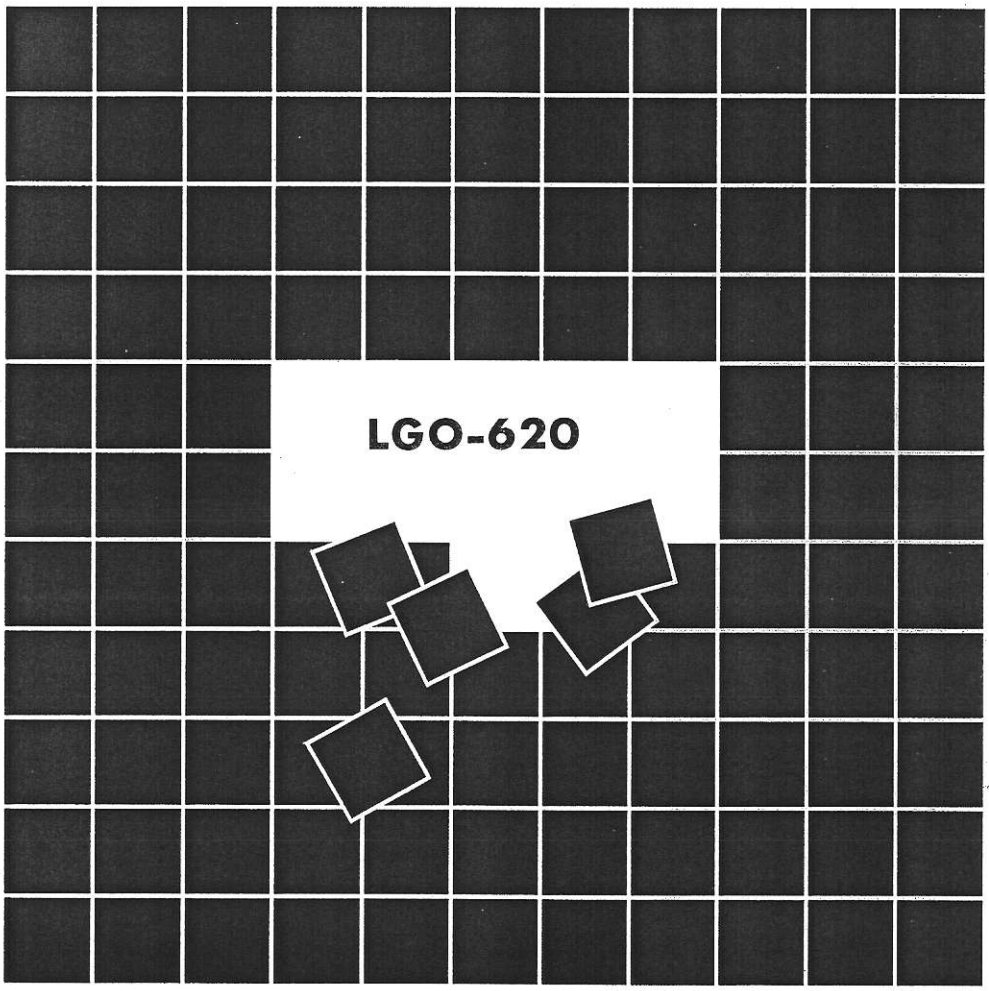
LEADER

AM/FM-IF GENESCOPE

INSTRUCTION MANUAL



LEADER ELECTRONICS CORI

C O N T E N T S

1. GENERAL DESCRIPTION

The LGO-620 is most suited for use in production line testing of the IF circuits in AM and FM radio receivers. It is a combination of a three-band sweep generator with markers, a 130mm (5") scope, and associated circuits.

The AM IFs can be tested at 262.5kHz and 455kHz, and the FM IF at 10.7MHz.

Sweep frequency signals are generated with varactor controlled circuits driven by a sawtooth generator. Suitable lowpass filters are used to cut out the harmonics and other spurious signals. An RF amplifier with ALC (automatic level control) and the attenuator system provide the sweep output signals.

Two crystal oscillators are used for reference in the frequency marking section. Markers for the 262.5kHz and 455kHz bands are generated by mixing 358.75kHz oscillator output with the sweep signals to produce beats at lower frequencies. Appropriate series circuits tuned to lower frequency generate pulses which are detected and fed to the waveshaper (pulser). For example, the 455kHz pulse is generated when the sweep and crystal frequencies are mixed to produce a signal at 96.25kHz (=455-358.75). The 262.5kHz pulse is generated at 96.25kHz (=358.25-262.5). The same principle is used in generating the 10.7MHz marker. Series tuned circuits at the lower frequencies make possible the use of high-Q elements.

The waveshaped signals are used for the pulse markers and also for intensifying the CRT beam at the same time. The pulse markers are fed to the vertical amplifier for proper indication on the trace.

The signal picked up at the test point of the circuit under examination is fed the vertical amplifier through a two-step attenuator and the gain control. The horizontal sweep is derived from the sawtooth generator. The CRT is provided with an astigmatism control circuit which automatically adjusts the beam for uniformity of the spot.

Operating DC voltages are obtained from appropriate rectified outputs with or without regulation.

2. SPECIFICATIONS

Frequency Characteristics

BAND: IF Channels	Car Radio: AM	AM	FM
Swept Range	227.5-297.5kHz	420-490kHz	10.2-11.2MHz
Center Frequency (adjustable)	262.5±35kHz	455±35kHz	10.7MHz±500kHz
Marker Frequencies	252.5 kHz 262.5 272.5	445 kHz 455 465	10.60 MHz 10.70 10.80

Sweep Data

Output Voltage	0.3Vrms, maximum, into 75Ω.
Output Control	80dB total: 70dB in 10dB steps and 0 to 10dB, variable.
Output Impedance	75Ω.
Output Flatness	±0.5dB or better at maximum sweep.
Linearity	Within ±5%.
Repetition Rate	at 1/2 line frequency, 25 or 30Hz;

Marker Data

Marking Method	Superposed pulses; simultaneously displayed.
Accuracy	±0.1% at maximum sweep width.
Amplitude	0 to 10mm. adjustable.

Oscilloscope Section

Cathode Ray Tube	130BXB31A(5" type).
Vertical Sensitivity	10m Vp-p or better: DC/3Hz to 50kHz.
Input Impedance	1MΩ
Calibrating Voltage	50m Vp-p; square wave.

General Data

Power Supply	100, 120, 200, 220, or 240 V as specified, 50/60 Hz; approx. 17VA.
Size and Weight	175(W) x 248(H) x 380(D) mm; 5.5kg.
Accessory, furnished	Coaxial cable, w/BNC connector & clips 2 ea. spare fuse 1 ea.

3. CONTROLS AND CONNECTORS

3.1 Front Panel

POWER switch: For turning on the AC power for operation; pilot lamp above will indicate when at on.

INTENSITY control: For adjusting the CRT spot to a suitable brightness.

FOCUS control: To focus the CRT spot for sharp definition.

CRT spot positioning controls: With arrows indicating the directions of spot positions.

V. GAIN control, with push-pull switch: For adjusting the vertical gain of the scope; the range setting determines the sensitivity.

FREQUENCY range switch: Sets the IF band of operation.

CENTER FREQUENCY control: Clockwise rotation raises the center frequency.

SWEEP WIDTH control: Clockwise rotation widens the sweep coverage.

ATTENUATION dB switches: For attenuation of the sweep output signal in 10dB steps, 0 to 70dB.

FINE control: For adjusting the sweep output level between the 10dB steps.

AC-DC-CAL switch: Sets the input signal mode – AC for blocking out the DC component in the signal; DC for direct coupling. At CAL, the 50mVp-p vertical calibrating signal is applied to the scope input.

FROM T.P. connector: BNC type; for input cable connection from the test point under examination.

OUTPUT connector: BNC type; for the sweep signal output connection; impedance is 75Ω.

3.2 At Rear and left Side

Cord hooks: For AC cord storage.

Fuseholder: 0.5A at 100 to 120V input; 0.25A at 200 to 240 V input.

MARKER SIZE adjuster: For setting the marker height, 0 to 10mm.

DC BALANCE adjuster: For balancing the vertical amplifier.

4. OPERATION

4.1 Preliminary Instructions

In order to achieve proper test results with use of the LGO-620, precautions in operation, described below, should be observed.

A. The manufacturer's servicing information should be referred to for proper connections of the sweep signal input, test signal pickup points, trace display and other details.

B. The sweep signal input to the test circuit should be as low as consistent in order to avoid overloading. On the other hand, when the AGC has not been cut out, the input should be lowered to the point where the control will not be effective.

C. The sweep width should be kept as narrow as possible, or with relatively wide spacing of the markers, consistent with obtaining the proper results. Wide sweep width will cause the "ringing" effect when high-Q circuits are under test.

D. When the local oscillator in the receiver is in operation, spurious response (beats) may be observed due to pickup of local signals, etc. This can be prevented by setting RF input tuning at the high frequency end, or at an unused channel.

E. For qualitative measurements, the sweep output may be directly connected to the antenna input. For testing sets with the built-in antenna (ferrite bar or rod), use of the standard test loop (IEEE Specifications) is recommended. The input will then be attenuated by 20dB when properly positioned at the standard 60cm distance.

F. When testing the IF circuit, the vertical scope gain should be at a constant setting and the input to the circuit lowered (attenuated) to compensate for the gain.

4.2 Preparation

1. Set the POWER switch at off.

   Remove the AC cord from hooks on the rear panel. After making certain that the AC line voltage is proper, connect the cord plug to the mains.

   Set the POWER switch at on. Allow five to ten minutes for warm-up.

   Raise the tilting standard, at bottom of the case, if necessary, for better viewing of the panel.

2. Initial settings:

   Switches: AC-DC-CAL at AC.
   ATTENUATION dB at 10.

   Controls: Spot positioning, vertical and horizontal, at midposition.
   CENTER FREQ. at midposition.
   INTENSITY and FOCUS for clear display.

