HICKOK

MODEL 256
CB/RF GENERATOR

INSTRUCTION MANUAL

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SECTION I
GENERAL INFORMATION

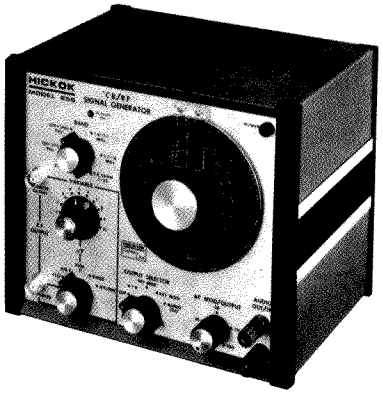


Figure 1-1. Hickok Model 256 CB/RF Generator

DESCRIPTION

The Model 256 CB/RF Signal Generator is a versatile, solid-state source of r f signals useful in a wide variety of applications: specifically, alignment, troubleshooting and testing of citizens band transceivers.

The Model 256 covers the 100kHz to 16MHz range in four overlapping bands for use in i f alignment and AM radio service, as well as having a special, dedicated CB band which covers the range of the present forty channels, on an easy-to-tune, low-drift, expanded scale.

The r f output on any range may be modulated from 0% to 100% with either the internal 1kHz source, or an external signal. In addition, a variable/step attenuator reduces the r f output from a maximum of 100mVrms down to submicrovolt levels.

An unattenuated r f output is provided at a front-panel-mounted BNC connector for use with a frequency counter. A 1kHz audio output signal is available at two front-panel-mounted banana jacks.

SPECIFICATIONS

Frequency Range:	100kHz to 16MHz in 4 bands and an expanded band for 26.9MHz to 27.6MHz
Tuning Control:	6-position rotary switch for: RF OFF, 100-370kHz, 370-1400kHz,

SPECIFICATIONS (Continued)

Tuning Control (Cont):	1.4MHz – 5.1MHz, 5.1MHz – 16MHz, and 26.9MHz to 27.6MHz. 350° Vernier tuning drive
Frequency Calibration Accuracy:	Within 1.5% of highest frequency on any range
Frequency Drift:	Less than 50ppm/1/2 hr after 1/2 hour warm-up
Output Level:	Less than 1.0μV to 100mV into 50Ω resistive load
Output Attenuator:	0 to 10μV continuously variable with rotary 5-step multiplier for X1.0, X10, X100, X1000, and X10,000
Accuracy:	±10% of full scale on CB range
Output Impedance:	
Attenuated Output:	50Ω
Counter Output:	80Ω
Audio Output:	6.9kΩ nominal
Internal Amplitude Modulation:	
Frequency:	1000Hz ±10%
Range:	0% to 100%, calibrated @ 30% and 50% ±10%
External Amplitude Modulation:	
Frequency:	50Hz to 10kHz
Level:	0.5Vrms = 100% modulation with control at 100%
Impedance:	7kΩ
Audio Output:	
Frequency:	1000Hz ±10%
Level:	1Vrms sinusoidal into open circuit
Leakage:	Negligible effect on receiver sensitivity measurement down to less than 1.0μV.
Connectors:	
Attenuated Output:	BNC
Counter Output:	BNC
Modulation Input/Audio Output:	Two 5-way binding posts
General:	
Power Requirements:	105-125 Vac/210-250 Vac, 50-400Hz 1.5 watts
Dimensions:	8-1/4" w X 7" h X 6-3/4" d
Weight:	5 lb

CONTROLS AND INDICATORS DESCRIPTION

Refer to Figure 1-2

	Item Number	
OUTPUT SELECTOR switch	1	Five-position rotary switch used to choose the type of operation desired. Each position is described below. **OFF** The unit is unpowered in this position. Any other position turns the unit on, as indicated by the illumination of the **POWER** lamp in the upper right hand corner. **RF** A continuous wave r f signal is internally generated and made available at both the **ATTENUATED** r f and **COUNTER OUTPUT** BNC jacks. The signal amplitude at the **COUNTER OUTPUT** jack is fixed. The amplitude at the **ATTENUATED** r f jack is determined by the position of the step and **VARIABLE μV** controls. The frequency of the r f signals appearing at the counter and attenuated r f jacks is determined by the **BAND** switch and the frequency dial. The **AUDIO OUT/IN** terminals are unconnected in this position, and the **% MOD** control is inoperative. **INT MOD** In this position, the r f signal, available at the **ATTENUATED** r f jack, may be modulated from 0% to 100% with an internally generated 1kHz sinusoid. The amount of modulation is determined by the position of the **% MOD** control. The overall amplitude of the modulated signal appearing at the **ATTENUATED** r f output jack is determined by the positions of the step and **VARIABLE μV** controls. The r f signal

	Item Number	
OUTPUT SELECTOR switch (Cont)		appearing at the **COUNTER OUTPUT** BNC terminal is unmodulated and fixed in amplitude. The frequency of the r f signals available at the counter and attenuated r f jacks is determined by the **BAND** switch and the frequency dial. The **AUDIO OUT/IN** terminals are unconnected in this position. **EXT MOD** In this position, the r f signal, available at the **ATTENUATED** r f BNC jack, may be modulated with an external signal source connected to the **AUDIO OUT/IN** terminals. The amount of modulation is determined by the amplitude of the external signal and the position of the **% MOD** control. The modulation frequency is determined by the frequency of the external signal source. The overall amplitude of the modulated signal appearing at the **ATTENUATED** r f output jack is determined by the positions of the step and **VARIABLE μV** controls. The r f signal appearing at the **COUNTER OUTPUT** BNC terminal is unmodulated and fixed in amplitude. The frequency of the r f signals available at the **COUNTER OUTPUT** and **ATTENUATED** r f jacks is determined by the **BAND** switch and frequency dial. **AUDIO OUT** In this position, the 1kHz internally generated sinewave is available at the **AUDIO OUT/IN** terminals. The output amplitude is fixed. All other controls operate as if the **RF** mode was selected, i.e., a continuous wave r f signal is available at the **COUNTER OUTPUT** and **ATTENUATED**

CONTROLS AND INDICATORS DESCRIPTION (Continued)

	Item Number	
OUTPUT SELECTOR switch (Cont)		jacks, with the r f frequency being determined by the **BAND** switch and the frequency dial. The amplitude of the signal at the **COUNTER OUTPUT** jack is fixed, while the output level at the **ATTENUATED** r f jack is varied by using the step and **VARIABLE μV** controls. The **% MOD** control is inoperative.
BAND switch	2	Six-position rotary switch selects the range of frequencies available at the front panel r f outputs. The first position, **RF OFF**, disables the internal r f oscillator so no signal is present. The next four positions cover the range of 100kHz to 16-MHz. The last position is a special CB range. The entire band covers the present CB frequencies for Channels 1 to 40. The frequency range extends from 26,965MHz to 27.6MHz.
CB BAND ADJ	3	An access hole to the CB range coil used in the internal r f oscillator. It allows calibration on the CB range to be touched-up to compensate for long term component aging, temperature effects, etc.
Frequency dial	4	350° vernier drive control selects the particular r f output frequency desired within the range determined by the **BAND** switch.
Step **μV**	5	Five-position rotary switch used in conjunction with the **VARIABLE μV** control to obtain any desired amplitude of r f signal between 100,000μV to less than 1μV at the **ATTENUATED** r f jack. The various positions scale the upper limit of the **VARIABLE μV** control to either 100,000 μV, 10,000μV, 1,000μV, 100μV or 10μV.
VARIABLE μV	6	Continuously variable control used in conjunction with the step **μV** switch to obtain any desired amplitude of r f signal, between 100,000μV to less than 1μV, at

CONTROLS AND INDICATORS DESCRIPTION (Continued)

	Item Number	
VARIABLE μV (Cont)	6	the **ATTENUATED** r f jack. The control is calibrated over a 10 to 1 range, but the span of attenuation is at least 30 dB below the full scale amplitude as set by the step μV switch.
% MOD	7	Variable control used to adjust the amount of modulation present in the r f signal appearing at the **ATTENUATED** r f jack. The control is active only when the **OUTPUT SELECTOR** switch is either in the **INT MOD** or **EXT MOD** position. When the **OUTPUT SELECTOR** switch is in the **INT MOD** position, the **% MOD** control is used to modulate the r f output signal from 0% to 100% using the internally generated 1kHz sinewave. When the **OUTPUT SELECTOR** is in the **EXT MOD** position, the **% MOD** control is used to attenuate the external modulation signal applied to the **AUDIO OUT/IN** terminals, before it is coupled to the internal modulation circuitry.
ATTENUATED output	8	Front-panel-mounted, shielded, BNC connector provides output of the attenuated, modulated (or unmodulated) r f signal. The amplitude, frequency and % modulation of the r f signal is determined by the positions of the front-panel-mounted step **μV, VARIABLE μV, BAND** selector, frequency dial, **OUTPUT SELECTOR** and **% MOD** controls. The r f output must work into a 50Ω load for the amplitude calibration to be valid.
COUNTER OUTPUT	9	Front-panel-mounted, shielded, BNC connector provides output of a fixed amplitude, unmodulated r f signal for frequency monitoring purposes by a suitable electronic frequency counter. The frequency

