Warranty

Radio Corporation of America warrants its test and measuring equipment, when properly registered, against defects in workmanship, materials, and construction under normal use and service for a period of one year from the date of original purchase. Under this warranty, our obligation is limited to repairing or replacing any defective parts.

This warranty does not apply to any instrument which has been tampered with in any way, or which has been misused or damaged by accident or negligence, or which has had the serial number removed, altered, or effaced.

RCA tubes and RCA batteries used in such equipment are covered by our standard tube or battery warranty.

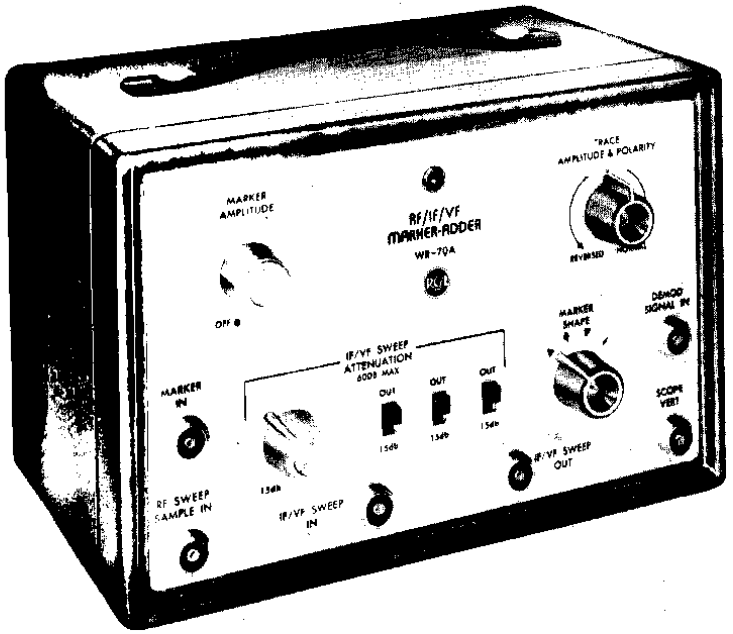
Tube Division
RADIO CORPORATION OF AMERICA
Harrison, New Jersey

This warranty is valid only when the card enclosed with the instrument is properly filled in and returned for registration.

PRICE 75 CENTS

RCA RF/IF/VF MARKER ADDER

Type WR-70A



- Specifications
- Applications
- Operation
- Maintenance

RADIO CORPORATION of AMERICA
TEST AND MEASURING EQUIPMENT
HARRISON, N. J.

Safety Precautions

The metal case of this instrument is connected to the ground of the internal circuit. For proper operation, the ground terminal of the instrument should always be connected to the ground of the equipment under test.

An important point to remember is that there is always danger inherent in testing electrical equipment which operates at hazardous voltages. Therefore, the operator should thoroughly familiarize himself with the equipment under test before working on it, bearing in mind that high voltages may appear at unexpected points in defective equipment. Additional precautions which experience in the industry has shown to be important are listed below.

1. It is good practice to remove power before connecting test leads to high-voltage points. If this is impractical, be *especially careful* to avoid accidental contact with equipment racks and other objects which can provide a ground. Working with one hand in your pocket and standing on a properly insulated floor lessens the danger of shock.
2. Filter capacitors may store a charge large enough to be hazardous. Therefore, discharge filter capacitors before attaching test leads.
3. Remember that leads with broken insulation provide the additional hazard of high voltages appearing at exposed points along the leads. Check test leads for frayed or broken insulation before working with them.
4. To lessen the danger of accidental shock, disconnect test leads immediately after test is completed.
5. Remember that the risk of severe shock is only one of the possible hazards. Even a minor shock can place the operator in hazard of more serious risks such as a bad fall or contact with a source of higher voltage.
6. The experienced operator continuously guards against injury and does not work on hazardous circuits unless another person is available to assist in case of accident.

Items Supplied With WR-70A

3 Jumper Cables		1 Pickup Cable
1 RCA-12AX7	2 RCA-12AU7	1 RCA-6X4
1 Instruction Booklet		1 Registration Card

TEST AND MEASURING EQUIPMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

WR-70A (1) 8-56
Printed in U.S.A.

Description

The RCA WR-70A RF/IF/VF Marker Adder is designed for use in rf, if, and video sweep-frequency alignment of both color and black-and-white and TV receivers. When used with conventional alignment instruments, such as the RCA WR-89A or WR-39C Calibrators and the WR-59C TV Sweep Generator, the WR-70A produces clean, narrow markers on the sweep-response curve displayed on an oscilloscope.

A choice of four different marker shapes is available with the WR-70A, thereby permitting use of the type of marker best suited to the response curve. During alignment, the marker signal is added to the sweep-response curve in the WR-70A after the demodulated sweep signal is taken out of the receiver under test. With conventional alignment procedures, in which both the sweep and marker signals are passed through the receiver circuits, overloading or clipping by the receiver circuits can introduce distortion of the marker and distortion of the sweep curve by the marker. The WR-70A system of adding markers to the response curve eliminates this source of distortion. In addition, the WR-70A permits simple and precise alignment of a variety of trap circuits without marker "suckout".

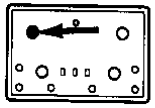
The four types of markers provided by the WR-70A are: (1) positive peak, (2) negative peak, (3) positive and negative peaks (wide band), (4) positive and negative peak (narrow band). Front panel controls on the unit provide for instant selection of the desired marker as well as control of marker amplitude. Sweep-trace polarity and amplitude may also be adjusted by a front-panel control. The functional grouping of these controls greatly simplifies the alignment procedure.

