

MODEL LSG-16
WIDE BAND SIGNAL GENERATOR
INSTRUCTION MANUAL

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Block Diagram
Schematic

General

LSG-16 is a very versatile solid-state, wide-band signal generator designed for the radio experimenter, hobbyist, service technician and instructional purposes. An FET is used in a stable oscillator circuit to cover the frequency range from 100kHz to 100MHz on fundamentals and up to 300MHz on harmonics. Among the many features are the large easy-to-read dial marked at 455kHz, 4.5MHz and 10.7MHz, one audio frequency for amplitude modulation or external use, provision for crystal oscillator operation and coaxial output cable. Serves as a marker generator when used with a sweep generator in checking and aligning RF and IF circuits in TV and FM receivers.

SECTION 1 SPECIFICATIONS

Frequency Range	100kHz to 100MHz (up to 300MHz on harmonics)
Band	A 100 – 320kHz B 320 – 1100kHz C 1.05 – 3.3MHz D 3.2 – 11MHz E 11 – 35MHz F 30 – 100MHz (90-300MHz, calibrated harmonics)
Frequency Accuracy	±1.5%
RF Output	100mVrms, approx., up to 35MHz.
Output Control	HIGH-LOW switch and fine adjuster.
Modulation	Int.: 1kHz Ext.: 50Hz-20kHz, at less than 1Vrms

Audio Output	: 1kHz; 1Vrms, maximum (fixed).
Crystal Oscillator	: For 1-15MHz crystal in Type FT-243 holder. (not included).
Power Supply	: 100, 115 or 230V as specified, 50/60Hz; approx. 3VA.
Size and Weight	: 150 (H) × 250 (W) × 130 (D) mm; 2.5kg. (6" × 10" × 5"; 5.5 lbs.)

SECTION 2 DESCRIPTION

2.1 Controls

1. Frequency dial Sets the RF output frequency in the range selected with FREQ RANGE switch.
2. FREQ RANGE switch with six positions for RF output frequency range.
3. XTAL socket For insertion of quartz crystal, 1-15MHz, in Type FT-243 holder.
4. PWR switch For tuning on the AC power.
5. Pilot lamp Indicates when AC power is on.
6. Mode switch EXT MOD: For modulation of carrier with an external source.
INT MOD: Use of internal 1kHz for modulation or external circuit testing.
XTAL: Crystal oscillator output; frequency depends on crystal used.

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|-----|--------------------|--|
| 7. | INPUT-OUTPUT | For external modulation input or output from internal 1kHz oscillator. |
| 8. | FINE control | Continuous RF output voltage adjuster. |
| 9. | RF LOW-HIGH switch | Sets the RF output level; at LOW, output is lowered by 1/10. |
| 10. | OUTPUT terminals | For connection to RF output leads. |

2.2 Circuit Design

The circuits which compose the LSG-16 will be described with reference to the functional block diagram and components designated on the schematic.

A. RF Circuit.

The RF oscillator uses an FET, Q101, in the Colpitts circuit to generate frequencies from 100kHz to 100MHz on fundamentals. The frequency of operation is set with the FREQ RANGE switch and the tuning dial. Calibration accuracy is better than $\pm 1.5\%$. For convenience in setting the IF circuit frequencies, tuning scales are marked at 455kHz, 4.5MHz and 10.7MHz.

The oscillator output is coupled through an RC network to the input of RF buffer, Q102. The RC network is employed to equalize the RF signal level over the wide frequency range of the oscillator. The RF output is controlled with the fine adjuster and LOW-HIGH switch.

For amplitude modulation, the audio signal is supplied by the modulator, Q103. This transistor is in series with the drain circuit of the RF oscillator. The modulating is done by varying the drain voltage at the audio rate.

B. AF Oscillator/Amplifier and Crystal Oscillator.

Transistor Q104 is used for three functions, depending on the positions of the mode switch.

At EXT MOD position, it serves as an audio amplifier for the external modulation input. The signal from INPUT is applied to the base through capacitor C119 and on to the modulator.

The 1kHz signal is generated with use of the phase-shift oscillator. The output is fed to the modulator and OUTPUT (when used externally).

At XTAL position, Q104 acts as an oscillator when a crystal, 1–15MHz, is inserted in the XTAL socket. The output is connected to the LOW terminal of LOW-HIGH output switch. The signal is available at the OUTPUT connector at the LOW position. It is possible to superimpose the RF oscillator signal on the crystal oscillator output at this position.

C. Power Supply.

Two DC voltages are supplied from a rectifier-filter system. Unregulated voltage at approximately +18V is used for the modulator and RF buffer collector circuits. Regulated DC at approximately +11V is supplied to the RF oscillator through the modulator Q103 and to the collector of Q104.