3. Adjustments

   Horizontal positioning to set the trace at the end vertical lines.

   CENTER FREQ. control to set the middle marker on the center vertical line.

   SWEEP WIDTH control to set the 10kHz side markers (at 455kHz and 262.5kHz center frequencies) spaced 2 or 3cm, for example, from the center marker.

   MARKER SIZE adjuster (at left side of the case), if required, to adjust the marker height on the trace.

4.3 Vertical Calibration

NOTE: For qualitative measurements, this calibration is not required.

1. Set the AC-DC-CAL switch at CAL.
2. Set the V-GAIN control at midposition and knob at PULL (1/1).

3. Adjust V-GAIN and vertical positioning control so that the horizontal traces are spaced as shown in the table below.

Initial Setting	Vertical spacing	SENSITIVITY	
		1/1 (PULL)	1/10 (PUSH)
1/1 (PULL)	5 cm	10 mVp-p/cm	100 mVp-p/cm
	2.5	20	200
	1.0	50	500
IMPORTANT!! After calibration, do not touch the V-GAIN control.			

4.4 Connections

OUTPUT: Connect a coaxial cable between the connector and input of the circuit under test, loop antenna, or balun (if used).

FROM T.P.: Connect a coaxial cable between the connector and the TP, or test point, in the circuit under examination.

When a demodulator is used, connect the clips at its output.

NOTE: When there is a high DC voltage at the test point, set the AC-DC-CAL switch at AC. This is to prevent DC saturation of the vertical amplifier.

Typical interconnections are shown in Fig. 4-1.

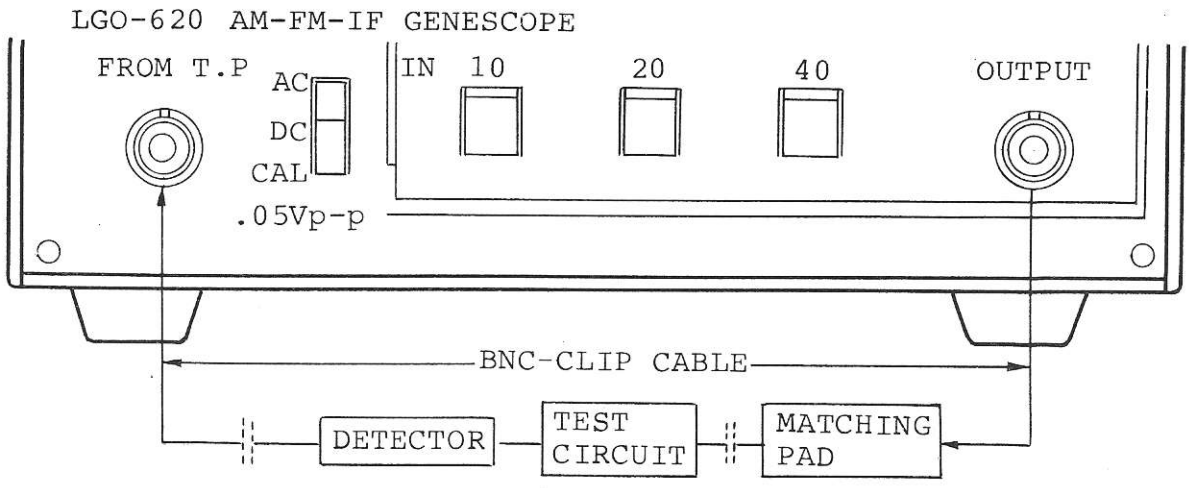


Fig. 4-1 Interconnections for testing.

4.5 AM IF Circuit Testing

General procedures will be described for testing the 455kHz IF circuits. Same procedures are followed for the 262.5kHz IF circuits – the only difference being in the center frequency.

1. Set the FREQUENCY switch at 455kHz.

2. Connect the sweep output to test point Ⓐ (at output of IF T-2) in Fig. 4-2; use a 0.01μF capacitor in the "hot" lead.

   Connect the detector output T.P. (AGC) sound output to the FROM T.P. connector.

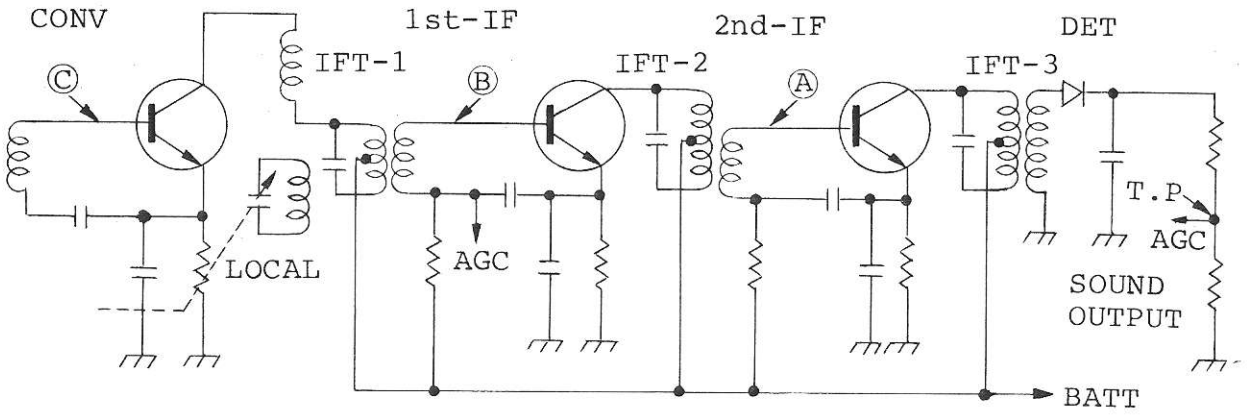


Fig. 4-2 Example: IF circuit alignment.

3. Circuit adjustments:

   Adjust IFT-3 for maximum trace amplitude, see (a) in Fig. 4-3. If the double-tuned IFT is used, then connect the sweep input at the collector and adjust the IFT. Repeat the adjustments, i.e., base side and collector side, for proper response, see (b) in Fig. 4-3.

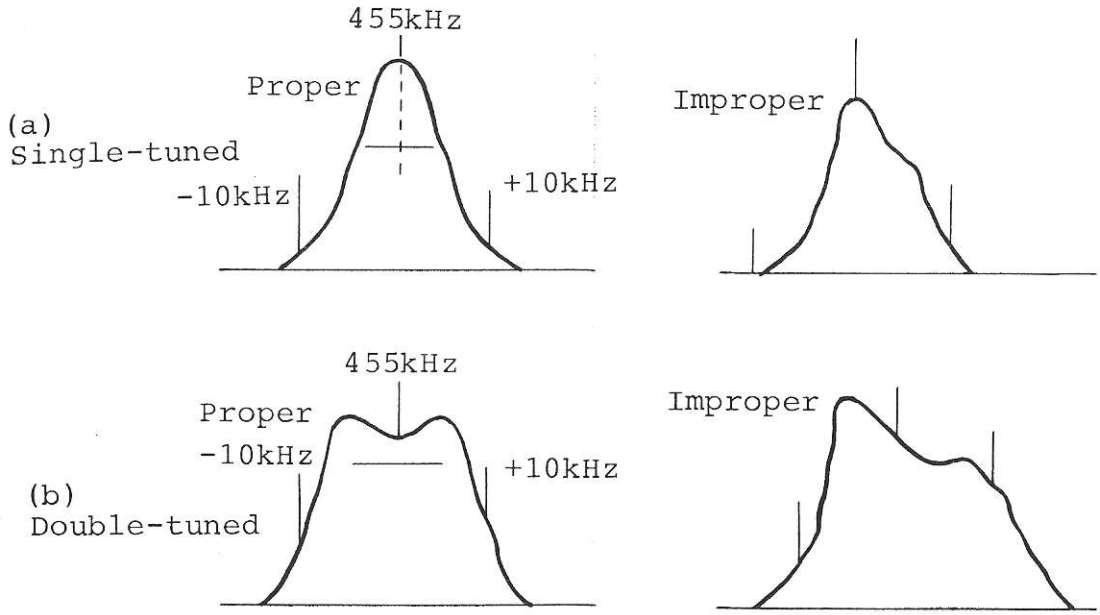


Fig. 4-3 IF detector output traces.

After the IFT-3 adjustment, connect the sweep input at (B) and adjust IFT-2. To compensate for the gain, lower the sweep voltage with the ATTENUATION dB switch as required; use FINE control when necessary.

At the next step, connect the sweep input at (C) and adjust IFT-1.

NOTE: Abnormal effects caused by regeneration and ringing are shown in Fig. 4-4. The ringing pattern will be displayed when a beat is produced between the sweep and local oscillators. In this event, reset (detune) the tuning dial at the front-end of the receiver to another channel.

Unsymmetrical trace Ringing, or beats

Fig. 4-4 Abnormal effects.

4.6 FM IF Circuit Testing

4.6.1 Preparation

1. Set the FREQUENCY switch at 10.7MHz.
2. Set the CENTER FREQ. control to position the center marker, 10.7MHz, at the middle vertical line.
3. Adjust the SWEEP WIDTH control to position the side markers at the desired spacing.
4. The test signal is picked up at the final limiter input, (A), in Fig. 4-5, for the FROM T.P. input.

   To eliminate the AM component, use of a smoothing filter, shown in Fig. 4-6, is recommended. The filter is connected between the pickup point and the connecting cable.