Included in the WR-70A is a built-in attenuator for use during if and video alignment. The attenuator provides for continuous adjustment of the sweep signal over a range of approximately 60 db.

The WR-70A utilizes a special electron-tube regulator circuit to stabilize the B+ voltage and thus insure exceptional trace stability and freedom from trace jitter and bounce.

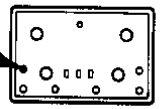
Four coaxial cables are provided with the Marker Adder to facilitate easy connection to the sweep and marker generators, the oscilloscope, and to the input and output circuits of the TV receiver under test. The WR-70A is housed in an attractive blue hammeroid case which measures 7½" h x 10½" w x 6¼" d. The panel is brushed aluminum.

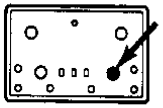
Functions of Controls and Connectors



OFF-MARKER AMPLITUDE — Applies power when turned clockwise from "OFF" position, and adjusts amplitude of frequency marker on sweep trace displayed on oscilloscope screen.

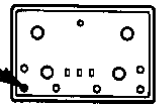
MARKER IN — The calibrated rf-marker signal from an external marker calibrator is fed into this connector.

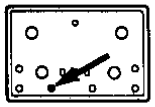




MARKER SHAPE—Has four positions and provides a choice of the four marker shapes indicated on the panel. (See Figures 2 and 4.)

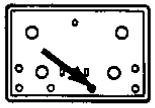
RF SWEEP SAMPLE IN—RF-sample voltage from "rf-sample out" terminal on the external sweep generator is fed into this connector.

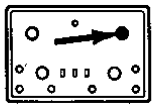




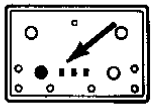
IF/VF SWEEP IN—The if- or video-sweep signal from an external sweep generator is fed into this connector. NOTE: The output-attenuator on the if/video generator should be set for maximum output.

IF/VF SWEEP OUT—The if/video sweep signal is fed into the IF/VF SWEEP IN connector of the WR-70A and is available at the IF/VF SWEEP OUT connector after the signal has passed through the adjustable attenuator networks.

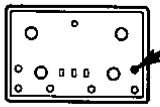




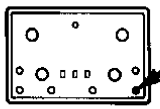
TRACE AMPLITUDE & POLARITY—Adjusts amplitude of the trace displayed on the oscilloscope screen. The trace may be displayed in an "upright" or "inverted" position, depending upon the setting of this control. As this control is rotated from the "NORMAL" to "REVERSED" settings, the sweep trace will vary in amplitude from maximum in one vertical direction to maximum in the opposite vertical direction. The polarity of the displayed trace at any setting of this control will depend upon the polarity of the sweep signal taken from the receiver.



IF/VF SWEEP ATTENUATION — Utilizes three slide switches and a potentiometer control to provide step attenuation of the if/video signal fed into the IV/VF SWEEP IN connector. When the slide switches are placed in their "down" positions, attenuation in steps of 15 db for each switch is provided. When the switches are set to their "up" or "0" positions, no attenuation occurs. The potentiometer control provides for precise setting of the degree of attenuation. When this control is turned fully clockwise, no attenuation is provided; when turned from "0" in a counter-clockwise direction, attenuation up to 15 db is provided. The potentiometer control may be used in conjunction with any or all of the slide switches to provide attenuation of the if/vf signal in any amount from zero to 60 db.



DEMOD SIGNAL IN—The demodulated rf- or if-sweep signal *taken from the TV receiver under test* is fed into this connector. For example, a sweep signal fed into the antenna terminals or into the tuner mixer stage may be taken out of the receiver at the picture or second detector and fed into the DEMOD SIGNAL IN connector.



SCOPE VERT—The output rf-, if-, or vf-sweep trace, with markers, is available at this terminal. Output is coupled directly from the SCOPE VERT terminal to the vertical-input terminals of the oscilloscope.

Specifications

Electrical

Input Frequencies:

IF/VF SWEEP IN connectors	50 Kc to 50 Mc
RF-input connectors	50 Mc to 250 Mc

Minimum Input Voltages*:

IF/VF SWEEP IN connector	0.1 min. volt (rms)
RF SWEEP SAMPLE IN connector	0.005 min. volt (rms)
MARKER IN connector	0.1 min. volt (rms)
Maximum Input Voltage at DEMOD SIGNAL IN	8 p-p volts

Maximum Output Voltages (Measured at SCOPE VERT connector):

Marker Signal	2.5 rms volts
Demodulated sweep signal	10 p-p volts

Input Impedances:

RF SWEEP SAMPLE IN connector	100 ohms
MARKER IN connector	100 ohms
IF/VF SWEEP IN connector	100 ohms
DEMOD SIGNAL IN connector	0.5 megohm
Output Impedance at IF/VF SWEEP OUT connector	100 ohms

Tube Complement

1 RCA-12AX7, 2 RCA-12AU7, 1 RCA-6X4

Mechanical

Power-Supply Characteristics:

Input voltage	105-125 volts
Frequency	50-60 cps
Power consumption	25 watts

Dimensions: 7½" h x 10½" w x 6¼" d

Weight (approx.): 8 lbs. (net)

Finish: blue-grey hammeroid case; etched aluminum panel

*These are minimum values required to produce a usable output marker.

