C0043

INSTALLATION AND OPERATING INSTRUCTIONS

# CONRAC®

## AUDIO-VIDEO RECEIVER
## TYPE AV12E

CONRAC DIVISION Glendora, California

A DIVISION OF GIANNINI CONTROLS CORPORATION

# CONRAC AV12E RECEIVER

The AV12E TELEVISION AUDIO-VIDEO RECEIVER is particularly designed for monitoring, video recording or rebroadcasting applications. It supplies composite video and separate audio from "off-the-air" signals. It is designed for use with either of two kinds of interchangeable plug-in units: Type CU controlled for any single VHF channel; or Type SU-213, a 12-channel turret type tuner.

The TYPE CU SINGLE VHF CHANNEL PLUG-IN UNIT employs a frame grid cascode R.F. amplifier, a crystal controlled local oscillator, a frequency multiplier chain and a pentode mixer.

The antenna input network contains a bandpass filter which can be adjusted to match any given set of antenna and signal strength conditions and to provide a VSWR of better than 1.2 to one.

The TYPE SU-213, 12-CHANNEL PLUG-IN TUNER employs a turret type VHF neutrode station selector.

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MODEL AV12E RECEIVER
EQUIPPED WITH AN SU-213 TUNER

CU-4 CRYSTAL CONTROLLED
PLUG-IN UNIT

## TECHNICAL SUMMARY

### ELECTRICAL SPECIFICATIONS

Input Power: 117/234 volts AC, 50/60 cycles, 95 watts, fused.

Input Signals: Normally supplied for 75 ohm input with SO239 (#83-1R) connector. If specified, the tuner may be reconnected at the factory for 300 ohm input with screw type terminals.

Outputs: Video: 1.4 volts (adjustable) at 75 ohms, sync negative, SO239 (#83-1R) connector.

Audio: Zero dbm, 600 ohms balanced. Peerless output transformer, screw terminals, with multi-tap audio output transformer connected to feed standard 600 ohm balanced lines. Can be reconnected for other commonly used impedances.

Controls: VIDEO LEVEL, AUDIO LEVEL, MANUAL R.F. GAIN, BIAS SELECTOR, POWER switch, (channel selector and fine tuning on SU-213), AGC DELAY, DETector LEVEL.

### TUBE COMPLEMENT

AV12E

| | | |
|---|---|---|
| V101 | 6AN8 | 1st Sound I.F. Amplifier |
| V102 | 6AU6 | 2nd Sound I.F. Amplifier |
| V103 | 6AL5 | Sound Detector |
| V104 | 6DJ8 | Audio Output |
| V201 | 6BZ6 | 1st I.F. Amplifier |
| V202 | 6BZ6 | 2nd I.F. Amplifier |
| V203 | 6BZ6 | 3rd I.F. Amplifier |
| V204 | 6CB6 | 4th I.F. Amplifier |
| V205 | 6AQ5 | 1st Video Amplifier |
| V206 | OA2 | Voltage Regulator |
| V207 | 6DJ8 | 2nd Video Amplifier |
| V208 | 5687 | 3rd Video Amplifier |
| V209 | 6AU6 | AGC Keyer |
| V210 | 6AQ5 | Keying Pulse Amplifier |
| V211 | 6BY6 | Sync Separator |
| V301 | 6AL5 | AGC Clamp & Bias Rectifier |

SILICON DIODES

| | | |
|---|---|---|
| D201 | 1N60 | Video Detector |
| D301 | 1N1764 | Low Voltage Rectifier |
| D302 | 1N1764 | Low Voltage Rectifier |

CU CONVERTER

| | | |
|---|---|---|
| V1 or V51 | 6CG8 | Crystal Oscillator and Frequency Multiplier |
| V2 | 6BN4 | 2nd Frequency Multiplier (channels 7 - 13 only) |
| V3 or V52 | ECC88 | Cascode R.F. Amplifier |
| V4 or V53 | 6CG8 | Mixer |

SU-213 TUNER

| | | |
|---|---|---|
| V1 | 6GK5 | R.F. Amplifier |
| V2 | 6CG8 | Mixer |

DIMENSIONS: Mounts in standard 19" rack, 7" high, 12-3/4" deep.

FINISH: Deep umber gray, baked enamel.

SHIPPING WEIGHT: 35 lbs.

## UNPACKING AND INSTALLING

Carefully remove all packing material from the equipment received and inspect it for possible damage incurred during shipment. Report to the carrier any shortage or damage.

### ANTENNA INPUT

The receiver is normally furnished for 75 ohm antenna input and equipped with an SO239 (#83-1R) connector. The unit may be provided for 300 ohm balanced input and equipped with screw terminals at the factory if so specified. If it is necessary to change a receiver from 75 ohm input to 300 ohm input in the field, the necessary parts and instructions will be furnished from the factory at no charge.

### RECEIVER INSTALLATION

When installing the receiver in a rack, better results will be obtained if care is taken to select a location where the temperature is relatively constant and not excessively hot.

## PRELIMINARY ADJUSTMENTS

The receiver should be allowed to warm up completely before tuning. On units employing an SU-213 tuner, the fine tuning would normally be adjusted while observing a picture monitor. It is also practical to use a waveform monitoring oscilloscope, and adjust the fine tuning control to reproduce a null in the 4.5 mc "fuzz" on the scope trace.

### AGC CONTROL SETTING

For normal operation, the BIAS SELECTOR control should be placed in the "AGC" position. This switch provides for manual gain control operation, if desired, in either the "D" (delayed) or "N" position.

### LOCAL OSCILLATOR ADJUSTMENT - SU-213 TUNER

If the fine tuning control knob does not turn far enough to properly bring in a particular station, set the fine tuning control at the middle of its range. Remove the fine tuning and station selector knobs. The local oscillator adjustment screw can be adjusted through the hole located 1/2" to the left and 3/4" above the station selector shaft. As the station selector is turned to a different station, a new screw will appear in the hole. Use a non-metallic screwdriver. Turn the oscillator adjustment screw clockwise until the picture has sound interference in it; turn the screw counterclockwise until the interference just disappears. A fraction of a turn will be sufficient.

AGC DELAY CONTROL

Insert a 15 db pad into the R.F. input (antenna) circuit. The AGC DELAY control on the front panel should be turned clockwise as far as it will go, and then counterclockwise to a point where the snow in the picture has just reached its minimum. Remove the 15 db pad.

AGC BIAS ADJUSTMENT (DETECTOR LEVEL CONTROL)

The video level at the detector is controlled by the setting of the DETector LEVEL adjustment control on the rear apron. It should be set so that with the VIDEO LEVEL control at its maximum setting the voltage level in the video output line is perhaps 20% above the desired output level, normally 1.4 volts peak-to-peak. The broadcast sync pulse is a reasonably reliable indication of level. If the sync pulse amplitude (distance from black level to peak sync) is set to approximately 1/2 volt peak-to-peak, the output of the unit will be approximately 20% above its normal 1.4 volts. The video level may then be reduced to 1.4 volts with the VIDEO LEVEL control on the front panel. Negative feedback and high AGC loop gain effectively stabilize the output of the AV12E. Setting the available output at a level higher than necessary compromises the receiver AGC with no corresponding benefit.

## CIRCUIT DESCRIPTION

STATION SELECTOR - SU-213

The SU-213 plug-in unit employs a 12-position neutrode turret tuner, Standard Coil Type GK. The standard input impedance is 75 ohms, with an SO239 (#83-1R) connector. If specified, the unit can be supplied for 300 ohm balanced input, using a 300 to 72 ohm balun and a conventional 2-terminal antenna input board. Spurious oscillator radiation falls well below FCC limits.

CU PLUG-IN UNIT

The CU unit employs an ECC88 tube as a cascode R.F. amplifier, a 6CG8 as a pentode mixer, and a 6CG8 as a crystal oscillator and frequency multiplier stage. CU units for channels 7 - 13 employ a 6BN4 as an additional frequency multiplier. CU units use fifth-overtone crystals, Type CR23/U.

I.F. AMPLIFIER

The converter to first I.F. grid coupling network consists of a "staggered couple" with a bifilar-T trap. The mixer plate circuit ("primary") is tuned to approximately 42 mc and loosely coupled to a bifilar-T circuit, T201, which is tuned to approximately 45 mc. The associated trap, L201, is set to reject 41.25 mc.

The next three interstage networks comprise a "flat staggered tuned triple" with adjacent channel traps. The first network is a shunt fed bifilar-T circuit. It, T202, is broadly tuned near 43 mc and the trap, L203, is set to produce about 30 db of attenuation at 47.25 mc.

The second I.F. coupling network, T203, is a standard bifilar-wound coil tuned to approximately 42 mc. A coupled trap tuned to 39.75 mc rejects upper adjacent channel picture information. T204 is quite similar to T203 and is tuned to approximately 45 mc with a coupled trap tuned to 47.25 mc for rejection of lower channel sound interference.

The coupling network between the fourth I.F. amplifier, V204/6CB6, and the video detector provides over 30 db of attenuation for the 41.25 mc accompanying sound component and has an essentially flat response from 41.75 mc to 45 mc. The input section of the filter is tuned to 45 mc and the output section is tuned near 42 mc. The sections are coupled by a bridged "T" network which rejects 41.25 mc. A crystal detector is used rather than a thermionic diode to provide optimum linearity and reduce capacitive loading.

The four-stage I.F. amplifier has a converter grid sensitivity of 75 db. The response curve is shown in Fig. 16.

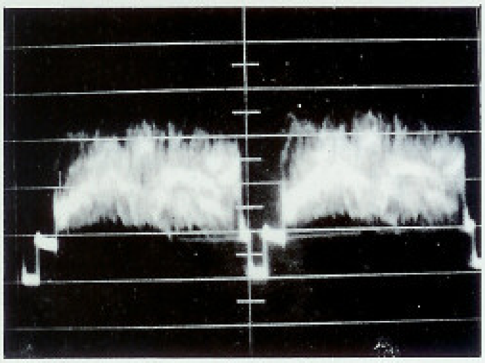
VIDEO AMPLIFIER

A series connected trap located in the video detector output circuit is tuned to 4.5 mc to reject any spurious beats between sound and picture carriers.

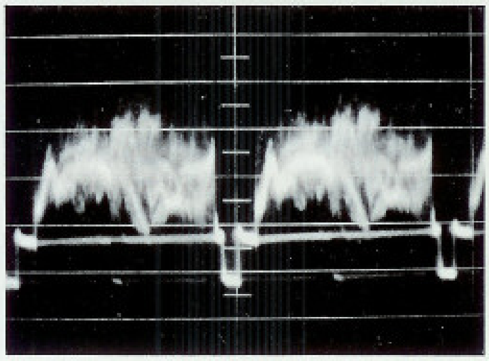
The first video amplifier, V205/6AQ5, is connected as a cathode follower to drive the VIDEO LEVEL control and also as a conventional video amplifier to drive the keyed AGC system.

The second video amplifier, V207/6DJ8, is connected as a "feedback pair." This amplifier has a maximum gain of about four times, and is flat to approximately 10 mc. The output stage employs a 5687 tube in a circuit which combines the advantages of a cathode follower with a plate-loaded amplifier to minimize differential gain and phase distortion. Typical waveforms are shown below.

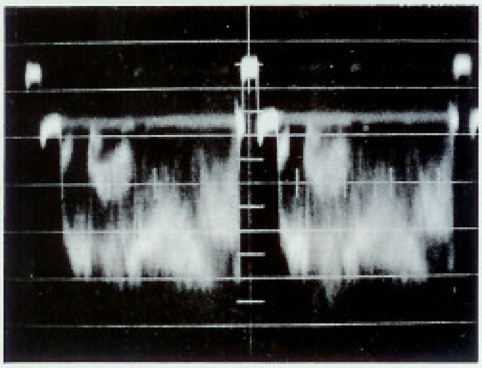
Conditions: Normal picture;
Detector set for 1.4 volts at output;
Both output jacks terminated.



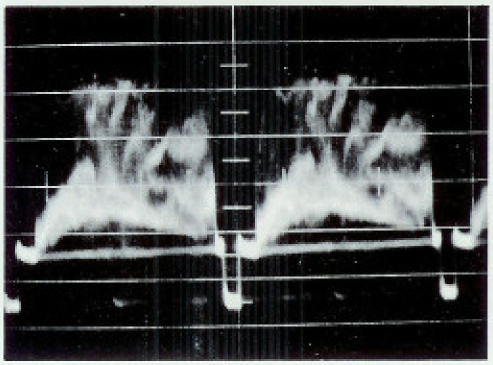
Grid (Pin 1) of V205/6AQ5
.3 Volt /Division
FIG. 1



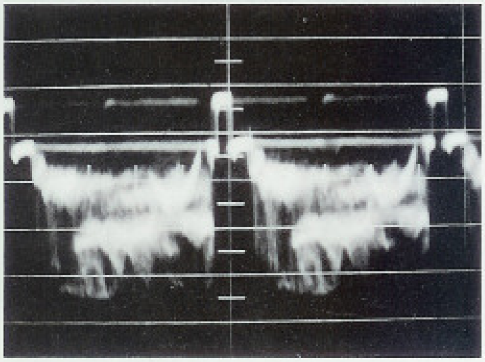
Grid (Pin 7) of V207A/6DJ8
.1 Volt/Division
FIG. 2



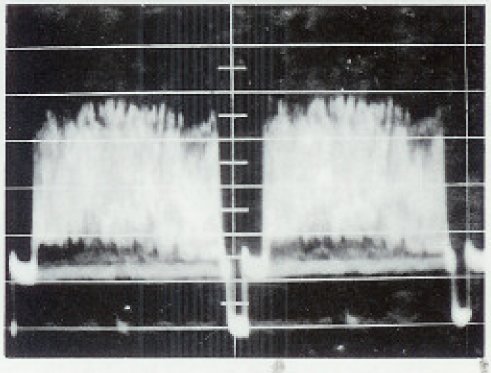
Grid (Pin 2) of V207B/6DJ8
.03 Volt/Division
FIG. 3



Grid (Pin 2) of V208A/5687
.5 Volt/Division
FIG. 4



Grid (Pin 7) of V208A/5687
1 Volt/Division
FIG. 5



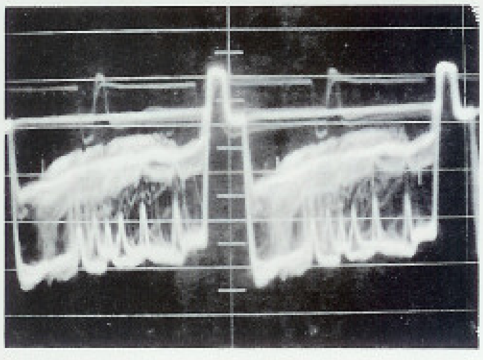
Video Output of Receiver
.3 Volt/Division
FIG. 6

KEYED AGC SYSTEM

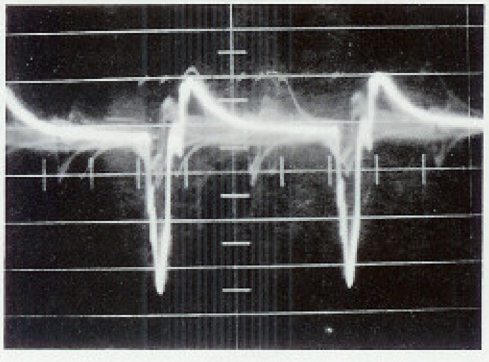
Video information from the plate of the first video amplifier stage, V205/6AQ5, is fed to a sync stripper, V211/6BY6. Stripped sync is amplified in V210/6AQ5 and fed through a pulse transformer, T206, to the AGC keyer tube, V209/6AU6. Waveforms are shown below.