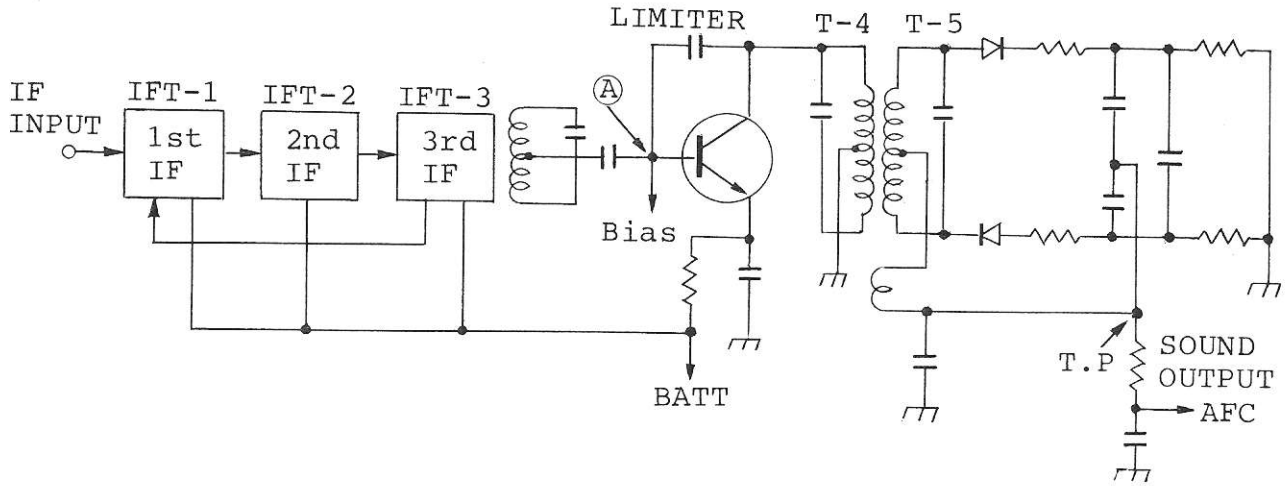


Fig. 4-5 FM IF circuit testing.

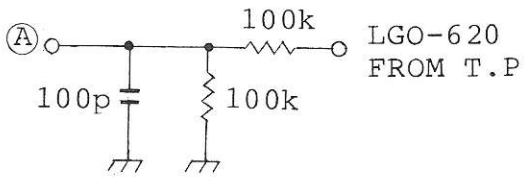


Fig. 4-6 Smoothing filter.

4.6.2 Limiter Stages

The circuits are adjusted by starting with the sweep signal connected at the input of the 3rd IF stage and working towards the converter stage. The procedure is the same as for AM-IF circuit testing; lower the sweep voltage level in proportion to the gain in the limiter stages.

When the limiters are properly aligned, the typical response at the pickup point (A) is shown in Fig. 4-7.

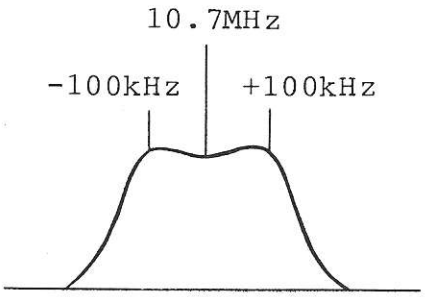


Fig. 4-7 Limiter response at double-tuned condition

4.6.3 Discriminator

Reference: Fig. 4-5

1. Connect a blocking capacitor, 0.01μF, between the sweep output cable and the input (base) of the final limiter stage, see (A) in the figure.
2. The test signal is picked up at T.P. SOUND OUTPUT, in the same figure.
3. Adjust coil T-5 so that the 10.7MHz marker is at the center of the S-curve, see Fig. 4-8.

   Next, adjust coil T-4 for "balance", or symmetry.

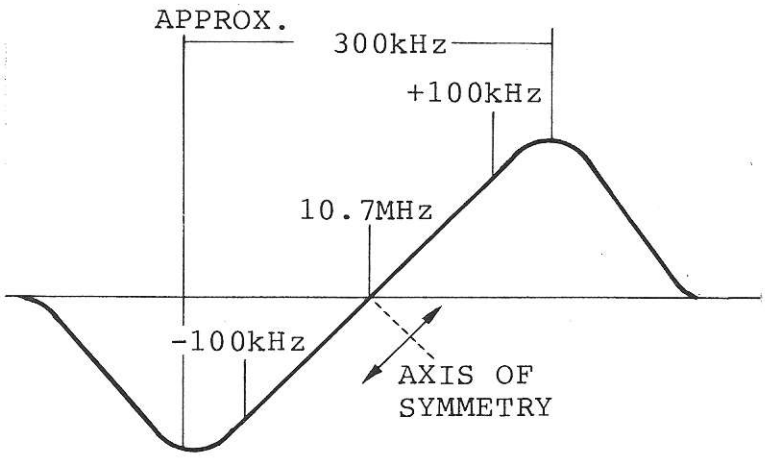


Fig. 4-8 Properly adjusted discriminator circuit.

4. If the discriminator is not properly adjusted, the trace will be distorted, see examples in Fig. 4-9.

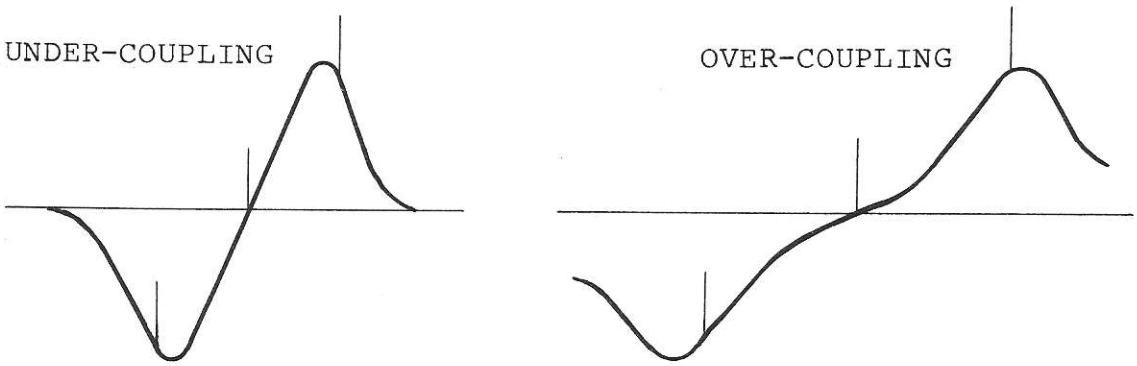


Fig. 4-9 Improperly adjusted discriminator circuit.

4.7 Sweep Output Voltage (dB) Adjustments

At maximum sweep output, the voltage is approximately 0.3Vrms into a 75Ω termination, or load.

Ranges covered with the ATTENUATION switches and FINE control are shown in TABLE 4-1.

TABLE 4-1 Approximate Sweep Output Ranges

ATTENUATION dB Switch setting	Output Range	
	Voltage	dB (0dB = 1μV)
0	0.10 - 0.3Vrms	100 - 110 dB
10	0.03 - 0.1Vrms	90 - 100
20	10 - 30mVrms	80 - 90
30 (10+20)	3 - 10mVrms	70 - 80
40	1 - 3mVrms	60 - 70
50 (10+40)	0.3 - 1mVrms	50 - 60
60 (20+40)	0.1 - 0.3mVrms	40 - 50
70 (40+20+10)	0.03 - 0.1mVrms	30 - 40

5. MAINTENANCE

5.1 General

In this section, procedures will be described for performance checking and for circuit adjustments.

Performance checks can usually be made without exposing the chassis. When it is necessary to examine the internal circuitry or parts, the cover can be removed in the following manner.

a. Set the POWER switch at off.
   Disconnect the AC plug from the AC input.

b. Remove the three screws at the rear and carefully pull the cover towards the back.

c. The bottom cover can be removed by unscrewing the two screws at the rear part.

CAUTION

When checking the circuit or parts, with the AC power at on, observe safety measures to avoid direct contact with the high voltage circuits and terminals.

5.2 Location of Circuits

The principal circuits are assembled on PCBs (Printed Circuit Boards) as shown in Fig. 5-1.

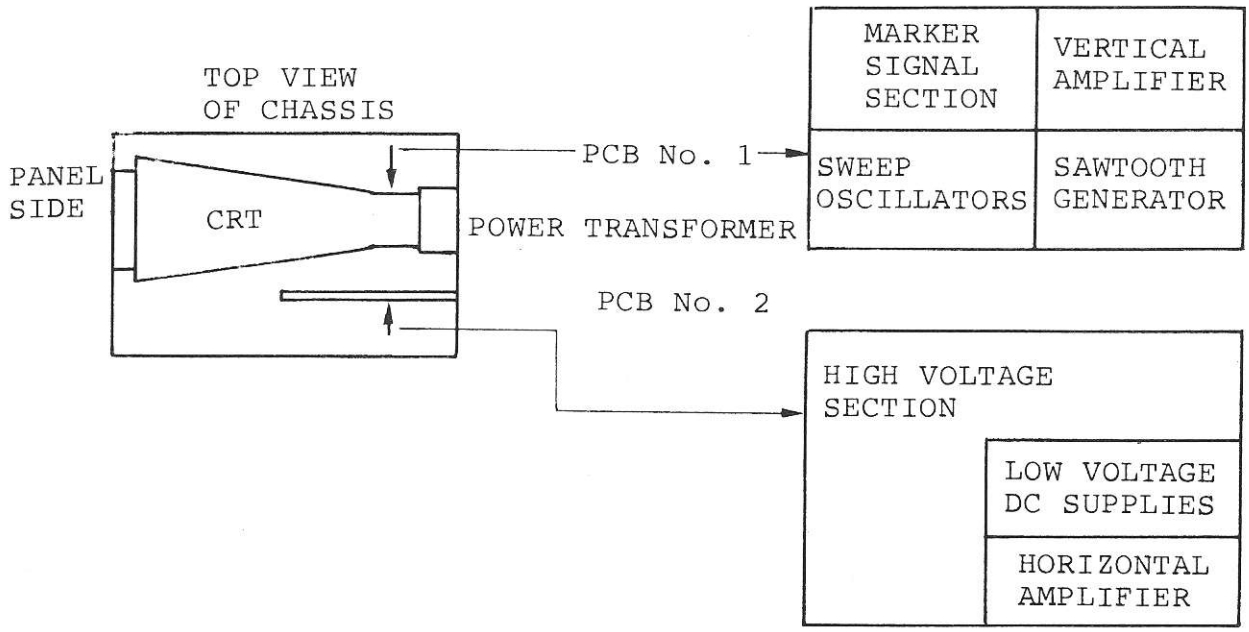


Fig. 5-1 Location of Circuits.