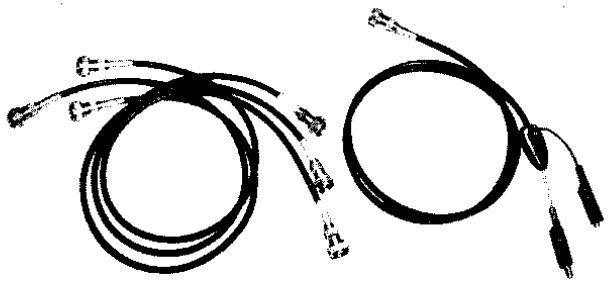


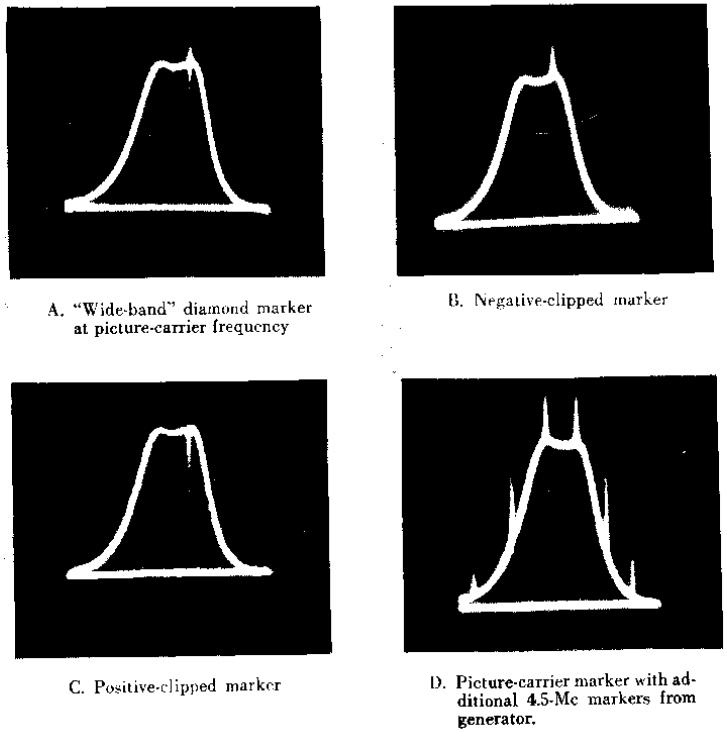
Figure 1. Cables supplied with WR-70A

Operation and Application

General Considerations:

Use of various marker shapes—Of the four types of markers produced by the WR-70A, the first three, illustrated in Figure 2A, 2B, and 2C, are classified as "wide-band" markers. For practical purposes, this designation means that these three types of markers will have a wider base and occupy more space along the horizontal axis of the scope trace. These three types of markers are available in the first three positions of the MARKER SHAPE switch. In the fourth, or extreme right-hand, position of this switch, a narrow-band marker is provided. This marker should be used when checking a frequency point on a sharply pitched curve, such as an "S" curve of an FM discriminator. (See Figure 4.) If a wide-band marker is used, the wider marker base may obscure the curve, as shown in Figure 4C.

The usefulness of markers having different shapes may be seen in Figure 3B. The trap notch shown in this figure is sharp and narrow and use of a diamond-shaped or negative-clipped marker would result in filling the part of the notch



A. "Wide-band" diamond marker at picture-carrier frequency

B. Negative-clipped marker

C. Positive-clipped marker

D. Picture-carrier marker with additional 4.5-Mc markers from generator.

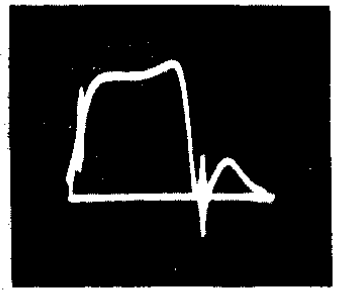
Figure 2. Three of the four types of markers produced by the WR-70A. Curves are from a TV tuner. Note absence of trace distortion with high-amplitude markers.

above the reference line. Use of a positive-clipped marker, as shown, provides a clear indication of the trap frequency and does not obscure the steep sides of the curve notch.

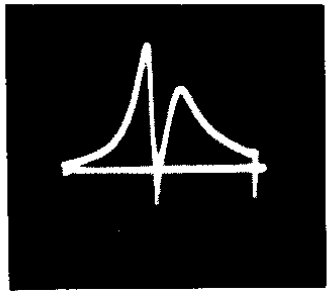
Adjustment of Controls—It is recommended that the vertical-amplifier in the oscilloscope be operated at less than maximum gain to avoid the possibility of hum and noise pickup which can cause twisting and modulation of the displayed trace. If the scope gain switch is set to an intermediate attenuator position, the MARKER AMPLITUDE and TRACE AMPLITUDE and POLARITY controls on the WR-70A can be used to adjust trace and marker height over a wide range of amplitude. A nominal scope sensitivity of 0.3 to 0.5 volt per inch should be satisfactory.

In some applications, sharp vertical spikes may be noticed at the beginning and end of the displayed trace. One of these spikes may be seen at the right-hand end of the trace in Figure 3B These spikes are caused by the retrace-blanking pulse in the sweep generator. The spikes may be eliminated or reduced by running the marker generator at full output, reducing the vertical gain of the scope, and adjusting the MARKER AMPLITUDE control on the WR-70A.

Cables—When taking a sweep curve out of a receiver at an rf test point, it will be necessary to demodulate the signal before feeding it into the DEMOD



A. Overall response curve with dual markers, one at picture-carrier frequency (shown at left) and one at sound-carrier frequency (in notch at right).



B. Response curve at sound take-off transformer showing sharp hole produced by if picture-carrier trap. Note that marker is sharp and easily recognized in notch.

Figure 3.