Video level information from the plate of V205 is supplied to the control grid of the AGC keyer tube, V209. A negative voltage which is proportional to the peak carrier level is developed in the plate of V209. An adjustable fraction of this voltage is supplied to the grid return of the first three I.F. amplifiers. A portion is also supplied to the first R.F. amplifier grid through a suitable delay and clamping network. The AGC voltage will maintain the peak video voltage at the detector at a constant level over an extremely wide range of input signal strengths. Typical waveforms are shown below.

KEYED AGC SYSTEM



Grid (Pin 7) of V211/6BY6
1 Volt/Division
FIG. 7



Grid (Pin 1) of V210/6AQ5
3 Volts/Division
FIG. 8

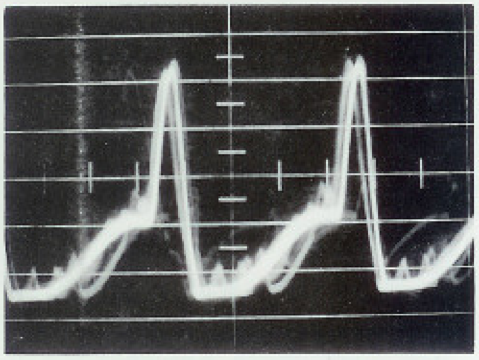


Plate (Pin 5) of V210/6AQ5
200 Volts/Division
FIG. 9

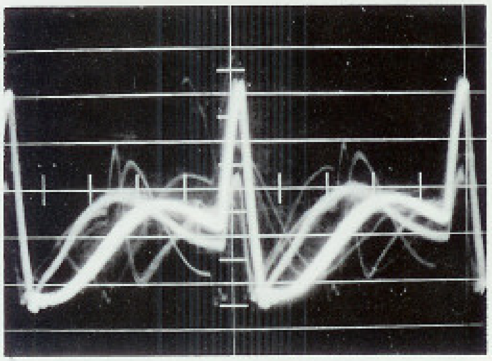


Plate (Pin 5) of V209/6AU6
300 Volts/Division
FIG. 10

AUDIO CIRCUIT

Sound information is removed at the plate of the last video I.F. amplifier, V204/6CB6. At this point, the level of the sound carrier component is about 26 db below the picture component of the signal, which is the optimum ratio for intercarrier sound detection. The sound signal is converted to 4.5 mc with a diode, V101A/6AN8, and fed through a two-stage 4.5 mc amplifier to a ratio detector. The second stage of the 4.5 mc amplifier functions as a limiter, which in conjunction with the ratio detector, gives excellent rejection of amplitude modulation.

A cathode coupled push-pull audio output stage is used to drive a high quality output transformer.

The audio output transformer is normally connected to feed a 600 ohm balanced audio line. It may be reconnected to provide various output impedances, as shown by the table below:

| IMPEDANCE | OUTPUT TERMINALS | STRAP |
|---|---|---|
| 500/600 | 7-12 | 9-10 |
| 333/400 | 8-12 | 9-10 |
| 250/300 | 7-12 | 9-11 |
| 200/240 | 8-11 | 9-10 |
| 125/150 | 7-9 | 7-10 & 9-12 |
| 50/60 | 8-11 | 8-10 & 9-11 |

MAINTENANCE

It must be emphasized that alignment of tuned circuits should not be attempted unless proper equipment is available. If proper equipment is not available, or if the receiver does not respond to the procedure as outlined below, it is recommended that the unit be returned to the factory for realignment. If the unit cannot be spared from service, contact the factory regarding a "loaner" or substitute unit.

EQUIPMENT REQUIRED

Sweep generator covering television channels and I.F. band.

Marker generator covering 39 mc - 48 mc and television carrier frequencies (crystal controlled or equivalent).

Oscilloscope with 75 ohm input termination.

## GENERAL DISCUSSION

Measurement and adjustment of high frequency receivers require good equipment and careful work. UNLESS PROPER PRECAUTIONS ARE TAKEN, COMPLETELY ERRONEOUS RESULTS WILL BE OBTAINED.

## ELIMINATION OF STRAY FEEDBACK

When signal generators, scopes, meters, etc., are connected to the receiver under test, these instruments and their lead cables may act as antennas, or couple to each other through the power line, thus providing stray feedback paths. Such feedback paths must be eliminated before correct results can be obtained.

The following techniques are suggested:

a. Lay a sheet of copper or aluminum on the test bench and set the receiver under test and all equipment connected to it on the metal sheet. Ground all instruments to this common ground plane.

b. Locate signal generators connected to the input circuits on one side of the receiver, and scopes and meters connected to the output circuit on the other side of the receiver.

c. If open wire leads are used to connect an oscilloscope or voltmeter to the receiver, insert a 45 mc R.F. choke between the end of the test lead and the point of connection to the receiver. A 10,000 or 20,000 ohm resistor is a satisfactory substitute for the R.F. choke. If a coaxial cable is used to connect a laboratory grade scope, such as Tektronix, this precuation is not necessary.

d. Keep exposed ends of signal generator leads as short as practical. This is especially important when high gain amplifiers are involved, such as in steps 1.6, 5.5 and 6.6. Long clip leads, such as are sometimes supplied with television repairmen's generators, are not suitable for accurate work.

e. Good quality signal generators are equipped with power-line filters. Some inexpensive television servicemen's equipment may require an external power-line filter to eliminate feedback.

## STANDING WAVES AND TERMINATIONS

The output end of the cable from a sweep generator must always be terminated with a resistor equal to the characteristic impedance of the cable. If the cable is not properly terminated, the sweep generator output will not be flat, and incorrect alignment of the receiver will result. When possible, a resistive matching pad having a loss of from 6 to 10 db should be inserted between the sweep generator and its load. This will reduce the effect of standing waves to negligible proportions. This applies particularly to feeding the antenna terminals of the receiver.

When it is necessary to feed a marker signal generator and a sweep generator into the same point, the marker signal must be coupled in a manner which will not disturb the sweep generator termination. Usually, this can be done by attaching a short piece of insulated wire to the marker generator output cable and holding it near or hooking it over the receiver input point. If sufficient signal cannot be obtained this way, the marker generator must be fed through a resistive mixer pad.

RESPONSE AT PICTURE CARRIER FREQUENCY

The response at the picture carrier frequency must be exactly 6 db below the flat top response (50% in amplitude). The curvature of the diode detector characteristic introduces a distortion which causes the picture carrier marker in a display, such as Fig. 19, to appear to be attenuated more than it actually is. This distortion is greater for weak signals at the detector than for strong signals. For this reason, care should be taken to set levels correctly, as described in the procedure.

The correct setting of the picture carrier point on the alignment response curve can be verified by observing a multiburst pattern or window signal from a television transmitter. If the response at the picture carrier frequency is too high, the low frequency burst will be of greater amplitude than the other bursts, and the window signal will exhibit a smear or rounding off of the corner of the transient. Television pictures will lack "snap" and sharpness, even though showing full test pattern wedge resolution.

Conversely, if the response at the picture carrier frequency has been set too low, the low frequency burst of a multiburst pattern will be smaller in amplitude than the other bursts, and a window signal will exhibit excessive overshoot. Sync pulses may exhibit a spike on their trailing edges.

Complete realignment of the receiver is rarely needed unless components have been replaced or adjustments disturbed. Tuned circuits will drift slightly due to tube and component aging, producing variations in amplitude response amounting to 1 or 2 db. A simple "touch-up" alignment, as described below, will usually achieve satisfactory performance.

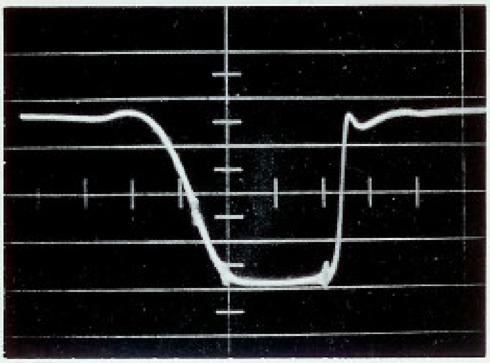
1. TOUCH-UP ALIGNMENT

1.1 Connect the output of the unit to an oscilloscope through a properly terminated cable. A .1 mfd capacitor may also be connected across the oscilloscope to "sharpen" the marks on the response curve.

1.2 Disconnect pin 1 of V201/6BZ6 from terminal "B" of T201.

1.3 Using a properly terminated cable, connect a sweep generator to pin 1 of V201 through a 470 mmfd (approximately) DC blocking capacitor. Set the AGC switch to MANUAL "N" position.

1.4 Adjust the R.F. GAIN control to provide a 1.5 volt bias to the I.F. amplifier tubes. Adjust the sweep generator output level to a point well below the overload point. The curve tends to "flatten out" when the overload condition is approached. The curve should be similar to that shown in Fig. 11. Marks are 45.75 mc, 45 mc and 42 mc.



Grid 1 of V201 to Output

FIG. 11

1.5 Loosely couple a 45.75 mc crystal controlled marker into the unit. Adjust T204 so that the 45.75 mc mark is at a point 50% down from the top of the curve.

1.6 If the curve is tilted, it may be corrected by "touching up" the bottom adjustment of T202.

1.7 Restore connection from pin 1 of V201 to terminal "B" at T201.

1.8 Over-all R.F. Response Check.

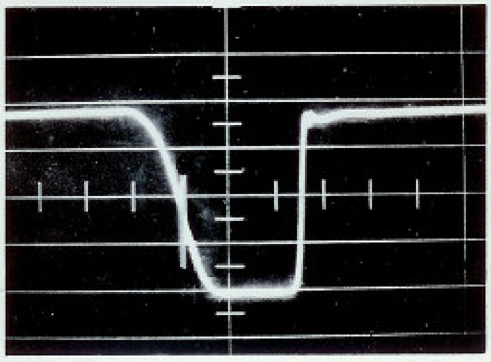
Connect the output of the receiver to a wideband oscilloscope through a properly terminated cable.

Remove the .1 mfd capacitor described in 1.1 above.

If the unit is equipped with an SU-213 tuner, the fine tuning must be set very accurately. One method by which this may be done is to feed the receiver with a signal generator tuned to the sound carrier frequency of the desired channel and modulated (approximately 30%) with an audio tone. Observe the output of the receiver on the oscilloscope. As the fine tuning is adjusted, a sharp null will be noted in the output level when this signal is in the bottom of the "sound notch" produced by the 41.25 mc traps. Set the fine tuning at this null point.

Reconnect the .1 mfd capacitor across the input to the scope. Connect an R.F. sweep generator to the antenna terminals. Set the R.F. GAIN control to minimum (full counterclockwise). Reduce the sweep generator output until the amplitude of the pattern on the scope is about 1 volt peak-to-peak. The response curve should be similar to that shown in Fig. 12. If the picture carrier is not at the correct 50% down point, it may be corrected by adjusting T204 bottom. If the pattern is tilted, it may be corrected by adjusting the bottom slug of T202. Check to see that the 47.25 mc trap, L203, is not seriously limiting the bandwidth. If the shape of the curve is not correct at the 42 mc edge, readjust T203 bottom.

If the correct pattern can be obtained with only minor touch-up adjustments, it can be assumed that the entire receiver is in satisfactory adjustment. If the correct pattern cannot easily be obtained with minor adjustments, a complete realignment of the receiver is required.



Over-All Sweep Response, Channel 10
1 Volt/Division
FIG. 12

COMPLETE REALIGNMENT PROCEDURE

## 2. ALIGNMENT OF DETECTOR FILTER

2.1 Connect the output of the unit to an oscilloscope through a properly terminated cable. A .1 mfd capacitor may also be connected across the oscilloscope to "sharpen" the marks on the response curve.

2.2 Unsolder the wire from pin 1 of V204/6CB6.

2.3 Connect the output leads of a 39 - 48 mc sweep generator to pin 1 of V204 and ground. Loosely couple the marker generator to the same point.

T205 bottom, L205 top, L205 bottom, L204 and C217 should be tuned to produce a response curve, as shown in Fig. 13. The following discussion will assist in achieving this result.

The "primary" circuit, T205 bottom, is always tuned near 45 mc.

The trap, L204, is always tuned to produce a null at 41.25 mc.

The "secondary" circuit controlled by L205 top, L205 bottom and C217 is always tuned near 42 mc. Since there are three adjustments, an infinite number of combinations exist which will tune to the correct frequency. The problem is to find by successive approximation the combination which matches the filter to its load and thus produces the correct response curve.

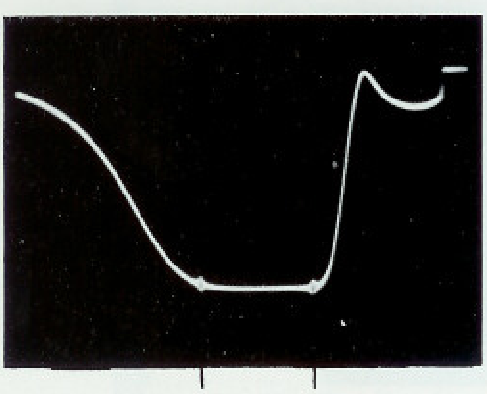
2.4 Turn C217 counterclockwise to the end of its travel; then three turns clockwise.