5.3 Test Equipment Required

* Standard signal generator, 150kHz to 30MHz
* Audio oscillator, 20Hz to 200kHz
  Oscilloscope, DC to 1MHz, with vertical calibration
  Termination resistor, 75Ω (VHF type)
  AC millivoltmeter, 0.1mV to 10V (wideband, AF to 20MHz)
  DC/AC voltmeter, 0.1 to 500V
  High voltage DC voltmeter, 0 to 2000V
  Detector unit, see Fig. 5-2
  * With accurate frequency calibration

5.4 Performance Checks

5.4.1 Vertical Input Range

1. Set the V. GAIN control at full clockwise.
2. Apply a 1kHz sinewave signal at 3.5mVrms to the FROM T.P connector.

   The trace amplitude should be better than 1cm.

3. Set the input signal at about 35mVrms

   Adjust the V. GAIN control for the same amplitude to check the 20dB control range. Note: If DC voltage is used, set the inputs at 10mV and at 35mV respectively. The trace movements in the vertical direction are the sensitivities.

5.4.2 Sweep Signal Outputs

1. Set the ATTENUATION switches at 0, and the FINE control at full clockwise.
2. Connect a 75Ω termination to the OUTPUT connector.
3. Connect at VHF millivoltmeter across the 75Ω load. The output voltages should be 300mVrms within ±30mV at the three frequency bands.

5.4.3 Sweep Output Flatness

1. Connect a detector circuit between the OUTPUT and FROM T.P connector, see Fig. 5-2.

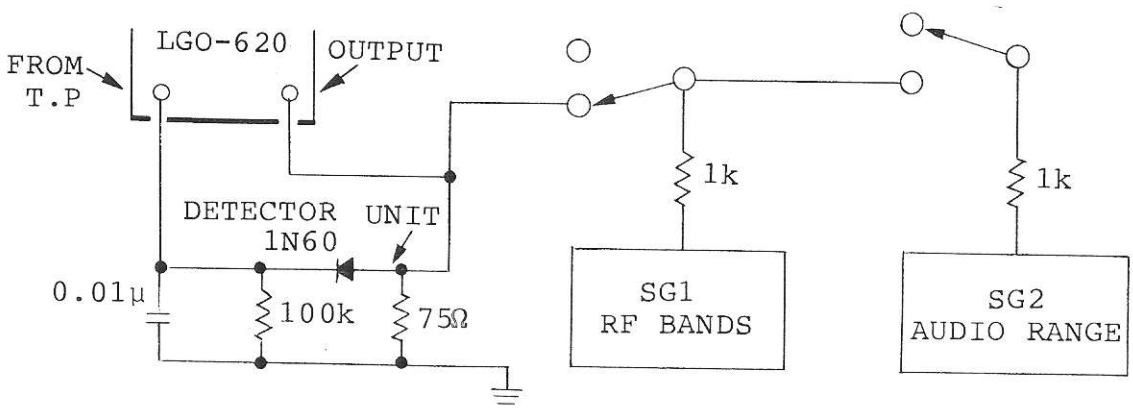


Fig. 5-2 Test connections.

2. With both signal generators disconnected, the trace display should be as shown in Fig. 5-3. The deviation in flatness should be within -0.5 and +0.5dB referred to the center amplitude, at the three bands.

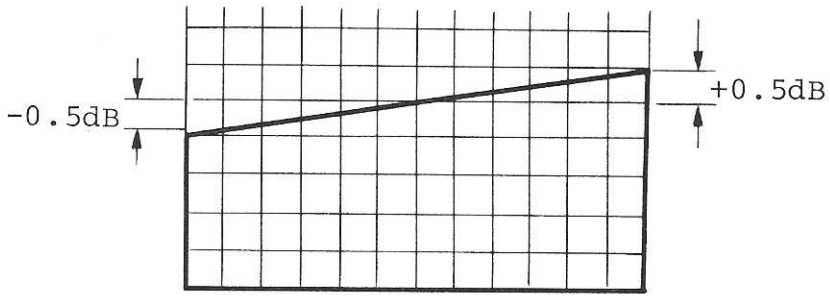


Fig. 5-3 Sweep output flatness check.

5.4.4 Frequency Linearity

1. Connect two signal sources, SG1 (RF bands) and SG2 (AF range) to the detector input, see Fig. 5-2.

2. Control settings:

   FREQUENCY switch at 262.5kHz.
   SWEEP WIDTH control at full clockwise.
   SG1 at 262.5kHz for the center frequency marker.
   SG2 at 35kHz for the side markers at 227.5kHz and 297.5kHz respectively for fc-fw and fc +fw.

3. Measurements:

   Referring to Fig. 5-4.

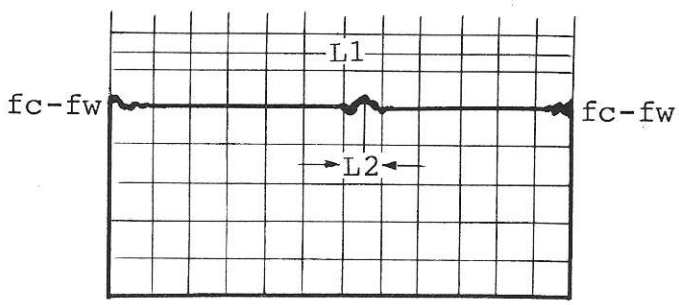


Fig. 5-4 Linearity checking.

L1 = full width of the trace, 10cm.

L2 = distance from the middle vertical line on the scale to the zero beat point in cm.

The linearity is calculated from the relation,

$$\frac{L2}{L1} \times 100\%.$$

The result should be less than 5%.

4. Following the same procedure, the linearity is measured at 455kHz and at 10.7MHz.

FREQUENCY switch setting	SG1	SG2
455kHz	455kHz	35kHz
10.7MHz	10.7MHz	100kHz

5.4.5 Frequency Marker Accuracy

1. Referring to Fig. 5-2, only SG1(RF band) is used.
2. Set the SWEEP WIDTH control at full clockwise.
3. Set the SG1 frequencies for zero beat condition at the different mark-frequencies in the respective FREQUENCY bands, see Fig. 5-5.

   The markers should be within ±0.1% of the specified frequencies.

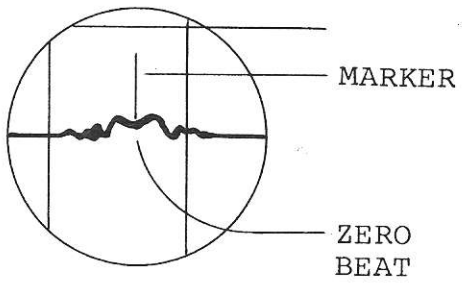


Fig. 5-5 Marker checking.

5.5 Circuit Checks and Adjustments

5.5.1 DC Power Supplies PCB No. 2
SCHEMATIC [6]

When the overall operation is not satisfactory, or the set is "dead", check the DC power supplies.

NOTE: Take utmost precaution to come into contact with the high voltage circuits!!

DC voltages at different test points are given below.

TEST POINT	CONDITION	
TP-1 TP-2	-15V +15V	The voltage at each point must be within ±10%, and ripple voltage less than 0.1mVp-p. If not, check the parts – rectifiers, transistors, etc., – in circuit. The voltage across capacitors, C101, C107, should be less than 20V. If over, the regulator circuit is defective. The emitter – base voltage of transistors should be about 0.7V; if over or less by a considerable amount, replace the transistors. If the series transistors, Q101 and/or Q104, are overheated, check for shorts in the output line.
TP-3 TP-4	+210V +320V	If not proper, check the rectifiers, etc., in the respective circuits.
TP-5	–1500V	The INTENSITY and FOCUS controls will be ineffective if not generated; the two neon lamps will not be on. Check the condition of Q110.

5.5.2 Display Section

A. No horizontal trace display PCB No. 1
SCHEMATIC [2]

Check the waveforms at different test points to localize the trouble.

The test points and waveform conditions are listed in TABLE 5-1, page 24.

B. Non-linearity in the vertical axis

PCB No. 2

SCHEMATIC [5]

When the response curve display is distorted as shown in Fig. 5-6, check the following:

Diode-connected transistors at the input, Q201-Q202, and the FET, Q203, Q204, for defects.

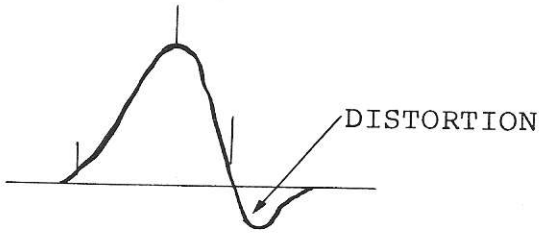


Fig. 5-6 Vertical non-linearity.

C. Vertical trace movement with V. GAIN control adjustment

Adjust the DC BALANCE control, as left side of the chassis so that there is no trace shift with V. GAIN adjustment.

D. Distorted marker display

PCB No. 1

SCHEMATIC [4] & [5]

The markers should be displayed without the undershoot effect.

If this condition is present, check the capacitor C207, in the emitter circuit of Q209 and also the pulser circuit waveformers, at TP-12... TP-15, see page 25.

E. Vertical positioning is ineffective

PCB No. 1

SCHEMATIC [5]

Check the voltage between the collector and emitter of output transistors, Q207 and Q208.

The voltage should be approximately 120V.

F. No input signal display PCB No. 1
SCHEMATIC [5]

Check the trace movement with the vertical positioning control. If there is movement, the input circuit is at fault.