SIGNAL IN connector. In some cases, it is possible to utilize an oscilloscope demodulator probe, such as the RCA WG-302A Signal-Tracing Probe or the WG-291 Demodulator Probe, which are "slip-on" types for use with RCA WG-300A, WG-218, and WG-294 Direct Probes and Cables. As these cables are equipped with microphone-type connectors at the 'scope end, the scope cable can be connected to the DEMOD SIGNAL IN connector.

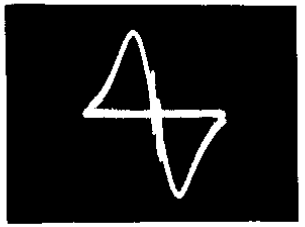
Rf Alignment:

The test setup for rf alignment of tuners, picture-if, and split-sound if amplifiers when the sweep signal is fed into the antenna terminals requires the following equipment:

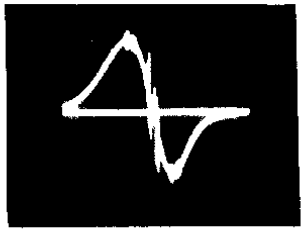
1. RCA WR-70A RF/IF/VF Marker Adder with 4 test cables.
2. A VHF television sweep generator, such as an RCA WR-59-series TV Sweep Generator, which has been modified to supply an rf-sample voltage.*

*Note: Modification of WR-59-series generators to provide a sampling voltage is relatively simple and requires few parts. For complete instructions, write to: RCA, Commercial Engineering, Harrison, N. J.

A. Narrow-band diamond marker indicates zero point on curve



B. Narrow-band diamond marker with 150-Kc sideband markers on peaks of curve



C. Distortion produced by use of wide-band marker

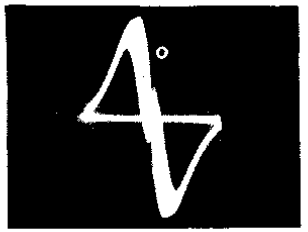


Figure 4. FM-discriminator "S" curve showing effects of different markers from WR-70A

3. A calibrated marker generator, such as the RCA WR-89A Crystal-Calibrated Marker Generator or an RCA WR-39-series TV calibrator.

4. Cathode-ray oscilloscope. Note: A wide-band, high-gain 'scope is not required for alignment with the WR-70A.

5. An external source of bias for the tuner and receiver if-amplifier stages which are normally biased from the age circuit.

The complete rf-alignment test setup is shown in Figure 5. Procedure is as follows:

1. Disable the age circuit in the receiver under test and connect an external source of bias to the tuner and if-amplifier age-bias buses. Adjust the bias voltages from the substitute source to the values recommended by the manufacturer. Apply power to the receiver.

2. Connect test equipment to a power source and apply power.

3. Connect a jumper cable from the RF-output connector on the marker generator to the MARKER IN connector of the WR-70A. Tune the marker generator to deliver a calibrated signal at the desired output frequency (picture carrier, for example). Set the output-attenuator control on the generator for maximum rf output. It will not be necessary to change the setting of this control during the alignment procedure.

4. Connect a jumper cable from the sample-voltage connector of the rf-sweep generator to the RF SWEEP SAMPLE IN connector of the WR-70A. Connect the rf-output cable of the sweep generator from the rf-attenuator output connector to the antenna terminals of the TV receiver. Set the sweep-generator attenuator control to deliver a usable output signal to the receiver. Set the sweep generator controls to deliver a swept-output signal on the desired channel.

5. Connect the pickup cable of the WR-70A to the DEMOD SIGNAL IN connector, clip the black test clip to a ground or shield point near the signal take-off

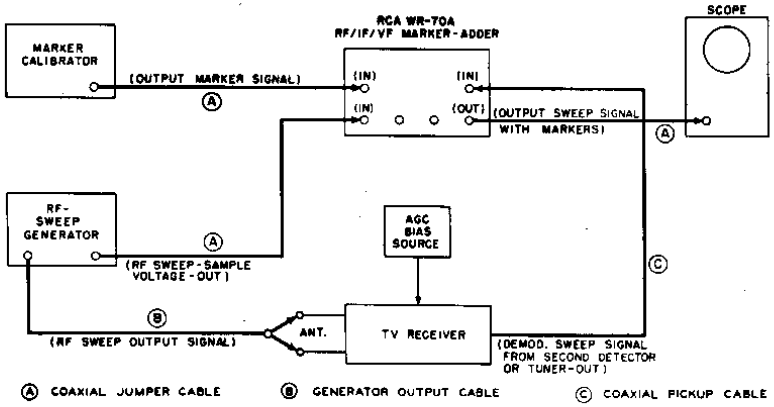


Figure 5. Test setup for rf alignment

point in the receiver, and clip the red test clip to the demodulated-signal test point of the receiver. Note: This test point may be across the load resistor of the receiver second detector if an overall response curve is desired in black-and-white receivers. If the shape of the tuner curves is to be observed, connect the clips to test points in the tuner mixer circuit. On some tuners, a demodulated signal can be obtained at this point. On other tuners, it will be necessary to demodulate the sweep signal by means of an rf probe or suitable rectifying-filtering circuit. In these cases, the manufacturer's service notes should be consulted for the correct procedure.

6. Connect a jumper cable from the SCOPE VERT connector to the vertical-amplifier input connector of the scope. Set the scope to sweep at a 60-cps rate and adjust the blanking control on the sweep generator to obtain the correct sweep trace.

The test setup is now complete. During the alignment procedure, all adjustments of marker shape, polarity, and amplitude can be made by means of controls on the WR-70A, as can adjustment of sweep-trace amplitude and polarity. It should not be necessary to readjust controls on other test equipment unless the marker or sweep frequencies are changed.