CONTROLS AND INDICATORS DESCRIPTION (Continued)

	Item Number	
COUNTER OUTPUT (Cont)		of the signal at the **COUNTER OUTPUT** is exactly the same as the signal appearing at the **ATTENUATED** r f output jack, and is controlled by the **BAND** selector switch and frequency dial. The **COUNTER OUTPUT** signal remains at a fixed amplitude regardless of the settings of the step and **VARIABLE μV** controls, and it remains unmodulated regardless of the positions of the **OUTPUT SELECTOR** and **% MOD** controls.
AUDIO OUT/IN	10	Front-panel-mounted 5-way binding post terminals provide a fixed amplitude 1kHz sinewave output when the **OUTPUT SELECTOR** switch is in the **AUDIO OUT** position. When the **OUTPUT SELECTOR** is in the **EXT MOD** position, the **AUDIO OUT/IN** terminals become an input through which an external audio signal is connected in order to modulate the r f signal appearing at the **ATTENUATED** r f jack. Note that the black terminal is connected to the case which is at earth ground potential.
POWER lamp	11	Front-panel-mounted LED lamp is illuminated whenever the unit is energized and ready for use. The unit is turned on by turning the **OUTPUT SELECTOR** switch to any position except **OFF.**

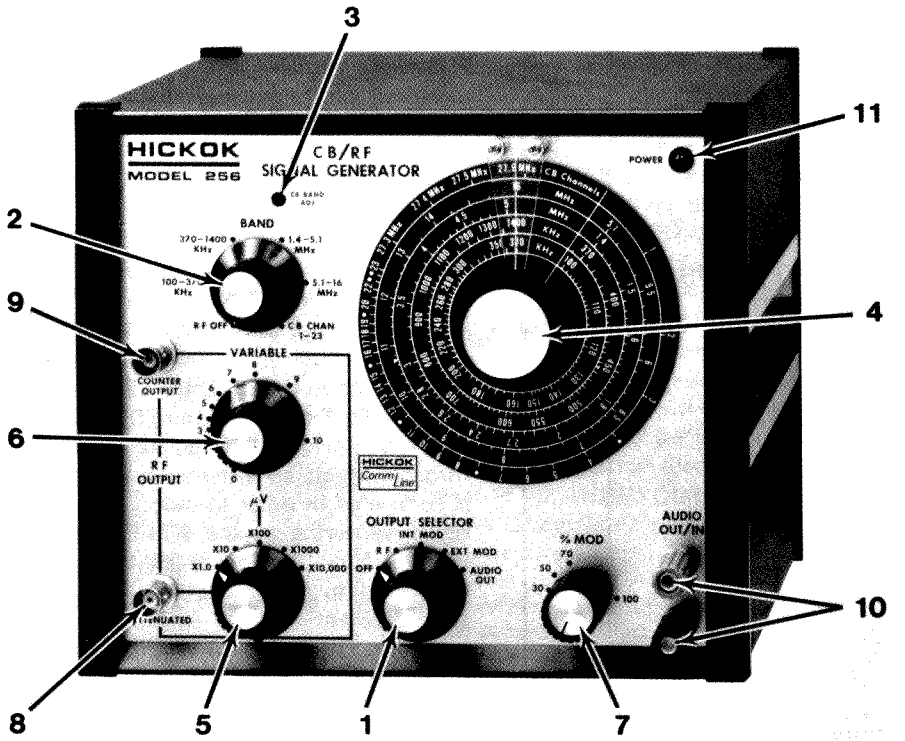


Figure 1-2. Front Panel of Model 256 CB/RF Generator

SECTION II
OPERATION

PRELIMINARY OPERATION

After removing unit from its shipping carton and inspecting for visible damage, proceed to the following set-up steps.

1. Connect AC power cord to an appropriate power source.

2. Turn unit on by rotating the **OUTPUT SELECTOR** switch to any position except **OFF.**

3. Check that the **POWER** lamp in the upper right corner of the front panel is illuminated. If it is not, refer to the MAINTENANCE section of the manual.

Obtaining a Continuous Wave RF Signal

1. Turn the **OUTPUT SELECTOR** switch to the r f position.

2. Set the desired r f signal amplitude by using the step and **VARIABLE μV** controls. The step **μV** control acts as a multiplier of the number dialed on the **VARIABLE μV** control. For example, to obtain a 5,000μV output, set the **VARIABLE μV** control to **5** and the step **μV** switch to **X1000** position.

3. Obtain the desired r f signal frequency by using the **BAND** switch and the frequency dial. The **BAND** switch determines which scale on the frequency dial is to be used. For example, to obtain a 10.7MHz r f signal, rotate the **BAND** switch to the **5.1MHz – 16MHz** position, then turn the frequency dial until the hairline marker rests on the mark for 10.7 as indicated on the **5.1MHz – 16MHz** scale.

NOTE

For a very precise frequency setting application, such as dialing in a CB channel to within FCC tolerances, the ***COUNTER OUTPUT*** *is used in conjunction with a suitable frequency counter, such as a unit from the Hickok Model 380 series. Connect a three foot, or less, length of RG-58 cable between the* ***COUNTER OUTPUT*** *BNC jack and the input to the frequency counter. Do not use a special termination for the cable. The unit is designed to drive an unterminated cable connected to a high input impedance (at least 1 Megohm) counter input. The counter*

can now be used to continuously monitor output frequency. The ***COUNTER OUTPUT*** *signal is unaffected by the settings of the step* ***μV, VARIABLE μV*** *and* ***% MOD*** *controls.*

4. Having set the desired amplitude and frequency, the r f signal is obtained at the front panel **ATTENUATED** r f BNC connector. The attenuated r f output must work into a 50 ohm load for the amplitude calibration to be correct. The **% MOD** control has no effect on the r f signal in this operational mode.

Obtaining an Internally Modulated RF Signal

1. Turn the **OUTPUT SELECTOR** switch to the **INT MOD** position.

2. Set the desired r f signal amplitude by using the step and **VARIABLE μV** controls. The step **μV** control acts as a multiplier of the number dialed on the **VARIABLE μV** control. For example, to obtain a 5,000μV output, set the **VARIABLE μV** control to **5** and the step **μV** switch to **X1000** position.

3. Obtain the desired r f signal frequency by using the **BAND** switch and the frequency dial. The **BAND** switch determines which scale on the frequency dial is to be used. For example, to obtain a 10.7MHz r f signal, rotate the **BAND** switch to the **5.1MHz – 16MHz** position, then turn the frequency dial until the hairline marker rests on the mark for 10.7 as indicated on the **5.1MHz – 16MHz** scale.

NOTE

For a very precise frequency setting application, such as dialing in a CB channel to within FCC tolerances, the ***COUNTER OUTPUT*** *is used in conjunction with a suitable frequency counter such as a unit from the Hickok Model 380 series. Connect a three foot, or less, length of RG-58 cable between the* ***COUNTER OUTPUT*** *BNC jack and the input to the frequency counter. Do not use a special termination for the cable. The unit is designed to drive an unterminated cable connected to a high input impedance (at least 1 Megohm) counter input. The counter can now be used to continuously monitor output frequency. The* ***COUNTER OUTPUT*** *signal is unaffected by the settings of the step* ***μV, VARIABLE μV*** *and* ***% MOD*** *controls.*

4. Set the amount of modulation desired in the r f signal by adjusting the **% MOD** control. The r f signal will be modulated by an internally generated 1kHz sinusoid. The degree of modulation can be set from 0% to 100% as indicated by the markings surrounding the **% MOD** control. For example, to obtain 30% modulation, set the **% MOD** control to **30**.

5. Having set the desired amplitude, frequency and amount of modulation, the r f signal is obtained at the front panel **ATTENUATED** r f BNC connector. The **ATTENUATED** r f output must work into 50 ohms for the amplitude calibrations to be correct.

Obtaining an Externally Modulated RF Signal

1. Turn the **OUTPUT SELECTOR** switch to the **EXT MOD** position.

2. Set the desired r f signal amplitude by using the step and **VARIABLE μV** controls. The step **μV** control acts as a multiplier of the number dialed on the **VARIABLE μV** control. For example, to obtain a 5,000μV output, set the **VARIABLE μV** control to **5** and the step **μV** switch to **X1000** position.

3. Obtain the desired r f signal frequency by using the **BAND** switch and the frequency dial. The **BAND** switch determines which scale on the frequency dial is to be used. For example, to obtain a 10.7MHz r f signal, rotate the **BAND** switch to the **5.1MHz – 16MHz** position, then turn the frequency dial until the hairline marker rests on the mark for 10.7 as indicated on the **5.1MHz – 16MHz** scale.

NOTE

For a very precise frequency setting application, such as dialing in a CB channel to within FCC tolerances, the ***COUNTER OUTPUT*** *is used in conjunction with a suitable frequency counter such as a unit from the Hickok Model 380 series. Connect a three foot, or less, length of RG-58 cable between the* ***COUNTER OUTPUT*** *BNC jack and the input to the frequency counter. Do not use a special termination for the cable. The unit is designed to drive an unterminated cable connected to a high input impedance (at least 1 Megohm) counter input. The counter can now be used to continuously monitor output frequency. The* ***COUNTER OUTPUT*** *signal is unaffected by the settings of the step* ***μV, VARIABLE μV*** *and* ***% MOD*** *controls.*

4. Connect an audio frequency source to the **AUDIO OUT/IN** terminals. Note that the black terminal is connected to the case which is at ground potential. The **% MOD** control can be used to attenuate the external source and thus control the amount of modulation present in the r f signal. Alternately, external control of the amplitude of the audio source may be used to set the modulation level. The markings surrounding the **% MOD** control will be approximately correct if the amplitude of the external audio source is 0.5Vrms. The frequency of modulation is determined by the frequency of the external source.

