TECHNICAL MANUAL

for

DIVERSITY VISUAL MONITOR UNIT MODEL DVM-2, 3, 4

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, ONTARIO

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IN-4007 Issue Date: 1 November 1962

NOTICE

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.

2. That the defect is not the result of damage incurred in shipment from or to the factory.

3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.

4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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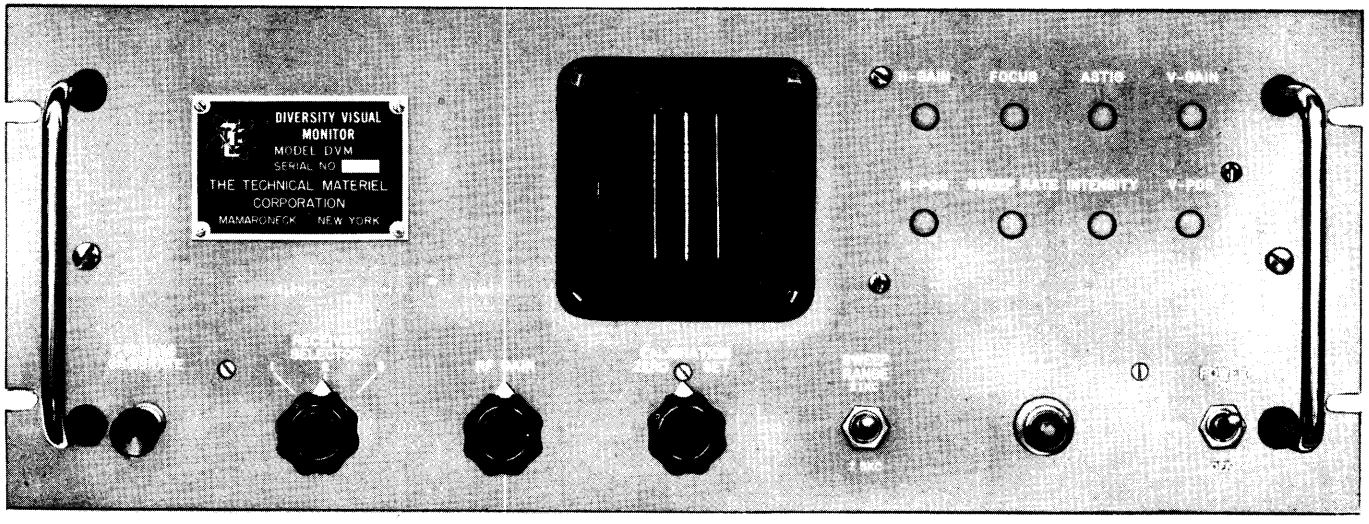


Figure 1-1 Diversity Visual Monitor Unit, Model DVM-2, 3, 4

SECTION I
GENERAL DESCRIPTION

1-1. INTRODUCTION

1-1-1. This manual contains technical information for the Diversity Visual Monitor Unit, Model DVM-2, 3 and 4, illustrated in figure 1-1. This unit provides visual indication of any type of incoming i-f carrier signal. The monitor unit is used with up to three receivers for immediate recognition of incorrect tuning, permitting extremely accurate tuning.

1-1-2. The monitor unit indicates incorrect tuning as a lateral displacement of a pulse pattern appearing on a calibrated oscilloscope. Correct tuning is indicated when the pulse pattern is centered on the oscilloscope. The oscilloscope is calibrated by use of an internal crystal-controlled oscillator. The monitor unit acts to continuously sweep an intermediate frequency. Sweep ranges of ±1 kc and ±5 kc are selected by the SWEEP RANGE switch on the front panel.

1-1-3. The monitor unit also provides an exact tuning of frequency shift signals. Calibration lines on the oscilloscope screen correspond to the mark and space frequencies of standard 850-cycle teletype.

1-2. GENERAL DESCRIPTION

1-2-1. The monitor unit consists of a chassis and a front panel. The chassis extends 14-1/8 inches behind the front panel and is self-supporting. Provision is made for slide mounting. Input and output connectors are located at the rear of the chassis. Controls and switches for operation of the monitor unit are mounted on the front panel. A monitor unit arranged for three 500-kc, 70-ohm inputs is designated as Model DVM-2. A monitor unit arranged for three 455-kc, 70-ohm inputs is designated as Model DVM-3. A monitor unit arranged for three 250-kc, 70-ohm inputs is designated as Model DVM-4. Monitor units arranged for other inputs are available on request. Table 1-1 lists the physical characteristics on all models of the equipment.

TABLE 1-1 PHYSICAL CHARACTERISTICS

CHARACTERISTICS	DIMENSIONS
Length*	19 inches
Height*	7 inches
Depth*	14-5/16 inches
Volume	1.1 cubic feet
Weight	25 pounds
* Installation dimensions	

1-2-2. The monitor unit has an internal power supply. Table 1-2 lists the electrical characteristics of the equipment.

TABLE 1-2 ELECTRICAL CHARACTERISTICS

Input (Model DVM-2)	500 kc from three diversity receivers (minimum 0.1 volt) 70-ohm line.
Input (Model DVM-3)	455 kc from three diversity receivers (minimum 0.1 volt) 70-ohm line.
Input (Model DVM-4)	250 kc from three diversity receivers (minimum 0.1 volt) 70-ohm line.
Output	Two 70-ohm i-f outputs
Power Requirements	105-115-125/210-230 volts
Frequency	50/60 cycles
Power Consumption	70 watts
Fuse Protection	1 ampere (115 volts) 0.5 ampere (230 volts)

1-2-3. The monitor unit is shipped in a durable wooden box. Table 1-3 lists the shipping data for the equipment.

TABLE 1-3 SHIPPING DATA

CHARACTERISTICS	DIMENSIONS
Length	24.5 inches
Height	10 inches
Depth	23 inches
Volume	2.7 cubic feet
Weight	44 pounds

1-2-4. The monitor unit has 11 electron tubes and 6 diodes. Table 1-4 lists these tubes and diodes with their reference designations.

1-2-5. The monitor unit is controlled by one push-button switch, one rotary selector switch, two toggle switches, and two potentiometers. Table 1-5 lists the controls and their functions. The monitor unit is adjusted by 1 variable capacitor, 2 adjustable i-f transformers, and 10 potentiometers. Table 1-6 lists the adjustment points, their functions, and their reference designations.

TABLE 1-4 ELECTRON TUBE AND DIODE COMPLEMENT

REFERENCE DESIGNATION	TUBE OR DIODE	QUANTITY
CR100, CR105	IN39B	2
CR101 through CR103	RX-107-2	3
CR104	IN482A	1
V100, V102	6AG5	2
V101	6BE6	1
V103	12AX7	1
V104	884	1
V105, V107	12AT7	2
V106	3WP1	1
V108	6U8A	1
V109	5Y3GT	1
V110	OB2	1

TABLE 1-5 CONTROLS

CONTROL	FUNCTION
PUSH TO CALIBRATE	Energizes marker oscillator and applies signal to oscilloscope for calibration. Disables receiver input to mixer.
RECEIVER SELECTOR	Selects input signal to be monitored.
RF GAIN	Adjusts height of signal pattern on oscilloscope.
CALIBRATION ZERO SET	Adjusts centering of marker oscillator signal pattern on oscilloscope.
SWEEP RANGE	Sets sweep range at ±1 kc or ±5 kc.
POWER ON-OFF	Turns monitor unit on and off.

TABLE 1-6 ADJUSTMENTS

ADJUSTMENT	REFERENCE DESIGNATION	FUNCTION
H-GAIN	R156	Sets horizontal response.
V-GAIN	R131	Sets vertical response.
H-POS	R152	Sets horizontal position.
V-POS	R137	Sets vertical position.
INTENSITY	R145	Controls trace brightness.
FOCUS	R147	Controls trace sharpness.
ASTIG	R140	Controls trace uniformity.
SWEEP RATE	R124	Controls sawtooth oscillator frequency.
1-kc sweep range adjustment	R161	Controls ±1-kc sweep range.
5-kc sweep range adjustment	R160	Controls ±5-kc sweep range.
Marker gain	C100	Controls marker oscillator gain.
Sweep oscillator, fine tuning	T102	Adjusts sweep oscillator.
Sweep oscillator, broad tuning	T102	Adjusts sweep oscillator.
100-kilocycle i-f primary	T100	Adjusts i-f coupling.
100-kilocycle i-f secondary	T100	Adjusts i-f coupling.

SECTION II
INSTALLATION

2-1. PACKAGING

2-1-1. The monitor unit is shipped from the factory in a shock-resistant, moistureproof package. The equipment is snugly packed in a unit package container. This container includes a bag of silica gel to absorb moisture. The unit package container is surrounded by a barrier bag (MIL-B-131C-Class 2). The container with bag is enclosed in a waterproof cardboard box and crated in a wooden crate with steel strapping.

2-1-2. Unpack the monitor unit carefully. Discard packing material and remove tape or cushioning material from the individual components. Check the equipment for obvious defects such as broken electron tubes or other physical damage.

2-2. INSTALLATION DETAILS

2-2-1. Determine power line voltage and frequency before connecting monitor unit to the power line. The monitor unit, as unpacked, is wired for 115-volt operation. Additional power transformer taps are available for use when line voltage is consistently high or low. The monitor unit may be operated on 210 to 230-volt primary power if power transformer taps 3a and 3b are used.

CAUTION

Change fuse F100 to a 1/2-ampere fuse if 210 to 230-volt operation is selected.

2-2-2. Do not reset any of the front panel or chassis screwdriver adjustments listed in Table 1-6. These adjustments are correctly set at the factory. Adjustment is not required during installation.

2-2-3. Install the monitor unit in the desired location. Refer to figure 2-1 for outline dimensions. Connect receiver inputs to jacks J101 through J103.

NOTE

Jacks J104 and J105 are output jacks that are taps on input jacks J101 and J102, respectively. Jacks J104 and J105 may be used to drive sideband converters, diversity combining units, etc.

2-3. INITIAL ADJUSTMENT

2-3-1. No initial adjustment of the monitor unit is required. Refer to Tables 3-1 and 3-2 for operation sequences for the equipment.

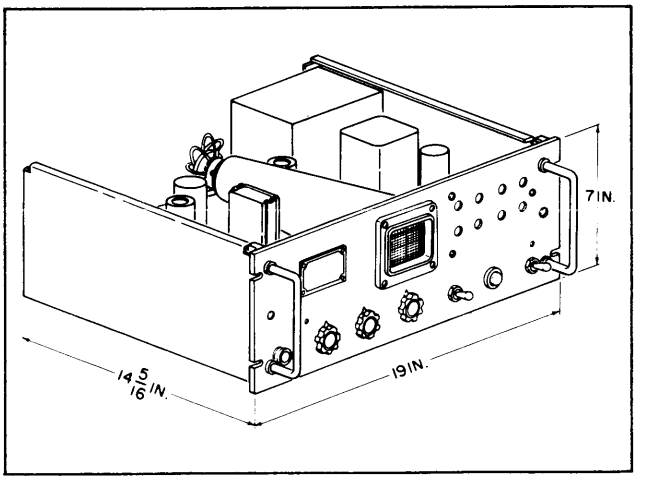


Figure 2-1 Outline Dimensional View for Diversity Visual Monitor Unit, Model DVM-2, 3, 4

SECTION III
OPERATOR'S SECTION

3-1. INTRODUCTION

3-1-1. Operation of the monitor unit is directly related to operation of the receivers that are connected to the monitor unit. The i-f inputs from the receivers are visualized on the oscilloscope of the monitor unit. Correct functioning of the monitor unit is dependent upon correct functioning of the interconnected receivers.

3-2. OPERATING INSTRUCTIONS

3-2-1. Tables 3-1 and 3-2 are operating charts for the monitor unit. Operate the monitor unit as outlined in these tables. Figure 3-1 provides reference designations for the operating controls.

3-3. OPERATOR'S MAINTENANCE

3-3-1. The monitor unit provides long-term, trouble-free continuous operation. Maintenance of the equipment should be performed by a qualified maintenance technician. Operators may perform the emergency maintenance discussed in the following paragraphs when properly authorized.

3-3-2. REPLACEMENT OF FUSE. Fuse failure is indicated by failure of the indicator lamp to light when the POWER switch is ON, and when the filaments of the electron tubes do not light. Check fuse F100 at the rear of the chassis. Replace if defective with a fuse of equal rating.

CAUTION

Do not replace fuse F100 with a fuse of higher rating unless continued operation of the monitor unit is more important than probable damage. If the fuse blows immediately after replacement, do not replace it again until the trouble has been corrected.

3-3-3. REPLACEMENT OF ELECTRON TUBES. Electron tube failure may be indicated by failure of tube filaments to light when the POWER switch is ON, and when the tubes do not heat. Remove questionable tubes and test with a tube tester. Be certain to reinstall tube shields after testing or replacing tubes.

TABLE 3-1 OPERATION CHART: CW/MCW OR PHONE OPERATION

STEP	CONTROL	OPERATION	PURPOSE
1	POWER switch	Turn to ON position. Determine that red indicator lights.	Energizes monitor unit.
2	SWEEP RANGE switch	Set to ± 5KC position.	Selects wide sweep range.
3	PUSH TO CALIBRATE switch	Depress and hold.	Energizes marker oscillator and applies signal to oscilloscope for calibration. Disables receiver input to mixer.
4	CALIBRATION ZERO SET control	Adjust control to center reference pulses on zero reference line of oscilloscope screen (figure 3-2).	Calibrates monitor unit.
5	PUSH TO CALIBRATE switch	Release.	Feeds receiver inputs to mixer stage.
6		Turn on and rough tune receivers connected to monitor unit.	Provides i-f inputs for monitor unit.
7	RECEIVER SELECTOR switch	Set to 1.	Feeds i-f output from receiver No. 1 to mixer stage of monitor unit.
8		Check receiver No. 1 pulse pattern on oscilloscope (figures 3-3 and 3-4).	Determines that monitor unit is operating.

STEP	CONTROL	OPERATION	PURPOSE
9	RF GAIN control	Adjust control until pulse pattern is 1 to 1-1/2 inches high.	Maximizes pulse pattern.
10		Tune receiver No. 1 until pulse pattern is centered on zero reference line of oscilloscope screen (figure 3-2).	Ensures that receiver No. 1 is correctly tuned.
11	SWEEP RANGE switch	Set to ± 1KC position.	Selects narrow sweep range.
12		Repeat steps 3 through 5. However, see figure 3-5 rather than figure 3-2.	Calibrates monitor unit.

NOTE

Repeat steps 3 through 5 whenever SWEEP RANGE switch position is changed. See figure 3-2 for desired pattern when SWEEP RANGE switch is set to ± 5KC position. See figure 3-5 for desired pattern when SWEEP RANGE switch is set to ± 1KC position.

STEP	CONTROL	OPERATION	PURPOSE
13		Fine tune receiver No. 1 until pulse pattern is centered on zero reference line of oscilloscope screen (figure 3-5).	Ensures that receiver No. 1 is correctly tuned.
14	RECEIVER SELECTOR switch	Set to 2.	Feeds i-f output from receiver No. 2 mixer stage.
15		Repeat steps 8 through 13 for receiver No. 2.	Ensures correct tuning of receiver No. 2.
16	RECEIVER SELECTOR switch	Set to 3.	Feeds i-f output from receiver No. 3 to mixer stage.
17		Repeat steps 8 through 13 for receiver No. 3.	Ensures correct tuning of receiver No. 3.
18	SWEEP RANGE switch	Set to ± 5KC position.	Selects wide sweep range.
19		Repeat steps 3 through 5.	Calibrates monitor unit.
20	RECEIVER SELECTOR switch	Set to 1, 2, or 3, as desired.	Continuous monitoring of receiver tuning.

NOTE

When the monitor unit is employed for continuous monitoring, drift, fading, and interference appears on the oscilloscope. Modulation appears as irregularities in pulse shape. Sidebands are not visible.

TABLE 3-2 OPERATION CHART: FREQUENCY SHIFT OPERATION (850 CYCLE)

NOTE

An FS signal usually consists of two carriers: a mark frequency and a space frequency. Normally, the mark frequency is higher. When tuning in an FS signal on standby transmitting condition, the FS usually is on the mark frequency, while the mark pulse peak indication appears to the right of the zero reference line on the oscilloscope screen. With start of pulse transmission, the mark and space pulse peaks of the receiver signals should be tuned to be equally distant from the zero reference line. For convenience in tuning 850-cycle shift FS signals, a calibrated screen is included. This screen is calibrated ±425 cycles from the zero reference line.

STEP	CONTROL	OPERATION	PURPOSE
1	POWER switch	Turn to ON position. Determine that red indicator lights.	Energizes monitor unit.
2	SWEEP RANGE switch	Set to ± 5KC position.	Selects wide sweep range.
3	PUSH TO CALIBRATE switch	Depress and hold.	Energizes marker oscillator and applies signal to oscilloscope for calibration. Disables receiver input to mixer.
4	CALIBRATION ZERO SET control	Adjust control to center reference pulses on zero reference line of oscilloscope (figure 3-2).	Calibrates monitor unit.
5	PUSH TO CALIBRATE switch	Release.	Feeds receiver inputs to mixer stage.
6		Turn on and rough tune receivers connected to monitor unit.	Provides i-f inputs for monitor unit.
7	RECEIVER SELECTOR switch	Set to 1.	Feeds i-f output from receiver No. 1 to mixer stage of monitor unit.
8		Check receiver No. 1 pulse pattern on oscilloscope (figures 3-3 and 3-4).	Determines that monitor unit is operating.
9	RF GAIN control	Adjust control until pulse pattern is 1 to 1-1/2 inches high.	Maximizes pulse pattern.
10a		If signal is being keyed, tune receiver No. 1 until pulsating peaks are equidistant from zero reference line (figure 3-6).	Ensures that receiver No. 1 is correctly tuned.
10b		If signal is static, tune receiver No. 1 so test pulse pattern coincides with right reference line.	Ensures that receiver No. 1 is correctly tuned.
11	SWEEP RANGE switch	Set to ± 1KC position.	Selects narrow sweep range.

