OPERATING INSTRUCTIONS

for

MEASUREMENTS MODEL 80

INSTRUMENT SERIAL No. 2205

MEASUREMENTS CORPORATION

BOONTON NEW JERSEY

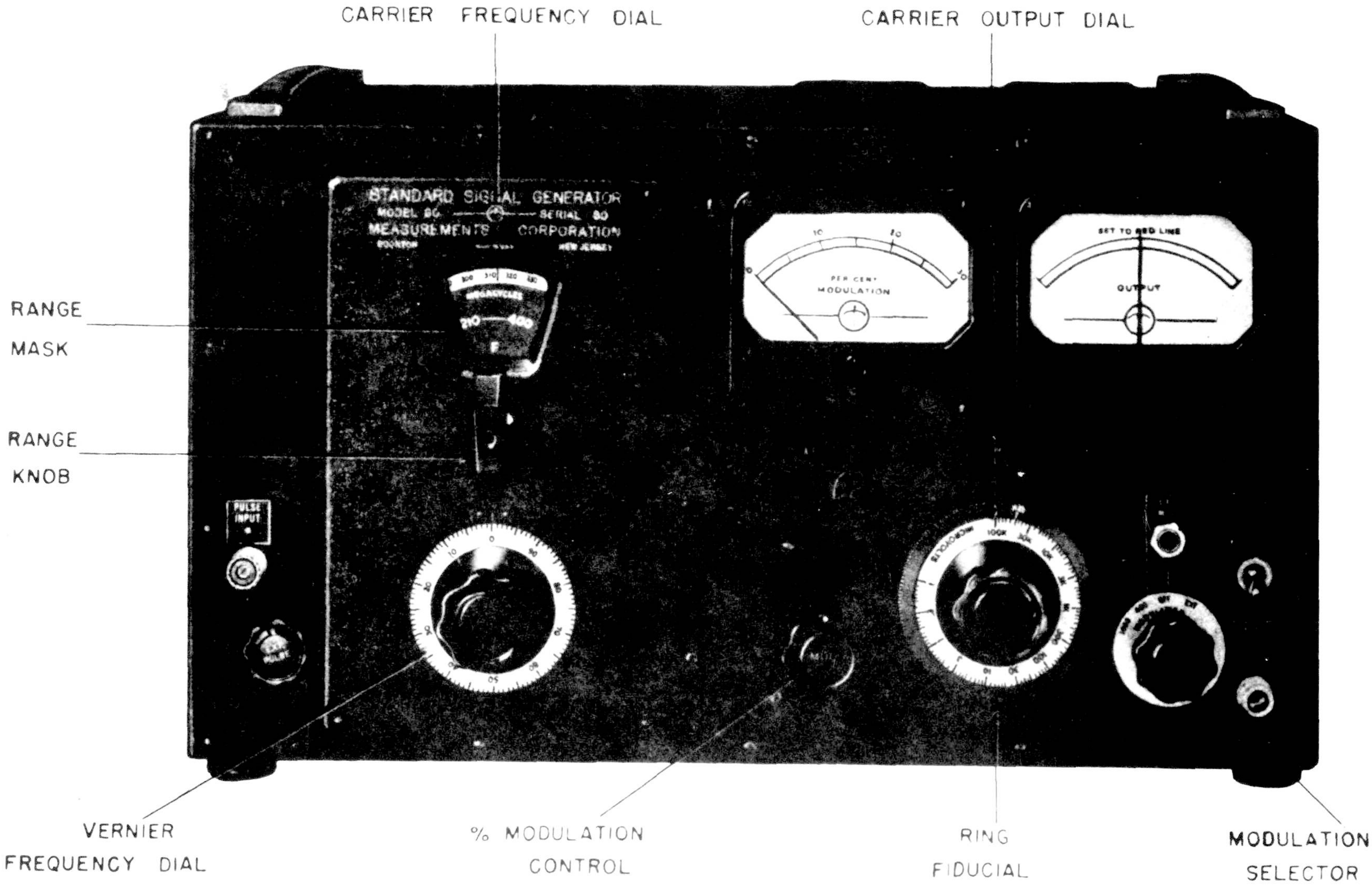


Figure 1-1—Front View of Model 80

SECTION I

GENERAL DESCRIPTION

1. INTRODUCTION.

a. This handbook describes the basic operation, construction and maintenance of the Model 80 Standard Signal Generator. Revision sheets will be supplied from time to time covering special problems of application and maintenance encountered by users of this equipment.