Check the diode-connected transistors, Q201, Q202, and the FETs, Q203, Q204, for defects.

The input circuit and voltage distribution are shown in Fig. 5-7.

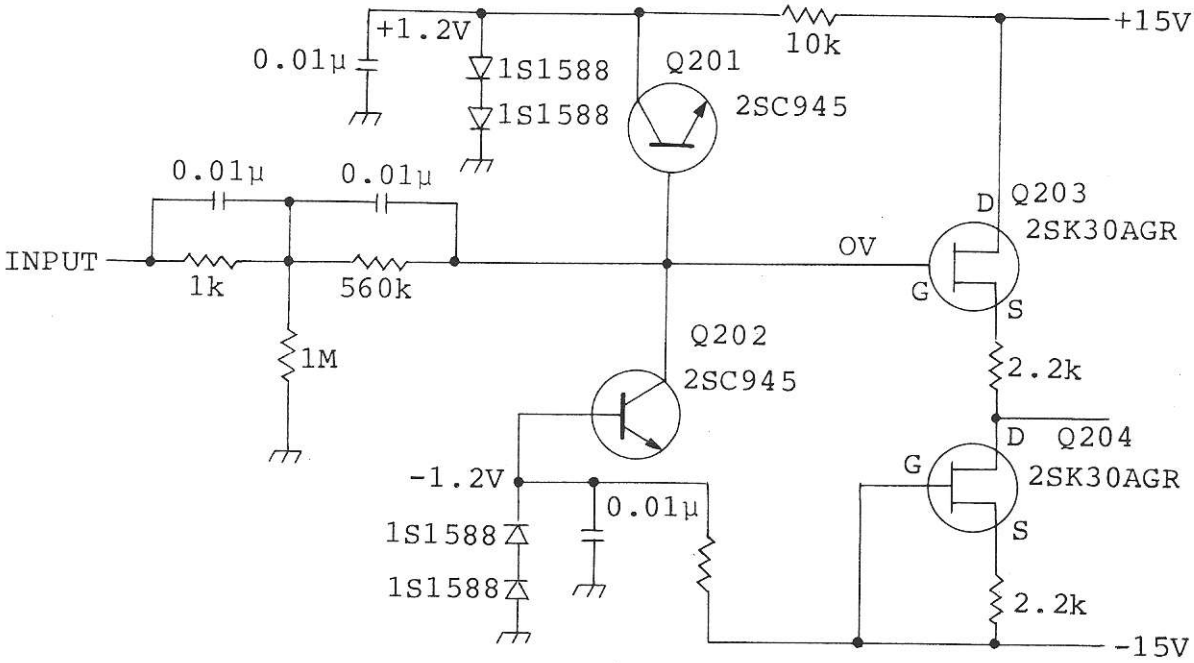


Fig. 5-7 Vertical input circuit.

5.5.3 Sweep/Marker Section

A. Instability caused by noise in sweep output

Check the FINE output control for noise generation; replace if defective.

Check the contacting action of the ATTENUATION dB switches. If satisfactory, the cause is in the sweep oscillator section.

B. Insufficient sweep width — PCB No. 1, SCHEMATIC [2]

Refer to Sect. 5.4.4, Part 3, for sweep width checking.

When the frequency width of the sweep is not sufficient for response curve display, this can be corrected with the adjusters as follows:

FREQUENCY switch setting	Adjuster
262.5kHz	VR406
455kHz	VR407
10.7MHz	VR408

C. Shift in the center frequency — PCB No. 1, SCHEMATIC [2]

When the center frequency in a given band has shifted by a considerable amount, this can be corrected with the adjusters as follows:

FREQUENCY switch setting	Adjuster
262.5kHz	VR409
455kHz	VR410
10.7MHz	VR411

If satisfactory adjustments can not be made, replace the varactor diodes, D302 and/or D308, on PCB No. 1, SCHEMATIC [1].

D. Base line not displayed — PCB No. 1, SCHEMATIC [2]

The fault is in the blanking circuit; check the condition of Q411.

E. Non-appearance of markers — PCB No. 1, SCHEMATIC [4]

1. When the markers for the three bands do not appear, check the waveforms in the pulser

circuit at TP12... TP15 to localize the trouble; see TABLE 5-1, page 24.

2. If certain markers in a given band do not appear, then the respective outputs are low. In this case, adjust as follows:

FREQUENCY switch setting	Adjust
262.5kHz	VR412
455kHz	VR413
10.7MHz	VR414

If the markers still do not appear, check the crystal oscillator and mixer circuits for defective parts and replace.

NOTE: The marker pulses can be checked by connecting a scope to TP-6 (PCB No. 1, SCHEMATIC [6]); see TABLE 5-1, page 24.

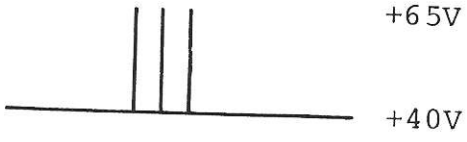
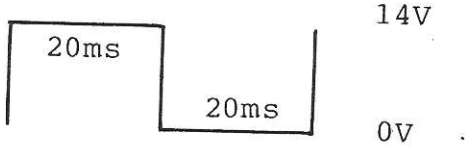
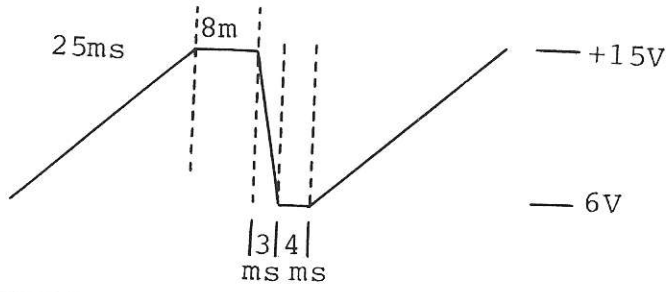
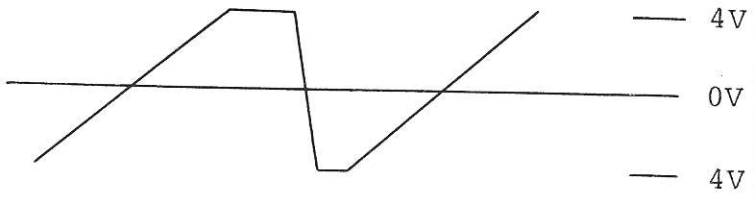
5.5.4 Vertical Calibrator

PCB No. 1
SCHEMATIC [2]

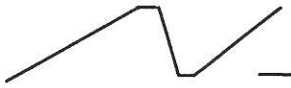
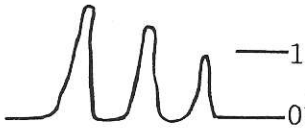
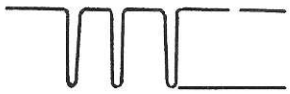
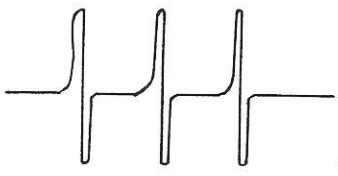
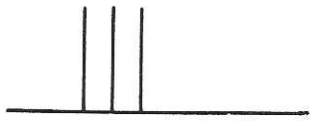
Connect a calibrated scope to TP-10.

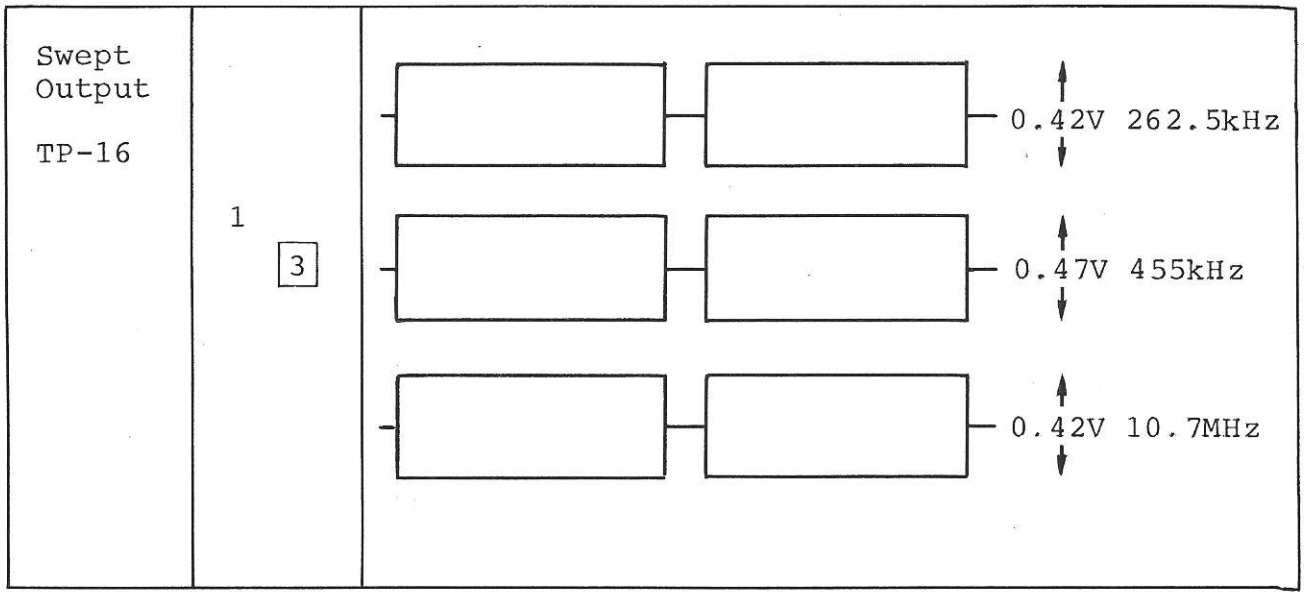
The voltage should be 50mVp-p. If not, adjust VR403.