2.5 Adjust T205 bottom to produce maximum response at 45 mc.

2.6 Adjust bottom slug of L205 to produce maximum response near 42 mc.

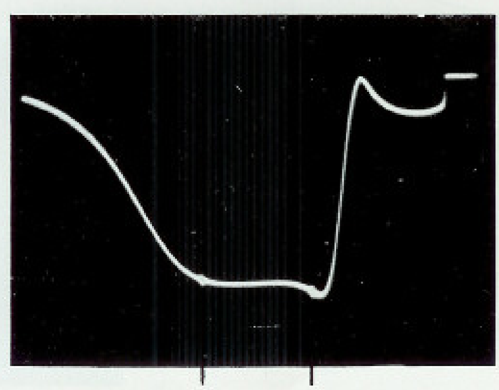
2.7 Adjust L204 to produce minimum response at 41.25 mc.

2.8A Observe the response curve and compare with Figures 13, 14 and 15. If there is a sharp tip at the 42 mc end of the curve, such as is shown in Fig. 14, increase the inductance of the coupling coil (by turning adjustment L205 top clockwise) and retune L205 bottom, as in step 2.6. Repeat steps 2.6 and 2.7 until correct response, Fig. 13, is achieved.



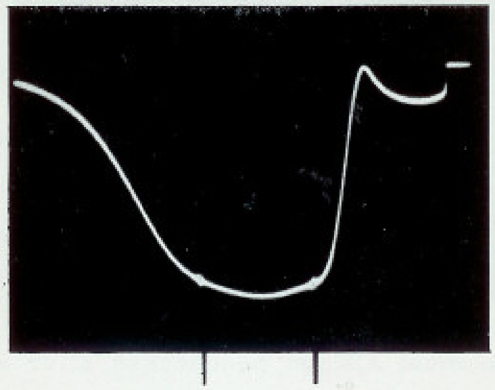
45 mc 42 mc
V204 Grid to Output
Correct Alignment

FIG. 13



45 mc 42 mc
V204 Grid to Output
Incorrect Alignment, Sharp Tip at 42 mc

FIG. 14



45 mc 42 mc
Incorrect Alignment, "Domed" Center

FIG. 15

If maximum inductance of L205 top is reached and the sharp tip still remains, it indicates the capacitance of C217 was set too low in step 2.4. To correct this, increase the capacitance of C217 by turning the screw clockwise about two turns and repeat steps 2.4 through 2.8. Repeat this procedure until correct response is obtained.

If the response curve is satisfactory, except for a bulge or dome in the center, as in Fig. 15, reduce the capacitance of C217 slightly by turning counterclockwise approximately two turns and retune L205 bottom.

2.8B The converse relations are also true. If in step 2.8A an excessive roll-off near 41.75 mc is noted, instead of a sharp tipped rise, the inductance of L205 top should be decreased and L205 bottom returned. Also, if the response curve has a dip in response near its center frequency, the capacity of C217 should be increased (turn adjustment clockwise) and steps 2.4 to 2.8 repeated.

This process can be speeded up considerably by using two adjustment wrenches and simultaneously turning the top and bottom slugs of L205. With proper alignment, the 45 mc response and the 41.75 mc response should be more than 1 db below the flat top response level.

2.9 Restore the connection between the grid, pin 1, of V204/6CB6 and T204.

3. ALIGNMENT OF STAGGER TUNED TRIPLE, T202, T203 AND T204

Set AGC switch to MANUAL position. Set R.F. GAIN control to position at which the bias on the I.F. stage is -1.5 volts.

3.1 Temporarily unsolder the connection between the grid, pin 1, of V201/6BZ6 and T201.

3.2 Connect the sweep generator to pin 1 of V201 through a 470 mmf capacitor.

3.3 Loosely couple the marker generator to pin 1 of V201.

3.4 Adjust the sweep generator output level to produce a 1 volt peak-to-peak signal at the input to the oscilloscope.

3.5 Adjust the bottom slug of T202 to produce maximum response at 43 mc.

3.6 Adjust T203 bottom to produce maximum response at 42 mc.

3.7 Adjust T204 bottom to produce maximum response at 45 mc.

3.8 Adjust L203 and T204 top for minimum response at 47.25 mc.

3.9 Adjust T203 top for minimum response at 39.75 mc.

3.10 Touch up the bottom slugs on T202, T203 and T204 to produce a response curve, as shown in Fig. 11.

The trap adjustments must always be checked after associated coils have been readjusted.

3.11 Restore the connection between pin 1 of V201/6BZ6 and T201.

4. ALIGNMENT OF CONVERTER TO I.F. COUPLING NETWORK

4.1A On units equipped with an SU-213 tuner, connect the "hot" lead of the terminated sweep generator cable to the test point on top of the station selector. Set the station selector between channels.

4.1B On units equipped with a type CU plug-in unit for channels 2 through 6, disconnect C77 and C59 from pin 9 of V53/6CG8. Connect the "hot" lead of the terminated sweep generator cable to pin 9 of V53 through a 100 mmf (approximately) DC blocking capacitor. Ground the shield of the cable to pin 8 of V53.

4.1C On units equipped with a type CU plug-in unit for channels 7 through 13, disconnect C31 and C13 from pin 9 of V4/6CG8. Connect the "hot" lead of the terminated sweep generator cable to pin 9 of V4 through a 100 mmf (approximately) DC blocking capacitor. Ground the shield of the cable to pin 8 of V4.

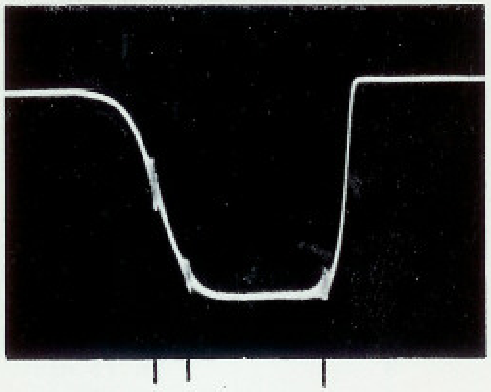
4.2 Readjust R.F. GAIN to a point well below the overload point.

4.3 Adjust T201 for maximum response at 45 mc.

4.4 Adjust L8 on SU-213, L61 on CU units for channels 2 through 6, or L14 on CU units for channels 7 through 13 for maximum output at 42 mc.

4.5 Loosely couple a 41.25 mc crystal controlled marker generator to pin 9 of V2. Adjust L202 for minimum response at 41.25 mc.

4.6 Repeat steps 4.3, 4.4 and 4.5 until the response is similar to that shown in Fig. 16.



Converter Grid to Output

FIG. 16

4.7 Restore the plug-in unit to normal and feed the sweep generator, with sound and picture carrier markers, into the antenna input connector. Set the sweeper and the receiver to the channel on which the unit is to be used. Readjust the R.F. GAIN to a level below the overload point, and check that the pattern on the scope is similar to that shown in Fig. 12. If it is not similar, see TUNER ALIGNMENT below.

5. SU-213 TUNER ALIGNMENT

5.1 Set VIDEO LEVEL control, R.F. GAIN control, and "AGC" adjustment potentiometer at their maximum clockwise positions.

5.2 Set the tuner on the channel which is to be used and adjust the fine tuning to its normal position. If the receiver is to be used on all channels, set the tuner to channel 10.

5.3 Connect the sweep generator to the receiver antenna terminals, and set to the desired channel. Ascertain that the sweep generator cable is properly terminated. It will probably be necessary to operate the sweep generator near its maximum output.

5.4 A marker frequency generator, capable of producing CW signals at the required sound and picture carrier frequencies, should be loosely coupled to the antenna terminals. If there is a local television transmitter on the desired channel, it is usually possible to obtain frequency markers by holding the antenna lead-in wire near the antenna terminals.

5.5 Connect the vertical input of a high gain oscilloscope to the test point "TP" on top of the Standard Coil tuner chassis. Remove termination resistor and capacitor from the scope input.

5.6 Adjust C12, C13 and C16 to produce maximum amplitude of the pattern on the scope and the flattest possible response (most nearly constant amplitude) between the sound and picture carrier frequencies of the channel under test.

6. CU UNIT ALIGNMENT

6.1 Connect a vacuum tube voltmeter lead to TP 1. Adjust L1 (L51 on CU 7 through 13) for maximum reading on the VTVM and verify that the crystal, CR1 or CR51, is operating at the proper frequency, as listed below:

| Channel | L51 and L52 |
|---|---|
| 2 | 50.5 mc |
| 3 | 53.5 mc |
| 4 | 56.5 mc |
| 5 | 61.5 mc |
| 6 | 64.5 mc |

| Channel | L1 and L2 |
|---|---|
| 7 | 55.25 mc |
| 8 | 56.75 mc |
| 9 | 58.25 mc |
| 10 | 59.75 mc |
| 11 | 61.25 mc |
| 12 | 62.75 mc |
| 13 | 64.25 mc |

6.2 Move the VTVM lead to TP 2 and adjust L2 or L52 for maximum reading. Check that L2 or L52 is operating at the frequency listed above.

6.3 Channels 7 through 13 Only.

Move the VTVM lead to TP 3 and adjust L3 for maximum. Verify that it is operating at the proper frequency, as listed below:

| Channel | L3 |
|---|---|
| 7 | 110.5 |
| 8 | 113.5 |
| 9 | 116.5 |
| 10 | 119.5 |
| 11 | 122.5 |
| 12 | 125.5 |
| 13 | 128.5 |

6.4 Move the VTVM lead to TP 4 and adjust L4 or L54 for maximum reading. Verify that L4 or L54 is operating at the frequency indicated below:

| Channel | L4 or L54 |
|---|---|
| 2 | 101 |
| 3 | 107 |
| 4 | 113 |
| 5 | 123 |
| 6 | 129 |
| 7 | 221 |
| 8 | 227 |
| 9 | 233 |
| 10 | 239 |
| 11 | 245 |
| 12 | 251 |
| 13 | 257 |

6.5 Move the VTVM lead to TP 5 and adjust L5 or L60 for maximum reading.

6.6 Remove the VTVM lead and connect a high gain oscilloscope to TP 5. Connect an R.F. sweep generator, with sound and picture carrier markers, to the grid (pin 2) of the R.F. amplifier, V3 or V52/ECC88. Turn R.F. GAIN to provide -2.5 to -3 volts bias to the tuner.

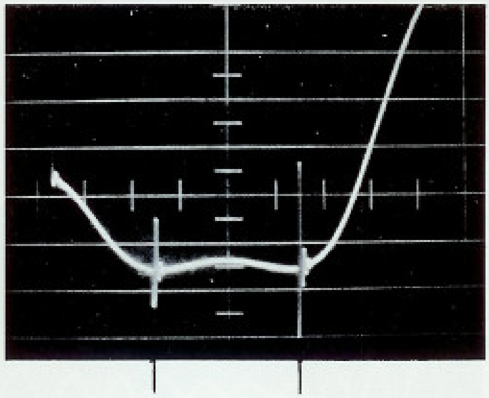
6.7 Adjust the following for maximum areas under the curve between sound and picture carrier markers.

| Channels 2 - 6 Units | Channels 7 - 13 Units |
|---|---|
| L59 | L11 |
| C76 | C29 |
| L60 | L12 |

6.8 Move the R.F. sweep and marker generator lead to the antenna terminals and adjust the following for maximum area under the curve between sound and picture carrier markers:

| Channels 2 - 6 Units | Channels 7 - 13 Units |
|---|---|
| L57 & C65 | L8 & C19 |
| L58 & C68 | L9 & C22 |

The curve should resemble that shown in Fig. 17:



193.25 197.75
Antenna to Test Point - Channel 10
1 Volt/Division
FIG. 17

## 7. STANDING WAVE VOLTAGE RATIO CHECK

7.1 Connect the R.F. sweep and marker generator to an R.F. detector and also to a panoramic line consisting of 100 to 200 feet of 75 ohm sweep tested R.F. cable. Connect the opposite end of the cable to the 75 ohm antenna terminal of the receiver, as shown in Fig. 18 below.

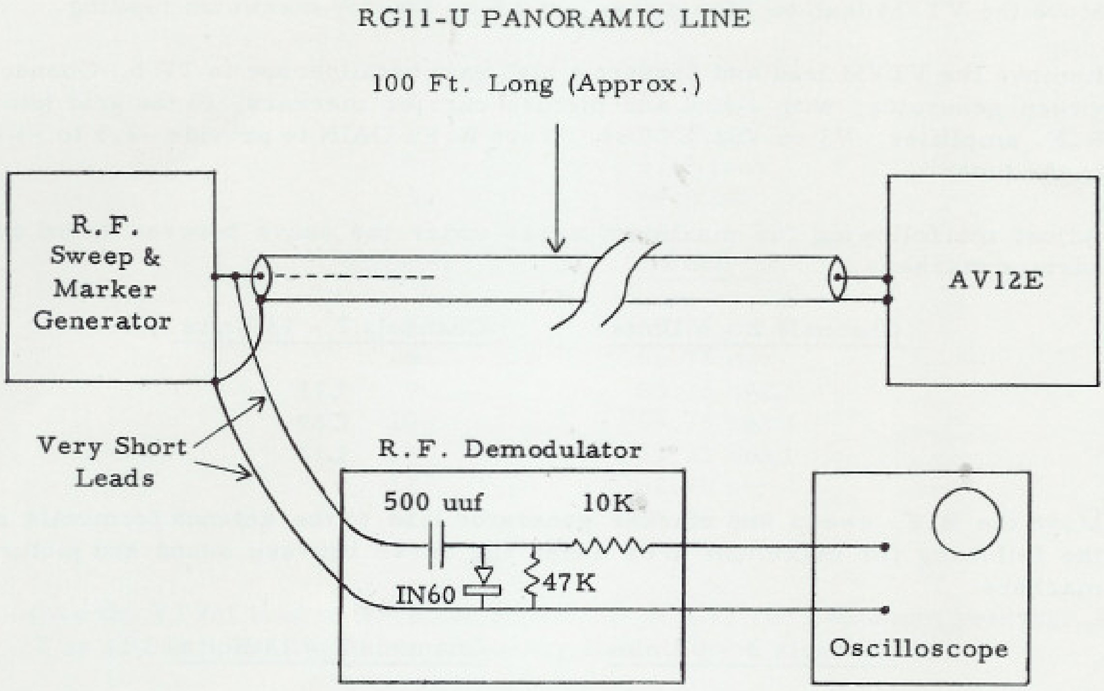
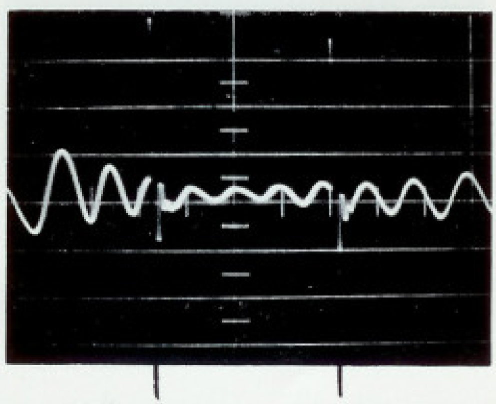


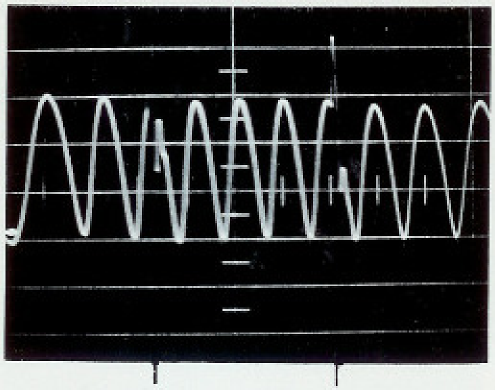

FIG. 18

7.2 Set the sweeper and marker generator to the channel to be tested. With the AGC switch in MANUAL position, set R.F. GAIN so that the bias on the tuner is -2.5 volts. Examine the scope pattern between the sound and picture carrier markers. A typical pattern is shown in Fig. 19 below.



