OPERATING INSTRUCTIONS

1181-B

TYPE 1181-B FREQUENCY DEVIATION MONITOR

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CAMBRIDGE 39, MASSACHUSETTS, USA

643-F

OPERATING INSTRUCTIONS

TYPE 1181-B FREQUENCY DEVIATION MONITOR

Form 643-F
August, 1958

GENERAL RADIO COMPANY

CAMBRIDGE 39 — MASSACHUSETTS

SPECIFICATIONS

TYPE 1181-B

SCALE RANGE:	±30 cps, readable to one cycle.
CARRIER FREQUENCY RANGE:	540 to 1600 kc.
ACCURACY:	When received, within ±5 parts per million. An adjustment is provided to bring the reading into agreement with monitoring station measurements.
STABILITY:	Better than one part in a million under normal operating conditions for six months after initial aging period. Adjustments are provided to correct the indicated frequency in terms of standard-frequency transmissions when necessary.
RF INPUT:	0.05 to 2.0 volts, modulated or unmodulated.
COUPLING TO TRANSMITTER:	A few inches of wire as antenna is usually sufficient coupling to transmitter.
QUARTZ CRYSTAL:	Type 376-T.
TUBES:	3 - 6SJ7, 2 - 6H6, 1 - 5V4-G, 1 - OC3/VR105, 2 - 6AC7, 2 - 6SQ7-GT, 1 - 6B4-G, 1 - 2050, 1 - 6V6-GT
ACCESSORIES SUPPLIED:	Quartz crystal, two CAP-35 Power Cords, spare fuses, and plug for external-meter connection.
REMOTE INDICATOR:	External meter can be used. Maximum external loop resistance is 5000 ohms.
POWER SUPPLY:	105 to 125 (or 210 to 250) volts, 50 to 60 cps.
POWER CONSUMPTION:	25 watts for heater circuits, 100 watts for monitor circuits.
MOUNTING:	19-inch relay-rack mounting.
PANEL FINISH:	Standard GR black crackle. Other standard finishes that can be processed in quantity will also be supplied.
DIMENSIONS:	Panel length 19 in, height 15-3/4 in, depth behind panel 13 in.
WEIGHT:	51 lb.

FCC Type Approval No.: 3-106.
General Radio Experimenter reference: Volume 32, No. 11, April, 1958.

U. S. Patents 2,298,177 and 2,362,503. Licensed under patents of Radio Corporation of America.

TYPE 1181-BT

Same as for Type 1181-B except:

INPUT FREQUENCY:	3.579545 Mc, unmodulated.
FREQUENCY STABILITY:	±1 cps for 30 days; ±5 cps for 1 year.
QUARTZ CRYSTAL:	Type 376-R.
COUPLING TO TRANSMITTER:	Shielded cable and plug provided.

TYPE 1181-BH

Same as for Type 1181-B, except:

FREQUENCY:	1.6 to 15 Mc.
FREQUENCY STABILITY:	±1 ppm for 30 days, or better; ±5 ppm for 1 year.
RF INPUT:	From 1.6 to 5 Mc, 0.1 to 2.5 volts, modulated or unmodulated. From 5 to 15 Mc, 0.4 to 3.0 volts, modulated or unmodulated.
QUARTZ CRYSTAL:	Type 376-R.
COUPLING TO TRANSMITTER:	Shielded cable and plug provided.

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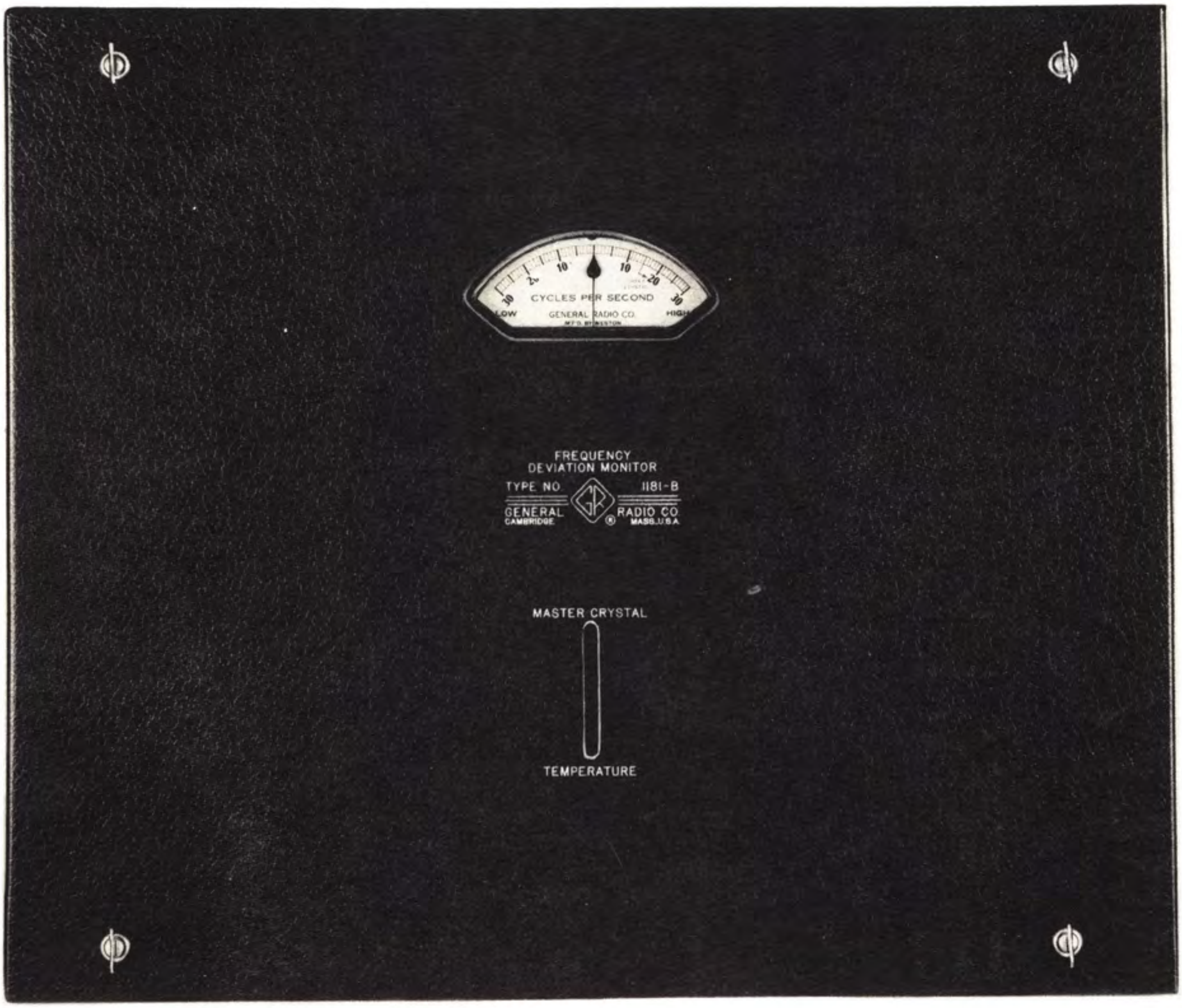

Figure 1. Type 1181-B Frequency Deviation Monitor.

TYPE 1181-B
FREQUENCY DEVIATION
MONITOR

Section 1

INTRODUCTION

1.1 PURPOSE. The Type 1181-B Frequency Deviation Monitor (Figure 1) indicates directly the magnitude and direction of the frequency deviation of an am broadcast transmitter to enable the station to comply with frequency tolerance specifications of the Federal Communications Commission and of similar commissions in other countries. The monitor can be used either at the transmitter site or at a location remote from the transmitter in accordance with FCC rules permitting unattended operation of transmitters. Because of the low input signal level required (about 50 millivolts), remote operation is possible at distances up to several miles from the transmitter with only a tuned antenna. Beyond this distance, an rf power amplifier, of the type commonly used with remote control systems, is required.

Ease of installation, operation, and maintenance were cardinal principles in the design of this monitor. All adjustments are color-coded either red, yellow, or green to distinguish between critical, semicritical, and noncritical adjustments. As a further aid to maintenance, the entire monitor can be withdrawn on slides and tilted forward for easy accessibility to all components.

