SWEEP TIME control to .5 MICROSECOND/CM, and adjust the VERTICAL POSITION control for two distinct chopped traces. There should be no signal at any input to the Oscilloscope.		
20	Check on alternate display	Oscilloscope	The display should show two distinct traces throughout the sweep range
	PROCEDURE: With the Oscilloscope setup as in step 19, change the Vertical Presentation Switch to the ALTERNATE position. Vary the SWEEP TIME from 20 MILLISECONDS/CM to 0.1 MICROSECONDS/CM.		

5-4. ADJUSTMENTS.

The procedures below give instructions for complete calibration to insure optimum equipment performance. However, complete calibration is seldom required, and the adjustment for any one particular section can be performed separately if the other sections are known to be calibrated and operating correctly. Table 3-4 lists the adjustments required following replacement of individual tubes, diodes, and transistors. Whether complete or partial calibration is to be done, make the adjustments in the sequence in which they are given below, since the adjustments on one section may influence the performance of another section. For cabinet removal procedure, see paragraph 5-2b.

Test equipment and special tools required to complete the adjustments are listed in table 5-9. Equipment with similar specifications can be substituted for that listed. The special vertical test connector shown in figure 5-1 is required to apply signals directly to the main vertical amplifier. The connector makes the frequency response adjustment in the main vertical amplifier independent of the plug-in units.

a. LOW-VOLTAGE POWER SUPPLY ADJUSTMENT. Location of adjustments in the low voltage supply is shown in figure 5-2. Test points are shown in table 5-3 and figure 4-14.

CAUTION

Never allow any power supply voltage to short directly to ground or to another circuit. Such a short will destroy the power supply transistors instantaneously.

(1) -100 VOLT SUPPLY. Adjust -100V Adj, R452, for exactly - 100 volts at test point A3 white-violet (or violet/white).

(2) ±6.3 VOLT SUPPLY.

(a) Adjust 6.3V Adj, R464, for +6.3 volts at test point A1 brown wire.

(b) Check for -6.3 volts ±0.1 volt at test point A2 white-brown (or gray) wire. Any unbalance is due to unbalance in tube heaters. If the unbalance is excessive, it can be remedied by changing vacuum tubes.

(3) +110 VOLT SUPPLY. Adjust +110V Adj, R431, for exactly +110 volts at test point A4 white-orange (or yellow brown) wire.

(4) +370 VOLT SUPPLY. Adjust +370V Adj, R411, for +370 volts at test point A5 white-red (or red/orange) wire.

b. HIGH-VOLTAGE POWER SUPPLY ADJUSTMENT. Location of the adjustment for the - 1500-volt-high-voltage power supply is shown in figure 5-3. Test points are shown in figure 4-15.

WARNING

Dangerous voltages will be encountered in the following procedure. Use extreme caution and follow the directions exactly.

(1) Remove the shield from the high voltage power supply which is accessible through the left-side gusset.

(2) Turn on the oscilloscope and allow a 5-minute warm-up period.

(3) Connect the high-voltage voltmeter (AN/USM-116) between ground and test point B1, V310 plate cap). The voltmeter should indicate -1500 volts. If not, recheck the oscilloscope low-voltage power supply before continuing.

(4) If necessary, adjust R321 to produce exactly 1500 volts. After making this adjustment, it will be necessary to recheck horizontal and vertical gains, frequency response, and sweep times.

TABLE 5-9. TEST EQUIPMENT FOR ADJUSTMENT PROCEDURES

DESIGNATION	NAME
AN/USM-98	Voltmeter
AN/USM- 116	High-Voltage Voltmeter
Model 738A	Voltmeter Calibrator (Hewlett-Packard)
Model 107	Square Wave Generator (Tektronix)
AN/USM- 108	Time- Mark Generator
AN/URM-90	Q Meter

NOTE: See table 1-2 for full description

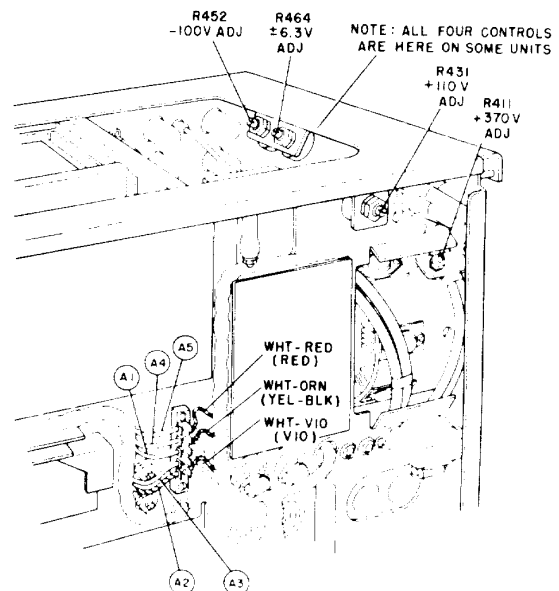


Figure 5-2. Location of Low-Voltage Power Supply Adjustments

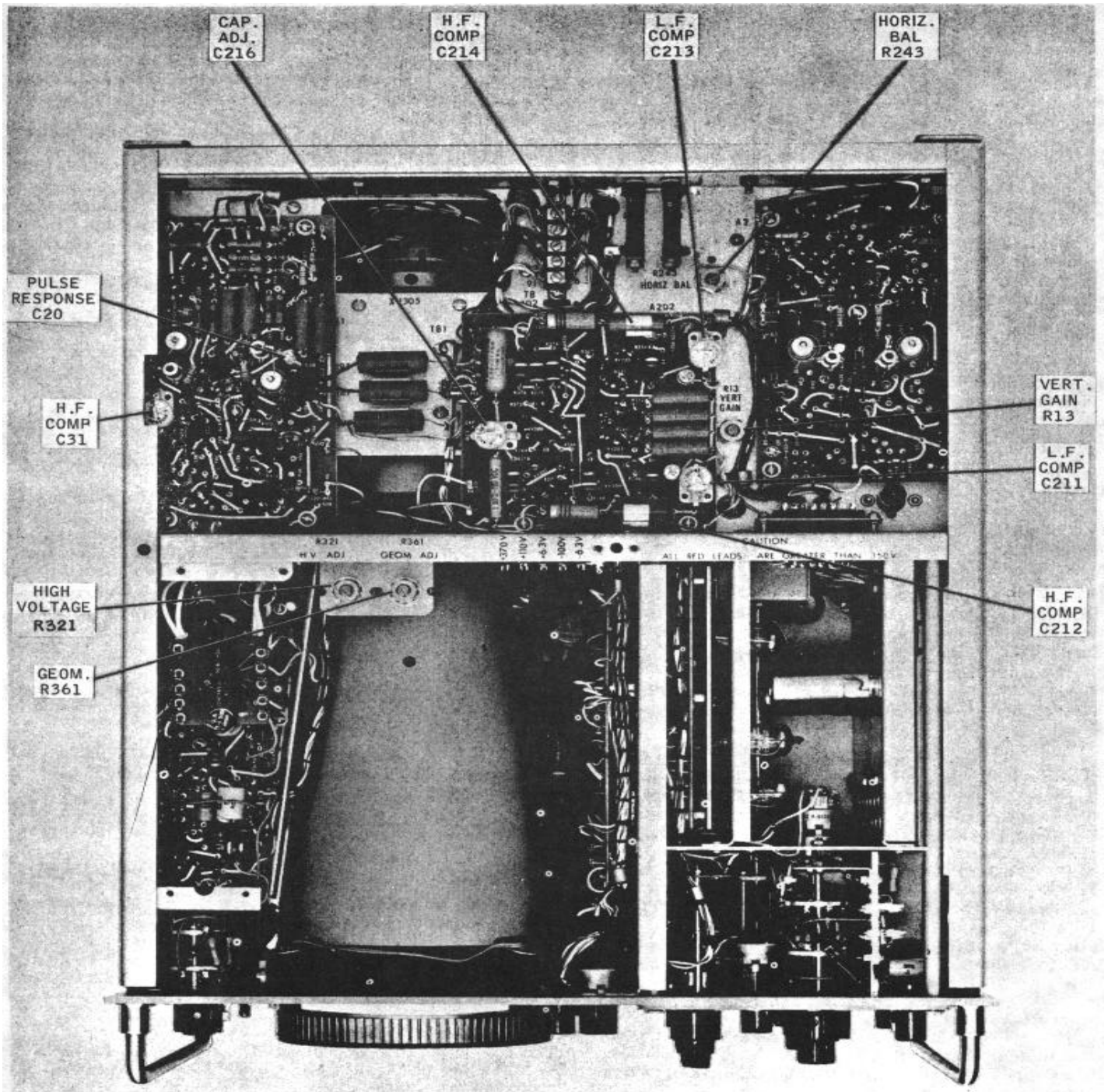


Figure 5-3. Top View, Location of Adjustments

CHANGE 1

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c. GEOMETRY ADJUSTMENT. The geometry adjustment control (R361) sets the voltage applied to the CRT grid (pin 4) for minimum deflection distortion at the edges of the graticule. Before making any adjustments, check that the CRT trace is properly aligned with the graticule.

(1) With the MX-2930B/USM Vertical Plug In installed, apply a signal from the amplitude CALIBRATOR to the vertical INPUT. Set the SWEEP MODE control just out of PRESET and position the vertical trace (4-cm high) parallel and next to the left edge of the graticule. Note any non linearity and reposition the display at the right edge of the graticule. Again note any non linearity in the display. Remove all vertical input signal-, and set the SWEEP MODE control to FREE RUN. Position the trace (10-cm long) alternately at the top and the bottom of the graticule, noting in each case any deviations from a straight line trace as compared to the graticule edge.

(2) If there is excessive distortion in the vertical or horizontal traces, change the adjustment of the Geometry control, R361, to correct this. The trace should be moved from one end to the opposite end of the graticule both horizontally and vertically to compare the effects of any adjustments. See figure 5-3 for location of R361.

d. HORIZONTAL AMPLIFIER ADJUSTMENT. The location of test points and adjustments for the horizontal amplifier are shown in figures 4-16, 4-17, and 5-24. For parts location refer to figure 5-23.

(1) BALANCE.

(a) Remove oscilloscope cabinet, turn ie instrument on and allow a 5-minute warm up.

(b) Set the HORIZONTAL DISPLAY control midway between the INTERNAL SWEEP X1 and the .1 VOLT/CM positions.

(c) Adjust the Balance control R243 (see figure 5-3) to center position the spot in the center of the CRT graticule.

(d) Set the HORIZONTAL DISPLAY control to .1 VOLTS/CM.

(e) Adjust the Vern. Bal. control R211 (see figure 5-4) until the spot remains horizontally stationary as the EXTERNAL VERNIER control is rotated over its full range. If necessary, adjust the HORIZONTAL POSITION control to keep spot approximately centered.

(2) SENSITIVITY.

(a) With the instrument off, unsolder the yellow wire on the edge of the etched circuit board A101 (see figure 5-17).

(b) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X1, and center spot with the HORIZONTAL POSITION control.

(c) Connect a 50-volt peak-to-peak sine wave from a Model 738 Voltmeter Calibrator to the etched circuit board A101 at the point from which the yellow wire was removed.

(d) Turn instrument on, allow a few minutes to warm up, and adjust Sweep Gain, R202 for 5.5-centimeters of deflection. (See figure 5-4).

(e) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X100.

(f) Change the 50-volt signal to a 0.5volt peak-to-peak sine wave from the voltmeter calibrator.

(g) If necessary, adjust the X100 Gain, R223, for 5.5-centimeters of deflection. See figure 5-4 for R223 location. Disconnect the voltmeter calibrator. Reconnect the yellow lead unless the frequency response should also be checked, as in paragraph 5-4d(3).

(h) Set the HORIZONTAL DISPLAY control to .1 VOLTS/CM and the horizontal AC-DC switch to AC.

(i) Connect a 1-volt peak-to-peak sine wave from the voltmeter calibrator to the horizontal INPUT, and, if necessary, adjust the Ext. Gain control, R212 (see figure 5-4), to give 10-centimeters horizontal deflection.

(3) FREQUENCY COMPENSATION.

(a) Turn instrument off and disconnect yellow lead from circuit board A101, if not already disconnected in previous adjustments.

(b) Connect the 75-ohm output of the Model 211A Square Wave Generator to etched circuit board A101 at the point from which the yellow lead mms removed. Connect the 600-ohm output of the Model 211A Square Wave Generator to the TRIGGER SOURCE INPUT connector, SWEEP MODE to PRESET.

(c) Connect the SWEEP OUTPUT connector to the vertical INPUT.

(d) Turn the instrument ON and allow a few minutes warm-up time.

(e) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X5 and the SWEEP TIME to.1 MILLISECONDS/CM.

(f) Set the vertical SENSITIVITY control to obtain a vertical sweep trace 4-centimeters long. Set the square wave generator frequency to 4 kc and the output amplitude as necessary to produce a 3centimeter wide square wave.

(g) Adjust the Sweep Gain Comp trimmer, C201 (see figure 5-4), to flatten the square wave, if necessary.

(h) Set the HORIZONTAL DISPLAY control to X10 and the SWEEP TIME to 5 MICROSECONDS/CM.

(i) Set the square wave generator frequency to 100 kc and the output to give about a 5centimeter deflection.

(j) Adjust the LF. Comp capacitors C211 and C213 (see figure 5-3) for an approximately flat-topped square wave, if necessary.

(k) Increase the Cap Driver Adj. trimmer, C216 (see figure 5-3), until some overshoot appears on the left side of square wave; then readjust until this overshoot just disappears.

(1) Increase the square-wave amplitude to maximum and adjust the HORIZONTAL POSITION control until the right side of the square wave is just visible on the left edge of CRT (most of the square wave is off the CRT to the left). Overshoot will appear on square wave.

(m) Readjust the L.F. Comp capacitors C211 and C213 until peak of overshoot is even with top of the square wave.

(n) Disconnect the square wave generator, turn off the oscilloscope, and reconnect the yellow wire to etched circuit board A101.

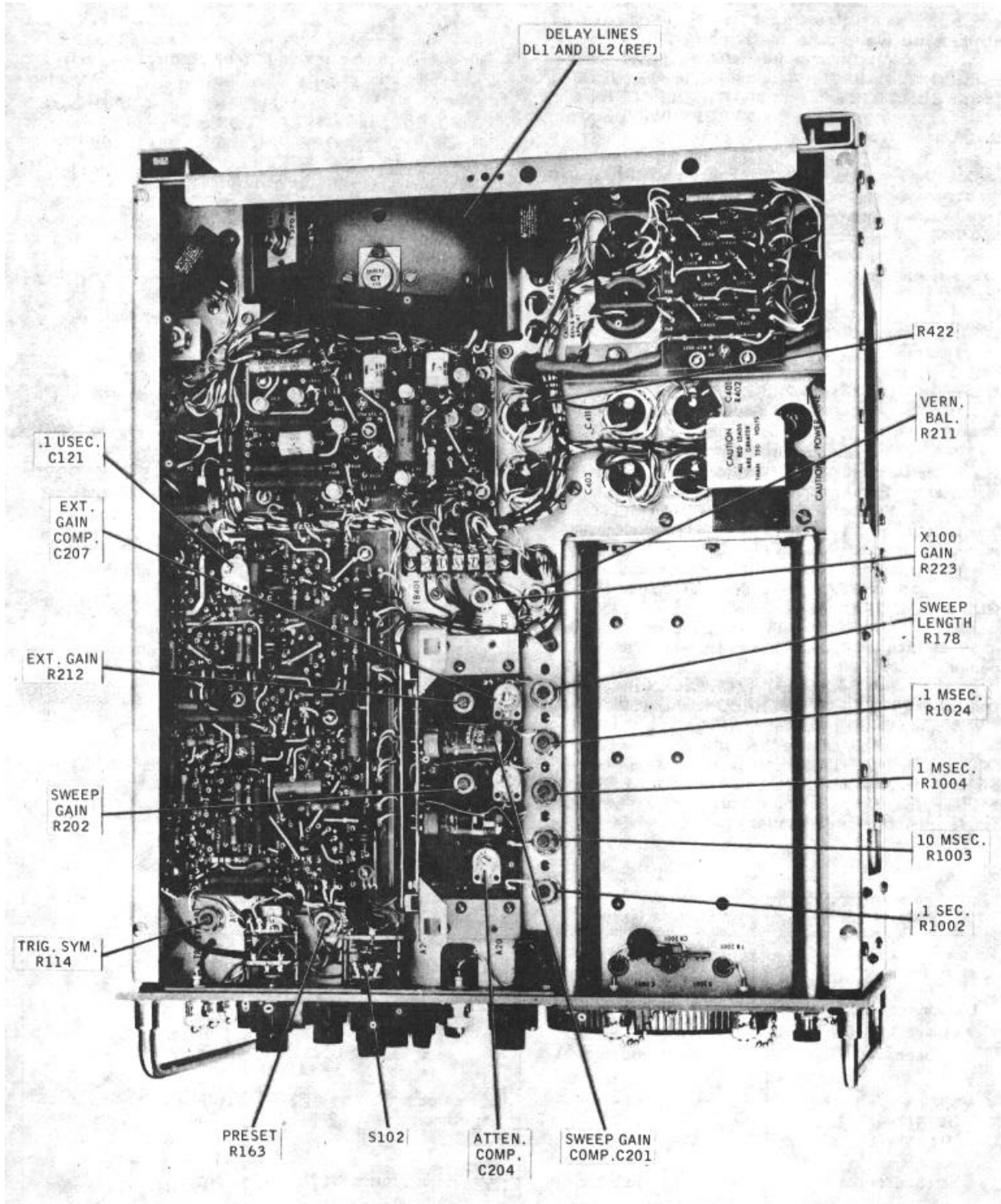


Figure 5-4. Bottom View, Location of Adjustments

(o) Connect a jumper from the junction of R143 and the white/yellow/violet wire on the etched circuit board A101 (see figure 5-17) to test point A3 at the white/violet wire (see figure 5-2).

(p) Turn on the instrument, and set the HORIZONTAL DISPLAY control to .5 VOLTS/CM and the SWEEP TIME control to .1 MILLISECONDS/CM.

(q) Connect the SWEEP OUTPUT to Channel A INPUT.

(r) Connect the 75-ohm output of the square wave generator to the horizontal INPUT, set square wave frequency to 4 kc, and adjust its amplitude to make square wave about five-centimeters wide on CRT.

(s) Set the vertical SENSITIVITY to make the sweep (now vertical) about four-centimeters high.

(t) Adjust the Ext. Gain Comp trimmer, C207 (see figure 5-4), to flatten the square wave, if necessary.

(u) Set the HORIZONTAL DISPLAY control to 1 VOLTS/CM and adjust the square wave generator output to obtain a five-centimeter wide square wave.

(v) Adjust the Atten Comp trimmer, C204 (see figure 5-4), to flatten the square wave, if necessary. Remove the jumper installed in step o.

e. SWEEP GENERATOR ADJUSTMENT. The location of test points and adjustments in the sweep generator is shown in figures 4-18 and 5-4. For parts location refer to figures 5-10 and 5-17.

(1) PRESET SENSITIVITY AND TRIGGER SYMMETRY.

(a) Remove the oscilloscope from the cabinet, turn it on, and allow a five-minute warm-up period.

(b) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X1 and the SWEEP TIME control to 1 MILLISECONDS/CM or faster.

(c) Measure the voltage at test point D20 (see figure 4-18) while slowly rotating the SWEEP MODE control from just out of PRESET to FREE RUN. Note the voltage at which the sweep starts (meter pointer jumps).

(d) Set the SWEEP MODE control to PRESET.

(e) Set the Preset Adj. control, R163 (see figure 5-4), fully counterclockwise, then turn it clockwise to obtain a voltmeter reading of exactly 1.5 volts less negative than the reading noted in step c.

(f) Set the TRIGGER SOURCE control to INT, the SWEEP MODE control to FREE RUN, the TRIGGER SLOPE control to +, and the SWEEP TIME control to .5 MILLISECONDS/CM.

(g) Connect the CALIBRATOR output to Channel A INPUT and set the Vertical Presentation Switch to CHANNEL A.,

(h) Set the CALIBRATOR control, vertical SENSITIVITY control, and sensitivity VERNIER control to obtain 0.2-centimeter vertical deflection.

(i) Ground pin 7 of V101 with a jumper (see figures 5-6 and 5-17).

(j) Set SWEEP MODE control to PRESET and adjust Trig Sym. control, R114 (see figure 5-4), to obtain a triggered sweep. Remove the ground jumper from V101.

(2) SWEEP LENGTH AND SWEEP RATE. (a) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X1, the SWEEP TIME control to 20 MILLISECONDS/CM, and the SWEEP MODE control to FREE RUN.

(b) Connect the CALIBRATOR output to the vertical INPUT and set the CALIBRATOR and vertical SENSITIVITY to obtain a 5-centimeter vertical deflection.

(c) -Adjust the TRIGGER LEVEL control to obtain the shortest POSSIBLE SWEEP.

(d) Adjust the Sweep Length control R178 (see figure 5-4) to obtain a sweep trace length exactly 11-centimeters long.

(e) Set the SWEEP MODE control to PRESET and the TRIGGER SOURCE control to EXT. AC.

(f) Connect the AN/USM-108 Time Mark Generator to the vertical INPUT and connect the time-mark generator trigger output to the TRIGGER SOURCE INPUT.

TABLE 5-10. SWEEP CALIBRATION

Sweep Time	Marker	Adjust	Adjust For
.1 msec/cm	100 μsec	.1 msec Timing R1024	1 marker/cm
1 msec/cm	1 msec	1 msec Timing R1004	1 marker/cm
10 msec/cm	10 msec	10 msec Timing R1003	1 marker/cm
.1 sec/cm	100 msec	.1 sec Timing R1002	1 marker/cm
.1 μsec/cm	10 mc (sine wave)	.1 μsec Timing C121 (on circuit board A101)	1 cycle/cm
.02 μsec/cm (HORIZONTAL DISPLAY set to X5)	10 mc (sine wave)	H. F. Comp C212 and C214 (on circuit board A202)	Adjust to equal values to make signal symmetrical about center line of graticule.
.2 μsec/cm	5 mc (sine wave)	.2 μsec Timing C1016	1 cycle/cm
.5 μsec/cm	1 μsec	.5 μsec Timing C1014	1 marker/2 cm
11 μsec/cm	1 μsec	1 μsec Timing C1012	1 marker/cm
10 μsec/cm	10 μsec	10 μsec Timing C1010	1 marker/cm

(g) Set the vertical SENSITIVITY to obtain easily read vertical deflection of markers.

(h) Refer to table 5-10 to select sweep time and time-mark generator output and to adjust indicated control. See figures 5-4, 5-17, and 5-18, for adjustment locations.

f. MAIN VERTICAL AMPLIFIER ADJUSTMENT. Location of test points and adjustments in the main vertical amplifier is shown in figures 4-19 and 5-3 and 5-15. For location of parts refer to figures 5-14 and 5-15.

(1) LOW-FREQUENCY GAIN.

(a) Remove the oscilloscope from the cabinet, turn it ON, and allow a five-minute warm-up.

(b) Remove the vertical plug-in unit and install the test connector shown in figure 5-1.

(c) Connect a 0.8-volt peak-to-peak 400-cps signal from the Model 738A Voltmeter Calibrator to the connector, as shown in table 5-7, step 10; set the oscilloscope controls as follows:

HORIZONTAL DISPLAY to X1
SWEEP TIME to 2 MILLISECONDS/CM
TRIGGER SOURCE to INT
SWEEP MODE to PRESET TRIGGER
LEVEL to 0

(d) Adjust the Vert Gain control, R13 (see figure 5-3), to produce exactly 4-centimeters vertical deflection on CRT. Disconnect the voltmeter calibrator.

(2) HIGH FREQUENCY COMPENSATION AND PULSE RESPONSE.

(a) Set the TRIGGER SOURCE control to INT, the SWEEP MODE control to PRESET, and the SWEEP TIME control to .5 MICROSECONDS/CM.

(b) Connect a Model 107 Square Wave Generator to the test connector. Set the square wave generator frequency to 0.5 megacycles and the output amplitude to obtain 3-centimeters vertical deflection on the CRT.

(c) Be sure the vertical deflection plate leads have maximum clearance between adjacent leads and any chassis parts.

(d) If necessary, adjust the Hi Freq Comp capacitor, C31 (see figure 5-3), to produce a flat-topped square wave. Ignore any high-frequency ringing at this time.

(e) Center the square wave vertically, and adjust the Pulse Response Adjust capacitor, C20 (see figure 5-3), to obtain the best leading edge on the square wave. Any ringing in step d should now decrease in amplitude. Disconnect the square wave generator.

(f) Perform the vertical passband test to table 5-7, step 11. If the passband is not equal to or greater than 30 megacycles (35 megacycles is typical) repeat steps d and e comprising the ideal square wave, but with overshoot not to exceed 0.05 centimeters.

g. MX-2930B/USM VERTICAL PLUG-IN. Location of test points and adjustments in the MX-2930B/USM Vertical Plug-In is shown in figures 4-21, 4-22 and 5-5. For location of parts refer to figures 5-30 through 5-34.

(1) BALANCE.

(a) Set the Vertical Presentation Switch to CHANNEL A and the SWEEP MODE switch to FREE RUN.

(b) Center the sweep vertically with the Channel A VERTICAL POSITION control.

(c) Adjust Channel A BAL, R508 (see figure 5-30), to obtain no vertical shift on the trace as the Channel A POLARITY switch is turned from +UP to -UP.

(d) Repeat the above for Channel B, setting the associated BAL control, R543 (see figure 5-30).

(2) SENSITIVITY. -

(a) Set the Vertical Presentation Control to CHANNEL A, the AC-DC switch to AC, the VERNIER adjustment to CALIBRATED, and the SENSITIVITY control to 0.02 VOLTS/CM.

(b) Set the HORIZONTAL DISPLAY control to X1, the SWEEP TIME control to 50 MICROSECONDS/CM, the SWEEP MODE control to PRESET, and the TRIGGER SOURCE switch to INT.

(c) Apply 400-cycle sine wave from a Model 738A Voltmeter Calibrator to the Channel A INPUT; set the amplitude to .05 volt peak-to-peak.

(d) Adjust the SENS CAL control for a CRT deflection height of exactly 2.5 centimeters. See figure 5-30.

(e) Check all the other ranges of the SENSITIVITY control and adjust the SENS CAL control if necessary for agreement with the following list.

SENSITIVITY VOLTS/CM	Peak-to-Peak Input Voltage	Display Height (centimeters)
0.02	0.05	2.5
0.05	0.2	3.88 to 4.12
0.10	0.3	2.91 to 3.09
0.20	0.5	2.42 to 2.58
0.50	2.0	3.88 to 4.12
1.00	3.0	2.91 to 3.09
2.00	5.0	2.42 to 2.58
5.00	20.0	3.88 to 4.12
10.0	30.0	2.91 to 3.09
20.0	50.0	2.42 to 2.58

(f) Repeat the above for Channel B, setting the associated SENS CAL control.

(3) ATTENUATOR COMPENSATION

(a) Set the Vertical Presentation Switch to CHANNEL A and the Channel A SENSITIVITY control to .02 VOLTS/CM.

(b) Connect the AN/URM-90 Q Meter to the Channel A INPUT and adjust the A Cap Adj, C1590, to make the input capacitance 30 pf.

(c) Set the Vertical Presentation Switch to CHANNEL B and the Channel B SENSITIVITY control to .02 VOLTS/CM.

(d) Connect the capacity meter to the Channel B INPUT and adjust the B Cap Adj, C1594, to make the input capacitance 30 pf.

(e) Set the Vertical Presentation Switch to CHANNEL A and connect the 600-ohm output of a Model 211A Square Wave Generator to the Channel A INPUT; set the square-wave frequency to 5 kc.

(f) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X1, the SWEEP TIME switch to 5 MILLISECONDS/CM, the TRIGGER SOURCE switch to INT, and the SWEEP MODE control to PRESET.

Figure 5-5

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AN/USM-140B
MAINTENANCE

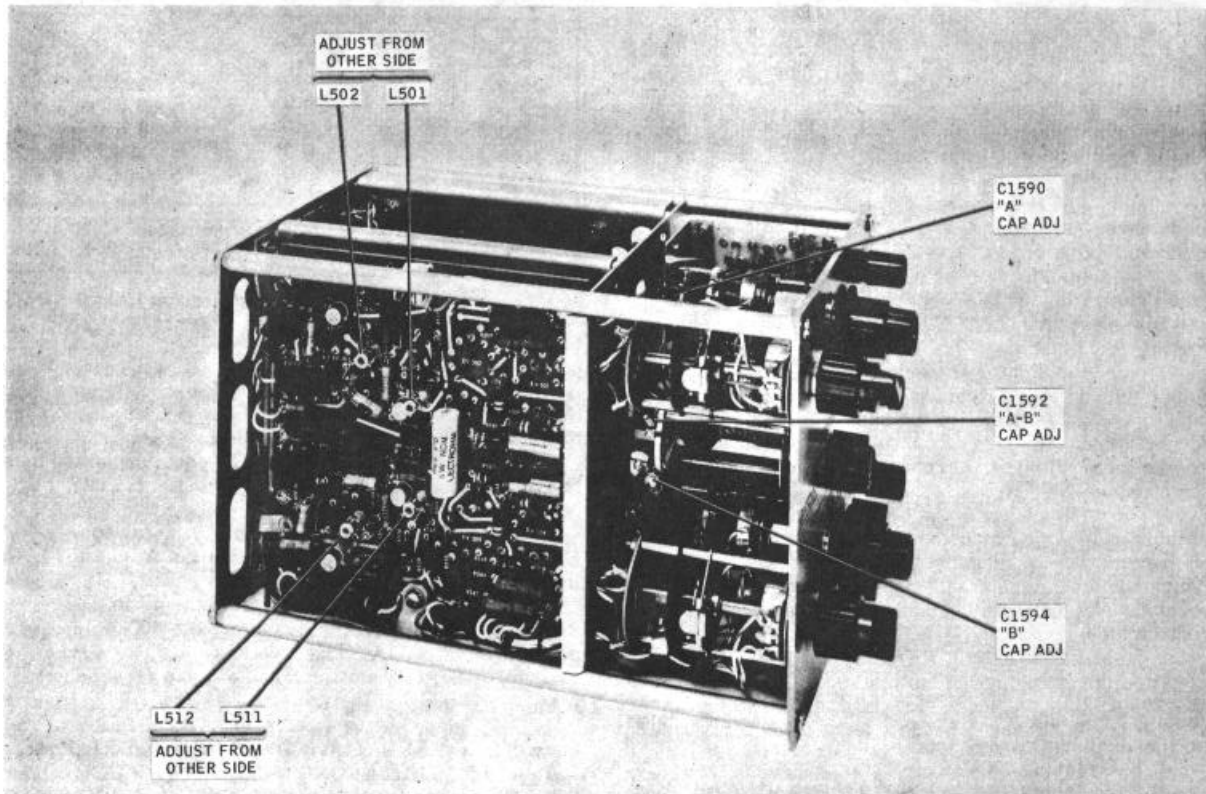
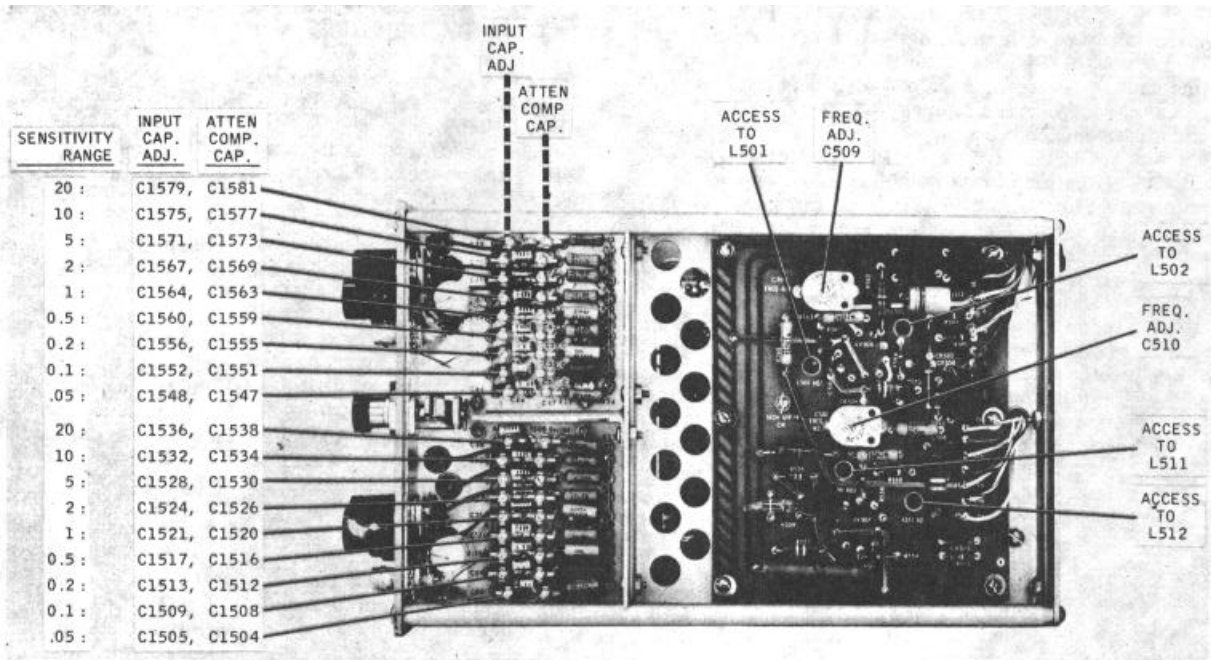


Figure 5-5. Location of Adjustments in MX-2930B/USM
5-16

(g) Set the Channel A SENSITIVITY as indicated in the list below. In each case adjust the square wave generator output amplitude for 2- or 3-centimeters of deflection and adjust the indicated capacitor for the best square wave on the CRT. See figure 5-5 for locations.

(h) Set the Vertical Presentation Switch to CHANNEL B and change the square wave generator output to the B INPUT.

(i) Repeat steps b and c above for Channel B controls.

SENSITIVITY VOLTS/CM	ADJUST	Channel A	Channel B
.05	.05	Atten Comp C1547	C1504
.1	.1	Atten Comp C1551	C1508
.2	.2	Atten Comp C1555	C1512
.5	.5	Atten Comp C1559	C1516
1	1	Atten Comp C1563	C1520
2	2	Atten Comp C1569	C1526
5	5	Atten Comp C1573	C1530
10	10	Atten Comp C1577	C1534
20	20	Atten Comp C1581	C1538

(4) INPUT CAPACITANCE

(a) Set Vertical Presentation Switch to Channel A and connect the AN/USM-90 Q Meter to the Channel A Input.

(b) Set the Channel A SENSITIVITY switch as indicated in the table below, in paragraph (e), and adjust each indicated capacitor for 30 pf. See figure 5-5 for locations.

(c) Set Vertical Presentation Switch to Channel B and connect the AN/URM-90 Q Meter to the Channel B Input.

(d) Set the Channel B SENSITIVITY switch as indicated in the table below, and adjust each indicated capacitor for 30 pf. See figure 5-5 for locations.

(e) Set the Vertical Presentation Switch to A-B and both SENSITIVITY switches to .02 VOLTS/CM. Leave the AN/URM-90 Q Meter on Channel B. Adjust the A-B Cap Adj, C1592, to make input capacitance 30 pf.

SENSITIVITY VOLTS/CM	ADJUST	Channel A	Channel B
.05	.05	Cap Adj C1548	C1505
.1	.1	Cap Adj C1552	C1509
.2	.2	Cap Adj C1556	C1513
.5	.5	Cap Adj C1560	C1517
1	1	Cap Adj C1564	C1521
2	2	Cap Adj C1567	C1524
5	5	Cap Adj C1571	C1528
10	10	Cap Adj C1575	C1532
20	20	Cap Adj C1579	C1536

(5) HIGH FREQUENCY RESPONSE. -

(a) Set the Vertical Presentation Switch to CHANNEL A, the Channel A SENSITIVITY to .02 VOLTS/CM, and the VERNIER to CALIBRATED.

(b) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X1, the SWEEP TIME switch to .5 MICROSECONDS/CM, the TRIGGER SOURCE control to INT, and SWEEP MODE to PRESET.

(c) Connect a fast-rise square wave generator to the Channel A INPUT. Adjust the square-wave frequency for 2 or 3 cycles on the CRT and 3or 4centimeters of deflection.

(d) Adjust the High Freq coils L501 and L502 for the best square wave with minimal overshoot. Although these coils are on the left side of the Dual Trace Preamplifier, they are adjusted from right side through special holes in the circuit board (see figure 5-5).

(e) Repeat steps a through d for Channel B; adjust the High Freq coils L511 and L512 for minimum overshoot.

(6) SWITCHING MULTIVIBRATOR FREQUENCY. -

(a) Set the HORIZONTAL DISPLAY control to INTERNAL SWEEP X1, the SWEEP TIME control to .1 MICROSECONDS/CM, the VERNIER to CAL, the TRIGGER SOURCE switch to INT, the SWEEP MODE control to FREE RUN, and the INTENSITY MODULATION control to EXTERNAL.

(b) Set the Vertical Presentation Switch to ALTERNATE and adjust the VERTICAL POSITION controls for two traces about 4 centimeters apart.

(c) Set the Vertical Presentation Switch to CHOPPED and the SWEEP MODE control to PRESET.

(d) Adjust Freq Adj capacitors C509 and C510 for symmetrical square wave 10-centimeters long (neglect transients during switching).

5-5. REPLACEMENT OF COMPONENTS.

a. TUBES. Electron tubes are best checked by replacement. Results obtained from an external tube tester can sometimes be misleading. Mark the tubes for identification as you remove them so you can return them to their original sockets if they are still good. Figure 5-6 shows the locations of the tubes and table 3-4 indicates the adjustments required following replacement of tubes, transistors, and diodes. Tube type 7308 may be replaced, in emergencies, by tube type 6922. The latter type, however, draws a different heater current and may unbalance the heater supplies. If such a substitution is made, check the \pm 6.3 volt supplies to assure that they are within 0.2 volts of each other. Balance can be restored by tube selection. An unused replacement 7308 tube may exhibit a stabilizing action for about 24 hours of operation after it is first placed in service. Tubes which have been "aged" at normal operating conditions for this period of time can be used for replacement if it is necessary to avoid a change in tube characteristics during this short break-in period. The V508 position in the MX2930B/USM Dual Trace Preamplifier is sensitive in this respect. Aged and balanced tubes are recommended for replacement use in this position.

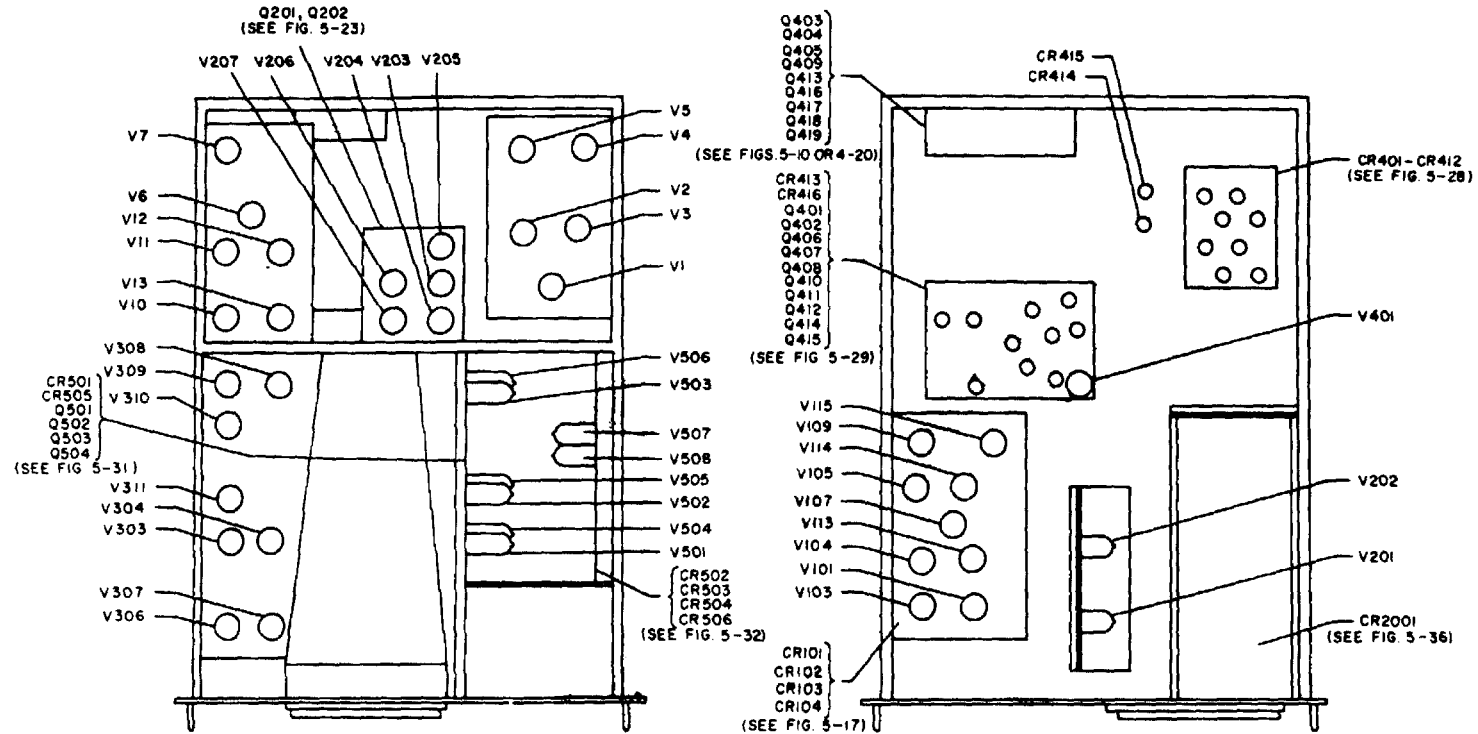


Figure 5-6. Top and Bottom Views, Location of Electron Tubes

b. TRANSISTORS AND DIODES. For the general procedure for component replacement on etched circuit boards, refer to paragraph 5-5f. Transistors on etched circuit boards are mounted on insulated spacers that provide added support for the pigtail leads. The simplest way to remove a transistor is to cut its leads, remove and save the spacer, and unsolder the ends of the leads that are left in the board. When removing these remaining leads, use a toothpick or a small awl to clear the holes of softened solder. Avoid excessive heat, and always insulate the instrument from ground or ground the body of the soldering iron to prevent leakage voltage from damaging the component. When connecting the replacement transistor, place the insulated spacer on the new transistor and trim the leads so they will penetrate the board about 1/16 inch with the transistor positioned about 1/8 inch above the board. Solder the leads with an absolute minimum of heat necessary to completely melt the solder. If possible, place a heat sink (such as a pair of needlenosed pliers) between the transistor and the soldering iron. Because of the inherent stability of transistors, they should be the last elements suspected in case of equipment failure. When other elements have been checked in the defective circuit, locate open or shorted transistors by resistance measurements across the elements. Because of the difference in ohmmeters, no specific information can be given about exact resistances; however, generally the ratio of forward and backward emitter-collector resistance is from 10:1 to 100:1, the ratio being lower for the higher powered transistors. When a defective transistor is located, always look for another faulty element in the circuit which might have caused its failure.

c. REMOVAL OF CATHODE RAY TUBE. To remove the CRT, refer to figure 5-7 and proceed as follows:

WARNING

Wear plastic face mask or goggles and gloves when handling the cathode ray tube. Flying glass and internal parts of the CRT caused by implosion can cause severe injury. Tube is not dangerous if handled with due care.

- (1) Remove the oscilloscope from cabinet, and place chassis upright.
- (2) Remove 5 leads from neck of CRT.
- (3) Loosen two screws holding clamp on CRT base. Do not remove screws or clamp.
- (4) Remove post-accelerator cap from CRT (see figure 5-7) by prying.
- (5) Remove four mounting screws from bezel and remove bezel, filter and graticule.
- (6) Slide CRT slightly forward and loosen rubber gaskets between the clamp and CRT.
- (7) Remove socket from CRT base.
- (8) Slide CRT forward out of instrument, keeping one hand on front face of the CRT.

To install CRT, reverse above procedure. When the CRT is installed, turn the instrument on, obtain a free-running sweep, and check sweep alignment with horizontal lines on the graticule. If necessary, loosen the clamp on the CRT base and rotate the CRT by means of the tab on the socket to align the sweep with the graticule.

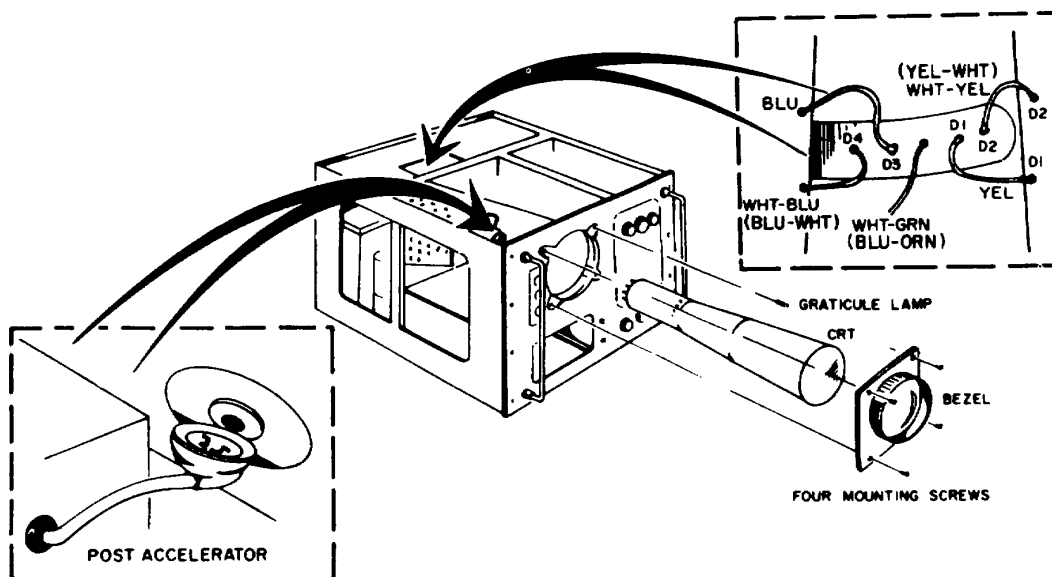


Figure 5-7. Removal of Cathode-Ray Tube
CHANGE 1 5-19

d. REMOVAL OF HIGH-VOLTAGE POWER SUPPLY TUBES. The four high-voltage rectifier tubes, the oscillator, and regulator tubes are located under a cover accessible through the left side gusset (see figures 5-6 and 5-12). To remove the cover, remove the four machine screws securing the cover to the high-voltage power supply. Disconnect oscilloscope from power source before working on any part of the high-voltage supply. Short the tube plate caps to ground before removing them from the tubes. To remove the four rectifier tubes remove the insulator plate that secures the tubes.

e. ACCESS TO SWEEP GENERATOR TUBES. The sweep generator tubes may be reached by removing the MX-2930B/USM Vertical Plug-In and the shield plate in tile floor on the empty plug-in well. Two screws hold the shield in place. Return the shield before replacing the plug-in unit. Refer to figure 5-6.

f. COMPONENT REPLACEMENT ON ETCHED CIRCUIT BOARDS. If a circuit board must be removed, first release tube clamps and remove all electron tubes. Use a low-power soldering iron (50 watts maximum) and apply heat sparingly to the lead of the part to be replaced. Slip the lead from the board as soon as the solder softens. For transistors and diodes, see the special procedure in paragraph 5-5b. Use a small awl or toothpick to clean the softened solder from the lead hole in the board. Bend the tinned leads of the replacement part and carefully insert through the cleaned holes. Hold the part against the board and, when possible, solder the leads from the other side. Avoid overheating and use ONLY a high quality rosin-core solder. NEVER USE PASTE FLUX. After soldering trim off excess leads and flux.

A break in the copper should be repaired by soldering a short length of tinned copper wire across the break. Copper that lifts off the board should be cemented in place with a quick drying acetate base cement having good electrical insulating properties. When replacing tube sockets cut all contacts to remove socket, then unsolder the remains.

When reinstalling the board, carefully align tube retainers with their respective chassis holes. Do not force the board into place by turning down on the mounting screws.

g. ACCESS TO FAN AND POWER SUPPLY TRANSISTORS. The fan motor and certain power supply transistors are mounted on the fan shroud.

(1) For removal of tile fan assembly and location of tile power transistors, refer to paragraph 5-2b and figures 4-20 and 5-10.

(2) To remove the fan blades, use the 1/8 inch Allen wrench mounted on the rear of the chassis. There is an access port for this wrench on the bottom of the fan shroud. Turn the fan blades until the socket head screw is visible.

h. REPLACEMENT OF HORIZONTAL DISPLAY SWITCH ASSEMBLY A200. -

Note

Read and understand each step before starting this procedure. See figure 5-21.

(1) Remove the cabinet and both plug-in units.

(2) Set the HORIZONTAL DISPLAY switch S202 to X100 and the EXTERNAL VERNIER switch to CA L.

(3) Remove both knobs with the Allen wrench mounted on rear chassis of instrument.

(4) Remove and save the front-panel mounting nut from the switch.

(5) Rear support bracket of switch S202 is part of the assembly. Remove and save the two screws holding the bracket to the chassis.

(6) Remove and save the shaft locknut and mounting hardware for the Vern Bal control R211 (figure 5-4).

(7) Remove and save shaft locknut and mounting hardware for the X100 Gain control R211 (figure 5-4).

(8) At the insulated terminal of the tie lug strip on the mounting bracket of switch S202, disconnect the white lead from the center terminal of R211 (see figure 5-21).

(9) At the grounded terminal of the tie lug strip, disconnect black wire from the cable.

(10) Disconnect the white, white/black, white/black/green, white,/yellow, and the white/orange/green wires from etched circuit board A201. This wiring is indicated in figure 5-8, which also shows the corresponding colors for Model AN/USM-140C.

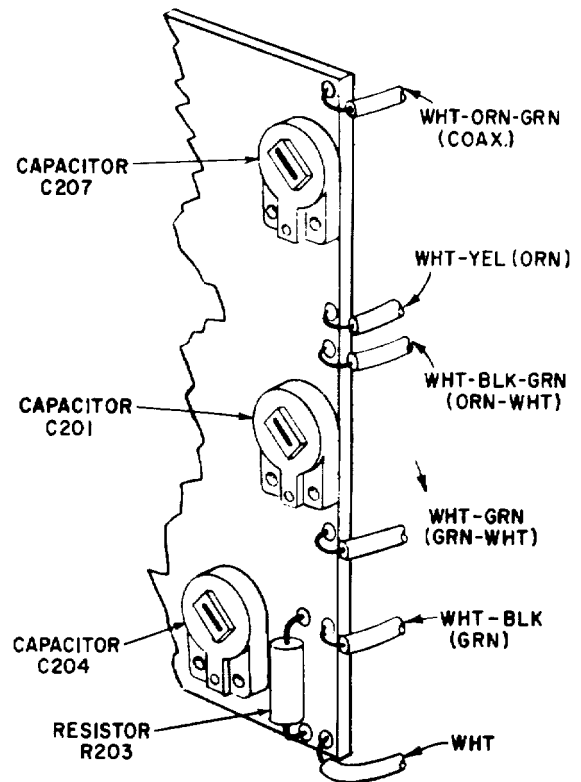


Figure 5-8. Wiring Between Switch S202 and Etched Circuit Board A201

(11) At the top of the AC-DC switch S201, disconnect the green wire from wafer A of S202.

(12) Remove the bottom shield plate of the plug-in unit well.

(13) Disconnect the white/brown/blue, white/brown/red, white/brown/orange, and white/brown/green wires from the top of wafer B of switch S202. These are the wires that go to the SWEEP TIME switch. They are shown on Figures 5-21 and 5-42. The corresponding colors for Model AN/USM-140C are shown in Figures 5-21A and 5-42A.

(14) Disconnect two white/brown (or gray) wires at terminal on wafer C of switch S202 (47 ohm, 2 watt resistor also connected to this terminal).

(15) Remove and save two screws holding assembly of circuit boards A201 and A203 to chassis (figure 5-10).

(16) Cut off following wires as close as possible to terminals on S202.

(a) Violet and white/yellow/violet (or violet/red) wire on wafer B.

(b) Green wire on bottom of wafer A.

(c) Two black wires on wafer A.

(d) White/green/violet (or coax.) wire on wafer C.

(e) White/yellow/blue (or orange) wire on wafer C.

(f) Twisted pair of yellow (or green) and white/yellow (or green/white) wires on wafer E.

(g) White/yellow/green (or orange/white) wire on wafer E.

(h) White/violet (or coax.) wire on rear of EXTERNAL VERNIER CAL switch S203.

(i) White/black/green (or white/green) wire on wafer A.

(17) Remove and discard defective switch assembly.

(18) Dress all leads on replacement switch toward bottom of switch except green lead from top of wafer A; white/brown/blue, white/brown/red, white/brown/orange, and white/brown/green from top of wafer B; white/brown wire from wafer C, white/yellow/green and twisted pair of yellow and white/yellow wires from wafer E. These wires are shown on figures 5-21 and 5-42. The corresponding colors for Model AN/USM-140C are shown in figures 5-21A and 5-42A.

(19) Insert replacement switch in instrument with shaft through front panel. Put on front panel mounting nut and tighten finger tight. Be sure the switch positioning lugs on the front of switch engage holes in the rear of front panel. Press leads dressed toward bottom of switch through the hole toward circuit board A201.

(20) Connect and solder the green wire from top of wafer A to the top of AC-DC switch S201.

(21) Connect and solder one black lead from wafer A of S202 to ground terminal on sweep generator circuit board A101. Disconnect the black lead left from old switch.

(22) Connect and solder the remaining black lead from wafer A of S202 to terminal on top of circuit board A203 in place of black lead from old switch.

(23) Connect and solder the violet wire from wafer B of S202 to the center terminal of R1002 (.1 Sec Timing) in place of the violet wire from the old switch.

(24) Connect and solder the white/yellow violet (or violet/red) wire from wafer B of S202 to one end of resistor R143 on sweep generator circuit board A101 in place of corresponding wire from old switch. Dress new wire along same route as old wire.

(25) Dress the white/brown/blue, white/brown/red, white/brown/orange, and white/brown/green wires from wafer B of S202 over to SWEEP TIME switch S1001 and connect and solder them to separate terminals on wafer A of S1001 as shown in figure 5-18, (figure 5-18A for Model AN/USM-140C). Remove each of the corresponding wires remaining from the replaced switch.

(26) White/yellow/blue (or orange) wire from wafer D of S202 should be connected to R223. However, it is easier to connect the old wire to terminal of wafer D of S202 in place of new wire supplied with replacement switch.

(27) White/yellow/green wire from wafer E of S202 should be connected to R223. However, it is easier to connect old wire to terminal of wafer E of S202 in place of wire supplied with replacement switch.

(28) White/violet (coax.) wire from EXTERNAL VERNIER CAL switch S203 should be connected to circuit board A203. However, it is easier to connect old wire to S203 in place of wire supplied with replacement switch.

(29) Route new twisted pair of yellow (or green) and white/yellow (or green/white) wires from wafer E of S202 along same path as wires from original switch and connect new wires in place of old ones. Connect yellow (or green) wire to junction of R244 and C211 on horizontal amplifier circuit board A202; connect white/yellow (or green/white) wire to junction of R259 and C213 on same board.

(30) Connect and solder white/brown (or gray) wire from the Vern Bal control R211 and white/brown wire from the SCALE LIGHT control R1025 to terminal on wafer C of S202 to which 47-ohm, 2-watt resistor is connected. Remove and discard corresponding wires supplied on switch.

(31) White/green/violet (or coax.) wire from wafer C of S202 should be connected to circuit board A203. However, it is easier to connect old white/green wire in place of wire supplied with replacement switch.

(32) Remove mounting nut from switch S202 and slide back to gain access to bottom terminal on wafer A to which green wire is attached.

(33) Replace the green wire from bottom of wafer A of switch S202 with green wire from circuit board A203.

(34) Replace white/black/green (or white/green) wire on bottom of wafer A to J201.

(35) Slide switch forward through panel and engage switch position lugs in holes on rear side of front panel. Replace front-panel mounting nut and tighten finger tight.

(36) All wires from S202 except the following five wires (and one white wire off S203) should be connected by previous steps:

(a) White/yellow (or orange) wire from EXTERNAL VERNIER CAL switch S203.

(b) White/orange/green (or coax.) and white/black/green (or orange/white) wires from wafer C.

(c) White and white/black (or white/green) wires from wafer A.

(37) Dress the five wires identified above so they are in sequence for connecting to circuit board A201 (see figure 5-8).

(38) Remount assembly of circuit boards A201 and A203 on chassis. Use two 6-32 x 3/4 inch mounting screws and #6 internal-tooth lockwasher under each screw head.

(39) Refer to figure 5-8 and connect five wires identified in step 37 to circuit board A201.

(40) Replace but do not tighten two 6-32 x 3/8 inch mounting screws for switch S202 rear mounting bracket. Place 6 x 3/8 inch flat washer under each screw head.

(41) Tighten front-panel mounting nut.

(42) Be sure no wires are pinched under switch S202 rear mounting bracket and tighten mounting bracket screws.

(43) Remount the X100 Gain control R223. Place internal-tooth lockwasher under mounting nut.

Be sure locating lug is in corresponding chassis hole before tightening mounting nut. Be sure no wires are pinched under control.

(44) Remount Vern Bal control R211. Follow same procedure given for R223 above.

(45) Replace shaft locknuts on R223 and R211.

(46) Connect and solder the white wire from the center terminal of the Vern Bal control R211 to insulated terminal of tie lug strip on the rear mounting bracket of S202.

(47) Connect and solder the black wire from cable to the grounded terminal of tie lug strip on the rear mounting bracket of S202.

(48) Replace the black knob on the HORIZONTAL DISPLAY switch S202. Be sure switch is rotated fully clockwise. Tighten both setscrews with knob pointer in X100 position.

(49) Replace the red knob on the EXTERNAL VERNIER control shaft. Rotate shaft fully clockwise to CAL position and tighten knob so pointer points to CAL.

(50) Replace bottom plate of vertical plug in unit amplifier well. Use two 6-32 x 3/8 inch machine screws with lockwashers.

(51) Switch replacement is complete. Before putting instrument back into service, check horizontal amplifier adjustment (paragraph 5-4d).

i. REPLACEMENT OF SWEEP TIME SWITCH ASSEMBLY A1000.

Note

Read and understand each step before starting this procedure. (See figures 5-13 and 5-18).

(1) Remove the cabinet and both plug-in units.

(2) Remove the knobs from the SWEEP TIME switch (S1001) and VERNIER control. Use the #8 Allen wrench mounted on rear chassis of instrument.

(3) Remove and save the front-panel mounting nut.

(4) Remove the bottom shield plate of the vertical plug-in unit well. This plate is held in place by two screws.

(5) Examine the coupling at the inner end of the center shaft of switch S1001. A small hair pin shaped coupler connects the shaft to R1009.

(6) Loosen but do not remove the mounting nut of R1009 and slide the control back far enough to free the coupler.

(7) Remove the coupler from the end of the shaft and save it.

(8) Remove and save washer(s), spacers, "O" ring, and spacer on the end of the shaft.

(9) Pull the shaft forward out of the instrument.

(10) Mark all tubes so they can be returned to the same sockets and remove V101, V113, V107, V114, and V115, (11) Remove and save both screws holding mounting rear bracket S1001 to chassis.

(12) Trace the coax center conductor from wafer C of S1001 to the junction of R151 and CR104 on the sweep generator circuit board A101; disconnect this coax center conductor at the circuit board A101.

(13) Trace the yellow wire from wafer D on S1001 through the chassis hole to the terminal on circuit board A101. Disconnect this yellow wire from S101 at circuit board A101.

(14) Disconnect white/black/yellow (or gray/orange) wire at terminal on wafer A of S1001 and remove ties holding wire to S1001 frame.

(15) Disconnect white/brown/green, white/brown/orange, white/brown/red, and white/brown/ blue wires at their respective terminals on wafer A of S1001. (See figure 5-18A for colors in AN/USM-140C).

(16) At the socket terminal for SWEEP UNCAL lamp DS1001, disconnect the brown (or white) wire from wafer A of S1001.

(17) Disconnect green wire from wafer D of S1001 at the rear terminal of 1.0 mfd 200 volt capacitor C1006.

(18) Disconnect the black wire from wafer D of S1001 at the front terminal of C1006.

(19) Disconnect the yellow wire on wafer D that goes to J105. (This wire not used in AN/USM-140C).

(20) Orange and white/orange/yellow (or yellow/orange) wires connect two terminals of wafer B of S1001 to two terminals on the CAL switch S1002 on the rear of the VERNIER control R1009. These wires will be used for connections to the replacement switch. Cut both wires at terminals on wafer B of S1001.

(21) Cut the six-wire cable connecting to wafer B of S1001 and remove the defective switch. This cable consists of a white/orange, white/black, white/red, white/green, black, and a violet wire.

(22) Pull the cable cut in step 21 into compartment for auxiliary plug-in.

(23) Remove the center shaft from replacement switch and place switch in instrument. Pass the yellow wire (disconnected in step 13) from wafer D of S1001 through chassis hole with other wires when inserting switch.

(24) Route the six-wire cable from wafer B of the replacement switch along same path as the cable from original switch.

(25) To gain access to the terminals of controls R178, R1024, R1004, R1003, and R1002 (figure 5-4)

remove the two mounting screws holding this assembly in place. Save screws and lockwashers.

(26) Observe color code and connect wires from replacement switch cable in place of wires from old switch:

(a) Black wire to ground terminal of tie lug strip on rear mounting bracket of HORIZONTAL DISPLAY switch S202.

(b) Violet wire to Sweep Length control R178.

(c) White/orange to .1 msec Timing control R1024.

(d) White/black to 1 msec Timing control R1004.

(e) White/red to 10 msec Timing control R1003.

(f) White/green to .1 sec Timing control R1002.

(27) Remount assembly of circuit boards A201 and A203. Use 6-32 x 3/4 inch screws and #6 internal-tooth lockwashers (see figure 5-10).

(28) Route the Orange and white/orange/ yellow (or yellow/orange) wires (disconnected in step 20) through S1001 switch wafer D to wafer B in place of wires with corresponding colors supplied on replacement switch. Connect the routed wires to wafer B terminals in place of supplied wires.

(29) Connect black wire from wafer D of S1001 to front terminal of 1.0 mfd 200-volt capacitor C1006. (See figure 5-40.)

(30) Connect the green wire from wafer D of S1001 to rear terminal of C1006.

(31) Connect the yellow wire from terminal 2 of wafer D to J105 (this wire omitted in Model AN/USM-140C.) An easier method is to clip off the existing yellow wire and reconnect the old wire disconnected to step 19.

(32) Connect the brown (or white) wire from wafer A of S1001 to vacant socket terminal of SWEEP UNCAL lamp DS1001.

(33) Connect white/brown/green, white/brown/ orange, white/brown/red, and white/brown/ blue wires from HORIZONTAL DISPLAY switch S202 to their respective terminals on wafer A of S1001. See figure 5-40 for proper locations. See figure 5-40A for colors in AN/USM-140C.

(34) Connect white/black/yellow (or gray/orange) wire (disconnected in step 14) from J105 to vacant terminal of rear side of wafer A of S1001. A 3.3-megohm resistor is connected to adjacent terminal. Use the same procedure as in step 31.

(35) Tie white/black/yellow (or gray/orange) wire to the frame of switch S1001 at wafers A and D.

(36) Connect the yellow wire from terminal 22 of wafer D of S1001 to terminal on circuit board A101.

(37) Dress the coax inner conductor from wafer C of S1001 through the chassis hole and hole in circuit board A101. Connect this wire to the junction of R151 and CR104 on circuit board A101.

(38) Dress the coax inner conductor along chassis and between tubes V114 and V115. Leave no slack at board A101.

(39) Replace but do not tighten the two 6-32 x 3/8 screws inch and #6 x 3/8 inch O.D. flat washers for rear mounting bracket of S1001. Be sure switch positioning lugs on front of switch engage holes in rear of front panel.

(40) Replace and tighten the front-panel mounting nut; then tighten the two rear mounting screws. Be sure no wires are pinched under mounting bracket.

(41) Insert the new shaft through center of S1001 and replace spacer, "O" ring, and spacer on inner end of center shaft.

(42) Replace washer(s) removed from shaft in step 8 and replace the hairpin coupler on end of shaft.

(43) Engage the coupler in the slot on the end of the shaft of the VERNIER control R1009.

(44) Tighten the mounting nut for R1009.

(45) The center shaft of S1001 should have approximately 1/32 inch end play and coupler must fully engage slot in shaft of R1009. Washer(s) placed on center shaft in step 42 determine end play and can be varied in number to adjust end play.

(46) Replace the tubes V115, V114, V107, V113, and V101.

(47) Replace the bottom shield plate of vertical plug-in unit well. Use two 6-32 x 3/8 inch machine screws with lockwashers.

(48) Replace the black knob on the SWEEP TIME switch. Be sure the switch is rotated fully clockwise and tighten both setscrews with knob pointer in .1 MICROSECONDS/CM position.

(49) Replace the red knob on the VERNIER control shaft. Rotate the shaft fully clockwise to CAL and tighten both setscrews so the pointer points to CAL.

(50) Switch replacement is complete. Before putting the instrument back into service, check sweep calibration, paragraph 5-4e.

5-6. LOCATION OF PARTS.

Figures 5-9 through 5-36 show locations of parts. All replaceable components and subassemblies are identified on the illustrations by reference designation and cross-referenced in the tables adjacent to each large etched circuit assembly and schematic drawing. These tables identify the location of each part on the adjacent illustration by use of "map-type" coordinates.

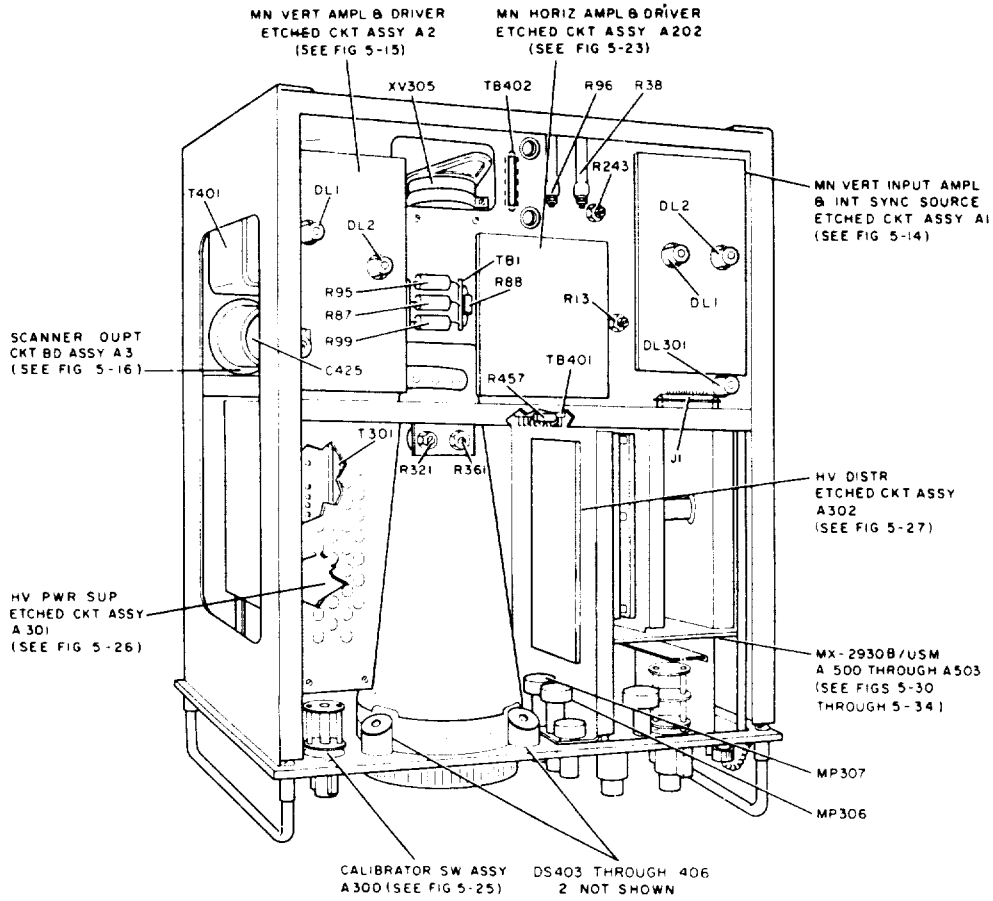


Figure 5-9. Top View, Location of Parts

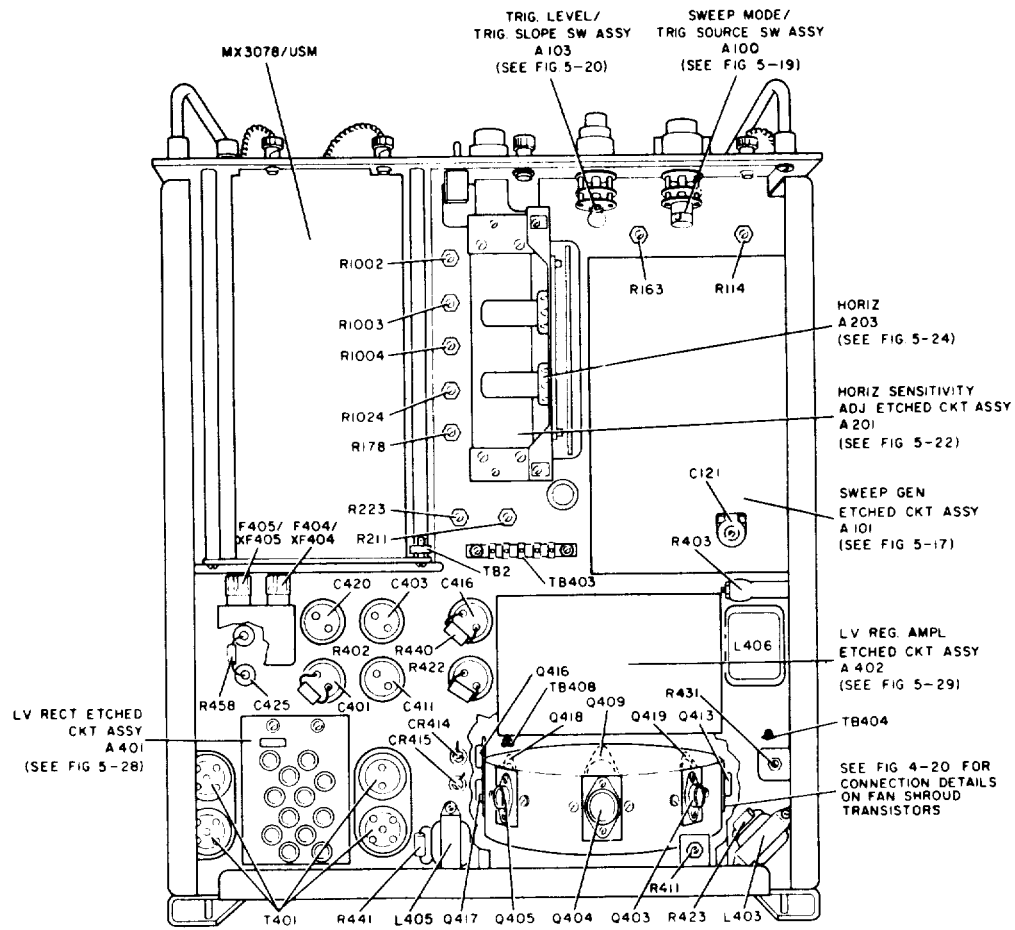


Figure 5-10. Bottom View, Location of Parts

CHANGE 1 5-25

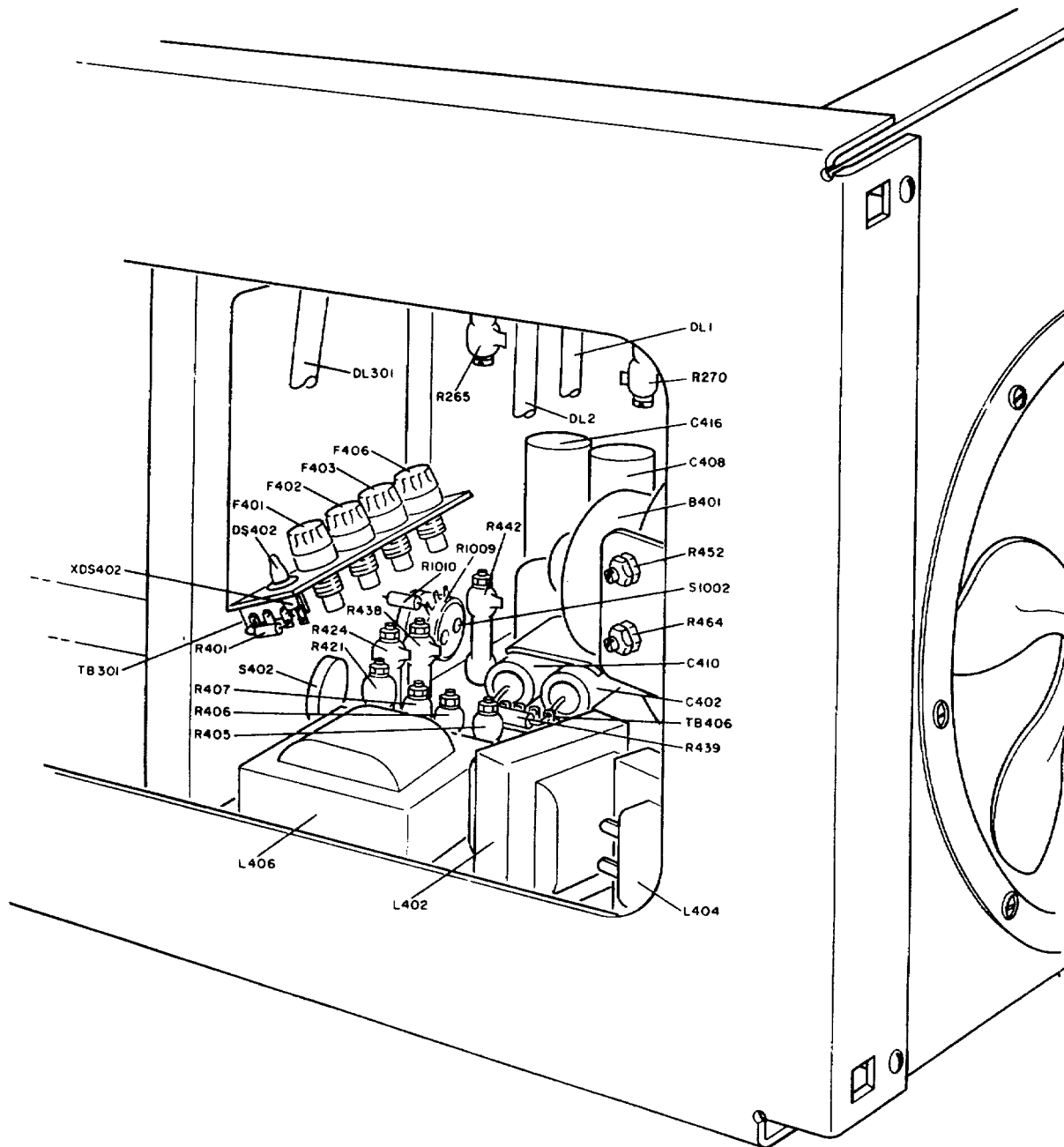


Figure 5-11. Right-Side View, Location of Parts

CHANGE 1 5-26

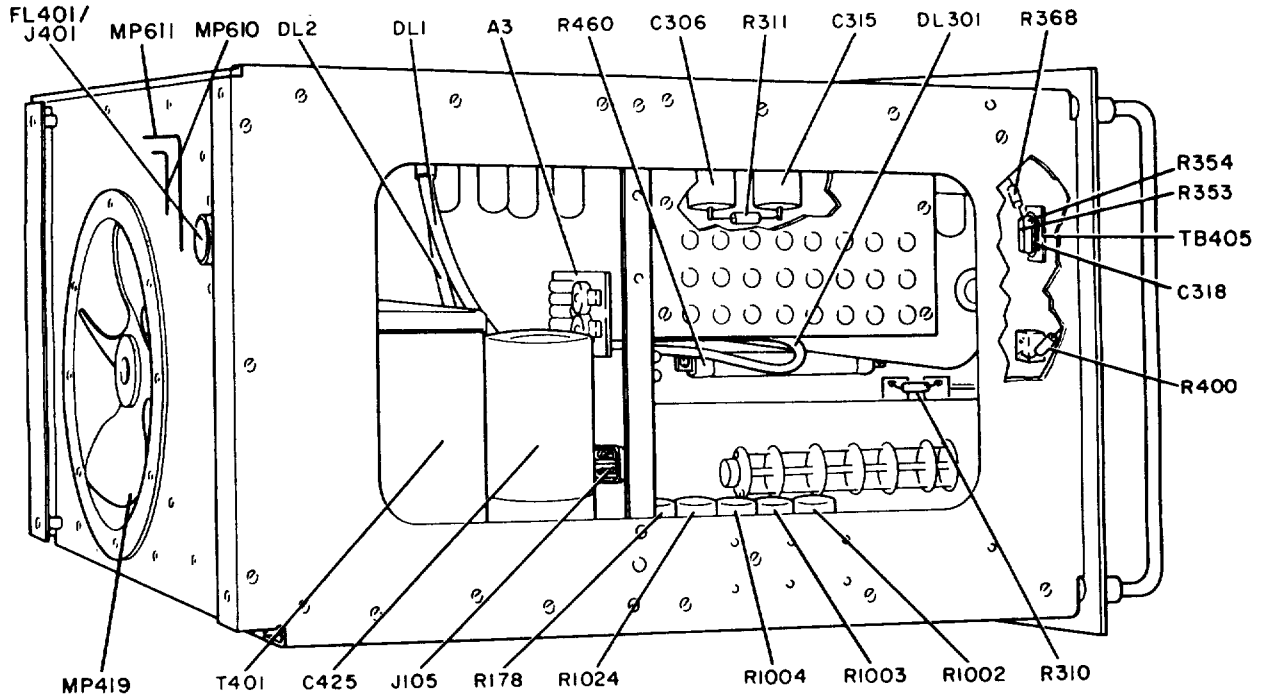


Figure 5-12. Left-Side View, Location of Parts

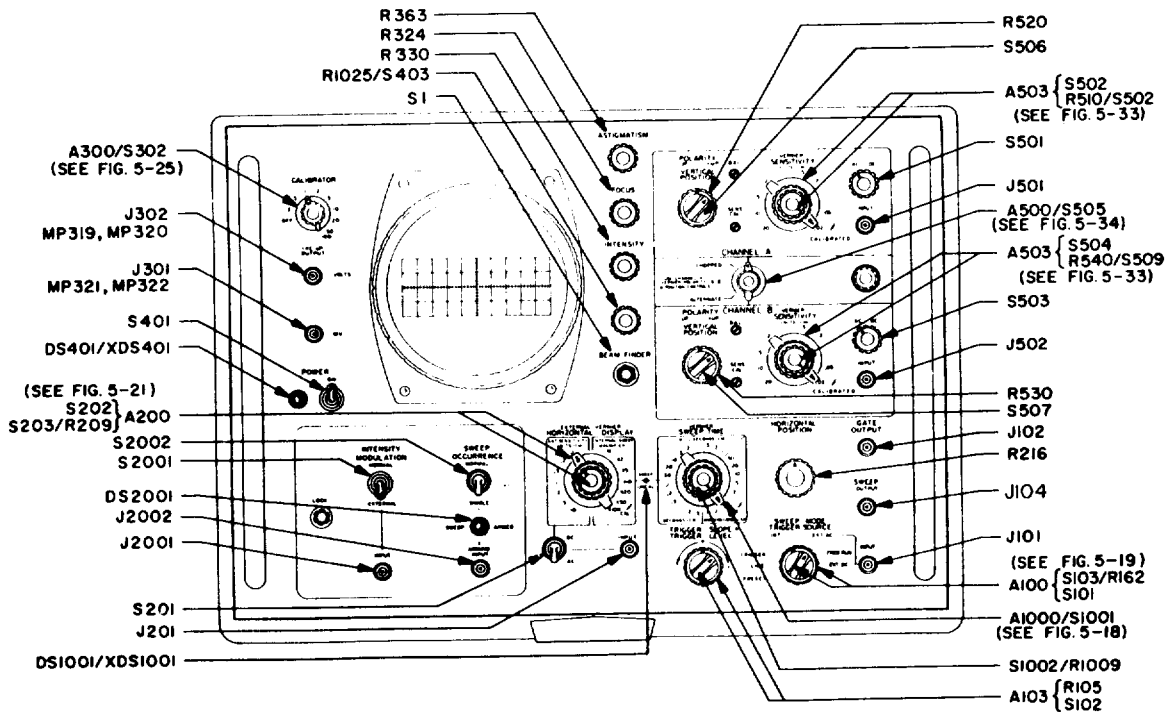
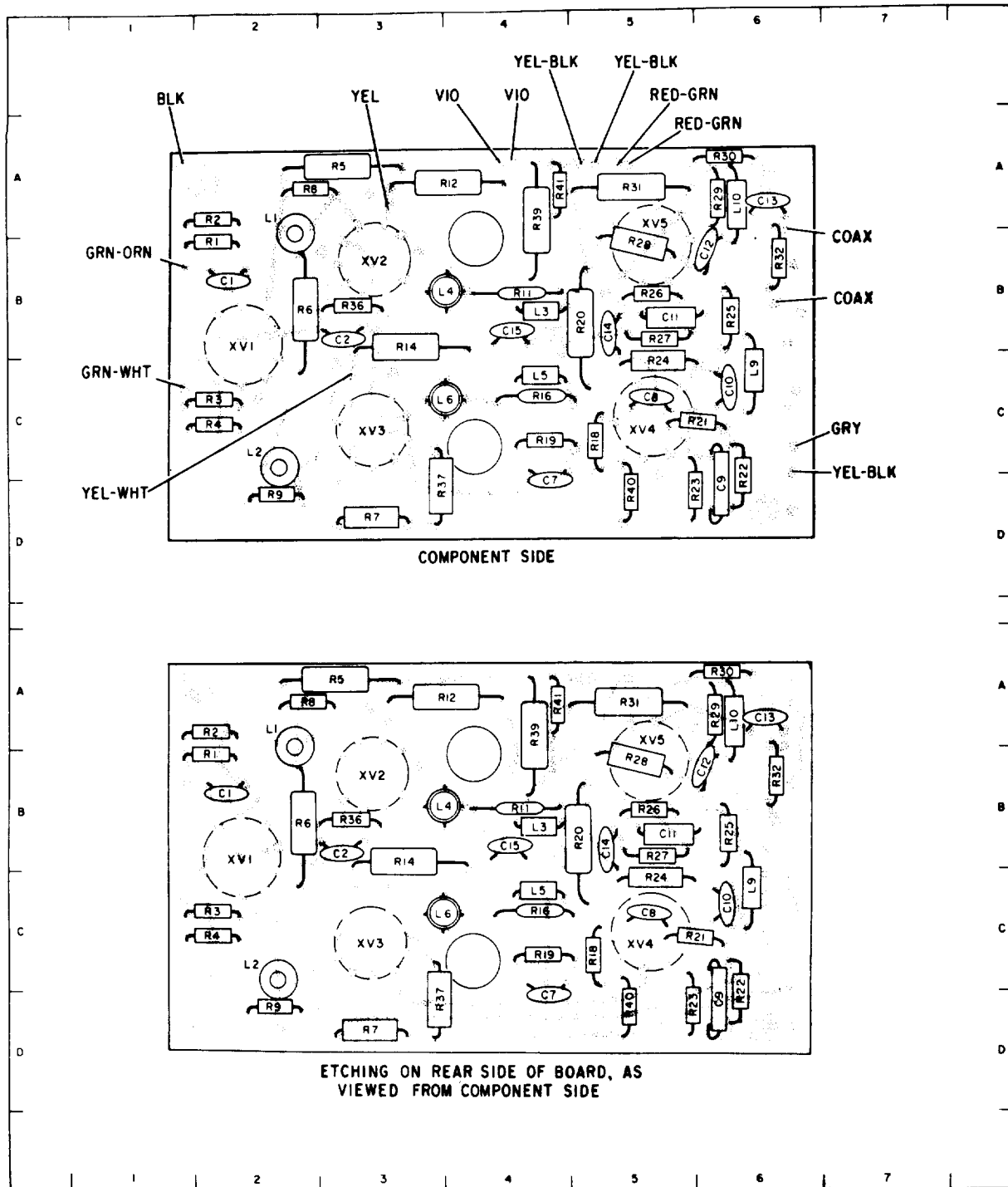