STEP	CONTROL	OPERATION	PURPOSE
12		Repeat steps 3 through 5. However, see figure 3-5 rather than figure 3-2.	Calibrates monitor unit.

NOTE

Repeat steps 3 through 5 whenever SWEEP RANGE switch position is changed. See figure 3-2 for desired pattern when SWEEP RANGE switch is set to ± 5KC position. See figure 3-5 for desired pattern when SWEEP RANGE switch is set to ± 1KC position.

STEP	CONTROL	OPERATION	PURPOSE
13		Fine tune receiver No. 1 until pulsating peaks are equidistant from zero reference line (figure 3-7) or single pulse pattern is centered on the right 425-cycle line (steps 10a and 10b).	Ensures that receiver No. 1 is correctly tuned.
14	RECEIVER SELECTOR switch	Set to 2.	Feeds i-f output from receiver No. 2 to mixer stage.
15		Repeat steps 8 through 13 for receiver No. 2.	Ensures correct tuning of receiver No. 2.
16	RECEIVER SELECTOR switch	Set to 3.	Feeds i-f output from receiver No. 3 to mixer stage.
17		Repeat steps 8 through 13 for receiver No. 3.	Ensures correct tuning of receiver No. 3.
18	SWEEP RANGE switch	Set to ± 5KC position.	Selects wide sweep range.
19		Repeat steps 3 through 5.	Calibrates monitor unit.
20	RECEIVER SELECTOR switch	Set to 1, 2, or 3, as desired.	Continuous monitoring of receiver tuning.

NOTE

When the monitor unit is employed for continuous monitoring, drift, fading, and interference appears on the oscilloscope. Modulation appears as irregularities in pulse shape. Sidebands are not visible.

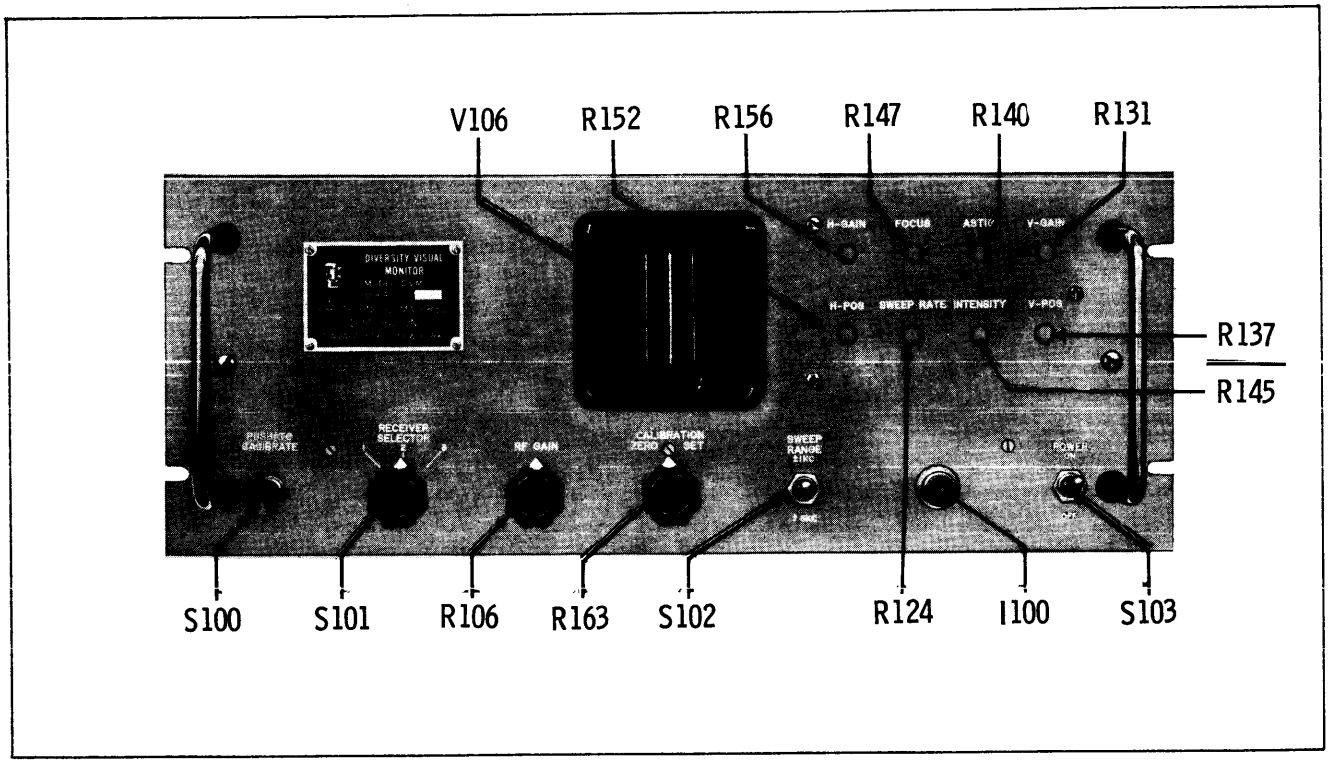


Figure 3-1 Reference Designations for Front Panel Controls

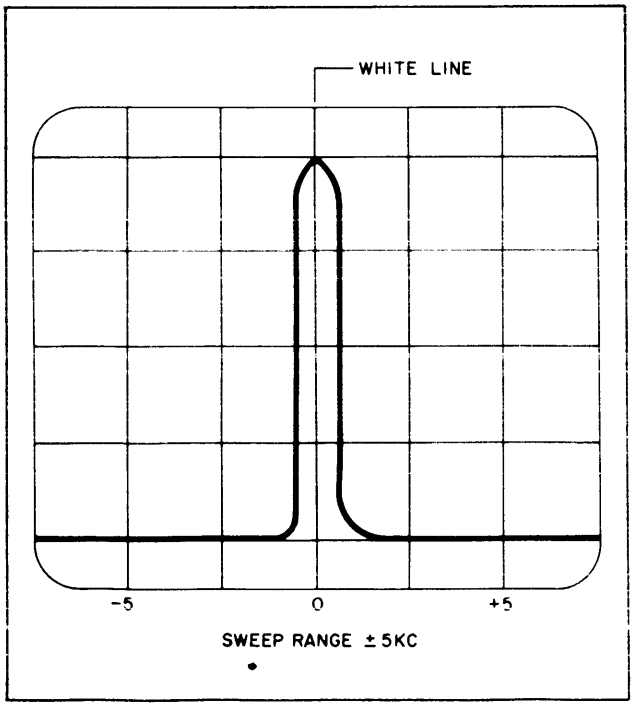


Figure 3-2 Reference Marker or Correctly Tuned Signal Pulse, Sweep Range at ±5 Kc

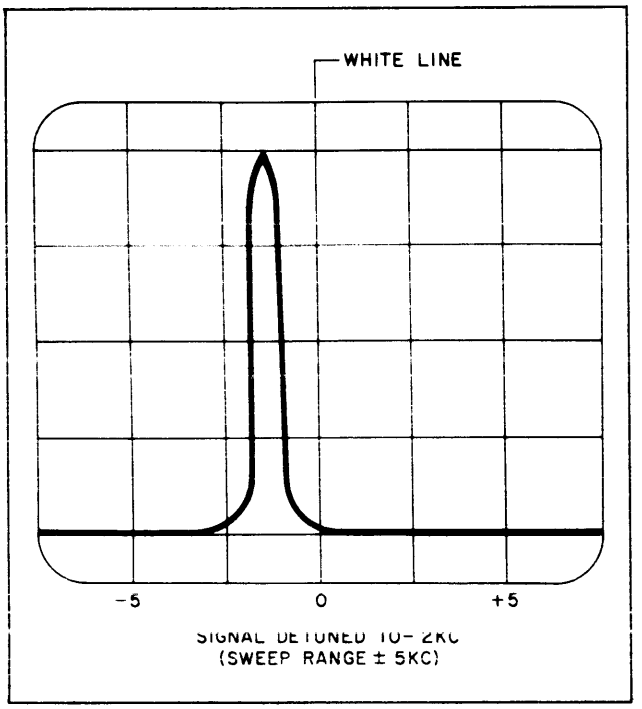


Figure 3-3 Incorrectly Tuned Signal, Sweep Range at ±5 Kc

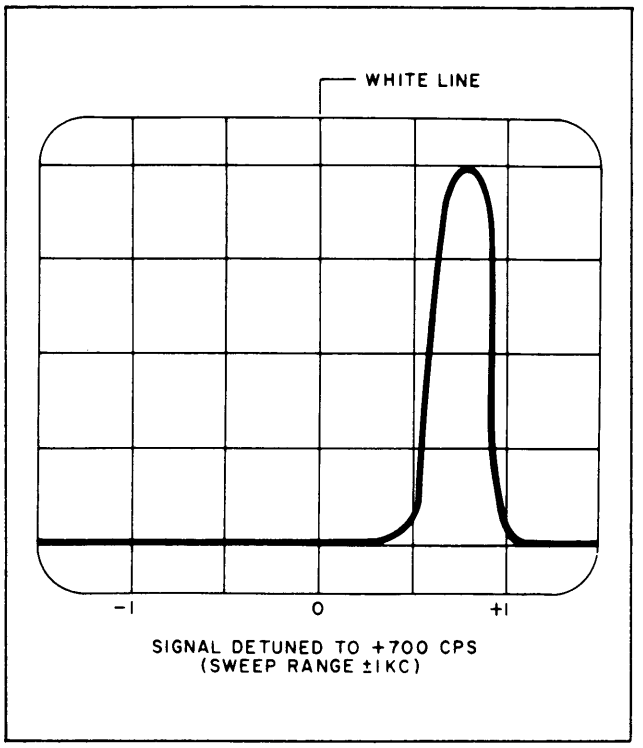


Figure 3-4 Incorrectly Tuned Signal, Sweep Range at ±1 Kc

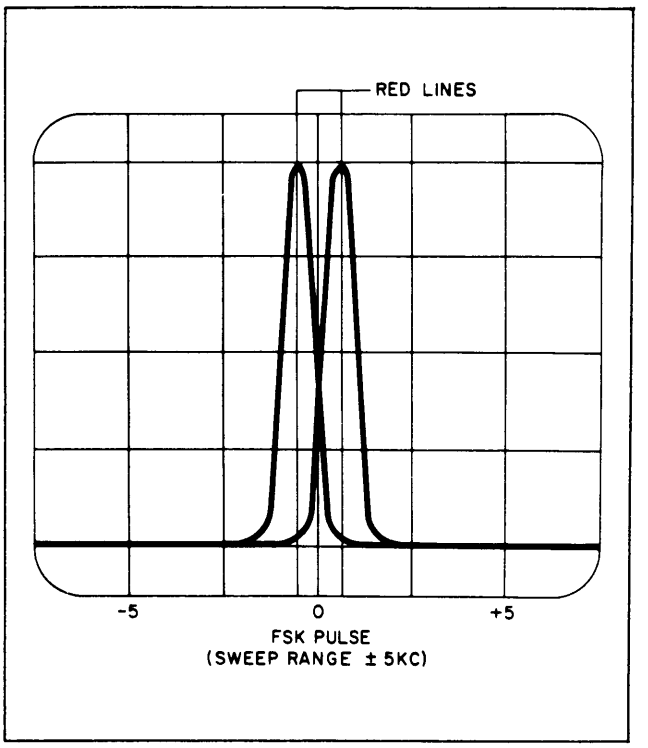


Figure 3-6 Frequency Shift Signal Correctly Tuned, Sweep Range at ±5 Kc

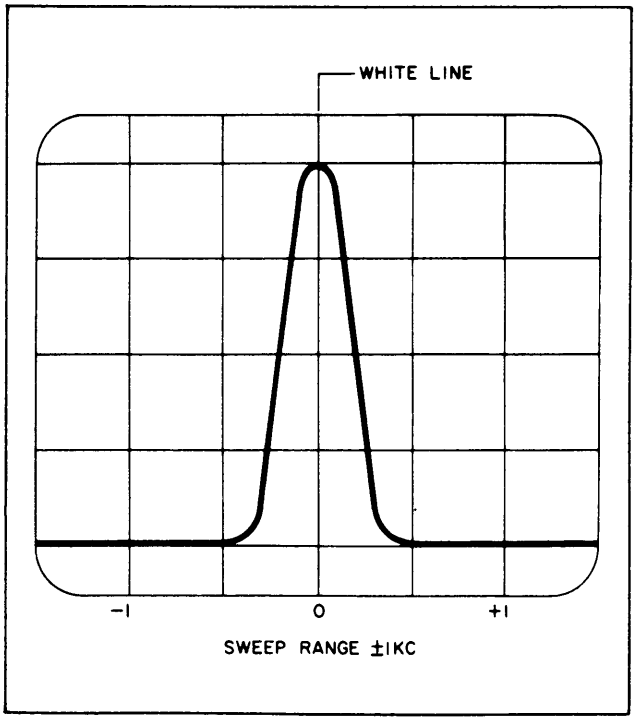


Figure 3-5 Reference Marker or Correctly Tuned Signal Pulse, Sweep Range at ±1 Kc

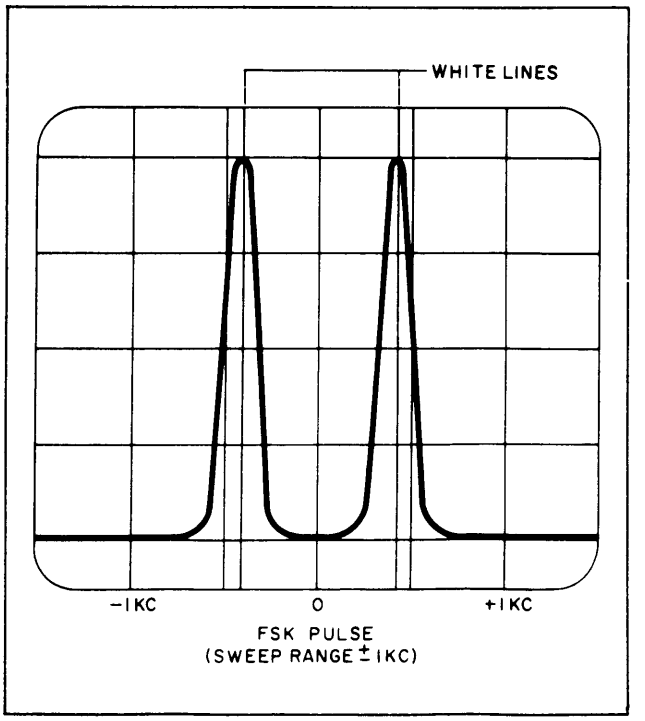


Figure 3-7 Frequency Shift Signal Correctly Tuned, Sweep Range at ±1 Kc

SECTION IV
THEORY

4-1. INTRODUCTION

4-1-1. Figure 4-1 is a block diagram of the monitor unit. This diagram shows the routing of an input i-f signal to the oscilloscope and also illustrates the sweep and associated circuitry. The following paragraphs discuss the theory of operation of the various stages appearing on the block diagram.

4-2. STAGE-BY-STAGE DESCRIPTION

4-2-1. MARKER OSCILLATOR. Figure 4-2 is a simplified schematic diagram of the marker oscillator. This crystal-controlled oscillator provides a reference signal that is used to calibrate the monitor unit when PUSH TO CALIBRATE switch S100 is depressed. The amplitude of the marker oscillator signal may be adjusted by resetting capacitor C100. The marker oscillator frequency is controlled by crystal Y100. The marker oscillator frequency in Model DVM-2 is 500 kc. The marker oscillator frequency in Model DVM-3 is 455 kc. The marker oscillator frequency in Model DVM-4 is 250 kc.

4-2-2. SAWTOOTH GENERATOR. Figure 4-3 is a simplified schematic diagram of the sawtooth generator. The sawtooth generator is a free-running relaxation oscillator at approximately 45 cycles per second. The frequency is determined by time constants R124, R123, and C115. Initially V104 does not conduct. C115 charges approximately linearly with time through R123 and R124. C115 charges until the voltage across it is high enough to cause V104 to conduct. C115 quickly discharges through V104. When the voltage across C115 drops, V104 stops conducting and the cycle repeats. The voltage change across C115, with respect to time, resembles a sawtooth. The repetition rate is approximately 45 cycles per second. The time base voltage synchronizes the vertical signal pulse with the input frequency through the reactance modulator and the horizontal amplifier.

4-2-3. REACTANCE MODULATOR/SWEEP OSCILLATOR. Figure 4-4 is a simplified schematic diagram of the reactance modulator and sweep oscillator. The time base voltage derived from the sawtooth generator, acting through the reactance modulator, causes the sweep oscillator frequency to vary linearly with time. The operating point of the sweep oscillator is chosen so that the oscillator maintains a center frequency exactly 100 kc above the desired i-f input frequency of the monitor unit when the sawtooth voltage has attained half its maximum value. As the amplitude of the sawtooth voltage increases above operating center, the sweep oscillator frequency increases above its center frequency. For amplitudes of sawtooth voltage below operating center, the sweep oscillator frequency is correspondingly lower than its center frequency. Center frequency of the sweep oscillator may be adjusted by resetting R163.

4-2-4. MIXER/CRYSTAL FILTER. Figure 4-5 is a simplified schematic diagram of the mixer/crystal filter. The i-f input signal and the sweep oscillator signal are heterodyned in the mixer. Since the varying sweep oscillator frequency centers about a frequency 100 kc greater than the i-f input frequency, a frequency-modulated voltage difference of 100 kc is produced in the plate circuit of the mixer. When the i-f input frequency is greater or less than the i-f input frequency that results from correct receiver tuning, the resulting 100-kc voltage difference is produced at a time when the sawtooth voltage controlling the horizontal sweep of the oscilloscope is greater or less than half its maximum value. The vertical pulse visible on the oscilloscope is not centered unless the i-f input frequency due to receiver tuning is correct. The time of production of the 100-kc voltage difference governs where the vertical pulse appears on the oscilloscope. Filter FL100 attenuates all frequencies except the 100-kc voltage difference that is to be seen on the oscilloscope.