IF Alignment:

The IF-alignment test setup in which the sweep signal is fed into the mixer grid circuit or into the first picture-if amplifier is illustrated in Figure 6. Equipment required is the same as that listed under "RF Alignment". The procedure is as follows:

1. Disable the age circuit in the receiver under test and connect an external source of bias to the tuner and if-amplifier age-bias buses. Adjust the bias voltages from the substitute source to the values recommended by the manufacturer. Apply power to the receiver.

(Continued on page 15)

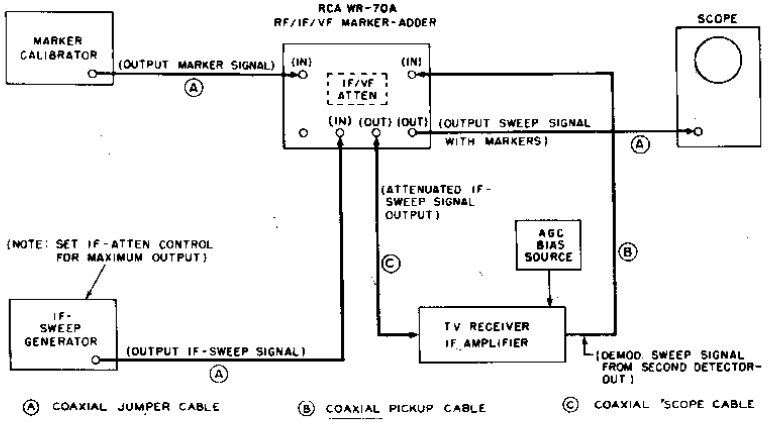
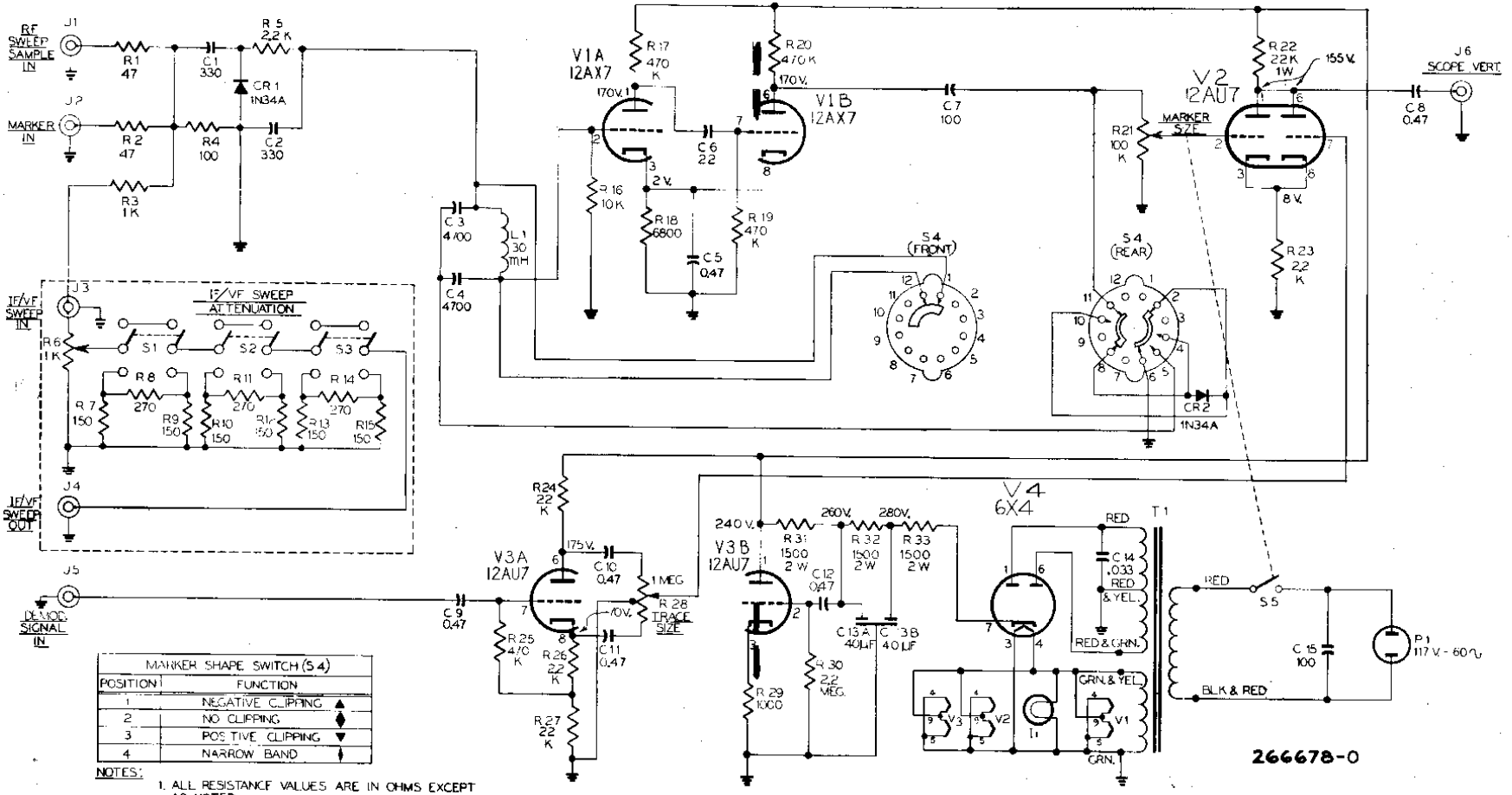


Figure 6. Test setup for if alignment



MARKER SHAPE SWITCH (S4)	
POSITION	FUNCTION
1	NEGATIVE CLIPPING ▲
2	NO CLIPPING ◆
3	POSITIVE CLIPPING ▼
4	NARROW BAND ▮

NOTES:

1. ALL RESISTANCE VALUES ARE IN OHMS EXCEPT AS NOTED.
2. CAPACITANCE VALUES LESS THAN 1.0 ARE IN µF AND 1.0 AND ABOVE ARE IN µµF EXCEPT AS INDICATED.
3. SWITCH S4 VIEWED FROM FRONT WHEN IN MAX. COUNTERCLOCKWISE POSITION.
4. ALL VOLTAGES MEASURED WITH A VOLTOHMYST.