The AC input winding on transformer TP101 is tapped for operation at 100, 115 and 230V. The neon pilot lamp is connected across the 100V winding. To minimize RF leakage, filter capacitors, C109-C110, are connected across the AC line.

SECTION 3

OPERATION

3.1 Preparation

1. Set the POWER switch at OFF.
2. Connect the AC plug to the AC supply.
3. Connect the RF output leads to OUTPUT terminals.
4. Set the FINE control at center and the RF slide switch at LOW.

During the tests, this switch is set at LOW or HIGH as required.

5. Set the FREQ RANGE switch at the operating band and rotate the frequency dial knob to set the pointer on the desired frequency.

3.2 Connections

The RF leads are connected to the input of the circuit under test. The red terminal is at high potential, or "hot", and black is at ground potential for chassis connection.

For the RF signal at the receiver antenna input, connect a 50 to 200 Ω resistor, 1/4W, in series. When checking sets with the bar or rod antenna, connect leads to a coil with a few turns of wire and couple the coil to the antenna.

In checking RF and IF amplifier circuits, connection should be made through a small capacitor, 1–5pF, in order to prevent detuning effects.

NOTE: When connecting directly to the input circuit, make certain that there is no high DC voltage present. Otherwise, connect a blocking capacitor, 0.05 μ F – 100pF, depending on the frequency.

3.3 Modulated Carrier, internal source

Set the mode switch at INT. MOD.

By tuning the receiver to the generator frequency, or vice versa, an audio tone will be heard in the loudspeaker. An audio voltmeter should be connected across the speaker terminals when aligning the internal circuits. A dummy resistor with suitable power rating can be used in place of the moving coil during the measurements.

It is advisable to keep the RF signal level as low as possible in order to prevent overloading the transistors or electron tubes in the circuit. Excessive input voltage will cause AGC action and/or two resonance points to appear and proper alignment or adjustment is impossible.

3.4 Modulated Carrier, external source

Set the mode switch at EXT. MOD.

Connect leads from an external audio generator to the INPUT.

Frequencies up to 15kHz can be used for modulation at RF above 3MHz. The audio input voltage should not exceed 2V; this is to prevent modulation distortion.

3.5 Unmodulated Carrier

Set the mode switch at EXT. MOD. There should be no connection to the INPUT.

The RF signal can be used in testing a receiver equipped with a beat oscillator, or circuits that do not require a modulated signal.

The RF signal can be applied to a sweep generator for the marker signal.

3.6 Crystal Oscillator Output

Control settings:

Mode switch at XTAL. Insert a crystal, in FT-243 holder, in the XTAL socket.

RF output switch at LOW.

FREQ RANGE switch at "F" and frequency dial at 100MHz.

FINE control at minimum.

The output signal is treated in the same manner as for the unmodulated carrier with the exception that the output level cannot be adjusted.

In certain calibration procedures a short lead near the test circuit will provide sufficient coupling.

NOTE: If the RF signal is required at the same time, set the output frequency with the FREQ RANGE switch and frequency dial as required. Adjust the RF FINE control.

3.7 AF Output, 1kHz

Control settings:

Mode switch at INT. MOD.

FREQ RANGE switch at "F" and frequency dial at 100MHz.

Connect leads from OUTPUT to the test circuit. Use an external potentiometer, 100k-1M Ω , to lower the voltage.

3.8 Oscillator Frequency Calibration

The RF oscillator frequency can be calibrated to a high degree of precision using the harmonics of the internal crystal oscillator and an external all-wave receiver. The latter is utilized as a frequency transfer unit.

Set the mode switch at XTAL.

2. Insert the "standard frequency" crystal, preferably at a multiple of 1MHz. For spot frequency checking, at say 10.7MHz, use a 10.7MHz crystal.
3. Set the RF slide switch at LOW.
Adjust the FINE control as required.
4. Connect the RF output to the receiver input, direct or through a small coupling capacitor to the rod antenna.
5. In the following example, use of a 1MHz crystal will be given.
6. Tune the receiver to 5MHz, or 5th harmonic of 1MHz.

Then by carefully tuning both the oscillator and receiver, an audio beat will be heard. The oscillator is adjusted to zero beat and the dial reading is noted. At other frequencies spaced 1MHz apart, the same procedure is repeated, namely, oscillator setting - tuning the receiver - retuning oscillator and noting the reading on the dial.

Practical use of harmonics up to the tenth or higher is possible. However, care must be exercised in selecting the proper harmonic, especially at high RF when a relatively low frequency crystal is used.

NOTE: When a receiver equipped with a beat frequency oscillator is used, the measurements can be simplified. The "zero-beat" condition is at the point where the steady beat is heard most clearly.

3.9 Exposing the chassis

The chassis can be exposed in the following manner for inspection:

1. Loosen two screws at front part of top cover.

2. Remove two screws on the bottom side.
3. Remove one screw at the back.
4. Take off the cover.



