STETHOTRACER

INSTRUCTION MANUAL

Model ST-111

Don Bosco
ELECTRONICS INC.
Littell Road • Hanover, N. J. •

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FIG. 1

INTRODUCTION

The Model ST-111 Stethotracer is a transistorized, pen-size, self-contained signal tracer or monitor, capable of performing the operations of standard bench type instruments, plus many other operations utilizing special accessory probes. The Stethotracer is a precision built instrument capable of continuous laboratory or field use. With reasonable care and handling, this instrument should give a lifetime of trouble-free service. The Model ST-111 Stethotracer is supplied with three attenuator probes, one RF detector crystal probe, earphone, cord, ground clip lead, and battery. Special probes are available as accessories. Accessories available include the following special probes: a Microwave RF Demodulator Probe, Miniature Microphone Probe, Magnetic Tape Head Probe, Vibration Pickup Probe, Telephone Pickup, Input Adapter, and Output Adapter (see page 14). An Ultrasonic Detection Probe, Tachometer Probe, Magnetic Induction Probe, and Photocell Probe will be available in the near future.

APPLICATIONS

The Model ST-111 Stethotracer is an extremely versatile instrument for laboratory and field use. It is ideal for trouble-shooting defective circuits in all types of radio, electronic equipment, HI-FI amplifiers and preamplifiers, phonographs, P.A. systems, magnetic tape recorders, dictating machines, telephones, audio circuits in television receivers, hearing aids, magnetic recording heads, microphones, phono pickup cartridges, etc. It is especially suited for locating hum, parasitic oscillations, ground loops, and breaks in printed circuit boards. Any low level microwatt audio or modulated radio frequency signals can be detected or demodulated and then highly amplified (approximately 1000 times) by the Stethotracer which will reproduce the signal through a high quality earphone. The Stethotracer output can also be viewed on an oscilloscope by using a special Output Adapter (optional). In this application the Stethotracer acts as a high gain pre-amplifier, thereby increasing the range of an oscilloscope to detect low level microwatt signals. The Output Adapter has an equivalent terminated impedance of 600 ohms, and is designed to fit most commercially available laboratory oscilloscopes, oscillographs, and voltmeters.

SPECIFICATIONS

AMPLIFICATION: 1000X approx. at 1kc. (600 ohm load).

LOW FREQUENCY BANDWIDTH: Useable from 60cps to 100kc.

MODULATED HIGH FREQUENCY BANDWIDTH: 100kc - 200mc (with 1kc audio modulation) — microwave frequencies with special probes.

INPUT IMPEDANCE: 3,500 ohm at 0 attenuation
35,000 ohm at 20db attenuation.
350,000 ohm at 40db attenuation.

MAXIMUM AC SIGNAL INPUT VOLTAGE: One millivolt peak-to-peak for linear operation across 600 ohm scope adaptor load. (0 attenuation).

MAXIMUM INPUT DC VOLTAGE: 250V DC max. from the input terminal to case ground.

OUTPUT VOLTAGE: 0.3 volts peak-to-peak across 600 ohm scope adaptor load (linear operation).

OUTPUT ACOUSTICAL LIMITING: The output sound is limited electrically to the earpiece at 2 milliwatt level so that audio output is limited to a comfortable and safe level.

EQUIVALENT INPUT NOISE LEVEL: 3 microvolt peak-to-peak broad band with input shorted.

DISTORTION: 5% max. harmonic distortion within its dynamic range.

POWER SOURCE: 1.5 volt standard A.A.A. size battery (EVEREADY #912 or equivalent). Battery life: 250 hrs. normal use.

PROBES: 0db, 20db, 40db, attenuator probes, and RF crystal diode probe included.

OSCILLOSCOPE PREAMPLIFIER ADAPTOR: (Optional) equivalent of 600 ohms impedance with a DC level of + 0.80 volt (use AC input on scope) output plug will fit all laboratory scopes with plug adaptor.