4-2-5. I-F AMPLIFIER. Figure 4-6 is a simplified schematic diagram of the i-f amplifier. This amplifier amplifies the filtered pulse signal from the mixer. The amplified signal is applied to the detector, envelope detector, and peak limiter.

4-2-6. ENVELOPE DETECTOR/PEAK LIMITER. Figure 4-7 is a simplified schematic diagram of the envelope detector and peak limiter. The a-c voltage difference from the i-f amplifier passes through CR105. This diode detects modulation and ringing. CR104 converts this to a d-c voltage which biases the detector, limiting intermodulation.

4-2-7. DETECTOR/PULSE AMPLIFIER/D-C RESTORER. Figure 4-8 is a simplified schematic diagram of the detector, pulse amplifier, and d-c restorer. The output of the detector is amplified by the pulse amplifier and is coupled through the d-c restorer to the push-pull vertical amplifier.

4-2-8. VERTICAL DEFLECTION AMPLIFIER. Figure 4-9 is a simplified schematic diagram of the vertical deflection amplifier. This amplifier amplifies the signal from the pulse amplifier and applies it to the vertical deflection plates of the oscilloscope. R131 controls vertical gain and R137 controls vertical position.

4-2-9. HORIZONTAL DEFLECTION AMPLIFIER. Figure 4-10 is a simplified schematic diagram of the horizontal deflection amplifier. This amplifier amplifies the signal from the sawtooth generator to produce the horizontal sweep. R156 controls horizontal gain and R152 controls horizontal position.