Schematic diagram of RCA WR-70A

Replacement Parts List

WR-70A RF/IF/VF Marker Adder

When ordering replacement parts, include the stock number and description of the part, as well as the serial number and code number of the instrument. Parts should be ordered through a local RCA tube and parts distributor.

Symbol No.	Description	Stock No.
	Capacitors	
C1 C2	Ceramic: 330 μμf ±10%, 500 v.	76552
C3 C4	Mica: 4700 μμf ±10%, 500 v.	39668
C5	Paper: 0.47 μf ±10%, 200 v.	73787
C6	Ceramic: 22 μμf ±10%, 500 v.	206046
C7	Ceramic: 100 μμf ±10%, 500 v.	75437
C8 C9 C10	Paper: 0.47 μf ±10%, 200 v.	73787
C11 C12	Paper: 0.47 μf ±10%, 400 v.	212108
C13A C13B	Electrolytic: 40-40 μf +100% −10%, 300 v.	212107
C14	Paper: 0.033 μf ±10%, 600 v.	73596
C15	Ceramic: 100 μμf ±10%, 500 v.	75437
	* * * * * *	
CR1 CR2	Crystal, diode: type 1N34-A	59395
I1	Lamp, pilot: 6.3 v	31480
J1 J2 J3 J4 J5	Connector: male, single contact, chassis mtg., less terminal	96257
J6	Connector: male, single contact, chassis mtg., with terminal	96257
L1	Reactor: rf, 30 millihenry ±10%, 20 ma	212105
P1	Cord, power: 78" long, with plug	70392
	Resistors	
R1 R2	Composition: 47 ohm ±10%, ½ w.	502047
R3	Composition: 1000 ohm ±10%, ½ w.	502210
R4	Composition: 100 ohm ±10%, ½ w.	502110
R5	Composition: 2200 ohm ±10%, ½ w.	502222
R6	Variable: wire wound, 1000 ohm ±20%, ½ w.	212109
R7	Composition: 150 ohm ±10%, ½ w.	502115
R8	Composition: 270 ohm ±10%, ½ w.	502127
R9 R10	Composition: 150 ohm ±10%, ½ w.	502115
R11	Composition: 270 ohm ±10%, ½ w.	502127
R12 R13	Composition: 150 ohm ±10%, ½ w.	502115
R14	Composition: 270 ohm ±10%, ½ w.	502127
R15	Composition: 150 ohm ±10%, ½ w.	502115
R16	Composition: 10,000 ohm ±10%, ½ w.	502310
R17	Composition: 470,000 ohm ±10%, ½ w.	502447
R18	Composition: 6800 ohm ±10%, ½ w.	502268
R19 R20	Composition: 470,000 ohm ±10%, ½ w.	502447
R21	Variable: wire wound, 100,000 ohm ±20%, ¼ w.	212110
R22	Composition: 22,000 ohm ±10%, 1 w.	512322
R23	Composition: 2200 ohm ±10%, ½ w.	502222
R24	Composition: 22,000 ohm ±10%, ½ w.	502322
R25	Composition: 470,000 ohm ±10%, ½ w.	502447
R26	Composition: 2200 ohm ±10%, ½ w.	502222
R27	Composition: 22,000 ohm ±10%, ½ w.	502322
R28	Variable: wire wound, 1 meg ±20%, ¼ w.	212111
R29	Composition: 1000 ohm ±10%, ½ w.	502210
R30	Composition: 2.2 meg ±10%, ½ w.	502522
R31 R32 R33	Composition: 1500 ohm ±10%, 2 w.	522215
	* * * * * *	
S1 S2 S3	Switch: sliding type, DPDT	46760
S4	Switch: rotary, single section, 4 positions, 3 circuits	212106
S5	Variable: wire wound, 100,000 ohm ±20%, ¼ w.	212110
T1	Transformer, power: 117 v., 60 cps., plate—600 v. 0.025 amp, fil—6.3 v. 2 amp	212101
	Miscellaneous	
	Cable, coaxial: complete with 2 female connectors	212096
	Cable, coaxial: complete with coaxial connector, shell, resistor, capacitor, and 2 clip leads	212097
	Clip, alligator: for test leads	210207
	Connector, cable: female, single contact, with spring guard	48982
	Connector, cable: female, single contact, complete with terminal and spring guard	203574
	Feet, rubber: for bottom of case	212104
	Handle, carrying: plastic	212102
	Insulator: black, for alligator clip	210209
	Insulator: red, for alligator clip	212098
	Knob, control: blue	210111
	Pilot lamp jewel	54660
	Pilot lamp socket	57760
	Shell: for coaxial cable	47452
	Socket, tube: 7-pin miniature	204899
	Socket, tube: 9-pin miniature	204900
	Stud: for case handle	212103

(Continued from page 11)

2. Connect test equipment to a power source and apply power.

3. Connect a jumper cable from the rf-output connector on the marker generator to the MARKER IN connector of the WR-70A. Tune the marker generator to deliver a calibrated signal at the desired output frequency (the picture-carrier intermediate frequency, for example). Set the output-attenuator control on the generator for maximum rf output. It will not be necessary to change the setting of this control during the alignment procedure.