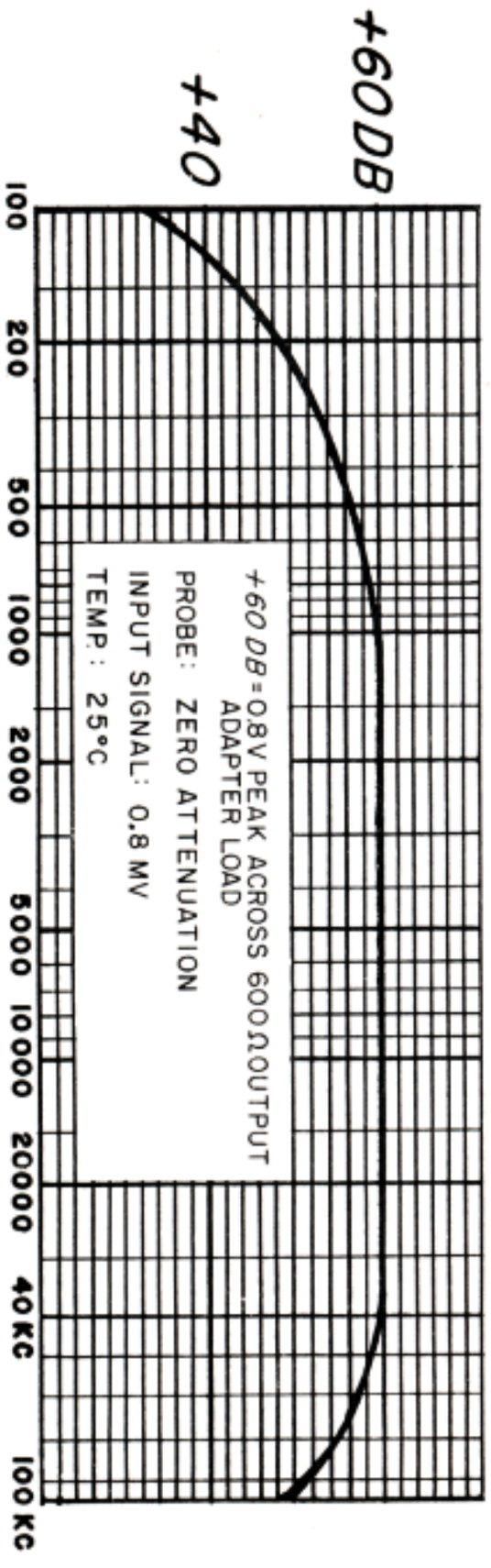

FIG. 2

Typical Frequency Response Curve of the Model ST-111 Stethotracer

INSTRUCTIONS

Before using the Model ST-111 Stethotracer, check the condition of the battery. If the battery is below 1.4 volts, replace as shown in figure 3.

WHEN USING THE STETHOTRACER, NEVER TRACE CIRCUITS WITH A DC VOLTAGE OVER 250 VOLTS, UNLESS A HIGHER RATED BLOCKING CAPACITOR IS PLACED IN THE INPUT.

After using the Stethotracer, make sure that it is turned off. If the Stethotracer is to be stored for long periods or is stored in a hot area, remove battery before storage.

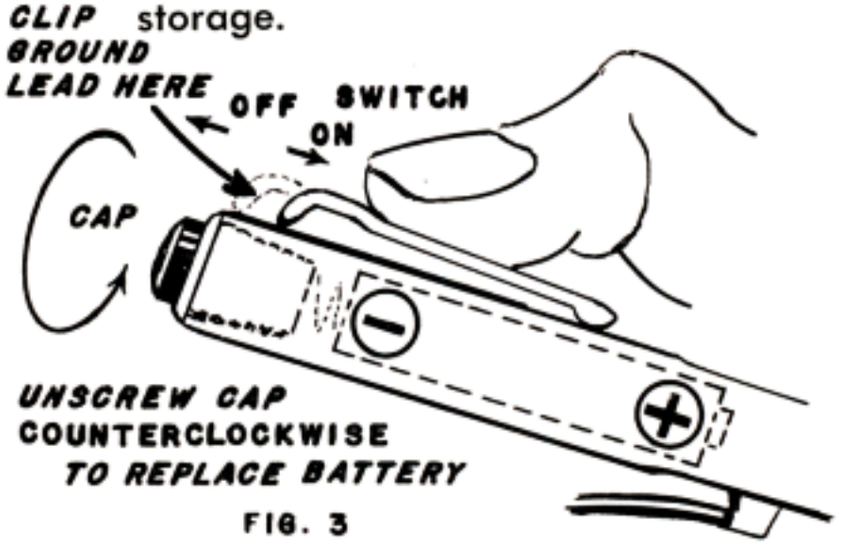

FIG. 3

USE OF ATTENTUATOR PROBES

FIG. 4

The Model ST-111 Stethotracer is supplied with three attenuator probes (0db, — 20db, and — 40db) for use in detecting low frequency signals (60cps to 100kc) of varying strengths. The — 40db probe is used to detect high strength signals, the — 20db probe is used to detect intermediate strength signals, and the 0db probe is used to detect weak signals. For characteristics of each probe, refer to the Probe Reference Chart below.