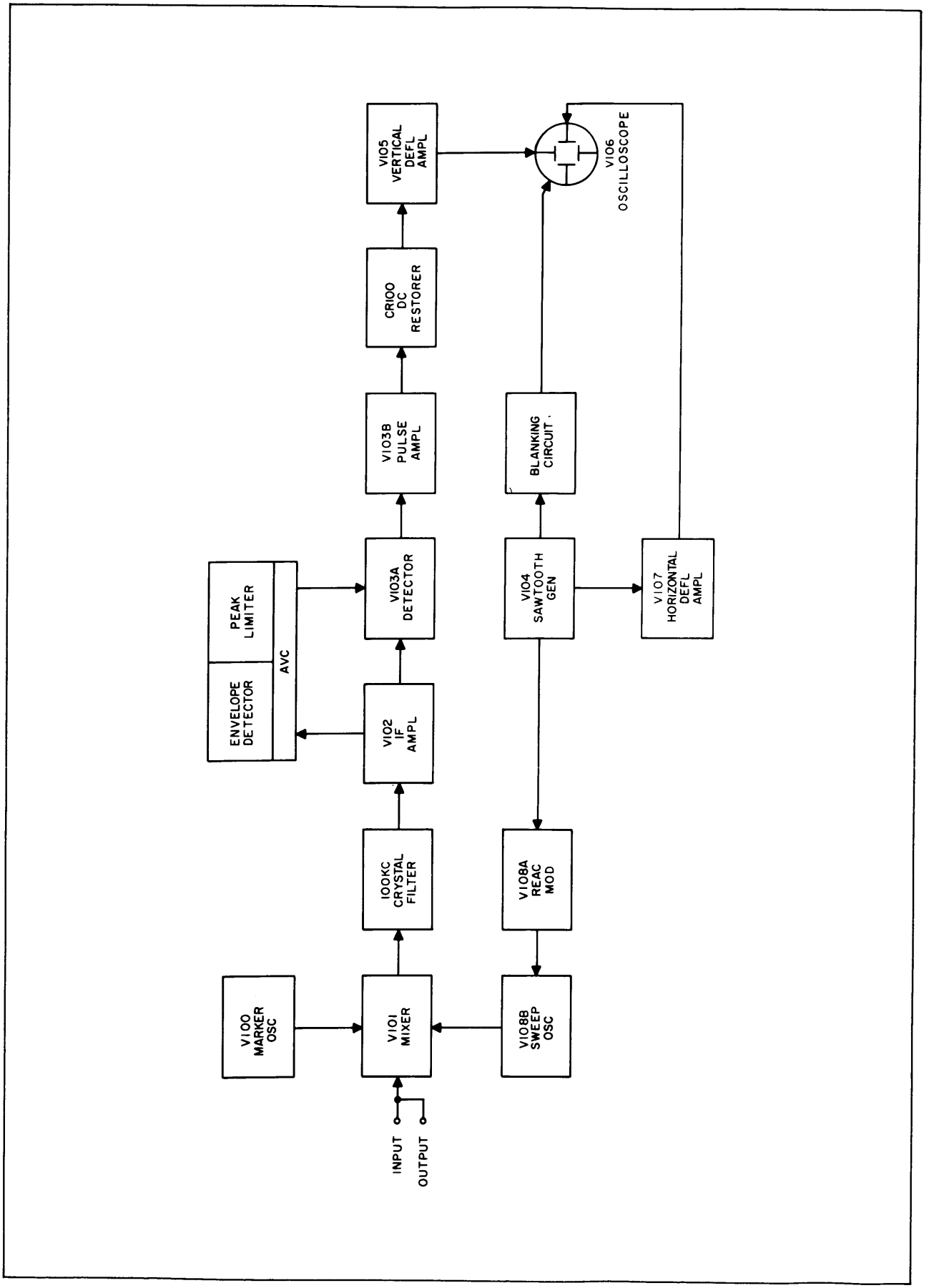


Figure 4-1 Block Diagram of Monitor Unit

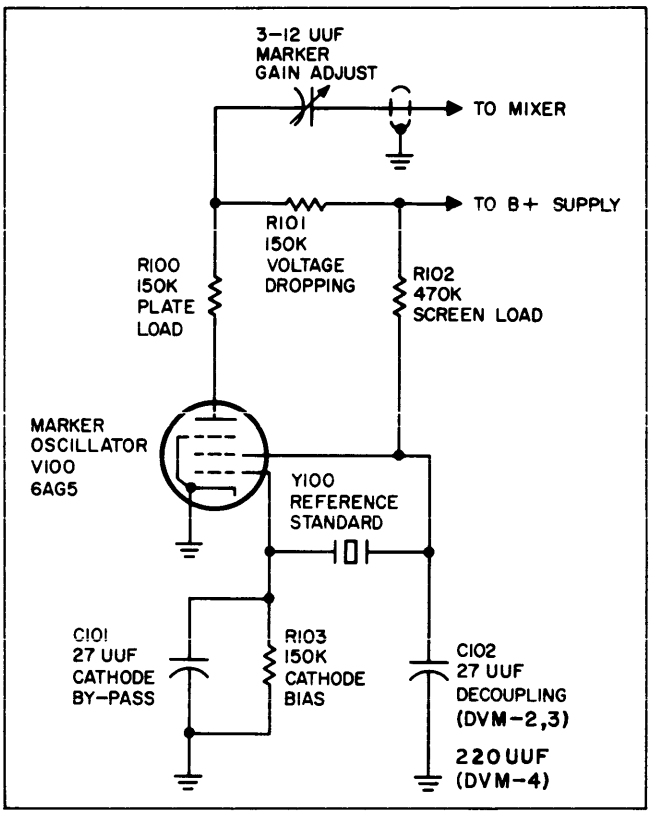


Figure 4-2 Simplified Schematic Diagram of Marker Oscillator

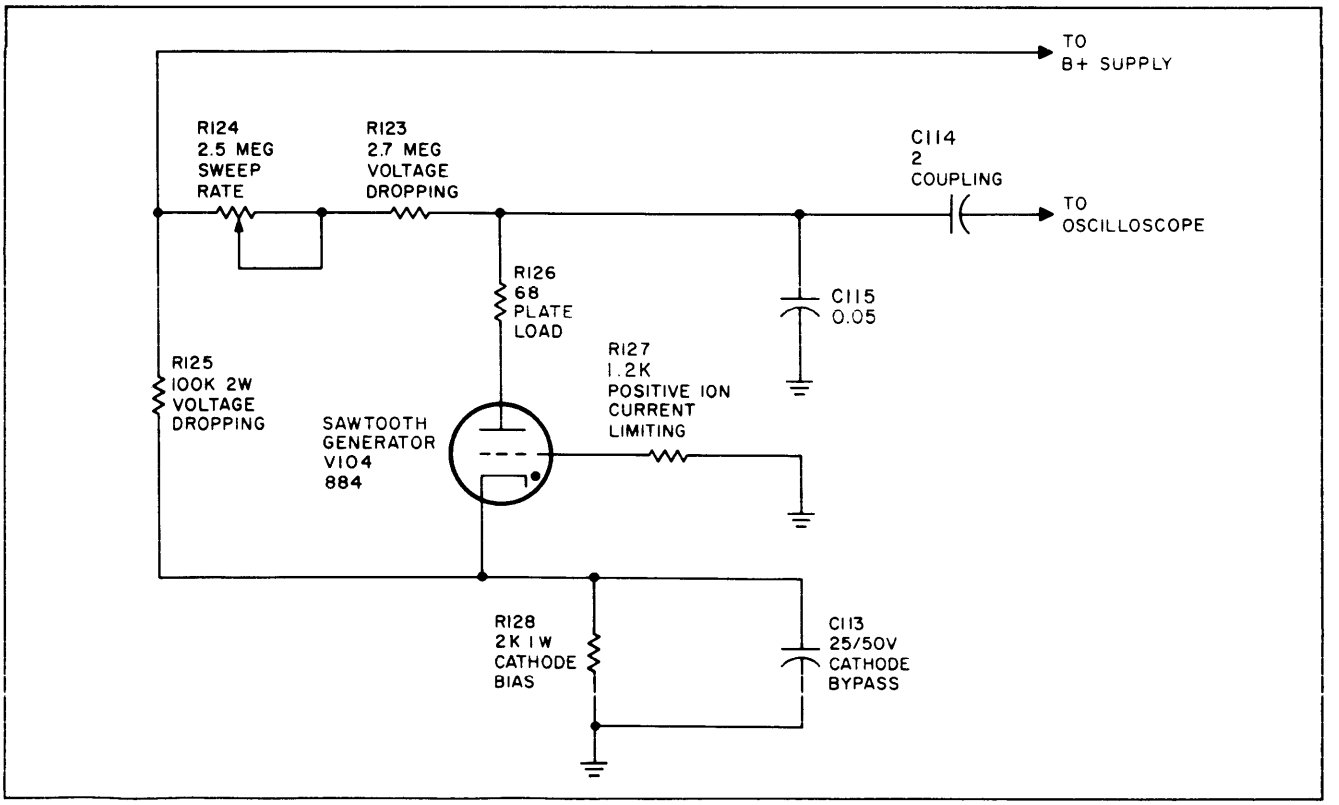


Figure 4-3 Simplified Schematic Diagram of Sawtooth Generator

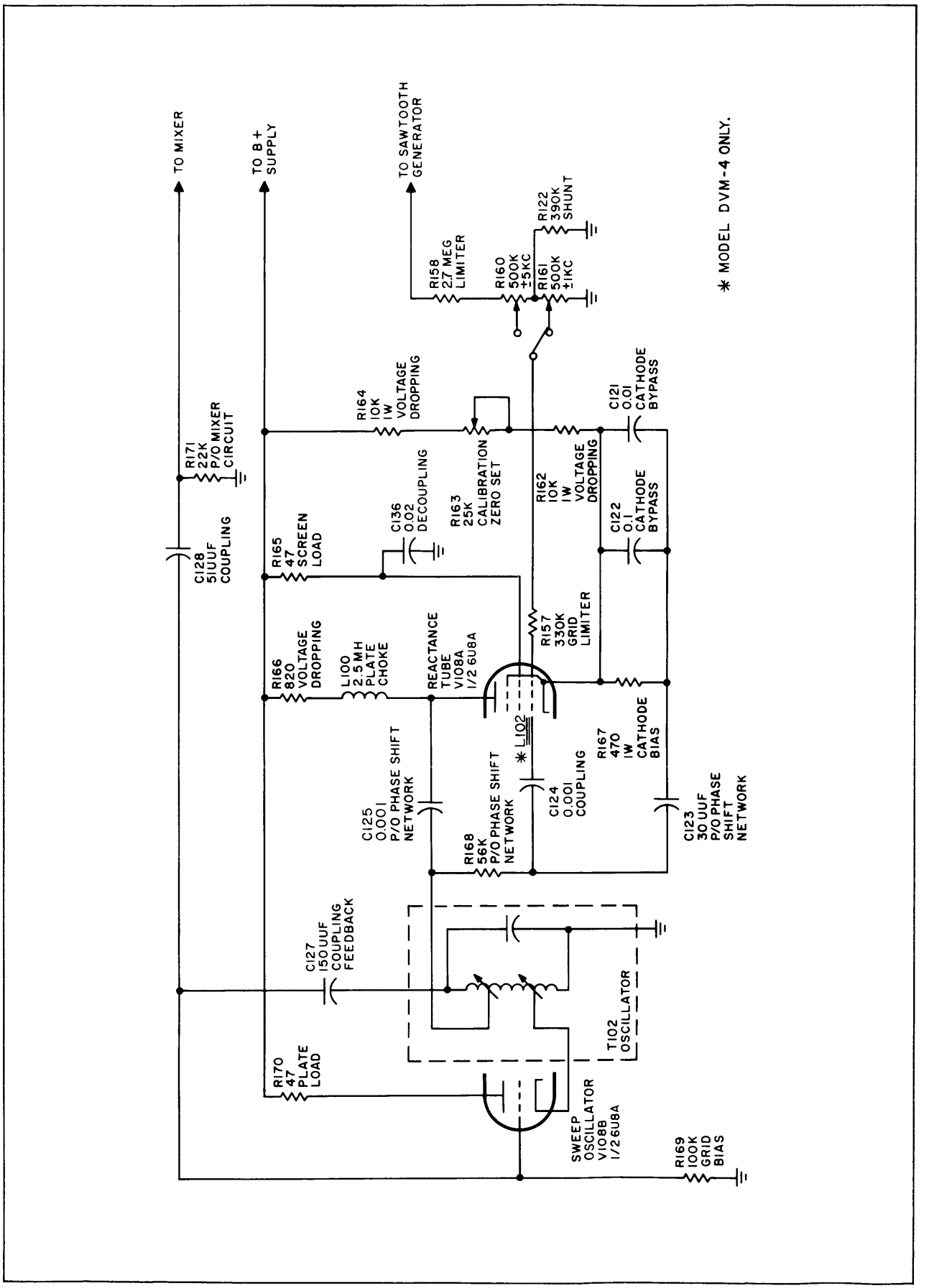


Figure 4-4 Simplified Schematic Diagram of Reactance Modulator/Sweep Oscillator

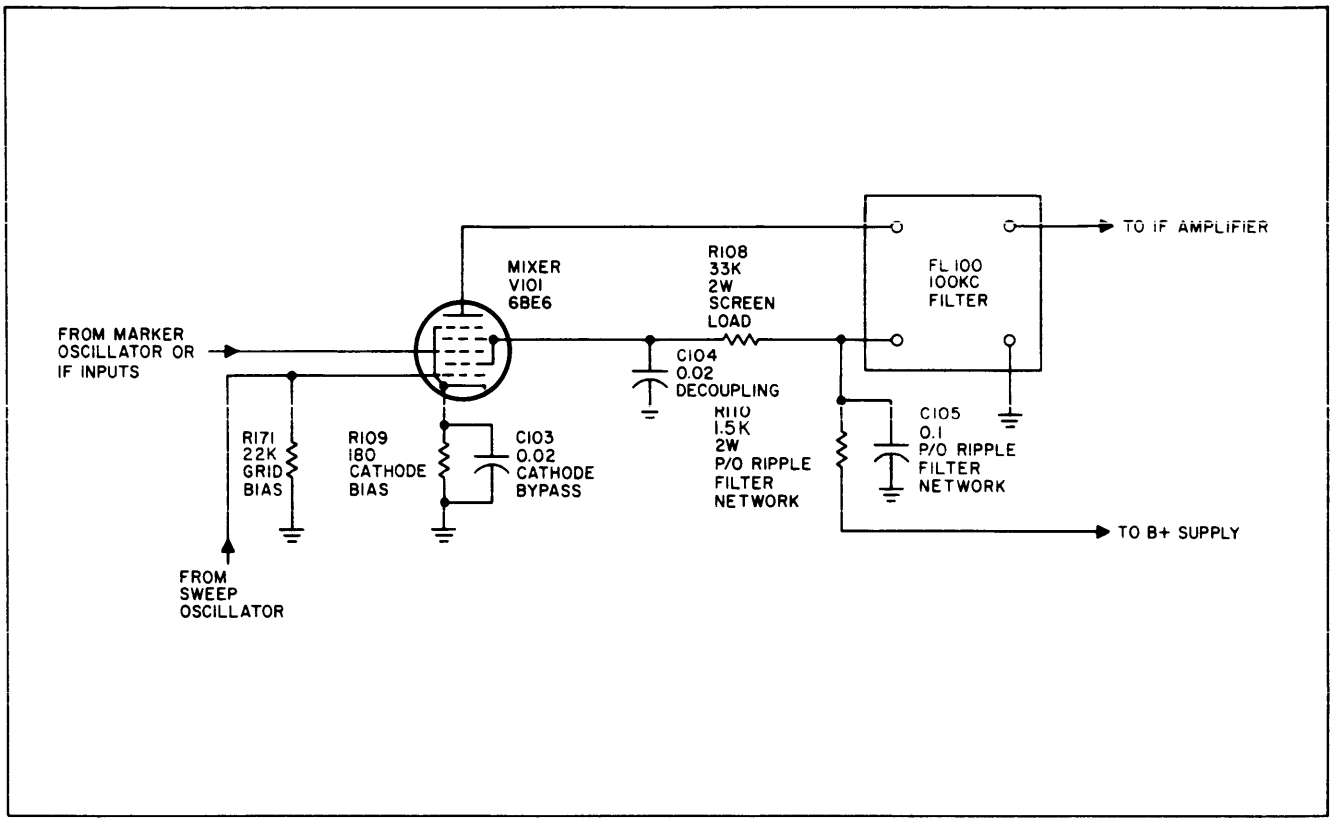


Figure 4-5 Simplified Schematic Diagram of Mixer/Crystal Filter

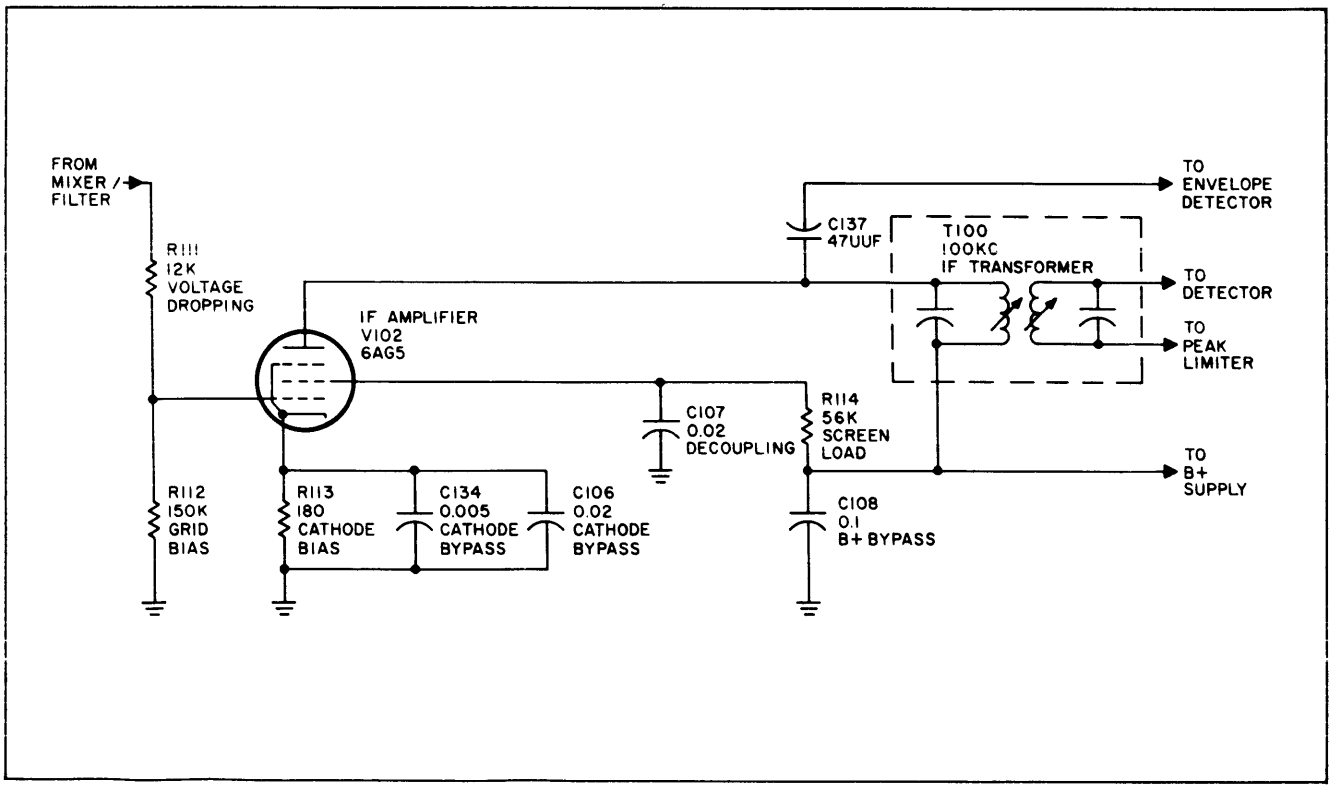


Figure 4-6 Simplified Schematic Diagram of I-f Amplifier

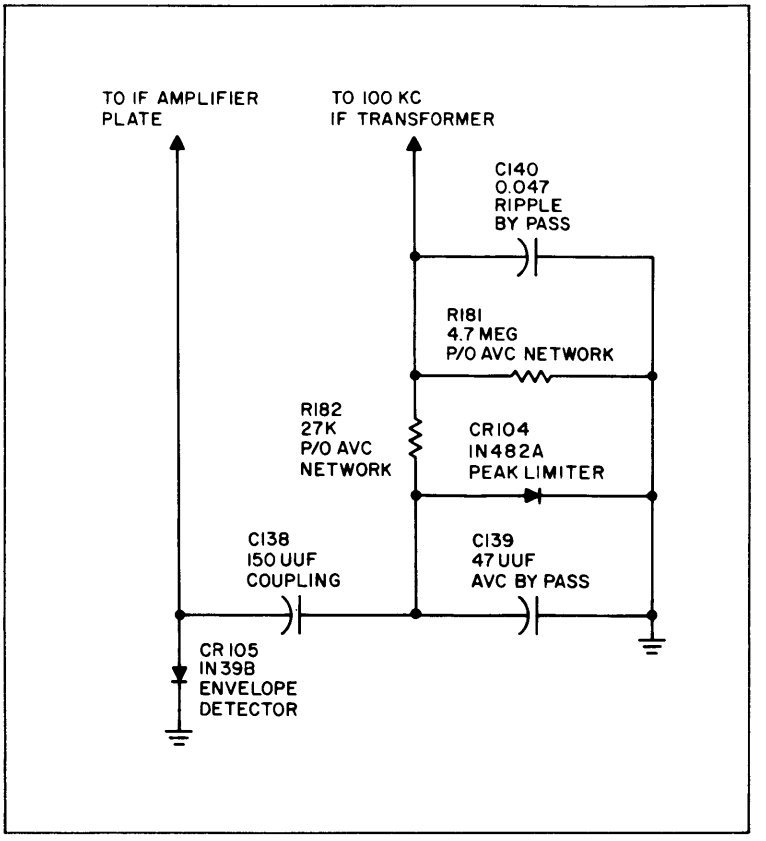


Figure 4-7 Simplified Schematic Diagram of Envelope Detector/Peak Limiter

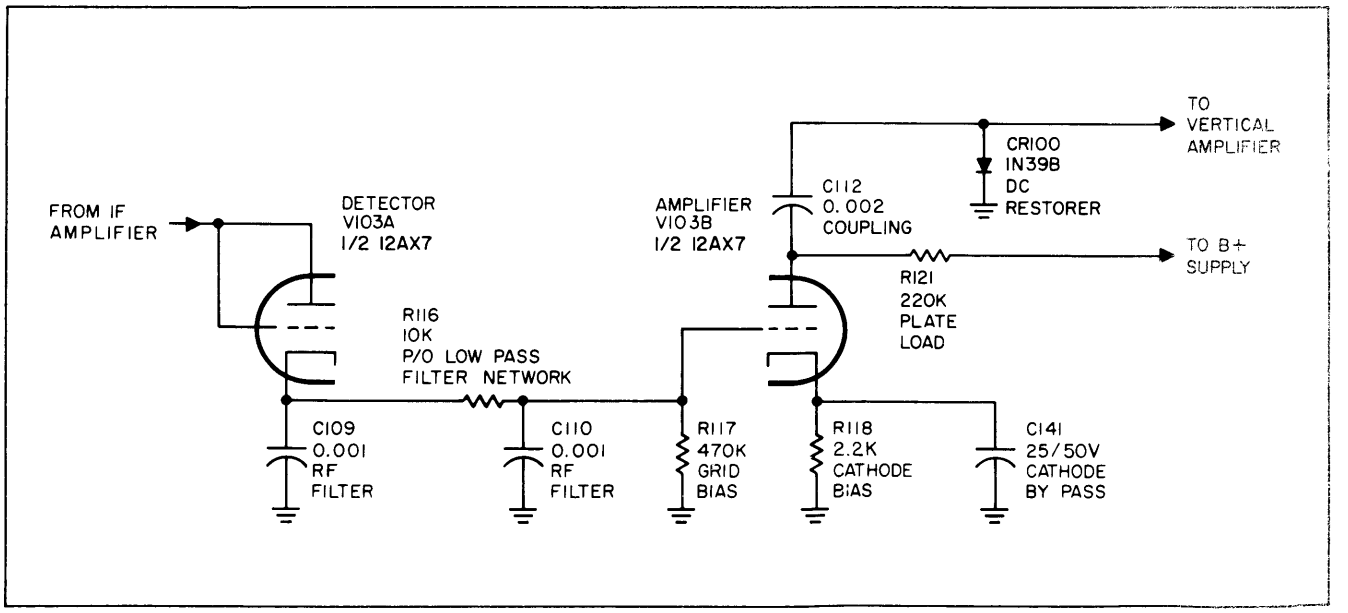


Figure 4-8 Simplified Schematic Diagram of Detector/Pulse Amplifier/D-c Restorer

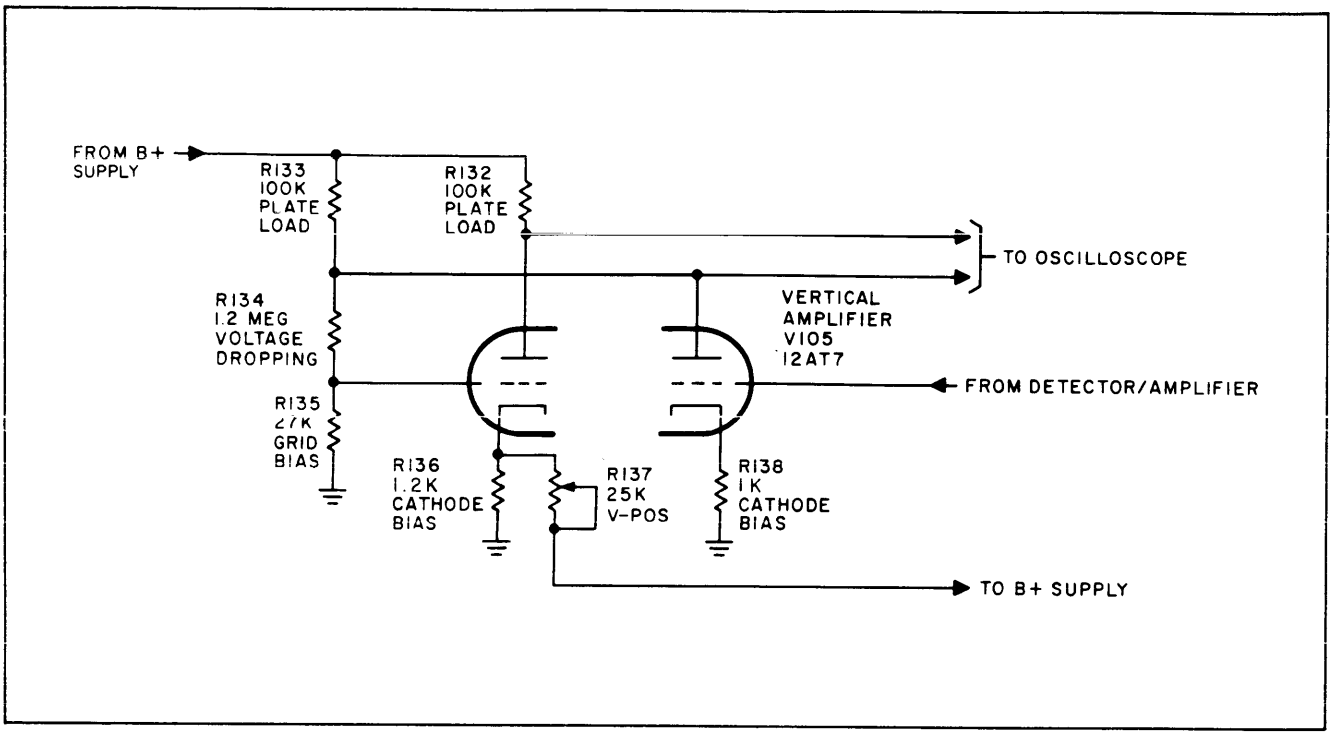


Figure 4-9 Simplified Schematic Diagram of Vertical Deflection Amplifier

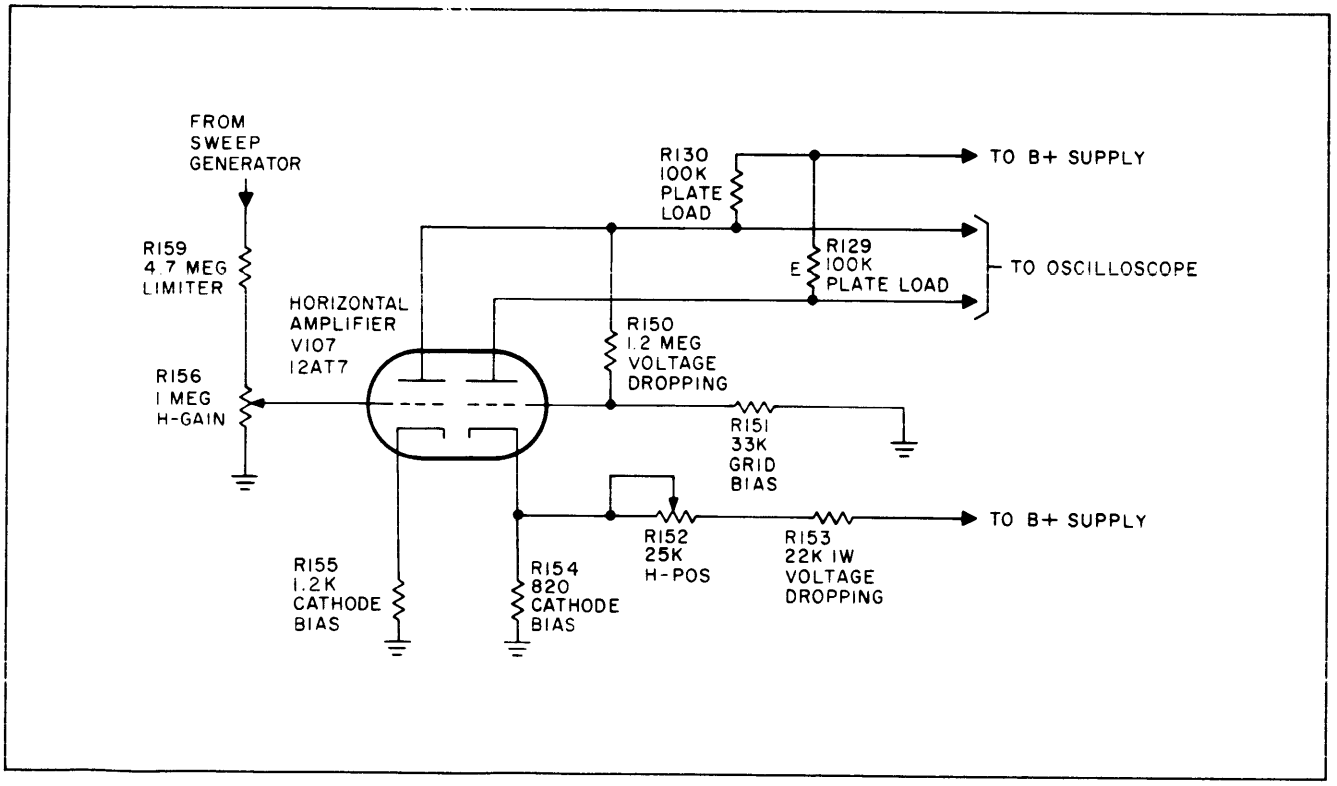


Figure 4-10 Simplified Schematic Diagram of Horizontal Deflection Amplifier

SECTION V
TROUBLESHOOTING

5-1. INTRODUCTION

5-1-1. When a monitor unit has been operating satisfactorily and suddenly fails, the cause of the failure may be apparent either because of circumstances at the time of failure or because of symptoms analogous to past failures. In this case, a lengthy and orderly course of troubleshooting need not be followed in order to localize the faulty part. Other simple causes of trouble are lack of input power, lack of input signal, and electron tube failure. Troubleshooting is more difficult when all conditions seem normal but the monitor unit does not operate. The orderly troubleshooting procedures presented in the following paragraphs assist the technician in correction of faults which prevent normal operation of the monitor unit.

5-2. VOLTAGE AND RESISTANCE MEASUREMENTS

5-2-1. Figure 5-1 lists and locates d-c voltages and resistances that may be measured at the contacts of the electron tube sockets on the chassis. Voltage readings were taken with all electron tubes in their sockets, with input power connected, and with the POWER switch in the ON position. Resistance measurements were made with all electron tubes in their sockets and input power disconnected. Table 5-1 lists signal voltages measured with the monitor unit in operation. A Ballantine Laboratories Model 314 R-f Voltmeter, or equivalent, can be used to measure these voltages. Table 5-2 lists AVC voltages that were measured with the monitor unit in operation. A Hewlett Packard Model 410-A-c Vacuum Tube Voltmeter, or equivalent, can be used to measure these voltages.

TABLE 5-1 SIGNAL VOLTAGES (R-f)

TEST POINT	SWEEP RANGE SWITCH SETTING	
	± 1KC	± 5KC
Pin 5 of V101	0.01	0.01
Pin 7 of V101	0.10	0.10
Pin 1 of V102	0.03	0.03
Pin 5 of V102	0.45	0.20
Pin 6 of V103	0.64	0.26
Pin 8 of V103	0.21	0.14
Pin 1 of V103	15.0	10.0
Pin 2 of V103	0.20	0.13
CR 100	5.00	3.0
Pin 7 of V105	0.55	0.35

TABLE 5-2 AVC VOLTAGES (D-c)

INPUT VOLTS	AVC VOLTS (Measured at C140, block terminal of T100)
0	-0.56
0.014	-0.56
0.1	-0.84
0.12	-0.96
0.14	-1.14
0.16	-1.26
0.18	-1.42
0.20	-1.6
0.25	-2.0
0.30	-2.5
0.40	-3.5
0.50	-4.54

5-3. LOCATION DATA

5-3-1. Figures 5-2 through 5-5 illustrate the location of major components of the monitor unit. Reference designations shown on these figures may be used to correlate the components illustrated with the designations on the schematic diagram (figures 8-1 and 8-2).

