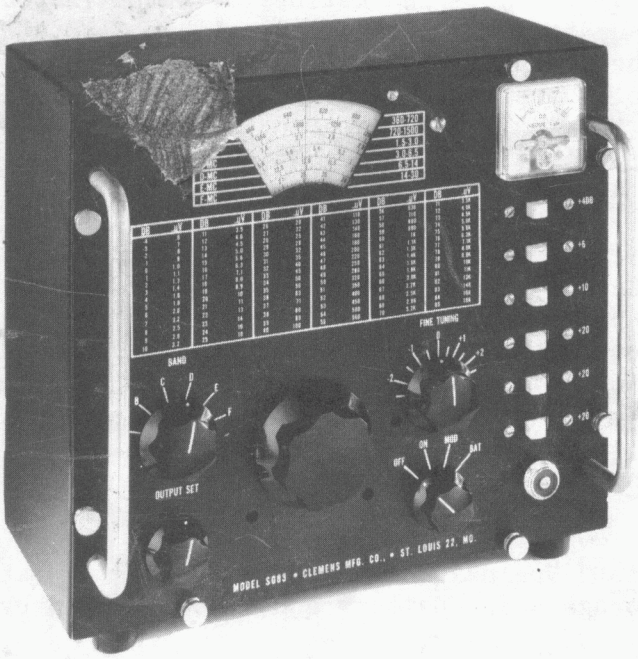
INSTRUCTIONS
for
MODEL SG-83
Standard Signal Generator



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Electronic Development and Manufacturing

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St. Louis 22, Mo.

MODEL SG-83 STANDARD SIGNAL GENERATOR
SPECIFICATIONS

Frequency Ranges:

Band A:	360-720 KC
Band B:	720-1500 KC
Band C:	1.5-3.0 MC
Band D:	3.0-6.5 MC
Band E:	6.5-14.0 MC
Band F:	14.0-30.0 MC

Output: 0.6 to 16,000 microvolts in 1 db steps. Output is factory adjusted with instruments of ±5% accuracy to 1000 microvolts at 600 KC. The calibrated output meter and switch attenuators are accurate to within 2 db at any other settings throughout the frequency range of the instrument. Leakage fields are equivalent to less than 0.3 microvolt at the output terminals and may produce this amount of error at output settings of 1 microvolt or below, decreasing to zero error at 10 microvolts or above.

Modulation: Output may be modulated or unmodulated. Modulation is factory adjusted to 30 ± 5%. Modulation percent is not affected by carrier frequency or output level. Modulation frequency 400 ± 20 cycles, sinusoidal. Modulating waveform distortion under 10%. There is no frequency modulation.

Calibration: Frequency is indicated to an accuracy of 1% or better.

Battery Life: Nominal 400 hours continuous operation or 1 year in average use. Battery condition checked by panel meter.

Size: 9" high x 9-1/2 wide x 6-5/8 deep overall.

Shipping Weight: 13 lbs.

Accessories Supplied: Four-foot output cable with terminating resistor and switch, Instruction Manual, and battery.

Warranty: Repair or replacement of any defective part with-

in ninety days after purchase will be made provided the unit is delivered with transportation charges prepaid to the factory and provided that the unit has not been subjected to misuse. This warranty is in lieu of all other warranties expressed or implied.

CORRECTIONS

C3 is 10 pf ±5%.

C7 is 15 pf ±5%.

Six 2-20 pf trimmers, C21 thru C26 have been added across L1 thru L6, respectively. The shield cover must be removed to adjust these trimmers.

Change the alignment procedure, Pages 9-10 as follows:

Band	Dial Setting for Trimmer Alignment	Dial Setting for Coil Slug Alignment
A	720 KC	360 KC
B	1500 KC	720 KC
C	3.0 MC	1.5 MC
D	6.0 MC	3.0 MC
E	14.0	7.0
F	28.0	14.0

INTRODUCTION

The model SG-83 Standard Signal Generator is a laboratory test instrument which generates accurately known r-f voltages in the 360 kc to 30 mc range. Either unmodulated or modulated output may be obtained.

