

Stethoscope Audio Test Fixture – Features and Operation

General

The Stethoscope Audio Test fixture enables testing of Stethoscopes for quality purposes to determine consistency in performance between identical models, and for use in comparing performance of one model to another. Any Stethoscope may be tested; any size Chestpiece may be used. The test fixture consists of a high stability sine wave generator with audio output, enclosed in a metal housing which doubles as the mechanical test fixture itself. An external sound level meter connects to the fixture to measure sound pressure levels (SPL) through the stethoscope.

Operation

The test fixture should be setup and used in a quiet location to prevent spurious background noise from affecting the test results. A 18VDC A/C adapter provides power to the fixture, and connects to the rear panel. An On/Off switch is located on the Front panel. A selector knob in the middle of the front panel sets one of four frequencies, 60, 125, 250, and 500Hz. An audio transducer on top of the unit emits the sound of the selected frequency.

A Extech 407750 Sound Level Meter is connected to the test fixture from the front, sliding the microphone of the meter into the clear plastic tubing. This is a snug fit and only needs to engage a small amount. The meter is positioned in front of the fixture (see photo for typical setup). Connect the supplied A/C adapter to the meter, or use the built in 9 volt battery. If using the battery however, the unit will shut itself off when it detects inactivity, though this feature can be disabled. At power-on, the meter performs a self-test, and sets the scale to "Aurorange". The meter by default also powers up into "Scale A" weighting, which simulates the hearing response of the human ear: this is how it should be used during testing. Additionally however, after power-on you may wish to press the "F/S" button, "Fast/Slow Response," from default "Fast" to averaging "Slow". The "Slow" setting takes longer but may be more stable than the "Fast" setting. The meter is now ready for testing. The display will directly read the SPL in decibels.

A stethoscope is attached directly to the fixture, the binaural earpiece straddling the sides and seating into the earpiece ports. The stethoscope itself should then lay flat on the table towards the rear. (see photo for typical setup)

For combination Stethoscope Chestpieces, select either the "Open Bell" side or the "Diaphragm" side. Place and hold the Chestpiece as a practitioner might, on top of the test fixture (if using the diaphragm side, one may have to manually block the bell hole). Select the first of four frequencies. After a moment for stabilization, observe the sound pressure level (SPL) in decibels on the sound level meter and record data in test results table (refer to sample data collection table). Then select in turn each of the other three frequencies, recording the SPL measurement in the table. For a combination Chestpiece, rotate it 180° to select the opposite side and repeat the tests, recording the data in the table.

Compare the test results with those from a known good sample, applying a predetermined tolerance for slight variation in test setup, which includes such things as Chestpiece pressure, and earpiece seating (tolerance to be determined by user's QA). Then judge pass/fail for the Stethoscope under test. (refer to sample stethoscope Pass/Fail Limits table)

Design

Research indicates that a Stethoscope operates most usefully within the frequency range of 20 to 500Hz, divided as follows; Bell – 20 to 200Hz; Diaphragm – 100 to 500 Hz. Since the Stethoscope is a tuned resonant mechanical instrument with fundamental and harmonic frequency reactance, it is not practical to linearly sweep through all frequencies within the designated range of 20 to 500 Hz, as the sound pressure level reading would vary considerably. For practical purposes a stepped frequency test is required, and this design utilizes four preset frequencies, of 60, 125, 250, and 500Hz. An indexed knob on the front panel is used to select the specific frequency.

A precision waveform generator monolithic integrated circuit is used to generate the Sine wave output. The circuit is temperature compensated for frequency drift. One of four R/C networks is selected using the front panel indexed control knob, which determines the frequency generated. A high linearity operational amplifier drives a full range miniature sound transducer, which acts as the audio source for the chestpiece, and is mounted inside the top of the test fixture. The circuit is powered by an external UL Listed wall mount power supply, 18VDC regulated, 300mA.

Calibration

Since the circuit is temperature compensated, has a precision wave form generator, and operates at low wattage levels, there is no need to routinely calibrate the device. However, should calibration be required or desired, it should be returned to the factory.