TABLE 5-1 TEST POINT DATA

Circuit & Test Point	PCB No. (Note)	Condition or Waveform
DC Power Supplies: TP-1 TP-2 TP-3 TP-4 TP-5	2 6	-15V +15V +210V +320V −1500V
Marker Pulses TP-6	2 6	
Sawtooth Section TP-7	1 2	
TP-8		
TP-9		 Set 0V with VR401 - "DC ZERO SET".

Note: SCHEMATIC indicated in □

TP-10	1 2	 Vertical calibration voltage.
TP-11		Nominal voltages: 262.5kHz 455kHz 10.7MHz 
Pulser Circuit TP-12		Minimum output when tuned: 150mV with VR415 (SLICE LEVEL at minimum). 
TP-13	1 4	To be set with VR415 (SLICE LEVEL). 
TP-14		 +6V is set with VR416 (MARKER POSITION).
TP-15		



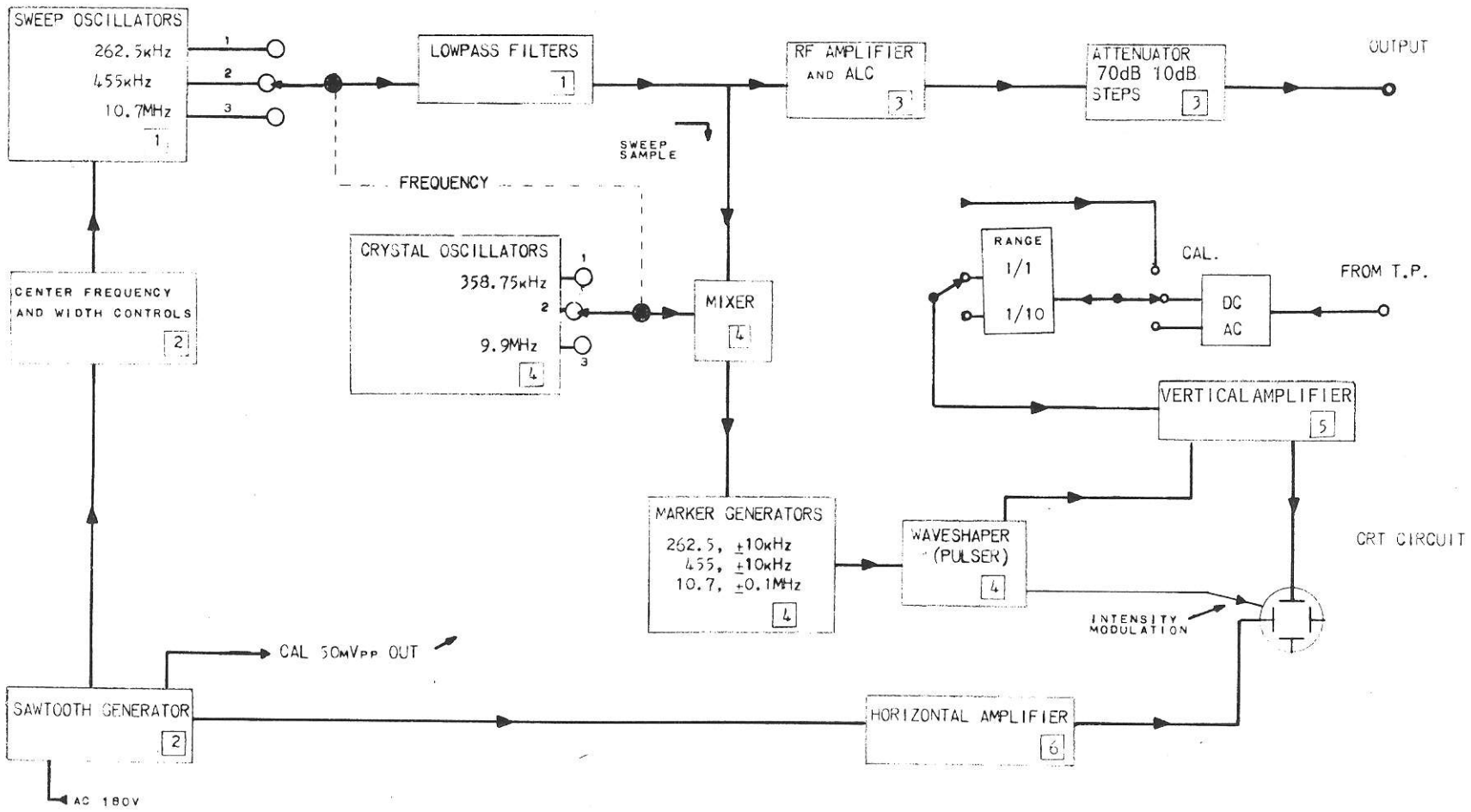
5.5.5 Marker Recalibration PCB No. 1 SCHEMATIC [4]

Recalibration is required when any of the marker frequencies are off by more than 0.1%; see Sect. 5.4.5.

Tuning adjustments for the zero-beat condition are made in the respective series circuits as follows:

FREQUENCY switch setting	MARKER frequency	Circuit	Adjust
262.5kHz	272.5kHz	Q428	L409
	262.5		L410
	252.5		L411
455kHz	465kHz	Q419	L409
	455		L410
	445		L411
10.7MHz	10.8MHz	Q416	L401
	10.7		L402
	10.6		L403

NOTE: Disregard the frequency notations in the schematic.



