



# HAM TIPS



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## AN RF MODULATION MONITOR:

### Modified RCA WO-33A 3-Inch Oscilloscope

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RCA's new WO-33A 3-Inch Oscilloscope, which is available both as an easy-to-assemble kit and as a completely-wired, factory-calibrated instrument, has proved excellent for amateur radio use. Because of its plate coupling network (L-2 and R-33 in Figure 4), and the high sensitivity of the 3AQ1 cathode-ray oscillograph tube, the WO-33A is ideally suited for the application of rf signals to its vertical-deflection plates. The sensitivity of the 3AQ1 alone is such that 15 volts rms of rf signal provides at least one inch of deflection on the screen.

Frequencies below 4 Mc can be applied directly to the vertical input terminal of the WO-33A. A simple modification procedure permits monitoring of rf signals from 4 Mc to more than 150 Mc.

Essentially, as shown in Figure 2, this modification consists of adding a 0.01- $\mu$ f ceramic

disc capacitor (C-101) as a high-frequency bypass from cathode to ground, and a 0.005- $\mu$ f ceramic disc capacitor (C-102) as a safety device to insure against excessive voltage being applied to the 3AQ1. A 4- to 40- $\mu$ f ceramic trimmer capacitor (C-103) is mounted on the rear of the WO-33A case for use as a gain control to provide fine adjustment of the rf carrier applied to the 3AQ1 vertical-deflection plates.

Specifically, the modification of the WO-33A as an rf modulation monitor consists of 14 steps, as follows:

(1) Carefully remove instrument from case.

(2) Install the two-lug terminal strip, TS-101, under the left-hand screw (as viewed from rear) holding the 3AQ1 support bracket. Position as shown in Figure 1.

(3) Connect C-101, the 0.01- $\mu$ f disc capacitor, between lug #3 of the 3AQ1 and the grounded lug of TS-101 (attached to chassis). Solder the connection to lug #3 of the 3AQ1.

(4) Connect C-102, the 0.005- $\mu$ f disc capacitor, between lug #6 of the 3AQ1 and the insulated lug of TS-101. Solder the connection to lug #6 of the 3AQ1.

(5) Connect one end of a 12-inch length of hookup wire to the grounded lug of TS-101. Solder.

(6) Connect one end of the other 12-inch length of hookup wire to the insulated lug of TS-101. Solder.

These six steps complete the modification to the chassis. As noted, all connections made

Figure 1: View of rear chassis.

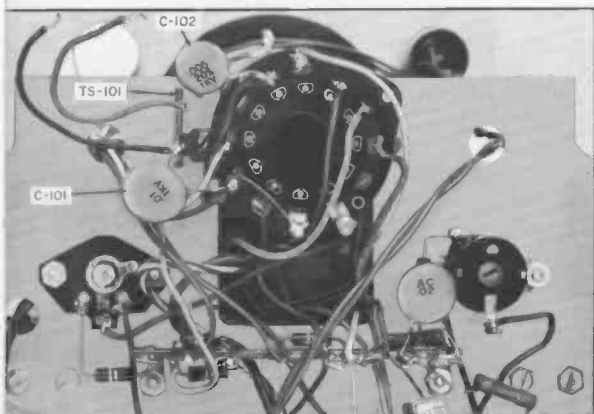
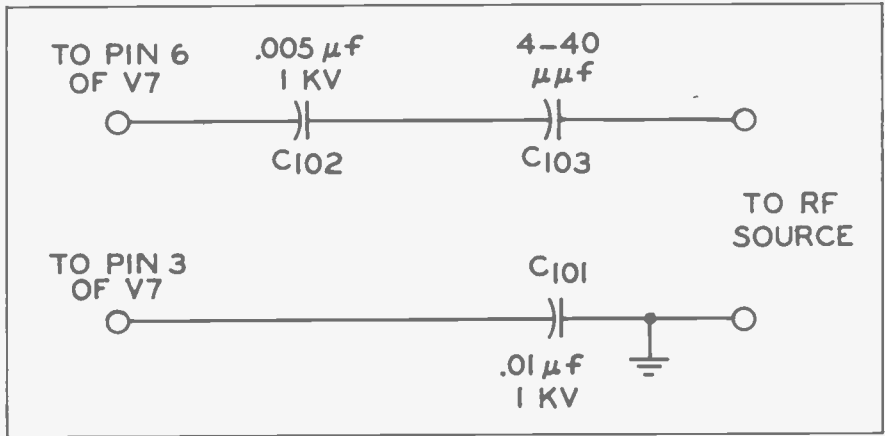


Figure 2: Circuit diagram for modification of WO-33A as an rf modulation monitor.



thus far should be soldered. Check the dress of the two capacitors to insure that the leads do not short against other wires or components. Then:

(7) Remove the knock-out plate on the rear of the WO-33A case.