5-4. TROUBLESHOOTING CHART

5-4-1. Table 5-3 is a troubleshooting chart based on the operation sequences detailed in Tables 3-1 and 3-2. Refer to the schematic diagram (figure 8-1 for Models DVM-2,3 or figure 8-2 for Model DVM-4) and the block diagram (figure 4-1) when troubleshooting.

NOTE

Check the stability of line voltage, absence of power line hum, condition of fuses and electron tubes before extensive troubleshooting. Do not disassemble filter FL100.

TABLE 5-3 TROUBLESHOOTING CHART

Step	Operation	Analysis
1	Perform step 1 of Table 3-1 or 3-2.	Energizes monitor unit. Pilot lamp and electron tube filaments glow. If these conditions are not met, trace the power circuit with an a-c voltmeter.
2	Perform steps 2 through 5 of Table 3-1 or 3-2.	Calibrates monitor unit. Oscilloscope should display signal pulses from marker oscillator. If this condition is not met, trace the marker oscillator signal.
3	Perform steps 6 through 8 of Table 3-1 or 3-2.	Applies i-f signal to unit for monitoring. Oscilloscope should display signal pulses from receiver. If this condition is not met, trace the signal from receiver to oscilloscope.
4	Perform step 9 of Table 3-1 or 3-2.	Adjusts input level of i-f signal to mixer stage. If this condition is not met, check RF GAIN control R106 and mixer tube V101.
5	Perform step 10 of Table 3-1 or 3-2.	Correctly tunes receiver. If this condition is not met, trace the signal from receiver to oscilloscope.
6	Perform steps 11 and 12 of Table 3-1 or 3-2.	Calibrates monitor unit. Oscilloscope should display signal pulses from marker oscillator. If this condition is not met, trace the marker oscillator signal.
7	Perform step 13 of Table 3-1 or 3-2.	Correctly tunes receiver. If this condition is not met, trace the signal from receiver to oscilloscope.
8	Perform steps 14 and 15 of Table 3-1 or 3-2.	Applies i-f signal to monitor unit. Oscilloscope should display signal pulses from receiver. If this condition is not met, trace the signal from receiver to oscilloscope.
9	Perform steps 16 and 17 of Table 3-1 or 3-2.	Applies i-f signal to monitor unit. Oscilloscope should display signal pulses from receiver. If this condition is not met, trace the signal from receiver to oscilloscope.
10	Perform steps 18 and 19 of Table 3-1 or 3-2.	Calibrates monitor unit. Oscilloscope should display signal pulses from marker oscillator. If this condition is not met, trace the marker oscillator signal.
11	Perform step 20 of Table 3-1 or 3-2.	Applies i-f signal to monitor unit for continuous monitoring. Oscilloscope should display signal pulses from receiver. If this condition is not met, trace the signal from receiver to oscilloscope.

TROUBLESHOOTING BY OBSERVATION OF OSCILLOSCOPE

Condition	Analysis
Oscilloscope is dark. (no baseline or signal pulse appears).	POWER switch is off. Turn to ON position.
	Power supply is defective. Check high voltage and B+ circuits.
	Deflection circuits are faulty. Check V105, V107, and associated circuitry.
	Intensity circuit is defective. Check circuit.
	Oscilloscope is defective. Check tube heater power supply.
Oscilloscope shows a vertical line.	Horizontal deflection circuit is faulty. Check V107 and associated circuitry.

Condition	Analysis
Oscilloscope shows a vertical line.	Horizontal gain circuit is faulty. Check H-GAIN control and leads of sawtooth generator and horizontal amplifier.
Oscilloscope shows a dot. **CAUTION** Reduce intensity or set out of focus in order to prevent oscilloscope damage.	Sawtooth generator circuit is faulty. Check V108 and associated circuitry.
	Trace path of sawtooth to horizontal amplifier and reactance modulator.
Oscilloscope trace has insufficient horizontal width.	Horizontal amplifier is defective. Check V107 and associated circuitry.
Oscilloscope trace is uniformly fuzzy.	Focus circuit is defective. Check FOCUS control and associated circuitry.
Oscilloscope trace is partially fuzzy (such as sharp in the middle and blurred at extremities).	Astigmatism circuit is defective. Check ASTIG control and associated circuitry.
Oscilloscope shows normal baseline and no signal pulse.	Signal input is weak or missing. Check marker oscillator circuit and signal input (advance RF GAIN control).
	Monitor unit is defective. Check signal from input to oscilloscope, center frequency of sweep oscillator, and alignment.
Oscilloscope shows irregular baseline or irregularities in an unmodulated signal pulse from marker oscillator.	Monitor unit is subject to hum. Check V103 and associated circuitry. Check all connections in horizontal, sawtooth, and reactance circuits. Check grounding of shielded cables.

Condition	Analysis
Oscilloscope shows a signal pulse that extends below baseline.	D-C restorer circuit is defective. Check CR 100 and associated circuitry.
Oscilloscope shows a slanted baseline.	Oscilloscope position is incorrect. Loosen tube clamp, rotate tube until baseline is horizontal, and tighten clamp.
Oscilloscope shows a signal pulse that jumps sideways.	Monitor unit is subject to hum. Check all connections in horizontal, sawtooth, and reactance circuits. Check grounding of shielded cables.
Oscilloscope shows pulses other than the signal pulse. These extra pulses move across the field.	Monitor unit is subject to hum. Check pulse amplifier, D-C restorer, and vertical amplifier circuits. Check grounding of shielded cables.
Oscilloscope shows ringing, multiple pulses, rapid variation of pulse height, wide irregular pulse, sidebands.	AVC circuit is defective. Check CR 104, CR 105, and associated circuitry. Check 100 KC I-F transformer and V 103.
Oscilloscope shows blanking retrace (line or extension of baseline beneath the signal pulse).	Blanking circuit is defective. Check C116, C118, C119, R141, R142, R143, R144, and associated circuitry. Check oscilloscope grid (pin 2).
	NOTE Disregard small pulse at extreme left of oscilloscope.