4. Connect a jumper cable from the if-sweep output connector on the sweep generator to the IF/VF SWEEP IN connector on the WR-70A. Set the generator controls to deliver a swept output signal of the required width at the desired frequency. Set the if-output control on the sweep generator for maximum output. Do not change the setting of this control during the remainder of the alignment procedure.

5. Connect the IF/VF-output cable of the sweep generator from the IF/VF SWEEP OUT connector on the WR-70A to the signal injection point in the mixer or first-if stage. Connect the black clip to ground and connect the red clip to the test point. NOTE: The required if-signal level is obtained by use of the IF/VF attenuator built into the WR-70A. For description of use, see "Functions of Controls and Connectors".

6. Connect the pickup cable from the DEMOD SIGNAL IN connector to the sweep-signal take-off point. This point may be at the load resistor of the second detector.

7. Connect a jumper cable from the SCOPE VERT connector to the vertical-amplifier input connector of the scope. Set the scope to sweep at a 60-cps rate and adjust blanking and phasing controls on the sweep generator to obtain the correct sweep trace.

The test setup is now complete. During the alignment procedure, all adjustments of marker shape, polarity, and amplitude can be made by means of controls on the WR-70A, as can adjustment of sweep-trace amplitude and polarity. It should not be necessary to readjust controls on other test equipment unless the marker or sweep frequencies are changed.

Checking Tuner-Oscillator Frequency:

Figure 7 shows the test setup required for use of the WR-70A in checking the frequency of the rf oscillator in a TV tuner. The marker calibrator is set to deliver an rf-output signal at the desired oscillator frequency. A jumper cable is connected from the calibrator to the "MARKER IN" connector on the WR-70A. The coaxial pickup lead is coupled from the tuner to the RF SWEEP SAMPLE IN connector. Place the clip end of the pickup lead into the tuner and adjacent to the oscillator tuned circuits. Do not overcouple.

Connect a jumper cable from the SCOPE VERT connector to the oscilloscope input connector. The receiver oscillator may be set to frequency by observing the

trace on the scope screen. If the signals from the marker generator and the receiver are not at the same frequency, a beat-frequency difference signal will result, producing modulation on the scope trace. Tune the receiver oscillator until zero beat is indicated by disappearance of the modulation. Exact zero beat may be impossible to obtain, however, and the oscillator adjustment should be set to the point which produces the lowest frequency beat signal, as observed on the trace. Set the sweep-frequency controls on the scope to their lowest frequency settings to provide lockin at low beat frequencies.

A headphone may be substituted for the oscilloscope if an audio indication of zero beat is desired.

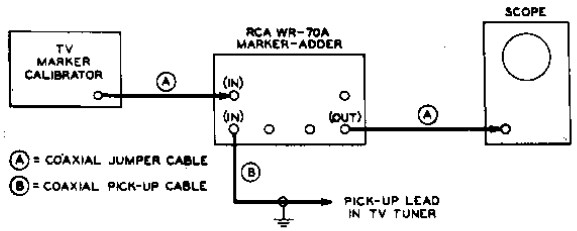


Figure 7. Test setup for checking tuner oscillator frequency of a TV receiver against calibrated marker generator

Maintenance

Note: See "Safety Precautions", Page 2.

A schematic diagram and a block diagram of the WR-70A are included in this instruction booklet to aid in troubleshooting. If trouble is encountered, voltage reading should be taken and compared with those shown on the schematic diagram. If it becomes necessary to replace any parts, only RCA replacement parts or their equivalents should be used. When ordering replacement parts for the WR-70A, consult the Replacement Parts List in this booklet.

The WR-70A may be removed from the case by removing two screws at the rear of the case, removing two screws from the bottom of the bezel, and working the bezel off the front of the case. The bezel, panel, and chassis should be removed as a single unit.

Principles of Operation

Reference to the section, "Function of Controls and Connectors" and to the block diagram in Figure 8 will be helpful in understanding the operation of the WR-70A.

Operation During RF Alignment:

When the WR-70A is used in an rf-test setup, such as that shown in Figure 5, operation is as follows. A sample voltage from the rf sweep generator is fed into the beat-frequency detector circuit, consisting of crystal diode CR1 and associated components, through the RF SWEEP SAMPLE IN connector. This rf sample voltage must be taken out of the rf-sweep generator ahead of the attenuator circuit to insure a constant voltage level at the input to the WR-70A, regardless of the setting of the generator attenuator. A sample-voltage output terminal is provided on late models of the RCA WR-59C and on modified WR-59-series TV Sweep Generators. The rf marker signal, at the desired marker frequency, is taken directly from the rf-output connector or output-attenuator of the marker generator and fed into the MARKER IN terminal. The sweep and marker signals are mixed in the CR1-detector circuit and a beat-frequency (difference) signal is obtained. The beat-frequency differences between the sweep and marker signals will vary from zero to the maximum swing of the sweep excursion. Only a limited band of beat frequencies are selected to form the marker signal. The beat signal is applied to stages V1A and V1B, which amplify the signal. The output from V1B is then applied to the mixer stage, V2, through the MARKER AMPLITURE control, R21, which adjusts marker height. Marker shape and polarity, are determined by L1, C3, and C4, which comprise a low-pass filter, and by CR2, which provides clipping. Switch S4 provides a choice of the markers. In the first three positions of S4, L1 is shorted out and C3 and C4 are disconnected from ground. In the fourth position, the beat signal is passed through the low-pass filter which filters out high-frequency components of the signal, resulting in a narrow marker on the 'scope trace. CR2 is disconnected in switch positions 2 and 4 and no clipping occurs. In position 1, the crystal clips the lower half of the marker; in position 3, polarity of the crystal connections is reversed and the top half of the marker is clipped.