NOTE: SCHEMATIC INDICATED IN ☐

DC POWER SUPPLIES

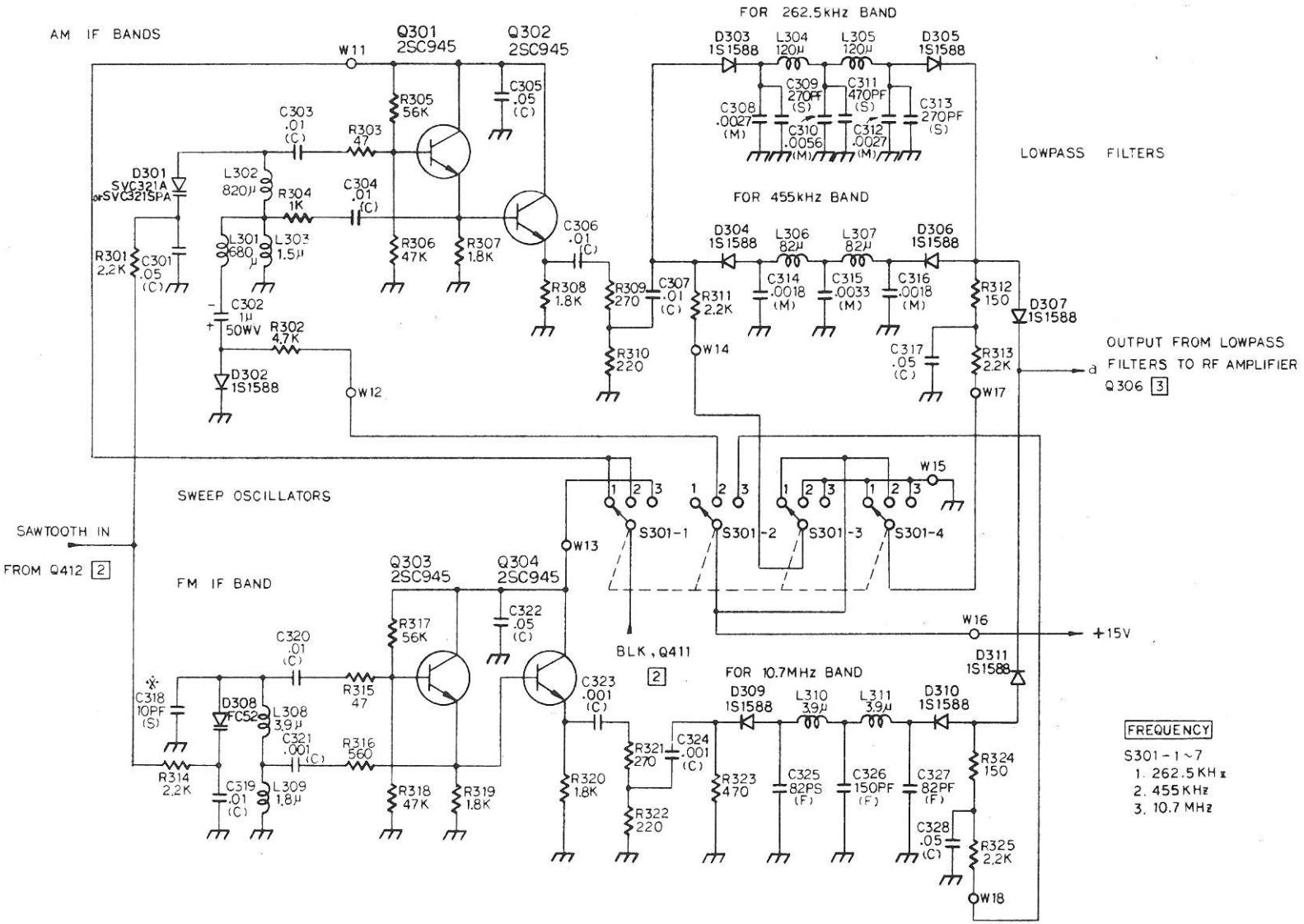
REGULATED: +15V
-15V
-1400 V

UNREGULATED:
+240V
+350V

6

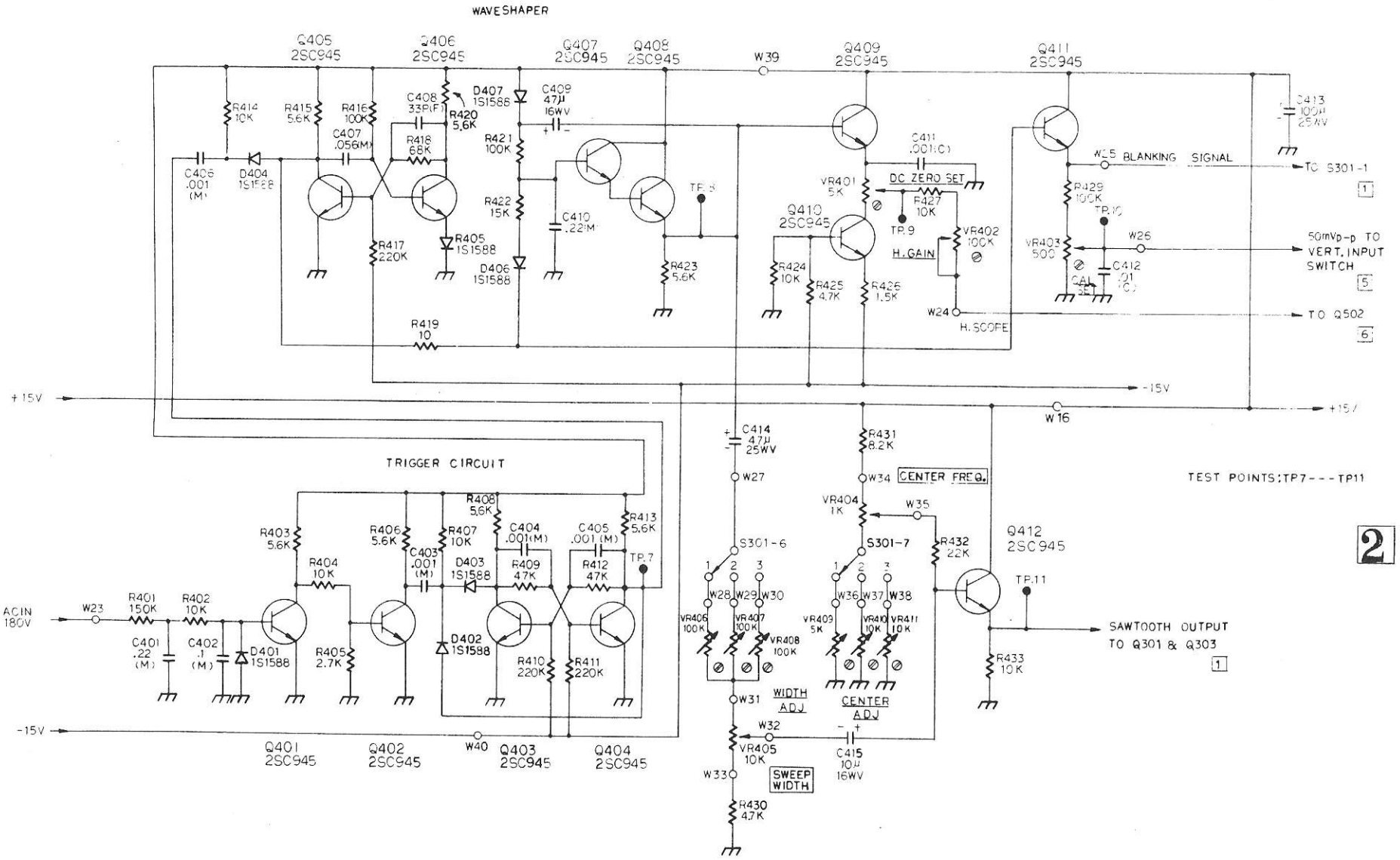
FUNCTIONAL BLOCK DIAGRAM:
620
AM/FM IF GENESCOPE

1976-MARCH



1

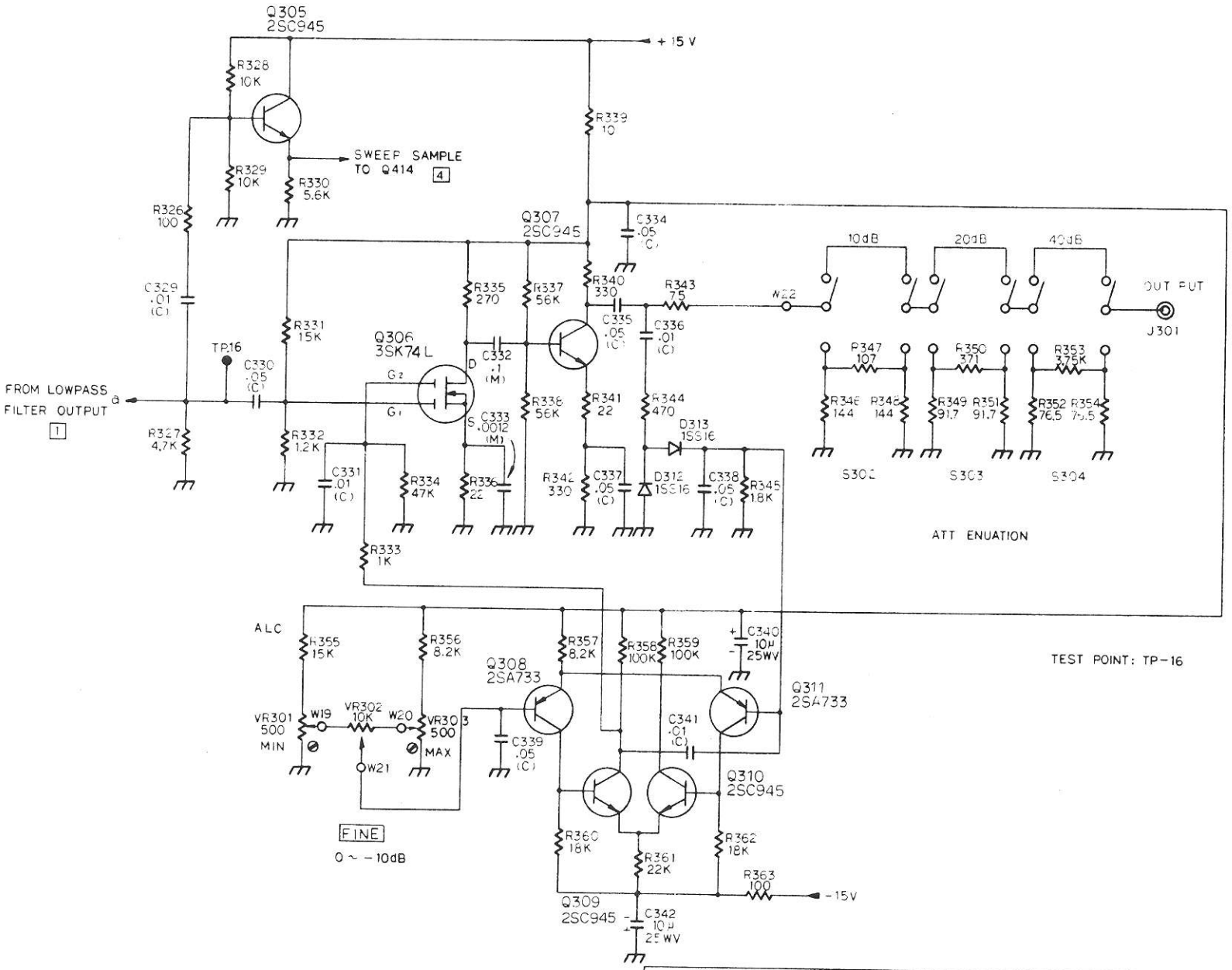
SCHEMATIC	Model 620	0 - 849 3/6
SWEEP GENERATOR	AM/FM - IF GENESCOPE	LEADER ELECTRONICS CORP.



2

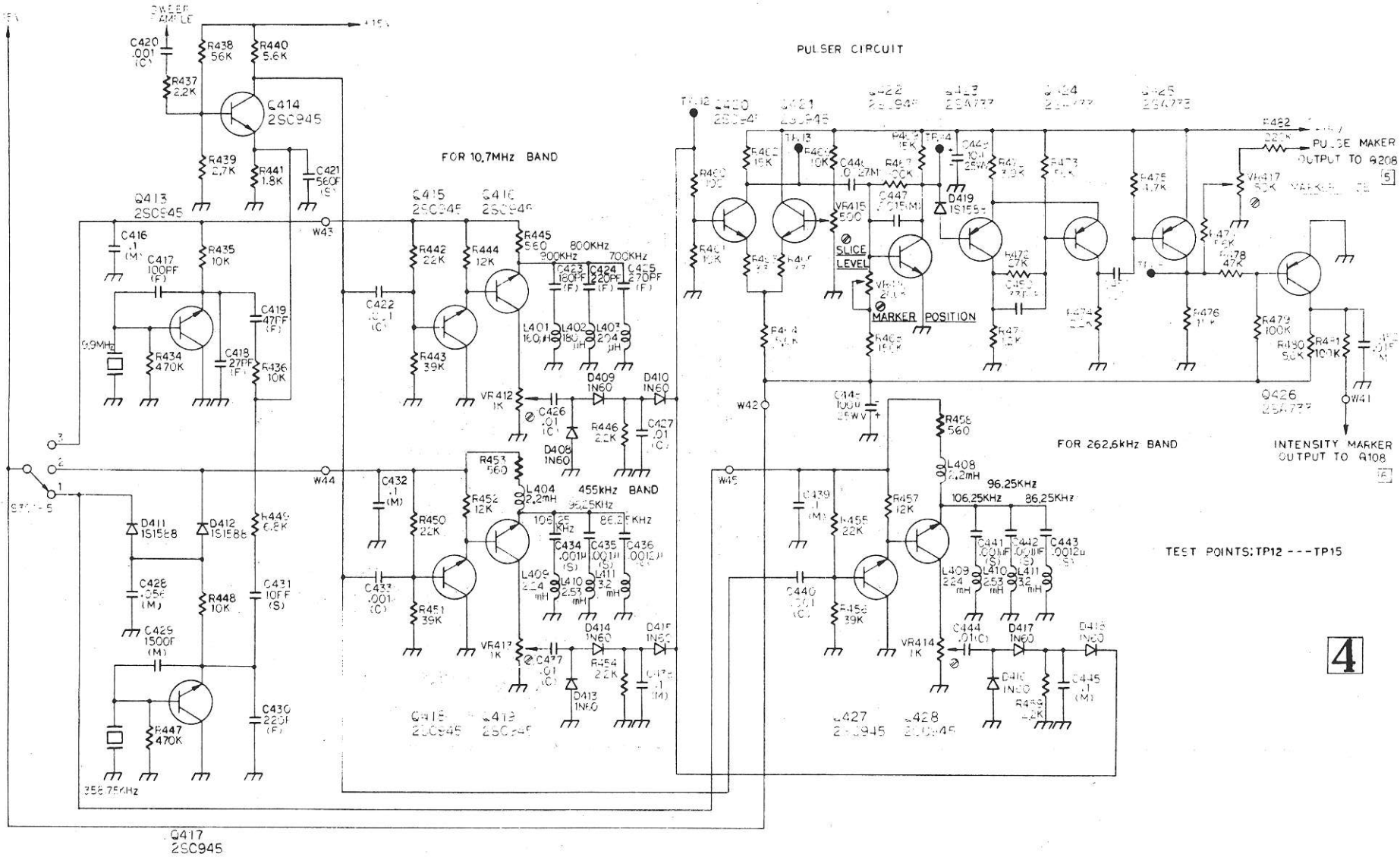
R428 NOT USED

SCHEMATIC	Model 620	0 - 849 5B/6
SAWTOOTH GENERATOR	AM/FM - IF GENESCOPE	LEADER ELECTRONICS CORP.