1.2 DESCRIPTION. As shown in the elementary block diagram (Figure 2), the rf signal from the broadcast transmitter is amplified and injected into a mixer, where it is compared with the amplified output of a piezoelectric oscillator set at a frequency 1 kc above or below the transmitter assigned frequency. The output of the mixer will therefore be 1 kc plus or

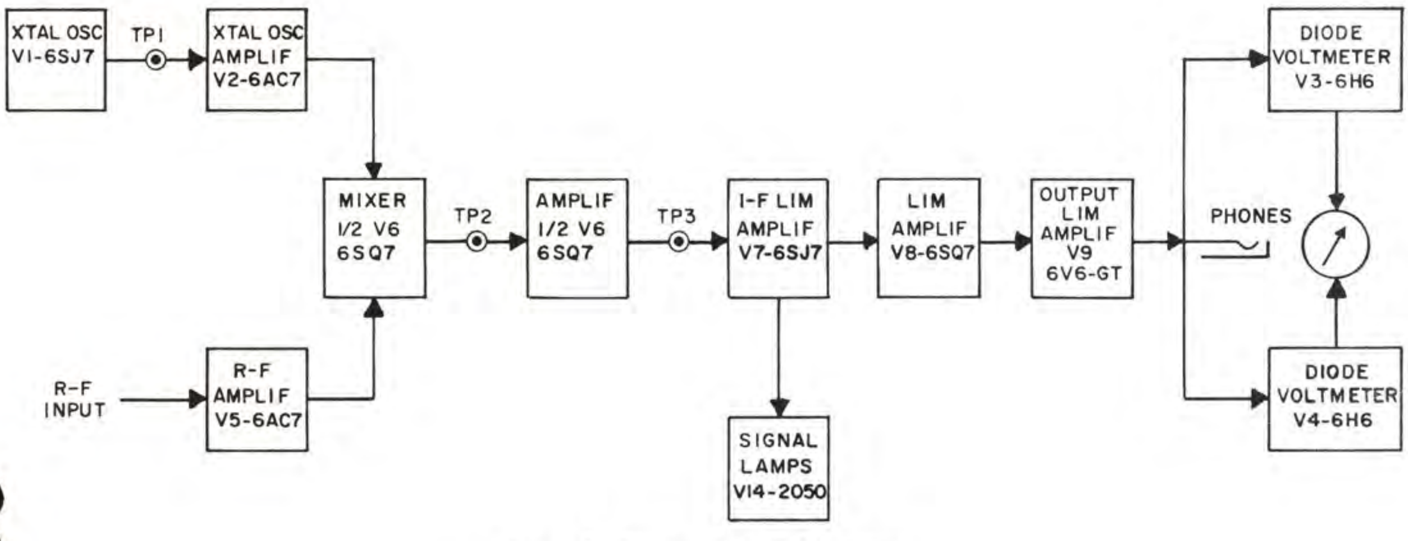

Figure 2. Elementary Block Diagram.

minus any deviation of the rf input signal. The mixer output is a sine wave, which is amplified, limited, and converted to a constant-amplitude square wave. The square-wave signal is transformer-coupled to a differential diode voltmeter, which is so designed that an input signal of a frequency other than 1 kc will cause current to flow in the panel meter, indicating the magnitude and direction of deviation.

1.3 ACCESSORIES. Accessories supplied with the Type 1181-B Frequency Deviation Monitor are: two Type CAP-35 Power Cords, a dummy plug (refer to paragraph 2.5), and spare fuses.

Section 2

INSTALLATION

2.1 MOUNTING CONSIDERATIONS. The relay rack that is to house the monitor should be grounded. If no relay rack is to be used, ground the monitor through the R-F INPUT ground binding post. Do not mount the monitor in racks above power rectifiers or near other equipment generating large amounts of heat, or else the monitor's temperature control system may malfunction. Under no circumstances should the monitor be subjected to an ambient temperature above 120 F. Instructions for installing the monitor in a relay rack are given in a separate sheet shipped with the instrument.

2.2 POWER SUPPLY. The power source for which the monitor is wired is indicated on the nameplate adjacent to the two power input receptacles at the rear of the monitor. If for any reason the supply voltage is to be changed, reconnect transformers T2 and T3 as indicated in Figure 7, reverse the nameplate, and replace the fuses as indicated in the Parts List.

2.3 COUPLING TO TRANSMITTER. Close coupling to the transmitter is not required, and a very short single wire in the room should be sufficient to provide the 50 millivolts required. A standard EIA monitoring output connection, if available on the transmitter, may be used if a 10:1 attenuator is inserted.

2.4 PRELIMINARY CONNECTIONS AND ADJUSTMENTS. The monitor is shipped with all tubes, thermostat, quartz crystal, etc in place. The thermometer is packed separately in the rear compartment of the instrument, and should be unpacked carefully and placed in the thermometer hole behind the window on the front panel.

a. Mount the monitor in the relay rack and dress the power, rf, and any external metering cables over the roller bar to allow for withdrawal of the monitor on its slides.

b. Connect the station standby line to the STANDBY connector, and the station transmitter line to the MONITOR connector. (In most cases continuous operation of the entire monitor is recommended, however.) Be sure voltage and frequency are as specified on the nameplate. When power is connected to the monitor, the OVEN CYCLE light on the front panel should come on.

c. Connect the rf input to the R-F INPUT binding posts.

d. If no external metering is to be used, check that the dummy plug is in place and that the front-panel METER switch is in INT ONLY.

e. Snap the MONITOR switch on, and allow the monitor to warm up for about two hours, or until the oven temperature is 60 C as indicated on the front-panel thermometer.

f. Check the crystal drive by holding the spring-return CRYSTAL DRIVE toggle switch down momentarily while checking that the meter pointer is deflected to or beyond the red line.

g. Check the rf input level using a vacuum-tube voltmeter or oscilloscope, if available. The level should be between 0.05 and 2.0 volts. If neither vtvm or oscilloscope is available, begin with the lowest possible input level and increase the level until the meter pilot lights (signal lamps) reach full brilliance. This assures that the crystal is oscillating and that the input is such as to produce an if frequency of 1000 cps (plus or minus deviation). Too high an input level will cause flickering of the signal lamps or small erratic jumps of the meter pointer with modulation applied to the transmitter, while too low a signal will cause the signal lamps to go almost completely out. Operation at the exact turn-on point of the meter lamps is not recommended, as a slight change in rf input will cause the lamp to go out completely, or to flicker violently. (The signal lamps will retain a dull glow to distinguish between lamp failure and signal failure.)

h. If no external meters are to be used, the monitor is now in normal operation.

2.5 EXTERNAL METERING. External meters, which should duplicate the panel meter's characteristics (100-0-100 µamp, 540 ohms) may be used with the monitor in either of two methods, depending on the total loop resistance of the external circuit. External metering is considered local when the total loop resistance of the external metering circuit is less than 800 ohms, as, for instance, with a single meter located in the same room as the monitor or in an adjacent room. Such a meter should be connected to terminals 1 (+) and 3 of the Jones plug, as indicated in Figure 7. When the METER switch is set to EXT ON, the local meter as well as the monitor panel meter will operate.

External metering is considered remote when the total loop resistance of the external metering circuit is more than 800 and less than 5000 ohms. Such a resistance would be encountered if an external meter were separated from the monitor by long ungrounded telephone lines, or if more than one external meter were used. (Although remote and local metering, as described above, cannot be used simultaneously, there is no reason why one of two or more "remote" meters cannot be placed near the monitor.) The remote metering circuit should be connected to terminals 1 (+) and 2 of the Jones plug (see Figure 7).

If remote metering is used, it is necessary to set the loop resistance of the entire remote circuit to 5000 ohms ±2% to match the internal standard resistance. This is easily accomplished by the insertion and adjustment of a series potentiometer in the meter circuit. When using an ohmmeter to measure the loop resistance, be careful not to damage the 100-0-100-µamp remote meter.

2.6 METER ADJUSTMENT. The range of the monitor deviation meter is ±30 cps, and if the transmitter is more than 30 cps (but less than 360 cps) off frequency, the meter pointer will be driven off scale. If the deviation is more than 360 cps, the meter may read on scale, but the reading will be false. The transmitter should be adjusted as closely as possible to assigned frequency before the monitor is used; then, with the monitor on, check for an on-scale meter deflection. As a quick check that the meter deflection is not false (due to excessive deviation, as mentioned above), plug a set of headphones into the PHONES jack on the left front panel, and check for the presence of a 1000-cycle (±30 cps) tone. The tone may be checked against a tuning fork or a calibrated audio oscillator.