(8) Locate and mark a point on the rear of the case  $2\frac{3}{8}$ " from the top, and  $3\frac{1}{4}$ " from either side (center). At this point, drill a  $\frac{5}{32}$ " hole for inserting the TS-102 mounting screw.

(9) Mount the four-lug terminal strip (TS-102) on the rear of the case, as shown in Figure 3. Use the #6-32 screw, with the #6 lockwasher and #6 hex nut on the inside of the case.

(10) Replace the instrument in the case, passing the two wires connected to TS-101 through the knock-out hole.

(11) Cut the two wires so that they extend approximately 2 inches outside the case.

(12) Mount the 4- to 40- $\mu\mu\text{f}$  trimmer capacitor (C-103) on the terminal strip TS-102 between lugs #2 and #4, as shown in Figure 3. (The grounded lug is designated as lug #1.)

(13) Connect the grounded hookup wire

to the grounded lug of TS-102 (lug #1).

(14) Connect the other hookup wire to lug #4 of TS-102. Solder lugs #1, #2, and #4 of TS-102. Be sure that good solder connections are made at the two lugs of the trimmer capacitor.

Coaxial cable or 300-ohm TV twinlead may be connected directly from an rf source to lugs #1 (ground) and #2 of terminal strip TS-102 on the rear of the WO-33A case. If coaxial cable is used, connect the braided shielding to lug #1, and the center conductor to lug #2 of TS-102.

When rf signals are applied directly to the vertical plates of the 3AQP1, the vertical input cable should be shorted out and the "Ver-

To modify RCA's WO-33A 3-Inch Oscilloscope for use in monitoring rf signals from 4 Mc to more than 150 Mc, only a few parts are needed, as follows:

- One C-101 (capacitor, ceramic disc, 0.01  $\mu\text{f}$ , 1 kv)
- One C-102 (capacitor, ceramic disc, 0.005  $\mu\text{f}$ , 1 kv)
- One C-103 (trimmer capacitor, ceramic, 4-40  $\mu\mu\text{f}$ )
- One TS-101 (terminal strip, two lugs—with one grounded)
- One TS-102 (terminal strip, four lugs—with one grounded lug at end)
- One screw (6-32 x  $\frac{1}{4}$ ", pan head)
- One #6 internal tooth lockwasher
- One #6 hex nut
- Two insulated hookup wires (12" length)

It is suggested that these two 12-inch lengths of hookup wire be of different color for identification purposes.