b. The Model 80 is a portable instrument providing standard radio frequency test signals of accurately known frequency and amplitude. Though designed as a laboratory standard, the Model 80 is sufficiently flexible for use in production testing or field maintenance of communications and video equipment.

2. GENERAL CHARACTERISTICS.

a. CARRIER FREQUENCY RANGE.

(1) 2 to 400 megacycles in six bands. The range switch operates a mask to conceal those frequency ranges that are not in use.

(2) Each range is individually calibrated and is accurate to within ±0.5%.

(3) Small increments of carrier frequency can be obtained by means of a 0 to 100 vernier dial which is adjustable to place its zero at any desired center frequency.

(4) Backlash in the tuning mechanism is less than one division of the vernier dial, (one part in 1,850).

b. CARRIER OUTPUT SYSTEM.

(1) Continuously variable from 0.1 to 100,000 microvolts.

(2) Stray radiation is less than 0.1 microvolt at any point outside the case.

(3) Continuous metering of the 100,000 microvolt absolute level permits manual correction for variations in output vs. frequency, without disturbing the "Microvolt Dial" setting.

c. OUTPUT IMPEDANCE.

(1) Approximately 50 ohms (across output jack).

(2) A selection of matching pads and output cables is available on order to match the Model 80 output to various types of equipment. See "Equipment Not Supplied", and "Connections for Operation".

d. MODULATION.

(1) Sine-wave modulation, continuously variable from 0 to 30%, is indicated directly on Per Cent Modulation Meter. Choice of 400 or 1,000 cycles from an internal RC type oscillator, or external modulation over the range of 50 to 10,000 cycles. An external signal of approximately 5 rms. volts is sufficient for 30% modulation.

(2) Input jack provided for pulse modulation from an external source (such as the Measurements Corp. Model 79 Pulse Generator). The minimum pulse width vs. carrier frequency varies somewhat, in accordance with the graph of Figure 4. A pulse amplitude of 180 peak volts will provide a carrier amplitude equivalent to the continuous-wave value of the Model 80 carrier output.

e. POWER SUPPLY SOURCE.

(1) Potential........ 117 volts
(2) Frequency........ 50 to 60 cycles
(3) Power Consumption.... 65 watts
(4) Fuse Protection........ one type 3AG 1 ampere

SECTION III

THEORY OF OPERATION

1. CARRIER OSCILLATOR.

a. A type 955 "acorn" triode is used in a Colpitts split-stator, plate-modulated oscillator circuit. The critical parts of this oscillator circuit are rigidly mounted on ceramic supports for maximum stability. A resistor, R11, is employed to minimize the effects of cathode lead inductance. (The Oscillator Assembly is shown in Figure 3-2).

b. The tuning condenser is coupled to the carrier frequency dial by a phenolic bushing. The frequency dial is rotated by a Vernier Frequency Dial which is pivoted so as to disengage when pressed downward. (See Figure 3-4). This permits resetting of the Vernier Frequency Dial so that its zero will correspond to any desired frequency. It is impossible to force the tuning mechanism when the stop is reached, since the Vernier Dial will automatically jump down and slip. The resulting jumpy action indicates that the usable part of the range has been passed. No moving contacts are used in the tuning condenser and the rotor is insulated from ground to eliminate tuning noise. Spring loading of the tuning reduction gears provides smooth operation with a minimum of dial backlash.

c. Band switching is accomplished by rotating a disc on which the six R.F. coils are mounted, (see Figure 3-3). Detents in the edge of the coil disc engage a spring-loaded detent roller to index the coils into proper position. The three contacts of each coil (shown in Figure 3-3), are formed of solid coin silver to provide reliable contact over long periods of use.

d. "Leakage" from the filament and plate supply lines of the oscillator tube, V-11, is prevented by three-section R.F. filters, each section being isolated within a separate shield.