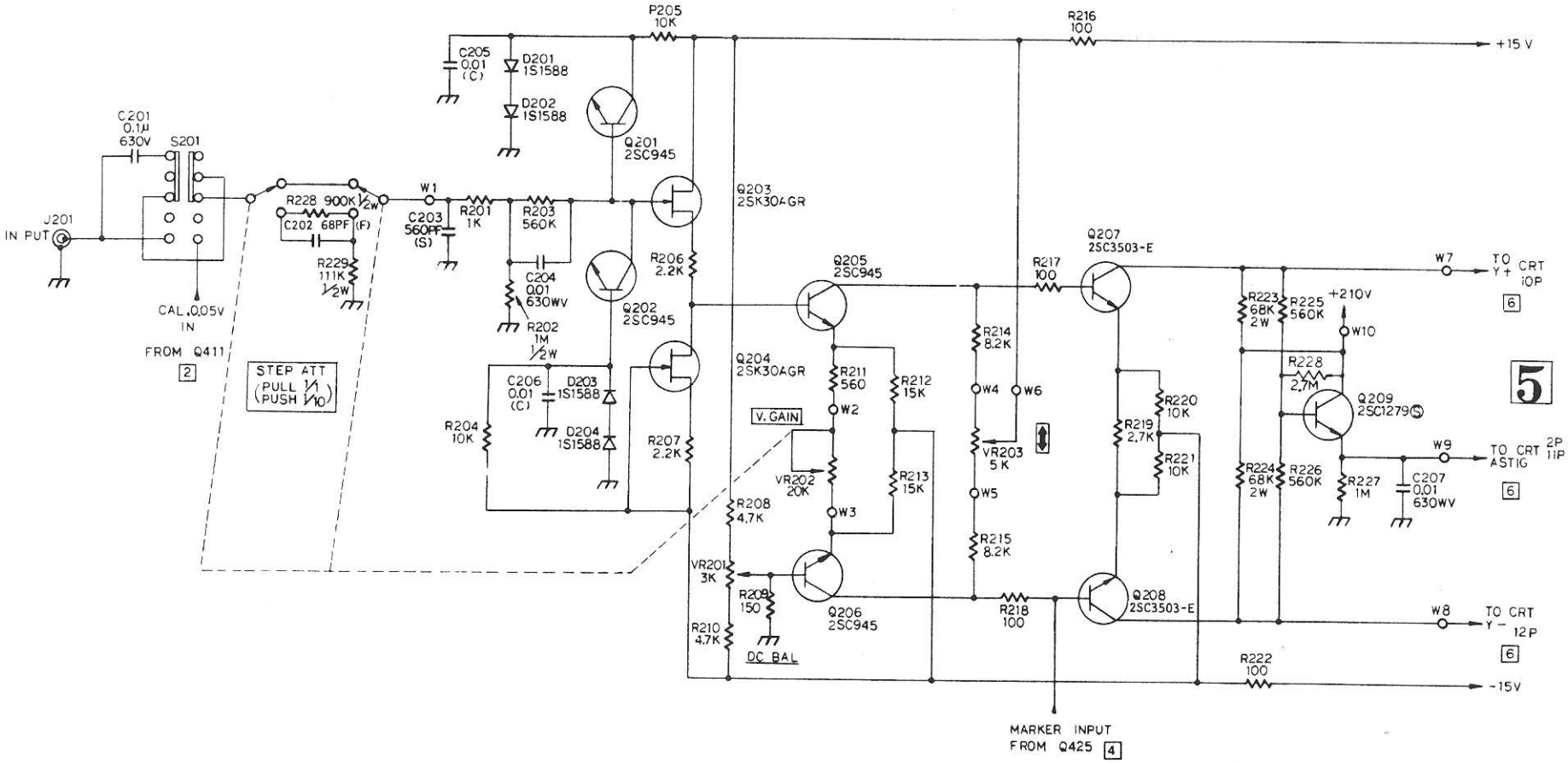
SCHEMATIC	Model · 620	0-849 4/6
RF AMP and ALC	AM/FM - IF GENESCOPE	LEADER ELECTRONICS CORP.

3

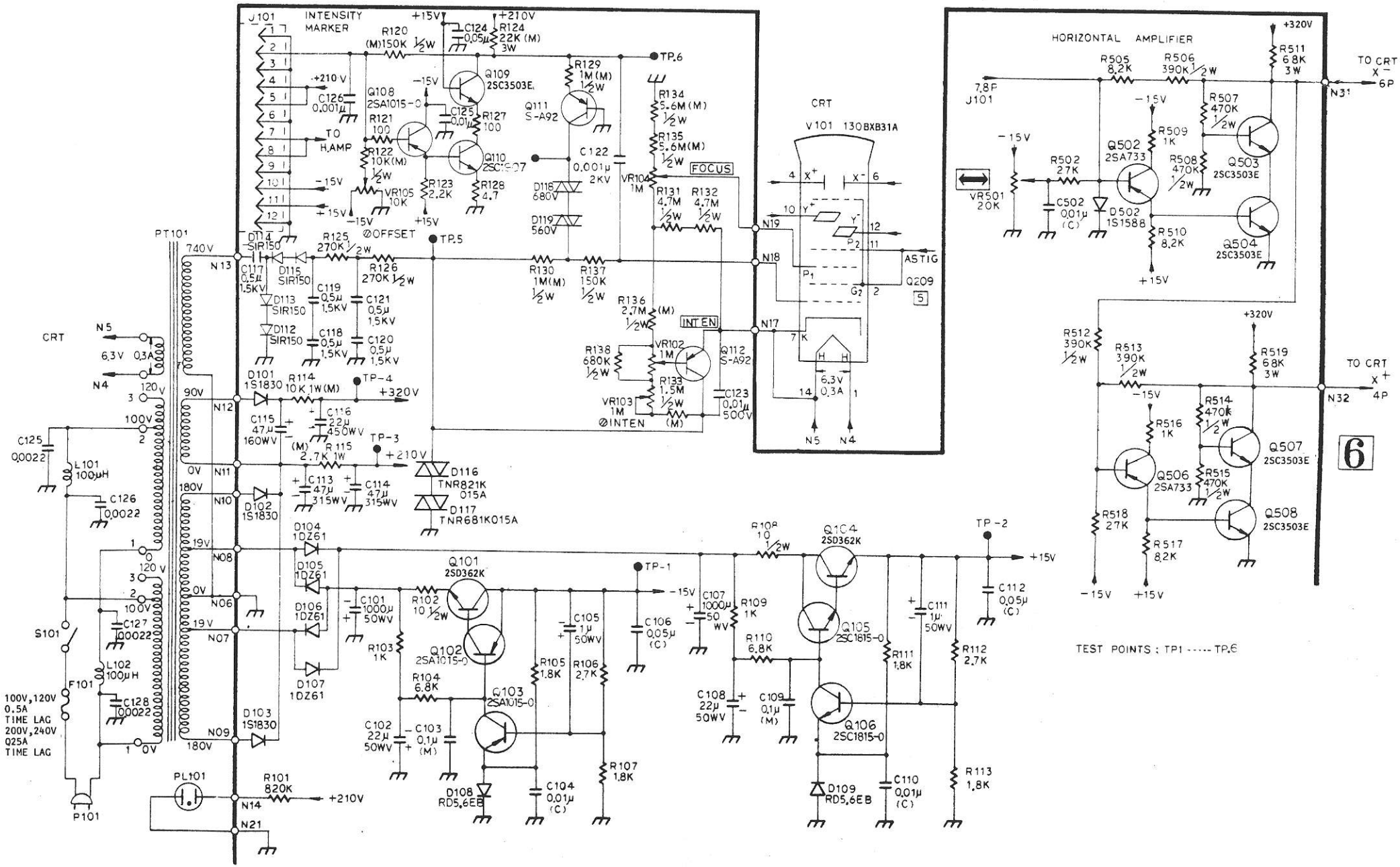


4

SCHEMATIC	Model 620	0-849 6/6
MARKER and PULSER	AM/FM-IF GENESCOPE	LEADER ELECTRONICS CORP.



SCHEMATIC	Model 620	0 - 849 2/6 A
VERTICAL AMP	AM/FM-1F GENESCOPE	LEADER ELECTRONICS CORP.



- 33 -

A'78.9.6

SCHEMATIC	Model 620	0-849 1C/6
POWER SUPPLY and H.AMP	AM/FM-IF GENESCOPE	LEADER ELECTRONICS CORP.

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