5. Having set the desired amplitude, frequency, and amount of modulation, the r f signal is obtained at the front panel **ATTENUATED** r f BNC connector. The **ATTENUATED** r f output must work into 50 ohms for the amplitude calibration to be correct.

Obtaining an Audio Signal

1. Turn the **OUTPUT SELECTOR** switch to the **AUDIO OUT** position.

2. A 1kHz nominal frequency sinewave will be present at the **AUDIO OUT/IN** terminals. The frequency is fixed, as well as the amplitude which is approximately 1 volt rms. Note that the black terminal is connected to the case which is at ground potential. The positions of the **BAND** switch frequency dial, step **μV, VARIABLE μV** and **% MOD** controls have no effect on the frequency or amplitude of the audio output.

SECTION III
APPLICATIONS

The Model 256 CB/RF Signal Generator can be used for a wide variety of applications including r f and i f alignment of AM and CB transceivers as well as checking AGC and squelch circuits, r f traps and filters.

A brief, general alignment procedure for a typical CB transceiver will be given here to illustrate the use of the Model 256 Signal Generator. The specific manufacturers service manual should always be obtained and followed precisely for accurate alignment on a particular CB unit. Correct alignment is a must for optimum sensitivity and selectivity.

Generally, the alignment process begins with tuning the i f transformers nearest the audio detector, and then tuning the preceding i f transformer and so on up to the antenna stage. The following procedure is outlined for a dual conversion super heterodyne receiver. For a single conversion receiver, eliminate steps 8, 9, 10 and 11.

1. Connect an ac voltmeter or audio wattmeter across the speaker terminals to observe the audio output voltage. Alternately, the audio output voltage may be monitored by connecting a high impedance voltmeter to the AGC line coming from the detector.

2. Disable the second local oscillator. This may be done by removing the appropriate crystal.

3. Couple the signal output of the Model 256 through a small capacitor (about 1,000pF) to the input of the second mixer. Then, common the Model 256 ground to the chassis of the receiver being tuned.

4. Set the **OUTPUT SELECTOR** to **INT MOD** and turn the **% MOD** control to **30**, to produce a 30% modulated r f signal. Then, with the aid of a frequency counter connected to the **COUNTER OUTPUT**, set the output frequency to coincide with the receiver second i f (usually 455kHz or 1650kHz).

5. With the receiver volume and squelch controls fully on and the noise limiters off, slowly increase the Model 256 output, starting from a low level, until the 1kHz audio modulation is heard through the receiver speaker.

6. Tune the detector i f transformer and then the preceding i f transformer(s) back up to the second mixer for maximum audio output.

Reduce the r f output from the Model 256 and then retune as before for maximum audio output.

7. To correct for any possible detuning effect caused by the connection of the Model 256 signal lead to the mixer input, disconnect the signal lead and merely drape it near the mixer. Then increase the r f output as necessary and retune as before.

8. Now connect the r f signal lead, (through the 1,000pF capacitor), to the input of the first mixer. Re-enable the second local oscillator, then disable the first local oscillator.

9. Readjust the Model 256 to coincide with the receiver first i f frequency. Starting from a low level, slowly increase the r f output until the 1kHz audio modulation is heard through the receiver speaker.

10. Tune the i f transformer(s) between the output of the first mixer and the input of the second mixer, beginning near the second mixer. Tune for maximum audio output. Reduce the r f output from the Model 256 and retune as before for maximum audio output.

11. To correct for any possible detuning effect caused by the connection of the Model 256 signal lead to the mixer input, disconnect the signal lead and merely drape it near the mixer. Then increase the r f output as necessary and retune as before.

12. Re-enable the first local oscillator and disconnect the Model 256 from the first mixer input.

13. Keeping the signal generator ground commoned to the receiver chassis, connect the signal lead directly to the antenna input through a .01μF capacitor. Select Channel 13 on the receiver and then set the frequency of the Model 256 to 27.115MHz.

14. Apply a very low r f signal (just enough to get an audio output indication) and tune the front end transformers for maximum audio output. Reduce the r f input signal as necessary during tuning, to prevent overdriving the audio output.

CAUTION

*The **ATTENUATED** output of the Model 256 is protected against momentary r f output from a CB transceiver with a maximum output of 4 watts average power. Extended application of transmitter r f power to the **ATTENUATED** output of the Model 256 may cause damage to the internal circuitry of the Model 256.*

With the Model 256 attached through a .01μF capacitor directly to the antenna input, a number of other adjustments can be made. Receiver manufacturers frequently have provisions to set squelch and "S" meter sensitivity. By applying a specified r f input amplitude, as called out in the manufacturers service manual, the adjustments for proper "S" meter deflection and squelch sensitivity threshold may be easily accomplished.

The Model 256 may also be used to obtain a measure of a CB receiver's sensitivity. Most receivers require .5 to 1μV input signal for a 10dB signal plus noise to noise ratio at the output. Although the Model 256 is not calibrated below 1μV, it is useful in determining whether or not the receiver sensitivity is close to specification. If the measured sensitivity is 2μV or greater, the receiver probably requires alignment or further troubleshooting. The sensitivity is determined as follows.

1. Turn the squelch control on the receiver fully off and turn off any noise limiters or blankers. Select Channel 13.

2. Monitor the audio output of the receiver by connecting an audio wattmeter (or ac voltmeter) across the speaker.

CAUTION

*The **ATTENUATED** output of the Model 256 is protected against momentary r f output from a CB transceiver with a maximum output of 4 watts average power. Extended application of transmitter r f power to the **ATTENUATED** output of the Model 256 may cause damage to the internal circuitry of the Model 256.*

3. Connect the Model 256 signal ground to the receiver chassis, then connect the r f output directly to the antenna input through a .01μF capacitor. Turn off the Model 256 by turning the **OUTPUT SELECTOR** to **OFF**, so that absolutely no signal emanates from the r f output.

4. Adjust the receiver volume control to obtain an audio output of .15W (1.1Vrms). Don't readjust the volume control for the rest of the test.

5. Turn on Model 256 by rotating **OUTPUT SELECTOR** to **INT MOD.** Set the **% MOD** control to **30.** Put the step **μV** control on **X1** and the **VARIABLE μV** control on **1.** Select the CB band and set the output frequency (using a frequency counter connected to the **COUNTER OUTPUT** jack) to 27.115MHz. The Model 256 is now emitting a 1μV signal on Channel 13, modulated 30% by a 1kHz audio tone.

6. Use the **VARIABLE μV** control to adjust the r f input signal to such a level that the audio output rises to 1.5W (3.5Vrms). This represents a 10dB increase over the original noise level. The required r f input into antenna is then a measure of the receiver sensitivity, and this is obtained by noting the position of the **VARIABLE μV** control. Note that the calibrations of the r f output are valid since the antenna input represents a 50 ohm load to the Model 256.

SECTION IV
THEORY OF OPERATION

Refer to the schematic in the back of the manual.

The active element in the r f oscillator is Q105. The transistor is running common collector, with the frequency determining LC tank circuit coupled through C111 to the base. A tap on the high end of the tank is tied to the emitter of Q105 to provide feedback for sustained oscillation. The signal amplitude is stabilized by the limiting action of the transistor, and will remain constant as long as the transistor bias point is steady.

Each frequency band has its own tank circuit, as selected by the **BAND** switch. The frequency is varied within the band by incorporating a variable capacitor, C125, into the tank circuit.

In the 100kHz – 370kHz and 370kHz – 1400kHz bands, C125A is paralled with C125B. The 1.4MHz – 5.1MHz band has C125A in parallel with the series combination of C125B and C121. The 5.1MHz – 16MHz band uses C125A alone. In the CB band, C125A is in series with C123 and C124, then the group is parallel with C122. The net change in tank capacitance as C125A is varied is thus reduced to a small value to allow accurate expanded narrowband tuning on the CB range.

The oscillator output is buffered with an emitter follower consisting of Q104 and associated components. From here the r f signal goes to two places. First, it is directed to another emitter follower, Q103, which serves as a buffer for the **COUNTER OUTPUT** jack. Then the signal passes through a dropping resistor to the **VARIABLE μV** control, R126.

The wiper of R126 is capacitor coupled to the base of Q102 which is connected as a Van der Bjil modulator. If no audio signal is present, Q102 acts simply as an r f amplifier. If an audio signal is present, it will be coupled into the base of Q102 via C116 and R123 and thus vary the gain of the r f amplifier at an audio rate, producing the desired modulation.

The degree of modulation is set by the amount of audio signal fed into Q102, as determined by R127. The audio source may be external or internal. The internal audio source consists of Q101 and associated components. This transistor is connected in a twin "T" oscillator circuit which generates a 1kHz sinusoid. The loop gain is set by R124. The audio signal is made available at the front-panel **AUDIO OUT/IN** terminals when the **OUTPUT SELECTOR** switch is in the **AUDIO OUT** position. The **INT MOD** position feeds the audio directly to the modulator.