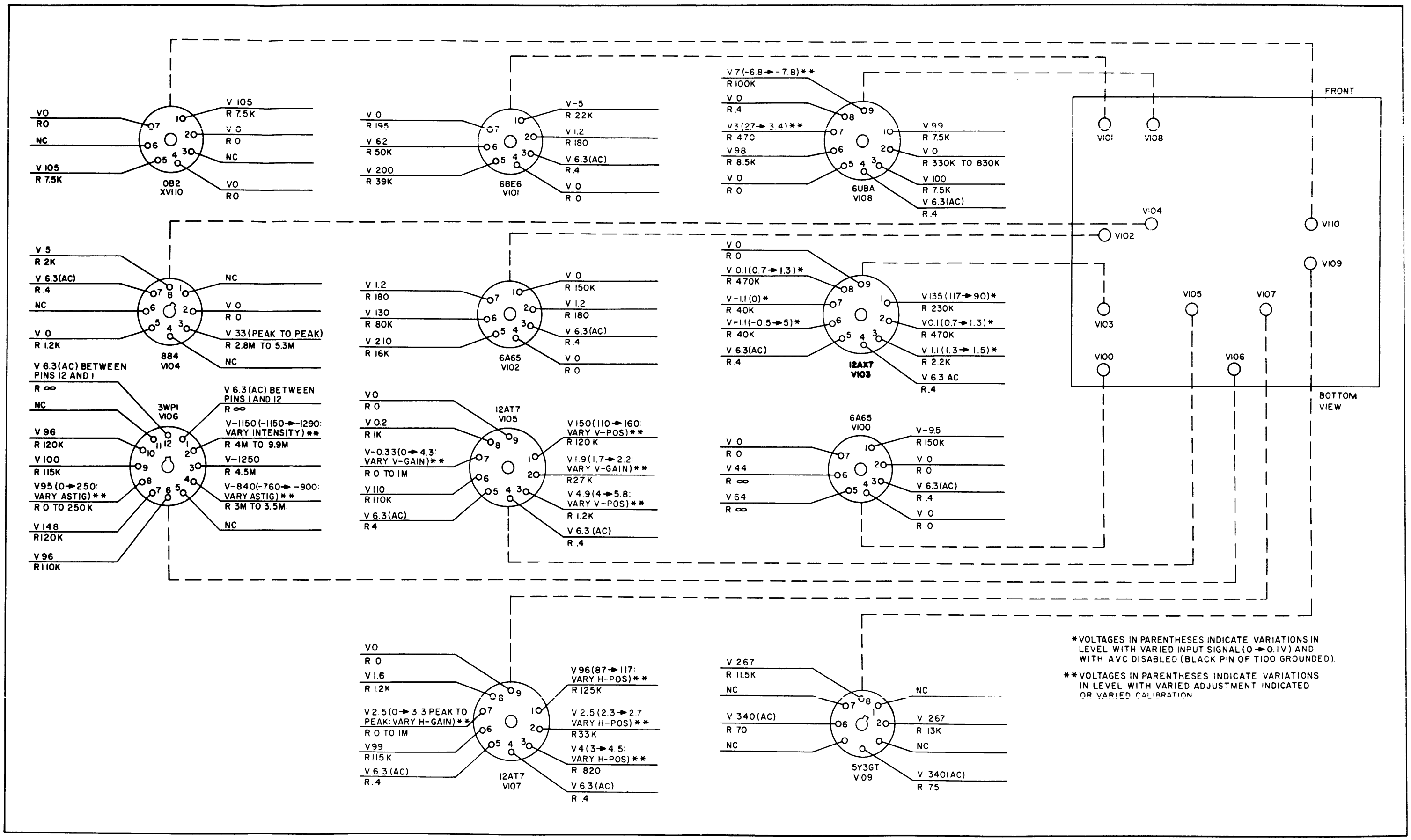


Figure 5-1 Voltage and Resistance Measurements at Electron Tube Sockets

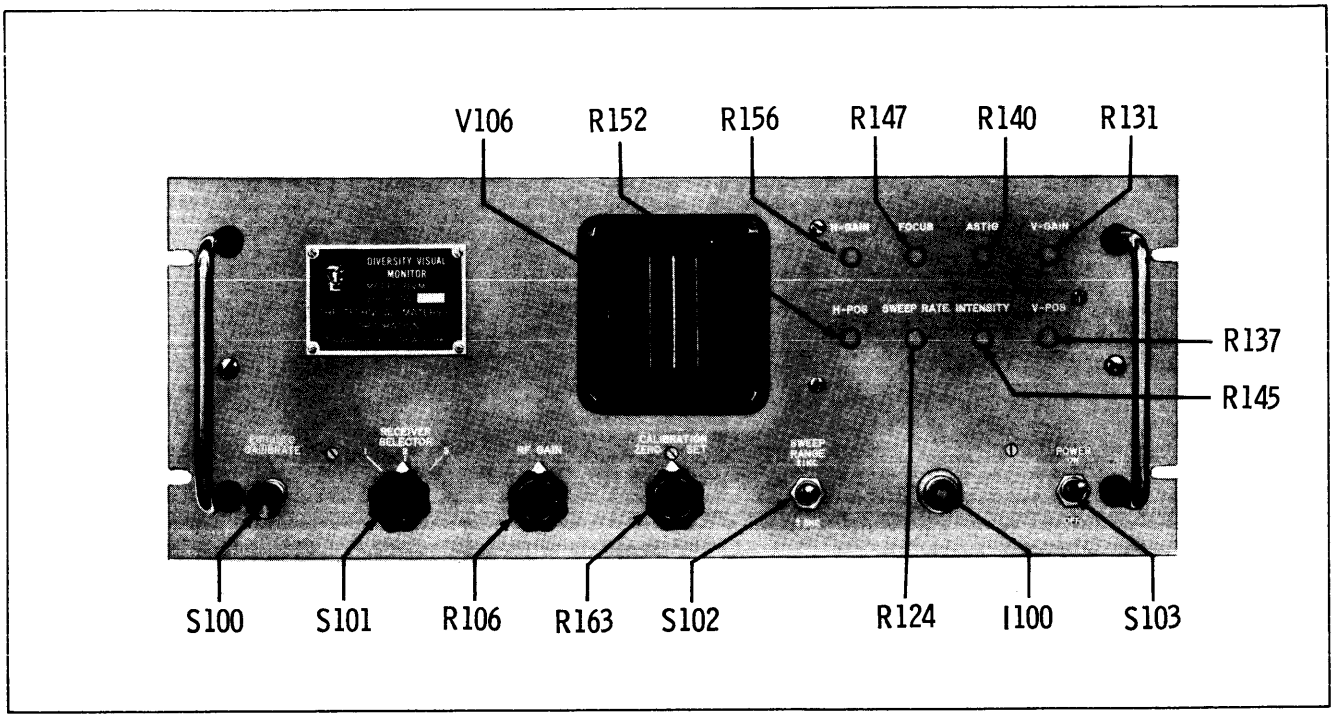


Figure 5-2 Reference Designations for Front Panel Controls

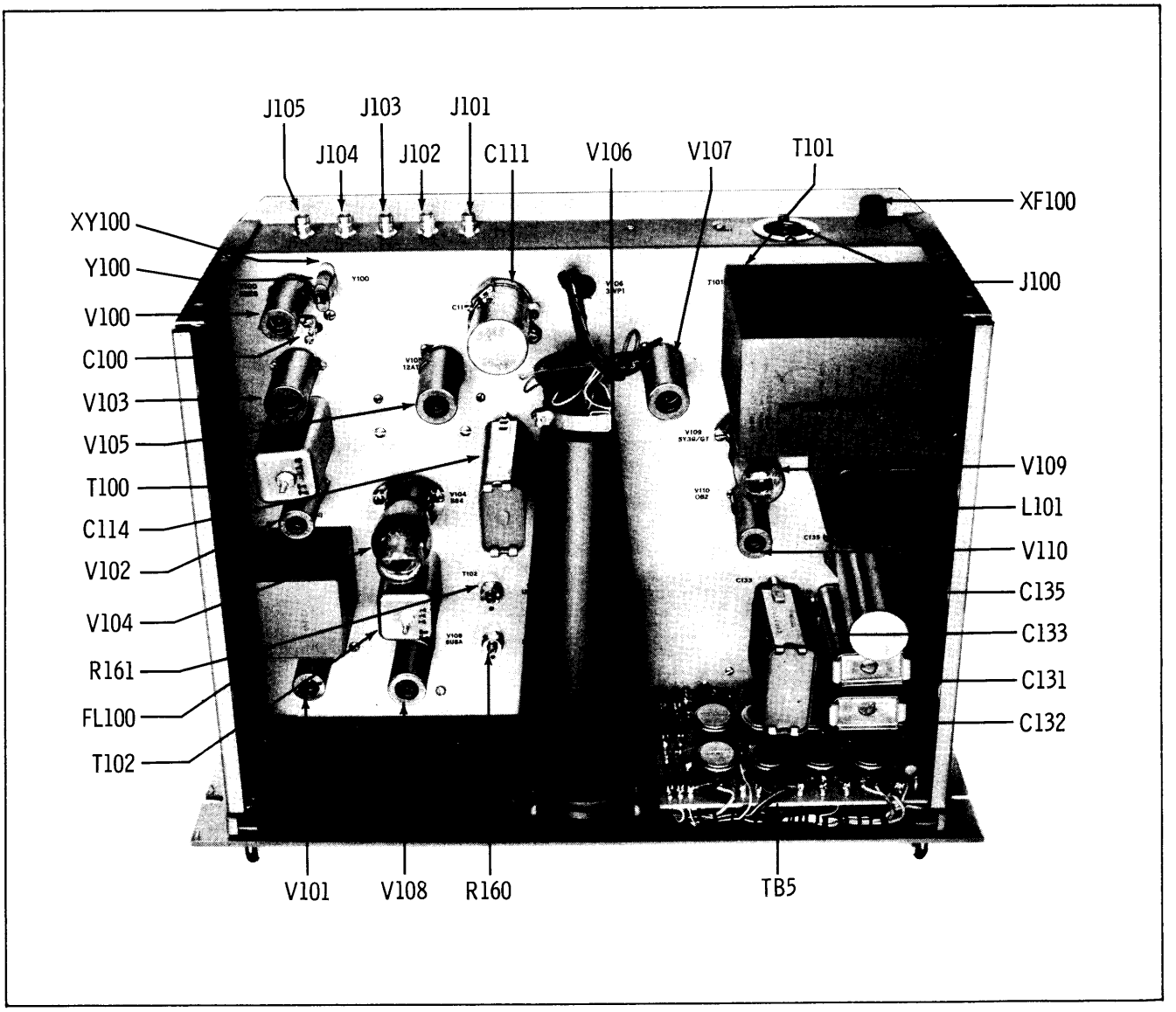


Figure 5-3 Reference Designations for Above Chassis Components

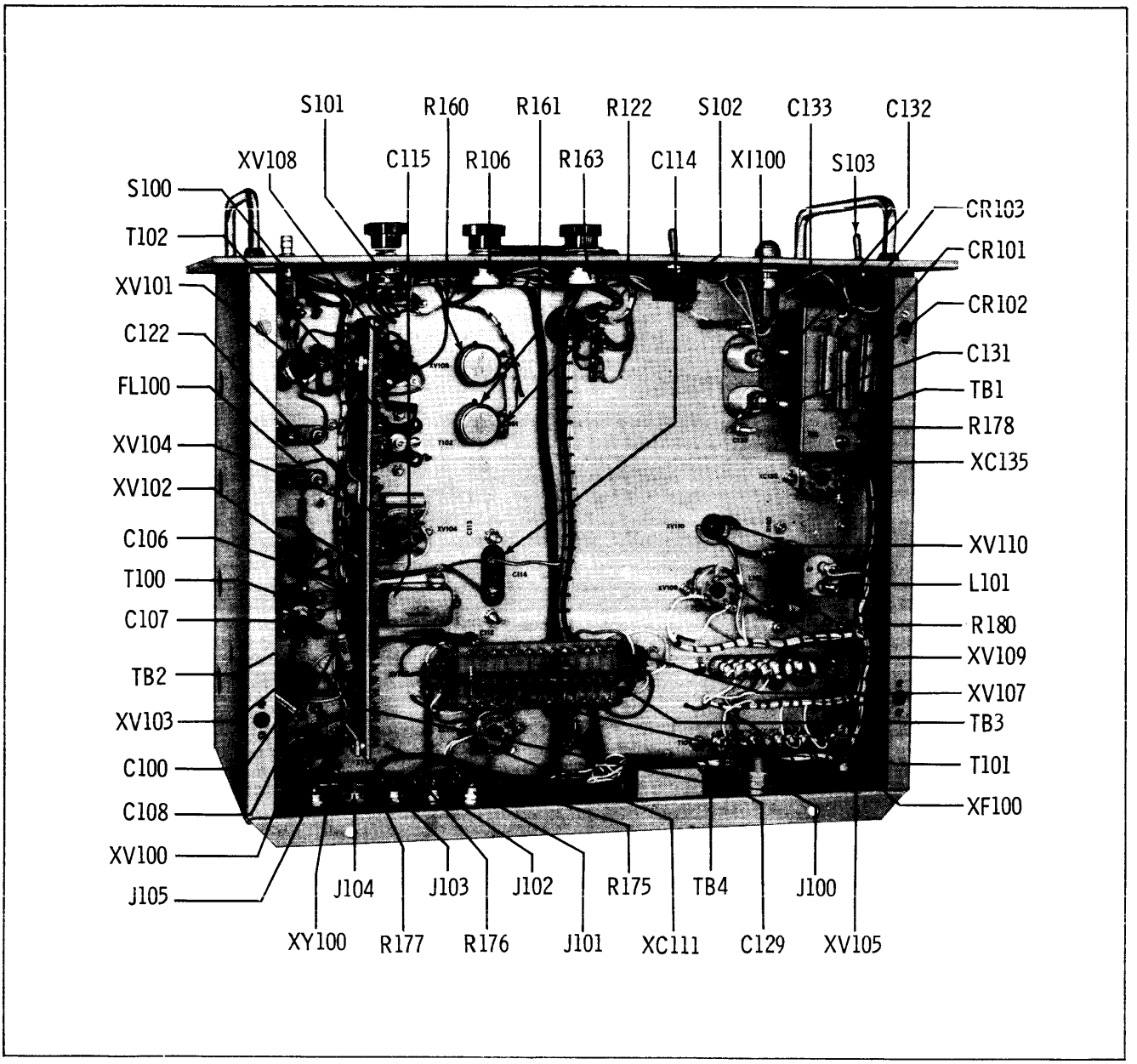


Figure 5-4 Reference Designations for Below Chassis Components

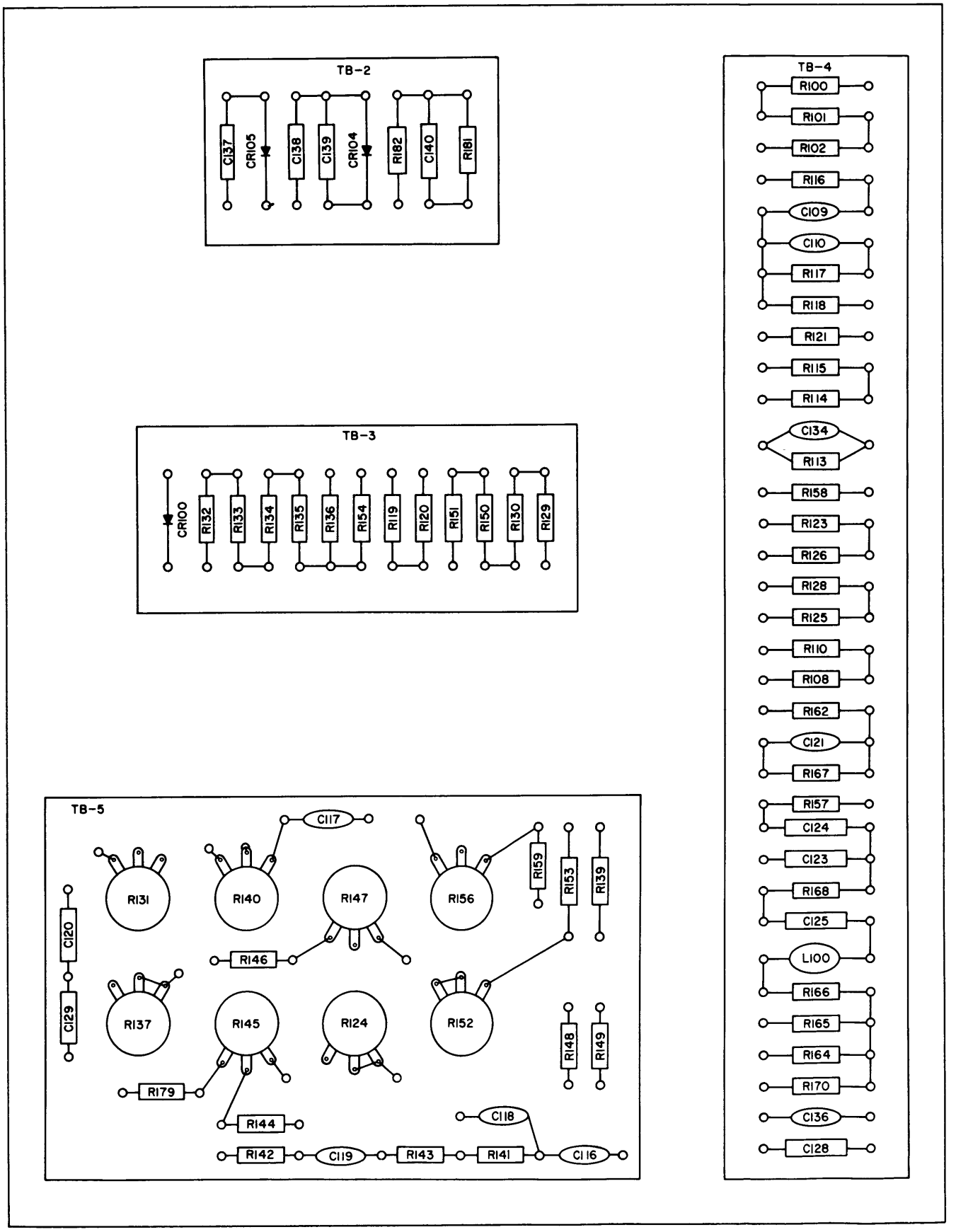


Figure 5-5 Reference Designations for Terminal Board Components

SECTION VI
MAINTENANCE

6-1. INTRODUCTION

6-1-1. Maintenance is required to prevent failure of the monitor unit. Preventive maintenance protects the equipment from corrosion, tube failures, dust, and other destructive ambient conditions. Maintenance procedures should be performed quarterly. Corrective maintenance protects the equipment from misalignment or maladjustment.

6-2. PREVENTIVE MAINTENANCE

6-2-1. CLEANING. Remove monitor unit from rack. Inspect the inside of the chassis for dirt, dampness, moulding, charring, and corrosion. Correct any defect found. Clean the electronic components with a clean, soft brush moistened with trichlorethylene.

WARNING

When using trichlorethylene, make certain that adequate ventilation exists. Avoid prolonged contact with the skin.

6-2-2. VOLTAGE AND RESISTANCE TESTING. Test voltages and resistances as discussed in paragraph 5-2-1. Investigate any large discrepancies.

6-2-3. ELECTRON TUBE TESTING. Test each electron tube with a reliable tube tester. Replace each satisfactory tube in the socket from which it was removed. Discard defective electron tubes.

NOTE

When reinstalling the monitor unit in the rack, be certain that all cable plugs at the rear are tight.

6-3. CORRECTIVE MAINTENANCE

6-3-1. ALIGNMENT PROCEDURE. Table 6-1 lists the test equipment required for alignment of the monitor unit. Table 6-2 details the alignment procedure.

6-3-2. INTENSITY, FOCUS, AND ASTIGMATISM. These controls located in the upper right-hand corner of the front panel may require attention during normal operation. Brightness of the trace is adjusted with the INTENSITY control. The INTENSITY and FOCUS controls are internally interlocked. Whenever the intensity is changed, the trace must be refocused for sharpness and clarity with the FOCUS control. The ASTIG control provides additional focus control. The control is adjusted so that the thickness of the trace remains uniform across the oscilloscope.

6-3-3. GAIN AND POSITIONING CONTROLS. During normal operation, the horizontal trace should be coincident with the horizontal base line. Any deviations can be corrected with the V-POS control. Set the V-GAIN control so that an incoming signal of 0.1 volt gives full screen deflection with the RF GAIN control fully advanced. Set the H-GAIN control to yield the greatest gain without the sawtooth becoming nonlinear. Make this adjustment with an oscilloscope showing the sawtooth waveform at pin 7 of V107. Do not change the H-GAIN setting unless it is positively determined that this circuit requires adjustment. When H-GAIN setting is changed, the sweep range must be recalibrated on both ±1- and ±5-kc ranges.

TABLE 6-1 TEST EQUIPMENT FOR ALIGNMENT

ITEM	MANUFACTURER
A-c vacuum tube voltmeter	Hewlett Packard Model 410, or equivalent
R-f voltmeter	Ballantine Laboratories Model 314, or equivalent
R-f signal generator	Measurements Model 82, or equivalent
Oscilloscope	DuMont Model 304, or equivalent

NOTE

When performing alignment, maintain line voltage at a constant level, corresponding to the taps used on the primary winding of the power transformer.

TABLE 6-2 ALINEMENT PROCEDURE

STEP	OPERATION	DESIRED RESULT
1	Test power supply.	D-c voltage to ground at pin 5 of C135 is +255 volts. D-c voltage to ground at pin 5 of V110 is +105 volts. D-c voltage to ground at pin 5 of C133 is -1500 volts. D-c voltage to ground at pin 5 of V110 does not change as R137 and R152 are varied.
2	Check oscilloscope system. Lock CRT in place.	Trace is horizontal.
3	Vary FOCUS control R147.	D-c voltage to ground at pin 4 of V106 varies from -810 to -960 volts.
4	Vary ASTIG control R140.	D-c voltage to ground at pin 4 of V106 varies from 0 to +255 volts.
5	Adjust ASTIG control R140 and FOCUS control R147.	Sharpest trace, with least distortion on ends.
6	Vary H-POS control R152.	Voltage at pin 3 of V107 varies from 3 to 4.6 volts.
7	Vary V-POS control R137.	Voltage at pin 3 of V105 varies from 4 to 6.3 volts.
8	Set V-GAIN control R131 and H-GAIN control R156 to zero. Vary H-POS control R152 and V-POS control R137.	Spot is centered on base line and zero reference line.
9	Set V-GAIN control R131 to 35% of maximum. Set H-GAIN control R156 to 50% of maximum	
10	Vary R145.	D-c voltage at wiper varies from -1390 to -1340 volts.
11	Use oscilloscope to check waveform at pin 2 of V106. Spikes indicate presence of blanking pulse.	
12	Use oscilloscope to check waveform at output of C114.	
13	Vary R124. Use oscilloscope to check waveform at output of C114.	Frequency of waveform in step 12, should vary from 35 to 50 cps.
14	Vary H-GAIN control R156. Use oscilloscope to check waveform at pin 7 of V107.	Same waveform as step 13. Voltage varies from 0 to 1.98* volts.
*Peak to Peak		

STEP	OPERATION	DESIRED RESULT
15	Set H-GAIN control R156 so that voltage at pin 7 of V107 is approximately 1.77* volts and linear.	Same waveform as step 12. Nonlinear waveform ⌒ indicates R156 is set too high.
16	Vary R160.	Voltage at wiper of R160 varies from 0.71* to 2.4* volts.
17	Set R160 so that voltage at wiper is 1.7* volts. Check waveform.	
18	Vary R161.	Voltage at wiper of R161 varies from 0 to 0.71* volt.
19	Set R161 so that voltage at wiper is 0.35* volt. Check waveform.	Same waveform as step 17.
20	Vary ZERO SET control R163.	D-c voltage to ground at pin 7 of V108 varies from 3.3 to 3.9 volts.
21	Check voltage at pin 1 of V101.	1.8 volts (rms).
22	Set SWEEP RANGE switch S102 to ± 1KC position. Set ZERO SET control R163 to center. Depress PUSH TO CALIBRATE switch S100. Adjust T102. (Bottom-Broad, Top-Vernier).	Marker pulse is centered.
23	Set SWEEP RANGE switch S102 to ± 1KC position. Install a crystal in XY100 that has a frequency 1 kc greater than original crystal Y100. Vary R161.	Marker pulse lines up with the right 1-inch line on oscilloscope screen.
24	Install a crystal in XY100 that has a frequency 1 kc less than original crystal Y100.	Marker pulse lines up with the left 1-inch line on oscilloscope screen.
25	Set SWEEP RANGE switch S102 to ± 5KC position. Install a crystal in XY100 that has a frequency 5 kc greater than the original crystal Y100. Vary R160.	Marker pulse lines up with the right 5-kc line on the oscilloscope screen.
26	Install a crystal in XY100 that has a frequency 5 kc less than the original Y100.	Marker pulse lines up with left 5-kc line on oscilloscope screen.
27	Reinstall original crystal Y100.	

*Peak to peak

STEP	OPERATION	DESIRED RESULT
28	Check output at R107 while PUSH TO CALIBRATE switch S100 is depressed. Vary C100 with a non-metallic tool.	R-f output at R107 should vary from 0.0075 to 0.025 volt.
29	Set C100 at minimum.	
30	Feed a 0.1-volt unmodulated r-f signal into J101. The frequency should be the same as that of crystal Y100. Set RECEIVER SELECTOR switch S101 to 1.	Signal pulse appears on oscilloscope.
31	Repeat step 30, for J102 with switch S102 set to 2 and J103 with switch S102 set to 3.	Signal pulse appears on oscilloscope.
32	Disable AVC by grounding black pin of T100.	
33	Adjust T100 for maximum gain. (Two slugs are present: one above and one below the chassis.)	Maximum vertical pulse height on oscilloscope.
34	Remove ground established in step 32.	
35	Set R106 at maximum. Vary R131.	Full pulse height on oscilloscope.
36	Push switch S100 and hold.	Energizes marker.
37	Vary C100 with a nonmetallic tool.	Full pulse height on oscilloscope.
38	Release S100.	Receiver input applied to mixer stage.
39	Trace signal.	Voltages should be as listed in Table 5-1.
40	Check AVC system.	Voltages should be similar to those listed in Table 5-2.

SECTION VII
PARTS LIST

INTRODUCTION

Reference designations have been assigned to identify all maintenance parts of the equipment. They are used for marking the equipment (adjacent to the part they identify) and are included on drawings, diagrams, and the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, amplifier, electron tubes, etc. The number differentiates between parts of the same generic group. Sockets associated with a particular plug-in device, such as electron tube or fuse, are identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for fuse F7 is designated XF7. The parts for each major unit are grouped together. Column 1 lists the reference series of each major unit, followed by the reference designations of the various parts in alphabetical and numerical order. Column 2 gives the name and describes the various parts. Major part assemblies are listed in their entirety; subparts of a major assembly are listed in alphabetical and numerical order with reference to its major assembly. Column 3 indicates how the part is used within a major component. Column 4 lists each Technical Materiel Corporation part number.