193.25 mc 197.75 mc
Standing Wave Pattern - Channel 10
100 Ft. Cable Feeding SU-213 Unit
FIG. 19

Disconnecting the R.F. cable from the CU unit should produce a pattern similar to that shown in Fig. 20.



193.25 mc 197.75 mc
Standing Wave Pattern
Channel 10, 100 Ft. Cable, Unterminated

FIG. 20

From these two waveforms, the standing wave voltage ratio can be computed as follows:

$$VSWR = \frac{X + Y}{X - Y}$$

where X equals peak-to-peak amplitude of the pattern with the cable unterminated and Y equals peak-to-peak amplitude of the pattern with the cable terminated by the receiver. Both patterns are measured within the passband of the unit being tested.

7.3 If the VSWR is excessive, reduce the amplitude of the pattern within the passband of the channel by slight readjustment of the following:

| CU 2 - 6 | CU 7 - 13 |
|---|---|
| L57 & C65 | L8 & C19 |
| L58 & C68 | L9 & C22 |

Connect the scope to TP 5 and the sweep and marker generator to the antenna terminals. If the curve differs from that shown in Fig. 17, touch up the following adjustments:

| CU 2 - 6 | CU 7 - 13 |
|---|---|
| L59 | L11 |
| C76 | C29 |
| L60 | L12 |

Recheck the VSWR, as outlined in section 7.1.

Recheck the response of the entire receiver, as outlined in section 1.

## 8. VIDEO AMPLIFIER ADJUSTMENT

8.1 Unsolder one end of the crystal diode, D201. CAUTION: Grasp the crystal lead wire between the crystal and the joint to be unsoldered, with a pair of long pliers. Unsolder the connection; wait a few seconds before releasing the pliers. This procedure prevents heat from the soldering iron from damaging the crystal junction.

8.2 Connect a crystal controlled 4.5 mc generator through a 3900 ohm composition resistor to the junction of C218 and L206.

8.3 Adjust L207 to produce minimum output at the video output jacks.

8.4 Disconnect the 4.5 mc generator and connect the video sweep generator through a 3900 ohm composition resistor to the junction of C218 and L206.

8.5 Adjust L208 and C226 to produce a video response curve which is flat from zero to beyond 4.1 mc.

ALTERNATE METHOD OF SETTING L207 (4.5 mc Trap)

Set up the receiver for normal reception and tune in a television station. Connect an oscilloscope to the output jack, J201 or J202, and adjust sweep to view a horizontal sync pulse. Detune the fine tuning adjustment of the receiver in the direction to produce sound carrier interference in the picture. This is visible as a "fuzz" (4.5 mc beat) on the sync pulse display on the scope.

Adjust L207 to produce minimum "fuzz" on the scope display.

9. OVER-ALL PERFORMANCE CHECK

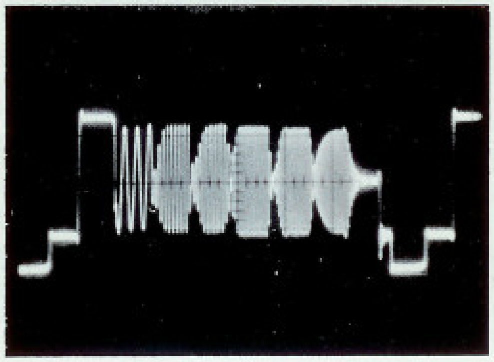
Connect the output of the receiver to a wideband oscilloscope through a properly terminated cable. Remove the capacitor described in section 1 from the input terminals.

If the unit is equipped with an SU-213 tuner, set the fine tuning as outlined in 1.8.

9.1 Video Transmitter Method

If "air time" on the transmitter to be received is not available, a test unit, such as the Kay "Megapix", should be used.

The video transmitter should be modulated by a "multiburst" generator, which has been carefully adjusted so that the bursts are all equal in amplitude. The pattern on the scope should be similar to the pattern from the "multiburst" generator, with all the bursts equal in peak-to-peak amplitude within 1 db. It will be noted that the "leading edge" of the 4.1 mc burst will be rounded off, as shown in Fig. 21.

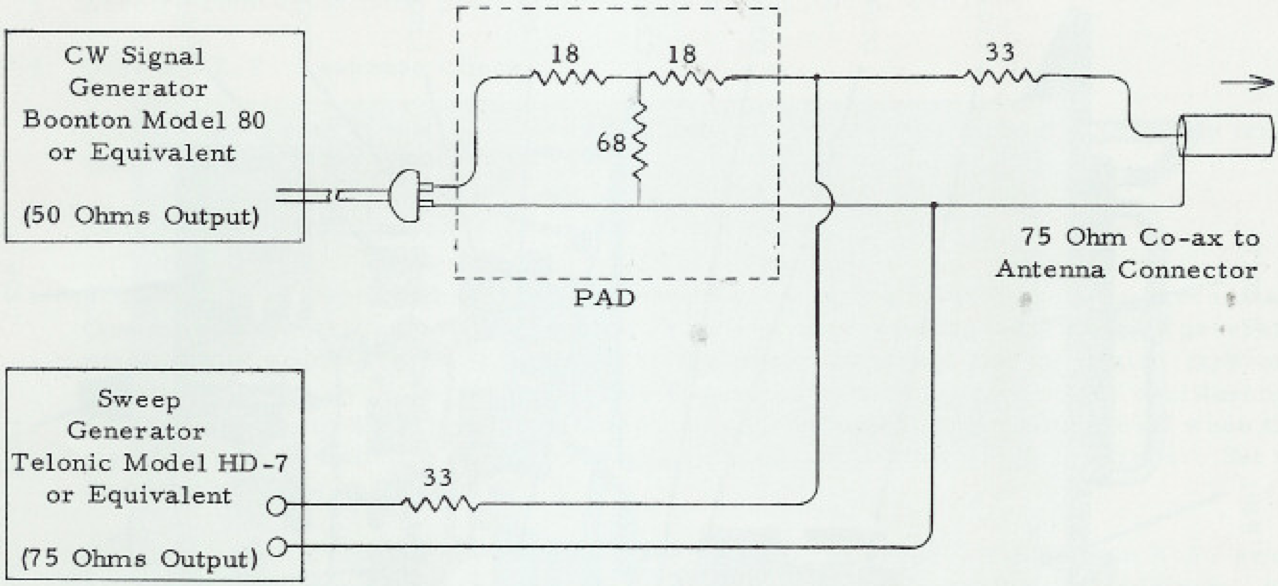


Multiburst Pattern

FIG. 21

9.2 Single Sideband Sweep Method

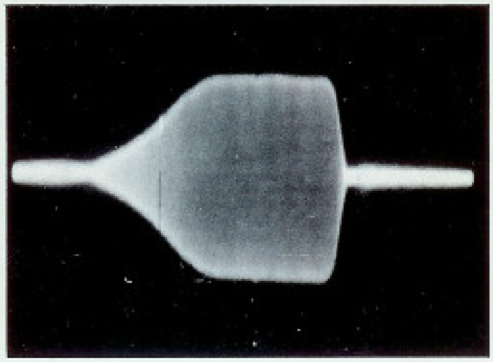
Connect the sweep generator and a CW signal generator, accurately tuned to the picture carrier frequency, to the receiver antenna terminals through a resistive matching pad, as sketched below.




Typical Test Set-Up
For Single Sideband Sweep Test of Receiver

FIG. 22

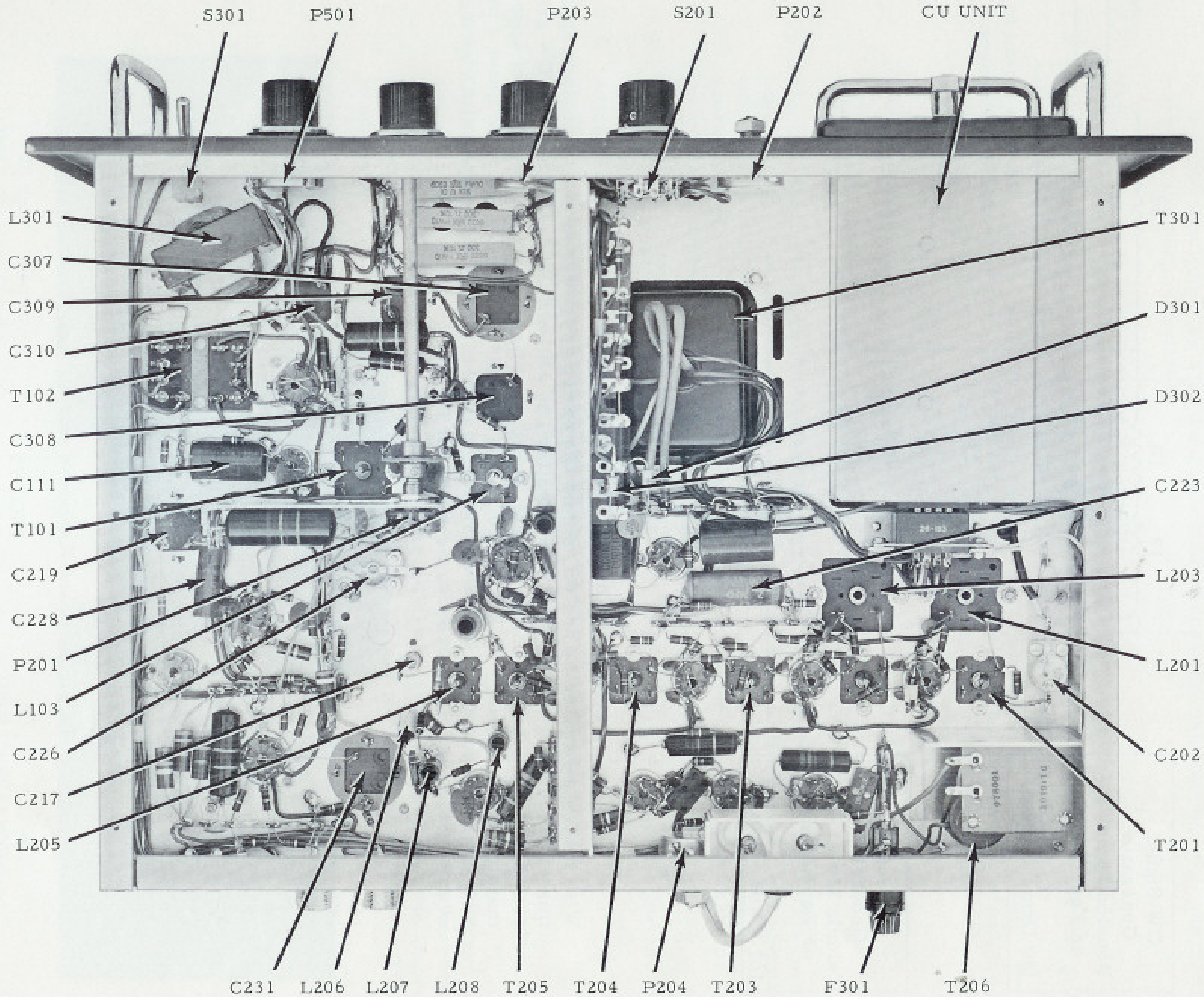
With the CW generator turned off, adjust the sweep generator output to produce approximately 2/10 volt peak-to-peak sweep pattern at J201 and J202. Turn on the CW generator and adjust its level until a sweep envelope pattern, with an amplitude of approximately 1 volt, appears on the scope. The response should be flat from about 1 mc to over 4 mc, as shown in Fig. 23. Switching off the CW generator permits viewing the over-all R.F. - I.F. response, as shown in Fig. 12.