An adjustment, labeled CENTER FREQ., is provided on the left front panel to allow the engineer to bring the monitor into agreement with measurements made by an external frequency-measuring service. Note that this adjustment is color-coded red. It should not be altered except to bring the meter into agreement with measurements made by a commercial monitoring service. For instance, if measurement indicates that the transmitter frequency is 10 cps high, the CENTER FREQ. adjustment should be set so that the meter reads +10-cps deviation. Then, when the transmitter is readjusted until the monitor again reads zero deviation, the station will be exactly on frequency.

Section 3

OPERATING PROCEDURE

3.1 OPERATIONAL CHECKS.

3.1.1 TEMPERATURE CONTROL CHECK. The OVEN CYCLE light, on the right front panel, should light immediately when power is connected and the MONITOR switch is snapped on. To check the operation of the temperature control circuit, momentarily short-circuit the thermostat by connecting a jumper across its two spade-lug terminals in the temperature control box. A relay should open and the OVEN CYCLE light should go out when this is done. A built-in fusible link melts at 72 C, opening the heater circuit and thereby protecting against excessive temperature due to relay or thermostat failure.

The heat will remain on (from a cold start) for about a half hour before the thermostat operates. After about an hour, the thermostat will cycle so that the heat is on (OVEN CYCLE light on) about 50 seconds and off (OVEN CYCLE light out) about 160 seconds at ordinary room temperature (70 to 80 F). A period of about four hours is required before the inner temperature reaches its final value. When final operating temperature has been reached, the thermometer should read 60.0 ±0.3 C.

3.1.2 RF INPUT AND CRYSTAL OSCILLATOR CHECKS. Assuming that the transmitter is not more than 300 cycles off frequency and that the crystal has reached normal operating temperature, dim or flickering signal lamps (meter pilot lights) may indicate insufficient rf input. (One other possible, but unlikely cause of meter flickering might be single-frequency test modulation at multiples of 60 cycles. Normal program modulation will not cause meter flickering unless excessive input signal levels are used.) The yellow-coded SIGNAL LAMPS control on the right front panel adjusts the bias of a thyratron to a predetermined cutoff potential. This control should be adjusted so that the meter lamps just turn on with 2 volts rms at 1 kc applied to test point TP3.

The signal lamps will always retain a very dim glow, regardless of rf input, so that lamp failure will not be confused with signal failure.

The green-coded CHECK CRYSTAL DRIVE switch on the left front panel furnishes a quick means of determining whether there is crystal drive at the mixer. When this spring-return switch is held down, the panel meter is connected directly to the mixer diode, and the cathode of the rf amplifier is ungrounded, eliminating transmitter rf input to the mixer. Thus the current produced in the mixer diode is the result of the output from the crystal amplifier only. Note that the meter is measuring the drive available at the mixer, and not the actual output of the crystal oscillator. If the needle is not deflected to the red line, refer to paragraph 5.4.5.

3.1.3 MIXER OUTPUT CHECKS. The green-coded PHONES jack on the left front panel is electrically at the output of the third limiter-amplifier, where, under normal circumstances, a 1-kc (plus or minus deviation) constant-amplitude square wave should be present. A quick check with a pair of headphones for a 1-kc (distorted) tone provides indication that such a signal is being presented to the differential diode voltmeter.

The 1-kc mixer output may also be inspected at two other points in its progress from sine to square wave. These are the green-coded test points TP2 and TP3, on the left side shelf. Conversely, a 1-kc tone can be injected at one point and checked at another to isolate difficulty to a particular stage.

3.2 STANDBY OPERATION. Operation of the front-panel MONITOR switch does not affect the temperature control circuit, which is fed from the STANDBY connection. Thus the monitor can be shut off when the transmitter is not operating, and be ready for restarting with the crystal maintained at proper temperature. When taking the monitor out of service for an extended period of time, remove the power plugs from both the MONITOR and STANDBY connectors. Where the monitor is to be used more than eight hours a day, continuous operation of the entire monitor is recommended.

Section 4

PRINCIPLES OF OPERATION

4.1 CRYSTAL OSCILLATOR CIRCUITS. The crystal used in the Type 1181-B is a General Radio Type 376-T, with a temperature coefficient of frequency of less than 1 part per million per degree centigrade over the normal operating range. The crystal is mounted in a sealed plug-in HC-6 type case, enclosed in a holder that includes the series capacitor frequency adjustment. This assembly is mounted in a chamber operating at a thermostatically controlled temperature of 60 C.

The crystal-controlled oscillator is of a type developed by General Radio specifically for use in standard frequency oscillators requiring high stability and reliability. No inductance coil is used in the frequency-determining system. The crystal operates close to its true series resonant frequency, and consequently much better stability is obtained.

The output of the crystal oscillator is fed through a Type 6AC7 isolation amplifier to the mixer.

4.2 RF AMPLIFIER. A Type 6AC7 buffer amplifier increases the input sensitivity and couples the rf input from the transmitter to the mixer and detector. Sufficient sensitivity is provided for inputs as low as 0.05 volt.

4.3 MIXER AMPLIFIER. The outputs from the crystal oscillator amplifier and the rf amplifier are fed into a Type 6SQ7-GT diode mixer-triode amplifier. Here a diode detector followed by a stage of audio-frequency amplification produces a beat note resulting from the difference between the crystal oscillator frequency and the transmitter frequency. An audio filter in the first if amplifier grid circuit suppresses modulation components that may be present on the transmitter signal.

4.4 LIMITER-AMPLIFIERS. The mixer-amplifier output is essentially a 1-kc sine wave, which is converted to a constant-amplitude square wave before being applied to the differential diode voltmeter. The necessary amplification and clipping takes place in the limiter-amplifier stages V7, V8, and V9. Positive and negative peaks are clipped by V7 and V8. V9 provides final amplification and limiting and is transformer-coupled to the differential diode voltmeter.

Part of the output from V7 is applied to thyratron V14, which activates the signal lamps, used as rf input indicators (refer to paragraph 3.1.2).

4.5 DIFFERENTIAL DIODE VOLTMETER. (See Figure 3.) The meter circuit consists of a full-wave differential diode voltmeter, which indicates the potential difference between the midpoints of two series-resonant circuits. Circuit constants are such as to cause nearly equal potentials to exist at exactly 1000 cycles, since the two circuits are series resonant, one above and the other below this frequency. Any deviation from this frequency will cause the current through the meter to assume a direction and amplitude directly proportional to the direction and magnitude of the frequency deviation, over the normal range of ±30 cycles per second. Voltage-frequency and meter-current characteristics are shown in Figure 4.

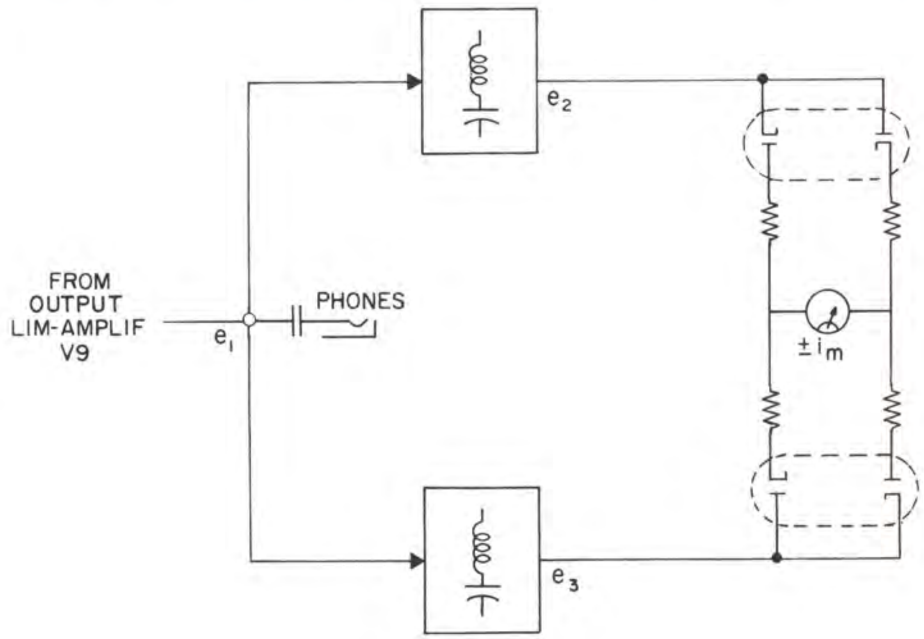

Figure 3.
Differential Diode
Voltmeter Circuit.