The r-f output is adjustable from 0.6 microvolt to 16,000 microvolts. The output signal level is read directly in decibels with zero db equal to one microvolt across a 50-ohm load. Other output levels from -4 db (0.6 uV) to +84 db (16,000 uV) are obtainable with various settings of the switch attenuator and output meter. On the front panel of the instrument is a chart to facilitate rapid conversion from db to uV.

The modulation of the SG-83 output signal by the internal 400 cps oscillator is held accurately to 30% amplitude modulation, completely free of incidental frequency modulation.

The SG-83 is battery powered from an inexpensive internal battery which will provide one year of service in average use.

OPERATION

The SG-83 Standard Signal Generator has the following operating controls:

(a) Power Switch - The power switch has four positions. In the first position (OFF), there is no battery drain. In the second position (ON), the output signal is unmodulated. In the third position (MOD), the output signal is modulated 30% by 400 cps. In the fourth position (BAT), the output meter becomes a voltmeter to measure battery voltage under normal load. Normal battery voltage is 9 volts. The battery should be replaced when the battery check falls outside the BATT OK Sector on the meter.

(b) Output Set - The output set control is an adjustable attenuator which varies the signal level applied to the output meter. (It is important to turn the output set control fully counterclockwise whenever the power switch is set to BAT to check the battery condition accurately.) Varying the output set attenuator over its full range will change the signal generator frequency a few cycles on the lower frequencies and as much as 75 kc at 30 mc. However, the frequency shift is ordinarily insignificant because there is usually no need for large excursions in the setting of the output set control.

(c) Bandswitch - The bandswitch selects the desired range.

(d) Fine Tuning - The fine tuning control is used for small changes in frequency. It is calibrated from + 2.5 Kc to -2.5 Kc at a center frequency of 455 Kc. At other frequencies the calibration is not directly readable in Kc. This control is especially useful in making i-f amplifier response curve measurements. The fine tuning control may also be used to recalibrate the main tuning dial against an external frequency standard.

(e) Main Tuning - The main tuning control and dial indicate the output frequency.

(f) Output Meter - The output meter reads the r-f signal level in db from -4 to +4 db, referred to 1 microvolt across a 50 ohm load. The output meter becomes a DC voltmeter with

the power switch in BAT position. It is necessary to rotate the Output Set control fully counterclockwise to check the battery voltage properly. If this is not done, the battery voltage check will be in error due to r-f output current through the meter in addition to the normal voltmeter current.

(g) Switch Attenuator - The six slide switches in a vertical row under the output meter are used to vary the r-f output in increments larger than the range available on the output meter. The slide switches may be used in any combination to obtain the desired output level. If all switches are set in the left hand position, the output of the signal generator will be exactly one microvolt, when the output meter reads mid-scale, or zero db. If one of the +20 db switches is moved to the right, the output is increased 20 db to 10 microvolts. If two of the 20 db switches are set to the right, the output is increased 40 db to 100 microvolts. The output voltage across a 50-ohm load is always the sum of the output meter and switch attenuator db readings. It may be quickly converted to microvolts by use of the conversion chart on the face of the instrument.

The output cable with termination unit and switch are connected to the signal generator front panel output connector. The binding posts on the termination unit are used to connect the instrument to the equipment under test. Note that one binding post connects to ground. With the switch on the termination unit set on "TERM" there is a 50-ohm resistor connected across the binding posts.

If the device under test represents a 50 ohm load across the binding posts, the switch on the termination unit should be left in the "OPEN" position. If the circuit being tested is a high impedance, however, such as the grid of an r-f amplifier, the termination unit switch should be in the "TERM" position so that the generator attenuator will give correct readings.