Probe Reference Chart

Probe Color Code	Input Z in Ohms	Attentuation	Freq. Range	Input Signal Voltage Range
Brown	3.8K	0 DB	60 CPS - 100 KC	10 - 300 MICROVOLTS
Orange	35K	- 20 DB	60 CPS - 100 KC	100 M.V. - 30 M.V.
Yellow	350K	- 40	60 CPS - 100 KC	1 MV - 300 M.V.
Black		DEMODULATOR	100 KC - 300 MC	MILLIVOLT RANGE

USE OF DETECTOR-CRYSTAL PROBE

The detector crystal probe supplied with the Model ST-111 Stethotracer is used to detect and demodulate signals in the carrier modulated radio frequency range (100kc — 300mc). Refer to the Probe Reference Chart above for characteristics of this probe.

TESTING AF CIRCUITS

When using the Stethotracer to test af circuits, start at the input stages and work towards the output stages. Use the Stethotracer as follows:

1. Select the desired attenuator probe (see page 6) and screw into Stethotracer probe head as shown in figure 4 .
2. Connect the polarized earphone cord to the Stethotracer as shown in figure 3 and insert earphone in ear. If the Stethotracer output is to be viewed on an oscilloscope, use the output adapter (refer to instructions on page 13).
3. Connect the ground clip lead from the Stethotracer ON/OFF shirt pocket clip (see figure 3) to a ground point on the chassis as near as possible to the signal take-off point.
4. Turn the Stethotracer ON by sliding the ON/OFF shirt pocket clip downward.
5. Touch the probe tip to the input of the first stage and note the presence of a signal and its level.
6. Touch the probe tip to the output of the first stage and the following stages until the signal is attenuated or lost. At this point check components associated with the particular stage, and replace suspected component(s). If signal still fails to be detected, continue tracing stage until defective component is located. Change the attenuator probe tips as the signal level varies.

TESTING RF MODULATED CIRCUITS

When using the Stethotracer to test modulated rf circuits, start at the input stage and work towards the output stage as in af circuits. Use the Stethotracer as follows:

1. Screw the detector-demodulator crystal probe (black code) into the Stethotracer probe head.
2. Connect the polarized earphone cord to the Stethotracer as shown in figure 3 and insert earphone in ear. If the Stethotracer output is to be viewed on an oscilloscope, use the output adapter (refer to instructions on page 13).
3. Connect the ground clip lead from the Stethotracer ON/OFF shirt pocket clip (see figure 3) to a ground point on the chassis as near as possible to the signal take-off point.
4. Turn the Stethotracer ON by sliding the ON/OFF shirt pocket clip downward.
5. Touch the probe tip to the input of the first stage and note the presence of a signal and its level.
6. Touch the probe tip to the output of the first stage and the following stages until the signal is attenuated or lost. At this point check components associated with the particular stage, and replace suspected component(s). If signal still fails to be detected, continue tracing stage until defective component is located. Change the attenuator probe tips as the signal level varies.

LOCATING PARASITIC OSCILLATIONS

When using the Stethotracer to locate parasitic oscillations, start with the — 40db probe tip (yellow code) and change probe tips as the signal level decreases. Use the Stethotracer as follows:

1. Screw the — 40db probe tip (yellow code) into the Stethotracer probe head as shown in figure 4.
2. Connect the polarized earphone cord to the Stethotracer as shown in figure 3 and insert earphone in ear. If the Stethotracer output is to be viewed on an oscilloscope, use the output adapter (refer to instructions on page 13).
3. Connect the ground clip lead from the Stethotracer ON/OFF shirt pocket clip (see figure 3) to a ground point on the chassis as near as possible to the circuit being traced.
4. Turn the Stethotracer ON by sliding the ON/OFF shirt pocket clip downward.
5. Start tracing at the input stage and proceed towards the output stage until the oscillation is detected.
6. Localize and eliminate the oscillation by conventional means.

LOCATING HUM

When using the Stethotracer to locate hum, start by using the — 40db probe tip (yellow code) for af circuits and the detector crystal probe tip (black code) for modulated rf circuits. When using the Stethotracer to locate hum in af circuits, change the attenuator probe tips as the signal level varies (see page 6). Use the Stethotracer as follows:

1. Screw the probe tip into the Stethotracer probe head as shown in figure 4.
2. Connect the polarized earphone cord to the Stethotracer as shown in figure 3 and insert earphone in ear. If the Stethotracer output is to be viewed on an oscilloscope, use the Output Adapter (refer to instructions on page 13).
3. Connect the ground clip lead from Stethotracer ON/OFF shirt pocket clip (see figure 3) to a ground point on the chassis as near as possible to the circuit being traced.
4. Turn the Stethotracer ON by sliding the ON/OFF shirt pocket clip downward.
5. Place the probe tip at the output of the first stage or the suspected stage, if hum is present, locate the source and correct by conventional means. If hum is still present, improve the input shielding. If the hum is still present continue checking each stage until the source is located.