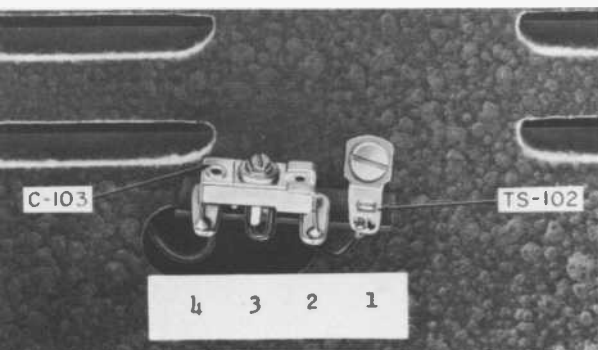


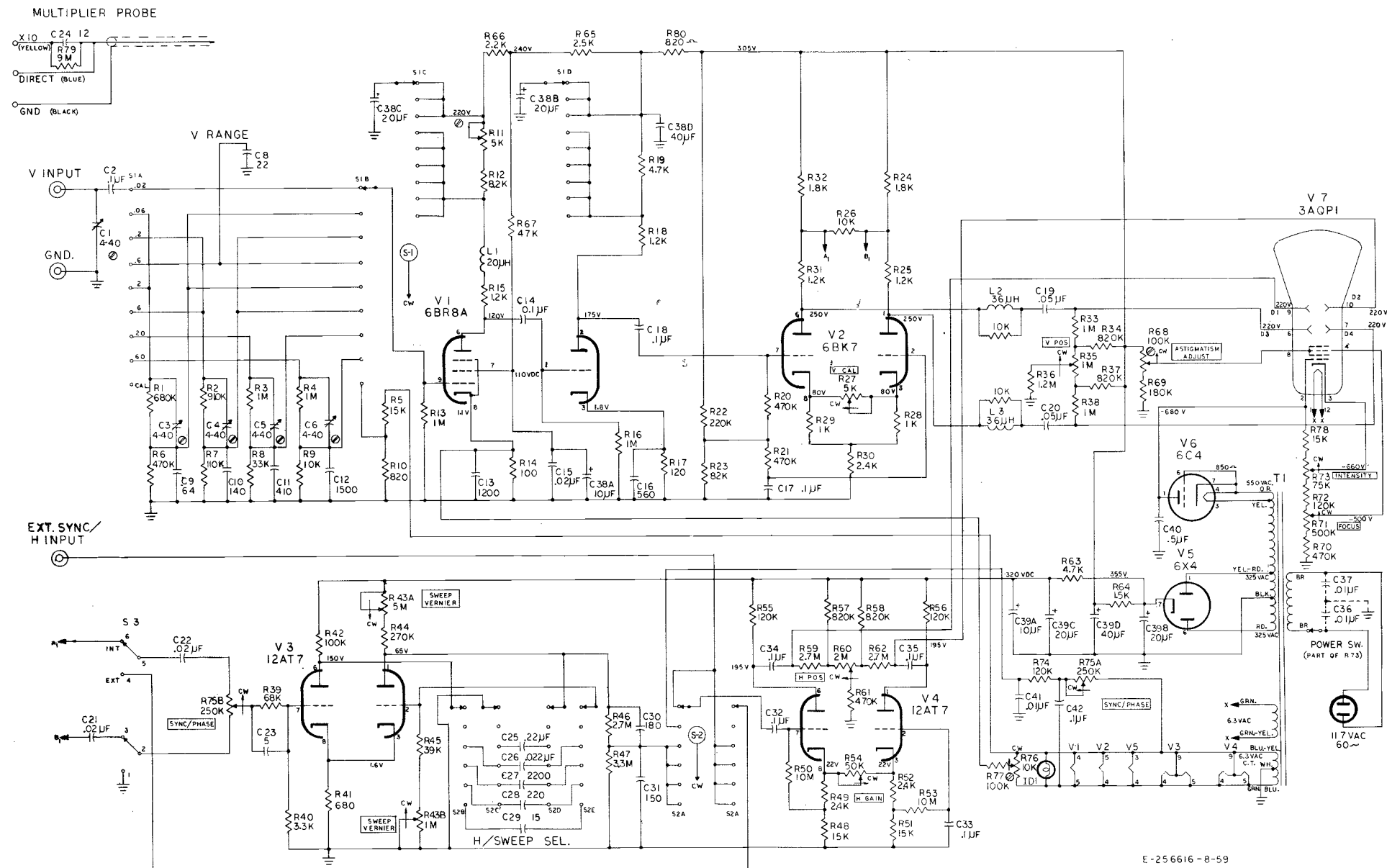
Figure 3: The four-lug terminal strip (TS-102) is mounted on the rear of the case.

tical Range" switch set to position "60". The horizontal amplifier and sweep circuits may be adjusted in the normal manner to obtain modulation patterns as desired.

Normal operation of the WO-33A should not be affected by this modification. However, cables or leads connected to the terminal strip on the rear of the case must be removed be-

fore normal operation is resumed; otherwise, performance is affected by the added capacitance of these cables in the V-2 plate circuit. For information concerning connections to

the transmitter, interpretation of the 'scope pattern, and additional rf applications, radio amateurs should consult the ARRL Handbook or similar publications.



**NOTES**  
 ALL CAPACITORS IN  $\mu\text{JF}$ , UNLESS OTHERWISE SPECIFIED.  
 ALL RESISTORS IN OHMS.  
 ALL VOLTAGES POSITIVE FROM GROUND, AND MEASURED WITH A VOLTOHMYST\*  
 SWITCHES S-1 AND S-2 SHOWN IN MAXIMUM CCW POSITION  
 INSTRUMENTS WITH SERIAL NO.'S 1001 THRU 2300 HAVE TWO 0.01  $\mu\text{F}$  DISC CAPACITORS BETWEEN THE AC LINE AND CASE GROUND

V RANGE	FULL SCALE VOLTS (R-P)	S-1 POSITION
1	0.02	(CCW MAX)
2	0.06	
3	0.2	NARROW BAND
4	0.6	
5	2.0	WIDE BAND
6	6.0	
7	20	
8	60	
9	CAL	

H/SWEEP SEL. SW.	S-2 POSITION	RANGE
1	(CCW MAX)	HOR. INT.
2		LINE
3		15 - 150
4		150 - 1500
5		1500 - 15KC
6		15KC - 75KC

SYNC SW. S-3	POSITION	RANGE
1	RIGHT	EXT.
2	LEFT	INT.

\* TRADE-MARK "VOLTOHMYST" REG. U.S. PAT. OFF.

Figure 4: Schematic diagram of WO-33A and WO-33A(K).