2. OUTPUT SYSTEM.

a. The Output Meter serves merely as a balance indicator for a High-Frequency Barretter Bridge. All values of carrier output are obtained with reference to an absolute level of 0.1 volt, this being the voltage existing across the "Barretter Loop" which, in turn, controls the position of the Output, or "Attenuator Loop".

b. The two mutual inductance type loops are mounted on separate sliding tubes which are concentric with respect to each other and to a fixed outer tube. The outer of the two sliding tubes is positioned by adjusting the "Output Ring Fiducial" until the loop affixed to it yields exactly 0.1 volt of carrier. A coaxial line couples this 0.1 volt level to a "bolometer" element which varies the resistance of one arm of the Barretter Bridge, according to the amount of R.F. power applied to the bolometer. There are two of these bolometer elements, since a "dummy" bolometer is employed in an opposite arm of the bridge to compensate for temperature effects.

c. The two bolometers are identical and consist of .0001″ platinum filaments in small evacuated glass envelopes. Careful matching is required, since the two bolometers should show similar resistance variations with respect to current and ambient temperature.

d. The Barretter Bridge operates on 60 cycle a.c. supplied by the power transformer. Variations above or below the 0.1 volt absolute carrier level will unbalance the Barretter Bridge, as the resistance of the Measuring Bolometer departs from its proper value. This unbalance causes a portion of the 60 cycle bridge driving voltage to appear at the input grid of V-9, the Bridge Amplifier.

e. The amplitude and phase of this "unbalance" voltage will determine the degree and polarity of the Output Meter deviation from its zero center position. The Output Meter is able to respond to changes in *phase* of the "unbalance" voltage because of a unique method of operating the twin-triode, V-10, entirely from 60 cycle a.c. Since the grids of V-10 are both driven by the 60 cycle "unbalance" voltage, an aiding and bucking condition occurs in the two plate currents, depending on the phase relation between the unbalance voltage and the voltages which are supplied to the cathodes of V-10. (See Figure 6-1).

f. This system of output metering enables the absolute reference level of 0.1 volts (100K microvolts) to be manually corrected by means of the Ring Fiducial without disturbing the Microvolt Dial setting. Since the Ring Fiducial adjustment carries the inner, or "attenuator" tube along with it, a carrier output correction is made which will assure that the actual output is in accordance with the setting of the Microvolt Dial.

g. The Output Meter will be affected by modulation of the carrier since the Barretter Bridge system is a power operated device and indicates r.m.s. values. The increases in carrier power which accompany amplitude modulation will therefore unbalance the Output Meter. This deflection should be ignored, however, since carrier output adjustments are in terms of "microvolts" across 50 ohms, and the average value of output *voltage* is not affected by modulation. A carrier output level *must* be established with the Modulation Selector Switch at "off" (continuous-wave) and this level should be checked from time to time by returning the switch to "off" and noting whether the Output Meter returns to the red center line.