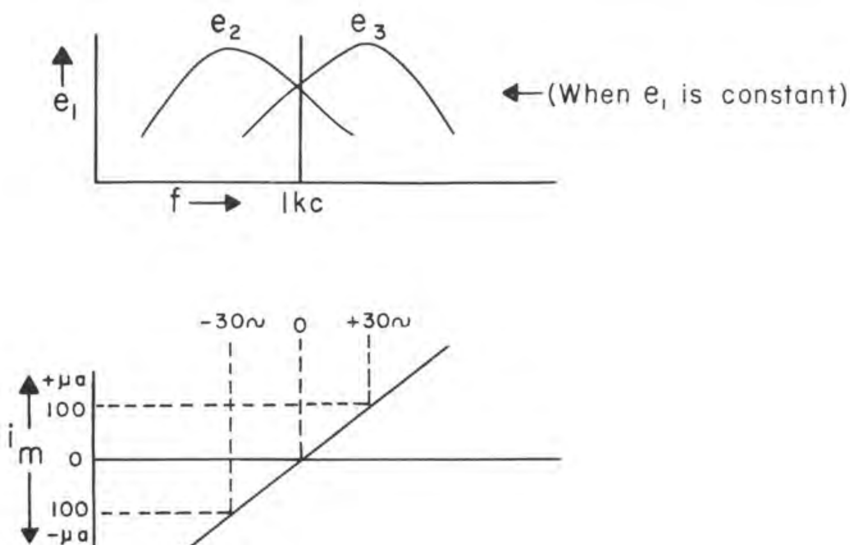

Figure 4. Voltage-Frequency and Meter-Current Characteristics of Voltmeter Circuit.

Section 5

SERVICE AND MAINTENANCE

5.1 GENERAL. This service information, together with that given in preceding sections, should enable the user to locate and correct ordinary difficulties resulting from normal use. Major service problems should be referred to our Service Department, which will cooperate as much as possible by furnishing information as well as by supplying the replacement parts needed. When notifying our Service Department of any difficulties in the operation or service of the instrument, please give the serial and type numbers of the instrument. Also give a complete report of trouble encountered and steps taken to eliminate the trouble. Before returning an instrument or part for repair please write to our Service Department requesting a Returned Material Tag, which includes shipping instructions. Use of this tag will insure proper handling and identification. A purchase order covering repair of material returned should also be forwarded to avoid unnecessary delay.

5.2 FORWARD TILT POSITION. One of the outstanding features of the Type 1181-B Monitor is the ease with which all parts are made accessible for servicing. The monitor can be withdrawn from the relay rack on slides and pivoted to the "forward tilt" position (Figure 5) without interruption of operation.

To place the monitor in the forward tilt position, pull the monitor out on its slides until the latch buttons (A) engage. Then push in on the upper front latch buttons (B) so that they clear the slide extensions (C), allowing the monitor to swing downward. Allow the monitor to pivot until it is in the position shown in Figure 5.

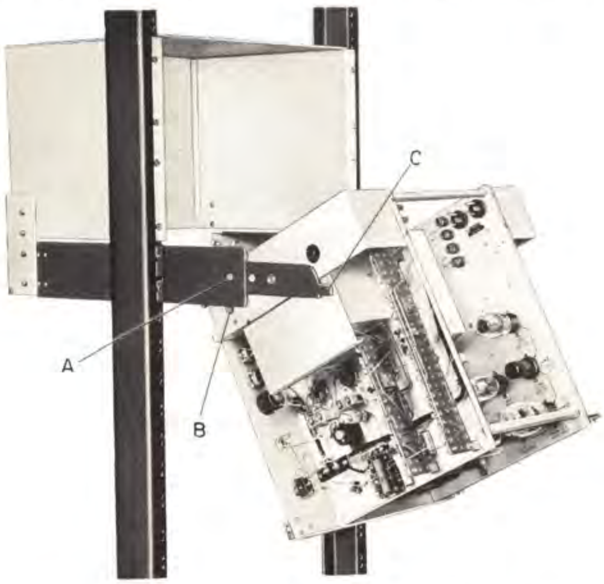

Figure 5. Monitor in 'Forward Tilt' Position.

To return the monitor to the upright position, slowly swing the front of the instrument toward you, holding it firmly at the bottom edge of the front panel, until the upper front latch buttons clear the slide extensions.

5.3 CONTROLS AND ADJUSTMENTS. All tubes, adjustments, signal paths, etc are extensively labeled on the panels and shelves of the Type 1181-B Monitor to make trouble-shooting the instrument as easy as possible. Moreover, each control is color-coded to indicate its effect on monitor calibration, and therefore, the amount of care that must be used in making adjustments. Those adjustments color-coded red are usually factory calibration adjustments made at the General Radio laboratory. Caution should be observed with yellow-coded controls, and controls color-coded green may be used without danger of upsetting monitor calibration.

Table 1 lists the function, location, and type of each control and adjustment in the monitor.

5.4 TROUBLE-SHOOTING PROCEDURE.

5.4.1 GENERAL. Trouble-shooting the Type 1181-B Monitor should not normally present much of a difficulty, in view of the extensive circuit markings and availability of test points by which trouble may be isolated. Most troubles will be evidenced by the failure of a pilot light, erratic meter readings, etc, and these indications are the bases for the following paragraphs. Components are designated as shown on the schematic diagram, Figure 7.

5.4.2 MONITOR INOPERATIVE.

a. Check power-line source, power cord, and power fuses.

b. Check that all tube heaters are on.

c. Check rf line filter (C40, C41) for short circuit.

d. If OVEN CYCLE lamp does not light, refer to paragraph 5.4.3.

TABLE 1. CONTROLS AND ADJUSTMENTS.

Name	Color	Location	Function
CHECK CRYSTAL DRIVE	Green	Left front panel	Checks availability of crystal drive at mixer. Meter should deflect to or beyond red line when switch is held down.
PHONES	Green	Left front panel	Test point for 1-kc output of limiter amplifiers.
CENTER FREQ	Red	Left front panel	Can be used to set panel meter in accordance with outside frequency measurements.
SCALE RANGE	Red	Left front panel	Adjusts magnitude of output voltage from T1 to change amplitude of signals supplied to diode voltmeter, affecting the magnitude of the scale range.
SCALE LIN.	Red	Left front panel	Adjusts for scale linearity either side of zero center, by proportional control of signal fed to series-resonant circuits.
SET B+ 250	Yellow	Right front panel	Used in conjunction with TP4 (immediately below) to set the regulated B+ to 250 volts.
SIGNAL LAMPS	Yellow	Right front panel	Adjusts V14 bias to produce a predetermined cutoff potential. Adjust so that meter lamps turn on with 2 volts at 1 kc at TP3.
MONITOR OFF		Right front panel	Monitor power switch. (Does not turn off crystal oven.)
CRYSTAL DRIVE	Yellow	Left side shelf	Adjusts crystal output. Adjust for 0.4 v at TP1, using high-impedance vtvm.
C1, C2	Red	Left side shelf	Oscillator amplitude adjustment. (Also affects frequency.)
C4	Red	Left side shelf	Oscillator coupling adjustment.
TP1	Red	Left side shelf	Test point for oscillator output (0.4 v as measured by vtvm).
TP2	Green	Left side shelf	1-kc test point between V5 and V6.
TP3	Green	Left side shelf	1-kc test point between V6 and V7.
TP4	Yellow	Right front panel	Test point for regulated plate voltage supply.

e. If thermometer pilot does not light, refer to paragraph 5.4.4.

f. If signal lamp does not light, refer to paragraph 5.4.6.

g. If crystal drive cannot be checked by CHECK CRYSTAL DRIVE switch, refer to paragraph 5.4.5.

h. If the thermometer does not indicate proper operating temperature, refer to paragraph 5.4.3.

i. If vacuum tubes need replacement, refer to paragraph 5.5.