This signal generator is calibrated in terms of the voltage (microvolts) appearing across a 50 ohm resistance load. Some signal generators are calibrated in open circuit voltage and have an internal series 50 ohm resistor, so that the voltage across a 50 ohm load will be one-half the output indicated on the generator. This difference must be taken into account in making comparisons with the Model SG-83. Other manufacturers use the convention which has been adopted for the SG-83, that is, the output is the voltage appearing across a 50-ohm load.

Proper precautions must be observed in connecting the standard signal generator to a receiver or other equipment if maximum accuracy of measurement is to be obtained. Leads from the termination unit binding posts must be kept short! No more than a few inches of wire should be used in making this connection. Long leads will induce r-f currents on the outside of the coax cable, cabinet, etc., and produce erroneous readings.

A metal work surface is recommended for maximum accuracy with both the equipment under test and the signal generator placed on the metal surface.

These precautions are most important at high frequencies such as 15-30 mc. At the lower frequencies there is less probability of measurement error due to technique.

THEORY OF OPERATION

The Model SG-83 Standard Signal Generator uses a high frequency transistor to generate a low level r-f signal. Six frequency bands are used to cover the 360 Kc - 30 mc range. By limiting each band to a 2:1 frequency range, uniform output on each range is obtained. This results in greater operating convenience since it is not necessary to readjust the output level continually as the signal generator is tuned across the band.

The dial scale has an average length of 12 inches on each band, resulting in high resolution, easy readability and excellent reset accuracy.

R-f output from the oscillator is taken by means of an adjustable attenuator to a crystal diode voltmeter. The adjustable attenuator is designed to maintain approximately constant impedance loading on the oscillator to minimize frequency changes due to changes in setting. The crystal voltmeter uses a low capacity point contact diode and has uniform frequency response over the entire frequency range of the signal generator.

Following the voltmeter is a second r-f attenuator. This attenuator is adjusted by a screwdriver through the front panel to set the r-f output at one microvolt when the output meter reads mid scale, or zero db. This is a factory adjustment which should not be changed unless adequate test instruments are available to recalibrate.

R-f output from the second adjustable attenuator is passed through the modulator diode circuit. The modulator is a silicon point contact diode biased in the forward direction by a small current from the battery. The attenuation introduced by the modulator diode is constant regardless of frequency, or signal level, due to the constant DC bias, which greatly exceeds the level of the r-f current passing through the diode. To obtain modulation of the output signal, the resistance of the diode is made to vary by superimposing an audio signal on the DC diode current.

This method of modulation has the important advantage of producing pure amplitude modulation. Frequency modulation of the oscillator is prevented because of the high degree of i-

solation between the modulator diode and the r-f oscillator.

The 400-cycle modulating signal is obtained from a single transistor, tuned L-C oscillator circuit which produces a low distortion sine wave. The modulation is adjusted to 30% by a screwdriver through the front panel which sets the amount of audio voltage impressed on the modulator diode. This is also a factory adjustment which should not be changed unless a high gain wideband oscilloscope is available to recalibrate.

The modulated or unmodulated r-f signal is brought out of the oscillator compartment by a shielded lead at a level of 10,000 microvolts at a zero db setting of the output voltmeter. The 10,000 microvolt signal is supplied to the input of the switch attenuator where the signal is reduced to the desired level. The switch attenuator is assembled on the front panel in a straight line to prevent coupling around the attenuator from input to output. Five percent resistors are used throughout the attenuator. Each section of the switch attenuator has an average accuracy of better than 1/4 db. It is essential that all screws be replaced if the oscillator shield is removed for any reason, to prevent signal leakage.

MAINTENANCE

Periodic battery replacement, at least once per year, or oftener if necessary, is easily accomplished by removing the eight knurled screws which secure the cabinet and removing the instrument. The battery holder screws can then be removed and the battery replaced. The correct battery is:

Burgess C6X or Eveready 2356.

The frequency, output attenuator, and per cent modulation are all adjustable without removing the instrument from the cabinet. Recalibration should be attempted only if accurate measuring instruments are available.