The r f output from Q102 is coupled through C103 to the decade step attenuator consisting of R129 through R138 and S3. This is a shielded ladder network which can pass the signal straight through to the output BNC connector, or attenuate it up to four decades.

The power supply for the system consists of T101 and associated components. The raw rectified ac is heavily filtered through a capacitor pi network consisting of C101, C104 and R101. The filtered dc is regulated by CR101, a zener diode.

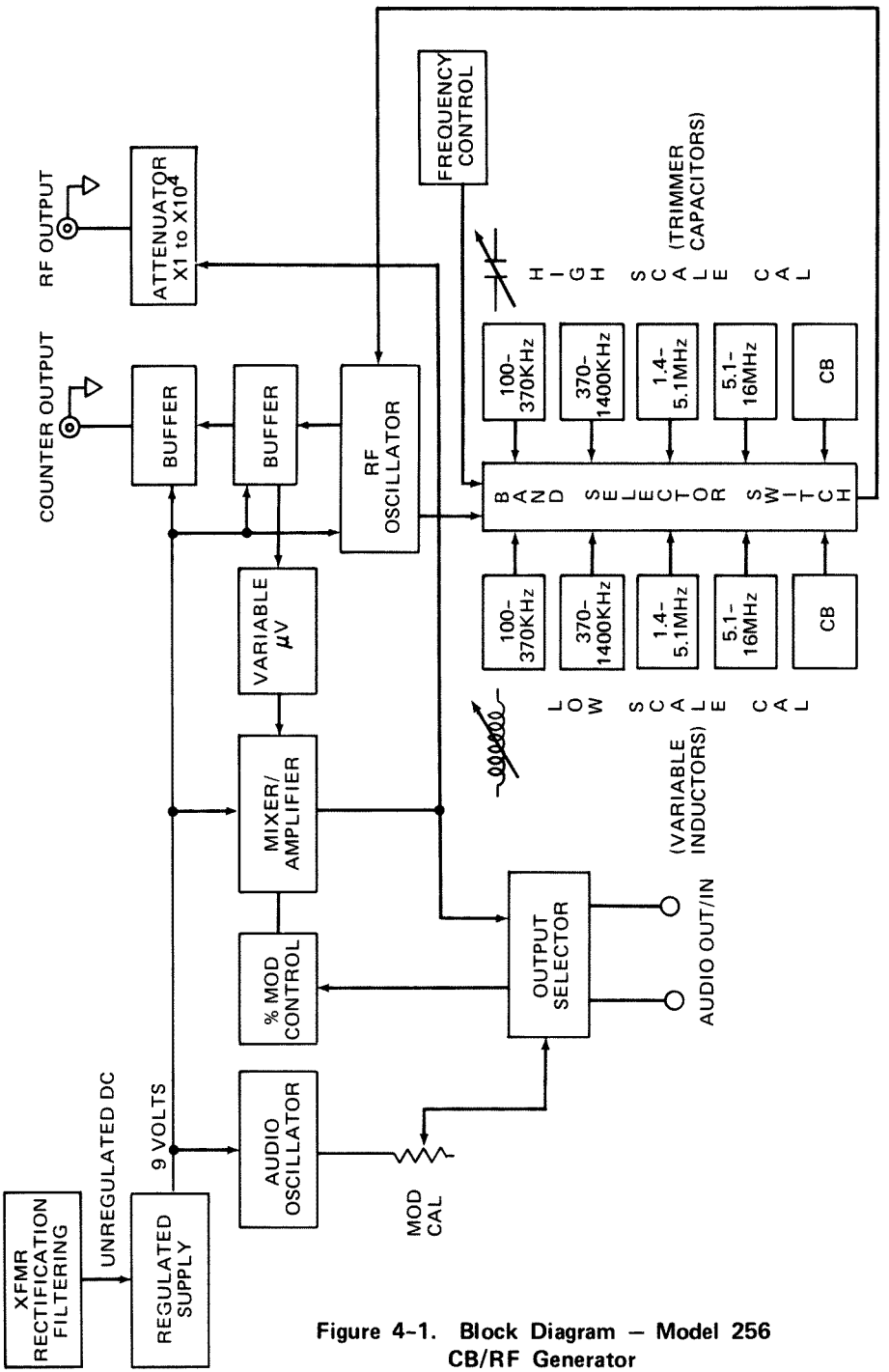


Figure 4-1. Block Diagram — Model 256 CB/RF Generator

SECTION V
MAINTENANCE

GENERAL

The Hickok Model 256 CB/RF Signal Generator is an all solid-state device which uses no "use-up" or "wear-out" components. There is, however, an internal 3AG 0.25A Slo-Blo fuse for protection of the power supply. If when the unit is activated, the **POWER** lamp does not illuminate, the fuse may have failed. To locate and replace the fuse follow the procedure below:

NOTE

A fuse failure may be symptomatic of a more serious circuit malfunction. Check for a cause of the fuse failure before replacing the fuse. Never replace the fuse with one of larger capacity.

1. Place the **OUTPUT SELECTOR** switch in the **OFF** position.
2. Disconnect line power by pulling the plug.
3. Remove 8 screws from 4 corner brackets (2 screws each).
4. Remove corner brackets.
5. Lift off top cover.
6. Locate fuse in rear of circuit board, retained in fuse clips.
7. With ohmmeter check continuity of fuse.
8. If fuse is open, check for burned or shorted components on circuit board.
9. After repair of faulty component, or if no reason for the fuse failure is apparent, replace fuse with 3AG 0.25A Slo-Blo.
10. Reconnect line cord and activate unit. If fuse fails again, more extensive troubleshooting and repair is required.

SECTION VI
CALIBRATION

The Hickok 256 CB/RF Signal Generator is factory calibrated to insure maximum accuracy. There may be times, because of component aging, repair or replacement, that it becomes necessary to recalibrate the unit to factory specifications. The calibration procedure is described below.

NOTE

The following calibration procedures must be performed only by qualified service personnel with the appropriate equipment.

PRELIMINARY

1. Connect unit to an appropriate power source and turn unit on by rotating **OUTPUT SELECTOR** switch to any position except **OFF**. **POWER** lamp in upper right hand corner will illuminate.

2. Allow unit to warm-up for at least 15 minutes before proceeding.

Equipment Needed

1. Frequency counter with seven digits – Hickok Model 380 or equivalent.

2. RF Voltmeter – Hewlett Packard 411 or equivalent.

3. Oscilloscope with probe – Hickok Model 5000A or equivalent.

4. Hex alignment tool for adjusting tuning coil slugs.

5. Insulated alignment tool for adjusting trimmer capacitors.

6. 50 ohm BNC feed through terminator.

7. Miscellaneous coaxial cables.

Dial Calibration – Low End of Band

NOTE

All dial calibration adjustments must be performed with the unit enclosed in its cabinet. Access to the coils and trimmer capacitors is made by removing the cover plate on the rear panel.

1. Verify that **% MOD** control is set to **0**, the step **μV** switch is on the **X1.0** range, the **VARIABLE μV** control is on **10**, and the **OUTPUT SELECTOR** is turned to the **RF** position.

2. Connect the frequency counter to the **COUNTER OUTPUT** jack using a coaxial cable no longer than three feet. Do not terminate the cable.

3. Turn the **BAND** selector switch to the **100-370kHz** position and set the dial to **100**.

4. Adjust L105 (see tuning adjustment location diagram, Figure 6-1) until the counter reads between 99.5 and 100.5kHz.

5. Turn the **BAND** selector switch to the **370-1400kHz** position and set the dial to **370**.

6. Adjust L106 until the counter reads between 368 and 372kHz.

7. Turn the **BAND** selector switch to the **1.4-5.1MHz** position and set the dial to **1.4**.

8. Adjust L102 until the counter reads between 1.393 and 1.407MHz.

9. Turn the **BAND** selector switch to the **5.1-16MHz** position and set the dial to **5.1**.

10. Adjust L103 until the counter reads between 5.074 and 5.126MHz.

Dial Calibration – High End of Band

NOTE

These calibrations are performed with the unit enclosed in its cabinet.

1. Verify that the **% MOD** control is set to **0**, the step **μV** switch is on the **X1.0** range, the **VARIABLE μV** control is on **10**, the **OUTPUT SELECTOR** is turned to the **RF** position, and the frequency counter is still connected to the **COUNTER OUTPUT** jack.

2. Turn the **BAND** selector switch to the **100-370kHz** position and set the dial to **370**.

3. Adjust C126 until the frequency counter reads between 368 and 372 kHz.

4. Turn the **BAND** selector switch to the **370-1400kHz** position and set the dial to **1400**.

5. Adjust C127 until the frequency counter reads between 1.393 and 1.407kHz.

6. Turn the **BAND** selector switch to the **1.4-5.1MHz** position and set the dial to **5.1**.

7. Adjust C119 until the frequency counter reads between 5.074 and 5.126MHz.

8. Turn the **BAND** selector switch to the **5.1-16MHz** position and set the dial to **16**.

9. Adjust C120 until the frequency counter reads between 15.92 and 16.08MHz.

NOTE

There is a slight interaction between the high end and low end of band calibrations. Repeat the low end calibration and retouch the coils if necessary. Repeat the high end calibrations, as necessary, for those bands which were retouched.