3. SINE-WAVE MODULATION.

a. The sine-wave oscillator included in the modulator section of the Model 80 operates on the resistance-tuned principle. Regeneration between the two tubes, V-1 and V-7, is controlled by the frequency selective network comprising C20, C21, R23 and R24. This regenerative network has a peak response at 400 cycles, causing the circuit to oscillate at that frequency. Two resistors, R25 and R26, may be switched across R23 and R24, tuning the network to 1,000 cycles. Another network, comprising C24 and R31, applies a degenerative voltage across the ballast lamp, V-3. The rapid increase in resistance of this lamp with respect to increases in feedback voltage tends to limit the oscillation to linear portions of the tube characteristics.

b. One section of the twin-triode, V-8, is used in a resistance coupled amplifier of which V-2 is the power output tube. The output of V-2 is metered in terms of per cent modulation by the other section of V-8, connected as a diode. The sensitivity of this diode is adjusted at the factory by means of R41 (% Mod. Cal.) while its small contact potential is balanced out by adjustment of R43 (% Mod. Zero Set).

4. PULSE MODULATION.

a. When the "Ext. Pulse" knob is turned from "off" to "on" the plate circuit of the carrier oscillator is switched from the modulator output to the "Pulse Input" jack. Since V-11 is now deprived of its plate voltage it will not oscillate unless an external supply is connected to the "Pulse Input" jack. The external supply may be a pulse generator, such as the Measurements Model 79-B. This pulse generator has the required minimum output of 150 peak volts and its type #49194 output jack corresponds to the "Pulse Input" jack of the Model 80 so that a #84-Z2-1 patch cable may be used (see "Equipment Not Supplied", Section I, 4).

b. Since the pulse filters are designed for a cutoff around four megacycles some "leakage" will be experienced when pulsing below fifteen megacycles. When the pulse switch is returned to the "off" position more filters are inserted and no difficulty should be experienced with leakage at any carrier frequency in the Model 80 range.

c. The output metering system will not indicate correctly when using pulse modulation. Approximately the same peak B+ voltage is applied from a Model 79-B Pulse Generator as is normally supplied to the oscillator of the Model 80 for continuous-wave operation of the carrier; therefore it is proper to assume the same peak value of carrier output for both conditions. This may not be quite true for very wide pulse widths, since the pulse voltage supplied by the Model 79-B is not quite constant for all pulse widths.

4. TO SET UP AND OPERATE.

a. Connect the a.c. line plug to a source of 117 volt, 50 to 60 cycle power and flip the toggle switch marked "Power" to its "On" position. Illumination of the dial marked "Megacycles" shows the instrument to be ready for operation.

b. After a brief warm-up period rotate the "Range" bar knob (see Figure 1-1), until the desired carrier frequency range appears in the dial window. Use sufficient torque when turning this knob to unseat the range detent and engage the desired range solidly in its proper contacts. Rock the knob slightly from side to side to test for detent.

c. To obtain a *continuous-wave* carrier output, turn the "Ext. Pulse" knob to its "Off" position and set the Modulation Selector also to "Off".

d. Set the Output Meter pointer to the red center line by adjusting the Ring Fiducial (shown in Figure 1-1). This adjustment should be made during continuous-wave operation only.

e. Final tuning may be completed at this point. To facilitate selectivity measurements about any center frequency the "Vernier Frequency" dial may be disengaged from the tuning mechanism by pressing downward on the Vernier Knob. While holding this knob down, rotate it so as to place its zero at the fiducial mark, then release the knob carefully so as not to disturb the carrier frequency setting. The Vernier Dial is now ready for selectivity or other measurements requiring small increments above and below a given frequency.

f. To set the *carrier output* to a desired value, merely adjust the "Microvolt" Dial with reference to the white line on the Ring Fiducial. If one of the 6 db. matching pads listed in Section I, 4 is used, the "Pad" mark on this ring becomes the output reference line. The maximum output obtainable from a 6 db. pad will then be 50K (50,000) microvolts.

g. Sine-wave modulation at 400 or 1,000 cycles is obtained by setting the "Modulation" Dial to 400 or 1000 and adjusting the "Mod." knob until the "Per Cent Modulation" meter indicates the desired depth of modulation. Other modulation frequencies can be obtained by plugging an external audio oscillator into the jack marked "Ext. Mod."

h. During sine-wave modulation the position of the Output Meter pointer will change. This is a normal response to the changes in carrier output power which accompany modulation and should be ignored. Do not disturb the Output Ring Fiducial unless the Output Meter remains off center when the Modulation Dial is returned to the "Off" position.

i. To *pulse modulate* the carrier an external pulse generator must be connected to the jack marked "Pulse Input". Turning the "Ext. Pulse" knob *clockwise* to "On" will disconnect the internal modulator to permit direct pulsing of the carrier from an external source. Figure 2-2 shows the minimum pulse width limits for an average Model 80 when connected to the Measurements Corp. Model 79-B Pulse Generator.