Frequency recalibration is performed by adjusting the tuning slugs inside the coils on each band by means of a slender shaft screwdriver through the 6 small holes in the front panel, in the area around the main tuning knob, as shown in Figure 1. The large 2" main tuning knob must be removed since it covers two of these adjustment holes.

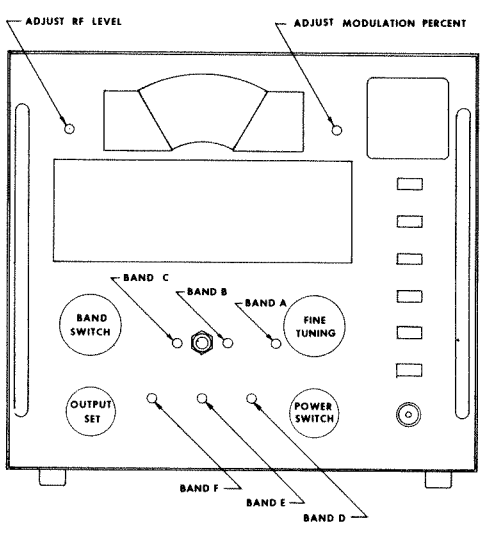


Figure 1

Use an unmodulated signal in making the frequency alignment. Set the output meter to zero db. Set the fine tuning control to zero. Use a 1 mc crystal standard frequency and its harmonics.

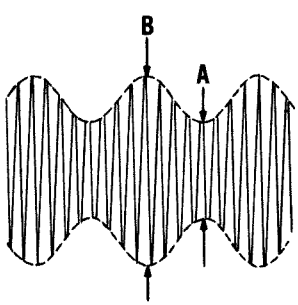
Alignment frequencies are as follows:

Band	Dial Setting
A	500 Kc (Use Generator Harmonic)
B	1000 Kc
C	2.0 Mc
D	5.0 Mc
E	10.0 Mc
F	20.0 Mc

The output attenuator is calibrated by means of a screwdriver adjustment thru a small hole in the panel just to the left of the main frequency dial window. This adjustment is made at 600 Kc on Band A with the terminated cable connected to an accurate vacuum tube voltmeter such as a Hewlett Packard model 400D. Set the switch attenuator and output meter for an output of 1000 microvolts. With a screwdriver adjust the calibration attenuator through the front panel for a reading of 1000 microvolts (.001 volts) on the vacuum tube voltmeter.

The modulation percent adjustment is also made by screwdriver through a small hole in the front panel just to the right of the main frequency dial window. An oscilloscope is required, with a simple L-C high pass filter to remove hum pickup or residual modulating audio voltage from the signal generator output. The sensitive oscilloscope is connected to the terminated cable through a .01 mfd blocking capacitor. A 2.5 mh r-f choke is connected across the oscilloscope terminals. With the power switch in the "mod" position and the frequency set at 1 mc, with 10,000 microvolt output from the signal generator, the modulation adjustment is set to obtain a 30% modulation pattern as shown below (See Figure 2). For 30%

Figure 2



modulation $\frac{B}{A} = 1.86$. Maximum modulation of approximately 40% occurs at about mid range on the modulation adjustment control.

Replace all screws tightly after opening the cabinet and internal shield to prevent r-f leakage which would circumvent the advantages of the extensive shielding of the Model SG-83.

APPENDIX

RECEIVER MEASUREMENT PROCEDURES

The most frequently made receiver measurements for which a standard signal generator is required are the: (1) Signal-Plus-Noise-to-Noise Ratio, (2) Response Curve, and (3) Image and Spurious Response Rejection. A description of the measurement technique for each follows.