Figure 5-13. Front-View, Location of Parts

CHANGE 1 5-27

PARTS LOCATION INDEX FOR FIGURE 5-14

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
C1	B2	R14	C3
C2	B3	R16	C4
C7	D5	R18	C5
C8	C5	R19	C4
C9	D6	R20	B5
C10	D6	R21	C6
C11	B5	R22	D6
C12	B6	R23	D6
C13	A6	R24	C5
C14	B5	R25	B6
C15	B4	R26	B5
L3	B4	R27	B5
L4	B4	R28	B5
L5	C4	R29	A6
L6	C4	R30	A6
L9	C6	R31	A5
L10	A6	R32	B6
R1	B2	R36	B3
R2	A2	R37	D4
R3	C2	R39	A4
R4	C2	R40	D5
R5	A3	R41	A5
R6	B2	XV1	B2
R7	D3	XV2	B3
R8	A3	XV3	C3
R9	D2	XV4	C5
R11	B4	XV5	A5
R12	A4		



(SEE INDEX ON PAGE 5-28)

Figure 5-14A. Main Vertical Amplifier and Internal Sync Source Etched Circuit Assembly A1, Location of Parts AN/USM-140C

CHANGE 1 5-28.1

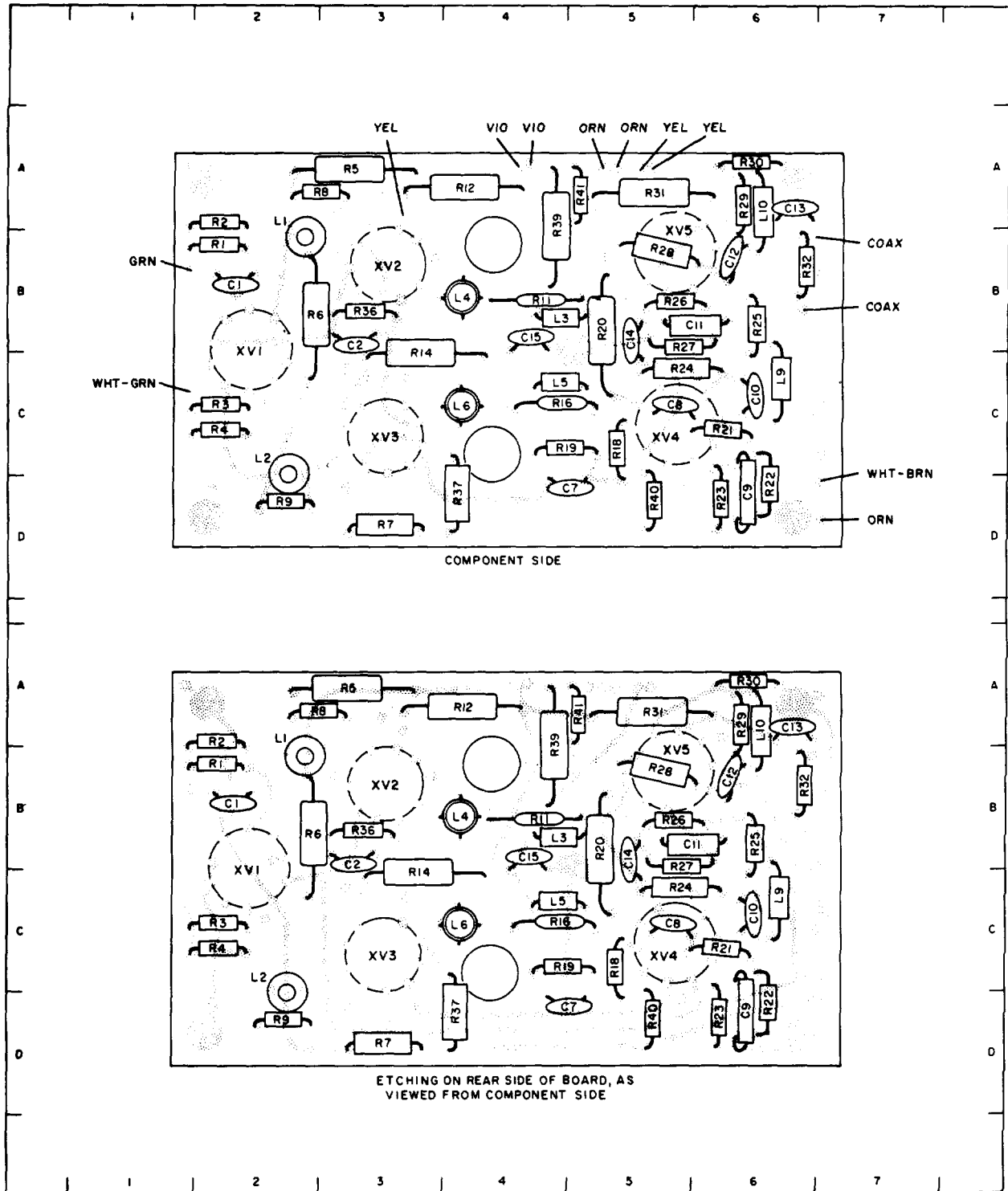
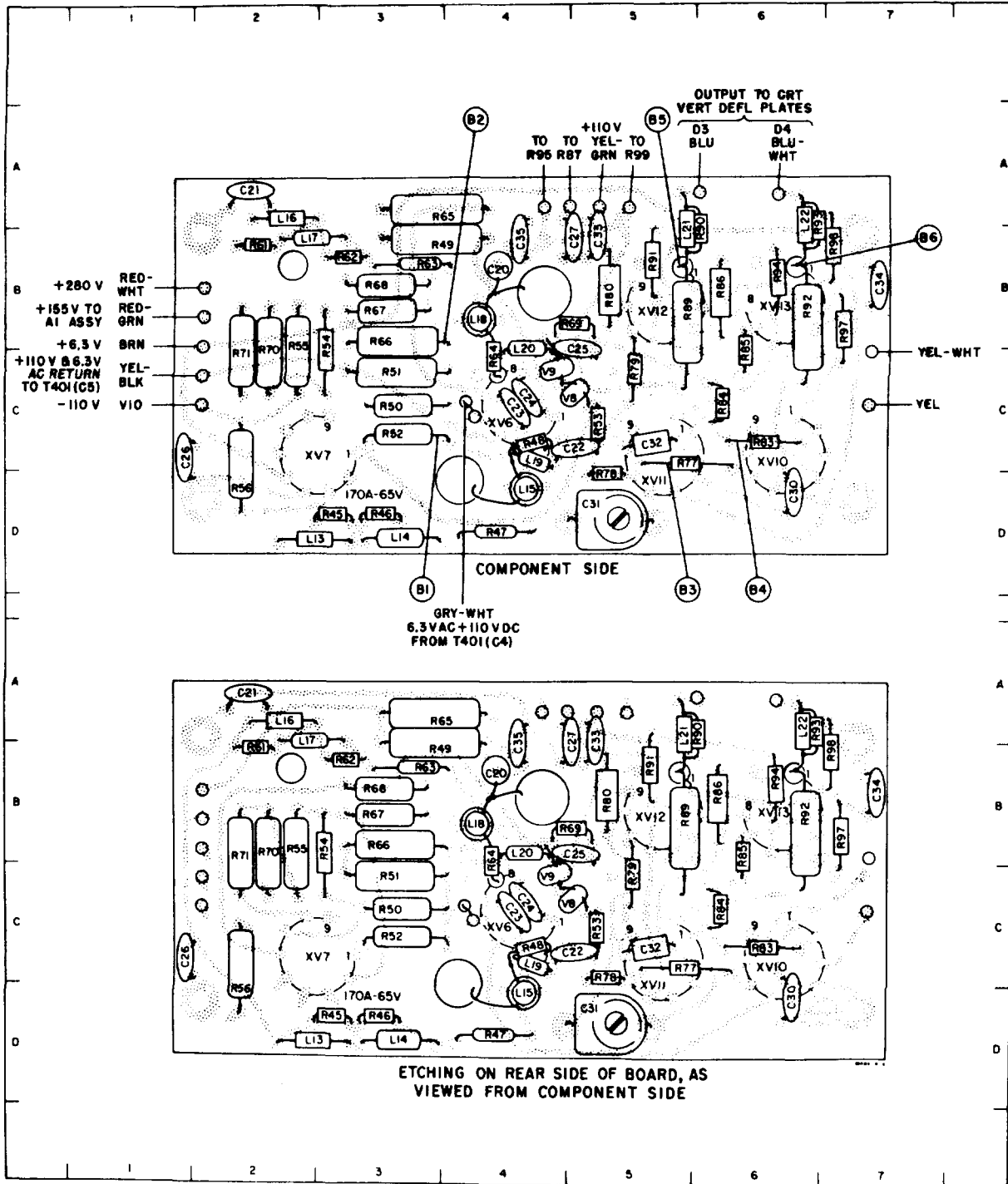


Figure 5-14. Main Vertical Input Amplifier and Internal Sync Source Etched Circuit Assembly, Location of Parts

PARTS LOCATION INDEX FOR FIGURE 5-15

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
C20	B4	R56	D2
C21	A2	R62	B2
C22	C4	R63	B3
C23	C4	R64	C4
C24	C4	R65	A3
C25	B4	R66	B3
C26	C1	R67	B3
C27	B4	R68	B3
C30	D6	R69	B4
C31	D5	R70	B2
C32	C5	R71	B2
C33	A5	R77	C5
C34	B7	R78	C5
C35	B4	R79	C5
L13	D2	R80	B5
L14	D3	R83	C6
L15	D4	R84	C6
L16	A2	R85	B6
L17	A2	R86	B6
L18	B4	R89	B5
L19	C4	R90	A5
L20	B4	R91	B5
L21	A5	R92	B6
L22	A6	R93	A6
R45	D2	R94	B6
R46	D3	R97	B7
R47	D4	R98	A7
R48	C4	V8	C4
R49	B3	V9	C4
R50	C3	XV6	C4
R51	C3	XV7	C2
R52	C3	XV10	C6
R53	C5	XV11	C5
R54	B2	XV12	B5
R55	B2	XV13	B6



(SEE INDEX ON PAGE 5-30)

Figure 5-15A. Main Vertical Input Amplifier and Driver Etched Circuit Assembly A2,
Location of Parts AN/USM-140C

CHANGE 1 5-30.1

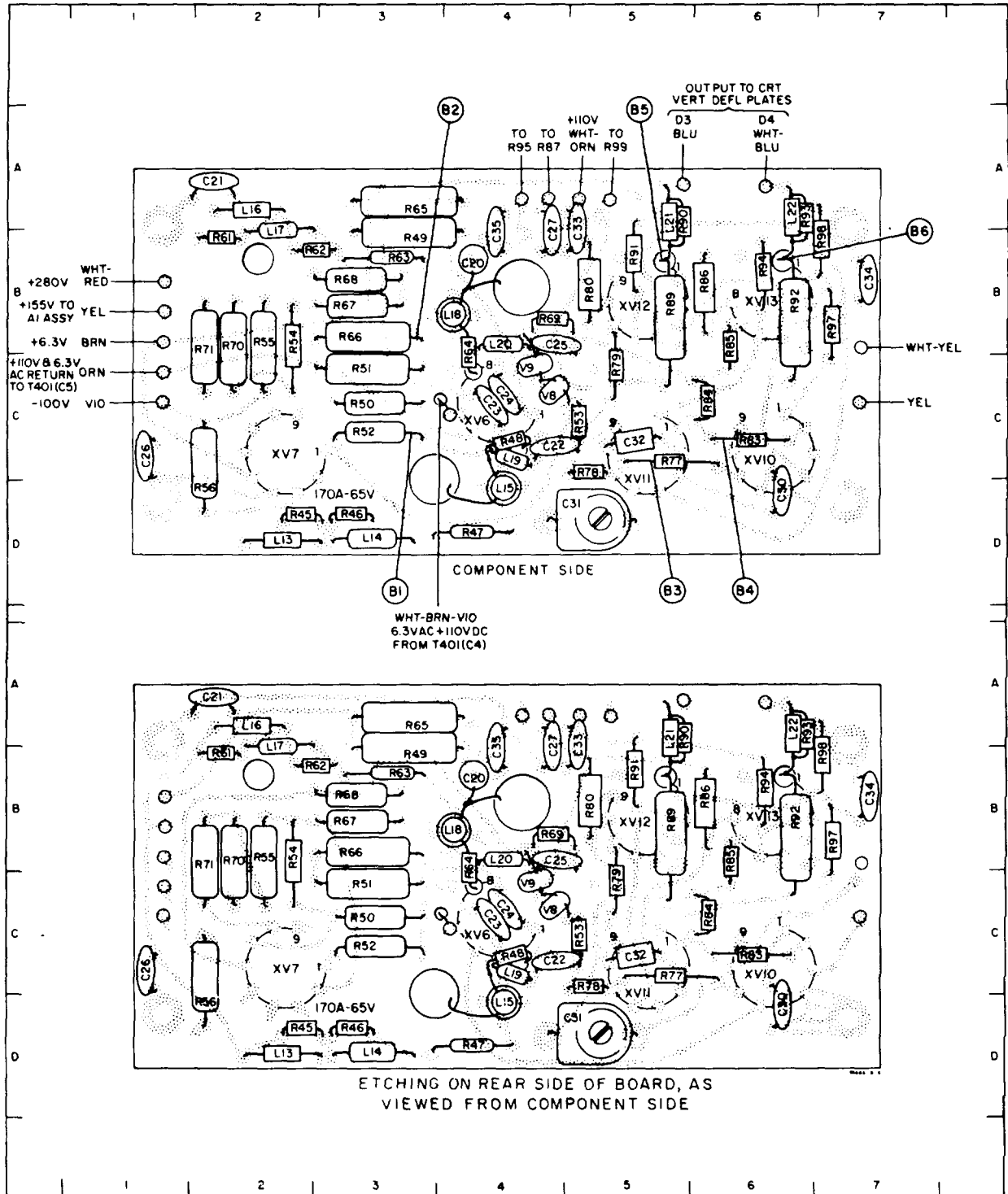


Figure 5-15. Main Vertical Amplifier and Driver Etched Circuit Assembly, Location of Parts

Figure
5-16

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NAVSHIPS 95706

AN/USM-140B
MAINTENANCE

PARTS LOCATION INDEX FOR FIGURE 5-17

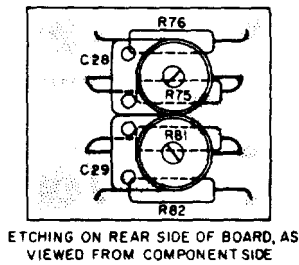
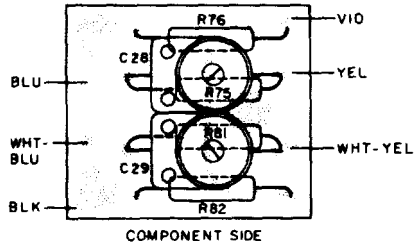
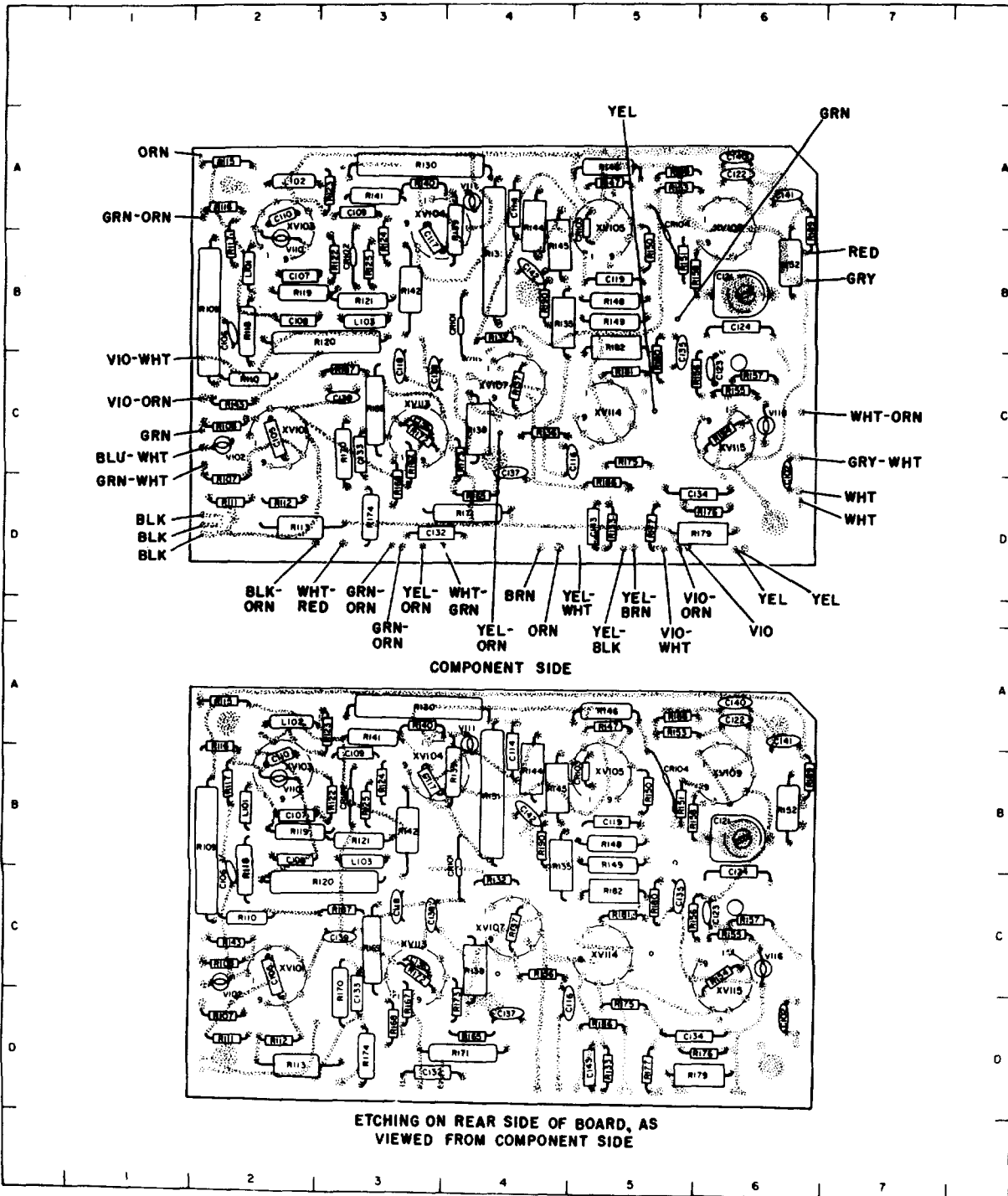


Figure 5-16. Scanner Output Etched Circuit Assembly, Location of Parts

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
CR101	B3	R137	C4
CR102	B3	R138	C4
CR103	A4	R139	B3
CR104	A5	R140	A3
C102	C6	R141	A3
C105	C2	R142	B3
C106	B2	R143	C2
C107	B2	R144	A4
C108	B2	R145	B4
C109	A3	R146	A5
C110	A2	R147	A5
C114	A4	R148	B5
C116	C4	R149	B5
C117	B3	R150	B5
C118	C3	R151	B5
C119	B5	R152	B6
C121	B6	R153	A5
C122	A6	R154	C6
C123	C6	R155	C6
C124	B6	R156	C5
C132	D3	R157	C6
C133	C3	R158	B5
C134	C5	R159	B6
C135	B5	R160	B6
C136	C3	R165	D4
C137	C4	R167	C3
C138	C3	R168	D3
C139	C3	R169	C3
C140	A6	R170	C3
C141	A6	R171	D4
C142	B4	R172	C3
C143	D5	R173	C4
L101	B2	R174	D3
L102	A2	R175	C5
L103	B3	R176	D5
R107	C2	R177	D5
R108	C2	R179	D5
R109	B2	R180	B5
R110	C2	R181	C5
R111	D2	R182	B5
R112	D2	R186	C5
R113	D2	R187	C3
R115	A2	R188	A5
R116	A2	R189	B6
R117	B2	R190	B4
R118	B2	V102	C2
R119	B2	V110	B2
R120	B2	V111	A4
R121	B3	V116	C6
R122	B3	XV101	C2
R123	A3	XV103	A2
R124	B3	XV104	A3
R125	B3	XV105	A5
R130	A3	XV107	C4
R131	B4	XV109	B6
R132	B4	XV113	C3
R133	D5	XV114	C5
R135	B4	XV115	C6
R136	C4		

PARTS LOCATION INDEX FOR FIGURE 5-17A

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
CR101	B3	R136	C4
CR102	B3	R137	C4
CR103	A4	R138	C4
CR104	A5	R139	B3
C102	C6	R140	A3
C105	C2	R141	A3
C106	B2	R142	B3
C107	B2	R143	C2
C108	B2	R144	A4
C109	A3	R145	B4
C110	A2	R146	A5
C114	A4	R147	A5
C116	C4	R148	B5
C117	B3	R149	B5
C118	C3	R150	B5
C119	B5	R151	B5
C121	B6	R152	B6
C122	A6	R153	A5
C123	C6	R154	C6
C124	B6	R155	C6
C132	D3	R156	C5
C133	C3	R157	C6
C134	C5	R158	B5
C135	B5	R165	D4
C136	C3	R167	C3
C137	C4	R168	D3
C138	C3	R169	C3
C139	C3	R170	C3
C140	A6	R171	D4
C141	A6	R172	C3
C142	B4	R173	C4
C143	B5	R174	D3
L101	B2	R175	C5
L102	A2	R176	D5
L103	B3	R177	D5
R107	C2	R179	D5
R108	C2	R180	B5
R109	B2	R181	C5
R110	C2	R182	B5
R111	D2	R186	C5
R112	D2	R187	C3
R113	D2	R188	A5
R115	A2	R189	B6
R116	A2	R190	B4
R117	B2	V102	C2
R118	B2	V110	B2
R119	B2	V111	A4
R120	B2	V116	C6
R121	B3	XV101	C2
R122	B3	XV103	A2
R123	A3	XV104	A3
R124	B3	XV105	A5
R125	B3	XV107	C4
R130	A3	XV109	B6
R131	B4	XV113	C3
R132	B4	XV114	C5
R133	D5	XV115	C6
R135	B4		



(SEE INDEX ON PAGE 5-32A)

Figure 5-17A. Sweep Generator Etched Circuit Assembly A101, Location of Parts

CHANGE 1 5-32.2

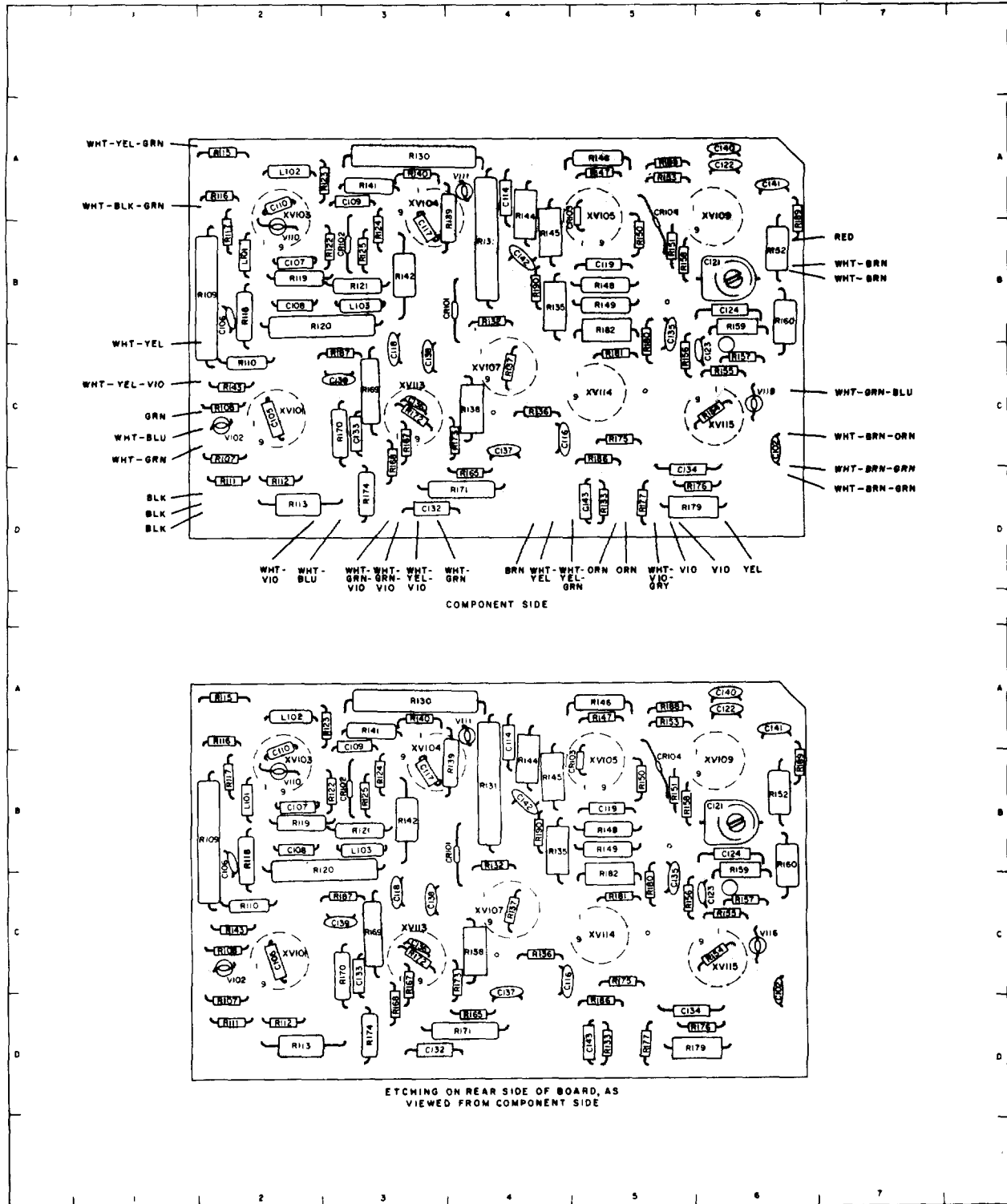


Figure 5-17. Sweep Generator Etched Circuit Assembly, Location of Parts

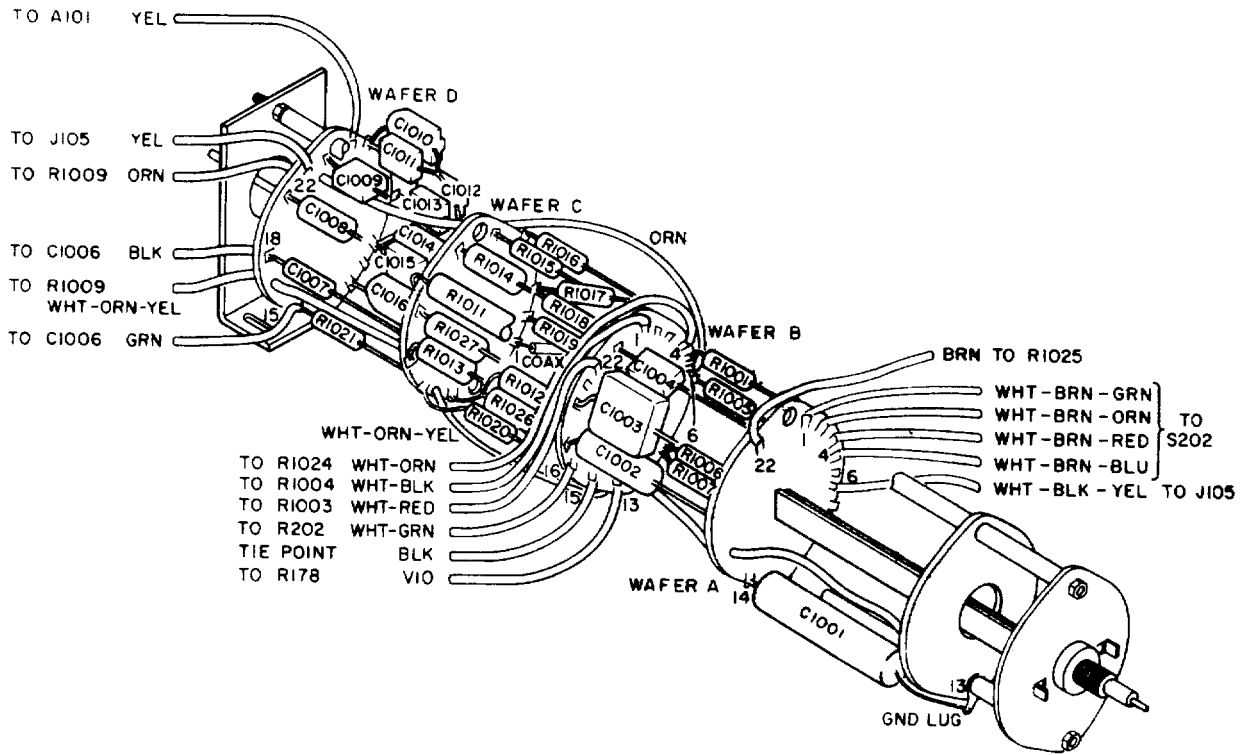


Figure 5-18. Sweep Time Switch Assembly, Location of Parts

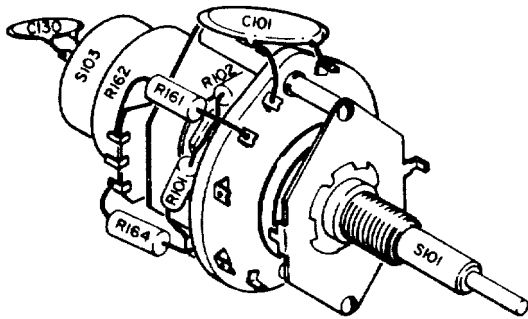


Figure 5-19. Sweep Mode/Trigger Source Switch Assembly, Location of Parts

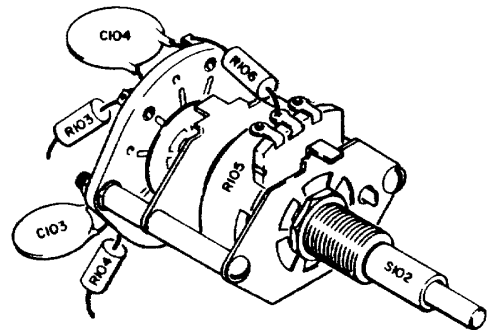


Figure 5-20. Trigger Level/Trigger Slope Switch Assembly, Location of Parts

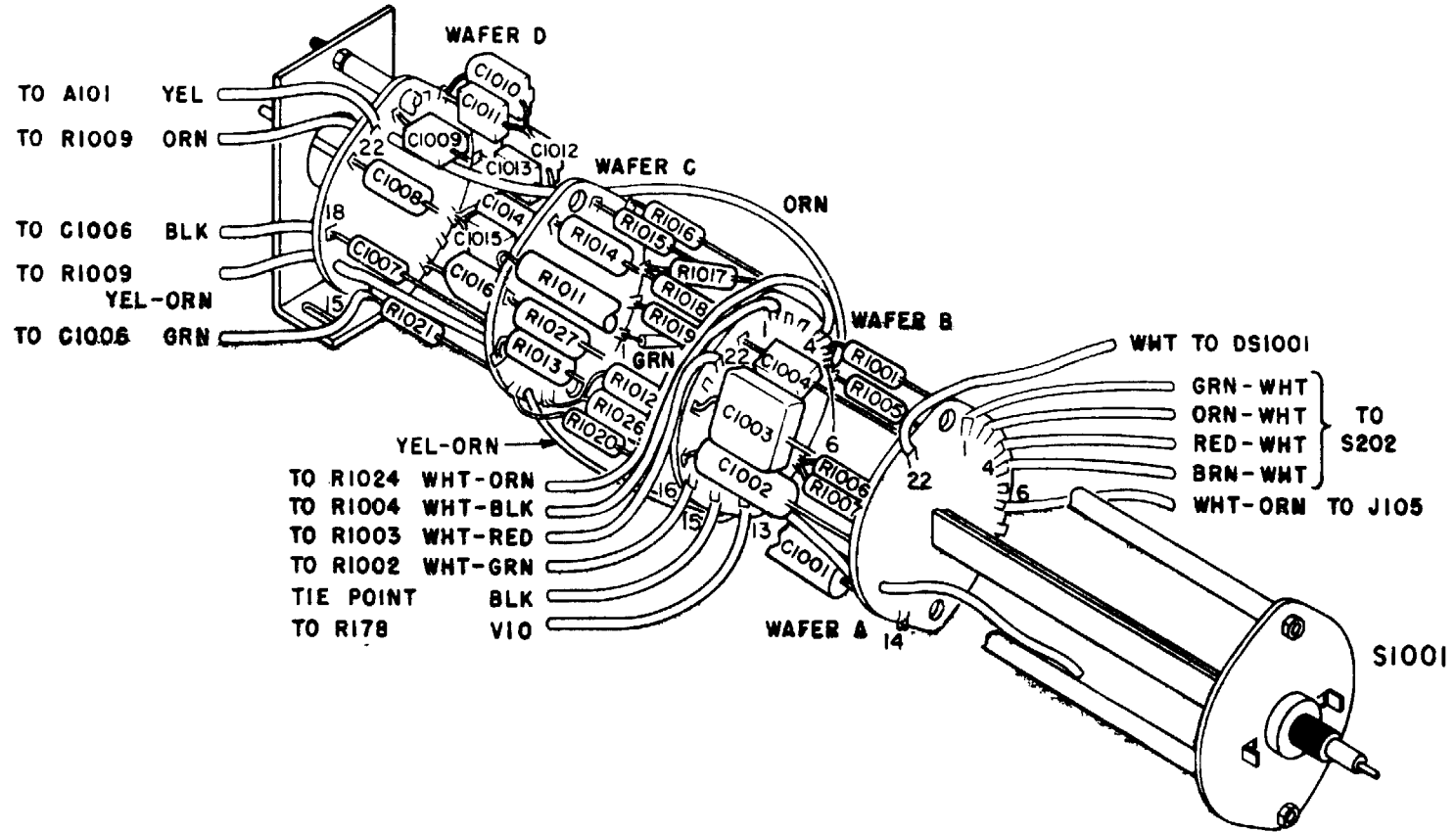


Figure 5-18A. Sweep Time Switch Assembly A1001 Location of Parts
AN/USM-140C

CHANGE 1 5-34.1

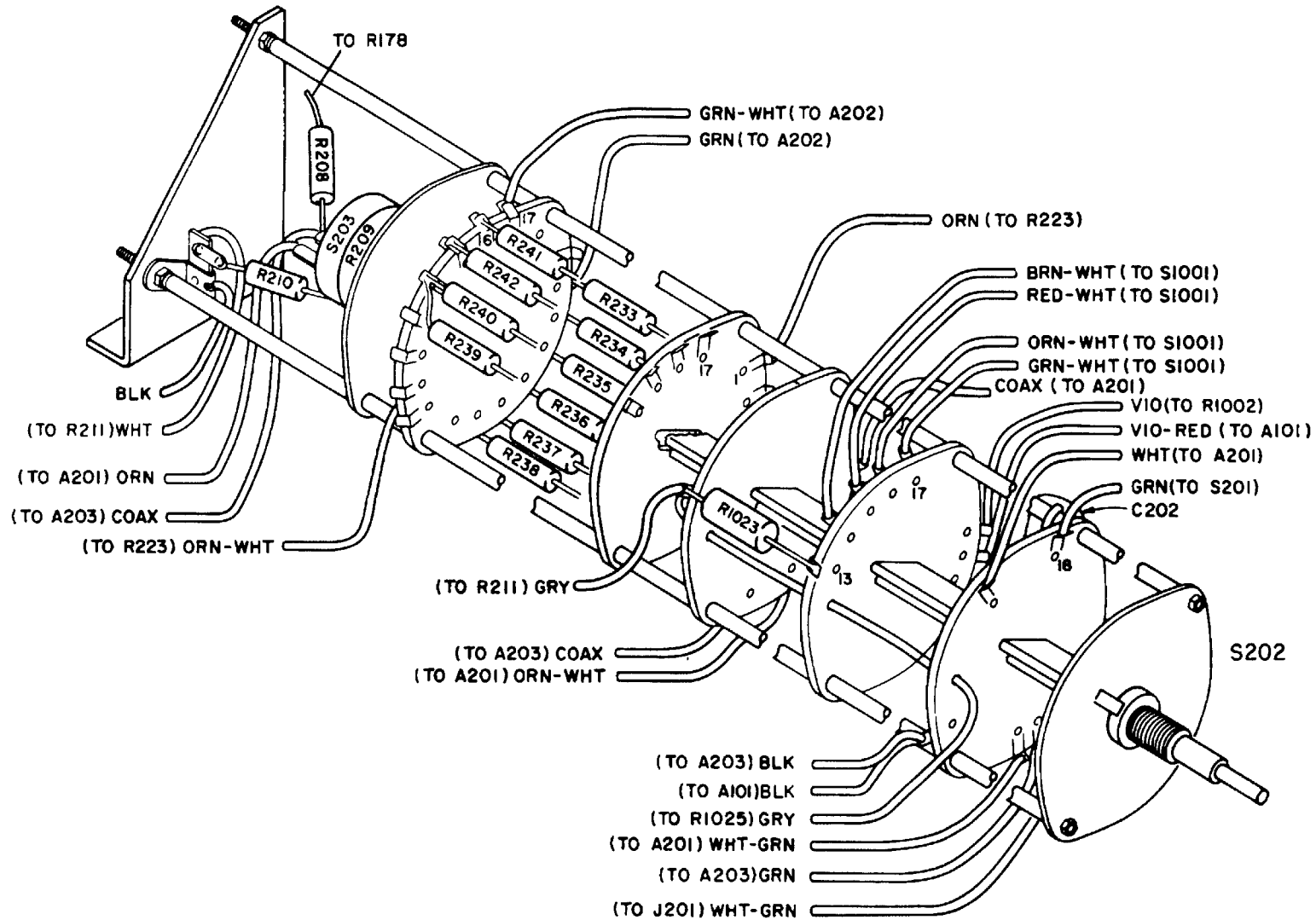


Figure 5-21A. External Vernier/Horizontal Display Switch Assembly A200. Location of Parts
AN/USM-140C

CHANGE 1 5-34.2

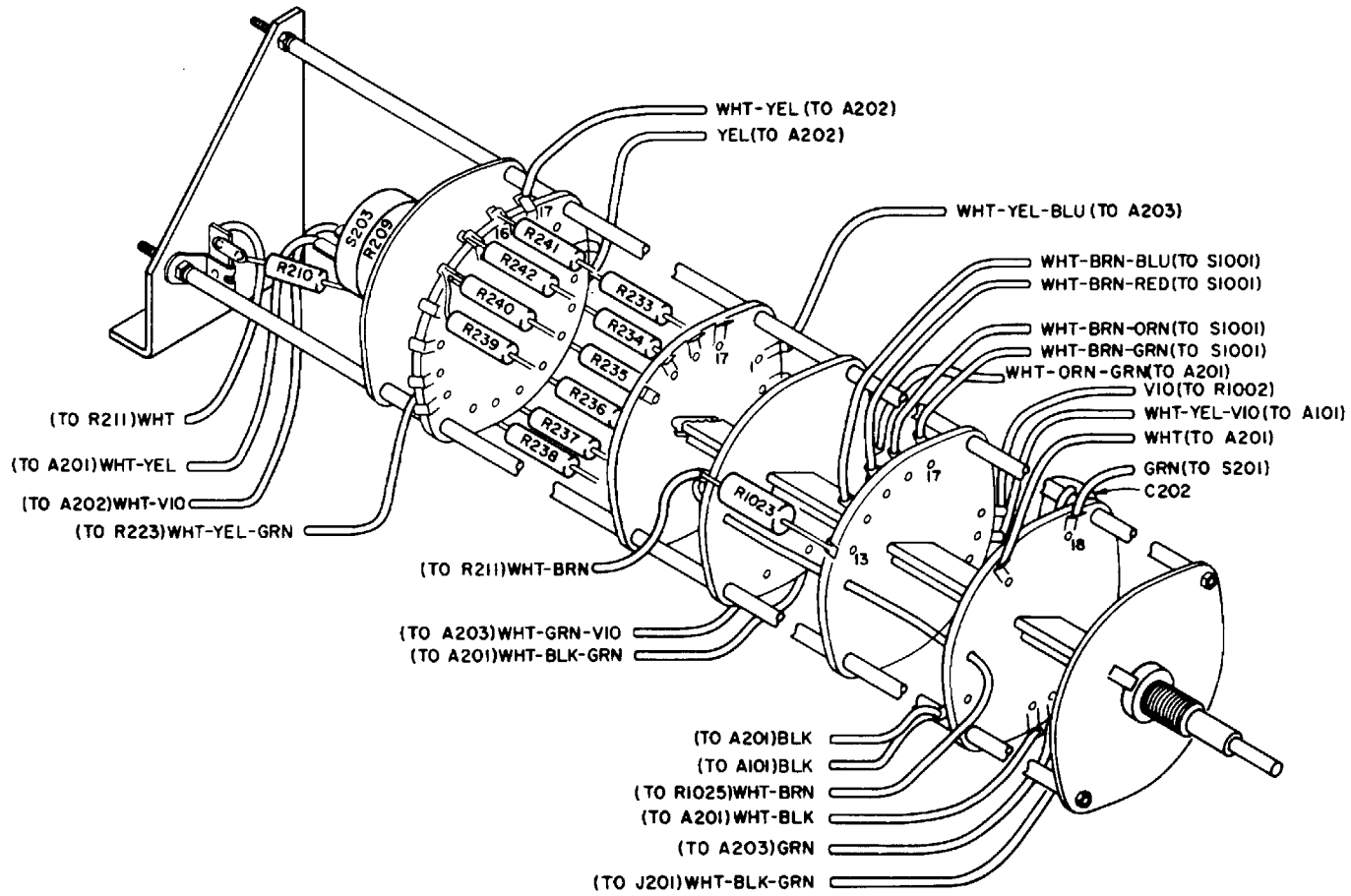


Figure 5-21. External Vernier/Horizontal Display Switch Assembly, Location of Parts

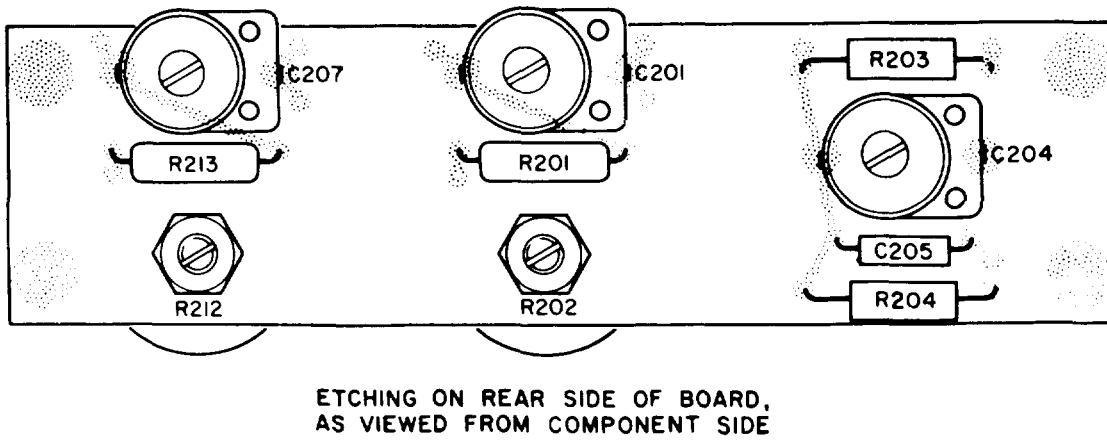
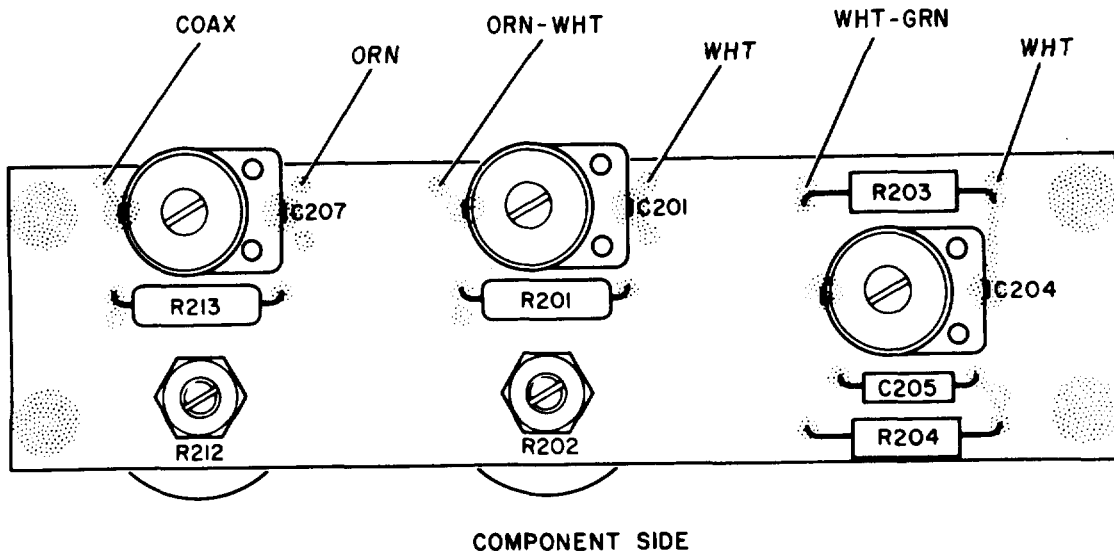


Figure 5-22A. Horizontal Sensitivity Adjustment Etched Circuit Assembly A201,
Location of Parts AN/USM-140C

CHANGE 1 5-36.1

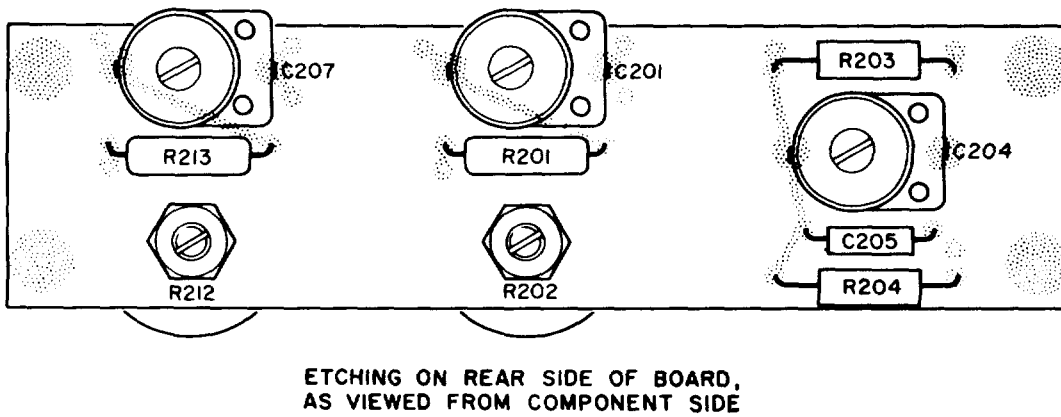
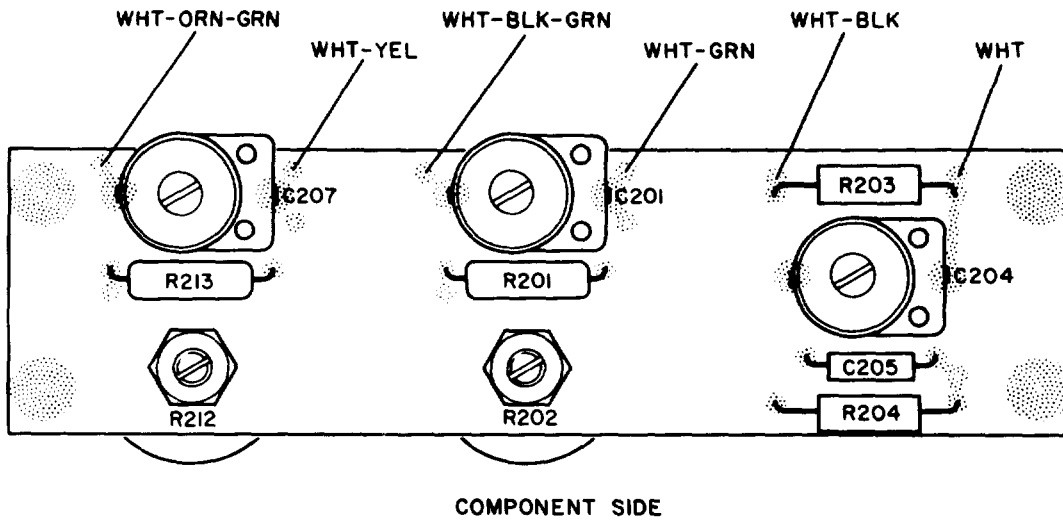
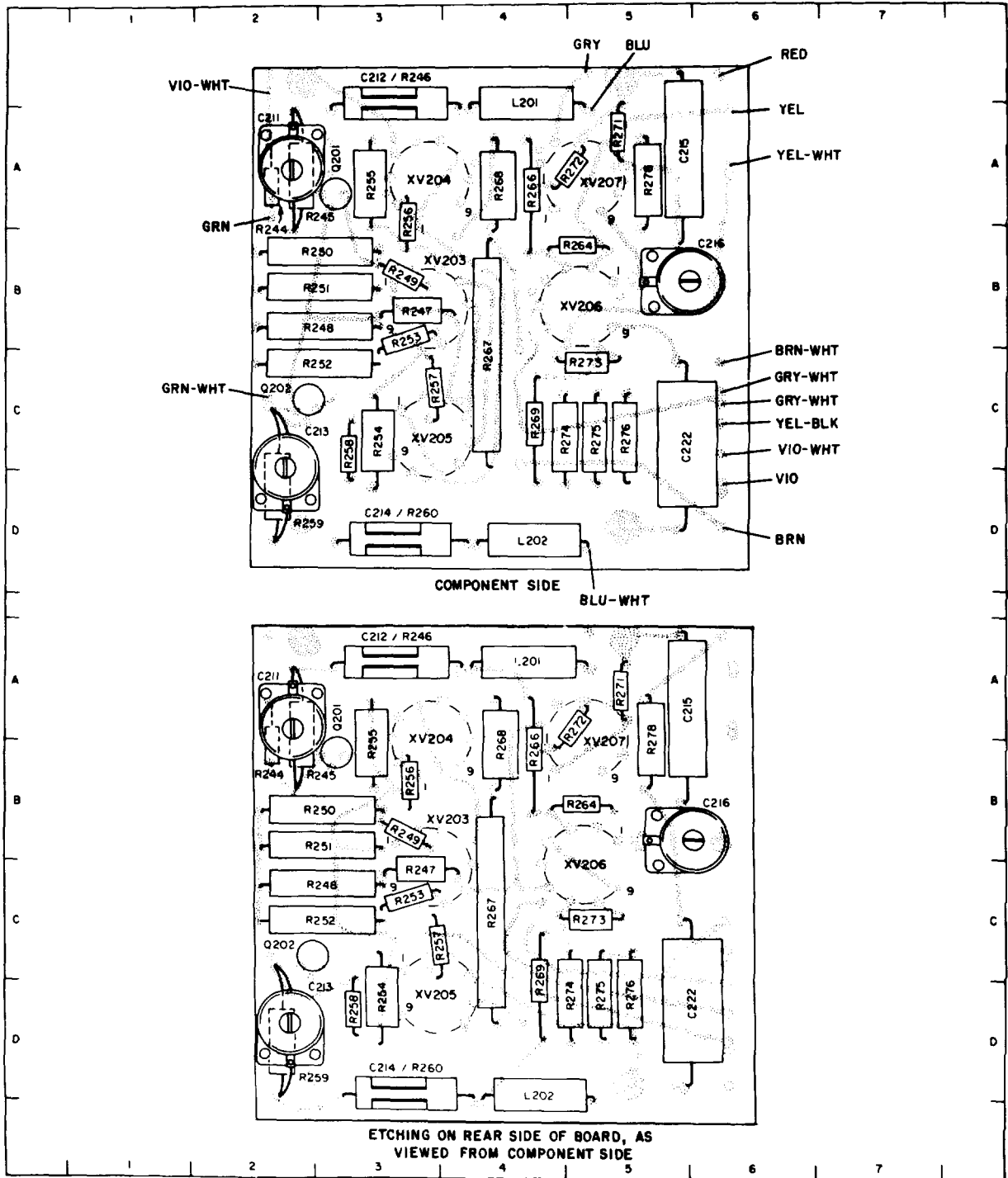


Figure 5-22. Horizontal Sensitivity Adjustment Etched Circuit Assembly, Location of Parts

PARTS LOCATION INDEX FOR FIGURE 5-23

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
C211	A2	R256	A3
C212	A3	R257	C4
C213	C3	R258	C3
C214	D3	R259	D2
C215	A6	R260	D4
C216	A6	R264	B5
C222	C6	R266	A4
L201	A4	R267	B4
L202	D4	R268	A4
Q201	A3	R269	C4
Q202	C2	R271	A5
R244	A2	R272	A5
R245	A3	R273	C5
R246	A3	R274	C5
R247	B3	R275	C5
R248	B3	R276	C5
R249	B3	R278	A5
R250	B3	XV203	B4
R251	B3	XV204	A3
R252	C3	XV205	C3
R253	B3	XV206	B5
R254	C3	XV207	A5
R255	A3		



(SEE INDEX ON PAGE 5-38)

Figure 5-23A. Main Horizontal Amplifier Assembly A202, Parts Location,
AN/USM-140C

CHANGE 1 5-38.1

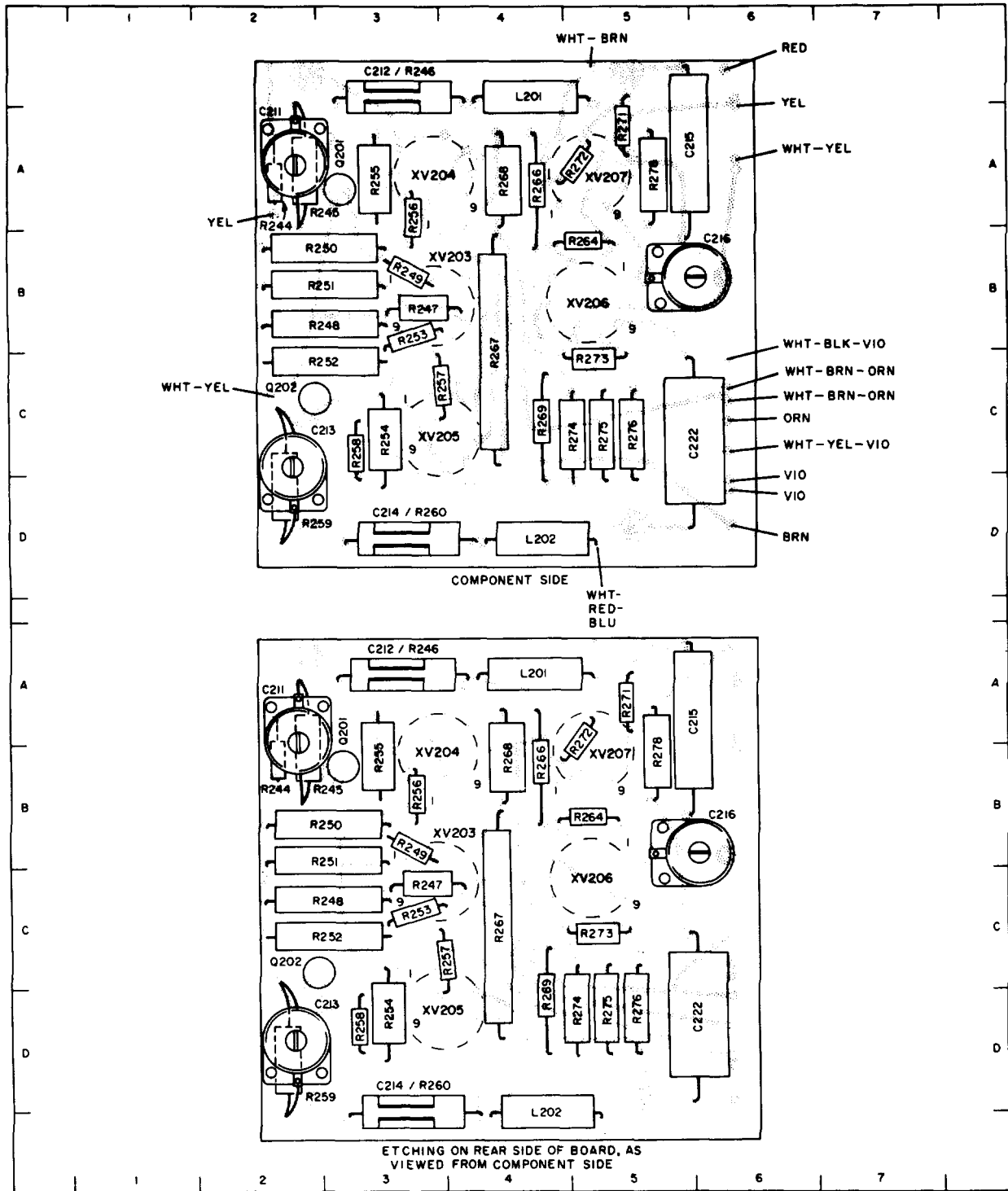


Figure 5-23. Main Horizontal Amplifier and Driver Etched Circuit Assembly, Location of Parts

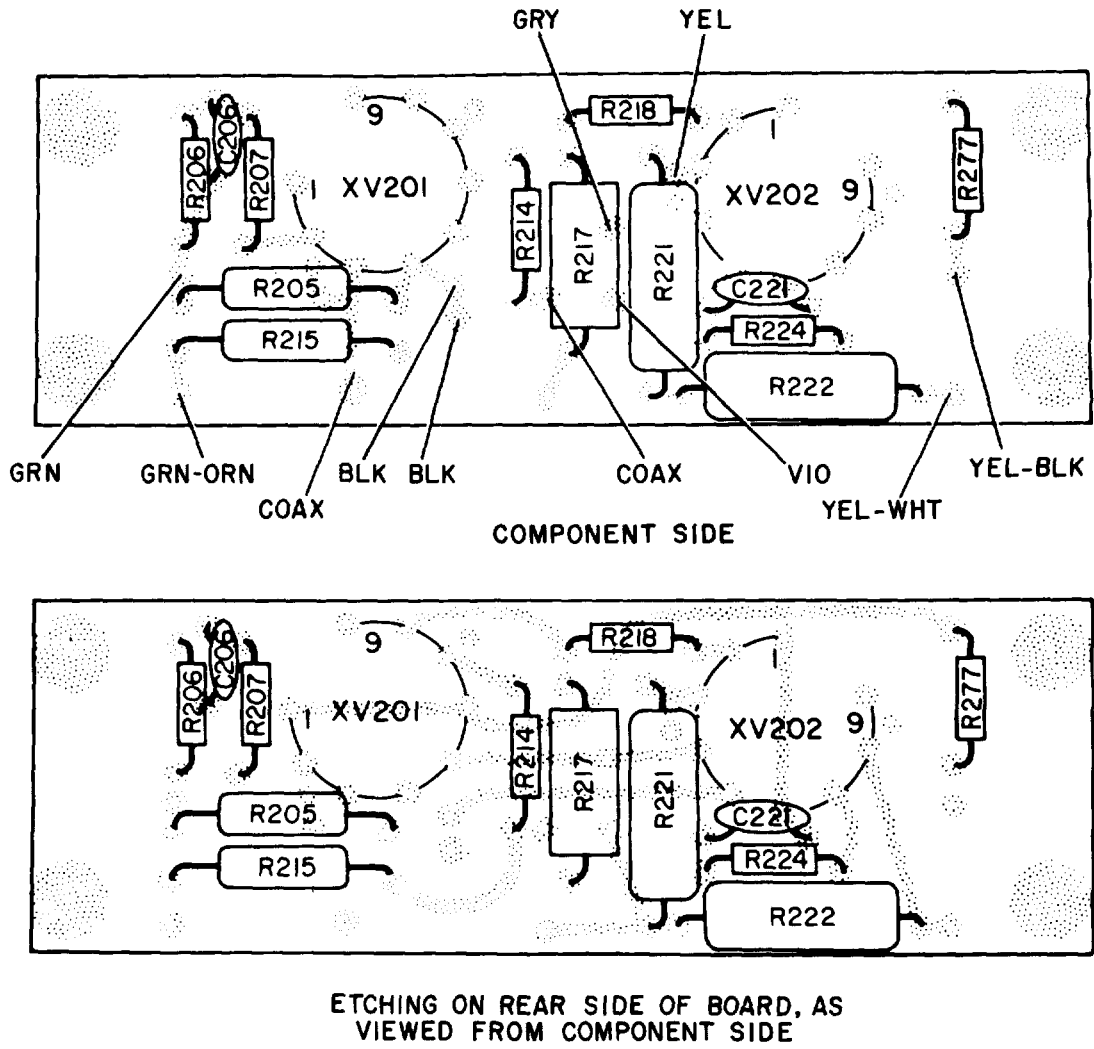


Figure 5-24A. Horizontal Impedance Matching Preamp Etched Circuit Assembly A203,
Location of Parts, AN/USM-140C

CHANGE 1 5-40.1

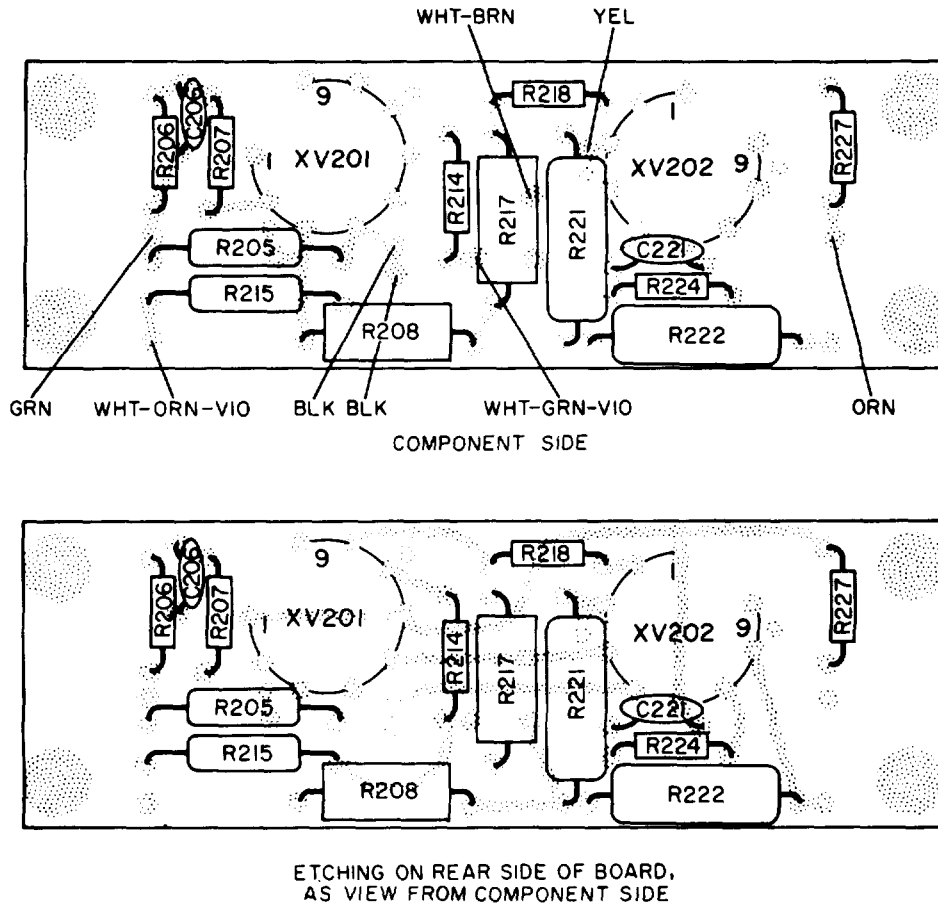


Figure 5-24. Horizontal Impedance Matching Previous Etched Circuit Assembly, Location of Parts

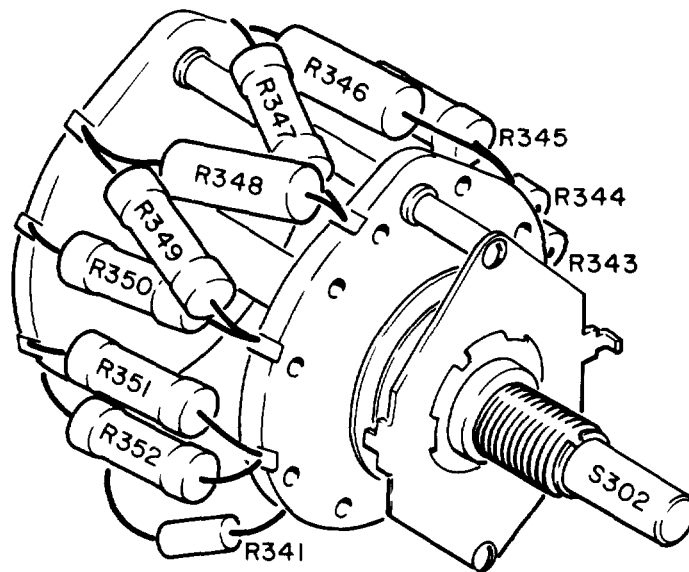


Figure 5-25. Calibrator Switch Assembly, Location of Parts
5-41

PARTS LOCATION INDEX FOR FIGURE 5-26

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
C301	D5	R335	B7
C302	B5	R336	B6
C303	B4	R337	D6
C304	A3	R338	B7
C310	B2	R339	C7
C316	C7	R340	D7
C317	C6	R342	C6
L301	C5	R367	B6
R302	B5	V303	C5
R303	C5	XV301	C5
R304	C5	XV304	B5
R305	B5	XV306	C7
R306	C5	XV307	B7
R308	B4	XV308	B1
R309	B4	XV309	C1
R312	A2	XV310	C3
R319	B5	XV311	C4

PARTS LOCATION INDEX FOR FIGURE 5-26A

REF. DESIG.	DRAWING LOCATION
C301	D5
C302	B5
C303	B4
C304	A3
C310	B2
C316	C7
C317	C6
L301	C5
R302	B5
R303	C5
R304	C5
R305	B5
R306	C5
R308	B4
R309	B4
R312	A2
R319	B5

REF. DESIG.	DRAWING LOCATION
R335	B7
R336	B6
R337	D6
R338	B7
R339	C7
R340	D7
R342	B6
R367	C6
V303	C5
XV301	C5
XV304	B5
XV306	C7
XV307	B7
XV308	B1
XV309	C1
XV310	C3
XV311	C4

5-42.1

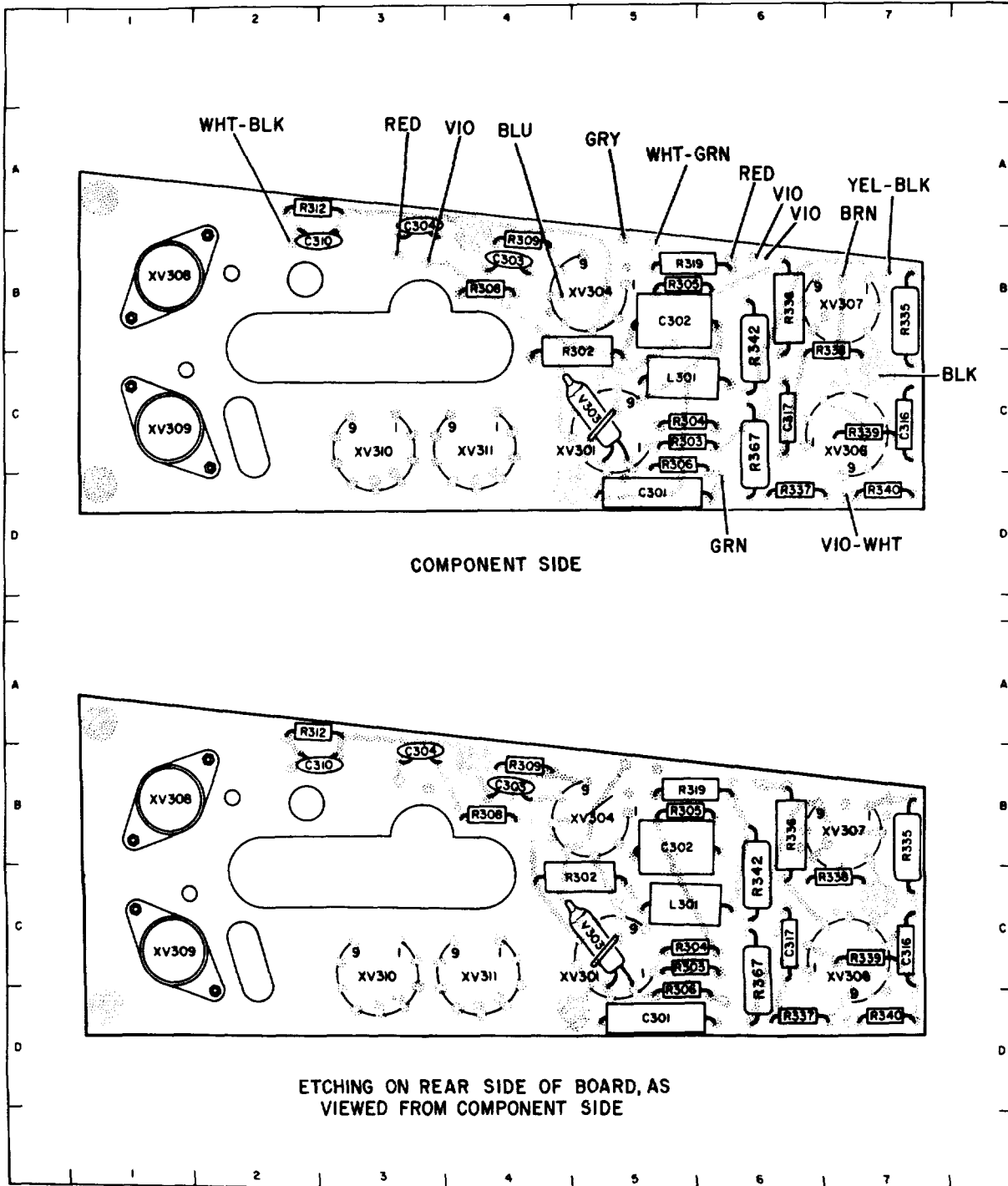


Figure 5-26A. High-Voltage Power Supply Etched Circuit Assembly A301, Location of Parts, AN/USM-140C