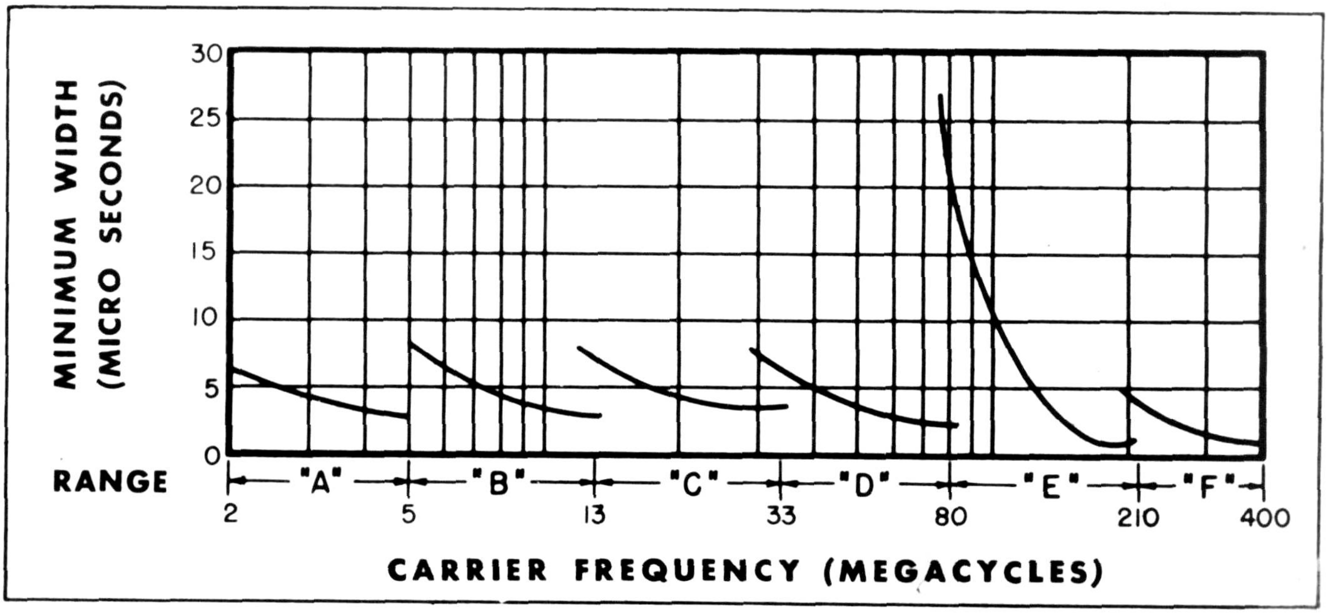


Figure 2-2—Minimum Pulse Width vs. Carrier Frequency

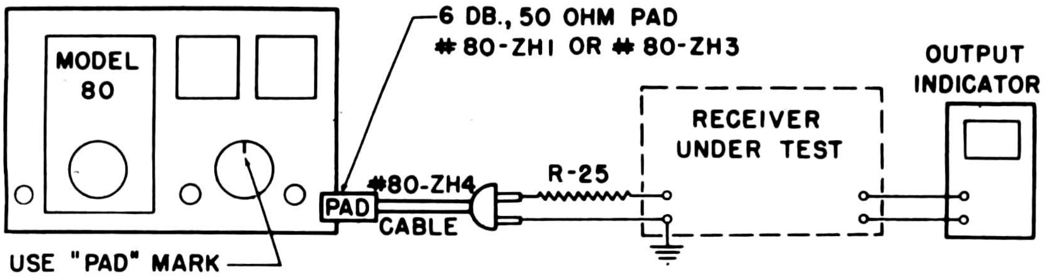


FIGURE 3-A. For unbalanced antenna inputs at frequencies below 200mc.
(R=resistance of antenna from which receiver is designed to work.)