1. Signal-Plus-Noise-to-Noise Ratio measures the ability of a receiver to extract the modulation from a weak signal. The receiver is operated in the normal condition for reception of amplitude modulation. An output voltmeter is connected across the audio output terminals or loudspeaker. The audio gain control is set for a convenient reading near full scale on the output meter, from a strong signal, modulated 30% by 400 cycles, from the signal generator. The signal generator is operated with the termination cable in the "OPEN" condition, since the receiver antenna circuit will terminate the signal generator. The output of the signal generator is then decreased gradually while the modulation is switched on and off, until there is a 10 db increase in receiver output with modulation over the receiver output from the unmodulated signal. The r-f level where this condition is obtained is the 10 db S+N/N sensitivity in microvolts.

2. Response Curves are usually measured at the i-f frequencies of the receiver since the selectivity of r-f amplifiers or other tuned circuits has little influence on the shape of the curve. Elements which may result in non-linearity in the receiver must be eliminated to obtain a valid measurement. For this reason, the AVC circuit is usually shorted or disabled and the second detector is operated at a constant level for all measurements. The response curve should be made using the lowest possible signal levels which will override noise because selective circuits are usually distributed between amplifier stages and care must be observed in preventing overload of any stage of the amplifier. A modulated signal and audio output meter may be used conveniently when measuring response curves in which the bandwidth is several kilocycles, but for very narrow response curves of 1 kilocycle or less in width, an unmodulated signal is necessary to avoid discrimination against the sidebands. A vacuum tube voltmeter

is used, with the unmodulated signal, and the dc voltage across the second detector load resistor is used as an output indicator.

Either the DC voltage across the second detector load resistor or the audio output voltage should be maintained constant as the input frequency and input level from the signal generator are varied. In this way the response curve can be measured over a 60 to 80 db range.

3. Image or Spurious Frequency Rejection is measured with the same requirements which apply to response curves, i.e., the reference level at the frequency to which the receiver is tuned should be held constant, and should be the lowest level capable of producing an easily discernible output. The AVC should also be disabled. After obtaining a reference sensitivity or input for standard output at the receiver frequency, the signal generator should be tuned to the image frequencies and the signal generator output increased until the same standard output level is obtained from the receiver. Image rejection is then the ratio of the signal generator level at image frequencies to the level at the receiver frequency for constant output. Other spurious responses are measured in a similar way, operating the signal generator at high output level as it is tuned over its complete range and then adjusting to the standard output for measurement of the spurious rejection ratio. Responses due to harmonic output from the signal generator are disregarded.