5.4.3 OVEN CYCLE LAMP DOES NOT OPERATE PROPERLY.

a. Check lamp P2.

b. Check fusible link F5 located inside oven. Due to cold flowing of the soft metal used, the mounting screws should be tightened occasionally.

CAUTION

Do not replace the fusible link with any device other than a General Radio replacement link, or serious damage to the oven, crystal, thermometer, and thermostat will result. Always keep a few spare links on hand. Replacement links can be shipped promptly from the factory when those supplied with the instrument are exhausted.

c. Check fuses F3 and F4.

d. Check rectifier RX1. The output should be about 11.6 volts dc.

e. Check the operation of thermostat S4. If there are breaks in the mercury column, cool the bulb so that all the mercury is drawn down into it. The column will be intact when the mercury again rises in the column. To check for proper operation remove the thermostat, connect an ohmmeter across the contacts, and heat the bulb by hot water. When the mercury column comes in contact with both internal electrodes, there should be an indication of a closed circuit by the ohmmeter.

CAUTION

Do not pass more than 5 ma through the thermostat contacts, or it may be damaged.

f. Check relay S5 for proper operation. Check the coil for an open circuit. The resistance of the coil is 1000 ohms. Then check the operation of the armature. About 3 volts dc is required to close the contacts against normal spring tension. To clean contacts, use crocus cloth or lint-free paper. A thin flat file may be used if the contacts are badly pitted.

g. Check R16, R54, R88, R89, R90, and C51.

5.4.4 THERMOMETER PILOT LAMP DOES NOT LIGHT.

a. Check lamp P1 and resistor R14.

b. Check fuses F1 and F2.

c. Check connections to primary of power transformer T2.

5.4.5 METER DOES NOT INDICATE TO RED LINE WHEN CHECK CRYSTAL DRIVE SWITCH IS HELD DOWN.

a. Check V1, V2 for G_m, and V6 for diode emission.

b. Check the meter for a change in sensitivity. Full-scale reading should be ±100 microamperes dc from 0. Internal resistance should be 450 ohms ±20%.

c. Check that the crystal unit Q1 is plugged into its jacks in the oven.

d. Check oscillator output by measuring at TP1 with vacuum-tube voltmeter. Voltage should be approximately 0.4 v, as measured with a low-capacitance vacuum-tube voltmeter.

e. If voltage measured in step d is incorrect and cannot be adjusted to 0.4 v by means of the CRYSTAL DRIVE adjustment (R49), try replacing V1,

5.4.6 SIGNAL LAMP DOES NOT LIGHT WITH RF SIGNAL APPLIED.

a. Check lamp P3 and resistor R18.

b. Check C52.

c. Check V14 and operating voltages against Figure 7. Ground pin 6 temporarily; signal lamp will light if V14 is normal. Check circuit operation by grounding pin 3 temporarily.

d. Measure voltages across primary and secondary of transformer T4 with V14 removed. Voltage between terminals 1 and 2 should be 30 volts ac; that between terminals 3 and 4 should be 2.6 volts ac.

e. Check V1, V2, V5, V6, and V7 and operating voltages against Figure 7.

CAUTION

The SIGNAL LAMPS control (R93) is adjusted in the General Radio laboratory, and should not be readjusted unless a 1-kc audio source of 2 volts is available. The adjustment is set so that the meter lamps turn on with 2 volts at TP3.

5.4.7 METER DOES NOT INDICATE CORRECT FREQUENCY DEVIATIONS.

a. Meter may be defective. Refer to paragraph 5.4.5a.

b. Check that connections on METER terminal strip are tight.

c. Check that dummy plug is in place at rear of monitor and making contact.

d. Check the connecting wires of the dummy plug when external meters are used.

e. Plug phones in panel PHONES jack to determine whether a 1-kc beat note is present. Use an accurately calibrated beat frequency oscillator or other accurate 1-kc source.

f. If the beat note is not approximately 1000 cps or is not present, refer to Trouble-Shooting Chart, Table 2.

g. If the 1-kc beat note is present at the PHONES jack and the meter does not indicate correctly, proceed as follows:

(1) Check contacts of the CHECK CRYSTAL DRIVE switch, S1.

(2) If the meter indicates off scale, check V3 and V4. Refer to paragraph 5.5.1.

(3) Check C11 and C16. Also check L3 and L4 for continuity.

(4) Check components associated with V3 and V4, including R6, R7, R8, R10, R11, and R12. Refer to paragraph 5.5.1.

(5) Make sure that transformer T1 is securely fastened to the instrument chassis and that mounting screws are drawn tight.

h. If the meter indication is erratic or jumps suddenly when the monitor is rapped or jarred, proceed as follows:

(1) Check the plate voltage on V1. Refer to paragraph 5.4.8d. If voltage is high or erratic, check R62, R63, R64, and R65.

(2) Try replacing V1 and V5. Either of these tubes may be oscillating, producing spurious beats in the output circuit.

TABLE 2. TROUBLE-SHOOTING CHART.

SUGGESTED SIGNAL-TRACING PROCEDURE (Use in conjunction with Figure 2)	Next Step Yes	Next Step No
(Start at 1, then go on to Step indicated in "Next Step" column under appropriate condition.)		
1. Listen for 1-kc beat at TP2	2	3
2. Listen for 1-kc beat at TP3	6	7
3. Inject 1 kc at TP2 and listen for it at "PHONES"	5	4
4. Inject 1 kc at TP3 and listen for it at "PHONES"	7	6
5. Check for 0.4 v at TP1	8	9
6. Check V7, V8, V9, and T1		
7. Check V6		
8. Check V2 and V5		
9. Check V1 and XTAL.		

(3) Check the oscillator output at TP1. This should be approximately 0.4 volt as measured with a vacuum-tube voltmeter.

(4) If the voltage at TP1 is low or erratic, either the quartz crystal or V1 may be defective.

5.4.8 POWER SUPPLY MALFUNCTIONS.

a. Check voltages at V10, V11, and V12 against Figure 7.

b. Check V13 and operating voltage. This tube should glow steadily if operating properly.

c. Check C42, C43, C44, and C45.

d. The plate voltage on V1 should be +250 volts. Check this at TP4 and adjust the front-panel SET B +250 control if necessary.

e. If the plate circuit develops shorted elements, resistors R56, R57, R58, and R59 may become defective.

5.5 TUBE REPLACEMENT.

5.5.1 REPLACEMENT OF V3 AND V4. Although V3 and V4 can be replaced without producing any serious error, some selection is desirable for best results. The procedure is as follows:

a. Remove the dummy plug from the REMOTE METER receptacle at the rear of the monitor, and set the METER switch to EXT. ON.

b. Set the mechanical zero adjustment on the monitor.

c. Remove the rf input connections and short-circuit these terminals.

d. Place a new 6H6 tube in one of the sockets. Set the METER switch to INT. ONLY and note the meter reading. Remove the tube and select a second tube that gives the same reading when placed in the same socket. Use these tubes as replacements.

5.5.2 REPLACEMENT OF V8 AND V9. If V8 or V9 is replaced, the electrical meter circuits may be affected somewhat. The maximum errors encountered will not exceed ±8% of the indicated reading, or ±6% of the indicated reading, respectively. It is good practice to replace tubes with tubes of the same manufacturer to minimize possible errors.

5.5.3 REPLACEMENT OF V14. After replacing V14, check the operation of the signal lamps. Refer to paragraph 5.4.6e.

5.5.4 REPLACEMENT OF OTHER TUBES. V1, V2, V5, V6, V7, V10, V11, V12, and V13 may be replaced without affecting the over-all performance of the monitor in any way.

5.6 TEST WAVEFORMS. As a further aid to trouble-shooting, typical waveforms found at various points in the monitor are shown in Figure 6. These drawings were made from oscillograms taken with a 1-volt rf input at 950 kc. A 949-kc crystal was used, and the crystal output level was at the red line on the panel meter. All voltages given are peak-to-peak values.