# HALF-KILOVOLT RF PROBE

By Joseph Talavage

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A 500-volt rf probe, useful for obtaining the resonance point of transmitter tank circuits, grid circuits, and other high voltage rf circuits, can be easily constructed with readily available components and two silicon rectifiers. Figure 5 shows the simple schematic diagram for the probe.

RCA-1N1764 silicon rectifiers are used in the probe. Because these rectifiers have a peak inverse voltage of 500 volts each, the two connected in series permit the probe to be useful to peak voltages of 500 volts, or about 350 volts rms. The addition of more rectifiers raises the peak-voltage rating of the probe by 250 volts for each additional rectifier, a decided advantage over a typical crystal-diode rf probe which has a maximum operating voltage of about 28 volts peak.

Circuit operation is such that the dc output of the probe is proportional to the peak value of the input wave. For this reason, and because of the value selected for  $R_1$ , best accuracy is obtained when the input wave is sinusoidal.

An increase in the value of  $C_1$  will extend the low-frequency response, but will also affect the accuracy of the reading. However, if  $C_1$  is increased in value, the accuracy of the probe can be adjusted to an optimum value by means of compensating changes in the value of  $R_1$ .

The probe circuit can be constructed to fit

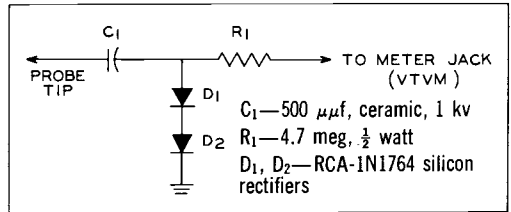
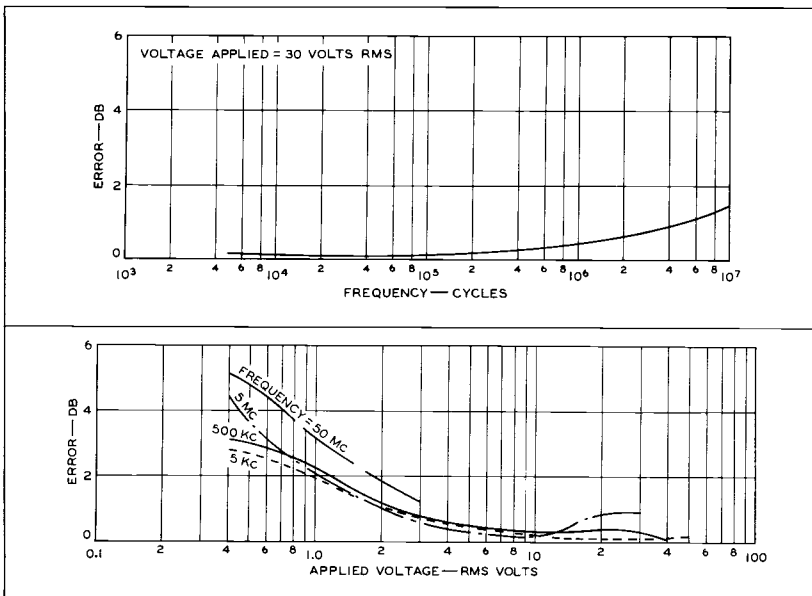


Figure 5: Simple schematic diagram and parts list of author's half-kv rf probe.

easily inside a discarded low-capacitance probe case. It was connected directly to an RCA WV-98A Senior *VoltOhmyst*<sup>®</sup>, through a shielded cable, and tested over a frequency range from 5 kilocycles to 50 megacycles, and a voltage range from 0.4 to 50 volts rms. Figures 6 and 7 show that for frequencies to 50 Mc, the greatest accuracy is obtained at voltages greater than 3 volts. The loading effect of the probe on resonant tank circuits was found to be negligible to at least 10 Mc.

Although all the tests were made with only one rectifier in the probe, the accuracy above 3 volts is relatively unaffected by the addition of the second rectifier.

Use of the probe involves a few simple steps: (1) place the selector switch of the VTVM in the "—DC" position; (2) apply the probe tip and ground wire to the correct points; and (3) read the *rms* value of the rf voltage on the appropriate dc scale.



Figures 6 (top) and 7, as noted in text, show that for frequencies to 50 Mc, the greatest accuracy is obtained at voltages over 3 volts.



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Harvey Slovik, Editor

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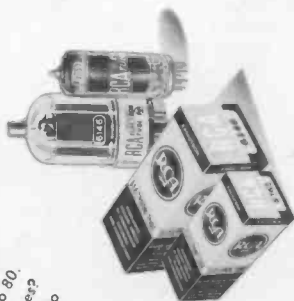
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