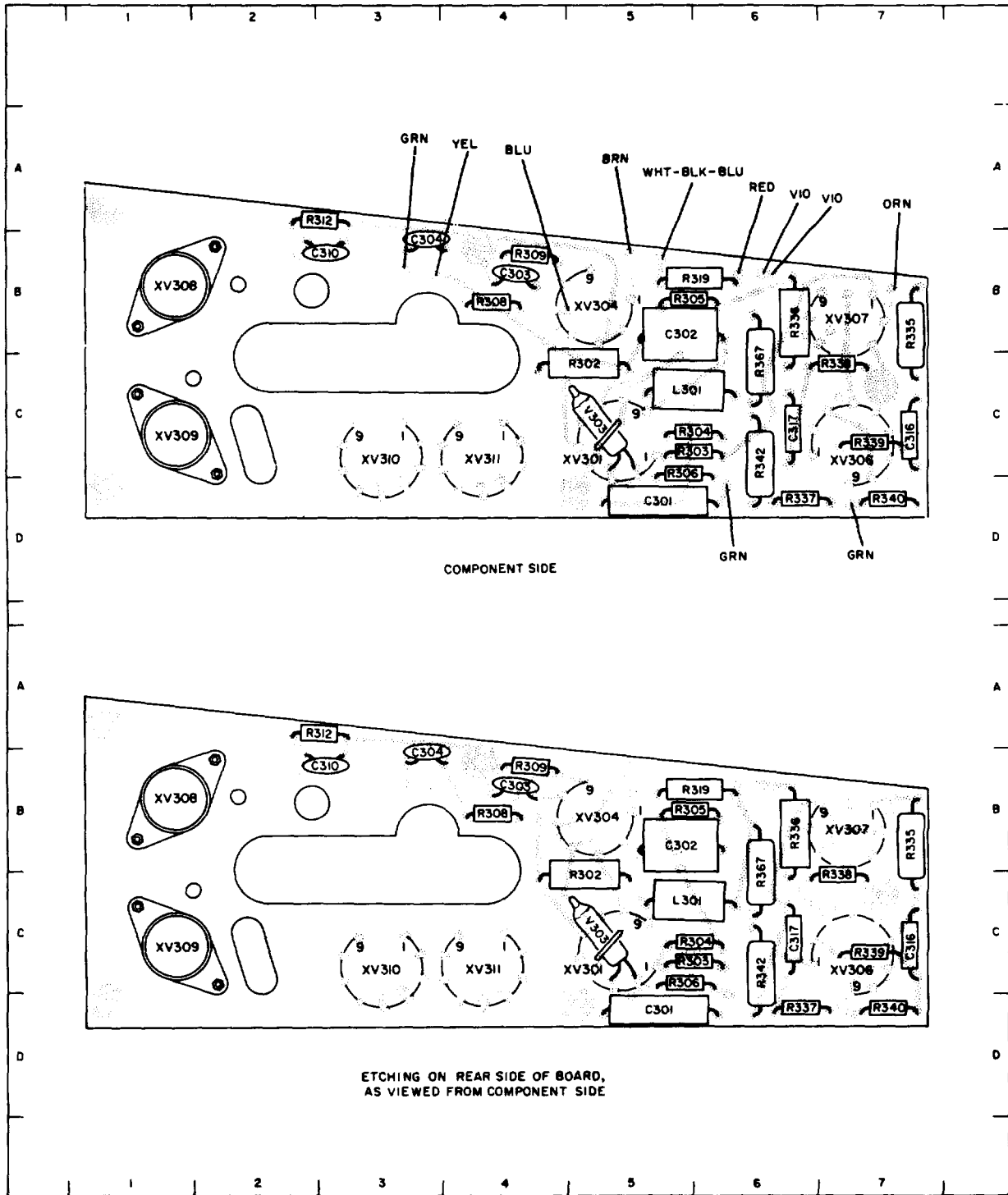


Figure 5-26. High-Voltage Power Supply Etched Circuit Assembly, Location of Parts

PARTS LOCATION INDEX FOR FIGURE 5-27

REF. DESIG.	DRAWING LOCATION
C307	B4
C308	C2
C309	C6
C311	B5
C312	B2
C313	C5
C314	A2
R313	B7
R314	B7
R315	C7
R316	B6
R317	B6
R318	B6
R322	C3
R323	C4
R325	D3
R326	D5

REF. DESIG.	DRAWING LOCATION
R327	D6
R328	D5
R331	C1
R332	D2
R333	B1
R334	B1
R355	B2
R356	A2
R357	A5
R358	B3
R359	B3
R360	A4
R362	A3
R364	B2
R365	B3
R366	B3

PARTS LOCATION INDEX FOR FIGURE 5-27A

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
C307	C4	R327	D6
C308	C1	R328	D5
C309	C6	R331	D1
C311	C6	R332	D3
C312	C2	R333	C1
C313	C5	R334	A1
C314	C1	R355	A2
R313	A7	R356	C3
R314	C7	R357	A5
R315	D7	R358	A3
R316	D7	R359	B3
R317	C7	R360	A4
R318	A7	R362	A3
R322	C4	R364	B3
R323	D4	R365	B3
R325	D4	R366	B3
R326	D5		

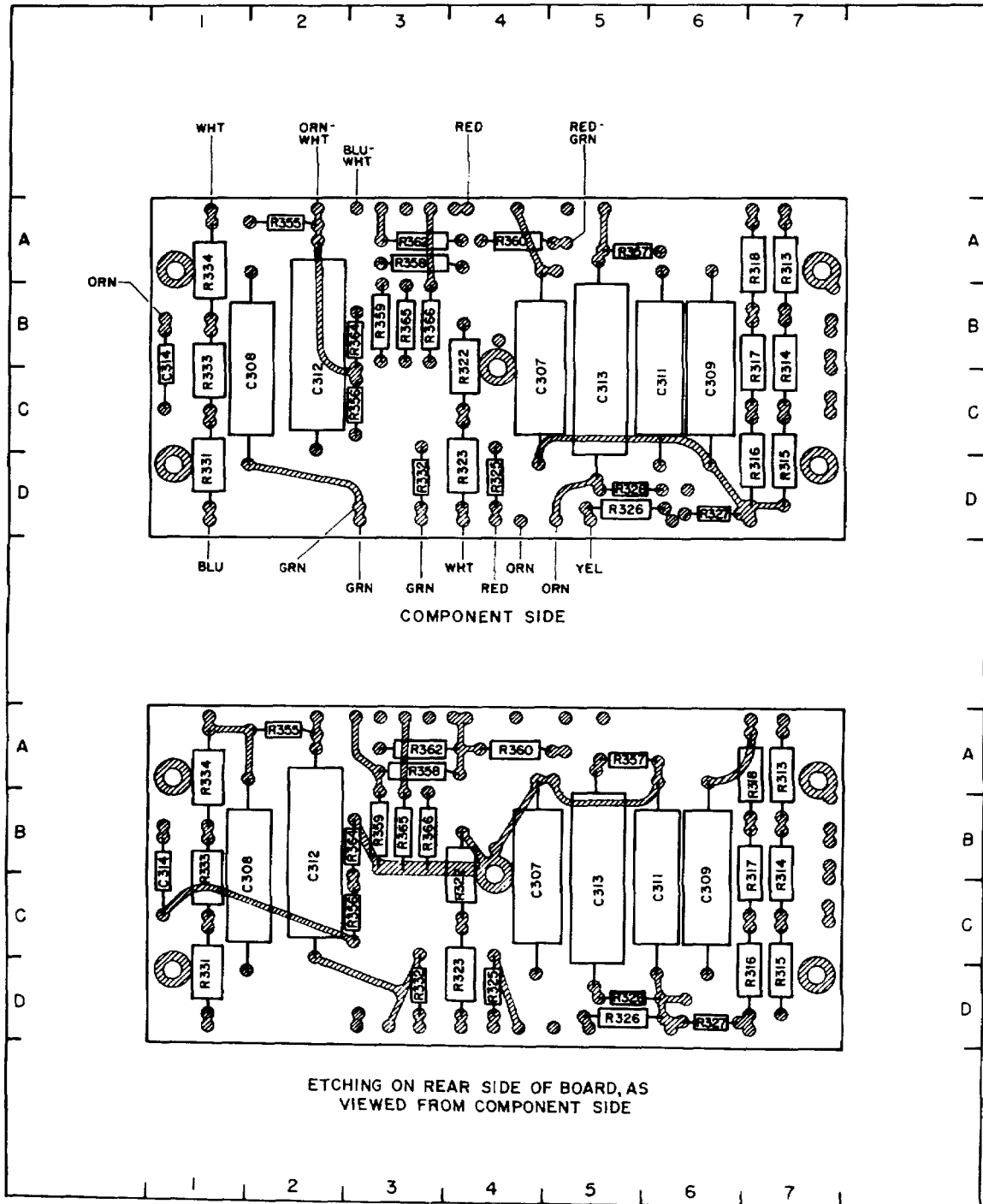


Figure 5-27A. High Voltage Distribution Etched Circuit Assembly, Location of Parts

CHANGE 1 5-44.2

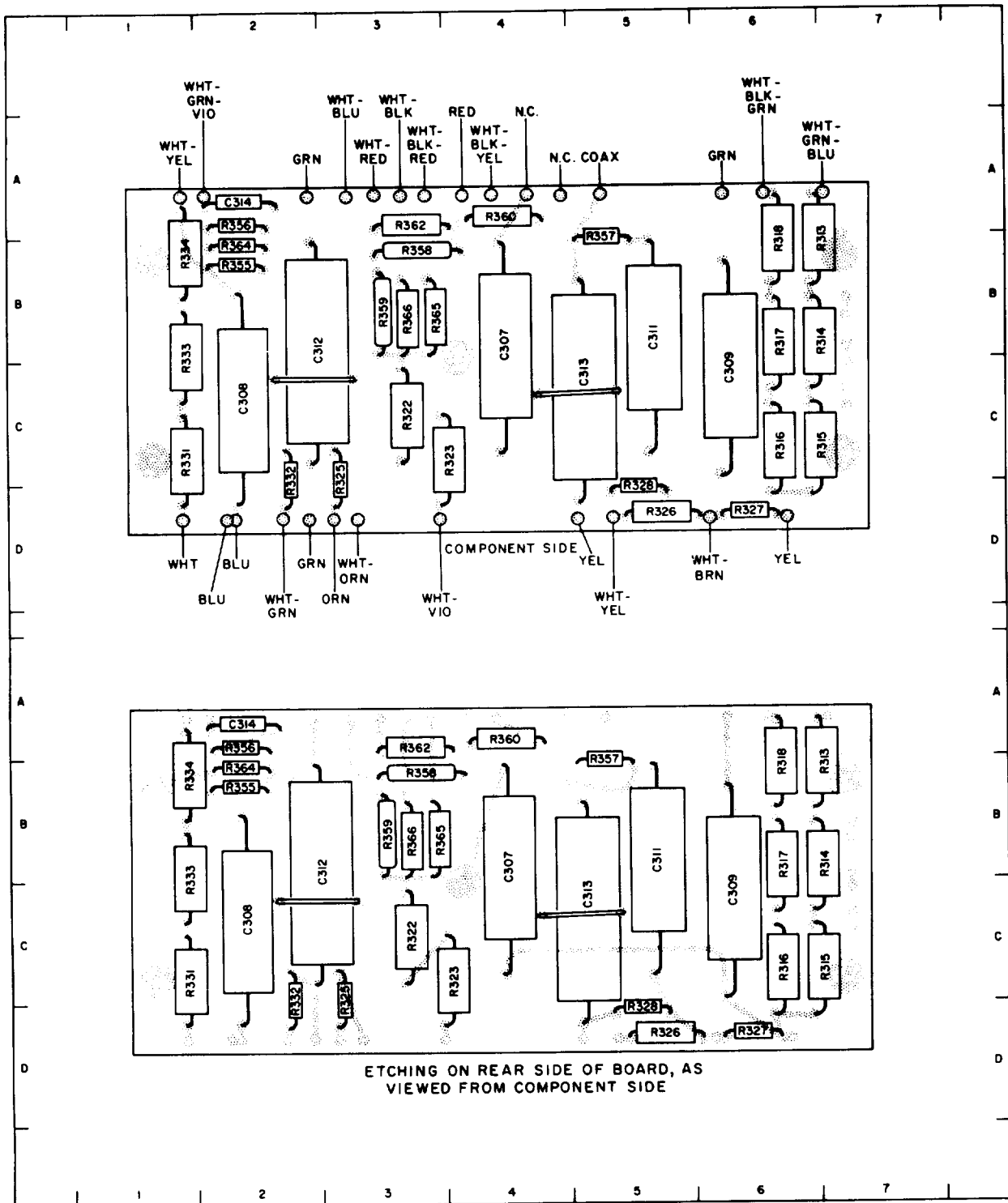
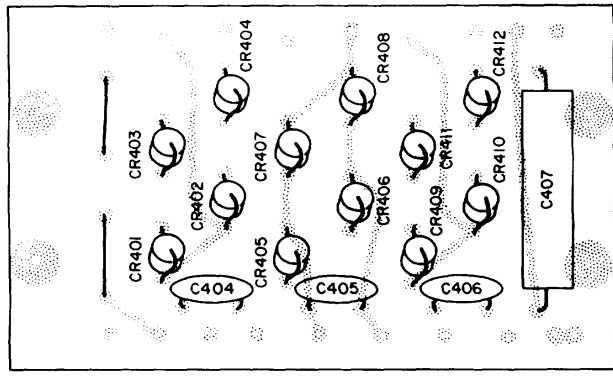
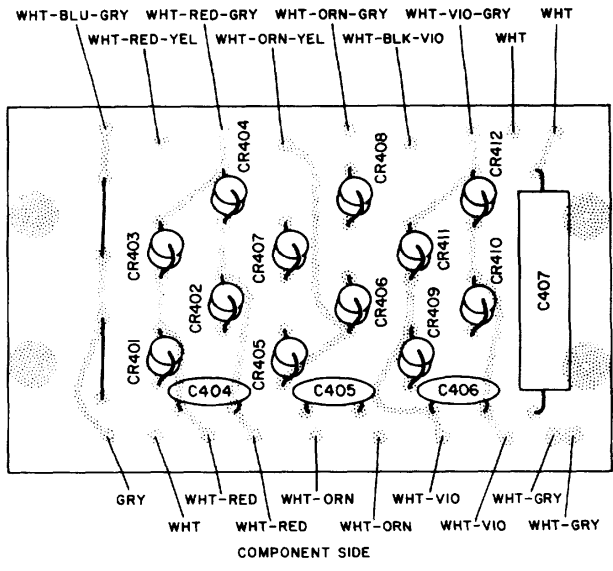


Figure 5-27. High-Voltage Distribution Etched Circuit Assembly, Location of Parts

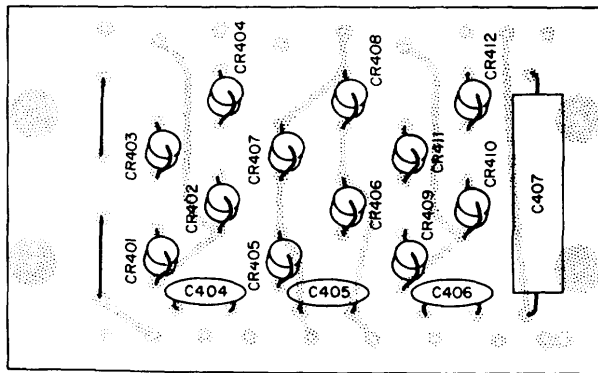
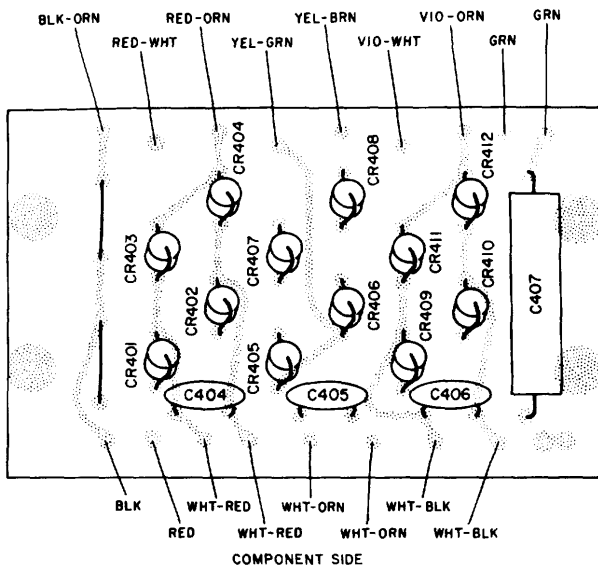


ETCHING ON REAR SIDE OF BOARD,
AS VIEWED FROM COMPONENT SIDE

Figure 5-28. Low-Voltage Rectifier Etched Circuit
Assembly, Location of Parts

PARTS LOCATION INDEX
FOR FIGURE 5-29

REF. DESIG.	DRAWING LOCATION
CR413	B5
CR416	B3
C409	A4
C412	C3
C413	B5
C417	A5
C418	C6
C419	C5
C426	A2
Q401	D3
Q402	B3
Q406	C5
Q407	C4
Q408	B5
Q410	B6
Q411	B6
Q412	B6
Q414	B3
Q415	B2
R408	C2
R409	D4
R410	D2
R412	B2
R413	D3
R415	C2
R416	C4
R417	C2
R425	A4
R426	A4
R427	C5
R428	D4
R430	D5
R432	C4
R433	C5
R434	C4
R435	C4
R443	A6
R444	A6
R445	B6
R446	A5
R447	B5
R448	C6
R449	B5
R450	C6
R451	D6
R459	A3
R461	B3
R462	B3
R463	C2
XV401	C6



ETCHING ON REAR SIDE OF BOARD,
AS VIEWED FROM COMPONENT SIDE

Figure 5-28A. Low-Voltage Rectifier Etched Circuit
Assembly A401, Parts Location AN/USM-140C

PARTS LOCATION
INDEX FOR
FIGURE 5-29A

REF. DESIG.	DRAWING LOCATION
CR413	B5
CR416	B3
C409	A4
C412	C3
C417	A5
C418	C6
C419	C5
C426	A2
Q401	D3
Q402	B3
Q406	C5
Q407	C4
Q408	B5
Q410	B6
Q411	B6
Q412	B6
Q414	B3
Q415	B2
R408	C2
R409	D4
R410	D2
R412	B2
R413	D3
R415	C2
R416	C4
R417	C2
R425	A4
R426	A4
R427	C5
R428	D4
R430	D5
R432	C4
R433	C5
R434	C4
R435	C4
R443	A6
R444	A6
R445	B6
R446	A5
R447	B5
R448	C6
R449	B5
R450	C6
R451	D6
R459	A3
R461	B3
R462	B3
R463	C2
XV401	C6

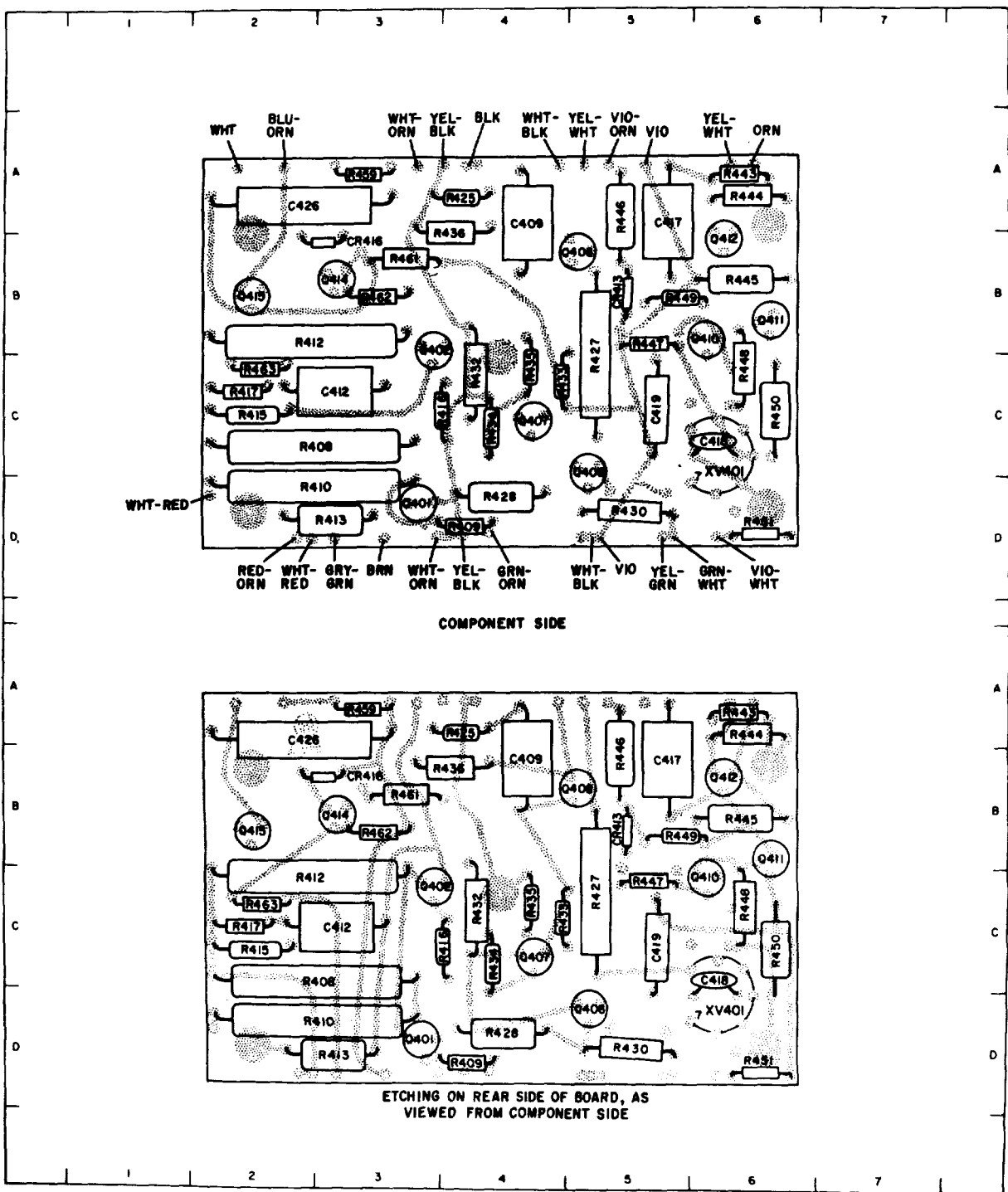


Figure 5-29A. Low-Voltage Regulator Amplifier Etched Circuit Assembly A402, Parts Location, AN/USM-140C

CHANGE 1 5-46.2

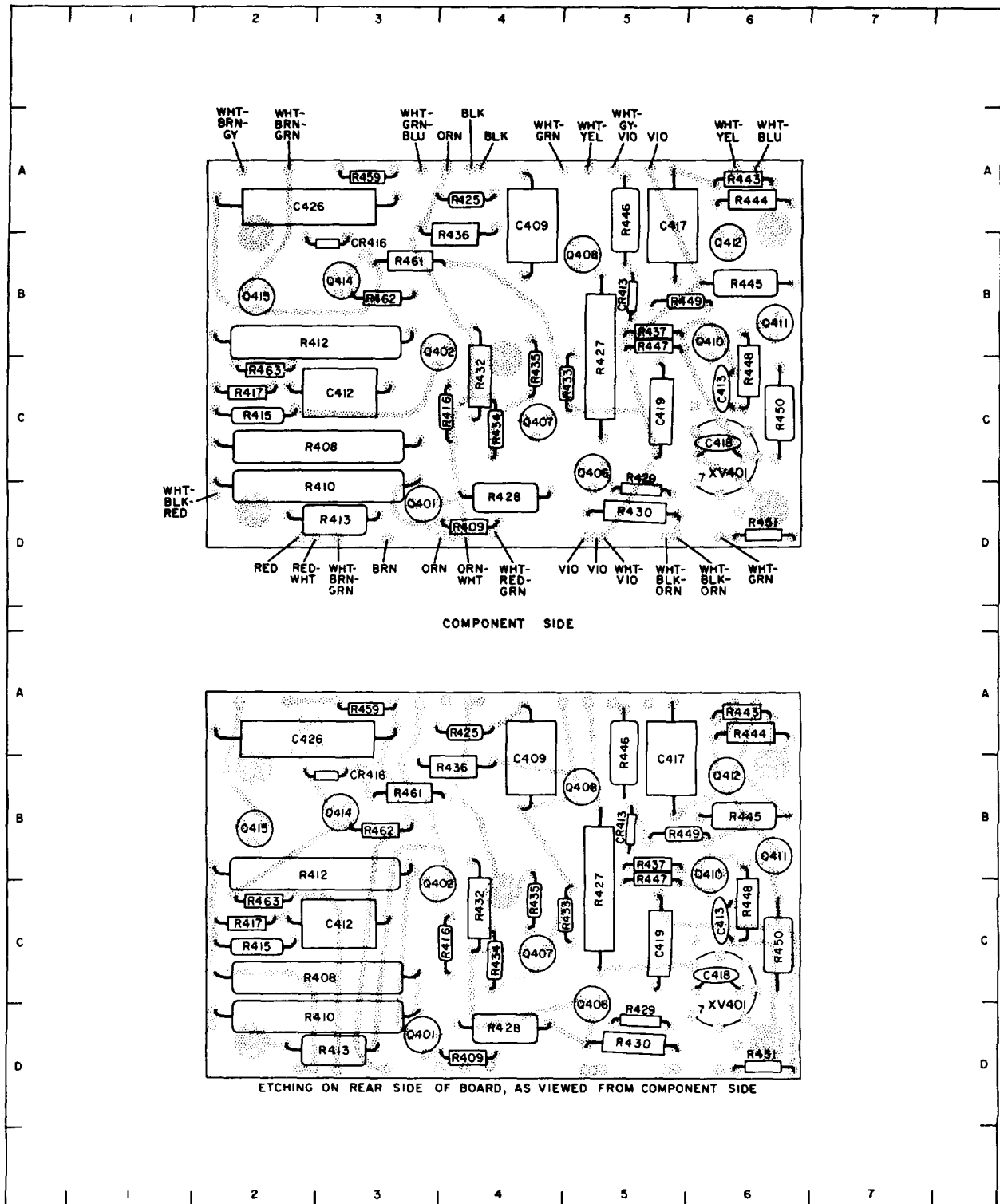


Figure 5-29. Low-Voltage Regulator Amplifier Etched Circuit Assembly, Location of Parts

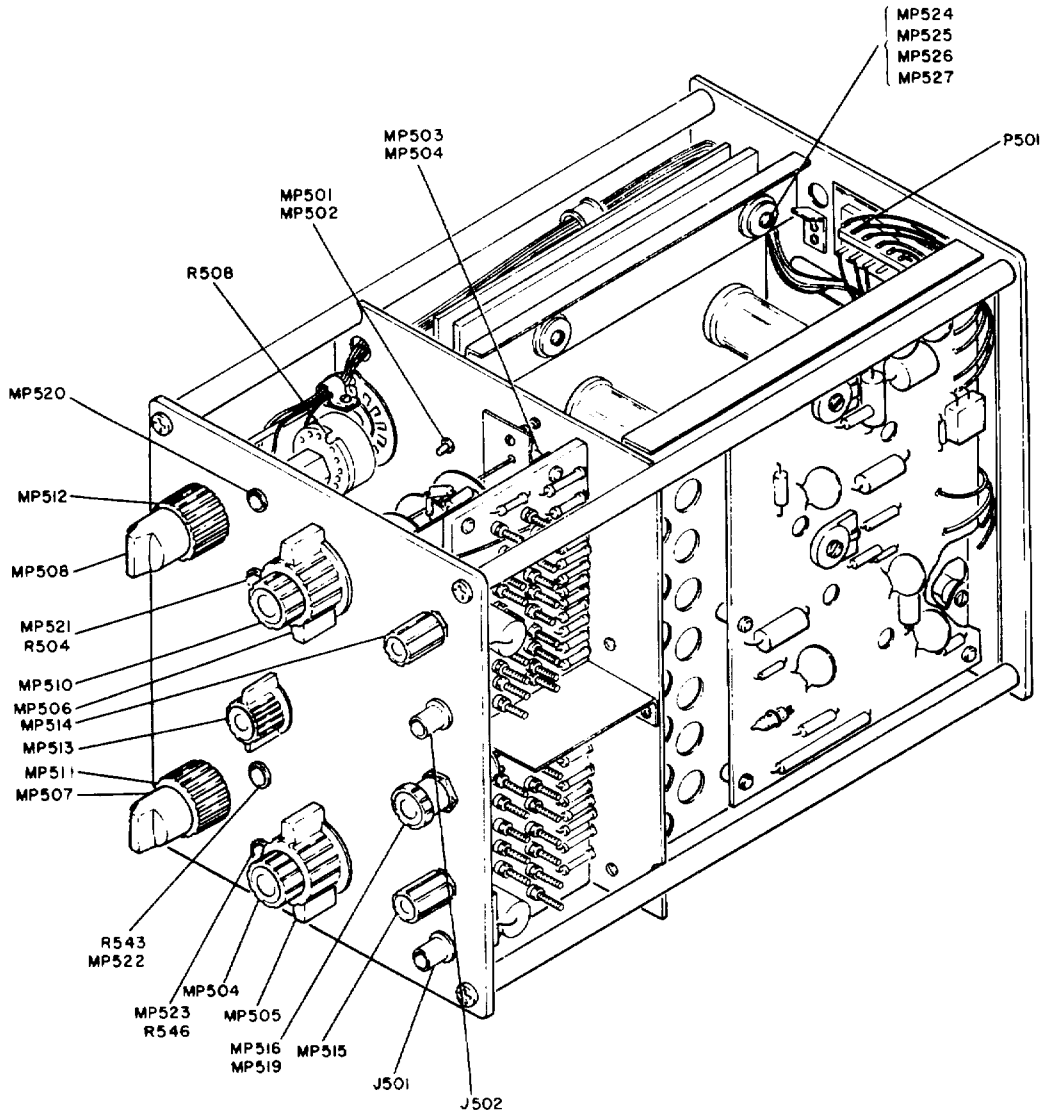
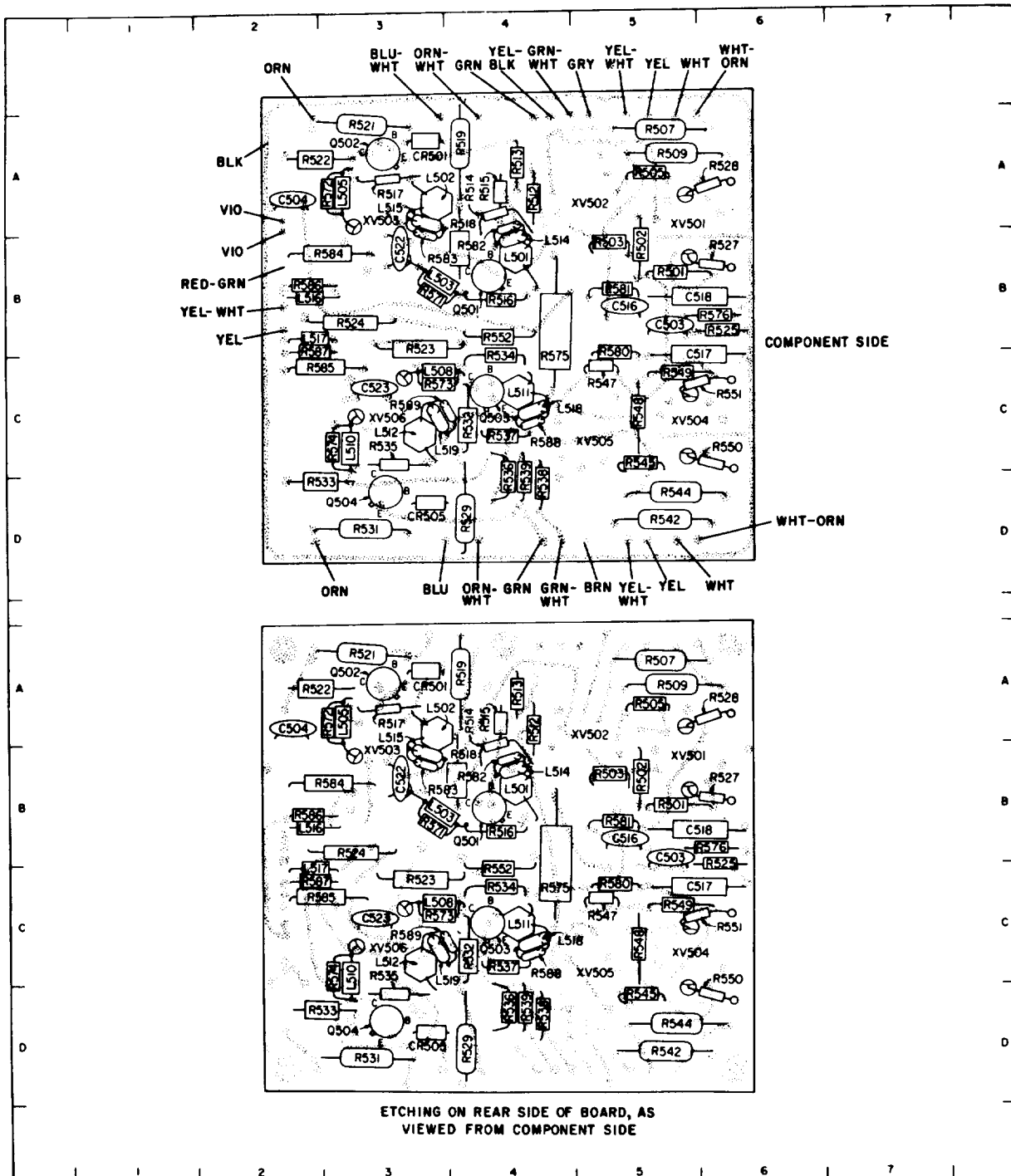


Figure 5-30. MX-2930B/USM, Location of Parts

PARTS LOCATION INDEX FOR FIGURE 5-31

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
CR501	A3	R524	B3
CR505	D3	R527	B6
C503	B5	R528	A6
C504	A2	R529	D4
C516	B5	R531	D3
C517	C6	R532	C4
C518	B6	R533	D2
C522	B3	R534	C4
C523	C3	R535	C3
L501	B4	R536	D4
L502	A3	R537	C4
L503	B3	R538	D4
L505	A3	R539	D4
L508	C3	R542	D5
L510	C3	R544	D5
L511	C4	R545	D5
L512	C3	R547	C5
L514	B4	R548	C5
L515	A3	R549	C5
L516	B2	R550	D6
L517	C2	R552	C4
L518	C5	R571	B3
L519	C3	R572	A3
Q501	B4	R573	C3
Q502	A3	R574	C3
Q503	C4	R575	C4
Q504	D3	R580	C5
R501	B5	R581	B5
R502	B5	R582	B4
R503	B5	R583	B3
R505	A5	R584	B3
R507	A5	R585	C2
R509	A5	R586	B2
R512	A4	R587	C2
R513	A4	R588	C4
R514	B4	R589	C3
R515	A4	XV501	B5
R516	B4	XV502	A5
R517	A3	XV503	B3
R519	A4	XV504	C5
R521	A3	XV505	C5
R522	A2	XV506	C3
R523	C3		



(SEE INDEX ON PAGE 5-50)

Figure 5-31A. MX-2930C/USM Dual Channel Vertical Amplifier Etched Circuit Assembly A501, Location of Parts

CHANGE 1 5-50.1

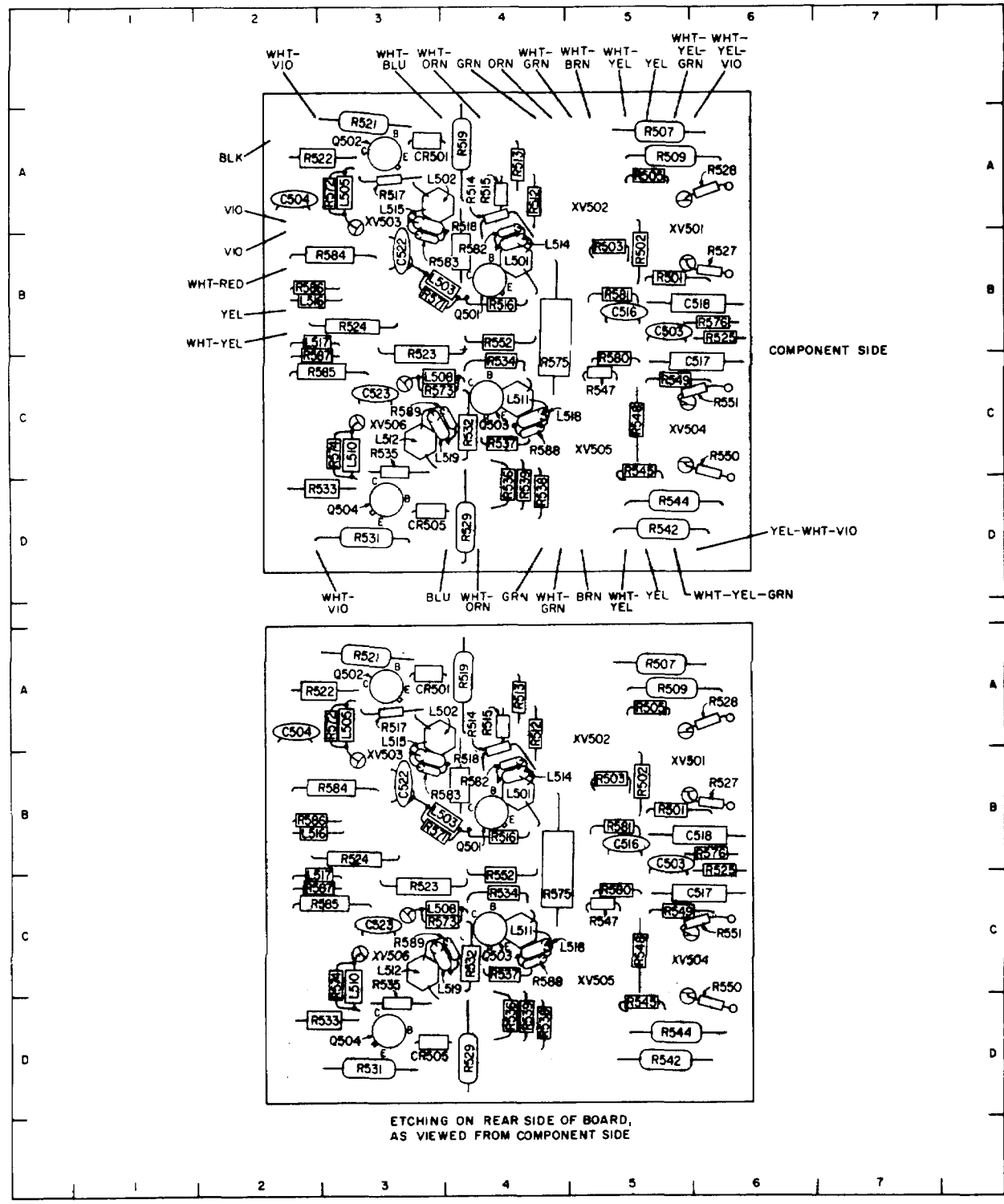


Figure 5-31. MX-2930B/USM Dual Channel Vertical Amplifier Etched Circuit Assembly, Location of Parts

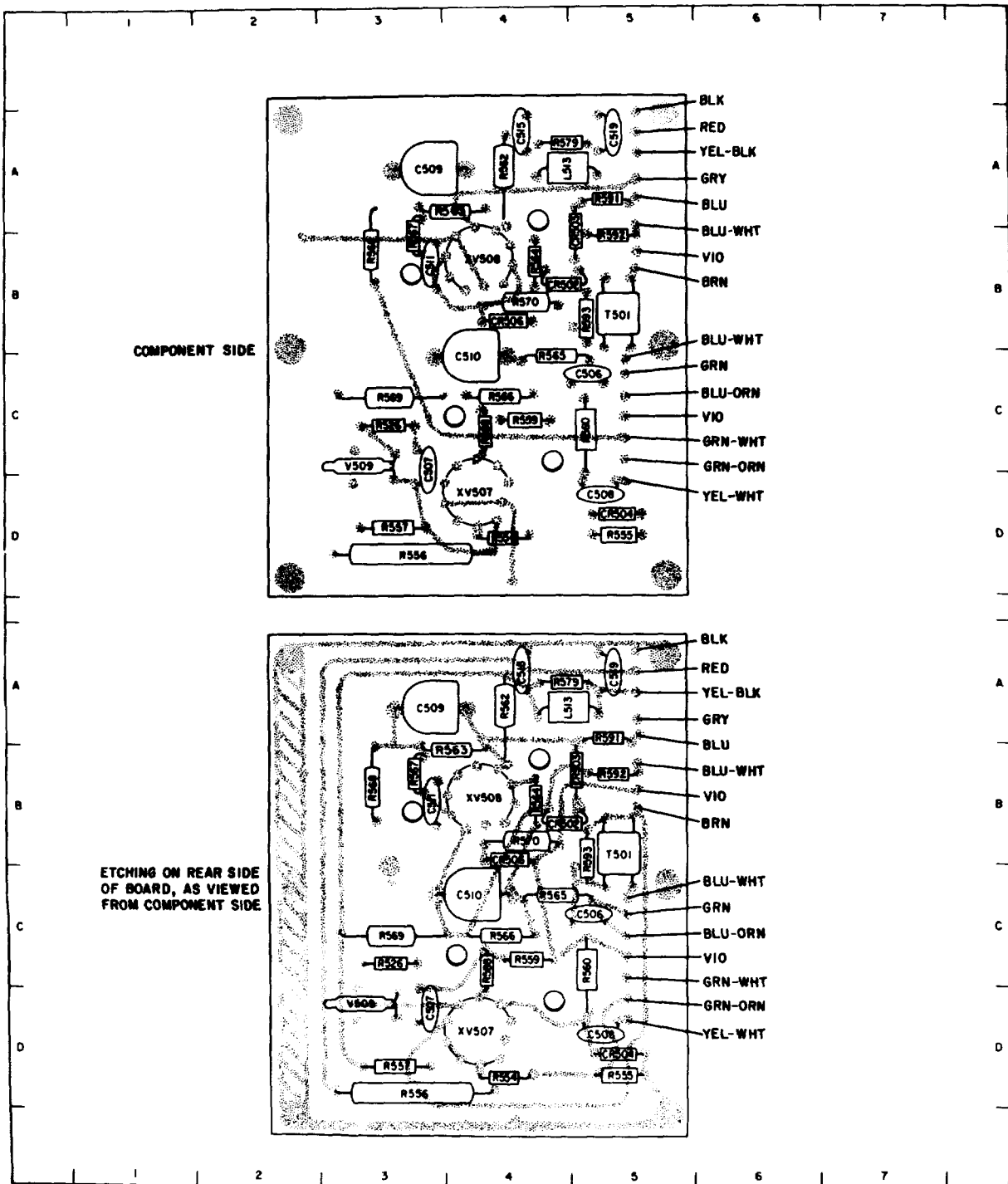
PARTS LOCATION INDEX FOR FIGURE 5-32

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
CR502	B4	R560	C5
CR503	B4	R562	A4
CR504	D5	R563	A3
CR506	B4	R564	B4
C506	C5	R565	C4
C507	C3	R566	C4
C508	D5	R567	B3
C509	A3	R568	B3
C510	C4	R569	C3
C511	B3	R570	B4
C515	A4	R579	A4
C519	A5	R588	C4
L513	A4	R591	B5
R526	C3	R592	A5
R554	D4	R593	B5
R555	D5	T501	B5
R556	D3	V509	C3
R557	D3	XV507	D4
R559	C4	XV508	B4

PARTS LOCATION INDEX FOR FIGURE 5-32A

REF. DESIG.	DRAWING LOCATION	REF. DESIG.	DRAWING LOCATION
CR502	B4	R560	C5
CR503	B4	R562	A4
CR504	D5	R563	A3
CR506	B4	R564	B4
C506	C5	R565	C4
C507	C3	R566	C4
C508	D5	R567	B3
C509	A3	R568	B3
C510	C4	R569	C3
C511	B3	R570	B4
C515	A4	R579	A4
C519	AS	R588	C4
L513	A4	R591	AS
R526	C3	R592	B5
R554	D4	R593	B5
R555	D5	T501	B5
R556	D3	V509	C3
R557	D3	XV507	D4
R559	C4	XV508	B4

CHANGE 1 5-52.1



(SEE INDEX ON PAGE 5-52)

Figure 5-32A. MX-2962C/USM Vertical Switching Etched Circuit Assembly A502, Location of Parts

CHANGE 1 5-52.2

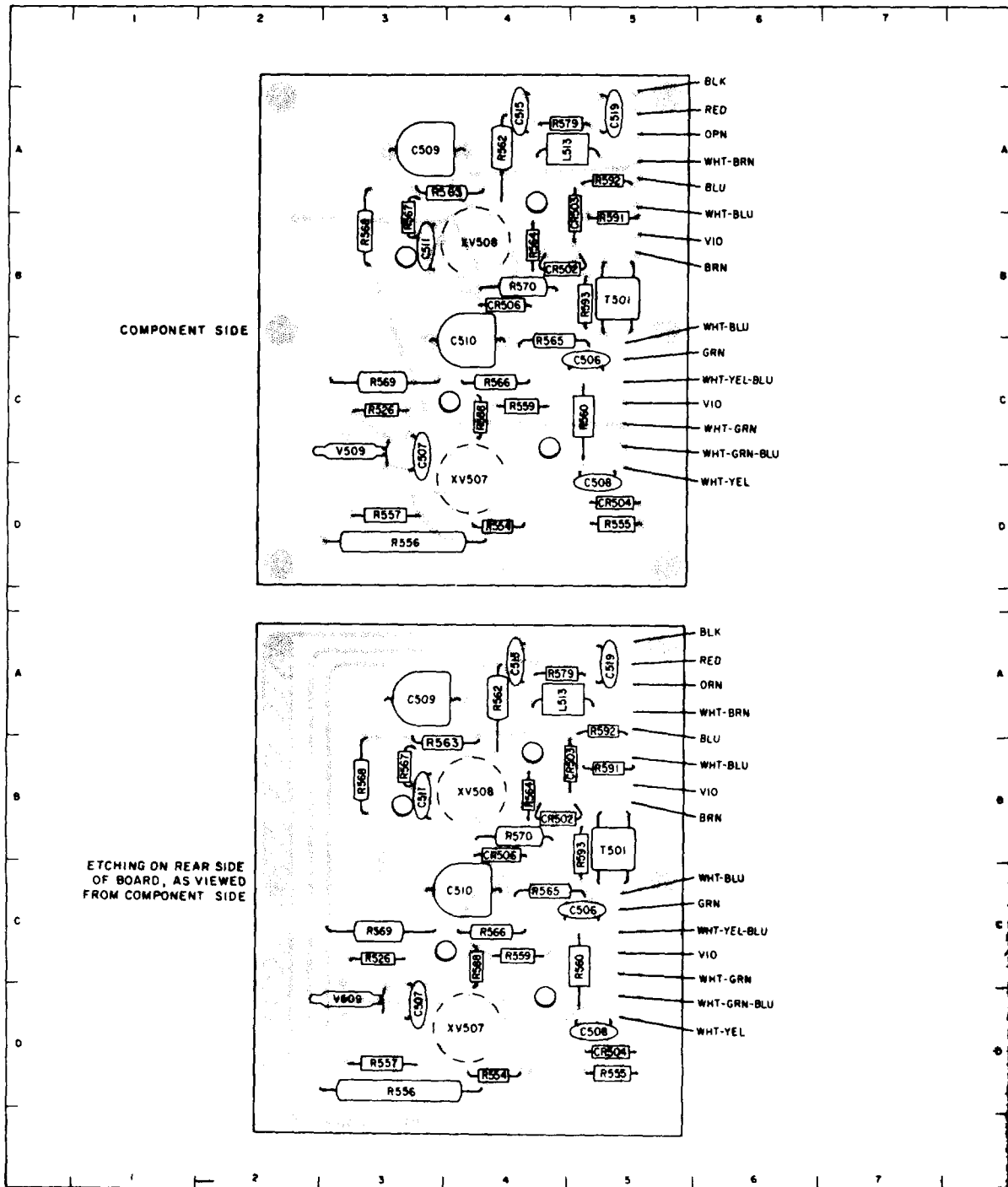


Figure 5-32. MX-2930B/USM Vertical Switching Etched Circuit Assembly, Location of Parts

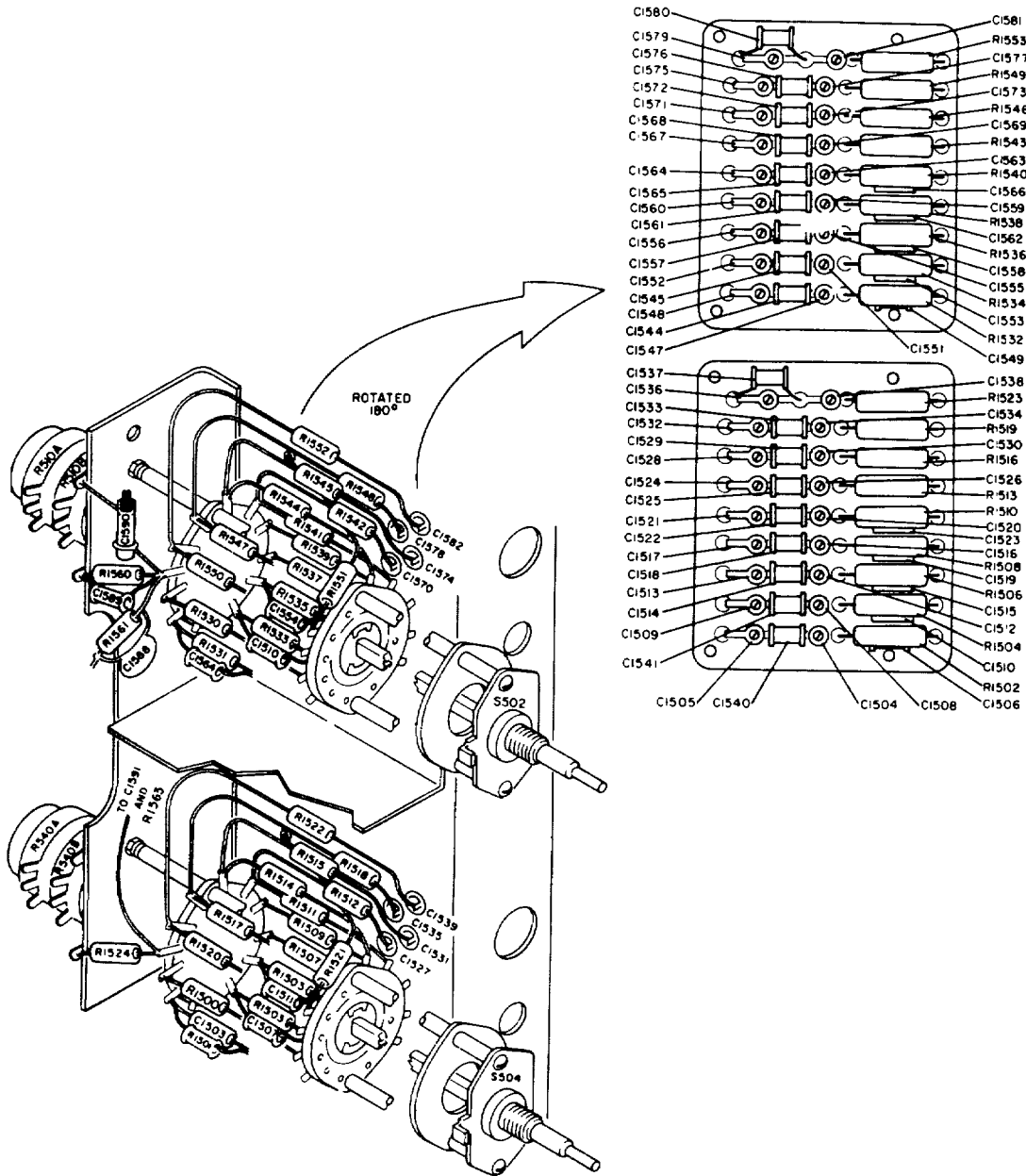


Figure 5-33. MX-2930B/USM Vernier/Sensitivity Switch Assembly, Location of Parts

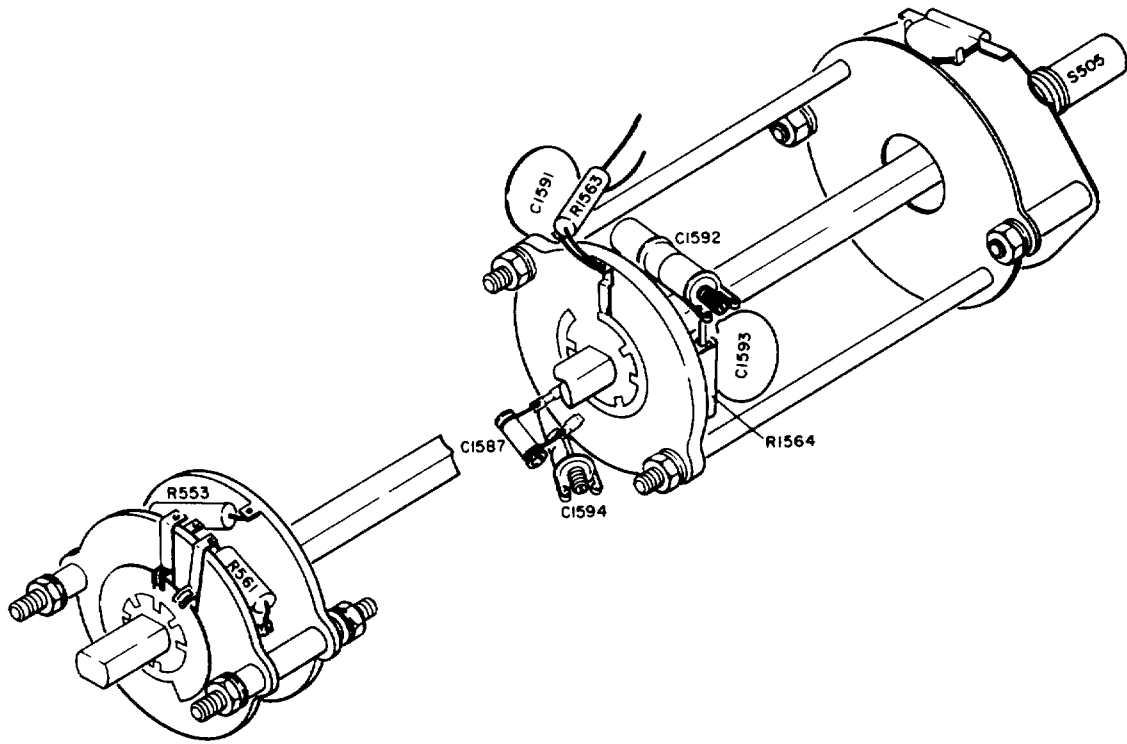


Figure 5-34. MX-2930B/USM Vertical Presentation Switch Assembly, Location of Parts

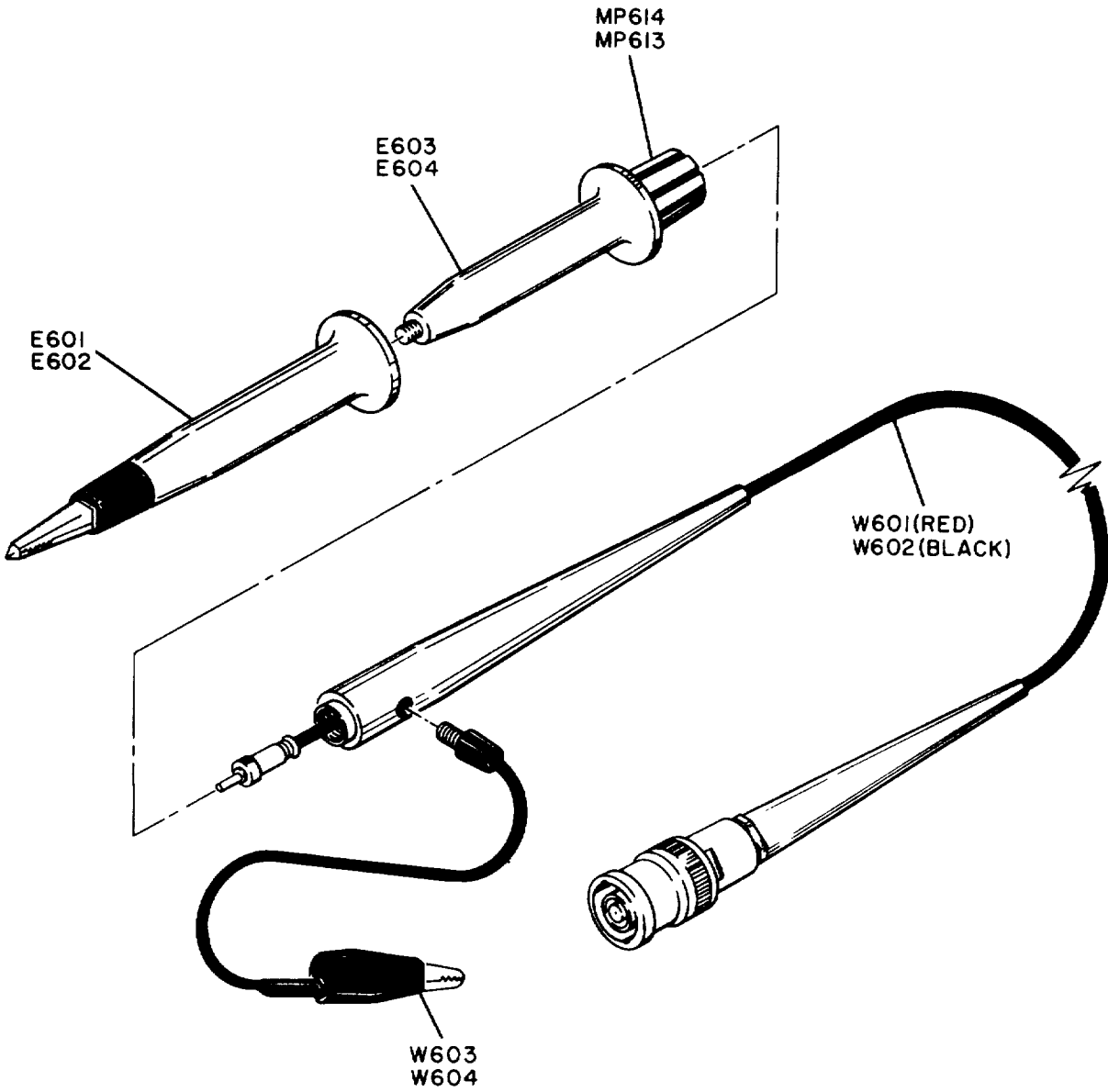


Figure 5-35. MX-2817/U Test Prod, Location of Replaceable Parts.

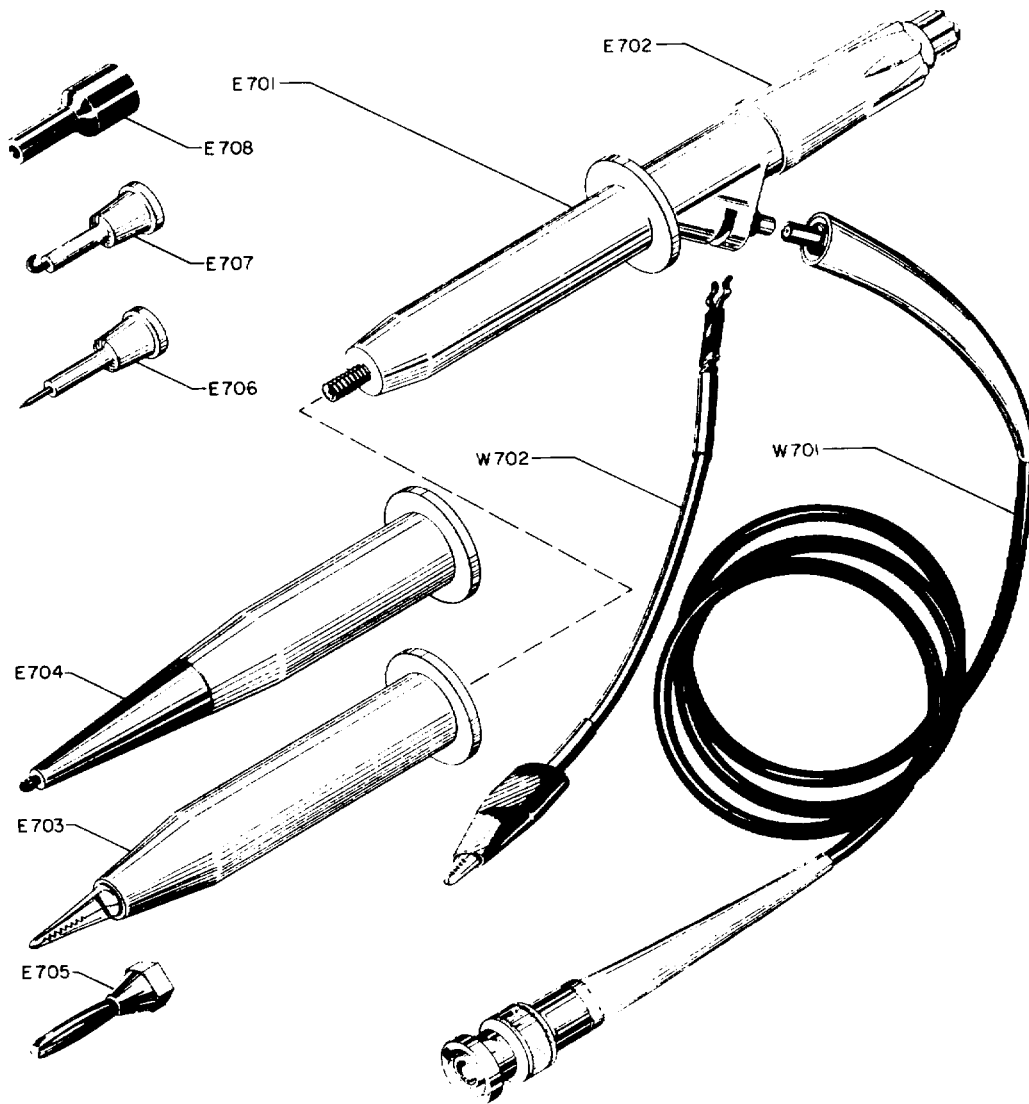


Figure 5-35A. MX-4073A/U Test Prod, Location of Replaceable Parts

CHANGE 1 5-56.1

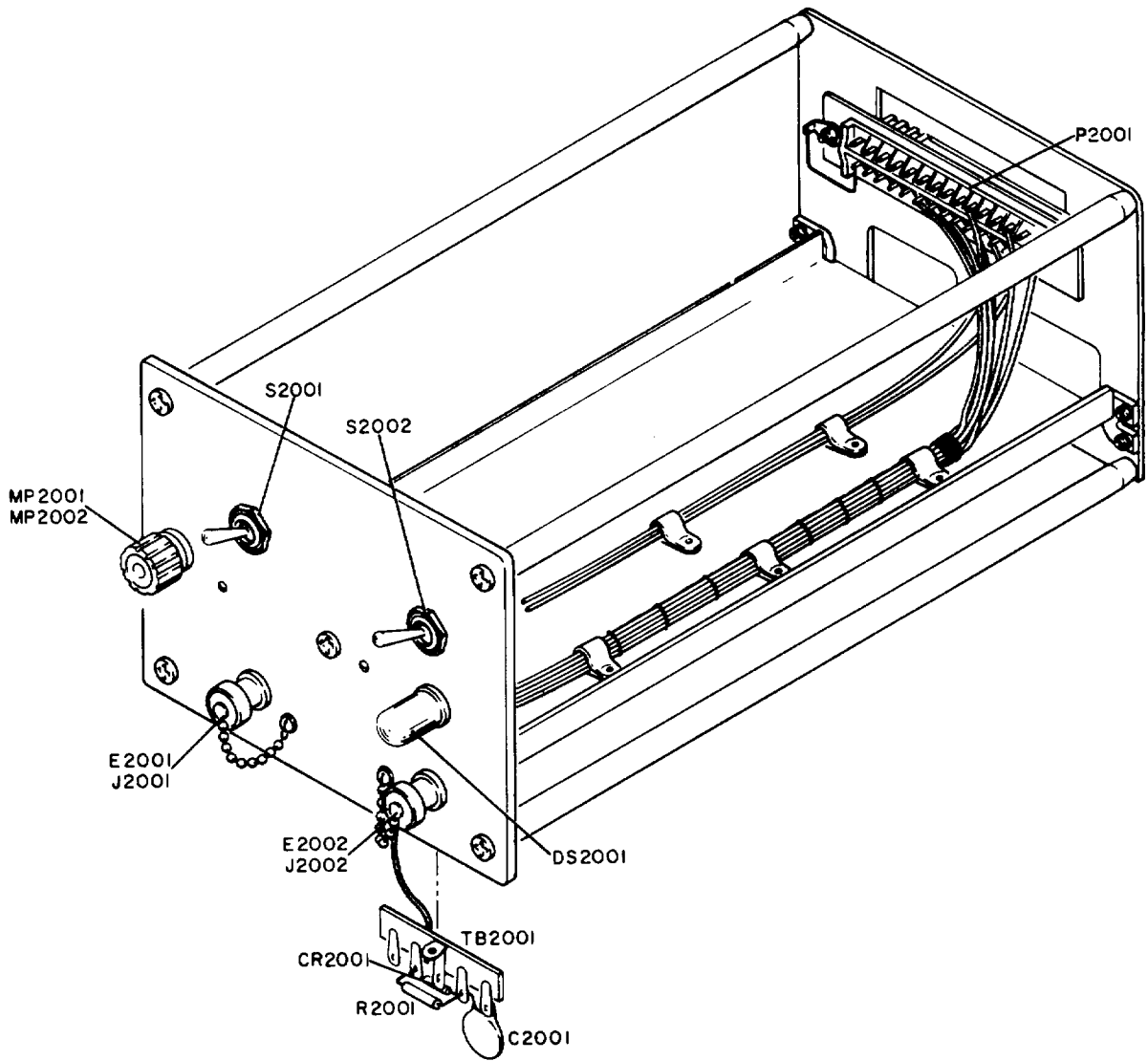


Figure 5-36. MX-3078/USM Horizontal Auxiliary Plug-In Unit, Location of Parts

TABLE 5-11. GENERAL SCHEMATIC DIAGRAM NOTES

1. Component values expressed in ohms, microhenries, and picofarads unless otherwise noted.
2. — - - — indicates etched circuit assembly boundaries.
3. Names of panel controls and connectors are enclosed in boxes.
4. Primary signal paths weighted. Feedback paths weighted and dashed.
5. DC voltages are preceded by "+" or "-". AC signal and ripple voltages are followed by VP-P.
6. The letters CW or CCW, placed adjacent to the appropriate terminals of a potentiometer, indicate the direction of rotation viewed from the shaft end.
7. AC signal and ripple voltages are measured with another AN/USM-140B Oscilloscope using the AM-3567/USM High Gain Differential Amplifier. An equivalent oscilloscope may be used. 400 cps sine waves are used for signal voltage measurements except where other waveforms are shown.
8. DC voltages are measured with the AN/USM-116 Voltmeter unless otherwise noted.
9. Special conditions or switch settings required for voltage measurements are noted on the schematics.
10. Because resistance measurements in circuits having many semiconductor elements can be misleading (see paragraph 5-5b) because they vary with the method of measurement, no tables of resistance values are given. Instead, a multiplicity of voltage test points is indicated, and additional voltages are provided in tables on the schematic aprons where necessary.
11. Parts location on each large schematic is given in a table of map-type coordinates on the schematic apron.

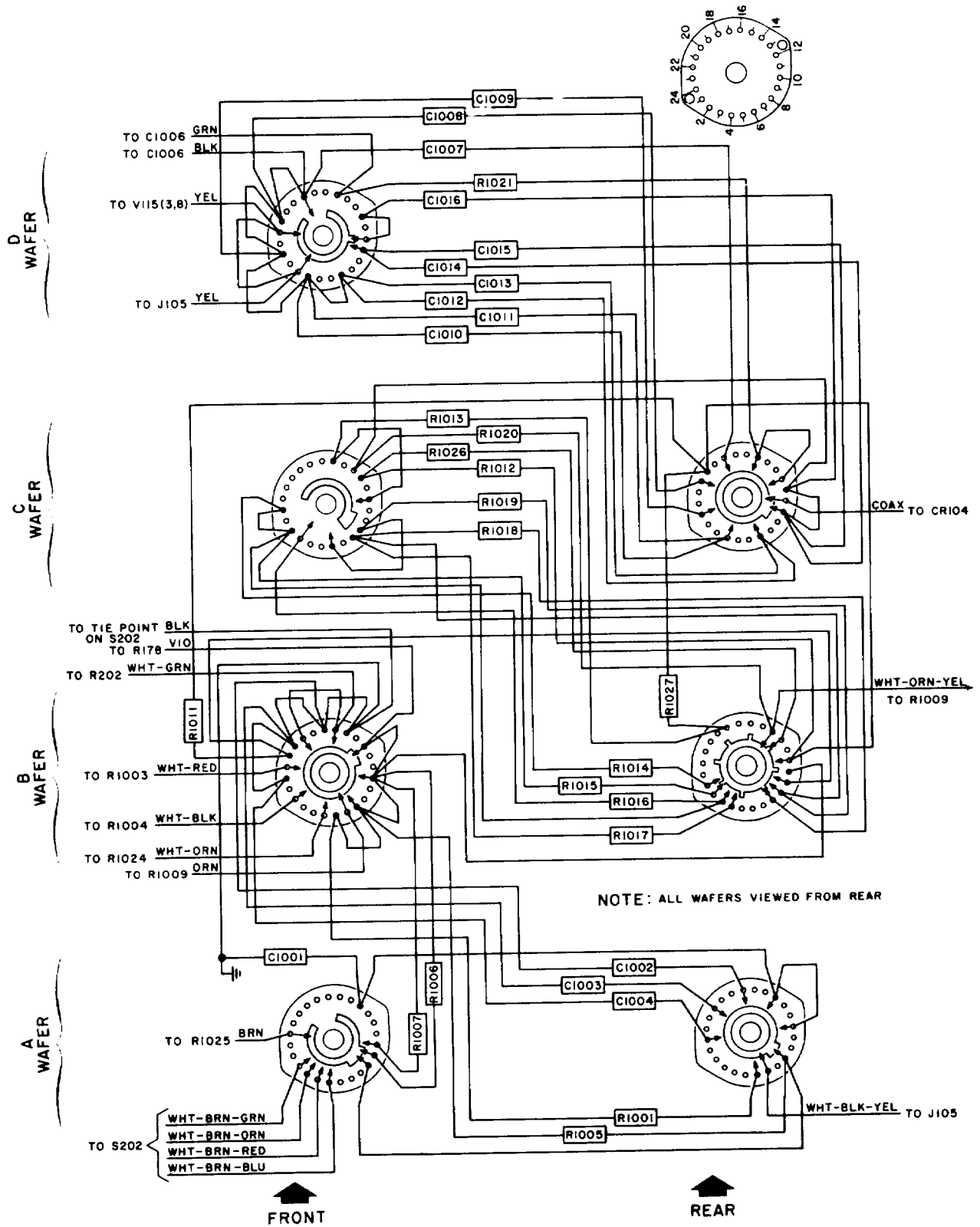


Figure 5-40. Sweep-Time Switch, Wiring Diagram

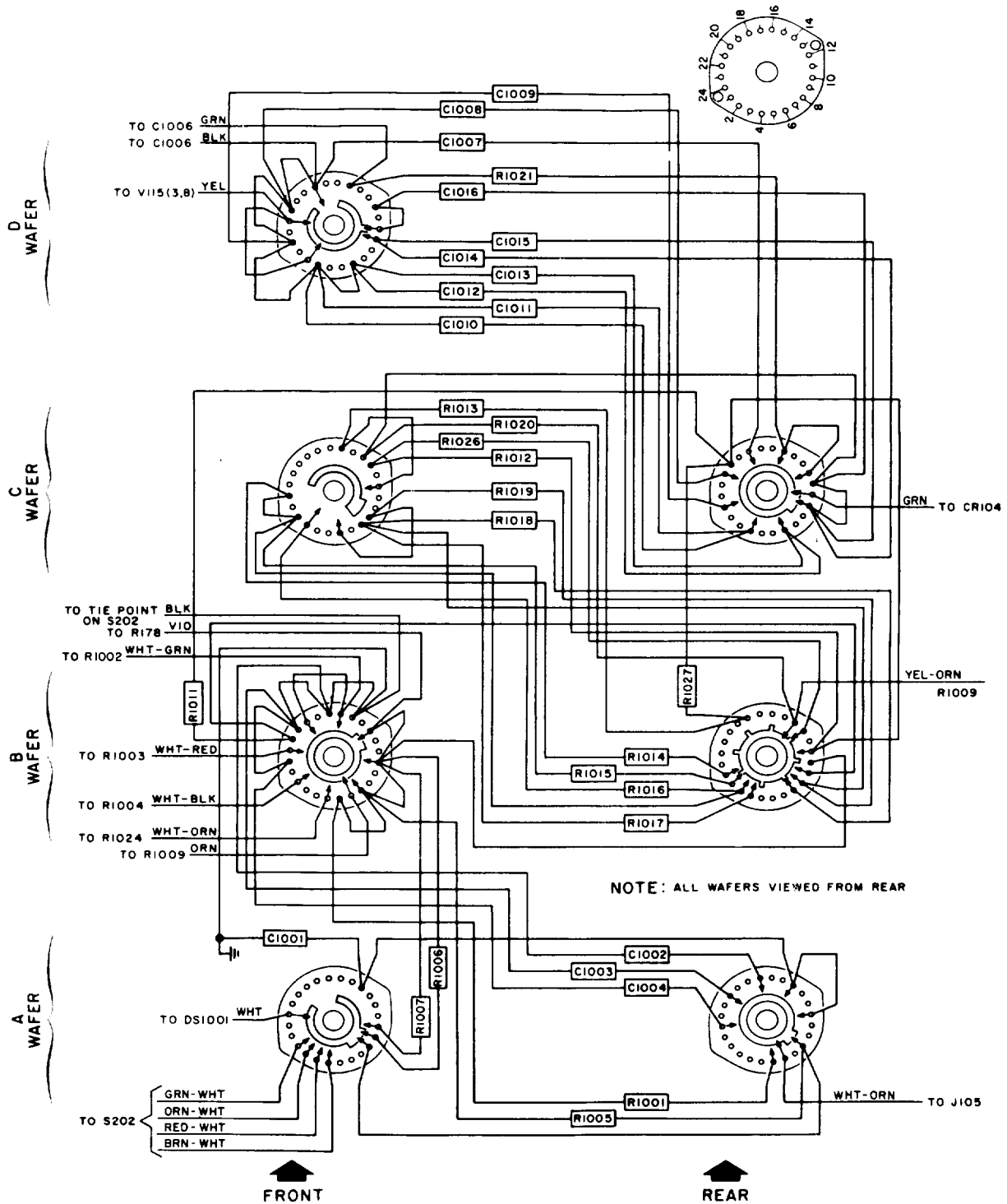


Figure 5-40A. Sweep-Time Switch, Wiring Diagram
AN-USM - 140C

CHANGE 1 5-66.1

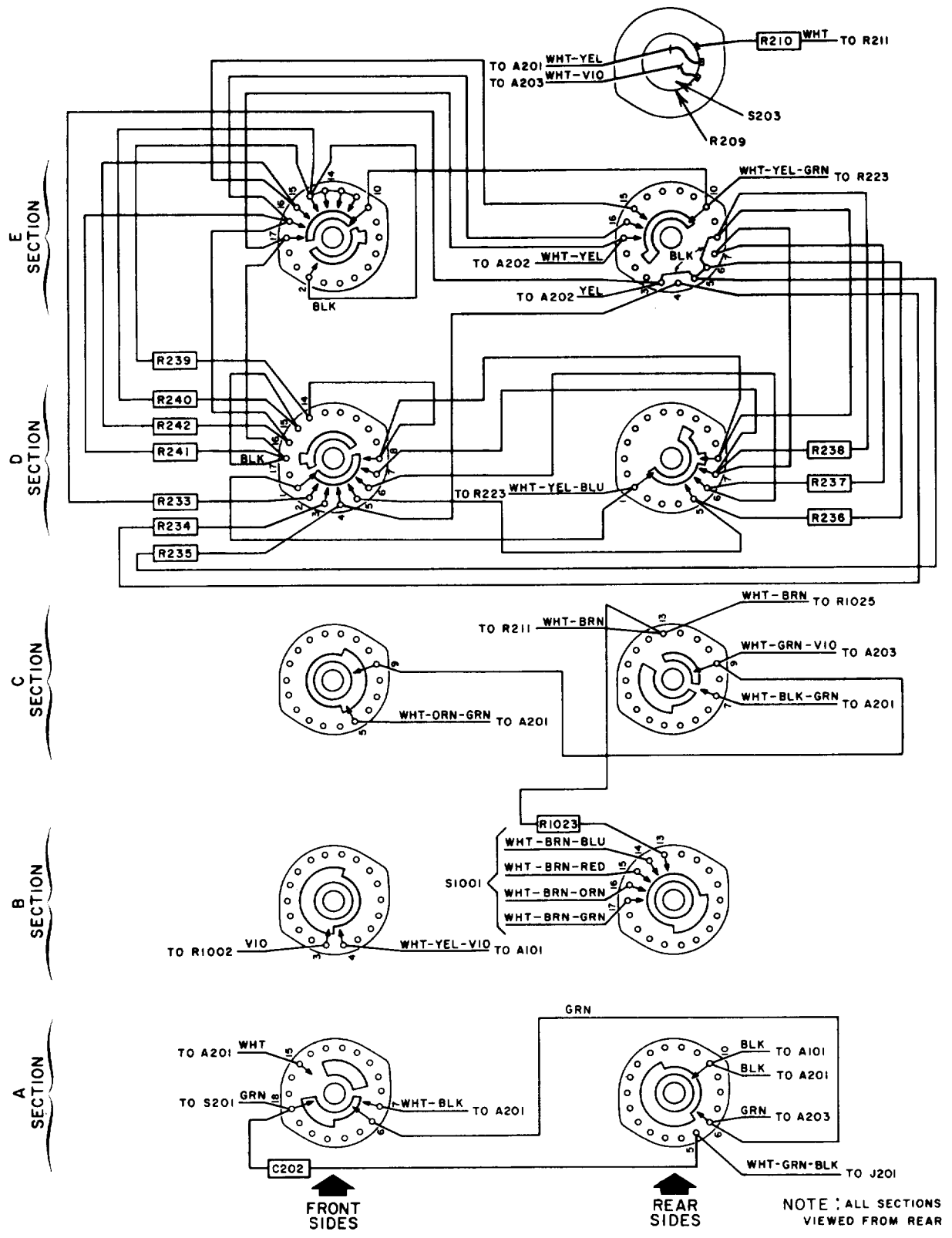


Figure 5-42. Horizontal Display Switch Schematic Diagram

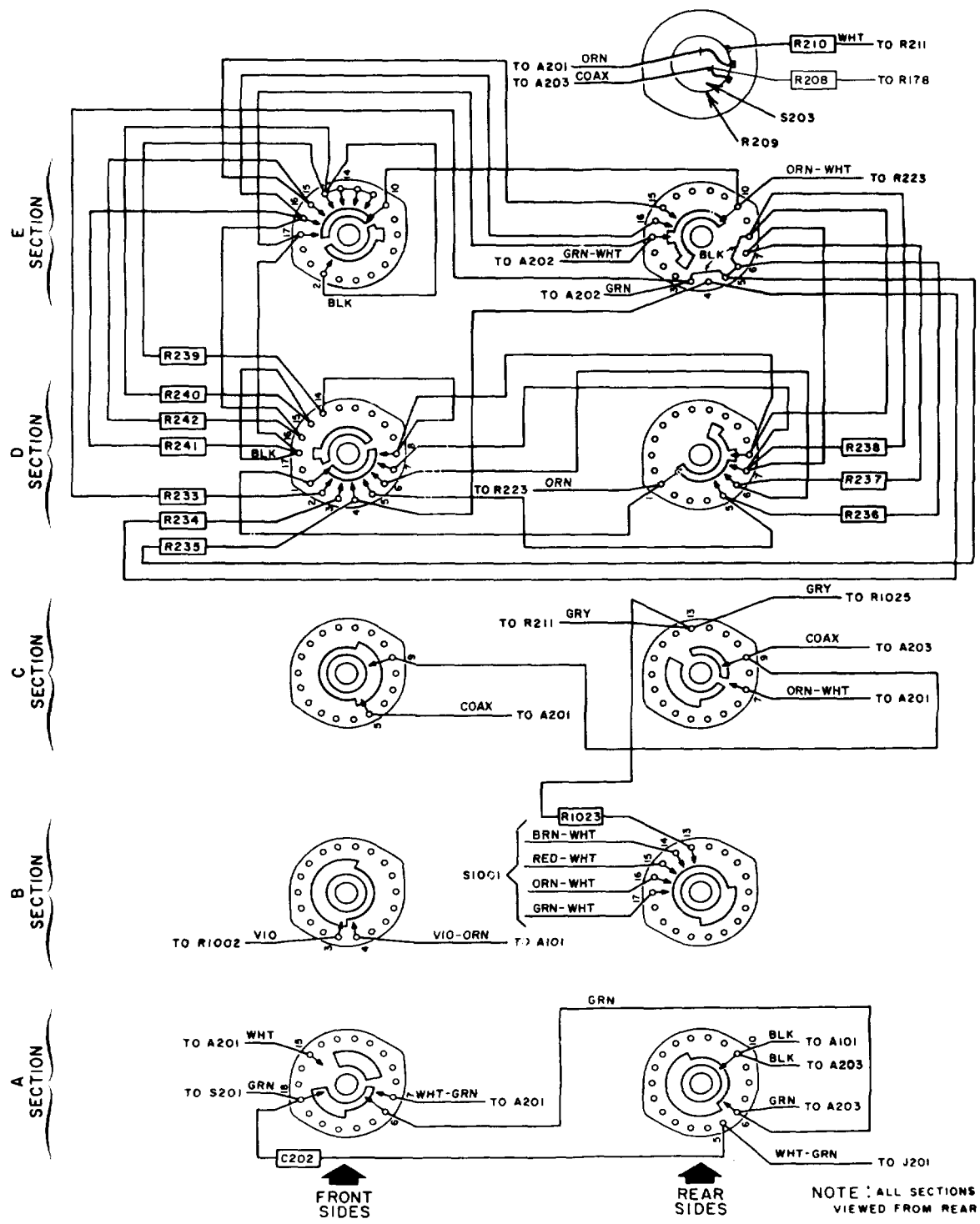
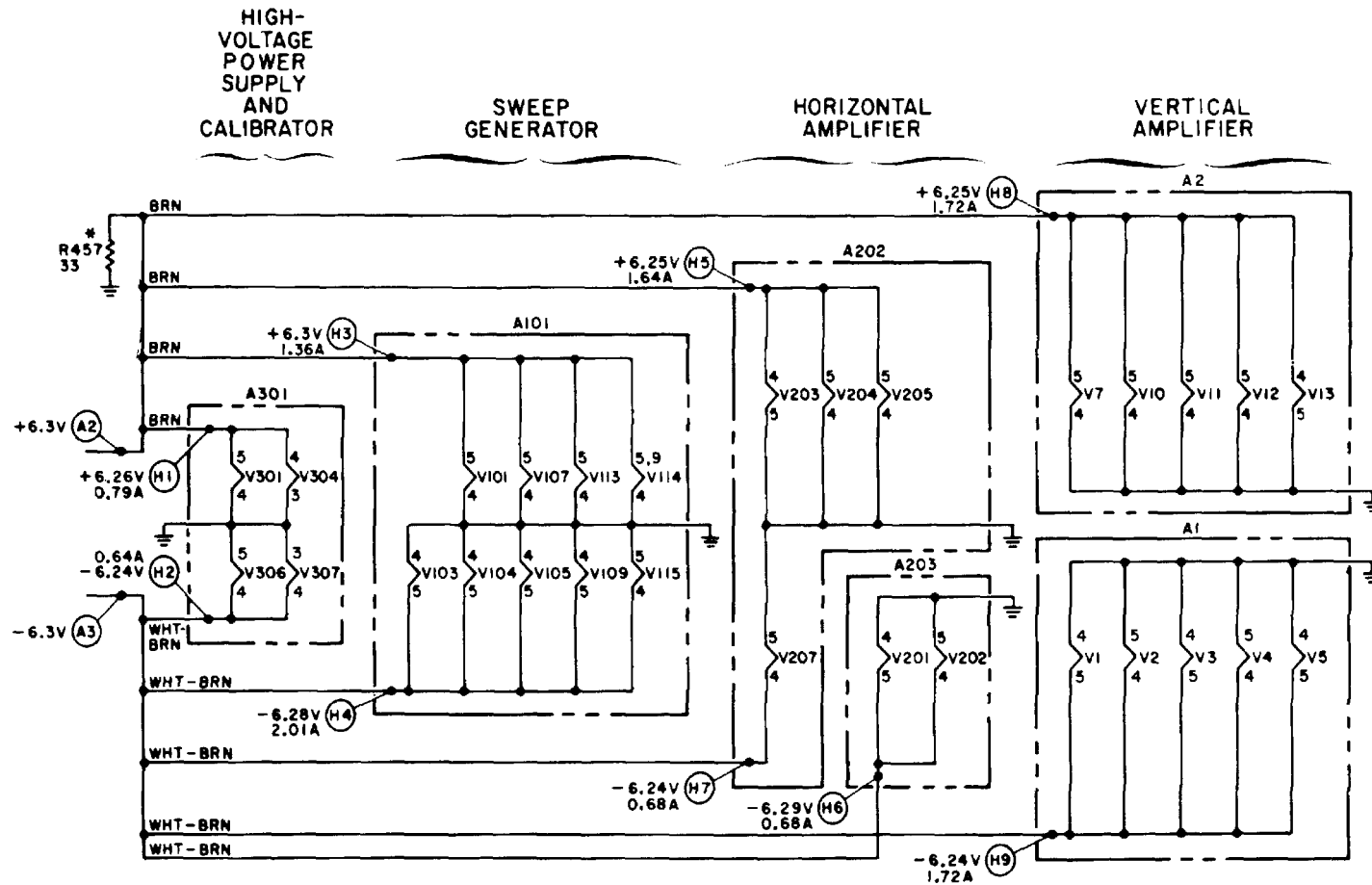


Figure 5-42A. Horizontal Display Switch Schematic Diagram
AN/USM-140C

CHANGE 1 5-70.1



NOTE:

* * LOCATED ON TERMINAL STRIP ON CENTER GUSSET.