Dial Calibration – CB Band

NOTE

These calibrations are performed with the unit enclosed in its cabinet.

1. Verify that the **% MOD** control is set to **0**, the step **μV** switch is on the **X1.0** range, the **VARIABLE μV** control is on **10**, the **OUTPUT SELECTOR** is turned to the **RF** position, and the frequency counter is still connected to the **COUNTER OUTPUT** jack.

2. Turn the **BAND** selector switch to the **CB** position.

3. Set the dial to Channel 1 and record the reading on the frequency counter.

4. Set the dial to **27.6MHz** and record the reading on the frequency counter.

5. Subtract the frequency reading obtained in step 3 from the reading taken in step 4. The difference must be 0.635MHz ±.01MHz (i.e., between .625 and .645MHz). If this condition is not met, adjust C123 and repeat steps 3, 4, and 5 until a correct value is obtained.

6. Set the dial to Channel 13.

7. Adjust L104 (**CB BAND ADJ** on front panel) until the frequency counter reads between 27.110 and 27.120MHz, preferably as close to 27.115MHz as possible.

8. Remove frequency counter.

NOTE

The remainder of the calibration adjustments are accessible only by removing the top cover of the unit. Proceed as follows:

1. Disconnect line power by pulling the plug.

2. Remove 8 screws from 4 corner brackets (2 screws each).

3. Remove corner brackets and lift off cover.

CAUTION

With line cord connected, hazardous line-voltage levels are present around the transformer, fuse, and power switch. Exercise care to avoid dangerous electrical shock or damaging short circuits.

4. Connect line cord and turn unit on.

RF Amplitude Calibration

1. Verify that the **% MOD** control is set to **0**, the **OUTPUT SELECTOR** is turned to the **RF** position, the **BAND** selector switch is in the **CB** position, and the dial is on Channel 13.

2. Turn the step **μV** switch to the **X10,000** position and set the **VARIABLE μV** control to **10**.

3. Connect the r f voltmeter to the **ATTENUATED** output jack using a 50 ohm terminated coaxial cable.

4. Adjust R115 (Oscillator Bias, refer to component location drawings in rear of manual) until the output voltage is 100 ±1mVrms.

5. Disconnect r f voltmeter.

Audio Output Calibration

1. The **BAND** selector switch, frequency dial, step **μV** switch, **VARIABLE μV** control and **% MOD** control may be in any position.

2. Turn the **OUTPUT SELECTOR** switch to the **AUDIO OUT** position.

3. Monitor the **AUDIO OUT/IN** jacks with an oscilloscope. A sinewave should be observed with a frequency of apprximately 1kHz.

4. Adjust R124 (Sine Adj.) until the sinewave amplitude is 2.8 ±0.2 volts peak-to-peak.

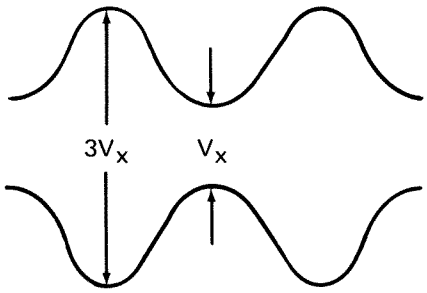
5. Disconnect oscilloscope from **AUDIO OUT/IN** jacks.

% Modulation Calibration

1. Make sure the step **μV** switch is set to the **X10,000** position, the **VARIABLE μV** control is on **10**, the **BAND** selector switch is at the **CB** position, and the dial is set to Channel 13.

2. Set the **% MOD** control to **50** and turn the **OUTPUT SELECTOR** switch to the **INT MOD** position.

3. Monitor the r f output with an oscilloscope and adjust R128 (Modulation Cal.) for 50% modulation, as shown on the following page.



The maximum peak-to-peak voltage of the modulation envelope should be three times that of the minimum peak-to-peak voltage of the envelope.

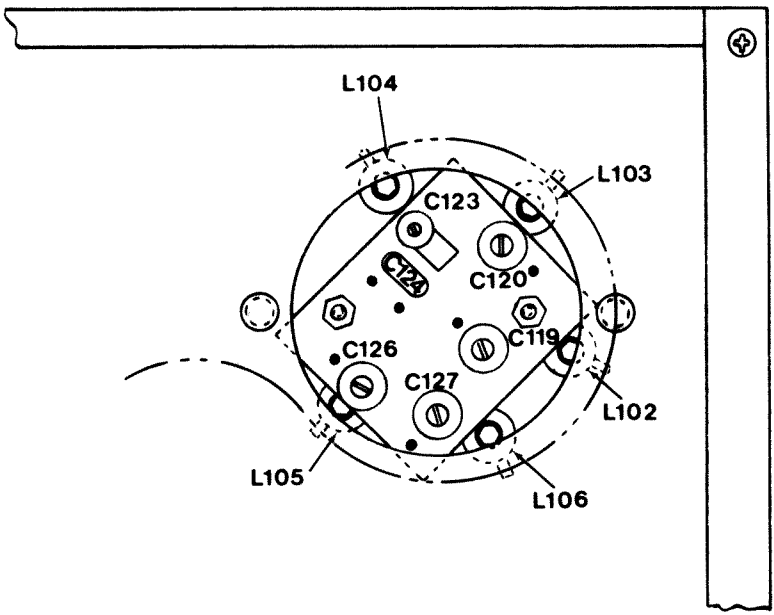


Figure 6-1. Tuning Coil Location – Model 256 CB/RF Generator

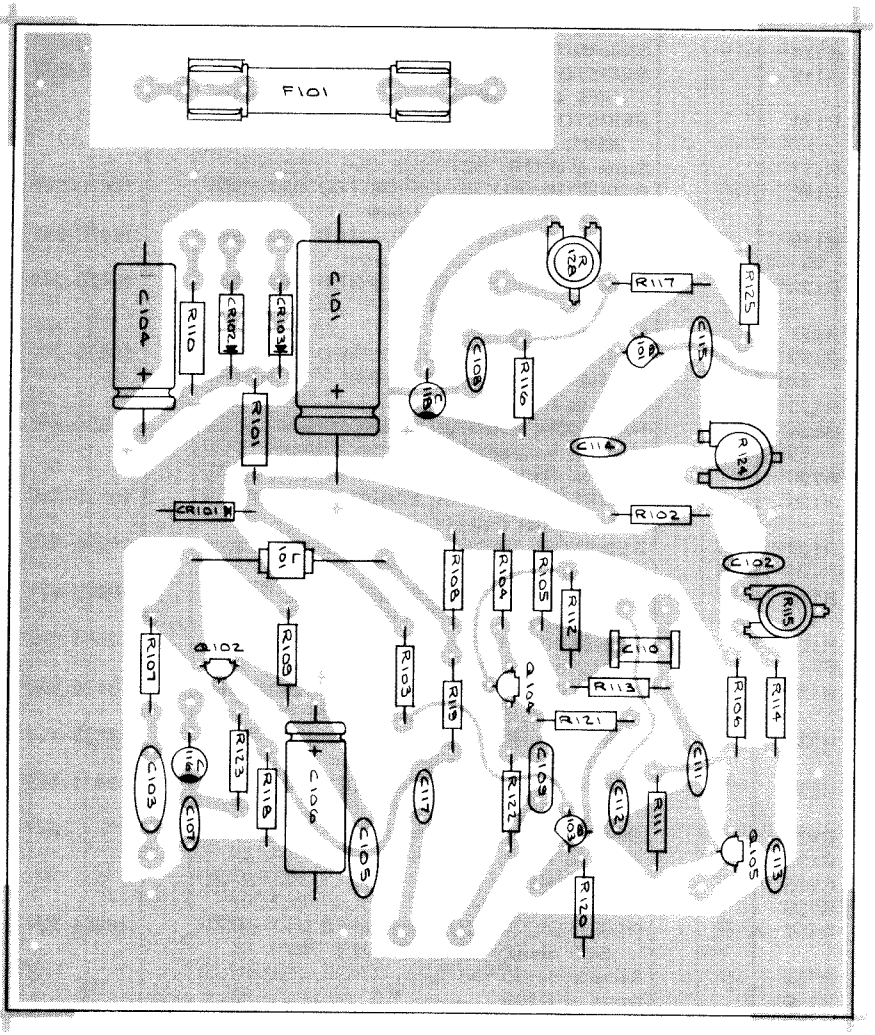
SECTION VII
PARTS LIST

When ordering parts be sure to give the reference designation, description, and the Hickok part number as listed in the following table. Unless otherwise indicated in the DESCRIPTION column, parts listed are applicable to all models. Also include the model and serial number of the equipment. There is a minimum billing charge of $20.00 for all parts orders.