LIMITED WARRANTY

Brotech Electronics guarantees that the Stethoscope Test fixture will be free from physical defects in material and workmanship for one year from date of purchase, when used within the limits set forth in the user manual.

In no event shall Brotech Electronics liability exceed the price paid for the product from direct, indirect, special, incidental, or consequential damages resulting from the use of the product. Brotech makes no warranty or representation, expressed, implied, or statutory, with respect to its products or the contents or use of this documentation, and specifically disclaims its merchantability or fitness for any particular purpose, other than as set forth in this manual. Brotech Electronics reserves the right to revise or update its product, software, or documentation without obligation to notify any individual or entity.

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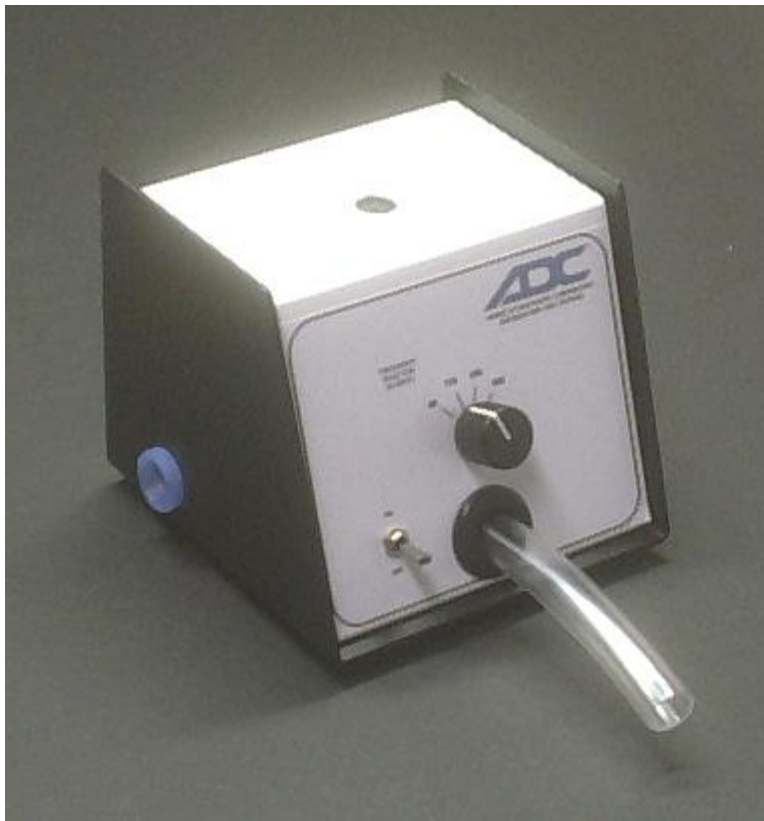
Stethoscope Test Data Sheet

DATE	MODEL	CHESTPIECE	F1 = 60Hz	F2 = 125Hz	F3 = 250Hz	F4 = 500Hz	PASS/FAIL
		Diaphragm	nn (test results)	nn (test results)	nn (test results)	nn (test results)	
		Bell	nn (test results)	nn (test results)	nn (test results)	nn (test results)	
		Diaphragm					
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Stethoscope Pass/Fail limits

<i>Model</i>	<i>Chestpiece</i>	<i>F1 = 60Hz</i>	<i>F2 = 125Hz</i>	<i>F3 = 250Hz</i>	<i>F4 = 500Hz</i>
	Diaphragm	nn.n +/-n	nn.n +/-n	nn.n +/-n	nn.n +/-n
	Bell	nn.n +/-n	nn.n +/-n	nn.n +/-n	nn.n +/-n
	Diaphragm	nn.n +/-n	nn.n +/-n	nn.n +/-n	nn.n +/-n
	Bell	nn.n +/-n	nn.n +/-n	nn.n +/-n	nn.n +/-n
	Diaphragm	nn.n +/-n	nn.n +/-n	nn.n +/-n	nn.n +/-n
	Bell	nn.n +/-n	nn.n +/-n	nn.n +/-n	nn.n +/-n
	Diaphragm				
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Stethoscope Audio Test Fixture



Typical Setup



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