Figure 5-45. Electron Tube Heater Circuit, Functional Diagram

CHANGE 1 5-75

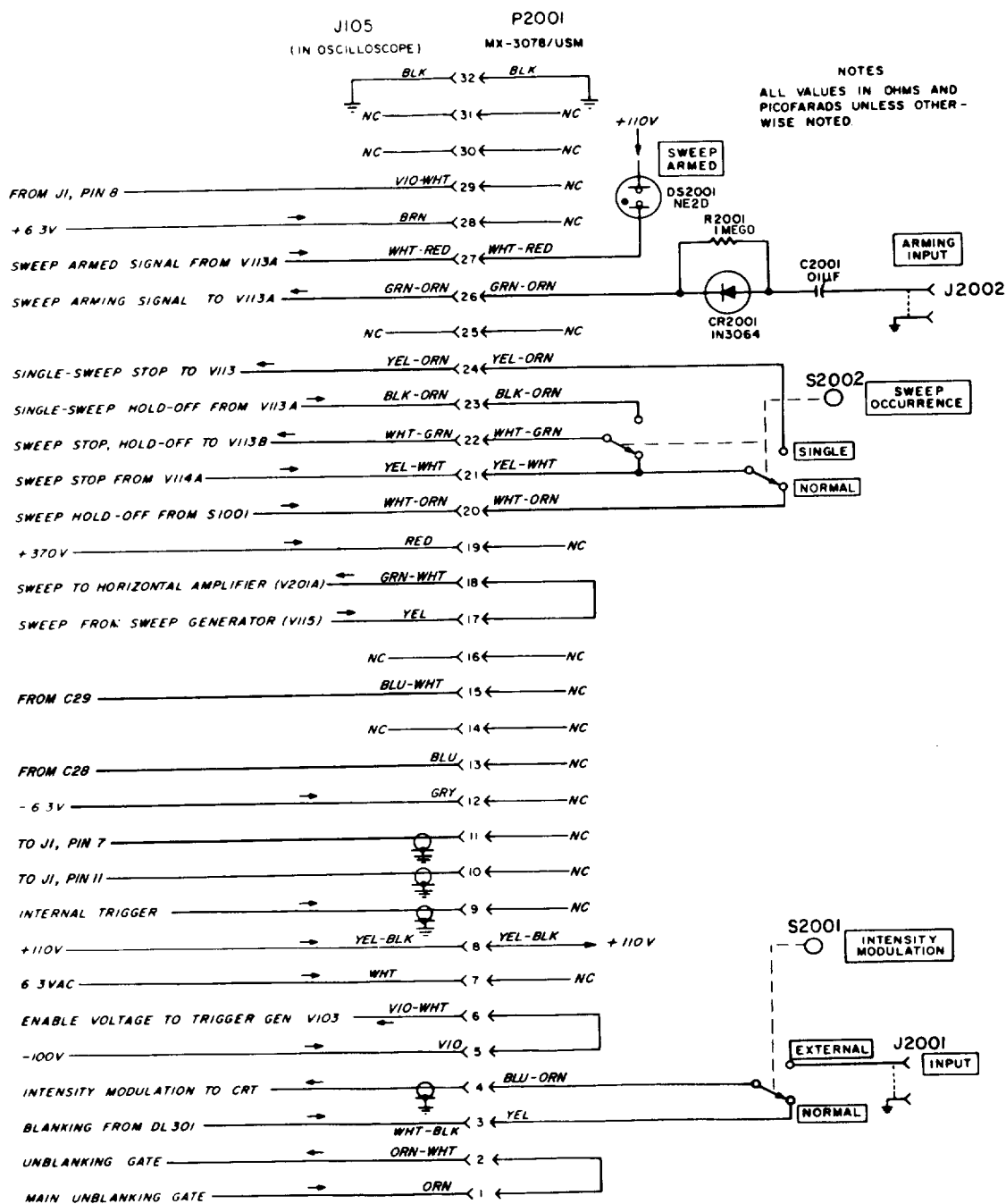


Figure 5-47A. MX-3078/USM Horizontal Channel Auxiliary Plug-In Unit Schematic Diagram

CHANGE 1 5-78.3

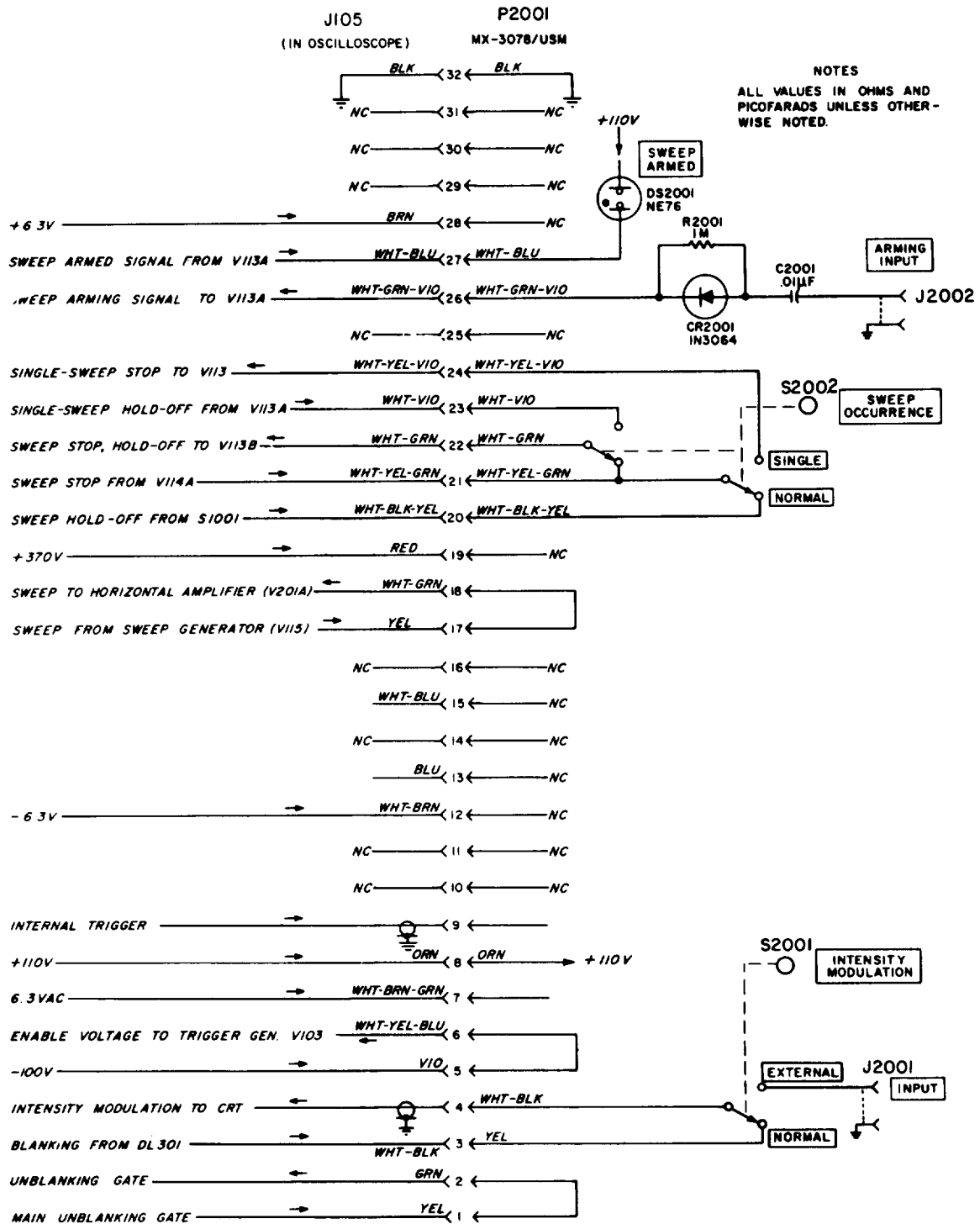


Figure 5-47. MX-3078/USM Horizontal Channel Auxiliary Plug-In Unit Schematic Diagram

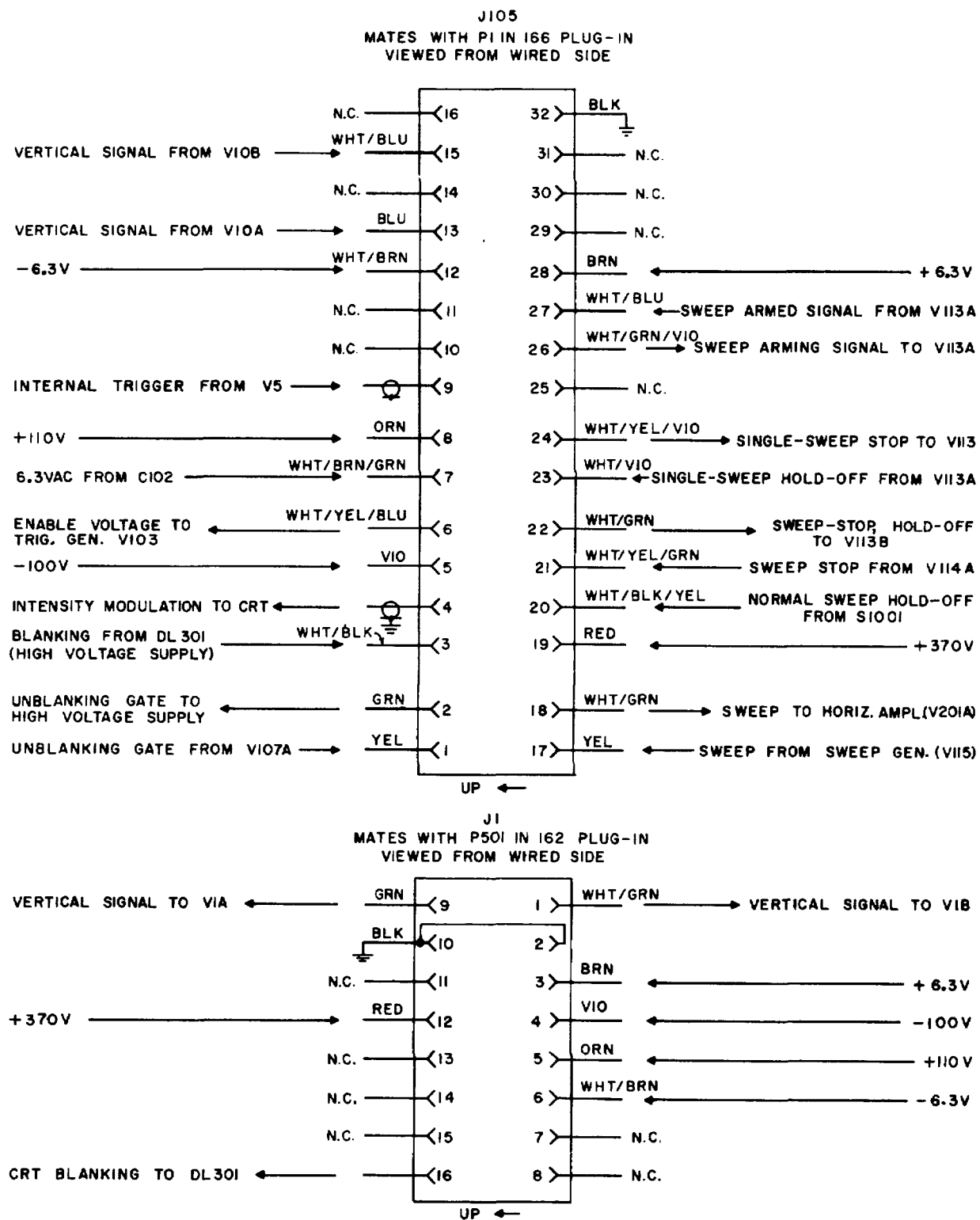


Figure 5-48. Connections to the Horizontal and Vertical Plug-in Connectors J105 and J1

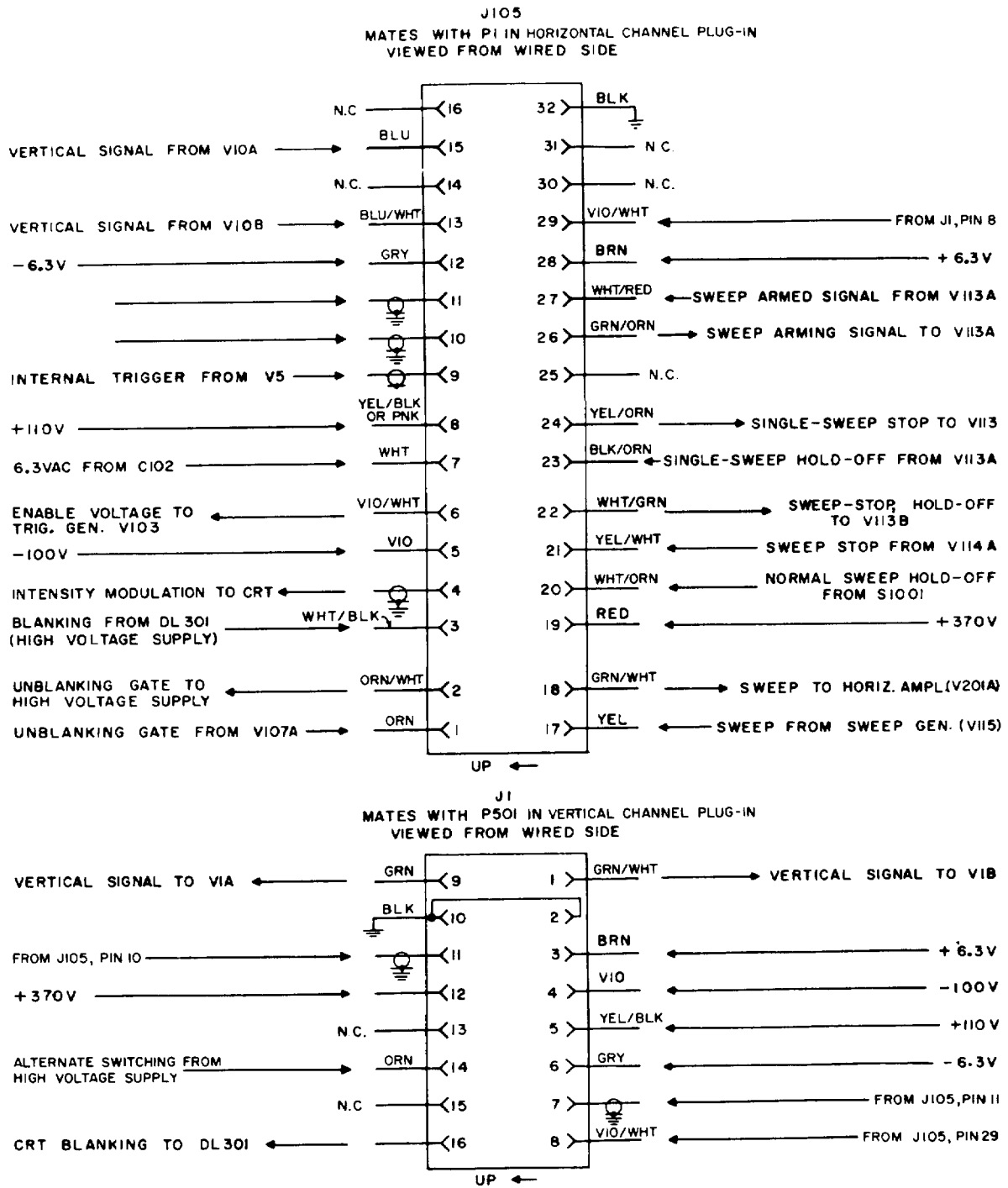


Figure 5-48A. Connections to the Horizontal and Vertical Plug-In Connectors J105 and J1
AN/USM - 140C

CHANGE 1 5-80.1

SECTION 6

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

6-1. Scope of Maintenance

The maintenance duties assigned to the operator and organizational repairman of the equipment are listed below, together with a reference to the paragraphs covering the specific maintenance functions.

- a. Daily preventive maintenance checks and services (para 6-4).
- b. Weekly preventive maintenance checks and services (para 6-5).
- c. Monthly preventive maintenance checks and services (para 6-6).
- d. Quarterly preventive maintenance checks and services (para 6-7).
- e. Cleaning (para 6-8).
- f. Touchup painting (para 6-9).

6-2. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 6-4 through 6-8 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (para 6-4 through 6-7) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronics equipment in a combat-serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are; the References column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by the corrective actions listed, higher level maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

6-3. Preventive Maintenance checks and Services Periods

Preventive maintenance checks and services of the equipment are required daily, weekly, monthly, and quarterly.

a. Paragraph 6-4 specifies the checks and services that must be accomplished daily (or at least once each week if the equipment is maintained in standby condition).

b. Paragraphs 6-5, 6-6, and 6-7 specify additional checks and services that must be performed weekly, monthly, and quarterly.

6-4. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item to be inspected	Procedure	References
1	Completeness	See that the equipment is complete.....	Appx.
2	Exterior surfaces	Clean the exterior surfaces, including the panel and the crt glass (para 6-8). Check the indicator lens for cracks.	Para 6-8.
3	Connectors.....	Check the tightness of all connectors.....	None.
4	Controls and indicators.	While making the operating checks (sequence No. 5), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding, and that there is no excessive looseness.	None.
5	Operation	Operate the equipment according to section 3. During operation, be alert for any unusual performance or condition.	None.

6-5. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item to be inspected	Procedure	References
1	Cables.....	Inspect cords, cables, and wires for chafed, cracked, or frayed insulation. Replace connectors that are broken, arced, stripped, or worn excessively.	None.
2	Handles and latches	Inspect handles and latches for looseness, Replace or tighten as necessary.	None.
3	Metal surfaces.....	Inspect exposed metal surfaces for rust and corrosion. Clean and touchup paint as required (para 6-9).	None.

6-6. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item to be inspected	Procedure	References
1	Pluckout items.....	Inspect seating of pluckout items. Make certain that tube clamps grip tubes tightly.	None.
2	Jacks	Inspect jacks for snug fit and good contact	None.
3	Transformer terminals.	Inspect terminals on power transformer and high-voltage transformer for dirt or corrosion. All nuts securing the transformer must be tight.	None.

6-6. Monthly Preventive Maintenance Checks and Services Chart (cont)

Sequence No.	Item to be inspected	Procedure	References
4	Terminal blocks.....	Inspect terminal blocks for loose connections and cracked or broken insulation.	None.
5	Resistors and capacitors.	Inspect resistors and capacitors for cracks, blistering, or other defects.	None.
6	Variable capacitors.....	Inspect variable capacitors for dirt, corrosion, and deformed plates.	None.
7	Air filter	Clean and inspect the air filter	Para 5-2a.

6-7. Quarterly Preventive Maintenance Checks and Services Chart

Sequence No.	Item to be inspected	Procedure	References
1	Publications.....	See that all publications are complete, serviceable, and current.	DA Pam 310-4.
2	Modifications	Check DA Pam 310-4 to determine whether new applicable MWO's have been published. All URGENT MWO's must be applied immediately. All NORMAL MWO's must be scheduled.	TM 38-750 and DA Pam 310-4.

6-7. Quarterly Preventive Maintenance Checks and Services Chart (cont)

Sequence No.	Item to be inspected	Procedure	References
3	Spare parts	Check all spare parts (operator and organizational) for general condition and method of storage. No overstock should be evident, and all shortages must be on valid requisitions.	Appx.
4	Lubrication of fan motor.	Check and lubricate the fan motor	Para 5-2b.

6-8. Cleaning

Inspect the exterior surfaces of Oscilloscope AN/USM-140B. The exterior surfaces must be free of dust, grease, and fungus.

- a. Remove dust and loose dirt with a clean, soft cloth.

Warning:

Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. DO NOT use near a flame. Avoid contact with the skin; wash off any that spills on your hands.

- b. Remove grease, fungus, and ground-in dirt from the case and covers of the oscilloscope; use a cloth dampened (not wet) with Cleaning Compound (FSN 7930-395-9542).

- c. Remove dust or dirt from plugs and jacks with a brush.

- d. Clean the front panel and control knobs; use a soft, clean cloth. If dirt is difficult to remove, dampen the cloth with water; use mild soap if necessary.

6-9. Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TB SIG 364.

SECTION 7

DEPOT OVERHAUL STANDARDS

7-1. Applicability of Depot Overhaul Standards

Tests outlined in paragraphs 7-6 through 7-12 are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet standards given in these tests.

SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of requirements for testing this equipment.

b. Modification Work Orders. Perform all modification work orders applicable to this equipment before making test specified. DA Pam 310-7 lists all available MWO's.

7-2. Applicable References

a. Repair Standards. Applicable procedures of the depots performing these tests, and the general standards for repaired electronic equipment given in TB

7-3. Test Facilities Required

The test equipments listed below are required for depot testing:

Nomenclature	Technical manual	Common name
Voltmeter, Electronic ME-2020A/U.	TM 11-6625-537-15-1	Ac differential voltmeter
Voltmeter, Meter ME-30(*)/U. ^a	TM 11-6625-320-12	Voltmeter, electronic.
Generator, Square Wave Tektronic Model 107.	.....	Square wave generator.
Generator, Electronic Marker AN/USM-108.	TM 11-6625-542-15	Marker generator.
Constant Amplitude Generator Tektronix Model 190A.	.....	Constant amplitude generator.
Voltmeter, Calibrator, Hewlett-Packard Model 738A.	.....	Voltmeter-calibrator.
Attenuator, Tektronix Model 190A.	.....	Attenuator.
Feed-Through Termination Tektronix, 52 ohm.	.....	Termination.
Main vertical amplifier test connector (fabricated according to para 7-4).	.....	Vertical amplifier test connector.

^a Refers to Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.

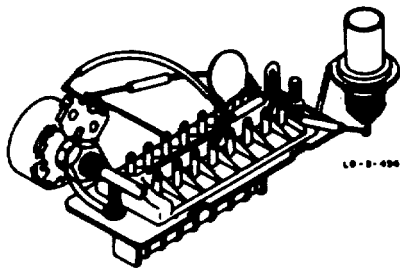
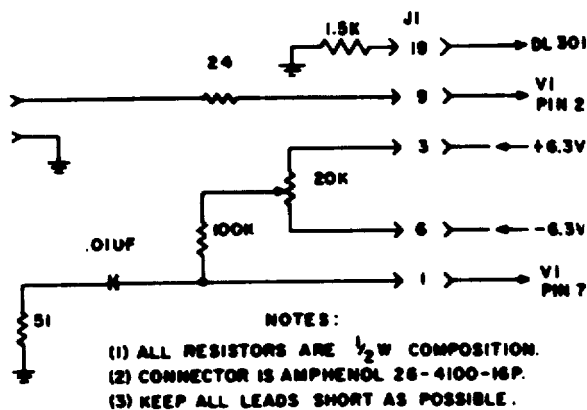
7-4. Fabrication of Main Vertical Amplifier Test Connector

Fabricate the main vertical amplifier test connector in accordance with figure 7-1.

7-5. General Test Requirements

All tests should be conducted under the conditions given below.

- a. All test equipment should be connected to 115



TM 6625-535-15-1-C1-1

Figure 7-1. Main vertical amplifier test connector.

volts ac $\pm 10\%$, 50 through 60 cps $\pm 10\%$ or 400 cps $\pm 10\%$.

b. All tests should be conducted at room temperature.

c. The test equipment should have a warmup time of 5 minutes or more before tests are performed.

7-6. Mechanical Test Requirements

All switches should have positive action; all controls should operate smoothly without binding. Proper operation should be inspected as follows:

- a. Turn the INTENSITY control fully clockwise.
- b. Connect the oscilloscope to the power source; place the POWER switch to ON and wait for the initial warmup. The pilot lamp should light.
- c. Place the HORIZONTAL DISPLAY switch at X1, and the VERNIER control at CAL.

d. Set the SWEEP TIME switch to .5 MILLISECONDS/CM, and the VERNIER control to CAL.

e. Place the SWEEP MODE control at PRESET, and the TRIGGER SOURCE switch at INT.

f. Set the INTENSITY MODULATION and SWEEP OCCURRENCE switches to NORMAL.

g. Connect the test prod BNC terminal to the CHANNEL A INPUT connector.

h. Place the vertical presentation switch at the CHANNEL A position.

i. Set the CHANNEL A SENSITIVITY switch to .05 VOLTS/CM.

j. Place the CALIBRATOR switch at 2.

k. Connect the test prod tip to the CALIBRATOR VOLTS connector.

l. Rotate the INTENSITY control clockwise until a trace appears. If the crt remains blank, press the BEAM FINDER pushbutton.

m. Adjust the HORIZONTAL POSITION and CHANNEL A VERTICAL POSITION controls until the trace is centered on the screen. If necessary, readjust the INTENSITY control.

n. Adjust the FOCUS and ASTIGMATISM controls to obtain a thin trace.

o. Loosen the knurled locknut behind the rear flange on the prod.

p. Hold the vinyl sheath behind the locknut and rotate the rear flange to obtain the best square wave. Check to see that the vertical deflection is 4 centimeters (corresponding to .05 volt/centimeter (cm) sensitivity with a 2-volt calibrator output and 10: 1 attenuation in the probe).

q. Tighten the prod locknut without changing the adjustment.

r. Turn the vertical presentation switch to CHANNEL B. Repeat the procedures given in i through c above for CHANNEL B and the other test prod.

s. Repeat the procedures (a through r above) with the vertical presentation switch set to ALTERNATE and with both prods connected to the calibrator (one driving CHANNEL A and one driving CHANNEL B) to test both channels simultaneously.

t. To display a single signal, connect either probe to the signal and -switch the vertical presentation switch to the corresponding channel. Adjust the SENSITIVITY, HORIZONTAL DISPLAY, and SWEEP TIME switches and the TRIGGER controls as necessary to obtain and synchronize the desired display.

- (3) SWEEP MODE: PRESET.
- (4) SWEEP TIME: 2 MILLISECONDS/ CM.
- (5) VERTICAL SENSITIVITY: 2 VOLTS/CM.
- (6) CALIBRATOR: OFF.

7-7. Power Supply Test

Perform the power supply test as follows:

a. Remove the oscilloscope from the cabinet and ground the chassis. Turn the instrument on and allow a few minutes warmup time. Ground the ME-202A/U to the chassis and measure the voltages at the test points shown in figure 7-2. Readings should be as shown in the chart below.

Test point	Voltage reading
A1	+6.3 volts \pm 1.
A2	-6.3 volts \pm 1.
A3	-100 volts \pm 0.4.
A4	+110 volts \pm 0.44.
A5	+370 volts \pm 3.7.

b. Disconnect the ME-202A/U from the chassis and connect the ground connection of the ME-30(*)/U to the oscilloscope chassis. Measure the ripple voltages at the test points shown in figure 7-2. Readings should be as shown in the chart below.

Test point	Voltage reading
A1	7mvac.
A2	7mvac.
A3	3mvac.
A4	7mvac.
A5	18mvac.

Note. These voltages are greater than typical voltages listed on the schematic diagram and are the maximum allowable.

7-8. Calibrator Test

Perform the calibrator test as described in a through d below:

- a. Set controls of the oscilloscope as follows:
 - (1) HORIZONTAL DISPLAY: X1.
 - (2) TRIGGER SOURCE: INT.

b. Adjust the voltmeter-calibrator to deliver 10 volts at 400 cycles peak-to-peak and connect this signal to the VERTICAL INPUT jack. Set the sensitivity vernier for exactly 4-cm deflection, and disconnect the voltmeter calibrator. Set the CALIBRATOR switch to a 10-volt output and connect the calibrator output at the VOLTS connector to the vertical INPUT connector. Note the exact amplitude of the square wave.

c. The amplitude of the sine-wave output from the voltmeter-calibrator and the squarewave output from the oscilloscope should not differ by more than 3 %.

d. Check all of the CALIBRATOR voltage ranges by comparing equal voltages from the voltmeter-calibrator and the CALIBRATOR output. Use the procedures given in b and c above.

7-9. Horizontal Amplifier Test

Perform the horizontal amplifier test as follows:

a. Connect the equipment as shown in figure 7-3.

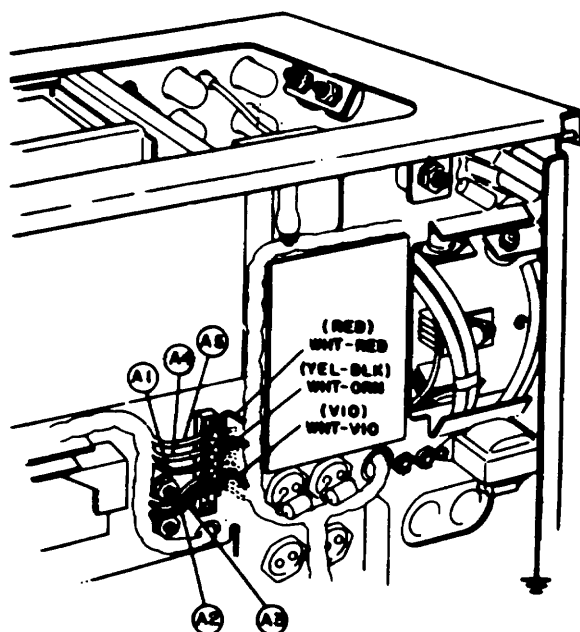
b. Set the voltmeter-calibrator to deliver 1 volt peak-to-peak. Adjust the position controls to center the horizontal trace.

c. Set the HORIZONTAL DISPLAY switch to .1 VOLTS/CM, the trace should extend 10 \pm 0.3 cm.

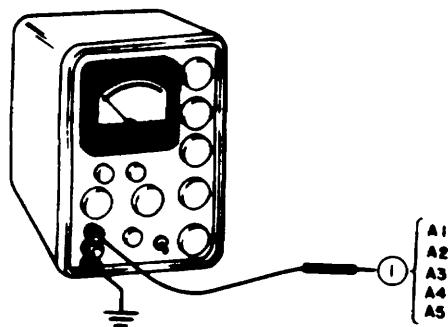
d. Set the HORIZONTAL DISPLAY switch to .2 VOLTS/CM, the trace should extend 5 \pm 0.15 cm.

e. For each setting of the HORIZONTAL DISPLAY switch, set the voltmeter-calibrator to deliver 10 times the voltage indicated; the trace should be 10 \pm 0.3 cm long. At each position of the voltmeter-calibrator, move the HORIZONTAL DISPLAY switch to the next higher position before increasing the voltmeter-calibrator output; the trace should then be 5 \pm 0.15 cm long.

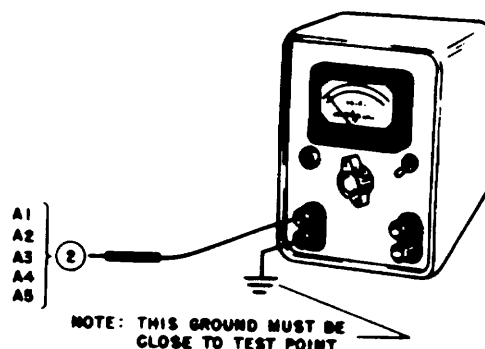
f. Connect the equipment as shown in figure 7-4. Set the HORIZONTAL DISPLAY switch to .1 VOLTS/CM. Set up the constant amplitude signal generator to deliver a 50-kilocycle (kc) output.



ME-202
VOLTMETER (FLUKE MODEL)
801 OR 803 DC VOLTMETER



ME-30/U
AC VOLTMETER



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Figure 7-2. Power supply voltage and ripple test connections.

Adjust the amplitude for a 10-cm horizontal deflection on the crt. Increase the frequency of the constant amplitude generator and note the deflection on the crt. The frequency at which the deflection on the crt decreases to 7.1 cm (3-decibel (db) point) should be greater than 1 megacycle (mc).

7-10. Sweep Generator Test

To perform the sweep generator test, connect the equipment as shown in figure 7-5 and proceed as follows:

- a. Connect the equipment as shown in A, figure 7-5. Set the marker generator to deliver 1-microsecond (μ sec) markers.

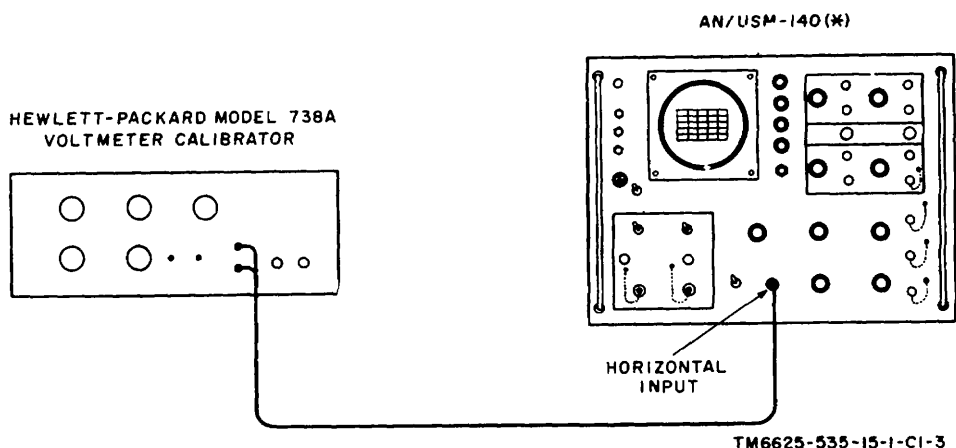


Figure 7-3. Horizontal attenuator test.

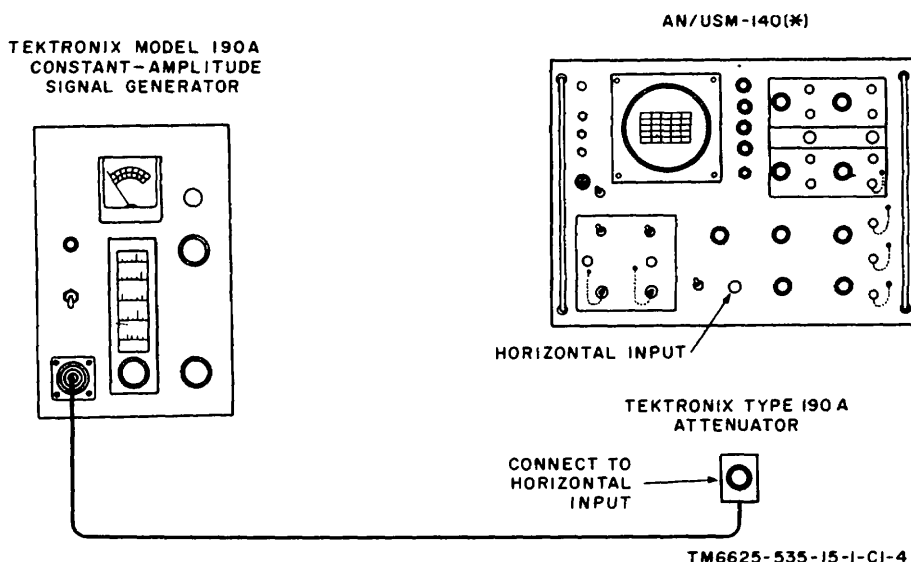


Figure 7-4. Horizontal amplifier frequency response test.

- b. Set the controls of the oscilloscope as follows:
- (1) HORIZONTAL DISPLAY: X1.
 - (2) TRIGGER SOURCE: INT.
- (3) SWEEP MODE: TRIGGER.
- (4) SWEEP TIME: 1 MICROSECOND/ CM.
- c. Adjust the VERTICAL SENSITIVITY for a 1-cm deflection. The markers should appear every cm $\pm 3\%$.
- d. Set the SWEEP TIME switch to 1 MILLISECOND/CM, and the marker generator to deliver 1-millisecond markers. The markers should appear every cm $\pm 3\%$.

- e. Set the SWEEP TIME switch to 1 SECOND/CM, and the marker generator to deliver 1-second markers. The markers should appear every cm $\pm 3\%$.

- f. Connect the equipment as shown in B, figure 7-5. Set the voltmeter-calibrator to deliver a 0.2-volt, peak-to-peak signal. Set the controls of the oscilloscope as follows:

- (1) VERTICAL SENSITIVITY: 1 VOLT/CM. Set the VERTICAL SENSITIVITY vernier to CALIBRATED.
- (2) SWEEP TIME: 1 MILLISECOND/ CM.

- (3) SWEEP MODE: PRESET.
- (4) TRIGGER LEVEL: 0.
- g. The sweep is triggered and without jitter.

7-1 1. Main Vertical Amplifier

Test Perform the main vertical amplifier test as follows:

a. Remove the vertical plug-in unit and insert the main vertical amplifier test connector, fabricated in paragraph 7-4, as shown in A, figure 7-6.

- b. Set the controls of the oscilloscope as follows:
 - (1) HORIZONTAL DISPLAY: X1.
 - (2) SWEEP TIME: 2 MILLISECONDS/ CM.
 - (3) TRIGGER SOURCE: INT.
 - (4) SWEEP MODE: PRESET.
 - (5) TRIGGER LEVEL: 0.

c. Adjust the voltmeter-calibrator to deliver 400 cps, 0.8 volt peak-to-peak. The peak-to-peak deflection on the crt should be 4 ± 0.2 cm.

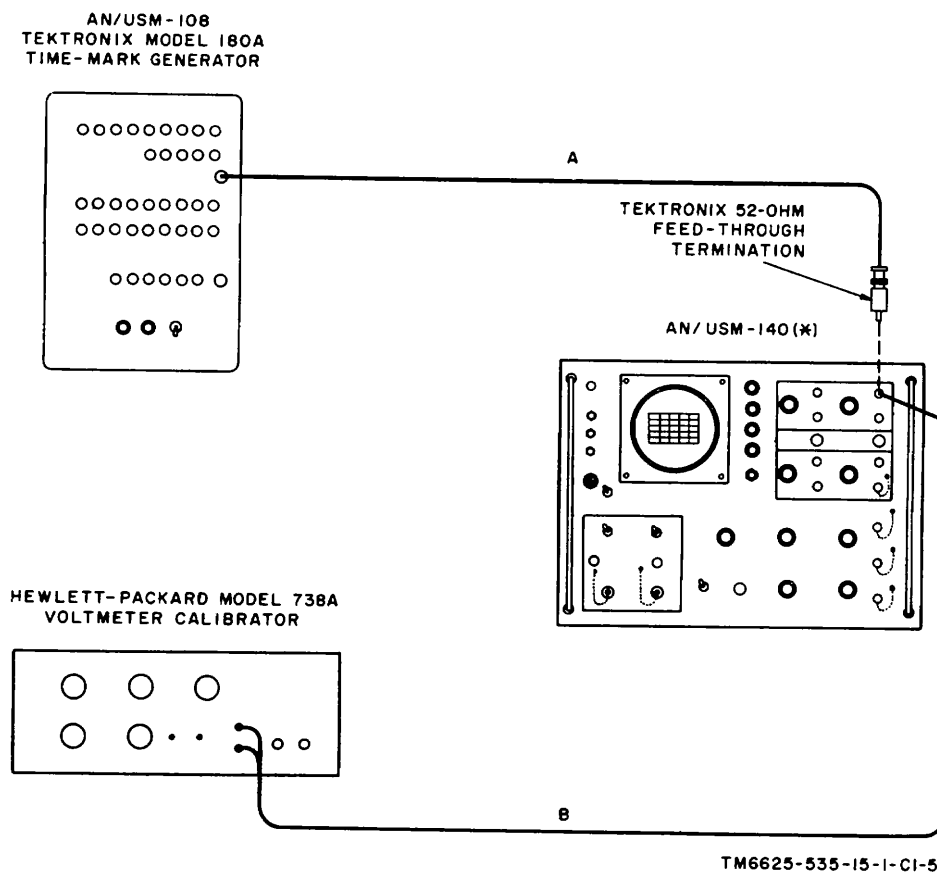
d. Connect the equipment as shown in B, figure 7-6. Adjust the constant amplitude generator for a 50-kc output. Adjust the amplitude of the constant amplitude signal generator output to achieve a 4-cm deflection on the crt.

e. Increase the frequency of the constant amplitude signal generator until the deflection on the crt decreases to 2.8 cm (3-db point). The frequency at this point should be a minimum of 30 mc, and is typically above 35 mc.

f. Connect the equipment as shown in C, figure 7-6. Set the controls of the oscilloscope as follows:

- (1) HORIZONTAL DISPLAY: X5.
- (2) SWEEP TIME: .1 MICROSECOND/ CM.
- (3) TRIGGER LEVEL: +.

g. Set the square wave generator to deliver a 1-mc, 0.5-volt square wave. Center the leading edge of the



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Figure 7-5. Sweep generator test setup.

square wave with the control on the main vertical amplifier test connector and the HORIZONTAL POSITION control. Adjust the TRIGGER LEVEL control to shift the leading edge of the square wave as far to the right as possible. The risetime (10 through 90%) should be 11 (μsec) (0.55 cm), or less.

7-12. MX-2930B/USM Vertical Plug-in Test

a. *Channel A Vertical Sensitivity.* Check the channel A vertical sensitivity as follows:

(1) Set the controls of the oscilloscope as follows:

- (a) CHANNEL A + B VERNIER: CAL.
- (b) AC-DC SWITCH: AC.
- (c) Vertical presentation switch:
- (d) SWEEP MODE: PRESET.
- (e) SWEEP TIME: 5
- (f) SENSITIVITY control vernier:
- (g) TRIGGER SOURCE: INT.

CHANNEL A.

MILLISECONDS/CM.

CALIBRATED.

(2) Connect the equipment as shown in A, figure 7-7. Adjust the voltmeter-calibrator to deliver 400 cycles at a 0.1-volt, peak-to-peak output. Set the SENSITIVITY switch of the oscilloscope to .02 VOLTS/CM. The vertical deflection on the oscilloscope crt should be 5 cm ±0.25.

(3) Repeat procedures given in (2) above for each position of the SENSITIVITY switch. Set the voltmeter-calibrator output as necessary to provide an adequate deflection on the crt. The deflection should be in accordance with the following formula:

$$\frac{\text{Output voltage}}{\text{SENSITIVITY}} = \text{cm} \pm 5\%$$

b. *Channel B Vertical Sensitivity.* To check channel B vertical sensitivity, repeat procedures given in a(1), (2), and (3) above, except the vertical presentation switch should be set to CHANNEL B, and the voltmeter-calibrator should be connected to the CHANNEL B INPUT connector.

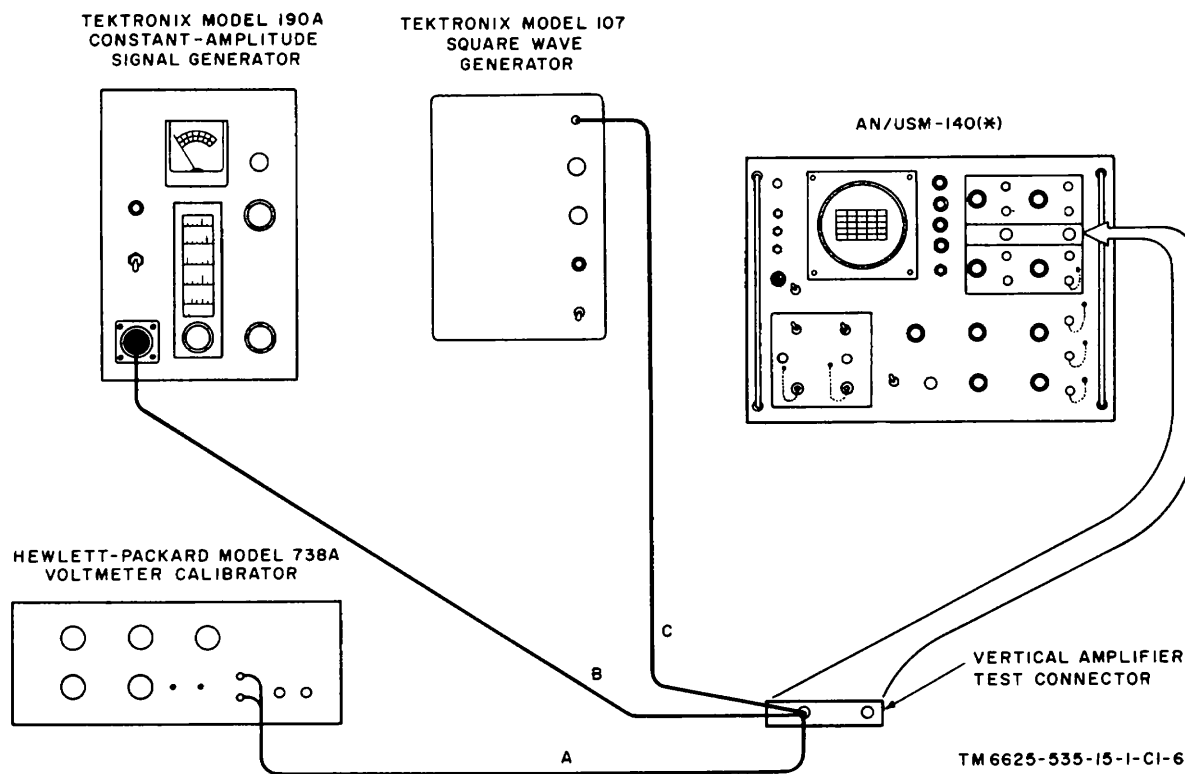


Figure 7-6. Main vertical amplifier test.

c. *Vertical Pulse Response Test.* Perform the vertical pulse response test as follows:

(1) Controls of the oscilloscope should be set as described in a above, except that the CHANNEL A SENSITIVITY switch should be set to 0.02 VOLTS/CM and the SWEEP TIME switch should be set to 0.2 MICROSECOND/CM.

(2) Connect the equipment as shown in B, figure 7-7. Set the square wave generator to produce a 0.25-volt, alternating current (ac) peak-to-peak signal.

(3) The vertical overshoot on the leading edge of the signal must not exceed 3%.

(4) Repeat procedures given in (1), (2), and (3) above for the CHANNEL B input.

d. *Vertical Bandwidth Test.* Perform the vertical bandwidth test as described in (1) through (4) below.

(1) Set controls of the oscilloscope as follows:

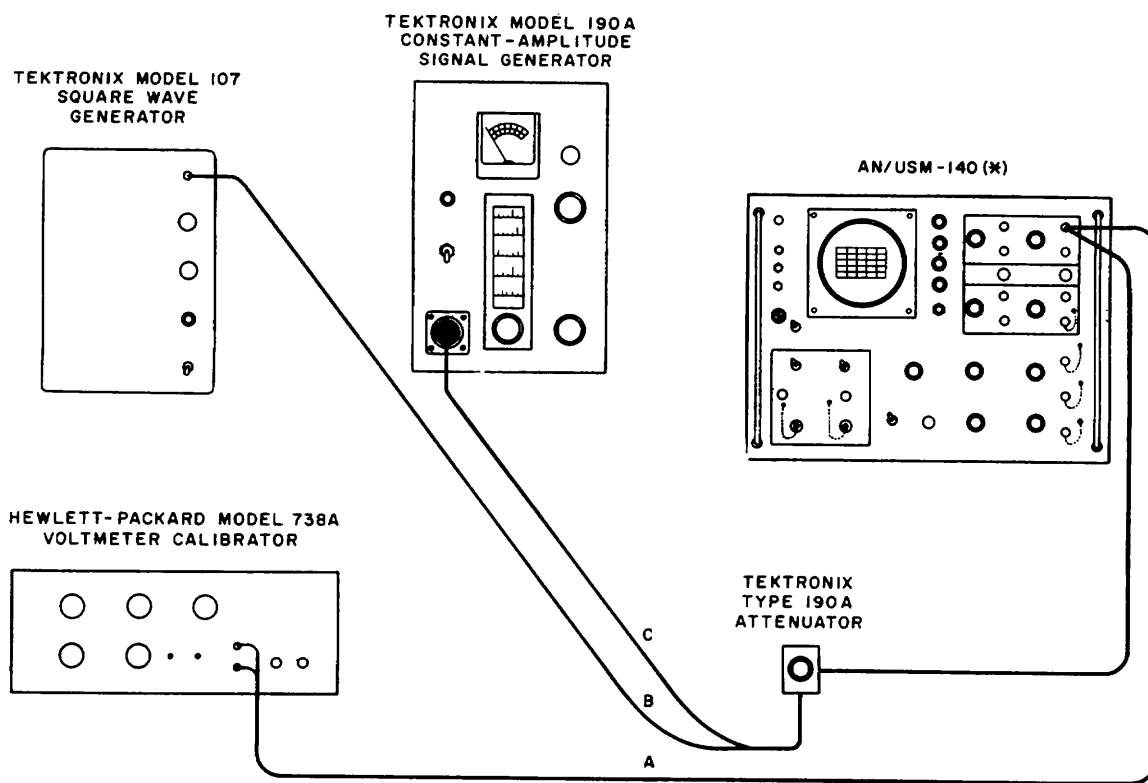
(a) SENSITIVITY: .02 VOLTS/CM.

(b) HORIZONTAL DISPLAY: X1.

(2) Connect the equipment as shown in C, figure 7-7, and set the constant-amplitude signal generator to deliver a 50-kc signal. Adjust the amplitude of the constant-amplitude signal generator to provide exactly 4 cm of deflection on the crt screen.

(3) Increase the frequency of the constant-amplitude signal generator until the height of the display on the crt is exactly 2.8 cm. The output frequency must not be less than 22 mc.

(4) Repeat procedures given in (1), (2), and (3) above for the CHANNEL B input.



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Figure 7-7. MX-2930B/USM vertical plug-in test.

e. *Isolation Test.* Conduct the isolation test as follows:

- (1) Set controls of the oscilloscope as follows:
 - (a) Vertical presentation switch: CHANNEL B.
 - (b) Channel A SENSITIVITY control: .02 VOLTS/CM.
 - (c) Channel B SENSITIVITY control: 0.5 VOLTS/CM.
 - (d) HORIZONTAL DISPLAY: X1.
 - (e) SWEEP TIME: 1 MILLISECOND/CM.

(2) Center display with the VERTICAL POSITION control and apply a 20-volt signal from the CALIBRATOR output to the CHANNEL A input, note the deflection. Reverse the procedures given in (1) above and note the deflection. The deflection in either case should not exceed 0.3 cm.

f. *Common Mode Rejection Test.* Perform the common mode rejection test as follows:

(1) Connect the output of the CALIBRATOR to CHANNEL A and B inputs (through a T connector). Change the vertical presentation switch to A-B, the AC-DC switch to DC, and leave the HORIZONTAL DISPLAY switch placed at X1.

(2) Measure the common mode rejection on all SENSITIVITY ranges and note that the deflection corresponds to that given in the chart below:

A & B SENSITIVITY	Input Voltage	Deflection (cm)
.02	2	1
.05	5	3

A & B SENSITIVITY	Input Voltage	Deflection (cm)
.10.....	10.....	3
.20.....	20.....	3
.50.....	50.....	3
1.00.....	100.....	3
2.00.....	100.....	1.5
5.00.....	100.....	0.6
10.00.....	100.....	0.3
20.00.....	100.....	0.15

g. *Chopped Display Test.* Perform the chopped display test as follows:

- (1) Remove all connections from the INPUT connectors.
- (2) Set controls of the oscilloscope as follows:
 - (a) Vertical presentation switch: CHOPPED.
 - (b) SWEEP TIME: .5 MICROSECONDS/CM.

(3) Adjust the VERTICAL POSITION control for two, distinct, chopped traces.

(4) The chopped period should be between 0.9 and 1.1 microseconds. The transition between the chopped traces should be blanked out at the normal intensity levels.

h. *Alternate Display Test.* To perform the alternate display test, proceed as follows:

- (1) Leave controls set as described in g above.
- (2) Set the vertical presentation switch to ALTERNATE.
- (3) Vary the SWEEP TIME from 20 MILLISECONDS/CM to 0.1 MICROSECONDS/CM.
- (4) The display should show two distinct traces throughout the sweep range.

APPENDIX I

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TB SIG 364	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 38-750	Army Equipment Record Procedures.

APPENDIX II

**BASIC ISSUE ITEMS LIST (BIIL) AND ITEMS TROOP
INSTALLED OR AUTHORIZED LIST (ITIAL)**

Section I. INTRODUCTION

A2-1. Scope

This appendix lists only basic issue items required by the crew/operator for installation, operation, and maintenance of Oscilloscope AN, USM-140B.

A2-2. General

This Basic Issue Items and Items Troop Installed or Authorized List is divided into the following sections:

- a. *Basic Issue Items List-Section II.* A list, in alphabetical sequence, of items which are furnished with, and which must be turned in with the end item.
- b. *Items Troop Installed or Authorized List - Sections III.* Not applicable.

A2-3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

- a. *Illustration.* Not applicable.
- b. *Federal Stock Number.* Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.
- c. *Part Number.* Indicates the primary number used by the manufacturer (individual, company, firm,

corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

d. *Federal Supply Code for Manufacturer (FSCM).* The FSCM is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., and is identified in SB 708-42.

e. *Description.* Indicates the Federal item name and a minimum description required to identify the item.

f. *Unit of Measure (UM).* Indicates the standard of basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, (e.g., ea, in., pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

g. *Quantity Furnished with Equipment (Basic Issue Items Only).* Indicates the quantity of the basic issue item furnished with the equipment.

Section II. BASIC ISSUE ITEMS LIST

(1) ILLUSTRATION		(2) FEDERAL STOCK NUMBER	(3) PART NUMBER	(4) FSCM	(5) DESCRIPTION USABLE ON CODE	(6) U/M	(7) QTY FURN WITH EQUIP
(a) FIG NO.	(b) ITEM NO.						
		6625-071-0789			COVER, OSCILLOSCOPE CW-511/USM	EA	1

APPENDIX III

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

A3-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature for Oscilloscope AN/USM-140B. It authorizes levels of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

A3-2. Explanation of Format for Maintenance Allocation Chart

a. Group Number. Group numbers correspond to the reference designation prefix assigned in accordance with ASA Y32.16, Electrical and Electronics Reference Designations. They indicate the relation of listed items to the next higher assembly.

b. Component Assembly Nomenclature. This column lists the item names of component units, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Maintenance Function. This column indicates the maintenance level at which performance of the specific maintenance function is authorized. Authorization to perform a function at any level also includes authorization to perform that function at higher levels. The numbers used to represent the various maintenance levels are as follows:

<u>Number</u>	<u>Maintenance Category</u> (or level)
1	Operator' s
2	Organizational
3	Direct support
4	General support
5	Depot

d. Tools and Equipment. The numbers appearing in this column refer to specific tools and equipment which are identified by these numbers in Section III.

e. Remarks. Self explanatory.

A3-3. Explanation of Format for Tool and Test Equipment Requirements

The columns in the tool and test equipment requirements chart are as follows:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The numbers in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, and test, and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number.

e. Tool Number. Not used.

SECTION II. MAINTENANCE ALLOCATION CHART
MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS										TOOLS AND EQUIPMENT	REMARKS					
		I N S P E C T	T E S T	S E R V I C E	A D J U S T	A L I G N	C A L I B R A T E	I N S T A L L	R E P L A C E	R E P A I R	O V E R H A U L			R E B U I L D				
	OSCILLOSCOPE AN/USM-140B	1		1													1,2,4 1,2,4,5,6,8 10	Replace fuses, lamps
	OSCILLOSCOPE OS-121B/USM-140		4		4												9 1,2,4,5,6 1,2,3,4,5,6,7, 9 1 thru 9	After change of tubes, resistors, etc.
	PREAMPLIFIER, DUAL TRACE MX-2390B/USM									2							10 9	Replace fuses, lamps
	AUXILIARY PLUG-IN MX-3078/USM									2							9	
	PROD, TEST MX-4073/U									4							9	
	CABLE ASSEMBLIES									4							9	

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOL AND TEST EQUIPMENT REQUIREMENTS				
TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	4, 5	GENERATOR, SIGNAL AN/URM-127	6625-783-5965	
2	4, 5	COUNTER, ELECTRONIC, DIGITAL READOUT AN/USM-207	6625-911-6368	
3	5	GENERATOR, ELECTRONIC MARKER AN/USM-108	6625-987-9564	
4	4,5	MULTIMETER ME-26/U	6625-646-9409	
5	4, 5	OSCILLOSCOPE AN/USM-140B	6625-987-6603	
6	4, 5	SIGNAL GENERATOR SG-299/U	6625-624-3516	
7	5	TEST SET, ELECTRON TUBE TV-2/U	6625-699-0263	
8	4	TEST SET, ELECTRON TUBE TV-7D/U	6625-820-0064	
9	4,5	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	5180-605-0079	
10	2	TOOLS AND TEST EQUIPMENT AVAILABLE TO REPAIRMAN-USER BECAUSE OF HIS ASSIGNED MISSION		

APPENDIX IV

**ORGANIZATIONAL, DS, GS, AND DEPOT MAINTENANCE
REPAIR PARTS AND SPECIAL TOOLS LIST**

Section I. INTRODUCTION

A4-1. Scope

This appendix lists repair parts required for the performance of organizational, general support, and depot maintenance of the AN/USM-140B and AN/USM-140C. This appendix is current as of 2 March 1971.

NOTE

**No parts are authorized for stockage
at direct support category of
maintenance.**

A4-2. General

This Repair Parts List is divided into the following sections:

a. Prescribed Load Allowance (PLA)-Section II. A composite listing of repair parts having quantitative allowances for initial stockage at the organizational level.

b. Repair Parts for Organizational Maintenance-Section III. A list of repair parts authorized for the performance of maintenance at the organizational level.

c. Special Tools, Test and Support Equipment for Organizational Maintenance-Section IV. Not applicable.

d. Repair Parts for Direct Support, General Support, and Depot Maintenance-Section V. A list of repair parts authorized for the performance of maintenance at the general support and depot level.

e. Special Tools, Test and Support Equipment for Direct Support, General Support, and Depot Maintenance-Section VI. Not applicable.

f. Index-Federal Stock Number Cross-Reference to Figure and Item Number or Reference Designation-Section VII. A list of Federal stock numbers in ascending numerical sequence, followed by a list of reference numbers in ascending alphanumeric

sequence, cross-referenced to the illustration figure number and reference designation.

g. Index-Reference Designation Cross-Reference to Page Number-Section VIII. A list of reference designations cross-referenced to page numbers.

A4-3. Explanation of Columns

The following provides an explanation of columns in the tabular lists:

a. Source, Maintenance, and Recoverability Codes (SMR).

(1) Source code indicates the selection status and source for the list item. Source codes are:

<i>Code</i>	<i>Explanation</i>
-------------	--------------------

P-Repair parts which are stocked in or supplied from the GSA/DSA or Army Supply system and authorized for use at indicated maintenance categories.

P2-Repair parts which are procured and stocked for insurance purposes because the combat or military essentially of the end item dictates that a minimum quantity be available in the supply system.

P9-Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment which are stocked and supplied by the Army COMSEC logistic system and which are not subject to the provisions of AR 380-41.

Code	Explanation
P10-	Assigned to items which are NSA design controlled: special tools, test, measuring and diagnostic equipment for COMSEC support which are accountable under the provisions of AR 380-41 and which are stocked and supplied by the Army COMSEC logistic system.
M-	Repair parts which are not procured or stocked but are to be manufactured in indicated maintenance levels.
A-	Assemblies which are not procured or stocked as such but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately, and can be assembled to form the required assembly at indicated maintenance categories.
X-	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item of component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1-	Repair parts which are not procured or stocked. The requirement for such items will be filled by use of the next higher assembly or component.
X2-	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain same through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
G-	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above DS and GS level or returned to depot supply level.

(2) Maintenance code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level codes are:

Code	Explanation
C.....	Operator/Crew
O.....	Organizational Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

(3) Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	Explanation
R-	Repair parts and assemblies that are economically repairable at DSU and GSU activities and normally are furnished by supply on an exchange basis.
S-	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T-	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U-	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. Indicates the Federal item name and any additional description of the item required. The index number has been included as part of the description to aid in the location of "same as" items. A part number, or other reference number, is followed by the applicable five-digit Federal supply code for manufacturers in parentheses.

d. Unit of Measure (UM). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. Indicates the quantity of the item used in the AN/USM-140B and AN/USM-140C. Subsequent appearances of the same item in the same assembly are indicated by the letters "REF."

f. 15-Day Organizational Maintenance Allowances.

(1) The allowance columns are divided into four subcolumns. Indicated in each subcolumn opposite the first appearance of each item is the total quantity of items authorized for the number of equipments supported. Subsequent appearances of the same item will have the letters "REF" in the allowance columns. Items authorized for use as required, but not for initial stockage, are identified with an asterisk in the allowance column.

(2) The quantitative allowances for organizational level of maintenance represents one initial prescribed load for a 15-day period for the number of equipments supported. Units and organizations authorized additional prescribed loads will multiply the number of prescribed loads authorized by the quantity of repair parts reflected in the appropriate density column to obtain the total quantity of repair parts authorized.

(3) Organizational units providing maintenance for more than 100 of these equipments shall determine the total quantity of parts required by converting the equipment quantity to a decimal factor by placing a decimal point before the next to last digit of the number to indicate hundredths, and multiplying the decimal factor by the parts quantity authorized in the 51-100 allowance column. Example, authorized allowance for 51-100 equipments is 12; for 140 equipments multiply 12 by 1.40 or 16.80 rounded off to 17 parts required.

(4) Subsequent changes to allowances will be limited as follows: No change in the range of items is authorized. If additional items are considered necessary, recommendation should be forwarded to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-MENMP-EM, Fort Monmouth, N.J. 07703 for exception or revision to the allowance list. Revisions to the range of items authorized will be made by the USAECOM based upon engineering experience, demand data, of TAERS information.

g. 30-Day DS/GS Maintenance Allowances.

NOTE
Allowances in GS Column are for GS maintenance only.

(1) The allowance columns are divided into three subcolumns. Indicated in each subcolumn, opposite the first appearance of each item, is the total quantity of items authorized for the number of equipments supported. Subsequent appearances of the same item will have the letters "REF" in the applicable allowance columns. Items authorized for use as required, but not for initial stockage, are identified with an asterisk in the allowance column.

(2) The quantitative allowances for GS level of maintenance will represent initial stockage for a 30-day period for the number of equipments supported.

(3) Determination of the total quantity of parts required for maintenance of more than 100 of these equipments can be accomplished by converting the equipment quantity to a decimal factor by placing a decimal point before the next to last digit of the number to indicate hundredths, and multiplying the decimal factor by the parts quantity authorized in the 51-100 allowance column. Example, authorized allowance for 51-100 equipments is 40; for 150 equipments multiply 40 by 1.50 or 60 parts required.

h. 1-Year Allowances Per 100 Equipments/Contingency Planning Purposes. Indicates opposite the first appearance of each item the total quantity required for distribution and contingency planning purposes. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments for one year.

i. Depot Maintenance Allowance Per 109 Equipments. Indicates opposite the first appearance of each item the total quantity authorized for depot maintenance of 100 equipments. Subsequent appearances of the same item will have the letters "REF" in the allowance column. Items authorized for use as required, but not for initial stockage, are identified with an asterisk in the allowance column.

j. Illustrations.

(1) *Figure number.* Indicates the figure number of the illustration in which the item is shown.

(2) *Item number or reference designation.*

Indicates the reference designation used to identify the item in the illustration.

A4-4. Special Information

a. Identification of the usable on codes of this publication are:

<i>Code</i>	<i>Used on</i>
1	AN/USM-140B
2	AN/USM-140C

b. Repair parts mortality is computed from failure rates derived from experience factors with the individual parts in a variety of equipments. Variations in the specific application and periods of use of electronics equipment, the fragility of electronic piece parts, plus intangible material and quality factors intrinsic to the manufacture of electronic parts, do not permit mortality to be based on hours of end item use. However, long periods of continuous use under adverse conditions are likely to increase repair parts mortality.

A4-5. Location of Repair Parts

a. This appendix contains two cross-reference indexes (sec VII and VIII) to be used to locate a repair part when either the Federal stock number, reference number (manufacturer's part number), or reference designation is known. The first column in each index is prepared in numerical and/or alphanumeric sequence in ascending order. Where a Federal stock number is not listed, refer to the reference number (manufacturer's part number) immediately following the Federal stock number.

b. When the Federal stock number is known, follow the procedures given in (1) and (2) below.

(1) Refer to the index of Federal stock numbers (sec VII) and locate the Federal stock number. The FSN is cross-referenced to the applicable figure and reference designation.

(2) When the reference designation is determined, refer to the reference designation index (sec VIII). The reference designations are listed in alphanumeric ascending order and are cross-referenced to the page number on which they appear in the repair parts list (sec III and V). Refer to the page number noted in the index and locate the reference designation in the repair parts list (col. 7b, Repair Parts for Organizational Maintenance; or col. 10b, Repair Parts for Direct Support, General Support, and Depot Maintenance). If the word "REF" appears in the allowance column for the repair part, note the Federal stock number (col. 2) or manufacturer's part number (col. 3). Refer to the FSN index and note the reference designation for that FSN or part number. Refer to the reference designation index and note the page number given for the reference designation. Refer to the page noted in the RPSTL (sec III or V) and locate the

reference designation in column 7b, Repair Parts for Organizational Maintenance; or col. 10b, Repair Parts for Direct Support, General Support, and Depot Maintenance, of the repair parts list.

c. When the reference designation is known, follow the procedures given in b (2) above.

d. When neither the FSN nor reference designation is known, identify the part in the illustration and follow directions given in c above, or scrutinize column 3 of the repair parts lists (sec III and V).

A4-6. Federal Supply Code for Manufacturers

Code	Manufacturer
00853	Sangamo Electronic Co. S. Carolina Div.
01121	Allen-Bradley Co.
01295	Texas Instruments Inc. Semiconductor & Components Div.
02286	Cole Rubber and Plastics Inc.
02660.....	Amphenol Corp.
04713.....	Motorola Semiconductor Products Inc.
06540.....	Amatom Electronic Hardware Co. Inc.
12697.....	Carostat Mfg. Co. Inc.
14674.....	Corning Glass Works
16299.....	Corning Glass Works Electronic Components Division
19701	Electra/Midland Co.
24455	General Electric Co., Lamp Division of Consumer Products Group
28480.....	Hewlett-Packard Co.
28569.....	Hickok Electrical Instrument Co.
56289.....	Sprague Electric Co.
62119	Universal Electric Co.
71450	CTS Corp.
71590.....	Globe-Union Inc. Centralab Div.
71785	Cinch Mfg. Co. and Howard B. Jones Div.
72825.....	Hugh H. Eby Inc.
72982.....	Erie Technological Products Inc.
75382.....	Kolton Electric Mfg. Co.
80063	Army Electronics Command

<i>Code</i>	<i>Manufacturer</i>
81349	Military Specifications
82647	Metals and Controls Inc. Control Products Group
83330	Herman H. Smith Inc.
91418	Radio Materials Co.
91637	Dale Electronics Inc.
91662	Elco Corp.
94222	South Chester Corp.
94330	Wire Cloth Products Inc.

<i>Code</i>	<i>Manufacturer</i>
95265	National Coil Co.
95354	Methode Manufacturing Corp.
96906	Military Standards
98003	Nielsen Hardware Corp.
98291	Seaelectro Corp.
98734	Hewlett-Packard Co. Paeco Division
99800.....	Delevan Electronics Corp.