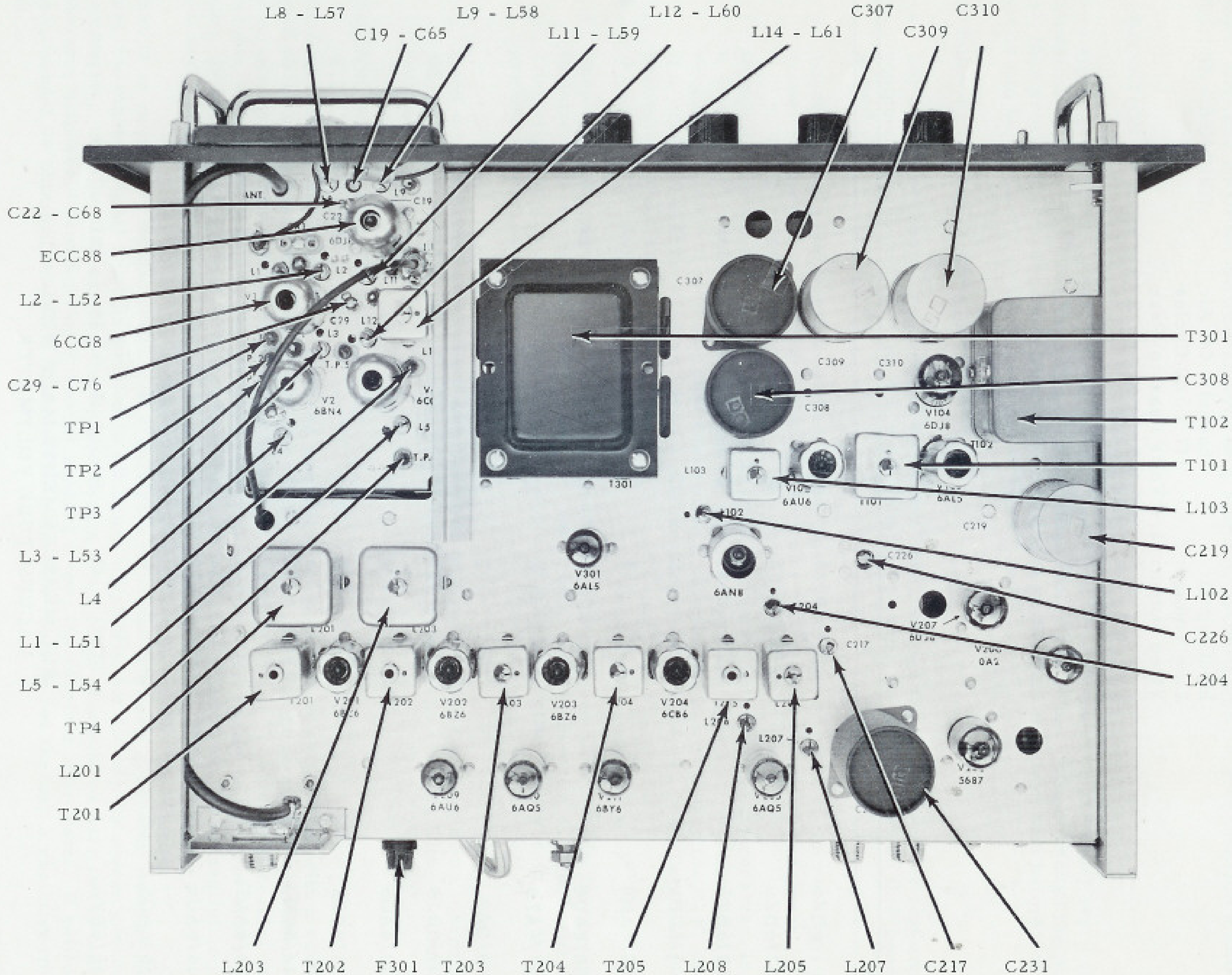
Single Sideband Response of Entire System

FIG. 23

If either the bottom or top half of the sweep envelope does not resemble the over-all R.F. - I.F. response, readjust L208 and C226.




MODEL AV12E, BOTTOM VIEW




MODEL AV12E, TOP VIEW

## VOLTAGE TABLE

AGC Switch in "Normal" AGC Position

| | |
|---|---|
| Input Signal: | Channel 4 Off Air |
| Line Voltage: | 117 V, 60 Cycles |
| Video Output: | 1.4 Volts Peak-to-Peak |

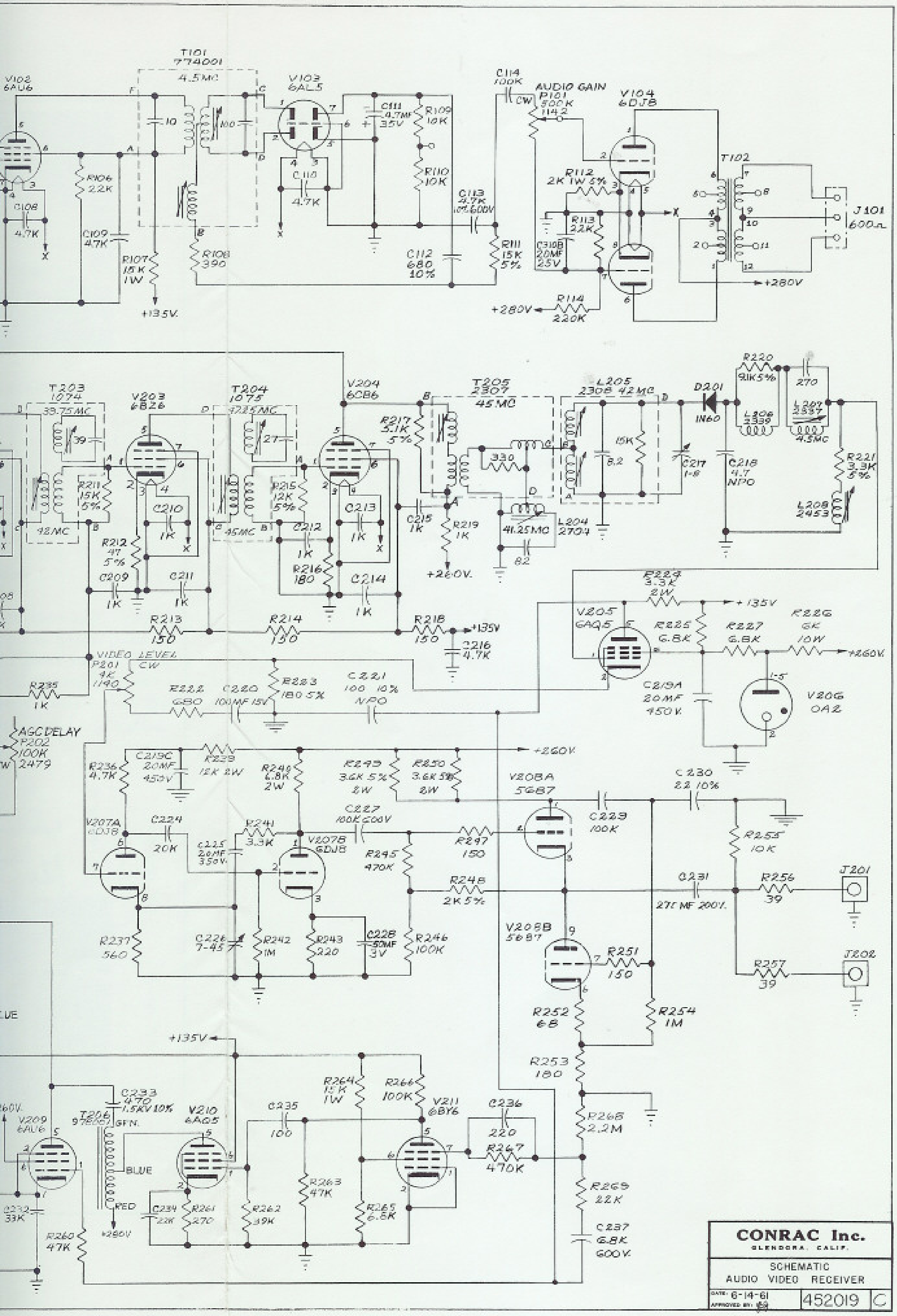
B+ Voltages:

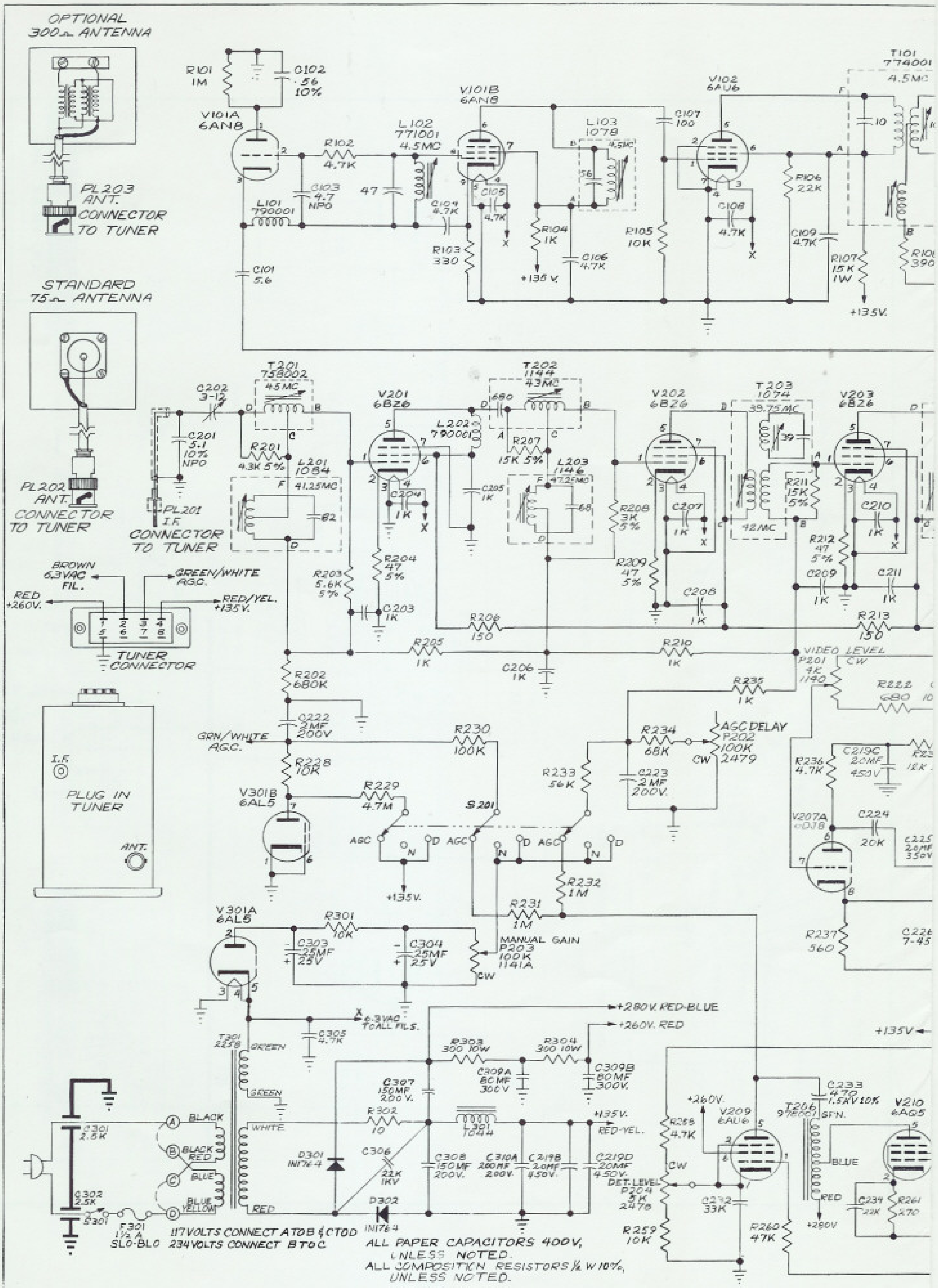
| | |
|---|---|
| Red-Blue Wires | 260 Volts |
| Red Wire | 230 Volts |
| Red-Yellow Wires | 135 Volts |

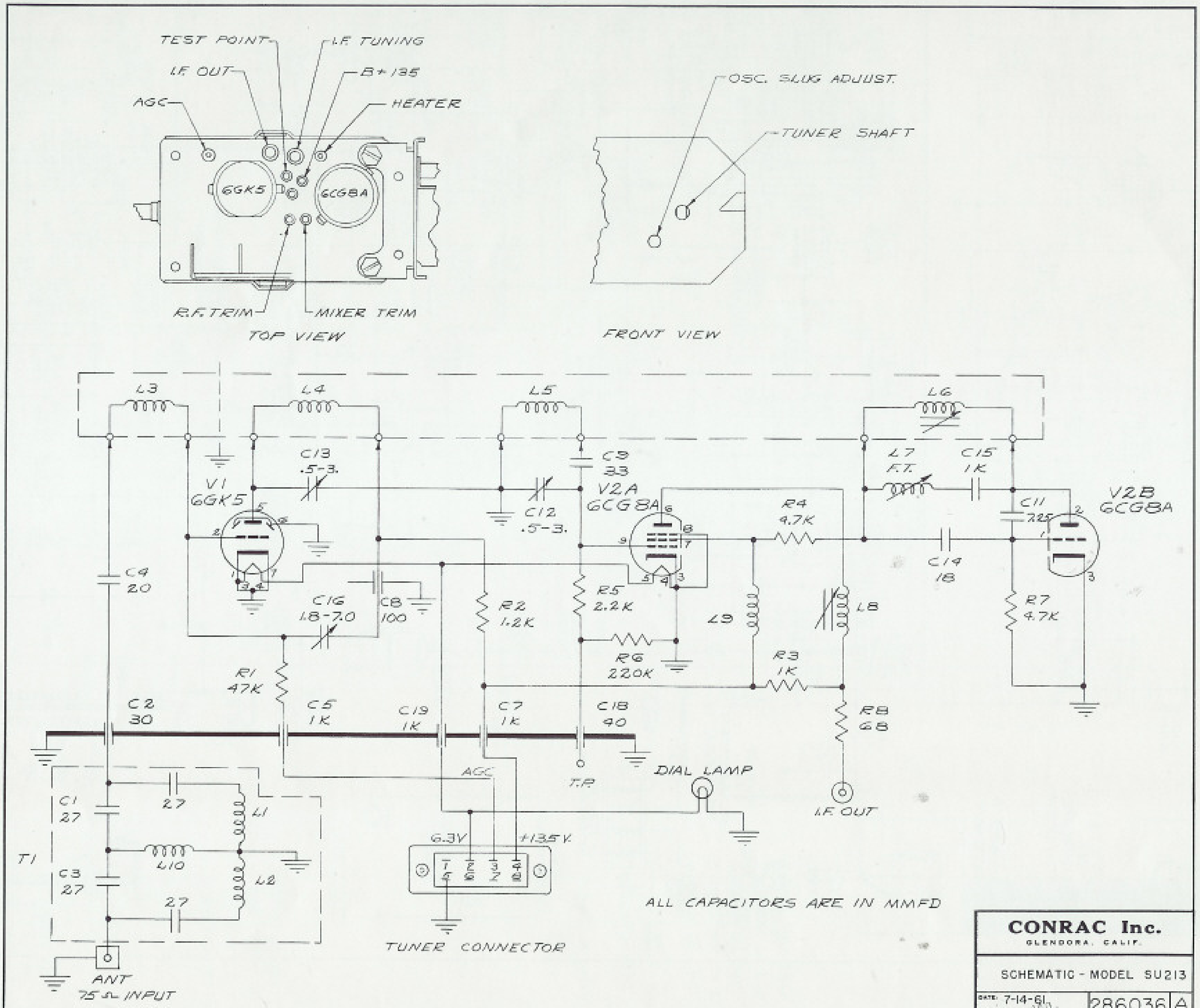
| PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| V101/6BZ6 | -2.9 | 0.25 | G | H | 128 | 128 | G | | |
| V102/6BZ6 | -2.9 | 0.26 | G | H | 128 | 128 | G | | |
| V103/6BZ6 | -2.9 | 0.34 | G | H | 129 | 130 | G | | |
| V104/6CB6 | 0 | 1.8 | G | H | 221 | 133 | G | | |
| V105/6AN8 | -4.8 | -2 | 0 | H | G | 128 | 128 | 0 | 2.4 |
| V106/6AU6 | -3.8 | G | H | G | 60 | 60 | G | | |
| V107/6AL5 | -3.4 | -3.6 | G | H | G | G | -6.1 | | |
| V108/OA2 | 150 | G | | | 150 | | | | |
| V109/6DJ8 | 252 | 22 | 30 | G | H | 252 | 22 | 30 | G |
| V110/6AQ5 | -1.1 | 4.2 | H | G | 68 | 131 | | | |
| V111/6DJ8 | 141 | 0 | 2.9 | G | H | 80 | 4.4 | 5.8 | G |
| V112/5687 | 188 | 90 | 97 | H | H | 5.6 | 4 | G | 97 |
| V113/6AL5 | G | -8.6 | G | H | H | G | -4.55 | | |
| V114/6AU6 | 65 | 72 | H | G | -40 | 230 | 72 | | |
| V115/6AQ5 | -0.1 | 6 | H | G | 260 | 135 | | | |
| V116/6BY6 | G | G | H | G | 36 | 21 | -3 | | |