PARTS LIST

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C100	CAPACITOR, variable: ceramic; 3-12 uuf, 500 wvdc.	Marker Gain Adjustment	CV11A120
C101	CAPACITOR, fixed: mica; 27 uuf, ±20%, 300 wvdc, char. B.	Cathode Bypass	CM152B270M
C102	Same as C101. (Models DVM-2, 3 only).	Decoupling	
C102	CAPACITOR, fixed: mica; 220 uuf, ±2%, 300 wvdc, (Model DVM-4 only).		CM15C221G
C103	CAPACITOR, fixed: ceramic; .02 uf, +80 -20%, 500 wvdc, disc type.	Same as C101	CC-100-24
C104	Same as C103.	Same as C102	
C105	CAPACITOR, fixed: mylar; .1 uf, ±20%, 200 wvdc.	p/o Filter Network	CN103C1003M
C106	Same as C103.	Same as C101	
C107	Same as C103.	Same as C102	
C108	Same as C105.	B+ Bypass	
C109	CAPACITOR, fixed: ceramic; 1000 uuf, ±10%, 500 wvdc, disc type.	RF Filter	CC-100-9
C110	Same as C109.	Same as C109	

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C111 A, B	CAPACITOR, fixed: dry electrolytic; polarized; dual unit; 20 uf, each section, 450 wvdc, char. E.	p/o Ripple Filter Network	CE52C200R
C112	CAPACITOR, fixed: paper; .002 uf, +60 -20%, 600 wvdc, plastic tubular case.	Coupling	CN-100-10
C113	CAPACITOR, fixed: electrolytic, 25 uuf, 50 wvdc.	Same as C101	CE-105-25-50
C114	CAPACITOR, fixed: paper dielectric, metal case, 2 uf, ±10%, char. E, 600 wvdc.	Same as C112	CP70B1EF205K
C115	CAPACITOR, fixed: bathtub case; .05 uf, ±10%, 600 wvdc.	Sawtooth Generator	CP53B2EF503K
C116	Same as C109.	p/o Differentiating Network	
C117	Same as C103.	Same as C108	
C118	Same as C109.	Same as C116	
C119	CAPACITOR, fixed: ceramic; disc, 3000 uuf, GMV, 500 wvdc.	Same as C112	CC-100-31
C120	Same as C105.	Same as C101	
C121	CAPACITOR, fixed: ceramic; .01 uf, GMV, 500 wvdc.	Same as C101	CC-100-16
C122	Same as C105.	Same as C101	
C123	CAPACITOR, fixed: mica; 30 uuf, ±10%, 500 wvdc, char. B.	p/o Phase Shift Network	CM20B300K
C124	CAPACITOR, fixed: mica; .001uf, ±2%, 500 wvdc, char. D.	Coupling	CM20D102G
C125	Same as C124.	Same as C123	
C126	CAPACITOR, fixed: mylar; plastic case, .047 uf, ±10%, 200 wvdc.	Hum Filter	CN108C4702K
C127	CAPACITOR, fixed: mica; 150 uuf, ±10%, 500 wvdc, char. B.	Coupling Feedback	CM20B151K
C128	CAPACITOR, fixed: mica; 51 uuf, ±10%, char. B, 500 wvdc.	Same as C112	CM20B510K
C129	Same as C105.	B- Bypass	
C130 A, B	CAPACITOR, fixed: bathtub case; .1 uf, ±15%, 600 wvdc.	Line Filter	CP53B6FF104L
C131	CAPACITOR, fixed: paper dielectric; metal case, .5 uf, ±10%, char. E, 1500 wvdc.	p/o Tripler Network	CP70B1EH504K
C132	Same as C131.	Same as C131	

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C133	CAPACITOR, fixed: paper dielectric; metal case, .5 uf, ±20%, char. E, 2000 wvdc.	Same as C131	CP70E1EJ504M
C134	CAPACITOR, fixed: ceramic; .005 uf, GMV, 500 wvdc, disc type.	Same as C101	CC-100-15
C135	CAPACITOR, fixed: dry electrolytic; polarized 80 uf, 450 wvdc.	Filter	CE51C800R
C136	Same as C103.	Same as C102	
C137	CAPACITOR, fixed: mica; 47 uuf, ±10%, 300 wvdc, char. C.	Same as C112	CM15C470K
C138	CAPACITOR, fixed: mica; 150 uuf, ±10%, 300 wvdc, char. C.	Same as C112	CM15C151K
C139	Same as C137.	AVC Bypass	
C140	Same as C126.	Ripple Bypass	
C141	Same as C113.	Same as C101	
CR100	CRYSTAL DIODE: 100 kc.	DC Restorer	IN39B
CR101	RECTIFIER, selenium cartridge, 25 cells in series cell size V; P type of terminal	Rectifier	RX-107-2
CR102	Same as CR101.	Rectifier	
CR103	Same as CR101.	Rectifier	
CR104	SILICON, diode	Peak Limiter	IN482A
CR105	Same as CR100.	Envelope Detector	
F100	FUSE, cartridge: 1 amp.	Power Line	FU-100-1
FL100	FILTER NETWORK, 100 Kc.	100 Kc Filter	FX-164
I100	LAMP, neon: miniature bayonet base; 100-125 volts, 1/25 watt, T-3-1/4 bulb.	Pilot Lamp	BI-101-51H
J100	CONNECTOR, receptacle: male; two contacts, 10 amps at 250 V, 15 amps at 125 V, twist lock type.	Power Receptacle	JJ-100
J101	CONNECTOR, receptacle: electrical; 1 female contact; 52 ohms; BNC type.	Input 500 Kc (Model DVM-2) 455 Kc (Model DVM-3) 250 Kc (Model DVM-4)	UG-625/U
J102	Same as J101.	Input 500 Kc (Model DVM-2) 455 Kc (Model DVM-3) 250 Kc (Model DVM-4)	
J103	Same as J101.	Input 500 Kc (Model DVM-2) 455 Kc (Model DVM-3) 250 Kc (Model DVM-4)	

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
J104	Same as J101.	Output 500 Kc (Model DVM-2) 455 Kc (Model DVM-3) 250 Kc (Model DVM-4)	
J105	Same as J101.	Output 500 Kc (Model DVM-2) 455 Kc (Model DVM-3) 250 Kc (Model DVM-4)	
L100	COIL, R. F.: 2.5 mh, 100 ma; molded.	Plate Choke	CL-140-1
L101	REACTOR, fixed: 15 henries; 85 ma DC; 285 ohms dc; 2500 V RMS test.	Filter Choke	TF-5000
L102	CORE, toroid: bead type, powder iron. (Model DVM-4 only).	Parasitic Suppressor	CI-120-1
R100	RESISTOR, fixed: composition; 150,000 ohms, ±10%, 1/2 watt.	Plate Load	RC20GF154K
R101	Same as R100.	Voltage Dropping	
R102	RESISTOR, fixed: composition; 470,000 ohms, ±10%, 1/2 watt.	Screen Load	RC20GF474K
R103	Same as R100	Cathode Bias	
R104	RESISTOR, fixed: composition; 220 ohms, ±10%, 1/2 watt.	Same as R101	RC20GF221K
R105	RESISTOR, fixed: composition; 47 ohms, ±10%, 1/2 watt.	Grid Limiter	RC20GF470K
R106	RESISTOR, variable: composition; 250 ohms, ±10%, 2 watts with locking bushing.	RF GAIN Adjustment	RV4ATRD251A
R107	Same as R104.	Grid Bias	
R108	RESISTOR, fixed: composition; 33,000 ohms, ±10%, 2 watts.	Same as R102	RC42GF333K
R109	RESISTOR, fixed: composition; 180 ohms, ±10%, 1/2 watt.	Same as R103	RC20GF181K
R110	RESISTOR, fixed: composition; 1,500 ohms, ±10%, 2 watts.	p/o Filter Network	RC42GF152K
R111	RESISTOR, fixed: composition; 12,000 ohms, ±10%, 1/2 watt.	Same as R104	RC20GF123K
R112	Same as R100.	Same as R107	
R113	Same as R109.	Same as R103	
R114	RESISTOR, fixed: composition; 56,000 ohms, ±10%, 1/2 watt.	Same as R102	RC20GF563K
R115	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1 watt.	Same as R110	RC32GF472K

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R116	RESISTOR, fixed: composition; 1000 ohms, ±10%, 1/2 watt.	p/o Low Pass Filter Network	RC20GF103K
R117	Same as R102.	Same as R107	
R118	RESISTOR, fixed: composition; 2200 ohms, ±10%, 1/2 watt.	Same as R103	RC20GF222K
R119	RESISTOR, fixed: composition; 1000 ohms, ±10%, 1/2 watt.	p/o Ripple Filter Network	RC42GF102K
R120	Same as R115.	Same as R119	
R121	RESISTOR, fixed: composition; 220,000 ohms, &10%, 1/2 watt.	Same as R100	RC20GF224K
R122	RESISTOR, fixed: composition; 390,000 ohms, ±10%, 1/2 watt.	Shunt	RC20GF394K
R123	RESISTOR, fixed: composition; 2.7 megohms, ±10%, 1/2 watt.	Same as R101	RC20GF275K
R124	RESISTOR, variable; composition; 2.5 megohms, &10%, 2 watts.	SWEEP RATE	RV4ATSA255A
R125	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 2 watts.	Same as R101	RC42GF104K
R126	RESISTOR, fixed: composition; 68 ohms, ±10%, 1/2 watt.	Same as R100	RC20GF680K
R127	RESISTOR, fixed; composition; 1200 ohms, ±10%, 1/2 watt.	Same as R107	RC20GF122K
R128	RESISTOR, fixed: composition; 2000 ohms, ±5%, 1 watt.	Same as R103	RC32GF202J
R130	Same as R129.	Same as R101	
R131	RESISTOR, variable: composition; potentiometer; 1 megohm, ±10%, 2 watts, linear taper.	V-GAIN Adjustment	RV4ATSA105B
R132	Same as R129.	Same as R100	
R133	Same as R129.	Same as R101	
R134	RESISTOR, fixed: composition; 1.2 megohm, ±10%, 1/2 watt.	Same as R101	RC20GF125K
R135	RESISTOR, fixed: composition; 27,000 ohms, ±10%, 1/2 watt.	Same as R107	RC20GF273K
R136	Same as R127.	Same as R103	
R137	RESISTOR, variable: composition; 25,000 ohms, ±10%, 2 watts, linear taper.	V-POS Adjustment	RV4ATSA253A
R138	Same as R116.	Same as R103	
R139	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1 watt.	Limiter	RC32GF223K

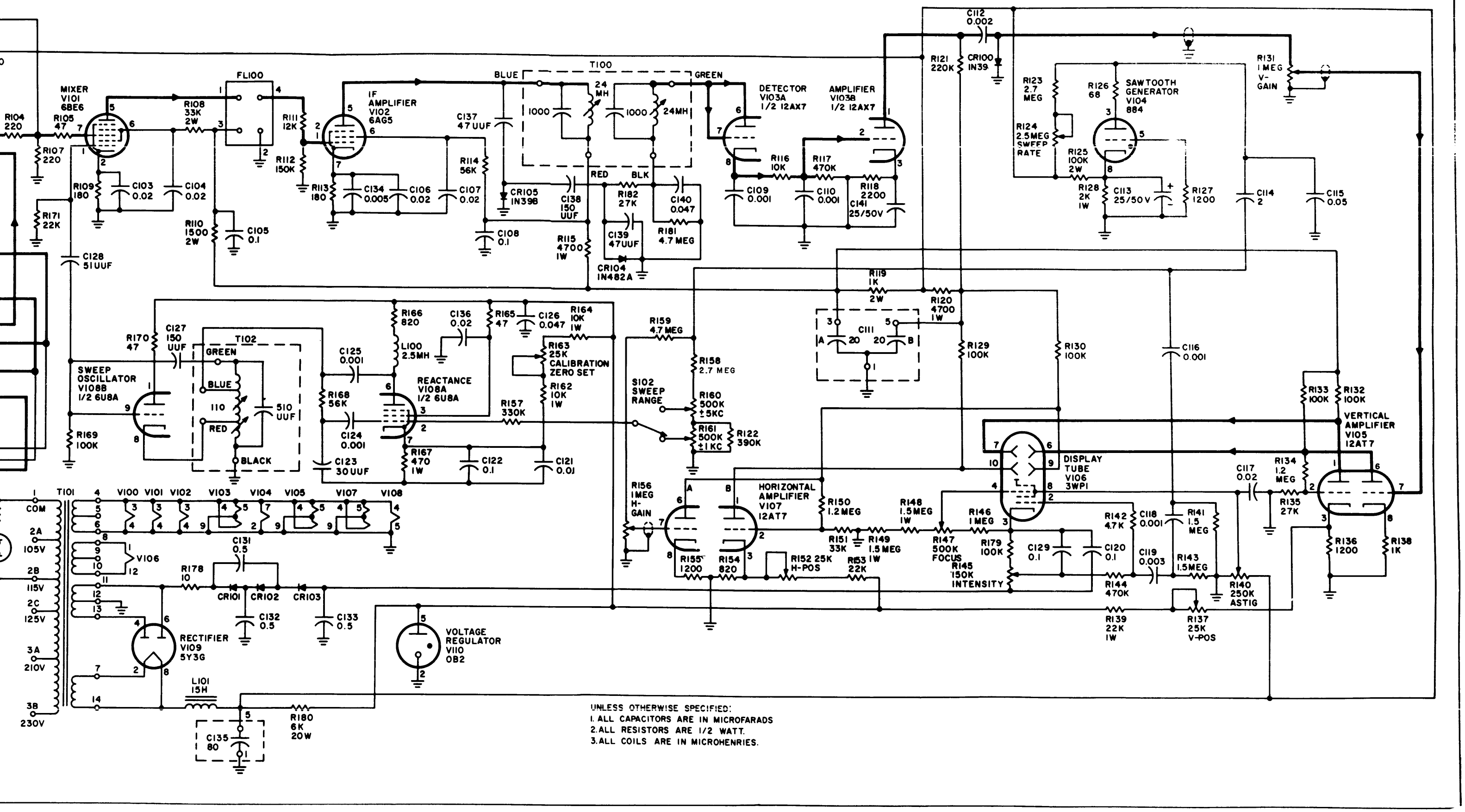
SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R140	RESISTOR, variable: composition; 250,000 ohms, ±10%, 2 watts, linear taper.	ASTIG Adjustment	RV4ATSA254A
R141	RESISTOR, fixed: composition; 1.5 megohms, ±10%, 1/2 watt.	p/o Differentiating Network	RC20GF155K
R142	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1/2 watt.	Same as R141	RC20GF472K
R143	Same as R141.	Same as R141	
R144	Same as R102.	Series Grid Bias	
R145	RESISTOR, variable: composition; 150,000 ohms, ±10%, 2 watts.	INTENSITY Adjustment	RV4ATSA154A
R146	RESISTOR, fixed: composition; 1 megohm, ±10%, 1/2 watt.	Same as R101	RC20GF105K
R147	RESISTOR, variable: composition; 500,000 ohms, ±10%, 2 watts, linear taper.	FOCUS Adjustment	RV4ATSA504A
R148	RESISTOR, fixed: composition; 1.5 megohms, ±10%, 1 watt.	Same as R101	RC32GF155K
R149	Same as R148.	Same as R101	
R150	Same as R134.	Same as R101	
R151	RESISTOR, fixed: composition; 33,000 ohms, ±10%, 1/2 watt.	Same as R107	RC20GF333K
R152	Same as R137.	H-POS Adjustment	
R153	Same as R139.	Same as R101	
R154	RESISTOR, fixed: composition; 820 ohms, ±10%, 1/2 watt.	Same as R103	RC20GF821K
R155	Same as R127.	Same as R103	
R156	Same as R131.	H-GAIN Adjustment	
R157	RESISTOR, fixed: composition; 330,000 ohms, ±10%, 1/2 watt.	Same as R105	RC20GF334K
R158	Same as R123.	Same as R139	
R159	RESISTOR, fixed: composition; 4.7 megohms, ±10%, 1/2 watt.	Same as R139	RC20GF475K
R160	RESISTOR, variable: composition; 500,000 ohms, ±10%, 2 watts, with locking bushing.	5Kc Adjust	RV4ATXA504A
R161	Same as R160.	1 Kc Adjust	
R162	RESISTOR, fixed: composition; 10,000 ohms, ±10%, 1 watt.	Same as R101	RC32GF103K

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R163	RESISTOR, variable: composition; 25,000 ohms, ±10%, 2 watts, linear taper.	CALIBRATION ZERO SET	RV4ATRD253A
R164	Same as R162.	Same as R101	
R165	Same as R105.	Same as R102	
R166	Same as R154.	Same as R101	
R167	RESISTOR, fixed: composition; 470 ohms, ±10%, 1 watt.	Same as R103	RC32GF471K
R168	Same as R114	p/o Phase Shift Network	
R169	Same as R129.	Same as R107	
R170	Same as R105.	Same as R100	
R171	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1/2 watt.	Same as R107	RC20GF223K
R172	Same as R154.	p/o Attenuating Network	
R173	Same as R154.	Same as R172	
R174	Same as R154.	Same as R172	
R175	RESISTOR, fixed: composition; 75 ohms, ±5%, 1/2 watt.	Terminating	RC20GF750J
R176	Same as R175.	Same as R175	
R177	Same as R175.	Same as R175	
R178	RESISTOR, fixed: composition; 10 ohms, ±10%, 1/2 watt.	Fuse	RC20GF100K
R179	Same as R129.	Same as R103	
R180	RESISTOR, fixed: wire wound; 6000 ohms, ±5%, 20 watts.	Voltage Load	RW-110-31
R181	Same as R159.	p/o AVC Network	
R182	Same as R135.	Same as R181	
R183	RESISTOR, fixed: composition; 82,000 ohms, ±10%, 1/2 watt.	Same as R101	RC20GF823K
R184	RESISTOR, fixed: composition; 680 ohms, ±10%, 1/2 watt. (Model DVM-4 only).	Attenuator	RC20GF681K
R185	Same as R184. (Model DVM-4 only).	Attenuator	
R186	Same as R184. (Model DVM-4 only).	Attenuator	
R187	Same as R184. (Model DVM-4 only).	Attenuator	
R188	Same as R105. (Model DVM-4 only).	Terminator	
R189	Same as R105. (Model DVM-4 only).	Terminator	

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R190	Same as R105. (Model DVM-4 only).	Terminator	
R191	Same as R105. (Model DVM-4 only).	Terminator	
S100	SWITCH, pushbutton: momentary contact, 1 amp, 125 VAC.	PUSH TO CALIBRATE	SW-168DPST2NOBB
S101	SWITCH, rotary: 3 positions 1 section, angle of throw 30°.	RECEIVER SELECTOR	SW-275
S102	SWITCH, toggle: SPDT; 6 amps.	SWEEP RANGE	ST-12D
S103	SWITCH, toggle: DPDT; 6 amps.	POWER ON OFF	ST-22K
T100	TRANSFORMER, R. F.: tuned; primary-1.25 mh (without core); secondary-1.25 mh (with core); Q primary greater than 55; Q secondary greater than 55; test frequency 250 Kc.	100 Kc IF	TT-113
T101	TRANSFORMER, power: primary-105V, 115V, 125V, 210V, 230V, 50/60 cps, single phase; secondary No. 1-6.3V at 5 amps CT; No. 2-6.3V at 2 amps CT; No. 3-340-0-340 RMS 100 ma DC operating into 4 uf filter input capacitor; No. 4-5.0V at 2 amps.	Power Transformer	TF-196
T102	TRANSFORMER, R. F.: tuned; L=105-115 uh, Q = greater than 45; test frequency 790 Kc. (Model DVM-2 only).	600 Kc Oscillator	TT-111
T102	TRANSFORMER, R. F.: tuned; L=105-115 uh, Q = greater than 45; test frequency 555 Kc. (Model DVM-3 only).	555 Kc Oscillator	TT-112
T102	TRANSFORMER, R. F.: tuned; L=300-330 uh, Q = greater than 75; test frequency 790 Kc. (Model DVM-4 only).	350 Kc Oscillator	TT-173
V100	TUBE, electron: sharp cutoff RF pentode; 7 pin miniature.	Marker Oscillator	6AG5
V101	TUBE, electron: pentagrid converter; 7 pin miniature.	Mixer	6BE6
V102	Same as V100.	IF Amplifier	
V103	TUBE, electron: medium-mu duo-triode; 9 pin miniature.	Detector Amplifier	12AX7
V104	TUBE, electron: thratron, gas filled triode; octal.	Sawtooth Oscillator	884
V105	TUBE, electron: duo-triode; 9 pin miniature.	Vertical Amplifier	12AT7
V106	TUBE, cathode ray: 12 pin.	Display Tube	3WP1
V107	Same as V105.	Horizontal Amplifier	
V108	TUBE, electron: 9 pin miniature.	Reactance/Sweep Oscillator	6U8A