The purpose of the operation just described is to provide a marker of the desired shape which can be applied to the sweep-response trace *after* the trace is taken

from the receiver. This method of superimposing the marker on the sweep trace eliminates trace distortion due to overloading of the receiver by the marker voltage and prevents obscuring the notches and other minute details in the trace by a wide-base marker. In addition, trap circuits in the receiver cannot "suck out" the marker.

The demodulated sweep trace is taken from the receiver at a demodulated-signal point in the tuner, at the second detector, or at high-frequency test points through a demodulator probe. The demodulated signal is fed to V3A through the DEMOD SIGNAL IN connector. V3A provides a small degree of amplification of the sweep signal and, in conjunction with TRACE AMPLITUDE & POLARITY control, R28, provides a means of adjusting polarity and amplitude of the trace displayed on the oscilloscope screen. The sweep signal is coupled from V3A to the adder stage, V2, where the marker pip is superimposed on the sweep trace. The output signal from the adder stage is available at the SCOPE VERT connector for application to the vertical-amplifier section of the oscilloscope.

An exceptional degree of freedom from "bounce", "jitter", and other undesirable scope-trace effects is provided by a unique voltage-stabilizing circuit consisting of V3B and associated resistors and capacitors. The component values are chosen to provide a long time constant. Any variation, such as a line-voltage surge, in the output voltage from the power supply, is applied to the grid of V3B. An out-of-phase signal at the plate causes cancellation of the surge voltage and a high degree of trace stability is obtained.

Operation During IF/Video Alignment:

The advantages of the WR-70A and the method of generating the marker signal, described under "Operation During RF Alignment", are the same for if/vf alignment except that the if/vf signal from the sweep generator is handled differently.

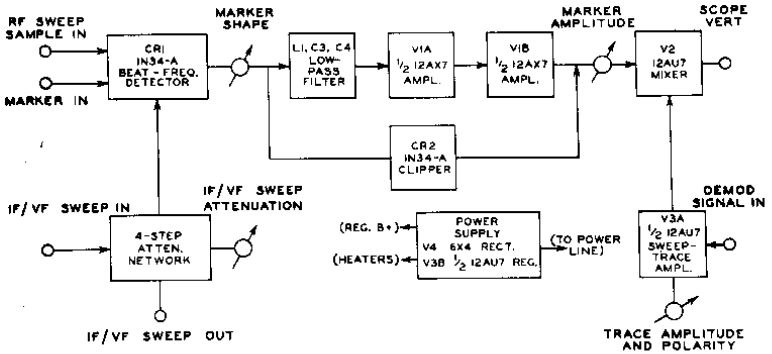


Figure 8. Block diagram of WR-70A

For generation of an if/vf marker, it is necessary, as in the case of an rf marker, to apply the full if/vf-sweep signal to the beat-frequency detector circuit. Because most if/vf-sweep generators are not equipped with a sample-voltage terminal located ahead of the if/vf attenuator, it is necessary to utilize the full if/vf-output voltage from the sweep generator for the WR-70A and to provide an additional means of attenuation before the sweep signal is applied to the receiver undergoing alignment. These requirements are met by feeding the maximum if/vf signal from the sweep generator directly into the WR-70A through the IF/VF SWEEP IN connector. The sweep voltage is fed to the beat-frequency detector circuit through resistor R3. The sweep signal is taken out of the WR-70A through the if/vf-attenuator section, which provides for attenuation of the signal over a range of 60 db. The output sweep voltage is available at the IF/VF SWEEP OUT connector for application to the receiver. The demodulated sweep signal from the receiver is fed into the DEMOD SIGNAL IN terminal, as previously described.

RCA Repair Service

RCA maintains a complete repair service for the adjustment, calibration, and maintenance of RCA test equipment. If it becomes necessary to service this equipment, the report forms enclosed in this booklet should be filled out as described. It is important that:

1. Test equipment be packed carefully.
2. A full description of the trouble be included in the report.
3. All probes, cables, and test leads used with the equipment be included in the shipment.

Attention to these details will help prevent damage in transit and delay in repairs.

(Cut along this line)

Test Equipment Service Report

Date _____ 19__

Name of instrument _____ Type No. _____ Serial No. _____

Is instrument believed to be in warranty? ☐ Yes ☐ No

Description of trouble:

What appears to be wrong? _____

_____

_____

Which controls do not work? _____

_____

Check one:

☐ Repair without quoting cost ☐ Quote cost before making repairs

Owner:

_____
Name

_____
Street

_____
City Zone State

THIS SPACE FOR DISTRIBUTORS ONLY:

☐ Ship instrument to distributor

☐ Ship instrument directly to owner

☐ Instrument is for stock

_____
Dist. Name

_____
Street

_____
City Zone State

To avoid delay in repairs:

1. Be sure to enclose all test leads and probes with instrument.
2. Pack carefully to avoid damage in shipment; test equipment is delicate.
3. Do *not* ship by parcel post. Use railway express or motor freight.
4. Retain a duplicate of this report. Enclose original copy with equipment.
5. Ship instrument prepaid to:

RCA SERVICE CO., INC.
Return Apparatus Control
Building 8-2
Camden, New Jersey

ICE-106A