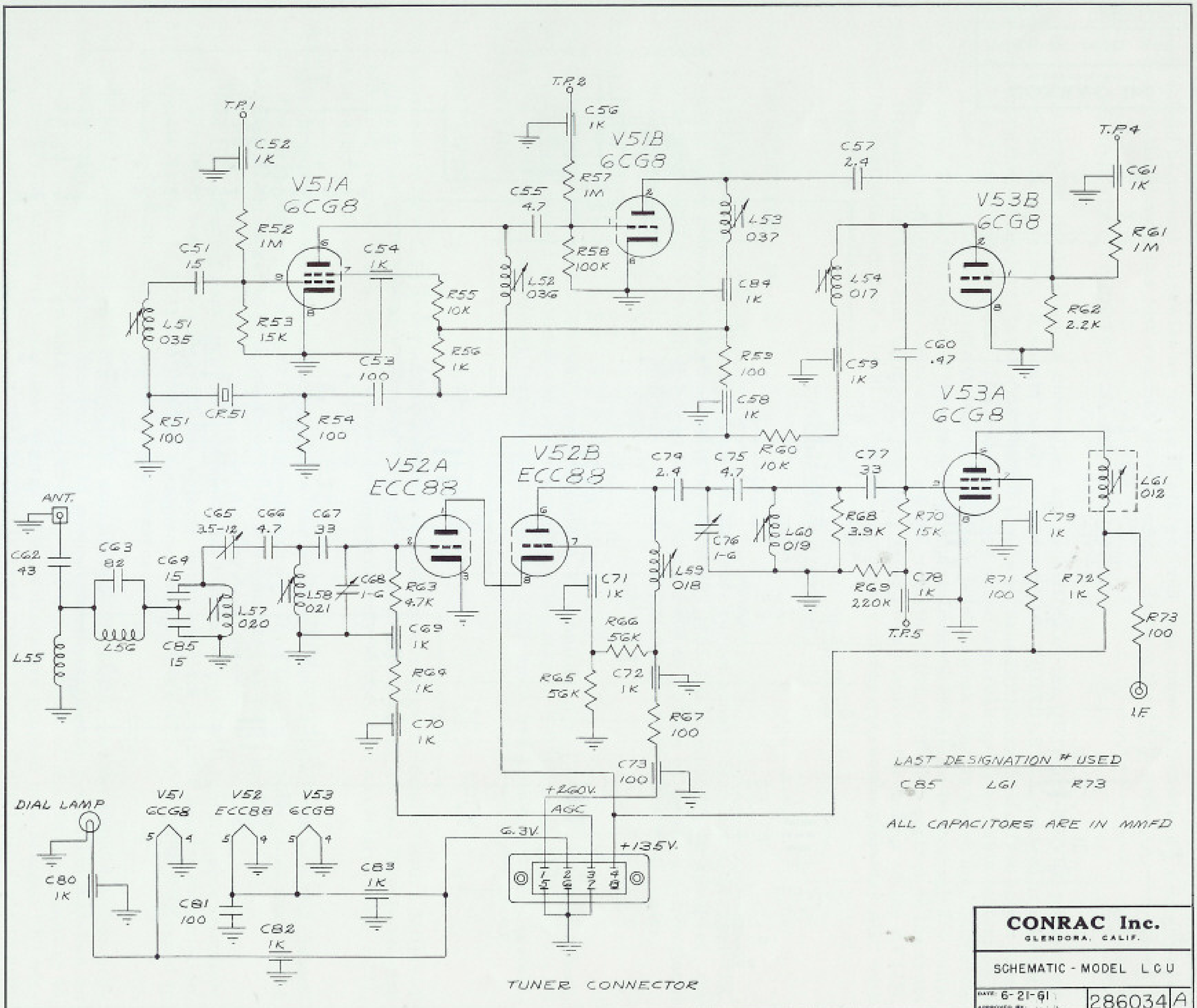
ALL MEASUREMENTS MADE WITH
VACUUM TUBE VOLTMETER

G = Ground
H = 6.3V A.C.


T101
774001
4.5MC
V102
6AU6
V103
6AL5
C111
4.7MF
35V
R109
10K
R110
10K
C110
4.7K
R106
2.2K
C108
4.7K
C109
4.7K
R107
15K
1W
R108
390
+135V.
C112
680
10%
C113
4.7K
10% 600V
R111
15K
5%
C114
100K
CW
AUDIO GAIN
P101
500K
1142
V104
6DJ8
R112
2K 1W 5%
R113
22K
C310B
20MF
25V
R114
220K
+280V
T102
J101
600Ω
+280V
T203
1074
33.75MC
42MC
V203
6BZ6
R211
15K
5%
C210
1K
R212
47
5%
C209
1K
C211
1K
T204
1075
42.25MC
45MC
R215
12K
5%
C212
1K
R216
180
V204
6CB6
C213
1K
C214
1K
R213
150
R214
150
R218
150
+135V
C216
4.7K
T205
2307
45MC
R217
5.1K
5%
330
C215
1K
R219
1K
+260V.
41.25MC
L204
2704
8.2
L205
2308 42MC
8.2
15K
C217
1-8
D201
1N60
C218
4.7
NPO
R220
9.1K 5%
L206
2339
270
L207
2337
4.5MC
R221
3.3K
5%
L208
2453
R224
3.3K
2W
+135V
V205
6AQ5
R225
6.8K
R227
6.8K
R226
6K
10W
+260V.
C219A
20MF
450V.
V206
OA2
VIDEO LEVEL
P201
4K
1190
CW
R235
1K
R222
680
C220
100MF 15V
R223
180 5%
C221
100 10%
NPO
AGC DELAY
P202
100K
2479
+260V.
R236
4.7K
C219C
20MF
450V
R239
15K 2W
R240
6.8K
2W
R249
3.6K 5%
2W
R250
3.6K 5%
2W
V208A
5687
C230
22 10%
C229
100K
V207A
6DJ8
C224
20K
C225
20MF
350V.
R241
3.3K
V207B
6DJ8
C227
100K 600V
R245
470K
R247
150
R255
10K
R248
2K 5%
C231
270 MF 200V.
R256
39
J201
R237
560
C226
7-45
R242
1M
R243
220
C228
50MF
3V
R246
100K
V208B
5687
R251
150
R257
39
J202
R252
68
R254
1M
R253
180
+135V
V209
6AU6
C233
470
1.5KV 10%
T206
97E007
GRN.
BLUE
RED
+280V
V210
6AQ5
C235
100
R264
15K
1W
R266
100K
V211
6BY6
C236
220
R267
470K
R268
2.2M
C234
22K
R261
270
R262
39K
R263
47K
R265
6.8K
R269
22K
C237
6.8K
600V
C232
33K
R260
47K
CONRAC Inc.
GLENDORA, CALIF.
SCHEMATIC
AUDIO VIDEO RECEIVER
DATE: 6-14-61
APPROVED BY:
452019
C


OPTIONAL 300Ω ANTENNA
PL203 ANT. CONNECTOR TO TUNER
STANDARD 75Ω ANTENNA
PL202 ANT. CONNECTOR TO TUNER
PL201 I.F. CONNECTOR TO TUNER
BROWN 6.3VAC FIL.
GREEN/WHITE AGC.
RED +260V.
RED/YEL. +135V.
TUNER CONNECTOR
I.F.
PLUG IN TUNER
ANT.
R101 1M
C102 .56 10%
V101A 6AN8
R102 4.7K
C103 4.7 NPO
L101 790001
C101 5.6
L102 771001 4.5MC
V101B 6AN8
C104 4.7K
C105 4.7K
R103 330
R104 1K
+135 V.
C106 4.7K
L103 1078 4.5MC
C107 100
R105 10K
V102 6AU6
C108 4.7K
R106 22K
C109 4.7K
R107 15K 1W
+135V.
T101 774001 4.5MC
C202 3-12
C201 5.1 10% NPO
T201 758002 45MC
R201 4.3K 5%
L201 1084 41.25MC
R203 5.6K 5%
C203 1K
R202 680K
V201 6BZ6
C204 1K
R204 47 5%
L202 790001
C205 1K
T202 1144 43MC
R207 15K 5%
L203 1146 47.25MC
R208 3K 5%
R209 47 5%
R206 150
R205 1K
C206 1K
R210 1K
V202 6BZ6
C207 1K
C208 1K
T203 1074 39.75MC
42MC
R211 15K 5%
V203 6BZ6
R212 47 5%
C209 1K
C210 1K
C211 1K
R213 150
VIDEO LEVEL P201 4K 1140 CW
R222 680
R235 1K
C222 .2MF 200V
GRN/WHITE AGC.
R230 100K
R228 10K
V301B 6AL5
R229 4.7M
S201
AGC N D
+135V.
R233 56K
R234 68K
AGC DELAY P202 100K 2479
CW
C223 .2MF 200V.
R232 1M
R231 1M
MANUAL GAIN P203 100K 1141A
R236 4.7K
C219C 20MF 450V
V207A 6DJ8
C224 20K
R237 560
V301A 6AL5
R301 10K
C303 25MF 25V
C304 25MF 25V
6.3VAC TO ALL FILS.
C305 4.7K
+280V. RED-BLUE
+260V. RED
T301 2258
GREEN
R303 300 10W
R304 300 10W
C309A 80MF 300V
C309B 80MF 300V.
C307 150MF 200V.
R302 10
L301 1044
+135V. RED-YEL.
WHITE
BLACK
BLACK RED
BLUE
BLUE YELLOW
RED
C301 2.5K
C302 2.5K
S301
F301 1½ A SLO-BLO
D301 IN1764
C306 .22K 1KV
D302 IN1764
C308 150MF 200V.
C310A 200MF 200V.
C219B 20MF 450V.
C219D 20MF 450V.
117VOLTS CONNECT A TO B & C TO D
234VOLTS CONNECT B TO C
ALL PAPER CAPACITORS 400V, UNLESS NOTED.
ALL COMPOSITION RESISTORS ½ W 10%, UNLESS NOTED.
+260V.
R258 4.7K
CW
DET. LEVEL P204 5K 2478
V209 6AU6
C232 33K
R259 10K
R260 47K
C233 470 1.5KV 10%
T206 978001
V210 6AQ5
BLUE
RED
+280V
C234 22K
R261 270
+135V


TEST POINT
I.F. TUNING
I.F. OUT
B+ 135
AGC
HEATER
6GK5
6CG8A
R.F. TRIM
MIXER TRIM
TOP VIEW
OSC. SLUG ADJUST.
TUNER SHAFT
FRONT VIEW
L3
L4
L5
L6
C13 .5-3.
C9 33
V1 6GK5
C12 .5-3.
V2A 6CG8A
R4 4.7K
L7 F.T.
C15 1K
C11 2.25
V2B 6CG8A
C14 18
C4 20
C16 1.8-7.0
C8 100
R2 1.2K
R5 2.2K
L9
L8
R7 4.7K
R6 220K
R1 47K
R3 1K
C2 30
C5 1K
C19 1K
C7 1K
C18 40
R8 68
AGC
T.P.
DIAL LAMP
I.F. OUT
C1 27
27
L1
T1
L10
C3 27
L2
27
6.3V
+135V
ANT 75 Ω INPUT
TUNER CONNECTOR
ALL CAPACITORS ARE IN MMFD
CONRAC Inc.
GLENDORA, CALIF.
SCHEMATIC - MODEL SU213
DATE: 7-14-61
APPROVED BY:
286036 A


T.P.1
C52 1K
V51A 6CG8
R52 1M
C51 15
C54 1K
R55 10K
L51 035
R53 15K
R56 1K
C53 100
CR51
R51 100
R54 100
T.P.2
C56 1K
V51B 6CG8
C55 4.7
R57 1M
R58 100K
L52 036
L53 037
C84 1K
R59 100
C58 1K
C57 2.4
T.P.4
C61 1K
V53B 6CG8
R61 1M
L54 017
R62 2.2K
C60 .47
C59 1K
R60 10K
V53A 6CG8
ANT.
C62 43
L55
C63 82
L56
C64 15
C85 15
L57 020
C65 3.5-12
C66 4.7
C67 33
L58 021
C68 1-6
V52A ECC88
V52B ECC88
R63 4.7K
C69 1K
R64 1K
C70 1K
C71 1K
C74 2.4
C75 4.7
C76 1-6
L60 019
L59 018
C77 33
R68 3.9K
R70 15K
R69 220K
C78 1K
T.P.5
C79 1K
L61 012
R71 100
R72 1K
R73 100
I.F.
R66 56K
R65 56K
C72 1K
R67 100
C73 100
+260V.
AGC
6.3V.
+135V.
DIAL LAMP
C80 1K
V51 6CG8
V52 ECC88
V53 6CG8
C81 100
C82 1K
C83 1K
TUNER CONNECTOR
LAST DESIGNATION # USED
C85 L61 R73
ALL CAPACITORS ARE IN MMFD
CONRAC Inc.
GLENDORA, CALIF.
SCHEMATIC - MODEL LCU
DATE 6-21-61
APPROVED BY:
286034 A

## AGC DELAY CONTROL

Insert a 15 db pad into the R.F. input (antenna) circuit. The AGC DELAY control on the front panel should be turned clockwise as far as it will go, and then counterclockwise to a point where the snow in the picture has just reached its minimum. Remove the 15 db pad.