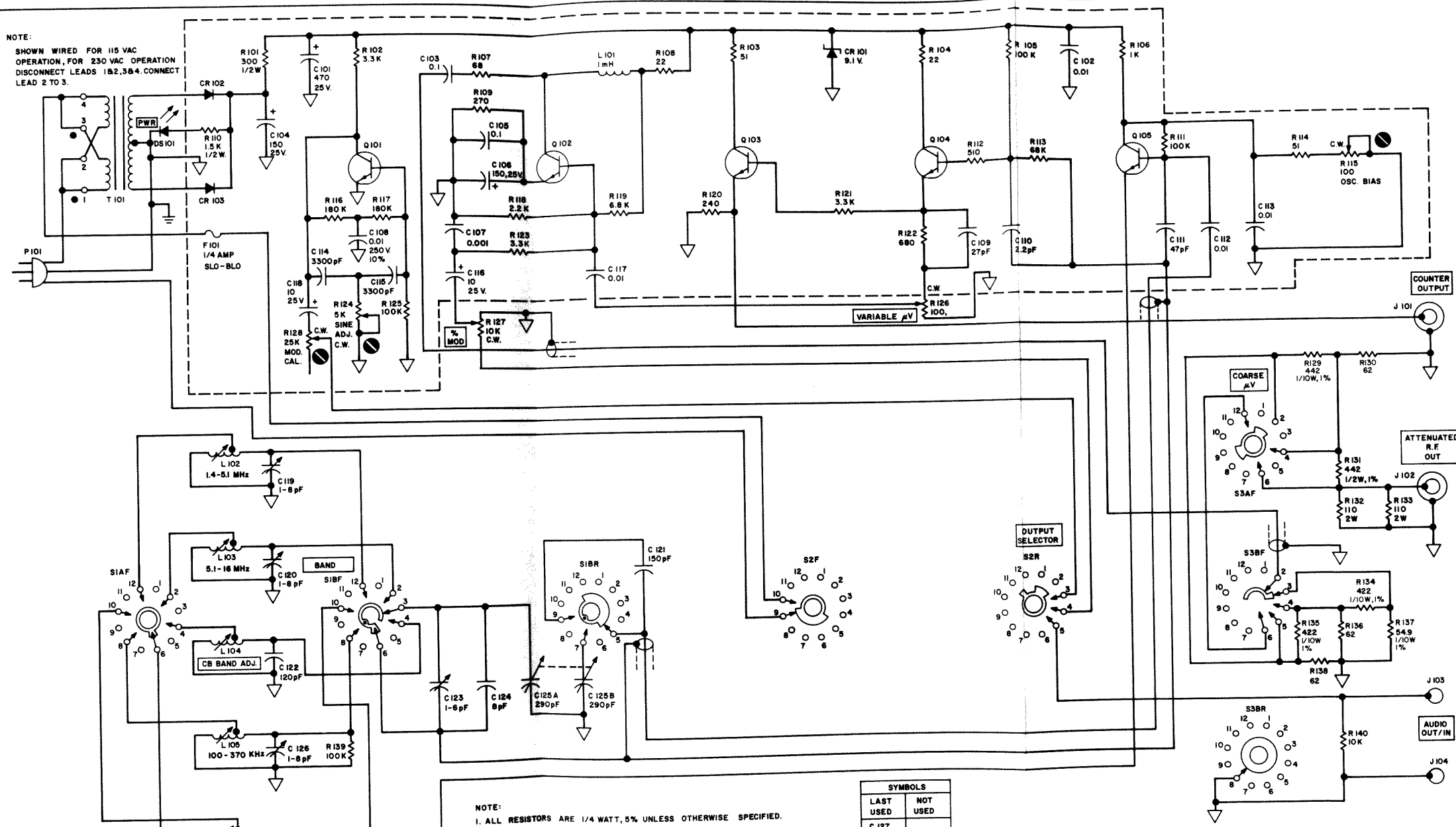
REF. DESIG.	NOTES	DESCRIPTION	HICKOK PART NO.
C101		CAPACITOR, FIXED, ELECTROLYTIC: 470 uf, 25 volts	3085-535
C102		CAPACITOR, FIXED, CERAMIC: 0.01 uf, 20%, 25 volts, disc type	3110-332
C103		CAPACITOR, FIXED, CERAMIC: 0.1 uf, 20%, 25 volts, disc type	3110-333
C104		CAPACITOR, FIXED, ALUMINUM ELECTROLYTIC: 150 uf, 25 volts	3085-450
C105		Same as C103	
C106		Same as C104	
C107		CAPACITOR, FIXED, CERAMIC: 1000 pf, disc type	3111-522
C108		CAPACITOR, FIXED, METALLIZED MYLAR: 0.01 uf, 10%, 250 volts	3090-101
C109		CAPACITOR, FIXED, DIPPED MICA: 27 pf, 5%, 500 volts	3096-511
C110		CAPACITOR, FIXED, CERAMIC: 2.2 pf, disc type	3111-502
C111		CAPACITOR, FIXED, CERAMIC: 47 pf, disc type	3111-514
C112		Same as C102	
C113		Same as C102	
C114		CAPACITOR, FIXED, CERAMIC: 3300 pf, disc type	3111-525
C115		Same as C114	
C116		CAPACITOR, FIXED, BEAD TANTALUM: 10 uf, 10%, 25 volts	3085-504
C117		Same as C102	
C118		Same as C116	
C119		CAPACITOR, VARIABLE: plastic trimmer, 1-8 pf	3115-81
C120		Same as C119	
C121		CAPACITOR, FIXED, CERAMIC: 150 pf, disc type	3111-517
C122		CAPACITOR, FIXED, DIPPED MICA: 120 pf, 5%, 500 volts	3096-527
C123		CAPACITOR, VARIABLE: 1-6 pf	3115-89

REF. DESIG.	NOTES	DESCRIPTION	HICKOK PART NO.
C124		CAPACITOR, FIXED, DIPPED MICA: 8 pf, 10%, 500 volts	3096-504
C125A, B		CAPACITOR, AIR VARIABLE: dual section, tuning, 290 pf per section	3120-46
C126		Same as C119	
C127		Same as C119	
CR101		SEMICONDUCTOR DEVICE: zener diode, 9.1v ±5%, 400 mw, type 1N5735B	3870-369
CR102		SEMICONDUCTOR DEVICE: silicon diode, 50 volt PIV, 1 amp, type 1N4001	3870-229
CR103		Same as CR102	
DS101		LAMP: LED, type LSL-3L, red diffused	12270-129
F101		FUSE: 1/4 amp, SLO-BLO	6900-78
J101		CONNECTOR, RECEPTACLE: UG-1094A/U	3475-294
J102		Same as J101	
J103		Binding post: red	2360-107
J104		Binding post: black	2360-106
L101		COIL: 1mH	3320-372
L102		COIL: tapped, variable inductor, 1.4-5.1MHz	3320-398
L103		COIL: tapped, variable inductor, 5.1-16MHz	3320-399
L104		COIL: tapped, variable inductor, CB band adj.	3320-400
L105		COIL: tapped, variable inductor, 100-370KHz	3320-396
L106		COIL: tapped, variable inductor, 370-1400KHz	3320-397
P101		CORD: line, grey	3675-49
Q101		TRANSISTOR: 2N3565 NPN silicon	20861-99
Q102		TRANSISTOR: 2N3904 NPN silicon	20861-141
Q103		TRANSISTOR: 2N5130 NPN	20861-171
Q104		Same as Q102	
Q105		Same as Q102	
R101		RESISTOR, FIXED, COMPOSITION: 300 ohms, 5%, 1/2 watt	18411-301
R102		RESISTOR, FIXED, DEPOSITED CARBON: 3.3K ohms, 5%, 1/4 watt	18470-332
R103		RESISTOR, FIXED, DEPOSITED CARBON: 51 ohms, 5%, 1/4 watt	18470-510
R104		RESISTOR, FIXED, DEPOSITED CARBON: 22 ohms, 5%, 1/4 watt	18470-220
R105		RESISTOR, FIXED, DEPOSITED CARBON: 100K ohms, 5%, 1/4 watt	18470-104
R106		RESISTOR, FIXED, DEPOSITED CARBON: 1K ohms, 5%, 1/4 watt	18470-102
R107		RESISTOR, FIXED, DEPOSITED CARBON: 68 ohms, 5%, 1/4 watt	18470-680
R108		Same as R104	
R109		RESISTOR, FIXED, DEPOSITED CARBON: 270 ohms, 5%, 1/4 watt	18470-271
R110		RESISTOR, FIXED, COMPOSITION: 1.5K ohms, 10%, 1/2 watt	18412-152
R111		Same as R105	
R112		RESISTOR, FIXED, DEPOSITED CARBON: 510 ohms, 5%, 1/4 watt	18470-511