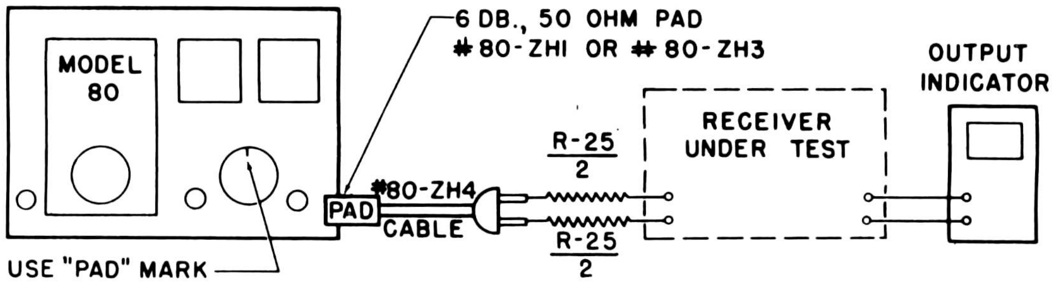


FIGURE 3-B. For balanced antenna inputs at frequencies below 200mc.
(R=resistance of antenna from which receiver is designed to work.)

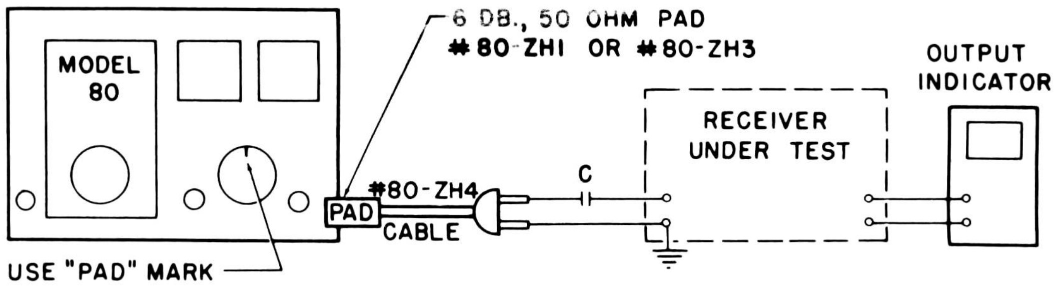


FIGURE 3-C. For short, pure capacity antenna at frequencies below 200mc.
(Xc should be much greater than 25 ohms.)

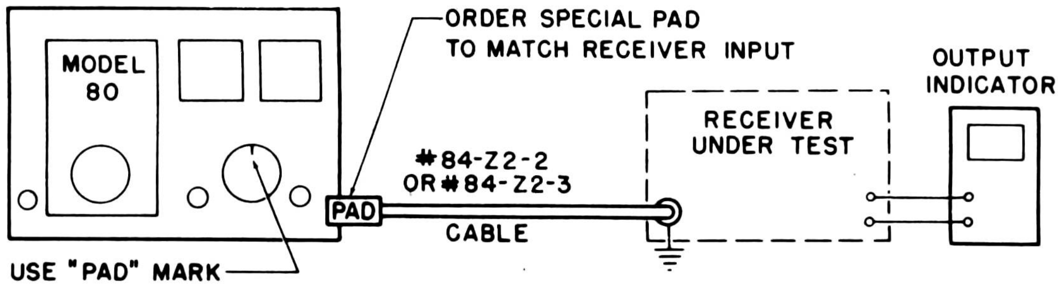


FIGURE 3-D. Recommended for frequencies above 100mc.
(#84-Z2-3 cable and #80-ZH3 pad preferred for 50 ohm inputs.)