SECTION II. PRESCRIBED LOAD ALLOWANCE

(1) FEDERAL STOCK NUMBER	(2) DESCRIPTION USABLE ON CODE	(3) 15-DAY ORGANIZATIONAL MAINTENANCE ALLOWANCE			
		(a) 1-5	(b) 6-20	(c) 21-50	(d) 51-100
5330-917-7011	GASKET, RUBBER: 496X (02286) 1		6	48	200
5920-280-4465	FUSE, CARTRIDGE: F02A250V1AS (81349) 1,2	2	2	6	11
5920-280-8344	FUSE, CARTRIDGE: F02A250V1/2AS (81349) 1,2	2	2	3	6
5920-295-9270	FUSE, CARTRIDGE: F03B32V10AS (81349) 1,2	2	2	3	6
5920-519-7733	FUSE, CARTRIDGE: F03A250V8AS (81349) 2	2	2	6	11
5920-894-4556	FUSE, CARTRIDGE: F03B250V8AS (81349) 1	2	2	6	11
5935-149-3534	ADAPTER, CONNECTOR UG-273A/U 1,2				2
5935-683-7892	ADAPTER, CONNECTOR UG-274B/U 1,2				2
5935-823-0639	ADAPTER, CONNECTOR UG-255/U 1,2				2
5935-856-9441	ADAPTER, CONNECTOR UG-1035/U 1			2	2
5935-962-8580	ADAPTER, CONNECTOR UG-1441/U 2			2	2
6240-155-8706	LAMP, INCANDESCENT: MS15571-2 (81349) 1,2		2	2	3
6625-758-4949	GROUND CABLE: 5060-0401 (28480) 1			2	2

SECTION III. REPAIR PARTS FOR ORGANIZATIONAL MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF NUMBER & MFR CODE	(4) USABLE ON CODE	(5) UNIT OF MEAS	(6) QTY INC IN UNIT	(6) 15-DAY ORGANIZATIONAL MAINTENANCE ALW				(7) ILLUS- TRATION	
						(a)	(b)	(c)	(d)	(a)	(b)
						1-5	6-20	21-50	51-100	FIG NO.	ITEM NO.
G-C-T	6625-072-5589	1 OSCILLOSCOPE AN/USM-140B	1								
	6625-999-3592	1A OSCILLOSCOPE AN/USH-140C	2								
G-C-T	6625-400-2681	2 OSCILLOSCOPE OS-121B/USM-140	1	EA	1					1-1	
P-O	5935-823-0639	2A OSCILLOSCOPE OS-121C/USM-140	2	EA	1					1-1	
		3 ADAPTER, CONNECTOR UG-255/U	1,2	EA	2	*	*	*	2	1-1	C7601, CP602
P-O	5935-149-3534	4 ADAPTER, CONNECTOR UG-273A/U	1,2	EA	2	*	*	*	2	1-1	CP603, CP604
P-O	5935-683-7892	5 ADAPTER, CONNECTOR UG-274B/U	1,2	EA	2	*	*	*	2	1-1	CP605, CP606
P-C	5935-856-9441	6 ADAPTER, CONNECTOR UG-1035/U	1	EA	4	*	*	2	2	1-1	CP607 thru CP610
P-C	5935-962-8580	7 ADAPTER, CONNECTOR UG-1441/U	2	EA	4	*	*	2	2	1-1	CP607 thru CP610
P-O	6240-155-8706	465 LAMP, INCANDESCENT:	1,2	EA	5	*	2	2	3	5-9	DS403 thru DS406
P-O	5920-894-4556	467 MS15571-2 (81349) FUSE, CARTRIDGE:	1	EA	2	2	2	6	11	5-13 5-11	DS1001 F401,F402
P-O	5920-519-7733	468 F03B250V8AS (81349) FUSE, CARTRIDGE:	2	EA	2	2	2	6	11	5-11	F401,F402
P-O	5920-280-8344	469 F03A250V8AS (81349) FUSE, CARTRIDGE:	1,2	EA	1	2	2	3	6	5-11	F403
P-O	5920-280-4465	470 F02A250V1/2AS (81349) FUSE, CARTRIDGE:	1,2	EA	2	2	2	6	11	5-10	F404,F405
P-O	5920-295-9270	471 F02A250V1AS (81349) FUSE, CARTRIDGE:	1,2	EA	1	2	2	3	6	5-11	F406
P-O	4110-727-8796	487 F03B32V10AS (81349) FILTER, AIR CONDITIONER:	1,2	EA	1	*	*	*	*	2-2	MP147
P-O	5330-917-7011	499 C-7066-3 (94330) GASKET, RUBBER:	1	PT	6	*	6	48	200	1-1	MP609
P-O	6625-072-5227	757 496X (02286) TEST PROD MX-2817/U	1	EA	2	*	*	*	*	5-35	A601,A602
P-O	6625-758-4949	758 GROUND CABLE: 5060-0401 (28480)	1	EA	2	*	*	2	2	5-35	W603,W604
P-O	6625-973-4775	759 PROD, TEST MX-4073A/U	2	EA	2	*	*	*	*	5-35A	
P-O		760 NUT, LOCKING: 6115-3 (28569)	2	EA	1	*	*	*	*	5-35A	E702
P-O	6625-167-9297	761 PROBE, TIP: 16975-54 (28569)	2	EA	1	*	*	*	*	5-35A	E703
P-O	6625-167-9798	762 PROBE, TIP: 16975-62 (28569)	2	EA	1	*	*	*	*	5-35A	E704
P-O	5935-502-0342	763 PROBE, TIP: 100 (83330)	2	EA	1	*	*	*	*	5-35A	E704
P-O	6625-167-9793	764 PROBE, TIP: 16970-63 (28569)	2	EA	1	*	*	*	*	5-35A	E706
P-O	6625-167-9794	765 PROBE, TIP: 16970-64 (28569)	2	EA	1	*	*	*	*	5-35A	E707
P-O	6625-167-9795	766 PROBE, TIP: 16970-75 (28569)	2	EA	1	*	*	*	*	5-35A	E708
P-O	6625-453-5650	767 CABLE ASSEMBLY: 3030-163 (28569)	2	EA	1	*	*	*	*	5-35A	W701
P-O	6625-436-1588	768 LEAD, GROUND: 3030-164 (28569)	2	EA	1	*	*	*	*	5-35A	W701

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					G-C-T	6625-072-5589	1 OSCILLOSCOPE AN/USM-140B	1							
	6625-999-3592	1A OSCILLOSCOPE AN/USM-140C	2												
G-C-T	6625-400-2681	2 OSCILLOSCOPE OS-121B/USM-140	1	EA	1							1-1			
		2A OSCILLOSCOPE OS-121C/USM-140	2	EA	1							1-1			
P-O	5935-823-0639	3 ADAPTER, CONNECTOR UG-255/U	1,2	EA	2			*	2	2	13	12	1-1	CP601, CP602	
P-O	5935-149-3534	4 ADAPTER, CONNECTOR UG-273A/U	1,2	EA	2			*	2	2	13	12	1-1	CP603, CP604	
P-O	5935-683-7892	5 ADAPTER, CONNECTOR UG-274B/U	1,2	EA	2			*	2	2	13	12	1-1	CP605, CP606	
P-C	5935-856-9441	6 ADAPTER, CONNECTOR UG-1035/U	1	EA	4			*	2	2	21	20	1-1	CP607 thru CP610	
P-C	5935-962-8580	7 ADAPTER, CONNECTOR UG-1441/U	2	EA	4			*	2	2	21	20	1-1	CP607 thru CP610	
A-H		8 MAIN VERTICAL INPUT AMPLIFIER AND INTERNAL TRIGGER SOURCE ETCHED CIRCUIT ASSEMBLY: 170A-65S(N) (28480)	1	EA	1								5-14	A1	
A-H		9 MAIN VERTICAL INPUT AMPLIFIER AND INTERNAL TRIGGER SOURCE ETCHED CIRCUIT ASSEMBLY: 2420-735 (28569)	2	EA	1								5-14	A1	
P-H	5910-993-8367	10 CAPACITOR, FIXED CERAMIC DIELECTRIC: CK63AY103X (81349)	1,2	EA	3				2	4	8	102	114	5-14	C1, C14, C15
P-H	5910-934-0327	11 CAPACITOR, FIXED CERAMIC DIELECTRIC: 841-000-Z5U0203M (72982)	1,2	EA	6			*	2	2	33	30	5-14	C2, C7, C8, C10, C12, C13	
P-H	5910-064-2344	12 CAPACITOR, FIXED MICA DIELECTRIC: CMISD331JN3 (81349)	1,2	EA	1			*	*	2	8	3	5-14	C9	
P-H	5910-889-4777	13 CAPACITOR, FIXED MICA DIELECTRIC: CM15C820JN3 (81349)	1,2	EA	1			*	2	2	13	6	5-14	C11	
P-H	5950-728-5333	14 COIL, RADIOFREQUENCY: 170A-60F(N) (28480)	1	EA	2			*	2	2	13	6	5-14	L1, L2	
P-H	5950-957-3013	15 COIL, RADIOFREQUENCY: 1025-02 (99800)	2	EA	2			*	2	2	13	10	5-14	L1, L2	
P-H	5950-754-9896	16 COIL, RADIOFREQUENCY: MS75008-5 (81349)	1	EA	2			2	2	3	40	24	5-14	L3, L5	
P-H	5950-053-8245	17 COIL, RADIOFREQUENCY: MS75008-26 (96906)	2	EA	2			2	2	3	39	40	5-14	L3, L5	
P-H	5950-893-1608	18 COIL, RADIOFREQUENCY: 170A-60D(N) (28480)	1	EA	2			*	*	2	13	6	5-14	L4, L6	
P-H	5950-052-2905	19 COIL, RADIOFREQUENCY: 3320-354 (28569)	2	EA	2			*	2	2	13	10	5-14	L4, L6	
P-H	5950-852-5167	20 COIL, RADIOFREQUENCY: MS75008-10 (81349)	1	EA	1			*	2	2	18	9	5-14	L9	
P-H	5950-701-5926	21 COIL, RADIOFREQUENCY: MS75008-34 (81349)	2	EA	1			2	2	3	34	35	5-14	L9	
P-H	5950-810-4611	22 COIL, RADIOFREQUENCY: MS75008-13 (81349)	1	EA	1			*	2	8	4		5-14	L10	
			2	EA	1			*	*	2	8	4	5-14	L10	
P-H	5905-252-4018	23 RESISTOR, FIXED COMPOSITION: RC20GF470J (81349)	1	EA	4			*	2	2	39	40	5-14	R1, R3, R18, R21	
			2	EA	4			2	4	8	95	105	5-14	R1, R3, R18, R21	
P-H	5905-192-0390	24 RESISTOR, FIXED COMPOSITION: RC20CF105J (81349)	1,2	EA	6			2	2	3	46	45	5-14	R2, R4, R19, R22, R26, R30	

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5905-769-8533	25 RESISTOR, FIXED, FILM: RL42S682J (81349)	1,2	EA	5					
P-H	5905-299-2051	26 RESISTOR, FIXED, COMPOSITION: RC32GF471J (81349)	1,2	EA	1				*	*	2	8	5	5-14	R7
P-H	5905-192-3973	27 RESISTOR, FIXED, COMPOSITION: RC20CF471J (81349)	1,2	EA	3				*	2	2	21	18	5-14	R8, R9, R32
P-H	5905-951-1478	28 RESISTOR, FIXED, FILM: RN60B9530F (81349)	1,2	EA	2				*	2	2	16	12	5-14	R11, R16
P-H	5905-767-6832	29 RESISTOR, FIXED, FILM: RL42S103J (81349)	1,2	EA	1				*	2	2	18	15	5-14	R20
P-H	5905-299-1541	30 RESISTOR, FIXED, COMPOSITION: RC20GF151J (81349)	1,2	EA	2				*	2	2	19	18	5-14	R23, R27
P-H	5905-473-5251	31 RESISTOR, FIXED, COMPOSITION: RC32GF102K (81349)	1,2	EA	1				*	*	2	8	5	5-14	R24
P-H	5905-279-1876	32 RESISTOR, FIXED, COMPOSITION: RC20GF222J (81349)	1,2	EA	1				*	2	2	13	9	5-14	R25
P-H	5905-279-1723	33 RESISTOR, FIXED, COMPOSITION: RC32GF222J (81349)	1,2	EA	1				*	*	*	5	4	5-14	R28
P-H	5905-195-6806	34 RESISTOR, FIXED, COMPOSITION: RC20GF102J (81349)	1,2	EA	1				*	2	2	16	12	5-14	R29
P-H	5905-171-2000	35 RESISTOR, FIXED, COMPOSITION: RC20GF684J (81349)	1,2	EA	1				*	*	2	8	5	5-14	R36
P-H	5905-903-6829	36 RESISTOR, FIXED, FILM: RL32S394J (81349)	1,2	IA	1				*	*	*	5	4	5-14	R13
P-H	5905-682-0230	37 RESISTOR, FIXED, WIREWOUND: RW29V272 (81349)	1,2	EA	1				*	*	*	5	4	5-14	R38
P-H	5905-913-3072	38 RESISTOR, FIXED, FILM: RAL42S332J (81349)	1	EA	1				*	*	*	5	4	5-14	R39
P-H	5905-257-0926	39 RESISTOR, FIXED, COMPOSITION: RC42GF332J (81349)	1	EA	0				*	*	*	5	4	5-14	R39
P-H	5905-190-8883	40 RESISTOR, FIXED, COMPOSITION: RC20GF100J (81349)	2	EA	1				*	2	2	13	10	5-14	R39
P-H	5905-190-8883	40 RESISTOR, FIXED, COMPOSITION: RC20GF100J (81349)	1,2	EA	1				*	*	*	5	4	5-14	R40
P-H	5905-171-1998	41 RESISTOR, FIXED, COMPOSITION: RC20GF333J (81349)	1,2	EA	1				*	*	2	10	6	5-14	R41
P-H	5960-806-5614	42 ELECTRON TUBE: 7308 (81349)	1,2	EA	5				16	37	71	1614	3300	5-6	V1 thru V5
P-H	5935-808-9569	43 SOCKET, ELECTRON TUBE: 121-51-11-060 (71785)	1	EA	3				2	3	5	59	52	5-14	XV1, XV4, XV5
P-H	5935-990-2827	44 SOCKET, ELECTRON TUBE: 3908-2-2 (91662)	2	EA	3				2	3	5	59	52	5-14	XV1
P-H	5935-849-9455	45 SOCKET, ELECTRON TUBE: 3901PHSPTD (91662)	1,2	EA	2				*	2	2	12	10	5-14	XV4, XV5 XV2, XV3
A-H		46 MAIN VERTICAL AMPLIFIER AND DRIVER ETCHED CIRCUIT ASSEMBLY: 1 170A-65V(N) (28480)	1	EA	1									5-15	A2
A-H		47 MAIN VERTICAL AMPLIFIER AND DRIVER ETCHED CIRCUIT ASSEMBLY: 2 2420-736 (28569)	2	EA	1									5-15A	A2
P-H	5910-275-6419	48 CAPACITOR, VARIABLE, PLASTIC DIELECTRIC: 535-034 4R (72982)	1,2	EA	1				2	6	11	141	114	5-15	C20
P-H	5910-993-8367	49 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1,2	EA	9				REP	REF	REF	REF	REF	5-15	C21, C22, C25, C26, C27, C30, C33, C34, C35
P-H	5910-823-1068	50 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CK62AW472M (81349)	1,2	EA	2				*	2	2	18	9	5-15	C23, C24
P-H	5910-578-5543	51 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: CV11B200 (81349)	1,2	EA	1				*	2	2	21	2	5-15	C31

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
					P-H	5910-816-6613	52 CAPACITOR, FIXED, MICA DIELECTRIC: CM15C470JN3 (81349)	1 EA 2 EA	1 1					
P-H	5950-812-2760	53 COIL, RADIOFREQUENCY: M575008-15 (81349)	1 EA	2				*	2	2	13	6	5-15	L13, L16
P-H	5950-724-6209	54 COIL, RADIOFREQUENCY: MS75008-39 (81349)	2 EA	2				*	2	2	13	16	5-15A	L13, L16
P-H	5950-852-5167	55 COIL, RADIOFREQUENCY: SAME AS 20	1 EA	2				REF	REF	REF	REF	REF	5-15	L14, L17
P-H	5950-701-5926	56 COIL, RADIOFREQUENCY: SAME AS 21	2 EA	2				REF	REF	REF	REF	REF	5-15A	L14, L17
P-H	5950-893-1607	57 COIL, RADIOFREQUENCY: 170A-60E(N) (28480)	1 EA	2				*	2	2	13	6	5-15	L15, L18
P-H	5950-936-7655	58 COIL, RADIOFREQUENCY: 3320-279 (28569)	2 EA	2				*	2	2	13	6	5-15A	L15, L18
P-H	5950-801-1525	59 COIL, RADIOFREQUENCY: M575008-1 (81349)	1 EA	2				*	2	2	13	6	5-15	L19, L20
P-H	5950-773-8948	60 COIL, RADIOFREQUENCY: MS75008-21 (96906)	2 EA	2				*	2	2	13	16	5-15A	L19, L20
P-H	5950-754-9896	61 COIL, RADIOFREQUENCY: SAME AS 16	1 EA	2				REF	REF	REF	REF	REF	5-15	L21, L22
P-H	5950-053-8245	62 COIL, RADIOFREQUENCY: SAME AS 17	2 EA	2				REF	REF	REF	REF	REF	5-15A	L21, L22
P-H	5905-814-7578	63 RESISTOR, FIXED, FILM: RL20S750J (81349)	1.2 EA	2				*	*	2	10	6	5-15	R45, R61
P-H	5905-766-8364	64 RESISTOR, FIXED, FILM: RL20S361J (81349)	1.2 EA	2				*	*	2	10	6	5-15	R46, R62
P-H	5905-951-1478	65 RESISTOR, FIXED, FILM: SAME AS 28	1.2 EA	2				REF	REF	REF	REF	REF	5-15	R47, R63
P-H	5905-802-6730	66 RESISTOR, FIXED, COMPOSITION: RC07GF470J (81349)	1 EA 2 EA	2 2				*	*	2 2	10 69	6 80	5-15 5-15	R48, R64 R48, R64
P-H	5905-553-9299	67 RESISTOR, FIXED, FILM: RN75B3011F (81349)	1.2 EA	4				*	2	2	16	12	5-15	R49, R51, R65, R66
P-H	5905-503-9138	68 RESISTOR, FIXED, FILM: RN70B1503F (81349)	1 EA	4				*	2	2	16	12	5-15	R50, R52, R67, R68
P-H	5905-062-1496	69 RESISTOR, FIXED, FILM: RN70C1493D (81349)	2 EA	4				*	2	2	16	12	5-15A	R50, R52, R67, R68
P-H	5905-683-2246	70 RESISTOR, FIXED, COMPOSITION: RC07GF473K (81349)	1.2 EA	2				*	2	2	16	12	5-15	R53, R69
P-H	5905-902-0676	71 RESISTOR, FIXED, FILM: RL20S113J (81349)	1.2 EA	1				*	*	*	5	4	5-15	R54
P-H	5905-069-9928	72 RESISTOR, FIXED, FILM: RN70D5112F (81349)	1.2 EA	2				*	*	2	11	6	5-15	R55, R70
P-H	5905-078-8756	73 RESISTOR, FIXED, FILM: RN70D6492F (81349)	1.2 EA	2				*	*	2	10	6	5-15A	R56, R71
P-H	5905-683-7721	74 RESISTOR, FIXED, COMPOSITION: RC07GF101J (81349)	1 EA 2 EA	2 4				*	2	2	13 21	10 20	5-15 5-15 5-15A	R77, R83 R77, R83 R90, R93
P-H	5905-817-7971	75 RESISTOR, FIXED, COMPOSITION: RC07CGF100J (81349)	1.2 EA	4				2	2	3	40	36	5-15	R78, R79, R84, R85
P-H	5905-933-3787	76 RESISTOR, FIXED, FILM: RL32AD571J (81349)	1 EA	2				*	*	2	10	6	5-15	R80, R86
P-H	5905-814-8413	77 RESISTOR, FIXED, FILM: RL32S561J (81349)	2 EA	2				*	*	2	10	6	5-15A	R80, R86
P-H	5905-715-0770	78 RESISTOR, FIXED, FILM: LP13-502J (14674)	1.2 EA	2				*	2	2	27	24	5-15	R89, R92
P-H	5905-726-6837	79 RESISTOR, FIXED, COMPOSITION: RC07GF681K (81349)	1 EA	2				*	*	2	16	12	5-15	R90, R93

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-767-3220	81 RESISTOR, FIXED, FILM: RL20S222J (81349)	1,2	EA	2				*	*	2	10	6	5-15	R91, R94
P-H	5905-774-8125	82 RESISTOR, FIXED, FILM: RL20S183J (81349)	1,2	EA	1				*	*	*	5	4	5-15	R97
P-H	5905-767-3204	83 RESISTOR, FIXED, FILM: RL20S104J (81349)	1,2	EA	1				*	*	2	10	6	5-15	R98
P-H	5960-806-5614	84 ELECTRON TUBE: SAME AS 42	1,2	EA	6				REF	REF	REF	REF	REF	5-15	V6, V7, V10 thru V13
P-H	6240-539-8959	85 LAMP, GLOW: SM-C-189591 (80063)	1,2	EA	2				2	4	8	107	800	5-15	V8, V9
P-H	5935-849-9455	86 SOCKET, ELECTRON TUBE: SAME AS 45	1,2	EA	3				REF	REF	REF	REF	REF	5-15	XV6, XV12, XV13
P-H	5935-808-9569	87 SOCKET, ELECTRON TUBE: SAME AS 43	1	EA	3				REF	REF	REF	REF	REF	5-15	XV7, XV10, XV11
P-H	5935-990-2827	88 SOCKET, ELECTRON TUBE: SAME AS 44	2	EA	3				REF	REF	REF	REF	REF	5-15A	XV7, XV10, XV11
A-H		89 SCANNER OUTPUT ETCHED CIRCUIT ASSEMBLY: 170A-65T(N) (28480)	1	EA	1									5-16	A3
A-H		90 SCANNER OUTPUT ETCHED CIRCUIT ASSEMBLY: 2420-739 (28569)	2	EA	1									5-16	A3
P-H	5910-578-1623	91 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: CV11C450 (81349)	1,2	EA	2				2	2	3	40	18	5-16	C28, C29
P-H	5905-557-2422	92 RESISTOR, FIXED, FILM: RN75B4991F (81349)	1	EA	4				*	2	2	28	32	5-16	R75,R76,R81,R82
A-H		93 SWEEP MODE/TRIGGER SOURCE SWITCH ASSEMBLY: 170A-19E(N) (28480)	2	EA	1				*	2	2	16	12	5-16	R75,R76,R81,R82
A-H		94 SWEEP MODE/TRIGGER SOURCE SWITCH ASSY: 19915-676 (28569)	2	EA	1									5-19	A100
P-H	5910-993-8367	95 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1,2	EA	1				REF	REF	REF	REF	REF	5-19	C101
P-H	5910-822-5682	96 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CK62BX102K (81349)	1,2	EA	1				*	2	2	18	9	5-19	C130
P-H	5905-254-9201	97 RESISTOR, FIXED, COMPOSITION: RC20GF473J (81349)	1,2	EA	2				*	2	2	21	18	5-19	R101, R164
P-H	5905-185-8510	98 RESISTOR, FIXED, COMPOSITION: RC20GF103J (81349)	1,2	EA	1				*	2	2	13	9	5-19	R102
P-H	5905-171-2004	99 RESISTOR, FIXED, COMPOSITION: RC20GF223J (81349)	1,2	EA	1				*	*	2	10	6	5-19	R161
P-H	5905-793-2176	100 RESISTOR, VARIABLE: 16925-405 (28569)	2	EA	1				*	*	*	5	3	5-19	R162
P-H	5930-757-3076	101 SWITCH, ROTARY: 3100-0783-9 (28480)	1	EA	1				*	*	2	10	6	5-19	S101
P-H	5930-960-0159	102 SWITCH, ROTARY: PPA022-2274 (71590)	2	EA	1				*	*	2	10	6	5-19	S101
A-H		103 SWEEP GENERATOR ETCHED CIRCUIT ASSEMBLY: 170A-65P(N) (28480)	1	EA	1									5-17	A101
A-H		104 SWEEP GENERATOR ETCHED CIRCUIT ASSEMBLY: 2420-734 (28569)	2	EA	1									5-17A	A101
P-H	5910-823-1068	105 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 50	1,2	EA	1				REF	REF	REF	REF	REF	5-17	C102
P-H	5910-825-4546	106 CAPACITOR, FIXED, MICA DIELECTRIC: CM15D241JN3 (81349)	1,2	EA	1				*	*	2	8	3	5-17	C105
P-H	5910-822-5682	107 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 96	1,2	EA	3				REF	REF	REF	REF	REF	5-17	C106, C123, C136

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5910-892-7395	108 CAPACITOR, FIXED, MICA DIELECTRIC: CM15C330JN3 (81349)	1,2	EA	1					
P-H	5910-823-1203	109 CAPACITOR, FIXED, MICA DIELECTRIC: CM15C750JN3 (81349)	1,2	EA	1				*	*	2	8	3	5-17	C108
P-H	5910-816-6613	110 CAPACITOR, FIXED, MICA DIELECTRIC: SAME AS 52	2	EA	2				REF	REF	REF	REF	REF	5-17	C109, C143
P-H	5910-727-3554	111 CAPACITOR, FIXED, MICA DIELECTRIC: CM15B100KN3 (81349)	1 2	EA EA	1 2				*	*	2 2	8 10	3 6	5-17 5-17A	C134 C109, C134
P-H	5910-543-0823	112 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CC20CK020C (81349)	1,2	EA	1				2	2	3	33	18	5-17	C110
P-H	5910-717-0169	113 CAPACITOR, FIXED, MICA DIELECTRIC: CM15F101G03 (81349)	1,2	EA	1				*	2	2	18	9	5-17	C114
P-H	5910-993-8367	114 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1,2	EA	9				REF	REF	REF	REF	REF	5-17	C116, C118, C122, C135, C137, C139 thru C142 C117
P-H	5910-543-0821	115 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CC20CH150G (81349)	1,2	EA	1				*	*	2	8	3	5-17	C119
P-H	5910-826-5466	116 CAPACITOR, FIXED, MICA DIELECTRIC: CM15D221JN3 (81349)	1,2	EA	1				*	*	2	8	3	5-17	C121
P-H	5910-556-9440	117 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: CV11A070 (81349)	1,2	EA	1				*	2	2	13	6	5-17	C124
P-H	5910-807-9305	118 CAPACITOR, FIXED, MICA DIELECTRIC: CM15D471JN3 (81349)	1	EA	1				*	2	2	13	6	5-17A	C124
P-H	5910-088-0385	119 CAPACITOR, FIXED, MICA DIELECTRIC: CM15D391JN3 (81349)	1,2	EA	1				*	*	2	8	3	5-17	C132
P-H	5910-807-2595	120 CAPACITOR, FIXED, MICA DIELECTRIC: CM15C680JN3 (81349)	2 1	EA EA	2 1				*	*	2 2	10 13	6 9	5-17A 5-17	C124, C133 C133
P-H	5910-934-0327	121 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 11	1	EA	1				REF	REF	REF	REF	REF	5-17	C138
P-H	5910-993-8367	122 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	2	EA	1				REF	REF	REF	REF	REF	5-17A	C138
P-H	5961-082-4201	123 SEMICONDUCTOR DEVICE, DIODE: 1N4363 (81349)	1,2	EA	1				*	*	2	8	3	5-17	CR101
P-H	5961-814-0768	124 SEMICONDUCTOR DEVICE, DIODE: 1N3064 (81349)	1,2	EA	1				2	2	3	33	21	5-17	CR102
P-H	5961-852-7549	125 SEMICONDUCTOR DEVICE, DIODE: 1N754A (81349)	1,2	EA	1				*	2	2	18	9	5-17	CR103
P-H	5961-082-4202	126 SEMICONDUCTOR DEVICE, DIODE: 1N4375 (81349)	1,2	EA	1				*	*	2	8	3	5-17	CR104
P-H	5950-802-1805	127 COIL, RADIOFREQUENCY: MS75008-8 (81349)	1	EA	1				*	*	2	8	3	5-17	L101
P-H	5950-059-3904	128 COIL, RADIOFREQUENCY: MS75008-32 (81349)	2	EA	1				*	*	2	8	3	5-17A	L101
P-H	5950-052-0748	129 COIL, RADIOFREQUENCY: MS75008-44 (81349)	1,2	EA	2				*	2	2 1	3	6	5-17	L102, L103
P-H	5905-279-3513	130 RESISTOR, FIXED, COMPOSITION: RC20GF221J (81349)	1 2	EA EA	1 1				*	2	2	16 31	12 30	5-17 5-17	R107 R107
P-H	5905-279-1898	131 RESISTOR, FIXED, COMPOSITION: RC20GF560K (81349)	1	EA	18				2	3	6	77	81	5-17	R108, R117, R122, R124, R136, R140, R143, R150, R151, R154, R155, R167 R173, R175, R181, R186, R187, R189
P-H	5905-195-5571	132 RESISTOR, FIXED, COMPOSITION: RC20GF680J (81349)	2	EA	1				*	*	*	5	3	5-17A	R108

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5905-804-6099	133 RESISTOR, FIXED, FILM: LP15-303K (14674)	1,2	EA	1					
P-H	5905-717-3343	134 RESISTOR, FIXED, FILM: RL32S332J (81349)	1,2	EA	1				*	*	*	5	3	5-17	R110
P-H	5905-299-1541	135 RESISTOR, FIXED, COMPOSITION: SAME AS 30	1,2	EA	2				REF	REF	REF	REF	REF	5-17	R111, R112
P-H	5905-769-8533	136 RESISTOR, FIXED, FILM: SAME AS 25	1,2	EA	1				REF	REF	REF	REF	REF	5-17	R113
P-H	5905-192-0390	137 RESISTOR, FIXED, COMPOSITION: SAME AS 24	1,2	EA	2				REF	REF	REF	REP	REF	5-17	R115, R133
P-H	5905-279-2515	138 RESISTOR, FIXED, COMPOSITION: RC20GF474J (81349)	1,2	EA	3				*	2	2	19	15	5-17	R116, R137, R157
P-H	5905-252-4018	139 RESISTOR, FIXED, CO(POSITION: SAME AS 23	2	EA	17				REF	REP	REF	REF	REF	5-17	R117, R122, R124, R136, R140, R143, R150, R151, R154, R155, R167, R173, R175 ,R181 ,R186, R187 R189
P-H	5905-556-3339	140 RESISTOR, FIXED, FILM: RN70B6980F (81349)	1,2	EA	1				*	*	*	5	3	5-17	R118
P-H	5905-069-4508	141 RESISTOR, FIXED, FILM: RN70D2493F (81349)	1,2	EA	2				*	*	2	10	6	5-17	R119, R141
P-H	5905-722-0054	142 RESISTOR, FIXED, FILM: LP14-113J (16299)	1,2	EA	1				*	*	*	5	3	5-17	R120
P-H	5905-884-0788	143 RESISTOR, FIXED, FILM: RN70D4993F (81349)	1	EA	3				*	2	2	12	15	5-17	R121 ,R148, R149
P-H	5905-279-1757	144 RESISTOR, FIXED, COMPOSITION: RC20CF152J (81349)	1	EA	2				*	*	2	10	6	5-17	R123, R125
P-H	5905-249-4195	145 RESISTOR, FIXED, COMPOSITION: RC20GF752J (81349)	2	EA	1				*	*	*	12	9	5-17	R123
P-H	5905-804-6100	146 RESISTOR, FIXED, FILM: LP15-123J (14674)	2	EA	1				*	*	*	5	3	5-17	R125
P-H	5905-852-4476	147 RESISTOR, FIXED, FILM: LP15-153J (14674)	1,2	EA	1				*	*	*	5	3	5-17	R130
P-H	5905-279-1876	148 RESISTOR, FIXED, COMPOSITION: SAME AS 32	1,2	EA	1				REF	REF	REF	REF	REF	5-17	R131
P-H	5905-192-0626	149 RESISTOR, FIXED, COMPOSITION: RC42GF123K (81349)	1	EA	2				*	2	2	12	15	5-17	R132
P-H	5905-171-1976	150 RESISTOR, FIXED, COMPOSITION: RC42GF153J (81349)	1	EA	1				*	*	*	8	5	5-17	R135, R138
P-H	5905-892-6479	151 RESISTOR, FIXED, FILM: RN70D1003F (81349)	2	EA	3				*	2	2	21	30	5-17	R179
P-H	5905-782-0901	152 RESISTOR, FIXED, FILM: RL42S512J (81349)	1,2	EA	2				*	*	2	10	6	5-17	R135, R138, R179
P-H	5905-195-6752	153 RESISTOR, FIXED, FILM: RN70D1003F (81349)	1,2	EA	1				*	*	33	5	3	5-17	R139, R170
P-H	5905-195-6752	153 RESISTOR, FIXED, COMPOSITION: RC42GF392J (81349)	1	EA	1				*	2	2	13	9	5-17	R142
P-H	5905-257-0937	154 RESISTOR, FIXED, COMPOSITION: RC42GF472J (81349)	2	EA	0				*	*	*	5	3	5-17	R144
P-H	5905-279-2303	155 RESISTOR, FIXED, COMPOSITION: RC42GF562K (81349)	1	EA	0				*	*	2	10	16	5-17	R144
P-H	5905-279-2528	156 RESISTOR, FIXED, COMPOSITION: R042GF682J (81349)	2	EA	1				*	2	2	13	19	5-17	R144
P-H	5905-581-1645	157 RESISTOR, FIXED, COMPOSITION: RC42GF562K (81349)	1	EA	1				*	*	2	10	6	5-17	R145
P-H	5905-062-0539	158 RESISTOR, FIXED, FILM: RN70D1621F (81349)	2	EA	1				*	*	*	5	3	5-17	R145
P-H	5905-279-3494	159 RESISTOR, FIXED, COMPOSITION: RC20CF823J (81349)	1,2	EA	1				*	*	*	5	3	5-17	R146
P-H	5905-279-3494	159 RESISTOR, FIXED, COMPOSITION: RC20CF823J (81349)	1,2	EA	1				*	*	*	5	3	5-17	R147

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5905-936-1537	160 RESISTOR, FIXED, FILM: RN70C5053D (81349)	2	EA	2					
P-H	5905-975-4358	161 RESISTOR, FIXED, FILM: RL42S183J (81349)	1	EA	1				*	*	*	5	3	5-17	R152
P-H	5905-721-4363	162 RESISTOR, FIXED, FILM: LP14-38K-10% (14674)	2	EA	1				*	*	*	5	3	5-17A	R152
P-H	5905-195-6799	163 RESISTOR, FIXED, COMPOSITION: RC20GF561K (81349)	1	EA	1				*	*	*	10	6	5-17	R153
P-H	5905-192-3973	164 RESISTOR, FIXED, COMPOSITION: SAME AS 27	2	EA	1				REF	REF	REF	REF	REF	5-17A	R153
P-H	5905-279-1754	165 RESISTOR, FIXED, COMPOSITION: RC20GF155J (81349)	1.2	EA	1				*	2	2	19	18	5-17	R156
P-H	3905-195-6741	166 RESISTOR, FIXED, COMPOSITION: RC20GF272K (81349)	1	EA	1				*	2	2	16	12	5-17	R158
P-H	5905-279-1876	167 RESISTOR, FIXED, COMPOSITION: SAME AS 32	2	EA	1				REF	REF	REF	REF	REF	5-17A	R158
P-H	5905-299-2025	168 RESISTOR, FIXED, COMPOSITION: RC32GF153K (81349)	1	EA	1				*	*	2	10	6	5-17	R159
P-H	5905-079-4448	169 RESISTOR, FIXED, FILM: RL42S203J (81349)	2	EA	0				*	*	2	10	6	5-17	R160
P-H	5905-079-4448	169 RESISTOR, FIXED, FILM: RL42S203J (81349)	1	EA	1				*	*	*	5	3	5-17	R160
P-H	5905-259-2990	170 RESISTOR, FIXED, COMPOSITION: RC20GF226J (81349)	1.2	EA	1				*	*	*	5	3	5-17	R165
P-H	5905-192-0662	171 RESISTOR, FIXED, COMPOSITION: RC20GF184K (81349)	1	EA	1				*	2	2	13	9	5-17	R168
P-H	5905-192-0667	172 RESISTOR, FIXED, COMPOSITION: RC20GF224J (81349)	1	EA	0				*	*	*	5	3	5-23	R258
P-H	5905-192-0667	172 RESISTOR, FIXED, COMPOSITION: RC20GF224J (81349)	2	EA	1				*	*	2	10	6	5-17A	R168
P-H	5905-556-4003	173 RESISTOR, FIXED, FILM: RN75B2552F (81349)	1	EA	1				*	2	2	13	9	5-17	R169
P-H	5905-054-0399	174 RESISTOR, FIXED, FILM: RN70C2522D (81349)	2	EA	1				*	*	*	5	3	5-17A	R169
P-H	5905-552-0614	175 RESISTOR, FIXED, FILM: RN75B1742F (81349)	1	EA	1				*	*	*	5	3	5-17	R171
P-H	5905-936-1539	176 RESISTOR, FIXED, FILM: RN75C1722D (81349)	2	EA	1				*	33	*	5	3	5-17A	R171
P-H	5905-195-6806	177 RESISTOR, FIXED, COMPOSITION: SAME AS 34	1.2	EA	1				REF	REF	REF	REF	REF	5-14	R172
P-H	5905-989-5579	178 RESISTOR, FIXED, FILM: RN65D7152F (81349)	1.2	EA	1				*	*	*	5	3	5-17	R174
P-H	5905-171-2004	179 RESISTOR, FIXED, COMPOSITION: SAME AS 99	1.2	EA	1				REF	REF	REF	REF	REF	5-17	R176
P-H	5905-279-2616	180 RESISTOR, FIXED, COMPOSITION: RC20GF153J (81349)	1.2	EA	1				*	*	*	5	3	5-17	R177
P-H	5905-171-1986	182 RESISTOR, FIXED, COMPOSITION: RC20GF563J (81349)	1	EA	1				*	2	2	19	15	5-17	R180
P-H	5905-767-7594	183 RESISTOR, FIXED, FILM: RL20S563J (81349)	2	EA	1				*	2	2	21	20	5-17A	R180
P-H	5905-249-4227	184 RESISTOR, FIXED, COMPOSITION: RC42GF183K (81349)	1	EA	1				*	*	*	5	3	5-17	R182
P-H	5905-279-2527	185 RESISTOR, FIXED, COMPOSITION: RC42GF223J (81349)	2	EA	1				*	*	*	5	3	5-17A	R182
P-H	5905-190-8889	186 RESISTOR, FIXED, COMPOSITION: RC20GF101J (81349)	1.2	EA	2				*	2	2	16	12	5-17	R188, R190
P-H	5240-539-8959	187 LAMP, GLOW: SAME AS 85	1.2	EA	4				REF	REF	REF	REF	REF	5-17	V102, V110, V111, V116
P-H	5935-808-9569	188 SOCKET, ELECTRON, TUBE: SAME AS 43	1	EA	9				REF	REF	REF	REF	REF	5-17	XV101, XV103, XV104, XV105, XV107, XV109, XV113, XV114, XV115

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5935-990-2827	189 SOCKET, ELECTRON TUBE: SAME AS 44	2	EA	9					
A-H		190 TRIGGER LEVEL/TRIGGER SLOPE SWITCH ASSEMBLY: 170A-19D(N) (28480)	1	EA	1									5-20	A103
A-H		191 TRIGGER LEVEL/TRIGGER SLOPE SWITCH ASSEMBLY: 19915-675 (28569)	2	EA	1									5-20	A103
P-H	5910-822-5682	192 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 96	1.2	EA	1				REF	REF	REF	REF	REF	5-20	C103
P-H	5910-993-8367	193 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1.2	EA	1				REF	REF	REF	REF	REF	5-20	C104
P-H	5905-192-0390	194 RESISTOR, FIXED, COMPOSITION: SAME AS 24	1.2	EA	1				REF	REF	REF	REF	REF	5-20	R103
P-H	5905-279-2515	195 RESISTOR, FIXED, COMPOSITION: SAME AS 138	1.2	EA	1				REF	REF	REF	REF	REF	5-20	R104
P-H	5905-254-9201	196 RESISTOR, FIXED, COMPOSITION: SAME AS 97	1.2	EA	1				REF	REF	REF	REF	REF	5-20	R106
P-H	5930-757-3077	197 SWITCH, ROTARY: 3100-0782-9 (28480)	1	EA	1				*	*	2	10	6	5-20	S102
P-H	5930-960-0158	198 SWITCH, ROTARY: PP033-058 (71590)	2	EA	1				*	*	2	10	6	5-20	S102
A-H		199 EXTERNAL VERNIER/HORIZONTAL DISPLAY SWITCH ASSEMBLY: 170A-19A(N) (28480)	1	EA	1									5-21	A200
A-H		200 EXTERNAL VERNIER/HORIZONTAL DISPLAY SWITCH ASSEMBLY: 19915-672 (28569)	2	EA	1									5-21A	A200
P-H	5910-728-2144	201 CAPACITOR, FIXED, PLASTIC DIELECTRIC: 27 (01295)	1	EA	1				2	2	3	30	18	5-21	C202
P-H	5910-976-3686	202 CAPACITOR, FIXED, PLASTIC DIELECTRIC: S92684 (56289)	2	EA	1				2	2	3	30	18	5-21A	C202
P-H	5905-793-3064	203 RESISTOR, VARIABLE: RGC-90 (71450)	1	EA	1				*	*	*	5	3	5-21	R209
P-H	5905-299-2049	205 RESISTOR, FIXED, COMPOSITION: RC32GF561K (81349)	2	EA	1				*	*	*	5	3	5-21A	R209
P-H	5905-814-8413	206 RESISTOR, FIXED, FILM: SAME AS 77	1	EA	1				*	*	*	5	3	5-21	R210
P-H	5905-078-8810	207 RESISTOR, FIXED, FILM: RN70D1182F (81349)	2	EA	1				REF	REF	REF	REF	REF	5-21A	R210
P-H	5905-078-8810	207 RESISTOR, FIXED, FILM: RN70D1182F (81349)	1.2	EA	1				*	*	2	10	6	5-21	R233
P-H	5905-957-0446	208 RESISTOR, FIXED, FILM: RN70C3611D (81349)	1.2	EA	1				*	*	*	5	3	5-21	R234
P-H	5905-752-7300	209 RESISTOR, FIXED, FILM: RN70B2121F (81349)	1.2	EA	1				*	*	*	5	3	5-21	R235
P-H	5905-990-9556	210 RESISTOR, FIXED, FILM: RN70C9200D (81349)	1.2	EA	1				*	*	*	5	3	5-21	R236
P-H	5905-782-0269	211 RESISTOR, FIXED, FILM: RN70D3650F (81349)	1.2	EA	2				*	*	2	10	6	5-21	R237, R242
P-H	5905-078-6916	212 RESISTOR, FIXED, FILM: RN70D1210F (81349)	1.2	EA	4				*	2	2	16	12	5-21	R238 thru R241
P-H	5905-279-3527	213 RESISTOR, FIXED, COMPOSITION: RC42GF470J (81349)	1.2	EA	1				*	*	*	5	3	5-21	R1023
P-H	5930-757-3078	214 SWITCH ROTARY: 3100-0781-9 (28480)	1	EA	1				*	*	2	10	4	5-21	S202
X1		215 SWITCH, ROTARY: 19912-527 (28569)	2	EA	1									5-21	S202
H-D		216 TERMINAL BOARD: 610 (06540)	1	EA	1									5-21	TB201

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					A-H		217 HORIZONTAL SENSITIVITY ADJUSTMENT ETCHED CIRCUIT ASSEMBLY: 170A-65R(N) (28480)	1	EA	1					
A-H		218 HORIZONTAL SENSITIVITY ADJUSTMENT ETCHED CIRCUIT ASSEMBLY: 2420-741 (28569)	2	EA	1								5-22A	A201	
P-H	5910-578-1623	219 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: SAKE AS 91	1.2	EA	2				REF	REF	REF	REF	REF	5-22	C201, C207
P-H	5910-556-9440	220 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: SAME AS 117	1.2	EA	1				REF	REF	REF	REF	REF	5-22	C204
P-H	5910-816-6613	221 CAPACITOR, FIXED, MICA DIELECTRIC: SAKE AS 52	1.2	EA	1				REF	REF	REF	REF	REF	5-22	C205
P-H	5905-884-0788	222 RESISTOR, FIXED, FILM: SAME AS 143	1	EA	2				REF	REF	REF	REF	REF	5-22	R201, R213
P-H	5905-936-1537	223 RESISTOR, FIXED, FILM: SAME AS 160	2	EA	2				REF	REF	REF	REF	REF	5-22A	R201, R213
P-R	5905-518-5609	224 RESISTOR, VARIABLE: RV41AYS105A (81349)	1.2	EA	2				*	2	2	13	9	5-22	R202, R212
P-H	5905-985-6059	225 RESISTOR, FIXED, FILM: RN65C8983D (81349)	1.2	EA	1				*	2	2	13	9	5-22	R203
P-H	5905-990-5020	226 RESISTOR, FIXED, FILM: RN65C1103F (81349)	1.2	EA	1				*	2	2	16	12	5-22	R204
A-H		227 MAIN HORIZONTAL AMPLIFIER AND DRIVER ETCHED CIRCUIT ASSEMBLY: 170A-65L(N) (28480)	1	EA	1									5-23	A202
A-H		228 MAIN HORIZONTAL AMPLIFIER AND DRIVER ETCHED CIRCUIT ASSEMBLY: 2420-740 (28569)	2	EA	1									5-23A	A202
P-H	5910-578-1623	229 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: SAME AS 91	1.2	EA	2				REF	REF	REF	REF	REF	5-23	C211, C213
P-H	5910-867-0118	230 CAPACITOR, ADJUSTABLE, CERAMIC DIELECTRIC: 19290-60 (28569)	1.2	EA	2				*	2	2	16	6	5-23	C212, C214
P-H	5910-807-5570	231 CAPACITOR, FIXED, PAPER DIELECTRIC: C05A1KE104K3 (81349)	1.2	EA	1				*	2	2	18	9	5-23	C215
P-H	5910-578-5543	232 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: SAME AS 51	1.2	EA	1				REF	REF	REF	REF	REF	5-23	C216
P-H	5910-879-4764	233 CAPACITOR, FIXED, PAPER DIELECTRIC: CP09A1KF104K3 (81349)	1.2	EA	1				*	*	2	8	3	5-23	C222
P-H	5950-809-4459	234 COIL, RADIOFREQUENCY: TB-5500-I (95265)	1.2	EA	2				*	2	2	13	6	5-23	L201, L202
P-H	5961-062-2320	235 TRANSISTOR: 2N2084 (81349)	1.2	EA	2				2	2	3	30	18	5-23	Q201, Q202
P-H	5905-195-6761	236 RESISTOR, FIXED, COMPOSITION: RC20GF104J (81349)	1.2	EA	2				*	2	2	19	15	5-23	R244, R264
P-H	5905-681-5979	237 RESISTOR, FIXED, FILM: RN70B3092F (81349)	1	EA	2				*	*	2	10	6	5-23	R245, R259
P-H	5905-936-1536	238 RESISTOR, FIXED, FILM: RN70C3052D (81349)	2	EA	2				*	*	2	10	6	5-23A	R245, R259
P-H	5905-552-5136	239 RESISTOR, FIXED, FILM: RN75B8062F (81349)	2	EA	2				*	*	2	10	6	5-23	R246, R260
P-H	5905-916-7727	240 RESISTOR, FIRED, FILM: RN75C7962D (81349)	2	EA	2				*	*	2	10	6	5-23A	R246, R260
P-H	5905-990-5020	241 RESISTOR, FIXED, FILM: SAME AS 226	1.2	EA	1				REF	REF	REF	REF	REF	5-23	R247
P-H	5905-556-4003	242 RESISTOR, FIXED, FILM: SAME AS 173	1	EA	2				REF	REF	REF	REF	REF	5-23	R248, R251

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a)	(b)	
					FIG. NO.	ITEM NO. OR REFERENCE DESIGNATION									
P-H	5905-983-5819	243 RESISTOR, FIXED, FILM: RN75C2522D (81349)	2	EA	2				*	2	2	13	10	5-23A	R248, R251
P-H	5905-279-1898	244 RESISTOR, FIXED, COMPOSITION: SAME AS 131	1	EA	6				REF	REF	REF	REF	REF	5-23	R249, R253, R256, R257, R266, R269
P-H	5905-252-4018	245 RESISTOR, FIXED, COMPOSITION: SAME AS 23	2	EA	6				REF	REF	REF	REF	REF	5-23A	R249, R253, R256, R257, R266, R269
P-H	5905-553-2389	246 RESISTOR, FIXED, FILM: RN75B9091F (81349)	1,2	EA	2				*	*	2	10	6	5-23	R250, R252
P-H	5905-185-8516	247 RESISTOR, FIXED, COMPOSITION: RC42GF103J (81349)	1,2	EA	2				*	2	2	13	9	5-23	R254, R255
P-H	5905-192-0667	248 RESISTOR, FIXED, COMPOSITION: SAME AS 172	1,2	EA	1				REF	REF	REF	REF	REF	5-23	R258
P-H	5905-722-0136	249 RESISTOR, FIXED, FILM: LP17-202J (14674)	1,2	EA	1				*	*	*	5	3	5-23	R267
P-H	5905-195-6752	250 RESISTOR, FIXED, COMPOSITION: SAME AS 153	1	EA	1				REF	REF	REF	REF	REF	5-23	R268
P-H	5905-192-3972	251 RESISTOR, FIXED, COMPOSITION: RC20GF391K (81349)	2	EA	1				REF	REF	REF	REF	REF	5-23A	R268
P-H	5905-882-0055	252 RESISTOR, FIXED, COMPOSITION: RL20S391J (81349)	1	EA	1				*	*	*	5	3	5-23	R271
P-H	5905-195-6741	253 RESISTOR, FIXED, COMPOSITION: SAME AS 166	2	EA	1				REF	REF	REF	REF	REF	5-23	R272
P-H	5905-279-1757	254 RESISTOR, FIXED, COMPOSITION: SAME AS 144	1	EA	1				REF	REF	REF	REF	REF	5-23A	R272
P-H	5905-279-3504	255 RESISTOR, FIXED, COMPOSITION: RC20GF472J (81349)	1,2	EA	1				*	*	2	10	6	5-23	R273
P-H	5905-257-0937	256 RESISTOR, FIXED, COMPOSITION: SAME AS 154	1,2	EA	2				REF	REF	REF	REF	REF	5-23	R274, R275
P-H	5905-279-2303	257 RESISTOR, FIXED, COMPOSITION: SAME AS 155	1	EA	1				REF	REF	REF	REF	REF	5-23	R276
P-H	5905-975-4362	258 RESISTOR, FIXED, FILM: RL42S562J (81349)	2	EA	1				*	*	*	5	3	5-23A	R276
P-H	5905-257-0926	259 RESISTOR, FIXED, COMPOSITION: SAME AS 39	1,2	EA	1				REF	REF	REF	REF	REF	5-23	R278
P-H	5935-808-9569	260 SOCKET, ELECTRON TUBE: SAME AS 43	1	EA	5				REF	REF	REF	REF	REF	5-23	XV203 thru XV207
P-H	5935-990-2827	261 SOCKET, ELECTRON TUBE: SAME AS 44	2	EA	5				REF	REF	REF	REF	REF	5-23A	XV203 thru XV207
A-H		262 HORIZONTAL IMPEDANCE MATCHING PREAMPLIFIER ETCHED CIRCUIT ASSEMBLY: 170A-65N(N) (28480)	1	EA	1									5-24	A203
A-H		263 HORIZONTAL IMPEDANCE MATCHING PREAMPLIFIER ETCHED CIRCUIT ASSEMBLY: 2420-742 (28569)	2	EA	1									5-24A	A203
P-H	5910-993-8367	264 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1,2	EA	1				REF	REF	REF	REF	REF	5-24	C206
P-H	5910-934-0327	265 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 11	1,2	EA	1				REF	REF	REF	REF	REF	5-24	C221
P-H	5905-892-6475	266 RESISTOR, FIXED, FILM: RN65D104F (81349)	1,2	EA	2				2	2	3	40	36	5-24	R205, 6215
P-H	5905-195-6761	267 RESISTOR, FIXED, COMPOSITION: SAME AS 236	1,2	EA	1				REF	REF	REF	REF	REF	5-24	R206
P-H	5905-190-8889	268 RESISTOR, FIXED, COMPOSITION: SAME AS 186	1,2	EA	1				REF	REF	REF	REF	REF	5-24	R207
P-H	5905-192-0626	269 RESISTOR, FIXED, COMPOSITION: SAME AS 149	1	EA	1				REF	REF	REF	REF	REF	5-24	R208

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5905-171-1976	270 RESISTOR, FIXED, COMPOSITION: SAME AS 150	2	EA	1					
P-H	5905-279-1898	271 RESISTOR., FIXED, COMPOSITION: SAME AS 131	1	EA	3				REF	REF	REF	REF	REF	5-24	R214, R218, R224
P-H	5905-252-4018	272 RESISTOR, FIXED, COMPOSITION: SAME AS 23	2	EA	3				REF	REF	REF	REF	REF	5-24	R214,1218,1224
P-H	5905-249-4243	273 RESISTOR, FIXED, COMPOSITION: RC42GF2731 (81349)	1	EA	1				*	*	*	5	3	5-24	R217
P-H	5905-279-2675	274 RESISTOR, FIXED, COMPOSITION: RC42GF333J (81349)	2	EA	1				*	*	*	5	3	5-24	R217
P-H	5905-804-6098	275 RESISTOR, FIXED, FILM: LP13-822J (14674)	1.2	EA	2				*	*	2	10	6	5-24	R221, R222
P-H	5905-252-4018	276 RESISTOR, FIXED, COMPOSITION: SAME AS 23	1.2	EA	1				REF	REF	REF	REF	REF	5-24	R277
P-H	5935-808-9569	277 SOCKET, ELECTRON TUBE: SAME AS 43	1	EA	2				REF	REF	REF	REF	REF	5-24	XV201, XV202
P-H	5935-990-2827	278 SOCKET, ELECTRON TUBE: SAME AS 44	2	EA	2				REF	REF	REF	REF	REF	5-24	XV201, XV202
A-H		279 CALIBRATOR SWITCH ASSEMBLY: 170A-19C(N) (28480)	1	E A	1									5-25	A300
A-H		280 CALIBRATOR SWITCH ASSEMBLY: 19915-674 (28569)	2	EA	1									5-25	A300
P-H	5910-760-7924	281 CAPACITOR, FIXED, MICA DIELECTRIC: C120FD561G03 (81349)	1.2	EA	1				*	*	2	8	3	5-25	C318
P-H	5905-295-3403	282 RESISTOR, FIXED, COMPOSITION: RC20GF225F (81349)	1.2	EA	1				*	*	2	10	6	5-25	R341
P-H	5905-988-0143	283 RESISTOR, FIXED, FILM: RN70D2001F (81349)	1.2	EA	1				*	*	*	5	3	5-25	R343
P-H	5905-078-8810	284 RESISTOR, FIXED, FILM: SAME AS 207	1.2	EA	1				REF	REF	REF	REF	REF	5-25	R344
P-H	5905-993-5987	285 RESISTOR, FIXED, FILM: RN70D6191F (81349)	1.2	EA	1				*	*	*	5	3	5-25	R345
P-H	5905-957-0445	286 RESISTOR, FIXED, FILM: RN70C2031D (81349)	1.2	EA	1				*	*	*	5	3	5-25	R346
P-H	5905-581-7467	287 RESISTOR, FIXED, FILM: RN70B1021F (81349)	1.2	EA	1				*	*	*	5	3	5-25	R347
P-H	5905-954-9088	288 RESISTOR, FIXED, FILM: RN70C5970D (81349)	1.2	EA	2				*	*	*	5	3	5-25	R348
P-H	5905-050-1128	289 RESISTOR, FIXED, FILM: RN70D2000F (81349)	1.2	EA	2				*	*	2	10	6	5-25	R349, R354
P-H	5905-088-5936	290 RESISTOR, FIXED, FILM: RN70D1000F (81349)	1.2	EA	1				*	*	*	5	3	5-25	R350
P-H	5905-734-4730	291 RESISTOR, FIXED, FILM: RN70D60R4P (81349)	1.2	EA	1				*	*	*	5	3	5-25	R351
P-H	5905-762-3660	292 RESISTOR, FIXED, FILM: RN70D40R2F (81349)	1.2	EA	1				*	*	*	5	3	5-25	R352
P-H	5905-993-5953	293 RESISTOR, FIXED, FILM: RN70D2003F (81349)	1.2	EA	1				*	*	*	5	3	5-25	R353
P-H	5930-757-7699	294 SWITCH, ROTARY: 3100-0780-9 (28480)	1	EA	1				*		2	10	4	5-25	S302
X1		295 SWITCH, ROTARY: 19912-427 (28569)	2	EA	1									5-25	S302
A-H		296 HIGH VOLTAGE POWER SUPPLY ETCHED CIRCUIT ASSEMBLY: 170A-65J (N) (28480)	1	EA	1									5-26	A301

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					A-H		297 HIGH VOLTAGE POWER SUPPLY ETCHED CIRCUIT ASSEMBLY: 2420-737 (28569)	2	EA	1					
P-H	5910-819-5745	298 CAPACITOR, FIXED, PAPER DIELECTRIC: CP05A1KC473K3 (81349)	1.2	EA	1				*	2	2	13	6	5-26	C301
P-H	5910-728-2144	299 CAPACITOR, FIXED, PLASTIC DIELECTRIC: SAME AS 201	1	EA	1				REF	REF	REF	REF	REF	5-26	C302
P-H	5910-976-3686	300 CAPACITOR, FIXED, PLASTIC DIELECTRIC: SAME AS 202	2	EA	1				REF	REF	REF	REF	REF	5-21A	C302
P-H	5910-883-4781	301 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CK63HX222K (81349)	1	EA	1				*	2	2	21	12	5-26	C303
P-H	5910-838-0869	302 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CK63BX332K (81349)	2	EA	0				*	*	*	10	8		
P-H	5910-838-0869	302 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CK63BX332K (81349)	2	EA	1				*	*	*	5	3	5-26A	C303
P-H	5910-851-7794	303 CAPACITOR, FIXED, CERAMIC DIELECTRIC: 29C214A3-H-1038 (56289)	1.2	EA	1				*	*	2	8	3	5-26	C304
P-H	5910-874-6903	304 CAPACITOR, FIXED, CERAMIC DIELECTRIC: 6KV470 (91418)	1.2	EA	1				*	*	2	8	3	5-26	C305
P-H	5910-993-8367	305 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1.2	EA	1				REF	REF	REF	REF	REF	5-26	C310
P-H	5910-804-2372	306 CAPACITOR, FIXED, MICA DIELECTRIC: CH15C270JW3 (81349)	1.2	EA	2				*	*	2	13	6	5-26	C316, C317
P-H	5950-802-0913	307 COIL, RADIOFREQUENCY: MS16223-21 (81349)	1	EA	1				*	*	2	13	9	5-26	L301
P-H	5950-880-0347	308 COIL, RADIOFREQUENCY: MS75055-4 (81349)	2	EA	1				*	*	2	13	19	5-26A	L301
P-H	5905-195-6756	309 RESISTOR, FIXED, COMPOSITION: RC42GF563K (81349)	1	EA	1				*	*	*	5	3	5-26	R302
P-H	5905-195-6754	310 RESISTOR, FIXED, COMPOSITION: RC42GF473K (81349)	2	EA	1				*	*	*	5	3	5-26A	R302
P-H	5905-254-7087	311 RESISTOR, FIXED, COMPOSITION: RC20GF683K (81349)	1.2	EA	1				*	*	*	5	3	5-26	R303
P-H	5905-279-2515	312 RESISTOR, FIXED, COMPOSITION: SAME AS 138	1.2	EA	1				REF	REF	REF	REF	REF	5-26	R304
P-H	5905-192-0390	313 RESISTOR, FIXED, COMPOSITION: SAME AS 24	1.2	EA	1				REF	REF	REF	REF	REF	5-26	R305
P-H	5905-279-1898	314 RESISTOR, FIXED, COMPOSITION: SAME AS 131	1	EA	1				REF	REF	REF	REF	REF	5-26	R306
P-H	5905-252-4018	315 RESISTOR, FIXED, COMPOSITION: SAME AS 23	2	EA	1				REF	REF	REF	REF	REF	5-26A	R306
P-H	5905-195-6806	316 RESISTOR, FIXED, COMPOSITION: SAME AS 34	1.2	EA	1				REF	REF	REF	REF	REF	5-26	R308
P-H	5905-195-6761	317 RESISTOR, FIXED, COMPOSITION: SAME AS 236	1.2	EA	1				REF	REF	REF	REF	REF	5-26	R309
P-H	5905-254-9201	318 RESISTOR, FIXED, COMPOSITION: SAME AS 97	1.2	EA	1				REF	REF	REF	REF	REF	5-26	R312
P-H	5905-299-1987	319 RESISTOR, FIXED, COMPOSITION: RC32GF395J (81349)	1	EA	1				*	*	*	5	3	5-26	R319
P-H	5905-299-1986	320 RESISTOR, FIXED, COMPOSITION: RC32GC365J (81349)	2	EA	1				*	*	*	5	3	5-26A	R319
P-H	5905-985-6058	321 RESISTOR, FIXED, FILM: RL42S113J (81349)	1.2	EA	2				*	2	2	13	9	5-26	R335, R342
P-H	5905-195-6752	322 RESISTOR, FIXED, COMPOSITION: SAME AS 153	1	EA	1				REF	REF	REF	REF	REF	5-26	R336
P-H	5905-914-6435	323 RESISTOR, FIXED, FILM: RL42S392J (81349)	1	EA	0				*	*	*	5	3		
			2	EA	1				*	*	2	10	6	5-26A	R336

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5905-252-4018	324 RESISTOR, FIXED, COMPOSITION: SAME AS 23	1,2	EA	2					
P-H	5905-279-1754	325 RESISTOR, FIXED, COMPOSITION: SAME AS 165	1	EA	2				REF	REF	REF	REF	REF	5-26	R338, R340
P-H	5905-279-2504	326 RESISTOR, FIXED, COMPOSITION: RC20GF156J (81349)	2	EA	2				*	*	2	10	6	5-26A	R338, R340
P-H	5905-762-6907	327 RESISTOR, FIXED, FILM: RL42S223J (81349)	1,2	EA	1				*	*	*	5	3	5-26	R367
P-H	6240-539-8959	328 LAMP, GLOW: SAME AS 85	1,2	EA	1				REF	REF	REF	REF	REF	5-26	V303
P-H	5935-808-9569	329 SOCKET, ELECTRON TUBE: SAME AS 43	1	EA	4				REF	REF	REF	REF	REF	5-26	XV301, XV306, XV310, XV311
P-H	5935-688-3404	330 SOCKET, ELECTRON TUBE: 121-51-11-049 (71785)	2	EA	4				*	2	2	16	12	5-26A	XV301, XV306, XV310, XV311
P-H	5935-856-6987	331 SOCKET, ELECTRON TUBE: 111-51-11-069 (71785)	1	EA	2				*	2	2	13	9	5-26	XV304, XV307
P-H	5935-687-1779	332 SOCKET, ELECTRON TUBE: 111-51-11-014 (71785)	2	EA	2				*	2	2	13	9	5-26A	XV304, XV307
P-H	5935-753-7565	333 SOCKET, ELECTRON TUBE: SKJ-799 (95354)	1,2	EA	2				*	*	2	10	6	5-26	XV308, XV309
A-H		334 HIGH VOLTAGE DISTRIBUTION ETCHED CIRCUIT ASSEMBLY: 170A-65U(N) (28480)	1	EA	1									5-27	A302
A-H		335 HIGH VOLTAGE DISTRIBUTION ETCHED CIRCUIT ASSEMBLY: 2420-738 (28569)	2	EA	1									5-27A	A302
P-H	5910-686-6603	336 CAPACITOR, FIXED, PLASTIC DIELECTRIC: 184P682030 (56289)	1,2	EA	4				*	2	2	21	12	5-27	C307, C308, C309, C311
P-H	5910-280-9608	337 CAPACITOR, FIXED, PLASTIC DIELECTRIC: 184P153030 (56289)	1,2	EA	2				*	2	2	13	6	5-27	C312, C313
P-H	5910-725-7647	338 CAPACITOR, FIXED, MICA DIELECTRIC: CM15C220J03 (81349)	1,2	EA	1				*	2	2	21	12	5-27	C314
P-H	5905-279-2298	339 RESISTOR, FIXED, COMPOSITION: RC42GF565J (81349)	1	EA	8				2	2	3	30	27	5-27	R313 thru R318, R331, R333
			2	EA	8				2	2	3	43	45	5-27	R313 thru R318, R331, R333
P-H	5905-279-1900	340 RESISTOR, FIXED, COMPOSITION: RC42CG475J (81349)	1,2	EA	2				*	*	2	10	6	5-27	R322, R323
P-H	5905-195-6799	341 RESISTOR, FIXED, COMPOSITION: SAME AS 163	1	EA	1				REF	REF	REF	REF	REF	5-27	R325
P-H	5905-192-3973	342 RESISTOR, FIXED, COMPOSITION: SAME AS 27	2	EA	1				REF	REF	REF	REF	REF	5-27A	R325
P-H	5905-279-1697	343 RESISTOR, FIXED, COMPOSITION: RC32GF125J (81349)	1,2	EA	1				*	*	*	5	3	5-27	R326
P-H	5905-185-8510	344 RESISTOR, FIXED, COMPOSITION: SAME AS 98	1,2	EA	1				REF	REF	REF	REF	REF	5-27	R327
P-H	5905-279-3499	345 RESISTOR, FIXED, COMPOSITION: RC20GF273J (81349)	1,2	EA	2				*	*	2	10	6	5-27	R328, R356
P-H	5905-279-1754	346 RESISTOR, FIXED, COMPOSITION: SAME AS 165	1,2	EA	1				REF	REF	REF	REF	REF	5-27	R332
P-H	5905-254-9201	347 RESISTOR, FIXED, COMPOSITION: SAME AS 97	1	EA	1				REF	REF	REF	REF	REF	5-27	R334
P-H	5905-279-2298	348 RESISTOR, FIXED, COMPOSITION: SAME AS 339	2	EA	1				REF	REF	REF	REF	REF	5-27A	R334
P-H	5905-171-1998	349 RESISTOR, FIXED, COMPOSITION: SAME AS 41	1,2	EA	1				REF	REF	REF	REF	REF	5-27	R355
P-H	5905-295-3403	350 RESISTOR, FIXED, COMPOSITION: SAME AS 282	1,2	EA	1				REF	REF	REF	REF	REF	5-27	R357

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGKY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-892-7108	351 RESISTOR, FIXED, FILM: RN70D4533F (81349)	1,2	EA	1				*	*	*	5	3	5-27	R358
P-H	5905-078-8801	352 RESISTOR, FIXED, FILM: RN70D4023F (81349)	1,2	EA	1				*	*	*	5	3	5-27	R359
P-H	5905-299-2016	353 RESISTOR, FIXED, COMPOSITION: RC32GF393E (81349)	1	EA	1				*	*	*	5	3	5-27	R360
P-H	5905-779-2009	354 RESISTOR, FIXED, FILM: RL32S393J (81349)	2	EA	1				*	*	*	5	3	5-27	R360
P-H	5905-299-2027	355 RESISTOR, FIXED, COMPOSITION: RC32GF123K (81349)	1	EA	2				*	*	2	10	6	5-27	R362, R365
P-H	5905-975-4347	356 RESISTOR, FIXED, FILM: RL32S123J (81349)	2	EA	2				*	*	2	5	10	5-27A	R362, R365
P-H	5905-195-6761	357 RESISTOR, FIXED, COMPOSITION: SAME AS 236	1,2	EA	1				REF	REF	REF	REF	REF	5-27	R364
P-H	5905-102-2740	358 RESISTOR, FIXED, COMPOSITION: RC32GF333J (81349)	1,2	EA	1				*	*	*	5	3	5-27	R366
A-H		359 LOW VOLTAGE RECTIFIER ETCHED CIRCUIT ASSEMBLY: 170A-65M(N) (28480)	1	EA	1									5-28	A401
A-H		360 LOW VOLTAGE RECTIFIER ETCHED CIRCUIT ASSEMBLY: 2420-574 (28569)	2	EA	1									5-28A	A401
P-H	5910-934-0327	361 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAKE AS 11	1,2	EA	3				REF	REF	REF	REF	REF	5-28	C404, C405, C406
P-H	5910-807-5570	362 CAPACITOR, FIXED, PAPER DIELECTRIC: SAME AS 231	1,2	EA	1				REF	REF	REF	REF	REF	5-28	C407
P-H	5961-883-4798	363 SEMICONDUCTOR DEVICE, DIODE: 1N3190 (81349)	1,2	EA	12				2	3	5	40	36	5-28	CR401 thru CR412
A-H		364 LOW VOLTAGE REGULATOR AMPLIFIER ETCHED CIRCUIT ASSEMBLY: 170A-65K(N) (28480)	1	EA	1									5-29	A402
A-H		365 LOW VOLTAGE REGULATOR AMPLIFIER ETCHED CIRCUIT ASSEMBLY: 2420-743 (28569)	2	EA	1									5-29A	A402
P-H	5910-728-2144	366 CAPACITOR, FIXED, PLASTIC DIELECTRIC: SAME AS 201	1	EA	3				REF	REF	REF	REF	REF	5-29	C409, C412, C417
P-H	5910-976-3686	367 CAPACITOR, FIXED, PLASTIC DIELECTRIC: SAME AS 202	2	EA	3				REF	REF	REF	REF	REF	5-29A	C409, C412, C417
P-H	5910-993-8367	368 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1 2	EA EA	2 1				REF REF	REF REF	REF REF	REF REF	REF REF	5-29 5-29A	C413, C418 C418
P-H	5910-803-2880	369 CAPACITOR, FIXED, ELECTROLYTIC: CL65BX200HP3 (81349)	1,2	EA	1				*	*	2	8	3	5-29	C419
P-H	5910-807-5570	370 CAPACITOR, FIXED, PAPER DIELECTRIC: SAME AS 231	1,2	EA	1				REF	REF	REF	REF	REF	5-29	C426
P-H	5961-852-7549	371 SEMICONDUCTOR DEVICE, DIODE: SAME AS 125	1,2	EA	2				REF	REF	REF	REF	REF	5-29	CR413, CR416
P-H	5961-752-5229	372 TRANSISTOR: 2N404A (81349)	1 2	EA EA	7 8				2 2	2 2	3 3	33 39	21 24	5-29 5-29A	Q401, Q402, Q407, Q408, Q412, Q414 Q415 Q401, Q402, Q406 Q407, Q408, Q412, Q414, Q415 Q406, Q410, Q411 Q410, Q411
P-H	5961-851-5923	373 TRANSISTOR: 2N1309 (81349)	1 2	EA EA	3 2				*	2	2	18 10	9 6	5-29 5-29A	Q406, Q410, Q411 Q410, Q411
P-H	5905-804-6099	374 RESISTOR, FIXED, FILM: SAME AS 133	1,2	EA	1				REF	REF	REF	REF	REF	5-29	R408
P-H	5905-190-8889	375 RESISTOR, FIXED, COMPOSITION: SAME AS 186	1,2	EA	1				REF	REF	REF	REF	REF	5-29	R409
P-H	5905-852-4474	376 RESISTOR, FIXED, FILM: LPI-5-20K (14674)	1,2	EA	2				*	*	2	10	6	5-29	R410, R412

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5905-985-6058	377 RESISTOR, FIXED, FILM: SAME AS 321	1,2	EA	1					
P-H	5905-730-0294	378 RESISTOR, FIXED, FILM: RL325134J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R415
P-H	5905-767-7587	379 RESISTOR, FIXED, FILM: RL20S511J (81349)	1,2	EA	2				*	*	2	10	6	5-29	R416, R435
P-H	5905-192-4490	380 RESISTOR, FIXED, COMPOSITION: RC20GF330J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R417
P-H	5905-988-2251	381 RESISTOR, FIXED, FILM: RL20AD111J (81349)	1	EA	1				*	*	*	5	3	5-29	R425
P-H	5905-192-3971	382 RESISTOR, FIXED, COMPOSITION: RC20GF331J (81349)	2	EA	1				*	*	*	5	3	5-29A	R425
P-H	5905-299-2020	383 RESISTOR, FIXED, COMPOSITION: RC32GP273J (81349)	1	EA	2				*	*	2	10	6	5-29	R426, R448
P-H	5905-769-8529	384 RESISTOR, FIXED, FILM: RL32S273J (81349)	2	EA	2				*	*	2	10	6	5-29A	R426, R448
P-H	5905-805-1432	385 RESISTOR, FIXED, WIREWOUND: RW55G180 (81349)	1	EA	1				*	*	*	5	3	5-29	R427
P-H	5905-779-2376	386 RESISTOR, FIXED, WIREWOUND: RW67V180 (81349)	2	EA	1				*	*	*	5	3	5-29A	R427
P-H	5905-769-8533	387 RESISTOR, FIXED, FILM: SAME AS 25	2	EA	1				REF	REF	REF	REF	REF	5-29	R428
P-H	5905-767-3233	388 RESISTOR, FIXED, FILM: RL20AD823J (81349)	1	EA	1				*	*	*	5	3	5-29	R429
P-H	5905-782-0901	389 RESISTOR, FIXED, FILM: SAME AS 152	1,2	EA	1				REF	REF	REF	REF	REF	5-29	R430
P-H	5905-542-9113	390 RESISTOR, FIXED, FILM: RN70B5112F (81349)	1	EA	1				*	*	*	5	3	5-29	R432
P-H	5905-975-1273	391 RESISTOR, FIXED, FILM: RL32S563J (81349)	2	EA	1				*	*	*	5	3	5-29A	R432
P-H	5905-552-5051	392 RESISTOR, FIXED, FILM: RN70D9092F (81349)	1	EA	1				*	2	2	16	12	5-29	R433
P-H	5905-975-1300	393 RESISTOR, FIXED, FILM: RL20S913J (81349)	2	EA	1				*	*	2	8	5	5-29A	R433
P-H	5905-767-3204	394 RESISTOR, FIXED, FILM: SAME AS 83	1,2	EA	1				REF	REF	REF	REF	REF	5-29	R434
P-H	5905-767-3219	395 RESISTOR, FIXED, FILM: RL20AD202J (81349)	1	EA	1				*	*	*	5	3	5-29	R437
P-H	5905-299-1541	396 RESISTOR, FIXED, COMPOSITION: SAME AS 30	1,2	EA	2				REF	REF	REF	REF	REF	5-29	R443, R462
P-H	5905-299-2022	397 RESISTOR, FIXED, COMPOSITION: RC32GF223J (81349)	1,2	EA	1				*	2	2	19	15	5-29	R444
P-H	5905-903-6828	398 RESISTOR, FIXED, FILM: RL42S240J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R445
P-H	5905-975-1273	399 RESISTOR, FIXED, FILM: RL42S182J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R446
P-H	5905-279-3503	400 RESISTOR, FIXED, COMPOSITION: RC20GF682J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R447
P-H	5905-767-3231	401 RESISTOR, FIXED, FILM: RL20S432J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R449
P-H	5905-769-8533	402 RESISTOR, FIXED, FILM: SAME AS 25	1,2	EA	1				REF	REF	REF	REF	REF	5-29	R450
P-H	5905-195-6791	403 RESISTOR, FIXED, COMPOSITION: RC20GF681J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R451
P-H	5905-279-3504	404 RESISTOR, FIXED, COMPOSITION: SAME AS 255	1,2	EA	1				REF	REF	REF	REF	REF	5-29	R459

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-299-2013	405 RESISTOR, FIXED, COMPOSITION: RC32GF473J (81349)	1,2	EA	1				*	*	*	5	3	5-29	R461
P-H	5905-252-4018	406 RESISTOR, FIXED, COMPOSITION: SAME AS 23	1,2	EA	1				REF	REF	REF	REF	REF	5-29	R463
P-H	5935-856-6987	407 SOCKET, ELECTRON TUBE: SAME AS 331	1	EA	1				REF	REF	REF	REF	REF	5-29	XV401
P-H	5935-850-6567	408 SOCKET, ELECTRON TUBE: 3807-2-2 (91662)	2	EA	1				*	*	*	5	3	5-29A	XV401
P-H	5995-985-7744	409 CABLE ASSEMBLY, POWER, ELECTRICAL: CX-4704/U(8'0"): 170A-16AL(N) (28480)	1,2	EA	1				*	*	2	5	3	1-1	A403
P-H	5935-843-7362	410 CONNECTOR, PLUG, ELECTRICAL: M524663 (81349)	1,2	EA	1				*	*	2	8	3	1-1	P401
P-H	5935-805-4991	411 CONNECTOR, PLUG, ELECTRICAL: MS3106R-14S-7S (81349)	1,2	EA	1				*	*	2	8	3	1-1	P402
P-H	6145-284-0579	412 CABLE, POWER, ELECTRICAL: CO-03LGF(3/18)0206 (81349)	1,2	FT	8				*	*	10	50	50	1-1	W401
P-H	5995-752-8781	413 CORD CG-409F/U: 170A-16AM(N) (28480)	1,2	EA	2				*	*	2	10	6	1-1	A603, A604
P-H	5935-577-2281	414 CONNECTOR, PLUG, ELECTRICAL UG-88C/U	1,2	EA	4				*	*	2	10	6	1-1	P601 thru P604
P-H	6145-542-6092	415 CABLE, RADIOFREQUENCY: RG-58C/U (81349)	1,2	FT	32				*	*	64	192	192	1-1	W605, W606
A-H		416 SWEEP TIE SWITCH ASSEMBLY: 170A-19B(N) (28480)	1	EA	1									5-18	A1000
P-H	5930-054-0356	417 SWEEP 13 SWITCH ASSEMBLY: 19915-673 (28569)	2	EA	1				*	*	*	4	2	5-18A	A1000
P-H	5910-820-6114	418 CAPACITOR, FIXED, PAPER DIELECTRIC: CP05A1KC474K3 (81349)	1,2	EA	1				*	*	2	8	3	5-18	C1001
P-H	5910-819-5745	419 CAPACITOR, FIXED, PAPER DIELECTRIC: SAM AS 298	1,2	EA	1				REF	REF	REF	REF	REF	5-18	C1002
P-H	5910-727-9848	420 CAPACITOR, FIXED, MICA DIELECTRIC: CM35D472JN3 (81349)	1,2	EA	1				*	*	2	8	3	5-18	C1003
P-H	5910-807-9305	421 CAPACITOR, FIXED, MICA DIELECTRIC: SAME AS 118	1	EA	1				REF	REF	REF	REF	REF	5-18	C1004
P-H	5910-762-2945	422 CAPACITOR, FIXED, MICA DIELECTRIC: CHM15F471G03 (81349)	2	EA	1				*	*	*	5	3	5-18A	C1004
P-H	5910-952-9440	423 CAPACITOR, FIXED, PLASTIC DIELECTRIC: CQ09A1MC105J3 (81349)	1,2	EA	1				*	*	2	8	3	5-18	C1006
P-H	5910-959-4596	424 CAPACITOR, FIXED, PLASTIC DIELECTRIC: CQ09A1MC104J3 (81349)	1,2	EA	1				*	*	2	8	3	5-18	C1007
P-H	5910-936-7514	425 CAPACITOR, FIXED, PLASTIC DIELECTRIC: CQ09A1MC103J3 (81349)	1,2	E A	1				*	*	2	8	3	5-18	C1008
P-H	5910-725-4795	426 CAPACITOR, FIXED, MICA DIELECTRIC: CH20F102G03 (81349)	1,2	EA	1				*	*	2	8	3	5-18	C1009
P-H	5910-578-1623	427 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: SAME AS 91	1,2	EA	4				REF	REF	REF	REF	REF	5-18	C1010, C1012, C1014, C1016
P-H	5910-889-4777	428 CAPACITOR, FIXED, MICA DIELECTRIC: SAME AS 13	1,2	EA	1				REF	REF	REF	REF	REF	5-18	C1011
P-H	5910-807-2595	429 CAPACITOR, FIXED, MICA DIELECTRIC: SAME AS 120	1,2	EA	1				REF	REF	REF	REF	REF	5-18	C1013
P-H	5910-725-7647	430 CAPACITOR, FIXED, MICA DIELECTRIC: SAME AS 338	1,2	EA	1				REF	REF	REF	REF	REF	5-18	C1015