REF. DESIG.	NOTES	DESCRIPTION	HICKOK PART NO.
R113		RESISTOR, FIXED, DEPOSITED CARBON: 68K ohms, 5%, 1/4 watt	18470-683
R114		Same as R103	
R115		RESISTOR, VARIABLE: 100 ohms, 30%, linear taper	16925-892
R116		RESISTOR, FIXED, DEPOSITED CARBON: 180K ohms, 5%, 1/4 watt	18470-184
R117		Same as R116	
R118		RESISTOR, FIXED, DEPOSITED CARBON: 2.2K ohms, 5%, 1/4 watt	18470-222
R119		RESISTOR, FIXED, DEPOSITED CARBON: 6.8K ohms, 5%, 1/4 watt	18470-682
R120		RESISTOR, FIXED, DEPOSITED CARBON: 240 ohms, 5%, 1/4 watt	18470-241
R121		Same as R102	
R122		RESISTOR, FIXED, DEPOSITED CARBON: 680 ohms, 5%, 1/4 watt	18470-681
R123		Same as R102	
R124		RESISTOR, VARIABLE: 5K ohms, 20%, horizontal mtg	16925-846
R125		Same as R105	
R126		RESISTOR, VARIABLE: 100 ohms, 20%, horizontal mtg	16925-818
R127		RESISTOR, VARIABLE: 10K ohms, 20%, linear taper	16925-893
R128		RESISTOR, VARIABLE: 25K ohms, 20%, horizontal mtg	16925-871
R129		RESISTOR, FIXED, METAL FILM: 442 ohms, 1%, 1/10 watt	18554-232
R130		RESISTOR, FIXED, DEPOSITED CARBON: 62 ohms, 5%, 1/4 watt	18470-620
R131		RESISTOR, FIXED, METAL FILM: 442 ohms, 1%, 1/2 watt	18526-152
R132		RESISTOR, FIXED, COMPOSITION: 110 ohms, 5%, 2 watt	18431-111
R133		Same as R132	
R134		Same as R129	
R135		Same as R129	
R136		Same as R130	
R137		RESISTOR, FIXED, METAL FILM: 54.9 ohms, 1%, 1/10 watt	18554-231
R138		Same as R130	
R139		Same as R105	
R140		RESISTOR, FIXED, DEPOSITED CARBON: 10K ohms, 5%, 1/4 watt	18470-103
S1		SWITCH: rotary, hand selector	19912-717
S2		SWITCH: rotary, output selector	19912-718
S3		SWITCH: rotary, attenuator	19912-719
T101		TRANSFORMER: power	20800-481



PC BOARD MODEL 256

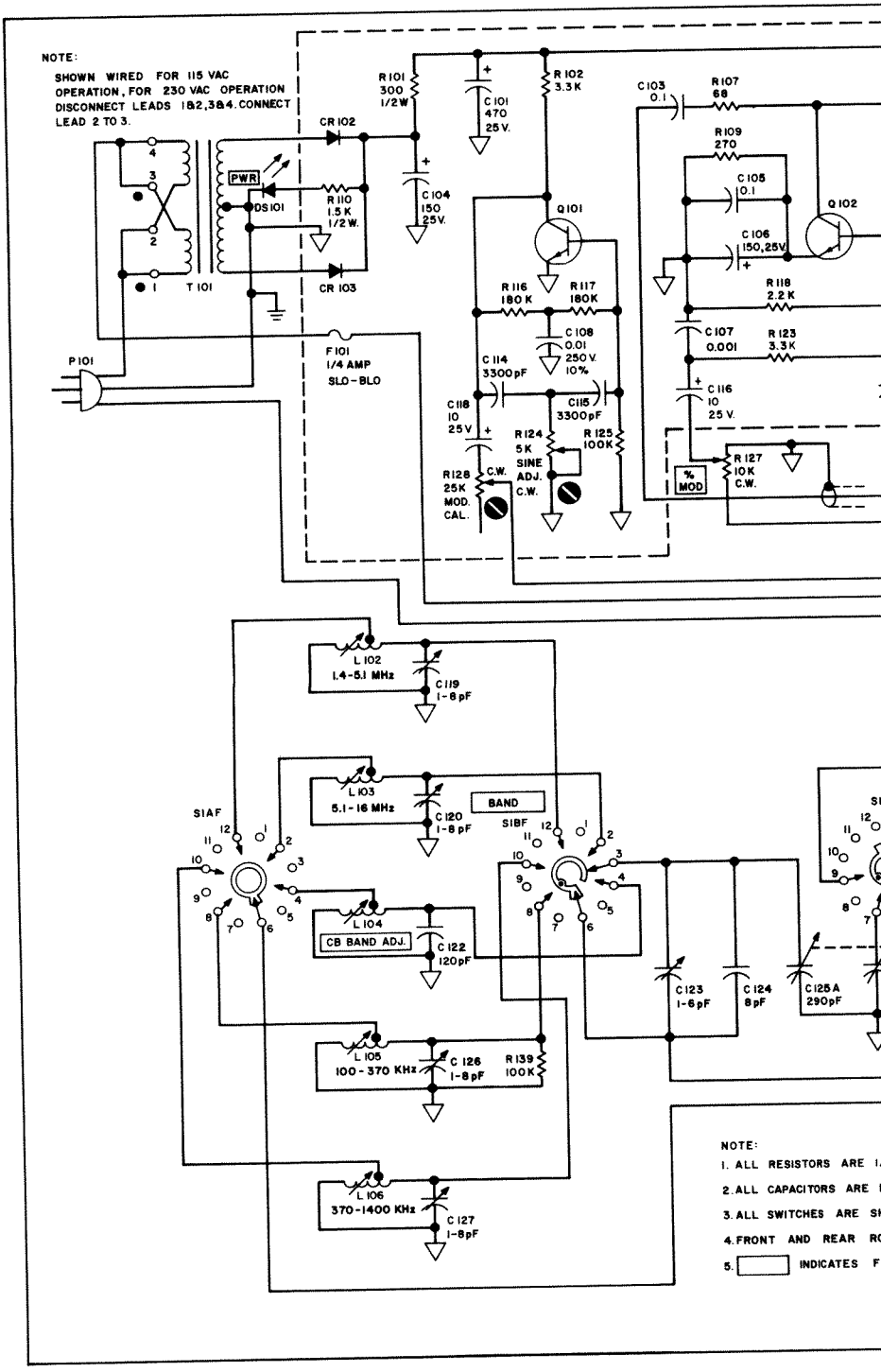


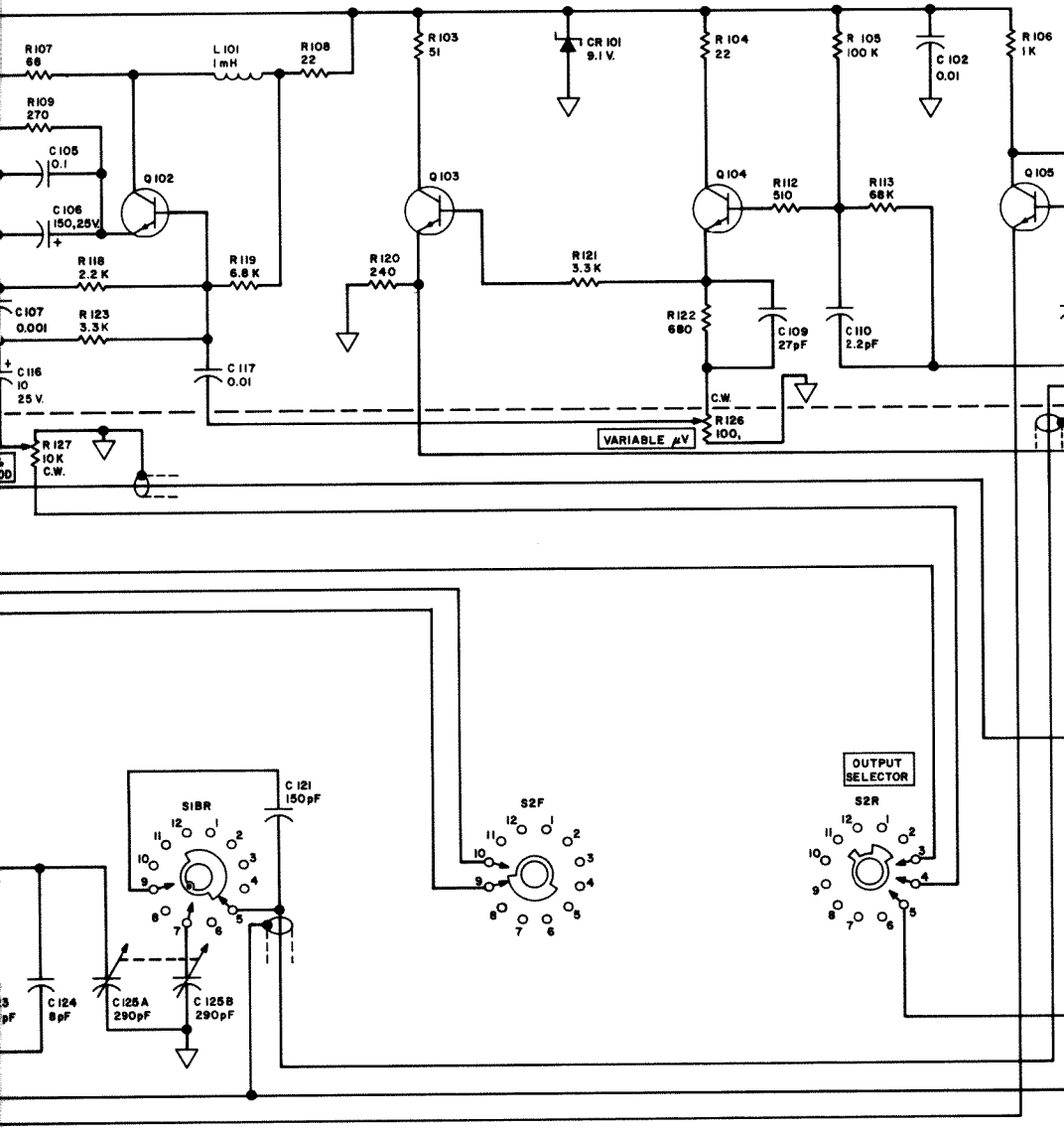
NOTE:

1. ALL RESISTORS ARE 1/4 WATT, 5% UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. ALL SWITCHES ARE SHOWN IN MAXIMUM COUNTER-CLOCKWISE POSITION.
4. FRONT AND REAR ROTORS OF S1B ARE ELECTRICALLY CONNECTED.
5. [ ] INDICATES FRONT PANEL NOMENCLATURE.