Figure 2-1—Receiver Antenna Connections

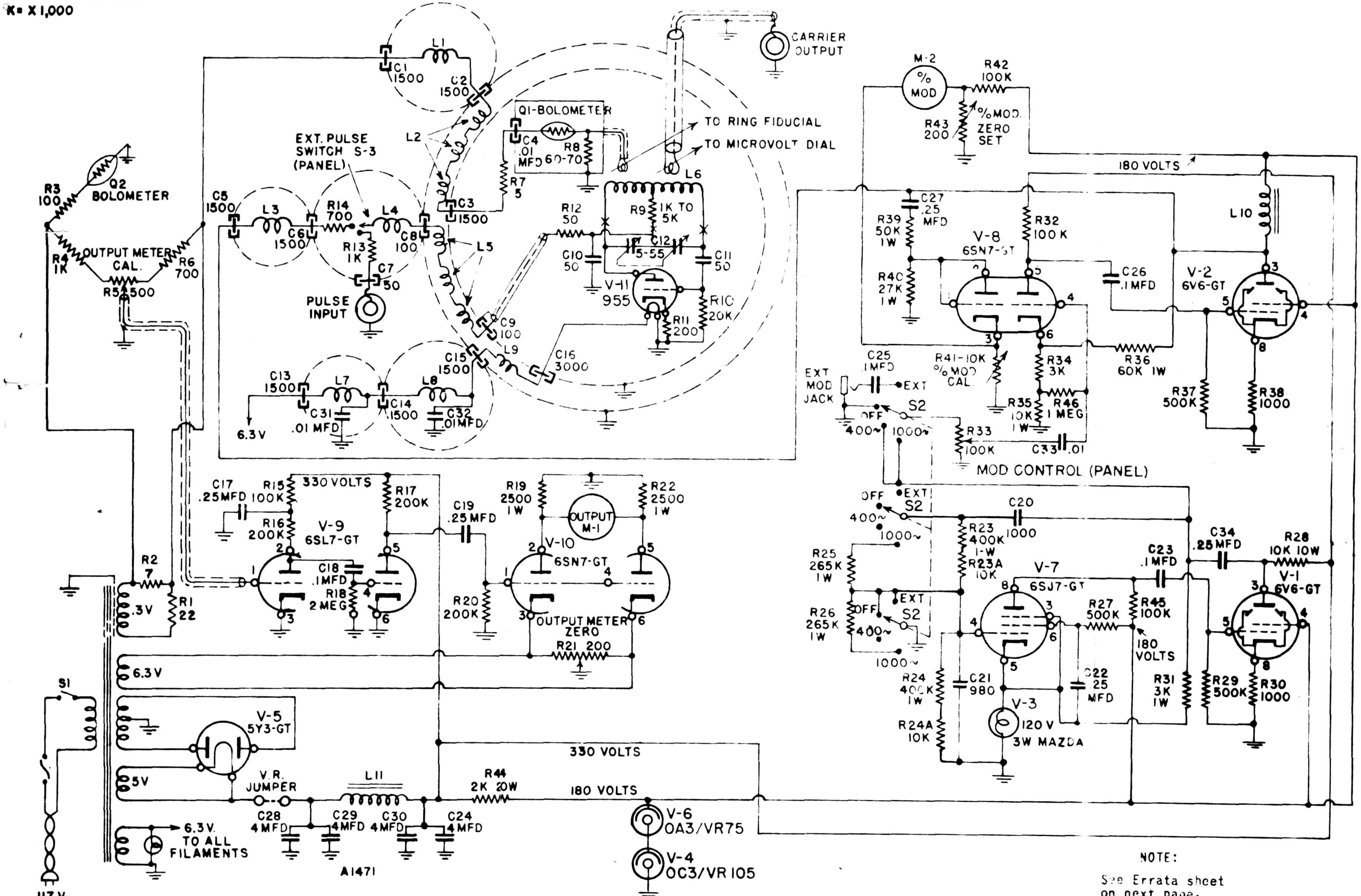
Figure 3-7

Tube Voltage Chart. All DC voltages are positive and measured from ground with 20,000 ohms per volt meter. All AC voltages are RMS measured from ground with a 1000 ohms per volt meter.