## AGC BIAS ADJUSTMENT (DETECTOR LEVEL CONTROL)

The video level at the detector is controlled by the setting of the DETector LEVEL adjustment control on the rear apron. It should be set so that with the VIDEO LEVEL control at its maximum setting the voltage level in the video output line is perhaps 20% above the desired output level, normally 1.4 volts peak-to-peak. The broadcast sync pulse is a reasonably reliable indication of level. If the sync pulse amplitude (distance from black level to peak sync) is set to approximately 1/2 volt peak-to-peak, the output of the unit will be approximately 20% above its normal 1.4 volts. The video level may then be reduced to 1.4 volts with the VIDEO LEVEL control on the front panel. Negative feedback and high AGC loop gain effectively stabilize the output of the AV12E. Setting the available output at a level higher than necessary compromises the receiver AGC with no corresponding benefit.

# CIRCUIT DESCRIPTION

## STATION SELECTOR - SU-213

The SU-213 plug-in unit employs a 12-position neutrode turret tuner, Standard Coil Type GK. The standard input impedance is 75 ohms, with an SO239 (#83-1R) connector. If specified, the unit can be supplied for 300 ohm balanced input, using a 300 to 72 ohm balun and a conventional 2-terminal antenna input board. Spurious oscillator radiation falls well below FCC limits.

## CU PLUG-IN UNIT

The CU unit employs an ECC88 tube as a cascode R.F. amplifier, a 6CG8 as a pentode mixer, and a 6CG8 as a crystal oscillator and frequency multiplier stage. CU units for channels 7 - 13 employ a 6BN4 as an additional frequency multiplier. CU units use fifth-overtone crystals, Type CR23/U.

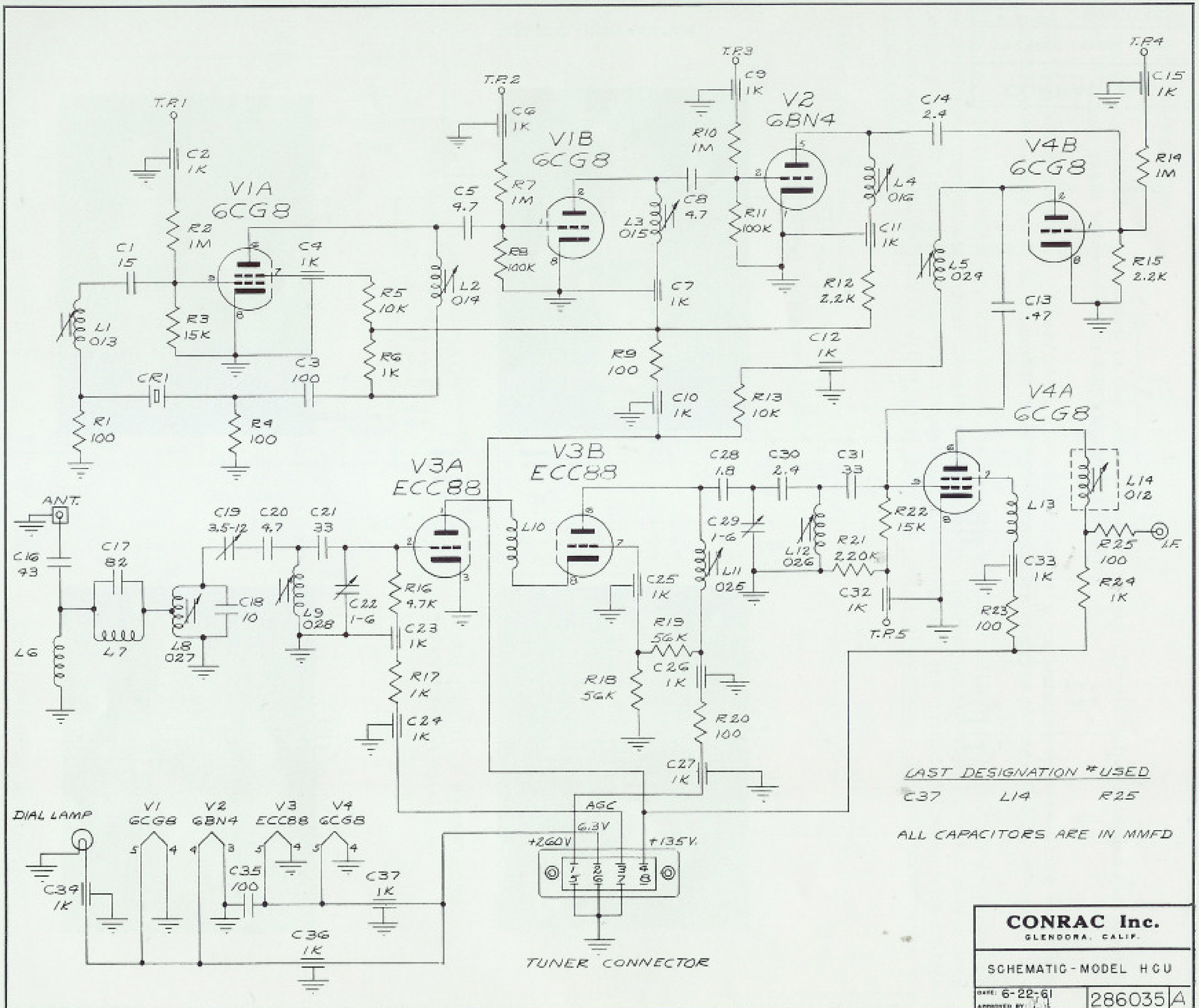
## I. F. AMPLIFIER

The converter to first I.F. grid coupling network consists of a "staggered couple" with a bifilar-T trap. The mixer plate circuit ("primary") is tuned to approximately 42 mc and loosely coupled to a bifilar-T circuit, T201, which is tuned to approximately 45 mc. The associated trap, L201, is set to reject 41.25 mc.

The next three interstage networks comprise a "flat staggered tuned triple" with adjacent channel traps. The first network is a shunt fed bifilar-T circuit. It, T202, is broadly tuned near 43 mc and the trap, L203, is set to produce about 30 db of attenuation at 47.25 mc.

The second I.F. coupling network, T203, is a standard bifilar-wound coil tuned to approximately 42 mc. A coupled trap tuned to 39.75 mc rejects upper adjacent channel picture information. T204 is quite similar to T203 and is tuned to approximately 45 mc with a coupled trap tuned to 47.25 mc for rejection of lower channel sound interference.

The coupling network between the fourth I.F. amplifier, V204/6CB6, and the video detector provides over 30 db of attenuation for the 41.25 mc accompanying sound component and has an essentially flat response from 41.75 mc to 45 mc. The input section of the filter is tuned to 45 mc and the output section is tuned near 42 mc. The sections are coupled by a bridged "T" network which rejects 41.25 mc. A crystal detector is used rather than a thermionic diode to provide optimum linearity and reduce capacitive loading.


V1A
6CG8
V1B
6CG8
V2
6BN4
V4B
6CG8
V3A
ECC88
V3B
ECC88
V4A
6CG8
T.P.1
T.P.2
T.P.3
T.P.4
T.P.5
ANT.
I.F.
DIAL LAMP
V1 6CG8
V2 6BN4
V3 ECC88
V4 6CG8
AGC
6.3V
+260V
+135V.
TUNER CONNECTOR
LAST DESIGNATION # USED
C37 L14 R25
ALL CAPACITORS ARE IN MMFD
CONRAC Inc.
GLENDORA, CALIF.
SCHEMATIC - MODEL HCU
DATE: 6-22-61
APPROVED BY:
286035 A

REPLACEABLE PARTS - MODEL AV12E RECEIVER

| SYMBOL | DESCRIPTION | PART NO. | MFR.* |
|---|---|---|---|
| | CAPACITORS | | |
| C101 | Cer. Tub., 5.6 mmf, 500 V, NPO | | MU |
| C102 | Cer. Tub., 56 mmf, 10%, 500 V | | MU |
| C103 | Cer. Tub., 4.7 mmf, 500 V, NPO | | MU |
| C104 | Cer. Disc, 4700 mmf, 20%, 500 V | | DI |
| C105 | Cer. Disc, 4700 mmf, 20%, 500 V | | DI |
| C106 | Cer. Disc, 4700 mmf, 20%, 500 V | | DI |
| C107 | Cer. Tub., 100 mmf, 500 V | 3-01GP1A | ER |
| C108 | Cer. Disc, 4700 mmf, 20%, 500 V | | DI |
| C109 | Cer. Disc, 4700 mmf, 20%, 500 V | | DI |
| C110 | Cer. Disc, 4700 mmf, 20%, 500 V | | DI |
| C111 | Electrolytic Tub., 4.7 mfd, 35 V, Solid Tantalum | TAS | MAL |
| C112 | Cer. Tub., 680 mmf, 10%, 500 V | | MU |
| C113 | Paper Tub., 4700 mmf, 10%, 600 V | 73P47296 | SP |
| C114 | Paper Tub., 100,000 mmf, 20%, 400 V | 67P10404 | SP |
| C201 | Cer. Disc, 5.1 mmf, 10%, 500 V, NPO | | DI |
| C202 | Cer. Trimmer, 3-12 mmf | 503-NPO | ER |
| C203 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C204 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C205 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C206 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C207 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C208 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C209 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C210 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C211 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C212 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C213 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C214 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C215 | Cer. Disc, 1000 mmf, 20%, 500 V | | DI |
| C216 | Cer. Disc, 4700 mmf, 20%, 500 V | | DI |
| C217 | Cer. Trimmer, 1-8 mmf | 532-08 | ER |
| C218 | Cer. Tub., 4.7 mmf, 500 V, NPO | | MU |
| C219 | Electrolytic, 20-20-20-20 mfd, 450 V | UPT222245 | CD |
| C220 | Electrolytic Tub., 100 mfd, 15 V | BBR100-15T | CD |
| C221 | Cer. Disc, 100 mmf, 10%, 500 V, NPO | | DI |
| C222 | "Metallized" Paper, 2 mfd, 200 V | MP2W2 | CD |
| C223 | "Metallized" Paper, 2 mfd, 200 V | MP2W2 | CD |
| C224 | Cer. Disc, 20,000 mmf, 600 V | DD-203 | CRL |
| C225 | Electrolytic Tub., 20 mfd, 350 V | BR2035 | CD |
| C226 | Cer. Trimmer, 7-45 mmf | 503-N500 | ER |
| C227 | Paper Tub., 100,000 mmf, 20%, 600 V | 73P10406 | SP |
| C228 | Electrolytic Tub., 50 mfd, 3 V | BBR50-3 | CD |
| C229 | Paper Tub., 100,000 mmf, 20%, 400 V | 67P10404 | SP |
| C230 | Cer. Disc, 22 mmf, 10%, 500 V | | DI |
| C231 | Electrolytic, 270 mfd, 200 V | 1291 | CONRAC |
| C232 | Paper Tub., 33,000 mmf, 20%, 400 V | 67P33304 | SP |
| C233 | Mica, 470 mmf, 10%, 1500 V | VCM20B471K | ELM |
| C234 | Paper Tub., 22,000 mmf, 20%, 400 V | 67P22304 | SP |

*See Manufacturers List, Page 40.

| SYMBOL | DESCRIPTION | | PART NO. | MFR.* |
|---|---|---|---|---|
| | CAPACITORS (Continued) | | | |
| C235 | Mica, 100 mmf, 20%, 500 V | | CM20B101M | ELM |
| C236 | Mica, 220 mmf, 20%, 500 V | | CM20B221M | ELM |
| C237 | Paper Tub., 6800 mmf, 20%, 600 V | | 73P68206 | SP |
| C301 | Cer. Feedthrough, 2500 mmf, 500 V | | FIS-A | AB |
| C302 | Cer. Feedthrough, 2500 mmf, 500 V | | FIS-A | AB |
| C303 | Electrolytic Tub., 25 mfd, 25 V | | BR252A | CD |
| C304 | Electrolytic Tub., 25 mfd, 25 V | | BR252A | CD |
| C305 | Cer. Disc, 4700 mmf, 20%, 500 V | | | DI |
| C306 | Paper Tub., 22,000 mmf, 20%, 1000 V | | 73P223010 | SP |
| C307 | Electrolytic, 150 mfd, 200 V | | UPE15020T | CD |
| C308 | Electrolytic, 150 mfd, 200 V | | UPE15020T | CD |
| C309 | Electrolytic, 80-80 mfd, 300 V | | 1289 | CONRAC |
| C310 | Electrolytic, 200 mfd, 200 V, 20 mfd, 25 V | | 1290 | CONRAC |
| | SILICON DIODES | | | |
| D201 | Rectifier, Diode | | 1N60 | SYL |
| D301 | Low Voltage Rectifier | | 1N1764 | RCA |
| D302 | Low Voltage Rectifier | | 1N1764 | RCA |
| | COILS | | | |
| L101 | 45 mc RF Choke | | 790001 | CONRAC |
| L102 | 4.5 mc | | 771001 | CONRAC |
| L103 | 4.5 mc | | 1078 | CONRAC |
| L201 | 41.25 mc Trap | | 1084 | CONRAC |
| L202 | 45 mc RF Choke | | 790001 | CONRAC |
| L203 | 47.25 mc Trap | | 1146 | CONRAC |
| L204 | 41.25 mc Trap | | 2704 | CONRAC |
| L205 | Detector Filter | | 2308 | CONRAC |
| L206 | Peaking | | 2339 | CONRAC |
| L207 | 4.5 mc Trap | | 2337 | CONRAC |
| L208 | Peaking | | 2453 | CONRAC |
| L301 | Filter Choke | | 1044 | CONRAC |
| T101 | Detector Ratio | | 774001 | CONRAC |
| T201 | Bifilar | | 758002 | CONRAC |
| T202 | Bifilar | | 1144 | CONRAC |
| T203 | IF | | 1074 | CONRAC |
| T204 | IF | | 1075 | CONRAC |
| T205 | Detector | | 2307 | CONRAC |
| | RESISTORS - VARIABLE | | | |
| P101 | Composition, 500,000 ohms | (Audio Gain) | 1142 | CONRAC |
| P201 | Composition, 4000 ohms | (Video Level) | 1140 | CONRAC |
| P202 | Composition, 100,000 ohms | (AGC Delay) | 2479 | CONRAC |
| P203 | Composition, 100,000 ohms | (Manual Gain) | 1141A | CONRAC |
| P204 | Composition, 5000 ohms | (Detector Level) | 2478 | CONRAC |

*See Manufacturers List, Page 40.