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGKY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-279-1883	431 RESISTOR, FIXED, COMPOSITION: RC20GF335J (81349)	1,2	EA	1				*	*	*	5	3	5-18	R1001
P-H	5905-279-2514	432 RESISTOR, FIXED, COMPOSITION: RC20GF564K (81349)	1	EA	1				*	*	*	5	3	5-18	R1005
P-H	5905-279-2515	433 RESISTOR, FIRED, COMPOSITION: SAME AS 138	2	EA	1				REF	REF	REF	REF	REF	5-18	R1005
P-H	5905-192-0662	434 RESISTOR, FILED, COMPOSITION: SAME AS 171	1	EA	2				REF	REF	REF	REF	REF	5-18	R1006, R1007
P-H	5905-768-5791	435 RESISTOR, FIXED, FILM: RL20S184J (81349)	2	EA	1				*	*	2	8	5	5-18	R1006
P-H	5905-880-2206	436 RESISTOR, FIXED, FILM: RL20S164J (81349)	2	EA	1				*	*	2	8	5	5-18	R1007
P-H	5905-279-5621	437 RESISTOR, FIXED, FILM: DC1 (36 meg) (19701)	1	EA	1				*	*	*	5	3	5-18	R1011
P-H	5905-056-6269	438 RESISTOR, FIXED, FILM: DC2 (37 meg) (91637)	2	EA	1				*	*	*	5	3	5-18	R1011
P-H	5905-646-5716	439 RESISTOR, FIXED, FILM: RN75B4534F (81349)	1,2	EA	4				*	2	2	16	12	5-18	R1012, R1013, R1026, R1027
P-H	5905-518-5644	440 RESISTOR, FIXED, FILM: RN75B3654F (81349)	1,2	EA	1				*	*	*	5	3	5-18	R1014
P-H	5905-057-9659	441 RESISTOR, FIXED, FILM: RN70D9093F (81349)	1,2	EA	2				*	*	2	10	6	5-18	R1015, R1016
P-H	5905-993-5968	442 RESISTOR, FIXED, FILM: RN70D3653F (81349)	1,2	EA	1				*	*	*	5	3	5-18	R1017
P-H	5905-552-5051	443 RESISTOR, FIXED, FILM: SAME AS 392	1	EA	3				REF	REF	REF	REF	REF	5-18	R1018, R1019, R1020
P-H	5905-988-0149	444 RESISTOR, FIXED, FILM: RN70D9092F (81349)	2	EA	3				*	2	2	13	10	5-18	R1018, R1019, R1020
P-H	5905-279-3513	445 RESISTOR, FIXED, COMPOSITION: SAME AS 130	1,2	EA	1				REP	REF	REP	REF	REF	5-18	R1021
P-H	5930-757-3079	446 SWITCH, ROTARY: 3100-0779-9 (28480)	1	EA	1				*	*	2	10	6	5-18	S1001
P-H	6105-757-3075	447 MOTOR, ALTERNATING CURRENT: YY1W027 (62119)	1	EA	1				*	*	2	8	4	5-11	B401
P-H	6105-134-9996	448 MOTOR, DIRECT CIRCUIT: YY1W-4AJR (62119)	2	EA	1				*	*	2	8	4	5-11	B401
P-H	5961-811-5799	449 SEMICONDUCTOR DEVICE, DIODE: 1N1202 (81349)	1,2	EA	2				*	2	2	13	6	5-10	CR414, CR415
P-H	5910-728-2212	450 CAPACITOR, FIXED, CERAMIC DIELECTRIC: 706C1 (56289)	1,2	EA	2				*	2	2	13	6	5-12	C306, C315
P-H	5910-809-4773	451 CAPACITOR, FIXED, ELECTROLYTIC: D29405 (56289)	1,2	EA	3				*	2	2	27	15	5-10	C401, C416
P-H	5910-827-0175	452 CAPACITOR, FIXED, PAPER DIELECTRIC: CP05A1KE105K3 (81349)	1,2	EA	2				*	2	2 13	6	5-11	5-11 C402	C408 C410
P-H	5910-809-1121	453 CAPACITOR, FIXED, ELECTROLYTIC: D29401 (56289)	1	EA	1				*	2	2	12	5	5-10	C403
P-H	5910-857-7280	454 CAPACITOR, FIXED, ELECTROLYTIC: CE41C450R (81349)	2	EA	1				*	*	2	8	5	5-10	C403
P-H	5910-809-4774	455 CAPACITOR, FIXED, ELECTROLYTIC: 029402 (56289)	1	EA	2				*	2	2	19	10	5-10	C411, C420
P-H	5910-615-9519	456 CAPACITOR, FIXED, ELECTROLYTIC: CE41C500N (81349)	2	EA	2				*	2	2	13	10	5-10	C411, C420
P-H	5910-754-6956	457 CAPACITOR, FIXED, ELECTROLYTIC: 32D 315 (56289)	1	EA	1				*	2	2	12	5	5-9	C425
P-H	5910-052-2025	458 CAPACITOR, FIXED, ELECTROLYTIC: CE71C702F (81349)	2	EA	1				*	*	*	8	5	5-9	C425

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGKY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	6625-893-1795	459 DELAY LINE: 170B-16A (28480)	1	EA	1					
P-H	6625-960-4308	460 DELAY LINE: 3030-170 (28569)	2	EA	1				*	*	2	13	10	5-9	DL1, DL2
P-H	5995-045-4579	461 CABLE ASSEMBLY, RADIOFREQUENCY:1.2 3030-212 (28569)	1.2	EA	1				*	*	2	8	5	5-9	DL301
P-H	6240-892-4420	462 LAMP, GLOW: MS25252-NE2D (81349)	1.2	EA	1				2	2	3	33	30	5-13	DS401
P-H	6240-539-8959	463 LAP, GLOW: SAME AS 85	1	EA	1				REF	REF	REF	REF	REF	5-11	DS402
P-H	6240-179-1811	464 LAMP, GLOW: NE-2 (24455)	2	EA	1				*	*	*	8	5	5-11	DS402
P-O	6240-155-8706	465 LAMP, INCANDESCENT: MS15571-2 (81349)	1.2	EA	5				2	3	6	71	50	5-9	DS403 thru DS406
P-H	5935-258-1767	466 COVER, ELECTRICAL CONNECTOR CW-123A/U	1	EA	6				*	2	2	28	24	5-13	DS1001
			2	EA	6				2	2	3	33	33	5-13	E101, E102, E104, E201, E301, E302
P-O	5920-894-4556	467 FUSE, CARTRIDGE: F035250V8AS (81349)	1	EA	2				2	4	11	242	200	5-11	E01, E102, E104, E201, E301, E302
P-O	5920-519-7733	468 FUSE, CARTRIDGE: F03A250V8AS (81349)	2	EA	2				2	4	11	242	200	5-11	F401, F402
P-O	5920-280-8344	469 FUSE, CARTRIDGE: F02A250V1/2AS (81349)	1.2	EA	1				2	6	11	130	100	5-11	F403
P-O	5920-280-4465	470 FUSE, CARTRIDGE: F02A250V1AS (81349)	1.2	EA	2				2	4	11	242	200	5-10	F404, F405
P-O	5920-295-9270	471 FUSE, CARTRIDGE: F03B32V10AS (81349)	1.2	EA	1				2	6	11	130	100	5-11	F406
P-H	5915-809-9638	472 FILTER, 1311: 0034 (98734)	1.2	EA	1				*	*	*	5	3	5-12	FL401
P-H	5935-082-0481	473 CONNECTOR, RECEPTACLE, ELECTRICAL: 26-4200-16S (02660)	1.2	EA	1				*	*	2	8	3	5-9	J1
P-H	5935-843-9008	474 CONNECTOR, RECEPTACLE, ELECTRICAL: MS35179-1094A (81349)	1	EA	6				2	2	3	33	33	5-13	J101, J102, J104, J201, J301, J302
P-H	5935-552-7660	475 CONNECTOR, RECEPTACLE, ELECTRICAL: UG-625B/U	2	EA	4				2	2	3	38	40	5-13	J101, J102, J104, J203
P-H	5935-502-5151	476 CONNECTOR, RECEPTACLE, ELECTRICAL: UG-657/U	2	EA	2				*	2	2	13	10	5-13	J301, J302
P-H	5935-295-6950	477 CONNECTOR, RECEPTACLE, ELECTRICAL: 26-4200-32S (02660)	1.2	EA	1				*	*	*	5	3	5-12	J105
P-H	5950-504-6500	478 REACTOR: 3250-86 (28569)	1.2	EA	2				*	*	2	10	6	5-11	L402, L404
P-H	5950-810-0824	479 REACTOR: 3250-87 (28569)	1.2	EA	2				*	*	2	10	6	5-10	L403, L405
P-H	5950-809-4797	480 REACTOR: 3250-88 (28569)	1.2	EA	1				*	*	*	5	3	5-10	L406
P-H	5355-737-4883	481 KNOB: 0370-0037-9 (28480)	1	EA	3				*	*	2	8	6	5-13	MP101, MP102, MP202
P-H	5355-656-1322	482 KNOB: 11505-90 (28569)	2	EA	4				2	2	3	38	40	5-13	MP101, MP102, MP106, MP202
P-H	5355-688-6955	483 KNOB: 0370-0061-9 (28480)	1	EA	1				*	*	*	8	3	5-13	MP103
P-H	5355-656-1319	484 KNOB: 11505-94 (28569)	2	EA	4				*	2	2	16	16	5-13	M203, MP104, MP105, MP203
P-H	5355-965-4881	485 KNOB: 0370-0062-9 (28480)	1	EA	3				*	2	2	12	10	5-13	MP104, MP105, MP203
P-H	5355-728-2881	486 KNOB: 0370-0067-9 (28480)	1	EA	1				*	2	2	13	9	5-13	MP106
P-O	4110-727-8796	487 FILTER, AIR CONDITIONER: C-7066-3 (94330)	1.2	EA	1				*	*	*	4	4	2-2	MP147

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5355-755-6804	488 KNOB: 0370-0029-9 (28480)	1	EA	1				*	*	*	4	2	5-13	MP201
P-H	5355-656-1321	489 KNOB: 11505-91 (28569)	2	EA	1				*	*	*	4	2	5-13	MP201
P-H	5355-682-3543	490 KNOB: 0370-0026-9 (28480)	1	EA	4				*	*	2	10	4	5-13	MP301, MP302, MP303, MP402
P-H	5355-656-1318	491 KNOB: 11505-87 (28569)	2	EA	5				*	2	2	16	16	5-13	MP301, MP302, MP303, MP304, MP402
P-H	5355-682-3544	492 KNOB: 0370-0077-9 (28480)	1	EA	1				*	*	*	5	4	5-13	MP304
X2-H		493 SHIELD, RESISTOR: 5040-0418 (28480)	1	EA	2									5-9	MP306, MP307
X2-H		494 INSULATOR, CONNECTOR: 5040-0702 (28480)	1	EA	4									5-13	MP319, MP320, MP321, MP322
P-H	4450-801-4051	495 IMPELLER, FAN, AXIAL: 3160-0009-9 (28480)	1	EA	1				*	*	*	5	3	5-12	MP419
P-H	4140-050-6356	496 IMPELLER, FAN, AXIAL: 2380-4 (28569)	2	EA	1				*	*	*	5	3	5-12	MP419
P-H	5940-543-8538	497 INSULATOR, FEEDTHRU: FT-SM-22 TUR (98291)	2	EA	1				*	*	2	15	14		MP420
X2-H		498 LATCH, STEEL: SC-B-83314-42 (98003)	1	EA	4									1-1	MP605, MP606, MP607, MP608
P-O	5330-917-7011	499 GASKET, RUBBER: 496X (02286)	1	FT	6				6	48	200	72	60	1-1	MP609
P-H	5961-082-4203	500 TRANSISTOR: 2N3132 (81349)	1	EA	8				2	2	3	40	32	5-10	Q403, Q404, Q405, Q409, Q413, Q416, Q418, Q419
P-H	5961-934-3002	501 TRANSISTOR: 2N3618 (04713)	2	EA	8				2	2	3	40	32	5-10	Q403, Q404, Q405, Q409, Q413, Q416, Q418, Q419
P-H	5961-846-7338	502 TRANSISTOR: 2N1358 (81349)	1.2	EA	1				*	*	2	8	4	5-10	Q417
P-H	5905-503-5984	503 RESISTOR, VARIABLE: RV4LAYS101A (81349)	1.2	EA	1				*	*	*	5	3	5-9	R13
P-H	5905-666-2556	504 RESISTOR, FIXED, WIREWOUND: RW155V182 (81349)	1.2	EA	1				*	*	*	5	3	5-9	R87
P-H	5905-254-9201	505 RESISTOR, FIXED, COMPOSITION: SAME AS 97	1.2	EA	1				REF	REF	REF	REF	REF	5-9	R88
P-H	5905-842-5895	506 RESISTOR, FIXED, WIREWOUND: RW55V302 (81349)	1.2	EA	1				*	*	*	5	3	5-9	R95
P-H	5905-549-5382	507 RESISTOR, FIXED, WIREWOUND: ,RW29V122 (81349)	1.2	EA	1				*	*	*	5	3	5-9	R96
P-H	5905-577-7207	508 RESISTOR, FIXED, WIREWOUND: RW55V562 (81349)	1.2	EA	1				*	*	*	5	3	5-9	R99
P-H	5905-552-2093	509 RESISTOR, VARIABLE: RV4LAYS254A (81349)	1.2	EA	2				*	*	2	10	6	5-10	R114, R243
P-H	5905-501-5184	510 RESISTOR, VARIABLE: RV4LAYS503A (81349)	1.2	EA	2				*	*	2	10	6	5-10	R163, R361
P-H	5905-501-7314	511 RESISTOR, VARIABLE: RV4LAYS253A (81349)	1.2	EA	5				*	2	2	19	15	5-10	R178, R1002, R1003, R1004, R1024
P-H	5905-646-5958	512 RESISTOR, VARIABLE: RV4LAYS102A (81349)	1.2	EA	2				*	*	2	10	6	5-10	R211
P-H	5905-983-7147	513 RESISTOR, VARIABLE: 2100-0121-9 (28480)	1	EA	1				*	*	*	5	3	5-11	R452
P-H	5905-054-0349	514 RESISTOR, VARIABLE: 16925-410 (28569)	2	EA	1				*	*	*	5	3	5-13	R216
P-H	5905-793-3065	515 RESISTOR, VARIABLE: JD1L040S101MC (01121)	1.2	EA	1				*	*	*	5	3	5-10	R223A/B

SECTION V REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCV	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-100-7936	517 RESISTOR, FIXED, WIREWOUND: RW32G123 (81349)	1	EA	2				*	*	2	10	6	5-11	R265, R270
P-H	5905-642-1680	518 RESISTOR, FIXED, WIREWOUND: RW33V123 (81349)	2	EA	2				*	*	2	10	6	5-11	R265, R270
P-H	5905-185-8510	519 RESISTOR, FIXED, COMPOSITION: SAME AS 98	1.2	EA	1				REF	REF	REF	REF	REF	5-12	R310
P-H	5905-192-0390	520 RESISTOR, FIXED, COMPOSITION: SAME AS 24	1.2	EA	1				REF	REF	REF	REF	REF	5-12	R311
P-H	5905-518-5609	521 RESISTOR, VARIABLE: SAME AS 224	1.2	EA	1				REF	REF	REF	REF	REF	5-9	R321
P-H	5905-769-5453	522 RESISTOR, VARIABLE: 53MV (12697)	1.2	EA	1				*	*	*	5	3	5-13	R324
P-H	5905-795-0651	523 RESISTOR, VARIABLE: CM24705 (12697)	1.2	EA	1				*	*	*	5	3	5-13	R330
P-H	5905-539-4900	524 RESISTOR, VARIABLE: RV4NAYS503A (81349)	1.2	EA	1				*	*	*	5	3	5-13	R363
P-H	5905-892-0158	525 RESISTOR, FIXED, WIREWOUND: RW59VR25 (81349)	1	EA	1				*	*	*	5	3	5-13	R368
P-H	5905-847-4306	526 RESISTOR, FIXED, WIREWOUND: 18577-156 (28569)	2	EA	1				*	*	*	5	3	5-13	R368
P-H	5905-171-1986	527 RESISTOR, FIXED, COMPOSITION: SAME AS 182	1	EA	1				REF	REF	REF	REF	REF	5-11	R400
P-H	5905-190-8882	528 RESISTOR, FIXED, COMPOSITION: RC20GF393K (81349)	2	EA	1				REF	REF	REF	REF	REF	5-44A	R400
P-H	5905-171-1998	529 RESISTOR, FIXED, COMPOSITION: SAME AS 41	1	EA	1				*	*	*	5	3	5-10	R401
P-H	5905-249-3663	530 RESISTOR, FIXED, COMPOSITION: RC42GF683J (81349)	2	EA	1				REF	REF	REF	REF	REF	5-10	R401
P-H	5905-855-4075	531 RESISTOR, FIXED, WIREWOUND: RW31V500 (81349)	1.2	EA	1				*	*	*	5	3	5-10	R402
P-H	5905-549-3752	532 RESISTOR, FIXED, WIREWOUND: RW29V161 (81349)	2	EA	2				*	*	*	5	3	5-11	R403
P-H	5905-518-5595	533 RESISTOR, VARIABLE: RV4LAYS103A (81349)	1.2	EA	4				*	2	2	16	12	5-11	R403, R424
P-H	5905-841-7440	534 RESISTOR, FIXED, WIREWOUND: RW32W710 (81349)	1.2	EA	1				*	*	*	5	3	5-10	R405, R406, R407, R438
P-H	5905-192-0626	535 RESISTOR, FIXED, COMPOSITION: SAME AS 149	1	EA	1				*	*	*	5	3	5-10	R411
P-H	5905-171-1976	536 RESISTOR, FIXED, COMPOSITION: SAME AS 150	2	EA	1				REF	REF	REF	REF	REF	5-11	R421
P-H	5905-279-3416	537 RESISTOR, FIXED, COMPOSITION: RC42GF330J (81349)	1	EA	2				REF	REF	REF	REF	REF	5-10	R422, R440
P-H	5905-811-9399	539 RESISTOR, FIXED, WIREWOUND: RW32V510 (81349)	2	EA	2				REF	REF	REF	REF	REF	5-10	R422, R440
P-H	5905-539-2567	540 RESISTOR, VARIABLE: RV4LAYS252A (81349)	1.2	EA	3				*	2	2	13	9	5-10	R423, R441
P-H	5905-542-9835	541 RESISTOR, FIXED, WIREWOUND: RW55V120 (81349)	2	EA	1				*	*	*	5	3	5-9	R457
P-H	5905-642-1969	542 RESISTOR, FIXED, WIREWOUND: RW29V121 (81349)	1.2	EA	1				*	*	*	5	3	5-11	R424
P-H	5905-253-1229	543 RESISTOR, FIXED, COMPOSITION: RC42GF3311 (81349)	1.2	EA	1				*	*	*	5	3	5-10	R431
P-H	5905-950-2856	544 RESISTOR, FIXED, WIREWOUND: RW24GIR5 (81349)	1.2	EA	1				*	*	*	5	3	5-11	R439
P-H	5905-503-6218	545 RESISTOR, VARIABLE: RV4LAYS251A (81349)	1.2	EA	1				*	*	*	5	3	5-11	R442
									*	*	*	5	3	5-10	R458
									*	*	*	5	3	5-12	R460
									*	*	*	5	3	5-11	R464

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
					P-H	5905-783-8818	546 RESISTOR, VARIABLE: RGC-90 (71450)	1,2	EA	1					
P-H	5905-299-2023	547 RESISTOR, FIXED, COMPOSITION: RC32GY183K (81349)	1	EA	1				*	*	*	5	3	5-11	R1010
P-H	5905-299-2025	548 RESISTOR, FIXED, COMPOSITION: SAME AS 168	2	EA	1				REF	REF	REF	REF	REF	5-11	R1010
P-H	5905-804-6088	549 RESISIOR, VARIABLE, WIREWOUND: RA20NBSD500A (81349)	1,2	EA	1				*	*	*	5	3	5-13	R1025
P-H	5930-809-4792	550 SWITCH, PUSH: 3101-0024-9 (28480)	1	EA	1				*	*	2	10	6	5-13	S1
P-H	5930-936-3789	551 SWITCH, PUSH: 19910-157 (28569)	2	EA	1				*	*	2	10	6	5-13	S1
P-H	5930-655-1514	552 SWITCH, TOGGLE: M535058-22 (81349)	1,2	EA	1				*	*	2	8	4	5-13	S201
P-H	5930-655-1575	553 SWITCH, TOGGLE: M5S35059-22 (81349)	1,2	EA	1				*	*	2	10	4	5-13	S401
P-H	5930-790-4889	554 SWITCH, THERMOSTATIC: 20400D/L140-2/4561-2 (82647)	1	EA	1				*	*	2	10	4	5-11	S402
P-H	5930-895-6393	555 SWITCH, THERMOSTATIC: 20400D-52-21-L140-2 (82647)	2	EA	1				*	*	2	10	14	5-11	S402
M-H		556 TERMINAL BOARD: DAIAIAIDAI (06540)	1	EA	1									5-9	TB1
M-D		557 TERMINAL BOARD: SAME AS 216	1	EA	2									5-10	TB2, TB404
M-H		558 TERMINAL BOARD: 744 (06540)	1	EA	1									5-11	TB301
X2-H		559 TERMINAL BOARD: 599M-ST-5 (75382)	1	EA	3									5-9	TB401, TB402
M-H		560 TERMINAL BOARD: 669 (06540)	1	EA	2									5-10	TB403
M-H		561 TERMINAL BOARD: 797 (06540)	1	EA	1									5-12	TB405
P-H	5950-757-7700	562 TRANSFORMER, HIGH VOLTAGE: 170A11BN (28480)	1	EA	1				*	*	2	8	4	5-10	TB408
P-H		563 TRANSFORMER, HIGH VOLTAGE: 20800-321 (28569)	2	EA	1				*	*	2	8	4	5-11	TB406
P-H	5950-504-6505	564 TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: 9463 (98734)	1	EA	1				*	*	*	5	3	5-9	T401
P-H	5950-795-9383	565 TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: 20800-259 (28569)	2	EA	1				*	*	*	5	3	5-9	T401
P-H	5960-806-5614	566 ELECTRON TUBE: SAME AS 42	1,2	EA	14				REF	REF	REF	REF	REF	5-6	V101, V103, V104, V105, V107, V113, V114, V115, V201, V202, V203, V206, V301, V306
P-H	5960-615-0243	567 ELECTRON TUBE: 6CL6 (81349)	1,2	EA	4				10	25	47	567	400	5-6	V109, V204, V205, V207
P-H	5960-669-6861	568 ELECTRON TUBE: 6005/6AQ5W (81349)	1,2	EA	1				2	2	3	59	100	5-6	V304
P-H	5960-881-6636	569 ELECTRON TUBE: 5BHP2A (81349)	1,2	EA	1				2	4	8	101	100	5-6	V305
P-H	5960-262-0185	570 ELECTRON TUBE: 5726/6AL5W (81349)	1,2	EA	1				2	2	3	59	100	5-6	V307
P-H	5960-272-8553	571 ELECTRON TUBE: 1X2B (81349)	1,2	EA	4				6	16	29	352	400	5-6	V308 thru V311
P-H	5960-262-0286	572 ELECTRON TUBE: 5651WA (81349)	1,2	EA	1				2	2	3	59	100	5-6	V401
P-H	6210-809-4274	573 LAMPHOLDER: LH74LC13RN (81349)	1,2	EA	1				*	*	2	10	3	5-13	XDS401

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
A-H		574 LAMPHOLDER ASSEMBLY: 1450-0024-9 (28480)	1,2	EA	1								5-9	XDS403 thru XDS406	
P-H	6250-283-9741	575 LAMPHOLDER: MS90282-3 (81349)	1,2	EA	4				*	2	2	16	12	5-13	XDS1001
P-H	5920-660-6705	576 FUSEHOLDER: FD-1 (81349)	1,2	EA	6				*	2	2	13	12	5-11	XF401 thru XF406
P-H	5935-237-6457	577 SOCKET, ELECTRON TUBE: 9709-7 (72825)	1	EA	1				*	*	*	5	3	5-9	XV305
P-H	5935-052-2899	578 SOCKET, ELECTRON TUBE: 19351-25 (28569)	2	EA	1				*	*	*	5	3	5-9	XV305
P-C-S	6625-759-0741	579 OSCILLOSCOPE SUBASSEMBLY, VERTICAL CHANNEL DUAL TRACE PREAMPLIFIER MX-2930B/USH	1	EA	1				*	*	*	5	3	1-1	A5
P-C-S		579A OSCILLOSCOPE SUBASSEMBLY, VERTICAL CHANNEL DUAL TRACE PREAMPLIFIER MX-2930C/USM	2	EA	1				*	*	*	5	3	1-1	A5
A-H		580 VERTICAL PRESENTATION SWITCH ASSEMBLY: 162A-19D(N) (28480)	1	EA	1									5-34	A500
P-H	5930-054-0358	581 VERTICAL PRESENTATION SWITCH ASSEMBLY: 19915-677 (28569)	2	EA	1				*	*	2	5	3	5-34	A500
P-H	5910-543-0823	582 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 112	1,2	EA	1				REF	REF	REF	REF	REF	5-34	C1587
P-H	5910-883-4781	583 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 301	1,2	EA	1				REF	REF	REF	REF	REF	5-34	C1591
P-H	5910-284-4756	584 CAPACITOR, VARIABLE, PLASTIC: 1 535-033 4R (72982)	EA	2	*				2	2	13	6	5-34	C1592, C1594	
P-H	5910-823-1056	585 CAPACITOR, VARIABLE, PLASTIC: 2 SK1459-000 (72982)	EA	2	*				2	2	13	1	6	5-34	C1592, C1594
P-H	5910-993-8367	586 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1,2	EA	1				REF	REF	REF	REF	REF	5-34	C1593
P-H	5905-726-5346	587 RESISTOR, FIXED, COMPOSITION: RC07GF182K (81349)	1	EA	1				*	*	*	5	3	5-34	R553
P-H	5905-717-3342	588 RESISTOR, FIXED, FILM: RL205182J (81349)	2	EA	1				*	*	*	5	3	5-34	R553
P-H	5905-726-5343	589 RESISTOR, FIXED, COMPOSITION: RC07GF152K (81349)	1	EA	1				*	*	*	5	3	5-34	R561
P-H	5905-279-1757	590 RESISTOR, FIXED, COMPOSITION: SAME AS 144	2	EA	1				REF	REF	REF	REF	REF	5-34	R561
P-H	5905-279-3513	591 RESISTOR, FIXED, COMPOSITION: SAME AS 130	1,2	EA	1				REF	REF	REF	REF	REF	5-34	R1551
P-H	5905-752-6396	592 RESISTOR, FIED, COMPOSITION: E84R75 (01121)	1,2	EA	1				*	*	2	10	6	5-34	R1552
P-R	5905-883-9198	593 RESISTOR, FIXED, FILM: RN65DIO01F (81349)	1,2	EA	1				*	*	2	10	6	5-34	R1553
P-H	5905-892-6475	594 RESISTOR, FIXED, FILM: SAME AS 266	1,2	EA	1				REF	REF	REF	REF	REF	5-34	R1560
P-H	5905-192-0390	595 RESISTOR, FIXED, COMPOSITION: SAME AS 24	1,2	EA	2				REF	REF	REF	REF	REF	5-34	R1561, R1563
P-H	5905-279-1754	596 RESISTOR, FIXED, COMPOSITION: SAME AS 165	1,2	EA	2				REF	REF	REF	REF	REF	5-34	R1564, R1568
P-H	5930-757-7702	597 SWITCH, ROTARY: 3100-0784-9 (28480)	1	EA	2				*	2	2	13	6	5-33	S502, S504
P-H	5930-795-9386	597A SWITCH, ROTARY: 19912-523 (28569)	2	EA	2				*	2	2	13	10	5-33	S502, S504
P-H	5930-757-3080	598 SWITCH, ROTARY: 3100-0785-9 (28480)	1	EA	1				*	*	2	8	3	5-34	S505

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
A-H		599 DUAL CHANNEL VERTICAL AMPLIFIER ETCHED CIRCUIT ASSEMBLY: 162A-65E(N) (28480)	1	EA	1								5-31	A501	
A-H		600 DUAL CHANNEL VERTICAL AMPLIFIER ETCHED CIRCUIT ASSEMBLY: 2420-748 (28569)	2	EA									5-31	A501	
P-H	5910-993-8367	601 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1.2	EA	3				REF	REF	REF	REF	REF	5-31	C503,C504,C516
P-H	5910-688-2822	602 CAPACITOR, FIXED, PAPER DIELECTRIC: CPOSAIKBI04K3 (81349)	1.2	EA	2				*	2	2	13	6	5-31	C517,C518
P-H	5910-822-5682	603 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 96	1.2	EA	2				REF	REF	REF	REF	REF	5-31	C522,C523
P-H	5961-814-0768	604 SEMICONDUCTOR DEVICE, DIODE: SAME AS 124	1.2	EA	2				REF	REF	REF	REF	REF	5-31	CR501,CR505
P-H	5950-504-6510	605 COIL, RADIOFREQUENCY: C577 (95265)	1.2	EA	4				*	2	2	19	12	5-31	L501,L502, L511,L512
P-H	5950-823-1209	606 COIL, RADIOFREQUENCY: MS16222-9 (81349)	1	EA	4				*	2	2	19	12	5-31	L503,L505, L508,L510
P-H	5950-701-5926	607 COIL, RADIOFREQUENCY: SAME AS 21	2	EA	4				REF	REF	REF	REF	REF	5-31A	L503,L505, L508,L510
P-H	5950-754-9896	608 COIL, RADIOFREQUENCY: SAME AS 16	1	EA	4				REF	REF	REF	REF	REF	5-31	L514,L515, L518,L519
P-H	5950-053-8245	609 COIL, RADIOFREQUENCY: SAME AS 17	2	EA	4				REF	REF	REF	REF	REF	5-31A	L514,L515,L518, L519
P-H	5950-752-3549	610 COIL, RADIOFREQUENCY: MS75008-3 (81349)	1	EA	2				*	2	2	13	6	5-31	L516,L517
P-H	5950-892-8209	611 COIL, RADIOFREQUENCY: M575008-23 (81349)	2	EA	2				*	2	2	13	6	5-31A	L516,L517
P-H	5961-062-2320	612 TRANSISTOR: SAME AS 235	1.2	EA	4				REF	REF	REF	REF	REF	5-31	Q501,Q502,Q503, Q504
P-H	5905-299-2022	613 RESISTOR, FIXED, COMPOSITION: SAME AS 397	1.2	EA	4				REF	REF	REF	REF	REF	5-31	R501,R502,R54R, R549
P-H	5905-755-0797	614 RESISTOR, FIXED, COMPOSITION: RC07GF560K (81349)	1	EA	8				2	2	3	40	39	5-31	R503,R505,R527, R528, R545,R547, R550,R551
P-H	5905-802-6730	615 RESISTOR, FIXED, COMPOSITION: SAME AS 66	2	EA	8				REF	REF	REF	REF	REF	5-31A	R503,R505,R527, R528, R545,R547, R550,R551
P-H	5905-715-0770	616 RESISTOR, FIXED, FILM: SAME AS 78	1.2	EA	8				REF	REF	REF	REF	REF	5-31	R507,R509,R519, R521, R529,R531, R542,R544
P-H	5905-809-4788	617 RESISTOR, VARIABLE: RWF2-90 (71450)	1.2	EA	1				*	*	2	10	8	5-31	R510A/B
P-H	5905-766-8362	618 RESISTOR, VARIABLE, WIREWOUND: RL20S303J (81349)	1.2	EA	4				*	2	2	16	12	5-31	R512,R513,R538, R539
P-H	5905-171-1986	619 RESISTOR, FIXED, COMPOSITION: SAME AS 182	1	EA	2				REF	REF	REF	REF	REF	5-31	R514,R537
P-H	5905-767-7594	620 RESISTOR, FIXED, FILM: SAME AS 183	2	EA	7				REF	REF	REF	REF	REF	5-31A	R514,R537
P-H	5905-195-6741	621 RESISTOR, FIXED, COMPOSITION: SAME AS 166	1	EA	7				REF	REF	REF	REF	REF	5-31	R515,R536
P-H	5905-775-0637	677 RESISTOR, FIXED, FILM: RL20S272J (81349)	7	EA	2				*	2	2	13	10	5-31	R515,R536
P-H	5905-726-5328	623 RESISTOR, FIXED, FILM: RN60BI1301F (81349)	1	EA	4				*	2	2	16	17	5-31	R516,R517,R534, R535
P-H	5905-800-8321	624 RESISTOR, FIXED, FILM: RN60D1271F (81349)	2	EA	4				*	2	2	16	12	5-31A	R516,R517,R534, R535

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCTY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-583-6233	625 RESISTOR, FIXED, FILM: RN65B1502F (81349)	1	EA	4				*	2	2	16	12	5-31	R518, R522, R532, R533
P-H	5905-855-7207	626 RESISTOR, FIXED, FILM: RN65D1472F (81349)	2	EA	4				*	2	2	16	12	5-31A	R518, R522, R532, R533
P-H	5905-557-2422	627 RESISTOR, FIXED, FILM: SAME AS 92	1	EA	4				REF	REF	REF	REF	REF	5-31	R523, R524, R584, R585
P-H	5905-936-1540	628 RESISTOR, FIXED, FILM: RN75C4931D (81349)	2	EA	4				*	2	2	16	12	5-31A	R523, R524, R584, R585
P-H	5905-817-7971	629 RESISTOR, FIXED, COMPOSITION: SAME AS 75	1.2	EA	2				REF	REF	REF	REF	REF	5-31	R525, R576
P-H	5905-764-7690	630 RESISTOR, FIXED, FILM: RL425202J (81349)	1.2	EA	1				*	*	*	5	3	5-31	R552
P-H	5905-726-6433	631 RESISTOR, FIXED, COMPOSITION: RC07GF222K (81349)	1	EA	4				*	2	2	16	12	5-31	R571 thru R574
P-H	5905-683-7723	632 RESISTOR, FIXED, COMPOSITION: RC07GF152K (81349)	2	EA	4				*	2	2	16	12	5-31A	R571 thru R574
P-H	5905-818-7071	633 RESISTOR, FIXED, WIREWOUND: RW55GR471 (81349)	1.2	EA	1				*	*	*	5	3	5-31	R575
P-H	5905-185-6575	634 RESISTOR, FIXED, COMPOSITION: RC20GF392K (81349)	1	EA	2				*	*	2	10	6	5-31	R580, R581
P-H	5905-767-3229	635 RESISTOR, FIXED, FILM: RL20S392J (81349)	2	EA	2				*	*	2	10	6	5-31A	R580, R581
P-H	5905-683-2235	636 RESISTOR, FIXED, COMPOSITION: RC07GC680J (81349)	1.2	EA	4				*	2	2	16	12	5-31	R582, R583, R588, R589
P-H	5905-192-3973	637 RESISTOR, FIXED, COMPOSITION: SAME AS 27	1	EA	2				REF	REF	REF	REF	REF	5-31	R586, R587
P-H	5905-279-3513	638 RESISTOR, FIXED, COMPOSITION: SAME AS 130	2	EA	2				REF	REF	REF	REF	REF	5-31A	R586, R587
P-H	5935-808-9569	639 SOCKET, ELECTRON TUBE: SAME AS 43	1	EA	4				REF	REF	REF	REF	REF	5-31	XV501, XV502, XV504, XV505
P-H	5935-990-2827	640 SOCKET, ELECTRON TUBE: SAME AS 44	2	EA	4				REF	REF	REF	REF	REF	5-31A	XV501, XV502, XV504, XV505
P-H	5935-849-9455	641 SOCKET, ELECTRON TUBE: SAME AS 45	1.2	EA	2				REF	REF	REF	REF	REF	5-31	XV503, XV506
A-H		642 VERTICAL SWITCHING ETCHED CIRCUIT ASSEMBLY: 162A-65F(N) (28480)	1	EA	1									5-32	A502
A-H		643 VERTICAL SWITCHING ETCHED CIRCUIT ASSEMBLY: 2420-747 (28569)	2	EA	1									5-32A	A502
P-H	5910-993-8367	644 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1.2	EA	6				REF	REF	REF	REF	REF	5-32	C506, C507, C508, C511, C515, C519
P-H	5910-578-5543	645 CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: SAME AS 51	1.2	EA	2				REF	REF	REF	REF	REF	5-32	C509, C510
P-H	5961-814-0768	646 SEMICONDUCTOR DEVICE, DIODE: SAME AS 124	1.2	EA	3				REF	REF	REF	REF	REF	5-32	CR502, CR503, CR504
P-H	5961-892-0748	647 SEMICONDUCTOR DEVICE, DIODE: 1N979B (81349)	1.2	EA	1				*	*	2	8	3	5-32	CR506
P-H	5950-802-0913	648 COIL, RADIOFREQUENCY: SAME AS 307	1	EA	1				REF	REF	REF	REF	REF	5-32	L513
P-H	5950-880-0347	649 COIL, RADIOFREQUENCY: SAME AS 308	2	EA	1				REF	REF	REF	REF	REF	5-32A	L513
P-H	5905-171-1986	650 RESISTOR, FIXED, COMPOSITION: SAME AS 182	1	EA	1				REF	REF	REF	REF	REF	5-32	R526
P-H	5905-767-7594	651 RESISTOR, FIXED, FILM: SAME AS 183	2	EA	1				REF	REF	REF	REF	REF	5-32A	R526
P-H	5905-755-0797	652 RESISTOR, FIXED, COMPOSITION: SAME AS 614	1	EA	4				REF	REF	REF	REF	REF	5-32	R554, R558, R564, R567

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-802-6730	653 RESISTOR, FIXED, COMPOSITION: SAME AS 66	2	EA	4				REF	REF	REF	REF	REF	5-32A	R554, R558, R564, R567
P-H	5905-254-9201	654 RESISTOR, FIXED, COMPOSITION: SAME AS 97	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R555
P-H	5905-804-6099	655 RESISTOR, FIXED, FILM: SAME AS 133	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R556
P-H	5905-299-2025	656 RESISTOR, FIXED, COMPOSITION: SAME AS 168	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R557
P-H	5905-192-0390	657 RESISTOR, FIXED, COMPOSITION: SAME AS 24	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R559
P-H	5905-185-8516	658 RESISTOR, FIXED, COMPOSITION: SAME AS 247	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R560
P-H	5905-767-6832	659 RESISTOR, FIXED, FILM: SAME AS 29	1,2	EA	2				REF	REF	REF	REF	REF	5-32	R562, R569
P-H	5905-552-3522	660 RESISTOR, FIXED, FILM: RN70B1823F (81349)	1	EA	4				*	2	2	16	12	5-32	R563, R565, R566, R568
P-H	5905-984-1993	661 RESISTOR, FIXED, FILM: RN70C1803D (81349)	2	EA	4				*	2	2	16	12	5-32A	R563, R565, R566, R568
P-H	5905-914-6435	662 RESISTOR, FIXED, FILM: SAME AS 323	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R570
P-H	5905-195-6806	663 RESISTOR, FIXED, COMPOSITION: SAME AS 34	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R579
P-H	5905-190-8880	664 RESISTOR, FIXED, COMPOSITION: RC20GF122J (81349)	1,2	EA	2				*	*	2	10	6	5-32	R591, R592
P-H	5905-192-3973	665 RESISTOR, FIXED, COMPOSITION: SAME AS 27	1,2	EA	1				REF	REF	REF	REF	REF	5-32	R593
P-H	6240-539-8959	666 LAMP, GLOW: SAME AS 85	1,2	EA	1				REF	REF	REF	REF	REF	5-32	V509
P-H	5935-763-2258	667 SOCKET, ELECTRON TUBE: 121-51-11-124 (71785)	1	EA	2				*	*	2	10	6	5-32	XV507, XV508
P-H	5935-841-7102	668 SOCKET, ELECTRON TUBE: 121-51-11-079 (71785)	2	EA	2				*	*	2	10	16	5-32A	XV507, XV508
A-H		669 VERNIER/SENSITIVITY SWITCH ASSEMBLY: 162A-34C(N) (28480)	1	EA	1									5-33	A503
A-H		670 VERNIER/SENSITIVITY SWITCH ASSEMBLY: 1920-30 (28569)	2	EA	1									5-33	A503
P-H	5930-057-5260	671 SWITCH ASSEMBLY: 19915-678 (28569)	2	EA	2				*	2	2	8	5	5-33	A1502, A1503
P-H	5910-728-2144	672 CAPACITOR, FIXED, PLASTIC DIELECTRIC: SAME AS 201	1	EA	2				REF	REF	REF	REF	REF	5-33	C1501, C1502
P-H	5910-976-3686	673 CAPACITOR, FIXED, PLASTIC DIELECTRIC: SAME AS 202	2	EA	2				REF	REF	REF	REF	REF	5-46A	C1501, C1502
P-H	5910-577-7925	674 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CC20CH200G (81349)	1	EA	2				*	2	2	13	10	5-33	C1503, C1546
P-H	5910-926-8036	675 CAPACITOR, FIXED, CERAMIC DIELECTRIC: 301-651COH829C (72982)	1	EA	8				2	2	3	32	40	5-46A	C1500, C1543, C1546, C1549
			2	EA	7				*	2	2	26	35	5-33	C1589 C1503, C1506, C1589
P-H	5910-275-6419	676 CAPACITOR, VARIABLE, PLASTIC DIELECTRIC: SAME AS 48	1,2	EA	37				REF	REF	REF	REF	REF	5-33	C1504, C1505, C1508, C1509, C1512, C1513, C1516, C1517, C1520, C1521, C1524, C1526, C1528, C1530, C1532, C1534, C1536, C1538, C1547, C1548, C1551, C1552, C1555, C1556, C1559, C1560, C1563, C1564, C1567, C1569, C1571, C1573, C1575, C1577, C1579, C1581, C1590

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCV	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5910-195-5157	677 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CC20CH10C (81349)	1	EA	16				2	3	5	48	48	5-33	C1506, C1507, C1518, C1522, C1525, C1529, C1533, C1537, C1549, C1550, C1561, C1565, C1568, C1572, C1576, C1580
			2	EA	14				2	2	3	43	42	5-33	C1507, C1518, C1522, C1525, C1529, C1533, C1537, C1550, C1561, C1565, C1568, C1572, C1576, C1580
P-H	5910-725-7647	678 CAPACITOR, FIXED, MICA DIELECTRIC: SAME AS 338	1,2	EA	2				REF	REF	REF	REF	REF	5-33	C1510, C1553
P-H	5910-556-9427	679 CAPACITOR, FIXED, CERAMIC DIELECTRIC: CC20CH050C (81349)	1,2	EA	4				*	2	2	19	12	5-33	C1511, C1514, C1554, C1557
P-H	5910-804-2377	680 CAPACITOR, FIXED, MICA DIELECTRIC: CM15C390JN3 (81349)	1,2	EA	4				*	2	2	16	12	5-33	C1515, C1519, C1558, C1562
P-H	5910-717-0169	681 CAPACITOR, FIXED, MICA DIELECTRIC: SAME AS 113	1,2	EA	2				REF	REF	REF	REF	REF	5-33	C1523, C1566
P-H	5910-893-7514	682 CAPACITOR, FIXED, MICA DIELECTRIC: CB11RD221J (81349)	1,2	EA	2				*	2	2	13	6	5-33	C1527, C1570
P-H	5910-816-9909	683 CAPACITOR, FIXED, MICA DIELECTRIC: CB11RD471 (81349)	1,2	EA	2				*	2	2	13	6	5-33	C1531, C1574
P-H	5910-990-6796	684 CAPACITOR, FIXED, MICA DIELECTRIC: CB11RE102G (81349)	1,2	EA	2				*	2	2	13	6	5-33	C1535, C1578
P-H	5910-806-3772	685 CAPACITOR, FIXED, MICA DIELECTRIC: M23-2000-E5-500V (00853)	1,2	EA	2				*	*	2	8	3	5-33	C1539, C1582
P-H	5910-543-0823	686 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 112	1,2	EA	4				REF	REF	REF	REF	REF	5-33	C1540, C1541, C1544, C1545
P-H	5910-883-4781	687 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 301	1,2	EA	2				REF	REF	REF	REF	REF	5-33	C1588, C1595
P-H	5905-809-4788	689 RESISTOR, VARIABLE: SAME AS 617	1,2	EA	1				REF	REF	REF	REF	REF	5-33	R540A/B
P-H	5905-894-3305	690 RESISTOR, FIXED, WIREWOUND: RW32G103 (81349)	1,2	EA	1				*	*	*	5	3	5-33	R590
P-H	5905-755-0797	691 RESISTOR, FIXED, COMPOSITION: SAME AS 614	1	EA	2				REF	REF	REF	REF	REF	5-33	R1500, R1530
P-H	5905-802-6730	692 RESISTOR, FIXED, COMPOSITION: SAME AS 66	2	RA	2				REF	REF	REF	REF	REF	5-33	R1500, R1530
P-H	5905-951-8520	693 RESISTOR, FIXED, FILM: RN65D6043F (81349)	1,2	EA	2				*	*	2	10	6	5-33	R1501, R1531
P-H	5905-951-4930	694 RESISTOR, FIXED, FILM: RN65D6653F (81349)	1,2	EA	4				*	*	2	10	6	5-33	R1502, R1532, R1533, R1534
P-H	5905-728-2774	695 RESISTOR, FIXED, FILM: RN65C7963D (81349)	1,2	EA	1				*	*	2	10	6	5-33	R1503
P-H	5905-814-3871	696 RESISTOR, FIXED, FILM: RN65D2493F (81349)	1,2	EA	1				*	*	2	10	6	5-33	R1504
P-H	5905-985-6059	697 RESISTOR, FIXED, FILM: SAME AS 225	1,2	RA	2				REF	REF	REF	REF	REF	5-33	R1505, R1535
P-H	5905-990-5020	698 RESISTOR, FIXED, FILM: SAME AS 226	1,2	EA	2				REF	REF	REF	REF	REF	5-33	R1506, R1536
P-H	5905-062-6661	699 RESISTOR, FIXED, FILM: RN65D9533F (81349)	1,2	EA	2				*	*	2	10	6	5-33	R1507, R1537
P-H	5905-577-7503	700 RESISTOR, FIXED, FILM: RN65B4122F (81349)	1	EA	2				*	*	2	10	6	5-33	R1508, R1538
P-H	5905-901-7883	701 RESISTOR, FIXED, FILM: RN65C4172D (81349)	2	EA	2				*	*	2	10	6	5-33	R1508, R1538

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5905-983-5479	702 RESISTOR, FIXED, FILM: RN65D9763F (81349)	1,2	EA	2				*	*	2	10	6	5-33	R1509, R1539
P-H	5905-978-7402	703 RESISTOR, FIXED, FILM: RN65C2032D (81349)	1,2	EA	2				*	*	2	10	6	5-33	R1510, R1540
P-H	5905-892-6475	704 RESISTOR, FIXED, FILM: SAME AS 266	1,2	EA	9				REF	REF	REF	REF	REF	5-33	R1511, R1514, R1517, R1520, R1524, R1541, R1544, R1547, R1550
P-H	5905-817-7971	705 RESISTOR, FIXED, COMPOSITION: SAME AS 75	1,2	EA	6				REF	REF	REF	REF	REF	5-33	R1512, R1515, R1518, R1542, R1545, R1548
P-H	5905-810-0507	706 RESISTOR, FIXED, FILM: RN60C1022F (81349)	1	EA	2				*	*	2	10	6	5-33	R1513, R1543
P-H	5905-062-6290	707 RESISTOR, FIXED, FILM: RN65C1012D (81349)	2	EA	2				*	*	2	10	16	5-33	R1513, R1543
P-H	5905-969-5857	708 RESISTOR, FIXED, FILM: RN65D4021F (81349)	1,2	EA	2				*	*	2	10	6	5-33	R1516, R1546
P-H	5905-087-6524	709 RESISTOR, FIXED, FILM: RN65D2001F (81349)	1,2	EA	2				*	*	2	10	6	5-33	R1519, R1549
P-H	5905-279-3513	710 RESISTOR, FIXED, COMPOSITION: SAME AS 130	1,2	EA	1				REF	REF	REF	REF	REF	5-33	R1521
P-H	5905-752-6396	711 RESISTOR, FIXED, COMPOSITION: SAME AS 592	1,2	EA	1				REF	REF	REF	REF	REF	5-33	R1522
P-H	5905-883-9198	712 RESISTOR, FIXED, FILM: SAME AS 593	1,2	EA	1				REF	REF	REF	REF	REF	5-33	R1523
P-H	5930-861-0412	713 SWITCH, ROTARY: PA200 (71590)	1	EA	2				*	2	2	13	6	5-33	5501, S503
P-H	5930-795-9388	714 SWITCH, ROTARY: 19912-428 (28569)	2	EA	2				*	2	2	13	6	5-33	S501, S503
P-H	5930-757-7702	715 SWITCH, ROTARY: SAME AS 597	1	EA	1				REF	REF	REF	REF	REF	5-33	S504
P-H	5950-757-7703	716 TRANSFORMER, PULSE: 162A60AN (28480)	1	EA	1				*	*	*	5	3	5-33	T501
P-H	5950-795-9381	717 TRANSFORMER, PULSE: 20800-262 (28569)	2	EA	1				*	*	*	5	3	5-33	T501
P-H	5935-258-1767	718 COVER, ELECTRICAL CONNECTOR CW-123AVU: SAME AS 466	2	EA	2				REF	REF	REF	REF	REF	5-13	E501, E502
P-H	5935-843-9008	719 CONNECTOR, RECEPTACLE, ELECTRICAL: SAME AS 474	1	EA	2				REF	REF	REF	REF	REF	5-30	J501, J502
P-H	5935-552-7660	720 CONNECTOR, RECEPTACLE, ELECTRICAL 00-625B/U: SAME AS 475	2	EA	2				REF	REF	REF	REF	REF	5-30	J501, J502
P-H	5910-805-2327	721 KNOB: 0370-0037-9 (28480)	1	EA	2				*	*	2	10	6	5-30	MP505, MP506
P-H	5355-656-1322	722 KNOB: SAME AS 482	2	EA	4				REF	REF	REF	REF	REF	5-30	MP505, MP506, MP511, MP512
P-H	5355-688-6955	723 KNOB: SAME AS 483	1	FA	2				REF	REF	REF	REF	REF	5-30	MP507, MP508
P-H	5355-656-1319	724 KNOB: SAME AS 484	2	EA	4				REF	REF	REF	REF	REF	5-30	MF507, MP508, MP509, MP510
P-H	5355-965-4881	725 KNOB: SAME AS 485	1	EA	2				REF	REF	REF	REF	REF	5-30	MP509, MP510
P-H	5355-728-2881	726 KNOB: SAME AS 486	1	EA	2				REF	REF	REF	REF	REF	5-30	MP511, MP512
P-H	5355-682-3544	727 KNOB: SAME AS 492	1	EA	1				REF	REF	REF	REF	REF	5-30	MP513
P-H	5355-656-1318	728 KNOB: SAME AS 491 MP514, MP515	2	EA	3				REF	REF	REF	REF	REF	5-30	MP513,
P-H	5355-725-3925	729 KNOB: 0370-0084-9 (28480) MP515	1	EA	2				*	*	2	10	6	5-30	MPF514,
P-H	5355-809-9332	730 KNOB: 0370-0088-9 (28480)	1	EA	1				*	*	2	10	6	5-30	MP516
P-H	5960-686-8087	731 SHIELD, ELECTRON TUBE: TS103U02 (81349)	1,2	EA	2				*	*	*	5	3	5-30	MP517, MP518

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-H	5940-543-8538	732 INSULATOR, FEEDTHRU: SAME AS 497	2	EA	6				REF	REF	REF	REF	REF	5-30	MP520 thru MP525
P-H	5935-258-5811	733 CONNECTOR, RECEPTACLE, ELECTRICAL: 26-4100-16P (02660)	1,2	EA	1				*	*	*	5	3	5-30	P501
P-H	5905-643-5626	734 RESISTOR, VARIABLE: RV4NAYS0502A (81349)	1,2	EA	2				*	*	2	10	6	5-30	R504, R546
P-H	5905-539-5013	735 RESISTOR, VARIABLE: RV4NAYS0252A (81349)	1,2	EA	2				*	*	2	10	6	5-30	R508, R543
P-H	5930-757-3081	736 SWITCH, ROTARY: 3100-0786-9 (28480)	1	EA	2				*	2	2	13	6	5-30	S506, S507
P-H	5930-795-9384	737 SWITCH, ROTARY: 19912-522 (28569)	2	EA	2				*	2	2	13	6	5-30	S506, S507
P-H	5960-806-5614	738 ELECTRON TUBE: SAME AS 42	1,2	EA	8				REF	REF	REF	REF	REF	5-6	V501 thru V508
P-C-S	6625-961-5888	739 OSCILLOSCOPE SUBASSEMBLY, HORIZONTAL CHANNEL AUXILIARY PLUG-IN UNIT MX-3078/USM	1	EA	1				*	*	*	5	3	5-36	A2000
P-C-S		739A OSCILLOSCOPE SUBASSEMBLY, HORIZONTAL CHANNEL AUXILIARY PLUG-IN UNIT MX-3078B/USM	2	EA	1				*	*	*	5	3	5-36	A2000
P-H	5910-993-8367	740 CAPACITOR, FIXED, CERAMIC DIELECTRIC: SAME AS 10	1,2	EA	1				REF	REF	REF	REF	REF	5-36	C2001
P-H	5961-814-0768	741 SEMICONDUCTOR DEVICE, DIODE: SAME AS 124	1,2	EA	1				REF	REF	REF	REF	REF	5-36	CR2001
P-H	6240-892-4420	742 LAMP, GLOW: SAME AS 462	1,2	EA	1				REF	REF	REF	REF	REF	5-36	DS2001
P-H	5935-258-1767	743 COVER, ELECTRICAL CONNECTOR CW-123A/U: SAME AS 466	1,2	EA	2				REF	REF	REF	REF	REF	5-36	E2001, E2002
P-H	5935-843-9008	744 CONNECTOR, RECEPTACLE, ELECTRICAL: SAME AS 474	1	EA	2				REF	REF	REF	REF	REF	5-36	J2001, J2002
P-H	5935-552-7660	745 CONNECTOR, RECEPTACLE, ELECTRICAL: SAME AS 475	2	EA	2				REF	REF	REF	REF	REF	5-36	J2001, 32002
P-H	5355-809-9332	746 KNOB: SAME AS 730	1	EA	1				REF	REF	REF	REF	REF	5-36	M20001
P-H	5325-709-1480	747 LATCH, FASTENER: 48-20-101-10 (94222)	1,2	EA	1				*	*	*	5	3	5-36	MP2002
P-H	5935-201-6511	748 CONNECTOR, RECEPTACLE, ELECTRICAL: 26-4100-32P (02660)	1,2	EA	1				*	*	*	5	3	5-36	O2001
P-H	5905-192-0390	749 RESISTOR, FIXED, COMPOSITION: SAME AS 24	1,2	EA	1				REF	REF	REF	REF	REF	5-36	R2001
P-H	5930-655-1515	750 SWITCH, TOGGLE: M535058-23 (81349)	1	EA	1				*	*	2	8	3	5-36	S2001
P-H	5930-655-1508	751 SWITCH, TOGGLE: MS35058-23 (81349)	2	EA	2				*	*	2	8	3	5-36	S2001, S2002
P-R	5930-655-1582	752 SWITCH, TOGGLE: M5S35059-23 (81349)	1	EA	1				*	*	2	8	3	5-36	S2002
M-H		753 TERMINAL BOARD: SAME AS 561	1	EA	1									5-36	TB2001
M-H		754 TERMINAL BOARD: 1542A (71785)	2	EA	1									5-36	TB2001
P-H	6210-809-4274	755 LAMP HOLDER: SAME AS 573	1	EA	1				REF	REF	REF	REF	REF	5-36	XDS2001
P-H	6210-078-7626	756 LIGHT, INDICATOR: LH74LC13CN (81349)	2	EA	1				*	*	2	8	5	5-36	XDS2001
P-O	6625-072-5227	757 TEST PROD MX-2817/U	1	EA	2				*	*	2	8	4	5-35	A601, A602
P-O	6625-758-4949	758 GROUND CABLE: 5060-0401 (28480)	1	EA	2				*	2	2	8	4	5-35	W603, W604
P-O	6625-973-4775	759 PROD, TEST MX-4073A/U	2	EA	2				*	*	*	5	6	5-35A	

SECTION V. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION USABLE ON CODE REFERENCE NUMBER & MFR CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE			(7) 30 DAY GS MAINT ALLOWANCE			(8) 1-YR ALW PER EQUIP CNTGCT	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS		
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION	
P-O		760 NUT, LOCKING: 6115-3 (28569)	2	EA	1				*	*	*	4	3	5-35A	E702
P-O	6625-167-9297	761 PROBE, TIP: 16975-54 (28569)	2	EA	1				*	*	*	5	3	5-35A	E703
P-O	6625-167-9798	762 PROBE, TIP: 16975-62 (28569)	2	EA	1				*	*	*	5	3	5-35A	E704
P-O	5935-502-0342	763 PROBE, TIP: 100 (83330)	2	EA	1				*	*	*	5	3	5-35A	E704
P-O	6625-167-9793	764 PROBE, TIP: 16970-63 (28569)	2	EA	1				*	*	*	5	3	5-35A	E706
P-O	6625-167-9794	765 PROBE, TIP: 16970-64 (28569)	2	EA	1				*	*	*	5	3	5-35A	E707
P-O	6625-167-9795	766 PROBE, TIP: 16970-75 (28569)	2	EA	1				*	*	*	5	3	5-35A	E708
P-O	6625-453-5650	767 CABLE ASSEMBLY: 3030-163 (28569)	2	EA	1				*	*	*	5	3	5-35A	W701
P-O	6625-436-1588	768 LEAD, GROUND: 3030-164 (28569)	2	EA	1				*	*	*	5	3	5-35A	W701

**SECTION VII. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE
TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION (CONTINUED)**

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
4110-727-8796	2-2	MP147	5905-062-6661	5-33	R1507
4140-050-6356	5-12	MP419	5905-062-6661	5-33	R1537
4450-801-4051	5-12	MP419	5905-069-4508	5-17	R119
5325-709-1480	5-36	MP2002	5905-069-4508	5-17	R141
5330-917-7011	1-1	HP609	5905-069-9928	5-15	R55
5355-656-1318	5-13	MP301	5905-069-9928	5-15	R70
5355-656-1318	5-13	MP302	5905-078-6916	5-21	R238
5355-656-1318	5-13	MP303	5905-078-6916	5-21	R239
5355-656-1318	5-13	MP304	5905-078-6916	5-21	R240
5355-656-1318	5-13	MP402	5905-078-6916	5-21	R241
5355-656-1318	5-30	MP513	5905-078-8756	5-15A	R56
5355-656-1318	5-30	MP514	5905-078-8756	5-15A	R71
5355-656-1318	5-30	MP515	5905-078-8801	5-27	R359
5355-656-1319	5-13	MP103	5905-078-8810	5-21	R233
5355-656-1319	5-13	MP104	5905-078-8810	5-25	R344
5355-656-1319	5-13	MP105	5905-079-4448	5-17	R160
5355-656-1319	5-13	MP203	5905-087-6524	5-33	R1519
5355-656-1319	5-30	MP507	5905-087-6524	5-33	R1549
5355-656-1319	5-30	MP508	5905-088-5936	5-25	R350
5355-656-1319	5-30	MP509	5905-100-7936	5-11	R265
5355-656-1319	5-30	MP510	5905-100-7936	5-11	R270
5355-656-1321	5-13	MP201	5905-102-2740	5-27	R366
5355-656-1322	5-13	MP101	5905-171-1976	5-17A	R135
5355-656-1322	5-13	MP102	5905-171-1976	5-17A	R138
5355-656-1322	5-13	MP106	5905-171-1976	5-17	R179
5355-656-1322	5-13	MP202	5905-171-1976	5-24	R208
5355-656-1322	5-30	MP505	5905-171-1976	5-10	R422
5355-656-1322	5-30	MP506	5905-171-1976	5-10	R440
5355-656-1322	5-30	MP511	5905-171-1986	5-17	R180
5355-656-1322	5-30	MP512	5905-171-1986	5-11	R400
5355-682-3543	5-13	MP301	5905-171-1986	5-44A	R400
5355-682-3543	5-13	MP302	5905-171-1986	5-31	R514
5355-682-3543	5-13	MP303	5905-171-1986	5-32	R526
5355-682-3543	5-13	MP402	5905-171-1986	5-31	R.537
5355-682-3544	5-13	MP304	5905-171-1998	5-14	R41
5355-682-3544	5-30	MP513	5905-171-1998	5-27	R355
5355-688-6955	5-13	MP103	5905-171-1998	5-10	R401
5355-688-6955	5-30	MP507	5905-171-2000	5-14	R36
5355-688-6955	5-30	MP508	5905-171-2004	5-19	R161
5355-725-3925	5-30	MP514	5905-171-2004	5-17	R176
5355-725-3925	5-30	MP515	5905-185-6575	5-31	R580
5355-728-2881	5-13	MP106	5905-185-6575	5-31	R581
5355-728-2881	5-30	MP511	5905-185-8510	5-19	R102
5355-728-2881	5-30	MP512	5905-185-8510	5-12	R310
5355-737-4883	5-13	MP101	5905-185-8510	5-27	R327
5355-737-4883	5-13	MP102	5905-185-8516	5-23	R254
5355-737-4883	5-13	MP202	5905-185-8516	5-23	R255
5355-755-6804	5-13	MP201	5905-185-8516	5-32	R560
5355-809-9332	5-30	MP516	5905-190-8880	5-32	R591
5355-809-9332	5-36	MP2001	5905-190-8880	5-32	R592
5355-965-4881	5-13	MP104	5905-190-8882	5-10	R401
5355-965-4881	5-13	MP105	5905-190-8883	5-14	R40
5355-965-4881	5-13	MP203	5905-190-8889	5-17	R188
5355-965-4881	5-30	MP509	5905-190-8889	5-17	R190
5355-965-4881	5-30	MP510	5905-190-8889	5-24	R207
5905-050-1128	5-25	R349	5905-190-8889	5-29	R409
5905-050-1128		R354	5905-192-0390	5-14	R2
5905-054-0349	5-13	R216	5905-192-0390	5-14	a4
5905-054-0399	5-17A	R169	5905-192-0390	5-14	R19
5905-056-6269	5-18A	R1011	5905-192-0390	5-14	a22
5905-057-9659	5-18	R1015	5905-192-0390	5-14	R26
5905-057-9659	5-18	R1016	5905-192-0390	5-14	R30
5905-062-0539	5-17A	R146	5905-192-0390	5-20	R103
5905-062-1496	5-15A	R50	5905-192-0390	5-17	R115
5905-062-1496	5-15A	R52	5905-192-0390	5-17	R133
5905-062-1496	5-15A	R67	5905-192-0390	5-26	R305
5905-062-1496	5-15A	R68	5905-192-0390	5-12	R311
5905-062-6290	5-33	R1513	5905-192-0390	5-32	R559
5905-062-6290	5-33	R1543	5905-192-0390	5-34	R1561

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FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5905-192-0390	5-34	R1563	5905-252-4018	5-17	R187
5905-192-0390	5-36	R2001	5905-252-4018	5-17	R189
5905-192-0626	5-17	R135	5905-252-4018	5-24A	R214
5905-192-0626	5-17	R138	5905-252-4018	5-24A	R218
5905-192-0626	5-24	R208	5905-252-4018	5-24A	R224
5905-192-0626	5-10	R422	5905-252-4018	5-23A	R249
5905-192-0626	5-10	R440	5905-252-4018	5-23A	R253
5905-192-0662	5-17	R168	5905-252-4018	5-23A	R256
5905-192-0662	5-18	R1006	5905-252-4018	5-23A	R257
5905-192-0662	5-18	R1007	5905-252-4018	5-23A	R266
5905-192-0667	5-17A	R168	5905-252-4018	5-23A	R269
5905-192-0667	5-23	R258	5905-252-4018	5-24	R277
5905-192-3971	5-29A	R425	5905-252-4018	5-26A	R306
5905-192-3972	5-23	R271	5905-252-4018	5-26	R337
5905-192-3973	5-14	R8	5905-252-4018	5-26	R339
5905-192-3973	5-14	R9	5905-252-4018	5-29	R463
5905-192-3973	5-14	R32	5905-253-1229	5-10	R458
5905-192-3973	5-17A	R153	5905-254-7087	5-26	R303
5905-192-3973	5-27A	R325	5905-254-9201	5-9	R88
5905-192-3973	5-31	R586	5905-254-9201	5-19	R101
5905-192-3973	5-31	R587	5905-254-9201	5-20	R106
5905-192-3973	5-32	R593	5905-254-9201	5-19	R164
5905-192-4490	5-29	R417	5905-254-9201	5-26	R312
5905-195-5571	5-17A	R108	5905-254-9201	5-27	R334
5905-195-6741	5-17	R158	5905-254-9201	5-32	R555
5905-195-6741	5-23	R272	5905-257-0926	5-14	R39
5905-195-6741	5-31	R518	5905-257-0926	5-23	R278
5905-195-6741	5-31	R536	5905-257-0937	5-17A	R144
5905-195-6752	5-17	R144	5905-257-0937	5-23	R274
5905-195-6752	5-23	R268	5905-257-0937	5-23	R275
5905-195-6752	5-23A	R268	5905-259-2990	5-17	R165
5905-195-6752	5-26	R336	5905-279-1697	5-27	R326
5905-195-6754	5-26A	R302	5905-279-1723	5-14	R28
5905-195-6756	5-26	R302	5905-279-1754	5-17	R156
5905-195-6761	5-24	R206	5905-279-1754	5-27	R332
5905-195-6761	5-23	R244	5905-279-1754	5-26	R338
5905-195-6761	5-23	R264	5905-279-1754	5-26	R340
5905-195-6761	5-26	R309	5905-279-1754	5-34	R1564
5905-195-6761	5-27	R364	5905-279-1754	5-34	R1568
5905-195-6791	5-29	R451	5905-279-1757	5-17	R123
5905-195-6799	5-17	R153	5905-279-1757	5-17A	R123
5905-195-6799	5-27	R325	5905-279-1757	5-17	R125
5905-195-6806	5-14	R29	5905-279-1757	5-23A	R272
5905-195-6806	5-14	R172	5905-279-1757	5-34	R561
5905-195-6806	5-26	R308	5905-279-1876	5-14	R25
5905-195-6806	5-32	R579	5905-279-1876	5-17	R132
5905-249-3663	5-10	R402	5905-279-1876	5-17A	R158
5905-249-4195	5-17A	R125	5905-279-1883	5-18	R1001
5905-249-4227	5-17	R182	5905-279-1898	5-17	R108
5905-249-4243	5-24	R217	5905-279-1898	5-17	R117
5905-252-4018	5-14	RI	5905-279-1898	5-17	R122
5905-252-4018	5-14	R3	5905-279-1898	5-17	R124
5905-252-4018	5-14	R18	5905-279-1898	5-17	R136
5905-252-4018	5-14	R21	5905-279-1898	5-17	R140
5905-252-4018	5-17	R117	5905-279-1898	5-17	R143
5905-252-4018	5-17	R122	5905-279-1898	5-17	R150
5905-252-4018	5-17	R124	5905-279-1898	5-17	R151
5905-252-4018	5-17	R136	5905-279-1898	5-17	R154
5905-252-4018	5-17	R140	5905-279-1898	5-17	R155
5905-252-4018	5-17	R143	5905-279-1898	5-17	R167
5905-252-4018	5-17	R150	5905-279-1898	5-17	R173
5905-252-4018	5-17	R151	5905-279-1898	5-17	R175
5905-252-4018	5-17	R154	5905-279-1898	5-17	R181
5905-252-4018	5-17	R155	5905-279-1898	5-17	R186
5905-252-4018	5-17	R167	5905-279-1898	5-17	R187
5905-252-4018	5-17	R173	5905-279-1898	5-17	R189
5905-252-4018	5-17	R175	5905-279-1898	5-24	R214
5905-252-4018	5-17	R181	5905-279-1898	5-24	R218
5905-252-4018	5-17	R186	5905-279-1898	5-24	R224

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FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5905-279-1898	5-23	R249	5905-299-2023	5-11	R1010
5905-279-1898	5-23	R253	5905-299-2025	5-17	R159
5905-279-1898	5-23	R256	5905-299-2025	5-32	R557
5905-279-1898	5-23	R257	5905-299-2025	5-11	R,010
5905-279-1898	5-23	R266	5905-299-2027	5-27	R362
5905-279-1898	5-23	R269	5905-299-2027	5-27	R365
5905-279-1898	5-26	R306	5905-299-2049	5-21	R210
5905-279-1900	5-27	R322	5905-299-2051	5-14	R7
5905-279-1900	5-27	R323	5905-473-5251	5-14	R24
5905-279-2298	5-27	R313	5905-501-5184	5-10	R163
5905-279-2298	5-27	R314	5905-501-5184	5-10	R361
5905-279-2298	5-27	R315	5905-501-7314	5-10	R178
5905-279-2298	5-27	R316	5905-501-7314	5-10	R1002
5905-279-2298	5-27	R317	5905-501-7314	5-10	R1003
5905-279-2298	5-27	R318	5905-501-7314	5-10	R1004
5905-279-2298	5-27	R331	5905-501-7314	5-10	R1024
5905-279-2298	5-27	R333	5905-503-5984	5-9	R13
5905-279-2298	5-27A	R334	5905-503-6218	5-11	R464
5905-279-2303	5-17	R145	5905-503-9138	5-15	R50
5905-279-2303	5-23	R276	5905-503-9138	5-15	R52
5905-279-2504	5-26A	R338	5905-503-9138	5-15	R67
5905-279-2504	5-26A	R340	5905-503-9138	5-15	R68
5905-279-2514	5-18	R1005	5905-518-5595	5-10	R411
5905-279-2515	5-20	R104	5905-518-5609	5-9	R321
5905-279-2515	5-17	R116	5905-518-5609	5-22	R202
5905-279-2515	5-17	R137	5905-518-5609	5-22	R212
5905-279-2515	5-17	R157	5905-518-5644	5-18	R1014
5905-279-2515	5-26	R304	5905-539-2567	5-10	R431
5905-279-2515	5-18A	R1005	5905-539-4900	5-13	R363
5905-279-2527	5-17A	R182	5905-539-5013	5-30	R508
5905-279-2528	5-17A	R145	5905-539-5013	5-30	R543
5905-279-2616	5-17	R177	5905-542-9113	5-29	R432
5905-279-2675	5-24A	R217	5905-542-9835	5-11	R439
5905-279-3416	5-10	R423	5905-549-3752	5-11	R405
5905-279-3416	5-10	R441	5905-549-3752	5-11	R406
5905-279-3416	5-9	R457	5905-549-3752	5-11	R407
5905-279-3494	5-17	R147	5905-549-3752	5-11	R438
5905-279-3499	5-27	R328	5905-549-5382	5-9	R96
5905-279-3499	5-27	R356	5905-552-0614	5-17	R171
5905-279-3503	5-29	R447	5905-552-2093	5-10	R114
5905-279-3504	5-23	R273	5905-552-2093	5-10	R243
5905-279-3504	5-29	R459	5905-552-3522	5-32	R563
5905-279-3513	5-17	R107	5905-552-3522	5-32	R565
5905-279-3513	5-31A	R586	5905-552-3522	5-32	R566
5905-279-3513	5-31A	R587	5905-552-3522	5-32	R568
5905-279-3513	5-18	R1021	5905-552-5051	5-29	R433
5905-279-3513	5-33	R1521	5905-552-5051	5-18	R1018
5905-279-3513	5-34	R1551	5905-552-5051	5-18	R1019
5905-279-3527	5-21	R1023	5905-552-5051	5-18	R1020
5905-279-5621	5-18	R1011	5905-552-5136	5-23	R246
5905-295-3403	5-25	R341	5905-552-5136	5-23	R260
5905-295-3403	5-27	R357	5905-553-2389	5-23	R250
5905-299-1541	5-14	R23	5905-553-2389	5-23	R252
5905-299-1541	5-14	R27	5905-553-9299	5-15	R49
5905-299-1541	5-17	R11	5905-553-9299	5-15	R51
5905-299-1541	5-17	R112	5905-553-9299	5-15	R65
5905-299-1541	5-29	R443	5905-553-9299	5-15	R66
5905-299-1541	5-29	R462	5905-556-3339	5-17	R118
5905-299-1986	5-26A	R319	5905-556-4003	5-17	R169
5905-299-1987	5-26	R319	5905-556-4003	5-23	R248
5905-299-2013	5-29	R461	5905-556-4003	5-23	R251
5905-299-2016	5-27	R360	5905-557-2422	5-16	R75
5905-299-2020	5-29	R426	5905-557-2422	5-16	R76
5905-299-2020	5-29	R448	5905-557-2422	5-16	R81
5905-299-2022	5-29	R444	5905-557-2422	5-16	R82
5905-299-2022	5-31	R501	5905-557-2422	5-31	R523
5905-299-2022	5-31	R502	5905-557-2422	5-31	R524
5905-299-2022	5-31	R548	5905-557-2422	5-31	R584
5905-299-2022	5-31	R549	5905-557-2422	5-31	R585

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5905-577-7207	5-9	R99	5905-752-6396	5-34	R1552
5905-577-7503	5-33	R1508	5905-752-7300	5-21	R235
5905-577-7503	5-33	R1538	5905-755-0797	5-31	R503
5905-581-1645	5-17	R146	5905-755-0797	5-31	R505
5905-581-7467	5-25	R347	5905-755-0797	5-31	R527
5905-583-6233	5-31	R518	5905-755-0797	5-31	R528
5905-583-6233	5-31	R522	5905-755-0797	5-31	R545
5905-583-6233	5-31	R532	5905-755-0797	5-31	R547
5905-583-6233	5-31	R533	5905-755-0797	5-31	R550
5905-642-1680	5-11	R265	5905-755-0797	5-31	R551
5905-642-1680	5-11	R270	5905-755-0797	5-32	R554
5905-642-1969	5-11	R442	5905-755-0797	5-32	R558
5905-643-5626	5-30	R504	5905-755-0797	5-32	R564
5905-643-5626	5-30	R546	5905-755-0797	5-32	R567
5905-646-5716	5-18	R1012	5905-755-0797	5-33	R1500
5905-646-5716	5-18	R1013	5905-755-0797	5-33	R1530
5905-646-5716	5-18	R1026	5905-762-3660	5-25	R352
5905-646-5716	5-18	R1027	5905-762-6907	5-26	R367
5905-646-5958	5-10	R211	5905-764-7690	5-31	R552
5905-646-5958	5-11	R452	5905-766-8362	5-31	R512
5905-666-2556	5-9	R87	5905-766-8362	5-31	R513
5905-681-5979	5-23	R245	5905-766-8362	5-31	R538
5905-681-5979	5-23	RZ59	5905-766-8362	5-31	R539
5905-682-0230	5-14	R38	5905-766-8364	5-15	R46
5905-683-2235	5-31	R582	5905-766-8364	5-15	R62
5905-683-2235	5-31	R583	5905-767-3204	5-15	R98
5905-683-2235	5-31	R588	5905-767-3204	5-29	R434
5905-683-2235	5-31	R589	5905-767-3219	5-29	R437
5905-683-2246	5-15	R53	5905-767-3220	5-15	R91
5905-683-2246	5-15	R69	5905-767-3220	5-15	R94
5905-683-7721	5-15	R77	5905-767-3229	5-31A	R580
5905-683-7721	5-15	R83	5905-767-3229	5-31A	R581
5905-683-7721	5-15A	R90	5905-767-3231	5-29	R449
5905-683-7721	5-15A	R93	5905-767-3233	5-29	R429
5905-683-7723	5-13A	R571	5905-767-6832	5-14	R20
5905-683-7723	5-13A	R572	5905-767-6832	5-32	R562
5905-683-7723	5-13A	R573	5905-767-6832	5-32	R569
5905-683-7723	5-13A	R574	5905-767-7587	5-29	R416
5905-715-0770	5-15	R89	5905-767-7587	5-29	R435
5905-715-0770	5-15	R92	5905-767-7594	5-17A	R180
5905-715-0770	5-31	R507	5905-767-7594	5-31A	R514
5905-715-0770	5-31	R509	5905-767-7594	5-32A	R526
5905-715-9770	5-31	R519	5905-767-7594	5-31A	R537
5905-715-0770	5-31	R521	5905-768-5791	5-18A	R1006
5905-715-0770	5-31	R529	5905-769-5453	5-13	R324
5905-715-0770	5-31	R531	5905-769-8529	5-29A	R426
5905-715-0770	5-31	R542	5905-769-8529	5-29A	R448
5905-715-0770	5-31	R544	5905-769-8533	5-14	R5
5905-717-3342	5-34	R553	5905-769-8533	5-14	R6
5905-717-3343	5-17	RI110	5905-769-8533	5-14	R12
5905-721-4363	5-17A	R152	5905-769-8533	5-14	R14
5905-722-0054	5-17	R120	5905-769-8533	5-14	R31
5905-722-0136	5-23	R267	5905-769-8533	5-17	R113
5905-726-5328	5-31	R516	5905-769-8633	5-29	R428
5905-726-5328	5-31	R517	5905-769-8533	5-29	R450
5905-726-5328	5-31	R534	5905-774-8125	5-15	R97
5905-726-5328	5-31	R535	5905-775-0637	5-31A	R515
5905-726-5343	5-34	R561	5905-775-0637	5-31A	R536
5905-726-5346	5-34	R553	5905-779-2009	5-27	R360
5905-726-6433	5-31	R571	5905-779-2376	5-29A	R427
5905-726-6433	5-31	R572	5905-782-0269	5-21	R237
5905-726-6433	5-31	R573	5905-782-0269	5-21	R242
5905-726-6433	5-31	R574	5905-782-0901	5-17	R142
5905-726-6837	5-15	R90	5905-782-0901	5-29	R430
5905-726-6837	5-15	R93	5905-783-8818	5-11	R1009
5905-728-2774	5-33	R1503	5905-793-2176	5-19	R162
5905-730-0294	5-29	R415	5905-793-3064	5-21	R209
5905-734-4730	5-25	R351	5905-793-3064	5-21A	R209
5905-752-6396	5-33	R1522	5905-793-3065	5-10	R223A/B