TUBE		PLATE		SCREEN		GRID		CATHODE		B+ SUPPLY
NO.	TYPE	PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	
V-1	6V6-GT	3	200	4	180	5	0	8	13.0	330
V-2	6V6-GT	3	180	4	180	5	0	8	13.0	180
V-3	120 V. 3 W. MAZDA	APPROX. 2 - 5 RMS. VOLTS TO GROUND								
V-4	OC3/VR 105	5	105	-	-	-	-	2	GROUND	-
V-5	5Y3-GT	4 6	300 AC 300 AC	-	-	-	-	2	340	-
V-6	OA3/VR 75	5	180	-	-	-	-	2	105	330
V-7	6SJ7-GT	8	85	6	45	4	0	5	2.0	180
V-8	6SN7-GT	2	0	-	-	1	0	3	0	-
"	"	5	230	-	-	*	30	6	40	330
V-9	6SL7-GT	2	50	-	-	1	0	3	GROUND	330
"	"	5	100	-	-	4	0	6	GROUND	330
V-10	6SN7-GT	2	0	-	-	1	0	3	3.15 AC	-
"	"	5	0	-	-	4	0	6	3.15 AC	-
V-11	955	-	170	-	-	-	0	-	1 TO 3.5	180

* Measured at junction of R34, R35 and R46.

RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
CAPACITIES IN MMFD " " "
K= X 1,000



NOTE:
See Errata sheet on next page.

FIGURE 6-1—WIRING DIAGRAM

REVISED

ERRATA SHEET - MODEL 80

Since this book was printed the Drawing Numbers of some of the parts have been changed.

Below we give the old number (used in the text and Table of Replaceable Parts) and the new number which replaces it. In ordering replacements, please refer to the new number wherever possible, to aid us in furnishing you with the proper replacement part.

OLD DWG. NO.	NEW DWG. NO.
80-A3	A-1432
80-A4	A-1433
80-C2-C	A-1435
80-C3-D	A-1436
80-C4-D	A-1437
80-C5-D	A-1438
80-C6-C	A-1439
80-C7-D	A-1440
80-C8	A-1441
80-C9	A-1442
80-C10	A-1443
80-C11	A-1444
80-DH1-N	B-1402
80-K1-E	A-1471
80-K2	A-1472
80-L1	A-1473
80-L2-G	A-1474
80-L2	A-1474
80-03	A-1478

OLD DWG. NO.	NEW DWG. NO.
80-061	A-1499
80-OH1-F	B-1407
80-OH2-E	B-1408
80-OH6-L	B-1411
80-R12	A-1513
80-R15	A-1516
80-R45-C	A-1535
80-R64	A-1560
80-RH2-J	Replaced by B-1423
80-RH11	A-1421
80-RH13-C	B-1423
80-RH14	A-1424
C-12	A-2591
C-13	A-2592
C-14	A-2593
C-15	A-2594

NOTE:

In section 1, par. 7, and in the "Wiring Diagram", V4 should be OA3/VR75 instead of VR-105-30 and V6 should be OC3/VR-105 instead of VR-75-30.

Capacitor C33 should be listed in the Table of Replaceable Parts as: .01 mfd 20% 600V Input Blocking Condenser Solar XT1M4 - .01 or Sangamo 2104 - .01.

Capacitor C34 should be listed as Solar XT1M6 - .25 or Sangamo 2106 - .25 instead of Solar XT1MW.