Section 6

TYPES 1181-BH AND 1181-BT MONITORS

6.1 TYPE 1181-BH MONITOR. The Type 1181-BH Frequency Deviation Monitor is the same as the Type 1181-B except that it covers the range from 1600 to 15,000 kc for am transmitters, using a Type 376-R crystal instead of a Type 376-T and incorporating two minor component changes.

6.2 TYPE 1181-BT MONITOR. The Type 1181-BT Color Subcarrier Monitor for 3.58 Mc incorporates minor component changes similar to those in the Type 1181-BT, as noted on the schematic diagram, Figure 7. The crystal used is a Type 376-R.

Your comments on these instructions, as well as any suggestions for their improvement, would be most welcome. Please write to:

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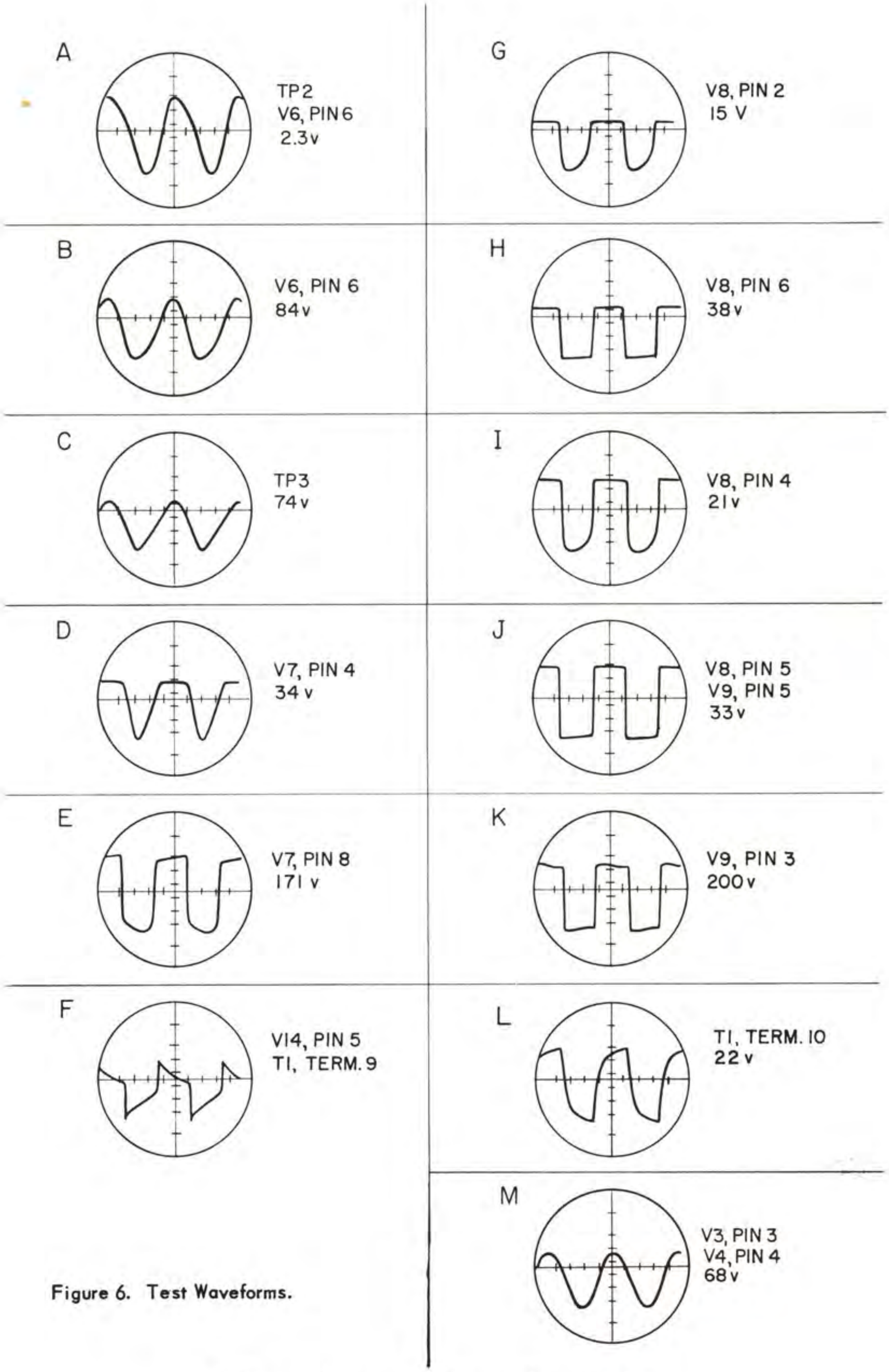


Figure 6. Test Waveforms.

Voltages shown are peak-to-peak amplitude.

PARTS LIST

RESISTORS (NOTE B)

				GR NO. (NOTE A)
R1	2.7 M	±5%	1/2 w	REC-20BF
R2	180 k	±5%	1/2 w	REC-20BF
R3	10 k	±5%	1/2 w	REC-20BF
R4	220	±10%	1/2 w	REW-3C
R5	100 k	±5%	1/2 w	REC-20BF
R6	40 k	±1%	1/3 w	REPR-16
R7	20 k			972-401
R8	40 k	±1%	1/3 w	REPR-16
R9	560	±1%	1/2 w	REF-70
R10	20 k			972-401
R11	40 k	±1%	1/3 w	REPR-16
R12	40 k	±1%	1/3 w	REPR-16
R13	250	±10%		POSW-3
R14	15	±10%	1/2 w	REW-3C
R16	15	±10%	1/2 w	REW-3C
R18	3.3	±10%	1 w	REW-4C
R19	22 k	±10%	1 w	REC-30BF
R20	560	±5%	1/2 w	REC-20BF
R21	27 k	±5%	1/2 w	REC-20BF
R22	2.2 k	±10%	1 w	REW-4C
R23	470 k	±5%	1/2 w	REC-20BF
R24	8.2 k	±10%	1 w	REC-30BF
R25	68 k	±5%	1/2 w	REC-20BF
R26	200 k	±5%	1/2 w	REC-20BF
R27	10 k	±5%	1/2 w	REC-20BF
R28	560	±5%	1/2 w	REC-20BF
R29	100 k	±5%	1/2 w	REC-20BF
R30	470 k	±5%	1/2 w	REC-20BF
R31	1.8 M	±5%	1/2 w	REC-20BF
R32	100	±10%	1/2 w	REW-3C
R33	470 k	±5%	1/2 w	REC-20BF
R34	56 k	±5%	1/2 w	REC-20BF
R35	150 k	±5%	1/2 w	REC-20BF
R36	470 k	±5%	1/2 w	REC-20BF
R37	150 k	±5%	1/2 w	REC-20BF
R38	1 M	±5%	1/2 w	REC-20BF
R39	1 M	±5%	1/2 w	REC-20BF
R40	22 k	±5%	1/2 w	REC-20BF
R41	47 k	±5%	1/2 w	REC-20BF
R42	2.2 M	±5%	1/2 w	REC-20BF
R43	100 k	±5%	1/2 w	REC-20BF
R44	1 M	±5%	1/2 w	REC-20BF
R45	620	±5%	1 w	REW-4C
R46	15 k	±10%	2 w	REC-41BF
R47	3.6 k	±5%	10 w	REPO-42-4
R48	250	±10%		POSW-3
R49	25 k	±10%		POSC-11
R54	1 k	±5%	1/2 w	REC-20BF
R55	1 k	±10%	1 w	REC-30BF
R56	1.5 k	±5%	5 w	REPO-42
R57	1.5 k	±5%	5 w	REPO-42
R58	1.5 k	±5%	5 w	REPO-42
R59	1.5 k	±5%	5 w	REPO-42
R60	1 M	±5%	1/2 w	REC-20BF
R62	470 k	±5%	1/2 w	REC-20BF
R63	820 k	±10%	2 w	REC-41BF
R64	560 k	±10%	1 w	REC-30BF
R65	22 k	±10%	2 w	REC-41BF
R66	470 k	±5%	1/2 w	REC-20BF
R67	270 k	±5%	1/2 w	REC-20BF
R68	50 k	±20%		POSC-11
R69	180 k	±5%	1/2 w	REC-20BF
R75	300	±5%	1 w	REW-4C
R76	35	±10%	7.4 w	REPO-4
R77	35	±10%	7.4 w	REPO-4
R78	35	±10%	7.4 w	REPO-4
R79	35	±10%	7.4 w	REPO-4
R80	35	±10%	7.4 w	REPO-4
R81	35	±10%	7.4 w	REPO-4
R82	35	±10%	7.4 w	REPO-4
R83	35	±10%	7.4 w	REPO-4
R84	35	±10%	7.4 w	REPO-4
R85	35	±10%	7.4 w	REPO-4
R86	35	±10%	7.4 w	REPO-4
R87	35	±10%	7.4 w	REPO-4
R88	43	±5%	2 w	REW-6C
R89	27	±5%	1/2w	REC-20BF
R90	1 k	±5%	1/2w	REC-20BF
R91	400	±10%	10w	REPO-42-2
R92	2 k	±10%	5w	REPO-42
R93	5 k	±10%		POSW-3
R94	10 k	±5%	1/2w	REC-20BF
R95	1 M	±5%	1/2 w	REC-20BF
R96	33	±5%	1/2 w	REC-20BF
R97	4.42 k	±1%	1/2 w	REF-70
R98	1.0 M	±5%	1/2 w	REC-20BF