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FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5905-795-0651	5-13	R330	5905-882-0055	5-23	R271
5905-800-8321	5-31A	R516	5905-883-9198	5-33	R1523
5905-800-8321	5-31A	R517	5905-883-9198	5-34	R1553
5905-800-8321	5-31A	R534	5905-884-0788	5-17	R121
5905-800-8321	5-31A	R535	5905-884-0788	5-17	R148
5905-802-6730	5-15	R48	5905-884-0788	5-17	R149
5905-802-6730	5-15	R64	5905-884-0788	5-22	R201
5905-802-6730	5-31A	R503	5905-884-0788	5-22	R213
5905-802-6730	5-31A	R505	5905-892-0158	5-13	R368
5905-802-6730	5-31A	R527	5905-892-6475	5-24	R205
5905-802-6730	5-31A	R528	5905-892-6475	5-24	R215
5905-802-6730	5-31A	R545	5905-892-6475	5-33	R1511
5905-802-6730	5-31A	R547	5905-892-6475	5-33	R1514
5905-802-6730	5-31A	R550	5905-892-6475	5-33	R1517
5905-802-6730	5-31A	R551	5905-892-6475	5-33	R1520
5905-802-6730	5-32	R554	5905-892-6475	5-33	R1524
5905-802-6730	5-32	R558	5905-892-6475	5-33	R1541
5905-802-6730	5-32A	R564	5905-892-6475	5-33	R1547
5905-802-6730	5-32A	R567	5905-892-6475	5-33	R1548
5905-802-6730	5-33	R1500	5905-892-6475	5-34	R1560
5905-802-6730	5-33	R1530	5905-892-6479	5-17	R139
5905-804-6088	5-13	R1025	5905-892-6479	5-17	R170
5905-804-6098	5-24	R221	5905-892-7108	5-27	R358
5905-804-6098	5-24	R222	5905-894-3305	5-33	R590
5905-804-6099	5-17	R109	5905-901-7883	5-33	R1508
5905-804-6099	5-29	R408	5905-901-7883	5-33	R1538
5905-804-6099	5-32	R556	5905-902-0676	5-15	R54
5905-804-6100	5-17	R13	5905-903-6828	5-29	R445
5905-805-1432	5-29	R427	5905-903-6829	5-14	R37
5905-809-4788	5-31	R510A	5905-913-3072	5-14	R39
5905-809-4788	5-31	R510B	5905-914-6435	5-26A	R336
5905-809-4788	5-33	R540A/B	5905-914-6435	5-32	R570
5905-810-0507	5-33	R1513	5905-916-7727	5-23A	R246
5905-810-0507	5-33	R1543	5905-916-7727	5-23A	R260
5905-811-9399	5-11	R424	5905-933-3787	5-15	R80
5905-814-3871	5-33	R1504	5905-933-3787	5-15	R86
5905-814-7578	5-15	R45	5905-936-1536	5-23A	R245
5905-814-7578	5-15	R61	5905-936-1536	5-23A	R259
5905-814-8413	5-15A	R80	5905-936-1537	5-17A	R148
5905-814-8413	5-15A	R86	5905-936-1537	5-17A	R149
5905-814-8413	5-21A	R210	5905-936-1537	5-22A	R201
5905-817-7971	5-15	R78	5905-936-1537	5-22A	R213
5905-817-7971	5-15	R79	5905-936-1539	5-17A	R171
5905-817-7971	5-15	R84	5905-936-1540	5-31A	R523
5905-817-7971	5-15	R85	5905-936-1540	5-31A	R524
5905-817-7971	5-31	R525	5905-936-1540	5-31A	R584
5905-817-7971	5-31	R576	5905-936-1540	5-31A	R585
5905-817-7971	5-33	R1512	5905-950-2856	5-12	R460
5905-817-7971	5-33	R1515	5905-951-1478	5-14	R11
5905-817-7971	5-33	R1518	5905-951-1478	5-14	R16
5905-817-7971	5-33	R1542	5905-951-1478	5-15	R47
5905-817-7971	5-33	R1545	5905-951-1478	5-15	R63
5905-817-7971	5-33	R1548	5905-951-4930	5-33	R1502
5905-818-7071	5-31	R575	5905-951-4930	5-33	R1532
5905-841-7440	5-11	R421	5905-951-4930	5-33	R1533
5905-842-5895	5-9	R95	5905-951-4930	5-33	R1534
5905-847-4306	5-13	R368	5905-951-8520	5-33	R1501
5905-852-4474	5-29	R410	5905-951-8520	5-33	R1531
5905-852-4474	5-29	R412	5905-954-9088	5-25	R348
5905-852-4476	5-17	R131	5905-957-0445	5-25	R346
5905-855-4075	5-11	R403	5905-957-0446	5-21	R234
5905-855-4075	5-11	R424	5905-969-5857	5-33	R1516
5905-855-7207	5-31A	R518	5905-969-5857	5-33	R1546
5905-855-7207	5-31A	R522	5905-975-1273	5-29A	R432
5905-855-7207	5-31A	R532	5905-975-1273	5-29	R446
5905-855-7207	5-31A	R533	5905-975-1300	5-29A	R433
5905-880-2206	5-18A	R1007	5905-975-4347	5-27A	R362

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FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5905-975-4347	5-27A	R365	5910-275-6419	5-33	C1534
5905-975-4358	5-17	R152	5910-275-6419	5-33	C1536
5905-975-4362	5-23A	R276	5910-275-6419	5-33	C1538
5905-978-7402	5-33	R1510	5910-275-6419	5-33	C1547
5905-978-7402	5-33	R1540	5910-275-6419	5-33	C1548
5905-983-5479	5-33	R1509	5910-275-6419	5-33	C1551
5905-983-5479	5-33	R1539	5910-275-6419	5-33	C1552
5905-983-5819	5-23A	R248	5910-275-6419	5-33	C1555
5905-983-5819	5-23A	R251	5910-275-6419	5-33	C1556
5905-983-7147	5-13	R216	5910-275-6419	5-33	C1559
5905-984-1993	5-32A	R563	5910-275-6419	5-33	C1560
5905-984-1993	5-32A	R565	5910-275-6419	5-33	C1563
5905-984-1993	5-32A	R566	5910-275-6419	5-33	C1564
5905-984-1993	5-32A	R568	5910-275-6419	5-33	C1567
5905-985-6058	5-26	R335	5910-275-6419	5-33	C1569
5905-985-6058	5-26	R342	5910-275-6419	5-33	C1571
5905-985-6058	5-29	R413	5910-275-6419	5-33	C1573
5905-985-6059	5-22	R203	5910-275-6419	5-33	C1575
5905-985-6059	5-33	R1505	5910-275-6419	5-33	C1577
5905-985-6059	5-33	R1535	5910-275-6419	5-33	C1579
5905-988-0143	5-25	R343	5910-275-6419	5-33	C1581
5905-988-0149	5-18A	R1018	5910-275-6419	5-33	C1590
5905-988-0149	5-18A	R1019	5910-280-9608	5-27	C312
5905-988-0149	5-18A	R1020	5910-280-9608	5-27	C313
5905-988-2251	5-29	R425	5910-284-4756	5-34	C1592
5905-989-5579	5-17	R174	5910-284-4756	5-34	C1594
5905-990-5020	5-22	R204	5910-543-0821	5-17	C117
5905-990-5020	5-23	R247	5910-543-0823	5-17	C110
5905-990-5020	5-33	R1506	5910-543-0823	5-33	C1540
5905-990-5020	5-33	R1536	5910-543-0823	5-33	C1541
5905-990-9556	5-21	R236	5910-543-0823	5-33	C1544
5905-993-5953	5-25	R353	5910-543-0823	5-33	C1545
5905-993-5968	5-18	R1017	5910-543-0823	5-34	C1587
5905-993-5987	5-25	R345	5910-556-9427	5-33	C1511
5910-052-2025	5-9	C425	5910-556-9427	5-33	C1514
5910-064-2344	5-14	C9	5910-556-9427	5-33	C1554
5910-088-0385	5-17	C132	5910-556-9427	5-33	C1557
5910-195-5157	5-33	C151	5910-556-9440	5-17	C121
5910-195-5157	5-33	C1506	5910-556-9440	5-22	C204
5910-195-5157	5-33	C1507	5910-577-7925	5-33	C1503
5910-195-5157	5-33	C1522	5910-577-7925	5-33	C1546
5910-195-5157	5-33	C1525	5910-578-1623	5-16	C28
5910-195-5157	5-33	C1529	5910-578-1623	5-16	C29
5910-195-5157	5-33	C1533	5910-578-1623	5-22	C201
5910-195-5157	5-33	C1537	5910-578-1623	5-22	C207
5910-195-5157	5-33	C1549	5910-578-1623	5-23	C211
5910-195-5157	5-33	C1550	5910-578-1623	5-23	C213
5910-195-5157	5-33	C1561	5910-578-1623	5-18	C1010
5910-195-5157	5-33	C1565	5910-578-1623	5-18	C1012
5910-195-5157	5-33	C1568	5910-578-1623	5-18	C1014
5910-195-5157	5-33	C1572	5910-578-1623	5-18	C1016
5910-195-5157	5-33	C1576	5910-578-5543	5-15	C31
5910-195-5157	5-33	C1580	5910-578-5543	5-23	C216
5910-275-6419	5-15	C20	5910-578-5543	5-32	C509
5910-275-6419	5-33	C1504	5910-578-5543	5-32	C510
5910-275-6419	5-33	C1505	5910-615-9519	5-10A	C411
5910-275-6419	5-33	C1508	5910-615-9519	5-10A	C420
5910-275-6419	5-33	C1509	5910-686-6603	5-27	C307
5910-275-6419	5-33	C1512	5910-686-6603	5-27	C308
5910-275-6419	5-33	C1513	5910-686-6603	5-27	C309
5910-275-6419	5-33	C1516	5910-686-6603	5-27	C311
5910-275-6419	5-33	C1517	5910-688-2822	5-31	C517
5910-275-6419	5-33	C1520	5910-688-2822	5-31	C518
5910-275-6419	5-33	C1521	5910-717-0169	5-17	C114
5910-275-6419	5-33	C1524	5910-717-0169	5-33	C1523
5910-275-6419	5-33	C1526	5910-717-0169	5-33	C1566
5910-275-6419	5-33	C1530	5910-725-4795	5-18	C1009
5910-275-6419	5-33	C1532	5910-725-7647	5-27	C314
5910-275-6419	5-33	C1532	5910-725-7647	5-18	C1015

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FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5910-725-7647	5-33	C1510	5910-827-0175	5-11	C410
5910-725-7647	5-33	C1553	5910-838-0869	5-26A	C303
5910-727-3554	5-17A	C109	5910-851-7794	5-26	C304
5910-727-3554	5-17	C134	5910-857-7280	5-10A	C403
5910-727-3554	5-17A	C134	5910-867-0118	5-23	C212
5910-727-9848	5-18	C1003	5910-867-0118	5-23	C214
5910-728-2144	5-21	C202	5910-874-6903	5-26	C305
5910-728-2144	5-26	C302	5910-879-4764	5-23	C222
5910-728-2144	5-29	C409	5910-883-4781	5-26	C303
5910-728-2144	5-29	C412	5910-883-4781	5-33	C1588
5910-728-2144	5-29	C417	5910-883-4781	5-33	C1595
5910-728-2144	5-33	C1501	5910-883-4781	5-34	C1591
5910-728-2144	5-33	C1502	5910-889-4777	5-14	C11
5910-728-2212	5-12	C306	5910-889-4777	5-18	C1011
5910-728-2212	5-12	C315	5910-892-7395	5-17	C107
5910-754-6956	5-9	C425	5910-893-7514	5-33	C1527
5910-760-7924	5-25	C318	5910-893-7514	5-33	C1570
5910-762-2945	5-18A	C1004	5910-926-8036	5-46A	C1500
5910-803-2880	5-29	C419	5910-926-8036	5-33	C1503
5910-804-2372	5-26	C316	5910-926-8036	5-33	C1506
5910-804-2372	5-26	C317	5910-926-8036	5-46A	C1543
5910-804-2377	5-33	C1515	5910-926-8036	5-46A	C1546
5910-804-2377	5-33	C1519	5910-926-8036	5-46A	C1549
5910-804-2377	5-33	C1558	5910-926-8036	5-33	C1589
5910-804-2377	5-33	C1562	5910-934-0327	5-14	C2
5910-805-2327	5-30	MP505	5910-934-0327	5-14	C7
5910-805-2327	5-30	MP506	5910-934-0327	5-14	C8
5910-806-3772	5-33	C1539	5910-934-0327	5-14	C10
5910-806-3772	5-33	C1582	5910-934-0327	5-14	C12
5910-807-2595	5-17A	C124	5910-934-0327	5-14	C13
5910-807-2595	5-17	C133	5910-934-0327	5-17	C138
5910-807-2595	5-17A	C133	5910-934-0327	5-24	C221
5910-807-2595	5-18	C1013	5910-934-0327	5-28	C404
5910-807-5570	5-23	C215	5910-934-0327	5-28	C405
5910-807-5570	5-28	C407	5910-934-0327	5-28	C406
5910-807-5570	5-29	C426	5910-936-7514	5-18	C1008
5910-807-9305	5-17A	C124	5910-952-9440	5-18	C1006
5910-807-9305	5-18	C1004	5910-959-4596	5-18	C1007
5910-809-1121	5-10	C403	5910-976-3686	5-21A	C202
5910-809-4773	5-10	C401	5910-976-3686	5-21A	C302
5910-809-4773	5-11	C408	5910-976-3686	5-29A	C409
5910-809-4773	5-10	C416	5910-976-3686	5-29A	C412
5910-809-4774	5-10	C411	5910-976-3686	5-29A	C417
5910-809-4773	5-10	C420	5910-976-3686	5-46A	C1501
5910-816-6613	5-15	C32	5910-976-3686	5-46A	C1502
5910-816-6613	5-17	C109	5910-990-6796	5-33	C1535
5910-816-6613	5-17	C143	5910-990-6796	5-33	C1578
5910-816-6613	5-22	C205	5910-993-8367	5-14	C1
5910-816-9909	5-10	C1531	5910-993-8367	5-14	C14
5910-816-9909	5-33	C1574	5910-993-8367	5-14	C15
5910-819-5745	5-26	C301	5910-993-8367	5-15	C21
5910-819-5745	5-18	C1002	5910-993-8367	5-15	C22
5910-820-6114	5-18	C1001	5910-993-8367	5-15	C25
5910-822-5682	5-20	C103	5910-993-8367	5-15	C26
5910-822-5682	5-17	C106	5910-993-8367	5-15	C27
5910-822-5682	5-17	C123	5910-993-8367	5-15	C30
5910-822-5682	5-17	C136	5910-993-8367	5-15	C33
5910-822-5682	5-19	C130	5910-993-8367	5-15	C34
5910-822-5682	5-31	C522	5910-993-8367	5-15	C35
5910-822-5682	5-31	C523	5910-993-8367	5-19	C101
5910-823-1056	5-34	C1592	5910-993-8367	5-20	C104
5910-823-1056	5-34	C1594	5910-993-8367	5-17	C116
5910-823-1068	5-15	C23	5910-993-8367	5-17	C122
5910-823-1068	5-15	C24	5910-993-8367	5-17	C135
5910-823-1068	5-17	C102	5910-993-8367	5-17	C137
5910-826-1203	5-17	C108	5910-993-8367	5-17A	C138
5910-825-4546	5-17	C105	5910-993-8367	5-17	C139
5910-827-0175	5-17	C119			
5910-827-0175	5-11	C402			

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5910-993-8367	5-17	C140	5935-052-2899	5-9	XV305
5910-993-8367	5-17	C141	5935-082-0481	5-9	J1
5910-993-8367	5-17	C142	5935-149-3534	1-1	CP603
5910-993-8367	5-24	C206	5935-149-3534	1-1	CP604
5910-993-8367	5-26	C310	5935-201-6511	5-36	P2001
5910-993-8367	5-29	C413	5935-237-6457	5-9	XV305
5910-993-8367	5-29	C418	5935-258-1767	5-13	E101
5910-993-8367	5-29A	C418	5935-258-1767	5-13	E102
5910-993-8367	5-31	C503	5935-258-1767	5-13	E104
5910-993-8367	5-31	C504	5935-258-1767	5-13	E201
5910-993-8367	5-32	C506	5935-258-1767	5-13	E301
5910-993-8367	5-32	C507	5935-258-1767	5-13	E302
5910-993-8367	5-32	C508	5935-258-1767	5-13	E501
5910-993-8367	5-32	C511	5935-258-1767	5-13	E502
5910-993-8367	5-32	C515	5935-258-1767	5-36	E2001
5910-993-8367	5-31	C516	5935-258-1767	5-36	E2002
5910-993-8367	5-32	C519	5935-258-5811	5-30	P501
5910-993-8367	5-34	C1593	5935-295-6950	5-12	J105
5910-993-8367	5-36	C2001	5935-502-0342	5-35A	E704
5915-809-9638	5-12	FL401	5935-502-5151	5-13	J301
5920-280-4465	5-10	F404	5935-502-5151	5-13	J302
5920-280-4465	5-10	F405	5935-552-7660	5-13	Jio01
5920-280-8344	5-11	F403	5935-552-7660	5-13	J102
5920-295-9270	5-11	F406	5935-552-7660	5-13	J104
5920-519-7733	5-11	F401	5935-552-7660	5-13	J203
5920-519-7733	5-11	F402	5935-552-7660	5-30	J501
5920-660-6705	5-11	XF401	5935-552-7660	5-30	J502
5920-660-6705	5-11	XF402	5935-552-7660	5-36	J2001
5920-660-6705	5-11	XF403	5935-552-7660	5-36	J2002
5920-660-6705	5-11	XF404	5935-577-2281	1-1	P601
5920-660-6705	5-11	XF405	5935-577-2281	1-1	P602
5920-660-6705	5-11	XF406	5935-577-2281	1-1	P603
5920-894-4556	5-11	F401	5935-577-2281	1-1	P604
5920-894-4556	5-11	F402	5935-683-7892	1-1	CP605
5930-054-0356	5-18A	A1000	5935-683-7892	1-1	CP606
5930-054-0358	5-34	A500	5935-687-1779	5-26A	XV304
5930-057-5260	5-33	A1502	5935-687-1779	5-26A	XV307
5930-057-5260	5-33	A1503	5935-688-3404	5-26A	XV301
5930-655-1508	5-36	S2001	5935-688-3404	5-26A	XV306
5930-655-1508	5-36	S2002	5935-688-3404	5-26A	XV310
5930-655-1514	5-13	S201	5935-688-3404	5-26A	XV311
5930-655-1515	5-36	S2001	5935-753-7565	5-26	XV308
5930-655-1575	5-13	S401	5935-753-7565	5-26	XV309
5930-655-1582	5-36	S2002	5935-763-2258	5-32	XV507
5930-757-3076	5-19	S101	5935-763-2258	5-32	X9508
5930-757-3077	5-20	S102	5935-805-4991	1-1	P402
5930-757-3078	5-21	S202	5935-808-9569	5-14	XV1
5930-757-3079	5-18	S1001	5935-808-9569	5-14	XV4
5930-757-3080	5-34	S505	5935-808-9569	5-14	XV5
5930-757-3081	5-30	S506	5935-808-9569	5-15	XV7
5930-757-3081	5-30	S507	5935-808-9569	5-15	XV10
5930-757-7699	5-25	S302	5935-808-9569	5-15	XV11
5930-757-7702	5-33	S502	5935-878-9569	5-17	XV101
5930-757-7702	5-33	S504	5935-808-9569	5-17	XV103
5930-757-7702	5-33	S504	5935-808-9569	5-17	XV104
5930-790-4889	5-11	S402	5935-808-9569	5-17	XV105
5930-795-9384	5-30	S506	5935-808-9569	5-17	XV107
5930-795-9384	5-30	S507	5935-808-9569	5-17	XV109
5930-795-9386	5-33	S502	5935-808-9569	5-17	XV113
5930-795-9386	5-33	S504	5935-808-9569	5-17	XV114
5930-795-9388	5-33	S501	5935-808-9569	5-17	XV115
5930-795-9388	5-33	S503	5935-808-9569	5-24	XV201
5930-809-4792	5-13	S1	5935-808-9569	5-24	XV202
5930-861-0412	5-33	S501	5935-808-9569	5-23	XV203
5930-861-0412	5-33	S503	5935-808-9569	5-23	XV204
5930-895-6393	5-11	S402	5935-808-9569	5-23	XV2C5
5930-936-3789	5-13	S1	5935-808-9569	5-23	XV206
5930-960-0158	5-20	S102	5935-808-9569	5-23	XV207
5930-960-0159	5-19	S101	5935-808-9569	5-26	XV301

**SECTION VII. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE
TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION (CONTINUED)**

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5935-808-9569	5-26	XV306	5940-543-8538	5-30	MP521
5935-808-9569	5-26	XV310	5940-543-8538	5-30	MP522
5935-808-9569	5-26	XV311	5940-543-8538	5-30	MP523
5935-808-9569	5-31	XV501	5940-543-8538	5-30	MP524
5935-808-9569	5-31	XV502	5940-543-8538	5-30	MP525
5935-808-9569	5-31	XV504	5950-052-0748	5-17	L102
5935-808-9569	5-31	XV505	5950-052-0748	5-17	L103
5935-823-0639	1-1	CP601	5950-052-2905	5-14A	L4
5935-823-0639	1-1	CP602	5950-052-2905	5-14A	L6
5935-841-7102	5-32A	XV507	5950-053-8245	5-14A	L3
5935-841-7102	5-32A	XV508	5950-053-8245	5-14A	L5
5935-843-7362	1-1	P401	5950-053-8245	5-15A	L21
5935-843-9008	5-13	J101	5950-053-8245	5-15A	L22
5935-843-9008	5-13	J102	5950-053-8245	5-31A	L514
5935-843-9008	5-13	J104	5950-053-8245	5-31A	L515
5935-843-9006	5-13	J201	5950-053-8245	5-31A	L518
5935-843-9008	5-13	J301	5950-053-8245	5-31A	L519
5935-843-9008	5-13	J302	5950-059-3904	5-17A	L101
5935-843-9008	5-30	J501	5950-504-6500	5-11	L402
5935-843-9008	5-30	J502	5950-504-6500	5-11	L404
5935-843-9008	5-36	J2001	5950-504-6505	5-9	T401
5935-843-9008	5-36	J2002	5950-504-6510	5-31	L501
5935-849-9455	5-14	XV2	5950-504-6510	5-31	L502
5935-849-9455	5-14	XV3	5950-504-6510	5-31	L511
5935-849-9455	5-15	XV6	5950-504-6510	5-31	L512
5935-849-9455	5-15	XV12	5950-701-5926	5-14A	L9
5935-849-9455	5-15	XV13	5950-701-5926	5-15A	L14
5935-849-9455	5-31	XV503	5950-701-5926	5-15A	L17
5935-849-9455	5-31	XV506	5950-701-5926	5-31A	L503
5935-850-6567	5-29A	XV401	5950-701-5926	5-31A	L505
5935-856-6987	5-26	XV304	5950-701-5926	5-31A	L508
5935-856-6987	5-26	XV307	5950-701-5926	5-31A	L510
5935-856-6987	5-29	XV401	5950-724-6209	5-15A	L13
5935-856-9441	1-1	CP607	5950-724-6209	5-15A	L16
5935-856-9441	1-1	CP608	5950-728-5333	5-14	L1
5935-856-9441	1-1	CP609	5950-728-5333	5-14	L2
5935-856-9441	1-1	CP610	5950-752-3549	5-31	L516
5935-962-8580	1-1	CP607	5950-752-3549	5-31	L517
5935-962-8580	1-1	CP608	5950-754-9896	5-14	L3
5935-962-8580	1-1	CP609	5950-754-9896	5-14	L5
5935-962-8580	1-1	CP610	5950-754-9896	5-15	L21
5935-990-2827	5-14	XV1	5950-754-9896	5-15	L22
5935-990-2827	5-14A	XV4	5950-754-9896	5-31	L514
5935-990-2827	5-14A	XV5	5950-754-9896	5-31	LS15
5935-990-2827	5-15A	XV7	5950-754-9896	5-31	L518
5935-990-2827	5-15A	XV10	5950-754-9896	5-31	L519
5935-990-2827	5-15A	XV11	5950-757-7700	5-9	T301
5935-990-2827	5-17A	XV101	5950-757-7703	5-33	T501
5935-990-2827	5-17A	XV103	5950-773-8948	5-15A	L19
5935-990-2827	5-17A	XV104	5950-773-8948	5-15A	L20
5935-990-2827	5-17A	XV105	5950-795-9381	5-33	T501
5935-990-2827	5-17A	XV107	5950-795-9383	5-9	T401
5935-990-2827	5-17A	XV109	5950-801-1525	5-15	L19
5935-990-2827	5-17A	XV113	5950-801-1525	5-15	L20
5935-990-2827	5-17A	XV114	5950-802-0913	5-26	L301
5935-990-2827	5-17A	XV115	5950-802-0913	5-32	L513
5935-990-2827	5-24A	XV201	5950-802-1805	5-17	L101
5935-990-2827	5-24A	XV202	5950-809-4459	5-23	L201
5935-990-2827	5-23A	XV203	5950-809-4459	5-23	L202
5935-990-2827	5-23A	XV204	5950-809-4797	5-10	L406
5935-990-2827	5-23A	XV205	5950-810-0824	5-10	L403
5935-990-2827	5-23A	XV206	5950-810-0824	5-10	L405
5935-990-2827	5-23A	XV207	5950-810-4611	5-14	L10
5935-990-2827	5-31A	XV501	5950-810-4611	5-14A	L10
5935-990-2827	5-31A	XV502	5950-812-2760	5-15	L13
5935-990-2827	5-31A	XV504	5950-812-2760	5-15	L16
5935-990-2827	5-31A	XV505	5950-823-1209	5-31	L503
5940-543-8538		MP420	5950-823-1209	5-31	L505
5940-543-8538	5-30	MP520	5950-823-1209	5-31	L508

**SECTION VII. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE
TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION (CONTINUED)**

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5950-823-1209	5-31	L510	5961-082-4201	5-17	CR101
5950-852-5167	5-14	L9	5961-082-4202	5-17	CR104
5950-852-5167	5-15	L14	5961-082-4203	5-10	Q403
5950-852-5167	5-15	L17	5961-082-4203	5-10	Q404
5950-880-0347	5-26A	L301	5961-082-4203	5-10	Q405
5950-880-0347	5-32A	L513	5961-082-4203	5-10	Q409
5950-892-8209	5-31A	L516	5961-082-4203	5-10	Q413
5950-892-8209	5-31A	L517	5961-082-4203	5-10	Q416
5950-893-1607	5-15	L15	5961-082-4203	5-10	Q418
5950-893-1607	5-15	L18	5961-082-4203	5-10	Q419
5950-893-1608	5-14	L4	5961-752-5229	5-29	Q401
5950-893-1608	5-14	L6	5961-752-5229	5-29A	Q401
5950-936-7655	5-15A	L15	5961-752-5229	5-29	Q402
5950-936-7655	5-15A	L18	5961-752-5229	5-29A	Q402
5950-957-3013	5-14A	L1	5961-752-5229	5-29A	Q406
5950-957-3013	5-14A	L2	5961-752-5229	5-29	Q407
5960-262-0185	5-6	V307	5961-752-5229	5-29A	Q407
5960-262-0286	5-6	V401	5961-752-5229	5-29	Q408
5960-272-8553	5-6	V308	5961-752-5229	5-29A	Q408
5960-272-8553	5-6	V309	5961-752-5229	5-29	Q412
5960-272-8553	5-6	V310	5961-752-5229	5-29A	Q412
5960-272-8553	5-6	V311	5961-752-5229	5-29	Q414
5960-615-0243	5-6	V109	5961-752-5229	5-29A	Q414
5960-615-0243	5-6	V204	5961-752-5229	5-29	Q415
5960-615-0243	5-6	V205	5961-752-5229	5-29A	Q415
5960-615-0243	5-6	V207	5961-811-5799	5-10	CR414
5960-669-6861	5-6	V304	5961-811-5799	5-10	CR415
5960-686-8087	5-30	MP517	5961-814-0768	5-17	CR102
5960-686-8087	5-30	MP518	5961-814-0768	5-31	CR501
5960-806-5614	5-6	V1	5961-814-0768	5-32	CR502
5960-806-5614	5-6	V2	5961-814-0768	5-32	CR503
5960-806-5614	5-6	V3	5961-814-0768	5-32	CR504
5960-806-5614	5-6	V4	5961-814-0768	5-31	CR505
5960-806-5614	5-6	V5	5961-814-0768	5-36	CR2001
5960-806-5614	5-15	V6	5961-846-7338	5-10	Q417
5960-806-5614	5-15	V7	5961-851-5923	5-29	Q406
5960-806-5614	5-15	V10	5961-851-5923	5-29	Q410
5960-806-5614	5-15	vil	5961-851-5923	5-29A	Q410
5960-806-5614	5-15	V12	5961-851-5923	5-29	Q411
5960-806-5614	5-15	V13	5961-851-5923	5-29A	Q411
5960-806-5614	5-6	vi01	5961-852-7549	5-17	CR103
5960-806-5614	5-6	V103	5961-852-7549	5-29	CR413
5960-806-5614	5-6	V104	5961-852-7549	5-29	CR416
5960-806-5614	5-6	V105	5961-883-4798	5-28	CR401
5960-806-5614	5-6	V107	5961-883-4798	5-28	CR402
5960-806-5614	5-6	V113	5961-883-4798	5-28	CR403
5960-806-5614	5-6	V114	5961-883-4798	5-28	CR404
5960-806-5614	5-6	V115	5961-883-4798	5-28	CR405
5960-806-5614	5-6	V201	5961-883-4798	5-28	CR406
5960-806-5614	5-6	V202	5961-883-4798	5-28	CR407
5960-806-5614	5-6	V203	5961-883-4798	5-28	CR408
5960-806-5614	5-6	V206	5961-883-4798	5-28	CR409
5960-806-5614	5-6	V301	5961-883-4798	5-28	CR410
5960-806-5614	5-6	V306	5961-883-4798	5-28	CR411
5960-806-5614	5-6	V501	5961-883-4798	5-28	CR412
5960-806-5614	5-6	V502	5961-892-0748	5-32	CR506
5960-806-5614	5-6	V503	5961-934-3002	5-10	Q403
5960-806-5614	5-6	V504	5961-934-3002	5-10	Q404
5960-806-5614	5-6	V505	5961-934-3002	5-10	Q405
5960-806-5614	5-6	V506	5961-934-3002	5-10	Q409
5960-806-5614	5-6	V507	5961-934-3002	5-10	Q413
5960-806-5614	5-6	V508	5961-934-3002	5-10	Q416
5960-881-6636	5-6	V305	5961-934-3002	5-10	Q418
5961-062-2320	5-23	Q201	5961-934-3002	5-10	Q419
5961-062-2320	5-23	Q202	5995-045-4579	5-9	DL301
5961-062-2320	5-31	Q501	5995-752-8781	1-1	A603
5961-062-2320	5-31	Q502	5995-752-8781	1-1	A604
5961-062-2320	5-31	Q503	5995-985-7744	1-1	A403
5961-062-2320	5-31	Q504	6105-134-9996	5-11A	B401

**SECTION VII. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE
TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION (CONTINUED)**

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	REFERENCE NO.	MFR. CODE	FIG. NO.	REF. DESIG OR ITEM NO.
6105-757-3075	5-11	B401	DA1AA11DA1	06540	5-9	TB1
6145-284-0579	1-1	W401	SC-B-83314-42	98003	1-1	MP605
6145-542-6092	1-1	W605	SC-B-83314-42	98003	1-1	MP606
6145-542-6092	1-1	W606	SC-B-83314-42	98003	1-1	MP607
6210-078-7626	5-36	XDS2001	SC-B-83314-42	98003	1-1	MP608
6210-809-4274	5-13	SDS401	1450-0024-9	28480	5-9	XDS403
6210-809-4274	5-36	XDS2001	1450-0024-9	28480	5-9	XDS404
6240-155-8706	5-9	DS403	1450-0024-9	28480	5-9	XDS405
6240-155-8706	5-9	DS404	1450-0024-9	28480	5-9	XDS406
6240-155-8706	5-9	DS405	1542A	71785	5-36	TB2001
6240-155-8706	5-9	DS406	162A-19D(N)	28480	5-34	A500
6240-155-8706	5-13	DS1001	162A-34C (N)	28480	5-33	A503
6240-179-1811	5-11	DS402	162A-65E (N)	28480	5-31	A501
6240-539-8959	5-11	DS402	162A-65F (N)	28480	5-32	A502
6240-539-8959	5-15	V8	170A-19A(N)	28480	5-21	A200
6240-539-8959	5-15	V9	170A-19B(N)	28480	5-18	A1000
6240-539-8959	5-17	V102	170A-19C(N)	28480	5-25	A300
6240-539-8959	5-17	V110	170A-19D(N)	28480	5-20	A103
6240-539-8959	5-17	V111	170A-19E(N)	28480	5-19	A100
6240-539-8959	5-17	V116	170A-65J(N)	28480	5-26	A301
6240-539-8959	5-26	V303	170A-65K(N)	28480	5-29	A402
6240-539-8959	5-32	V509	170A-65L(N)	28480	5-23	A202
6240-892-4420	5-13	DS401	170A-65M(N)	28480	5-28	A401
6240-892-4420	5-36	DS2001	170A-65N(N)	28480	5-24	A203
6250-283-9741	5-13	XDS001001	170A-65P(N)	28480	5-17	A101
6625-072-5227	5-35	A601	170A-65R(N)	28480	5-22	A201
6625-072-5227	5-35	A602	170A-65S(N)	28480	5-14	A1
6625-167-9297	5-35A	E703	170A-65T(N)	28480	5-16	A3
6625-167-9793	5-35A	E706	170A-65U(N)	28480	5-27	A302
6625-167-9794	5-35A	E707	170A-65V(N)	28480	5-15	A2
6625-167-9795	5-35A	E708	1920-30	28569	5-33	A503
6625-167-9798	5-35A	E704	19912-427	28569	5-25	S302
6625-436-1588	5-35A	W702	19912-527	28569	5-21	S202
6625-453-5650	5-35A	W701	19915-672	28569	5-21A	A200
6625-758-4949	5-35	W603	19915-674	28569	5-25	A300
6625-758-4949	5-35	W604	19915-675	28569	5-20	A103
6625-759-0741	1-1	A5	19915-676	28569	5-19	A100
6625-893-1795	5-9	DL1	20800-321	28569	5-9	T301
6625-893-1795	5-9	DL2	2420-574	28569	5-28A	A401
6625-960-4308	5-9	DL1	2420-734	28569	5-17A	A101
6625-960-4308	5-9	DL2	2420-735	28569	5-14A	A1
6625-961-5888	5-36	A2000	2420-736	28569	5-15A	A2
			2420-737	28569	5-26A	A301
			2420-738	28569	5-27A	A302
			2420-739	28569	5-16	A3
			2420-740	28569	5-23A	A202
			2420-741	28569	5-22A	A201
			2420-742	28569	5-24A	A203
			2420-743	28569	5-29A	A402
			2420-747	28569	5-32A	A502
			2420-748	28569	5-31	A501
			5040-0418	28480	5-9	MP306
			5040-0418	28480	5-9	MPF307
			5040-0702	28480	5-13	MP319
			5040-0702	28480	5-13	MP320
			5040-0702	28480	5-13	MP321
			5040-0702	28480	5-13	MP322
			599M-ST-5	75382	5-9	TB401
			599M-ST-5	75382	5-9	TB402
			599M-ST-5	75382	5-10	TB403
			610	06540	5-10	TB2
			610	06540	5-21	TB201
			610	06540	5-10	TB404
			6115-3	28569	5-35A	E702
			669	06540	5-12	TB405
			669	06540	5-10	TB408
			744	06540	5-11	TB301
			797	06540	5-11	TB406
			797	06540	5-36	TB2001

**SECTION VIII. INDEX- REFERENCE DESIGNATION
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REFERENCE DESIGNATION	PAGE NUMBER	REFERENCE DESIGNATION	PAGE NUMBER	REFERENCE DESIGNATION	PAGE NUMBER
A1	3	C110	7	C412	16
A2	4	C114	7	C413	16
A3	6	C116	7	C416	19
A5	24	C117	7	C417	16
A100	6	C118	7	C418	16
A101	6	C119	7	C419	16
A103	10	C121	7	C420	19
A200	10	C122	7	C425	19
A201	11	C123	6	C426	16
A202	11	C124	7	C503	25
A203	12	C130	6	C504	25
A300	13	C132	7	C506	26
A301	13	C133	7	C507	26
A302	15	C134	7	C508	26
A401	16	C135	7	C509	26
A402	16	C136	6	C510	26
A403	18	C137	7	C511	26
A500	24	C138	7	C515	26
A501	25	C139	7	C516	25
A502	26	C140	7	C517	25
A503	27	C141	7	C518	25
A601	2,30	C142	7	C519	26
A602	2,30	C143	7	C522	25
A603	18	C201	11	C523	25
A604	18	C202	10	C1001	18
A1000	18	C204	11	C1002	18
A1502	27	C205	11	C1003	18
A1503	27	C206	12	C1004	18
A2000	30	C207	11	C1006	18
B401	19	C211	11	C1007	18
C1	3	C212	11	C1008	18
C2	3	C213	11	C1009	18
C7	3	C214	11	C1010	18
C8	3	C215	11	C1011	18
C9	3	C216	11	C1012	18
C10	3	C221	12	C1013	18
C11	3	C222	11	C1014	18
C12	3	C301	14	C1015	18
C13	3	C302	14	C1016	18
C14	3	C303	14	C1500	27
C15	3	C304	14	C1501	27
C20	4	C305	14	C1502	27
C21	4	C306	19	C1503	27
C22	4	C307	15	C1504	27
C23	4	C308	15	C1505	27
C24	4	C309	15	C1506	27
C25	4	C310	14	C1507	28
C26	4	C311	15	C1508	27
C27	4	C312	15	C1509	27
C28	6	C313	15	C1510	28
C29	6	C314	15	C1511	28
C30	4	C315	19	C1512	27
C31	4	C316	14	C1513	27
C32	5	C317	14	C1514	28
C33	4	C318	13	C1515	28
C34	4	C401	19	C1516	27
C35	4	C402	19	C1517	27
C101	6	C403	19	C1518	28
C102	6	C404	16	C1519	28
C103	10	C405	16	C1520	27
C104	10	C406	16	C1521	27
C105	6	C407	16	C1522	28
C106	6	C408	19	C1523	28
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C108	7	C410	19	C1525	28
C109	7	C411	19	C1526	27

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C1555	27	CR415	19	L16	5
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C1560	27	CR504	26	L21	5
C1561	28	CR505	25	L22	5
C1562	28	CR506	26	L101	7
C1563	27	CR2001	30	L102	7
C1564	27	DL1	20	L103	6
C1565	28	DL2	20	L201	11
C1566	28	DL301	20	L202	11
C1567	27	DS401	20	L301	14
C1568	28	DS402	20	L402	20
C1569	27	DS403	2,20	L403	20
C1570	28	DS404	2,20	L404	24
C1571	27	DS405	2,20	L405	24
C1572	28	DS406	2,20	L406	20
C1573	27	DS1001	2,20	L501	25
C1574	28	DS2001	30	L502	25
C1575	27	E101	20	L503	25
C1576	28	E102	20	L505	25
C1577	27	E104	20	L508	25
C1578	28	E201	20	L510	25
C1579	27	E301	20	L511	25
C1580	28	E302	20	L512	25
C1581	27	E501	29	L513	23
C1582	28	E502	29	L514	25
C1587	24	E702	2,31	L515	25
C1588	28	E703	2,31	L516	25
C1589	27	E704	2,31	L517	25
C1590	27	E706	2,31	L518	25
C1591	24	E707	2,31	L519	25
C1592	24	E708	2,31	MP101	20
C1593	24	E2001	30	MP102	20
C1594	24	E2002	30	MP103	20
C1595	28	F401	2,20	MP104	20
C2001	30	F402	2,20	MP105	20
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TB2001	30	XDS1001	24		
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V4	4	XF403	24		
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V7	6	XF406	24		
V8	6	XV1	4		
V9	6	XV2	4		
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V11	6	XV4	4		
V12	6	XV5	4		
V13	6	XV6	6		
V101	23	XV7	6		
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V103	23	XV11	6		
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V203	23	XV202	13		
V204	23	XV203	12		
V205	23	XV204	12		
V206	23	XV205	12		
V207	23	XV206	10		
V301	23	XV207	12		
V303	15	XV301	15		

Typical Peak-to-Peak
Ripple Voltage Levels

TEST POINT	VOLTS
A4-A5	6 mv
A20-A22	10 mv
A22-A25	11 V
A5-A25	11 V
A26	675 V
A4-Gnd	4.5 mv
A13-A16	20 mv
A16-A18	10 V
A4-A18	11 V
A19	475 V
A3-Gnd	2 mv
A6-A9	3 mv
A9-A11	8 V
A12	425 V
A1-A2	2.5 mv
A27-A28	75. mv
A28-A30	1.2 V
A1-A30	1.2 V
A31	130 V

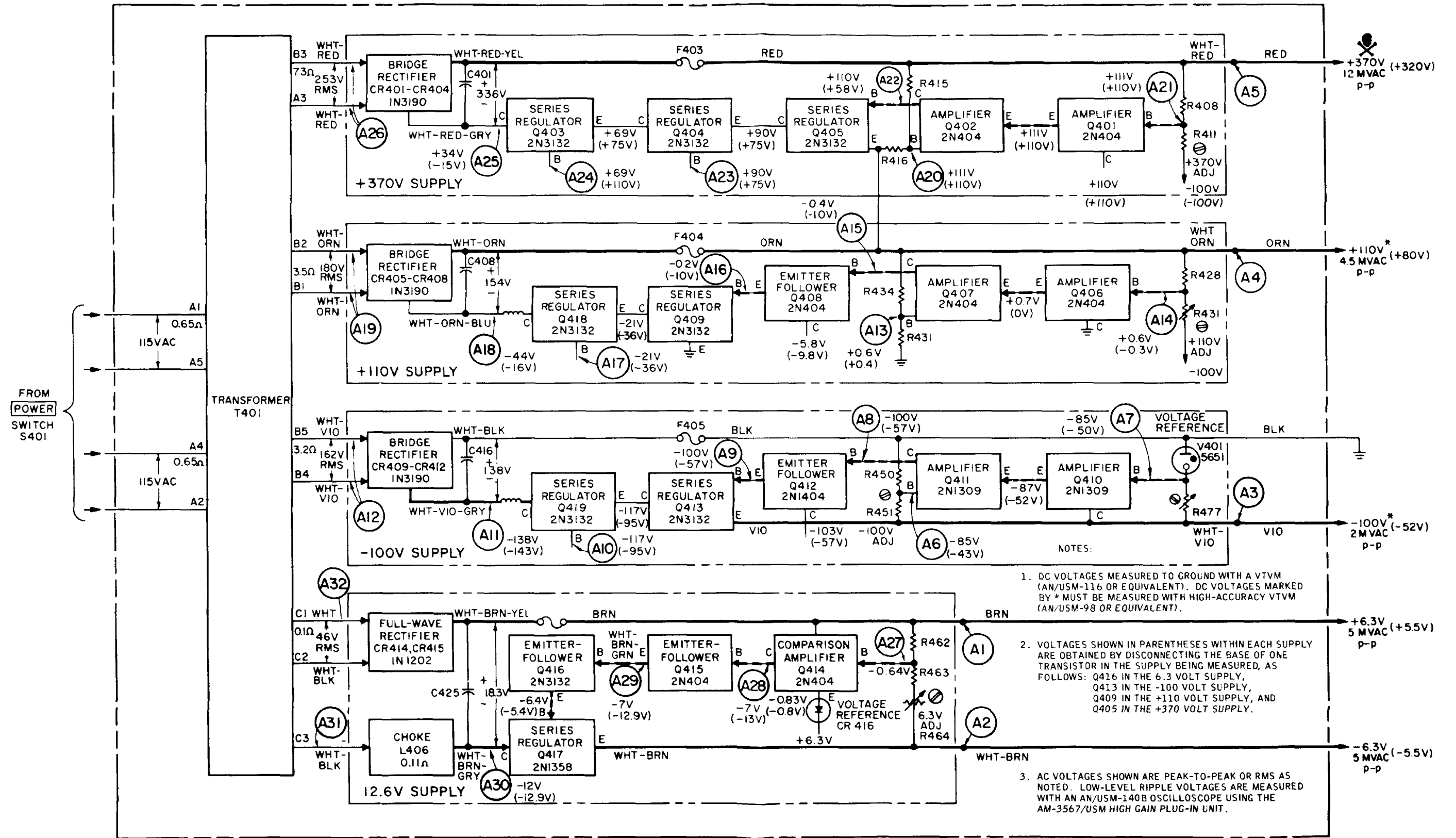


Figure 4-3. Low-Voltage Power Supply Functional and Servicing Block Diagram

Typical Peak-to-Peak
Ripple Voltage Levels

TEST POINT	VOLTS
A4-A5	6 mv
A20-A22	10 mv
A22-A25	11 V
A5-A25	11 V
A26	675 V
A4-Gnd	4.5 mv
A13-A16	20 mv
A16-A18	10 V
A4-A18	11 V
A19	475 V
A3-Gnd	2 mv
A6-A9	3 mv
A9-A11	8 V
A12	425 V
A1-A2	2.5 mv
A27-A28	75. mv
A28-A30	1.2 V
A1-A30	1.2 V
A31	130 V

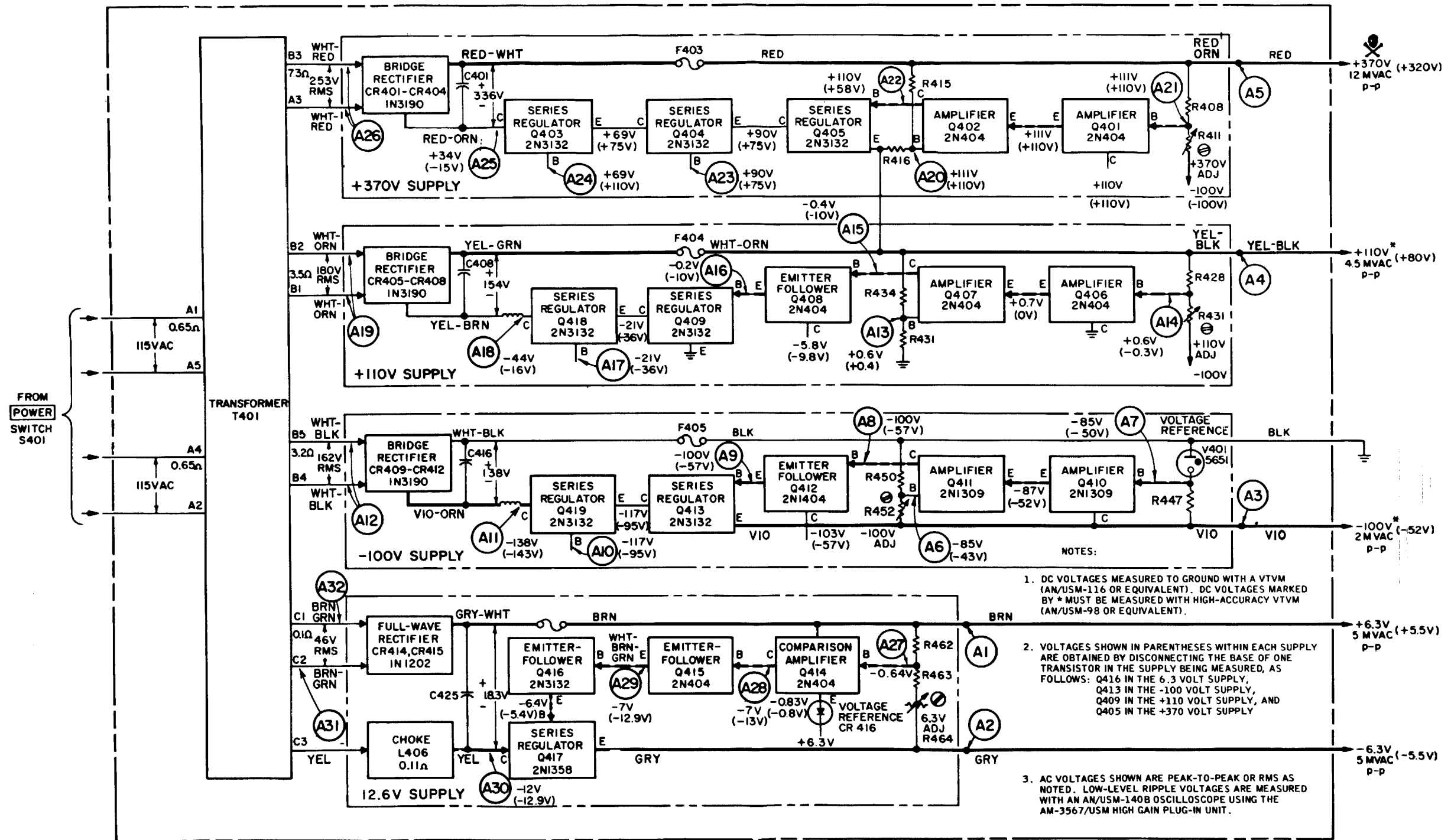


Figure 4-3A. Low Voltage Power Supply Functional and Servicing Block Diagram, AN/USM-140C

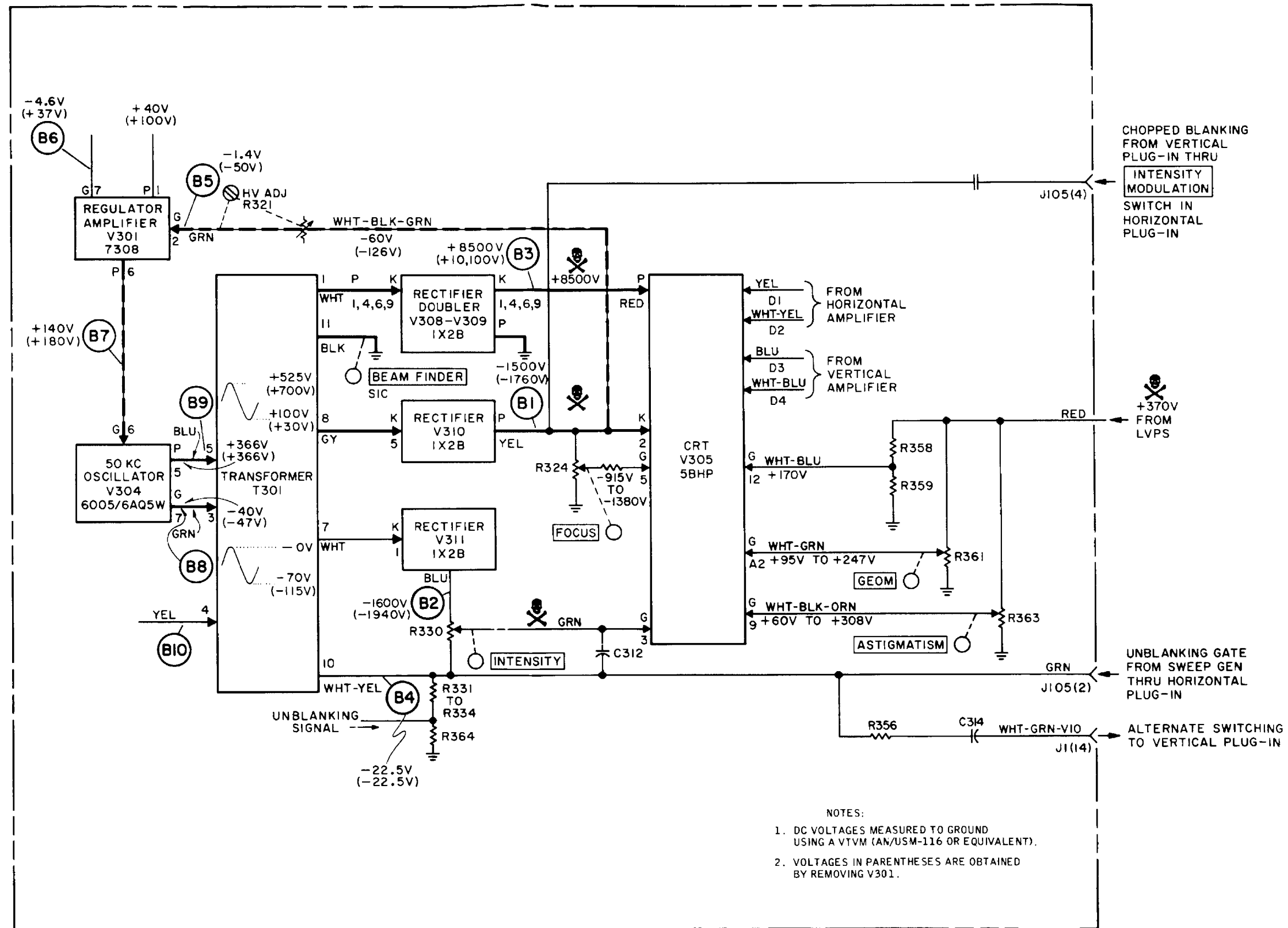


Figure 4-4. High-Voltage Power Supply Functional and Servicing Block Diagram

Typical DC Voltages in the Vertical Amplifier
for the Following Indicated Spot Positions

Test Point	Location	Voltage (Spot 2 cm High) (Spot Center) (Spot 2 cm Low)	Test Point	Location	Voltage (Spot 2 cm High) (Spot Center) (Spot 2 cm Low)
E1	V1(2)	-1.87	None	V7(6)	+2.4
		-2.07			+1.55
		-2.28			+0.75
E2	V1(7)	-2.28	E11	V11(7)	+0.75
		-2.07			+1.6
		-1.87			+2.5
E3	V1(3) V2(7)	-0.12	E12	V11(2)	+2.5
		-0.33			+1.6
		-0.55			+0.75
E4	V1(8) V3(7)	-0.55	E13	V11(6)	+94.5
		-0.33			+94.3
		-0.12			+94.1
None	V2(6)	+71.6	E14	V11(1)	+94.1
		+71.8			+94.3
		+72			+94.5
None	V3(6)	+72	None	V11(8)	+2.5
		+71.8			+3.3
		+71.6			+4.0
E5	V2(1) V6(2)	+149	None	V11(3)	+4.0
		+150			+3.3
		+151			+2.5
E6	V3(1) V6(7)	+151	E15	V12(1)	+187
		+150			+181
		+149			+175
E9	V6(3)	+150	E16	V13(1)	+175
		+151			+181
		+152			+187
E10	V6(8)	+152	E18	V10(8)	+3.1
		+151			+4.0
		+150			+4.8
None	V7(1)	+0.75	E19	V10(3)	+4.8
		+1.55			+4.0
		+2.4			+3.1

Conditions of Measurement: Spot set to the three positions using the VERTICAL POSITION control. The voltages shown on the schematic correspond to spot center.

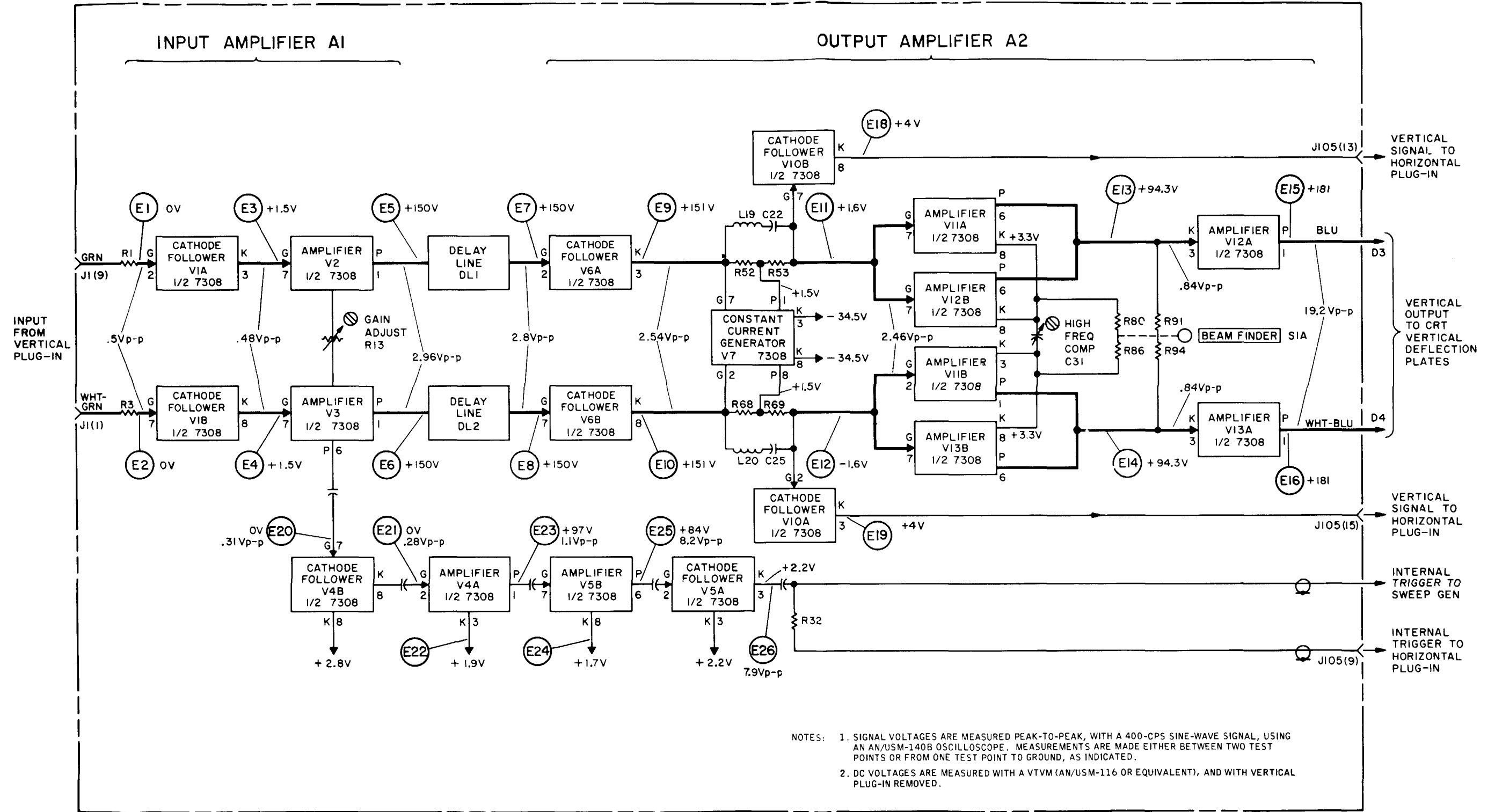


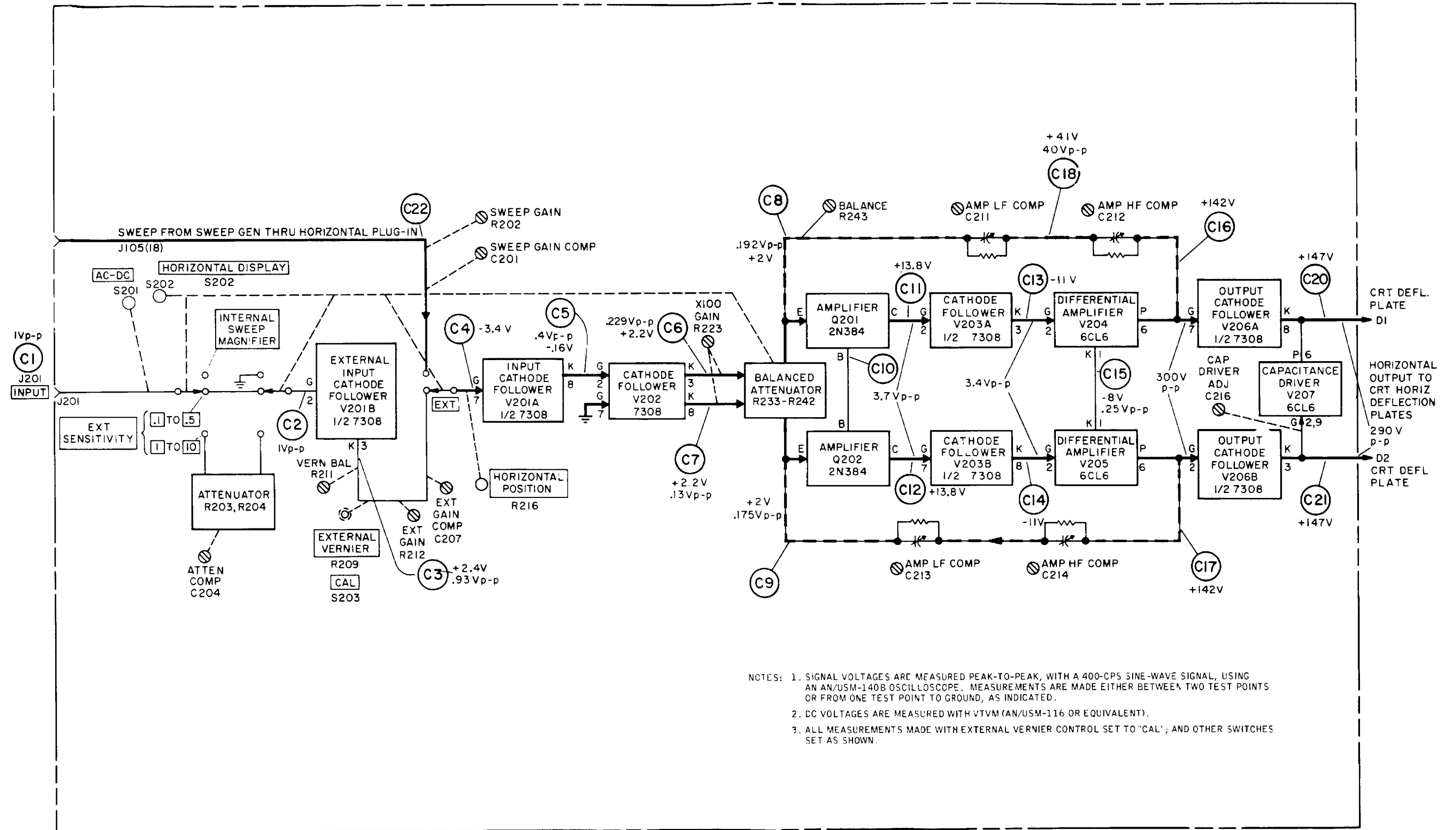
Figure 4-8. Main Vertical Amplifier Functional and Servicing Block Diagram

Typical DC Voltages in the Horizontal Amplifier
for the Following Indicated Spot Positions

Test Point	Location	Voltage vs Spot Location		
		2 cm Left	Center	2 cm Right
C4	V201(7)	-3.3	-3.1	-2.9
C5	V202(2)	0.058	-0.16	0.37
C6	V202(3)	+2.1	+2.2	+2.3
C7	V202(8)	+2.3	+2.2	+2.1
C8	Q201(E)	+2.1	+2.2	+2.3
C9	Q202(E)	+2.3	+2.2	+2.1
C10	Q201(B), Q202(B)	+1.9	+2.0	+2.1
C11	Q201(C)	+14.8	+13.8	+12.8
C12	Q202(C)	+12.8	+13.8	+14.8
C13	V204(2,9)	-12	-11	-10
C14	V205(2,9)	-10	-11	-12
C15	V204(1), V205(1)	-8.0	-8.0	-8.0
C16	V206(7)	+217.5	+142	+73
C17	V206(2)	+73	+142	+217.5
C18	R245-R246	+63	+42.	+21
C19	R259-R260	+21	+42.	+63
C20	V206(8)	+225	+147	+75
C21	V206(3)	+75	+147	+225
None	"+370 (B)"	+322	+311	+294

Conditions of Measurement:

Spot set to the three positions using the HORIZONTAL POSITION control; HORIZONTAL DISPLAY switch set to .1 MV/CM; application of the voltmeter test probe shall not deflect the spot. The voltages shown on schematic correspond to spot center.



- NOTES: 1. SIGNAL VOLTAGES ARE MEASURED PEAK-TO-PEAK, WITH A 400-CPS SINE-WAVE SIGNAL, USING AN AN/USM-140B OSCILLOSCOPE. MEASUREMENTS ARE MADE EITHER BETWEEN TWO TEST POINTS OR FROM ONE TEST POINT TO GROUND, AS INDICATED.
2. DC VOLTAGES ARE MEASURED WITH VTVM (AN/USM-116 OR EQUIVALENT).
3. ALL MEASUREMENTS MADE WITH EXTERNAL VERNIER CONTROL SET TO 'CAL'; AND OTHER SWITCHES SET AS SHOWN.

Figure 4-9. Horizontal Amplifier Functional and Servicing Block Diagram
4-33, 4-34

Supplementary Troubleshooting Voltages for
Non-Operating Sweep

NOTE: Voltages measured by disconnecting R124 from TP D7 and with a clip lead alternately connecting R124 to -100 volts (from any violet lead) and then momentarily to ground; voltage measured for each state with the voltage measured in the grounded condition listed first.

Test Point	Location	Voltage (R124 grounded) (R124 at -100V)	Test Point	Location	Voltage (R124 grounded) (R124 at -100V)
D6	R171	-38.	D15	V105(7)	-51
		-5.3	D17	R175	-75.
D7	V104(7)	-0.36 v			-8.4
		-100. v	D18	V114(8)	-66.
D8	V104(6)	+8.			-3.
		+110.	D19	V113(7)	-66.
None	V104(2)	-22.9			-3.
		+50.6	D20	V113(8)	-38.
D9	V105(2)	-51.			-0.04
		-17.	D21	V113(1)	-7.
D10	V105(3)	-1.8			+82.
		-17.	D22	see D19	
D11	V105(1)	-4.2	D23	V107(2)	-20.
		-6.5			+51.
D12	R151	-4.6	D24	V107(3)	-16.
		-7.			+52.
D13	V109(6)	+66.5	D25	V107(7)	-15.
		+332.			+50.
R157 junction with WHT-ORN lead		+95.	D26	V107(8)	0
		+36.			+53.
D14	R155	-58.	D27	V114(2)	-51.
		+83.			+80.
D15	V115(8)	-51.	D28	V114(3)	-46.
		+85.			+81.

Waveforms for Test Points Indicated

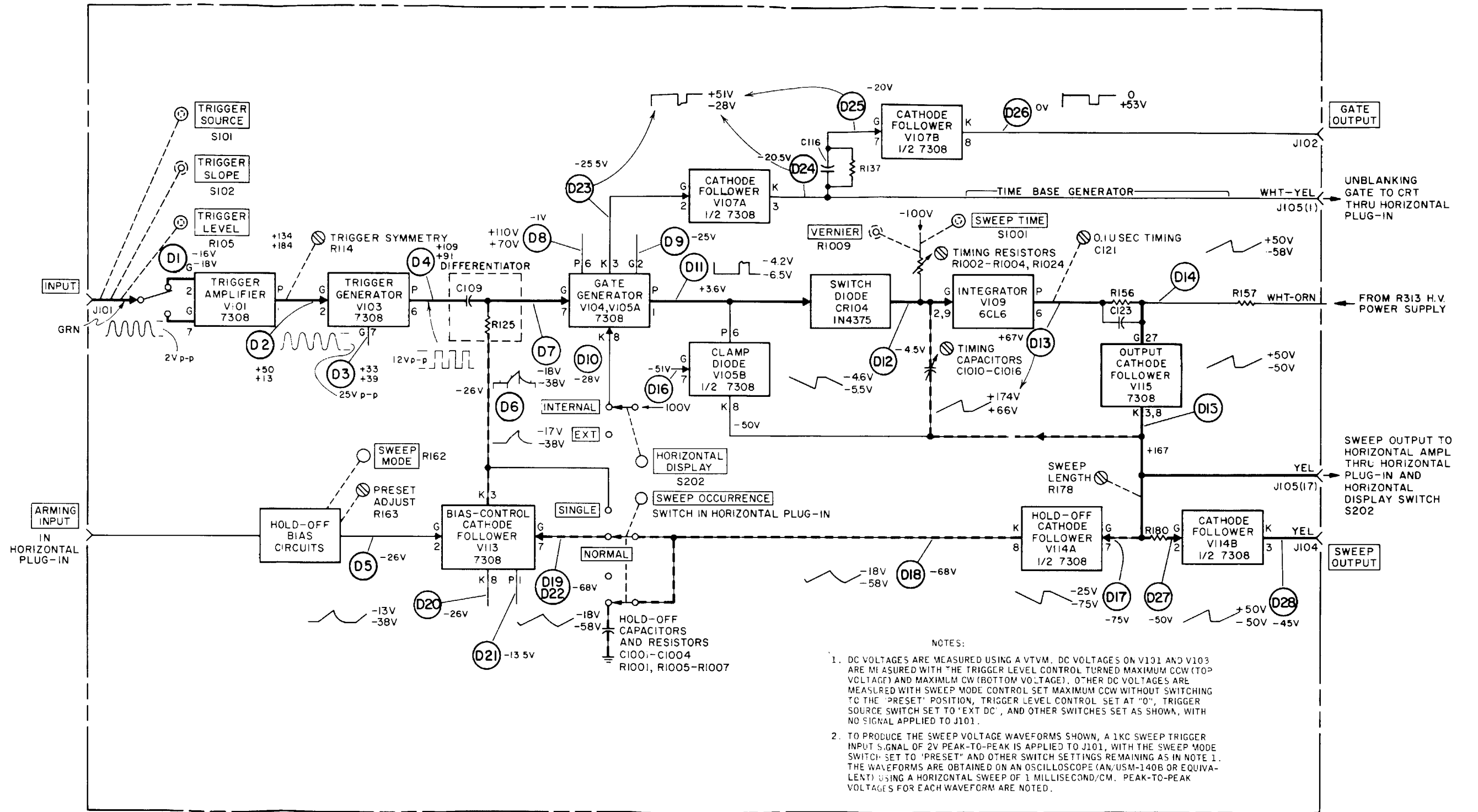
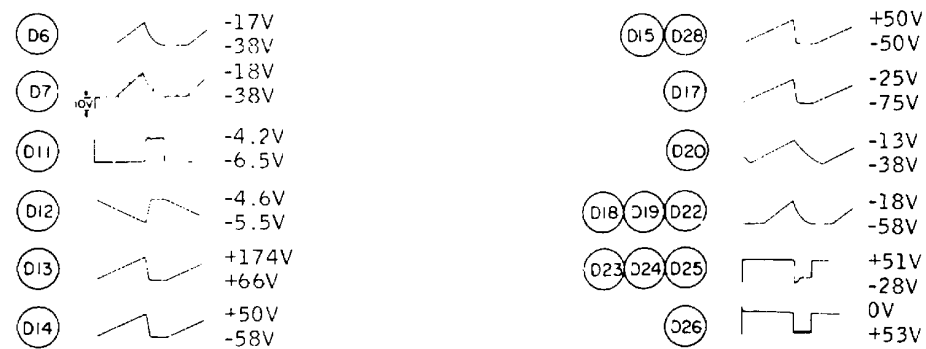


Figure 4-11. Sweep Generator Functional and Servicing Block Diagram

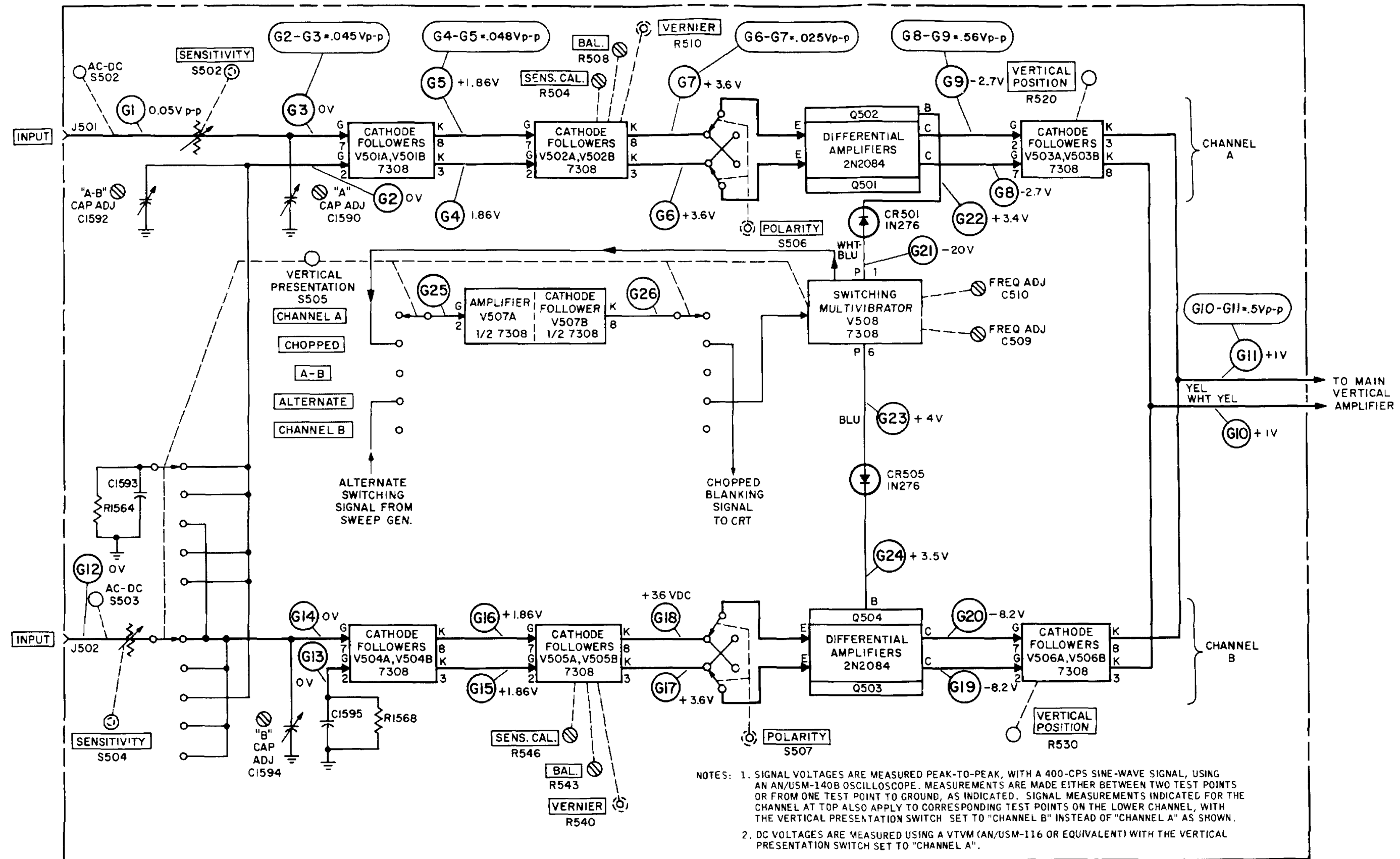


Figure 4-13. Vertical Plug-in Functional and Servicing Block Diagram
4-45, 4-46

MAINTENANCE

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
A1	A7	R13	C5	R91	C16
A2	A15	R14	C5	R92	G15
A3	B14	R16	D6	R93	G16
	F14	R18	F2	R94	F16
C1	E2	R19	G1	R95	E17
C2	F2	R20	G2	R96	E17
C7	F1	R21	G3	R97	A17
C8	G3	R22	G3	R98	A17
C9	H4	R23	H3	R99	D17
C10	F4	R24	F3	R310	D18
C11	H5	R25	F4		
C12	F5	R26	G4	S1	C17
C13	G6	R27	H5	V1A	A3
C14	F3	R28	F5	V1B	D3
C15	C6	R29	F5	V2A	B4
C20	G8	R30	G5	V2B	B4
C21	F17	R31	H6	V3A	D5
C22	B11	R32	G6	V3B	D5
C23	E9	R36	F2	V4A	G4
C24	D9	R37	E2	V4B	F3
C25	F11	R38	E17	V5A	F6
C26	F17	R39	B6	V5B	G5
C27	D12	R40	E2	V6A	B10
C28	G13	R41	B6	V6B	F10
C29	B13	R45	C8	V7A	C11
C30	A16	R46	C8	V7B	E11
C31	D15	R47	B8	V8	C12
C32	D15	R48	B9	V9	E12
C33	E16	R49	B10	V10A	G13
C34	A16	R50	D10	V10B	A13
C35	E16	R51	C10	V11A	C14
DL1	A7	R52	C10	V11B	F14
DL2	E7	R53	C11	V12A	B16
J105	H7	R54	D10	V12B	C16
L1	B4	R55	D10	V13A	F16
L2	D4	R56	D11	V13B	E16
L3	B6	R61	E8	W1	G7
L4	A6	R62	F8	W2	G7
L5	D6	R63	F8		
L6	E6	R64	F9		
L9	G4	R65	G10		
L10	G5	R66	F10		
L13	C8	R67	E9		
L14	C8	R68	F10		
L15	E8	R69	F11		
L16	E8	R70	E10		
L17	F8	R71	E11		
L18	F8	R75	G13		
L19	B10	R76	F13		
L20	F10	R77	B12		
L21	B16	R78	C12		
L22	G16	R79	C12		
R1	A2	R80	D14		
R2	B2	R81	B13		
R3	D2	R82	B13		
R4	D2	R83	F12		
R5	B3	R84	E12		
R6	C3	R85	E12		
R7	E2	R86	E14		
R8	B4	R87	D17		
R9	C4	R88	D18		
R11	A6	R89	A16		
R12	C5	R90	B16		

Typical DC Voltages in the Vertical Amplifier for the Following Indicated Spot Positions

Test Point	Location	Voltage (Spot 2 cm High) (Spot Center) (Spot 2 cm Low)	Test Point	Location	Voltage (Spot 2 cm High) (Spot Center) (Spot 2 cm Low)
E1	V1(2)	-1.87	None	V7(6)	+2.4
		-2.07			+1.55
		-2.28			+0.75
E2	V1(7)	-2.28	E11	V11(7)	+1.6
		-2.07			+2.5
		-1.87			
E3	V1(3)	-0.12	E12	V11(2)	-2.5
		-0.33			+1.6
		-0.55			+0.75
E4	V1(8)	-0.55	E13	V11(6)	+94.5
		-0.33			+94.3
		-0.12			+94.1
None	V2(6)	+71.6	E14	V11(1)	+94.1
		+71.8			+94.3
		+72			+94.5
None	V3(6)	+72	None	V11(8)	+2.5
		+71.8			+3.3
		+71.6			+4.0
E5	V2(1)	+149	None	V11(3)	+4.0
		+150			+3.3
		+151			+2.5
E6	V3(1)	+151	E15	V12(1)	-187
		+150			-181
		+149			+175
E9	V6(3)	+150	E16	V13(1)	-175
		+151			-181
		+152			-187
E10	V6(8)	+152	E18	V10(8)	+3.1
		+151			+4.0
		+150			+4.8
None	V7(1)	+0.75	E19	V10(3)	+4.8
		+1.55			+4.0
		+2.4			+3.1

Conditions of Measurement: Spot set to the three positions using the VERTICAL POSITION control. The voltages shown on the schematic correspond to spot center.