| SYMBOL | DESCRIPTION | PART NO. | MFR.* |
|---|---|---|---|
| | RESISTORS | | |
| R101 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| R102 | Composition, 4700 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R103 | Composition, 330 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R104 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R105 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R106 | Composition, 22,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R107 | Composition, 15,000 ohms, 10%, 1 w | | AB |
| R108 | Composition, 390 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R109 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R110 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R111 | Composition, 15,000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R112 | Composition, 2000 ohms, 5%, 1 w | | AB |
| R113 | Composition, 22,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R114 | Composition, 220,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R201 | Composition, 4300 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R202 | Composition, 680,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R203 | Composition, 5600 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R204 | Composition, 47 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R205 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R206 | Composition, 150 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R207 | Composition, 15,000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R208 | Composition, 3000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R209 | Composition, 47 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R210 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R211 | Composition, 15,000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R212 | Composition, 47 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R213 | Composition, 150 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R214 | Composition, 150 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R215 | Composition, 12,000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R216 | Composition, 180 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R217 | Composition, 5100 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R218 | Composition, 150 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R219 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R220 | Composition, 9100 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R221 | Composition, 3300 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R222 | Composition, 680 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R223 | Composition, 180 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R224 | Composition, 3300 ohms, 10%, 2 w | | AB |
| R225 | Composition, 6800 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R226 | Composition, 6000 ohms, 10%, 10 w | | AB |
| R227 | Composition, 6800 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R228 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R229 | Composition, 4.7 megohms, 10%, $\frac{1}{2}$ w | | AB |
| R230 | Composition, 100,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R231 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| R232 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| R233 | Composition, 56,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R234 | Composition, 68,000 ohms, 10%, $\frac{1}{2}$ w | | AB |

*See Manufacturers List, Page 40.

| SYMBOL | DESCRIPTION | PART NO. | MFR.* |
|---|---|---|---|
| | RESISTORS (Continued) | | |
| R235 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R236 | Composition, 4700 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R237 | Composition, 560 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R239 | Composition, 12,000 ohms, 10%, 2 w | | AB |
| R240 | Composition, 6800 ohms, 10%, 2 w | | AB |
| R241 | Composition, 3300 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R242 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| R243 | Composition, 220 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R245 | Composition, 470,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R246 | Composition, 100,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R247 | Composition, 150 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R248 | Composition, 2000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R249 | Composition, 3600 ohms, 5%, 2 w | | AB |
| R250 | Composition, 3600 ohms, 5%, 2 w | | AB |
| R251 | Composition, 150 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R252 | Composition, 68 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R253 | Composition, 180 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R254 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| R255 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R256 | Composition, 39 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R257 | Composition, 39 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R258 | Composition, 4700 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R259 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R260 | Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R261 | Composition, 270 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R262 | Composition, 39,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R263 | Composition, 47,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R264 | Composition, 15,000 ohms, 10%, 1 w | | AB |
| R265 | Composition, 6800 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R266 | Composition, 100,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R267 | Composition, 470,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R268 | Composition, 2.2 megohms, 10%, $\frac{1}{2}$ w | | AB |
| R269 | Composition, 22,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R301 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R302 | Wire Wound, 10 ohms, 10%, 10 w | PW10 | IRC |
| R303 | Wire Wound, 300 ohms, 10%, 10 w | PW10 | IRC |
| R304 | Wire Wound, 300 ohms, 10%, 10 w | PW10 | IRC |
| | TRANSFORMERS | | |
| T102 | Audio Output | 16448Q | PRL |
| T206 | Pulse | 978001 | CONRAC |
| T301 | Power | 2258 | CONRAC |

*See Manufacturers List, Page 40.

## REPLACEABLE PARTS - MODEL AV12E RECEIVER

| SYMBOL | DESCRIPTION | PART NO. | MFR.* |
|---|---|---|---|
| | MISCELLANEOUS | | |
| F301 | Fuse: $1\frac{1}{2}$ amp. | 31301.5 | LF |
| J101 | Terminal Strip: 3 Terminals | 1783 | CI |
| J201 | Receptacle: Female (SO239) | 888002 | CONRAC |
| J202 | Receptacle: Female (SO239) | 888002 | CONRAC |
| S201 | Switch: 4 Circuit, 3 Position | 2469 | CONRAC |
| S301 | Switch: Line | 1802 | CONRAC |
| | Co-ax: Brown | 985003 | CONRAC |
| | Connector: Female Tuner | 745003 | CONRAC |
| | Connector: Male | M93 | CI |
| | Cord: Line (Grey) | CS-206Q | PH |
| | Coupling: Flexible | FC845 | BUD |
| | Extractor Fuse Post | 342012 | LF |
| | Handle: Front Panel | 344502 | CONRAC |
| | Knobs | 3044 | CONRAC |
| | Plug: Snap-Hole | 7308 | WA |
| | Shaft: Extension | 1154 | CONRAC |
| | Shield: 7 Pin Socket | 1700 | GO |
| | Shield: 9 Pin Socket | S194CL | ME |
| | Socket: 7 Pin Molded | SM154-125L | ME |
| | Socket: 9 Pin Molded | SM162-125L | ME |

## REPLACEABLE PARTS - MODEL SU-213 PLUG-IN TURRET TUNER

| | | | |
|---|---|---|---|
| | Tuner: V.H.F. Turret | 980008 | CONRAC |
| | Connector: Antenna | BNC UG290/U | - |
| | Connector: Male (Tuner) | 26-182 | AM |
| | Fastener: Tuner Front Panel | 325502 | CONRAC |
| | Knob: Fine Tuning | 1208 | CONRAC |
| | Knob: Channel Selector | 362004 | CONRAC |
| | Lamp: Frosted | 1847 | GE |

*See Manufacturers List, Page 40.

MODEL LCU, CHANNELS 2 THROUGH 6
MODEL HCU, CHANNELS 7 THROUGH 13

| SYMBOLS LCU | HCU | DESCRIPTION | PART NO. | MFR.* |
|---|---|---|---|---|
| | | CAPACITORS | | |
| C51 | C1 | Cer. Disc, 15 mmf, 10%, 500 V, N150 | | DI |
| C52 | C2 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C53 | C3 | Cer. Disc, 100 mmf, 10%, 500 V | DM-15-101-K | ELM |
| C54 | C4 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C55 | C5 | Cer. Disc, 4.7 mmf, 10%, 500 V | | QC |
| C56 | C6 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C57 | | Cer. Disc, 2.4 mmf, 10%, 500 V | | QC |
| C58 | C7 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| | C8 | Cer. Disc, 4.7 mmf, 10%, 500 V | | QC |
| C59 | C9 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| | C10 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| | C11 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| | C12 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C60 | C13 | Cer. Disc, .47 mmf, 10%, 500 V | | QC |
| | C14 | Cer. Disc, 2.4 mmf, 10%, 500 V | | QC |
| C61 | C15 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C62 | C16 | Cer. Disc, 43 mmf, 5%, 500 V | DM-15-430-J | ELM |
| C63 | C17 | Cer. Disc, 82 mmf, 5%, 500 V | DM-15-820-J | ELM |
| | C18 | Cer. Disc, 10 mmf, 10%, 500 V, N150 | | DI |
| C64 | | Cer. Disc, 15 mmf, 10%, 500 V, N150 | | DI |
| C65 | C19 | Cer. Trimmer, 3.5-12 mmf | 827-B | CRL |
| C66 | C20 | Cer. Disc, 4.7 mmf, 10%, 500 V | | QC |
| C67 | C21 | Cer. Disc, 33 mmf, 10%, 500 V, N150 | | DI |
| C68 | C22 | Cer. Tub., 1-6 mmf, 500 V | 829-6 | CRL |
| C69 | C23 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C70 | C24 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C71 | C25 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C72 | C26 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C73 | C27 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| | C28 | Cer. Disc, 1.8 mmf, 10%, 500 V | | QC |
| | C29 | Cer. Tub., 1-6 mmf, 500 V | 829-6 | CRL |
| C74 | C30 | Cer. Disc, 2.4 mmf, 10%, 500 V | | QC |
| | C31 | Cer. Disc, 33 mmf, 10%, 500 V, N150 | | DI |
| C75 | | Cer. Disc, 4.7 mmf, 10%, 500 V | | QC |
| C76 | | Cer. Tub., 1-6 mmf, 500 V | 829-6 | CRL |
| C77 | | Cer. Disc, 33 mmf, 10%, 500 V, N150 | | DI |
| C78 | C32 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C79 | C33 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C80 | C34 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C81 | C35 | Cer. Disc, 100 mmf, 500 V, GMV | | DI |
| C82 | C36 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C83 | C37 | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C84 | | Cer. Feedthrough, 1000 mmf, 500 V | CF720EA 102Z-0 | SO |
| C85 | | Cer. Disc, 15 mmf, 10%, 500 V, N150 | | DI |

*See Manufacturers List, Page 40.

MODEL LCU, CHANNELS 2 THROUGH 6
MODEL HCU, CHANNELS 7 THROUGH 13

| SYMBOLS LCU | HCU | DESCRIPTION | PART NO. | MFR.* |
|---|---|---|---|---|
| | | COILS | | |
| L51 | L1 | Iron Core | 770013 | CONRAC |
| L52 | L2 | Iron Core | 770014 | CONRAC |
| L53 | L3 | Iron Core | 770015 | CONRAC |
| | L4 | Iron Core | 770016 | CONRAC |
| L54 | | Iron Core | 770017 | CONRAC |
| | L5 | Iron Core | 770024 | CONRAC |
| L55 | L6 | Air Core | 770022 | CONRAC |
| L56 | L7 | Air Core | 770022 | CONRAC |
| L57 | | Iron Core | 770020 | CONRAC |
| L58 | | Iron Core | 770021 | CONRAC |
| L59 | | Iron Core | 770018 | CONRAC |
| L60 | | Iron Core | 770019 | CONRAC |
| | L8 | Iron Core | 770027 | CONRAC |
| | L9 | Iron Core | 770028 | CONRAC |
| | L10 | Iron Core | 770010 | CONRAC |
| | L11 | Iron Core | 770025 | CONRAC |
| | L12 | Iron Core | 770026 | CONRAC |
| | L13 | Air Core | 770011 | CONRAC |
| L61 | L14 | Iron Core, Shielded | 770012 | CONRAC |
| | | RESISTORS | | |
| R51 | R1 | Composition, 100 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R52 | R2 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| R53 | R3 | Composition, 15,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R54 | R4 | Composition, 100 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R55 | R5 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R56 | R6 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R57 | R7 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| R58 | R8 | Composition, 100,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R59 | R9 | Composition, 100 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R60 | | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R61 | R10 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| | R11 | Composition, 100,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R62 | R12 | Composition, 2200 ohms, 10%, $\frac{1}{2}$ w | | AB |
| | R13 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| | R14 | Composition, 1 megohm, 10%, $\frac{1}{2}$ w | | AB |
| | R15 | Composition, 2200 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R63 | R16 | Composition, 4700 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R64 | R17 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R65 | R18 | Composition, 56,000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R66 | R19 | Composition, 56,000 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R67 | R20 | Composition, 100 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R68 | | Composition, 3900 ohms, 5%, $\frac{1}{2}$ w | | AB |
| R69 | R21 | Composition, 220,000 ohms, 10%, $\frac{1}{2}$ w | | AB |

*See Manufacturers List, Page 40.

## REPLACEABLE PARTS - CRYSTAL CONTROLLED VHF PLUG-IN TUNERS

### MODEL LCU, CHANNELS 2 THROUGH 6
### MODEL HCU, CHANNELS 7 THROUGH 13

| SYMBOLS LCU | SYMBOLS HCU | DESCRIPTION | PART NO. | MFR.* |
|---|---|---|---|---|
| | | RESISTORS (Continued) | | |
| R70 | R22 | Composition, 15,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R71 | R23 | Composition, 10,000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R72 | R24 | Composition, 1000 ohms, 10%, $\frac{1}{2}$ w | | AB |
| R73 | R25 | Composition, 100 ohms, 5%, $\frac{1}{2}$ w | | AB |
| | | MISCELLANEOUS | | |
| | | Crystal (Freq. Optional) | CR23U | |
| | | Holder: Crystal | 126-105 | JO |
| | | Lamp: Frosted | 1847 | GE |
| | | Plug: Power | 745002 | CONRAC |
| | | Receptacle: Female (Antenna) | UG290/U | AM |
| | | Receptacle: Female (I.F.) | 4-4113 | AL |
| | | Shield: 7 Pin Socket | SLM-173-CL | ME |
| | | Shield: 9 Pin Socket | SLM-213-CL | ME |

*See Manufacturers List Below.

### MANUFACTURERS OF REPLACEABLE PARTS

| CODE | MANUFACTURERS | LOCATION |
|---|---|---|
| AB | Allen-Bradley Co. | Milwaukee 4, Wisconsin |
| AL | Alcon Metal Products | Chicago, Illinois |
| AM | Amphenol-Borg Electronics Corp. | Chicago, Illinois |
| BUD | Bud Radio, Inc. | Cleveland, Ohio |
| CD | Cornell-Dubilier Electric Co. | South Plainfield, New Jersey |
| CI | Cinch Manufacturing Co. | Chicago, Illinois |
| CONRAC | Conrac Division | Glendora, California |
| CRL | Centralab | Milwaukee 1, Wisconsin |
| DI | Dilectron Corp. | Monrovia, California |
| ELM | Elmenco Products Co. | New York, New York |
| ER | Erie Resistor Corp. | Erie, Pennsylvania |
| GE | General Electric Co. | Schenectady, New York |
| GO | Fred Goat Co., Inc. | Brooklyn, New York |
| IRC | International Resistance Co. | Philadelphia 8, Pennsylvania |
| JO | E. F. Johnson Co. | Waseca, Minnesota |
| LF | Littelfuse Inc. | Des Plaines, Illinois |
| MAL | P. R. Mallory & Co., Inc. | Indianapolis, Indiana |
| ME | Methode Manufacturing Corp. | Chicago, Illinois |
| MU | Muter Co. | Chicago, Illinois |
| PH | Phalo Plastics Corp. | Shrewsbury, Massachusetts |
| PRL | Peerless Division of Altec Lansing Corp. | Anaheim, California |
| QC | Quality Components, Inc. | St. Marys, Pennsylvania |
| RCA | Radio Corporation of America | Camden 2, New Jersey |
| SO | Solar Manufacturing Corp. | Los Angeles, California |
| SP | Sprague Electric Co. | North Adams, Massachusetts |
| SYL | Sylvania Electric Products | Seneca Falls, New York |
| WA | Walsco Electronics Manufacturing Co. | Rockford, Illinois |