CAPACITORS (NOTE C)

				GR NO. (NOTE A)
C1	13-320μμf			COA-6
C2	13-320μμf			COA-6
C3	250μμf	±10%		COM-20B
C4	3-25μμf		600 dcwv	COA-1
C5	0.022	±10%	600 dcwv	COL-71
C6	0.022	±10%	600 dcwv	COL-71
C7	0.022	±10%	600 dcwv	COL-71
C8	0.022	±10%	600 dcwv	COL-71
C9	0.022	±10%	600 dcwv	COL-71
C10	0.0047	±10%		COM-35B
C11	0.1110	±1/2%		COM-50B
C12	0.1	±10%	600 dcwv (C12, C13)	COLB-18
C13	0.1	±10%		
C14	0.1	±10%	600 dcwv (C14, C15)	COLB-18
C15	0.1	±10%		
C16	0.1110	±1/2%		COM-50B
C20	0.001	±10%		COM-20B
C21	0.001	±10%		COM-20B
C22	0.022	±10%	600 dcwv	COL-71
C23	0.022	±10%	600 dcwv	COL-71
C24	100μμf	±10%		COM-20B
C25	0.001	±10%		COM-20B
C26	0.01	±5%		COM-35D
C27	0.003	±5%		COM-30D
C28	0.001	±10%		COM-20B
C29	500μμf	±10%		COM-20B
C30	15		350 dcwv	COE-53 (C30, C33)
C33	15		350 dcwv	
C31	0.01	±10%		COM-35b
C32	0.0025	±10%		COM-35B
C34	0.022	±10%	600 dcwv	COL-71
C35	0.022	±10%	600 dcwv	COL-71
C36	25		25 dcwv	COE-48
C37	500μμf	±10%		COM-20B
C38	50μμf	±10%		COM-20B
C39	0.013	±5%		COM-50D
C40	0.01	±10%	600 dcwv	COL-71
C41	0.01	±10%	600 dcwv	COL-71
C42	20	+50%-10%	450 dcwv (C42–C45)	COEB-25
C43	20	+50%-10%		
C44	20	+50%-10%		
C45	20	+50%-10%		
C46	4.0	±10%	600 dcwv	COL-8
C47	0.022	±10%	600 dcwv	COL-71
C48	0.0047	±10%	600 dcwv	COL-71
C50	100		50 dcwv	COE-15
C51	0.1	±10%	600 dcwv	COL-71
C52	3.0	±10%	600 dcwv	COL-7
C53	250	±10%		COM-20B
C54	25	+50%-10%	25 dcwv	COE-48

FUSES

		GR NO. (NOTE A)
F1	1 amp Slo-Blo Type 3AG (115 v)	FUF-1
F1	0.5 amp Slo-Blo Type 3AG (230 v)	FUF-1
F2	1 amp Slo-Blo Type 3AG (115 v)	FUF-1
F2	0.5 amp Slo-Blo Type 3AG (230 v)	FUF-1
F3	0.4 amp Slo-Blo Type 3AG (115 v)	FUF-1
F3	0.2 amp Slo-Blo Type 3AG (230 v)	FUF-1
F4	0.4 amp Slo-Blo Type 3AG (230 v)	FUF-1
F4	0.2 amp Slo-Blo Type 3AG (230 v)	FUF-1

		GR NO. (NOTE A)
L1	CHOKE, 2.5 mh	CHA-597
L3	CHOKE, 200 mh	681-42
L4	CHOKE, 295 mh	681-43
L5	CHOKE, 1.27 h ±2.5%	746-409
L8	CHOKE, 2.5 mh	CHA-597
L9	CHOKE, 2.5 mh	CHA-597
L10	CHOKE, 25 mh	CHA-1226
M1	METER, 200 μa, 540 ohms	MEDS-13
M2	THERMOMETER, 60° C	TH-488
P1	LAMP, 6.3 v, Mazda 44	2LAP-939
P2	LAMP, 6.3 v, Mazda 44	2LAP-939
P3	LAMP, 6.3 v, Mazda 44F (2 required in M1)	2LAP-939F
Q1	CRYSTAL, 540 - 1600 kc	376-T
Q1	CRYSTAL, 1600-5000 kc	376-R
RX1	RECTIFIER	2RE-1400-6
S1	SWITCH, dpdt	SWT-11A
S2	SWITCH, dpst	SWT-333
S3	SWITCH, spdt	SWT-320
S4	THERMOSTAT, 60° C	TH-503
S5	RELAY	Z3RE-2
T1	TRANSFORMER	485-442
T2	TRANSFORMER	365-450-2
T3	TRANSFORMER	485-441
T4	TRANSFORMER	745-406

TUBES

V1	6SJ7-GT	V8	6SQ7-GT
V2	6AC7	V9	6V6-GT
V3	6H6	V10	5V4-G
V4	6H6	V11	6B4-G
V5	6AC7	V12	6SJ7-GT
V6	6SQ7-GT	V13	OC3
V7	6SJ7-GT	V14	2050

NOTES

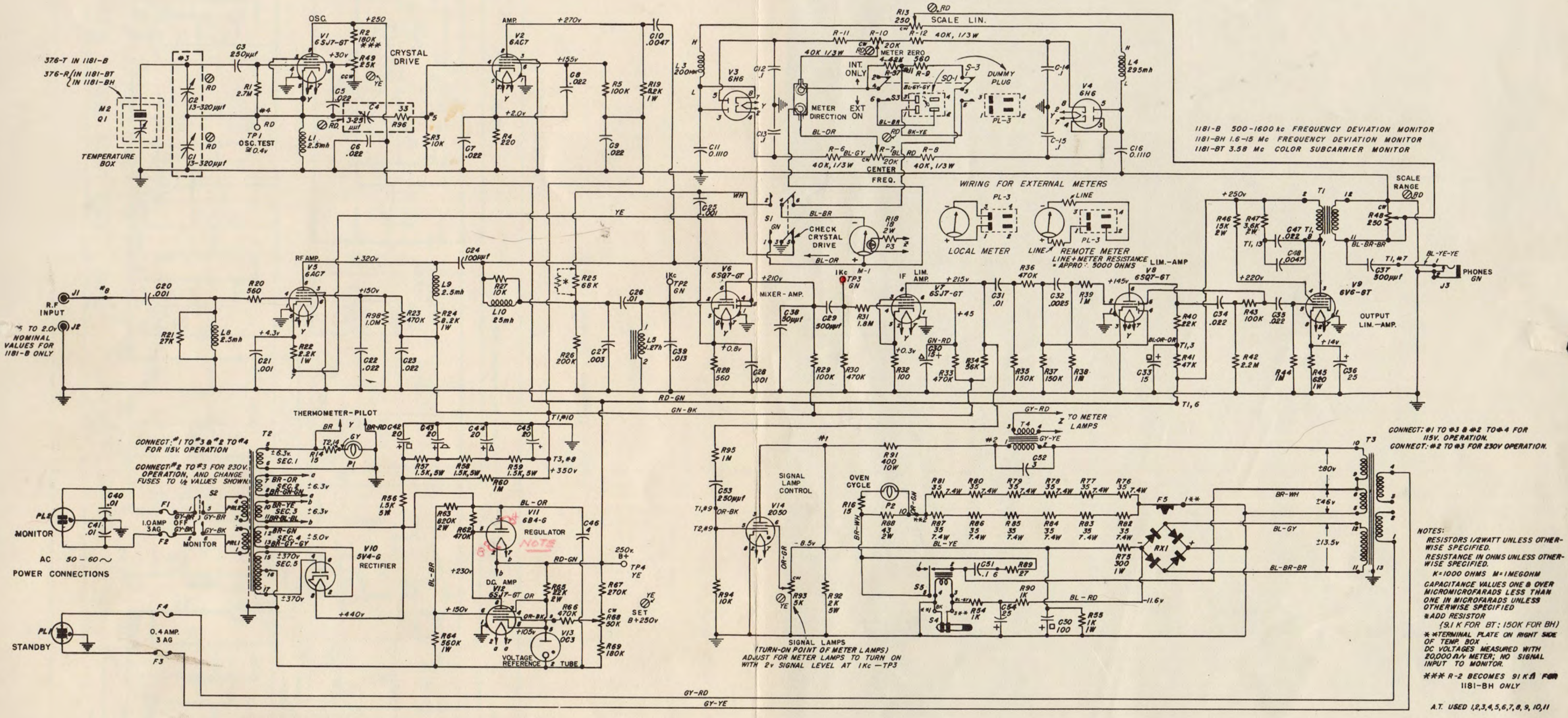
(A) GR Type designations as follows:

COA - Capacitor, air
COE - Capacitor, electrolytic
COEB - Capacitor, electrolytic block
COL - Capacitor, oil-impregnated
COLB - Capacitor, oil-impregnated block
COM - Capacitor, mica
POSC - Potentiometer, composition
POSW - Potentiometer, wire-wound
REC - Resistor, composition
REF - Resistor, film
REPO - Resistor, power
REPR - Resistor, precision
REW - Resistor, wire-wound

(B) All resistances are in ohms except as otherwise indicated by k (kilohms) or M (megohms).

(C) All capacitances are in microfarads except as otherwise indicated by μμf (micromicrofarads).

When ordering replacement components, be sure to include complete description as well as Part Number. (Example: R85, 51k ±10%, 1/2w, REC-20BF).



NOTE: CONNECT PIN 3 TO 4 AND 2 TO 8 FOR USE WITH EITHER 6B4G OR 6W6GT.

Figure 7. Schematic Diagram.

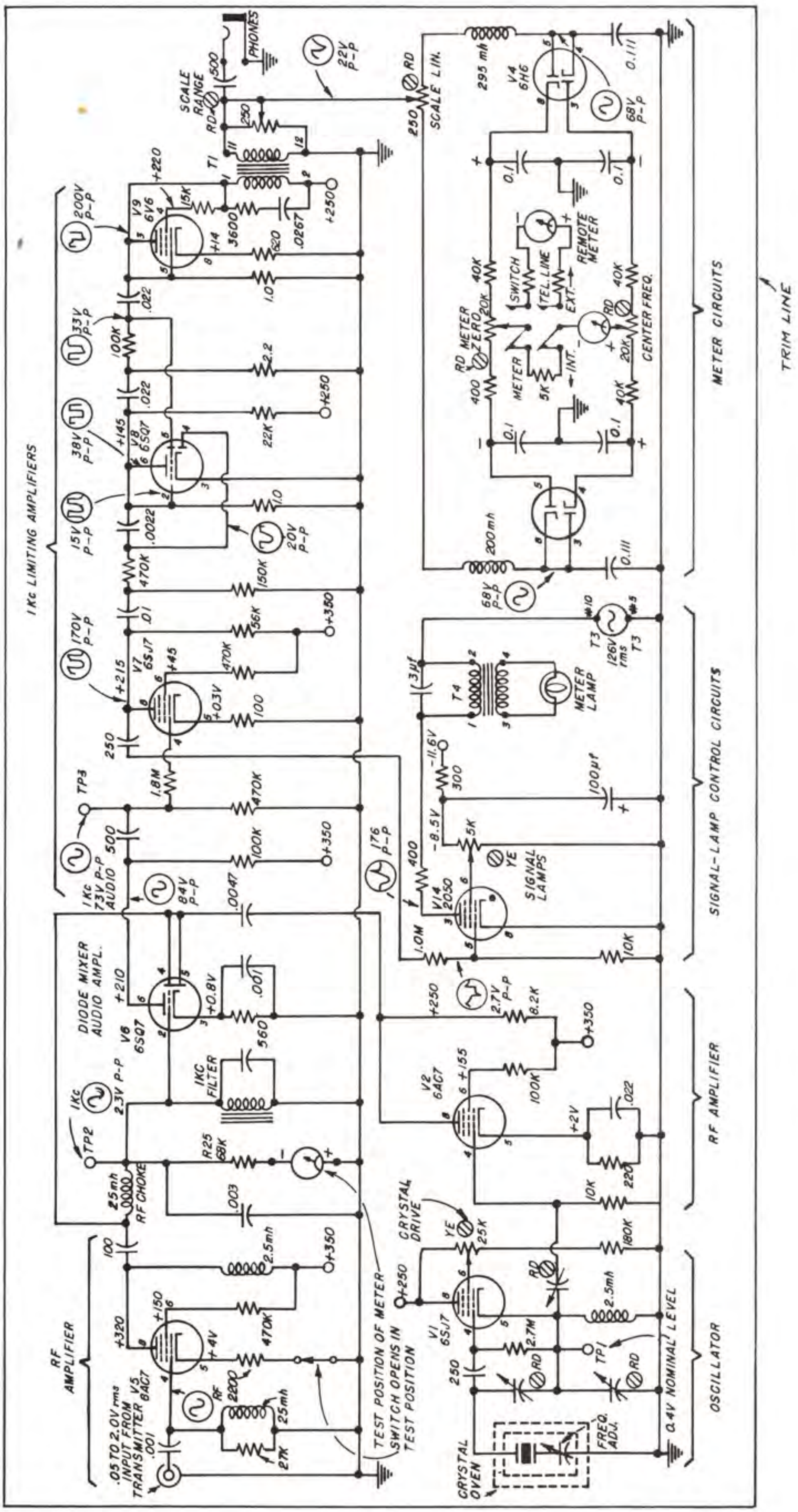


Figure 8. Elementary Schematic Diagram.

OTHER GENERAL RADIO BROADCAST EQUIPMENT

TYPE 1184-A TELEVISION TRANSMITTER MONITOR

The Type 1184-A provides, in one slide-out, tilt-over unit, all the operations required by the FCC for the monitoring of television transmitters, plus other functions to enable the station staff to determine quickly the operating condition of the transmitter. The Type 1184-A will:

Indicate continuously the frequency deviation of both aural and visual transmitters,

Indicate continuously the difference, or intercarrier, frequency,

Indicate continuously the frequency-modulation (swing) of the aural transmitter,

Indicate when the swing exceeds a preset value, by flashing a light,

Provide audio-fidelity (distortion, noise, and frequency response) measurements, measurements of residual am noise on the aural transmitter, and residual fm noise on the visual transmitter, and a complete intercarrier demodulation system. The monitor operates on any uhf or vhf channel, with black-and-white and color transmitters.

TYPE 1931-B AMPLITUDE-MODULATION MONITOR

The Type 1931-B, which features the same tilt-over design as used in the Type 1181-B, measures and indicates continuously the percentage modulation of broadcast and other radio-telephone transmitters. This monitor will operate at any carrier frequency from 0.5 to 60 Mc, and requires only 0.5 watt rf in the broadcast range. As with the Type 1181-B, provisions are made for remote metering.

TYPE 1932-A DISTORTION AND NOISE METER

The Type 1932-A Distortion and Noise Meter measures distortion, noise, and hum level in audio-frequency circuits. In conjunction with the Type 1931-B Modulation Monitor or Type 1184-A TV Monitor, it can be used to measure these quantities directly in the output of radio and television broadcast transmitters. It is also useful in the electronics laboratory, and in the production testing of radio receivers, where it can be used as a highly sensitive voltmeter to measure signal-to-noise ratio, AVC characteristics, and hum level. With the aid of an oscilloscope, individual hum and distortion components can be identified.

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