SYMBOLS	
LAST USED	NOT USED
C 127	
CR 103	
DS 101	
F 101	
J 104	
L 106	
P 101	
Q 105	
R 140	
S3BR	
T 101	

SCHEMATIC MODEL 256
Drawing Number 902-528W

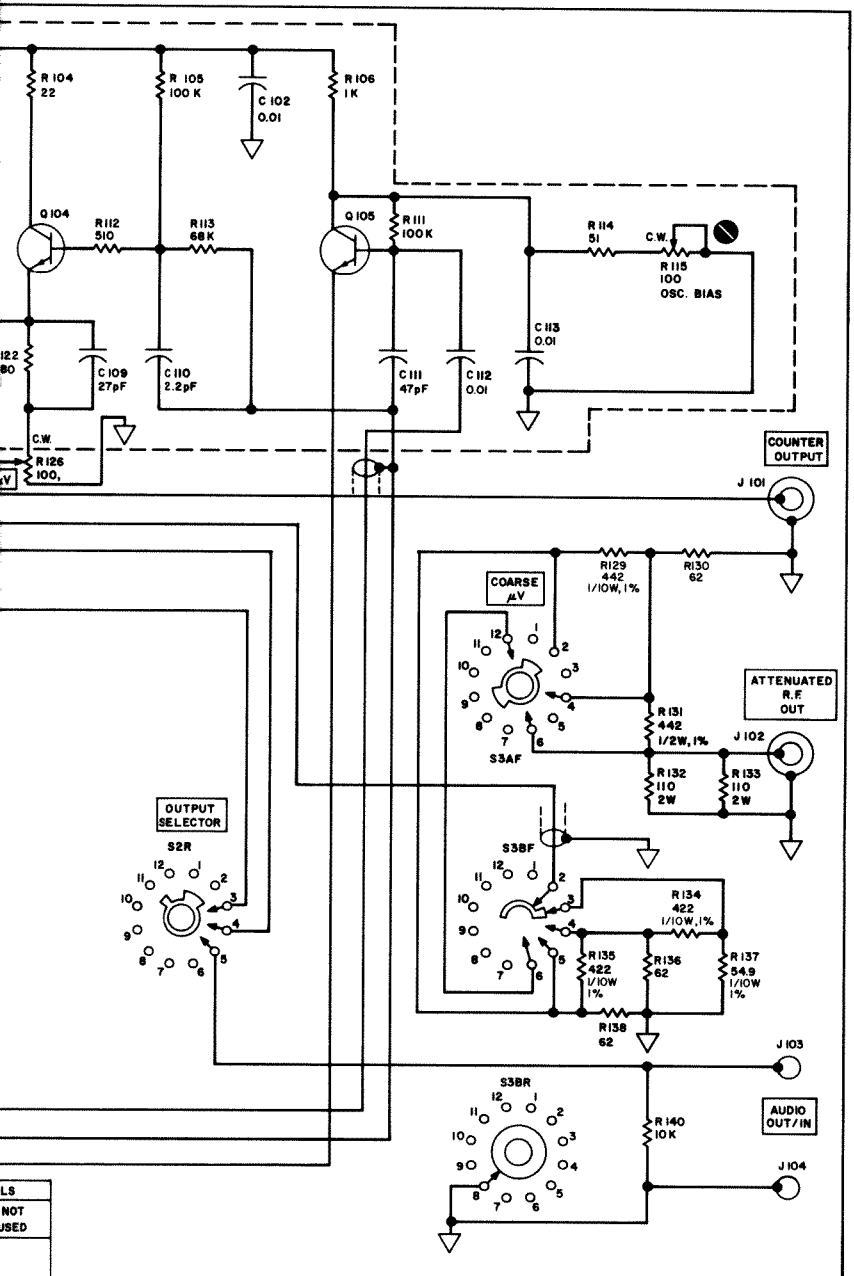

NOTE:
SHOWN WIRED FOR 115 VAC OPERATION, FOR 230 VAC OPERATION DISCONNECT LEADS 1&2,3&4. CONNECT LEAD 2 TO 3.
T101
PWR
DS101
CR102
CR103
R110 1.5K 1/2W.
C104 150 25V.
R101 300 1/2W
C101 470 25V.
R102 3.3K
P101
F101 1/4 AMP SLO-BLO
Q101
R116 180K
R117 180K
C108 0.01 250V. 10%
C114 3300pF
C115 3300pF
C118 10 25V
R124 5K SINE ADJ. C.W.
R125 100K
R128 25K MOD. CAL.
C.W.
C103 0.1
R107 68
R109 270
C105 0.1
C106 150,25V.
Q102
R118 2.2K
C107 0.001
R123 3.3K
C116 10 25V.
% MOD
R127 10K C.W.
L102 1.4-5.1 MHz
C119 1-8pF
L103 5.1-16 MHz
C120 1-8pF
BAND
S1AF
S1BF
L104 CB BAND ADJ.
C122 120pF
L105 100-370 KHz
C126 1-8pF
R139 100K
L106 370-1400 KHz
C127 1-8pF
C123 1-6pF
C124 8pF
C125A 290pF
NOTE:
1. ALL RESISTORS ARE
2. ALL CAPACITORS ARE
3. ALL SWITCHES ARE
4. FRONT AND REAR
5. INDICATES



NOTE:

1. ALL RESISTORS ARE 1/4 WATT, 5% UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. ALL SWITCHES ARE SHOWN IN MAXIMUM COUNTER-CLOCKWISE POSITION.
4. FRONT AND REAR ROTORS OF S1B ARE ELECTRICALLY CONNECTED.
5. [ ] INDICATES FRONT PANEL NOMENCLATURE.

SYMBOLS	
LAST USED	NOT USED
C 127	
CR 103	
DS 101	
F 101	
J 104	
L 106	
P 101	
Q 105	
R 140	
S3BR	
T 101	



SCHEMATIC MODEL 256
Drawing Number 902-528W

CAUTION

THIS UNIT MAY BE EQUIPED WITH 1/4 AMP 125 VOLT FUSE, 3AG 313.250. IF THIS UNIT IS TO BE CONVERTED TO 210/250 VOLT OPERATION THIS FUSE MUST BE REPLACED WITH A 250 VOLT FUSE. USE BUSSMAN NO. MDL 1/4 250 VOLT, HICKOK PART NO. 6900-78.

HICKOK

Dear Customer:

Thank you for purchasing the Model 256. We feel that this generator is an outstanding value as it is the only RF Generator in its price class that has the 3 key features needed for CB service work:

1) An expanded CB Band on the tuning dial that makes CB channel frequencies easy to set.
2) An attenuated output with levels to 1μV and under.
3) A separate high level output for monitoring the output with a counter for frequency precision.

In using this fine instrument keep in mind that as a tunable generator it will be subject to frequency drift and shifts not found in crystal controlled generators (which cost 2 to 4 times as much). Through careful design, these frequency shifts have been minimized in the Model 256 as much as possible.

In CB Channel frequencies, after a ½ hour warm-up, a drift with time of approximately 600Hz/hr. can be expected - this is a stability of 20ppm/hr. or .002%/hr. In addition, full rotation of the VARIABLE μV control can be expected to cause a frequency shift of approximately 2-7kHz which is less than .03%. Shifts of more than one and half times this amount indicate defective components and the unit should be returned for service.

Although this shift can cause inconvenience, no loss of accuracy is encountered because the counter output provides continuous frequency monitoring. This inconvenience can be minimized by first setting the μV OUTPUT control to (or near) the desired setting before setting the frequency. Rotation of the VARIABLE control between 1μV and 5μV causes a shift of typically less than .002MHz. If attenuated high and low level signals are needed at the same frequency, consider using different step attenuator settings since the step attenuator causes considerably less frequency shift than the variable attenuator.

Please also note that the CB band accuracy is considerably better than the 1.5% guaranteed specifications. Although this accuracy (approx. .04%) is excellent for a tunable oscillator it still represents an error of approximately 10kHz (or 1 channel) with the result that the channel indications on the dial are only approximate. The CB BAND ADJ available through the front panel (use an insulated hex tuning wand) can bring the dial accuracy closer but the key to frequency accuracy is the use of a frequency counter connected to the COUNTER OUTPUT jack - it is this feature that allows precision at low cost. The counter should remain connected to the COUNTER OUTPUT whenever precision frequencies are required - disconnecting the counter will cause the output frequency to change.

Keep these operating tips in mind and we are confident you will obtain years of excellent service from your Model 256 - a generator with performance unmatched by any other instrument in its price class.

Very truly yours,

THE HICKOK ELECTRICAL INSTRUMENT COMPANY