PARTS LIST

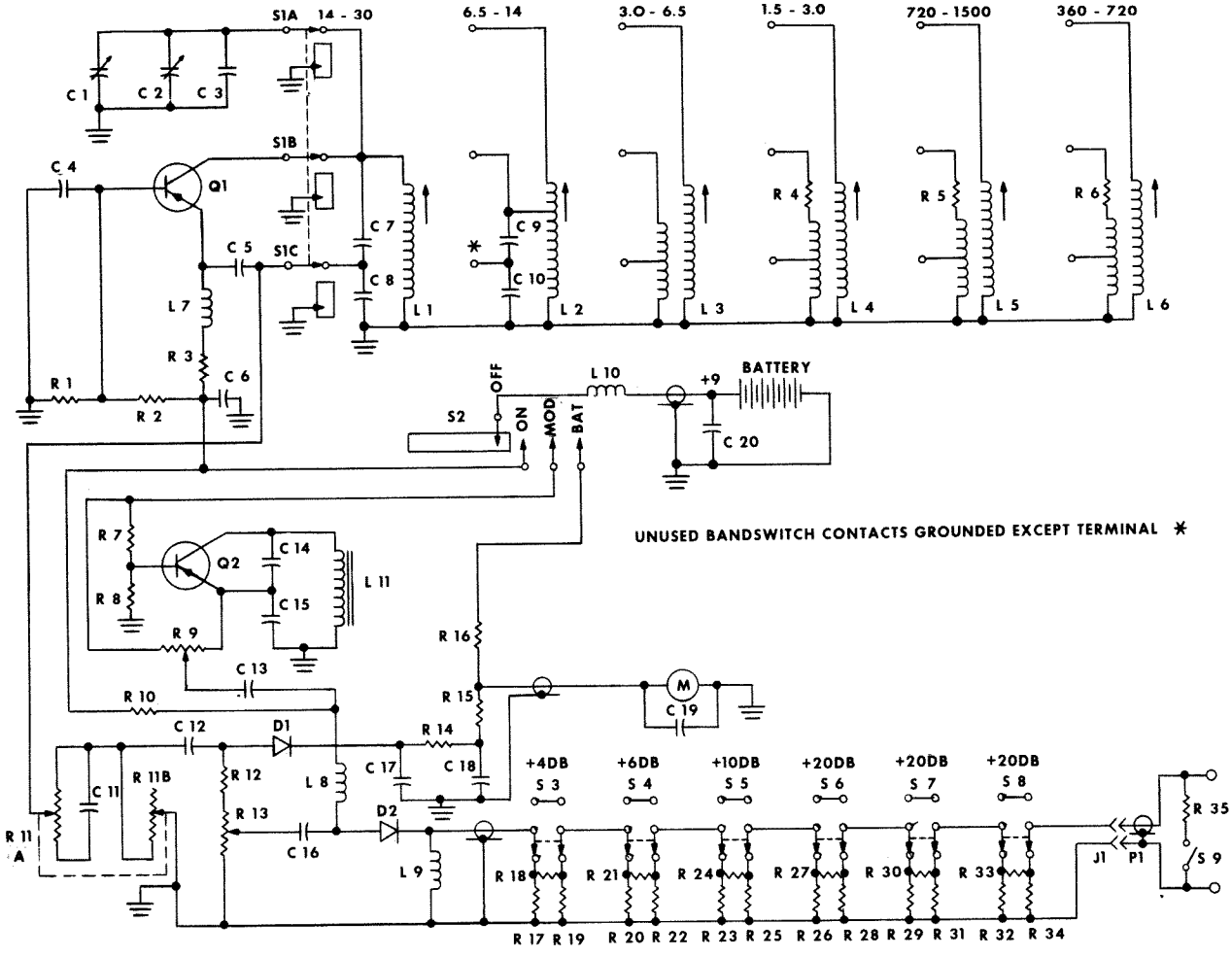
C1 7-201 pf variable
C2 3-6 pf variable
C3 22 pf ± 5% Silver Mica
C4, C5, C12, C17, C18, C19, C20
.01 mfd ± 10% Ceramic
C6, C14, C16 .1 mfd ± 10% 200v mylar
C7, C11 10 pf ± 5% Silver Mica
C8 68 pf ± 5% Silver Mica
C9 100 pf ± 5% Silver Mica
C10 360 pf ± 5% Silver Mica
C13 5 mfd electrolytic
C15 .18 mfd ± 10% 200v mylar

D1 1N34A
D2 1N82A

L1 .49uh Slug tuned
L2 2.3 uh Slug tuned
L3 11 uh Slug tuned
L4 52 uh Slug tuned
L5 220 uh Slug tuned
L6 1.25 mh Slug tuned
L7, L8, L9, L10 250 uhy
L11 1.5 hy

M 50 uA
Q1 2N2188 or equivalent
Q2 2N1273 or equivalent

R1, R14 10K ± 10%
R2, R15 2.2K ± 10%
R3, R12 390 ± 5%
R4, R5, R6, R27, R30, R33 240 ± 5%
R7 4.7K ± 10%
R8, R10 18K ± 5%
R9 5K ± 10% Linear
R11A 350 ± 10% Linear
R11B 1600 ± 10% Special Taper
R13 100 ± 10% Linear
R16 180K ± 5%
R17, R19 220 ± 5%
R18 22 ± 5%
R20, R22 150 ± 5%
R21 39 ± 5%
R23, R25 100 ± 5%
R24 68 ± 5%
R26, R28, R29, R31, R32, R34 62 ± 5%
R35 51 ± 5%



MODEL SG-83 SCHEMATIC DIAGRAM