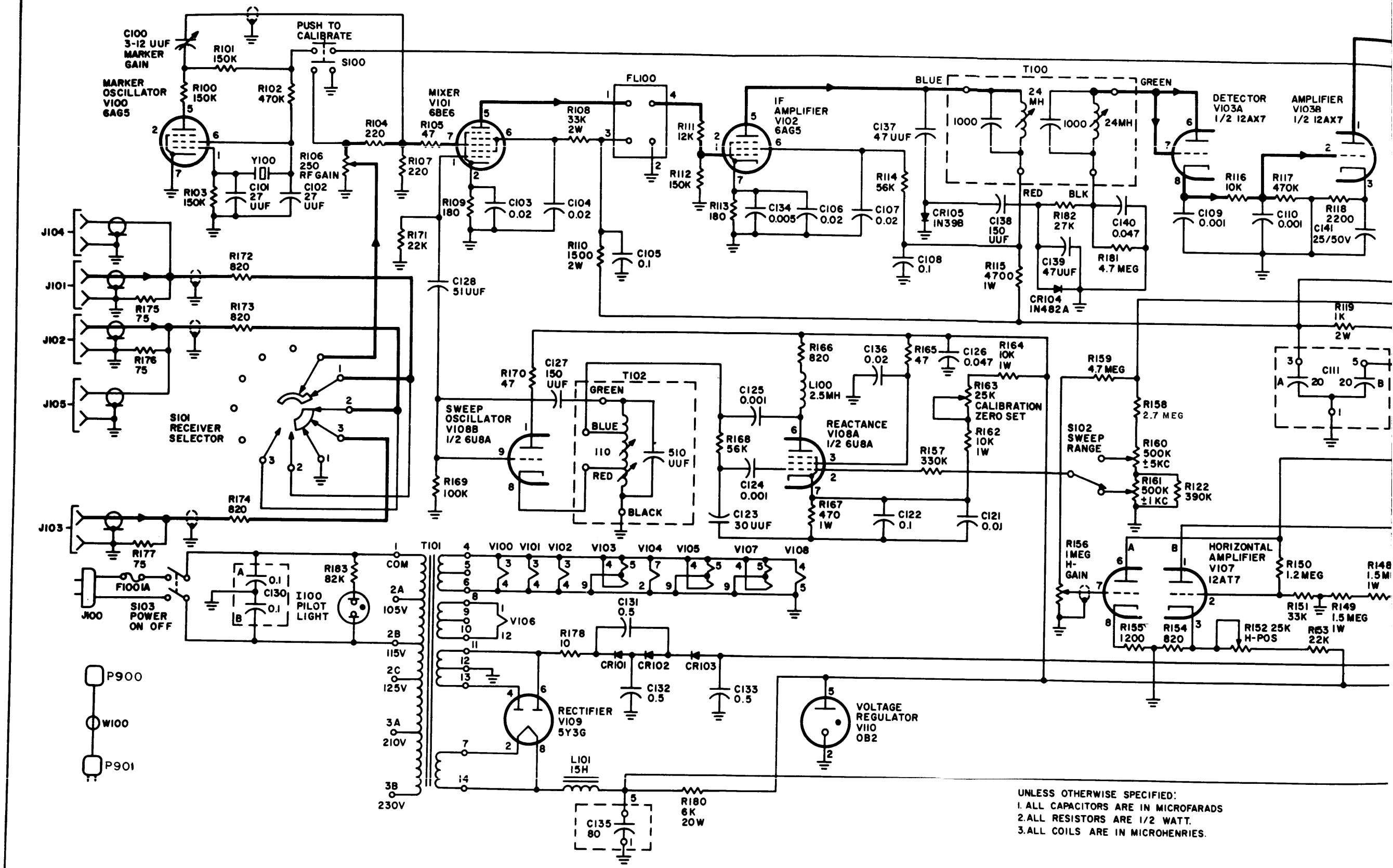
SYM	DESCRIPTION	FUNCTION	TMC PART NO.
V109	TUBE, electron: full-wave rectifier; octal base.	Rectifier	5Y3GT
V110	TUBE, electron: voltage regulator; 7 pin miniature.	Voltage Regulator	OB2
W100	CABLE, power: electrical 2 conductor, 6 ft. lg., with integral make plug one end, and female plug other end.	Input Power	CA-103-72
XC111	SOCKET, electron tube: octal.	Socket for C111	TS-101-PO1
XC135	Same as XC111.	Socket for C135	
XF100	FUSEHOLDER, extractor post type; 250 V, 15 amp.	Socket for F100	FH-100-2
XI100	LIGHT, indicator: with red frosted lens; for miniature bayonet base T-3-1/4 bulb.	Socket for I100	TS-106-1
XV100	SOCKET, electron tube: 7 pin miniature.	Socket for V100	TS-102-PO1
XV101	Same as XV100.	Socket for V101	
XV102	Same as XV100.	Socket for V102	
XV103	SOCKET, electron tube: 9 pin miniature.	Socket for V103	TS-103-PO1
XV104	Same as XC111.	Socket for V104	
XV105	Same as XV103.	Socket for V105	
XV106	SOCKET, duo decal.	Socket for V106	TS-112
XV107	Same as XV103.	Socket for V107	
XV108	Same as XV103.	Socket for V108	
XV109	Same as XC111.	Socket for V109	
XV110	Same as XV100.	Socket for V110	
XY100	SOCKET, crystal: 486" spacing for .050"pin dia.	Socket for Y100	TS-104-1
Y100	CRYSTAL UNIT, quartz: 500 Kc. (Model DVM-2 only).	Crystal Oscillator	CR-46/U-.500P
Y100	CRYSTAL UNIT, quartz: 455 Kc. (Model DVM-3 only).	Crystal Oscillator	CR-46/U-.455P
Y100	CRYSTAL UNIT, quartz: 250 Kc. (Model DVM-4 only).	Crystal Oscillator	CR-46/U-.250P

SECTION VIII
SCHEMATIC DIAGRAMS



UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITORS ARE IN MICROFARADS
2. ALL RESISTORS ARE 1/2 WATT.
3. ALL COILS ARE IN MICROHENRIES.

Figure 8-1 Schematic Diagram for Diversity Visual Monitor Unit, Model DVM-2, 3


C100 3-12 UUF MARKER GAIN
R101 150K
PUSH TO CALIBRATE
S100
MARKER OSCILLATOR V100 6AG5
R100 150K
R102 470K
R104 220
R105 47
MIXER V101 6BE6
R108 33K 2W
FL100
R111 12K
IF AMPLIFIER V102 6AG5
T100
BLUE
GREEN
24 MH
1000
24MH
DETECTOR V103A 1/2 12AX7
AMPLIFIER V103B 1/2 12AX7
R106 250 RF GAIN
R107 220
Y100
C101 27 UUF
C102 27 UUF
R103 150K
R109 180
C103 0.02
C104 0.02
R110 1500 2W
C105 0.1
R112 150K
R113 180
C134 0.005
C106 0.02
C137 47 UUF
R114 56K
C107 0.02
C108 0.1
CR105 IN398
C138 150 UUF
R115 4700 1W
RED
BLK
R182 27K
C139 47UUF
CR104 IN482A
C140 0.047
R181 4.7 MEG
R116 10K
R117 470K
C109 0.001
C110 0.001
R118 2200
C141 25/50V
R119 1K 2W
C111
20
20
R171 22K
C128 51UUF
J104
J101
J102
J105
J103
R172 820
R173 820
R174 820
R175 75
R176 75
R177 75
S101 RECEIVER SELECTOR
R170 47
C127 150 UUF
SWEEP OSCILLATOR V108B 1/2 6U8A
T102
GREEN
BLUE
110
510 UUF
RED
BLACK
R169 100K
C125 0.001
R166 820
L100 2.5MH
C136 0.02
R165 47
C126 0.047
R164 10K 1W
R163 25K CALIBRATION ZERO SET
R162 10K 1W
REACTANCE V108A 1/2 6U8A
R168 56K
C124 0.001
C123 30 UUF
R167 470 1W
C122 0.1
C121 0.01
R157 330K
R159 4.7MEG
R158 2.7 MEG
S102 SWEEP RANGE
R160 500K ±5KC
R161 500K ±1KC
R122 390K
R156 1 MEG H-GAIN
HORIZONTAL AMPLIFIER V107 12AT7
R150 1.2 MEG
R151 33K
R149 1.5 MEG
R155 1200
R154 820
R152 25K H-POS
R153 1W 22K
R148 1.5M 1W
F100 1A
J100
S103 POWER ON OFF
C130 A 0.1
C130 B 0.1
I100 PILOT LIGHT
R183 82K
COM
2A 105V
2B 115V
2C 125V
3A 210V
3B 230V
T101
V100 V101 V102 V103 V104 V105 V107 V108
V106
C131 0.5
R178 10
CR101
CR102
CR103
C132 0.5
C133 0.5
RECTIFIER V109 5Y3G
VOLTAGE REGULATOR V110 0B2
L101 15H
C135 80
R180 6K 20W
P900
W100
P901
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1. ALL CAPACITORS ARE IN MICROFARADS
2. ALL RESISTORS ARE 1/2 WATT.
3. ALL COILS ARE IN MICROHENRIES.

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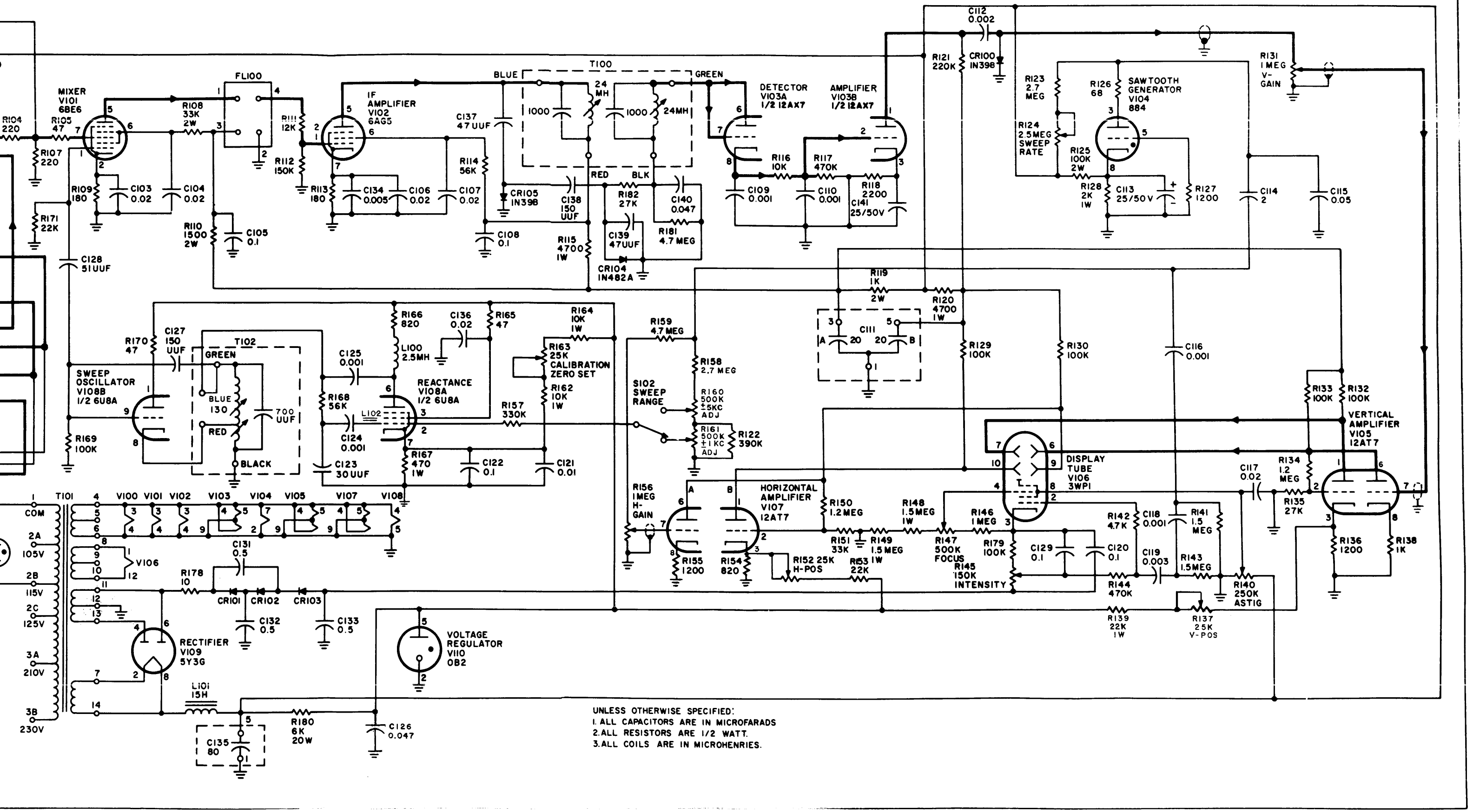

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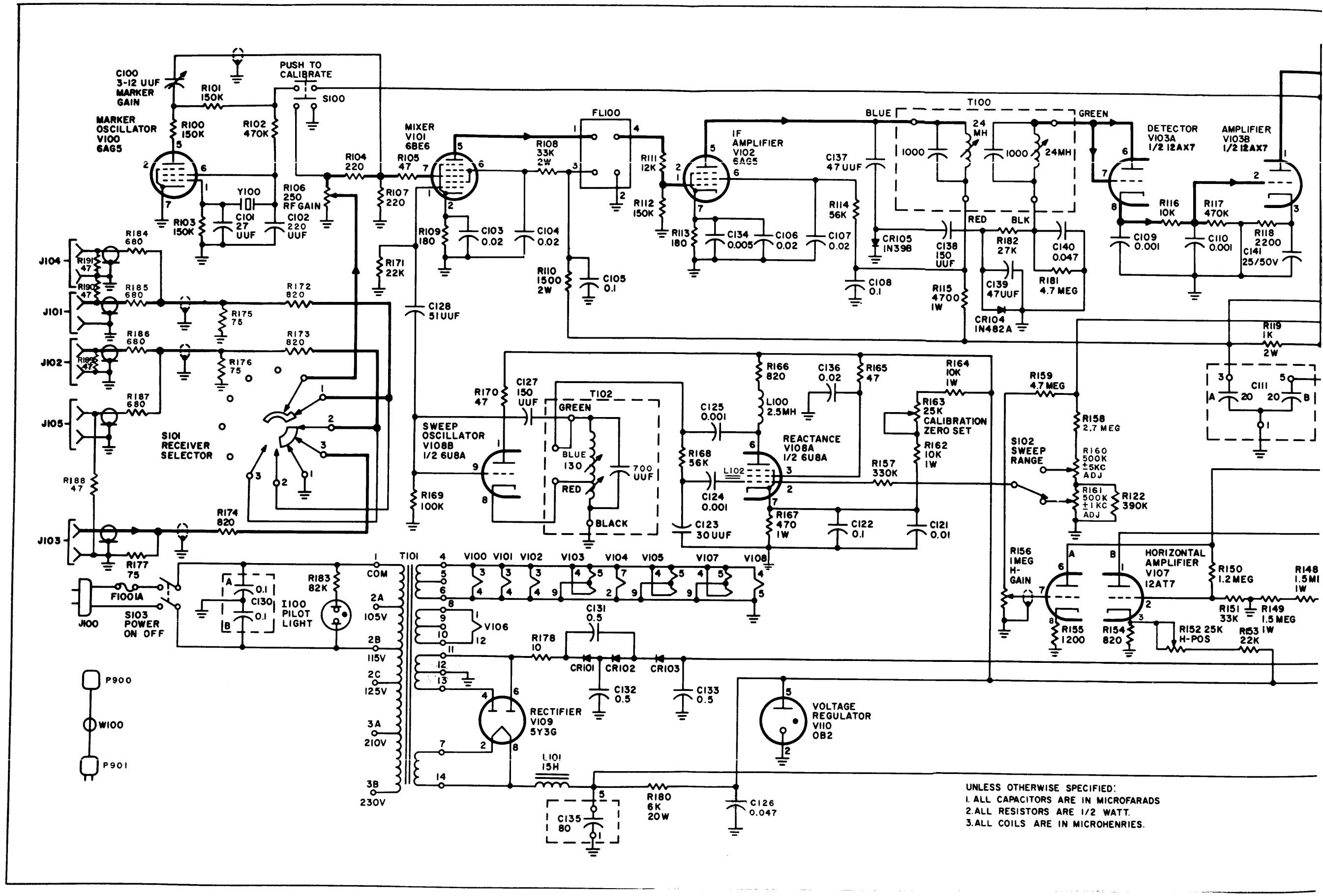
1. ALL CAPACITORS ARE IN MICROFARADS
2. ALL RESISTORS ARE 1/2 WATT.
3. ALL COILS ARE IN MICROHENRIES.

Figure 8-2 Schematic Diagram for Diversity Visual Monitor Unit, Model DVM-4



UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITORS ARE IN MICROFARADS
2. ALL RESISTORS ARE 1/2 WATT.
3. ALL COILS ARE IN MICROHENRIES.

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