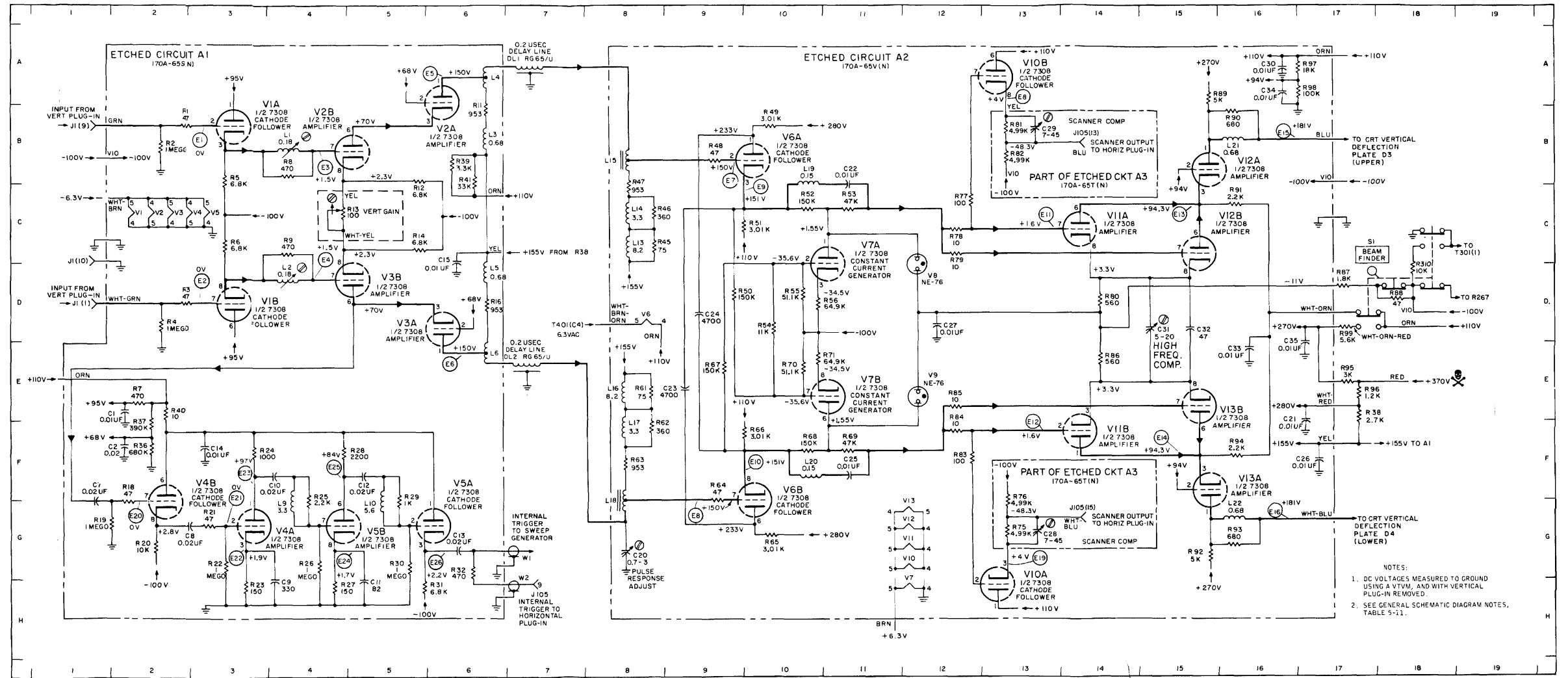


Figure 5-37. Main Vertical Amplifier Schematic Diagram

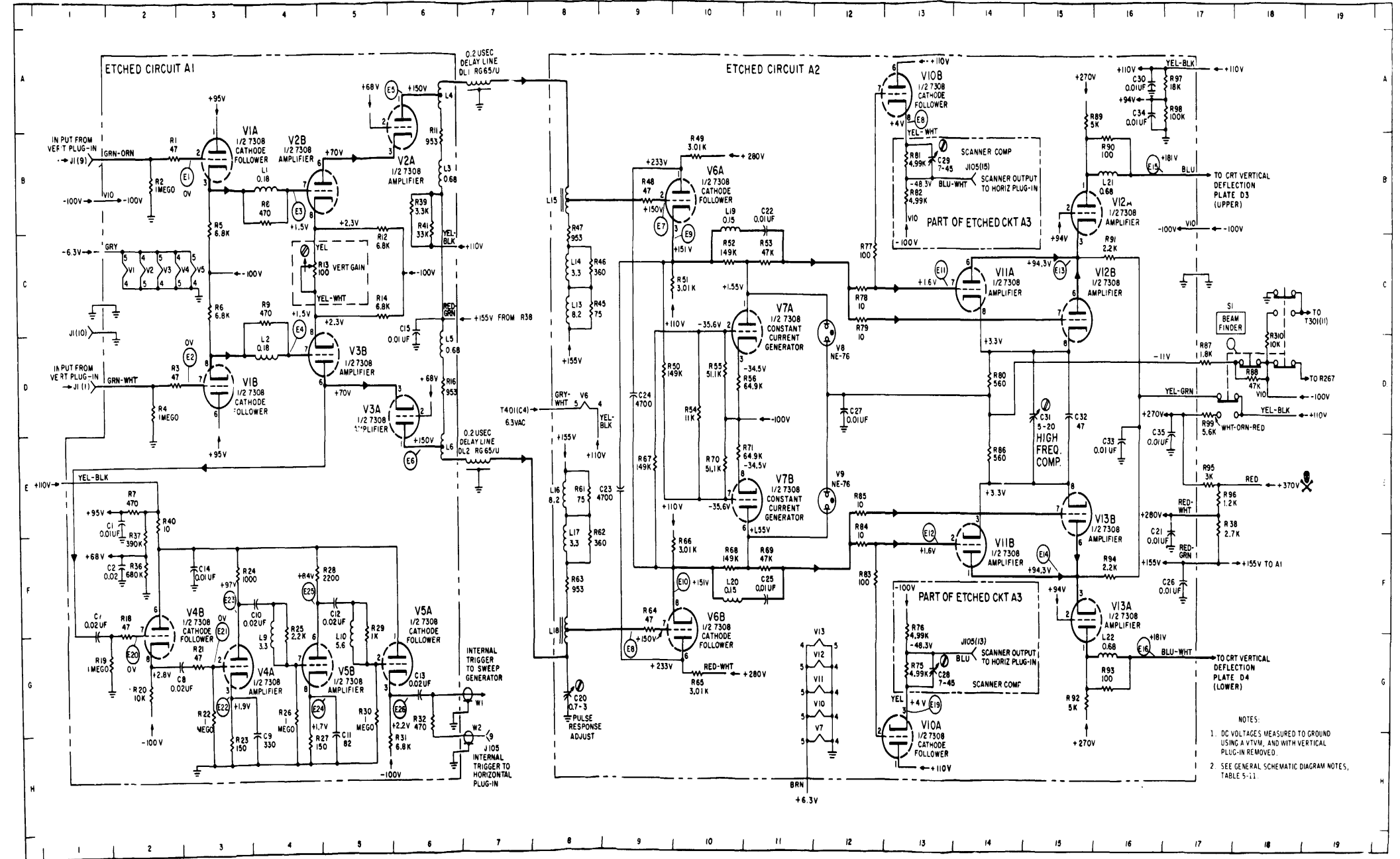
AN/USM-140C
MAINTENANCE

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
A1	A7	R13	C5	R91	C16
A2	A15	R14	C5	R92	G15
A3	B14	R16	D6	R93	G16
	F14	R18	F2	R94	F16
C1	E2	R19	G1	R95	E17
C2	F2	R20	G2	R96	E17
C7	F1	R21	G3	R97	A17
C8	G3	R22	G3	R98	A17
C9	H4	R23	H3	R99	D17
C10	F4	R24	F3	R310	D18
C11	H5	R25	F4		
C12	F5	R26	G4	S1	C17
C13	G6	R27	H5	V1A	A3
C14	F3	R28	F5	V1B	D3
C15	C6	R29	F5	V2A	B6
C20	G8	R30	G5	V2B	B4
C21	F17	R31	H6	V3A	D5
C22	B11	R32	G6	V3B	D5
C23	E9	R36	F2	V4A	G4
C24	D9	R37	E2	V4B	F3
C25	F11	R38	E17	V5A	F6
C26	F17	R39	B6	V5B	G5
C27	D12	R40	E2	V6A	B10
C28	G13	R41	B6	V6B	F10
C29	B13	R45	C8	V7A	C11
C30	A16	R46	C8	V7B	E11
C31	D15	R47	B8	V8	C12
C32	D15	R48	B9	V9	E12
C33	E16	R49	B10	V10A	G13
C34	A16	R50	D10	V10B	A13
C35	E16	R51	C10	V11A	C14
DL1	A7	R52	C10	V11B	F14
DL2	E7	R53	C11	V12A	B16
J105	H7	R54	D10	V12B	C16
L1	B4	R55	D10	V13A	F16
L2	D4	R56	D11	V13B	E16
L3	B6	R61	E8	W1	G7
L4	A6	R62	F8	W2	G7
L5	D6	R63	F8		
L6	E6	R64	F9		
L9	G4	R65	G10		
L10	G5	R66	F10		
L13	C8	R67	E9		
L14	C8	R68	F10		
L15	B8	R69	F11		
L16	E8	R70	E10		
L17	F8	R71	E11		
L18	F8	R75	G13		
L19	B10	R76	F13		
L20	F10	R77	B12		
L21	B16	R78	C12		
L22	G16	R79	C12		
R1	A2	R80	D14		
R2	B2	R81	B13		
R3	D2	R82	B13		
R4	D2	R83	F12		
R5	B3	R84	E12		
R6	C3	R85	E12		
R7	E2	R86	E14		
R8	B4	R87	D17		
R9	C4	R88	D18		
R11	A6	R89	A16		
R12	C5	R90	B16		

Typical DC Voltages in the Vertical Amplifier for the Following Indicated Spot Positions

Test Point	Location	Voltage (Spot 2 cm High) (Spot 2 cm Low)	Test Point	Location	Voltage (Spot 2 cm High) (Spot 2 cm Low)
E1	V1(2)	-1.87 -2.07 -2.28	None	V7(6)	+2.4 +1.55 +0.75
E2	V1(7)	-2.28 -2.07 -1.87	E11	V11(7)	+0.75 +1.6 -2.5
E3	V1(3) V2(7)	-0.12 -0.33 -0.55	E12	V11(2)	+2.5 +1.6 +0.75
E4	V1(8) V3(7)	-0.55 -0.33 -0.12	E13	V11(6)	+94.5 +94.3 +94.1
None	V2(6)	+71.6 +71.8 +72	E14	V11(1)	+94.1 +94.3 +94.5
None	V3(6)	+72 +71.8 +71.6	None	V11(8)	+2.5 +3.3 +4.0
E5	V2(1) V6(2)	+149 +150 +151	None	V11(3)	+4.0 +3.3 +2.5
E6	V3(1) V6(7)	+151 +150 +149	E15	V12(1)	+187 +181 +175
E9	V6(3)	+150 +151 +152	E16	V13(1)	+175 +181 +187
E10	V6(8)	+152 +151 +150	E18	V10(8)	+3.1 +4.0 +4.8
None	V7(1)	+0.75 +1.55 +2.4	E19	V10(3)	+4.8 +4.0 +3.1

Conditions of Measurement: Spot set to the three positions using the VERTICAL POSITION control. The voltages shown on the schematic correspond to spot center.



CHANGE 1

Figure 5-37A. Main Vertical Amplifier Schematic Diagram, AN/USM-140C 5-60.1

AN/USM-140B
MAINTENANCE

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
A101	A9	R119	C7	S103	G5
CR101	C8	R120	E7	S202	E11
CR102	E8	R121	E8	V101A	C4
CR103	C12	R122	D8	V101B	F4
CR104	C12	R123	C8	V102	D5
C101	D2	R124	D9	V103A	D7
C102	E2	R125	E8	V103B	D8
C103	D3	R130	B9	V104A	D9
C104	F3	R131	B9	V104B	B10
C105	E4	R132	B10	V105A	D10
C106	C6	R133	F12	V105B	D13
C107	C7	R135	B11	V107A	A10
C108	F7	R136	B11	V107B	B12
C109	C8	R137	B11	V109	A3
C114	B10	R138	C12	V110	E7
C116	B11	R139	C9	V111	D10
C117	C9	R140	C9	V113A	F7
C118	E9	R141	C9	V113B	F9
C119	D11	R142	E9	V114A	E13
C121	B14	R143	E9	V114B	F16
C122	C15	R144	D10	V115	B4
C123	D16	R145	E10	V116	E16
C124	C16	R146	C11		
C130	G5	R147	C11		
C132	G8	R148	C11		
C133	F9	R149	E11		
C134	E14	R150	D12		
C135	E16	R151	C14		
C136	G10	R152	A14		
C137	B3	R153	C15		
C138	B8	R154	D14		
C139	B3	R155	D16		
C140	C3	R156	D16		
C141	C3	R157	D16		
C142	C3	R158	C14		
C143	F13	R159	B15		
J101	D1	R160	A15		
J102	A12	R161	G4		
J104	F17	R162	G3		
J105	E1	R163	H4		
L101	B7	R164	H3		
L102	B8	R165	F10		
L103	F1	R167	F8		
R10	F15	R168	E8		
R18	C2	R169	F9		
R19	F1	R170	G9		
R102	D3	R171	G9		
R103	D3	R172	G9		
R104	D3	R173	F10		
R105	E3	R174	G10		
R106	F4	R175	F13		
R107	F4	R176	E14		
R108	D4	R177	F14		
R109	C5	R178	G14		
R110	C5	R179	F15		
R111	E5	R181	F16		
R112	E5	R182	F16		
R113	E5	R186	B2		
R114	F5	R187	B2		
R115	F5	R188	C2		
R116	E6	R189	C2		
R117	D6	S101	E3		
R118	B7	S102	E3		

Supplementary Troubleshooting Voltages for
Non-Operating Sweep

NOTE: Voltages measured by disconnecting R124 from TP D7 and with a clip lead alternately connecting R124 to -100 volts (from any violet lead) and then momentarily to ground; voltage measured for each state with the voltage measured in the grounded condition listed first.

Test Point	Location	Voltage (R124 grounded) (R124 at -100V)	Test Point	Location	Voltage (R124 grounded) (R124 at -100V)
D6	R171	-38.	D16	V105(7)	-51
		-5.3	D17	R175	-52.
D7	V104(7)	-0.36 v	D18	V114(8)	-8.4
		-100. v	D19	V113(7)	-66.
D8	V104(6)	+8.			-3.
		+110.	D20	V113(8)	-66.
None	V104(2)	-22.9			-3.
		+50.6	D20	V113(8)	-38.
D9	V105(2)	-51.	D21	V113(1)	-7.
		-17.	D22	see D19	+82.
D10	V105(3)	-1.8			
		-17.	D23	V107(2)	-20.
D11	V105(1)	-4.2			+51.
		-6.5	D24	V107(3)	-16.
D12	R151	-4.6			+52.
		-7.	D25	V107(7)	-15.
D13	V109(6)	+66.5	D26	V107(8)	0
		+332.			+53.
R157 junction with WHT-ORN lead		+95.	D27	V114(2)	-51.
		+36.			+80.
D14	R155	-58.	D28	V114(3)	-46.
		+83.			-81.
D15	V115(8)	-51.			
		+85.			

Waveforms for Test Points Indicated

D6	-17V	D15	+50V
D7	-38V	D17	-50V
	-18V	D20	-25V
	-38V	D20	-38V
D11	-4.2V	D18	-13V
	-6.5V	D23	-18V
D12	-4.6V	D23	-28V
	-5.5V	D24	+51V
D13	+174V	D25	-28V
	+66V	D26	0V
D14	+50V		+53V
	-58V		

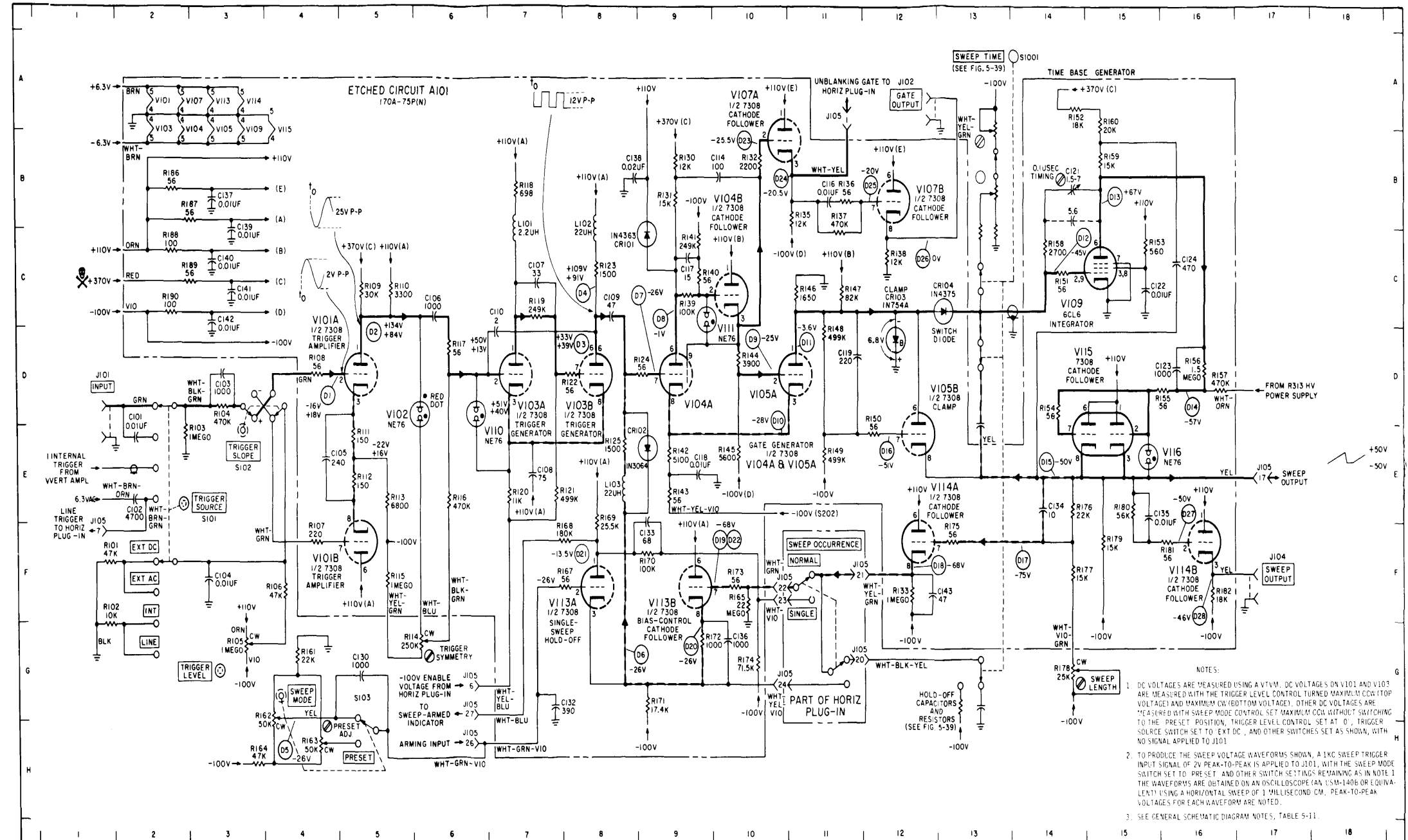


Figure 5-38. Sweep Generator Schematic Diagram
UNCLASSIFIED
5-61, 5-62

ORIGINAL

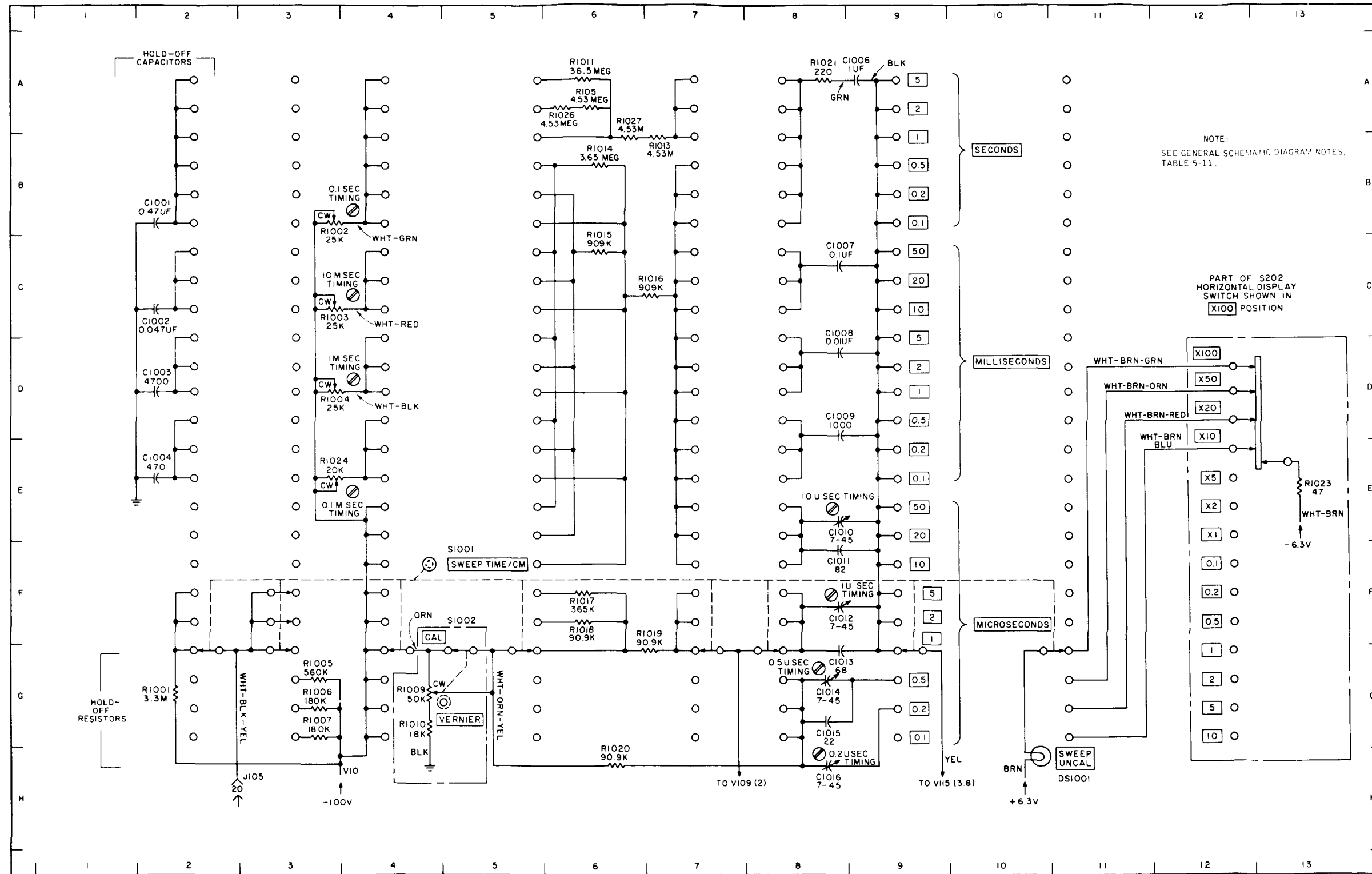


Figure 5-39. Sweep-Time Switch, Functional Schematic Diagram
UNCLASSIFIED
5-63, 5-64

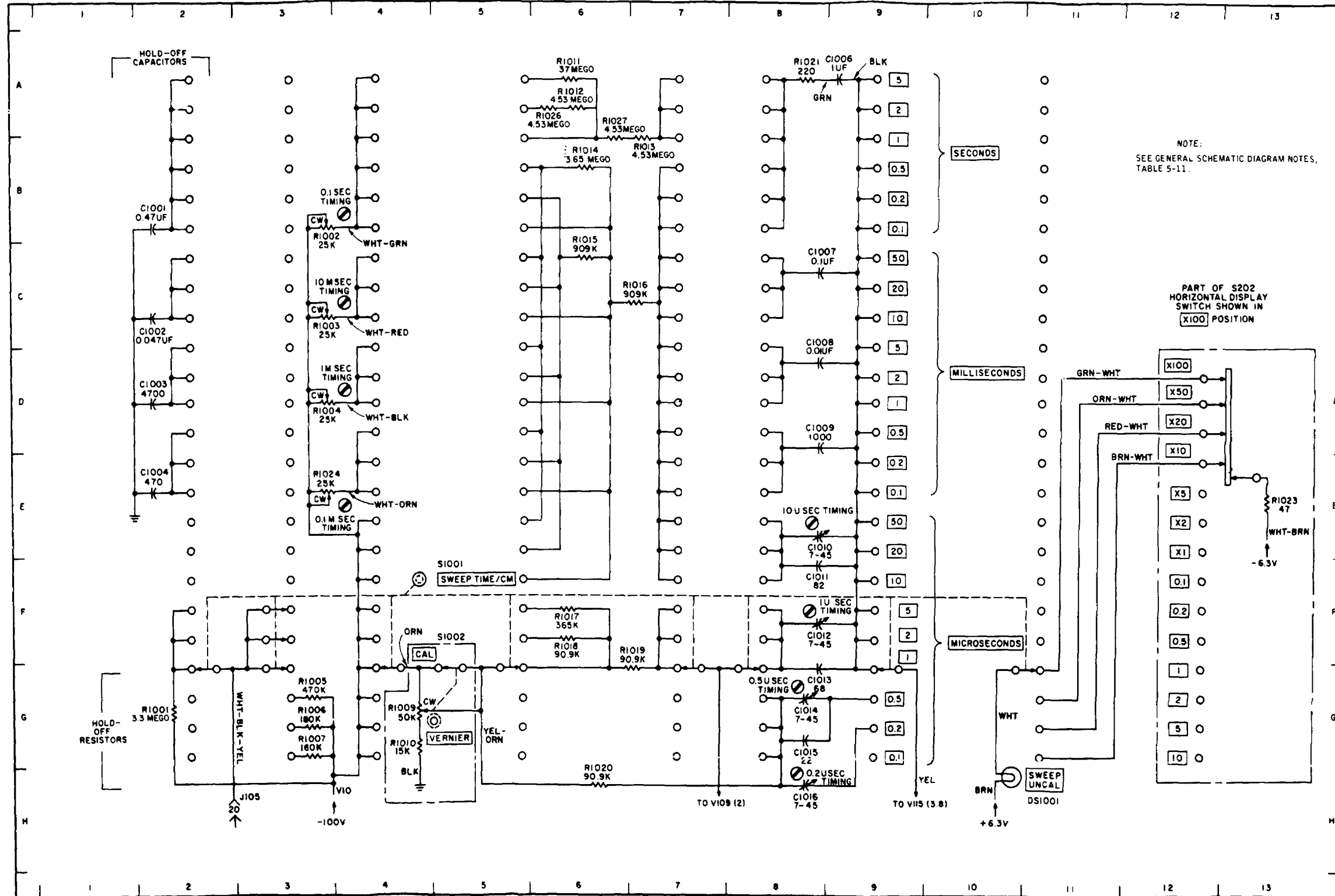


Figure 5-39A. Sweep-Time Switch, Functional Schematic Diagram, AN/USM-140C
UNCLASSIFIED

CHANGE 1 5-64.1

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
A201	A5	R238	A11
A202	B16	R239	D12
A203	A9	R240	E12
C201	B6	R241	E11
C202	C2	R242	E11
C204	B3	R243	A13
C205	B3	R244	B13
C206	C4	R245	B14
C207	C6	R246	B14
C211	B14	R247	D13
C212	B14	R248	D13
C213	G15	R249	C14
C214	G15	R250	D14
C215	E17	R251	D14
C216	D17	R252	E14
C221	G9	R253	F14
J201	C1	R254	E14
L201	B15	R255	D14
L202	G15	R256	C15
Q201	C13	R257	F15
Q202	F13	R258	F14
R201	B6	R259	F15
R202	B6	R260	F15
R203	B3	R264	C16
R204	B3	R265	A15
R205	D4	R266	B16
R206	C4	R267	E16
R207	C5	R268	E16
R208	D5	R270	G12
R209	E6	R271	E17
R210	E6	R272	D17
R211	E6	R273	F16
R212	C6	R274	F17
R213	C6	R275	G17
R214	B8	R276	G17
R215	C8	R278	G13
R216	C8	S201	D2
R217	D9	S202	A2
R218	C9	S203	A2
R221	D9	V201A	B9
R222	E9	V201B	D5
R223A	D10	V202A	D9
R223B	E10	V202B	E9
R224	F9	V203A	C14
R227	G9	V203B	F14
R233	B12	V204	C15
R234	B11	V205	F15
R235	B12	V206A	B17
R236	B12	V206B	G16
R237	A11	V207	C17

Typical DC Voltages in the Horizontal Amplifier for the Following Indicated Spot Positions

Test Point	Location	Voltage vs Spot Location		
		2 cm Left	Center	2 cm Right
C4	V201(7)	-3.3	-3.1	-2.9
C5	V202(2)	0.058	-0.16	0.37
C6	V202(3)	+2.1	+2.2	+2.3
C7	V202(8)	+2.3	+2.2	+2.1
C8	Q201(E)	+2.1	+2.2	+2.3
C9	Q202(E)	+2.3	+2.2	+2.1
C10	Q201(B), Q202(B)	+1.9	+2.0	+2.1
C11	Q201(C)	+14.8	+13.8	+12.8
C12	Q202(C)	+12.8	+13.8	+14.8
C13	V204(2,9)	-12	-11	-10
C14	V205(2,9)	-10	-11	-12
C15	V204(1), V205(1)	-8.0	-8.0	-8.0
C16	V206(7)	+217.5	+142	-73
C17	V206(2)	-73	+142	+217.5
C19	R259-R260	-21	+42	-63
C20	V206(8)	+225	+147	-75
C21	V206(3)	-75	+147	+225
None	"370 (B)"	+322	-311	-294

Conditions of Measurement:

Spot set to the three positions using the HORIZONTAL POSITION control; HORIZONTAL DISPLAY switch set to .1 MV/CM; application of the voltmeter test probe shall not deflect the spot. The voltages shown on schematic correspond to spot center.

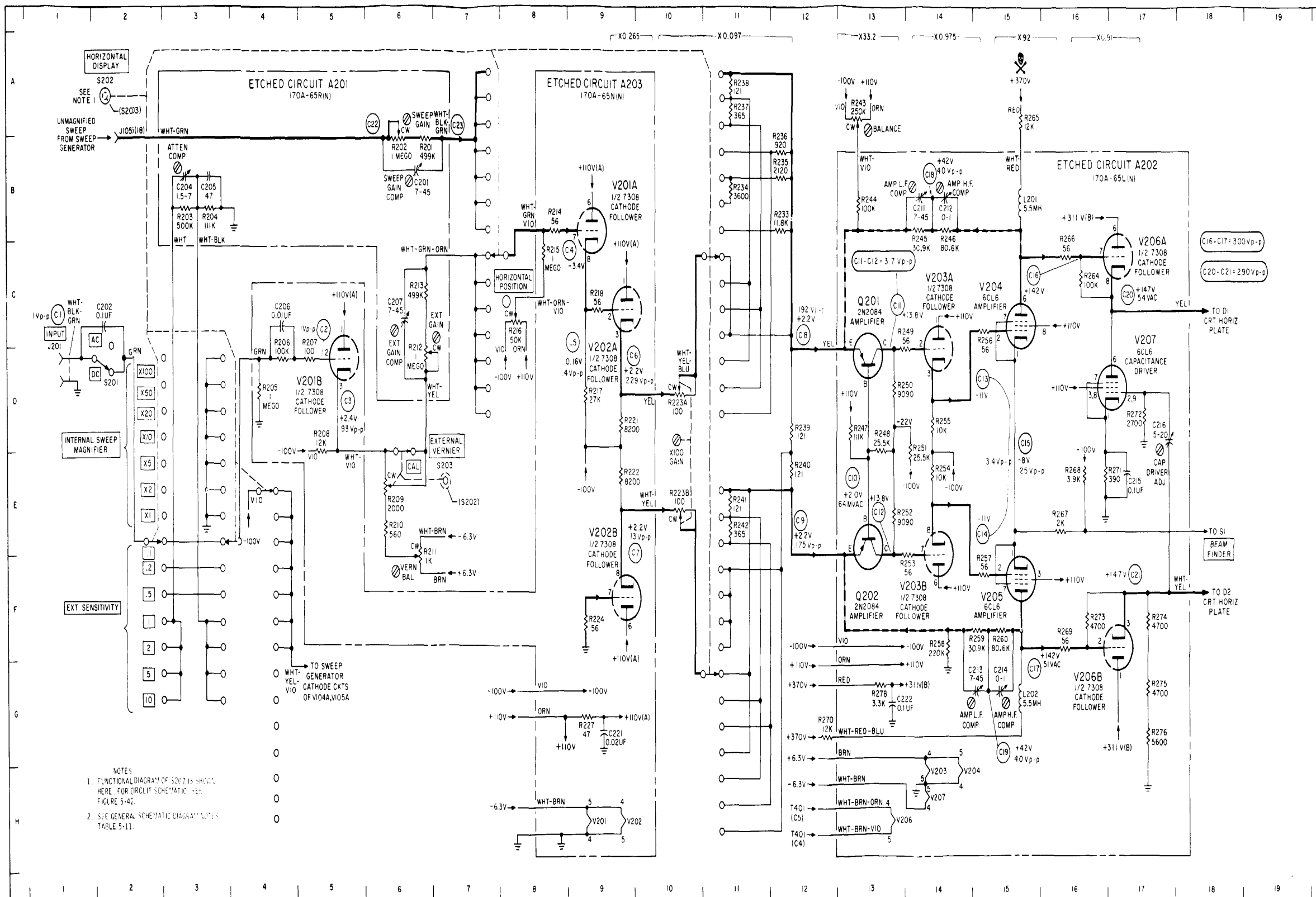


Figure 5-41. Horizontal Amplifier Schematic Diagram
UNCLASSIFIED
5-67, 5-68

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
A201	A5	R238	A11
A202	B16	R239	D12
A203	A9	R240	E12
C201	B6	R241	E11
C202	C2	R242	E11
C204	B3	R243	A13
C205	B3	R244	B13
C206	C4	R245	B14
C207	C6	R246	B14
C211	B14	R247	D13
C212	B14	R248	D13
C213	G15	R249	C14
C214	G15	R250	D14
C215	E17	R251	D14
C216	D17	R252	E14
C221	G9	R253	F14
J201	C1	R254	E14
L201	B15	R255	D14
L202	G15	R256	C15
Q201	C13	R257	F15
Q202	F13	R258	F14
R201	B6	R259	F15
R202	B6	R260	F15
R203	B3	R264	C16
R204	B3	R265	A15
R205	D4	R266	B16
R206	C4	R267	E16
R207	C5	R268	E16
R208	D6	R270	G12
R209	E6	R271	E17
R210	E6	R272	D17
R211	E6	R273	F16
R212	C6	R274	F17
R213	C6	R275	G17
R214	B8	R276	G17
R215	C8	R277	G9
R216	C8	R278	G13
R217	D9	S201	D2
R218	C9	S202	A2
R221	D9	S203	A2
R222	E9	V201A	B9
R223A	D10	V201B	D5
R223B	E10	V202A	D9
R224	F9	V203A	C14
		V203B	F14
R233	B12	V204	C15
R234	B11	V205	F15
R235	B12	V206A	B17
R236	B12	V206B	G16
R237	A11	V207	C17

Typical DC Voltages in the Horizontal Amplifier for the Following Indicated Spot Positions

Test Point	Location	Voltage vs Spot Location		
		2 cm Left	Center	2 cm Right
C4	V201(7)	-3.3	-3.1	-2.9
C5	V202(2)	0.058	-0.16	0.37
C6	V202(3)	+2.1	+2.2	+2.3
C7	V202(8)	+2.3	+2.2	+2.1
C8	Q201(E)	+2.1	+2.2	+2.3
C9	Q202(E)	+2.3	+2.2	+2.1
C10	Q201(B), Q202(B)	+1.9	+2.0	+2.1
C11	Q201(C)	+14.8	+13.8	+12.8
C12	Q202(C)	+12.8	+13.8	+14.8
C13	V204(2,9)	-12	-11	-10
C14	V205(2,9)	-10	-11	-12
C15	V204(1), V205(1)	-8.0	-8.0	-8.0
C16	V206(7)	+217.5	+142	-73
C17	V206(2)	+73	+142	+217.5
C18	R245-R246	+63	+42.	+21
C19	R259-R260	+21	+42.	+63
C20	V206(8)	+225	+147	+75
C21	V206(3)	+75	+147	+225
None	"-370 (B)"	+322	+311	-294

Conditions of Measurement:

Spot set to the three positions using the HORIZONTAL POSITION control; HORIZONTAL DISPLAY switch set to .1 MV/CM; application of the voltmeter test probe shall not deflect the spot. The voltages shown on schematic correspond to spot center.

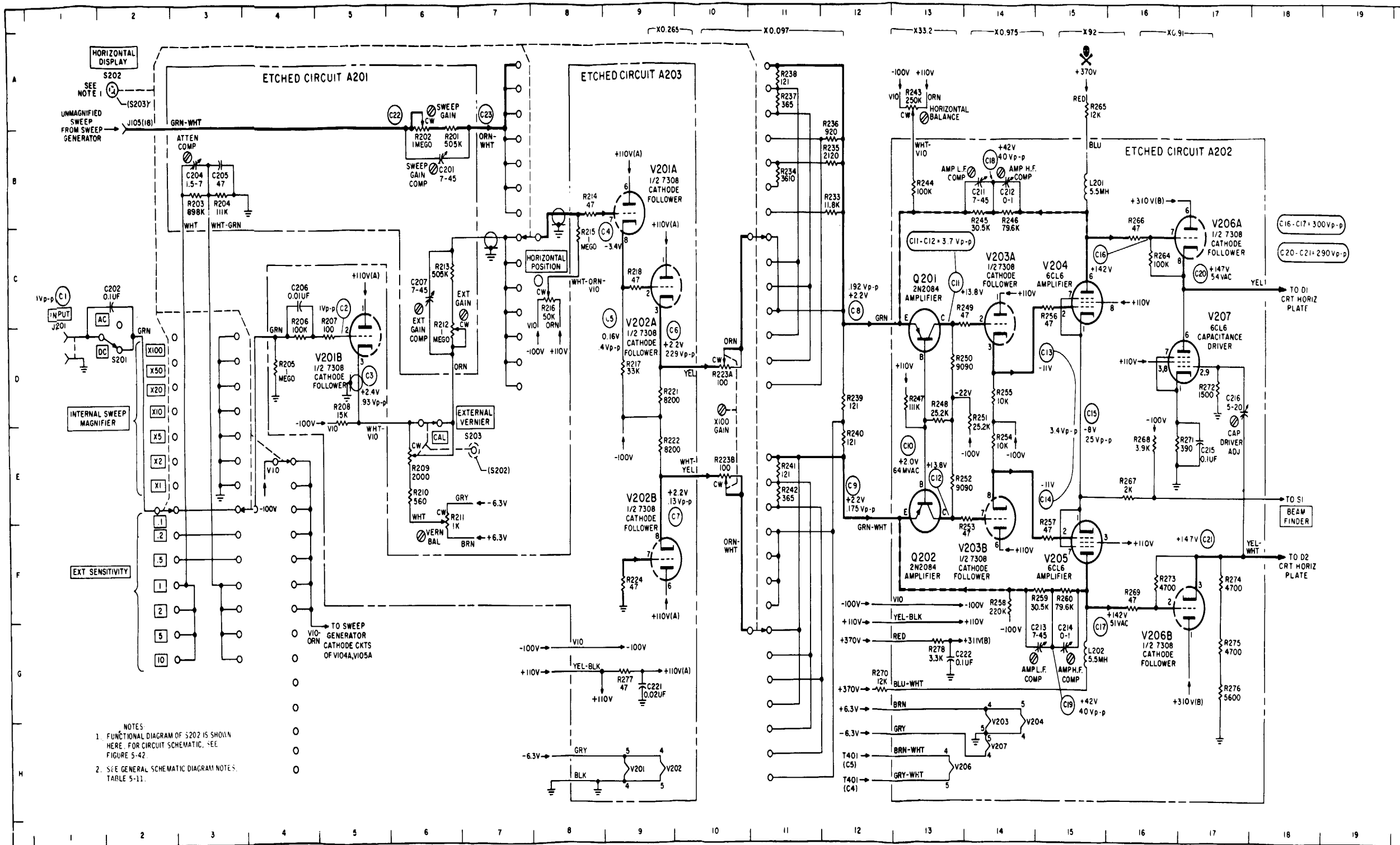


Figure 5-14A. Horizontal Amplifier Schematic Diagram, AN/USM-140C
UNCLASSIFIED
5-68.1

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
C301	B8	R335	C3
C302	A5	R336	D2
C303	D6	R337	D3
C304	D7	R338	D3
C306	C10	R339	D4
C307	F11	R340	D4
C308	G11	R341	H3
C309	D11	R342	B4
C310	F9	R343	E5
C311	F12	R344	E6
C312	F14	R345	F6
C313	E14	R346	F6
C314	G14	R347	F6
C315	C10	R348	G6
C316	C3	R349	G6
C317	C4	R350	G6
C318	G7	R351	H6
DL301	E17	R352	H6
J1	G15	R353	E7
J105	E15	R354	F7
J302	E7	R355	G14
L301	A5	R356	F14
R302	A6	R357	F14
R303	A7	R358	B13
R304	B7	R359	B14
R305	B6	R360	A13
R306	B7	R361	A14
R308	D7	R362	A14
R309	D7	R363	A15
R311	B10	R364	F14
R312	F9	R365	A14
R313	F11	R366	A14
R314	F11	R367	F7
R315	F11	R368	C4
R316	E11	S302	E6
R317	D11	T301	F16
R318	C11	T301	C8
R319	A8	V301A	B6
R321	B9	V301B	B7
R322	C12	V303	C7
R323	D12	V304	C6
R324	D12	V305	C13
R325	D12	V306A	C2
R326	E12	V306B	D5
R327	E12	V307A	B5
R328	E12	V307B	C5
R330	G12	V308	C9
R331	G13	V309	D9
R332	F13	V310	E9
R333	G13	V311	G9
R334	G14		

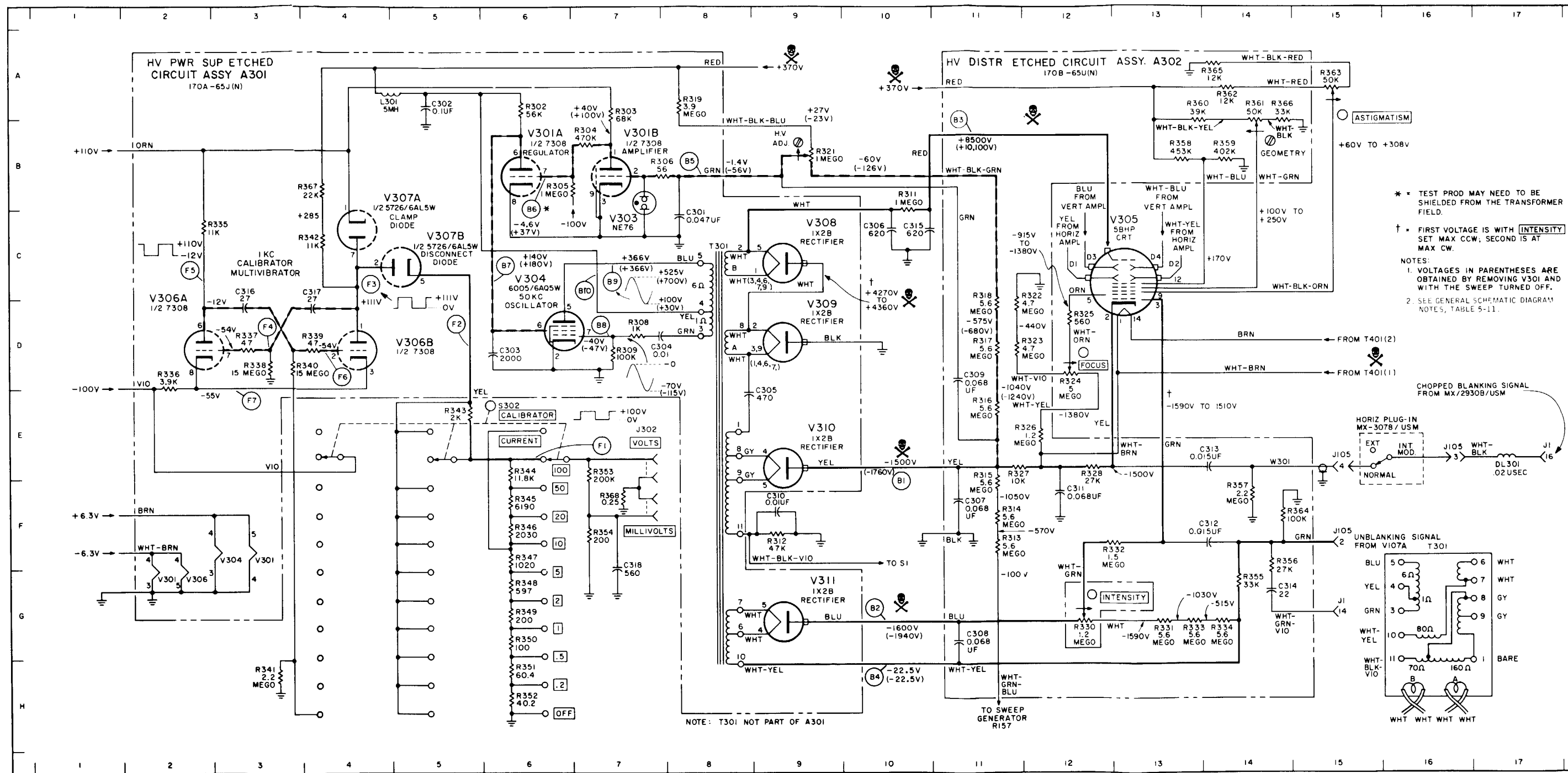


Figure 5-43. High Voltage Power Supply and Calibrator Schematic Diagram.

REF. DESIG.	SCHEMATIC LOCATION	RF. DESIG.	SCHEMATIC LOCATION
C301	B8	R335	C3
C302	A5	R336	D2
C303	D6	R337	D3
C304	D7	R338	D3
C306	C10	R339	D4
C307	F11	R340	D4
C308	G11	R341	H3
C309	D11	R342	B4
C310	F9	R343	E5
C311	F12	R344	E6
C312	F14	R345	F6
C313	E14	R346	F6
C314	G14	R347	F6
C315	C10	R348	G6
C316	C3	R349	G6
C317	C4	R350	G6
C318	G7	R351	H6
DL301	E17	R352	H6
J1	G15	R353	E7
J105	E15	R354	F7
J302	E7	R355	G14
L301	A5	R356	F14
R302	A6	R357	F14
R303	A7	R358	B13
R304	-7	R359	B14
R305	-36	R360	A13
R306	B7	R361	A14
R308	D7	R362	A14
R309	D7	R363	A15
R311	B10	R364	F14
R312	F9	R365	A14
R313	F11	R366	A14
R314	F11	R367	C4
R315	F11	R368	F7
R316	E11	S302	E6
R317	D11	T301	F16
R318	C11	T301	C8
R319	A8	V301A	B6
R321	B9	V301B	B7
R322	C12	V303	C7
R323	D12	V304	C6
R324	D12	V305	C13
R325	D12	V306A	C2
R326	E12	V306B	D5
R327	E12	V307A	B5
R328	E12	V307B	C5
R330	G12	V308	C9
R331	G13	V309	D9
R332	F13	V310	E9
R333	G13	V311	G9
R334	G14		

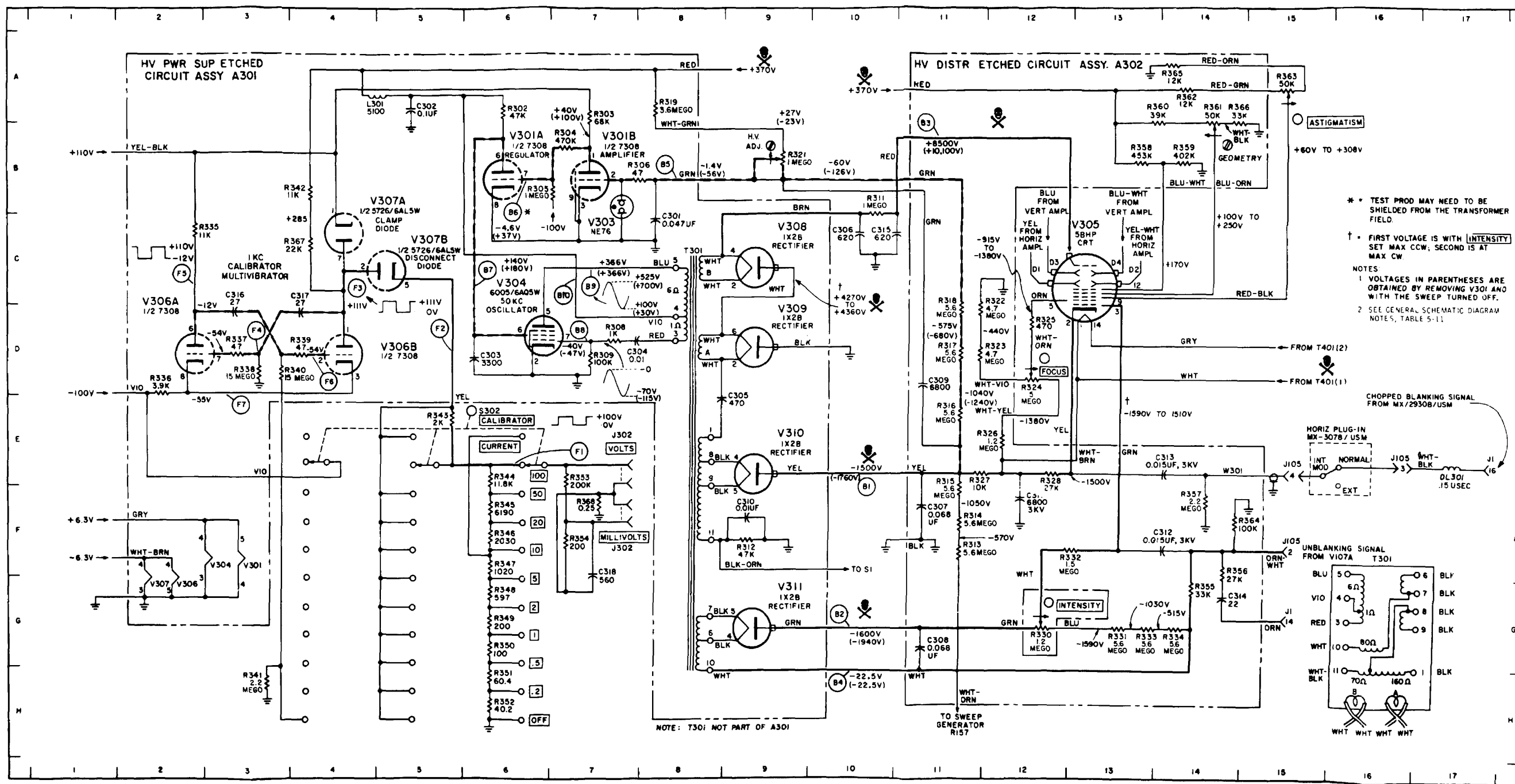


Figure 5-43A. High Voltage Power Supply and Calibrator Schematic Diagram.
AN/USM-140C
UNCLASSIFIED

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
A401	A3	FL401	B2	R416	B12
A402	A8	F401	B1	R417	A8
B401	G6	F402	B2	R421	D5
CR401	A3	F403	A5	R422	C5
CR402	A4	F404	C5	R423	D6
CR403	B3	F405	D5	R424	D6
CR404	B3	F406	G5	R425	C9
CR405	C3	J401	A2	R426	C8
CR406	C4	L402	B4	R427	D8
CR407	D3	L403	D5	R428	C9
CR408	D3	L404	D4	R429	D10
CR409	D3	L405	E5	R430	D9
CR410	F4	P401	A2	R431	D9
CR411	E3	P402	A1	R432	C10
CR412	F3	Q401	A10	R433	D10
CR413	F10	Q402	A10	R434	C12
CR414	G3	Q403	A5	R435	D12
CR415	H3	Q404	A6	R437	F10
CR416	G9	Q405	B7	R438	F5
C401	A4	Q406	C10	R439	F5
C402	D9	Q407	C10	R440	E5
C403	A5	Q408	D8	R441	F5
C404	A3	Q409	D7	R442	F6
C405	C3	Q410	E10	R443	E8
C406	E3	Q411	E10	R444	E8
C407	H3	Q412	F8	R445	F9
C408	C4	Q413	F7	R446	F8
C409	C9	Q414	G10	R447	E9
C410	B9	Q415	H8	R448	E10
C411	C5	Q416	H7	R449	F11
C412	A8	Q417	H5	R450	E12
C413	10F	Q418	C6	R451	E12
C416	E4	Q419	E5	R452	F12
C417	F8	R400	E2	R458	G5
C418	F9	R401	D2	R459	G8
C419	F11	R402	A4	R460	H5
C420	F5	R403	B5	R461	H9
C425	G4	R405	B5	R462	G11
C426	G9	R406	B5	R463	G11
DS401	E2	R407	C6	R464	H13
DS402	E2	R408	A9	R1025	H14
DS403	G14	R409	B9	S401	C2
DS404	H14	R410	B9	S402	H2
DS405	G15	R411	B9	S403	G14
DS406	H15	R412	A10	T401	A2
		R413	B10	V401	E9
		R415	A12	W401	A2

Typical Peak-to-Peak
Ripple Voltage Levels

TEST POINT	VOLTS
A4-A5	6 mv
A20-A22	10 mv
A22-A25	11 V
A5-A25	11 V
A26	675 V
A4-Gnd	4.5 mv
A13-A16	20 mv
A16-A18	10 V
A4-A18	11 V
A19	475 V
A3-Gnd	2 mv
A6-A9	10 mv
A9-A11	8 V
A12	425 V
A1-A2	2.5 mv
A27-A28	75. mv
A28-A30	1.2 V
A1-A30	1.2 V
A31	130 V

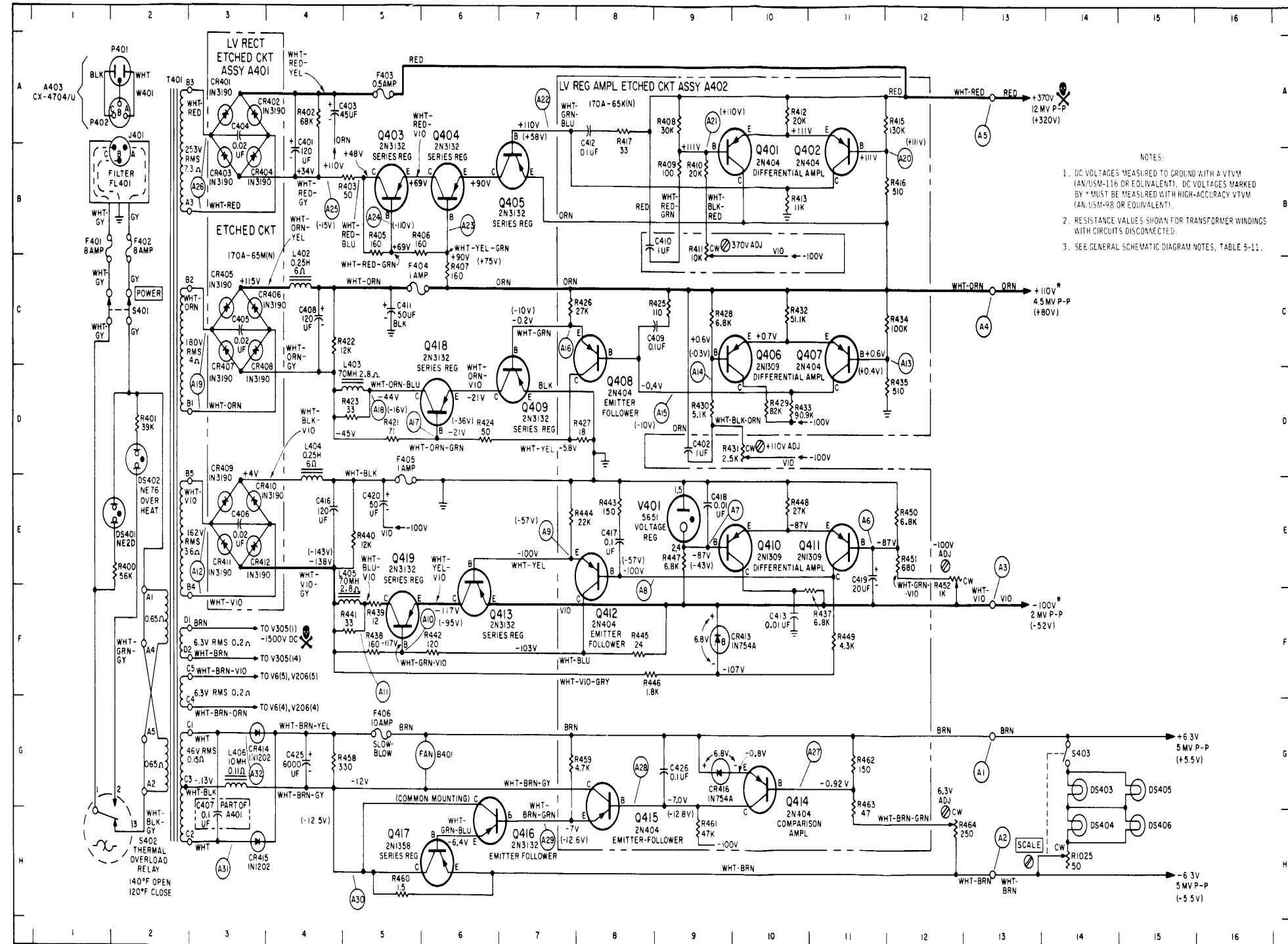


Figure 5-44. Low Voltage Power Supply Schematic Diagram.

UNCLASSIFIED
ORIGINAL 5-73, 5-74

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
A401	A3	FL401	B2	R416	B12
A402	A8	F401	B1	R417	A8
B401	G6	F402	B2	R421	D5
CR401	A3	F403	A5	R422	C5
CR402	A4	F404	C5	R423	D5
CR403	B3	F405	D5	R424	D6
CR404	B3	F406	G5	R425	C9
CR405	C3	J401	A2	R426	C8
CR406	C4	L402	B4	R427	D8
CR407	D3	L403	D6	R428	C9
CR408	D3	L404	D4		
CR409	D3	L405	E5	R430	D9
CR410	E4	P401	A2	R431	D9
CR411	E3	P402	A1	R432	C10
CR412	E3	Q401	A10	R433	D10
CR413	F10	Q402	A10	R434	C12
CR414	G3	Q403	A5	R435	D12
CR415	H3	Q404	A6		
CR416	G9	Q405	B7	R438	F5
C401	A4	Q406	C10	R439	F7
C402	D9	Q407	C10	R440	E5
C403	A5	Q408	D8	R441	F5
C404	A3	Q409	D7	R442	A3
C405	C3	Q410	E10	R443	E8
C406	E3	Q411	E10	R444	E8
C407	H3	Q412	F8	R445	F9
C408	C4	Q413	F7	R446	F8
C409	C9	Q414	G10	R447	E9
C410	B9	Q415	H8	R448	E10
C411	C5	Q416	H7	R449	F11
C412	A8	Q417	H5	R450	E12
		Q418	C6	R451	E12
C416	E4	Q419	E5	R452	E12
C417	E8	R400	E2	R458	G5
C418	E9	R401	D2	R459	G8
C419	E11	R402	A4	R460	H5
C420	E5	R403	B5	R461	H9
C425	G4	R405	B5	R462	G11
C426	G9	R406	B5	R463	G11
DS401	E2	R407	C6	R464	H13
DS402	E2	R408	A9	R1025	H14
DS403	G14	R409	B9	S401	C2
DS404	H14	R410	B9	S402	H2
DS405	G15	R411	B9	S403	G14
DS406	H15	R412	A10	T401	A2
		R413	B10	V401	E9
		R415	A12	W401	A2

Typical Peak-to-Peak Ripple Voltage Levels

TEST POINT	VOLTS
A4-A5	6 mv
A20-A22	10 mv
A22-A25	11 V
A5-A25	11 V
A26	675 V
A4-Gnd	4.5 mv
A13-A16	20 mv
A16-A18	10 V
A4-A18	11 V
A19	475 V
A3-Gnd	2 mv
A6-A9	3 mv
A9-A11	8 V
A12	425 V
A1-A2	2.5 mv
A27-A28	75. mv
A28-A30	1.2 V
A1-A30	1.2 V
A31	130 V

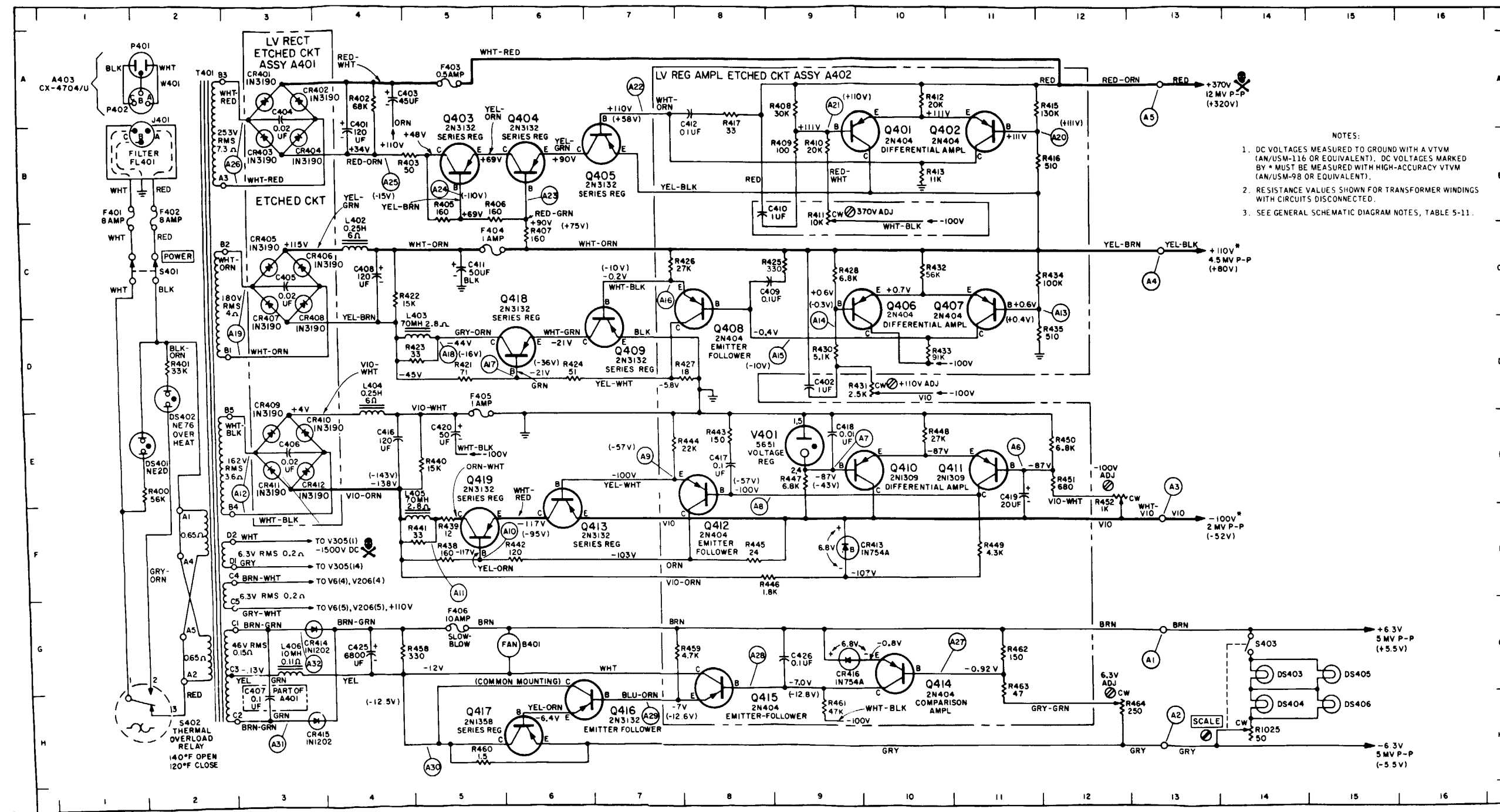


Figure 5-44A. Low Voltage Power Supply Schematic Diagram, AN/USM-140C.
UNCLASSIFIED
CHANGE 1 5-74.1

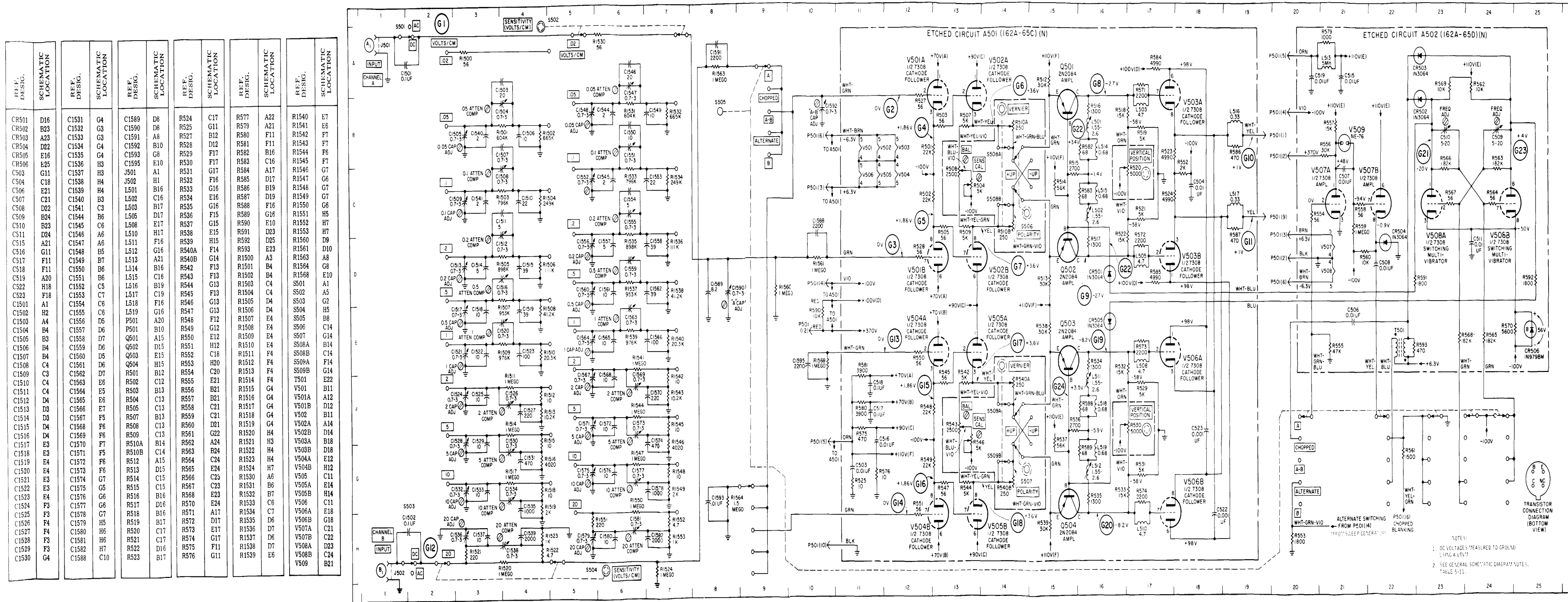


Figure 5-46. MX-2930B Dual Trace Preamplifier Schematic Diagram.
UNCLASSIFIED
ORIGINAL 5-77, 5-78

REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION	REF. DESIG.	SCHEMATIC LOCATION
CR501	D16	C1531	G4	C1589	D8	R524	C17	R577	A22	R1540	E7		
CR502	B23	C1532	G3	C1590	D8	R525	G11	R579	A21	R1541	E6		
CR503	A23	C1533	G3	C1591	A8	R527	B12	R580	F11	R1542	F7		
CR504	D22	C1534	G4	C1592	B10	R528	D12	R581	F11	R1543	F7		
CR505	E16	C1535	G4	C1593	G8	R529	F17	R582	B16	R1544	F6		
CR506	E25	C1536	H3	C1595	E10	R530	F17	R583	C16	R1545	F7		
C503	G11	C1537	H3	J501	A1	R531	G17	R584	A17	R1546	G7		
C504	C18	C1538	H4	J502	H1	R532	F16	R585	D17	R1547	G6		
C506	E21	C1539	H4	L501	B16	R533	G16	R586	B19	R1548	G7		
C507	C21	C1540	B3	L502	C16	R534	E16	R587	D19	R1549	G7		
C508	D22	C1541	C3	L503	B17	R535	G16	R588	F16	R1550	G8		
C509	B24	C1544	B6	L505	D17	R536	F15	R589	G16	R1551	H5		
C510	B23	C1545	C6	L508	E17	R537	G15	R590	E10	R1552	H7		
C511	D24	C1546	A6	L510	H17	R538	E15	R591	D23	R1553	H7		
C515	A21	C1547	A6	L511	F16	R539	H15	R592	D25	R1560	D9		
C516	G11	C1548	B5	L512	G16	R540A	F14	R593	E23	R1561	D10		
C517	F11	C1549	B7	L513	A21	R540B	G14	R1500	A3	R1563	A8		
C518	F11	C1550	B6	L514	B15	R542	F13	R1501	B4	R1564	G8		
C519	A20	C1551	B6	L515	C16	R543	F13	R1502	B4	R1568	E10		
CS22	H18	C1552	C5	L516	B19	R544	G13	R1503	C4	S501	A1		
CS23	F18	C1553	C7	L517	C19	R545	F13	R1504	C4	S502	A5		
C1500	A4	C1554	C6	L518	F16	R546	G13	R1505	D4	S503	G2		
C1501	H1	C1555	C6	L519	G16	R547	G13	R1506	D4	S504	H5		
C1502	H2	C1556	D5	P501	A20	R548	F12	R1507	E4	S505	B8		
C1503	A4	C1557	D6	P501	B10	R549	G12	R1508	E4	S506	C14		
C1504	B4	C1558	D7	Q501	A15	R550	F12	R1509	E4	S507	G14		
C1505	B3	C1559	D6	Q502	D15	R551	H12	R1510	E4	S508A	B14		
C1506	B4	C1560	D5	Q503	E15	R552	C18	R1511	F4	S508B	C14		
C1507	B4	C1561	D6	Q504	H15	R553	H20	R1512	F4	S509A	F14		
C1508	C3	C1562	D7	R501	B12	R554	C20	R1513	F4	S509B	G14		
C1509	C4	C1563	E6	R502	C12	R555	E21	R1514	F4	T501	E22		
C1510	C4	C1564	E5	R503	B13	R556	B21	R1515	G4	V501	B11		
C1511	D4	C1565	E6	R504	C13	R557	B21	R1516	G4	V501A	A12		
C1512	D4	C1566	E7	R505	C13	R558	C21	R1517	G4	V501B	D12		
C1513	D3	C1567	F5	R507	B13	R559	C21	R1518	G4	V502	B11		
C1514	D4	C1568	F6	R508	C13	R560	D21	R1519	G4	V502A	A14		
C1515	D4	C1569	F6	R509	C13	R561	G22	R1520	H4	V502B	D14		
C1516	D4	C1570	F7	R510A	B14	R562	A24	R1521	H3	V503A	B18		
C1517	E3	C1571	F5	R510B	C14	R563	H24	R1522	H4	V503B	D18		
C1518	F4	C1572	F6	R512	A15	R564	C24	R1523	H4	V504A	E12		
C1519	F4	C1573	F6	R513	D15	R565	L24	R1524	H7	V504B	H12		
C1520	F4	C1574	G7	R514	C15	R566	C22	R1525	A6	V505	C11		
C1521	E3	C1575	G5	R515	C15	R567	C23	R1526	B6	V505A	E14		
C1522	E3	C1576	G6	R516	B16	R568	E23	R1527	B7	V505B	H14		
C1523	E4	C1577	G6	R517	D16	R569	E24	R1528	C6	V506	C11		
C1524	F3	C1578	G7	R518	B16	R570	E24	R1529	C7	V506A	E18		
C1525	F3	C1579	H5	R519	B17	R572	D17	R1530	D6	V506B	G18		
C1526	F4	C1580	H6	R520	C17	R573	E17	R1531	B7	V507A	C22		
C1527	F4	C1581	H6	R521	C17	R574	E17	R1532	D6	V507B	C21		
C1528	F3	C1582	H7	R522	D16	R575	F11	R1533	D7	V508A	D23		
C1529	F3	C1583	H7	R523	D16	R576	F11	R1534	D7	V508B	C24		
C1530	G4	C1584	C10	H523	B17	R576	G11	R1539	E6	V509	B21		

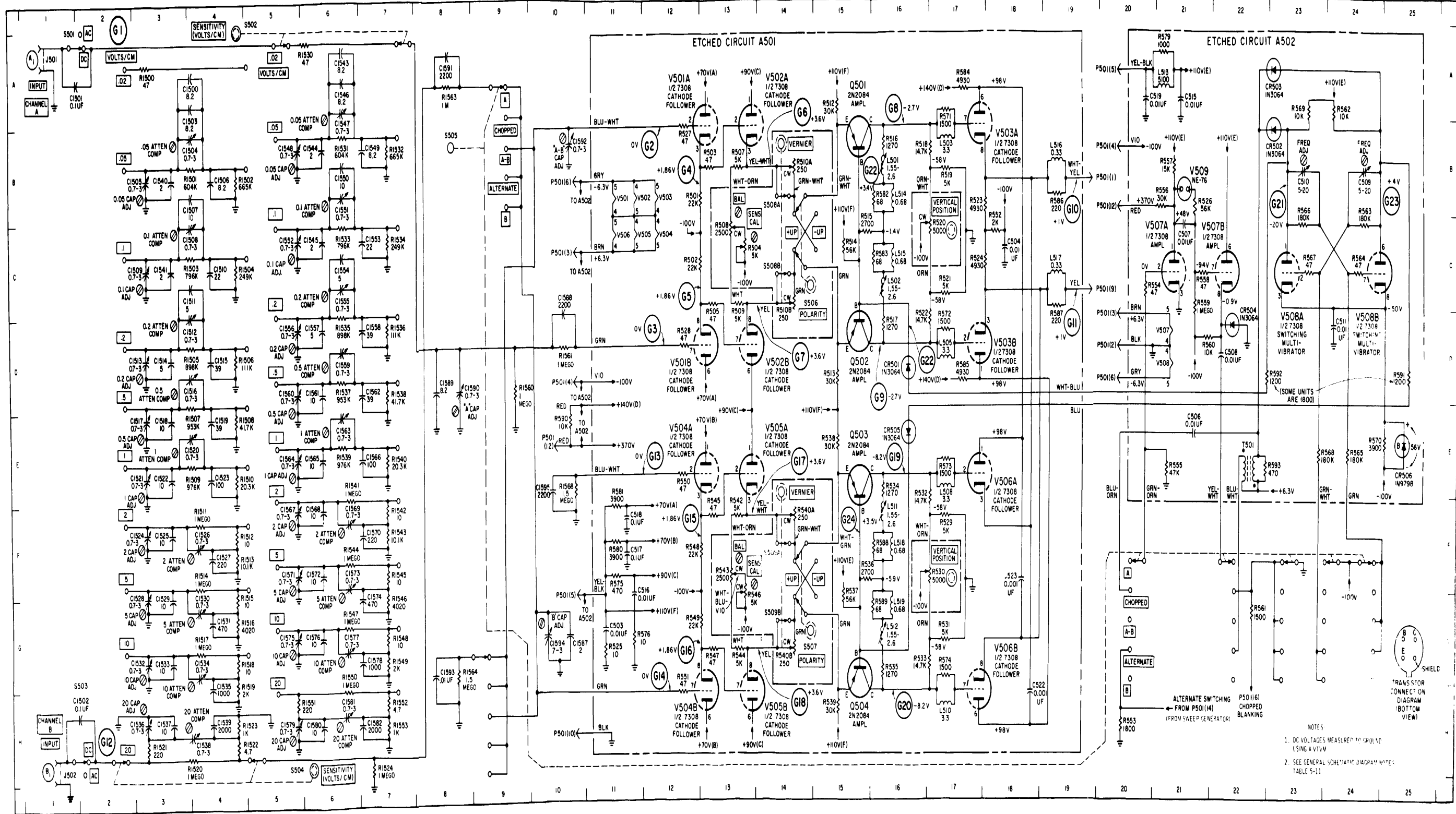


Figure 5-46A. MX-2930 Dual Trace Preamp Schematic Diagram.
AN/USM-140C
UNCLASSIFIED
CHANGE 1 5-78.1


Ft Carson (25)	11-157 (2)
Ft Knox (12)	11-158 (2)
Ft Devens (5)	11-215 (2)
JCA, Ft Ritchie (5)	11-216 (2)
Army Dep (2) except	11 -225 (2)
LBAD (14)	11-226 (2)
SAAD (30):	11-500 AA-AC (2)
TOAD (14)	11-587 (2)
FTWOAD (10)	11.592 (2)
LEAD (7)	11-597 (2)
SHAD (3)	17 (2)
NAAD (5)	17-100 (2)
SVAD (5)	29-1 (2)
CHAD (3)	29-11 (2)
ATAD (10)	29-15 (2)
GENDEP (OS) (2)	29-16 (2)
Sig Sec, GENDEP (OS) (5)	29-21 (2)
Sig Dep (OS) (12)	29-25 (2)
Sig Fld Maint Shops (2)	29-26 (2)
AMS (1)	29-35 (2)
USAERDAA (2)	29-36 (2)
USAERDAW (13)	29-41 (2)
USACRREL (2)	29-51 (2)
USAEHA (5)	29-55 (2)
USAPA (5)	29-56 (2)
MAAG, Taiwan (5)	29-75 (23)
MAAG, Vietnam (53)	29-85 (2)
USA Comm Agcy, Taiwan (5)	29-86 (2)
AFIP (5)	29-87 (2)
Ft Monmouth Sig Spt Fac (5)	29-105 (2)
FGH (5)	29-109 (2)
Units org under fol TOE:	31-105 (2)
1-307 (2)	32-56 (2)
6-101 (2)	32-77 (2)
6-615 (2)	32-500 (2)
6-616 (2)	37 (2)
7 (2)	37-100 (23)
7-100 (2)	44-235 (2)
11-6 (2)	44-236 (2)
11-35 (2)	44-536 (2)
11-36 (2)	44- 547 (2)
11-37 (2)	44-548 (2)
11-38 (2)	44-568 (2)
11-39 (2)	47 (2)
11-56 (2)	55-50 (2)
11-57 (2)	55-89 (2)
11-97 (2)	55-99 (2)
11-98 (2)	55-405 (2)
11-105 (2)	55-407 (2)
11-106 (2)	55-417 (2)
11-117 (2)	55-457 (2)
11-127 (2)	55-458 (2)
11-155 (2)	57 (2)
11-156 (2)	57-100 (2)

NG: State AG (3); Units-same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320-50

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

 <div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 20px;"> <p style="margin: 0;"><i>THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.</i></p> </div>		SOMETHING WRONG WITH PUBLICATION	
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PAGE NO.	PARA- GRAPH	FIGURE NO.	TABLE NO.
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PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER			SIGN HERE

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PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 decagram = 10 grams = .35 ounce
 1 hectogram = 10 decagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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