NOTE

Be sure to adjust the input circuit properly, so that the actual hum level is not confused with the pickup signal, due to open input stages.

LOCATING GROUND LOOPS

When using the Stethotracer to locate ground loops, start by using the 0db probe tip (brown code). Use the Stethotracer as follows:

1. Screw the 0db probe tip into the Stethotracer probe head as shown in figure 4.
2. Connect the polarized earphone cord to the Stethotracer as shown in figure 3 and insert earphone in ear. If the Stethotracer output is to be viewed on an oscilloscope, use the output adapter (refer to instructions on page 13).
3. Connect the ground clip lead from the Stethotracer ON/OFF shirt pocket clip (see figure 3) to a ground point on the chassis as near as possible to the circuit being traced.
4. Turn the Stethotracer ON by sliding the ON/OFF shirt pocket clip downward.
5. Start tracing the ground path at the circuit ground and follow the signal wherever it is strongest (if a signal is detected at other ground points, ground loops are present).

LOCATING BREAKS IN PRINTED CIRCUITS

When using the Stethotracer to locate breaks in printed circuit boards, start by using the — 40db probe tip (yellow code). Use the Stethotracer as follows:

1. Screw the — 40db probe tip into the Stethotracer probe head as shown in figure 4.
2. Connect the polarized earphone cord to the Stethotracer as shown in figure 3 and insert earphone in ear. If the Stethotracer output is to be viewed on an oscilloscope, use the Output Adapter (refer to instructions on page 13).
3. Connect the ground clip lead from the Stethotracer ON/OFF shirt pocket clip (see figure 3) to a ground point as near as possible to the area being traced.
4. Turn the Stethotracer ON by sliding the ON/OFF shirt pocket clip downward.
5. Turn the circuit board over and trace the circuit to a point where a signal is detected and then intermitts in the same printed circuit path. Examine the printed circuit board at this point for breaks.

FIG. 5

USING THE MODEL SA-113 OUTPUT ADAPTER

(AVAILABLE OPTIONALLY)

The Model SA-113 Output Adapter is used to connect the Model ST-111 Stethotracer output to a voltmeter, power amplifier, oscilloscope, oscillograph, or to any indicating or recording instrument. The Output Adapter has an input socket designed to fit the miniature plug on the Stethotracer earphone cord and a dual banana plug with standard ¾ inch spacing to fit any conventional input jack (see figure 5). The Output Adapter has an impedance of 600 ohms with a DC voltage level of + 0.80 volts when used with the Model ST-111 Stethotracer, the Stethotracer in this application acts as a 1000X gain preamplifier, increasing the range sensitivity of an oscilloscope or other instrument to include the detection of low level microvolt signals. The Stethotracer is used in this application for more accurate output measurements of signals. To use the Stethotracer as a preamplifier, proceed as follows:

1. Connect the polarized earphone cord to the Stethotracer and connect the other end of the earphone cord to the output adapter as shown in figure 5, noting plug polarization (the dot designates ground).
2. Connect the output adapter to the AC input of an oscilloscope or other instrument, observing ground.
3. The Stethotracer is now ready for use in any of its applications.

SHORT FORM CATALOG

VIBRATION PICK-UP MODEL SA112
Detects minute mechanical vibration such as ticking of a watch, the flow of gases and liquids through pipes, and movement of bearings, shafts, etc. The frequency range is from 200 cycles up to and including ultrasonic frequencies. (Output adapter and oscilloscope are required for ultrasonic frequency observation.)

OUTPUT ADAPTER MODEL SA113
Connects Stethotracer to oscilloscope or recording instrument for accurate output measurement. It provides 600 ohms impedance with a DC level of 0.80 volt (use AC input on scope). Stethotracer with output adapter is an excellent high gain preamplifier providing a gain of 1000.

MICROWAVE DEMODULATOR MODEL SA114
This probe detects, demodulates any modulated microwave frequency signals from 30 MC up to 10 KMC.

MAGNETIC TAPE HEAD [Monaural] MODEL SA115
This probe monitors recorded information of magnetic sheet or tape while any of those are in motion — from the simplest to the most sophisticated magnetic tape recording device. Ideal to study magnetic recording behavior.

MICROPHONE PROBE [Magnetic] MODEL SA116
The frequency range covers the speech range. This is a rugged, miniature, dynamic microphone used with the Stethotracer to detect low level sound. Handy for acoustical measurements.

INPUT ADAPTER MODEL SA117
Connects Stethotracer to output of any device through any standard miniature phono pin plug.

An Ultrasonic Detection Probe, Tachometer Probe, Magnetic Induction Probe, and Photocell Probe will be available in the near future.